TESTING AND MEASURING EQUIPMENT/ALLOWED SUBCONTRACTING
Power cables with extruded insulation and their accessories for rated voltages from 1kV (U_m=1,2kV) up to 30kV (U_m=36kV)
Part 2: Cables for rated voltages from 6kV (U_m=7,2kV) up to 30kV (U_m=36kV)
IEC 60502-2 3.0 Edition (2014-02)
PROVISIONAL

R=Required by Lab
S=May be subcontracted

Clause	Measurement/testing	Testing / measuring equipment / material needed	Subcontracting
17	Sample tests		
17.4	Conductor examination	Vernier caliper or micrometer caliper.	R
17.5	Measurement of thickness of insulation and of non-metallic sheaths(including extruded separation sheaths, but excluding inner extruded coverings)	Measuring microscope or profile projector of at least 10 x magnification.	R
17.6	Measurement of thickness of lead sheath		
17.6.2	Strip method	Micrometer with a plane faces of 4mm to 8mm diameter and an accuracy ±0,01mm.	R

17.6.3	Ring method	Micrometer having either one flat nose and one ball nose, or one flat nose and a flat rectangular nose 0,8mm wide and 2,4mm long with an accuracy ±0,01mm.	R
17.7	Measurement of armour wires and tapes		
17.7.1	Measurement on wires	Micrometer having two flat noses to an accuracy of ±0,01mm.	R
17.7.2	Measurement on tapes	Micrometer having two flat noses of approximately 5mm in diameter to an accuracy of ±0,01mm.	R
17.8	Measurement of external diameter	Micrometer, profile projector, measuring tape, a direct reading diameter tape or similar apparatus.	R
17.9	Voltage test for 4h	High voltage power supply (AC); a suitable time meter.	R
17.10	Hot set test for EPR, HEPR and XLPE insulations and elastomeric sheaths	Oven with natural air flow or air flow by pressure, airflow rate: 8～20 completed air changes per hour; Grips, weights, system for measurement of the elongation.	R
18	Type tests, electrical		
18.2	Cable having conductor screens and insulation screens		
18.2.4	Bending test	Test cylinder with different diameter.	R
18.2.5	Partial discharge test	High voltage power supply(AC); voltmeter; measuring circuit; discharge calibrator; double pulse generator; terminal impedance	R

		or reflection suppressor(if necessary).	
18.2.6	Tan δ measurement for cables of rated voltage 6/10kV and above	Tank of liquid, oven or current heating system; thermometer of thermocouple; voltage power supply(AC); tan δ measurement apparatus.	R
18.2.7	Heating cycle test, followed by partial discharge test	Current heating system; thermocouple; suitable time meter; high voltage power supply(AC); voltmeter; measuring circuit; discharge calibrator; double pulse generator; terminal impedance or reflection suppressor(if necessary).	R
18.2.8	Impulse test followed by a voltage test	Current heating system; thermocouple; impulse voltage generator; high voltage power supply (AC); suitable time meter.	R
18.2.9	Voltage test for 4h	High voltage power supply (AC); suitable time meter.	R
18.2.10	Resistivity of semi-conducting screens	Oven; silver paint; testing apparatus for measuring resistivity.	R
18.3	Cables of rated voltage 3,6/6(7,2)kV having unscreened insulation		
18.3.2	Insulation resistance measurement at ambient temperature	Water tank; thermometer; insulation resistance tester with DC source between 80 V and 500 V.	R
18.3.3	Insulation resistance measurement at maximum conductor temperature	Heated water tank; thermometer; insulation resistance tester with DC source between 80 V and 500 V.	R
18.3.4	Voltage test for 4h	High voltage power supply (AC); suitable time meter; water tank.	R
18.3.5	Impulse test	Current heating system; thermocouple; impulse voltage generator;	R

		high voltage power supply (AC); suitable time meter.	
19	Type tests, non-electrical		
19.2	Measurement of thickness of insulation	Measuring microscope or profile projector of at least 10 x magnification.	R
19.3	Measurement of thickness of non-metallic sheaths (including extruded separation sheaths, but excluding inner coverings)	Measuring microscope or profile projector of at least 10 x magnification.	R
19.4	Measurement of thickness of lead sheath	Refer requirements in 17.6.2 or 17.6.3	R
19.5	Tests for determining the mechanical properties of insulation before and after ageing	Tensile machine and system for measurement of the elongation; equipment for punching dumb-bell test pieces and equipment for cutting or grinding the insulation to obtain 2 parallel surfaces; Optical measuring instrument / dial gauge; Oven with natural air flow or air flow by pressure, airflow rate: 8～20 completed air changes per hour.	R
19.6	Tests for determining the mechanical properties of non-metallic sheaths before and after ageing	Tensile machine and system for measurement of the elongation; equipment for punching dumb-bell test pieces and equipment for cutting or grinding the insulation to obtain 2 parallel surfaces; Optical measuring instrument / dial gauge; Oven with natural air flow or air flow by pressure, airflow rate: 8～20 completed air changes per hour.	R
19.7	Additional ageing test on pieces of completed	Tensile machine and system for measurement of the elongation;	R

	cables	equipment for punching dumb-bell test pieces and equipment for cutting or grinding the insulation to obtain 2 parallel surfaces; Optical measuring instrument / dial gauge; Oven with natural air flow or air flow by pressure, airflow rate: 8～20 completed air changes per hour.	
19.8	Loss of mass test on PVC sheaths of type ST2	Oven with natural air flow or air flow by pressure, airflow rate: 8～20 completed air changes per hour; analytical balance with a sensitivity of 0,1mg; punching dies for dumb-bell test pieces; desiccator with silica gel or similar material.	R
19.9	Pressure test at high temperature on insulations and non-metallic sheaths	Indentation device consists of a rectangular blade with an edge 0,7±0,01mm wide, loads (weights) and supports; air oven; microscope or profile projector with two decimal places.	R
19.10	Test on PVC insulation and sheaths at low temperatures		
	Bending test at low temperature	Suitable low temperature cabinet; cold bend test apparatus consisting essentially of a revolving mandrel and guiding devices for the test pieces; mandrels with different diameters.	R
	Elongation test at low temperature	Tensile machine with a cooling device or tensile machine installed in a cooling chamber; system for measurement of the elongation; equipment for cutting or grinding the sample and equipment for punching dumb-bell test pieces.	R
	Impact test at low temperature	Impact test apparatus; pad of sponge rubber about 40mm; suitable low temperature cabinet; hammers; caliper for	R

		measurement of the height of fall hammer.	
19.11	Test for resistance of PVC insulation and sheaths to cracking (heat shock test)	Mandrel with different diameters; air oven	R
19.12	Ozone resistance test for EPR and HEPR insulations	Device for generating a controlled amount of ozone; a means for circulating ozonized air under controlled conditions of humility and temperature through a chamber containing the test pieces to be tested; a means for determination of ozone concentration; suitable device for the clamping and elongation of test pieces; cylindrical mandrels consisting of wood or metal; desiccator filled with silica gel or equivalent material; accurate laboratory balance reading to 0,1mg.	S
19.13	Hot set test for EPR, HEPR and XLPE insulations and elastomeric sheaths	Oven with natural air flow or air flow by pressure, airflow rate: 8～20 completed air changes per hour; grips; weights; system for measurement of the elongation.	R
19.14	Oil immersion test for elastomeric sheaths	Tensile machine and system for measurement of the elongation; equipment for punching dumb-bell test pieces equipment for cutting or grinding the sheath to obtain 2 parallel surfaces; Oil no. 2 (IRM 902); heated oil bath.	R
19.15	Water absorption test on insulation	**a) Electrical test:** AC and d.c. voltage sources; voltmeter; water bath with heating equipment. **b) Gravimetric water absorption test:** filter paper; air oven or low-pressure oven; a desiccator filled with silica gel or equivalent material; analytical balance with a sensitivity of 0,1mg; test mandrel with different diameter; glass vessel; preboiled distilled or deionized water; vacuum (residual pressure close to 1 mbar); glass tube with condenser or beaker covered with glass lid.	R

19.16	Flame spread test on single cables	Propane gas burner: 1 kW pre-mixed flame including system of confirmation of test flame 3-sided metallic screen 1200 mm high, 300 mm wide and 450 mm deep with open front and closed top and bottom; suitable timer; vernier caliper with an accuracy of 1mm; propane gas with the prescribed purity.	R
19.17	Measurement of carbon black content of black PE oversheaths	Device consists of furnace, combustion boat about 75mm long, hard glass/silica / porcelain combustion tube with bore approximately 30mm and length 400±50mm, stopper carrying a thermometer and tube; desiccator; analytical balance with a sensitivity of 0,1mg; Nitrogen; air or oxygen. Thermogravimetric analysis as an alternative test method.	S
19.18	Shrinkage test for XLPE insulation	Vernier caliper; air oven; support or talc bath.	R
19.19	Thermal stability test for PVC insulation	Glass tubes closed at one end, 110mm long with an outer diameter of approximately 5mm and inner diameter of 4,0± 0,5mm; universal indicating paper with a pH range of 1 to 10; thermostatically controlled heating apparatus; thermometer calibrated in divisions of 0,1℃; stop-watch or a suitable time meter.	R
19.20	Determination of hardness of HEPR insulation	Test instrument for measuring hardness; Groove or metal jig; V-blocks.	R
19.21	Determination of the elastic modulus of HEPR insulation	Tensile machine; equipment for punching dumb-bell test pieces and equipment for cutting or grinding the insulation to obtain 2 parallel surfaces; optical measuring instrument / dial gauge.	R
19.22	Shrinkage test for PE oversheaths	Vernier caliper; air oven; support or talc bath.	R

19.23	Strippability test for insulation screen	Tensile machine; oven with natural air flow or air flow by pressure, airflow rate: 8～20 completed air changes per hour; vernier caliper.	R
19.24	Water penetration test	Test cylinder; current heating system; timer; thermocouple; apparatus for water penetration test.	R

Note: The presence of equipment alone does not indicate a satisfactory situation. Assessors must evaluate the equipment design, calibration, uncertainty and documentation to ensure compliance with the directions of the standard. The requirements of ISO/IEC 17025 regarding validation are applicable, as the tests of this standard are not standardised tests.