

# **SADCMEL**

## **DOCUMENT 3**

### **METROLOGICAL AND TECHNICAL REQUIREMENTS FOR NON-AUTOMATIC, UNDENOMINATED BEAM SCALES AND BALANCES SUBJECT TO LEGAL METROLOGY CONTROL**

## **FOREWORD**

This document covers metrological and technical requirements for the regulation of non-automatic beam scales and balances by legal metrology authorities within the SADCMEL region. It is based on applicable requirements contained in OIML R 76-1 and incorporates additional requirements as deemed necessary to address conditions and design of instruments found in the region. It was drafted to give effect to the SADCMEL aim of harmonising technical regulations within the region in order to eliminate technical barriers to trade.

# **METROLOGICAL AND TECHNICAL REQUIREMENTS FOR NON-AUTOMATIC, UNDENOMINATED BEAM SCALES AND BALANCES SUBJECT TO LEGAL METROLOGY CONTROL**

## **1. SCOPE**

This document specifies the metrological and technical requirements for non-automatic, undenominated beam scales and balances that are subject to metrological control in terms of legal metrology legislation.

### **PROHIBITION**

Beam Scales and balances with loaded weight pans and accelerating beam scales and balances are not permitted for trade and therefore are not part of this document.

## **2. DEFINITION**

2.1 Beam Scale or Beam Balance, referred to in this document as a balance, means an equal-arm weighing instrument with pans below the beam, either suspended without arrestment device or otherwise supported with or without arrestment device.

2.2 Undenominated Beam Scale or Balance means a beam scale or a balance with a graduated indicating plate that does not have the verification scale intervals defined.

NOTE: Beam Scales and balances fitted with a denominated, graduated indicating plates from which a mass value can be read, are semi-self indicating scales and are not covered in this document.

## **3. CLASSIFICATION**

- a) Beam Scales and balances shall be divided into classes as follows:
- Class 1 shall comprise precision balances provided with a means for relieving all of the knife-edges and bearings.
- Class 2 shall include balances, other than precision balances, for measuring the mass of medicines, chemicals, precious metals,

precious stones and comparable goods whether or not they are provided with a means for relieving all the knife edges and bearings Class 3 shall include beam scales and balances for weighing general merchandise.

- (b) It will be acceptable if classes are marked I, II or III or A,B or C as alternatives to 1,2 or 3 respectively.

#### **4. MARKINGS**

##### **4.1 Class**

Every beam scale or balance belonging to Class 1, class 2 or class 3 shall be indelibly marked with its class as the case may be.

##### **4.2 Capacity**

The capacity of a beam scale or balance shall be stamped or engraved on the beam or on a plate permanently secured to an essential part of the instrument.

##### **4.3 Manufacturers Name**

All new beam scales and balances shall be marked with the name of the manufacturer before the time of initial verification.

#### **5. CONSTRUCTION**

##### **5.1 Knives, bearings and friction plates.**

###### **a) Types of connection.**

Beams shall be fitted with knives only. These shall be pivoted on bearings. The line of contact between knives and bearings shall be a straight line.

###### **b) Symmetry of beam.**

The beam shall be symmetrical longitudinally about the fulcrum knife-edge and transversally about the center line of the knife edges, except that the ends of the beam may be shaped differently so as to prevent the interchange of removable stirrups.

**c) Fitting of knives.**

Except in the case of a class 1 or a class 2 scale provided with means for relieving all of the knife edges and bearings, knife edges shall be fitted in slots across the beam, to match continuous bearings or fitted in holes across the beam, to match divided bearings, or shall be bolted in recesses of suitable shape.

The knife edges of a class 1 or a class 2 scale provided with means for relieving all of the knife edges and bearings may be mounted on adjustable holders.

The edges of all knives shall be practically parallel and shall be situated in one plane.

**d) Friction plates**

Except in the case of class 1 or class 2 scales provided with a means for relieving knife edges and bearings and where such mechanism correctly positions the bearing on the knife edge thereby excluding any possibility of friction with other components, the longitudinal play of the knife edges shall be limited by friction plates.

There shall be point contact between knife edge and friction plates and it shall be situated on the extension of the line(s) of contact between knife edge and bearing(s). The friction plate shall form a plane through the point of contact with the knife and its plane shall be perpendicular to the line of contact between knife and bearing. A friction plate shall not be welded or soldered to the bearing.

**e) Hardness.**

Contact parts of knife edges, bearings and friction plates shall have a hardness of at least 58 Rockwell C.

**5.2 Indicating plates and indication of equilibrium**

The beam shall have an index pointer that is provided with a reference point against which to indicate equilibrium. The scale may be fitted with a fixed graduated, undenominated indicating plate over which the index pointer moves. If the indicating plate is graduated, graduations shall be on either side of the equilibrium reference line. There shall be an equal number of graduations on either side and the reference line shall be identified by being longer than the other graduation lines.

**5.3 Balancing devices**

Except in the case of class 1 or class 2 scales, the device for adjusting the balance at zero load shall be permanently secured and shall comprise a balance box securely attached to either pan support, so attached that it cannot readily be tampered with.

A class 1 or class 2 scale may be provided with a balancing device in the form of threaded screws (centre or at each end) on the beam or a flag, in place of or in addition to the balance box provided for above.

**5.4 Minimum travel**

The beam shall have equal travel each way from the position of equilibrium.

- a) Except in the case of a scale provided with an index pointer moving across a graduated indicating plate, travel by the index pointer each way from the equilibrium reference point shall be not less than:

<b>CAPACITY</b>	<b>TRAVEL</b> <b>mm</b>
Up to 50g	4
Over 50g and up to 500g	6
Over 500g and up to 5kg	9
Over 5kg	12

- b) When fitted with a graduated indicating plate, the index pointer shall have minimum travel beyond the extreme graduation on each side for a distance equivalent to the smallest graduation.

### **5.5 Prohibition/restriction**

The following instruments may have special requirements or be prohibited for use for certain measurements in certain countries according to national interest

- swan necked beam scale
- box end beam scales
- beam scales with wooden boards of capacity of less than 100kg.

## **6. TEST METHOD**

A beam scale or balance shall be tested as follows:

- (a) Lateral test for instruments that are fitted with knife edges and frictions.**

With the pans loaded centrally with certified mass pieces equal to one half of the capacity of the beam scale or balance, any

difference in the accuracy of the instrument resulting from moving the knife edges or bearings laterally, or backwards and forwards, within the limits of movements shall not exceed one half of the maximum permissible error specified.

**(b) Eccentric test**

With the pans loaded with certified mass pieces equal to one third of the capacity of the beam scale or balance the instrument shall indicate equilibrium within the limits of one half the maximum permissible error when the mass pieces are placed so that the centre of gravity thereof is anywhere within a distance from the centre of each pan equal to one third of its diameter.

**(c) Accuracy test**

When certified mass pieces equal to one half of the maximum capacity, maximum capacity and at any other load deemed necessary are placed centrally in each pan of a beam scale or balance, the instrument shall indicate equilibrium within the permissible errors specified for such loads.

**(d) Sensitivity test**

A beam scale shall be tested in both directions for sensitivity at full capacity and at any other load deemed necessary. When the prescribed sensitivity allowance is placed on the scale the index pointer shall be displaced from a position of equilibrium to the extent prescribed in (a or b) hereunder. The sensitivity allowance shall be placed with a slight impact in order to eliminate the effects of discrimination threshold.

- a) Beams with an index pointer moving over a graduated index plate shall turn such that the pointer moves past the extreme graduation for a distance at least equal to the distance between graduation lines. It shall maintain a displaced

position at least equal to the required minimum displacement.

- b) Beams with an index pointer and single equilibrium reference point shall turn such that the pointer is displaced by at least:

1mm for a scale of class 1 or class 2,

1 mm for a scale of class 3 with a capacity up to and including 30kg

5 mm for a scale of class 3 with a capacity exceeding 30kg

The beam shall maintain a displaced position at least equal to the required minimum displacement.

## **7 APPLICATION OF VERIFICATION MARK**

The verification mark shall be applied in one of the following ways:

- a) by means of a stamp on a lead plug inserted in an undercut hole in a conspicuous and easily accessible part of an exposed beam, or
- b) by means of a sticker applied externally to a conspicuous part of the base. Such sticker shall not be removable without destruction, or
- c) by means of an imprinted lead seal secured to the base by inserting sealing wire through holes in the base in a conspicuous position that does not interfere with the metrological integrity of the beam scale.

## 8 MAXIMUM PERMISSIBLE ERRORS

8.1 The following maximum permissible errors apply at initial and subsequent verification during error testing and as a turning allowance during tests for sensitivity. They may be doubled for in-service inspections before a scale is deemed to be unfit for trade use.

8.2 The following maximum permissible errors apply to test loads exceeding half capacity. For test loads not exceeding half capacity they shall be halved.

8.3 Maximum permissible errors for scales with capacities other than those in the relevant table shall be the permissible error of the next higher capacity.

**TABLE 1**  
**BEAM SCALES AND BALANCES- CLASS 1**

<b>CAPACITY</b>	<b>MAXIMUM PERMISSIBLE ERROR/SENSITIVITY</b>
<b>g</b>	<b>mg</b>
10	2
20	4
50	6
100	8
200	10
500	12
1 000	24
2 000	50
5 000	100
10 000	150
20 000	300

**TABLE II**  
**BEAM SCALES AND BALANCES- CLASS 2**

<b>CAPACITY</b>	<b>MAXIMUM PERMISSIBLE ERROR/SENSITIVITY</b>
<b>g</b>	<b>mg</b>
20	10
50	15
200	25
500	30
1 000	60
2 000	120
5 000	250
10 000	500
20 000	1 000
50 000	2 000

**TABLE III**  
**BEAM SCALES AND BALANCES- CLASS 3**

<b>CAPACITY</b>	<b>MAXIMUM PERMISSIBLE ERROR/SENSITIVITY</b>
<b>g</b>	<b>mg</b>
500	1 000
1 000	2 000
2 000	3 000
5 000	5 000
10 000	7 000
20 000	10 000
50 000	15 000

