

TEST MANUAL FOR STEEL TAPE MEASURES

1.0 GENERAL

This manual deals with steel tape measures which are used for measurements where the use of rigid length measures is not convenient or practicable.

2.0 CLASSES OF ACCURACY

Steel tape measures shall be divided into three classes, namely; Class I, Class II and Class III, in accordance with their accuracy.

3.0 NOMINAL LENGTHS

The tape measure shall be made in nominal lengths of 0.5m, 1m, 1.5m, 2m, 3m, 4m, 5m or multiples of 5m, provided that the maximum nominal length does not exceed 200m.

NOTE: The nominal length of a steel tape measure is the distance at the reference temperature of $\pm 0^{\circ}\text{C}$, between the initial and terminal graduation lines, when the tape measure is stretched, without friction, on a horizontal plane surface, under a tension of 50Newtons. The length so measured shall be equal, within the limits of maximum permissible errors, to the nominal length of the tape measure.

4.0 MATERIALS

- (a) The materials used shall be adequately strong, stable and resistant to environmental influences under normal conditions of use and shall comply with the following requirements:
- (i) When ordinarily used at temperatures between $\pm 0^{\circ}\text{C}$ of the reference temperature, variation in length of the temperature shall not exceed the maximum permissible error;
 - (ii) When used with a change of \pm percent in the tension, the variation in length of the tape measure shall not exceed the maximum permissible error.
- (b) The tape measure shall be made from steel or stainless steel.

5.0 MANUFACTURE

- (a) Tape measures shall be well made robust and carefully finished.
- (b) The cross section of the tape measure shall have such dimensions and shape that, under normal conditions of use, it allows the tape measure to have the accuracy specified for its class.
- NOTE:* It is recommended for guidance of manufacturers and users that tape measures may have a width of not less than 5mm and a maximum thickness of 0.4mm.
- (c) The steel tape measure shall be so made that when it is stretched on a plane surface, the edges have to be practically straight and parallel.

- (d) At the zero ends, tape measures shall be provided with a ring or other device for facilitating withdrawal. The ring or other device, when provided, shall be fastened to the tape measure by a metal strip of the same width as the tape.
- (e) The tape measures shall be capable of being wound into suitable container or other winding device of robust construction and made of metal, plastic, leather or other suitable material.
- (f) The winding devices shall be so designed that they do not cause any inaccuracy or permanent deformation on the tape.
- (g) The edges of tape measures shall be slightly rounded.
- (h) The tape measure shall be provided with a rust proof coating and shall be free from burrs.

6.0 GRADUATION

(a) General requirements:-

- (i) Graduation lines shall be clear, uniform, indelible and so made as to ensure easy and unambiguous reading.
 - (ii) The value of the graduations shall be of the form 1×10^n , 2×10^n or 5×10^n metres, the exponent 'n' being a positive or negative whole number or zero. The value of graduations, however, shall not exceed:-
 - 1 cm, on measures of nominal length less than or equal to 2m,
 - 10 cm, on measures of nominal length more than 2m but less than 10m,
 - 20 cm, on measures of nominal length more than 10m, but less than 50m,
 - 50 cm, on measures of nominal length equal to or more than 50m.
 - (iii) Graduation lines shall be reasonably straight perpendicular to the axis of the tape measure, and of uniform thickness throughout their length.
 - (iv) Graduation lines shall be so made that they form a clear and distinct scale and that their thickness does not cause any inaccuracy of reading.
 - (v) The tape measure shall be graduated only in metric units and graduations or other indications showing or relating to units other than metric units shall not be made on only surface of the tape measure.
- (b) Tape measures above 5m to 200m shall be graduated only on one side. Tape measures of 0.5m to 5m may be graduated on both sides. (Only metric scale)
 - (c) The graduated lines, numbers and other markings shall be either in itself, engraved, typographically printed or made in any other suitable manner.

- (d) The zero of the scale may be located at the outer or inner edge of the ring or other device, or may also be located on the tape measure itself, at a length equal to or greater than:-
- (i) 50m from the outer end of the ring or other device, in the case of tape measures of nominal length 0.5m to 5m; and
 - (ii) 100mm from the outer end of the ring or other device, in the case of tape measures of nominal lengths above 5m.
- (e) Tape measures of denominations 0.5m to 5m may be graduated throughout at every millimetre, every 5 millimetres or every 10 millimetres.
- (i) The graduation lines at every 10mm shall be marked in such a manner that there is no confusion between the 100mm graduation lines and the millimeters or every 10 millimetres.
 - (ii) In the case of tape measures graduated at every 5mm or 10mm, not less than the first 100mm shall be subdivided into millimetres.
- (f) In the case of tape measures of nominal length above 5m, every graduation line at 50mm shall have the same length as the graduation line at 10mm but may have an arrow at its end. This requirement shall not apply to tape measures graduated at every millimetre.
- (g) The thickness of the graduation lines shall not exceed the following limits:-
- 0.4mm in the case of Class I and Class II tape measures, and
 - 0.5mm in the case of Class III tape measures.
- (h) In the case of tape measures of nominal length 0.5m to 5m, the graduation lines may have a length between one fourth and full width of the tape, depending upon convenience. In the case of tape measures of nominal length above 5m, the length of the graduation lines may be as follows:-
- For millimetre graduation lines, about one-third of the width of the tape;
 - For 5 millimetre graduation lines, about half the width of the tape;
 - For 10 millimetre graduation lines, about two-thirds the width of the tape; and
 - For 100 millimetre graduation lines and for metre graduation lines as well as for the zero graduation lines, equal to the width of the tape.

7.0 NUMBERING

(a) General requirements:-

- (i) The numerals shall be indicated clearly, uniformly and indelibly and shall be easily and ambiguously legible.
- (ii) The place, dimension, shape, colour and contrast of the numerals shall be suitably for the scale and the graduation lines to which they relate.

- (iii) The numerals shall be marked parallel to or perpendicular to the axis of the tape measure depending upon the intended manner of use of the measure.
- (b) The following graduation lines shall be numbered:-
 - 10mm, for tape measures of nominal length 0.5m to 5m,
 - 100mm, for tape measures of nominal length exceeding 5m
- (c) The metre graduation lines shall be numbered and accompanied by a symbol 'm'
- (d) In the case of the tape measures of nominal length of 0.5m to 5m, the height of the numerals shall be such as would facilitate the reading of the measurement without ambiguity.
- (e) In the case of tape measures of nominal length 5m and above, after the graduation line at one metre, every graduation line at 100mm may be marked with an additional numeral, indicating the completed number of metres. This numeral, if provided, may be located just above below or in line with the numeral of the 100mm graduation line. The height of this numeral may be approximately half the height of the numerals indicating 100mm.
- (f) In the case of tape measures of nominal length 5m and above the height of numerals, except those given in sub-clause (e) above, may be:-
 - (i) About $\frac{1}{3}$ of the width of the tape, for 10mm graduation lines,
 - (ii) About $\frac{1}{2}$ of the width of the tape, for 100mm graduation lines, and
 - (iii) About $\frac{2}{3}$ of the width of the tape, for metre graduation lines.
- (g) If tapes of 0.5m to 5m are contained in special container may be marked with its dimension, for example, 50mm, to facilitate measurement of internal dimensions.

8.0 MAXIMUM PERMISSIBLE ERROR

- (a) On verification, under the conditions specified in clause 2, the error on the length between the axis of any two graduation lines shall not exceed:-
 - ***For Class I $\pm (0.1 \pm 0.1L)mm$***
 - ***For Class II $\pm (0.3 \pm 0.2L)mm$, and***
 - ***For Class III $\pm (0.6 \pm 0.4L)mm$;***
 Where L is the length between two graduation lines concerned, expressed in metres, rounded off to the next higher whole number of metres.
- (b) The maximum permissible error on tape measures on inspection shall be twice that specified for verification, the method of verification remaining unchanged.
- (c) Steel tape measures of nominal length 0.5m to 5m shall belong to accuracy Class I or Class II.
- (d) Tape measures of nominal length above 5m to 200m shall belong to accuracy Class I, Class II or Class III.

9.0 MARKING

- (a) The steel tape measures shall be marked at a suitable place near the end and on the container, where provided with the following markings:-
 - (i) Nominal length in metres,
 - (ii) An indication of the location of the zero of the scale,
 - (iii) The manufacturer's name or trade mark or both,
 - (iv) Class of accuracy: I, II, III in an oval.
- (b) The inscriptions shall be clearly visible and legible.
- (c) Advertising inscriptions, if made, shall be carried out in such a manner that they do not intrude in any way with the use of the tape measure.

10.0 SEALING

The stamp of verification shall be affixed on the metal or other device affixed at the beginning of the tape measure.