

Technical Construction File EN IEC 61558-1:2019 Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests	
Report reference No.....	TLZJ22072040020
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Date of issue.....	July 22, 2022
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Reviewing location.....	Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China.
Applicant.....	AKSAY ENERGY CO. , LTD.
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Manufacturer.....	AKSAY ENERGY CO. , LTD.
Address.....	No. 60-66 Xinguang Avenue, Xinguang Industrial Zone, Liushi Town, Yueqing City, Zhejiang Province
Factory.....	The same as manufacturer
Address.....	The same as manufacturer
Standard.....	<input checked="" type="checkbox"/> EN IEC 61558-1:2019
Review Report Form No.....	EN 61558-1
TRF originator.....	GTS
Master TRF.....	Reference No. EN IEC 61558-1:2019
Review procedure	GTS
Type of Review object.....	TRANSFORMER (CONTROL TRANSFORMER)
Trademark.....	/
Model/type reference.....	AKSG-500VA~5000KVA, DBK-50VA~200KVA, GSG-1.5KVA~1500KVA, SG-500VA~3000KVA, SBK-1.5KVA~3000KVA, ZSG-10KVA~1000KVA, JSG-500VA~200KVA, JBK-63VA~5000VA
Main Model.....	AKSG-500VA~5000KVA
Rating.....	/



<p>Possible review case verdicts:</p> <ul style="list-style-type: none"> - review case does not apply to the test object..... : N(.A.) - review object does meet the requirement..... : P(ass) - review object does not meet the requirement..... : F(ail) 	
<p>General remarks:</p> <p>”(see remark #)” refers to a remark appended to the report.</p> <p>”(see appended table)” refers to a table appended to the report.</p> <p>Throughout this report a comma is used as the decimal separator.</p> <p>The review results presented in this report relate only to the object reviewed.</p> <p>This report shall not be reproduced except in full without the written approval of the third party.</p>	
<p>Testing:</p> <p>Date of receipt of review item:</p> <p>Date(s) of performance of review:</p>	<p>July 15, 2022</p> <p>July 15, 2022 to July 22, 2022</p>
<p>General product information:</p> <p>TRANSFORMER (CONTROL TRANSFORMER)</p>	
<p>Summary of reviewing:</p> <p>This review report includes:</p> <p>Annex I: 1 page(s) of photo documentation.</p>	
<p>Copy of marking plate</p>	
<p>TRANSFORMER (CONTROL TRANSFORMER), Model AKSG-500VA~5000KVA</p> <p>AKSAY ENERGY CO. , LTD.</p>	<p>Marking</p> <div style="text-align: center; font-size: 2em; font-weight: bold;">  </div>

8	MARKING AND OTHER INFORMATION	P
8.1	Transformer marked with:	P
	a) rated supply voltage or voltage range (V)	P
	b) rated output voltage (V)	P
	c) rated output (VA, kVA or W)	P
	d) rated output current (A)	P
	e) rated frequency (Hz)	P
	f) rated power factor (if not 1)	P
	g) symbol AC for alternating current, or DC for direct current-output	P
	h) symbol for safety isolating transformer (electrical function)	P
	i) manufacturer's name or trademark or name of the responsible vendor	AKSAY ENERGY CO. , LTD. P
	j) model or type reference	AKSG-500VA~5000KVA P
	k) vector group according to IEC 60076 for three-phase transformer	P
	l) symbol for Class I	P
	m) symbol for Class III	P
	n) index IPXX if other than IP00	P
	o) rated max. ambient temperature t_a (if not 25 °C)	P
	p) rated minimum ambient temperature $t_{a \text{ min}}$, if <10° C and if a temperature sensitive device is used	P
	q) short-time duty cycle: operating time Intermittent duty cycle: operating and resting time (e.g. 5min/30min)	P
	r) for tw-marked transformers marked with the rated max. operating temperature, increased by multiples of 5 (e.g. tw 120; tw 125)	P
	s) transformers used with forced air cooling shall be marked with "AF" in m/s	P
	t) Information from the manufacturer to the purchaser (data sheet) :	P
	– short-circuit voltage (% rated supply voltage) for stationary transformers >1000 VA	P
	– electrical function of the transformer	P
8.2	Marking for transformers IP00 or for associated transformers: type and trademark, instruction sheets	P
8.3	Adjusted voltage easily and clearly discernible	P
8.4	For each tapping or winding: rated output voltage and rated output	P
	necessary connections clearly indicated	P
8.5	For short-circuit proof transformers or non-inherently short-circuit proof transformers:	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	P

	Manufacturer's model or type reference and rating of the device for non-inherently short-circuit proof transformers with incorporated replaceable protective device (other than fuses)		P
	Construction sheet for transformers with replaceable protective device (other than fuses) information with information about the replacement.		P
8.6	Terminals for neutral: "N"		P
	Terminal for protective earth marked with earthing symbol		P
	Identification of input terminals: "PRI"		P
	Identification of output terminals: "SEC"		P
	Symbol for any point/terminal in connection with frame or core		P
8.7	Indication for correct connection		P
8.8	Instruction sheet for type X, Y, Z attachments		P
8.9	Transformer for indoor use shall be marked with the relevant symbol.		P
8.10	Symbol for Class II construction not confused with maker's name or trademark.		P
	Class II transformer with parts to be mounted – delivered with all parts for class II after mounting.		P
	Symbol for class II transformer placed on the part which provide class II.		P
8.11	Correct symbols:		P
	Volts		P
	Amperes		P
	Volt amperes (or volt-amperes reactive for TRANSFORMER (CONTROL TRANSFORMER)s)		P
	Watts		P
	Hertz		P
	Input		P
	Output		P
	Direct current		P
	Neutral		P
	Single-phase a.c.		P
	Three-phase a.c.		P
	Three-phase and neutral a.c.		P
	Power factor		P
	Class II construction		P
	Class III construction		P
	Fuse-link		P
	Rated max. ambient temperature		P
	Frame or core terminal		P
	Protective earth		P
	IP number		P
	Earth (ground for functional earth)		P
	For indoor use only		P
	tw5 YYY		P
	tw10 YYY		P
	twx YYY		P
	Fail-safe separating transformer (EN 61558-2-1)		P

	Non-short-circuit proof separating transformer (EN 61558-2-1)		P
	Short-circuit proof separating transformer (EN 61558-2-1)		P
8.12	Figures, letters or other visual means for different positions of regulating devices and switches		P
	OFF position indicated by figure 0		P
	Greater output, input etc. indicated by higher figure		P
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		P
	Marking for terminals: no confusion between input and output		P
	Marking for interchangeable protective devices positioned adjacent to the base		P
	Marking for interchangeable protective devices clearly discernible after removal of cover and protective device		P
8.14	Special information for installation (in the catalogue, data sheet, or instruction sheet) if necessary:		P
	For non-inherently short-circuit proof transformers with non-self-resetting or non replaceable devices (weak-point, thermal link): The device can not be resetted or replaced		P
	For transformers generating a protective earth conductor current of 10 mA (see also cl. 18.5.2): The installation shall be made according to the wiring rules.		P
	For associated- and IP00-transformers: At 10% over or under voltage in the supply voltage, the rated output of the transformer shall be selected accordingly.		P
	For stationary transformers exceeding 1000 VA: The short circuit voltage in % of the rated voltage		P
	For all transformers the electrical function: An information about the electrical function of the transformer (e.g. inherently short circuit proof safety isolating transformer)		P
	For associated- and IP00-transformers: The max. abnormal winding temperature		P
	For tw-transformers: The specific constant S is (e.g. S6 says S = 6000)		P
	For transformers with more than one output winding, not for series or parallel connection		P
	–an information in the in the instruction sheet: the transformer is not intended for se-ries/parallel connection		P
	For IP00 – Transformers the test of 27.2 is not performed. The result may be affected by the enclosure in the final application.		P
8.15	Marking durable and easily legible		P
9	PROTECTION AGAINST ELECTRIC SHOCK		P

9.1	Protection against contact with hazardous live parts		P
9.1.1	A live part is not a hazardous live part if:		P
	– the it is separated from the supply by double or reinforced insulation		P
	– the requirements of 9.1.1.1 and 9.1.1.2 are fulfilled.		P
9.1.1.1	The touch voltage is <35 V(peak) a.c. or < 60 Vd.c.		P
9.1.1.2	If the touch voltage is > 35 V(peak)a.c. or > 60 V d.c., the following requirements shall be fulfilled:		P
	The touch current shall not exceed:		P
	– for a.c. 0,7 mA (peak)		P
	– for d.c. 2,0 mA (see Annex J)		P
	In addition, when a capacitor is connected to live parts:		—
9.1.1.2.1	discharge: < 45 μ C (between 60 V and 15 kV)		P
9.1.1.2.2	energy: < 350 mJ (voltage >15 kV)		P
9.1.2	Transformers shall have an adequate protection against accessibility to hazardous live parts:		P
	The enclosure of class I and class II transformers gives a adequate protection against accidental contact with hazardous live parts.		P
	Class I transformers: accessible parts are separated from hazardous live parts by at least basic insulation.		P
	Class II transformers: no accessibility to basic insulation, or conductive parts separated from hazardous live parts by basic insulation.		P
	Hazardous live parts are not accessible after removal of detachable parts.		P
	Hazardous live parts are not accessible after removal of detachable parts except for:		P
	–lamps having caps larger B9 and E10		P
	–type D fuse holder		P
	Lacquers, enamel, paper, cotton, oxide film on metal parts not used for protection against accidental contact with hazardous live parts:		P
	Shafts, handles, operating levers, knops are not hazardous life parts.		P
	Compliance is checked by inspection and by relevant tests according to IEC 60 529		P
	Class II transformers and Class II parts of Class I construction are tested with the test pin (fig. 3)		P
	Hazardous live parts shall not be touchable by test finger (fig. 2)		P
	for Class II transformers: metal parts separated by basic insulation from hazardous live parts not touchable by test finger		P
	hazardous live parts shall not be touchable with the test pin		P
9.1.3	Accessibility of non hazardous live parts		P
	Non hazardous live parts of the output circuit may be accessible if they are isolated from the input circuit by double or reinforced insulation and if the following conditions are fulfilled:		P
	– The no load output voltage is < 35 V peak a.c. or < 60 V ripple free d.c., both poles are accessible		P

	– The no load output voltage is > 35 V peak a.c. or > 60 V ripple free d.c., only one pole are accessible		N/A
9.2	Transformers with primary supply plug: 1 s after the interruption of the supply the voltage between the pins do not exceed 35 V (peak) a.c. or 60 V ripple free d.c.		P
	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) a.c. or 60 V ripple free d.c.		N/A
	The following tests are required :		P
	If the nominal capacitance is < 0,1 μ F – no test is conducted.		P
	– 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 d.c., the discharge must be \leq 45 μ C.		N/A
10	CHANGE OF INPUT VOLTAGE SETTING		N/A
	Voltage setting not possible to change without a tool		N/A
	Different rated supply voltages:		N/A
	– indication of voltage for which the transformer is set, is discernible on the transformer.		N/A
11	OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD		P
11.1	Difference from rated value (without rectifier; with rectifier):		P
	a) inherently short-circuit proof transformers with one rated output voltage for output voltage: a.c. \leq 10% ; d.c. \leq 5%		N/A
	b) inherently short-circuit proof transformers with more than 1 rated output voltage for high-est output voltage: a.c. \leq 10%; d.c. \leq 15%		N/A
	c) idem for other output voltages: a.c. \leq 15%; d.c. < 20%		N/A
	d) other transformers for output voltages: a.c. \leq 5%; d.c. \leq 10%	(see appended table)	P
12	NO-LOAD OUTPUT VOLTAGE (see supplementary requirements in Part 2)		P
	Remark: with rectifier measuring on both sides of the rectifier		P

13	SHORT-CIRCUIT VOLTAGE		N/A
	Difference from marking for short-circuit voltage \leq 20%		N/A
14	HEATING		P
14.1	General requirements		P
	No excessive temperature in normal use		P
	Room temperature: rated ambient temperature t_a+5 °C		—
11	OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD		P
11.1	Difference from rated value (without rectifier; with rectifier):		P

	a) inherently short-circuit proof transformers with one rated output voltage for output voltage: a.c. $\leq 10\%$; d.c. $\leq 5\%$		N/A
	b) inherently short-circuit proof transformers with one more than 1 rated output voltage for highest output voltage: a.c. $\leq 10\%$; d.c. $\leq 15\%$		N/A
	c) idem for other output voltages: a.c. $\leq 15\%$; d.c. $< 20\%$		N/A
	d) other transformers for output voltages: a.c. $\leq 5\%$; d.c. $\leq 10\%$	(see appended table)	P
12	NO-LOAD OUTPUT VOLTAGE (see supplementary requirements in Part 2)		P
	Remark: with rectifier measuring on both sides of the rectifier		P
12.101	Difference between output voltage at no load and at rated output (EN 61558-2-1)		P
	Rated output (VA) (EN 61558-2-1)		P
	Required value (%) (EN 61558-2-1)		P
12.102	No-load output voltage ≤ 1000 V a.c. or ≤ 1415 V ripple-free d.c.(EN 61558-2-1)		P

13	SHORT-CIRCUIT VOLTAGE		N/A
	Difference from marking for short-circuit voltage $\leq 20\%$		N/A
14	HEATING		P
14.1	General requirements		P
	No excessive temperature in normal use		P
	Room temperature: rated ambient temperature $t_a + 5$ °C		—
	Type X, Y, Z attachments: 1 pull (5 N) to the connection windings		P
	Upri (V): 1,1 times rated supply voltage loaded with rated impedance – for independent transformers		—
	Upri (V): 1,1 times rated supply voltage: with 1 sec (A), measured with rated impedance and 1,0 times of the rated supply voltage for others than independent transformers		—
	Type X, Y, Z attachments: 1 pull (5 N) to the connection windings		P
	Max. temperature windings.....:		P
	–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
	–metal: ≤ 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: $\leq 55\text{ }^{\circ}\text{C}$		N/A
	–continuously held parts of other material: $\leq 75\text{ }^{\circ}\text{C}$		P
	–not continuously held parts of metal: $\leq 60\text{ }^{\circ}\text{C}$		N/A
	– not continuously held parts of other material: $\leq 80\text{ }^{\circ}\text{C}$		N/A
	Temperature of terminals for external conductors $70\text{ }^{\circ}\text{C}$		N/A
	Temperature of terminals of switches $\leq 70\text{ }^{\circ}\text{C}$		N/A
	Temperature of internal and external wiring:		P
	– rubber: $\leq 65\text{ }^{\circ}\text{C}$		P
	– PVC: $\leq 70\text{ }^{\circ}\text{C}$		P
	Temperature of parts where safety can be affected:		N/A
	– rubber: $\leq 75\text{ }^{\circ}\text{C}$		N/A
	– phenol-formaldehyde: $\leq 105\text{ }^{\circ}\text{C}$		N/A
	– urea-formaldehyde: $\leq 85\text{ }^{\circ}\text{C}$		N/A
	– impregnated paper and fabric: $\leq 85\text{ }^{\circ}\text{C}$		N/A
	– impregnated wood: $\leq 85\text{ }^{\circ}\text{C}$		N/A
	– PVC, polystyrene and similar thermoplastic material: $\leq 65\text{ }^{\circ}\text{C}$		N/A
	– varnished cambric: $\leq 75\text{ }^{\circ}\text{C}$		N/A
	Temperature rise of supports $\leq 85\text{ }^{\circ}\text{C}$		P
	Temperature of printed boards:		N/A
	– bonded with phenol-formaldehyde: $\leq 105\text{ }^{\circ}\text{C}$		N/A
	– melamine-formaldehyde: $\leq 105\text{ }^{\circ}\text{C}$		N/A
	– phenol-furfural: $\leq 105\text{ }^{\circ}\text{C}$		N/A
	– polyester: $\leq 105\text{ }^{\circ}\text{C}$		N/A
	– bonded with epoxy: $\leq 140\text{ }^{\circ}\text{C}$		N/A
	Electric strength between input and output windings (18.3, 1 min); test voltage (V)		N/A
14.2	Application of 14.1 or 14.3 according to the insulation system		P
14.2.1	Class of isolating system (classified materials according to IEC 60 085 and IEC 60 216)		P
14.2.2	No classified material, or system but the measured temperature does not exceed the value of Class A		N/A
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 isolating system		N/A
	Cycling test (10 cycles):		N/A
	– measuring of the no-load input current (mA)		N/A
14.3.1	– heat run (temperature in table 2)		N/A
14.3.2	– vibration test: 30 min; amplitude 0,35 mm; frequency range: 10 Hz, 55 Hz, 10 Hz		N/A
14.3.3	– moisture treatment (48 h, 17.2)		N/A
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

	– 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; Up-ri(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		P
	Tests direct after 14.1 at the same t_a and without changing position.	(see appended table)	P
	Supply voltage between 0,9 times and 1,1 times of the rated supply voltage		—
	Transformer with rectifier tests of 15.2 and 15.3 at the input and the output terminals of the rectifier.		N/A
	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
	Wiring protected inherently (15.2)		N/A
	– Max. temperature of winding protected inherently (insulation class): $\leq 150\text{ }^\circ\text{C}$ (A); $\leq 165\text{ }^\circ\text{C}$ (E); $\leq 175\text{ }^\circ\text{C}$ (B); $\leq 190\text{ }^\circ\text{C}$ (F); $\leq 210\text{ }^\circ\text{C}$ (H)		P
	Winding protected by protective device:		N/A
	– a) 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 4 (a) (insulation class): $\leq 200\text{ }^\circ\text{C}$ (A); $\leq 215\text{ }^\circ\text{C}$ (E); $\leq 225\text{ }^\circ\text{C}$ (B); $\leq 240\text{ }^\circ\text{C}$ (F); $\leq 260\text{ }^\circ\text{C}$ (H)		N/A
	– b) Test according 15.3.1: max. temperature of winding during the first hour, peak value (insulation class): $\leq 200\text{ }^\circ\text{C}$ (A); $\leq 215\text{ }^\circ\text{C}$ (E); $\leq 225\text{ }^\circ\text{C}$ (B); $< 240\text{ }^\circ\text{C}$ (F); $\leq 260\text{ }^\circ\text{C}$ (H)		N/A
	– <Test according 15.3.1: max. temperature of winding after first hour, peak value (insulation class): $< 175\text{ }^\circ\text{C}$ (A); $< 190\text{ }^\circ\text{C}$ (E); $200\text{ }^\circ\text{C}$ (B); $< 215\text{ }^\circ\text{C}$ (F); $< 235\text{ }^\circ\text{C}$ (H)		N/A
	– Test according 15.3.1: max. temperature of winding after first hour, arithmetic mean value (insulation class): $< 150\text{ }^\circ\text{C}$ (A); $< 165\text{ }^\circ\text{C}$ (E); $< 175\text{ }^\circ\text{C}$ (B); $< 190\text{ }^\circ\text{C}$ (F); $< 210\text{ }^\circ\text{C}$ (H)		N/A
	Max. temperature of external enclosures (accessible by test finger) $< 105\text{ }^\circ\text{C}$		P
	Max. temperature of insulation of wiring (rubber and PVC) $< 85\text{ }^\circ\text{C}$		N/A
	Temperature rise of supports $< 105\text{ }^\circ\text{C}$		P
15.2	For inherently short-circuit proof transformers and for transformers with rectifiers test by short circuit of the output winding at rated supply voltage x 1,1: temperature rises $<$ values in table 3		N/A
15.3	For non-inherently short-circuit proof transformers and for transformers with rectifiers: temperature rises $<$ values in table 3		N/A

15.3.1	Output terminals short-circuited: protection device operates, test at 0,9 ... 1,1 of the rated supply voltage		N/A
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 4.		N/A
15.3.3	If protected by a fuse accordance with either IEC 60 127 or ISO 8820, or a technical equivalent fuse, the transformer is loaded with the current as specified for the longest pre arcing time. If protected by a miniature fuses in accordance to IEC 60127, 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 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 60 898) test with 0,95 times of operating current		N/A
	If an internal weak 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 3		N/A
15.3.6	If thermal cut-outs, test with 0,95 times of operating current		N/A
15.4	For non-short-circuit proof transformers: temperature rises < values in table 3, tests as indicated in 15.3		N/A
15.5	For fail-safe transformers:		P
	– U _{pri} (V): 1,1 times rated supply voltage		—
	– I _{sec} (A): 1,5 times rated output current		—
	– time until steady-state conditions t ₁ (h)		—
	– time until failure t ₂ (h): ≤t ₁ ; <5 h		P
	During the test:		P
	– no flames, molten material, etc.		P
	– temperature of enclosure < 175°C		P
	– temperature of plywood support < 125°C		P
	After the test:		P
	– 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		P
	– bare hazardous live parts not accessible by test finger through holes of enclosure		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		P
	– no damage for insulating barriers		P
	– handles, levers, etc. have not moved on shafts		N/A
16.2	Transformers (stationary and portable s. 16.1)		P

	For stationary and portable transformers: 3 blows, impact energy 0,5 Nm		P
16.3	Portable transformers (except of plug in transformers)		P
	For portable transformers: 100 falls, 25 mm		P
16.4	Transformers with integrated pins (plug in transformers), the following tests are carried out:		P
	a) plug-in transformers: tumbling barrel test: 50 x < 250 g; 25 x > 250 g		P
	b) torque test of the plug pins with 0,4 Nm		P
	c) pull force according to table 5 for each pin		P
17	PROTECTION AGAINST HARMFUL INGRESS OF WATER AND MOISTURE		P
17.1	Degree of protection (IP code marked on the transformer)		P
	Test according to 17.1.1 and for other IP ratings test according to IEC 60 529:		P
	– stable operating temperature before starting the test for < IPX8		P
	– transformer mounted and wired as in normal use		P
	– fixed transformer mounted as in normal use by the tests according to 17.1.1 A to L		P
	– portable transformers placed in the most unfavourable position and wired as in normal use		P
	– glands tightened with a torque equal to two-thirds of 25.6		N/A
	After the tests:		P
	– dielectric strength test according to 18.3		P
	Inspection:		P
	a) in dust-proof transformers no deposit of talcum powder		N/A
	b) no deposit of talcum powder inside dust-tight transformers		N/A
	c) 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		P
	d) no accumulation of water in transformers IPX1 so as to impair safety		P
	e) no trace of water entered in any part of water-tight transformer		N/A
	f) no entry into the transformer by the relevant test probe		P
17.1.1	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
	B) Solid-object-proof transformers:		P
	– wire 2,5 mm; force 3 N		P
	– IP4X, wire 1 mm; force 1 N		P
	C) Dust-proof transformers, IP5X; 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 to C)		N/A
	E) Drip-proof transformers (IPX1) test according to fig. 3 of IEC 60 529 for 10 min		N/A
	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°)		P
	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):		P
	– insulation resistance and electric strength (Cl. 18)		P

18	INSULATION RESISTANCE AND ELECTRIC STRENGTH		P
18.2	Insulation resistance between:		N/A
	– live parts and body for basic insulation $\geq 2 \text{ M}\Omega$		N/A
	– live parts and body for reinforced insulation $\geq 7 \text{ M}\Omega$		N/A
	– input circuits and output circuits for basic insulation $\geq 2 \text{ M}\Omega$		N/A
	– input circuits and output circuits for double or reinforced insulation $\geq 5 \text{ M}\Omega$		N/A
	– each input circuit and all other input circuits connected together $\geq 2 \text{ M}\Omega$		P
	– each output circuit and all other output circuits connected together $\geq 2 \text{ M}\Omega$		N/A
	– hazardous live parts and metal parts with basic insulation (Class II transformers) $\geq 2 \text{ M}\Omega$		P
	– body and metal parts with basic insulation (Class II transformers) $\geq 5 \text{ M}\Omega$		N/A
	– metal foil in contact with inner and outer surfaces of enclosures $\geq 7 \text{ M}\Omega$		N/A
	Table 7: the value between input and output circuits for double or reinforced insulation is not applicable (EN 61558-2-1)		N/A
18.3	Electric strength test (1 min): no flashover or breakdown:		P

	1) basic insulation between input circuits and output circuits; working voltage (V); test voltage (V)		P
	2) double or reinforced insulation between input circuits and output circuits; working voltage (V); test voltage (V)		P
	3) basic or supplementary insulation between:		P
	a) live parts of different polarity; working voltage (V); test voltage (V)		P
	b) live parts and the body if intended to be connected to protective earth		P
	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
	Table 8: box 2 is not applicable (EN 61558-2-1)		
18.4	Upri (V): 2 times rated input voltage; no load; frequency (Hz): 2 times rated frequency; duration (min): 5 min		P
	No breakdown between:		P
	– turns of winding		P
	– input and output windings		P
	– adjacent input or output windings		N/A
	– windings and iron core		P
18.5	Touch current and protective earth current		P
18.5.1	Touch current		P
	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 8. Measuring network according Figure J1 (Annex J). If the frequency is >30kHz, measuring across the 500 Ohm resistor of J1 (burn effects).		P
	Measurement of the touch current with switch p of picture 8 in both positions and in combination with switches e and n. The measured values are less than the required values of table 8b.		P
	– switches n and e in on position		P
	– switch n: off and switch e: on		P
	– switch n: on and switch e: off		N/A
18.5.2	Protective earth conductor current		N/A
	The transformer is connected as in clause 14 Impedance of the ammeter < 0,5 Ohm, connected between earth terminal of the transformer and protective earth conductor		N/A
	The measured values are less than the required values of table 8b.		N/A
19	CONSTRUCTION		P
19.1	Input and output circuits electrically separated (IEC 61558-2-6)		N/A
	No possibility of any connection between these circuits (IEC 61558-2-6)		N/A

19.1.1	The insulation between input and output winding(s) consist of double or reinforced insulation (exception see 19.1.3) (IEC 61558-2-6)		N/A
	Class I transformers (IEC 61558-2-6)		—
	– Insulation between input windings and body, connected to earth, consist of basic insulation rated to the input voltage (IEC 61558-2-6)		N/A
	– Insulation between output windings and body, connected to earth consist of basic insulation rated for the output voltage (IEC 61558-2-6)		N/A
	Class I transformers intended for connection to the mains by a plug (EN 61558-2-6:09):		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 (IEC 61558-2-6)		N/A
	– Insulation between input windings and body consist of double or reinforced insulation to the input voltage (IEC 61558-2-6)		N/A
	– Insulation between output windings and body consist of double or reinforced insulation to the output voltage (IEC 61558-2-6)		N/A
19.1.2	Transformers with intermediate conductive parts not connected to the body (between input/output) (IEC 61558-2-6):		N/A
19.1.2.1	Class I and Class II transformers (IEC 61558-2-6)		N/A
	the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation, rated to the working voltage. (IEC 61558-2-6)		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)		NA
	– 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
19.1.2.2	Class I transformers with earthed core, and not allowed for class II equipment (IEC 61558-2-6)		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 out-put voltage		N/A
19.1.2.3	Insulation between : input to intermediate conductive parts and output and intermediate parts consist of at least basic insulation (IEC 61558-2-6)		N/A
	– 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

19.1.3	For class I transformers, with protective screen, not connected to the mains by a plug the following conditions comply (IEC 61558-2-6):		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 our wire is soldered or fixed to the protective screen.		N/A
	Protective screening is not allowed for transformers with plug connection to the mains (IEC 61558-2-6)		N/A
19.1.4	No connection between output circuit and protective earth, except of associated transformers (al-lowed by equipment standard) or 19.8 is fulfilled. (IEC 61558-2-6)		N/A
19.1.5	No connection between output circuit and body, except of associated transformers (allowed by equipment standard) (IEC 61558-2-6)		N/A
19.1.6	The distance between input and output terminals for the connection of external wiring is ≥ 25 mm		N/A
19.101	Portable transformers having an rated output < 630 VA (IEC 61558-2-6)		N/A
19.102	No connection between input and output circuit, except of associated transformers (allowed by equipment standard) (IEC 61558-2-6)		N/A
19.103	Protective screening is not allowed for transformers with plug connection to the mains (IEC 61558-2-6)		N/A
19.2	Fiercely burning material not used		P
	Unimpregnated cotton, silk, paper and fibrous material not used as insulation		P
	Wax-impregnated, etc. not used		P
19.3	Portable transformer: short-circuit proof or fail-safe		P
19.4	Class II transformers: contact between accessible metal parts and conduits or metal sheaths of supply wiring impossible		N/A
19.5	Class II transformers: part of supplementary or reinforced insulation, during reassembly after routine servicing not omitted		N/A
19.6	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 $\leq 50\%$ specified values (Cl. 26)		P

19.7	Conductive parts connected to accessible metal parts by resistors or capacitors shall be separated from hazardous live parts by double or reinforced insulation		N/A
19.8	Resistors or capacitors connected between hazardous live parts and the body (accessible metal parts) consist of:		N/A
	– components according to IEC 60 065, 14.1 or capacitor Y1 according to IEC 60 384-14		N/A
	– 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		N/A
19.9	Insulation material input/output and supplementary insulation of rubber resistant to ageing		P
	Creepage distances (if cracks) \geq specified values (Cl. 26)		P
19.10	Protection against accidental contact by insulating coating:		N/A
	a) ageing test (section I, IEC 60 068-2-2), test Ba: 168 h; 70°C		N/A
	b) impact test (spring-operated impact hammer according to IEC 60 068-2-63; $0,5 \pm 0,05$ J)		N/A
	c) scratch test (hardened steel pin) electric strength test according to Cl. 18		N/A
19.11	Handles, levers, knobs, etc.:		N/A
	– insulating material		N/A
	– supplementary insulation covering		N/A
	– separated from shafts or fixing by supplementary insulation		N/A
19.12	Windings construction		P
19.12.1	Undue displacement in all types of transformers not allowed:		P
	– of input or output windings or turns thereof		P
	– of internal wiring or wires for external connection		P
	– of parts of windings or of internal wiring in case of rupture or loosening		P
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 cheekless bobbins the end turns of each layer shall be prevented from being displaced		N/A
19.12.3	Insulated windings wires:		N/A
	– to all types of transformers for basic or supplementary insulation taken separately		N/A
	a) Winding wire with basic or supplementary insulation:		N/A
	– comply with Annex K		N/A
	– the insulation of the conductor: two layers		N/A
	b) Winding wire with double or reinforced insulation:		N/A
	– comply with Annex K		N/A

	– the insulation of the insulated winding wire: three layers		N/A
	– dielectric strength test with the values according to 18.3 multiplied by 1,25		N/A
	Where the wire is wound:		N/A
	– upon metal or ferrite cores		N/A
	– upon enamelled wire		N/A
	– under enamelled wire		N/A
	An additional insulation with a distance of supplementary insulation provided between insulated and enamelled wires		N/A
	100 % Routine test according to Annex K.3 for windings giving double or reinforced insulation		N/A
	For windings providing reinforced insulation the values in table 13, table C.1 and table D1, box 2) c), are not required		N/A
19.13	Handles, operating levers and the like shall be fixed		N/A
19.14	Protection against electric shock: covers securely fixed, 2 independent fixing means, one with tool		P
19.15	Transformer with pins for fixed socket-outlets: no strain on socket-outlet		P
	Additional torque $\leq 0,25$ Nm		P
19.16	Protection index for portable transformers:		N/A
	≤ 200 VA \geq IP20 and instructions for use		N/A
	> 200 VA $\leq 2,5$ kVA \geq IPX4 (single-phase)		N/A
	> 200 VA $\leq 6,3$ kVA \geq IPX4 (polyphase)		N/A
	$> 2,5$ VA (single-phase) \geq IP21		N/A
	$> 6,3$ VA (polyphase) \geq IP21		N/A
19.17	Transformers IPX1 - IPX6 totally enclosed, except for drain hole (diameter ≥ 5 mm or 20 mm ² with width ≥ 3 mm); drain hole not required for transformer completely filled with insulating materials		N/A
19.18	Transformers \geq IPX1 with a moulded, if any		P
19.19	Class I transformers with a non-detachable flexible cable or cord with earth conductor and a plug with earth contact		N/A
19.20	Live parts of SELV and PELV-circuits: separation not less than PRI/SEC of a safety isolating transformer		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	No such case	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		P
	Nominal voltage (V) > 25 V a.c. or 60 V d.c., the required insulation fulfils the high voltage test according to table 8 a		N/A
19.20.2	PELV-circuits double or reinforced insulation is necessary		N/A
19.21	FELV-circuits: protection against contact fulfils the min. test voltage required for the primary circuit	No such case	N/A
19.22	Class II transformers shall not be provided with means for protective earth		N/A

	For fixed transformers an earth conductor with double or reinforced insulation to accessible metal parts is allowed		N/A
19.23	Class III transformers shall not be provided with means for protective earth		N/A
20	COMPONENTS		P
	Components such as switches, plugs, fuses, lamp holders, flexible cables and cords, comply with relevant IEC standard		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).		P
	– Components without markings tested under transformer conditions including inrush current.		N/A
	– If no IEC standard exist, the component is tested under transformer conditions.		N/A
20.1	Appliance couplers for main supply shall comply with:		N/A
	– IEC 60 320 for IPX0		N/A
	– IEC 60 309 for other		N/A
20.2	Automatic controls shall comply with IEC 60 730-1		N/A
20.3	Thermal-links comply with IEC 60691		P
20.4	Switches shall comply with annex F		N/A
	Disconnection from the supply:		N/A
	– by a switch, disconnecting all poles of the supply (full disconnection under the relevant over-voltage 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
20.5	Socket-outlets of the output circuit shall be such that there is no unsafe compatibility to plugs complying with input circuit.		P
	Plugs and socket-outlets for SELV systems with both a rated current $\leq 3A$ and a rated voltage $\leq 24 V$ shall comply with following:		P
	SELV plug and socket-outlets shall comply with IEC 60 884-2-4 and IEC 60 906-3		P
	– 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		P
	– Socket outlets do not have a protective earth contact		P
	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
20.6	Thermal cut-outs, overload releases etc. have adequate breaking capacity		P
	– Thermal cut outs fulfil the relevant requirements of 20.7 and 20.8		N/A
	– Thermal links fulfil the relevant requirements of 20.8		P
	– The breaking capacity is in accordance with the relevant fuse standard		N/A
20.6.1	For Fuses According IEC 60127 and IEC 60269, the fuse current does not exceed 1,1 times of the rated value		N/A
20.7	Thermal cut outs shall meet the requirements of 20.7.1.1 and 20.7.2, or 20.7.1.2 and 20.7.2.		N/A
20.7.1	Requirements according to IEC 60730-1		N/A
20.7.1.1	Thermal cut-out tested as component shall comply with IEC 60 730-1		N/A
20.7.1.2	Thermal cut-out tested as a part of the transformer		N/A
	a) Thermal cut outs type 1 or type 2 (IEC 60730-1)		N/A
	b) Thermal cut outs fulfil the requirements of micro-interruption (type 1C or 2 C) or micro-disconnection, (type 1B or 2B) (see IEC 60730-1)		N/A
	c) Thermal cut outs with manual rest have a trip free mechanism (type 1E and 2E) (see IEC 60730-1)		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 IEC 60730-1, 6.14.2		N/A
	f) Characteristic of thermal cut-outs:		N/A
	– ratings according IEC 60730-1, cl. 5		N/A
	– classification according to:		N/A
	1) nature of supply to IEC 60730-1, cl. 6.1		N/A
	2) type of load controlled to IEC 60730-1, cl. 6.2		N/A
	3) degree of protection IPX0 to IEC 60730-1, cl. 6.5.1		N/A
	4) degree of protection IP0X to IEC 60730-1, cl. 6.5.2		N/A
	5) pollution degree to IEC 60730-1, cl. 6.5.3		N/A
	6) comparative tracking index to IEC 60730-1, cl. 6.13		N/A

	7) max. ambient temperature to IEC 60730-1, cl. 6.7		N/A
20.7.1.2	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)		N/A
	– 300 h aged at t_a (transformer) + 10°C		N/A
	– subjected to a number of cycles for automatic operating according 20.7.1.1		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
20.7.2	Thermal cut-outs shall have adequate breaking capacity		N/A
20.7.2.1	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 $t_{a\ min}$		N/A
	– 3 cycles at $t_{a\ min}$ for transformers with $t_{a\ min}$		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
20.7.2.2	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 $t_{a\ min}$		N/A
	– 24 h at t_a and 24 h at $t_{a\ min}$ for transformers with $t_{a\ min}$		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
20.7.3	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. t_a		N/A
	5 cycles: transformer short-circuited for 48 h by 0,9 times of the input voltage and min. t_a (if de-		N/A
	After the test: withstand the test of clause 18, show no damage in sense of this standard, and be operational.		N/A
20.8	Thermal links shall be tested in one of the following two ways.		P
20.8.1	Thermal-links shall comply with IEC 60 691 as a separate component.		P
	– electrical conditions to IEC 60691, cl. 6.1		P
	– thermal conditions to IEC 60691, cl. 6.2		P
	– ratings to IEC 60691, cl. 8 b		P
	– suitability of sealing components, impregnating fluids or cleaning solvents IEC 60691, cl. 8 c		P
20.8.2	Thermal-links tested as a part of the transformer:		N/A
	– ageing test 300 h by 35 °C or t_a + 10 °C		N/A

	– 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
20.9	Self-resetting devices not used if mechanical, electrical, etc. hazards		N/A
20.10	Thermal cut-outs which can be reset by soldering operation are not allowed		N/A
20.11	Overload protection devices do not operate during test (20 times switched on and off, at no load); U _{pri} (V): 1,1 times rated supply voltage.		N/A
21	INTERNAL WIRING		P
21.1	Internal wiring and electrical connections protected or enclosed		P
	Wire-ways smooth and free from sharp edges		P
21.2	Openings in sheet metal: edges rounded (radius ≥ 1,5 mm) or bushings of insulating material		N/A
21.3	Bare conductors: distances adequately maintained		N/A
21.4	When external wires are connected to terminal, internal wiring shall not work loose		P
21.5	Insulation of heat-resistant and non-hygroscopic material for insulated conductors subject to temperature rise > limiting values given in 14.2		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		N/A
	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:		N/A
	– possible to connect after fixing		N/A
	– inside space for wires allow easy introduction and connection of conductors		N/A
	– fitting of cover without damage to conductors		N/A
	– 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 between 2 m and 4 m; without 0,5 mm ²		P
22.5	Power supply cords for transformers IPX0 and transformers “for indoor use only” > IPX0:		P
	– for transformers with a mass < 3 kg: 60227 IEC52 (H03VV-..) (60245 IEC 53)		P
	– for transformers with a mass > 3 kg: 60227 IEC53 (H05VV-..) or 60245 IEC 53		N/A
	Power supply cords for transformers for outdoor use: > IPX0: 60245 IEC57 (H05RN-..)		P
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		N/A
22.7	Nominal cross-sectional area (mm ²); input current (A) at rated output not less than shown in table 9		P
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 according to IEC 60 083, IEC 60 906-1 or IEC 60 309		N/A
22.9	Type X, Y or Z attachments: see relevant part 2		P
22.9.1	For type Z attachment: moulding enclosure and power supply cable do not affect insulation of cable		P
22.9.2	Inlet openings or inlet bushing: without risk of damage to protective covering of power supply cord		P
	Insulation between conductor and enclosure:		P
	– 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
22.9.3	Inlet bushings:		N/A
	– no damage to power supply cord		N/A
	– reliably fixed		N/A
	– not removable without tool		N/A
	– not integral with power supply 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 portable transformers which are moved while operating:		P
	– cord guards, if any, of insulating material and fixed		P
	Compliance is tested by the oscillating test according to fig. 7:		P
	– loaded force during the test according to fig. 7		P
	– 10 N for a cross-sectional area > 0,75		N/A
	– 5 N for a cross-sectional area ≤ 0,75		P
	After the test according to fig. 7:		P
	– no short-circuit between the conductors		P
	– no breakage of more than 10% of strands of any conductor		P
	– no separation of the conductor from the terminal		P
	– no loosening of any cord guards		P
	– no damage of the cord or cord guard		P
	– no broken strands piercing the insulation and not becoming accessible		P
22.9.5	Cord anchorages for type X attachment:		N/A
	– 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
	– labyrinths, if clearly how, permitted		N/A
	Tests for type X with special cords, type Y, type Z		P
	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 11		N/A
	– not possible to push cable into transformer		P
	– 25 pulls of 1 s		P
	– 1 min torque according to table 10		P
	– 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		N/A
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, terminals		N/A
	Terminals are integral part of the transformer:		N/A
	– comply with IEC 60 999-1 under transformer conditions		N/A
	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
	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 metal parts should conductor break away $\geq 50\%$ of specified value (Cl. 26)		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 metal parts should conductor break away 50% of specified value (Cl. 26)		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
	– 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		N/A
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 inaccessible metal parts 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		N/A
	Class II transformers: no provision for 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
	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 $\leq 0,1 \Omega$ with a min. 25 A or 1,5 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		N/A
	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		P
	Screws to be removed (replacement etc. of power supply cord) not of insulating material if their replacement by metal screws can impair basic insulation		N/A
	No damage after torque test: diameter (mm); torque (Nm); ten times		P
	No damage after torque test: diameter (mm); torque (Nm); five times		N/A
25.2	Screws in engagement with thread of insulating material:		N/A
	– length of engagement ≥ 3 mm + 1/2 screw diameter or 8 mm		P
	– correct introduction into screw hole		N/A
25.3	Electrical connections: contact pressure not transmitted through insulating material		N/A
25.4	In case of use of thread-forming (sheet metal) screws for connection of current-carrying parts: clamping and locking means provided		N/A
	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		N/A
	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 12. After the test no damage at the transformer and the gland.		N/A
26	CREEPAGE DISTANCES AND CLEARANCES		P
	Specified values according to:		P
	– table 13, material group IIIa		P
	– table C, material group II		N/A
	– table D, material group I		N/A
	1. Insulation between input and output circuits (basic insulation):		N/A
	a) measured values \geq specified values (mm) .:		N/A
	2. Insulation between input and output circuits (double or reinforced insulation):		P
	a) measured values \geq specified values (mm) .:		P
	b) measured values \geq specified values (mm) .:		N/A
	c) measured values \geq specified values (mm) .:		
	3. Insulation between adjacent input circuits: measured values \geq specified values (mm)		N/A
	Insulation between adjacent output circuits: measured values \geq specified values (mm)		N/A
	4. Insulation between terminals for external connection:		N/A
	a) measured values \geq specified values (mm) .:		P
	b) measured values \geq specified values (mm) .:		N/A
	c) measured values \geq specified values (mm) .:		N/A
	5. Basic or supplementary insulation:		N/A
	a) measured values \geq specified values (mm) .:		P
	b) measured values \geq specified values (mm) .:		N/A
	c) measured values \geq specified values (mm) .:		N/A
	d) measured values \geq specified values (mm) .:		N/A
	e) measured values \geq specified values (mm) .:		N/A
	6. Reinforced or double insulation: measured values \geq specified values (mm)		N/A
	7. Distance through insulation:		N/A
	a) measured values \geq specified values (mm) .:		N/A

	b) measured values \geq specified values (mm) .:		N/A
	c) measured values \geq specified values (mm) .:		N/A
	Creepage distances and clearances are measured:		N/A
	– for fixed wiring and type X attachments with max. and min. size		N/A
	– for type X with a special cord, Y or Z attachments with the supply cable as delivered		N/A
	– for layers of serrated tapes the values are so determined as if the serration coincided through the different layers		N/A
	– for printed wiring shall be used the unreduced values for live parts as in table 13, C.1 or D.1, except if printed wiring complies with IEC 60 664-3		N/A
	If the pollution generates high and persistent conductivity caused:		N/A
	– clearances of P3 increased with min. 1,6 mm		N/A
	– value X in Annex A increased with 4,0 mm		N/A
26.2	Creepage distances (cr) and clearances (cl)		P
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
26.2.2	Uncemented insulating parts pollution degree P2 or P3		P
	– all isolating material are classified acc. to IEC 60085 and IEC 60216		P
	– values of pollution degree 1 are not applicable		P
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
	– 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
26.2.4	Enclosed parts, by impregnation or potting		N/A
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
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
	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
26.3	Distance through insulation		P
	For double or reinforced insulation, the required values of Tables 13, C1, and D1 – boxes 2b, 2c and 7 are fulfilled		P
	The insulation fulfil the material classification according IEC 60085 or 60216 or the test of 14.3		P

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
26.3.2	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 26.3.3 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” are 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” are 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” are 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 < 100 VA 2/3 of the value in square brackets apply		N/A
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
	– pull force of 150 N		N/A

	– high voltage test of 5,0 kV or the test volt-age 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 volt-age 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 volt-age of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdown.		N/A
26.101	The values for creepage distances clearances and distances through insulation for voltages above 1000 V are found by extrapolation.		N/A
27	RESISTANCE TO HEAT, FIRE AND TRACKING		P
27.1	Resistance to heat		P
	All insulating parts are resistant to heat		P
	For parts of rubber, which passed the test of 19.9, no additional test is required.		N/A
	The tests are not required for cables and small connectors with a rated current < 3 A, a rated volt-age < 24 V a.c. or 60 V d.c. and a power < 72 W		P
27.1.1	External accessible parts		P
	The Ball-pressure test -: diameter of impression ≤ 2 mm; heating cabinet temperature ($^{\circ}$ C) at 70° C or the temperature T of 14.1 (T + 15) - is fulfilled.		P
27.1.2	Internal parts		P
	For insulating material retaining current carrying parts in position , the ball-pressure test -: diameter of impression ≤ 2 mm; heating cabinet temperature ($^{\circ}$ C) at 125° C or the temperature T of 14.1 (T + 15) - is fulfilled		P
27.2	Resistance to abnormal heat under fault conditions		N/A
	Insulating material of transformers \geq IP20: no source of ignition for surroundings in case of abnormal heat or fire. Hazardous live parts shall not be accessible.		N/A
	Two special prepared specimens for the test in which short-circuit windings are built-in		N/A
27.2.1	Portable transformers are placed on a dull painted plywood support, as described in 14.1		N/A
	Stationary transformers fixed in the most unfavourable position on a dull painted support:		N/A
	– if this position for use is vertical or ceiling trans-former and support 200 mm above a pinewood board with tissue paper		N/A
	Self-resettable devices are short-circuit		N/A
	Input circuits protected with 10 times rated current, min. 16 A (fuse)		N/A
	Test time for protective devices of the transformer without load:		N/A
	– max. 15 days, or		N/A

	– definitive interruption in the input circuit		N/A
	If non-self-resettable or replaceable protective devices are used the following cycle test is necessary:		N/A
	– non-self-resettable: 30 cycles with no load until interruption and 2 h cool down		N/A
	– replaceable protective device: 10 cycles with no load until interruption and 2 h cool down		N/A
	During the tests:		N/A
	– no flames occur		N/A
	– support temperature shall not exceed 125 ° C		N/A
	– no ignition of the tissue paper		N/A
27.2.2	After the tests:		N/A
	a) transformer with definitive interruption in the input circuit withstands the test with 35% of the values according to table 8a		N/A
	b) transformer with no definitive interruption withstands the test voltage (100%) according to table 8a of Cl. 18: hazardous live parts are not touchable by the stranded test finger		N/A
27.3	Resistance to fire		P
	All isolating parts of the transformer shall be resistant to ignition and spread of fire. The test according to IEC 60696-2-10 is required		P
27.3.1	External accessible parts (glow wire tests)		P
	– 650° C for enclosures		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		N/A
	– 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
27.3.2	Internal parts		P
	– 550° C for internal insulating material – not retaining current carrying parts in position		N/A
	– 650° C for coil formers (bobbins)		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		N/A
	– 850° C for parts retaining current carrying parts in position and terminals for external conductors with non fixed wiring. Current > 0,2 A		P
27.4	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 IIIa		N/A
	Test (175 V): no flashover or breakdown before 50 drops		N/A
28	RESISTANCE TO RUSTING		P
	Ferrous parts protected against rusting		P

E	ANNEX E , GLOW WIRE TEST		P
	The test is required according to IEC 60695-2-10 and IEC 60695-2-11 with the following additions:		P
E 1	Clause 6, "Severities" of IEC 60695-2-11, apply with the temperature stated in 27.3 of IEC 61558-1		P
E 2	Clause 8, "Conditioning", of IEC 60695-2-11 apply, preconditioning is required		P
E 3	Clause 10, "Test Procedure", of IEC 60695-2-11 apply, The tip of the glow wire is applied to the flat side of the surface.		P
F	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 under the conditions of F2.		N/A
F 3	Manually operated mechanical switches tested as part of the transformer shall comply with the conditions specified under F.3		N/A
H	ANNEX H, ELECTRONIC CIRCUITS (IEC 61558-1)		N/A
H 1	General notes on tests (addition to clause 5)		N/A
H 2	SHORT-CIRCUIT AND OVERLOAD PROTECTION (ADDITION TO CLAUSE 15)		N/A
H 2.1	Circuits designed and applied so that fault conditions do not render the appliance unsafe		N/A
	During and after each test:		N/A
	– temperatures do not exceed values specified in table 3 of Cl. 15.1		N/A
	– transformer complies with conditions specified in sub-clause 15.1		N/A
	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 2.2	Fault conditions a) to f) of sub-clause H.2.3 are not tested if the following conditions are met:		N/A
	– electronic circuit is a low-power circuit as specified		N/A
	– safety of the appliance as specified does not rely on correct functioning of the electronic circuit		N/A
H 2.3	Fault conditions tested as specified when relevant:		N/A
	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		N/A
	c) short-circuit of capacitors, unless they comply with IEC 60 384-14		N/A
	d) short-circuit of any two terminals of an electronic component as specified		N/A
	e) any failure of an integrated circuit as specified		N/A
	f) low-power circuit: low-power points are connected to the supply source		N/A
	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

	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 2.4	If for a fuse-link complying with IEC 60 127-3 rated fuse current I1 is used, current I2 is measured as specified:		N/A
	– if $I2 < 2,1 \times I1$ test of 15.8 is repeated with fuse-link short-circuited		N/A
	– if $I2 > 2,75 \times I1$, no other tests are necessary		N/A
	If $I2 > 2,1 \times I1$ and $I2 < 2,75 \times I1$ 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		N/A
H 3	CREEPAGE DISTANCES, CLEARANCES AND DISTANCES THROUGH INSULATION		N/A
H 3.1	For live parts separated by basic insulation smaller cr and cl as in 26 are allowed, if H2 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, clause 4 are applicable,		N/A
	For potted transformers cycling tests acc, 26.2. are applicable		N/A
H 3.2	The ma. surface temperature of optocouplers is 50 K		N/A
K	ANNEX K, INSULATED WINDING WIRES FOR USE AS MULTIPLE LAYER INSULATION		N/A
K.1	Wire construction:		N/A
	– insulated winding wire with min. two layers for basic or supplementary insulation		N/A
	– insulated winding wire with min. three layers for reinforced insulation		N/A
	– winding insulation material		N/A
K.2	Conformance test		N/A
K.2.1	Test 13 of IEC 60 851-5 nominal conductor diameter $\geq 0,018 \text{ mm} \leq 0,1 \text{ mm}$, test as specified in 4.2.1 and 4.2.2 of IEC 60 851-5		N/A
	Nominal conductor diameter $> 0,1 \text{ mm}, \leq 2,5 \text{ mm}$, test as specified in 4.3.1 and 4.3.2 of IEC 60 851-5		N/A
	Nominal conductor diameter $< 2,5 \text{ mm}$, test as specified in 4.4.1 and 4.4.2 of IEC 60 851-5		N/A
	High voltage test immediately after the above specified tests:		N/A
	– test voltage for two layers 3 kV		N/A
	– test voltage for three layers 5,5 kV		N/A
K.2.2	Adherence and flexibility, test as specified under 5.1.4 of IEC 60 851-3		N/A
	– high voltage test immediately after this test		N/A
	– test voltage for two layers 3 kV		N/A
	– test voltage for three layers 5,5 kV		N/A
K.2.3	Heat shock, test as specified under 3.1 or 3.2 of IEC 60 851-6:		N/A
	– high voltage test immediately after this test		N/A
	– test voltage for two layers 3 kV		N/A

	– test voltage for three layers 5,5 kV		N/A
K.2.4	Retention of dielectric strength after bending, test as specified under test 13 of 4.6.1 c) of IEC 60 851-5		N/A
	1. high voltage test immediately after this test		N/A
	2. test voltage for two layers 3 kV		N/A
	3. test voltage for three layers 5,5 kV		N/A
U	ANNEX U – INFORMATIVE – OPTIONAL TW – MARKING FOR TRANSFORMERS		N/A
	The tests of Annex U are based on constant S = 4500. Other constants are possible, if the test of U.5.2 is done with positive result.		N/A
U1	General notes and tests		N/A
	8 transformers of one type are necessary for the test. Tests according U5.		N/A
U.2	Heating (addition to clause 14)		N/A
14.4	Thermal endurance test		N/A
	Test according U5 and measurements according 11.1		N/A
	Transformers tested as a integral part of the equipment (option), assigned with tw		N/A
	The thermal conditions are so adjusted, that the duration of test is as indicated by the manufacturer.		N/A
	If no indications are given, the test period is 30 days		N/A
	After the test, when the transformers have returned to room temperature, they fulfil the following requirements:		N/A
	a) The output voltage has not changed from the measured value at the beginning by more than allowed value of clause 11.1		N/A
	b) The insulation resistance between input and output winding and between windings and body is, measured with 500 V d.c. , not less than 1 MOhm		N/A
	c) The transformer fulfil the dielectric strength test with 35% of the values in Clause 18, Table 8.a.		N/A
	The test result is positive, is min. 6 of the 7 samples have passed the test.		N/A
	The test result is negative, if 2 or more samples fail the test		N/A
	If the result is negative, the test can be repeated with 7 new samples		N/A
U.3	Short circuit and overload protection (addition to clause 15)		N/A
	At short circuit and overload tests the winding temperature if less than the required value of table U.1		N/A
U.5	General requirements and information about thermal endurance test on windings		N/A
U.5.1	Thermal endurance test		N/A
	Transformers tested at rated output		N/A
	Loads outside of the oven		N/A

	7 transformers are placed in the oven		N/A
	The temperature of the hottest winding of each of the 7 transformers is-together with the oven temperature, at the applicable temperature of table U.2		N/A
	After 4 hours measuring of the actual winding temperatures. Regulation of the oven temperature if necessary		N/A
	After 24 hours again measuring of the winding temperature. The temperatures of the 7 samples are very near to the required temperature of the values of table U.2. The test time of the coldest winding is not longer than twice the theoretical test time based on table U.2		N/A
U.5.2	The use of constant S other than 4500 in tw tests		N/A
U.5.2.1	Procedure a)		N/A
	The manufacturer prepares test results with a minimum of samples of 30.		N/A
	T and log L are calculated from the dates		N/A
	The diagram according to Figure U.2 will be found.		N/A
U.5.2.3	Procedure b)		N/A
	The testing authority shall test 14 new transformers		N/A
	Test 1, based on clause U.5.1 but at the calculated test room temperature for 10 days. The test is continued until all transformer fail.		N/A
	Calculation of the mean life L2 at temperature T2 according to U4		N/A
	Test 2, based on clause U.5.1 but at a calculated room temperature T2 (for 120 days).The test time with T2 exceeds L2.		N/A
	If all transformers fail before L2, the result is nega-		N/A
V	ANNEX V, SYMBOLS TO BE USED FOR THERMAL CUT-OUTS		P
V.2.1.1	Restored by manual operation		N/A
	IEC 489/98		
V.2.1.2	Restored by disconnection of the supply		N/A
	IEC 490/98		
V.2.1.3	Thermal link		P
	IEC 491/98		
V.2.2	Self-resetting thermal cut-out		N/A
	IEC 492/98		

19.15	<p>Transformers provided with pins intended to be introduced into fixed socket-outlets shall not impose undue strain on these socket-outlets.</p> <p><i>Compliance is checked by inserting the transformer, as in normal use, into a fixed socketoutlet complying with IEC 60083, the socket-outlet being pivoted about the horizontal axis through the central lines of the contact tubes at a distance of 8 mm behind the engagement face of the socket-outlet.</i></p>		N
	<p><i>Compliance is checked by inserting the transformer, as in normal use into a socket-outlet capable of accepting a 10 A plug complying with Figure 2.1(a) of AS/NZS 3112.</i></p>		N
	<p><i>The socketoutlet has a horizontal pivot at a distance of 8 mm behind the engagement face of the socketoutlet and in the plane of the lower intersection of the centre lines of the contact apertures.</i></p>		N
19.201	<p>Transformers having integral pins for insertion into socket outlets shall comply with the appropriate requirements of AS/NZS 3112.</p>		N
	<p><i>Compliance is checked as specified in Appendix J of AS/NZS 3112</i></p>		N
	<p>NOTE 1 Clause J.2.2.3 (Internal connections for plug portions) of AS/NZS 3112 is covered by clause 19.6 and clause 21 of this standard</p>		N
	<p>NOTE 2 Clause J.2.2.6.2 (High voltage test) of AS/NZS 3112, except for the test of the insulation of the insulated pins, is covered by clause 18 of this standard.</p>		N
	<p>NOTE 3 Clause J.2.2.6.4 (Temperature rise test) of AS/NZS 3112 is covered by clause 14 of this standard</p>		N
	<p>NOTE 4 Clause J.2.2.6.7 (Equipment with integral pins intended to be supported by the contacts of a socketoutlet) of AS/NZS 3112 is covered by clause 19.15 of this standard</p>		N
20	<p>Components</p>		N
	<p>Components such as switches, plugs, fuses, lampholders, capacitors and flexible cables and cords shall comply with the relevant IEC or Australian/New Zealand standard as far as it reasonably applies.</p>		N
	<p>Components incorporated in or supplied with the transformers are subjected to all tests of this standard as part of the transformer.</p>		N
	<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.</p>		N
20.5	<p>There shall be no unsafe compatibility between the socket-outlets in the output circuit and a plug intended for direct connection to a socket-outlet which could be used for the input circuit in relation to installation rules, voltages, and frequencies.</p>		N

	Plugs and socket-outlets for SELV systems shall comply with the requirements of Annex E in AS/NZS 3112 or IEC 60906-3 and 60884-2-4. However, plugs and socket-outlets for SELV systems with both a rated current ≤ 3 A and a maximum voltage of 24 V a.c. or 60 V d.c. with a power not exceeding 72 W are allowed to comply only with the following requirements:		N
22.6	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 .		N
22.8	Each Power supply cord of class I transformers shall have a green/yellow coloured cord connected to the protective earth terminal of the transformer and to the protective earth contact of the plug, if any.		N/A
	Power supply cords of single-phase portable transformers having an input current at rated output not exceeding 16 A shall be provided with plugs complying with IEC 60083 or IEC 60906-1. Other portable transformers may be provided with plugs complying with IEC 60309.		N
	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		N

Type of equipment: Rectifier Bridge

Details of:

View:

general

front

rear

right

left

top

bottom



Details of:

View:

general

front

rear

right

left

top

bottom

