

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 MΩ, exceptions > 50 kΩ	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 μC		- 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 + R _{supply 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 μF By 450 < U < 15 kV discharge should not exceed 45 μC	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 μs – 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 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 _{rms}		Double / V _{rms}							
			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	
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)							

Standard	Continuity test of protective circuits	Insulation resistance	Dielectric strength	Discharging of electrical charges	Leakage current	Some other tests
EN 50144 Hand-held motor-operated tools	< 12 Vac, type: > 25 A or 1,5 I _N , 0,1 Ω, routine: > 10 Aac; 0,3 Ω (cable up to 5 m) + 0,12 Ω (any further length of 5 m) Annex E,	1 min, 500 Vdc,	supply has short circuit current > 200 mA,) , type: 1 min., tripping current -100 mA ; routine: 3 s, tripping current -5 mA, annex E	On pins of the plug: 1 s, < 34 V, 8,5,	U _{test} = 1.06 U _n , R _{mes. leads} = 1750 Ω ± 250 Ω, time const. of circuit = 225 μs ± 15 μs, U = 1,06 U _n	- Starting - Heating - Moisture resistance - Environmental requirements - Endurance - Abnormal operation - Mechanical prop. - Distances - Resistance to heat, fire, tracking and rusting - Protection against electric shock
		Insul. type MΩ	class I type routine			
VDE 0701 T 1-240 Repair and modification inspections	T1 5.3 4 V <U < 24 V d.c or a.c., I > 0,2 A, 0,3 Ω cord up to 5 m(+0.1 Ω any further length of 7.5 m) but not more than 1 Ω	Class	T 1 – annex E:		5.5 Leakage current, for direct measurement (int. R _{mes.} < 5 Ω); appl. insulated from earth, else with difference current measurement anex G Appl. type Limit most ≤ 3,5 mA Heating, P ≥ 3,5 kW ≤ 1 mA / kW 5.6 Touch leak. Curr. , I ≤ 0,5 mA 5.7 Substitute leak. Curr.: measurement voltage 25 V < U _{mes.} < 250 V, measurement resistance 2 kΩ. Meas. equipment has I _{SC} < 3,5 mA at 50 V < U _{mes.} < 250 V ; limits the same as 5.5.	- functional test - endurance
		MΩ				
VDE 0702 T 1 Repeat tests of electrical appliances	≤ 0.3 Ω cord up to 5 m(+0.1 Ω any further length of 7.5 m)	I+ Heating P < 3,5 kW 0,3	Electric tools, Annex E 3 s (supply has short circuit current > 200 mA, tripping current -5 mA) Protection class accessible conductive part		Electric cooking, backing, Annex G 5.5 Leakage current Appl. type Limit P ≤ 6 kW ≤ 7 mA P > 6 kW ≤ 15 mA 5.7 Substitute leak Appl. type Limit P ≤ 6 kW ≤ 7 mA P > 6 kW ≤ 15 mA	
		I+ Heating P ≥ 3,5 kW If < 0,3 pr. 5.5				
	T240 Supply cord: < 0.3 Ω (1 up to 1 A) permanent: < 1 Ω in system: difference < 0.2 Ω				5.6 Touch leak. Curr. , I ≤ 0.25 (0.5) mA (R _{mes} 2 kΩ)	- functional test
		500 V dc Class MΩ			Substitute leak. Curr.: measurement voltage 25 V < U _{mes.} < 250 V, measurement resistance 2 kΩ. Meas. equipment has I _{SC} < 3,5 mA at 50 V < U _{mes.} < 250 V class I (heat. dev. ≤ 6W) < 7 mA class I (heat. dev > 6W) < 15 mA Leakage current 3,5 mA Touch leak. Curr. 0,5 mA	