SR – 05
SUPPLEMENTARY REQUIREMENTS FOR THE ACCREDITATION OF CALIBRATION LABORATORIES

1. Introduction

1.1. This supplement is a part of the Laboratory Accreditation System accordingly to SNI 19-17025: 2000 (adopted from ISO/IEC 17025: 1999)

1.2. KAN, which is operated based on Pedoman BSN 117 (adopted from ISO/IEC Guide 58) use this documents for the activities in the assessment of calibration laboratories

1.3. This supplementary requirement describes the classification of accreditation scopes, which may be granted by KAN and the recommended calibration interval for reference standards and measuring equipments used by calibration laboratories

2 Scope of Accreditation

2.1. For the purpose of accreditation, calibration laboratory shall fill FR.01.02, the proposed scope of accreditation, which includes calibration field, instrument to be calibrated, measurement range, best measurement capability and method or specification.

2.2. Accreditation is not restricted to high precision measurements. It can be obtained for comparatively large measurement uncertainties if this appropriate for the work being done by the laboratory.

2.3. The classification of the scope of KAN accreditation for calibration laboratories is shown below:

Calibration fields	**Instruments to be calibrated**
1. Temperature	1.1 Liquid-in glass thermomter
	1.2. Temperature sensor with display unit : 1.2.1 thermocouple sensor with display unit 1.2.2 resistance thermometer sensor with display unit
	1.3. Temperature Indicator (without sensor) : 1.3.1 for thermocouple sensor 1.3.2 for Resistance thermometer sensor
	1.4. Resistance thermometer sensor
	1.5. Themocouple sensor 1.5.1 T – type 1.5.2 J - type 1.5.3 E – type 1.5.4 K – type 1.5.5 S and R - type 1.5.6 B - type

1. Temperature (cont'd)	1.6. Radiation thermometer 1.6.1 Infrared photodetector 1.6.2 Visible-light photodetector
	1.7. Optical pyrometer 1 diminishing filament pyrometer
	1.8. Hygrometer, hygrograph
	1.9. Thermohygrometer, Thermohygrograph
	1.10. Temperature enclosure 1.10.1 Oven 1.10.2 Furnace 1.10.3 Bath 1.10.4 Incubator 1.10.5 Refrigerator
	1.11. Humidity Chamber
2. Mass	2.1 Conventional Mass (mass standards, weights)
	2.2 Balances 1.2.1 Electronic Balance 1.2.2 Mechanical Balance 1.2.3 Equal Arm Balance 1.2.4 Batching Plant
3. Volumetric	3.1 Volumetric proving measures 3.2 Volumetric glassware (buret / pipet / labu ukur / etc)
4. Pressure	4.1 Dead Weight Tester (DWT – Pressure Balance) 4.2 Pressure Test Gauge (used for calibration for pressure gauge) 4.3 Pressure Gauge 4.4 Electromechanical manometer (indicated pressure transducer, pressure transmitter, digital manometer) 4.5. Vacuum gauge (gauge or absolute indication) 4.6 Barometer
5. Force	5.1 Load cell 5.2 Tension force testing machines 5.3 Compression force tersting machines 5.4 Universal force testing machine 5.5 Hydraulic Jack 5.6 Force gauge / proving ring 5.7 Impact Testing Machine
6. Torque	6.1 Torque meter
7. Hardness	7.1 Hardness testing machines
8. Flow	8.1 Flowmeter

9. Length	9.1 Length standards 9.1.1 *Gauge blok / end gauge / slip gauge* 9.1.2 *Step gauge - Vernier caliper cheker, inside checker, chek master.*
	9.2 Micrometer 9.2.1 Outside micrometer 9.2.2 Inside micrometer 9.2.3 Micrometer head 9.2.4 3-point inside micrometer 9.2.5 Depth micrometer 9.2.6 indicating micrometer 9.2.7 Mikrometer roda gigi
	9.3 Calliper 9.3.1 *Vernier caliper* 9.3.2 *Height gauge* 9.3.3 *Depth caliper*
	9.4 *Dial Gauge* 9.4.1 Dial indicator 9.4.2 Mechanic dial comparator 9.4.3 Electronic dial comparator 9.4.4 Dial Test indikator 9.4.5 *Linear scale* / LVDT 9.4.6 *Bore gauge*
	9.5 *Gauges* *9.5.1 Feeler gauge* *9.5.2 Pin gauge* *9.5.3 Straight edge* *9.5.4 Plug gauge* *9.5.5 Ring gauge*
	9.6 Angle measuring devices *9.6.1 Bevel Protactor* *9.6.2 Waterpass / Spirit level / bubble / clinometer* *9.6.3 Theodolite* 9.6.4 Telescope *9.6.5 Square* *9.6.6 Sine bar*
	9.7 Me*easuring Machine* 9.7.1 *Profile projector* 9.7.2 *Roughness meter* 9.7.3 *Coordinate Measuring Machine* 9.7.4 *Microskop* 9.7.5 *Roundnessmeter* 9.7.7 *Dial gauge tester* 9.7.8 *Digital mu checker*

9. Length (Cont'd)	9.8.Miscellaneous 9.8.1Thickness gauge 9.8.2 *Surface plate* 9.8.3 *Height master* 9.8.4 *Electronic distance meter* 9.8.5 *Walking measurer* 9.8.6 *Planimeter* 9.8.7 *Tape measure* 9.8.8 *Steel ruler* 9.8.9 *V-blok*
10. Electrical	10.1 . Current 10.1.1 AC/DC Current source 10.1.2 AC/DC Ampere meter 10.1.3 AC/DC current recorder 10.1.4 Current transducer
	10.2. Voltage 10.2.1 AC/DC Voltage source 10.2.2 AC/DC Voltmeter 10.2.3 AC/DC voltage recorder 10.2.4 AC/DC voltage devider) 10.2.5 AC/DC voltage transducer
	10.3. Resistance 10.3.1 Resistor 10.3.2 Decade resistor 10.3.3 Hammond resistor 10.3.4 Current shunt 10.3.5 Ohmmeter 10.3.6 Resistance bridge
	10.4. Capacitance 10.4.1 Capasitor 10.4.2 Decade capacitor 10.4.3 Capacitance bridge 10.4.4 Capacitance meter
	10.5. Inductance 10.5.1 Inductor 10.5.2 Decade capacitor 10.5.3 Inductance bridge 10.5.4 Inductance meter
	10.6. Electric Power and Phase 10.6.1 Power meter 10.6.2 Cos Φ meter 10.6.3 Energy meter 10.6.4 Power transducer

11. Time and Frequency	11.1 Time 11.1.1 Stopwatch 11.1.2 Tirner 11.2. Frequency 11.2.1 Frequency standard 11.2.1.1 Rubidium frequency standard 11.2.1.2 X'tal frequency standard 11.2.2 Counter 11.2.2.1 Frequency counter 11.2.2.2 Frequency meter 11.2.2.3 Microwave frequency counter 11.2.2.4 Universal time counter 11.2.3 Frequency converter 11.2.4 Down converter 11.2.5 RPM converter 11.2.5.1 Optical 11.2.5.2 Electromagnetic 11.2.5.3 Mechanical 11.3. AF & RF signal 11.3.1 *AF signal* 11.3.1.1 *AF oscillator* 11.3.1.2 *Function generator* 11.3.1.3 *Pulse generator* 11.3.2 *RF Signal* 11.3.2.1 *Synthesized signal generator* 11.3.2.2 *Synthesized sweeper* 11.3.2.3 *AM / FM signal generator* 11.4. *RF Power & Attenuation* 11.4.1 RF Power meter 11.4.2 RF attenuator 11.4.3 Power divider / coupler 11.4.4 RF Amplifier 11.5 *AF / RF Analyzer* 11.5.1 Analyzer 11.5.1.1 *Distortion analyzer / distortion meter* 11.5.1.2 *Modulation analyzer / modulation meter* 11.5.1.3 *Spectrum analyzer* 11.5.1,4 *Impedance analyzer* 11.5.1.5 *Audio analyzer* 11.5.1.6 *Network analyzer* 11.5.2 Osiloskop 11.5.2.1 Oscilloscope 11.5.2.2 *Digitizing oscilloscope* 11.5.2.3 *Storage oscilloscope* 11.5.2.4 *Plug-in-type oscilloscope* 11.5.3 *Measuring receiver / signal analyzer* 11.5.4 *Other measuring equipment*

12. Accoustics and Vibration	12.1 Accoustics 12. 1.1 Sound level meter 12. 1.2 Microphone
	12.2 Vibration 12.2.1 Accelerometer 12.2.2 Displacement 12.2.3 Vibratiometer / Vibrometer
13. Analytical Instruments	13.1 Spectro-photometry 13.1.1 UV - Vis Spectrophotometer
	13.2 Chemical testing Instruments 13.2.1 PH meter 13.2.2 Viscometer
14. Optical	14.1 Optical Power Meter 14.2 Optical Time Domain Reflectometer 14.3 Optical Light Source 14.4 Optical Attenuator

3. Criteria for Accreditation

This section provides specific interpretation of the SNI 19-17025: 2000 for the purpose of accreditation of calibration laboratories.

3.1 Personnel (SNI 19-17025: 2000 clause 5.2)

3.1.1. The officer in charge of a laboratory, and his section leaders in larger laboratories, must have a sound knowledge of the principles of metrology and the ability to make critical evaluations of the results of measurement. KAN is concerned with the adequacy of such knowledge and ability, and not with the means by which they have been acquired. It accordingly recognizes the competence and standing of those officers who do not hold and academic qualification.

3.1.2. The extent of the basic technical knowledge required of senior staff with the complexity and accuracy of the measurements for which registration is sought. For very precise and complex work, senior officer should have a knowledge of the relevant branches of physics and mathematics expected of the holder of a degree in engineering or science.

3.1.3. In small laboratories the officer-in-charge must decide who can work under direction and who under supervision. Each must be provided at each level of the staff structure to ensure close adherence to laboratory procedures and accepted techniques at all times.

3.2 Accommodation and Environment (SNI 19-17025: 2000 clause 5.3)

3.2.1. Accommodation requirements vary greatly depending on the nature of the articles to be measurement and the order of accuracy required from the measurements.

3.2.2. Laboratory shall specifiy limits on the environmental conditions to be achieved in the laboratory and on-site calibration works in accordance with the specific requirements for “each instruments to be calibrated’, they ask for accreditation. The limits on the environmental condition may be based on the requirements of international standards on method or specification for specific type of instruments. The condition shall be appropriate to the level of best measurement capabilities claimed by the laboratory

3.2.3. Measuring equipment and measurement standards shall be calibrated and used in an environment adequately controlled for the intended purpose. Due consideration shall be given to temperature, rate of change of temperature, humidity, vibration, dust control, cleanliness, electromagnetic disturbance, interference, lighting and other factors affecting measurement.

3.2.4. The environmental conditions shall be monitored at appropriate intervals and calibration works affected shall be stopped when the environmental condition fall otside the specified limits.. Records shall contain both the original and the corrected data.

3.3 Measurement uncertainty (SNI 19-17025: 2000 clause 5.4.6)

3.3.1. Procedure for evaluation of measurement uncertainty shall be based on KAN Guide on the Evaluation and Expression of Measurement Uncertainty and equivalent documents written based on the ISO Guide to the Expression of Uncertainty in Measurement

3.3.2. Laboratory shall have written procedure for the evaluation of measurement uncertainty, which includes important step in measurement uncertainty evaluation in accordance with outline describe in the appendix B of this document

3.3.3. For the purpose of accredition, statements of Best Measurement Capability (BMC) included in the proposed accreditation scope shall be evaluated based on clause 17 of DP.01.23: “KAN Guide on Evaluation and Expression of Measurement Uncertainty” and supported by uncertainty budget in accordance with the written procedure of the applicant laboratories

3.4 Measurement standards and equipments (SNI 19-17025: 2000 clause 5.5)

3.4.1. All measurement standards and equipment shall meet the requirements of the calibration method and/or shall be capable of achieving the best measurement capability by the laboratory for specific unit under test proposes by the laboratory for the purposes of accreditation.

3.4.2. The laboratory shall ensure that its equipment is suitable for the purpose for which it is used and that its suitability for that purpose is maintained throughout its working life.

3.4.3. Calibration is only one element of the laboratory's responsibility for its equipment and by itself is not an adequate assurance of measurement accuracy. This overall responsibility for equipment encompasses its selection, its installation, its maintenance and intermediate checks between successive calibration as well as proper operation of the equipment.

3.4.4. Accuracy ratio is the ratio of the accuracy of the measurement standards to the accuracy of the equipment under test. Generally, the accuracy ratio is targeted between 4:1 and 10:1 but with a minimum of 2:1.

3.4.5. All measurement standards and measuring equipment shall be labelled, coded or otherwise identified to indicate their calibration status, i.e. the date of last calibration and the next calibration date.

3.4.6. Any limitation of calibration or restriction of use shall be clearly indicated on the equipment.

3.4.7. When neither labelling nor coding is practicable, or is not considered essential for control purposes, other procedures shall be established to ensure conformance to these requirements.

3.4.8. Access to adjustable devices on measurement standards and measuring equipment, which are fixed at the time of calibration, shall be sealed or otherwise safeguarded to prevent tampering by unauthorised personnel.

3.4.9. Seals shall be designed so that tampering will destroy them.

NOTE: This requirement does not apply to adjustable devices that are intended to be set by the user without needing external references.

3.5 Traceability of measurement (SNI 19-17025: 2000 clause 5.6)

The elements of traceability are characterised by :

1. an unbroken chain of comparisons – going back to stated references acceptable to the parties, usually a national or international standard;

2. uncertainty of measurement – the uncertainty of measurement for each step in the traceabiliy chain must be calculated or estimated according to agreed methods and must be stated so that an overall uncertainty for the whole chain may be calculated or estimated;

   Note: The measurement uncertainty for each step in the traceability chain shall be evaluated according to the ISO “Guide to the Expression of Uncertainty in Measurement “ (GUM).

3. documentation - each step in the chain must be performed according to documented and generally acknowledged procedures; the results must be recorded;

4. competence **-** the laboratories or bodies performing one or more steps in the chain must supply evidence for their technical competence (e.g. by demonstrating that they are accredited);

5. reference to SI units – the chain of comparisons must, where possible, end at primary standard for the realisation of the SI units.

6. calibration intervals - calibration**s** must be repeated at appropriate intervals; the length of these intervals will depend on a number of variables, (eg. uncertainty required, frequency of use, way of use, stability of the equipment).

3.6 Calibration intervals

3.6.1. All new quantitative measuring instruments and measurement standards shall be calibrated before being put into service.

3.6.2. Measuring instruments and measurement standards in a calibration system shall be calibrated at intervals established on the basis of their stability, purpose, environment and degree of usage.

3.6.3. The maximum calibration interval determined from at least three earlier calibrations shall indicate that the measurement standard is stable.

3.6.4. The frequency of calibration of each of this equipment shall be such as to establish reasonable confidence that the limits of specification between successive calibrations are not exceeded.

3.6.5. Calibration intervals should not exceed the maximum period specified by the accreditation body as indicated in Appendix A, Recommended Calibration Intervals. However, laboratories may choose to exceed the recommended maximum intervals provided that substantial past calibration records and evaluation have proven the calibration intervals could be extended without increasing risk of instruments being out of specification.

3.7 Computerized calibration system

3.7.1. The equipment shall be satisfactory for its intended purpose. The adequacy of the equipment will be determined by the accuracy and speed of making the reading.

3.7.2. The system shall be satisfactory calibrated. If the measuring equipment cannot be isolated from the data processing system, the system as a whole shall be calibrated either statically or dynamically. If the measuring equipment can be isolated from the data processing system, the equipment can be calibrated in the conventional manner and a separate verification of the data processing system can be undertaken.

3.7.3. The data processing system shall maintain the original integrity of the measured data. The limiting factor on the precision of the numbers which the data processing system can handle must be taken into account.

3.7.4. The data processing system shall allow for the detection of errors in data input and the monitoring of the progress of the calibration.

3.7.5. The system shall be capable of being checked for error-free operation with respect to data capture, data processing and freedom from sources of external interference. This check shall be determined by manual check or by a set of artefact data, etc.

Appendix A
Recommended Calibration Interval

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

- That the equipment is of good quality and proven adequate stability, and
- That the laboratory has both the equipment capability and staff expertise to perform adequate intermediate checks, and
- That if any suspicion or indication of overloading or mishandling arises the equipment will be checked immediately and thereafter at fairly frequent intervals until it can be shown that stability has not been impaired.
- Where the above criteria cannot be met appropriately, shorter intervals shall be specified.

The list of standards and measuring instruments is by no means exhaustive, and will be updated periodically.

No	Type of instruments	Maximum calibration intervals
	Temperature	
1	Calibration bath and Furnace	Initial spatial and temporal surveys should be carried out Check temperature distribution at one temperature every five years
2	Thermocouple	
	Rare metal, reference for use below 1000^0 C	100 hours use or three years
	Rare metal,reference for use above 1000^0C	10 hours use or three years
	Rare metal, working standard	100 hours use or three years
	Base metal, working standard	Calibration interval to suit particular application
3	Thermometer:	
	Liquid in glass (reference thermometer)	Check ice point or other suitable reference point each time of use or at interval of one to two months, whichever is the sooner until the secular change is less than half the uncertainty of calibration. Then check every six months. Recalibrate every five years when reference point changes by five or more scale divisions

	Liquid in glass (working thermometer)	Compare working thermometer with reference thermometer at two points in the working range every six months. Recalibrate every five years or when a change of five or more scale division is noted
	Resistance – temperature thermometer	Check ice point before use or at least every six months Recalibrate every five years or when ice point change by more than the equivalent of five times the uncertainty of calibration
4	Psychrometers	Check thermometer ice point every six months. Calibrate thermometers every five years or when ice point changes by more than five scale divisions
5	Pyrometers	1 year
6	Strip lamps	100 hours use or five years
7	Hygrometer	1 year
	Mass and Related Quantities	
1	Mass standards	
	Reference standards	3 years
	Working standards	1 year
2	Balances	
	Electronic, mechanic	1 year
		With monthly single point check at full scale
	Mass comparator	Repeatability check every 6 months
3	Dead Weight Tester (Pressure Balance)	
	Accuracy < 0.01%	3 years, with spin-rate examination anually
	Accuracy > 0.01%	5 years, with spin-rate examination anually
4	Pressure Test Gauge for calibrating pressure gauge	1 year
6	Manometer :	
	Reference std (liquid)	10 years, with checking the cleanliness of the fluid every 36 months
	Working std (liquid)	5 years, with checking the cleanliness of fluid every 36 months
	Electronic	1 year
7	Barometer:	
	Fortin	Initial, with one point check using transfer instrument every 5 years
	Aneroid	1 year
8	Load Cell	2 years
9	Torque:	
	Standard – beam and masses	4 years than 8 years subsequent
	Transducer	1 years

10	Force Testing Machine:	
	Dead Weight	5 year
	Elastic Dynamometer	2 year
	Hydraulic, Pneumatic	2 year
11	Hydrometer:	
	Reference	5 years
	Working - glass	Check against reference hydrometer or in newly prepared solutions of known density every 1 year
	Working - metal	Check against reference hydrometer or in newly prepared solutions of known density every 6 months
12	Density Bottles	2 years then 5 years subsequent
13	Volumetric Glassware	initial
14	Orifice Plates	Initial, with visual check for wear and damage every 6 months

Length, Angle and Dimensional

1	Gauge Block:	
	Reference standard	3 years
	Working standard	1 year
2	Angle Gauge:	
	Reference standard	4 years
	Working standard	2 years
3	Comparator	3 years
4	Height setting micrometer and Riser Blocks	3 years with annual performance checks
5	Setting rings and plugs:	
	Reference standard	3 years
	Working standard	1 year
6	Autocollimator	6 years
7	Dividing Head and Rotary Tables	5 years
8	Callipers	2 years
9	Dial Gauges	2 years
10	Alignment Telescopes	6 years
11	Surface plates:	
	Cast iron	1 years
	Granite	3 years
12	Measuring Machine (Other than CMC):	
	Precision scale	10 years
	Geometric Test	5 years
	Micrometer Heads	3 years
13	Optical flats/parallels	Three years
14	Linear transducer	1 year, with performance check before use
15	Micrometers	5 years, with annual zero, one point check (against gauge block) and condition of anvil

16	Length bar:	
	Reference	4 years
	Working	2 years
17	Precision Level	4 years
18	Precision Linear scale	5 years
19	Micrometer setting gauge	3 years
20	Optical projectors	5 years
21	Pitch Diameter reference disc	4 years
22	Precision Polygon	5 years
23	Rollers and Balls	4 years
24	Roundness standard	5 years
25	Roughness standards:	
	Metal	4 years, with annnual microscopic inspection
	Glass	Initial, with annual microscopic inspection
26	Screw check for ring gauge	3 years
27	Screw pitch reference standard	3 years
28	Screw thread measurement cylinder and vee pieces	Initial, with annual visual inspection
29	Setting cylinder	3 years
30	Sine bars, centres and tables	3 years
31	Squareness testers	3 years
32	Squares:	
	Try squares	2 years
	Block squares	4 years
	Steel / cast iron Straight Edges	3 years
	Granites	4 years
33	Tape measures, Rules:	
	Tape measures	Initial, wiht check at maximum length every 2 to 5 months dpending on use and accuracy required
	Steel rules	Initial, wiht check at maximum length every 2 to 5 months dpending on use and accuracy required

Electrical

1	Electronic standard cells	1 year
2	Digital meters	1 year, compare every sixth month
3	Analog meters	2 years, compare every sixth months
4	Resistors	3 years, compare anually
5	Capacitor	3 years, compare anually
6	Standard cell, Weston	2 years, compare at least sixt monthly
7	AC-DC Transfer standards	2 years, compare immediately after calibration
8	Bridges	3 years (full calibration), check against laboratory standard anually

9	Potentiometer	3 years, compare anually
	Time and Frequency	
1	Signal Generator	1 year
2	Attenuator	3 years (frequency response) resistance check anually where appropriate
3	RF Power Meter	1 year
4	Stop watches, clock	1 year
	Photometry	
1	Luminous intensity lamps	1 year
2	Luminous flux lamps	1 year
3	Illuminance (lux) meter	1 year
4	Luminance meter	1 year
	Radiometry	
1	Spectral irradiance lamps	100 hours burning time or three years, whichever is earlier
2	UV irradiance meters	6 months (heavy usage) 1 year (light usage)
3	Laser/optical power meter	1 year
4	Fibre optic power meter	1 year
5	Laser wavelength (fiber optic)	1 year
	Spectrophotometry	
1	Wavelength standard filters	1 year
2	Transmittance standard filters	1 year
3	Reflectance standards	1 year