

TESTING AND MEASURING EQUIPMENT/ALLOWED SUBCONTRACTING
IEC 60730-1:2013/AMD1:2015, Edition 5.0
Automatic electrical controls – Part 1: General requirements

“R”	Required
“S”	May be subcontracted, see OD 2012
“SPTL”	Specialized Facility, see IECEE 02-2
“W”	Witness testing in the categories “MED” and “MEAS”
“3PPS”	Three Phase Power Supply required

Clause	Measurement/testing	Testing / measuring equipment / material needed	Subcontracting
3	General requirements	None	-
4	General notes on tests	None	-
5	Rating	None	-
6	Classification	None	-
7	Information	None	-
8	Protection against electric shock	Test finger (Fig. 2), force gauge, test pin (Fig. 1), milliammeter, voltmeter, ruler, micrometer, timer	R
9	Provision of protective earthing	Ammeter, voltmeter, vernier calipers	R
		Appropriate material analyzing equipment (e.g. scanning electron microscope, energy dispersive x-ray spectrometer)	S
10	Terminals and terminations	According to IEC 60998, Torque tester, force gauge tester, screwdriver, micrometer, vernier calipers, ruler, flexing tester	R

Clause	Measurement/testing	Testing / measuring equipment / material needed	Subcontracting
11	Construction requirements	Electric strength tester, HV test supply with at least 500 A short-circuit capacity, isolation transformer, insulation tester, DC voltage supply, flexing tester (Fig. 9), voltmeter, ammeter, freezer chamber, temperature recorder, torque tester, force gauge, time clock, test finger (Fig. 2), charging and discharging circuit for battery testing, equipment used in Clause 20, apparatus to simulate removal of a cover with applicable force applied at the contacts, oscilloscope	R
12	Moisture and dust resistance	According to IEC 60529, electric strength tester, conditioning chambers: heat-humidity, leakage current meter, metal foil	R
13	Electric strength and insulation resistance	Insulation tester, electric strength tester with trip current ≥ 100 mA, leakage current tester, metal foil	R
14	Heating	Temperature meter/recorder, fine wire thermocouples, winding resistance measurement system – 4-wire low-ohm meter (if required), environmental chambers (heat, freeze), current loads per ratings, voltmeter, ammeter, regulated power supply, timer, blackened discs of copper or brass	R
15	Manufacturing deviation and drift	Voltmeter, ammeter Equipment as required by Part 2-x depending on the type of control such as e.g. environmental chamber (heat, cold, humidity), temperature meter/recorder, humidity meter/recorder, pressure meter/recorder, etc. Remark: For those types of controls for which the atmospheric pressure is relevant for the determination of the manufacturer deviation and drift the atmospheric pressure has to be measured by a pressure meter or alternatively it is acceptable to get the information about the atmospheric pressure online via local metrological service.	R
16	Environmental stress	Environmental chambers – heat, freeze, humidity	R
17	Endurance	Environmental chambers – heat, freeze, humidity; voltmeter, ammeter, power analyzer meter, oscilloscope, inductive loads, resistive loads, pilot duty loads, motor loads, activation source and cycling mechanism as required by the Part 2-x, timer, variable speed rotary and linear mechanisms with end of travel torque capability	R 3PPS
18	Mechanical strength	Apparatus in IEC 60068-2-75, impact tester (Fig. 4), tumbling barrel (Fig. 5), force tester, torque tester, pull tester All as required by Part 2-x	R

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19	Threaded parts and connections	Screwdrivers, torque tester	R
20	Creepage distances, clearances and distances through solid insulation	Measuring ruler, force tester, test finger (Fig. 2), impulse voltage tester, electric voltage tester, insulation resistance meter, oscilloscope, electric strength tester, micrometer, oven	R
21	Resistance to heat, fire and tracking	Ball pressure test apparatus (Fig. 6 of IEC 60730-1), glow-wire test apparatus, environmental chamber or heating cabinet, tracking test apparatus, scales, vernier calipers	R
22	Resistance to corrosion	Humidity chamber, heating cabinet	R
23	EMC requirements – emission	Apparatus in accordance with CISPR 14-1 or CISPR 22, class B. Equipment in accordance with Clause 17, oscilloscope	S
24	Components	Test apparatus in accordance with IEC 61558-2-6 (linear xfms) or IEC 61558-2-16 (SMPS), and other IEC component standards voltmeter, ammeter, cotton, non-renewable fuse, power supply with a min. of 1000 A short-circuit supply, timer, electronic test loads, variable resistors, oscilloscope/wattmeter	R
25	Normal operation	Refer to Annex H; Power supply, variac, environmental chamber, oscilloscope	R
26	EMC requirements – immunity	Refer to Annex H	-
27	Abnormal operation	Voltmeter, ammeter, electric strength tester, power supply, thermocouples, load banks, timer	R
28	Guide of the use of electronic disconnection	Refer to Annex H	-

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Annex A	Indelibility of Marking	Apparatus described in Fig. 8; Solvents: – Neutral liquid detergent blended from alkyl benzene sulphonate and non-ionic detergents or 2 % of a solvent in deionized (distilled) water where the solvent consists of: <ul style="list-style-type: none"> • 70 % (with volume) Natriumdodecylbenzylsulfonat, (Isomere), formula: C₁₈H₂₉NaO₃S, CAS-No. 25155-30-0, and • 30 % (with volume) Glycerin (other names: Glycerol, 1,2,3-Propantriol, Propantriol, E 422), formula: C₃H₈O₃, CAS-No. 56-81-5; – n-hexane (aliphatic solvent hexane with a content of aromatics of maximum 0,1 volume %, initial boiling point of approximately 69 °C, and specific gravity of approximately 0,66 g/cm ³ , CAS-No. 110-54-3), and – deionized (distilled) water	R
Annex B	Measurement Guide	None	-
Annex C	Cotton for Mercury Switch Test	Common as described in Annex C	R
Annex D	Heat, fire and tracking	Informative guide – None	-
Annex E	Circuit for measurement leakage current	Circuit apparatus according to Figure E.1	R
Annex F	Fire hazard testing	Informative guide for IEC 60335 applications – None	-
Annex G	Heat and Fire Resistance Tests	Glow-wire test apparatus per IEC 60695-2-10 and IEC 60695-2-11, Ball pressure test apparatus per IEC 60695-10-2, Fig. 6, PTI Test apparatus per IEC 60112	R
Annex H	Requirements for Electronic Controls	Refer to Annex H, sub-clauses below:	-
H8	Protection against electric shock	Leakage current meter, measuring circuits	R
H11	Constructional requirements	Ammeter, voltmeter, chart recorder Remark: For safety software assessments, special emulator tools and set-ups would be required. Agreement between the manufacturer and the CBTL should be established. Details to be recorded in report.	R
H13	Electric strength and insulation resistance	Same as Clause 13 above	R
H17	Endurance	Thermal cycling test apparatus	R
H18	Mechanical Strength	Refer to Clause 18 above	R

Clause	Measurement/testing	Testing / measuring equipment / material needed	Subcontracting
H20	Creepage distance, clearance and distance through insulation	Refer to Clause 20 above	R
H23	EMC requirements – emission	Refer to Clause 23 above; equipment in accordance with CISPR 11	S
H25	Normal Operation	Refer to Clause 25 above	R
H26	EMC requirements – immunity	<p>Test instruments/equipment in accordance with IEC 61000 series of standards.</p> <p>Environmental chamber, voltage dips and short voltage interruption apparatus, variable voltage supply, 3-phase auto-transformer, surge test apparatus, fast transient/burst test apparatus, ring wave surge test apparatus, electrostatic discharge test apparatus, conducted radiofrequency test apparatus, radiated EM field test apparatus, supply frequency variations test apparatus, power frequency magnetic field test apparatus</p> <p>Remark: For controls employing class B/C control functions, validation of the control functions shall be done before, during and after the H.26 tests. Therefore, arrangements shall be made between the primary CBTL and the contractor lab to ensure that the safety integrity is not compromised when the H.26 tests are sub-contracted.</p>	S
H27	Abnormal Operation	Voltmeter, ammeter, oscilloscope, temperature meter, power supply rated adequately for the test, oscilloscope, timers	R
H28	Guide on use of electronic disconnection	None	-
Annex J	Requirements for thermistor elements and controls using thermistors	Same which are used for Clauses 8 through 28, test apparatus to do R/T measurements	R
Annex K	Nominal voltages	None	-
Annex L	Overvoltage categories	None	-
Annex M	Typical usage	Informative Annex – None	-
Annex N	Pollution degree	None	-
Annex P	Printed circuit board coating performance test	Heating chamber, humidity chamber, environmental cycling chamber, electric strength tester	R
Annex Q	Printed circuit board coating performance test	Freezing chamber, environmental cycling chamber, electric strength tester	R

Clause	Measurement/testing	Testing / measuring equipment / material needed	Subcontracting
Annex R	Explanatory notes for surge immunity test	Informative Annex – None	-
Annex S	Guidance for applying Clause 20	Informative Annex – None	-
Annex T	Requirements for SELV and PELV	None	-
Annex U	Requirements for relays when used as controls in IEC 60335 appliances	Same which are used for Clauses 8 through 28	R 3PPS
Annex V	Requirements for controls powered by secondary batteries (rechargeable)	Same which are used for Clauses 8 through 28	R