TEST REPORT

IEC 61558-2-12
Safety of power transformers, power supply units and similar devices
Part 2-12: Particular requirements for constant voltage transformers

Test Report No..... :	**STR-62-021**
Equipment Under Test (EUT) No...:	**ST-61-0296**
TISI No...... :	--
Testing Laboratory Name ..... :	**Electrical and Electronic Products Testing Center**
Address ..... :	141 Thailand Science Park Innovation Cluster 2 Phahonyothin Rd. Khlong Nueng, Khlong Luang, Pathum Thani 12120, Thailand.
Applicant's Name..... :	**FEIGIN ELECTRIC CO., LTD**
Address ..... :	40/1 Moo.5 Huay Yai Ra., Huay Yai, Banglamung, Chonburi 20150
Manufacturer's Name.....:	**FEIGIN ELECTRIC CO., LTD**
Address ..... :	40/1 Moo.5 Huay Yai Ra., Huay Yai, Banglamung, Chonburi 20150
Test specification	
Standard ..... :	IEC 61558-1:2005+A1:2009 IEC 61558-2-12:2011
Non-standard test method ..... :	N/A
Test item description..... :	**Smart Optimizer ECOD**
Trademark ..... :	feiginelectric Energy savings technology / ecod smart optimizer
Model and/or type reference ..... :	ES-IN-ML-50
Serial number ..... :	-
Date(s) of performance of test ..... :	November 18 to December 14, 2018
Date of report issue ..... :	December 20, 2018

Tested by

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Approved by

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Operation manager

Particulars: test item vs. test requirements	
Rating(s)..... :	220-266V, 50A 35kVA, 50/60Hz
Type of transformers ..... :	Isolation transformer
Protection against electric shock..... :	Class I
Protection index..... :	IP40
Other characteristics ..... :	N.A
Rated ambient temperature ta (℃)..... :	-40 to +50 °C
Test case verdicts	
Test case does not apply to the test object :	N/A
Test item does meet the requirement ..... :	P(Pass)
Test item does not meet the requirement .. :	F(Fail)

General remarks

- Test marked (*) in this Report are not included in the TISI Accreditation Schedule for our Laboratory.
- This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval by PTEC.
- The test results presented in this report relate only to the item(s) tested.
- "(see remark #)" refers to a remark appended to the report.
- "(see Annex #)" refers to an annex appended to the report.

summary of test results

The EUT was tested and past the referent standard IEC 61558-2-12:2011

Tested product:

IEC 61558-2-12			
Clause	Requirement + Test	Result - Remark	Verdict
7	**Classification**	Class I	P
8	**MARKING AND OTHER INFORMATION**		--
8.1	Transformer marked with:		P
	a) rated supply voltage(s) and input voltage variation in % .....:	220-265V, +-0.2%	P
	b) rated output voltage(s) and the regulation tolerance of this voltage(s) in % .....:	208-253V, +-0.2%	P
	c) rated output (VA, kVA or W) ..... :	35 kVA	P
	d) rated output current (A) ..... :	50 Amp	P
	e) rated frequency (Hz) ..... :	50/60 Hz	P
	f) rated power factor (if not 1)..... .:		N/A
	g) symbol for nature of output current for transformers with rectifier		N/A
	h) symbol for electrical function		N/A
	Constant voltage transformers shall be marked with one of the graphical symbols shown in 8.11:		N/A
	i) manufacturer's name or trademark		P
	j) model or type reference		P
	k) vector group according to IEC 76 for three- phase transformer		N/A
	l) symbol for Class II		N/A
	m) symbol for Class III		N/A
	n) index IP (if not IP00 or ordinary transformer)	IP 40	P
	o) rated max. ambient temperature ta (if not 25 ℃) .....:	ta - 50 ℃	P
	p) short-time operation or intermittent operation: rated operating and resting time		N/A
	q) duty cycle		N/A
	r) declared values of the rated maximum operating temperature of the winding		N/A
	s) “AF” followed by the air speed		N/A
	t) additional information		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 voltage Adjustor	N/A
8.4	For each tapping or winding: rated output voltage and rated output	208-253V, +-0.2%	P

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Clause	Requirement + Test	Result - Remark	Verdict
8.5	Symbol for short-circuit proof transformers or non-inherently short-circuit proof transformers		N/A
	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 ..... :	No fuse	N/A
	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)	Feigin electric ES-IN-ML	P
	Characteristic symbol for fail-safe transformers		N/A
8.6	Terminals for neutral: "N"	N	P
	Terminal for earthing	G	P
	Identification of input terminals: "PRI"		N/A
	Identification of output terminals: "SEC"		N/A
	Symbol for any point/terminal in connection with frame or core	Bypass	P
8.7	Indication for correct connection	Evident from the design	P
8.8	Instruction sheet for type X, Y, Z attachments	Type Y	P
8.9	Transformer for indoor use shall be marked on the label or in the instruction sheet with the words: "for indoor use only"		N/A
8.10	Symbol for Class II construction not confused with maker's name or trademark	Class I	N/A
8.11	Correct symbols:		--
	Volts	V	P
	Amperes	A	P
	Volt amperes (or volt-amperes reactive for reactors)	VA	P
	Watts		N/A
	Hertz	Hz	P
	Input	Input	P
	Output	Ouput	P
	Direct current	For AC	N/A
	Neutral	N	P
	Single-phase a.c.		N/A
	Three-phase a.c.		N/A
	Three-phase and neutral a.c.	3N~ AC	P
	Power factor	Cos ø 0.99	P
	Class II construction		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Class III construction		N/A
	Fuse-link	No fuse	N/A
	Rated max. ambient temperature	ta=50C	P
	Frame or core terminal		N/A
	Protective earth		P
	IP number	IP 40	P
	For indoor use only (text)		N/A
	tw marked transformer only with 5 years life expectancy		N/A
	tw marked transformer only with 10 years life expectancy		N/A
	tw marked transformer only where x=life expectancy		N/A
8.12	Figures, letters or other visual means for different positions of regulating devices and switches		P
	OFF position indicated by figure 0		N/A
	Greater output, input etc. indicated by higher figure		--
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 if necessary		N/A
8.15	Marking durable and easily legible		P
9	**PROTECTION AGAINST ELECTRIC SHOCK**		**--**
9.1	Protection against contact with hazardous live parts		--
9.1.1	Determination of hazardous live parts		P
	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 19.1.1.1 or 9.1.1.2 are met when the transformer is supplied at rated supply voltage		--
9.1.1.1	The voltage shall not exceed 35 Va.c. peak or 60 V ripple free d.c.		P
9.1.1.2	Where the voltage exceeds 35 V (peak)a.c. or 60 V ripple free d.c., the touch-current shall not exceed:		--
	- for a.c.: 0,7 mA (peak)		N/A
	- for d.c.: 2,0 mA		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	When a capacitor is connected to the live parts:		--
9.1.1.2.1	The discharge shall not exceed 45 µC for stored voltage between 60 V and 15 kV		N/A
9.1.1.2.2	The energy of discharge shall not exceed 350 mJ for stored voltage exceeding 15 kV		N/A
9.1.2	Accessibility to hazardous live parts	Comply whit requirement	P
	Transformers shall be constructed to provide adequate protection against accessibility to hazardous live parts		P
	Class I and II transformers shall be so constructed and enclosed that there is adequate protection against accidental contact with hazardous live parts	Class I	P
	For class I transformers, accessible parts shall be separated from hazardous live parts by at least basic insulation		P
	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. Only parts separated from hazardous live parts by double or reinforced insulation may be accessible	Class I	N/A
	Hazardous live parts shall not be accessible after removal of detachable parts except for:	Not be accessible parts	P
	– lamps having caps larger than B9 and E10		N/A
	– type D fuse-holders		N/A
	Lacquers, enamel, paper, cotton, oxide film on metal parts not used for protection against accidental contact with hazardous live parts:		--
	Shafts, handles, operating levers, knobs and the like shall not be hazardous live parts		P
	- Compliance is checked by inspection and by relevant tests according to IEC 60529		P
	- Ordinary transformer: test according to fig. 2 (test finger)		P
	- Class II transformers and Class II parts of Class I construction are tested with the test pin shown in fig. 3	Class I	N/A
	- hazardous live parts shall not be touchable by test finger		P
	- for Class II transformers: metal 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		P
9.1.3	Accessibility to non-hazardous live parts	Not be touch non-hazardous live parts	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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:		N/A
	– for no-load output voltages not exceeding 35 V peak a.c. or 60 V ripple-free d.c., both poles may be accessible		N/A
	– for no-load output voltages exceeding 35 V peak a.c. or 60 V ripple-free d.c. and not exceeding 250 V a.c., only one of the poles may be accessible		N/A
9.2	Protection against hazardous electrical discharge		P
	For transformers with a primary supply plug, the pins of the plug shall not be hazardous live measured 1s after withdrawal of the plug	No used plug	N/A
	For transformers without a primary supply plug, the terminals provided for connecting the transformer to the supply source shall not be hazardous live measured 5 s after disconnection of the supply source	3.2 Sec	P
	Compliance is checked by the specified test		P
	Except nominal capacitance across the pins does not exceed 0,1 µF		N/A
10	**CHANGE OF INPUT VOLTAGE SETTING**		**--**
	Voltage setting not possible to change without a tool	No such device	N/A
	Different rated supply voltages:		N/A
	- indication of voltage on the transformer discernible		N/A
11	**OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD**		**--**
11.1	The output voltage shall not differ from the rated value by more than the regulation tolerance.		P
	Measuring the output voltage when steady-state conditions are established	See appended table	P
	For transformers incorporating a rectifier, the output voltage is measured at the terminals of the d.c. circuit by means of a voltmeter giving the arithmetical mean value, unless the effective (r.m.s.) value is specifically stated (see 8.1)	No use rectifier	N/A
	For transformers with more than one rated supply voltage, the requirement is applicable for each of the rated supply voltages.		N/A
	For transformers with multiple output windings, the loads are applied to every multiple section simultaneously, unless otherwise declared.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
11.2	The rated output, the rated output voltage, the rated output current, and the rated power factor, shall be substantially in agreement with each other	See Unit Marking	P
	If no rated output current is assigned to the transformer, the rated output current for the of this specification can be calculated from the purpose rated output and the rated output voltage		N/A
12	**NO-LOAD OUTPUT VOLTAGE (see supplementary requirements in Part 2)**		**--**
	Remark: with rectifier measuring on both sides of the rectifier		N/A
12.101	The no-load output voltage shall not exceed		
	1 000 V a.c. or 1 415 V ripple-free d.c. for constant voltage auto-transformers and constant voltage separating transformers;		N/A
	500 V a.c. or 708 V ripple-free d.c. for constant voltage isolating transformers;	See appended table	P
	50 V a.c. or 120 V ripple-free d.c. for constant voltage safety isolating transformers		N/A
	The no-load output voltage shall exceed		--
	50 V a.c. or 120 V ripple-free d.c. for constant voltage independent auto- and separating transformers.		N/A
12.102	The difference between the no-load output voltage and the output voltage under load shall not be exceed 10%. $\frac{U_{no-load} - U_{load}}{U_{load}} \times 100\%$	Maximum -6.35%	P
13	**SHORT-CIRCUIT VOLTAGE**		**--**
	Difference from marking for short-circuit voltage ≤ 20%	No shot-circuit voltage marked	N/A
	The transformer being at ambient temperature		N/A
14	**HEATING**		**--**
14.1	No excessive temperature in normal use	See appended table	P
	Upri (V): 1,06 times rated supply voltage .....:	1.06x 260=275	P
	Cos f = rated power factor .....:	1.0	P
	Room temperature: rated ambient temperature (°C) .....:	50	P
	Type X, Y, Z attachments: 1 pull (5 N) to the connection windings	Type Y	P
	Electric strength between input and output windings (18.3, 1 min); test voltage (V) .....:	See 18.3	P

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Clause	Requirement + Test	Result - Remark	Verdict
14.2	Application of 14.1 or 14.3 according to the insulation system		P
	Modification of the ninth paragraph starting with "Transformers are connected..." as follows:		--
	The constant voltage transformers are connected to rated supply voltage and loaded with an impedance which would give rated output, at rated output voltage and, for a.c., at rated power factor. The supply voltage is then increased to the value of the highest input voltage variation declared by the manufacturer. After this voltage increase, no change or adjustment is made in the circuit.		P
	The test is repeated under no-load condition if this is a more unfavourable situation.		N/A
14.2.1	Classified material according to IEC 60 085 and IEC 60 216 insulating class temperature index	No classified	N/A
14.2.2	No classified material but the measured temperature does not exceed the value of Class A		P
14.2.3	No classified material 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 (10 cycles):		--
	- no load current (mA) (18.4) .....:	Does not subjected to tests of this clause	N/A
	- no load input (18.4)		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, 100 Hz		N/A
14.3.3	- moisture treatment (48 h, 17.2)		N/A
14.3.4	After each test:		N/A
	- insulation resistance (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
	- electric strength, no breakdown (18.4); no load; duration (min): 2 min; Upri (V): 2 times rated supply voltage; frequency (Hz): 2 times rated frequency ..:		N/A
	- no load current ≤ 30% (18.4) deviates from the first measurement.....:		N/A
	- no load input ≤ 30% (18.4) deviates from the first measurement.....:		N/A
15	**SHORT-CIRCUIT AND OVERLOAD PROTECTION**		**--**

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Clause	Requirement + Test	Result - Remark	Verdict
15.1	which are carried out immediately after the test according to 14.2,		P
15.2	Inherently short-circuit-proof constant voltage transformers		N/A
15.3	For non-inherently short-circuit proof transformers and for transformers with rectifiers: temperature rises ≤ values in table 3		P
15.3.1	The output windings are short-circuited or overloaded as stated in 15.2.	Breaker protective	P
15.3.2	If protected by a fuse according to IEC 60269-2 or IEC 60269-3 or a technically equivalent fuse, transformer is loaded with time T and a current equal to k times values according to table 4	No used fuse	N/A
15.3.3	If protected by a fuse according to IEC 60 127 or ISO 8820 or a technically equivalent fuse, transformer is loaded for the longest pre-arcing time with the redundant current as specified in the standard sheet		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		N/A
15.3.5	If other overload protection than a fuse (IEC 60 127), a circuit-breaker (IEC 60 898) or an intentional weak part test with 0,95 times of operating current		N/A
15.4	For non-short-circuit proof transformers: temperature rises ≤ values in table 3		P
15.5	For fail-safe transformers:		--
15.5.1	Three additional new specimens are used only for the following test.		N/A
	- Upri (V): rated supply voltage variation declared .:		N/A
	- Isec (A): 1,5 times rated output current .....:		N/A
	- time until steady-state conditions t1 (h) .....:		N/A
	- time until failure t2 (h): ≤ t1; ≤ 5 h .....:		N/A
	During the test:		--
	- no flames, molten material, etc.		N/A
	- temperature of enclosure ≤ 175 ℃		N/A
	- temperature of plywood support ≤ 125 ℃		N/A
	After the test:		--
	- electric strength (Cl. 18, 1 min, test voltage: 35% of specified value); no flashover or breakdown for primary-to-secondary only for safety isolating, isolating and separating transformer and for primary-to-body for all kinds of transformer		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- bare hazardous live parts not accessible by test finger through holes of enclosure		N/A
16	**MECHANICAL STRENGTH**		**--**
16.1	After tests of 16.2 and 16.3 and 16.4:		--
	- 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		P
16.2	For stationary transformers: 3 blows, impact energy 0.5 Nm		P
16.3	For portable transformers: 100 falls, 25 mm		N/A
16.4	Transformers with integrated pins, the following tests are carried out:		--
	a) plug-in transformers: tumbling barrel test: 50 x ≤ 250 g; 25 x ≤ 250 g		N/A
	b) torque test of the plug pins with 0,4 Nm		N/A
	c) pull force according to table 5 for each pin		N/A
17	**PROTECTION AGAINST HARMFUL INGRESS OF DUST, SOLID OBJECTS AND MOISTURE**		**--**
17.1	IP number marked on the transformer	IP40	P
	Test according to 17.1.1 and for other IP ratings test according to IEC 60529:		--
	- stable operating temperature before starting the test for < IPX8		N/A
	- transformer mounted and wired as in normal use		N/A
	- fixed transformer mounted as in normal use by the tests according to 17.1.1 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:		--
	- dielectric strength test according to 18.3	See clause 18.3	P
	Inspection:		--
	a) in dust-proof transformers no deposit of talcum powder		N/A
	b) no deposit of talcum powder inside dust-tight transformers		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	c) no trace of water on live parts or insulation if hazard for the user or surroundings no reduction of creepage distances		N/A
	d) no accumulation of water in transformers > IPX1 so as to impair safety		N/A
	e) no trace of water entered in any part of watertight transformer		N/A
	f) no entry into the transformer by the relevant test probe		N/A
17.1.1	Tests on transformers with enclosure		--
	A) Solid-object-proof transformers: first IP numeral 2 test finger (IEC 60529) and test pin (fig. 3)	IP40	N/A
	B) Solid-object-proof transformers:		N/A
	- first IP numeral 3, wire 2,5 mm; force 3 N		N/A
	- first IP numeral 4, wire 1 mm; force 1 N		P
	C) Dust-proof transformers, first characteristic IP numeral 5; dust chamber according to IEC 60 529, fig. 2:	IP40	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 (IPX6) test according to C)		N/A
	E) Drip-proof transformers (IPX1) test according to fig. 3 of IEC 60529 for 10 min		N/A
	F) Drip-proof transformers (IPX2) test according to fig. 3 of IEC 60529 For 10 min with any angle up to 15^{o}		N/A
	G) Spray-proof transformers (IPX3) test according to fig. 4 of IEC 60529 for 10 min in operation and 10 min switched off (the tube shall oscillate 2 x 120 °C)		N/A
	H) Splash-proof transformers (IPX4) test according to fig. 4 of IEC 60529 (see F) for 10 min in operation and 10 min switched off (the tube shall oscillate 2 x 360 °C)		N/A
	I) Jet-proof transformer test according to fig. 6 of IEC 60529		N/A
	J) Powerful jet-proof transformers test according to fig. 6 of IEC 60529		N/A
	K) Water-tight transformers (IPX7)		N/A
	L) Pressure watertight transformers (IPX8)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
17.2	Humidity treatment		P
	After moisture test (48 h for ≤ IP20, 168 h for other transformers):		--
	- insulation resistance and electric strength (Cl. 18)	See clause 18	P
18	**INSULATION RESISTANCE AND ELECTRIC STRENGTH**		**--**
18.2	Insulation resistance between:		--
	- live parts and body for basic insulation > 2 MΩ	95.6 MΩ	P
	- live parts and body for reinforced insulation > 7 MΩ	14 GΩ	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		N/A
	- 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
	- body and metal parts with basic insulation (Class II transformers) > 5 MΩ		N/A
	- metal foil in contact with inner and outer surfaces of enclosures (class II transformers) > 7 MΩ		N/A
18.3	Electric strength test (1 min): no flashover or breakdown:		--
	1) basic insulation between input circuits and output circuits; working voltage (V); test voltage (V)	Working voltage 260V Test voltage 1500V	P
	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:		--
	a) live parts of different polarity; working voltage (V); test voltage (V)…..:		N/A
	b) live parts and the body if intended to be connected to protective earth .....:	Working voltage 260V Test voltage 1500V	P
	c) inlet bushings and cord guards and anchorages.....:		P
	d) live parts and an intermediate conductive part ……...:		N/A
	e) intermediate conductive parts and body .....:		N/A
	f) each input circuit and all other input circuits connected together .....:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	4) Reinforced insulation between the body and live parts; working voltage (V); test voltage (V) .....:		N/A
18.4	Upri (V): 2 times rated input voltage; no load; frequency (Hz): 2 times rated frequency; duration (min): 5 min .....:	520V, 100Hz, 5 min	P
	No breakdown between:		--
	- turns of winding		P
	- input and output windings		P
	- adjacent input or output windings		P
	- windings and iron core		P
18.5	Touch current and protective earth conductor current		P
	Measured as described under 18.5.1 and 18.5.2		P
18.5.1	Touch current		N/A
	the touch current measured shall be equal to or less than in Table 8b	Class I	N/A
18.5.2	Protective earth conductor current		P
	The protective earth conductor current (s) shall not exceed the values specified in Table 8b	0.78mA, (<10mA)	
19	**CONSTRUCTION**		**--**
A)	Constant voltage auto-transformers		N/A
19.101.A)to 19.105.A)	Void.		--
19.106.A)	Plug-connected constant voltage auto- transformers, where the rated supply voltage is higher than the rated output voltage, shall not have any potential to earth at the output socket higher than the rated output voltage.		N/A
19.106.1. A)	Polarized input and output plug and socket-outlet system		N/A
19.106.2. A)	Self-acting device		N/A
	Not exceed the rated output voltage.		N/A
	The measured potential to earth of each pole shall not exceed the maximum output voltage under load		N/A
	The contact separation of the device shall be 3 mm minimum in each pole.		N/A
	This current shall not exceed 0,75 mA and shall only flow for the period of measurement until the output voltage is turned on.		N/A
	The potential to earth of each pole shall not exceed the maximum output voltage under load plus the highest output voltage variation for more than 5 s.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
19.107.A) to 19.110.A)	Void.		--
B)	Constant voltage separating transformers		N/A
19.1.B)	The input and output circuits shall be electrically separated from each other, and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, via other metal parts.		N/A
19.1.1.B)	The insulation between the input and output winding(s) shall consist of at least basic insulation.		N/A
19.1.2.B)	For constant voltage transformers with intermediate metal part (for example, the iron core) or a resonant circuit, not connected to the body and located between the input and output windings, the insulation between the intermediate metal part (or a resonant circuit) and the input windings or between the intermediate metal part (or a resonant circuit) and the output windings shall consist of at least basic insulation.		N/A
19.101.B)	Parts of output circuits may be connected to protective earth.		N/A
19.102.B)	There shall be no connections between the output circuit and the body unless this is allowed by the relevant equipment standard for associated transformers.		N/A
C)	Constant voltage isolating and safety isolating transformers		N/A
19.1.C)	The input and output circuits shall be electrically separated from each other, and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, via other metal parts.		N/A
19.1.1.C)	The insulation between the input and output winding(s) shall consist of double or reinforced insulation, unless the requirements of 19.1.3 are complied with.		N/A
19.1.2.C)	For constant voltage transformers with intermediate metal parts (for example, the iron core) or a resonant circuit not connected to the body and located between the input and output windings, the insulation between the intermediate metal part (or a resonant circuit) and the input windings or between the intermediate metal part (or a resonant circuit) and the output windings shall consist of at least basic insulation.		N/A
19.1.3.C)	For class I constant voltage transformers with protective screening, the insulation between the input and output windings may consist of basic insulation plus protective screening instead of double or reinforced insulation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
19.1.4.C)	Transformers shall not be provided with capacitors which electrically connect input and output circuits.		N/A
19.101.C)	There shall be no connections between the output circuit and the protective earth		N/A
19.102.C)	There shall be no connections between the output circuit and the body		N/A
19.103.C)	The input and output terminals for the connection of external wiring shall not less than 25 mm.		N/A
19.104.C)	Portable transformers having a rated output not exceeding 630 VA shall be of class II.		N/A
19.105.C)	For transformers intended for connection to the mains supply by means of a plug of any type, the alternative construction with basic insulation plus protective screening is not allowed.		N/A
19.106.C) to 19.110.C)	Void		--
19.2	Fiercely burning material not used		P
	Unimpregnated cotton, silk, paper and fibrous material not used as insulation		P
	Wax, impregnants, etc. not used		P
19.3	Portable transformer: short-circuit proof or fail-safe		N/A
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 ≤ 50% specified values (Cl. 26)		P
19.7	Parts connected to accessible metal parts by resistors or capacitors shall be separated from hazardous live parts by double or reinforced insulation		P
19.8	Resistors or capacitors connected between hazardous live parts and accessible metal parts consist of:		--
	- at least two separate components		P
	- if one component is short-circuited or open circuited, values specified in Cl. 9 shall not be exceeded		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- components according to IEC 60065, 14.1 or capacitor Y1 according to IEC 60 384-14		N/A
19.9	Insulation material separating input/output windings, and supplementary insulation of rubber resistant to ageing		N/A
	Creepage distances (if cracks) > specified values (Cl. 26)		N/A
19.10	Protection against accidental contact by insulating coating:		P
	a) ageing test (section I, IEC 60 068-2-2), test Ba: 168 h; 70 ℃		P
	b) impact test (spring-operated impact hammer according to IEC 60 068-2-63; 0,5 ± 0,05 J)		P
	c) scratch test (hardened steel pin) electric strength test according to Cl. 18		P
19.11	Handles, levers, knobs, etc.:		P
	- insulating material		P
	- supplementary insulation covering		P
	- separated from shafts or fixing by supplementary insulation		P
19.12	Windings construction		P
19.12.1	In all types of transformer, precautions shall be taken to prevent:		--
	- undue displacement of input or output windings or turns thereof		P
	- undue displacement of internal wiring or wires for external connection		P
	- undue displacement of parts of windings or of internal wiring in case of rupture or loosening		P
19.12.2	Serrated tape:		--
	- 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:		--
	- to all types of transformers for basic or supplementary insulation taken separately		N/A
	- transformers for switch mode power supplies for all types of insulation even in combination		N/A
	a) Winding wire with basic insulation:		N/A
	- comply with Annex K		N/A
	- the insulation of the conductor: two layers		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	b) Winding wire with reinforced insulation:		N/A
	- comply with Annex K		N/A
	- the insulation of the conductor: three layers		N/A
	- subjected to the relevant dielectric strength test of 18.3		N/A
	An additional insulation complying with dti in Table 13 for supplementary insulation shall be provided between the insulated wires and the core or between the insulated wires and the enamelled wires		N/A
	The manufacturer of the transformer shall demonstrate that the winding wire has been subjected to 100 % routine dielectric strength test as in K.3		N/A
	No requirements for creepage distances and clearances are applicable for the insulated winding wires		N/A
	For windings providing reinforced insulation, no value is required in box 2) c) of Table 13, Table C.1 and Table D.1		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		N/A
	Additional torque ≤ 0,25 Nm		N/A
19.16	Protection index for portable transformers:		N/A
	≤ 200 VA > IP20 and instructions for use		N/A
	> 200 VA ≤ 2,5 kVA > IPX4 (single-phase)		N/A
	> 200 VA ≤ 6,3 kVA > IPX4 (polyphase)		N/A
	> 2,5 KVA (single-phase) > IP21		N/A
	> 6,3 KVA (polyphase) > IP21		N/A
19.17	Transformers IPX1-IPX6 totally enclosed, except for drain hole (diameter > 5 mm or 20 mm² with width > 3 mm); drain hole not required for transformer completely filled with insulating materials	IP40	N/A
	Transformers > IPX7 totally enclosed		N/A
19.18	Transformers > IPX1 with a moulded, if any		N/A
19.19	Class I transformers with a non-detachable flexible cable or cord with earthing conductor and a plug with earthing contact		P
19.20	Live parts of SELV and PELV-circuits: separation not less than PRI/SEC of a safety isolating transformer		N/A
19.20.1	SELV circuits and parts not connected to earth, to live parts, or protective conductors forming part of other circuits		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Nominal voltage (V) > 25 V a.c. or 60 V d.c., the required insulation fulfils the high voltage test according to table 8 .....:		N/A
19.20.2	PELV-circuits double or reinforced insulation is necessary		N/A
19.21	PELV-circuits: protection against contact fulfils the min. test voltage required for the primary circuit		N/A
19.22	Class II transformers shall not be provided with means for protective earthing		N/A
	For fixed transformers an earthing 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 earthing		N/A
20	**COMPONENTS**		**--**
	Switches, plugs, fuses, lampholders, flexible cables and cords comply with relevant IEC standard	See appended table	P
20.1	Appliance couplers for main supply shall comply with:	No such component	N/A
	- IEC 60 320 for IPX0		N/A
	- IEC 60 309 for other		N/A
20.2	Automatic controls shall comply with IEC 60730 series and appropriate parts 2 unless they are tested with the transformer	No such component	N/A
20.3	Thermal-links shall comply with IEC 60691 as far as reasonable	No such component	N/A
20.4	Switches forming part of the transformer assembly shall comply with Annex F	No such component	N/A
20.5	Socket-outlets in the output circuit shall not comply with socket-outlets of the input circuit	No such component	N/A
	Plugs and socket-outlets for SELV for general use comply with the requirements of IEC 60 906-3 and 60884-2-4		N/A
	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:		N/A
	- plugs shall not be able to enter in socket-outlets of other standardized voltage systems		N/A
	- socket-outlets shall not admit plugs of other standardized voltage		N/A
	- no protective earthing contact on socket-outlets		N/A
	Plugs and socket-outlets for PELV systems shall comply with:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- plugs shall not be able to enter in socket-outlets of other standardized voltage systems		N/A
	- socket-outlets shall not admit plugs of other standardized voltage systems		N/A
	- no protective earthing contact on socket-outlets		N/A
	Plugs and socket-outlets for FELV systems shall comply with:		N/A
	- plugs shall not be able to enter in socket-outlets of other standardized voltage systems		N/A
	- socket-outlets shall not admit plugs of other standardized voltage systems		N/A
20.6	Thermal cut-outs, thermal links, overload relays, fuses and other overload protective devices shall have adequate breaking capacity		N/A
20.6.1	Fuses according to IEC 60127 and IEC 60269 are allowed to be continuously loaded by a current not exceeding 1,1 times 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-outs when tested as separate components shall comply with the appropriate requirements and tests of IEC 60730-1		N/A
20.7.1.2	A thermal cut-out when tested as part of a transformer		N/A
20.7.2	Thermal cut-outs shall have adequate breaking capacity		N/A
20.7.2.1	A transformer with a non-self-resetting thermal cut-out		N/A
20.7.2.2	A transformer with a self-resetting thermal cut-out		N/A
20.7.2.3	A PTC resistor of indirect heating type is considered to be a non-self-resetting thermal cut- out by this standard		N/A
20.8	Thermal-links shall be tested in one of the following two ways		N/A
20.8.1	The thermal-links, when tested as separate components, shall comply with the requirements and tests of IEC 60691		N/A
20.8.2	Thermal-links tested as part of a transformer		N/A
20.9	Self-resetting thermal protective devices shall not be used unless no mechanical, electrical, or other hazards occur from their operation during and after the tests of this standard		N/A
20.10	Thermal cut-outs intended to be reset by soldering operation shall not be used for overload protection		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
20.11	Overload protective devices shall not operate when the supply voltage is switched on		N/A
21	**INTERNAL WIRING**		**--**
21.1	Internal wiring and electrical connections protected or enclosed		P
	Wireways smooth and free from sharp edges		P
21.2	Openings in sheet metal: edges rounded (radius > 1,5 mm) or bushings of insulating material	bushings of insulating material	P
21.3	Bare conductors: distances adequately maintained		P
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		P
22	**SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CABLES AND CORDS**		**--**
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		P
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
	- contact between insulation of external supply wires and live parts of different polarity not allowed		P
22.4	Length of power supply cord for portable transformers		N/A
22.5	Power supply cords:		--
	- for transformers IPX0 for indoor use only with a mass < 3 kg: H03 VV-F	No Power supply cords	N/A
	- for transformers IPX0 for outdoor use only with a mass > 3 kg: H05 RR-F or H05 VV-F		N/A
	- for transformers IPX0 for outdoor use: H05 RN-F		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
22.6	Power supply cords for single-phase portable transformers with input current ≤ 16 A:		--
	- cord set fitted with an appliance coupler in accordance with IEC 60 320		N/A
22.7	Nominal cross-sectional area (mm²); 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 earthing terminal		P
	Plug for single-phase transformer with input current at rated output ≤ 16 A according to IEC 60083, IEC 60906-1 or IEC 60 309		N/A
22.9	Type X, Y, or Z attachments, unless otherwise specified in the relevant Part 2	Type Y	P
22.9.1	For type Z attachment: moulding enclosure and power supply cable do not affect insulation of cable		N/A
22.9.2	Inlet openings or inlet bushing: without risk of damage to protective covering of power supply cord		N/A
	Insulation between conductor and enclosure:		--
	- 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:		--
	- 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:		--
	- cord guards, if any, of insulating material and fixed		N/A
	Compliance is tested by the oscillating test according to fig. 7:		N/A
	- loaded force during the test according to fig. 7		N/A
	- 10 N for a cross-sectional area > 0,75		N/A
	- 5 N for a cross-sectional area ≤ 0,75		N/A
	After the test according to fig. 7:		--
	- no short-circuit between the conductors		N/A
	- no breakage of more than 10% of stands of any conductor		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- 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:	Type Y	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 whole 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
	- screws do not serve to fix any other component unless if omitted or incorrectly mounted the transformer is inoperative or clearly incomplete; compliance or parts not removable without tool		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 external flexible cable or cord insulated from accessible metal parts by:		--
	- 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:		--
	- replacement of external flexible cable or cord does not impair compliance with standard		N/A
	- the whole flexible cable or cord with covering can be mounted into the cord anchorage		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- 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		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:		--
	- 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		N/A
	- 25 pulls of 1 s		N/A
	- 1 min torque according to table 10		N/A
	- mass (kg); pull (N); torque (Nm) .....:		N/A
	- not possible to push cable into transformer		N/A
	- 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 supply cables or external flexible cable or cord for fixed wiring and for type X, and Y attachments:		--
	- before fitting cover, possibility to check correct connection and position of conductors		P
	- cover fitted without damage to supply cords		P
	- for portable transformers: contact with accessible metal parts if conductor becomes loose not allowed unless for type X, 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:		--
	- 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**		**--**
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		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Terminals are integral part of the transformer:		--
	- comply with IEC 60999-1 under transformer conditions		N/A
	Other terminals:		--
	- separately checked according to IEC 60998-2-1, 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 metal parts should conductor break away > 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:		--
	- test by inspection according to 23.1 and 23.2		N/A
	- pull of 5 N to the connection before test according to 14.2		N/A
23.3	Other terminals than Y and Z attachments shall be so fixed that when the clamping means is tightened or loosened:		--
	- 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:		--
	- 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

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Clause	Requirement + Test	Result - Remark	Verdict
23.5	Terminals for fixed wiring and for type X: located near their associated terminals of different polarities and the earthing terminal if any		P
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):		--
	- Class I transformers: no connection between live parts and accessible metal parts		N/A
	- free wire of earthing 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:		--
	- pressure plate, or	Certify by circuit breaker	N/A
	- two clamping screws		N/A
23.9	When terminal, other than protective earthing conductor, screws loosened as far as possible, no contact:		--
	- between terminal screws and accessible metal parts		P
	- between terminal screws and accessible metal parts for Class II transformers		N/A
24	**PROVISION FOR PROTECTIVE EARTHING**		**--**
24.1	Class I transformers: accessible parts connected to earthing terminal		P
	Class II transformers: no provision for earthing		N/A
24.2	Protective earthing 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 earthing terminal and other terminal		P
	In case of earthing terminal body of A1, no risk of corrosion from contact between Cu and A1		P
	Body of earthing terminal or screws/nuts of brass or other metal resistant to corrosion		P
24.4	Resistance of connection between earthing terminal and metal parts ≤ 0,1 Ω with a min. 25 A or 1,5 times rated input current at 1 min	0.014 Ω	P
24.5	Class I transformers with external flexible cables or cords		--
	- current-carrying conductors becoming taut before the earthing conductor		P

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Clause	Requirement + Test	Result - Remark	Verdict
25	**SCREWS AND CONNECTIONS**		**--**
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		P
	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		P
	No damage after torque test: diameter (mm); torque (Nm); ten times .....:		P
25.2	Screws in engagement with thread of insulating material:		--
	- length of engagement > 3 mm + 1/3 screw diameter or 8 mm		N/A
	- correct introduction into screw hole		N/A
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		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 earthing 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		P
	Rivets for current-carrying connections subject to torsion locked against loosening		N/A
25.6	Screwed glands shall comply with the following test		N/A
26	**CREEPAGE DISTANCES AND CLEARANCES**		**--**
26.1	Specified values according to:		--
	- table 13, material group III		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- table C, material group II (except for box 1 of C.1)		N/A
	- table D, material group I (except for box of D.1)		N/A
	1. Insulation between input and output circuits (basic insulation):		--
	a) measured values > specified values (mm) .....:		N/A
	b) measured values > specified values (mm) .....:		N/A
	c) measured values > specified values (mm) .....:		N/A
	2. Insulation between input and output circuits (double or reinforced insulation):		--
	a) measured values > specified values (mm) .....:	Cr> 6.0 mm Between live part and metal encloser	P
	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
	Insulation between adjacent output circuits: measured values > specified values (mm) .....:		N/A
	4. Insulation between terminals for external connection:		--
	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:		--
	a) measured values > specified values (mm) .....:	Cr=>4.7 mm Cl= > 3.0 mm	P
	b) measured values > specified values (mm) .....:	Cr=>4.7 mm Cl= > 3.0 mm	P
	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:		--
	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
	Creepage distances and clearances are measured:		--
	- for fixed wiring and type X attachments with max. and min. size		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- for type X with a special cord, Y or Z attachments with the supply cable as delivered		P
	- 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, for instance, by conductive dust or by rain or snow:		--
	- 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 and clearances (cr)		--
	The creepage distance and clearance values are shown in Tables 13, C.1 and D.1		P
26.2.1	Windings covered with adhesive tape		N/A
26.2.2	Uncemented insulation parts		P
26.2.3	Cemented insulating parts		N/A
26.2.4	Enclosed parts		N/A
26.3	Distance through insulation (dti)		P
	The distances through insulation (dti) are required for supplementary, double or reinforced insulation only as shown in boxes 2b,2c and 7 of Tables 13, C.1 and D.1		P
	The insulation shall fulfil either the material classification as given in IEC 60085 and IEC 60216 or the test of 14.3		P
	The requirements concerning distance through insulation do not imply that the prescribed distance shall be through solid or thin sheet insulation only. It may consist of the thickness of solid or thin sheet insulation plus a specified clearance distance		P
26.3.1	solid insulation		P
26.3.2	Insulation constructed of thin sheets of insulated material		P
26.3.3	the mandrel test		N/A
27	**RESISTANCE TO HEAT, ABNORMAL HEAT, FIRE AND TRACKING**		**--**
27.1	Ball-pressure test: diameter of impression ≤ 2 mm; heating cabinet temperature (°C) .....:	125C, 1.22 mm	P
27.2	Insulating material retaining live parts in position of transformers > IP20: no source of ignition for surroundings in case of abnormal heat or fire		P
	Two special prepared specimens for the test in which short-circuit windings are built-in		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
27.2.1	Portable transformers are placed on a dull painted plywood support		N/A
	Stationary transformers fixed in the most unfavourable position on a dull painted support:		--
	- if this position for use is vertical or ceiling transformer and support 200mm 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:		--
	- 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:		--
	- no flames occur		N/A
	-support temperature shall not exceed 125 ℃		N/A
	- no ignition of the tissue paper		N/A
27.2.2	After the tests:		--
	a) transformer with definitive interruption in the input circuit withstands the test with 35% of the values according to table 8		N/A
	b) transformer with no definitive interruption withstands the test voltage (100%) according to table 8 of Cl. 18: hazardous live parts are not touchable by the stranded test finger		N/A
27.3	Glow-wire test:		N/A
	- any flame or glowing of the specimen extinguish within 30 s of withdrawing the glow-wire		N/A
	- no ignition of a single layer of tissue paper		N/A
27.4	Resistance to tracking		N/A
28	**RESISTANCE TO RUSTING**		**--**
	Ferrous parts protected against rusting		P

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Clause	Requirement + Test	Result - Remark	Verdict

11, 12	TABLE: output voltage and output current under load; no-load output voltage						P
Clause		(11) Under Load		12 (No Load)			
type / rated output	rated output voltage V	Measured sec. voltage V	delta Usec %	Measured sec. voltage under no-load V	delta Usec %	further information	
170-260V~, 50kVA	170	171.14	0.67%	170.11	0.06%	170V~, 10kVA	
170-260V~, 50kVA	230	231.05	0.45%	217.25	-5.54%	230V~, 10kVA	
170-260V~, 50kVA	260	260.92	0.35%	245.65	-5.55%	260V~, 10kVA	
Remark: Limit of difference between output voltage under rated load and rated output voltage is 10%							

14	TABLE: heating		P
	room temperature t1 (℃) ..... :	25.1	---
	room temperature t2 (℃) ..... :	25.0	---
	test condition..... :	275.6V/50Hz	---
temperature T of part/at:		T (℃)	required T (℃)
Main cable		29.2	70
Input Circuit breaker		28.3	40
Output Circuit breaker		28.4	40
Bypass Circuit breaker		24.2	40
N Terminal		28.6	For rference
DR-45-8 Surface Body		37.6	40
PH-04MB1 Surface Body (L1)		34.1	40
WCT-63 Surface Body (L1)		42.8	40
WCT-25 Surface Body (L1)		41.2	40
DZ47-100 Surface Body (L1)		31.6	40
Shunt Resister (L1)		27	85
Capacitor Surface Body (L1)		28.6	85
PH-04MB1 Surface Body (L2)		32.8	40
WCT-63 Surface Body (L2)		41.4	40
WCT-25 Surface Body (L2)		39.5	40
DZ47-100 Surface Body (L2)		31.6	40
Shunt Resister (L2)		27.4	85
Capacitor (L2)		27.8	85

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Clause	Requirement + Test	Result - Remark	Verdict

PH-04MB1 Surface Body (L3)	30.8	40
WCT-63 Surface Body (L3)	42.7	40
WCT-25 Surface Body (L3)	38.7	40
DZ47-100 Surface Body (L3)	28.1	40
Shunt Resister (L3)	25.3	85
Capacitor (L3)	26.1	85
Terminal for T1	28.4	For reference
Transformer Winding (L1)	87.4	100
Transformer Bobbin (L1)	79.4	100
Terminal for T2	28.7	For reference
Transformer Winding (L2)	90.1	100
Transformer Bobbin (L2)	81.2	100
Transformer Winding (L3)	91.6	100
Transformer Bobbin (L3)	81.5	100
Terminal for T3	29.7	For reference
External metal enclosures	25.7	65

temperature rise of winding:	R_1 (Ω)	R_2 (Ω)	dT (K)	required dT (K)	insulation class
	---	---	---	---	---

Note:

15	TABLE: short-circuit and overload protection		N/A
	ambient temperature (℃) ..... :	–	—

Clause 15

type/rated output	r-cold Ω	r-warm Ω	temp. ℃	ext. encl.℃	input wire℃	Output wire ℃	further information
--	--	--	--	--	--	--	--

Note: overload

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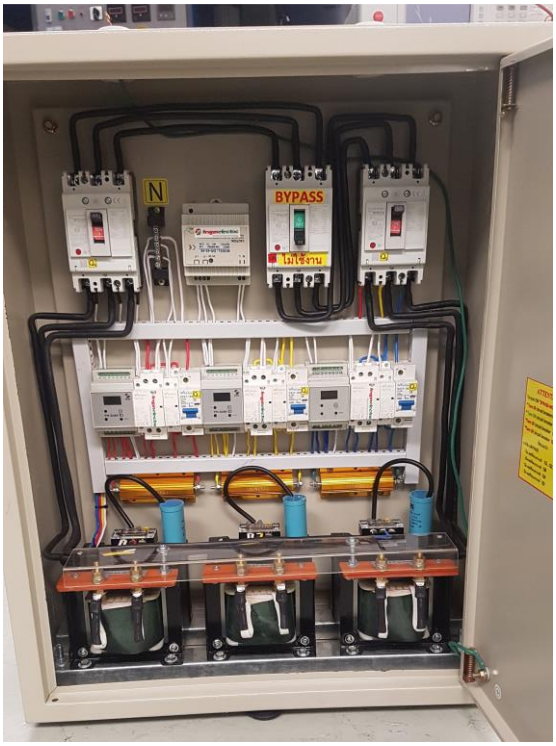
Clause	Requirement + Test	Result - Remark	Verdict

18	TABLE: electric strength tests and impulse tests		P
test voltage applied between:		test voltage (V)	breakdown
Input and metal enclosure		2100	No breakdown
Output and metal enclosure		2100	No breakdown
Input and non- metal device		4200	No breakdown

20.1	TABLE: components					P
object/part No.	manufacturer /trademark	type/model	technical data	standard	mark(s) of conformity[1])	
Main Circuit Breaker	--	NF63-CW	600V, 63A, 3P, 40C	IEC 60947-2	PSE JET	
Circuit Breaker	Winston	DZ47-100	415V, 100A, 2P, 40C	IEC 60947-2		
AC/DC Power Supply	--	DR-45-48	I/P: AC100-240V, 1.8A Output: DC48V, 0.9A	-	-	
Magnetic contactor	Winston	WCT-63	250V, 63A, 40C	IEC 61095	--	
	Winston	WCT-25	250V, 25A, 40C	IEC 61095	--	
	Feigin Electric	PH-04M B2	AC 220V, 5A, 50Hz DC 30V, 5A	Test in appliance	--	
Isolation Trans former	-	-	220V, 0.6 KVA, Class A	Test in appliance	--	
Resistor	--	100W2RJ	2 Ω, 100W, 85C	Test in appliance	--	
Capacitor	RS	MR-P-MC-S-NF	440V, 50Hz, 2uF, 85C	Test in appliance	--	
Main Cable	DEEMA CABLE	IEC 01 THW	1x16 SQ MM PVC 450/750 V 70C	TIS 11-2553 PART 3 60227	TIS	

26	TABLE: creepage distances and clearances and distances through insulation				N/A
	Test with three transformers				
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 ℃)	1 hour 25 ℃	2 hour 0 ℃	1 hour 25 ℃	
1.	--	--	--	--	--
2.	--	--	--	--	--
3.	--	--	--	--	--

Appendix A (Continous)
Photographs of Test Samples



Appendix A (Continous)
Photographs of Test Samples

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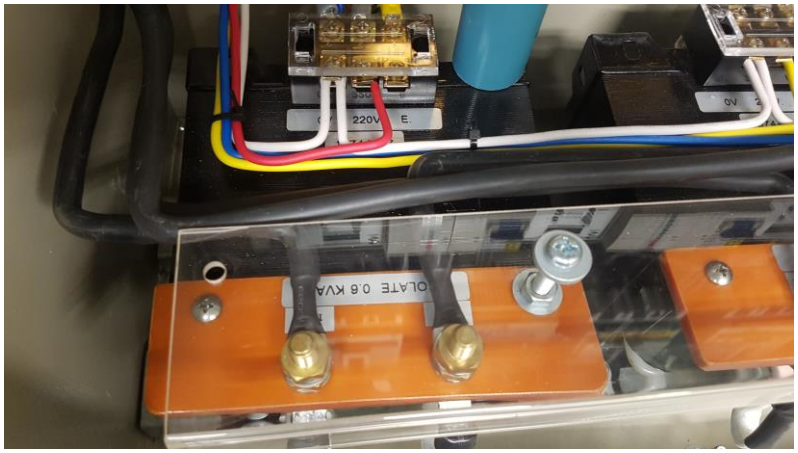
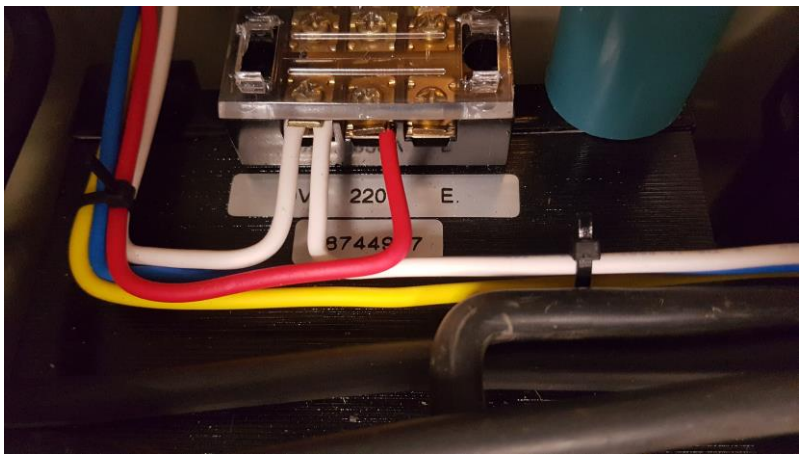
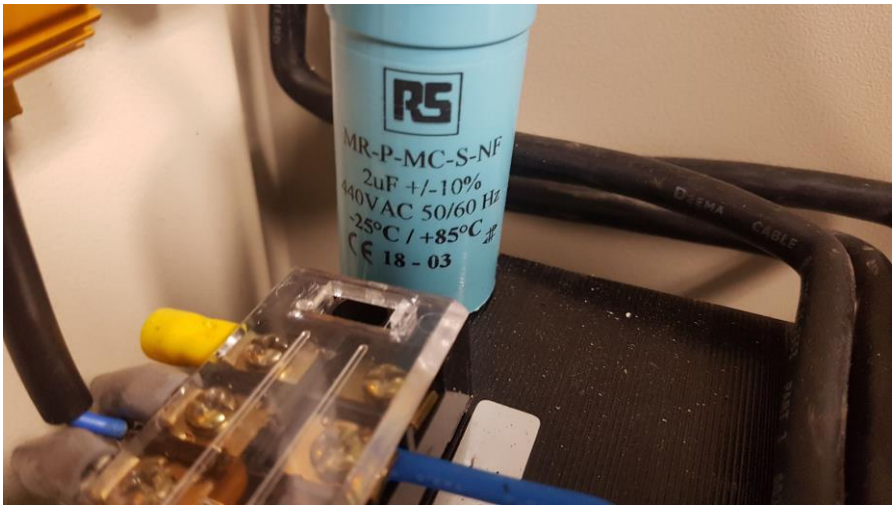
Photographs of Test Samples





Appendix A (Continous)
Photographs of Test Samples



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