

3. SHAPE

(a) The secondary standard capacity measure of five litre shall be cylindrical and have its inside diameter equal to the height of the measure. This shall have two handles attached securely to its sides.

(b) The measure of 21 and below shall be of the same shape as above but shall not have any handles.

(c) The denominations of the secondary standard capacity measures shall be engraved on the outside surface.

(d) Each secondary standard capacity measure shall be provided with a specially selected striking glass on the measures and glasses shall be securely packed in velvet lined teakwood boxes.

4. MAXIMUM PERMISSIBLE ERROR

Denomination	Permissible error
	: ml
51	2
21	1
11	0.8
500ml	0.5
!	0.4
200ml	0.3
100ml	0.2
50ml	0.1
20ml	

5. PROTECTIVE AND CARRYING CASES

These capacity measures shall be stored in their boxes made from teak wood or any other suitable non-corrosive material with proper housing lined with velvet, chamois leather or soft plastic material. Wood used in such boxes shall be reasonably free from resins and volatile materials. Glue may not be used for fixing velvet or such other materials. Each capacity measure shall be housed in such a manner so as to avoid their excessive movement during transit.

Each striking glass of the capacity measure shall be securely housed in proper grooves so as to protect them from breakage during transit.

6. INSCRIPTIONS

The boxes containing these capacity measures shall have the following inscriptions:

- (a) the inscription 'Secondary Standard capacity measures';
- (b) the identification number of secondary standard capacity measures;
- (c) the name of the manufacturer;
- (d) the year of manufacture;
- (e) the mark of verification of proper verification authority.

THIRD SCHEDULE

(See rule 5)

DENOMINATIONS, MATERIAL, SHAPE AND PERMISSIBLE ERRORS IN RESPECT OF WORKING STANDARDS

PART-I WORKING STANDARD WEIGHTS 1. DENOMINATIONS

Kilogram series	Gram series	Milligram series
	20 500	500
	10 200	200
5 200 2 100 2 50 1 20	10,	200
	5	100
	~	50
	2	20
	1	10
		5
		2
		2
		1

2. MATERIAL

(a) Weights of 20 kg to 1 g shall be cast from admiralty bronze (88 Cu, 10 Sn, 2 Zn), or made from cupro-nickel (75 Cu, 25 Ni) or nickel chromium alloy (80 Ni, 20 Cr) or austenitic stainless steel (25 Ni, 20 Cr) or (20 Ni, 25 Cr).

(b) Weights of 500 mg to 100 mg shall be made from admiralty bronze (rolled) (88 Cu, 10 Zn, 2 Sn)

or from the sheets of nickel chromium alloy (80 Ni 20 Cr) or austenitic stainless steel (25 Ni, 20 Cr) or (20 Ni, 25 Cr).

(c) Weights of 50 mg to 1 mg shall be made of aluminium sheets. Copper, silicon and iron contained as impurities in the aluminium shall not exceed 0.3 per cent in the aggregate.

3. SHAPE AND FINISH

(a) Weights of 20 kg and 10 kg shall be cylindrical in shape and shall be cast in two parts, the top part

being screwed snugly into the bottom part. The top part shall be cast in the form of a handle for lifting purposes. The two parts after assembly shall be locked by means of a set screw over which the seal of the verifying authority shall be affixed.

(b) Weights of 5 kg to 200 gm, (inclusive) shall be cast in two parts, the top part being screwed snugly into the bottom part. The top part shall be cast in the form of a knob for lifting purposes. The two parts, after assembly, shall be locked by means of a set screw, over which the seal of the verifying authority shall be affixed.

(c) Weights of 100 g to 10 g (inclusive) shall be as in (b) above except that there shall be no locking arrangement.

(d) Weights of 5 g to 1 g (inclusive) shall be integral weights with knob.

(e) Weights of ~00 mg to 1 mg (inclusive) shall be of square shape with the one of the sides bent at right angles to the flat surface for ease of handling.

(f) The denominations shall be marked on the weights.

(g) The entire surface of the weights, including their base and corners shall be free from roughness. The surface of the weights, when inspected visually, shall not show any porosity and shall have a mirror polish appearance.

4. MAXIMUM PERMISSIBLE ERROR

The permissible errors in excess and in deficiency shall be as follows:

Denomination	Permissible error :mg
2~g 300 10kg ISO 5kg 75 2kg	
30 1kg 15	
500g 7.5	
200g 3.0 100g 1.5	
50g	1. 0
20g 0.8	
109 0.6 5g 0.6	
2g ,	0.4
1g 0.3	
500mg 0.25 200mg 0.20 100mg 0.15	
50mg' 0.12 20mg 0.10 10mg 0.08 5mg	
0.06 2mg 0.06 1mg 0.06	

5. PROTECTIVE ~ND CARRYING CASE

(a) These weights shall be stored in their boxes made from teakwood or any other suitable noncorrosive material with proper housing lined with chemically neutral velvet, chamois leather or soft plastic material. Wood lised in such boxes shall be reasonably free from resins and volatile, materials: Glue shall not be used for fixing velvet or such other material. The weights shall be housed in such a manner so as to avoid their movement during transit.

(b) Each milligram weight shall be provided with a separate housing. A cover!! Jlass or a sheet of any other transparent, non-reactive alld non-corrosive material shall tic prm ided so as to cnsure that these weights arc not dislocated during l...ilhit.

(c) A suitable dc\ ice for lifting the kilogram and gram weights, covered with chamois leather or other suitable material, shall he provkkd. A pair of

ti'fl.:eps capable of lifting easily milligram weights shall also be provided.

INSCRIPTION

The boxes cOntaining the weights shall have the following inscriptions:

(a) the words 'WORKING STANDARD WEIGHTS'

(b) the identification number of the working standard weights,

(c) the name of the manufacturer,

(d) the year of manufacture,

(e) t.he marks of verification.

PART-II: WORKING S)'ANDARD METRE BAR
.I. MATERIAL

TI:te working standard metre bar (hereinafter called metre bar) shall be manufactured from 58 per cent nickel-steel, or austenctic stainless steel, or stainless steel with 13 per cent chromium or pure nickel (minimum purity 99 per cent).

2. SHAPE AND DIMENSIONS

(a) The metre bar shall have a rectangular cross section of minimum dimensions 20mmx10mm. The existing cross section with dimensions 30mmx15mm shall be preferred.

(b) The overall length of the metre bar shall be 1030:t I mm and the graduated length shall be 1010mm.

(c) UngraduateQ length of 10mm shaiJ be left after the last graduated marks.

3. FINISH

The 'graduated surface shall be bright, polished nicely and free from surface irregularities neighbourhood in the of the graduation marks.

4. GRADUATIONS

(a) The metre bar shall be graduated in millimetres throughout from 0 to 1000 mm on the wider upper surface.

(b) ."" L:ngt!! or 10 mm before the zero graduation mark shall also be graduated in millimetres.

(c) The scale shall be 'regular. The thickness .of the graduation marks shall be uniform and shall lie between 30 and 80 micrometrcs.

Cd) The width of the graduation marks shall be uniform to within :t fifteen p~r cent of thoil average width or all the marks.

(0) The graduation marb repre,enting c"ntim~lro:s shall he longer than tho'e representing half centimctres and the graduation m:trks representing half' c.:ntim~tre' shall b~ longer than tho;~ ri:!'re;;cnting millimetres.

(f) Each graduation mark shall be straight to within ten micrometres over its length.

(g) The graduation marks shall be parallel to one another to within ten micrometres.

(h) The length of the graduation marks shall be not less than

- 3 mm for mm marks
- 5 mm for half cm marks
- 8 mm for cm marks.

(i) The centimetres graduation marks shall be numbered in the increasing order of numeration.

(j) The height of the numerals and the letters (symbols) shall be approximately 3 mm.

(k) The graduation marks shall be square to the scale axis to within 30 minutes of arc.

5. CURSOR

(a) The errors on the length measure under verification shall be determined by means of a scale marked on a plate, made from transparent material, which is carried by a cursor capable of moving along the length of the metre bar. The plate shall have appropriate and constant dimensions and thickness.

(b) The scale on the plate shall:

- (i) either be a length of 9 mm divided into 10 parts thus forming a vernier scale to read the errors to the nearest of 0.1 mm; or
- (ii) one millimetre divided into 10 parts for reading the errors directly to the nearest of 0.1 mm.

(c) The thickness of the graduation marks on the scale shall be less than that of the graduation marks on the metre bar.

(d) The graduation marks on the scale shall be inscribed on the surface facing the graduation marks on the metre bar.

(e) The readings shall be taken by means of a magnifying glass, the magnification of which shall be not less than 5x if the scale is graduated in 0.1 mm and not less than 3x if the scale is of vernier type.

(f) The cursor shall be such that it would be possible to move it smoothly without jerks, along a straight line from one end of the measure to the other.

(g) A mechanism to raise, lower and laterally move the measure under verification, within a view to putting its graduated surface at a proper level and aligning its zero mark with that of the metre bar shall be provided.

(h) For facilitating the verification of end measures, two vertical stops bearing reference lines shall be provided. The first stop shall be such that its reference line can be aligned with the zero mark of the metre bar. The second stop shall be capable of moving along the entire length of the metre bar.

6. MAXIMUM PERMISSIBLE ERRORS

(a) The error on the length between any two graduation marks on the working standard length measure, at the standard temperature of 20 C, shall not exceed the value calculated according to the following formula:

$$e = (50 - L/20) \text{ micrometres.}$$

where L is the nominal length in millimetres of that part of the metre bar between the two graduation marks, the error on which is being determined. The calculated value of "e" shall be rounded to the nearest

integer.

(b) The errors on the length between any two graduation lines on the plate shall not exceed 20 micrometres.

7. INSCRIPTION

The metre bar shall bear the following inscription:

(a) the words "WORKING STANDARD METRE BAR"

(b) identification number of the metre bar,

(c) the name of the manufacturer,

(d) the material of the metre bar

(e) the words, figures and letter "STANDARD AT 20 C"

(f) the year of manufacture.

8. PROTECTIVE AND CARRYING CASE

(a) The standard metre bar shall be housed in a case made from suitable material and provided with a handle, lined internally with velvet, a plastic material or any other material and in such a way that the metre bar is not likely to be damaged, particularly by shocks or corrosion.

(b) The case shall have affixed on it a plate bearing the inscription "WORKING STANDARD METRE BAR" and the identification number.

NOTE: The existing working standard length measure (metre bar) may differ in minor details in regard to inscriptions etc. on it.

PART-III WORKING STANDARD CAPACITY MEASURES

I. DENOMINATION

Litre series (l)	Millilitre series (ml)
10	500
5	200
2	100
1	50
	20

2. MATERIAL

Working standard capacity measures shall be pressed out of oxygen free, deoxidized annealed copper sheets of copper drawing quality.

3. SHAPE

(a) Working standard capacity measure of 10 litres shall be cylindrical and have its inside diameter approximately equal to the height of the measure. This shall have two handles attached securely to its sides.

(b) Working standard capacity measures of 5 litres and below shall be of the same shape as above but shall not have any handles.

(c) The outside of the body of the working standard capacity measures shall be oxidized to give a smooth dull black surface and the inside shall be tinned.

(d) The denominations of the working standard measures shall be engraved on the outside surface.

(e) Each working standard capacity measure shall be provided with specially selected striking glass and the measures and glasses shall be securely packed in velvet lined teakwood boxes.

4. MAXIMUM PERMISSIBLE ERROR

Denomination	Permissible errors	in ml
	:tml	
10 litres	8	
5 litres	4	
2 litres	2	
1 litre	1.5	
500ml	1.0	
200ml	0.8	
100ml	0.6	
50ml	0.4	
20 ml	0.2	

5. PIPETTE MEASURES . Pipettes of the following description may also be used as working standard measures:

- (a) One mark pipettes of capacities 10 ml and 5ml;
- (b) Graduated pipettes of capacities 5 ml graduated at every tenth of ml.

6. DELIVERY TIME AND MAXIMUM PERMISSIBLE ERRORS OF PIPETTE MEASURES.

Denomination ml	Delivery time in seconds		Permissible error :tml
	Minimum	Maximum	
10	25	15	0.04 0.03
5	10	20	0.05
5 (Graduated)	10	40	

Capacity	Sensitivity figure, mg/div.	Mini. scale division.	Maximum variation in sensitivity figure with respect to load.	Mini. overall accuracy of measurement.
20 kg	25	1.5 mm	10 per cent	25 mg in 10 kg
5 kg	7.5	1.0 mm	10	7.5mg in 2kg
1 kg	1.5	1.0 mm	10	1.5 mg in 500 g
200 g	0.5	1.0 mm	10	0.5 mg in 50 g,
20 g	0.1	1.0 mm	10	0.01 mg in 1 mg
10 g	0.05	0.75 mm	10	0.02mg in 1 mg

7. PROTECTIVE AND CARRYING 'CASES

These capacity measures shall be stored in their boxes made from tea, wood or any other suitable non-corrosive material with proper lining lined with velvet, chamois leather or soft plastic material. Wood used in such boxes shall be reasonably free from resins and volatile materials. Glue may not be used for fixing velvet or such other materials. Each capacity measure shall be housed in such a manner so as to avoid their excessive movement during transit.

Each striking glass of the capacity measure shall be securely housed in proper covers so as to protect them from breakage during transit.

8. INSCRIPTIONS

The boxes containing these capacity measures shall have the following inscriptions:

- (a) the words 'Working Standard Capacity Measures',
- (b) the identification number of the capacity measures,
- (c) the name of the manufacturer,
- (d) the year of manufacturer,
- (e) the mark(s) of verification of proper verification authority.

FOURTH SCHEDULE

(See rule 7, 8 and 9)

SPECIFICATIONS FOR STANDARD EQUIPMENT

PART-I REFERENCE STANDARD BALANCES

Every reference standard balance shall be of such robust construction and have such metrological qualities so as to ensure the continued good performance, as indicated in paragraph 2.

2. Sensitivity figure/readability and precision of measurement of every reference standard balance shall be such as to give overall precision of measurement of 1 part in one million for weights from 10 kg to 10 g and 1 part in 100 for weights from 5 g to 1 mg.

PART-II SECONDARY STANDARD BALANCES

1. Every secondary standard balance shall conform as regards capacity, sensitivity figure in mg per division, minimum scale division, variation in sensitivity figure with respect to load and overall accuracy of measurement, to the specifications as indicated below :

(c) The loading hole shall be cylindrical and shall pass through the axis of the weight open out on the upper surface of the knif and have wider diameter at its upper end as shown in Fig. 5.

(d) The loading hole shall be closed either by means of a threaded brass plug or a flat brass disc (see Fig. 5)

NOTE : The thread used shall be that commonly known as 'ISO Metric'.

(i) The threaded plug shall have a slot for adjusting it by means of a screw driver.

(ii) The flat disc shall be provided with a suitable hole in the centre to facilitate handling.

(e) The plug or the flat disc shall be closed by means of lead pellets pressed firmly into the circular groove in the wider part of the loading hole.

(f) Weights without a loading hole shall be adjusted by machining or grinding.

(g) Weights with loading hole shall be adjusted with heavy metallic materials such as lead shots.

(h) In the case of new weights about two-third of the depth of the loading hole shall remain empty after adjustment.

6. MARKING

(a) The denomination of the weight and the maker's or manufacturer's name or trade mark shall be indicated indelibly, in the sunken form or in relief, on the flat knob. (see Fig. 5).

(b) The denomination of weights of 10 kilograms to 500 grams may also be indicated on the cylindrical body of the weight, provided that the numerals and letters of the symbol shall be larger than those used for indicating them on the knob.

(c) The denomination of the weight shall be indicated in the international form of Indian numerals in an indelible manner with the symbols as illustrated below:

f- or f'f' 5 Kg
81 or 111 100 g

Note : The abbreviation f.I.; n. f.n.T. !IT or !IJf may be indicated in the regional script.

7. DIMENSIONS

(a) The dimensions of cylindrical weights shall be as specified in Tables 3 and 4.

(b) The tolerances on dimensions shall be :

- (i) for weights 1 kg and below :t 10 per cent.
- (ii), for weights above 1 kg :t 5 per cent.

8. FINISH

The weights shall be polished smooth. They may be protected against corrosion by applying an appropriate waling which is resistant to normal usage and wear and tear. •

9. PERMISSIBLE ERROR

The maximum permissible errors shall be as specified below

Denomination	Permissible error	
	Verification (mg)	Inspection (mg)
10 kg	160	:t
5 kg	0	1600 :t
2 kg	800	800 :t
1 kg	400	400
500g	200	:t 200
200 g	10	:t 100 :t
100 g	0	50 :t 30
50 g	50	:t 30 :t
20 g	30	20 :t 10
10 g	30	20 :t 10
5 g	20	5
2 g	20	:t 5
1 g	10	:t
1 g	5	:t
1 g	5	5

10. STAMPING

(a) The Inspector's seals shall be stamped on the load part within the loading hole, where loading hole is provided,

(b) The Inspector's seals shall be stamped on the bottom of weights which have no loading hole. C. IRON WEIGHTS, HEXAGONAL (50 kg to 50 g) 1.

DENOMINATIONS

Hexagonal iron weights shall have the following denominations :

gram series : 500, 200, 100 and 50.

Kilogram series : 50, 20, 10, 5, 2 and 1.

2. SHAPE

(a) The weights shall be integral and hexagonal. The shape shall be as shown in Figure 6 and 6A.

(b) The weights of denominations of 50 kg and down to and including 5 kg shall be provided with cast-in handles made of mild steel.

(c) The weights of denominations 2 kg and down to and including 50 g shall nest with each other. 3. MATERIAL

The weights shall be made or manufactured from grey cast iron. 4. METHOD OF MANUFACTURE

The weights shall be made or manufactured by means of any suitable foundry and moulding process. 5. LOADING HOLE

The weights must have a loading hole formed at the foundry

- (a) for weights in Figure 6 this hole must be in the shape of a right circular cone located axially (opening in the top face of the weight with its smaller diameter.

- (b) for weights in Figure 6A this hole must be in the shape of a frustum of a pyramid with rectangular base and opening into the bottom face of the weight with its smaller end.
- (c) in the case of new weights about two third of the depth of the loading hole shall remain empty after adjustment.

6. MARKING

(a) The denomination of the weights and the maker's or manufacturer's 'name or trade mark shall be indicated indelibly 'in the sunken form or in relief, on the upper surface of the central portion of the weight (see Fig. 6.)

(11) The denomination of the weight shall be indicated in the international form of Indian numerals in indelible manner with the symbols as illustrated below. (see Fig. 6.)

r'!>," orf'!> VT 2 kg

VT or IfTIf . 200 g.

Note : The abbreviation f~ ffi liT n p~ orvLi may be

- indicated in the regional script.

7. DIMENSIONS

(a) The dimentions shall be as specified in Tabk-5 and SA.

- (b) The tolerances on dimensions shall be
 - (i) for weights I kg and below i: 10 per cent
 - (ii) For weights above I kg :t 5 per cent.

8. FINISH

The weight shall be finished smooth and be free from pits, blow-holes and other defects. They shall be protected against corrosion by applying an appropriate coating which is resistant to normal usage of wear and tear.

9. PERMISSIBLE ERROR

The maximum permissible errors shall be as specified below :

Denomination	Permissible error	
	Verification (mg)	Inspection (mg)
25000	+25000	
10000	±10000	
5000	±5000	
2500	±2500	
1000	±1000	
500	±500	±
250	250	
100	±100	±100
100	100	
100		

TABLE I

Parallelepiped Weights Dimensions for Type 1 Weights

(In millimeters)

DENOMINATION	A	A'	B	B'	H	C	D	E	F	GIG
5 kg	150	152	75	77	84	36	30	6	66	12/20
10 kg	190	193	95	97	109	46	38	8	84	12/20
20 kg	230	234	115	117	139	61	52	12	109	24/32
50 kg	310	314	155	157	192	83	74	16	152	24/32

DENOMINATION	I	J	K	T	L	N	0	U	V	\V	P
5 kg	145	5	12	M16x 1.5	14	1	2	16.5	18	16	5
10 kg	185	6	16	M16x 1.5	14'	1	2	16.5	18	16.	5
20 kg	220	8	20	M27x 1.5	21	2	3	27.5	30	27	8
50 kg	300	10	25	M27x 1.5	21	2	3	27.5	30	17	8

Sides A & A' as also B & 8' may be inversed.