NATIONAL ACCREDITATION BOARD FOR TESTING AND CALIBRATION LABORATORIES

SPECIFIC CRITERIA for CALIBRATION LABORATORIES IN MECHANICAL DISCIPLINE : MASS (Weighing Scale & Balance)

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1 General Requirement:

- The purpose of this document is to specify requirements with which a laboratory has to operate and demonstrate its competency to carry out calibration in accordance with ISO/IEC 17025:2005.

- To achieve uniformity between the laboratories, assessors and assessment process in terms of maximum permissible error, CMC, measurement uncertainty etc in line with National/International standards.

- To achieve uniformity in selection of equipment's, calibration methods, maintaining required environmental conditions, personnel with relevant qualification and experience.

1.1 Scope

This specific criteria lays down the specific requirements in Calibration of weighing balance and mass comparator under mechanical discipline. This part of the document thus amplifies the specific requirements for calibration of weighing balance & mass comparator and supplements the requirements of ISO/IEC 17025:2005.

1.2 Calibration and Measurement Capability (CMC)

1.2.1 CMC is one of the parameters that is used by NABL to define the scope of an accredited calibration laboratory, the others being parameter/quantity measured, standard/master used, calibration method used and measurement range. The CMC is expressed as "the smallest uncertainty that a laboratory can achieve when calibrating the best existing device". It is an expanded uncertainty estimated at a confidence level of approximately 95% corresponding to a coverage factor k=2.

1.2.2 For evaluation of CMC laboratories should follow NABL 143 - Policy on Calibration and Measurement Capability (CMC) and Uncertainty in Calibration.

1.3 Personnel, Qualification and Training

1.3.1 Technical Personnel:

1.3.1.1 Qualification required for carrying out calibration activity

The following are the specific requirements. However, qualification and experience will not be the only criteria for the required activity. They have to prove their skill, knowledge and competency in their specific field of calibration activity.

a) B.E / B.Tech or M.Sc. (having Physics as one of the subject) degree with 3 months experience in Basics of Mass Metrology and Balance Calibration.

b) B.Sc (with Physics as one of the subject) or Diploma with 6 months experience in Basics of Mass Metrology and Balance Calibration.

c) ITI with 1 year of experience in Basics of Mass Metrology and Balance Calibration.

1.3.1.2 Training and experience required:

a) Training may be external/ internal depending on the expertise available in the field.

b) Training in Mass Metrology, balance calibration and in Uncertainty Measurements, CMC including statistical analysis for Technical Manager.

c) Experience and competence in Basics of Mass Metrology and balance calibration.

d) Sufficient knowledge about handling of reference equipment, maintenance, traceability, calibration procedure and effect of environmental conditions on the results of calibration.

e) During training calibration activity should be done under supervision.

1.3.2 Authorised Signatory:

1.3.2.1 Qualification required for interpretation of results and signing the calibration certificates:

The following are only guidelines. However, qualification and experience will not be the only criteria for the required activity. They have to prove their skill, knowledge and competency in analysis and interpretation of calibration results.

a) B.E / B.Tech or M.Sc. (with having Physics as one of the subject) degree with 6 months experience in Basics of Mass Metrology and balance calibration.

b) B.Sc. (with Physics as one of the subject) or Diploma with 1 year experience in Basics of Mass Metrology and balance calibration.

1.3.2.2 Training and experience required:

a) Training may be external/ internal depending on the expertise available in the field.

b) Training, Experience and Competence in Basics of Mass Metrology and balance calibration and Training in Uncertainty Measurements, CMC including statistical analysis for Technical Manager.

c) Sufficient knowledge and competence in effective implementation of ISO/IEC 17025, specific criteria and NABL guidelines.

d) Competency in reviewing of results, giving opinion and interpretations.

e) During training the relevant activity has to be done under supervision.

1.4 Accommodation and Environmental Conditions

A Laboratory may be offering calibration services under different categories:

i. Permanent Laboratory Service

ii. Onsite Service

The above category of laboratories may provide following types of services.

a) Service that intended primarily for measurement standards, reference equipments which are further used for calibration purposes or high accuracy measurements which requires high degree of accuracy and better CMC.

b) Service that intended primarily for calibration and adjustment of test, measurement and diagnostic equipments to use in such areas as product testing, manufacturing and servicing.

Accommodation and environmental conditions adversely affect the results of calibration and measurement accuracy unless they are controlled and monitored. Hence, they play a very important role.

The influencing parameters may be one or more of the following i. e. temperature, relative humidity, atmospheric pressure, vibration, acoustic noise, dust, air currents/draft, illumination(wherever applicable), voltage fluctuations, electrical earthing and direct sunlight etc., depending on the nature of calibration services provided. The variables described above can play a major factor on calibration results.

The main difference between the permanent laboratory and onsite calibration services has to do with environmental conditions only. Since the onsite calibration relies on where the service is provided, it affects the results of calibration.

The laboratories are advised to follow the requirement of accommodation and environment depending on the types of services provided as recommended.

- By the manufacturers of the reference equipment.
- By the manufacturers of the Unit under calibration.
- As specified in the National/ International Standards or guidelines followed for the calibration.

The environmental monitoring equipments used should also meet the requirement of manufacturers' recommendations and specifications as per the relevant standards followed.

If, accommodation and environmental conditions are not specified either by manufacturer or by National/International standards / guidelines, the laboratory shall follow the below recommendations.

1.4.1 Vibration

The calibration area shall be free from vibrations generated by central air-conditioning plants, vehicular traffic and other sources to ensure consistent and uniform operational conditions. The laboratory shall take all special/ protective precautions like mounting of sensitive apparatus on vibration free tables and pillars etc., isolated from the floor, if necessary.

1.4.2 Acoustic Noise

Acoustic noise level in the laboratory shall be maintained to facilitate proper performance of calibration work. Noise level shall be maintained less than 60 dBA, wherever it affects adversely the required accuracy of measurement.

1.4.3 Illumination

The calibration area shall have adequate level of illumination, where permissible, fluorescent lighting is preferred to avoid localized heating and temperature drift. The recommended level of illumination is 250-500 lux on the working table.

1.4.4 Environmental Conditions and Monitoring

The environmental conditions for the activity of the laboratory shall be such as not to adversely affect the required accuracy of measurement. Facilities shall be provided whenever necessary for recording temperature, pressure and humidity values prevailing during calibration. The atmospheric conditions maintained in the laboratory during calibration shall be reported in the calibration report/ certificate.

1.5 Special Requirements of Laboratory

1.5.1 The calibration laboratory shall make arrangements for regulated and uninterrupted power supply of proper rating. The recommended voltage regulation level is ± 2% or better, and Frequency variation ± 2.5Hz or better on the calibration bench.

1.5.2 The reference standards shall be maintained at temperatures specified for their maintenance on order to ensure their conformance to the required level of operation.

1.5.3 The laboratory shall take adequate measures against dust and external air pressure.

1.6 Safety Precautions

1.6.1 Relevant fire extinguishing equipment for possible fire hazards, shall be available in the corridors or convenient places in the laboratory. Adequate safety measures against electrical, chemical fire hazards must be available at the work place. Laboratory rooms/ areas where highly inflammable materials are used/ stored shall be identified. Access to the relevant fire equipment shall be assured near these rooms/ areas.

1.6.2 Specification SP 31- 1986, a special publication in the form of a wall chart, giving the method of treatment in case of electric shock, should be followed. The chart shall be placed near the power supply switchgear and at other prominent places as prescribed under Indian Electricity Rules 1956.

1.6.3 Effective mains earthing shall be provided in accordance with relevant specification IS: 3043. This shall be periodically checked to ensure proper contact with earth rod.

1.7 Other Important Points

1.7.1 Entry to the Calibration Area: As far as possible, only the staff engaged in the calibration activity should permitted entry inside the calibration area.

1.7.2 Space in Calibration Area: The calibration Laboratory shall ensure adequate space for calibration activity without adversely effecting the results.

1.8 Proficiency Testing

To give further assurance to the accuracy or Uncertainty of measurements, a laboratory will be required to participate, from time to time, in Proficiency Testing Program. The laboratory shall remain prepared to participate in the Proficiency Testing Program through inter-laboratory, inter-comparison schemes wherever it is technically feasible. (Ref. NABL 162, 163 and 164 for further details)

2. Specific Requirements - Calibration of Weighing Scale/Balance

2.1. Scope: Calibration of Weighing Balance and Mass Comparator

2.1.1. Specific Requirements

Sl. No	Parameter	Relevant Standard	Permanent Facility	Onsite Calibration	Mobile Facility
1	Non-automatic Weighing Balances	EURAMET cg - 18/v.3 or OIML-R-76-1 and OIML-R76-2	√*	√	x
2	Electronic Balances		√*	√	x
3	Comparators		√*	√	x
4	High Capacity Weighing Machines (above 50 kg)	OIML R 47	√*	√	x

***Note – 1** Permanent facility for their internal use only and not meant for external customer.

Note – 2 This technical requirement is based on the above mentioned guideline. Lab may follow any relevant standard, however care shall be taken to follow the requirements in totality.

2.2. National/ International Standards, References and Guidelines

- **OIML R76-1 2006** Metrological and technical requirements – Non automatic weighing instruments.
- **OIML R76-2 2007** Non automatic weighing instruments – Test report format.
- **EURAMET cg – 18 V.03** guidelines on the calibration of Non automatic weighing instruments.
- **OIML-R-111-1 Weights of classes** E1, E2, F1, F2, M1, M1-2, M2, M2-3 and M3 metrological and Technical requirements.
- **OIML R 47-** Standard weights for testing of high capacity weighing machine.
- **OIML D28 2004:** Conventional value of the result of weighing in air.
- **UKAS Guide Lab - 14:** Calibration of weighing balance**.**

2.3. Metrological Requirements

2.3.1. Reference and Standard weights used for calibration of weighing balance and comparator shall follow the requirement of OIML R-111-1.

2.3.2. Place of Calibration: Calibration shall be performed at the place where the balance is being used. If the balance is moved to another location after calibration, possible effects are due to:

i) difference in local ‘g’ acceleration due to gravity (refer 2.10)

ii) variation in environmental conditions.

iii) mechanical and thermal conditions during transportation and are likely to alter the performance of the balance and may invalidate the status of calibration. Moving the

balance after calibration shall therefore be avoided and the calibration certificate shall not be accepted as evidence of traceability.

2.3.3. Lab cannot calibrate balances using lower class of accuracy weights than required (Table 2.5.2)

2.4. Terms and Definitions

Readability

- The smallest scale division or digital interval of the weighing Instrument. For same mechanical weighing Instruments the scale marks may be sufficiently far apart for an estimation to be made of the actual weighing instrument reading when the pointer lies between two scale marks. The estimated readability may therefore be lower than the marked readability.

Resolution

- The readability expressed as a portion of the capacity. For example a weighing Instrument with a capacity of 3000g and a readability of 0.1g has a resolution of 1 part in 30000.

Scale Interval

- The value expressed in units of Mass
- In the case of analog indication, the difference between the values that correspond to two scale marks
- In the case of digital Indication, the difference between two consecutively indicated values.

Conventional Mass

- The conventional mass of a body is the mass of a standard weight of density 8000 kg/m^3 at 20 ^{0}C which balances this body in air of density 1.2 kg/m^3.

True Mass

- The true mass of a body relates to the amount of material it contains. The prefix true is added to the word mass where it is important to make it clear that a particular mass being considered is not a conventional mass value and it is important to avoid potential ambiguity. The International prototype kilogram, on which the International mass scale is realized is defined as a true mass of exactly 1 kilogram. Most high accuracy comparisons are performed on a true mass basis, and converted to conventional mass when quoted on a certificate.

Eccentricity

- Eccentricity test gives a numerical value of the indication error when the load is applied off-center.

Error of Indication

- It is the difference between indication of an weighing instrument and the conventional value of the corresponding mass

Buoyancy Correction

- A buoyancy correction is the correction applied when weights of different densities are compared with each other during the calibration process, the buoyancy being a result of the upward force when the weight is immersed in a fluid (such as air) during the weighing process.

Classification of Weighing Scale/Balances

- Weighing Scale/balances are classified into different accuracy class based on their minimum readability

2.4.1. Following types of balances are considered in this guideline: Table-1

Sl. No.	Type of Balance	Minimum Readability (d)	No. of Digits after Decimal Place (g)	Accuracy Class
1	Ultra-micro balance	d = 0.1 μg = 0.0000001 g	7	I
2	Micro balance	d = 1 μg = 0.000001 g	6	I
3	Semi-micro balance	d = 0.01 mg = 0.00001 g	5	I
4	Analytical balance	d = 0.1 mg = 0.0001 g	4	I
5	Precision balance	d = 50 mg to 1 mg = 0.05 g to 0.001 g	2 to 3	II
6	Medium balance	d = 1 g to 2 g	0	III
7	Ordinary balance	d > 5 g	0	IV

2.4.2. Classifications are based on OIML R-76-1: Table-2

Accuracy Class		**Verification of Scale Interval, e**	**Number of Verification Scale Intervals, n = Max/e**		**Minimum Capacity, Min (Lower limit)**
			Minimum	**maximum**	
Special	I	0.001 g ≤ e*	50 000**	-	100 e
High	II	0.001g ≤ e ≤ 0.05 g 0.1 g ≤ e	100 5 000	100 000 100 000	20 e 50 e
Medium	III	0.1g ≤ e ≤ 2 g 5 g ≤ e	100 500	10 000 10 000	20 e 20 e
Ordinary	IIII	5 g ≤ e	100	1 000	10 e

* It is not normally feasible to test and verify an instrument e<1 mg, due to uncertainty of the test loads.

** Refer see exception in 3.4.4 of OIML R 76-1.

2.5. Selection of Reference Weights for Balance/ Comparator Calibration

2.5.1. The reference weight used for calibration shall have traceability and satisfy the following:

2.5.1.1. Determination of the known conventional value of mass m_c and/or the correction δm_c to its nominal value m_N : $\delta m_c = m_c - m_N$, together with the expanded uncertainty of the calibration U_{95} , or

2.5.1.2. Confirmation that m_c is within specified maximum permissible errors.

mpe: $m_N - (mpe - U_{95}) \leq m_c \leq m_N + (mpe - U_{95})$

2.5.1.3. The standards shall further satisfy the following requirements to the extent as appropriate in view of their accuracy:

a) density ρ_s sufficiently close to $\rho_C = 8000$ kg/m³,

b) surface finish suitable to prevent a change in mass through contamination by dirt or adhesion layers,

c) magnetic properties such that interaction with the instrument to be calibrated is minimized.

2.5.1.4. Weights that comply with the relevant specifications of the International Recommendation OIML R 111 [4] should satisfy all these requirements.

2.5.1.5. The maximum permissible errors or the uncertainties of calibration of the standard weights shall be compatible with the scale interval of the instrument and/or the needs of the customer with regard to the uncertainty of the calibration of his instrument.

2.5.2. A probable selection of weights for calibration of weighing machines depending on capacity and scale division (resolution):

Class of weights to be selected ⇩	**n = Capacity divided by scale division(resolution)**				
	n>300000 or above	**n> 100000 to 300000**	**n> 30000 to 100000**	**n>10000 to 30000**	**n = 10000 or smaller**
E_1	√	√	√	√	√
E_2		√	√	√	√
F_1			√	√	√
F_2				√	√
M_1					√

2.5.3. The design and accuracy of weights used for in-house calibrations shall be appropriate to the weighing machine being calibrated, and where possible should have a 95% confidence level uncertainty of calibration less than half the smallest digit size or recorded scale interval of the weighing machine to be calibrated. Where groups of weights are to be used to make up a single load, this criterion shall be applied to the arithmetic sum of the weight's individual calibration uncertainties.

2.5.4. Weighing machines as described in Table 1 can usually be calibrated using calibrated weights in the pattern of the designated OIML class. The table assumes that the uncertainty of calibration of the weights used will be 1/3 of its specified maximum permissible error. In most cases it will be possible to obtain smaller calibration uncertainties than this, and it may therefore be possible to use a weight of a lower class. However, when selecting suitable weights, attention shall still be given to properties of the weights other than accuracy, such as magnetism, corrosion and wear resistance. In most laboratory applications, it would not be appropriate to select a class lower than M1.

2.5.5. Example for Selection of Weights for Balance Calibration:

Capacity of the balance	Calibration weight required	Readability	Required accuracy of weight (Readability/3)	Error as per E_2 class	Error as per F_1 class	Selectable class as per requirement
1000 g	1 kg	0.01g = 10 mg	10/3 = 3 mg	1.6 mg	5mg	1.6 mg

From the above table it is clear that, we need to select 1kg of E_2 class for calibration of the above balance.

Note: Lab cannot calibrate balances using lower class of accuracy weights than required.

2.6. Calibration Interval

For the reference weights used in calibration of balance/ comparator at permanent lab or at site facility.

Reference Weights	Recommended Interval (Permanent)	Recommended Interval (For on-Site)
Weights of E_1 class	3 years	2 years
Weights of class E_2 to F_2	2 years	1 years
Weights of class M_1 to M_2	1 Year	1 Year

Note: Based on the historical data validity of reference weights may be extended upto 5 years for E_1.

2.7. Legal Aspects

Calibration of weighing balance done by any accredited laboratories is meant for scientific and industrial purpose only. However, if used for commercial trading, additional recognition/ approval shall be complied as required by Dept. of Legal Metrology, Regulatory Bodies, etc.

2.8. Environmental Conditions

2.8.1. Lab is advised to follow Manufacturer's recommendation for environmental conditions, operation and maintenance of weights, weighing balance etc.

2.8.1.1. Accuracy or reliability of weighing results is closely connected with the place where, mass comparators are installed, and also with the weights used, with the measuring room conditions and the staff qualification and experience. The place of installation (measuring room) for mass comparators should be designed in such a way that, the disturbances of the environment do not affect the result. Manufacturer's recommendation should be considered.

2.9. Thermal Stabilization Requirements

The effect of Convection:

- When the reference weights used are transported for calibration site, they may not have the same temperature as that of the balance and its environment, then there will be heat exchange between the weights and their environment. Due to this there will be apparent change in mass in relation to the temperature difference.

- An initial temperature may be reduced to a smaller value by acclimatization (habituation to a new climate) over time. This occurs faster for smaller weights than for larger weights.

- When a weight is put on the load receptor of a balance, the actual difference in temperature will produce an air flow about the weight leading to parasitic forces which results in conventional mass of the weight. This value will be greater for large weights than for small ones.

Hence, proper thermal stabilization time may be required before proceeding for calibration of the weighing balance.

2.10. Effect of Gravity 'g' on Calibration of Balance

2.10.1. The weighing values are different when the weighing height changes.

2.10.2. The further a weight is from the centre of earth, the smaller the gravitational force acting on it. It decreases with the square of the distance.

Example: The weight display changes when the weighing is performed at 10 m higher (moving from the first floor to fourth floor of a building). To determine the weight of a body, the balance measures the weight force i.e., the force of attraction (Gravitation force) between the earth & the weighing sample. The force depends essentially on the latitude of the location & its height above sea level (distance from the centre of earth).

2.10.3. The nearer a location is to the equator, the greater the centrifugal acceleration due to the rotation of the earth. The centrifugal acceleration counteracts the force of attraction (Gravitation Force).

2.10.4. The poles are the greatest distance from the equator & closest to the earth centre. The force acting on a mass is therefore greatest at the poles.

Example: In the case of 200 g weight that shows exactly 200.00000 g on the first floor, the following weight result on the fourth floor (10m height).

$$200g \times r^2 / (r + \Delta)^2$$

Where, r is the radius of earth at that point of measurement
Δ is change in height

$$200 \times 6370000^2 / 6370010^2 = 199.99937g$$

2.11. Calibration Methods

Recommended to refer the standard OIML R 76-1 or Euramet guidelines cg -18 V.03 on the calibration of non-automatic weighing instruments.

Elements of calibration

- Applying test loads to the instrument under specified conditions,
- Determining the error or variation of the indication, and
- Evaluating the uncertainty of measurement to be attributed to the results.

2.12. Calibration Procedure

Performance Check of the balance:

2.12.1. Repeatability Test

This test is carried out at max load capacity and half load capacity of the balance under calibration. Atleast 10 readings for balance upto 10 kg and 5 readings for balance above 10 kg shall be taken and the standard deviation gives the repeatability values. Maximum of the two should be considered for uncertainty calculation.

2.12.2. Linearity Test or Departure of Indication from the Nominal Value

The departure of indication from nominal value or the linearity of the scale is measured at sufficiently equally spaced points over the ranges of the blance to ensure safe interpolation, if needed between these points. Usually minimum 10 such readings are taken including no load and the maximum capacity load.

2.12.3. Eccentricity Test

This test is carried out at a load recommended by the manufacturer of the balance or if it is not known a load between one-third (1/3) and half (1/2) of the maximum capacity of the balance may be used. A single weight should be used for this test.

2.12.4. Hysteresis Test (if the Balance is calibrated first time or after a major repair)

This test is required to be carried out only if the balance is calibrated for the first time or after a major repair. It is carried out with a weight equal to half the capacity of the balance and the reading P1 is noted. Then weight(s) are added to nearer to the maximum capacity of the balance and reading Q1 is noted. Remove all the weights. Repeat these steps 3 more times and note down the values of P2 Q2, P3 Q3 and P4 Q4. Then the average difference between the P values and Q values gives the hysteresis error.

2.13. Measurement Uncertainty

2.13.1. Uncertainty Components in Balance Calibration (u_{ba})

The components of measurement uncertainty to be considered but are not limited to the following:

- Repeatability
- Linearity or departure of indication
- Resolution
- Reference standard weights
- Drift in mass or instability of the mass of weights used
- Eccentricity (whenever the test is carried out)

2.13.2. Uncertainty due to Repeatability

At least six repeated readings shall be taken with a weight near to the maximum capacity of the balance or the range to be calibrated. Estimated standard deviation will be the repeatability contribution.

2.13.3. Uncertainty due to Eccentric Loading

If this contribution is known to be significant, the magnitude must be estimated and if necessary the contribution must be included in the uncertainty budget.

Acceptable solution for the uncertainty due to eccentricity:

$$\mathbf{u_E = [(d_1/d_2) * D]/ (2*\sqrt{3})}$$

Where: D is the difference between maximum and minimum values from the eccentricity test performed according to OIML R 76-2; d_1 is the estimated distance between the centers of the weights; and d_2 is the distance from the center of the load receptor to one of the corners.

Note: When 10 readings are taken for estimation of repeatability error, the contribution of eccentricity need not be added to the uncertainty.

2.13.4. Uncertainties associated with the Balance Correction Factor

a) Uncertainty due to the display resolution of a digital balance

For a digital balance with the scale interval, d, the uncertainty due to resolution is:

$$\mathbf{u_d = (d/2/\sqrt{3})}$$

b) Uncertainty due to Reference Mass

$$\mathbf{u_s = (Us/k)}$$

Where Us is the standard uncertainty of the reference standard weight and k is the coverage factor from its calibration certificate.

c) Uncertainty due to Drift in Mass

Drift in Mass u_D = 10% of u_s/ $\sqrt{3}$

d) Uncertainty due to Repeatability

Standard uncertainty due to Repeatability

$u_A = s/\sqrt{n-1}$

2.13.5. Combined Standard Uncertainty of the Weighing Balance

$$\mathbf{u_c = \sqrt{(u_s^2 + u_d^2 + U_D + u_A^2)}}$$

Expanded uncertainty $\mathbf{U = k * u_c}$

2.13.6. Overall Uncertainty of the Balance

The oveall uncertainty of the balance to be reported is the limit of the performance (F) of the balance given by:

$$F = k * SD(max) + |C_{max}| + U(C_{max})$$

Where,

SD(max) = the maximum standard deviation of repeatability at half load and full load

$|C_{max}|$ = magnitude of the maximum correction for the balance reading

U(Cmax) = the expanded uncertainty associated with C_{max} the correction of the balance

2.14. Reporting of Results

2.14.1. The calibration certificates issued to the customer shall be in accordance with clause 5.10 of ISO/IEC/17025:2005. Apart from that it shall also include the following:

a. Thermal stabilization hours (as per 2.9)

b. Class of weight used for calibration depending on the class of accuracy of balance

c. Environmental conditions during calibration

d. Exact location of the balance during calibration

e. Declaration that, the calibration certificate issued for weighing balance used for scientific or industrial purposes only.

2.14.2. Verification of Comparator

To verify the performance of the comparator same procedure shall be followed to ascertain its performance as per manufacturer specification. Only uncertainty due to standard deviation (from repeatability) is considered during calibration of weights. No other components like eccentricity, error of indication etc are taken into account for a comparator.

2.15. Evaluation of CMC

2.15.1. Refer NABL 143 for CMC Evaluation

2.15.2. CMC value is not the same as expanded uncertainty reported in the calibration Certificate/Report. CMC values exclude the uncertainties which are attributed to the UUT (Unit under test/calibration).

2.15.3. For the purpose of CMC evaluation the following components should be considered:

a) Type A uncertainty

b) Uncertainty of the reference standard weight.

c) Uncertainty due to drift in reference standard weight (due to wear and tear, transportation or temperature variation)

2.16. Sample Scope:

An illustrative example: Correct Presentation of Scope

Laboratory: XYZ							Date(s) of Visit:
Discipline: Mechanical							
Sl	Parameter* / Device under Calibration	Master equipment used	Range(s) of measurement	Calibration and Measurement Capability **			Remarks+/ Method Used
				Claimed by Laboratory	Observed by Assessor	Recommended by Assessor	
1	Mass - Electronic Weighing Balance Readability: 1mg	F2 Class Standard Weights	up to 210 g	1.5 mg	2 mg	2 mg	Calibration of electronic weighing balance of Class II and coarser As per OIML R-76-1

* Only for Electro-technical discipline; scope shall be recommended parameter wise (where applicable) and the ranges may be mentioned frequency wise.

** NABL 143 shall be referred for the recommendation of CMC

+ Remarks shall also include whether the same scope is applicable for site calibration as well. NABL 130 shall be referred while recommending the scope for site calibration.

Signature, Date & Name of Lab Representative	Signature, Date & Name of Assessor(s)	Signature, Date & Name of Lead Assessor

2.17. Key Points:

2.17.1. The laboratory has to demonstrate at least class IV ordinary weighing balances as per OIML R76-1for qualifying accreditation.

2.17.2. The laboratory may be having E2 class weight which is suitable for weighing balance of special accuracy of Class I, will not automatically qualified unless it is demonstrated.

2.17.3. Demonstration of any CMC values doesn't automatically qualify for granting accreditation until the lab satisfies the stipulated requirement given in this document.

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