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TESTING
CNAS L4062

TEST REPORT

Reference No.	:	WTX24X03064559S
Applicant	:	GlobTek, Inc.
Address	:	186 Veterans Dr. Northvale, NJ 07647 USA
Manufacturer	:	GlobTek, Inc.
Address	:	186 Veterans Dr. Northvale, NJ 07647 USA
Product Name	:	DC/DC Converter
Model No	:	GTD93035L6013.2-F, GTD93035H6013.2-F
Test specification	:	IEC 61558-2-16:2021 used in conjunction with IEC 61558-1:2017 Include deviations for Australia and New Zealand Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V Part 2: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units
Date of Receipt sample	:	2024-03-28
Date of Test	:	2024-03-28 to 2024-04-18
Date of Issue	:	2024-04-19
Test Report Form No.	:	WTX_IEC61558_2-16_2021A
Test Result	:	**Pass**

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of approver.

Prepared By:
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Tested by: John Zhong

John Zhong

Approved by:

Harvid Wei

Test item description .....:	DC/DC Converter
Trademark .....:	GlobTek, Inc.
Model and/or type reference .....:	GTD93035L6013.2-F, GTD93035H6013.2-F
Serial number .....:	/
Rating(s).....:	Model GTD93035L6013.2-F: Input: 9-60Vdc, 9.0A; output: 13.2Vdc, 4.54A. Model GTD93035H6013.2-F: Input: 55-150Vdc, 2.0A; output: 13.2Vdc, 4.54A.

Remark:
Whether parts of tests for the product have been subcontracted to other labs:
☐ Yes ☒ No

If Yes, list the related test items and lab information:
Test items:
Lab information:

Summary of testing:

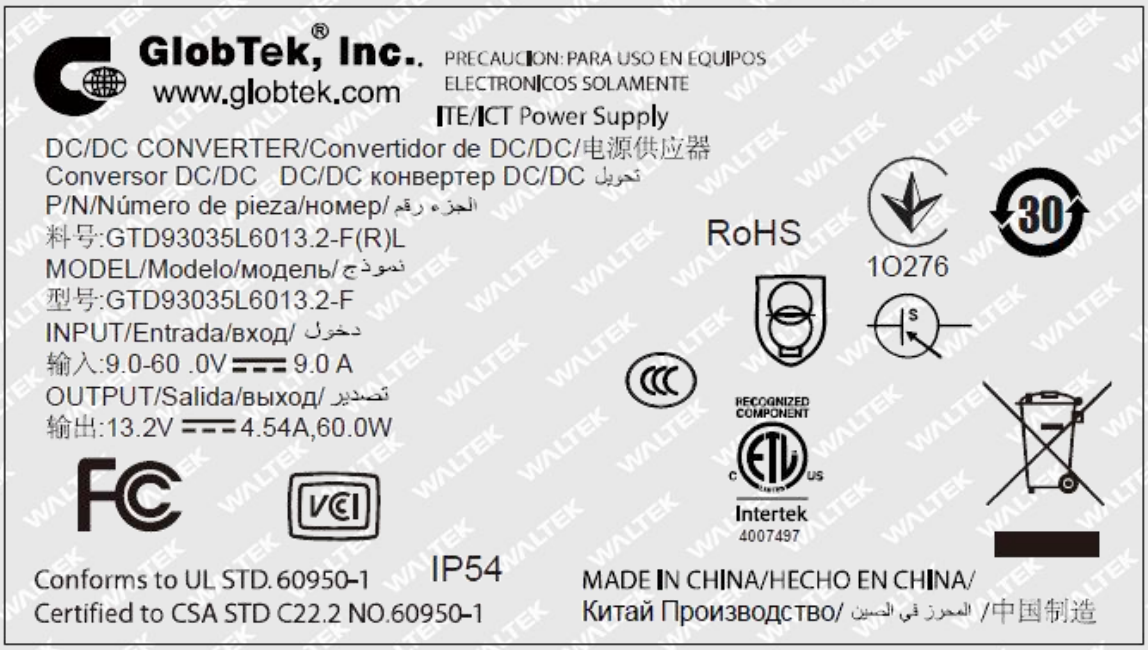
Tests performed (name of test and test clause):	**Testing location:**
- IEC 61558-1:2017 - IEC 61558-2-16:2021 - AS/NZS 61558.1:2018+A1:2020+A2:2020 - AS/NZS 61558.2.16:2022 The submitted samples were found to comply with the requirements of above specification.	Waltek Testing Group (Shenzhen) Co., Ltd. Address: 1/F., Room 101, Building 1, Hongwei Industrial Park, Liuxian 2nd Road, Block 70 Bao'an District, Shenzhen, Guangdong, China

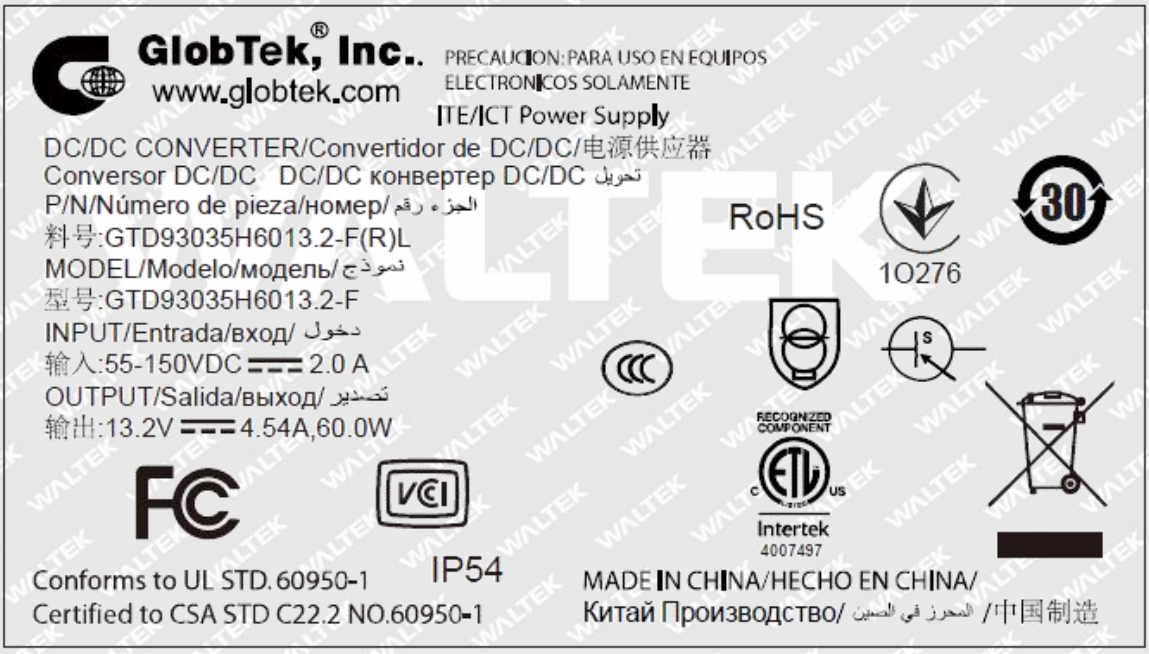
Summary of compliance with National Differences:

List of countries addressed: AU
AU=Australia

The product fulfils the requirements of European, Australia and New Zealand National Differences

Copy of marking plate:





Test item particulars.....:	
Protection against electric shock..... :	Built-in component
Supply Connection..... :	DC mains
.....:	
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A (not applicable)
- test object does meet the requirement..... :	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Name and address of factory (ies)..... :	1. GlobTek, Inc. 186 Veterans Dr. Northvale, NJ 07647 USA 2. GlobTek (Suzhou) Co., Ltd Buildng 4, No. 76 JinLing East Road, Suzhou Industrial Park, Suzhou, 215021, JiangSu, China

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
Throughout this report a comma (point) is used as the decimal separator.

General product information:

Product covered by this report is DC/DC Converter, which is built-in type and designed for continuous operation. It is intended to be used as a part of vehicle power system. If used for other electrical system, extra tests and evaluation required.

One assembly structure is optional that internal circuits are sealed through gum preventing water and dust. For that, the equipment was submitted and evaluated for maximum manufacturer's recommended ambient temperature of 50 °C.

Mode differences

Models GTD93035L6013.2-F and GTD93035H6013.2-F are identical in appearance and also share most of the critical components. Both two models were evaluated in the report.

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
8	**MARKING AND OTHER INFORMATION**		
8.1	Transformers shall be marked with the following (for symbols see Table 1):		P
	a) rated supply voltage(s) or the rated supply voltage range(s) (V) .....:	See marking label	P
	b) rated output voltage(s) (V or kV) ..... :	See marking label	P
	c) rated output (VA, kVA, or W) …….:	See marking label	P
	d) rated output current(s) (A or mA) ……..:	See marking label	P
	e) rated supply frequency(ies) (Hz) ……..:		N/A
	f) rated power factor (if not 1) ……..:		N/A
	g) symbol AC for alternating current, or DC for direct current-output	The symbol ⎓ for DC	P
	h) relevant graphical symbols shown in Table 101 that indicate the kind of transformer in addition with the symbol for SMPS. (IEC 61558-2-16: 2021)	For example: 	P
	i) name or trademark of the manufacturer or responsible vendor	See marking label	P
	j) model or type reference	See marking label	P
	k) vector group in accordance with IEC 60076-1 for three phase transformer	Not a 3-phase transformer.	N/A
	l) symbol for class II construction	For building-in equipment and shall be evaluated in the end-product	N/A
	symbol for class III construction		N/A
	m) indication of the protection index IP	IPX0	P
	n) rated maximum ambient temperature t_a, if other than 25 °C …….:	50°C	P
	o) rated minimum ambient temperature t_{amin}, if lower than +10 °C and if a temperature sensitive device is used		N/A
	p) duty cycle, if any, unless the operating time is limited by the construction of the transformer or corresponds to the operating conditions specified in the relevant part of IEC 61558-2.		N/A
	q) symbol for overvoltage category, if other than OVC II		N/A
	r) transformers used with forced air cooling shall be marked with ”AF” in m/s		N/A
	s) Information from the manufacturer to the purchaser (data sheet)	See below.	P
	- short-circuit voltage (% rated supply voltage) for stationary transformers > 1000 VA		N/A
	- electrical function of the transformer	The electrical input/output rating is shown.	P

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	- All markings except those under i) and j) may be illustrated as QR Code according ISO/IEC 18004.		P
	t) symbol indicating the maximum altitude of installation, if higher than 2 000 m		N/A
8.2	Marking for transformers IP00 or for associated transformers: type and trademark, instruction sheets		N/A
8.3	Adjusted voltage easily and clearly discernible	No adjustable voltage.	N/A
8.4	For each tapping or winding: rated output voltage and rated output	Single output.	N/A
	necessary connections clearly indicated		N/A
8.5	For non-short-circuit proof transformers or non-inherently short-circuit proof transformers designed to be protected by fuses shall be marked:	Symbol  provided on marking plate.	P
	Rated current (A or mA) and symbol for time current characteristics of the fuses for non-inherently short-circuit proof transformer with incorporated fuses and non-short-circuit proof transformer .....:		N/A
	For non-short-circuit proof transformers or non-inherently short-circuit proof transformers designed to be protected with protective devices other than fuses shall be marked:		N/A
	Manufacturer's models or type reference of the protective device, and/or the ratings of the protective device		N/A
	Instruction sheet for transformers with replaceable protective device (other than fuses) information with information about the replacement.		N/A
8.6	Terminals for neutral: "N"		N/A
	Terminal for protective earth marked with earthing symbol		N/A
	Identification of input terminals:		N/A
	Identification of output terminals:		N/A
	Symbol for any point/terminal in connection with frame or core		N/A
8.7	Indication for correct connection		P
8.8	Instruction sheet for type X, Y, Z attachments		N/A
8.9	Transformer for indoor use shall be marked with the relevant symbol.		N/A
8.10	Symbol for Class II construction not confused with manufacturer's name or any other identification		N/A
	Class II transformer with parts to be mounted – delivered with all parts for class II after mounting.	No such parts.	N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	Symbol for class II transformer placed on the part which provides class II.		P
8.11	Correct symbols:		P
	Volts	V	P
	Amperes	A (mA)	P
	Volt amperes (or volt-amperes reactive for reactors)	VA or (VAR)	N/A
	Watts	W	P
	Hertz	Hz	N/A
	Input	PRI	N/A
	Output	SEC	N/A
	Direct current	d.c. (DC) or ⎓	P
	Neutral	N	P
	Single-phase a.c.	~	P
	Three-phase a.c.	3 ~	N/A
	Three-phase and neutral a.c.	3N ~	N/A
	Power factor	cos φ	N/A
	Class II construction	⧈	N/A
	Class III construction	III	N/A
	Equipment of overvoltage category I	I	N/A
	Equipment of overvoltage category II	II	P
	Equipment of overvoltage category III	III	N/A
	Equipment of overvoltage category IV	IV	N/A
	Fuse		P
	Rated max. ambient temperature	t_a	P
	Rated minimum ambient temperature	t_{amin}	N/A
	Rated minimum temperature	t_{min}	N/A
	Frame or chassis (or core terminal)		N/A
	Protective earth (ground)		N/A
	IP number	IPX0	P

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	Earth (ground or functional earth)		N/A
	For indoor use only		N/A
	To indicate that the appliance is intended to be usable up to the maximum altitude 3 000 m.		P
	To indicate that the power supply unit shall not be used, if pins of the plug part are damaged.		N/A
	Additional Symbols (IEC 61558-2-16:2021)		P
	SMPS (Switch mode power supply unit)		P
	SMPS incorporating a Fail-safe separating transformer		N/A
	SMPS incorporating a Non-short-circuit-proof separating transformer		N/A
	SMPS incorporating a Short-circuit-proof separating transformer (inherently or non-inherently)		N/A
	SMPS incorporating a Fail-safe isolating transformer		N/A
	SMPS incorporating a Non-short-circuit-proof isolating transformer		N/A
	SMPS incorporating a Short-circuit-proof isolating transformer (inherently or non-inherently)		N/A
	SMPS incorporating a Fail-safe safety isolating transformer		N/A
	SMPS incorporating a Non-short-circuit-proof safety isolating transformer		N/A
	SMPS incorporating a Short-circuit-proof safety isolating transformer (inherently or non-inherently)		P
	SMPS incorporating a Fail-safe auto-transformer		N/A
	SMPS incorporating a Non-short-circuit proof auto-transformer		N/A
	SMPS incorporating a Short-circuit proof auto-transformer (inherently or non-inherently)		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
8.12	Number, letters or other visual means for different positions of regulating devices and switches		N/A
	OFF position indicated by number 0		N/A
	Greater output, input etc. indicated by higher number		N/A
8.13	Marking not on screws or other easily removable parts		P
	Marking clearly discernible (transformer ready for use)		P
	Marking for terminals clearly discernible if necessary after removal of the cover		N/A
	Marking for terminals: no confusion between input and output		N/A
	Marking for interchangeable protective devices positioned adjacent to the base		N/A
	Marking for interchangeable protective devices clearly discernible after removal of cover and protective device		N/A
8.14	Visible information (symbols) shall be provided, when it is necessary to take special precautions for installation, transportation or use (in the catalogue, data sheet, instruction sheet or packaging):		P
	For non-inherently short-circuit proof transformers with non-self-resetting or non-replaceable devices and non-replaceable intentional weak parts: The device cannot be reset or replaced after a short-circuit or an overload		N/A
	For transformers generating a protective earth conductor current greater than 10 mA and are intended for permanent connection The installation shall be made according to the wiring rules.		N/A
	For stationary transformers exceeding 1000 VA: The short circuit voltage expressed as a percentage of the rated supply voltage		N/A
	The electrical function of the transformer		P
	the limiting temperature of the winding under abnormal conditions which shall be respected when the transformer is built into an appliance as information for appliance design;		N/A
	For transformers not designed for series and/or parallel connection with more than one output winding, not for series or parallel connection		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	For IP00-transformers the test of 27.2 is not performed. The result may be affected by the enclosure in the final application.		N/A
8.15	Marking durable and easily legible		P
8.16	Portable transformers with integrated plugs complying with EN 50075 (IEC plug type C), shall use the symbol IEC 60417-6352:2015-10. The instruction sheet of the plug in transformer shall contain the following information, or equivalent: if the pins of the plug parts are damaged, the plug-in power supply shall be scrapped.		N/A
9	**PROTECTION AGAINST ELECTRIC SHOCK**		P
9.1	General		P
	Transformers shall be enclosed and provided with adequate protection against contact with hazardous-live-parts and shall have no risk of an electric shock from stored charge on capacitors.		P
9.2	Protection against contact with hazardous-live-parts		P
9.2.1	Determination of hazardous-live-parts		P
9.2.1.1	A live part is not a hazardous-live-part if it is separated from the supply by double or reinforced insulation and the requirements of 9.2.1.2 or 9.2.1.3 are met when the transformer is supplied at rated supply voltage		P
9.2.1.2	The voltage shall not exceed 35 V AC peak or 60 V ripple free DC.	Measured maximum output voltage: Max. 13.2Vd.c.	P
9.2.1.3	Where the voltage exceeds 35 V (peak) AC or 60 V ripple free DC, the touch current shall not exceed:		N/A
	- for AC. 0,7 mA (peak)		N/A
	- for DC. 2,0 mA		N/A
	In addition, when a capacitor is connected to live parts:		N/A
9.2.1.3.1	The discharge shall not exceed 45 µC for stored voltages between 60 V and 15 kV, or		N/A
9.2.1.3.2	The energy of discharge shall not exceed 350 mJ for stored voltages exceeding 15 kV.		N/A
9.2.2	Accessibility to hazardous-live-parts	For building-in equipment and shall be evaluated in the end-product	N/A
	Transformers shall be constructed to provide adequate protection against accessibility to hazardous-live-parts.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Class I and II transformers shall be so constructed and enclosed that there is adequate protection against accidental contact with hazardous-live-parts.		N/A
	For class I transformers, accessible parts shall be separated from hazardous-live-parts by at least basic insulation.		N/A
	Class II transformers shall be so constructed and enclosed that there is adequate protection against accessibility to basic insulation and to conductive parts separated from hazardous-live-parts by basic insulation only.		N/A
	Only parts separated from hazardous-live parts by double or reinforced insulation may be accessible		N/A
	Hazardous-live-parts shall not be accessible after removal of detachable parts except for	No detachable parts.	N/A
	- lamps having caps larger B9 and E10		N/A
	- type D fuse holder		N/A
	IP00 transformers shall comply with the end product standard after incorporation in the end product.		N/A
	The insulating properties of lacquer, enamel, paper, cotton, oxide film on conductive parts and sealing compound shall not be considered as giving the required protection against accidental contact with hazardous-live-parts with the exception of fully insulated winding wire (FIW).		N/A
	Shafts, handles, operating levers, knobs and the like shall not be hazardous-live-parts.		N/A
	Compliance is checked by inspection and by the relevant tests of IEC 60529.		N/A
	Class II transformers and Class II parts of Class I construction are tested with the test pin (fig. 3)		N/A
	Hazardous live parts shall not be touchable by test finger (fig. 4) with the exception of fully insulated winding wire (FIW).	No live parts were touched.	N/A
	for Class II transformers: conductive parts separated by basic insulation from hazardous live parts not touchable by test finger		N/A
	hazardous live parts shall not be touchable with the test pin	No live parts were touched.	N/A
9.2.3	Accessibility of non-hazardous live parts		P
	Non-hazardous live parts of the output circuit isolated from the input circuit by double or reinforced insulation may be accessible under the following conditions:		P

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	- for no-load output voltages not exceeding 35 V peak AC or 60 V ripple-free DC, both poles may be accessible;	The no load output voltage is 13.2Vdc Max.	P
	- for no-load output voltages exceeding 35 V peak AC or 60 V ripple-free DC and not exceeding 250 V AC, only one of the poles may be accessible.		N/A
9.3	Protection against hazardous electrical discharge		N/A
	Transformers with primary supply plug: 1 s after the interruption of the supply the voltage between the pins do not exceed 35 V (peak) AC or 60 V ripple free DC		N/A
	Transformers without a primary supply plug: 5 s after the interruption of the supply the voltage between the input terminals do not exceed 35 V (peak) AC. or 60 V ripple free DC.		N/A
	If the nominal capacitance is ≤ 0,1 µF – no test is conducted.		N/A
	- 10 times switch the supply source on and off, or use a special equipment for to switch off at the most unfavourable electrical angle		N/A
	If the measured voltage is > 60 V ripple free DC, the discharge must be ≤ 45 µC.		N/A
10	**CHANGE OF INPUT VOLTAGE SETTING**		P
	Transformers with more than one rated supply voltage shall be so constructed that the voltage setting cannot be changed without the aid of a tool.	No such devices.	N/A
	Transformers which can be set to different rated supply voltages:		N/A
	- The indication of voltage for which the transformer is set is discernible on the transformer.		N/A
10.101	A wide range (e.g. 100 V AC to 240 V AC) of supply voltage is allowed (IEC 61558-2-16: 2021)		P
	- if the output voltage does not exceed the rated output voltage		P
	- if the no-load output voltage does not exceed the limits of the output voltage deviation		P
11	**OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD**		P
11.1	Difference from rated value (without rectifier; with rectifier):	With rectifier. (see appended table)	P
	a) inherently short-circuit proof transformers with one rated output voltage for the output voltage: AC≤ 10%; DC≤ 15%		N/A
	b) inherently short-circuit proof transformers with more than one rated output voltage for the highest output voltage: AC≤10%; DC≤15%		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	c) inherently short-circuit proof transformers with more than one rated output voltage for the other output voltages: AC≤15%; DC≤20%		N/A
	d) other transformers for the output voltages: AC≤5%; DC≤10%	(see appended table)	P
11.2	If a transformer is marked with the rated output, the rated output voltage, the rated output current, and the rated power factor, these values shall be substantially in agreement with each other.		P
	If no rated output current is assigned to the transformer, the rated output current for the purpose of this specification can be calculated from the rated output and the rated output voltage.		N/A
12	**NO-LOAD OUTPUT VOLTAGE (IEC 61558-2-16:2021)**		P
	Remark: with rectifier measuring on both sides of the rectifier if they are accessible to the user	Input terminals of the rectifier are not accessible to user.	P
12.101	The no load output voltage shall not exceed :		P
	- For SMPS incorporating separating or auto-transformers: 1000V AC. or 1415 V ripple free DC		N/A
	- For SMPS including isolating transformers: 500 V AC. or 708 V ripple-free DC		N/A
	- For SMPS including safety isolating transformers: 50 V AC. or 120 V ripple-free DC		P
	For independent SMPS incorporating separating transformers, isolating transformers or auto-transformers: 50 V AC. or 120 V ripple-free DC		N/A
	For independent SMPS, this output voltage limitation applies even when output windings, not for interconnection, are connected in series		N/A
	The requirement for series connection does not apply to associated or IP 00 SMPS		N/A
12.202	The difference between no-load output voltage and the output voltage measured in clause 11 does not exceed the values of table 102		P
12.103	Unless otherwise specified by the manufacturer, SMPS shall be tested with 20 cm to 200 cm length of wire connected to the output terminals under the most unfavourable conditions. Twisted wires or cables rated in accordance with IEC 60227-5:2011 (type 60227 IEC 53) may be used. The cross sectional area of the conductors shall be determined in accordance with the rated output current of the SMPS, and the current density shall not exceed 5 A/mm^2 in normal use.		P
13	**SHORT-CIRCUIT VOLTAGE**		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	The short-circuit voltage measured shall not deviate by more than 20 % from the value marked.	No marked.	N/A
14	**HEATING**		P
14.1	General requirements		P
14.1.1	Temperature-rise test		P
	No excessive temperature in normal use		P
	The manufacturer may choose the simulated load methods according to 14.1.2.1 or 14.1.2.2 instead of the direct load method that may be applied.		P
	Room temperature: rated ambient temperature ta ± 5 °C		P
	Type X, Y, Z attachments: 1 pull (5 N) to the connection windings		N/A
	Upri (V): 1,1 times rated supply voltage loaded with rated impedance – for independent transformers		P
	Upri (V): 1,1 times rated supply voltage: with I sec (A), measured with rated impedance and 1,0 times of the rated supply voltage for others than independent transformers		N/A
	Max. temperature windings ……:	(see appended table)	N/A
	- Class A: 100 °C		N/A
	- Class E: 115 °C		N/A
	- Class B: 120 °C		P
	- Class F: 140 °C		N/A
	- Class H: 165 °C		N/A
	- other classes		N/A
	Temperature of external enclosures of stationary transformers:		N/A
	- bare metal: 65 °C		N/A
	- metal covered by lac or varnish: 70 °C		N/A
	- other material: 80 °C		N/A
	Temperature of external enclosure of stationary transformer 85 °C (not touchable with the IEC test finger)		N/A
	Temperature of external enclosures, handles, etc. of portable transformers:		P
	- continuously held parts of metal: 48 °C		N/A
	- continuously held parts of other material: 48 °C		N/A
	- not continuously held parts of metal: 60 °C		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	- not continuously held parts of other material: 80 °C	Plastic enclosure.	P
	Temperature of terminals for external conductors and terminals of switches 70 °C	No switch.	N/A
	Temperature of internal and external wiring:		P
	- rubber: 65 °C	No rubber.	N/A
	- PVC: 70 °C	Internal plug pin lead wire	P
	Temperature of parts where safety can be affected:		N/A
	- rubber: 75 °C		N/A
	- phenol-formaldehyde: 105 °C		N/A
	- urea-formaldehyde: 85 °C		N/A
	- impregnated paper and fabric: 85 °C		N/A
	- impregnated wood: 85 °C		N/A
	- PVC, polystyrene and similar thermoplastic material: 65 °C		N/A
	- varnished cambric: 75 °C		N/A
	Temperature rise of supports 85 °C		P
	Temperature of printed boards:	UL approved PCB used, the limit is 130 °C	P
	- bonded with phenol-formaldehyde: 105 °C		N/A
	- melamine-formaldehyde: 105 °C		N/A
	- phenol-furfural: 105 °C		N/A
	- polyester: 105 °C		N/A
	- bonded with epoxy: 140 °C	PCB rating: 130°C	P
	Electric strength between input and output windings (18.3, 1 min); test voltage (V) ……:		P
14.101	Winding temperature measured by thermocouples at the surface of the winding (IEC 61558-2-16: 2021)		P
	- if the internal frequencies is > 500Hz		P
	- the values of Table 2 for windings temperatures are reduced by 10°C	Class: 120-10=110° C	P
14.102	SMPS shall be tested at 0,9 times and 1,1 times the rated supply voltage		P
14.2	Application of 14.1 or 14.3 according to the insulation system		P
14.2.1	Class of insulation system (classified materials according to IEC 60 085 and IEC 60 216)	Class B	P
14.2.2	No classified material, or system but the measured temperature does not exceed the value of Class A		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
14.2.3	No classified material or system but the measured temperature exceeds the value for Class A, the live parts of the transformers are submitted to the test of 14.3		N/A
14.3	Accelerated ageing test for undeclared class of insulation system		N/A
14.3.1	General Cycling test (10 cycles):	Measured transformer winding within the specified limit on normal heating test.	N/A
14.3.2	Heat run (temperature in table 4)		N/A
14.3.3	Vibration test: 30 min; amplitude 0,35 mm; frequency range: 10 Hz, 55 Hz, 10 Hz		N/A
14.3.4	Moisture treatment (48 h, 17.2)		N/A
14.3.5	Measurements and tests at the beginning and after each test:		N/A
	- deviation of the no-load input current, measured at the beginning of the test less than 30%		N/A
	- insulation resistance acc. cl.18.1 and 18.2		N/A
	- electric strength, no breakdown (18.3 and 18.4); 2 min; test voltage 35% of specified value		N/A
	- Transformers (50 or 60 Hz version) are tested after the dielectric strength test as follows: under no load; duration: 5 min; Upri(V):1,2 times rated supply voltage; frequency (Hz): 2 times rated frequency		N/A
15	**SHORT-CIRCUIT AND OVERLOAD PROTECTION**		P
15.1	General requirements		P
15.1.1	Short circuit and overload test method		P
	Tests direct after 14.1 at the same ta and without changing position.	(see appended table)	P
	Supply voltage between 0,9 times and 1,1 times of the rated supply voltage		P
	Transformer with rectifier tests of 15.2 and 15.3 at the input and the output terminals of the rectifier.		P
	Transformers with more than one output winding or tapping, all windings tested with normal load, the winding with the highest temperature is short circuited.		N/A
	Wining protected inherently (15.2)		N/A
	- Max. temperature of winding protected inherently (insulation class): 150°C (A); 165°C (E); 175°C (B); 190°C (F); 210°C (H)		N/A
	Winding protected by protective device:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- Test according 15.3.2 - 15.3.3 – 15.3.4: max. temperature of winding during the time required or the time T given in table 6 (insulation class): 200 °C (A); 215 °C ;(E); 225 °C (B); 240 °C (F); 260 °C (H)		N/A
	- Test according 15.3.1: max. temperature of winding during the first hour, peak value (insulation class): 200 °C (A); 215 °C (E); 225 °C (B); 240 °C (F); 260 °C (H)	Protected, no high temperature	P
	- Test according 15.3.1: max. temperature of winding after first hour, peak value (insulation class): 175 °C (A); 190 °C (E); 200 °C (B); 215 °C (F); 235 °C (H)		P
	- Test according 15.3.1: max. temperature of winding after first hour, arithmetic mean value (insulation class):150 °C (A); 165 °C (E); 175 °C (B); 190 °C (F); 210 °C (H)		P
	- Test according 15.3.5: max. temperature of winding (insulation class): 175 °C (A); 190 °C (E); 200 °C (B); 215 °C (F); 235 °C (H)		P
	Max. temperature of external enclosures (accessible by test finger) 105 °C		P
	Max. temperature of insulation of wiring (rubber and PVC) 85 °C		P
	Temperature rise of supports 105 °C		P
15.1.2	Alternative short circuit and overload test method		P
	The manufacturer may choose to apply any of the following methods described in 14.1.2.1 and 14.1.2.2. These test procedures are according to IEC 60076-11:2004, 23.2.1 and 23.2.2		P
15.2	Inherently short-circuit proof transformers		N/A
	Inherently short-circuit proof transformers are tested by short-circuiting the output windings until steady-state conditions are reached		N/A
15.3	Non-inherently short-circuit proof transformers		P
	Non-inherently short-circuit proof transformers are tested as follows		P
15.3.1	Output terminals short-circuited: protection device operates, test at 0,9 … 1,1 of the rated supply voltage		P
15.3.2	If protected by a fuse accordance with either IEC 60 269-2 or IEC 60 269-3, or a technical equivalent fuse, the transformer is loaded as in table 6.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
15.3.3	If protected by a fuse accordance with either IEC 60 127(all parts) or ISO 8820(all parts), or a technical equivalent fuse, the transformer is loaded with the current as specified for the longest pre arcing time. If protected by miniature fuses in accordance to IEC 60127(all parts), 1,5 times of the rated fuse, until steady state condition (in addition)		N/A
15.3.4	If protected by a circuit-breaker according to IEC 60 898(all parts) the transformer is loaded with a current equal to 1,45 times the value of the circuit-breaker rated current		N/A
15.3.5	If other overload protection than a fuse (IEC 60 127) or a circuit-breaker (IEC 60 269) test with 0,95 times of operating current	Protected by electronic circuit	P
	If an internal week point is used, the test must be repeated with two new samples. The two additional samples works similar to the first sample. Temperatures in the limit of table 5		N/A
15.4	For non-short-circuit proof transformers: temperature rises values in table 5, tests as indicated in 15.3		N/A
15.5	For fail-safe transformers:		N/A
15.5.1	Three additional new specimens are used		—
	- Upri (V): 1,1 times rated supply voltage ……...:		—
	- Isec (A): 1,5 times rated output current ……...:		—
	- time until steady-state conditions t1 (h) ……:		—
	- time until failure t2 (h): t1; 5 h ……:		—
15.5.2	During the test:		N/A
	- no flames, molten material, etc.		N/A
	- temperature of enclosure 175 °C		N/A
	- temperature of plywood support 125 °C		N/A
	After the test:		N/A
	- electric strength (Cl. 18, 1 min, test voltage: 35% of specified value); no flashover or break-down for primary-to-secondary only for safety isolating, isolating and separating transformer and for primary-to-body for all kinds of transformer		N/A
	- bare hazardous live parts not accessible by test finger through holes of enclosure		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
15.101	Electronic circuits shall be so designed and applied that a fault condition within the SMPS will not cause electric shock, or fire hazard, and unintentional operation of the appliance will not impair safety.	(Details see Annex H)	P
16	**MECHANICAL STRENGTH**		P
16.1	General		P
	After tests of 16.2, 16.3 and 16.4		P
	- no damage		P
	- hazardous live parts not accessible by test pin according to 9.2.2		P
	- no damage for insulating barriers		P
	- handles, levers, etc. have not moved on shafts		N/A
16.2	Stationary transformers		N/A
	3 blows, impact energy 0,5 ±0,05 J		N/A
16.3	Portable transformers (except of direct plug in transformers)		N/A
	For portable transformers: 100 falls, 25 mm		N/A
16.4	Portable transformers provided with integral pins for introduction in socket outlets of the fixed wiring		N/A
16.4.1	General requirements		N/A
	Portable transformers with integral pins for introduction into fixed socket-outlets shall have adequate mechanical strength.		N/A
	Plug in power supply units with integral main plug complying with IEC TR 60083, without plugs complying with EN 50075 (IEC plug type C) shall be tested:		N/A
	a) plug-in transformers: tumbling barrel test: 50 times, x ≤ 250 g; 25 times, x > 250 g		N/A
	b) torque test of the plug pins with 0,4 Nm		N/A
	c) pull force according to table 7 for each pin		N/A
16.4.2	Portable transformers provided with integral pins according to EN 50075 (IEC plug type C) for introduction in socket-outlets of the fixed wiring		N/A
	a) The test is carried in a tumbling barrel as described in IEC 60068-2-31.		N/A
	- 1000 times: x ≤ 100 g; 500 times: 100 g< x ≤ 200 g; 200 times: g< 100 x		N/A
	- pull force according to IEC 60884-1:2002, 24.10 for each pin		N/A
	b) torque test of the plug pins with 0,4 Nm		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
16.5	Additional requirements for transformers to be used in vehicles and railway applications		N/A
16.5.1	Transformers to be used in vehicles and railway applications		N/A
	An test according IEC 61373 shall be performed with conditions of Table 8 and Table 9 and the frequency values depending on the weight of the specimen are defined in Table 10		N/A
16.5.2	Test requirements for the transportation of transformers		N/A
	Shock and vibration testing requirements for transformers subjected to while being transported per IEC 60721-3-2 with conditions according to Table 11 and Figure 8.		N/A
17	**PROTECTION AGAINST HARMFUL INGRESS OF WATER AND MOISTURE**		P
17.1	Degree of protection (IP code marked on the transformer)		P
17.1.1	General requirements	IPX0	P
	Test according to 17.1.2 and for other IP ratings test according to IEC 60 529:		P
	- stable operating temperature before starting the test for < IPX8		N/A
	- the water for the test shall be at a temperature of 15±10℃		N/A
	- transformer mounted and wired as in normal use		N/A
	- fixed transformer mounted as in normal use by the tests according to 17.1.2 A to J		N/A
	- portable transformers placed in the most unfavourable position and wired as in normal use		N/A
	- glands tightened with a torque equal to two-thirds of 25.6		N/A
	After the tests:		N/A
	- dielectric strength test according to 18.3		N/A
	Inspection:		N/A
	a) no access with hazardous-live-parts or hazardous moving parts with the relevant test probe according to the test described in 17.1.2, items A 1), B 1) and C 1). The test finger may penetrate but the stop face (ø 50 x 20 mm) shall not pass through the openings for the number 2 of the first characteristic numeral		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	b) no entry into the transformer enclosure by the relevant test probe for solid-object-proof transformers according to test described in 17.1.2, items A 2) and B 2). The protection is satisfactory if the full diameter of the probe does not pass through any openings;		N/A
	c) no deposit of talcum powder in dust-proof transformers		N/A
	d) no deposit of talcum powder inside dust-tight transformers		N/A
	e) no trace of water on live parts except SELV parts below 15 V AC or 25 V DC or insulation if hazard for the user or surroundings no reduction of creepage distances		N/A
	f) no accumulation of water inside the enclosures of drip-proof, spray-proof, splash-proof and jet-proof transformers, which may impair safety		N/A
	g) no trace of water entered in any part of water-tight transformer		N/A
17.1.2	Tests on transformers with enclosure:		P
	A) Solid-object-proof transformers:		P
	- 2 IP2X test finger (IEC 60 529) and test pin (fig. 3)		P
	- rigid sphere		P
	B) Solid-object-proof transformers:		N/A
	- IP3X, wire 2,5 mm; force 3 N		N/A
	- IP4X, wire 1 mm; force 1 N		N/A
	C) Dust-proof transformers, IP5X;		N/A
	1) At every possible point with a probe according to test probe D of B 1).		N/A
	2) dust chamber according to IEC 60 529, fig. 2:		N/A
	a) transformer has operating temperature		N/A
	b) transformer, still operating, is placed in the dust chamber		N/A
	c) the door of the dust chamber is closed		N/A
	d) fan/blower is switched on		N/A
	e) after 1 min transformer is switched off for cooling time of 3 h		N/A
	D) Dust-tight transformers (IP6X) test according with C)		N/A
	E) Drip-proof transformers (IPX1) test according to fig. 3 of IEC 60 529 for 10 min		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	F) Rain-proof transformers (IPX2) test according to fig. 3 of IEC 60 529 for 10 min in operation, any angle up to 15°		N/A
	G) Spray proofed transformers (IPX3) test according to fig. 4 of IEC 60 529 for 10 min in operation and 10 min switched off , time for complete oscillation (2 x 120°) is 4 sec.		N/A
	H) Splash-proof transformers (IPX4) test according to fig. 4 of IEC 60 529 (see F) for 10 min in operation and 10 min switched off (the tube shall oscillate ≈360)		N/A
	I) Jet-proof transformer (IPX5) test according to fig. 6 of IEC 60 529 (nozzle 6,3mm)		N/A
	J) Powerful Jet-proof transformer (IPX6) test according to fig. 6 of IEC 60 529 (nozzle 12 mm)		N/A
	K) Watertight transformers (IPX7)		N/A
	L) Pressure watertight transformers (IPX8)		N/A
17.2	After moisture test (48 h for IP20, 168 h for other transformers):	48h	P
	- insulation resistance and electric strength (Cl. 18)		P
18	**INSULATION RESISTANCE AND ELECTRIC STRENGTH**		P
18.2	Insulation resistance between:		P
	- live parts and body for basic insulation ≥ 2 MΩ		N/A
	- live parts and body for reinforced insulation ≥ 7 MΩ	>100MΩ	P
	- input circuits and output circuits for basic insulation ≥ 2 MΩ		N/A
	- input circuits and output circuits for double or reinforced insulation ≥ 5 MΩ	>100MΩ	P
	- each input circuit and all other input circuits connected together ≥ 2 MΩ		N/A
	- each output circuit and all other output circuits connected together ≥ 2 MΩ		N/A
	- hazardous live parts and metal parts with basic insulation (Class II transformers) ≥ 2 MΩ		N/A
	- conductive parts of class II transformers which are separated from hazardous-live parts by basic insulation only, and the body ≥ 5 MΩ		N/A
	- metal foil in contact with inner and outer surfaces of insulating enclosures ≥ 7 MΩ		N/A
18.3	Electric strength test (1 min): no flashover or breakdown:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Overvoltage category ……:	III	P
	1) functional insulation; working voltage (V); test voltage (V) ……:		N/A
	2) basic insulation; working voltage (V); test voltage (V) ……..:	(see table 18.3)	P
	3) supplementary insulation; working voltage (V); test voltage (V) ……:		N/A
	4) double or reinforced insulation……:	(see table 18.3)	P
	5) Functional insulation for windings intended to be connected in series or parallel (test voltage = working voltage + 500 V)		N/A
18.3.1	A partial discharge test according to IEC 60664-1, (see test description below) shall be performed, if FIW wires or TIW wires are used and if the recurring peak working voltage Ut across the insulation is greater than 750 V. The relevant recurring peak voltage is the maximum measured voltage between the input and the output circuit, if the secondary side is earthed. The measuring shall be done at 1,0 of the maximum rated input voltage.		N/A
18.3.1.101	For transformers incorporated in an SMPS in accordance with Annex BB, a partial discharge type test in accordance with Annex AA shall be performed		N/A
18.4	Does not apply (IEC 61558-2-16:2021)		-
18.101	SMPS shall fulfil the impulse dielectric test in accordance with Annex R of IEC 61558-1:2017		P
	After the test of 18.3, the SMPS shall be connected to the impulse test equipment. The impulse dielectric test shall be carried out in accordance with Annex R of IEC 61558-1:2017 between the input and output terminals of the SMPS. The interval between the impulses shall be at least 1 s if the impulses are produced inside the SMPS.		P
	During the test, there shall be no breakdown of the insulation between turns of a winding, between input and output circuits, between adjacent input or output circuits, or between the windings and any conductive core		P
18.5	**Touch current and protective earthing conductor current**		N/A
18.5.1	General		N/A
18.5.2	Touch current		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Touch current measured after the clause 14 test (hot) for class I and class II transformers (class II transformers with metal foil at the plastic surface). The test circuit according figure 10. Measuring network according Figure J.1 (Annex J). If the frequency is >30kHz, measuring across the 500 ohm resistor of J.1 (burn effects).		N/A
	Measurement of the touch current with switch p in both positions and in combination with switches e and n. The measured values are less than the required values of table 15.		N/A
	switches n and e in on position		N/A
	switch n: off and switch e: on		N/A
	switch n: on and switch e: off		N/A
18.5.3	Protective earthing conductor current		N/A
	The transformer is connected as in clause 14 Impedance of the ammeter < 0,5 ohm, connected between earthing terminal of the transformer and protective earthing conductor		N/A
	The measured values are less than the required values of table 15.		N/A
19	**CONSTRUCTION**		P
19.1	General construction		P
19.1.1	General	For building-in equipment and shall be evaluated in the end-product	P
19.1.2	Auto-transformers	No auto-transformers	N/A
19.1.2.1	Plug connected auto-transformers where the rated input voltage is higher than the rated output voltage, shall not have any potential to protective earthing at the output socket higher than the rated output voltage.	No polarised input	N/A
19.1.2.2	Polarised input and output plug and socket-outlet system: an instruction shall be given for not using such a transformer with a nonpolarized plug and socket-outlet system.		N/A
19.1.2.3	A polarity detecting device only energises the output in the case: output potential to earth ≤ rated output voltage, also with reversed input plug.		N/A
	- The contact separation of the device is ≥ 3mm		N/A
	- A current to earth does not exceed 0,75 mA.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- All tests are repeated under fault conditions of H.3.3. The potential to earth does not exceed 1,1 times the max output voltage for more than 5 s.		N/A
	- for class I transformers, the insulation between the input / output winding and the body shall consist of at least basic insulation (rated for the working voltage)		N/A
	- for class II transformers, the insulation between the input / output winding and the body shall consist of double or reinforced insulation (rated for the working voltage).		N/A
19.1.3	Separating transformers		P
19.1.3.1	Input and output circuits electrically separated.		P
19.1.3.2	The insulation between input and output winding(s) consist of basic insulation		P
	Class I transformer		--
	- Insulation between input windings and body consist of basic insulation		N/A
	- Insulation between output windings and body consist of basic insulation		N/A
	Class II transformer		N/A
	- Insulation between input windings and body consist of double or reinforced insulation		N/A
	- Insulation between output windings and body consist of double or reinforced insulation		N/A
19.1.3.3	The insulation between input windings and intermediate conductive parts and the output windings and intermediate part consist of basic insulation		N/A
	For class I transformer the insulation between input and output windings via the intermediate conductive parts consist of basic insulation		N/A
	For class II transformer the insulation between input winding and the body and between the output windings and the body via the intermediate conductive parts consist of double or reinforced insulation.		N/A
19.1.3.4	Parts of output circuits may be connected to protective earthing		N/A
19.1.3.5	No direct contact between output circuits and the body, unless:		N/A
	- Allowed for associated transformers by the relevant equipment standard		N/A
19.1.4	Isolating transformers and safety isolating transformers		P

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Clause	Requirement + Test	Result - Remark	Verdict
19.1.4.1	Input and output circuits electrically separated		P
	No possibility of any connection between these circuits		P
19.1.4.2	The insulation between input and output winding(s) consist of double or reinforced insulation (exception see 19.1.4.4)		P
	Class I transformers not intended for connection to the mains by a plug:		N/A
	- Insulation between input windings and body connected to earth consist of basic insulation (rated for the input voltage)		N/A
	- Insulation between output windings and body, connected to earth consist of basic insulation rated (rated for the output voltage)		N/A
	Class I transformers intended for connection to the mains by a plug:		N/A
	- Insulation between input windings and body connected to earth consist of basic insulation (rated to the working voltage)		N/A
	- Insulation between output windings and body, connected to earth consist of supplementary insulation (rated for the working voltage)		N/A
	Class II transformers		N/A
	- Insulation between input windings and body consist of double or reinforced insulation (rated for the input voltage)		N/A
	- Insulation between output windings and body consist of double or reinforced insulation (rated for the output voltage)		N/A
19.1.4.3	For transformers with intermediate conductive parts not connected to the body (between input/output):		N/A
19.1.4.3.1	For class I and class II transformers the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation (rated for the working voltage)		N/A
	- For class II transformers the insulation between input winding and the body and between the output windings and the body via the intermediate conductive parts consist of double or reinforced insulation. (rated for the input voltage and output voltage), for SELV circuits only basic insulation is required.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- For transformers, different from independent, the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation (rated for the working voltage)		N/A
19.1.4.3.2	Class I transformers with earthed core, and not allowed for class II equipment		N/A
	- Insulation between the input winding and the earthed core: basic insulation rated for the input voltage		N/A
	- Insulation between the output winding and the earthed core: basic insulation rated for the output voltage		N/A
19.1.4.3.3	Insulation between: input and intermediate conductive parts, and output and intermediate parts consist of at least basic insulation		P
	- If the insulation from input or output to the intermediate metal part is less than basic insulation, the part is considered to be connected to input or output.		P
19.1.4.4	For class I transformers, with protective screen, not connected to the mains by a plug the following conditions comply:		N/A
	- The insulation between input winding and protective screen consist of basic insulation (rated for the input voltage)		N/A
	- The insulation between output winding and protective screen consist of basic insulation (rated for the output voltage)		N/A
	- The protective screen consist of metal foil or a wire wound screen extending the full width of the windings and has no gaps or holes		N/A
	- Where the protective screen does not cover the entire width of the input winding, additional insulation to ensure double insulation in this area, is used.		N/A
	- If the protective screen is made by a foil, the turns are isolated, overlap at least 3 mm		N/A
	- The cross-section of the screen and the lead out wire is at least corresponding to the rated current of the overload protective device		N/A
	- The lead out wire is soldered or fixed to the protective screen.		N/A
	For transformers for connection to the mains by the means of a plug of any type (incorporating or not), the alternative with basic insulation plus protective screening is not allowed.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
19.1.4.5	No connection between output circuit and protective earth, except of associated transformers (allowed by equipment standard) or 19.8 is fulfilled.		N/A
19.1.4.6	No connection between output circuit and body, except of associated transformers (allowed by equipment standard) or when 19.8 is fulfilled.		N/A
19.1.4.7	The distance between input and output terminals for the connection of external wiring is ≥ 25 mm		P
19.1.4.8	Portable transformers having an rated output ≤ 630 VA shall be class II.		N/A
19.1.4.9	No connection between output circuit and body except of associated transformers (allowed by equipment standard)		N/A
19.1.4.10	Protective screening is not allowed for transformers with plug connection to the mains		N/A
19.2	Flammability of materials		N/A
	Materials known to be highly flammable, such as celluloid, shall not be used in the construction of transformers.		N/A
	Cotton, silk, paper and similar fibrous material shall not be used as insulation, unless impregnated.		N/A
	Wax and similar impregnators shall not be used, unless suitably restrained from migration		N/A
	Wood, even if impregnated, shall not be used as supplementary or reinforced insulation		N/A
19.3	Short-circuit characteristics of portable transformers		N/A
	Portable transformer: short-circuit proof or fail-safe		N/A
19.4	Class II transformer contact prevention of accessible conductive parts		N/A
	There shall be provisions to prevent contact between accessible conductive parts and conduits or metal sheaths of supply wiring for class II transformers.		N/A
19.5	Class II transformer insulation reassembling after service		N/A
	Parts of class II transformers serving as supplementary insulation or reinforced insulation which might be omitted during reassembly after servicing, shall either:		N/A
	- be fixed in such a way that they cannot be removed without being seriously damaged; or		N/A
	- be so designed that they cannot be replaced in an incorrect position and that, if they are omitted, the **transformer** is rendered inoperable or is manifestly incomplete		N/A
	Sleeving may, however, be used as **supplementary insulation** on internal wiring, if it is retained in position by positive means.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
19.6	Loosening of wires, screws or similar parts		N/A
	Class I and II transformers: creepage distances and clearances over supplementary or reinforced insulation if wire, screw, nut, etc. become loose or fall out of position not less than 50% specified values (Cl. 26)		N/A
19.7	Resistor or capacitor connection with accessible conductive parts		N/A
	Conductive parts connected to accessible metal parts by resistors or capacitors shall be separated from hazardous live parts by double or reinforced insulation	No such parts	N/A
19.8	Bridging of separated conductive parts by resistors or capacitors		P
	Resistors or capacitors connected between hazardous live parts and the body (accessible metal parts) consist of:		P
	- components according to IEC 60 065, 14.2 or capacitor Y2 according to IEC 60 384-14	Certified Y-capacitor according to IEC 60384-14	P
	- at least two separate components		N/A
	- if one component is short-circuited or opened, values specified in Cl. 9 shall not be exceeded		N/A
	- if the working voltage is ≤ 250 V, one Y1 capacitor according 60384-14 is allowed	CY6 used between primary and secondary circuit	P
	- For a working voltage above 250 V AC and not exceeding 500 V AC and an overvoltage category III, two Y1 capacitors are required.		N/A
19.9	Insulating material separating input and output windings		N/A
	Insulation material input/output and supplementary insulation of rubber resistant to ageing		N/A
	Creepage distances (if cracks) > specified values (Cl. 26)		N/A
19.10	Accidental contact protection against hazardous-live-parts provided by isolating coating		N/A
	Protection against accidental contact by insulating coating:		N/A
	a) ageing test (IEC 60068-2-14), test Na: 168 h; 70± 2℃		N/A
	b) impact test (spring-operated impact hammer according to IEC 60 068-2-75; 0,5 ± 0,05 J)		N/A
	c) scratch test (hardened steel pin) electric strength test according to Cl. 18.3		N/A
19.11	Insulating material of handles, operating levers, knobs and similar parts		N/A
	Handles, levers, knobs, etc.:		N/A
	- insulating material		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- supplementary insulation covering		N/A
	- separated from shafts or fixing by supplementary insulation		N/A
19.12	Winding construction		P
19.12.1	Undue displacement in all types of transformers not allowed:		P
	- of input or output windings or turns thereof	Primary and secondary winding are fixed by tape and bobbin	P
	- of internal wiring or wires for external connection	PRI lead wires, soldered to the winding / thermal link, and fixed in position by several layers of insulation tape. SEC output cord, Fixed by tape. Output cord routed through a cord anchorage/bushing into the enclosure.	P
	- of parts of windings or of internal wiring in case of rupture or loosening	Windings will remain in position due to mechanical fixation and usage of bobbin and tape	P
19.12.2	Serrated tape:		P
	- distance through insulation according to table 22		P
	- one additional layer of serrated tape, and		P
	- one additional layer without serration		P
	- in case of cheekless bobbins the end turns of each layer shall be prevented from being displaced		P
19.12.3	Insulated winding wires, in an insulation system providing basic, supplementary or reinforced insulation, shall meet the following requirements.		N/A
	• Multi-layer extruded or spirally wrapped insulation, passed the tests of annex K		N/A
	• Basic insulation: two wrapped or one extruded wire		N/A
	• Supplementary insulation: two layers, wrapped or extruded		N/A
	• Reinforced insulation: three layers wrapped or extruded		N/A
	Spirally wrapped insulation:		N/A
	• creepage distances between wrapped layers > cl. 26 _ P1 values		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	• path between wrapped layers sealed, the test voltage of K2 is multiplied with 1,35		N/A
	• test 26.2.4 – Test A, passed for wrapped layers		N/A
	• the finished component pass routine test for the electric strength test according to cl. 18.3		N/A
a)	Insulated winding wire used for basic or supplementary insulation in a wound part:		N/A
	• comply with annex K		N/A
	• two layers for supplementary insulation		N/A
	• one layer for basic insulation		N/A
	• one layer for mechanical separation between the insulated wires of primary and secondary. This layer fulfils the requirement of basic insulation.		N/A
b)	Insulated winding wire used for reinforced insulation in a wound part:		N/A
	• comply with annex K		N/A
	• three layers		N/A
	• relevant dielectric strength test of 18.3		N/A
	Where the insulated winding wire is wound:		N/A
	• upon metal or ferrite cores		N/A
	• upon enamelled wire		N/A
	• under enamelled wire		N/A
	• one layer for mechanical separation between the insulated wires and the core or the enamelled wires is required. This layer fulfils the requirement of basic insulation.		N/A
	• both windings shall not touch each other and also not the core.		N/A
	100 % routine test of Annex K3 is fulfilled		N/A
	no creepage distances and clearances for insulated winding wires		N/A
c)	Toroidal cores used with TIW wires for double or reinforced insulation between the primary and secondary circuits shall comply with the following:		N/A
	1) a coating which fulfils the requirements of basic insulation between a winding and the core		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	2) The primary winding consists of TIW wire with 3 layers (reinforced insulation) and the secondary winding consists of enamelled wire. These independent windings shall not be able to contact each other either by mechanical separation or a gap which fulfil the dielectric strength tests for basic insulation.		N/A
	3) For polyfilar windings (primary and secondary windings in contact with each other), the primary winding consists of TIW wire with 3 layers and the secondary winding consists of a TIW wire with 1 layer (requirements for primary and secondary windings can be changed). This construction also is allowed for use with EE-cores or similar.		N/A
d)	Toroidal cores used with FIW wires for double or reinforced insulation between the primary and secondary circuits shall comply with the following:		N/A
	1) a coating, which fulfil the requirements of basic insulation.		N/A
	2) The primary winding consists of FIW wire for reinforced insulation and the secondary winding consist of FIW wire – of basic insulation. These independent windings shall not be able to contact each other either by mechanical separation or a gap which fulfil the dielectric strength test for basic insulation.		N/A
	3) For polyfilar windings (primary and secondary windings in contact with each other), the primary winding and the secondary winding consist of FIW wire for reinforced insulation. This construction also is allowed to use for EE-core or similar.		N/A
e)	Toroidal cores used with TIW in combination with FIW wire, for double or reinforced insulation between the primary and secondary circuits shall comply with the following:		N/A
	1) a coating, which fulfils the requirements of basic insulation.		N/A
	2) The primary winding consists of FIW wire for reinforced insulation, and the secondary winding consists of TIW wire for basic insulation (1 layer). These independent windings shall not be able to contact each other either by mechanical separation or a gap which fulfil the dielectric strength tests for basic insulation.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	3) For polyfilar windings (primary and secondary windings in contact with each other), the primary winding consists of TIW wire for reinforced insulation (3 layer) and the secondary winding consists of FIW wire for reinforced insulation. This construction also is allowed for use with EE-cores or similar.		N/A
f)	Toroidal cores used with TIW in combination with FIW wire, for basic insulation between the primary and secondary circuits shall comply with the following:		N/A
	1) a coating, which fulfils the requirements of basic insulation		N/A
	2) The primary winding consists of FIW wire for basic insulation, and the secondary winding consists of TIW wire for basic insulation (1 layer). These independent windings shall not be able to contact each other either by mechanical separation or a gap which fulfils the dielectric strength tests for basic insulation.		N/A
	3) For polyfilar windings (primary and secondary windings in contact with each other), the primary winding consists of TIW wire for supplementary insulation (2 layers) and the secondary winding consists of FIW wire for basic insulation. This construction also is allowed for use with EE-cores or similar.		N/A
	4) Further polyfilar constructions with FIW and TIW wires in combination with enamelled wires for basic insulation only: 4.1) Primary winding consists of enamelled wire, secondary winding consists of FIW wire for reinforced insulation 4.2) Primary winding consists of enamelled wire, secondary winding consists of TIW wire for reinforced insulation		N/A
19.12.3.1	Max. class F for transformers which use FIW-wire		N/A
19.12.3.2	FIW wires comply with IEC 60851-5:2008, IEC 60317-0-7 and IEC 60317-56.		N/A
	• other nominal diameter as mentioned in table 24 can be calculated with the Formula (6) in 26.3.5:		N/A
	FIW wire used for basic or supplementary insulation for transformers according 19.1.3:		--
	• the test voltage of table 14, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 24		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	• one layer for mechanical separation is located between the insulated wires of primary and secondary. This layer fulfil the requirement of basic insulation		N/A
	• between FIW and enamelled wire, no requirements of creepage distances and clearances		N/A
	• no touch of FIW and enamelled wires		N/A
	FIW wire used for double or reinforced insulation for transformers according 19.1.4:		--
	• the test voltage of table 14, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 24		N/A
	• for primary and secondary winding FIW-wire for basic insulation is used		N/A
	• one layer for mechanical separation is located between the insulated wires of primary and secondary. This layer fulfil the requirement of basic insulation		N/A
	• no touch between the basic insulated PRI and SEC FIW-wires		N/A
	• between PRI- and SEC-FIW wires, no requirements of creepage distances and clearances		N/A
	Alternative construction used for reinforced insulation (reinforced insulated FIW wire and enamelled wire)		N/A
	• the test voltage of table 14, based on the working voltage reinforced insulation, comply with the min. voltage strength of table 24		N/A
	• one layer for mechanical separation is located between the reinforced insulated FIW wire and the enamelled wire. This layer fulfil the requirement of basic insulation		N/A
	• no touch between the FIW wire and the enamelled wire		N/A
	• between the reinforced FIW wire and any other parts, no requirements of creepage distances and clearances exist		N/A
	Alternative construction with FIW wires, basic or supplementary insulated for transformers with double or reinforced insulation:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	• the test voltage of table 14, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 24		N/A
	• PRI or SEC basic insulated FIW wire and to the other winding (enamelled wire) requirements of supplementary insulation		N/A
	• creepage distances and clearances between the basic insulated FIW wire and the enamelled wire for basic or supplementary insulation are required.		N/A
	Where the FIW wire is wound		N/A
	• upon metal or ferrite cores		N/A
	• one layer for mechanical separation between the insulated wires and the core or the enamelled wires is required. This layer fulfils the requirement of basic insulation.		N/A
	• both windings shall not touch each other and also not the core.		N/A
19.13	Fixing of handles, operating levers and similar parts		N/A
	Handles, operating levers and similar parts shall be fixed in a reliable manner so that they will not become loose as a result of heating, vibration, etc. which may occur in normal use.		N/A
19.14	Fixing of covers providing protection against electric shock		P
	Protection against electric shock: covers securely fixed, 2 independent fixing means, one with tool	For building-in equipment and shall be evaluated in the end-product	P
19.15	Strain on fixed socket-outlets caused by pin-transformers connection		N/A
	Transformer with pins for fixed socket-outlets: no strain on socket-outlet		N/A
	Additional torque ≤ 0,25 Nm		N/A
19.16	Portable transformers for use in irregular or harsh conditions		N/A
	Portable transformers for use in irregular or harsh conditions		N/A
	Portable transformers having a weight not exceeding 18 kg shall have a protection index IPX4 or higher.		N/A
19.17	Drain hole of transformers protected against ingress of water		N/A
	Transformers having a protection index from IPX1 up to and including IPX6 shall have an effective drain hole at least 5 mm in diameter or 20 mm2 in area, with a width of at least 3 mm.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The drain hole is not required if the transformer, including its windings and core and all uninsulated live parts, are completely embedded in a potting material.		N/A
19.18	Plug connected transformers protected against ingress of water		N/A
	Transformers classified for a protection index higher than IPX1 and having a cord provided with a plug; it shall be a moulded-on plug.		N/A
19.19	Flexible cable or flexible cord connection for class I portable transformers		N/A
	Class I transformers with a non-detachable flexible cable or cord with earth conductor and a plug with earth contact		N/A
19.20	SELV- and PELV-circuit separation of live parts		N/A
	Live parts of SELV- and PELV-circuits shall be electrically separated from each other and from other circuits	For building-in equipment and shall be evaluated in the end-product	N/A
	- SELV output circuits separated by double or reinforced insulation from all other than SELV or PELV circuits		N/A
	- SELV output circuits separated by basic insulation from other SELV or PELV circuits		N/A
19.20.1	SELV circuits and parts not connected to protective earth, to live parts, or protective conductors forming part of other circuits		N/A
	Nominal voltage (V) > 25 V a.c. or 60 V d.c., the required insulation fulfils the high voltage test according to table 14		N/A
19.20.2	PELV-circuits double or reinforced insulation is necessary		N/A
19.21	Protection against contact for FELV-circuit		N/A
	FELV-circuits: protection against contact fulfils the min. test voltage required for the primary circuit		N/A
19.22	Protective earthing regarding class II transformers		N/A
	Class II transformers shall not be provided with means for protective earth		N/A
	A class II transformer intended for looping-in may have an internal terminal for maintaining the electrical continuity of a protective earthing conductor not terminating in the transformer, provided that the terminal is insulated from the accessible conductive parts by class II insulation.		N/A
19.23	Protective earthing regarding class III transformers		N/A
	Class III transformers shall not be provided with means for protective earth		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
20	**COMPONENTS**		P
20.1	Components such as switches, plugs, fuses, lamp holders, capacitor and flexible cables and cords, comply with relevant IEC standard	See appended Critical Component list.	P
	Components inside the transformer pass all tests of this standard together with the transformer tests		P
	Testing of components separately to the transformer according the relevant standard:		P
	- Ratings of the component in line with the transformer ratings, including inrush current. Component test according the component standard, based on the component marking (rating).		N/A
	- Components without markings tested under transformer conditions including inrush current.		P
	- If no IEC standard exists, the component is tested under transformer conditions.	Components complied with IEC or UL. Components which comply with UL standard only are tested additionally under transformer conditions.	P
20.2	Appliance couplers for main supply shall comply with:		N/A
	- IEC 60 320 for IPX0		N/A
	- IEC 60320-2-3 or IEC 60309 for other		N/A
20.3	Automatic controls shall comply with IEC 60730-1		N/A
20.4	Thermal-links comply with IEC 60691		N/A
20.5	Switches shall comply with annex F	No switch	N/A
	Disconnection from the supply:		N/A
	- by a switch, disconnecting all poles of the supply (full disconnection under the relevant overvoltage category)		N/A
	- or a flexible supply cable and cord with plug		N/A
	- or an instruction sheet: disconnection by all-poles switches incorporated in fixed wiring		N/A
20.6	Socket-outlets of the output circuit shall be such that there is no unsafe compatibility to plugs complying with input circuit.		N/A
	SELV plug and socket-outlets shall comply with IEC 60 884-2-4 and IEC 60 906-3		N/A
	Plugs and socket-outlets for SELV systems with both a rated current ≤3A and a rated voltage ≤ 24 VAC or 60VDC with a power not exceeding 72W are allowed to comply only with following:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- It is not possible for plugs to enter socket-outlets of other standardised voltage system		N/A
	- Socket outlets do not accommodate plugs of other standardised voltage systems		N/A
	- Socket outlets do not have a protective earth contact		N/A
	PELV plug and socket-outlets shall comply with following:		N/A
	- It is not possible for plugs to enter socket-outlets of other standardised voltage system		N/A
	- Socket outlets do not accommodate plugs of other standardised voltage systems		N/A
	- Socket outlets do not have a protective earth contact		N/A
	FELV plug and socket-outlets shall comply with following:		N/A
	- It is not possible for plugs to enter socket-outlets of other standardised voltage system		N/A
	- Socket outlets do not accommodate plugs of other standardised voltage systems		N/A
20.7	Thermal cut-outs, thermal links, overload relays, fuses and other overload protective devices shall have adequate breaking capacity		P
	- Thermal cut outs fulfil the relevant requirements of 20.8 and 20.9		N/A
	- Thermal links fulfil the relevant requirements of 20.9		N/A
	- The breaking capacity is in accordance with the relevant fuse standard		P
	For fuses according IEC 60127 and IEC 60269, the fuse current does not exceed 1,1 times of the rated value		P
20.8	Thermal cut outs shall meet the requirements of 20.8.1.1 and 20.8.2, or 20.8.1.2 and 20.8.2.		N/A
20.8.1	Requirements according to IEC 60730-1		N/A
20.8.1.1	Thermal cut-out tested as component shall comply with IEC 60 730-1		N/A
	a) Thermal cut outs type 1 or type 2 (see 6.4 of IEC 60730-1:2013)		N/A
	b) Thermal cut outs fulfil the requirements of micro-interruption (type 1.C or 2.C) or micro-disconnection, (type 1.B or 2.B) (see IEC 60730-1:2013)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	c) Thermal cut outs with manual rest have a trip free mechanism (type 1.E and 2.E) (see IEC 60730-1:2013)		N/A
	d) The number of cycles of automatic action shall be:		N/A
	- 3000 cycles for self-resetting thermal cut-outs		N/A
	- 300 cycles for non-self-resetting thermal cut-outs resetting by hand		N/A
	- 300 cycles for non-self-resetting thermal cut-outs resetting disconnecting		N/A
	- 30 cycles for non-self-resetting thermal cut-outs which are only resettable by a tool		N/A
	e) Thermal cut outs fulfil the electrical stress according 6.14.2 of IEC 60730-1:2013		N/A
	f) Characteristic of thermal cut-outs:		N/A
	- ratings according IEC 60730-1:2013, cl. 5		N/A
	- classification according to:		N/A
	1) nature of supply to IEC 60730-1:2013, cl. 6.1		N/A
	2) type of load controlled to IEC 60730-1:2013, cl. 6.2		N/A
	3) degree of protection IPX0 to IEC 60730-1:2013, cl. 6.5.1		N/A
	4) degree of protection IP0X to IEC 60730-1:2013, cl. 6.5.2		N/A
	5) pollution degree to IEC 60730-1:2013, cl. 6.5.3		N/A
	6) comparative tracking index to IEC 60730-1:2013, cl. 6.13		N/A
	7) max. ambient temperature to IEC 60730-1:2013, cl. 6.7		N/A
20.8.1.2	Thermal cut-out tested as a part of the transformer, test with 3 samples:		N/A
	- at least micro-interruption or micro-disconnection (IEC 60730-1:2013)		N/A
	- 300 h aged at ta (transformer) + 10°C		N/A
	- subjected to a number of cycles for automatic operating according 20.8.1.1		N/A
	During the test no sustaining arcing shall occur, during and after the test no damage at the thermal cut out and the transformer in the sense of this standard		N/A
20.8.2	Thermal cut-outs shall have adequate breaking capacity		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
20.8.2.1	The output of the transformer with a non-self-resetting thermal cut out is short circuited at a supply voltage 1, 1 of rated supply voltage. After opening of the cut off, the supply voltage is switched of, until the transformer is cooling down.		N/A
	- 3 cycles at 25° C for transformers without t_{amin}		N/A
	- 3 cycles at t_{amin} for transformers with t_{amin}		N/A
	- after the 3 cycles short circuit of the output at 1,1 of rated supply voltage for 48 h.		N/A
	During the tests no sustaining arcing shall occur After the test: withstand the test of clause 18, show no damage in sense of this standard, and be operational.		N/A
20.8.2.2	The output of the transformer with a self-resetting thermal cut out is short circuited at a supply voltage 1, 1 of rated supply voltage.		N/A
	- 48 h at 25° C for transformers without t_{amin}		N/A
	- 24 h at ta and 24 h at t_{amin} for transformers with t_{amin}		N/A
	During the tests no sustaining arcing shall occur After the test: withstand the test of clause 18, show no damage in sense of this standard, and be operational.		N/A
20.8.3	Test of a PTC resistor:		N/A
	5 cycles: transformer short-circuited for 48 h by 1,1 times of the input voltage and max. ta		N/A
	5 cycles: transformer short-circuited for 48 h by 0,9 times of the input voltage and min. ta (if declared)		N/A
	After the test: withstand the test of clause 18, show no damage in sense of this standard, and be operational.		N/A
20.9	Thermal links shall be tested in one of the following two ways.		N/A
20.9.1	Thermal-links shall comply with IEC 60 691 as a separate component.		N/A
	- electrical conditions to IEC 60691, cl. 6.1		N/A
	- thermal conditions to IEC 60691, cl. 6.2		N/A
	- ratings to 8 b) of IEC 60691:2015		N/A
	- suitability of sealing components, impregnating fluids or cleaning solvents 8 c) of IEC 60691:2015		N/A
20.9.2	Thermal-links tested as a part of the transformer:		N/A
	- ageing test 300 h by 35 °C or ta + 10 °C		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- After transformer fault condition the thermal link operate without sustaining arcing		N/A
	- after opening the thermal-link shall have an insulation resistance of at least 0,2 MΩ		N/A
	- 3 cycles for replaceable thermal-links		N/A
	- 3 new specimens for not replaceable thermal-links		N/A
20.10	Self-resetting devices not used if mechanical, electrical, etc. hazards		N/A
20.11	Thermal cut-outs intended to be reset by soldering operation shall not be used for overload protection.		N/A
20.12	Overload protection devices do not operate during test (20 times switched on and off, at no load); Upri (V): 1,1 times rated supply voltage.		P
21	**INTERNAL WIRING**		N/A
21.1	Internal wiring and electrical connections protected or enclosed		N/A
	Wire-ways smooth and free from sharp edges		N/A
21.2	Openings in sheet metal: edges rounded (radius ≥ 1,5 mm) or bushings of insulating material		N/A
21.3	Uninsulated conductors: distances adequately maintained		N/A
21.4	When external wires are connected to terminal, internal wiring shall not loosen up		N/A
21.5	Insulation of heat-resistant and non-hygroscopic material for insulated conductors subject to temperature rise > limiting values given in 14.1		N/A
22	**SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CABLES AND CORDS**		P
22.1	All cables, flexible cords etc. shall have appropriate current and voltage ratings		P
22.2	Input and output wiring inlet and outlet openings for external wiring: separate entries without damage to protective covering of cable or cord		P
	Input and output wiring inlet and outlet openings for flexible cables or cords: insulating material or bushing of insulating material		P
	Bushings for external wiring: reliably fixed, not of rubber unless part of cord guard		N/A
22.3	Fixed transformer:		P
	- possible to connect after fixing		P
	- inside space for wires allow easy introduction and connection of conductors		P
	- fitting of cover without damage to conductors		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- contact between insulation of external supply wires and live parts of different polarity not allowed		N/A
22.4	Length of power supply cord for portable transformers:		N/A
	- not exceed 2 m for cross-sectional area of 0,5 mm^2		N/A
	- exceed 2 m for cross-sectional areas greater than 0,5 mm^2.		N/A
22.5	Power supply cords for transformers IP20 or higher and transformers for “indoor use only” ≥ IP20:		N/A
	- for transformers with a mass ≤ 3 kg: IEC 60227-5:2011 – type 60227 IEC 52 or ordinary tough rubber sheathed flexible cable or cords according to IEC 60245-4:2011 – type 60245 IEC 53;		N/A
	- for transformers with a mass > 3 kg: IEC 60227-5:2011 – type 60227 IEC 53 or ordinary tough rubber sheathed flexible cable or cords according to IEC 60245-4:2011 – type 60245 IEC 53.		N/A
	Power supply cords for transformers for outdoor use: ≥ IPX0: IEC 60245-4:2011 – type 60245 IEC 57		N/A
22.6	Power supply cords for single-phase portable transformers with input current ≤ 16A:		N/A
	- cord set fitted with an appliance coupler in accordance with IEC 60320(all parts)		N/A
22.7	Nominal cross-sectional area (mm^2); input current (A) at rated output not less than shown in table 16		N/A
22.8	Class I transformer with power supply flexible cable: green/yellow core connected to earth terminal		N/A
	Plug for single-phase transformer with input current at rated output ≤16 A shall comply with IEC TR 60083, IEC 60 906-1 or IEC 60 309(all parts)		N/A
22.9	Type X, Y or Z attachments: see relevant part of IEC 61558-2.		N/A
22.9.1	For type Z attachment: moulding enclosure and external flexible cable or cord do not affect insulation of cable		N/A
22.9.2	Inlet openings or inlet bushing: without risk of damage to protective covering of external flexible cable or cord		N/A
	Insulation between conductor and enclosure:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- for Class I transformer: insulation of conductor plus separate basic insulation		N/A
	- for Class II transformer: insulation of conductor plus double or reinforced insulation		N/A
	The sheath of an external flexible cable or cord equivalent to at least that of a cord complying with IEC 60227 (all parts) or 60245 (all parts) is regarded as basic insulation.		N/A
	A lining or a bushing of insulating material in a metallic enclosure is only regarded as supplementary insulation		N/A
	An enclosure of insulating material is regarded as reinforced insulation		N/A
22.9.3	Inlet bushings:		N/A
	- no damage to external flexible cable or cord		N/A
	- reliably fixed		N/A
	- not removable without tool		N/A
	- not integral with external flexible cable or cord (for type X attachment)		N/A
	- not of natural rubber except for Class I transformer with type X, Y and Z attachments		N/A
22.9.4	For transformers which are moved while operating:		N/A
	- cord guards, if any, of insulating material and fixed		N/A
	Compliance is tested by the oscillating test according to fig. 12:		N/A
	- loaded force during the test according to fig. 12		N/A
	- 10 N for a cross-sectional area > 0,75		N/A
	- 5 N for other cords		N/A
	After the test according to fig. 12:		N/A
	- no short-circuit between the conductors		N/A
	- no breakage of more than 10% of stands of any conductor		N/A
	- no separation of the conductor from the terminal		N/A
	- no loosening of any cord guards		N/A
	- no damage of the cord or cord guard		N/A
	- no broken strands piercing the insulation and not becoming accessible		N/A
22.9.5	Cord anchorages for type X attachment:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- glands in portable transformers not used unless possibility for clamping all types and sizes of cable		N/A
	- moulded-on designs, tying the cable into a knot and tying the end with string not allowed		N/A
	- labyrinths, if clearly how, permitted		N/A
	- replacement of cable easily possible		N/A
	- protection against strain and twisting clearly how		N/A
	- suitable for different types of cable unless only one type of cable for transformer		N/A
	- the entire flexible cable or cord with covering can be mounted into the cord anchorage		N/A
	- if tightened or loosened no damage		N/A
	- no contact between cable or cord and accessible or electrically connected clamping screws		N/A
	- cord clamped by metal screw not allowed		N/A
	- one part securely fixed to transformer		N/A
	- for Class I transformer: insulating material or insulated from metal parts		N/A
	- for Class II transformers: insulating material or supplementary insulation from metal parts		N/A
	Cord anchorages for type X, Y, Z attachments: cores of power external flexible cable or cord insulated from accessible metal parts by:		N/A
	- basic insulation (Class I transformers), separate insulating barrier/cord anchorage		N/A
	- supplementary insulation (Class II transformers), special lining/cable or cord sheath of cable sheath of cable		N/A
	Cord anchorages for type X and Y attachments:		N/A
	- replacement of external flexible cable or cord does not impair compliance with standard		N/A
	- the entire flexible cable or cord with covering can be mounted into the cord anchorage		N/A
	- if tightened or loosened no damage		N/A
	- no contact between cable or cord and accessible or electrically connected clamping screws		N/A
	- cord clamped by metal screws not allowed		N/A
	- knots in cord not used		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- labyrinths, if clearly how, permitted		N/A
	Tests for type X with special cords, type Y, type Z		N/A
	Test for type X attachments one test with a cord with smallest and one test with a cord with the largest cross-sectional area:		N/A
	- for the test with clamping screws or tightened with torque 2/3 of that specified in table 18		N/A
	- not possible to push cable into transformer		N/A
	- 25 pulls of 1 s		N/A
	- 1 min torque according to table 17		N/A
	- mass (kg); pull (N); torque (Nm) ……:		—
	- during test: cable not damaged		N/A
	- after test: longitudinal displacement ≤ 2 mm for cable or cord and ≤ 1 mm for conductors in terminals		N/A
	- creepage distances and clearances values specified in Cl. 26		N/A
22.9.6	Space for external cords or cable for fixed wiring and for type X and Y attachments:		N/A
	- before fitting cover, possibility to check correct connection and position of conductors		N/A
	- cover fitted without damage to supply cords		N/A
	- for portable transformers: contact with accessible metal parts if conductor becomes loose not allowed unless for type X and Y attachments terminations of cords do not slip free of conductor		N/A
	Space for external cords or cable for type X attachment and for connection to fixed wiring, in addition:		N/A
	- conductor easily introduced and connected		N/A
	- possibility of access to terminal for external conductor after removal of covers without special purpose tool		N/A
23	**TERMINALS FOR EXTERNAL CONDUCTORS**		P
23.1	Transformer for connection to fixed wiring and transformer without power supply cords with type Y and Z attachments: only connections by screws, nuts or equally effective devices.		P
	Terminals are integral part of the transformer:		P
	- comply with IEC 60 999-1 under transformer conditions		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Other terminals:		N/A
	- separately checked according to IEC 60 998-2-1, IEC 60 998-2-2 or IEC 60 947-7-1		N/A
	- used in accordance with their marking		N/A
	- checked according to IEC 60 999-1 under transformer conditions		N/A
	Transformer with type X attachments: soldered connection permitted if reliance not placed upon soldering, crimping or welding alone unless by barriers, creepage distances and clearances between hazardous live parts and other conductive part cannot be reduced to less than 50% of specified value (Cl.26) should conductor break away		N/A
	Transformer with type Y and Z attachments for external conductors: soldered, welded, crimped, etc. connections allowed		N/A
	For Class II transformer: reliance not placed upon soldering, crimping or welding alone unless by barriers, creepage distances and clearances between hazardous live parts and other conductive parts cannot be reduced to less than 50% of specified value (Cl.26) should conductor break away		N/A
23.2	Terminals for type X with special cords Y and Z attachments shall be suitable for their purpose:		N/A
	- test by inspection according to 23.1 and 23.2		N/A
	- pull of 5 N to the connection before test according to 14.1		N/A
23.3	Other terminals than Y and Z attachments shall be so fixed that when the clamping means is tightened or loosened:		N/A
	- terminal does not work loose		N/A
	- internal wiring is not subjected to stress		N/A
	- creepage distances and clearance are not reduced below the values specified in Cl. 26		N/A
23.4	Other terminals than Y and Z attachments shall be so designed that:		N/A
	- they clamp the conductor between metallic surfaces with sufficient contact pressure		N/A
	- without damage to the conductor		N/A
	- test by inspection according to 23.3 and 23.4		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- 10 times fastening and loosening a conductor with the largest cross-sectional area with 2/3 of the torque specified in Cl. 25		N/A
23.5	Terminals for fixed wiring and for type X: located near their associated terminals of different polarities and the earth terminal if any		N/A
23.6	Terminal blocks not accessible without the aid of a tool		P
23.7	Transformer with type X attachments: stranded conductor test (8 mm removed):		N/A
	- Class I transformers: no connection between live parts and accessible metal parts		N/A
	- free wire of earth terminal: no touching of live parts		N/A
	- Class II transformers: no connection between live parts and accessible metal parts, no connection between live parts and metal parts separated from accessible metal parts by supplementary insulation		N/A
23.8	Terminals for a current > 25 A:		N/A
	- pressure plate, or		N/A
	- two clamping screws		N/A
23.9	When terminal, other than protective earth conductor, screws loosened as far as possible, no contact:		N/A
	- between terminal screws and accessible metal parts		N/A
	- between terminal screws and accessible metal parts separated only by basic or supplementary insulation for Class II transformers		N/A
24	**PROVISION FOR PROTECTIVE EARTHING**		N/A
24.1	Class I transformers: accessible conductive parts connected to earth terminal	For building-in equipment and shall be evaluated in the end-product	N/A
	Class II transformers: no provision for protective earth		N/A
24.2	Protective earth terminal for connection to fixed wiring and for type X attachment transformers: comply with Cl. 23, adequately locked, not possible to loosen without a tool		N/A
24.3	No risk of corrosion from contact between metal of earth terminal and other terminal		N/A
	In case of earth terminal body of Al, no risk of corrosion from contact between Cu and Al		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Body of earth terminal or screws/nuts of brass or other metal resistant to corrosion		N/A
24.4	Resistance of connection between earth terminal and metal parts ≤0,1Ω with a min. 25 A or 1,5 times rated input current at 1 min		N/A
24.5	Class I transformers with external flexible cables or cords:		N/A
	- current-carrying conductors becoming touch before the earth conductor		N/A
25	**SCREWS AND CONNECTIONS**		**P**
25.1	Screwed connections withstand mechanical stresses		P
	Screws transmitting contact pressure or likely to be tightened by the user or having a diameter < 2,8 mm, shall screw into metal		P
	Screws not of metal which is soft or liable to creep (Zn, Al)		P
	Screws of insulating material: not used for electrical connection		N/A
	Screws not of insulating material if their replacement by metal screws can impair supplementary or reinforced insulation		N/A
	Screws to be removed (replacement etc. of power supply cord) not of insulating material if their replacement by metal screws can impair basic insulation		P
	For a screw in engagement with the threads of insulating material: No damage after torque test: diameter (mm); torque (Nm); ten times	(see appended table)	P
	For nuts and other screws: No damage after torque test: diameter (mm); torque (Nm); five times		N/A
25.2	Screws in engagement with thread of insulating material:		P
	- length of engagement ≥ 3 mm + 1/3 screw diameter or 8 mm whichever is shorter		P
	- correct introduction into screw hole		P
25.3	Electrical connections: contact pressure not transmitted through insulating material		P
25.4	In case of use of thread-forming (sheet metal) screws for connection of current-carrying parts: clamping and locking means provided		P
	Thread-cutting (self-tapping) screws used for the connection of current-carrying parts allowed if they generate a full form machine screw thread and if not operated by the user		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Thread-cutting screws and thread-forming screws used for earth continuity allowed if at least 2 screws for each connection are used and it is not necessary to disturb the connection in normal use		N/A
25.5	Screws for current-carrying mechanical connections locked against loosening		N/A
	Rivets for current-carrying connections subject to torsion locked against loosening		N/A
25.6	Test of screwed glands with a torque according table 19. After the test no damage at the transformer and the gland.		N/A
26	**CREEPAGE DISTANCES, CLEARANCES AND DISTANCES THROUGH INSULATION**		P
26.2	Creepage distances and clearances		P
26.2.1	General		P
	The creepage distance and clearance values are shown in Table 20 and Table 21.		P
26.2.2	Windings covered with adhesive tape		P
	- all insulating materials are classified according to IEC 60085 and IEC 60216 (all parts);		N/A
	- the impulse voltage dielectric test of 6.1.2.2.1 of IEC 60664-1:2007 is fulfilled; and		P
	- test A of 26.2.4 is fulfilled		N/A
26.2.3	Uncemented insulating parts pollution degree P2 or P3	Pollution degree 2	P
	- all isolating material are classified acc. to IEC 60085 and IEC 60216(all parts)		P
	- values of pollution degree 1 are not applicable		P
26.2.4	Cemented insulating parts		N/A
	- all isolating materials are classified acc. to IEC 60085 and IEC 60216(all parts)		N/A
	- values of distance through insulation (dti) are fulfilled		N/A
	- creepage distances and clearances are not required		N/A
	- test A of this sub clause is fulfilled		N/A
	Test A		N/A
	- thermal class		N/A
	- working voltage		N/A
	- Test with three specially specimens, with uninsulated wires, without impregnation or potting	(see appended table)	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Two of the three specimens are subjected to:		N/A
	- the relevant humidity treatment according to 17.2 (48 h)		N/A
	- the relevant dielectric strength test of 18.3 multiplied with factor 1,35		N/A
	- One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,35 immediately at the end of the last cycle with high temperature		N/A
	Impulse dielectric test according to 6.1.2.2.1 of IEC 60664-1:2007 – see Annex R of IEC 61558-1		N/A
26.2.5	Enclosed parts (e.g. by impregnation or potting)		N/A
26.2.5.1	- The requirements of reduced values as stated for pollution degree 1 (P1) are fulfilled		N/A
	- all isolating materials are classified acc. to IEC 60085 and IEC 60216(all parts)		N/A
	Test B		N/A
	- thermal class		N/A
	- test voltage of 500 V or the working voltage		N/A
	- Test with three specially specimens, potted or impregnated. The dielectric strength test is applied directly to the joint.	(see appended table)	N/A
	Two of the three specimens are subjected to:		N/A
	- the relevant humidity treatment according to 17.2 (48 h)		N/A
	- the relevant dielectric strength test of 18.3 multiplied with factor 1,25		N/A
	- One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,25 immediately at the end of the last cycle with high temperature		N/A
	The three spacemen pass the Impulse dielectric test according to 6.1.2.2.1 of IEC 60664-1:2007– see Annex R of IEC 61558-1		N/A
26.2.5.2	- The requirements of distance through insulation (dti) are fulfilled. (P1 values are not required)		N/A
	- all isolating materials are classified acc. to IEC 60085 and IEC 60216(all parts)		N/A
	Test C		N/A
	- thermal class		N/A
	- test voltage of 500 V or the working voltage		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- Test with three specimens, potted or impregnated. (finished components)	(see appended table)	N/A
	- Neither cracks, nor voids in the insulating compounds		N/A
	Two of the three specimens are subjected to:		N/A
	- the relevant humidity treatment according to 17.2 (48 h)		N/A
	- the relevant dielectric strength test of 18.3 multiplied with factor 1,35		N/A
	- One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,35 immediately at the end of the last cycle with high temperature		N/A
	The three spacemen pass the Impulse dielectric test according to 6.1.2.2.1 of IEC 60664-1:2007 – see Annex R of IEC 61558-1		N/A
26.3	Distance through insulation		P
26.3.1	For supplementary, double or reinforced insulation, the required values of Tables 22 are fulfilled		P
	The insulation fulfil the material classification according IEC 60085 and 60216(all parts) or the test of 14.3		P
26.3.2	Reduced values of the thickness of insulation for supplementary or reinforced insulation are allowed if the following conditions are fulfilled:		N/A
	- the isolating materials are classified acc. to IEC 60085 and IEC 60216(all parts)		N/A
	- the test of 14.3 is fulfilled		N/A
	- If both requirements are fulfilled, the required values for solid insulation can be multiplied by 0,4		N/A
	- Minimum thickness of reinforced insulation ≥0,2 mm		N/A
	- Minimum thickness of supplementary insulation ≥0,1 mm		N/A
26.3.3	Insulation in thin sheet form		P
	- If the layers are non-separable (glued together):		N/A
	• The requirement of 3 layers is fulfilled		N/A
	• The mandrel test according 26.3.4 is fulfilled with 150±10 N		N/A
	• The required values for d.t.i. of thin layers in Tables 22 is fulfilled.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- If the layers are separated:		P
	• The requirement of 2 layers is fulfilled	Insulation tape wrap around external of switch mode transformer	P
	• If serrated tape is used, 1 additional layer (serrated) and one additional layer without serration is required		N/A
	• The mandrel test according 26.3.4 is fulfilled on each layer with 50±5 N		P
	• The required values for d.t.i. of thin layers in Tale 22 is fulfilled.		P
	- If the layers are separated (alternative):		N/A
	• The requirement of 3 layers is fulfilled		N/A
	• If serrated tape is used, 1 additional layer (serrated) and one additional layer without serration is required		N/A
	• The mandrel test according 26.3.4 is fulfilled on 2/3 of the layers with 100±5 N		N/A
	• The required values for d.t.i. of thin layers in Tale 22 is fulfilled.		N/A
	Test according to 14.3 and if the isolating materials are classified acc. to IEC 60085 and IEC 60216(all parts) no distances through insulation are required for insulation in thin sheet form		N/A
	The values for thin layers are used for insulation in thin sheet form as follows:		P
	- rated output > 100 VA values for thin layers apply		N/A
	- rated output ≥ 25 VA and ≤ 100 VA 2/3 of the values for thin layers apply		P
	- rated output < 25 VA 1/3 of the values for thin layers apply		N/A
26.3.4	Mandrel test of insulation in thin sheet form (specimen of 70±0,5 mm width are necessary):		P
	- If the layers are non-separable – at least 3 layers glued together fulfil the test:		N/A
	- pull force of 150±10 N		N/A
	- high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,35 whatever is the greater. No flashover, no breakdown.		N/A
	- If the layers are separable and 2/3 of at least 3 layers fulfil the test.		N/A
	- pull force of 100±5 N		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdowns.		N/A
	- If the layers are separable 1 of at least 2 layers fulfil the test:		P
	- pull force of 50±5 N		P
	- high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdown.		P
26.3.5	For transformers with FIW wires		N/A
	- thermal cycles		N/A
	- test voltage of 500 V or the working voltage		N/A
	- Test with three specimens	(see appended table)	N/A
	Two of the three specimens are subjected to:		N/A
	- the relevant humidity treatment according to 17.2 (48 h)		N/A
	- the relevant dielectric strength test of 18.3		N/A
	- One of the three specimens is subjected to the relevant dielectric strength test of 18.3 immediately at the end of the last cycle with high temperature		N/A
	The partial discharge test shall be done at the end of the cycling test at normal room temperature as performed in 18.3.1.		N/A
	The values of allowed voltage strength for other FIW dimensions than defined in Table 24 are calculated		N/A
26.101	Creepage distances and distances through insulation given in Table 21, Table 22 and Table 23 of IEC 61558-1:2017 are generally applicable (IEC 61558-2-16: 2021)	(see appended table)	P
26.102	In compliance with IEC 60664-4:2005, the requirements of 26.103 to 26.106 for creepage distances, clearances and solid insulation are required above 30 kHz and up to the frequency of 3 MHz. For frequencies above 3 MHz, the tests in accordance with 7.4 and 7.5 of IEC 60664-4:2005, high-frequency testing (high-frequency high-voltage test and high-frequency partial discharge test) shall be carried out.		P
26.103	Clearance (IEC 61558-2-16:2021)		P
	a) Clearance for frequency ≥ 30 kHz according figure 101 two determinations are necessary:		N/A
	• determination based on the rated impulse voltage of the rated supply voltage in accordance with Table 103 and Table 104.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	• determination based on the measured peak working voltage in accordance with Table 106.		N/A
	b) Clearance for frequency ≤ 30 kHz according figure 101 two determinations are necessary:		P
	• determination based on the rated impulse voltage of the rated supply voltage in accordance with Table 103 and Table 104.		P
	• determination based on the measured peak working voltage in accordance with Table 105.		P
26.104	The working voltages of Table 105 and Table 106 for determination of clearances are peak working voltages. (IEC 61558-2-16: 2021)		P
	All peak working voltages including µs-peaks shall be used to determine clearances in accordance with Table 105 and Table 106.		P
26.105	Creepage distances (IEC 61558-2-16: 2021)		P
	Two determinations of creepage distances are necessary (see Figure 102)		P
	• determination based on the measured RMS working voltage in accordance with Table 21 of IEC 61558-1:2017;		P
	• determination based on the measured peak working voltage in accordance with Table 107 to Table 112 and the fundamental frequency shall be considered		P
	A high-frequency RMS ripple voltage content not more than 10% can be neglected.	II	P
	The values in Table 107 to Table 112 do not take into account the effects of tracking phenomena for frequencies above 30 kHz.		P
	The most severe value of the required creepage distances in accordance with Table 107 to Table 112 for frequencies above 30 kHz and the relevant values in Table 21 of IEC 61558-1:2017 shall take precedence.		P
	If the value of the creepage distance is lower than the value of the clearance, the value of the clearance shall be applicable for the creepage distance.		P
	The peak working voltage also includes any DC voltage and any repetitive peak impulse generated by the SMPS (see 26.105). A determination based on RMS values is also required (see 26.104 and Table 112).		N/A
26.106	Distance through insulation (IEC 61558-2-16:2021)		P
	Instead of partial discharge with high frequency voltage the test of the distance and the calculation of the electric field is applicable under the following conditions:		P
	- the max. frequency is < 10 MHz		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- the field strength approximately comply with Figure 103		P
	- no voids or gaps are present in between the solid insulation		P
	For thick layers d1 ≥ 0,75 the peak value of the field strength is ≤ 2 kV/mm		N/A
	For thin layers d2 ≤ 30 µm the peak value of the field strength is ≤ 10 kV/mm		N/A
	For d1 > d > d2 formula (2) is used for calculation the field strength		N/A
27	**RESISTANCE TO HEAT, FIRE AND TRACKING**		P
27.1	General		P
27.2	Resistance to heat		P
27.2.1	All insulating parts are resistant to heat		P
	For parts of rubber, which passed the test of 19.9, no additional test is required.	No rubber used	N/A
	The tests are not required for cables and small connectors with a rated current ≤ 3 A, a rated voltage ≤ 24 V AC or 60 V DC and a power ≤ 72 W		P
27.2.2	External accessible parts		P
	The Ball-pressure test: diameter of impression ≤ 2 mm; heating cabinet temperature (°C) at 70±2 °C or the temperature T of 14.1 (T+15±2) is fulfilled.	(See appended table)	P
27.2.3	Internal parts		P
	For insulating material retaining current carrying parts in position, the ball-pressure test -: diameter of impression ≤ 2 mm; heating cabinet temperature (°C) at 125±2 °C or the temperature T of 14.1 (T + 15±2) is fulfilled	(See appended table)	P
27.3	Resistance to abnormal heat under fault conditions		N/A
27.4	Resistance to fire		P
27.4.1	All isolating parts of the transformer shall be resistant to ignition and spread of fire. The test according to IEC 60695-2-10 is required		P
27.4.2	External accessible parts (glow wire tests)		N/A
	- 650°C for enclosures		N/A
	- 650 °C for parts retaining current carrying parts in position and terminals for external conductors Current ≤ 0,2 A		N/A
	- 750° C for parts retaining current carrying parts in position and terminals for external conductors with fixed wiring. Current > 0,2 A		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- 850° C for parts retaining current carrying parts in position and terminals for external conductors with non-fixed wiring. Current > 0,2 A		N/A
27.4.3	Internal parts		P
	- 550 °C for internal insulating material – not retaining current carrying parts in position		N/A
	- 650 °C for coil formers (bobbins)	T1	P
	- 650 °C for parts retaining current carrying parts in position and terminals for external conductors. Current ≤ 0,2 A		N/A
	- 750 °C for parts retaining current carrying parts in position and terminals for external conductors with fixed wiring. Current > 0,2 A	Bobbin, PCB, Terminal	P
	- 850 °C for parts retaining current carrying parts in position and terminals for external conductors with non-fixed wiring. Current > 0,2 A	Bobbin, PCB, Terminal	P
27.5	For IP other than IPX0: If insulating parts retaining current carrying parts in position and under P3 conditions, the material resistance to tracking is at least material of group IIIb		N/A
	Material group IIIb (100≤CTI≤175) is not recommended for application in pollution degree 3 above 630V		N/A
	Test (175 V): no flashover or breakdown before 50 drops		N/A
28	**RESISTANCE TO RUSTING**		**N/A**
	Ferrous parts protected against rusting		N/A
ANNEX E	**GLOW WIRE TEST**		**P**
E.1	The test is required according to IEC 60695-2-10 and IEC 60695-2-11 with the following additions:	Considered.	P
E.2	The requirements of 8.2, “Test temperatures” of IEC 60695-2-11:2014, apply with the temperature stated in 27.4 of IEC 61558-1		P
E.3	Clause 7, “Conditioning”, of IEC 60695-2-11:2014 apply, preconditioning is required		P
E.4	Clause 8, “Test procedure”, of IEC 60695-2-11:2014 apply, the tip of the glow wire is applied to the flat side of the surface.		P
ANNEX F	**REQUIREMENTS FOR MANUALLY OPERATED SWITCHES WHICH ARE PARTS OF THE TRANSFORMER**		**N/A**
F.2	Manually operated mechanical switches, tested as separate component, shall comply with IEC 61058:2016 under the conditions of F.2.		N/A

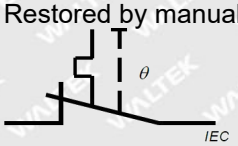
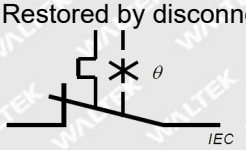
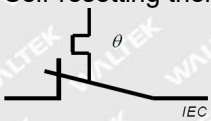
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Clause	Requirement + Test	Result - Remark	Verdict
F.3	Manually operated mechanical switches tested as part of the transformer shall comply with the conditions specified under F.3		N/A
ANNEX H	**ELECTRONIC CIRCUITS**		**P**
H.1	For transformers including electronic circuits, the following requirements apply additionally to Clauses 5, 15, 26. This annex is not required for associated transformers		P
H.2	General notes on tests (addition to clause 5)		P
H.3	SHORT-CIRCUIT AND OVERLOAD PROTECTION (ADDITION TO CLAUSE 15)		P
H.3.1	Circuits designed and applied so that fault conditions do not render the appliance unsafe		P
	During and after each test:		P
	- temperatures do not exceed values specified in table 5		P
	- transformer complies with conditions specified in sub-clause 15.1		P
	If a conductor of a pcb becomes open circuited, the transformer is considered to have withstood the particular test, provided that all six conditions as specified are met		N/A
H.3.2	Fault conditions a) to f) of sub-clause H.3.3 are not tested if the following conditions are met:		P
	- electronic circuit is a low-power circuit as specified		P
	- safety of the appliance as specified does not rely on correct functioning of the electronic circuit		P
H.3.3	Fault conditions tested as specified when relevant:		P
	a) short-circuit of creepage distances and clearances, if less than specified in Cl. 26		N/A
	b) open circuit at the terminals of any component		P
	c) short-circuit of capacitors, unless they comply with IEC 60 384-14		P
	d) short-circuit of any two terminals of an electronic component as specified		P
	e) any failure of an integrated circuit as specified		N/A
	f) low-power circuit: low-power points are connected to the supply source		P
	Cl. 15 is repeated with a simulated fault as indicated in a) to e), if the transformer incorporates an electronic circuit to ensure compliance with Cl. 15		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Fault condition e) is applied for encapsulated and similar components		N/A
	PTC's and NTC's are not short-circuited if they are used as specified		N/A
H.3.4	If for a fuse-link complying with IEC 60 127-3 rated fuse current I1 is used, current I2 is measured as specified:		P
	- if I2 < 2,1 x I1 test of 15.8 is repeated with fuse-link short-circuited		N/A
	- if I2 > 2,75 x I1, no other tests are necessary		N/A
	If I2 > 2,1 x I1 and I2 < 2,75 x I1 test of 15.8 is repeated as specified		N/A
	For fuses other than those complying with IEC 60 127-3, the test is carried out as specified 15.3.2 to 15.3.5		P
H.4	CREEPAGE DISTANCES, CLEARANCES AND DISTANCES THROUGH INSULATION (ADDITION TO CLAUSE 26)		N/A
H.4.1	For live parts separated by basic insulation smaller cr and cl as in 26 are allowed, if H.3 is fulfilled.		N/A
	In optocouplers no requirements of cr and cl		N/A
	For coatings annex W applies. Smaller distances as required in IEC 60664-3:2016, clause 4 are applicable,		N/A
	For potted transformers cycling tests according to 26.2. are applicable		N/A
H.4.2	The ma. surface temperature of optocouplers is 50 K		N/A
ANNEX K	**INSULATED WINDING WIRES**		**N/A**
K.1	Wire construction:		N/A
	• insulated winding wire for basic or supplementary insulation (see 19.12.3)		N/A
	• insulated winding wire for reinforced insulation (see 19.12.3)		N/A
	• splid circular winding wires and stranded winding wires with 0,05 to 5,0 mm diameter		N/A
	• spirally wrapped insulation – overlapping		N/A
K.2	Type tests		N/A
K.2.1	General Tests between ambient temperature between 15°C and 35°C and at a humidity between 25% and 75 %		N/A
K.2.2	Electric strength test		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
K.2.2.1	Solid circular winding wires and stranded winding wires		N/A
	Test samples prepared according to clause 4.4.1 of IEC 60851-5:2008 (twisted pair)		N/A
	Dielectric strength test: 6 kV for reinforced insulation		N/A
	Dielectric strength test: 3 kV for basic or supplementary insulation		N/A
K.2.2.2	Square or rectangular wires.		N/A
	Test samples prepared according to clause 4.7.1 of IEC 60851-5:2008		N/A
	Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
K.2.3	Flexibility and adherence		N/A
	Claus 5.1 in Test 8 of IEC 60851-3:2009 shall be used		N/A
	Test samples prepared according to clause 5.1.1.4 of IEC 60851-3:2009		N/A
	Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
	Mandrel diameter according table K.1		N/A
	The tension to the wire during winding on mandrel is 118 N/mm² (118 MPa)		N/A
K.2.4	Heat shock		N/A
	Test samples prepared according to 3.2.1 (in Test 9) of IEC 60851-6:2012		N/A
	• high voltage test immediately after this test		N/A
	• Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	• Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
K.2.5	Retention of dielectric strength after bending (test as specified under test 13 of 4.6.1 c) of IEC 60 851-5)		N/A
	• high voltage test immediately after this test		N/A
	• Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	• Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
K.3	Testing during manufacturing		N/A
K.3.1	General Tests as subjected in K.3.2 and K.3.3		N/A
K.3.2	Routine test		N/A
	• Dielectric strength test: 4,2 kV for reinforced insulation		N/A
	• Dielectric strength test: 2,1 kV for basic or supplementary insulation		N/A
K.3.3	Sampling test		N/A
K.3.3.1	Solid circular winding wires and stranded winding wires		N/A
	Test with a twisted pair, prepared according clause 4.4.1 of IEC 60851-5:2008		N/A
	• Dielectric strength test: 6 kV for reinforced insulation		N/A
	• Dielectric strength test: 3 kV for basic or supplementary insulation		N/A
K.3.3.2	Square or rectangular wire		N/A
	Samples prepared according to clause 4.7.1 of IEC 60851-5:2008		N/A
	• Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	• Dielectric strength test: 3 kV for basic or supplementary insulation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX V	ANNEX V, SYMBOLS TO BE USED FOR THERMAL CUT-OUTS		N/A
Figure V.1	Restored by manual operation 		N/A
Figure V.2	Restored by disconnection of the supply 		N/A
Figure V.3	Thermal link 		N/A
Figure V.4	Self-resetting thermal cut-out 		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

11 and 12	TABLE: OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD; NO-LOAD OUTPUT VOLTAGE					P
Clause		11		12		
type/rated output/	rated voltage (V)	sec. voltage (V)	delta Usec (%)	Usec V no-load output	delta Usec no-load output %	further information
GTD93035L6013.2-F / 13.2VDC 4.54A	13.2	12.98	-1.6	13.22	+1.8	9 VDC
	13.2	12.98	-1.6	13.22	+1.8	60 VDC
GTD93035H6013.2-F / 13.2VDC 4.54A	13.2	12.72	-3.6	13.13	+3.2	55 VDC
	13.2	12.72	-3.6	13.13	+3.2	150 VDC
Limits	---	---	±10	---	±20	---

14	TABLE: Heating Test					P
	Supply voltage (V) .....:	9VDC	9VDC	60VDC	60VDC	—
	Ambient (°C) .....:	See below	See below	See below	See below	—
Maximum measured temperature T of part/at.....:		T (°C)				max. temperature limit, (°C)
		Vertical	Horizontal	Vertical	Horizontal	--
Model: GTD93035L6013.2-F						
Input connector CON1		98.0	90.1	68.3	65.9	105
Output connector CON2		88.7	86.9	71.7	71.1	105
LF1 winding		106.8	101.1	70.2	68.6	120
LF2 winding		104.8	99.4	70.8	71.9	120
ZNR1 body		102.9	101.2	72.7	70.6	105
CY1 boy		52.8	98.8	68.2	50.7	125
C4 body		103.2	102.1	75.1	70.6	105
C10 body		102.3	98.3	76.5	74.8	105
PCB near D3 and L1		110.7	105.7	80.3	77.1	130
L1 core		103.8	99.5	75.8	73.4	120
L1 winding		115.1	110.2	79.3	77.0	120
T1 core		98.4	95.0	76.9	75.9	110
T1 winding		100.1	96.6	78.4	77.3	110
T2 core		98.7	95.3	74.8	73.3	110
T2 winding		101.3	97.7	77.1	75.6	110
PCB near T1		100.2	96.3	78.5	76.9	130
CY6 body		92.7	90.5	73.7	72.9	125

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Clause	Requirement + Test	Result - Remark	Verdict

U3 body	97.4	94.6	77.3	76.4	100
U4 body	97.0	94.0	77.3	76.2	100
CY4 body	88.4	86.1	70.3	69.9	125
CY5 body	90.9	88.1	72.1	71.4	125
L2 winding	95.9	92.8	76.1	75.2	120
C42 body	91.8	89.1	73.0	72.3	105
Enclosure outside near T1	85.8	81.5	65.7	67.5	--
Support near pin	83.6	82.3	55.7	64.6	85
Ambient	50.0	50.0	50.0	50.0	--

Supplementary information:

Temperature T of winding:	t_1 (°C)	R_1 (Ω)	t_2 (°C)	R_2 (Ω)	T (°C)	Allowed T_{max} (°C)	Insulation class
--	--	--	--	--	--	--	--

Supplementary information:

1. The heating test performed at unit continuous operation.
2. The maximum ambient temperature specified by manufacturer is 50°C.

14	TABLE: Heating Test					P
	Supply voltage (V) .....:	55VDC	55VDC	150VDC	150VDC	—
	Ambient (°C) .....:	See below	See below	See below	See below	—
Maximum measured temperature T of part/at.....:		T (°C)				max. temperature limit, (°C)
		Vertical	Horizontal	Vertical	Horizontal	--
Model: GTD93035H6013.2-F						
Input connector CON1		60.1	58.7	63.1	62.6	105
Output connector CON2		67.4	66.5	71.6	67.1	105
LF1 winding		62.1	60.9	67.0	65.0	120
LF2 winding		61.9	60.7	66.6	64.6	120
ZNR1 body		63.4	62.3	69.9	68.0	85
CY1 boy		61.4	60.2	66.0	64.0	125
CY8 boy		61.6	60.5	66.7	64.9	125
C4 body		64.7	63.8	72.7	70.8	105
C10 body		66.6	65.6	76.3	73.9	105
T3 winding		68.8	68.0	73.7	69.9	120
PCB near D3 and L1		66.5	65.4	77.5	75.4	130
L1 core		63.8	59.7	51.1	73.3	120
L1 winding		65.4	64.3	77.6	75.6	120

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Clause	Requirement + Test	Result - Remark	Verdict

T1 core	62.7	61.6	69.2	67.1	110
T1 winding	66.9	66.0	72.4	69.5	110
T2 core	66.1	68.3	74.4	70.1	110
T2 winding	69.2	65.3	72.8	71.5	110
PCB near T1	68.4	67.5	75.2	72.4	130
CY6 body	69.2	68.1	76.8	74.3	125
U3 body	72.3	71.3	77.3	74.0	100
U4 body	71.7	70.6	76.4	73.0	100
CY4 body	65.9	65.0	70.3	67.0	125
CY5 body	66.9	65.9	71.2	68.1	125
L2 winding	70.0	69.1	74.7	71.7	120
C42 body	67.5	66.7	72.1	68.8	105
Enclosure outside near T1	63.7	65.4	71.4	65.2	--
Support near pin	60.3	59.1	64.0	62.8	85
Ambient	50.0	50.0	50.0	50.0	--

Supplementary information:

Temperature T of winding:	t_1 (°C)	R_1 (Ω)	t_2 (°C)	R_2 (Ω)	T (°C)	Allowed T_{max} (°C)	Insulation class
--	--	--	--	--	--	--	--

Supplementary information:

1. The heating test performed at unit continuous operation.
2. The maximum ambient temperature specified by manufacturer is 50°C.

15	TABLE: SHORT-CIRCUIT AND OVERLOAD PROTECTION						P
	ambient temperature (°C) ..... :		50				

type/rated output	r-cold Ω	r-warm Ω	temp. °C	ext. encl. °C	support °C	int. + ext. wire	further information
GTD93035L6013.2-F / Input:9Vdc, output:13.2Vdc, 4.54A	--	--	133.8	95.0	97.3	--	--
GTD93035H6013.2-F / Input:150Vdc, output:13.2Vdc, 4.54A	--	--	82.3	69.4	67.3	--	--

Note:

1. The model of GTD93035L6013.2-F that output overload to 4.91A, the unit protected, L1 winding max. temp.: 133.8°C no hazards.
2. The model of GTD93035H6013.2-F that output overload to 6.86A, the unit protected, L1 winding max. temp.: 82.3°C no hazards.
3. Rated ambient temperature ta: 50°C

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Clause	Requirement + Test	Result - Remark	Verdict

18.2	TABLE: insulation resistance measurements		P
Insulation resistance R between:		R (MΩ)	Required R (MΩ)
Model: GTD93035L6013.2-F			
Input “+” to “-” (disconnect fuse)		>100	2
Input to enclosure		>100	5
Input to output terminal		>100	5
1 layer insulation tape		>100	5
T1: primary and secondary		>100	5
T1: core and secondary		>100	5
Model: GTD93035H6013.2-F			
Input “+” to “-” (disconnect fuse)		>100	2
Live part (L/N) to enclosure (rounded with metal foil)		>100	5
Live part (L/N) to output terminal		>100	5
1 layer insulation tape		>100	5
T1: primary and secondary		>100	5
T1: core and secondary		>100	5
Supplementary information:			

18.3	TABLE: Dielectric Strength		P
Test voltage applied between:		Test potential applied (V)	Breakdown / flashover (Yes/No)
Model: GTD93035L6013.2-F			
Input “+” to “-” (disconnect fuse)		700 VDC	No
Input to enclosure		1400 VDC	No
Input to output terminal		1400 VDC	No
T1: primary and secondary		1400 VDC	No
T1: core and secondary		1400 VDC	No
1 layers of insulating tape		1400 VDC	No
Model: GTD93035H6013.2-F			
Input “+” to “-” (disconnect fuse)		1400 VDC	No
Input to enclosure		2800 VDC	No
Input to output terminal		2800 VDC	No
T1: primary and secondary		2800 VDC	No

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Clause	Requirement + Test	Result - Remark	Verdict

T1: core and secondary	2800 VDC	No
1 layers of insulating tape	2800 VDC	No
Supplementary information:		

ANNEX H	Electronic circuits fault test		P
	ambient temperature (°C) ..... :	25.0	
	Test voltage(V) ..... :	264V	

Component No.	fault	Test voltage	Test time	Fuse No.	Fuse current(A)	Result
Model: GTD93035L6013.2-F						
Q1 pin S-D	SC	60	1s	F1	0	Fuse (F1) opened immediately, no hazard.
Q1 pin S-G	SC	60	1s	F1	0	Fuse (F1) opened immediately, no hazard.
Q1 pin D-G	SC	60	1s	F1	0	Fuse (F1) opened immediately, no hazard.
Q3 pin S-D	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
Q3 pin S-G	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
Q3 pin D-G	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
Q5 pin S-D	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q5 pin S-G	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q5 pin D-G	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
D2	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
D3	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
C1	SC	60	1s	F1	0	Fuse (F1) opened immediately, no hazard.
C4	SC	60	1s	F1	0	Fuse (F1) opened immediately, no hazard.
T1 (pin A-B)	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
T1 (pin 4-5)	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
T1 (pin C-D)	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

ANNEX H	Electronic circuits fault test		P
	ambient temperature (°C) ..... :	25.0	
	Test voltage(V) ..... :	264V	

Component No.	fault	Test voltage	Test time	Fuse No.	Fuse current(A)	Result
T1 (pin 8-9)	SC	60	1s	F1	0	Fuse (F1) opened immediately, no hazard.
T1 (pin 7-10)	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q12 pin S-D	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
Q12 pin S-G	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
Q12 pin D-G	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
C44	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
D11	SC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
US3 pin 1	OC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
US3 pin 3	OC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
US3 pin 1-2	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
US3 pin 3-4	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
US4 pin 1	OC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
US4 pin 3	OC	60	10min	F1	0.02	Unit shut down, no damage, no hazard.
US4 pin 1-2	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
US4 pin 3-4	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
Output	SC	60	10min	F1	0.01	Unit shut down, no damage, no hazard.
Model: GTD93035H6013.2-F						
Q1 pin S-D	SC	150	1s	F1	0	Fuse (F1) opened immediately, no hazard.
Q1 pin S-G	SC	150	1s	F1	0	Fuse (F1) opened immediately, no hazard.

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX H	Electronic circuits fault test		P
	ambient temperature (°C) ..... :	25.0	
	Test voltage(V) ..... :	264V	

Component No.	fault	Test voltage	Test time	Fuse No.	Fuse current(A)	Result
Q1 pin D-G	SC	150	1s	F1	0	Fuse (F1) opened immediately, no hazard.
Q3 pin S-D	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q3 pin S-G	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q3 pin D-G	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q5 pin S-D	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q5 pin S-G	SC	150	10min	F1	0.02	Unit shut down, no damage, no hazard.
Q5 pin D-G	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
D3	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
D6	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
C1	SC	150	1s	F1	0	Fuse (F1) opened immediately, no hazard.
C4	SC	150	1s	F1	0	Fuse (F1) opened immediately, no hazard.
T1 (pin A-B)	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
T1 (pin 4-5)	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
T1 (pin C-D)	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
T1 (pin 8-9)	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
T1 (pin 7-10)	SC	150	1s	F1	0	Fuse (F1) opened immediately, no hazard.
Q12 pin S-D	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q12 pin S-G	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
Q12 pin D-G	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

ANNEX H	Electronic circuits fault test		P
	ambient temperature (°C) ..... :	25.0	
	Test voltage(V) ..... :	264V	

Component No.	fault	Test voltage	Test time	Fuse No.	Fuse current(A)	Result
C44	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
D11	SC	150	1hr	F1	0.466→ 0.946→ 0.02	Unit input current increases to 0.946A, after 30min, unit shut down, no damage, no high temperature, no hazard.
US3 pin 1	OC	150	10min	F1	0.02	Unit shut down, no damage, no hazard.
US3 pin 3	OC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
US3 pin 1-2	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
US3 pin 3-4	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
US4 pin 1	OC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
US4 pin 3	OC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
US4 pin 1-2	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
US4 pin 3-4	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
Output	SC	150	10min	F1	0.01	Unit shut down, no damage, no hazard.
Note: S-C: Shout circuit, O-C: Open circuit						

20	TABLE: Components				P
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity1)
PCB	SHENZHEN TONGCHUANGXIN ELECTRONICS CO LTD	TCX	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E250336
Alt. use	SHUANG MING INDUSTRY CO LTD	T005V0, T015V0	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E78017

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Clause	Requirement + Test	Result - Remark	Verdict

20	TABLE: Components				P
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity1)
Alt. use	SHANGHAI H-FAST ELECTRONICS CO LTD	211001	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E337862
Alt. use	GUANGDE BOYA XINXING ELECTRONIC TECHNOLOGY CO LTD	BY-1	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E475783
Alt. use	SHENZHEN GOLDEN BOARD CIRCUIT CO LTD	JYH-2	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E489124
Alt. use	ZHEJIANG WANZHENG ELECTRONICS SCIENCE & TECHNOLOGY CO.,LTD.	JWZ-2	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E302598
Alt. use	JIANGXI ZHONG XIN HUA ELECTRONICS INDUSTRY CO LTD	ZXH-2	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E331298
Alt. use	SHENZHEN JIA LI CHUANG TECHNOLOGY DEVELOPMENT CO LTD	JLC-1	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E479892
Alt. use	WALEX ELECTRONIC (WUXI) CO LTD	T4, T5	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL E78017
Alt. use	Interchangeable	Interchangeable	Min. 1,6 mm thickness, min. V-0, 130°C	UL 796	UL
SMT fuse (F1) for 55-150Vdc model	AEM COMPONENTS (SUZHOU) CO LTD	AF2	3.50A, 125V; Rated breaking capacity 50A.	UL 248-1 UL 248-14	UL E232989
SMT fuse (F1) for 9-60Vdc model	AEM COMPONENTS (SUZHOU) CO LTD	AF2	12A, 65V; Rated breaking capacity 50A.	UL 248-1 UL 248-14	UL E232989

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Clause	Requirement + Test	Result - Remark	Verdict

20	TABLE: Components				P
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity1)
Y-Capacitor (CY6) (optional)	TDK CORPORATION	CD	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40029780 UL E37861
Alt. use	Success Electronics Co., Ltd.	SE	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40037211 VDE 40020002 UL E114280
Alt. use	Success Electronics Co., Ltd.	SB	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40037221 VDE 40020001 UL E114280
Alt. use	Murata Mfg. Co., Ltd.	KX	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40002831 UL E37921
Alt. use	Walsin Technology Corp.	AH	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40001804 UL E146544
Alt. use	JYA-NAY Co., Ltd.	JN	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	TUV 69242987 UL E201384
Alt. use	Haohua Electronic Co.	CT7	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40003902 UL E233106
Alt. use	Jyh Chung Electronic Co., Ltd.	JD	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 137027 UL E187963
Alt. use	WELSON INDUSTRIAL CO LT D	WD	Y1, min. 250VAC, 125°C max.1000pF	IEC/EN 60384-14	VDE 40016157 UL E104572

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

20	TABLE: Components				P
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity1)
Optocoupler (U3, U4)	Lite-On Technology Corporation	LTV-817	Dti=0.8mm Int. , EXT.dcr=7.8mm, thermal cycling test,110°C	IEC/EN 60747-5-2 UL 1577	VDE 40015248 UL E113898
Alt. use	Everlight Electronics Co., Ltd.	EL817	Dti=0.5mm Int. , dcr=6.0mm EXT.dcr=7.7mm, thermal cycling test,110°C	IEC/EN 60747-5-2 UL 1577	VDE 132249 UL E214129
Alt. use	Bright Led Electronics Corp.	BPC-817 A/B/C/D/L BPC-817 M BPC-817 S	Dti=0.4mm EXT.dcr=7.0mm, thermal cycling test,110oC	IEC/EN 60747-5-2	VDE 40007240
Alt. use	COSMO Electronics Corporation	K1010 / KP1010	Dti=0.6mm Int. , dcr=4.0mm EXT.dcr=5.0mm, thermal cycling test,115oC	IEC/EN 60747-5-2	VDE 101347
Line filter (LF1) (Optional)	GlobTek/ HAOPUWEI /BOAM	LF011	130°C	IEC 61558-1 IEC 61558-2-16	Tested with appliance
Line filter (LF2) (Optional)	GlobTek/ HAOPUWEI /BOAM	LF012	130°C	IEC 61558-1 IEC 61558-2-16	Tested with appliance
Boost inductor (L1) (Optional)	GlobTek/ HAOPUWEI /BOAM	LF013 for 55-150Vdc; LF014 for 9-60Vdc.	130°C	IEC 61558-1 IEC 61558-2-16	Tested with appliance
Current transducer (T2)	GlobTek/ HAOPUWEI /BOAM	LF009	130°C	IEC 61558-1 IEC 61558-2-16	Tested with appliance
Transformer (T1)	GlobTek/ HAOPUWEI /BOAM	TF017	Class B	IEC 61558-1 IEC 61558-2-16	Tested with appliance
-Insulation System	GLOBTEK INC	GTX-130-TM	Class B	IEC 61558-1 IEC 61558-2-16 UL 1446	UL E243347 Tested with appliance

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

20	TABLE: Components				P
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity1)
- Alt. use	WUXI HAOPUWEI ELECTRONICS CO LTD	ZT-130	Class B	IEC 61558-1 IEC 61558-2-16 UL 1446	UL E315275 Tested with appliance
- Alt. use	SHAN DONG BOAM ELECTRIC CO LTD	BOAM-01, B1	Class B	IEC 61558-1 IEC 61558-2-16 UL 1446	UL E252329 Tested with appliance
Varistor (ZNR1) (Optional) for GTD93035L60 13.2-F	Success Electronics Co., Ltd.	SVR14D101K	Max continue Voltage 100Vdc, Min V-1 coating, 105°C	IEC 61051-1 IEC 61051-2 IEC 61051-2-2	VDE 123677
Alt. use	Brightking (Shenzhen) Co., Ltd.	101KD14	Max continue Voltage 100Vdc, Min V-1 coating, 105°C	IEC 61051-1 IEC 61051-2 IEC 61051-2-2	VDE 40027827
Alt. use	Centra Science Corp.	CNR14D101K	Max continue Voltage 100Vdc, Min V-1 coating, 105°C	IEC 61051-1 IEC 61051-2 IEC 61051-2-2 DIN EN 61051-1:2009	VDE 40008220
Varistor (ZNR1) (Optional) for GTD93035H60 13.2-F	Success Electronics Co., Ltd.	SVR10D241K	Max continue Voltage 200Vdc, Min V-1 coating, 105°C	IEC 61051-1 IEC 61051-2 IEC 61051-2-2	VDE 123677
Alt. use	Brightking (Shenzhen) Co., Ltd.	241KD10	Max continue Voltage 200Vdc, Min V-1 coating, 105°C	IEC 61051-1 IEC 61051-2 IEC 61051-2-2	VDE 40027827
Alt. use	Centra Science Corp.	CNR10D241K	Max continue Voltage 200Vdc, Min V-1 coating, 105°C	IEC 61051-1 IEC 61051-2 IEC 61051-2-2 DIN EN 61051-1:2009	VDE 40008220
Y-Capacitor (CY1, CY2, CY7, CY8) (optional)	Success Electronics Co., Ltd.	SF	Y2 type, min. 250VAC, 125°C max.4700pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40016665 UL E114280
Alt. use	TDK CORPORATION	CY	Y2 type, min. 250VAC, 125°C max.4700pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 138759 UL E37861

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

20	TABLE: Components				P
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity1)
Alt. use	SHANTOU HIGH-NEW TECHNOLOGY DEVELOPMNT ZONE SONGTIAN ENTERPRISE CO LTD	CE	Y2 type, min. 250VAC, 125°C max.4700pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40025748 UL E208107
Y-Capacitor (CY4,CY5) (optional)	Success Electronics Co., Ltd.	SF	Y2 type, min. 250VAC, 125°C max.10000pF	IEC/EN 60384-14 UL 60384-14 UL 1414	VDE 40016665 UL E114280
DC Connector	Cixi Kaifeng electronic co., ltd	KF103	Min.250V, min.10A, Max.105°C	UL 486	UL E305844
Metal enclosure	Interchangeable	Interchangeable	Metal, Min. thickness:1.5mm	IEC 61558-1 IEC 61558-2-16	Tested with appliance
1) An asterisk indicates a mark which assures the agreed level of surveillance					
Supplementary information: N/A					

26	TABLE: Working voltage measurement.		P
Location	RMS voltage (V)	Peak voltage (V)	Comments
Input to output	150Vdc	150Vdc	
Note(s): Used to determine the test voltage of dielectric strength and clearance, creepage distance and Dti. Model GTD93035H6013.2-F was chosen as representative.			

26	Table: creepage distances and clearances and distances through insulation						P
Insulation	Required Insulation	Clearance		Creepage		Dti	
		Measured (mm)	Required (mm)	Measured (mm)	Required (mm)	Measured (mm)	Required (mm)
Input “+” to “-” before fuse	BI	2.6	2.3 2)	2.6	2.3	--	--
Two terminals of F1	BI	3.2	2.3 2)	3.2	2.3	--	--

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

Optocoupler U3 or U4	RI	6.4	4.5 2)	6.4	4.5	--	--
Y-Capacitor CY6	RI	6.3	4.5 2)	6.3	4.5	--	--
Along soldering sides of T1 on PCB	RI	6.8	4.5 2)	6.8	4.5	--	

Remark:

B = basic insulation S = supplementary insulation R = reinforced insulation

1) If no specified, the worst condition was considered.
2) Procedure 1 for determining clearance applied. With the equipment to be operated at 5000m above sea level max. the minimum clearances shall be multiplied by the factor 1.48.
3) Model GTD93035H6013.2-F was chosen as representative. Model GTD93035L6013.2-F shares the same clearance and creepage distance in these areas.

27.2	TABLE: BALL-PRESSURE TEST FOR ENCLOSURE		N/A
Material	Temperature (°C)	Result (mm)	Comments
--	--	--	--
Remark: metal enclosure			

27.4	TABLE: GLOW-WIRE TEST FOR ENCLOSURE		N/A
Material	Temperature (°C)	Result (mm)	Comments
--	--	--	--
Remark: metal enclosure			

27.2	TABLE: BALL-PRESSURE TEST FOR INSULATION MATERIAL RETAINING CURRENT CARRYING PART		P
Material	Temperature (°C)	Result (mm)	Comments
T1 bobbin	125	1.0	See table 20
PCB	125	0.6	See table 20
DC connector (CON1, CON2)	125	0.8	See table 20
Remark: --			

27.4	TABLE: GLOW-WIRE TEST FOR INSULATION MATERIAL RETAINING CURRENT CARRYING PART		P
Material	Temperature (°C)	Result (mm)	Comments
PCB	750 / 850	No flame / No flame	See table 20
T1 bobbin	650 / 750	No flame / No flame	See table 20
DC connector (CON1, CON2)	750 / 850	No flame / No flame	See table 20
Remark: --			

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

26.2 TEST A	**TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION**					**N/A**
	Test with three special prepared specimens with uninsulated wires, without potting or impregnation					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		

26.2 TEST B	**TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION**					**N/A**
	Test with three specially prepared specimens with potting or impregnation (P1)					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		

26.2 TEST C	**TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION**					**N/A**
	Test with three specially prepared specimens with potting (only dti is required)					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		

Annex U	**U.5.1 THERMAL ENDURANCE TEST**
Type ref.	
Rated PRI-Voltage	
Rated SEC-Voltage	
Material of Winding	
Material of bobbin	
Material of resin	
Material of potting	

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

26.2 TEST C	**TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION**					**N/A**
	Test with three specially prepared specimens with potting (only dti is required)					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		

Material of foil														
Components removed for test														
tw														
S														
Objective test duration (days)														
Theoretical test temperature														
Sample	1		2		3		4		5		6		7	
Winding	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC
Start – Rk														
After 4 h – Rw														
After 4 h – winding temperature														
After 4 h - oven temperature														
After 24 h – Rw														
After 24 h – winding temperature														
After 24 h - oven temperature														
Final test period (days)														
Output voltage (11.1) under load														
Insulating resistance														
High voltage test (35% of the values in Table 8.a														

Annex U	**U.5.2 The use of an other constant S other than 4500 in tw tests**

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Clause	Requirement + Test	Result - Remark	Verdict

	Test1:10 days													
Type ref.														
Rated PRI-Voltage														
Rated SEC-Voltage														
Material of Winding														
Material of bobbin														
Material of resin														
Material of potting														
Material of foil														
Components removed for test														
tw														
S														
Objective test duration (days)														
Theoretical test temperature														
Sample	1		2		3		4		5		6		7	
Winding	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC
Start – Rk														
After 4 h – Rw														
After 4 h – winding temperature														
After 4 h - oven temperature														
After 24 h – Rw														
After 24 h – winding temperature														
After 24 h - oven temperature														
Final test period (days)														
Output voltage (11.1) under load														
Insulating resistance														
High voltage test (35% of the values														

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
in Table 8.a			

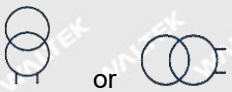
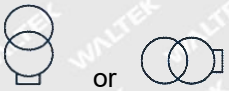
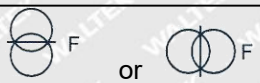
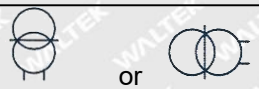
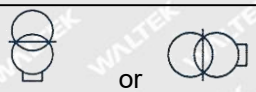
Annex U	**U.5.2 The use of an other constant S other than 4500 in tw tests Test2:120 days**													
Type ref.														
Rated PRI-Voltage														
Rated SEC-Voltage														
Material of Winding														
Material of bobbin														
Material of resin														
Material of potting														
Material of foil														
Components removed for test														
tw														
S														
Objective test duration (days)														
Theoretical test temperature														
Sample	1		2		3		4		5		6		7	
Winding	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC
Start – Rk														
After 4 h – Rw														
After 4 h – winding temperature														
After 4 h - oven temperature														
After 24 h – Rw														
After 24 h – winding temperature														
After 24 h - oven temperature														
Final test period (days)														
Output voltage (11.1) under load														
Insulating														

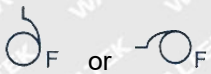
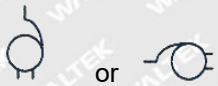
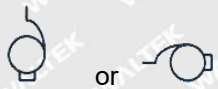
IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

resistance							
High voltage test (35% of the values in Table 8.a							

WALTEK

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
AA	**ANNEX AA**		**N/A**
	PARTIAL DISCHARGE (PD) TEST		**N/A**
BB	**ANNEX BB**		**N/A**
	Particular requirements for associated transformers for switch mode power supplies with internal frequencies > 500 Hz		N/A
	See separate test report-form for these Annex.		N/A
BB.8	MARKING AND OTHER INFORMATION		N/A
BB.8.2	Marking for transformers IP00 or for associated transformers: type and trademark, instruction sheets		N/A
BB.8.11	Correct symbols:		N/A
	Volts	V	N/A
	Amperes	A (mA)	N/A
	Volt amperes (or volt-amperes reactive for reactors)	VA or (VAR)	N/A
	Watts	W	N/A
	Hertz	Hz	N/A
	Input	PRI	N/A
	Output	SEC	N/A
	Direct current	d.c. (DC) or ⎓	N/A
	Neutral	N	N/A
	Single-phase a.c.	~	N/A
	Three-phase a.c.	3 ~	N/A
	Three-phase and neutral a.c.	3N ~	N/A
	Power factor	cos φ	N/A
	Class II construction		N/A
	Class III construction		N/A
	Equipment of overvoltage category I		N/A
	Equipment of overvoltage category II		N/A
	Equipment of overvoltage category III		N/A
	Equipment of overvoltage category IV		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	Fuse-link		N/A
	Rated max. ambient temperature	t_a	N/A
	Rated minimum ambient temperature	t_{amin}	N/A
	Rated minimum temperature	t_{min}	N/A
	Frame or core terminal		N/A
	Protective earth		N/A
	IP number	IPXX	N/A
	Earth (ground for functional earth)		N/A
	For indoor use only		N/A
	To indicate that the appliance is intended to be usable up to the maximum altitude 3 000 m.		N/A
	To indicate that the power supply unit shall not be used, if pins of the plug part are damaged.		N/A
	Additional Symbols (IEC 61558-2-16:09)		N/A
	SMPS incorporating a Fail-safe separating transformer		N/A
	SMPS incorporating a Non-short-circuit-proof separating transformer		N/A
	SMPS incorporating a Short-circuit-proof separating transformer (inherently or non-inherently)		N/A
	SMPS incorporating a Fail-safe isolating transformer		N/A
	SMPS incorporating a Non-short-circuit-proof isolating transformer		N/A
	SMPS incorporating a Short-circuit-proof isolating transformer (inherently or non-inherently)		N/A
	SMPS incorporating a Fail-safe safety isolating transformer		N/A
	SMPS incorporating a Non-short-circuit-proof safety isolating transformer		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	SMPS incorporating a Short-circuit-proof safety isolating transformer (inherently or non-inherently)		N/A
	SMPS incorporating a Fail-safe auto-transformer		N/A
	SMPS incorporating a Non-short-circuit proof auto-transformer		N/A
	SMPS incorporating a Short-circuit proof auto-transformer (inherently or non-inherently)		N/A
	SMPS (Switch mode power supply unit)		N/A
BB.9	PROTECTION AGAINST ELECTRIC SHOCK		N/A
BB.10	CHANGE OF INPUT VOLTAGE SETTING		N/A
BB.11	OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD		N/A
BB.12	NO-LOAD OUTPUT VOLTAGE (see supplementary requirements in Part 2)		N/A
BB.13	SHORT-CIRCUIT VOLTAGE		N/A
BB.14	HEATING		N/A
BB.14.2	Application of 14.1 or 14.3 according to the insulation system		N/A
BB.14.2.1	Class of isolating system (classified materials according to IEC 60 085 and IEC 60 216)		N/A
BB.14.2.2	No classified material, or system but the measured temperature does not exceed the value of Class A		N/A
BB.14.2.3	No classified material or system but the measured temperature exceeds the value for Class A, the live parts of the transformers are submitted to the test of 14.3		N/A
BB.14.3	Accelerated ageing test for undeclared class of isolating system		N/A
	Cycling test (10 cycles):		N/A
	– measuring of the no-load input current (mA)		N/A
BB.14.3.1	– heat run (temperature in table 2)		N/A
BB.14.3.2	– vibration test: 30 min; amplitude 0,35 mm; frequency range: 10 Hz, 55 Hz, 10 Hz		N/A
BB.14.3.3	– moisture treatment (48 h, 17.2)		N/A
BB.14.3.4	Measurements and tests at the beginning and after each test:		N/A
	– deviation of the no-load input current, measured at the beginning of the test is 30%		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– insulation resistance acc. cl.18.1 and 18.2		N/A
	– electric strength, no breakdown (18.3); 2 min; test voltage 35% of specified value (table VI)		N/A
	– Transformers (50 or 60 Hz version) are tested after the dielectric strength test as follows: under no load; duration: 5 min; Upri(V):1,2 times rated supply voltage; frequency (Hz): 2 times rated frequency		N/A
BB.15	SHORT-CIRCUIT AND OVERLOAD PROTECTION		N/A
BB.16	MECHANICAL STRENGTH		N/A
BB.17	PROTECTION AGAINST HARMFUL INGRESS OF WATER AND MOISTURE		N/A
BB.18	INSULATION RESISTANCE AND ELECTRIC STRENGTH		N/A
BB.18.2	Insulation resistance between:		N/A
	– live parts and body for basic insulation 2 M		N/A
	– live parts and body for reinforced insulation 7 M		N/A
	– input circuits and output circuits for basic insulation 2 M		N/A
	– input circuits and output circuits for double or reinforced insulation 5 M		N/A
	– each input circuit and all other input circuits connected together 2 M		N/A
	– each output circuit and all other output circuits connected together 2 M		N/A
	– hazardous live parts and metal parts with basic insulation (Class II transformers) 2 M		N/A
	– body and metal parts with basic insulation (Class II transformers) 5 M		N/A
	– metal foil in contact with inner and outer surfaces of enclosures 2 M		N/A
BB.18.3	Electric strength test (1 min): no flashover or breakdown:		N/A
	1) basic insulation between input circuits and output circuits; working voltage (V); test voltage (V) ..... :		N/A
	2) double or reinforced insulation between input circuits and output circuits; working voltage (V); test voltage (V) ..... :		N/A
	3) basic or supplementary insulation between:		N/A
	a) live parts of different polarity; working voltage (V); test voltage (V) ..... :		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	b) live parts and the body if intended to be connected to protective earth ..... :		N/A
	c) inlet bushings and cord guards and anchorages ..... :		N/A
	d) live parts and an intermediate conductive part ..... :		N/A
	e) intermediate conductive parts and body . :		N/A
	4) Reinforced insulation between the body and live parts; working voltage (V); test voltage (V) ..... :		N/A
	5) Functional insulation for windings intended to be connected in series or parallel (test voltage = working voltage + 500 V) (IEC 61558-2-16:2009)		N/A
18.102 (A1)	Partial discharge tests according IEC 60664-1 , if the working voltage is > 750 V peak		N/A
	Partial discharge is ≤ 10 pC at time P2 See Fig. 19.101		N/A
BB.19	CONSTRUCTION		N/A
BB.19.1	General construction		N/A
BB.19.1.1	General		N/A
BB.19.1.2	Auto-transformers		N/A
BB.19.1.2.1	For plug connected auto-transformers with rated input voltage > rated output voltage the potential to earth shall not exceed the rated output voltage.		N/A
BB.19.1.2.2	Polarised input and output plug and socket-outlet system: an instruction is given with the information, that the transformer shall not be used with non-polarised plug and socket outlet system.		N/A
BB.19.1.2.3	A polarity detecting device only energises the output in the case: output potential to earth ≤ rated output voltage, also with reversed input plug.		N/A
	– The contact separation of the device is ≥ 3mm		N/A
	– A current to earth does not exceed 0,75 mA.		N/A
	– All tests are repeated under fault conditions of H.3.3 of annex H of part 1. The potential to earth does not exceed the max output voltage for more than 5 s.		N/A
BB.19.1.3	Separating transformers		N/A
BB.19.1.3.1	Input and output circuits electrically separated.		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
BB.19.1.3.2	The insulation between input and output winding(s) consist of basic insulation		N/A
	Class I SMPS		N/A
	– Insulation between input windings and body consist of basic insulation		N/A
	– Insulation between output windings and body consist of basic insulation		N/A
	Class II SMPS		N/A
	– Insulation between input windings and body consist of double or reinforced insulation		N/A
	– Insulation between output windings and body consist of double or reinforced insulation		N/A
BB.19.1.3.3	The insulation between input windings and intermediate conductive parts and the output windings and intermediate part consist of basic insulation		N/A
	For class I SMPS the insulation between input and output windings via the intermediate conductive parts consist of basic insulation		N/A
	For class II SMPS the insulation between input winding and the body and between the output windings and the body via the intermediate conductive parts consist of double or reinforced insulation.		N/A
BB.19.1.3.4	Parts of output circuits may be connected to protective earth		N/A
BB.19.1.3.5	No direct contact between output circuits and the body, unless:		N/A
	– Allowed for associated transformers by the equipment standard		N/A
BB.19.1.4	Isolating transformers and safety isolating transformers		N/A
BB.19.1.4.1	Input and output circuits electrically separated		N/A
	No possibility of any connection between these circuits		N/A
BB.19.1.4.2	The insulation between input and output winding(s) consist of double or reinforced insulation (exception see 19.1.4.4)		N/A
	Class I transformers **not** intended for connection to the mains by a plug:		—
	– Insulation between input windings and body connected to earth consist of basic insulation rated to the input voltage		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– Insulation between output windings and body, connected to earth consist of basic insulation rated for the output voltage		N/A
	Class I transformers intended for connection to the mains by a plug:		N/A
	– Insulation between input windings and body connected to earth consist of basic insulation rated to the working voltage		N/A
	– Insulation between output windings and body, connected to earth consist of supplementary insulation rated for the working voltage		N/A
	Class II transformers		N/A
	– Insulation between input windings and body consist of double or reinforced insulation rated to the input voltage		N/A
	– Insulation between output windings and body consist of double or reinforced insulation, rated to the output voltage		N/A
BB.19.1.4.3	For transformers with intermediate conductive parts not connected to the body (between input/output):		-
BB.19.1.4.3.1	For class I and class II transformers the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation, rated to the working voltage.		N/A
	– For class II transformers the insulation between input winding and the body and between the output windings and the body via the intermediate conductive parts consist of double or reinforced insulation. (rated to the input voltage, for SELV circuits only basic insulation to the body)		N/A
	– For transformers, different from independent, the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation, rated to the working voltage.		N/A
BB.19.1.4.3.2	Class I transformers with earthed core, and not allowed for class II equipment		N/A
	– Insulation from the input to the earthed core: basic insulation rated for the input voltage		N/A
	– Insulation from the output voltage to the earthed core: basic insulation rated for the output voltage		N/A
BB.19.1.4.3.3	Insulation between : input to intermediate conductive parts and output and intermediate parts consist of at least basic insulation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– If the insulation from input or output to the intermediate metal part is less than basic insulation, the part is considered to be connected to input or output.		N/A
BB.19.1.4.4	For class I transformers, with protective screen, **not** connected to the mains by a plug the following conditions comply:		N/A
	– The insulation between input winding and protective screen consist of basic insulation (rated input voltage)		N/A
	– The insulation between output winding and protective screen consist of basic insulation (rated output voltage)		N/A
	– The protective screen consist of metal foil or a wire wound screen extending the full width of the windings and has no gaps or holes		N/A
	– Where the protective screen does not cover the entire width of the input winding, additional insulation to ensure double insulation in this area, is used.		N/A
	– If the screen is made by a foil, the turns are isolated, overlap at least 3 mm		N/A
	– The cross-section of the screen and the lead out wire is at least corresponding to the rated current of the overload device		N/A
	– The lead out wire is soldered or fixed to the protective screen.		N/A
	Protective screening is not allowed for transformers with plug connection to the mains		N/A
BB.19.1.4.5	No connection between output circuit and protective earth, except of associated transformers (allowed by equipment standard) or 19.8 is fulfilled.		N/A
BB.19.1.4.6	No connection between output circuit and body, except of associated transformers (allowed by equipment standard)		N/A
BB.19.1.4.7	The distance between input and output terminals for the connection of external wiring is ≥ 25 mm		N/A
BB.19.1.4.8	Portable transformers having an rated output ≤ 630 VA shall be class II.		N/A
BB.19.1.4.9	No connection between output circuit and body except of associated transformers (allowed by equipment standard)		N/A
BB.19.1.4.10	Protective screening is not allowed for transformers with plug connection to the mains		N/A
BB.19.12	Windings construction		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
BB.19.12.1	Undue displacement in all types of transformers not allowed:		N/A
	– of input or output windings or turns thereof		N/A
	– of internal wiring or wires for external connection		N/A
	– of parts of windings or of internal wiring in case of rupture or loosening		N/A
BB.19.12.2	Serrated tape:		N/A
	– distance through insulation according to table 13		N/A
	– one additional layer of serrated tape, and		N/A
	– one additional layer without serration		N/A
	– in case of cheek less bobbins the end turns of each layer shall be prevented from being displaced		N/A
BB.19.12.3	Insulated windings wires providing basic, supplementary or reinforced insulation, meet the following requirements:		N/A
	• Multi-layer extruded or spirally wrapped insulation, passed the tests of annex K		N/A
	• Basic insulation: two wrapped or one extruded wire		N/A
	• Supplementary insulation: two layers, wrapped or extruded		N/A
	• Reinforced insulation: three layers wrapped or extruded		N/A
	Spirally wrapped insulation:		N/A
	• creepage distances between wrapped layers > cl. 26 _ P1 values		N/A
	• path between wrapped layers sealed, the test voltage of K2 is multiplied with 1,35		N/A
	• test 26.2.4 – Test A, passed for wrapped layers		N/A
	• the finished component pass the electric strength test according to cl. 18.3		N/A
a)	Insulated winding wire used for basic or supplementary insulation in a wound part:		N/A
	• comply with annex K		N/A
	• two layers for supplementary insulation		N/A
	• one layer for basic insulation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	• one layer for mechanical separation between the insulated wires of primary and secondary. This layer fulfils the requirement of basic insulation.		N/A
b)	Insulated winding wire used for reinforced insulation in a wound part:		N/A
	• comply with annex K		N/A
	• three layers		N/A
	• relevant dielectric strength test of 18.3		N/A
	Where the insulated winding wire is wound:		N/A
	• upon metal or ferrite cores		N/A
	• upon enamelled wire		N/A
	• under enamelled wire		N/A
	• one layer for mechanical separation between the insulated wires and the core or the enamelled wires is required. This layer fulfils the requirement of basic insulation.		N/A
	• both windings shall not touch each other and also not the core.		N/A
	100 % routine test of Annex K3 of part 1 is fulfilled		N/A
	no creepage distances and clearances for insulated winding wires		N/A
c)	Toroidal cores used with TIW wires for double or reinforced insulation between the primary and secondary circuits shall comply with the following:		N/A
	1) a coating which fulfils the requirements of basic insulation between a winding and the core		N/A
	2) The primary winding consists of TIW wire with 3 layers (reinforced insulation) and the secondary winding consists of enamelled wire. These independent windings shall not be able to contact each other either by mechanical separation or a gap which fulfil the dielectric strength tests for basic insulation.		N/A
	3) For polyfilar windings (primary and secondary windings in contact with each other), the primary winding consists of TIW wire with 3 layers and the secondary winding consists of a TIW wire with 1 layer (requirements for primary and secondary windings can be changed). This construction also is allowed for use with EE-cores or similar.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
d)	Toroidal cores used with FIW wires for double or reinforced insulation between the primary and secondary circuits shall comply with the following:		N/A
	1) a coating, which fulfil the requirements of basic insulation.		N/A
	2) The primary winding consists of FIW wire for reinforced insulation and the secondary winding consist of FIW wire – of basic insulation. These independent windings shall not be able to contact each other either by mechanical separation or a gap which fulfil the dielectric strength test for basic insulation.		N/A
	3) For polyfilar windings (primary and secondary windings in contact with each other), the primary winding and the secondary winding consist of FIW wire for reinforced insulation. This construction also is allowed to use for EE-core or similar.		N/A
e)	Toroidal cores used with TIW in combination with FIW wire, for double or reinforced insulation between the primary and secondary circuits shall comply with the following:		N/A
	1) a coating, which fulfils the requirements of basic insulation.		N/A
	2) The primary winding consists of FIW wire for reinforced insulation, and the secondary winding consists of TIW wire for basic insulation (1 layer). These independent windings shall not be able to contact each other either by mechanical separation or a gap which fulfil the dielectric strength tests for basic insulation.		N/A
	3) For polyfilar windings (primary and secondary windings in contact with each other), the primary winding consists of TIW wire for reinforced insulation (3 layer) and the secondary winding consists of FIW wire for reinforced insulation. This construction also is allowed for use with EE-cores or similar.		N/A
f)	Toroidal cores used with TIW in combination with FIW wire, for basic insulation between the primary and secondary circuits shall comply with the following:		N/A
	1) a coating, which fulfils the requirements of basic insulation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	2) The primary winding consists of FIW wire for basic insulation, and the secondary winding consists of TIW wire for basic insulation (1 layer). These independent windings shall not be able to contact each other either by mechanical separation or a gap which fulfils the dielectric strength tests for basic insulation.		N/A
	3) For polyfilar windings (primary and secondary windings in contact with each other), the primary winding consists of TIW wire for supplementary insulation (2 layers) and the secondary winding consists of FIW wire for basic insulation. This construction also is allowed for use with EE-cores or similar.		N/A
	4) Further polyfilar constructions with FIW and TIW wires in combination with enamelled wires for basic insulation only: 4.1) Primary winding consists of enamelled wire, secondary winding consists of FIW wire for reinforced insulation 4.2) Primary winding consists of enamelled wire, secondary winding consists of TIW wire for reinforced insulation		N/A
BB.19.12.3.1	Max. class F for transformers which use FIW-wire		N/A
BB.19.12.3.2	FIW wires comply with IEC 60851-5:2008, IEC 60317-0-7 and IEC 60317-56.		N/A
	• other nominal diameter as mentioned in table 24 can be calculated with the Formula (6) in 26.3.5:		N/A
	FIW wire used for basic or supplementary insulation for transformers according 19.1.3:		–
	• the test voltage of table 14, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 24		N/A
	• one layer for mechanical separation is located between the insulated wires of primary and secondary. This layer fulfil the requirement of basic insulation		N/A
	• between FIW and enamelled wire, no requirements of creepage distances and clearances		N/A
	• no touch of FIW and enamelled wires		N/A
	FIW wire used for double or reinforced insulation for transformers according 19.1.4:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	• the test voltage of table 14, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 24		N/A
	• for primary and secondary winding FIW-wire for basic insulation is used		N/A
	• one layer for mechanical separation is located between the insulated wires of primary and secondary. This layer fulfil the requirement of basic insulation		N/A
	• no touch between the basic insulated PRI and SEC FIW-wires		N/A
	• between PRI- and SEC-FIW wires, no requirements of creepage distances and clearances		N/A
	Alternative construction used for reinforced insulation (reinforced insulated FIW wire and enamelled wire)		N/A
	• the test voltage of table 14, based on the working voltage reinforced insulation, comply with the min. voltage strength of table 24		N/A
	• one layer for mechanical separation is located between the reinforced insulated FIW wire and the enamelled wire. This layer fulfil the requirement of basic insulation		N/A
	• no touch between the FIW wire and the enamelled wire		N/A
	• between the reinforced FIW wire and any other parts, no requirements of creepage distances and clearances exist		N/A
	Alternative construction with FIW wires, basic or supplementary insulated for transformers with double or reinforced insulation:		–
	• the test voltage of table 14, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 24		N/A
	• PRI or SEC basic insulated FIW wire and to the other winding (enamelled wire) requirements of supplementary insulation		N/A
	• creepage distances and clearances between the basic insulated FIW wire and the enamelled wire for basic or supplementary insulation are required.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Where the FIW wire is wound		N/A
	• upon metal or ferrite cores		N/A
	• one layer for mechanical separation between the insulated wires and the core or the enamelled wires is required. This layer fulfils the requirement of basic insulation.		N/A
	• both windings shall not touch each other and also not the core.		N/A
BB.20	COMPONENTS		N/A
BB.21	INTERNAL WIRING		N/A
BB.22	SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CABLES AND CORDS		N/A
BB.23	TERMINALS FOR EXTERNAL CONDUCTORS		N/A
BB.24	PROVISION FOR PROTECTIVE EARTHING		N/A
BB.25	SCREWS AND CONNECTIONS		N/A
BB.26	CREEPAGE DISTANCES AND CLEARANCES		N/A
BB.26.1	See 26.101		N/A
BB.26.2	Creepage distances (cr) and clearances (cr)		N/A
BB.26.2.1	Windings covered with adhesive tape		N/A
	– the values of pollution degree 1 are fulfilled		N/A
	– all isolating material are classified acc. to IEC 60085 and IEC 60216		N/A
	– test A of 26.2.3 is fulfilled		N/A
BB.26.2.2	Uncemented insulating parts pollution degree P2 or P3		N/A
	– all isolating material are classified acc. to IEC 60085 and IEC 60216		N/A
	– values of pollution degree 1 are not applicable		N/A
BB.26.2.3	Cemented insulating parts		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	– values of distance through insulation (dti) are fulfilled		N/A
	– creepage distances and clearances are not required		N/A
	– test A of this sub clause is fulfilled		N/A
	Test A		N/A
	– thermal class		N/A
	– working voltage		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– Test with three specially specimens, with uninsulated wires, without impregnation or potting	(see appended table)	N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,35		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,35 immediately at the end of the last cycle with high temperature		N/A
	Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
BB.26.2.4	Enclosed parts, by impregnation or potting		N/A
BB.26.2.4.1	– The requirements of reduced values as stated for pollution degree 1 (P1) are fulfilled		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	Test B		N/A
	– thermal class		N/A
	– working voltage		N/A
	– Test with three specially specimens, potted or impregnated. The dielectric strength test is applied directly to the joint.	(see appended table)	N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,25		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,25 immediately at the end of the last cycle with high temperature		N/A
	The three spacemen pass the Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
BB.26.2.4.2	– The requirements of distance through insulation (dti) are fulfilled. (P1 values are not required)		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Test C		N/A
	– thermal class		N/A
	– working voltage		N/A
	– Test with three specimens, potted or impregnated. (finished components)	(see appended table)	N/A
	– Neither cracks, nor voids in the insulating compounds		N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,35		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,35 immediately at the end of the last cycle with high temperature		N/A
	The three spacemen pass the Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
BB.26.3	Distance through insulation		N/A
	For double or reinforced insulation, the required values of Tables 13, C1, and D1 – boxes 2b, 2c and 7 are fulfilled		N/A
	The insulation fulfil the material classification according IEC 60085 or 60216 or the test of 14.3		N/A
BB.26.3.1	Reduced values of the thickness of insulation for supplementary or reinforced insulation are allowed if the following conditions are fulfilled:		N/A
	– the isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	– the test of 14.3 is fulfilled		N/A
	– If both requirements are fulfilled, the required values for solid insulation can be multiplied by 0,4		N/A
	– Minimum thickness of reinforced insulation ≥0,2 mm		N/A
	– Minimum thickness of supplementary insulation ≥0,1 mm		N/A
BB.26.3.2	Insulation in thin sheet form		N/A
	– If the layers are non-separable (glued together):		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– The requirement of 3 layers is fulfilled		N/A
	– The mandrel test according 26.3.3 is fulfilled with 150 N		N/A
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index ”e” is fulfilled.		N/A
	– If the layers are separated:		N/A
	– The requirement of 2 layers is fulfilled		N/A
	– If serrated tape is used, 1 additional layer (serrated) and one additional layer without serration is required		N/A
	– The mandrel test according 26.3.3 is fulfilled on each layer with 50 N		N/A
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index ”e” is fulfilled.		N/A
	– If the layers are separated (alternative:		N/A
	- The requirement of 3 layers is fulfilled		N/A
	– If serrated tape is used, 1 additional layer (serrated) and one additional layer without serration is required		N/A
	– The mandrel test according 26.3.3 is fulfilled on 2/3 of the layers with 100 N		N/A
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index ”e” is fulfilled.		N/A
	Test according to 14.3 and if the isolating materials are classified acc. to IEC 60085 and IEC 60216 no distances through insulation are required for insulation in thin sheet form		N/A
	The figures within square brackets in box 2 and 7 of table 13 (C.1/D.1) are used for insulation in thin sheet form as follows:		N/A
	– rated output > 100 VA values in square brackets apply		N/A
	– rated output 25 VA 100 VA 2/3 of the value in square brackets apply		N/A
	– rated output __ 25 VA 1/3 of the value in square brackets apply		N/A
BB.26.3.3	Mandrel test of insulation in thin sheet form (specimen of 70 mm width are necessary):		N/A
	– If the layers are non-separable – at least 3 layers glued together fulfil the test:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– pull force of 150 N		N/A
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdown.		N/A
	– If the layers are separable and 2/3 of at least 3 layers fulfil the test.		N/A
	– pull force of 100 N		N/A
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdowns.		N/A
	– If the layers are separable 1 of at least 2 layers fulfil the test:		N/A
	– pull force of 50 N		N/A
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdown.		N/A
BB.26.101	Creepage distances, clearances and distances through insulation, specified values according to (IEC 61558-2-16:09):		N/A
	– table 13, material group IIIa (part 1)		N/A
	– table C, material group II (part 1)		N/A
	– table D, material group I (part 1)		N/A
	– working voltage		N/A
	– rated supply frequency 50/60 Hz		N/A
	– rated internal frequency		N/A
	1. Insulation between input and output circuits (basic insulation):		N/A
	a) measured values specified values (mm) .....:		N/A
	2. Insulation between input and output circuits (double or reinforced insulation):		N/A
	a) measured values specified values (mm) .....:		N/A
	b) measured values specified values (mm) .....:		N/A
	c) measured values specified values (mm) .....:		N/A
	3. Insulation between adjacent input circuits: measured values specified values (mm) .....:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Insulation between adjacent output circuits: measured values specified values (mm) .....:		N/A
	4. Insulation between terminals for external connection:		N/A
	a) measured values specified values (mm) .....:		N/A
	b) measured values specified values (mm) .....:		N/A
	c) measured values specified values (mm) .....:		N/A
	5. Basic or supplementary insulation:		N/A
	a) measured values specified values (mm) .....:		N/A
	b) measured values specified values (mm) .....:		N/A
	c) measured values specified values (mm) .....:		N/A
	d) measured values specified values (mm) .....:		N/A
	e) measured values specified values (mm) .....:		N/A
	6. Reinforced or double insulation: measured values specified values (mm) ..... :		N/A
	7. Distance through insulation:		N/A
	a) measured values specified values (mm) .....:		N/A
	b) measured values specified values (mm) .....:		N/A
	c) measured values specified values (mm) .....:		N/A
BB.26.102	Values of IEC 61558-2-16 applicable for frequency up to 3 MHz (IEC 61558-2-16:09)		N/A
	For frequency above 3 MHz clause 7 of IEC 60664-4 is applicable (high frequency testing)		N/A
BB.26.103	Clearance (IEC 61558-2-16:09)		N/A
	a.) Clearance for frequency $\geq$ 30 kHz according figure 101 two determinations are necessary:		N/A
	– determination based on peak working voltage according Table 104 :		N/A
	Peak working voltage		N/A
	Basic insulation: required / measured		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Double or reinforced insulation: required / measured value		N/A
	– and alternative if applicable for approximately homogeneous field according to Table 102		N/A
	Peak working voltage		N/A
	Basic insulation: required / measured		N/A
	Double or reinforced insulation: required / measured value		N/A
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		N/A
	The minimum clearance is the greater of the two values.		N/A
	b.) Clearance for frequency ≤ 30 kHz according figure 101 two determinations are necessary:		N/A
	– determination based on peak working voltage with recurring peak voltages according Table 103 :		N/A
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		N/A
	The minimum clearance is the greater of the two values.		N/A
BB.26.104	The working voltages of Table 102, 103 and 104 are peak voltages including µsec peaks IEC 61558-2-16:09)		N/A
	The working voltage according to Table 13 of part 1 are r.m.s. voltages		N/A
BB.26.105	Creepage distances		N/A
	Two determinations of creepage distances are necessary (see Figure 102)		N/A
	– determination based on measured peak working voltage according Tables 105 to 110		N/A
	Peak working voltage		N/A
	Pollution degree		N/A
	Basic or supplementary insulation: required / measured		N/A
	Double or reinforced insulation: required / measured value		N/A
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	If the values based on table 105 to 110 are lower than the relevant values in Tables 13, C.1 or D.1, the higher values shall be applicable		N/A
BB.26.106	Distance through insulation (IEC 61558-2-16:09)		N/A
	Instead of partial discharge with high frequency voltage the test of the distance and the calculation of the electric field is applicable under the following conditions:		N/A
	– the max. frequency is < 10 MHz		N/A
	– the field strength approximately comply with Figure 103		N/A
	– no voids or gaps are present in between the solid insulation		N/A
	For thick layers d1 ≥ 0,75 the peak value of the field strength is ≤ 2 kV/mm		N/A
	For thin layers d2 ≤ 30 µm the peak value of the field strength is ≤ 10 kV/mm		N/A
	For d1 > d > d2 equation (1) is used for calculation the field strength		N/A
BB.26.107 (A1)	For transformers with FIW wires the following test is required		N/A
	• 10 cycles are required		N/A
	• 68 h test at max heating temperature + 10°C or test at max. allowed winding temperature based on the insulation class (required in table 1) + 10°C		N/A
	• 1 h at 25° C		N/A
	• 2 h at 0° C		N/A
	• 1 h at 25° C – (next cycle start again with 68 h max winding temp + 10)		N/A
	• during the 10 cycles test 2 x working voltage is connected between PRI and SEC		N/A
	• after 10 cycle test 2 transformers are subjected to the 17.2 test for 48 h and direct after the 48 h the dielectric strength test of 18.3 (100 % test voltage) is done		N/A
	• after the 10 cycle test the third sample is tested at the end of the last cycle in the hot position with the dielectric strength test of 18.3 (100 % test voltage)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	• the partial discharge test according to 18.101 is done after the cycling test and after the high voltage test, if the **peak** working voltage is >750 V		N/A
BB.27	RESISTANCE TO HEAT, FIRE AND TRACKING		N/A
BB.E	**ANNEX E , GLOW WIRE TEST**		**N/A**
	The test is required according to IEC 60695-2-10 and IEC 60695-2-11 with the following additions:		N/A
BB.E.1	Clause 6, ”Severities” of IEC 6095-2-11, apply with the temperature stated in 27.3 of IEC 61558-1		N/A
BB.E2	Clause 8, ”Conditioning”, of IEC 60695-2-11 apply, preconditioning is required		N/A
BB.E3	Clause 10, ”Test Procedure”, of IEC 60695-2-11apply, The tip of the glow wire is applied to the flat side of the surface.		N/A
BB.F	**ANNEX F, REQUIREMENTS FOR MANUALLY OPERATED SWITCHES WHICH ARE PARTS OF THE TRANSFORMER**		**N/A**
BB.H	**ANNEX H, ELECTRONIC CIRCUITS** (IEC 61558-1)		**N/A**
BB.K	**ANNEX K, INSULATED WINDING WIRES FOR USE AS MULTIPLE LAYER INSULATION**		**N/A**
BB.K.1	Wire construction:		N/A
	• insulated winding wire for basic or supplementary insulation (see 19.12.3)		N/A
	• insulated winding wire for reinforced insulation (see 19.12.3)		N/A
	• splid circular winding wires and stranded winding wires with 0,05 to 5 mm diameter		N/A
	• spirally wrapped insulation - overlapping		N/A
BB.K.2	Type tests		N/A
BB.K.2.1	General Tests between ambient temperature between 15° C and 35° C and at an humidity between 45% and 75 %		N/A
BB K.2.2	Electric strength test		N/A
BB K.2.2.1	Solid circular winding wires and stranded winding wires		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Test samples prepared according to clause 4.4.1 of IEC 60851-5:2008 (twisted pair)		N/A
	Dielectric strength test: 6 kV for reinforced insulation		N/A
	Dielectric strength test: 3 kV for basic or supplementary insulation		N/A
BB K.2.2.2	Square or rectangular wires .		N/A
	Test samples prepared according to clause 4.7.1 of IEC 60851-5:2008		N/A
	Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
BB K.2.3	Flexibility and adherence		N/A
	Claus 5.1 in Test 8 of IEC 60851-3:2009 shall be used		N/A
	Test samples prepared according to clause 5.1.1.4 of IEC 60851-3:2009		N/A
	Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
	Mandrel diameter according table K.1		N/A
	The tension to the wire during winding on mandrel is 118 N/mm² (118 MPa)		N/A
BB.K.2.4	Heat shock		N/A
	Test samples prepared according to 3.1.1 (in Test 9) of IEC 60851-6:1996		N/A
	• high voltage test immediately after this test		N/A
	• Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	• Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
BB.K.2.5	Retention of dielectric strength after bending (test as specified under test 13 of 4.6.1 c) of IEC 60 851-5)		N/A
	• high voltage test immediately after this test		N/A
	• Dielectric strength test: 5,5 kV for reinforced insulation		
	• Dielectric strength test: 2,75 kV for basic or supplementary insulation		

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Clause	Requirement + Test	Result - Remark	Verdict
BB.K.3	Testing during manufacturing		N/A
BB.K.3.1	General Tests as subjected in K.3.2 and K.3.3		N/A
BB K.3.2	Routine test		N/A
	• Dielectric strength test: 4,2 kV for reinforced insulation		N/A
	• Dielectric strength test: 2,1 kV for basic or supplementary insulation		N/A
BB K.3.3	Sampling test		N/A
BB K.3.3.1	Solid circular winding wires and stranded winding wires		N/A
	Test with a twisted pair, prepared according clause 4.4.1 of IEC 60851-5:2008		N/A
	• Dielectric strength test: 6 kV for reinforced insulation		N/A
	• Dielectric strength test: 3 kV for basic or supplementary insulation		N/A
BB K.3.3.2	Square rectangular wire		N/A
	Samples prepared according to clause 4.7.1 of IEC 60851-5:2008		N/A
	• Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	• Dielectric strength test: 3 kV for basic or supplementary insulation		N/A

BB.U	**ANNEX U – INFORMATIVE – OPTIONAL TW – MARKING FOR TRANSFORMERS**	**N/A**
V	**ANNEX V, SYMBOLS TO BE USED FOR THERMAL CUT-OUTS**	**N/A**

BB.26.2 TEST A	**TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION**					**N/A**
	Test with three special prepared specimens with uninsulated wires, without potting or impregnation					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		
1.						
2.						
3.						
4.						

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

BB.26.2 TEST A	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION				N/A
	Test with three special prepared specimens with uninsulated wires, without potting or impregnation				
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	
5.					
6.					
7.					
8.					
9.					
10.					

BB.26.2 TEST B	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION				N/A
	Test with three specially prepared specimens with potted – P1 values are required				
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

BB.26.2 TEST C	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION				N/A
	Test with three specially prepared specimens with potting (only dti is required)				
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

BB.26.2 TEST C	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
	Test with three specially prepared specimens with potting (only dti is required)					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

BB.26.3.5	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
	Test for transformers, use FIW-wire					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

BB 18.2	TABLE: insulation resistance measurements		N/A
Insulation resistance R between:	R (MΩ)	Required R (MΩ)	

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:		

BB 18.3	TABLE: Dielectric Strength	N/A
Test voltage applied between:	Test potential applied (V)	Breakdown / flashover (Yes/No)
Supplementary information:		

BB 26	TABLE: Clearance And Creepage Distance Measurements					N/A
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Supplementary information:						

BB 26	TABLE: Distance Through Insulation Measurements			N/A
Distance through insulation di at/of:	U r.m.s. (V)	Test voltage (V)	Required di (mm)	di (mm)
Supplementary information:				

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IEC61558_2_16E ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
ATTACHMENT TO TEST REPORT **IEC 61558-2-16** **AUSTRALIA/NEW ZEALAND NATIONAL DIFFERENCES** (Safety of power transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Safety – Part 2-16: Particular requirements and tests switch mode power supply units and transformers for switch mode power supply units)			
Differences according to.....:	AS/NZS 61558.2.16:2022 AS/NZS 61558.1:2018 +A1:2020 + A2:2020		
TRF template used:.....:	IECEE OD-2020-F3, Ed. 1.1		
Attachment Form No..... :	AU_NZ_ND_IEC61558_2_16H		
Attachment Originator.....:	NZ Electrotechnical Committee/Standards New Zealand		
Master Attachment..... :	Date 2022-07-08		
Copyright © 2022 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.			
	National Differences		--
5	**GENERAL CONDITIONS FOR THE TESTS**		P
5.2	*Add* the following variation:		P
	If the tests of AZ.19.201 need to be performed they are carried out on separate specimens, the number of specimens is that required by AS/NZS 3112. (AS/NZS 61558.1:2018/A2:2020)		P
5.5	Replace the text with the following variation:		P
	For a.c., test voltages are of substantially sinusoidal wave form, and, if not otherwise specified, have a frequency of 50 Hz. (AS/NZS 61558.1:2018)		P
16	**MECHANICAL STRENGTH**		N/A
16.4	*Replace* the text with the following variation:		N/A
	VOID (AS/NZS 61558.1:2018/A2:2020)		N/A
19	**CONSTRUCTION**		P
19.15	Replace the test specification with the following variation:		N/A
	VOID (AS/NZS 61558.1:2018/A2:2020)		N/A
19.201	Transformers having integral pins for insertion into socket outlets shall comply with the appropriate requirements of AS/NZS 3112.		N/A

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	Compliance is checked as specified in Appendix J of AS/NZS 3112 (AS/NZS 61558.1:2018)		P
20	**COMPONENTS**		P
	Replace the first paragraph with the following variation:		P
	Components shall comply with the safety requirements specified in the relevant IEC or Australian/New Zealand Standards as far as they reasonably apply. (AS/NZS 61558.1:2018)		P
	Replace the third paragraph with the following variation:		P
	Compliance with the IEC or Australian/New Zealand Standards for the relevant component does not necessarily ensure compliance with the requirements of this Standard (AS/NZS 61558.1:2018)		P
20.6	Insert the following variation:		P
	Plugs and socket-outlets for SELV systems may also comply with the requirements of Appendix E in AS/NZS 3112 (AS/NZS 61558.1:2018/A2:2020)		P
22	**SUPPLY CONNECTION AND OTHER EXTERNAL FLEXIBLE CABLES OR CORDS**		P
22.4	Replace the text by the following variation:		N/A
	VOID. (AS/NZS 61558.1:2018)		N/A
22.6	Replace the text by the following variation		P
	Power supply cords may be cord sets fitted with appliance couplers in accordance with IEC 60320, provided the transformers are single-phase portable transformers with input current not exceeding 10 A at the rated output (AS/NZS 61558.1:2018)		P
22.8	Replace the second paragraph in the requirement, with the following variation:		N/A
	Power supply cords of portable transformers shall be fitted with an appropriately rated plug complying with AS/NZS 3112 or AS/NZS 3123 or IEC 60309 (AS/NZS 61558.1:2018)		N/A

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IEC61558_2_16E ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
ANNEX H	**ELECTRONIC CIRCUITS**		P
H.3.1	Add the following to the test specification after the existing third paragraph		N/A
	During and after the tests the no-load output voltage of an accessible safety extra-low voltage outlet or connector or Universal Serial Bus (USB) outlet shall not have increased by more than 3 V or 10% of its no-load output voltage in normal use, whichever is higher. (AS/NZS 61558.1:2018)	For building-in equipment and shall be evaluated in the end-product	N/A
	Special national conditions (if any)		N/A
	Australia		N/A
8	**MARKING AND OTHER INFORMATION**		P
8.1	After Item a) insert the following variation:		P
	The marking of rated supply voltage or rated supply voltage range of single-phase transformers shall cover 240 V and for poly-phase transformers, 415 V (AS/NZS 61558.1:2018/A2:2020)	DC main	N/A
	New Zealand		P
8	**MARKING AND OTHER INFORMATION**		P
8.1	After Item a) insert the following variation:		P
	The marking of rated supply voltage of single-phase transformers shall be 230 V and for poly-phase transformers shall be 400 V. (AS/NZS 61558.1:2018/A2:2020)		N/A
	The marking of rated supply voltage range of single-phase transformers shall cover 230 V and for poly-phase transformers, 400 V (AS/NZS 61558.1:2018/A2:2020)		N/A

Photo Documentation

Model: GTD93035L6013.2-F

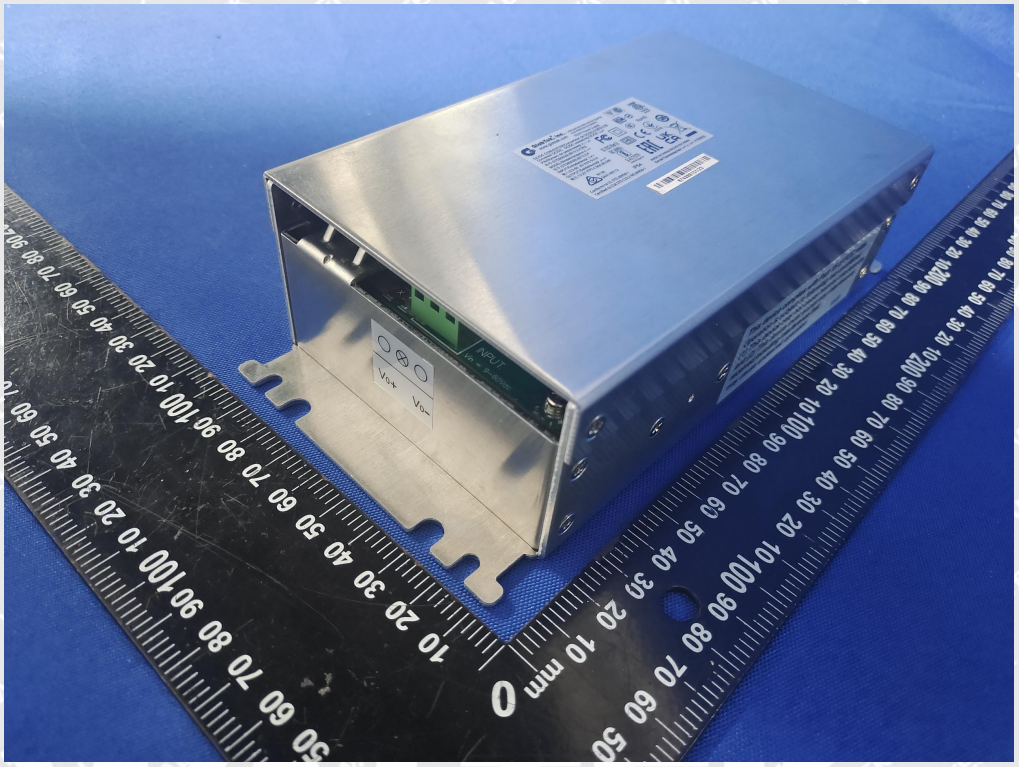


Photo 1

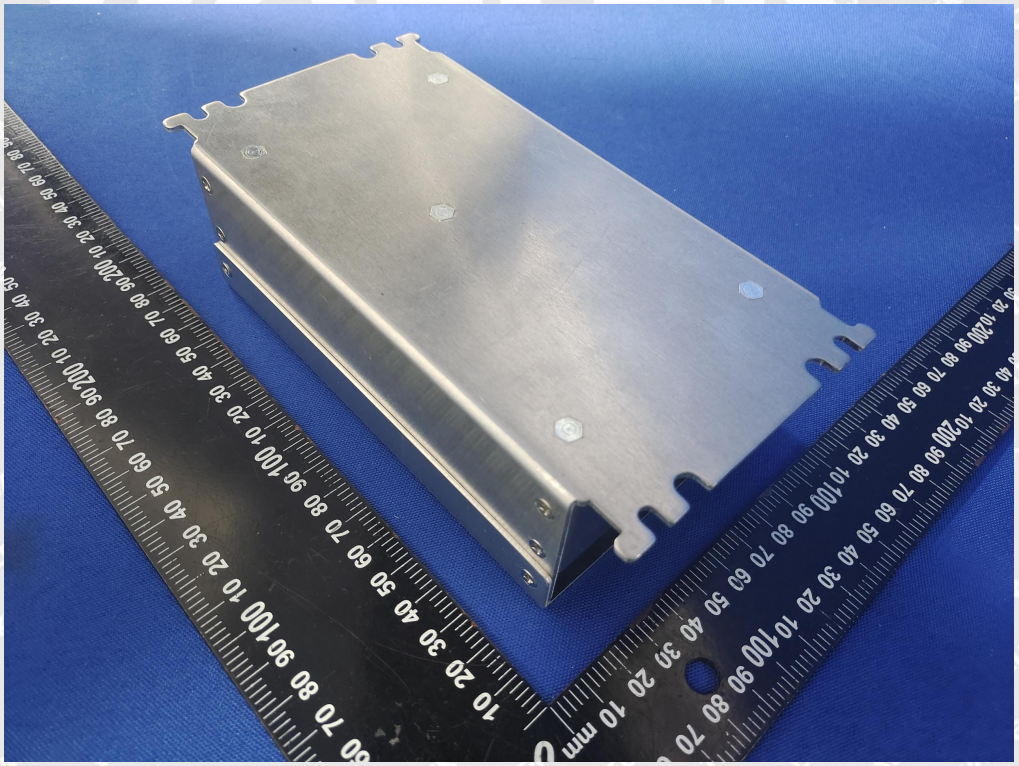


Photo 2

Photo Documentation

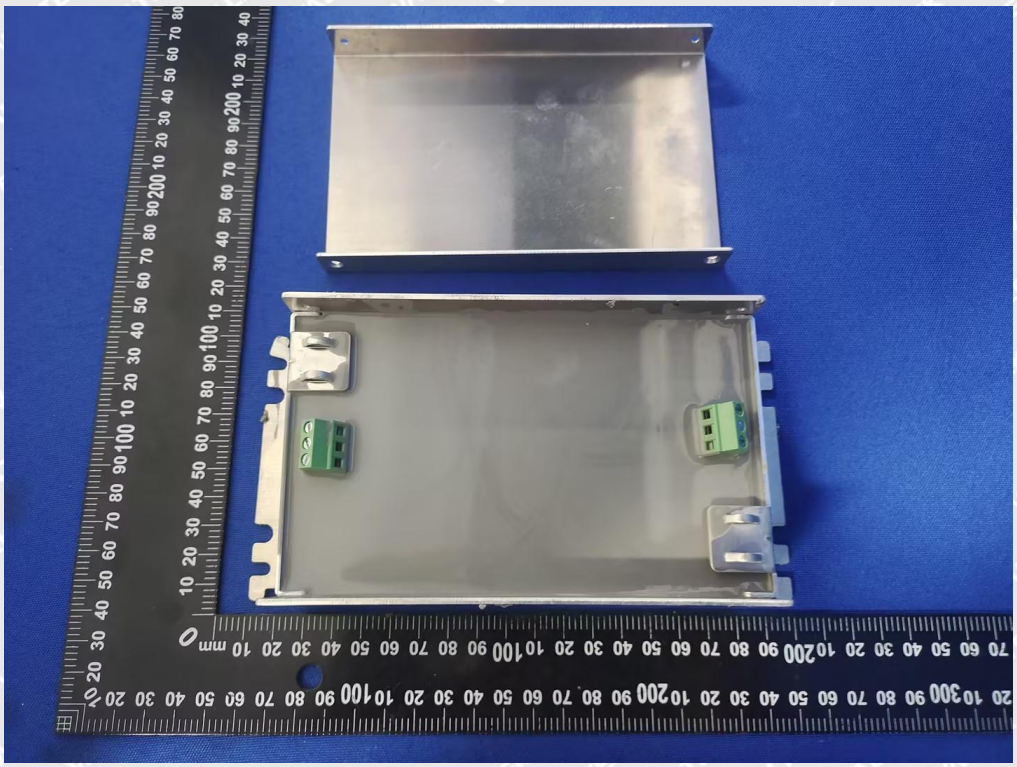


Photo 3 (Seal through gum)

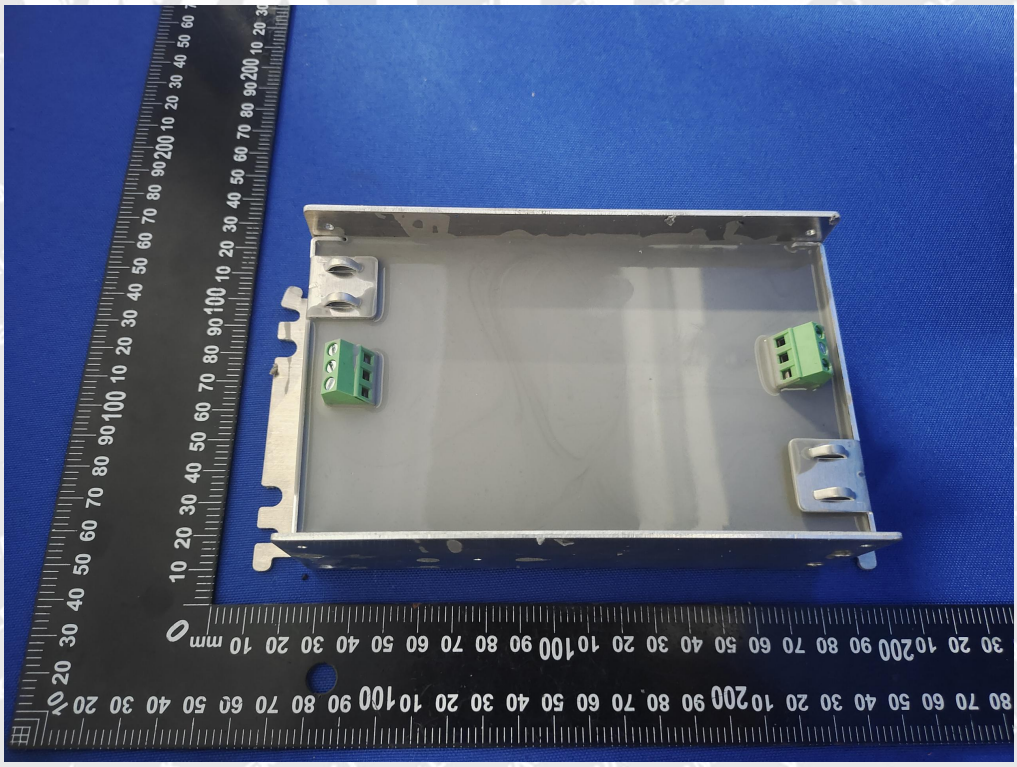


Photo 4 (Seal through gum)

Photo Documentation

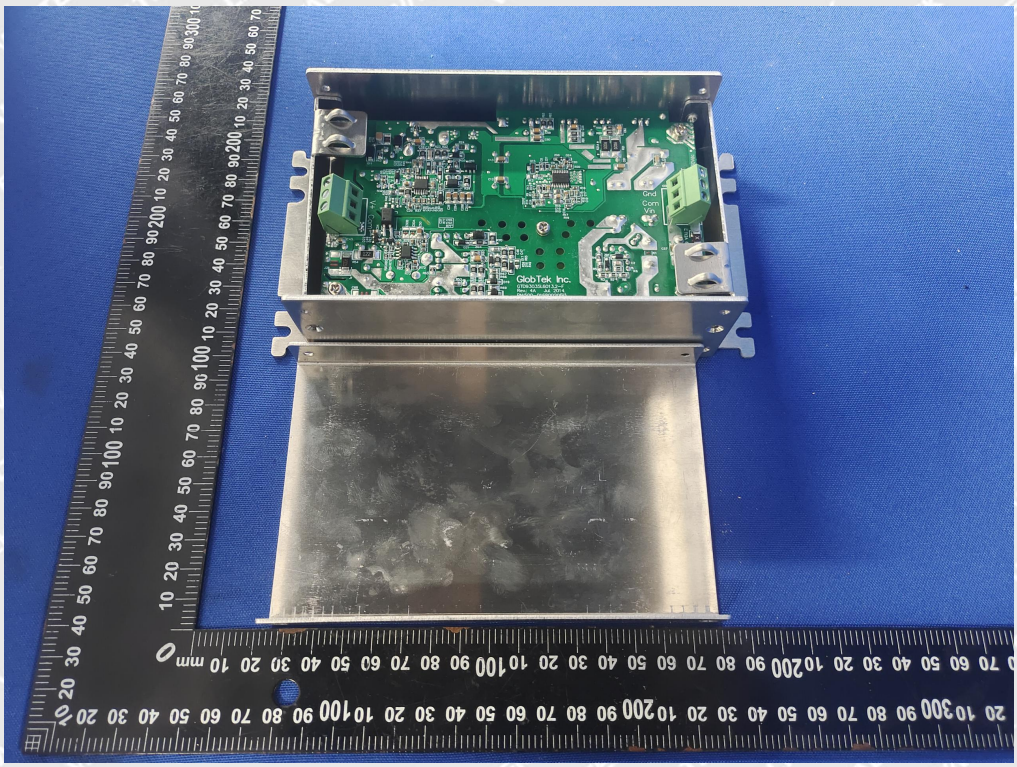


Photo 5 (Without gum sealed)

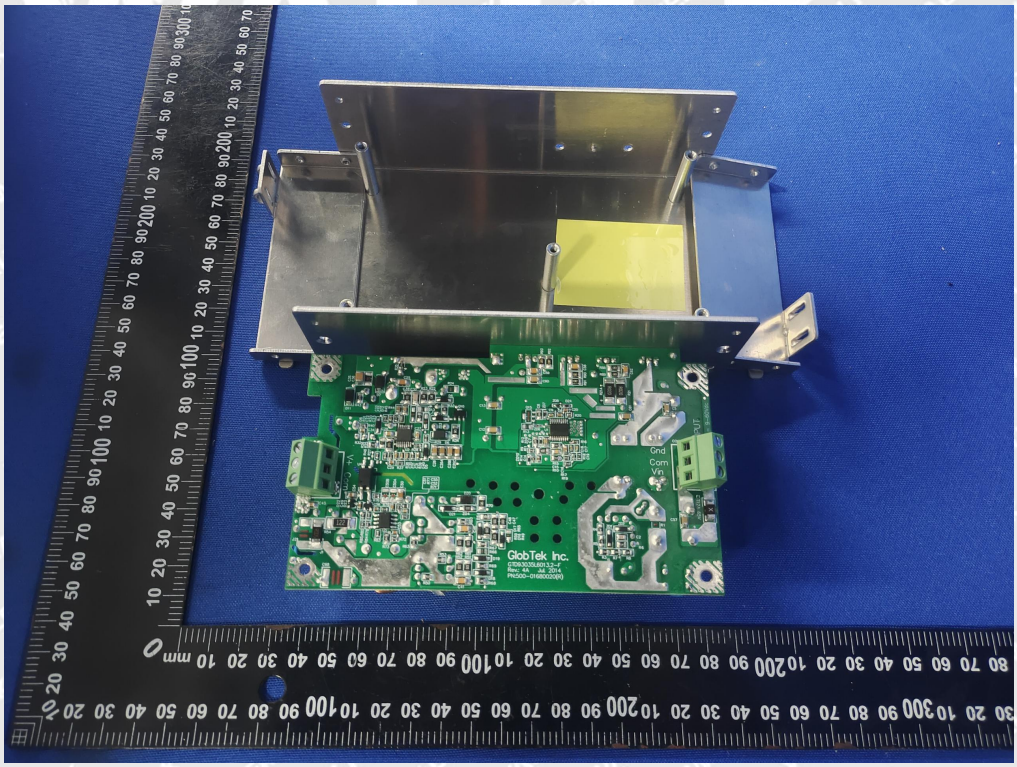


Photo 6 (Without gum sealed)

Photo Documentation

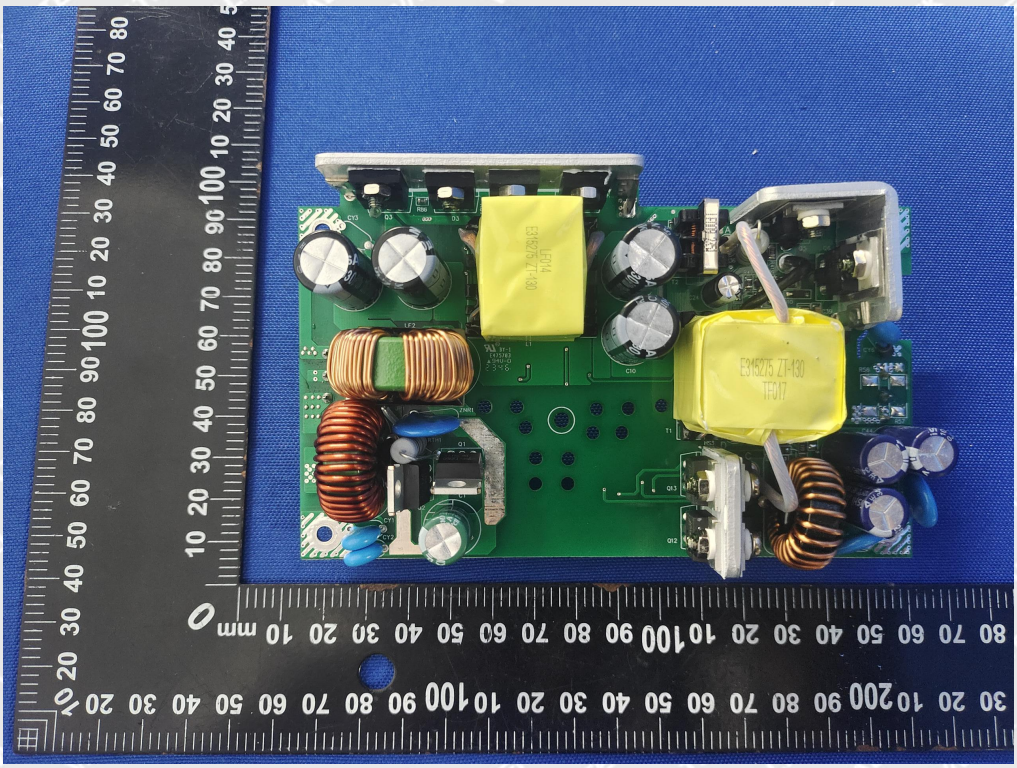


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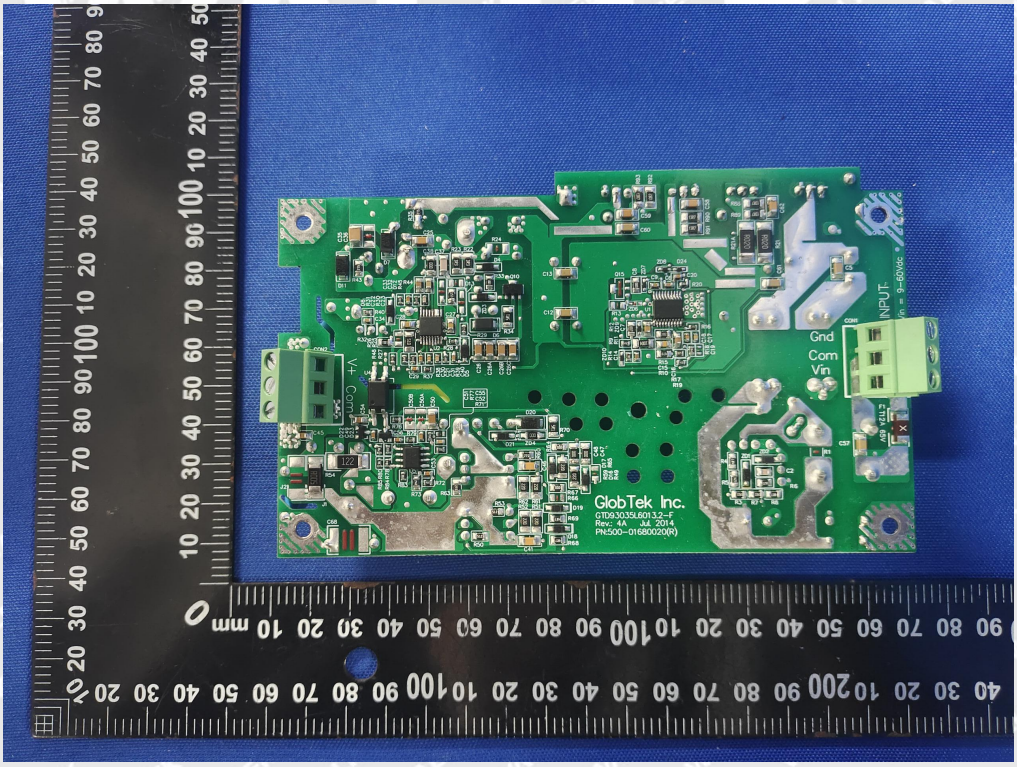


Photo 8

Photo Documentation

Model: GTD93035H6013.2-F

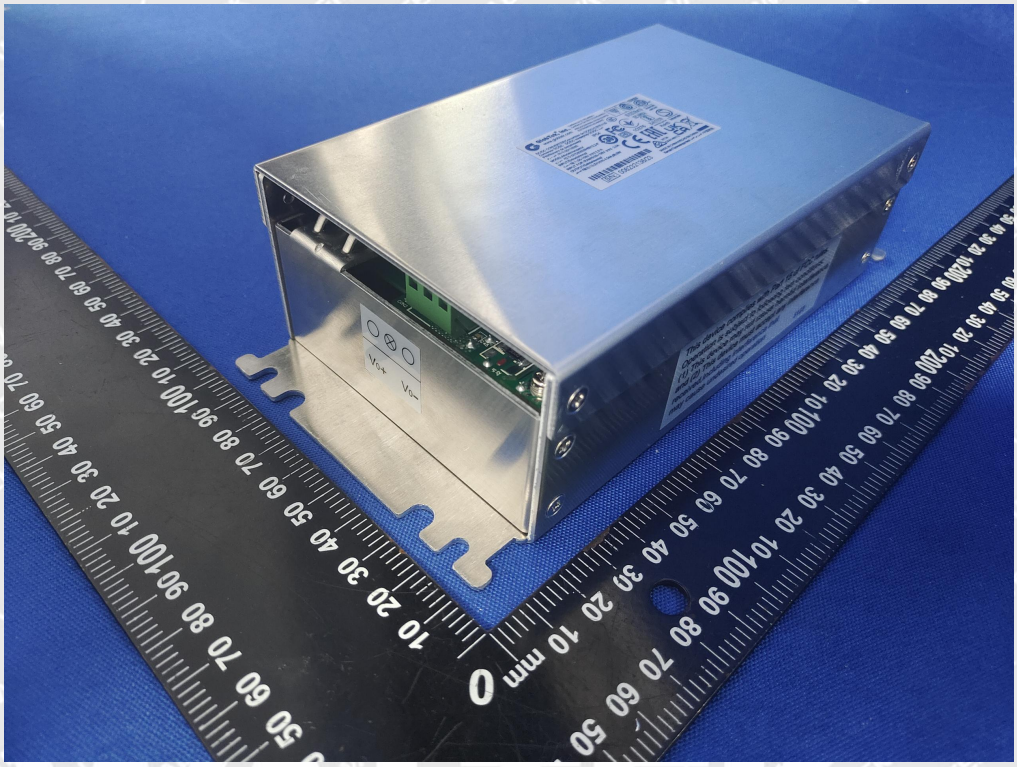


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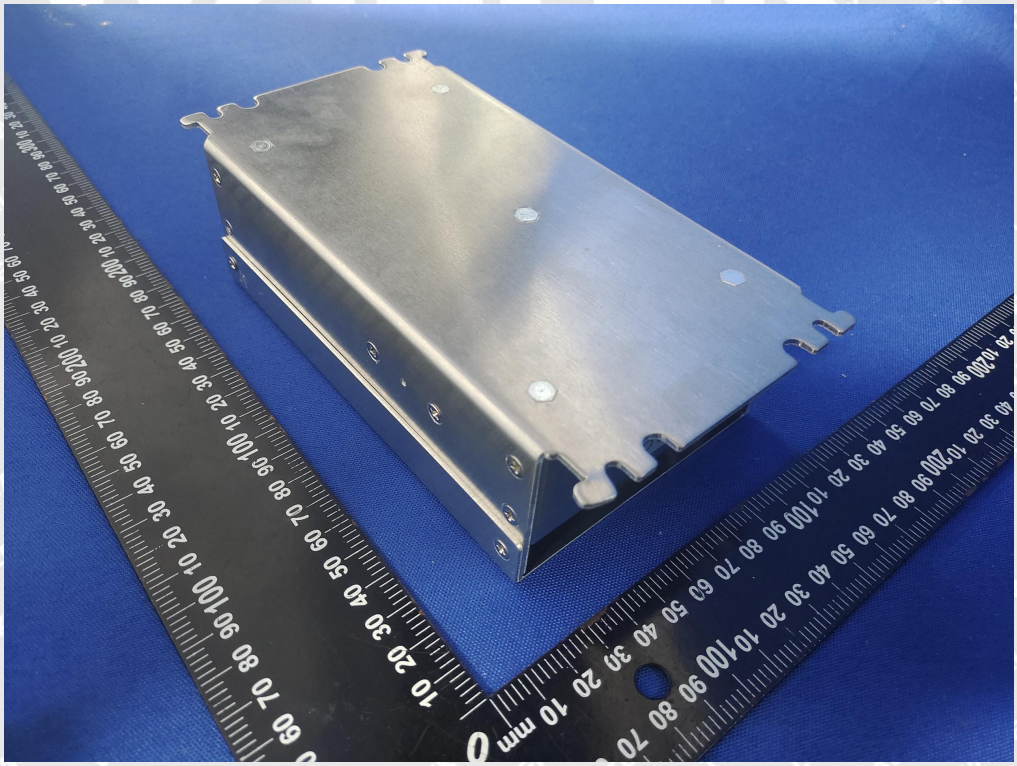


Photo 10

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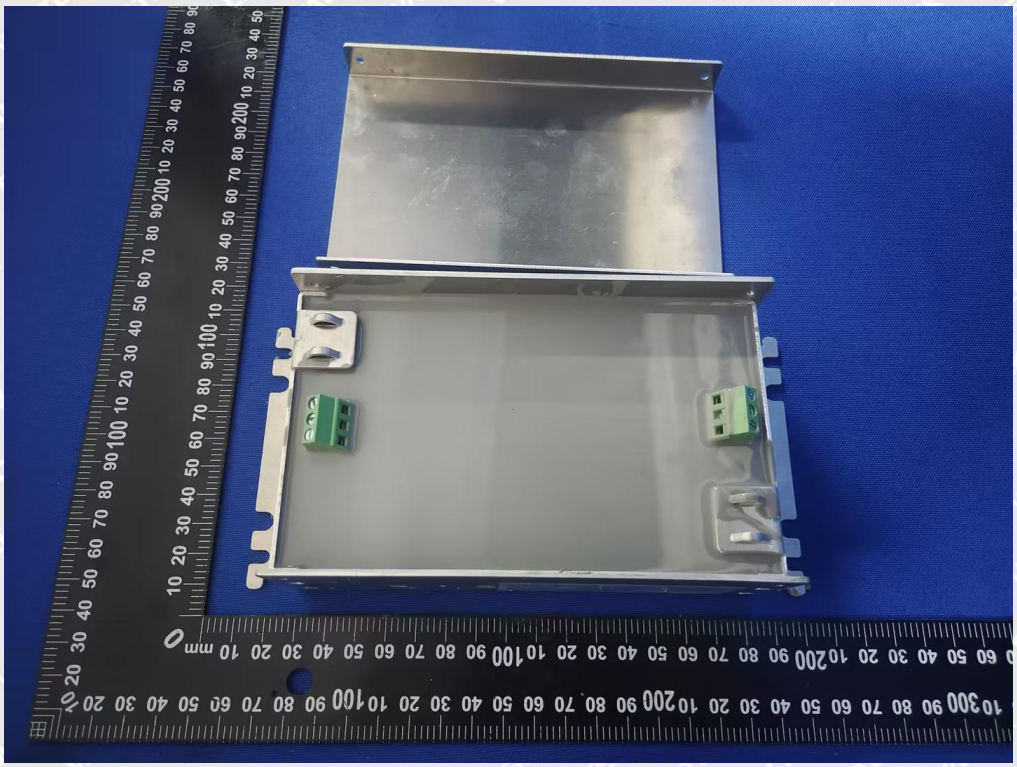


Photo 11 (Seal through gum)

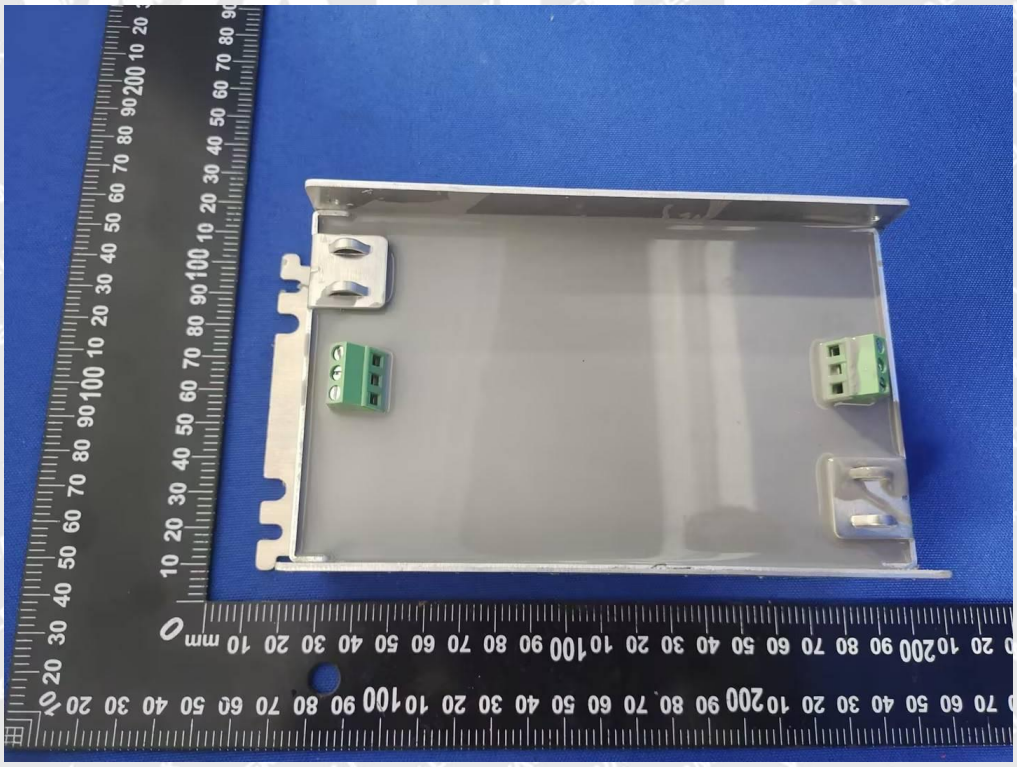


Photo 12 (Seal through gum)

Photo Documentation

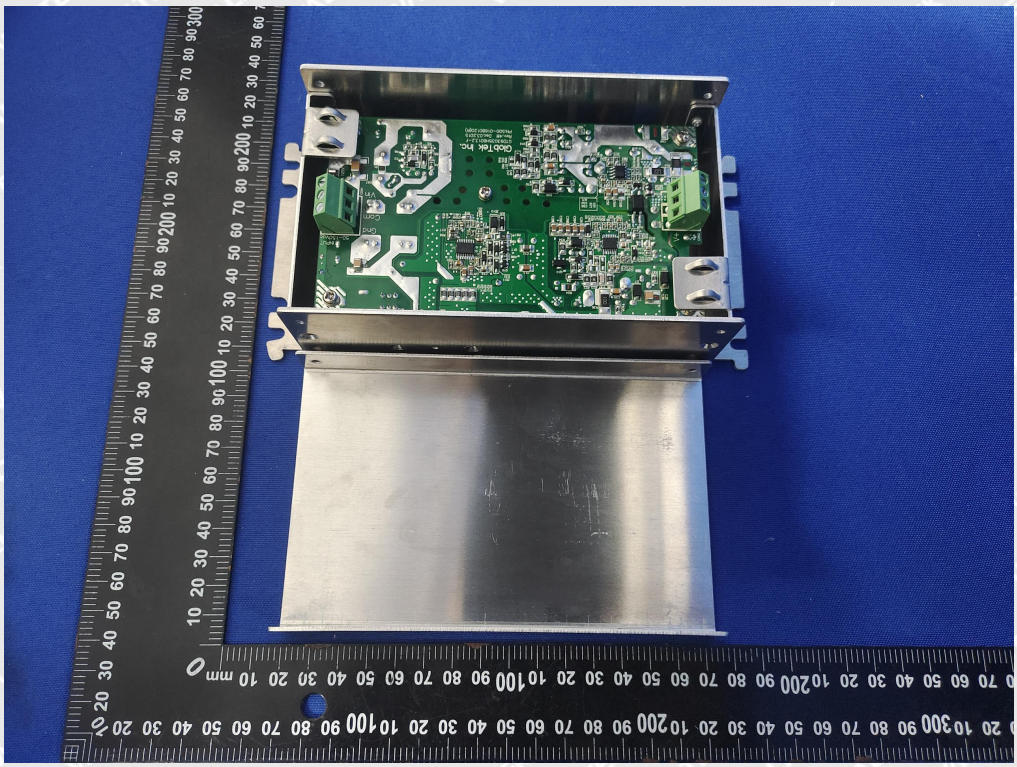


Photo 13 (Without gum sealed)

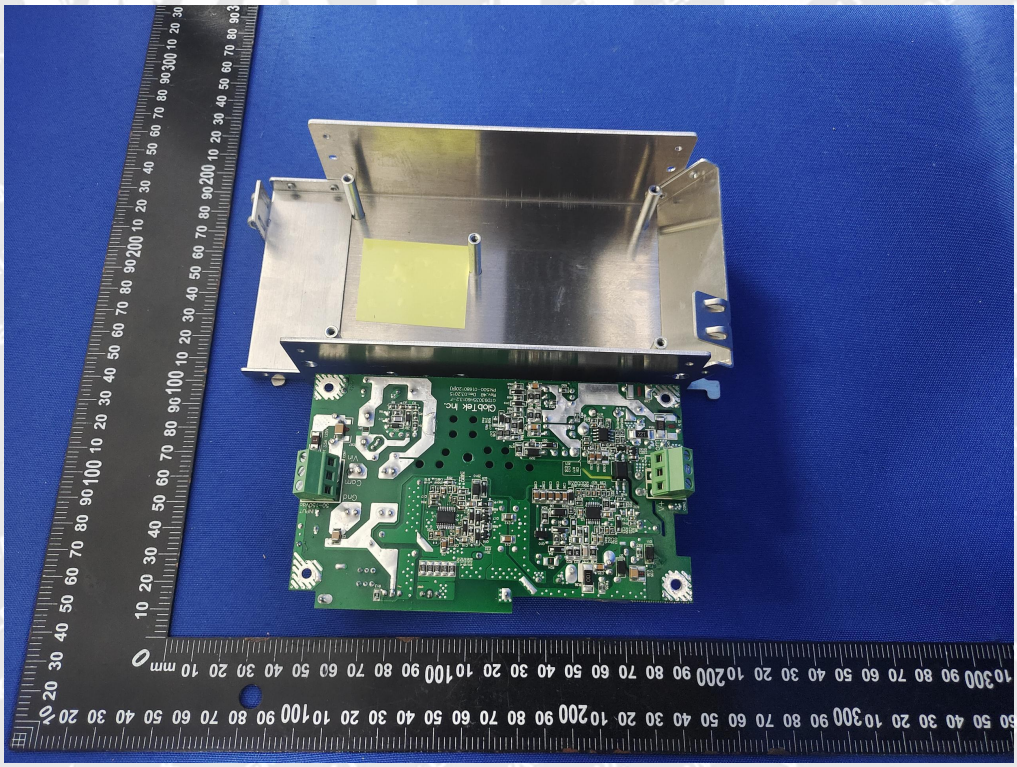


Photo 14 (Without gum sealed)

Photo Documentation

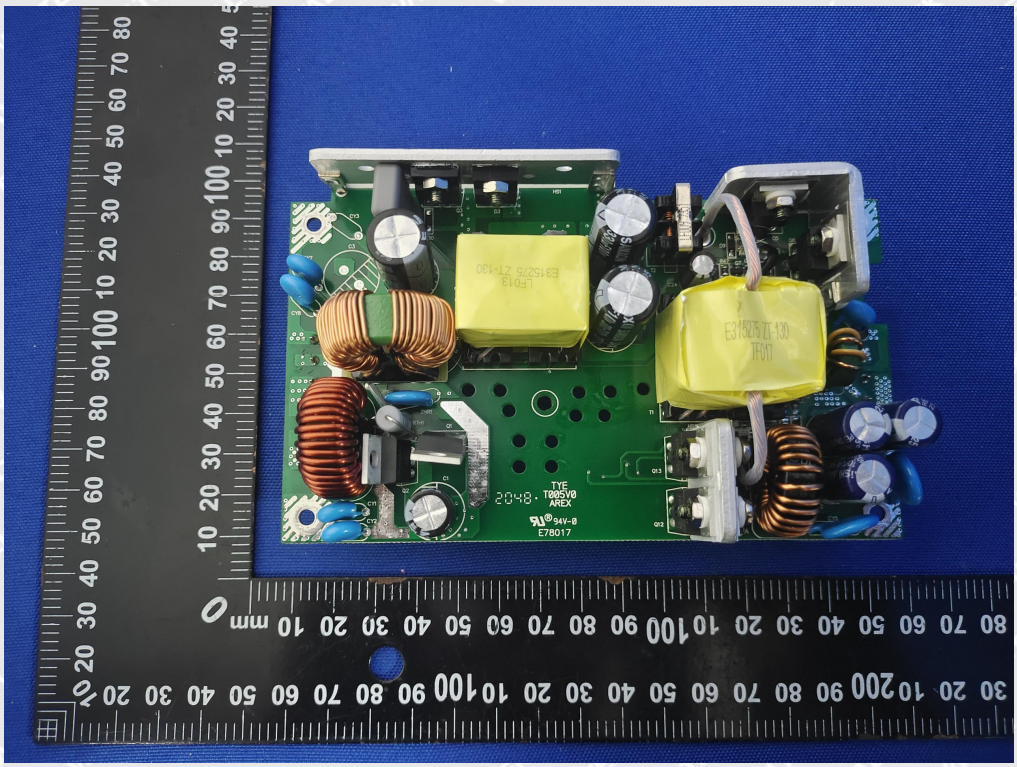


Photo 15

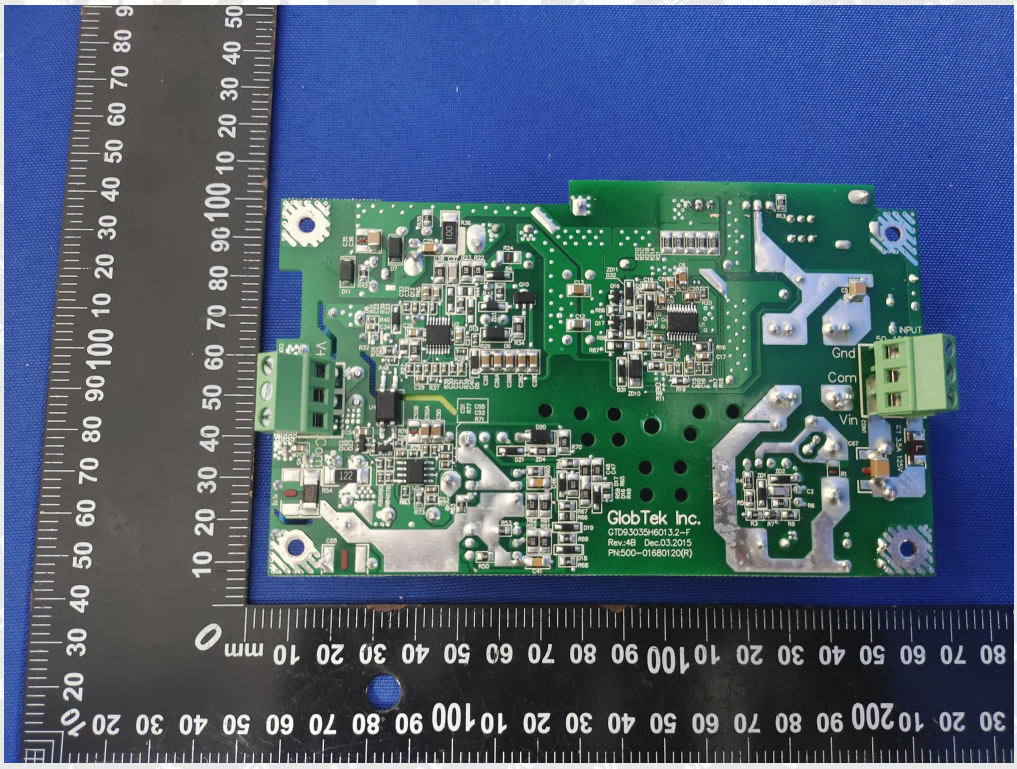


Photo 16

====== End of Report ======