

TYPE TESTS AND ROUTINE TESTS

Standard	Continuity test of protective circuits	Insulation resistance	Dielectric strength	Discharging of electrical charges	Leakage current	Some other tests
IEC 60204-1 Electrical equipment of machines	19.2: 6-24 Vac, >10 A Cross-sectional area of the branch under test /mm 1,0 1,5 2,5 4,0 >6,0	19.3 500 Vdc 1 M Ω , exceptions > 50 k Ω	19.4 t > 1 s supply 500 VA >1000 V or 2U _N insulation of cables: 5 min, U _{test} > 2000 V	6.2.4 5 s, except on plug where is 1 s, < 60 V or charge < 60 μ C		- Functional tests - retesting - Protection of equipment
IEC 60335-1 Household and similar electrical appliances	27.5 12 Vac or dc, > 1,5 I _n or 25 A < 0,1 Ω routine test – Annex A: 12 Vac or dc, > 10 A, supply cord < 0.2 Ω or , < 0.1 Ω + Rsupply cord -other: < 0,1 Ω		Type test: 1 min, Test voltage supply to 4 kV, I _{sc} =200 mA, I _{trip} ≥ 100 mA, 800 VA and 400VA above table 5 on page 79 Routine test: 1 s, I _{trip} ≥ 5 mA (to max. 30 mA by high leakages) 13.3 Hot Basic for SELV 500 V Insulation type Rated voltage / V Work. U/V U ≤ 150 150 < U ≤ 250 > 250 Basic 1000 1000 V 1,2 U + 700 Supplementary 1000 1750 V 1,2 U + 1450 Reinforced 2000 3000 V 2,4 U + 2400 16,3 After humidity precondition. table 7 Basic for SELV 500 V Insulation type Rated voltage / V Work. U/V U ≤ 150 150 < U ≤ 250 > 250 Basic 1000 1000 V 1,2 U + 950 Supplementary 1500 1750 V 1,2 U + 1450 Reinforced 2500 3000 V 2,4 U + 2400 Winding with C against surroundings 2 U + 1000V Routine test – Annex A Class 0, 0I, I, II app. Class III Rated voltage / V Insulation type ≤ 150 > 150 - basic 800 1000 400 Double or reinforced 2000 2500 -	For U < 450 V is C < 0,1 μ F By 450 < U < 15 kV discharge should not exceed 45 μ C	13.2 U testing is 1.06 U _N for motors, and 1.15 for heating devices - P _N (l-pe, n-pe) and after humidity precondition (non operate) 1,06 U _N (l+n-pe); annex G class 0, 0I and III 0,5 mA Portable class I 0,75 mA Stationary class I – motor operated 3,5 mA class I - heating appliance. 0,75 mA or 0,75 / kW, but max. 5mA Class II 0,25 mA	- Power - Starting - Heating - Moisture resistance - Endurance - Abnormal operation - Mechanical prop. - Distances - Resistance to heat, fire, rusting - Transient overvoltages - Protection against electric shock
(EN) IEC 60439-1 Low-voltage switchgear and control gear assemblies; Part 1: Type-tested and partially type-tested assemblies	Type test: 8.2.4.1 -10 A a.c or d.c. -resistance between conductive part and protective conductor not exceed 0,1 Ω	8.3.4: For PTTA (partially-type tested low-voltage switchgear and control gear assemblies – 500 Vdc > 1000 Ω /V per circuit referred to the nominal voltage to earth of these circuits	Type test - 8.2.2: voltage is maintained for 5 s; Routine test – 8.3.2.: voltage is maintained for 1 s Additional dielectric tests with 1,5 x U testing from table 10 for enclosures and external operating handles made of insulating material If the manufacturer has declared a value of the rated impulse withstand voltage (see Table 13) – impulse voltage withstand test – 1,2/50 μ s – 3 times for each polarity at intervals of 1 s min or power frequency a.c.- 3 cycles or dc. – 10 ms for each polarity Rated insulation voltage (line to line) V Dielectric test voltage a.c., r.m.s. V For main circuit and auxiliary circuits which are not covered by table 11 - Table 10 U ≤ 60 1000 60 < U ≤ 300 2000 300 < U ≤ 690 2500 690 < U ≤ 800 3000 800 < U ≤ 1000 3500 1000 < U ≤ 1500 – d.c. 3500 For auxiliary circuits which are unsuitable for being directly supplied from the main circuit – Table 11 U ≤ 12 250 12 < U ≤ 60 500 U > 60 2 U + 1000V with a min. of 1500 V	NOTE in 7.4.4 Static charge fall below 120 V dc in less than 5 s after disconnection		- Temperature – rise limits - Short-circuit withstand strength - Effectiveness of the protective circuit - Distances - Mechanical operation - Degree of protection - Electrical operation - Protective measurements - Protection against electric shock

Standard	Continuity test of protective circuits	Insulation resistance	Dielectric strength	Discharging of electrical charges	Leakage current	Some other tests								
IEC 60598 – 1 Luminaries	> 10 A, 0,5 Ω, 7.1 type test: 1 min. < 12 Vac, Annex Q: routine test: 1 s, 6 to 12 V a.c.	Type: 1 min, routine: 1 s; 500 Vdc	10,2.2: Type: 1 min (supply has short circuit current > 200 mA, tripping current -100 mA) Annex Q: routine: 1 s, tripping current – 5 mA	8.2.7: 60 s < 50 V	Luminary type	max. R.m.s. leakage current mA	<ul style="list-style-type: none"> - Construction - Protect. again. acc. to hazard. live part - Resistance to dust, solid object, and moisture - Distances - Endurance - Thermal tests - Resistance to heat, fire, tracking 							
		Insulation type I MΩ	SELV – basic + class III	500 V	400 V									
		basic 2	Other voltages	Test voltage ac. or d.c.		Portable (C>0,1 μF)		class 0 and II	0,5					
		supplementary 2	Basic	2 U + 1000 V	1,5 kV	Other with plug C > 0,1 μF		Portable, class I	1,0					
		reinforced 4	supplementary	2 U + 1750 V	-	5 s < 60		fixed – class I up to 1 kVA, increasing by 1,0 mA/kVA up to a max. Of 5,0 mA	1,0 mA					
SELV (<100 Vdc)	1	Double or reinforced	4 U + 2750 V	1500 V										
Routine: all	2													
IEC 60742 Isolating transformers and safety isolating transformers – Partly overseeded	23.5 < 12 V, > 25 A or 1,5 I _N 0,1 Ω routine: < 12 V, > 10 A	17.2 1 min., 500 V dc	17.3 1 min, routine: 2 s				<ul style="list-style-type: none"> - Output voltage and current - short-circuit voltage - Heating - short-circuit and overload protection - Mechanical prop. - Protect. against harmful ingress of water and moisture - Distances - Resistance to heat, fire, tracking and rusting 							
		Insulation type MΩ	Working voltage											
		basic 2	Ins. type	≤ 50	150	250		440	690	1000				
		supplementary 5	basic	250	1000	1750		2100	2500	2750				
reinforced 7	reinforced	500	2000	3500	4200	5000	5500							
IEC 60745 Hand-held motor-operated electric tools	< 12 Vac or d.c., > 25 A or 1,5 I _N R ≤ 0,1 Ω	1 min, 500 V dc > 2 MΩ	1 min. (supply has short circuit current > 200 mA, tripping current -100 mA)			13.2, 14.3 R _{mes. leads} = 1750 Ω ± 250 Ω, time const. of circuit = 225 μs ± 15 μs - annex C U = 1,06 U _n , app. insulated from earth	<ul style="list-style-type: none"> - Starting - Heating - Protection against electric shock - Moisture resistance - Overload protection of transformers - Endurance - Abnormal operation - Mechanical prop. - Distances - Resistance to heat, fire, tracking and rusting 							
			Insulation type	class III	class II			other	class III	0,5 mA				
			Live parts – accessible parts	basic	500			1250	1250	class I	0,75 mA			
			reinforced	3750	3750				class II	0,25 mA				
			Parts with double ins. - metal part sepp. from live p. by basic and	- live parts	1250			1250		Leakage after moisture treatment – currents are doubled (for class only if ALL controls have an OFF position)				
			- accessible parts	2500	2500									
			Point where are C and winding together	- accessible parts	2 U + 1000V									
			metal part sepp. From live p. by basic	2 U + 1000V										
			Handles, knobs,... and their shafts	2500	2500									
			Accessible parts – cord guard	2500	1250									
If clearance between enclosure and live parts is lower than required	2500	1250												
IEC 60755 Residual current operated protective devices		1 min, 500 V dc > 2 MΩ	1 min, + impulse tests of 6 kV and 8 kV – 5 x each polarity – 8.13				<ul style="list-style-type: none"> - Operation - Temperature tests - Short circuit - Mechanical prop. - Reliability - Mechanical and electrical endurance 							
			Working voltage	Test voltage										
			0 < V ≤ 30	600										
			30 < V ≤ 50	1000										
			50 < V ≤ 110	1500										
			110 < V ≤ 250	2000										
250 < V ≤ 500	2500													
IEC 60950 Safety of information technology equipment	2.6.3.3 < 12 Vac or d.c., I _n ≤ 16 A, I = 1,5 I _N , t = 1 min, R ≤ 0,1 Ω I _n > 16 A, I = 2 I _N , t = 2 min, ΔU ≤ 2,5 V 2.6.3 I from the telecommunication network 1,5 I _n or 2 A	6.2.2.3 Connection to telecommunication network 500 V dc 2 MΩ, (minimum measurement range 1000 MΩ)	5.2.2 1 min, (for higher voltages up to 10 kV see Va or Vb in table 5B part 2 for voltages between 10 kV and 50 kV pp or dc use for testing voltage 1,06 U) and for routine tests 5B but max 3 kV and with impulse generator 6.2.2.1- 1500 V, 2500 V	2.1.1.7 U	2.8.2 t/s	Equipment	max. touch I/mA 5.1.6/5.1.8.1	<ul style="list-style-type: none"> - Protection from hazards - Physical requirements - Electrical requirements and simulated abnormal conditions - Connection to telecomm. networks 						
			Primary -.. (working V _{pp} or dc, test voltage rms)	secondary - ..	Connection to telecomm. network (V ac)				Permanent + plug. Equip.- B	37 %	10	all	0,25	
			Ins. type	≤ 184 184 < U ≤ 354 354 < U ≤ 1410	≤ 42,4 V pp or 60 Vdc // -II				42,4 V pp or 60 Vdc < U < 10 kV pp or dc			Hand - held	0,75	
			Functional	1000 1500	Va in table 5B part 2				Va in table 5B part 2			Movable (other than hand-held but including transportable)	3,5	
			basic	1000 1500	Va in tab. 5B part 2				1000	Plug. equi. -A	37 %	1	Stationary, pluggable type A I to a telecommunication network (5.1.8.1)	0,25 mA
			Reinforced	2000 3000 3000	Vb in tab 5B part 2				1500	Prot. by interlocks	60 Vdc or < 20 J	2	All other stationary –not subject to conditions 5.1.7	3,5
			wire insul.	2xU from 5B but not less than 6kV								- subject to conditions 5.1.7 (protective cond. I)	5% I _{vh}	

Standard	Continuity test of protective circuits	Insulation resistance	Dielectric strength	Discharging of electrical charges	Leakage current	Some other tests						
IEC 60989 Separating transformers autotransformers, variable transformers and reactors – partly replaced	23.5 < 12 Vac, > 25 A or 1,5 I _N 0,1 Ω Appendix 1-A: routine test: < 12 Vac, > 10 A	17.2 1 min, 500 Vdc Insul. type MΩ basic 2 reinforced 7 Metal parts of class II, separated from live parts by basic insulation and body 5	17.3 type: 1 min, routine: 2 s					Ignition transformers: leakage current < 5 mA	- output voltage and current - short-circ. U - heating - short-circuit and overload protection - Mech. prop - Protection against electric shock - Protection against harmful ingress of water and moisture - distances - Resist. to heat, fire, tracking and rusting			
			Working voltage									
			Ins. type	<50	200	>200	700			1000		
			basic	250	1400	2100	2500			2750		
			reinforced	500	2800	4200	5000			5500		
			Ignition transformers: 1 min, f _{test} = 2 f _N , U = 1.5 U _n									
			Transformers with U > 1000 V									
			Working voltage 15000 V									
			Ins. type 1,4 x working voltage + 1400 V									
			Basic or supplementary reinforced 2,8 x working voltage + 2800 V									
IEC 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use	6.5.1.3 1 min plug connected: ac ali dc, greater of 25 A or 2 I _N < 0,1 Ω permanently connected: 2 I _N overcurr. protect. ΔU < 10 Vr.m.s. or d.c.		6.8.4	Test voltage is a.c. or d.c.- 5 s or impulse test – 3 pulses of each polarity			6.6.2 terminals: 10 s, < 70 V dc 6.10.3 plug: 5 s, < 70 V dc By U < 15 kVpp or dc charge should not exceed 45 μC, for U > 15 kVpp or dc stored energy < 350 mJ	- Touch current: - Normal operation: 0.5 mArms, 0.7 mApp or 2 mAdc - Single fault: 3.5 mArms, 5 mApp or 15 mAdc	- Temperature – rise limits and resistance to heat - Protection against electric shock - Clearances and creepage distances - Mechanical resistance - Degree of protection			
			Basic / V _{r.m.s}		Double / V _{r.m.s}							
			Working voltage	Meas. categories		Meas. categories						
				II	III	IV				II	III	IV
			50	370	500	840				600	800	1350
			100	500	840	1390				800	1350	2230
			150	840	1390	2210				1350	2230	3540
			300	1390	2210	3320				2230	3540	5320
			600	2210	3320	4300				3540	5320	6900
			1000	3320	4300	6600				5320	6900	10560
IEC 61029 Safety of transportable motor-operated electric tools	< 12 Vac, > 25 A or 1,5 I _N , 0,1 Ω,	1 min, 500 Vdc, Insul. type MΩ Live parts - body Basic 2 reinforced 7 Parts with double ins. - metal part sepp. from live p. by basic To body 5 To live parts 2	1 min (supply has short circuit current > 200 mA, tripping current -100 mA),			1 s, < 34 V, or C < 0,1 μF	R _{mes. leads} = 1750 Ω ± 250 Ω, time const. of circuit = 225 μs ± 15 μs annex 1A U = 1,06 U _n ,	- Starting - Heating - Moisture resistance - RSO - suppression - Endurance - Abnormal operation - Mechanical prop. - Distances - Protection against electric shock - Resistance to heat, fire, tracking and rusting				
			Insulation type	class III	class II				class I			
			Live parts - body	Live parts – body								
			Basic	500	/				1250			
			reinforced	/	3750				3750			
			Parts with double ins. - metal part sepp. from live p. by basic	Live parts of different polarity	500				1250	1250		
			To body	If clearance between enclosure and live parts is lower than required	2500				1250	/		
			To live parts	Handles, .. and their shafts	/				2500	2500		
			Point where are C and winding together									
			body	/	/				2 U + 1000V			
metal part sepp. from live p. by basic	/	2 U + 1000V	/									
21.1: Internal wiring: conductor – conductor insulation (15 min)					2000							
IEC 61558-1 Transformers and power supply units	24.4 < 12 Vac, type: > 25 A or 1,5 I _N ; 1 min, 0,1 Ω Annex L: routine: > 10 A; no decrease of I	18.2 1 min, 500 Vdc Insul. type MΩ Basic 2 double 5 reinforced 7	18.3 type: 1 min, routine 1s (supply has short circuit current > 200 mA, tripping current -100 mA)					9,1 5 s, < 60 V _{d.c.} or q < 50 μC for 60 < U < 15 kV or < 350 mJ for U > 15 kV	9.1.1 Touch current: 0,7 mApp, 2 mAdc	- output voltage and current - short-circuit voltage - heating - short-circuit and overload protection - Mechanical prop. - Protect. against acc. to hazardous live part and harmful ingress of dust, solid objects and moisture - distances - Resistance to heat, fire, tracking and rusting		
			working voltage									
			Ins. type	<50	150	300	600				1000	
			Basic	250	1400	2100	2500				2750	
			double	500	2800	4200	5000				5500	
reinforced												
EN 60065 Audio video and similar electronic apparatus	15.2 < 12 V, > 25 A dc or ac, 1 min, <0.1 Ω (Canada 30 A) Routine: < 12 V, 10 A ac, 1÷4 s, detach. pow. supply cord – <0.1 Ω Nondetachable - <0.2 Ω	10.3.2 500 V dc Insul. type MΩ Basic 2 reinforced 4	1 min, for d.c. circuits or by corona, testing is with dc, in other cases ac pp (supply has short circuit current > 200 mA, tripping current -100 mA), Annex N: routine: 1÷4 s, test voltage ac or dc			9.1.1. U < 60 V _{d.c.} or q < 45 μC for 60 < U < 15 kV or 350 mJ for U > 15 kV	9.1.2 Touch current: 0,7 mApp, 2 mAdc Fault condition: 2,8 mApp, 8 mAdc	- Heating - Protection against electric shock - Fault conditions - Mechanical prop. - Distances - Resistance to fire - Surge tests (50 x with C= InF, 10 kV)				
			Rated mains	U _N < 150 V	U _N > 150 V							
			Type	parts of diff. polar. connect. to mains	1410 V				2120 V			
			Basic	routine	1130 (800 rms)				2120 (1500 rms)			
			Double or reinf.	2120 (1500 rms)	3540 (2500 rms)							
			Working voltage (L-N)						34 V p	354 Vp		
			Basic	Curve A	707 V p				2120V p			
			reinforced	Curve B	1410 V p				4240 Vp			

