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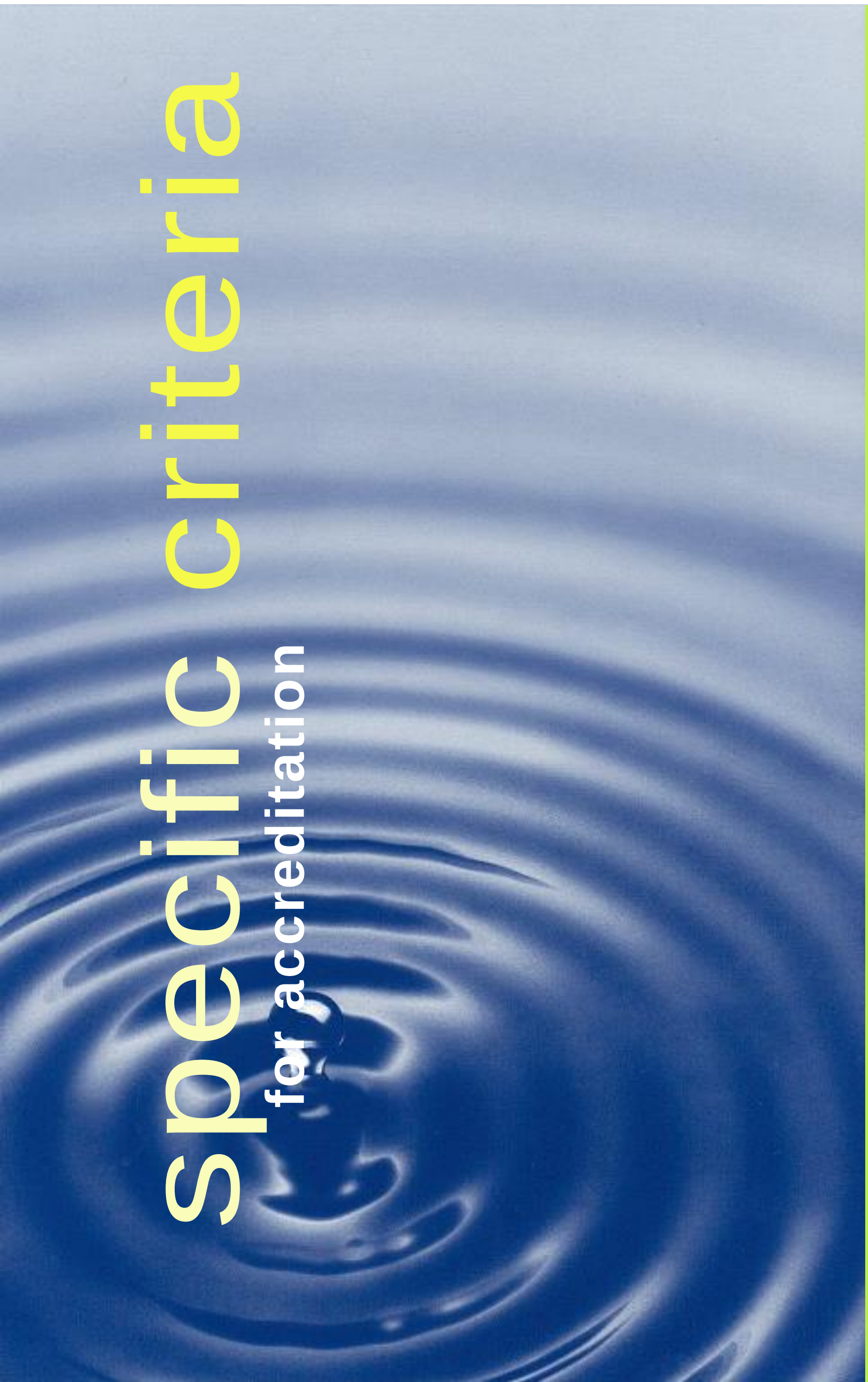

Electrical Testing

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specific criteria for accreditation

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Contents

1 Introduction

International Accreditation New Zealand (IANZ) Specific Criteria amplify or particularise the IANZ general accreditation criteria, for specific fields of technology or for specific types of business activity.

A list of all Criteria documents published to date is available from IANZ on request or can be viewed on www.ianz.govt.nz/publications. Specific Criteria 3 defines specific technical requirements for accreditation of electrical testing laboratories.

This document must be read together with current issues of the IANZ general criteria for accreditation NZS ISO/IEC 17025: *General requirements for the competence of testing and calibration laboratories*, and *Procedures and Conditions of Accreditation*, the latter document describing the organisation and operation of the IANZ Accreditation Programmes.

This document provides information on classes of test (Appendix 1), staff, accommodation, equipment and other aspects of good laboratory management practice which are considered a minimum standard for electrical laboratories.

2 Scope

This criteria schedule sets out the specific requirements an electrical testing laboratory has to meet, in addition to the general requirements of NZS ISO/IEC 17025, if it is to be accredited by IANZ.

3 Definitions and acronyms

Uncertainty, calibration

Definitions of these terms and other terms relating to measurements are contained in *International Vocabulary of Basic and General Terms in Metrology* (VIM) (see references).

CISPR: The Comité International Spécial des Perturbations Radioélectriques (CISPR; English: International Special Committee on Radio Interference

IECEE CB: International Electrotechnical Commission System of Conformity Assessment Schemes for Electrotechnical Equipment and Components Certification Body

4 Classes of Test

IANZ Accreditation does not constitute a blanket approval of all of a laboratory's activities. The classes of test are an arbitrary subdivision of the potential range of activities involved in electrical testing on the basis of the type of measurements being made, the scientific disciplines involved and the techniques employed. It is therefore possible for a particular test or technique to be included under several classes of test. These classes and subclasses do not necessarily however, constitute any restriction on the work which a laboratory can perform but provide a convenient means of expressing an accredited laboratory's capabilities.

Accreditation is normally granted only for work which is performed regularly and for which the laboratory is properly equipped and has demonstrated its capability. The extent of a laboratory's scope of accreditation will therefore vary with the range of work performed, the scope and complexity of the tests involved, the competence and organisation of laboratory staff and the level of technology available in the laboratory.

Issued Schedules to the Certificate of Accreditation (Scopes of Accreditation) can be viewed via the IANZ Directory at www.ianz.govt.nz.

The field of Electrical Testing covers tests of an essentially electrical nature performed on instruments, equipment, appliances, components, and materials (classes of test are attached in Appendix 1). The calibration of electrical and electronic measuring instruments and equipment is included in the Metrology and Calibration field.

5 Laboratory Accommodation and Safety

5.1 Accommodation

Accommodation requirements for electrical testing laboratories vary quite widely depending upon the nature of the items to be tested and the uncertainty with which measurements are to be made. A formal laboratory area will be required for precise electrical measurements but many measurements and tests can be satisfactorily performed in production areas or in the field.

Formal laboratory areas must have good lighting (minimum of 400 lux), adequate bench space, freedom from dust and fumes, freedom from vibration and acoustic noise and have appropriate control of temperature and humidity. The extent to which these environmental factors apply will vary according to the type of measurement and precision (uncertainty) with which measurements are made.

When precise measurements are to be made in laboratories, the following factors may assume greater importance:

(a) Isolation from sources of mechanical vibration and shock likely to have a detrimental effect on sensitive instruments, e.g. lifts, plant rooms, busy roads, etc.
(b) Smooth, antistatic finishes for walls, ceilings and floors and, where necessary, air filtration to facilitate dust control
(c) Double glazing of windows and shading from direct sunlight
(d) Temperature control of the laboratory where relevant but in any case with variation typically less than 2 °C per hour
(e) Humidity control as required (typically in the range 35 % to 70 % RH)
(f) Isolation from electromagnetic interference. This is less likely to be necessary for DC and low frequency AC measurements but assumes importance at RF frequencies. Screening may be necessary for some precise electrical measurements (see particular requirements for Open Area Test Sites-OATS below). Radiation from local transmitters and computer equipment may be a hazard to many measurements and its effects may need to be assessed
(g) Stabilisation or filtering of incoming mains power supply where purity of waveform and constancy of voltage is important
(h) Management of the laboratory environment by regular cleaning
(i) Freedom from fumes which are likely to have an adverse effect on equipment (and staff).

5.1.1 Open Area Test Sites (OATS)

OATS must comply with the requirements of the IEC International Special Committee on Radio Interference (CISPR) 16-1. For category (d) sites, pre-OATS scanning of the equipment under test (EUT) must be carried out in a screened room and any emissions that could be masked by ambient emissions must be identified in the report.

Note: Use of a screened room for EMC emission measurement is not currently an option under CISPR procedures.

Site attenuation tests must be carried out regularly as required by CISPR 16-1.

Test sites used to make measurements above 1 GHz will need to have the site Voltage Standing Wave Ratio (VSWR) measured and recorded to demonstrate compliance with CISPR 16-1-4:2010 or American National Standards Institute (ANSI) C63.4:2014, depending on customer and/or market regulator requirements. Compliance with alternative editions of these standards may be permitted if required by the regulator.

5.2 Safety

For laboratories performing electrical testing where there is a higher health and safety risk, for example high voltage, the laboratory should endeavour to have at least two staff members present during the testing.

While safety falls outside the scope of accreditation, laboratories are expected to comply with the Electrical Safety Regulations and any other relevant health and safety requirements. AS 2243 is recommended as a guide to safe practices in laboratories.

5.3 Access to Test Areas

Laboratories carrying out type tests on electrical equipment will be expected to control access to test areas to provide security for new client designs and innovative technical solutions, particularly where the laboratory is contained within a production facility and performs tests for the public.

6 Laboratory Equipment Management and Calibration

Management and calibration requirements for equipment are given in NZS ISO/IEC 17025. Guidelines on calibration intervals for laboratory equipment are given in Appendix 2.

6.1 Measurement Traceability

Traceability of a measurement result is ensured when the result can be related to a stated reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty (see reference 4).

The IANZ policy on traceability of measurement is set out in the IANZ Technical Policy No.1: *Traceability of Measurement* (reference 9). All IANZ accredited electrical testing laboratories are required to maintain conformity with this policy.

The calibration certificates issued by accredited laboratories must be endorsed in accordance with the requirements of the accreditation bodies concerned. This constitutes proof of traceability.

6.2 Calibration

Calibration involves controlled comparison of the device under test (DUT) against a "known" instrument over the range of values of use of the DUT. The differences between the "known" instrument and the DUT are tabulated for a range of pre-selected calibration points. The uncertainty and these differences must be reported for the comparison process. Electrical laboratories must obtain such calibration certificates for all critical measuring equipment. Alternatively, they may perform comparisons in-house where they have appropriate reference equipment and can demonstrate performance to a documented method. Uncertainty of measurement must be determined for internal calibration of critical items.

Where electrical instruments submitted to a calibration laboratory are likely to be adjusted, appropriate "as received" measurements must be requested by the submitting electrical laboratory. The full calibration is then carried out after the adjustment. If this procedure is not followed, then historical stability data is lost along with the electrical testing laboratory's ability to take appropriate corrective action on out-of-calibration equipment. Historical stability data can be used to justify extending calibration intervals.

When the laboratory’s reference equipment contains software adjustments for calibration purposes, these adjustments must be made only by the laboratory carrying out the reference equipment calibration. Once an adjustment has been made, any existing calibration certificate is invalidated.

6.2.1 Thermocouples

The effects of inhomogeneity, compensating leads, cold junction compensation and thermal losses on temperature measurements should be evaluated. It is important to note that the emf in a thermocouple is produced at the temperature gradient and not at the thermocouple tip. Calibrations of thermocouples should include the compensating lead to be used.

Type K thermocouple wire can suffer from large errors arising from its immersion history. Where critical high temperature measurements need to be made, use of a type N wire is advised in place of type K.

Standard uncertainty due to thermocouple inhomogeneity can be evaluated using the following formula:

$u = 0.15 + 0.0003 \cdot t + 0.000004 \cdot t^2$

where:
u = standard uncertainty for thermocouple inhomogeneity,
t = temperature in degrees Celsius.

6.3 Performance Verification

The manufacturer's performance verification against the equipment specification is not considered to be a calibration unless an appropriate range of the instrument's hardware and software is covered.

6.4 Electronic Instruments

Electronic and software controlled instruments are acceptable as reference devices providing their long term stability and total uncertainty are considered appropriate (see Appendix 2 - Calibration Intervals).

7 Laboratory Staff

NZS ISO/IEC 17025 gives the general requirements for laboratory staff and management. The requirements for laboratory approved signatories are set out in Appendix 3.

Staff assessing products for conformance with electrical safety requirements will be expected to have a tertiary electrical engineering or related qualification and to have extensive knowledge of the risks against which protection is required e.g. electric shock, fire, burning of skin and of other important aspects of the relevant test specifications.

Staff assessing products for conformance with EMC requirements will be expected to have a tertiary electrical engineering or related qualification and to have extensive knowledge of the risks against which protection is required e.g. the effect of unwanted emissions on other users of the spectrum, the effect of emissions on critical electrical and electronic equipment such as medical equipment for critical care, air traffic control equipment, etc. In addition, staff seeking signatory approval would need to be familiar with immunity requirements for equipment under test as specified in the relevant test specifications.

Staff assessing products for conformance with Spark New Zealand, Australian Communications and Media Authority (ACMA) or similar telecommunications requirements will be expected to have a tertiary electrical engineering or related qualification and to have extensive knowledge of the electrical safety risks against which protection is required e.g. the risks associated with any low voltage items which form a part of the telecommunications terminal equipment (TTE), the additional risks to the public switched telephone network (PSTN) posed by the low voltage equipment, the additional risks to the network introduced by the PSTN side of the TTE. Testing staff would be expected to be familiar with relevant test specifications.

Laboratory staff performing electrical safety type tests, tests on TTE and EMC tests within a production facility must be independent of the production management and any influence or direction from that management that could affect the proper outcome of the tests. They would also be expected to have a good knowledge, whether they use it to advise clients or not, of the design types and general component arrangements that provide physical protection to the product, network or user against such risks.

8 Laboratory Test Methods

Where test methods and in-house calibration methods are based on standard test methods or manufacturer's methods, these must be tailored for the laboratory's own test equipment. Calibration procedures must exercise all relevant parts of the hardware and software of the instrument, particularly for in-house calibration purposes.

9 Uncertainty of Measurement

Electrical testing laboratories certifying conformance with specification limits for electrical safety and electromagnetic compatibility tests must define and document a policy on calculation of measurement uncertainties (see references 1, 2, and 3 for guidance; the second is preferred).

The policy must include consideration of all contributions to uncertainty (type A and type B) and must define the method the laboratory will use to combine these effects and the confidence interval within which the test result can be expressed. Where relevant, measurement uncertainties must be reported in test reports.

When test results lie within the uncertainty band about a specification limit, the laboratory must define its policy on reporting conformance and must report the uncertainty.

10 Identification of Items under Test

Items under test must be uniquely and unambiguously identified. This may include circuit diagrams, block diagrams, operating manuals, board layouts, photographs, drawings as well as the version and configuration of any software used in the item. For type testing, in particular, accurate characterisation of the design type that was certified as complying is critical.

The item under test submitted for final approval must be representative of production. Any modifications made to the hardware or software of the item to enable it to comply must also be explicitly identified in the records of the test unless the test is to be completely repeated.

11 Reports and Records

Reports covering electrical safety testing or EMC type tests must cover all relevant clauses of the applicable test method. Where any clause is not applied, the report must clearly show that it is not relevant or the report must refer to another report where those clauses were assessed.

When test methods relating to particular appliances or equipment call up clauses from generic methods such as AS/NZS 3100, AS/NZS 60335.1, or AS/NZS 3350, then the report must clearly and unambiguously show that these have been covered in the tests. One way to ensure that is to use the testing report format of the IECEE CB Scheme.

Reports covering retests of equipment that has previously failed to comply must clearly show what modifications have been made to the equipment and where these are partial tests, must make clear reference to the earlier report covering the other compliant clauses. Where complete retests are carried out, detail of modifications is not as important as specifying the new design with drawings, photos, layouts, PCB designs, etc.

Where cords, switches, plugs, etc. are deemed to comply on the basis of test reports supplied by the customer, these must be:

(a) From a laboratory accredited by IANZ or by a national laboratory accreditation authority with which IANZ has a mutual recognition arrangement or from a CB accredited laboratory, and
(b) The applicable report must be referenced as required by accreditation criteria (see NZS ISO/IEC 17025 and the appendix in *Procedures and Conditions of Accreditation*).

12 Computer-Controlled Test Equipment

Appropriate quality assurance is needed of all in-house developed software (see NZS ISO/IEC 17025). Automatic test equipment must be calibrated in a similar manner to other equipment being calibrated.

The following comments apply to the use of computers for direct data capture and control of the calibration operation. Where control is by proprietary software such as that supplied with some calibrators, validation will only be required of the individual calibration routines for instruments and not for the programme supplied by the manufacturer.

For in-house developed software, standard packages of raw data can be developed for feeding through the system to check routines on development or modification of the system. Care should be taken to ensure that such packages cover the expected range of values and include combinations of peculiar circumstances to highlight faults in basic logic of the programme or its subroutines. Alternative systems using spreadsheets or other software may also be used.

Reference artefacts may be held to check the operation of the whole system at appropriate intervals.

The results of this testing should be recorded and incorporated in the maintenance history. Software maintenance should include a back-up regime and a system recovery plan.

Electronic data must be treated in an equivalent way to hard copy to ensure it is not lost or changed without an audit trail.

13 Proficiency Testing

The IANZ policy on participation in proficiency testing activities is set out in the IANZ Technical Policy No.2: *Participation in Proficiency Testing Activities*. All IANZ accredited electrical testing laboratories are required to maintain conformity with this policy.

14 References

1. *The expression of Uncertainty and Confidence in Measurement for Calibration*, UKAS M3003, Edition 2, Jan 2007.

2. JCGM 100:2008 (GUM 1995 with minor corrections) *Evaluation of measurement data — Guide to the expression of uncertainty in measurement*.

3. *Radio Equipment and Systems; Uncertainties in the measurement of mobile radio equipment characteristics*, ETSI Report ETR 028, Edition 2, 1994

4. ISO/IEC Guide 99: 2007. *International vocabulary of metrology-Basic and general concepts and associated terms (VIM)*.

5. *IANZ Procedures and Conditions of Accreditation*, AS 1.

6. CISPR 16-1: *Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods*, Part 1: Radio Disturbance and Immunity Measuring Apparatus.

7. NZS ISO/IEC 17025 *General requirements for the competence of testing and calibration laboratories.*

9. *IANZ Measurement traceability policy*, AS TP1.

10. *IANZ PT participation policy*, AS TP2.

Appendix 1
Classes of Test

Laboratories are accredited for classes of test. Individual laboratories may be accredited for the performance of a single class of test, for any combination of the classes of test listed or even for one specific test within a class of test.

Divisions in the list of classes of test are based essentially on the nature of instruments, equipment, components or materials under test. While some exceptions to the general principle have been inevitable, this method of division of the field has been adopted to reduce repetition. As the scope of accreditation of any individual laboratory normally details the range of frequency, current, voltage, etc, in which measurements are made, it is possible for each class of test to cover the work of laboratories with widely differing interests. The list of classes of test is used with flexibility to ensure that the scope of accreditation of each laboratory is fully informative, to the advantage of both the laboratory and its clients.

3.01 Conductors and Resistance Alloys

3.02 Resistors, Resistance Boxes and Potential Dividers

3.03 Insulators and Insulating Materials
- (a) Electric strength tests
- (b) Insulation resistance tests
- (c) Surface and volume resistivity tests
- (d) Loss tangent tests
- (e) Relative permittivity tests
- (f) Direct voltage tests
- (g) Alternating voltage tests
- (h) Tracking
- (i) Dielectric dispersion coefficient
- (j) Moisture absorption
- (k) Insulating oils and oil insulated systems
- (l) Ageing
- (m) Partial discharge tests
- (n) Impulse voltage tests
- (o) Thermal stability tests
- (p) Other tests

3.05 Magnetic Materials and Magnetic Instruments
- (a) Magnetic materials
- (b) Magnets, solenoids and Helmholtz coils
- (c) Magnetic permeameters
- (d) Magnetic frames and squares
- (e) Fluxmeters
- (f) Magnetometers and search coils
- (g) Hibbert magnetic standards and other flux linkage generators
- (h) Flux density meters

3.20 Cells and Batteries
- (a) Primary cells
- (b) Accumulators
- (c) Power conditioners

3.21 Power Supplies and Stabilisers
- (a) Power supplies
- (b) Stabilisers
- (c) Power conditioners

3.23 Power Rectifiers and Switches
- (a) Rotary, vibratory, and other mechanical types
- (b) Silicon controlled rectifiers and allied control devices
- (c) Vacuum tube rectifiers
- (d) Semiconductor rectifiers

3.24 Electronic Components
- (a) Fixed resistors
- (b) Capacitors
- (c) Semi-conductor devices
- (d) Printed circuits
- (e) Connectors
- (f) Relays
- (g) Integrated circuits
- (h) Other components and sub-assemblies

3.25 Communications Equipment
- (a) Line transmission measuring equipment
- (b) Radio transmission measuring equipment
- (c) Field intensity measuring equipment
- (d) Electrical noise and interference measuring equipment
- (e) Impedance and reflection measuring equipment
- (f) Spectrum analysis measuring equipment
- (g) Data transmission equipment
- (h) Power measuring equipment
- (i) Attenuators and amplifiers
- (j) Waveguide and coaxial components
- (k) Communication systems
- (l) Data acquisition systems
- (m) Processor controlled systems

(n) Other equipment

3.30 Electrical Machines and Auxiliary Apparatus
- (a) Motors, generators and other rotating machines
- (b) Starters, controllers, regulators
- (c) Other equipment

3.31 Circuit Switching and Rupturing Devices
- (a) Circuit breakers and controllers
- (b) Protection and control relays
- (c) Switches and isolators
- (d) Time switches
- (e) Fuses and fuse links
- (f) Surge diverters

3.35 Cables and Feeders
- (a) Conductor resistance tests
- (b) Insulation resistance tests
- (c) Capacitance tests
- (d) Direct voltage tests
- (e) Alternating voltage tests
- (f) Spark tests
- (g) Partial discharge tests
- (h) Dielectric tests
- (i) Electric field intensity tests
- (j) Magnetic field flux density tests
- (k) Sequence impedance tests
- (l) Electrical tests on fittings
- (m) Mechanical tests on fittings
- (n) Other tests

3.36 Power Supply Equipment and Systems
- (a) Electrical parameters
- (b) Waveform characteristics
- (c) Power system disturbances
- (d) Temperature rise and thermal rating tests
- (e) Other tests

3.40 High Voltage Testing
- (a) Direct voltage tests
- (b) Alternating voltage tests
- (c) Impulse voltage tests
- (d) Impulse current tests
- (e) Partial discharge tests
- (f) Dielectric tests
- (g) Switching impulse voltage tests

3.41 Radio communication Equipment
- (a) Receiving equipment
- (b) Transmitting equipment

3.42 Electromagnetic Compatibility Testing
- (a) Radiated emissions
- (b) Radiated susceptibility
- (c) Conducted emissions
- (d) Conducted susceptibility
- (e) Transient testing

3.43 United States Federal Communications Commission Recognised Laboratory (47 CFR Part 2.948)

3.44 United States Department of Homeland Security P25 CAP Recognised Laboratory

3.45 High Power and High Current Testing
- (a) Short time withstand and peak withstand current tests
- (b) Short circuit making and breaking capacities
- (c) Making and breaking capacities
- (d) Overload performance
- (e) Electrical endurance
- (f) Arcing fault tests due to internal fault
- (g) Determination of cut-off current characteristic
- (h) Determination of joule integral characteristic
- (i) Temperature rise tests
- (j) Other tests

3.50 Optical Fibre Systems
- (a) Optical power
- (b) Optical attenuation
- (c) Optical wavelength
- (d) Optical time-domain reflectometry
- (e) Optical bandwidth
- (f) Optical fibre system components
- (g) Fibre and core geometry
- (h) Other tests

3.60 Environmental Tests
- (a) Cold tests
- (b) Dry heat tests
- (c) Damp heat tests
- (d) Impact tests
- (e) Vibration tests
- (f) Acceleration tests
- (g) Storage tests
- (h) Mould growth tests
- (i) Corrosion tests
- (j) Low air pressure tests
- (k) Change of temperature tests
- (l) Sealing tests
- (m) Solar radiation tests
- (n) Soldering tests
- (o) Robustness of terminations tests
- (p) Combined tests
- (q) Other specified tests

3.65 Miscellaneous Electrical Tests
- (a) Insulating gloves and tools
- (b) High voltage operating equipment
- (c) Insulated platform vehicles
- (d) Fire extinguishers
- (e) Other tests

3.70 Antistatic Materials
- (a) Flooring
- (b) Other tests

3.75 Performance Tests on Telecommunications Equipment

3.80 Approval Tests on Electrical Appliances
- (a) General requirements to AS/NZS 3100 *
- (b) Particular requirements to AS/NZS 31XXX
- (c) General requirements to AS/NZS 3350.1 or AS/NZS 60335.1
- (d) Particular requirements to AS/NZS 3350.2.XX or AS/NZS 60335.2.XX
- (e) IP ratings to AS/NZS 60529 *
- (f) Fire hazard testing of electrotechnical products to AS/NZS 60695 series*
- (g) Insulation tests
- (h) Temperature measurements
- (i) DC component from AC equipment
- (j) (Switch endurance tests
- (k) Motor rating tests
- (l) Socket outlet's current-breaking tests
- (m) Other tests

*and other IEC equivalents

3.85 Performance Tests on Electrical Appliances and Accessories

3.90 Electrical Equipment for Explosive Atmospheres

3.95 Electromedical Equipment
- (a) Approval tests
- (b) Performance tests

3.96 Medical Treatment Areas
- (a) Antistatic flooring
- (b) Patient equipotential areas

Appendix 2
Calibration Intervals

The following table sets out the normal periods between successive calibrations for a number of reference standards and measuring instruments. It must be stressed that each period is generally considered to be the maximum appropriate in each case providing that the other criteria as specified below are met:

(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, appropriately shorter intervals may be necessary. IANZ is, however, prepared to consider submissions for extension of calibration intervals based on factors such as history of stability, frequency of use, accuracy required, ability of staff to perform regular checks and successful participation in proficiency testing programmes. It is the responsibility of the testing laboratory to provide evidence that its calibration system will ensure that confidence in the equipment is maintained. Application of the requirements of ISO 10012, Parts 1 and 2 need to be considered when seeking an extension of intervals.

Items marked with an asterisk in the table are those which can be calibrated in-house by the staff of a laboratory if it is suitably equipped and the staff are competent to perform such re-calibrations. Inter-comparisons may also be carried out by laboratory staff. Where calibrations have been performed by the staff of a laboratory, adequate records of these measurements must be maintained, which includes the measurement uncertainty estimations.

The second column shows the maximum recommended period between the initial calibration and the first recalibration. The third column shows the maximum period between subsequent recalibrations, where applicable, provided that the two earlier calibrations indicate that the item is stable. These recalibration intervals apply only to equipment of good quality and stability that is used, handled and stored with care. Excessive usage of equipment would lead to a reduction in these periods.

Equipment	Recommended maximum period (years) between successive calibrations	
	Initial	**Subsequent**
Attenuators	Three (attenuation and frequency response). Resistance and return loss check annually where appropriate.	Three
Bridges	Three (full calibration). Range check annually.	Three
Capacitors	Three. Inter-compare annually.	Five
Digital meters*	One	Two
Digital calibrators with self-checking	One	Two
Inductors	Three. Inter-compare annually.	Three
Instruments, indicating and recording* (analogue only)	Three. Inter-compare every six months or more frequently as required.	Three

Equipment	Recommended maximum period (years) between successive calibrations	
	Initial	**Subsequent**
Instrument and ratio transformers	Five	Five
Instrument transformer test sets	Three (full calibration). Annual inter-comparison of transformers to detect major problems.	Five
Potentiometers	Five	Five
Resistors	One, after initial drift rate has been established. Inter-compare annually.	Three
RF noise sources	Two	Two
RF power measuring equipment	One, for power references. Three, for thermistor and diode sensors. Annual check of VSWR.	Three
Signal generators	One (frequency accuracy, output level and attenuator ratio).	Two
Standard cells and electronic references	One. Inter-compare at least three monthly to establish drift rate of a group. One cell in a group needs to be calibrated annually then inter-compare with group as required.	One
Time, time interval, and frequency standards*	One. Note: Calibration interval dependent on equipment frequency type and accuracy required. This may be as frequently as daily if the highest possible performance is required (via TV line six). Audit the data collection system every two years	One
Transfer standards, AC-DC	Five, with annual self-check for a stand-alone passive instrument. Two, for active devices.	Five (passive). Two (active).
Volt ratio boxes	Three. Annual resistance checks.	Three
Watt-hour meters (electromechanical)	One. Inter-compare every three months.	Two
Wattmeters and watt-hour meters (electronic)	One, with regular inter-comparisons; intervals to be based on performance history.	Two
Ancillary Equipment		
Accelerometers	One	One
Anemometers	One	One
Environmental chambers*	Three: time and spatial variation (temperature variations, recovery time, rate of ventilation).	Five
Balances and weighing appliances	One year initially. *Additional requirements and considerations in MSL Technical Guide 12.*	Up to three years depending on use.
Force testing machines	Two to five years depending on type (where required by a standard method this period may be less).	Two to five

Equipment	**Recommended maximum period (years) between successive calibrations**	
	Initial	**Subsequent**
Hygrometers*		
(a) Assman and sling type psychrometers	Six months (compare thermometers at room temperature with wick dry). Five, (complete calibration)	Five
(b) mechanical (e.g. hair type) thermohygrometers	Three months.	One
(c) electrical impedance sensor	One	One
(d) chilled mirror sensor	One	One
(e) other	One	One
Masses	One to five years depending on use and accuracy required (See AS LAB C5)	One to five
Micrometers, dial gauges, callipers etc.*	See IANZ Technical Guide AS TG 1	
Pressure and vacuum gauges		
(a) Reference	One	Two
(b) Working*	One (with three-to-six monthly internal intermediate checks)	One
Thermocouples (probe only)		
(a) rare metal	100 hours use or three years whichever is the sooner.	
(b) base metal	Calibration intervals to suit the particular application.	

Equipment	Recommended maximum period (years) between successive calibrations Initial	Subsequent
Thermometers (a) reference liquid-in-glass	Five years (full calibration). Check ice point immediately after initial calibration then at least every six months.	Five
(b) working liquid-in-glass*	Five years (full calibration). Check ice point immediately after initial calibration then at least every six months.	Five
(c) or alternatively	Inter-compare with reference thermometer(s) at points in the working range every six months (See IANZ Technical Guide AS TG 3 *Working Thermometers – Calibration Procedures*).	
(d) electronic (sensors that are thermocouples, thermistors or other integrated circuit devices)*	One year (full calibration)	One
(e) resistance reference	Five years (full calibration) or when the ice point drift is more than five times the uncertainty of calibration. Check at ice point before use or at least every six months.	Five
(f) resistance working	Working hand-held resistance thermometers can be checked using the alternative procedure for glass thermometers above.	
EMC and Electrical Safety Testing Equipment		
Absorbing Clamps	Annual calibration or verification	One
Antennae	Three years	Three
Artificial networks (EMC and Telecoms) (LISN etc)*	Annual checks of voltage division factor, rf impedance, and mains voltage drop at rated current and no load.	One
Attenuators, cables, couplers and preamplifiers*	Annual calibration or verification	One
Harmonic and voltage fluctuation measuring equipment	Annual calibration. Intermediate checks as appropriate.	One
Immunity field strength meters	Three years	Three
Impact hammers	Five years	Five
Impulse testers	Annual calibration or verification	One
ESD testers	Annual full calibration for two years then three years with intermediate checks on voltage network in house.	Three
Receivers	Annual calibration.	One

Equipment	Recommended maximum period (years) between successive calibrations	
	Initial	**Subsequent**
Surge generators and other immunity testing equipment	Intermediate checks as appropriate.	

Appendix 3
Approved Signatories and Other Staff

Supervisory staff in accredited organisations must be competent and experienced in the areas covered by their accreditation. They must be able to oversee the operations and cope with any problems that might arise in their work or that of their colleagues or those who report to them. Such staff members, nominated by their organisations, may be granted signatory approval by IANZ. Approved Signatories authorise technical procedures and the release of IANZ endorsed work.

The qualifications and experience required of Approved Signatories and other staff members cannot be rigidly specified but must be appropriate to the work in which they are engaged. Approved Signatories would normally hold tertiary qualifications or equivalent professional recognition in the relevant discipline. Organisations engaged in a restricted range of repetitive work may have that work controlled by a Signatory with appropriate practical experience and specific training in that work but without formal qualifications.

Approved Signatories

Approved Signatories are the knowledgeable staff members who, where relevant:
(a) Develop and implement new procedures
(b) Design quality control procedures, set action criteria and take corrective actions
(c) Identify and resolve problems
(d) Authorise the release of reports
(e) Take responsibility for the validity of test results.

Every accredited organisation must have at least one Approved Signatory covering each class of test on its scope of accreditation. Accreditation is automatically suspended for any scope item(s) where there is no Signatory for the item(s) due to Signatory/ies leaving the organisation or otherwise losing their approval for that part of the scope.
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All IANZ endorsed test certificates or reports must be authorised by an Approved Signatory holding approval in the relevant class(es) of test, who will take full responsibility for the validity of the work. Authorisation can be by signing or by electronic signature with appropriate software safeguards covering release of the report information.

Signatory approval is recognition of personal competence. However, it relates to the accreditation of the employing organisation and is therefore not automatically transferable to another organisation. It lapses when a Signatory leaves the accredited organisation or changes their role significantly within the accredited organisation.

The following are considered when IANZ assesses the suitability of staff members as Approved Signatories:
(a) Relevant qualifications and/or experience. If the signatories do not have relevant tertiary qualifications they must have sufficient relevant experience enabling them to comply with the requirements listed below
(b) Position in the staff structure. Approved Signatories are preferably personnel closely involved in the day to day operations of the accredited organisation
(c) Familiarity with procedures and awareness of any limitations of these procedures; appropriate personal experience in the calibration procedures for which they hold approval, awareness of any limitations of these procedures, understanding of the scientific basis of the procedures
(d) Sufficient experience with the accredited organisation to address the above points. It is difficult to specify an exact time a proposed Signatory should have spent in the organisation, as it is dependent on their previous knowledge and experience and their current role in the accredited organisation. It is unlikely that the time would be less than six months, but exceptional circumstances may apply.
(e) Signatory approval is normally granted only to a staff member in charge, a section leader, a departmental manager or a senior staff member who authorises the release of reports and who can also satisfy the above requirements.

(f) Staff members may be granted signatory approval for all of the work included in their organisation's scope of accreditation or for only specific work or classes of work relating to their area of personal expertise.

(g) Signatory approval is available to a person engaged by an accredited organisation as a consultant, with respect to work done within the scope of accreditation of that organisation, provided that there is a written agreement between the parties setting out the extent of the authority and responsibility of the consultant in relation to the services provided. The consultant's position in the organisation must be such that they can perform their role as a decision maker as effectively as if they were an employee.

(h) Staff members of the accredited organisation who are not engaged full time are also eligible for signatory approval, provided that the circumstances in which they are called upon to exercise their signatory function and their access to, and knowledge of, the operations are such that they are able to take full responsibility for the reports they authorise.

(i) The position and function of an Approved Signatory are quite distinct from that of an Authorised Representative. An organisation will normally have only one Authorised Representative who is appointed by the organisation and is only the contact point for IANZ and need not have any particular professional or technical expertise. The organisation may, however, have several Signatories approved by IANZ and with their own individual areas of expertise.

(j) An Authorised Representative who is not also an Approved Signatory may not authorise the release of IANZ endorsed reports.