ACCREDITATION SCHEME FOR LABORATORIES

Technical Notes EL 001

General Requirements for Electrical Testing Laboratories

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The SAC Accreditation Programme is managed by Enterprise Singapore

1. Introduction

1.1 The field of Electrical Testing covers a wide range of tests and is divided into the following broad areas:

- Appliances
  A consuming device, other than a lamp, in which electricity is converted into heat, motion, or any other form of energy, or is substantially changed in its electrical character

- Luminaire
  Apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing and protecting the lamps, but not the lamp themselves, and where necessary circuit auxiliaries together with the means for connecting them to the supply

- Conduit & Trunking System
  A wiring system consisting of conduit/trunking fittings for the protection and management of insulated conductors and/or cables in electrical or communication installations

- Accessory
  A device other than current-using equipment, associated with such equipment or with the wiring of an installation

- Equipment
  An equipment for such purpose as generation, conversion, transmission or distribution protection, such as generator, transformer, switchgear, protective devices etc

- Electronic Components
  Any of the parts that make up or needed for a whole especially for an electronic system, e.g. capacitor, resistor or electronic devices etc

- Electromagnetic Compatibility
  The ability of an electronic system to function properly in its intended electromagnetic environment and not to be a source of pollution to that environment

- Environmental Reliability
  Environmental simulation with temperature cycling or vibration stress to determine the types of failure under these environmental stresses

1.2 This document should be read in conjunction with documents SAC 01[1] "Terms and Conditions for Accreditation" and PROF 001[2] "Policies on Proficiency Testing".

1.3 Supplementary information for specific areas of testing within the Electrical Testing field may be published as other Technical Notes.

2. Accommodation and Testing Environment

2.1 Construction of testing laboratories

(a) Adequate space to house workbenches, ancillary apparatus and instrument and enclosed storage space for working equipment.

(b) Adequate space for the required number of test operators and supervisory staff. Evacuation corridor should be clearly marked for emergency exit.

(c) The walls, floor and ceiling should be constructed to minimise the effects of external noise, vibration and electromagnetic interference, if relevant.

(d) Proper shielding should be erected to ensure testing is not affected by the stray magnetic field. Water pipes in the wall, floor or ceiling are a potential source of stray fields. It may be necessary to electrically isolate the pipes and ground them to the laboratory earth. Electrical supply cables, particularly those supplying other parts of the building or site, should be enclosed in steel ductwork which should not be earthed to the laboratory earth.

(e) Proximity to plant rooms and heavy equipment workshop should be avoided. Acoustic noise may be reduced using double glazing windows.

(f) The laboratory floor should have an antistatic covering particularly when high-resistance circuits and instruments are to be used.

(g) For testing of equipment at high voltage, it shall be carried out in a room or enclosed area which are provided with adequate safety protection (e.g. a rubber mat or inter-locking device etc).

(h) For testing of materials at high temperature, it shall be carried out in properly constructed test chamber provided with adequate exhaust to disperse the combustible waste e.g. toxic gases and the elimination of pungent odours etc.

2.2 Air conditioning and ventilation

- The air exchange rate should be adequate to cope with altering temperature conditionings. The incoming air should be filtered to minimise dust and heat intake.

- The ambient condition should be maintained at a temperature according to the test condition required for the purpose of preventing condensation.

In addition, unless the test equipment and items under test have short thermal time constants, a considerable part of the working day will be lost waiting for the test system to reach thermal equilibrium.

2.3 Lighting

Workbench should be adequately illuminated and the illuminance should preferably be in the range of 400 to 500 lux.

2.4 Electrical Supply

- The electric power to the air conditioning unit, the workbench and room lighting should be supplied from an independent circuit which is separated from the supply to other factory or office.

- Power from general purpose outlets at the workbench should be controlled via a line conditioner or voltage stabilizer. An earthing bus common to all benches should be provided to earth each piece of electrical instrument or apparatus as required.

3. Calibration Intervals for Electrical Testing Equipment

3.1 **Annex 1** sets out nominal recommended maximum periods between successive calibrations for a number of measuring instruments. It must be stressed that these periods are generally considered to be the recommended maxima appropriate in each case provided that:

(a) the equipment is of good quality and of proven adequate stability, and

(b) the laboratory has both the equipment capability and staff expertise to perform adequate internal checks, and

(c) if any suspicion or indication of overloading or mishandling arises, the equipment will be checked immediately and thereafter at frequent intervals until it can be shown that stability has not been impaired.

Where the above criteria cannot be met, appropriate shorter intervals should be specified.

3.2 Submission for extension of calibration interval based on factors such as history of stability, frequency of use, accuracy required and ability of staff to perform regular checks may be considered. It is the responsibility of the accredited testing laboratories to provide evidence that its calibration system ensures that confidence in the equipment can be maintained.

3.3 When calibrations have been performed by the staff of a laboratory, proper records of measurement must be documented and maintained.

4. Approved Signatories for Emerging Area

4.1 The nominee for signatory approval for emerging area shall have related industry experience and be with the organisation for at least 1 year, trained and assessed by experts in the emerging field (e.g. overseas founder).

4.2 All other requirement specified in clause 5 of SAC-SINGLAS 001[3] shall apply.

5. References

1 SAC 01 – Terms and Conditions for Accreditation

2 PROF- 001 – Policies on Proficiency Testing

3 SAC-SINGLAS 001 – Accreditation Process

Annex 1

Types of equipment	Recommended maximum period between successive calibrations
Attenuators	3 years (frequency response) Where appropriate conduct annual check on resistance and return loss values
Bridges	3 years (full calibration) Range check annually
Capacitors	3 years Intercompare annually
Digital meters	1 year
Digital calibrators with self checking	2 years
Inductors	3 years Intercompare annually
Instruments, indicating and recording (analogue only)	3 years Intercompare every 6 months or more frequently as required
Instrument and ratio transformers	5 years
Instrument transformer test sets	3 years (full calibration) Annual intercomparison of transformers to detect major problems
Potentiometers	2 years
Resistors	3 years Intercompare annually
RF noise sources	2 years
RF power measuring equipment	2 years Annual check VSWR
Signal generators	1 year
Volt ratio boxes	3 years Intercompare annually

Types of equipment	Recommended maximum period between successive calibrations
Watthour meters(Electro-mechanical)	1 year Intercompare every three months
Wattmeters and Watthour meters(Electronic)	1 year with regular intercomparison. Intervals to be based on history of performance
Standard cells and electronic references	2 years Intercompare at least six monthly
Time and frequency standards	Calibration interval dependent on equipment frequency type and accuracy required. This may be as frequently as daily if the highest possible performance is required.
Transfer standards, AC-DC	5 years with annual self-check for a stand-alone instrument. 8 years with annual self-check and 4-yearly intercomparison
Ancillary Equipment	
Accelerometers	1 year
Anemometers	2 years
Environmental chambers	1 year
Force testing machines	2 years
Hygrometers	Assman hygrometers and sling - 5 years Recorders accurate to +/- 1% RH - 2 years Other recorders including hair type - 1 year
Mass	Reference - 3 years Working - 1 year
Micrometers, dial gauges, caliper, etc.	1 year
Pressure and vacuum gauges	1 year
Thermocouples	a) Rare metal - 100 hrs use or 3 years b) Base metal - Calibration interval to suit the particular application
Weighing appliances	1 year

Types of equipment	Recommended maximum period between successive calibrations
Thermometers	**Liquid-in-glass (reference thermometer)** Check ice point or other suitable reference point each time used or at intervals of 1 to 2 months, whichever is the sooner until the secular change is less than half the uncertainty of calibration. Then check every 6 months. Recalibrate every 5 years when reference point changes by 5 or more scale divisions. **Liquid-in-glass (working thermometer)** As working thermometer intercompare with reference thermometer at two points in the working range every 6 months. Recalibrate every 5 years or when a change of 5 or more scale divisions is noted. **Resistance-temperature thermometer** Check ice point before use or at least every 6 months. Recalibrate every 5 years or when ice point changes by detector more than the equivalent of five times the uncertainty of calibration.
EMC and Electrical Safety Testing Equipment	
Absorbing Clamps	Annual check
Antennae	3 years
Attenuators, cables, couplers and preamplifiers	Annual check
Harmonic and voltage fluctuation measuring equipment	Annual calibration
Immunity Field strength meters	3 years
Impact hammers	5 years
Impulse testers ESD testers	Annual check
Receivers	Annual calibration
Surge generators	Annual check

Types of equipment	Recommended maximum period between successive calibrations
Solar Testing Equipment	
DC current shunt Resister box (1M, 10M, 100M, 500M, 1G ohms)	Annual calibration
IV curve tracer	Annual calibration
Mechanical load test stand	Annual calibration
Multi-channel Hipot tester	Annual calibration
Luxmeter	Annual calibration
Pyranometer	Annual calibration
World PV Scale (WPVS) reference cell	Annual calibration
Reference cell	Annual calibration
Sensor UVA	Annual calibration
Sensor UVB	Annual calibration
Sun simulator module	Annual calibration
Solar simulator wavelength filters	Annual calibration
Weather multi-sensor	Annual calibration
Torque screwdriver	Annual calibration
Hail tester stand inclusive ice projectile making unit/mold	Annual calibration