BS 6365:2008

BSI British Standards

Specification for precision vernier depth gauges

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Publishing and copyright information

ISBN 978 0 580 62082 9

ICS 17.040.30

The following BSI references relate to the work on this standard:
Committee reference TDW/4
Draft for comment 08/30178095 DC

Publication history

First published May 1983
Second (present) edition, November 2008

Amendments issued since publication

Amd. No.	Date	Text affected

Contents

Summary of pages
This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 10, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI and came into effect on 30 November 2008. It was prepared by Technical Committee TDW/4, *Technical product realization*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 6365:1983, which is withdrawn.

Relationship with other documents

prEN ISO 13385-2 is in preparation and covers metrological characteristics of calliper depth gauges with either analogue indication (vernier scale or circular scale) or digital indication (digital display).

Information about this document

This new edition has been fully revised to bring it up to date.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

The principal features of vernier depth gauges are shown in Figure 1 but details of design may vary between manufacturers. The accuracy of performance is based upon the quality and precision of the various features, e.g. the accuracy of dividing of the scales, the quality of the graduation marks, the straightness of the guiding edge of the beam, the flatness of the datum face and the measuring face. These are all features that the manufacturer controls in order that measurements made with the gauge are reliable within the tolerances specified in Clause **5**.

1 Scope

This British Standard specifies requirements for the construction, accuracy at the reference temperature of 20 °C and the protection of metric and imperial precision vernier depth gauges. It applies to metric depth gauges that measure from zero up to 600 mm using a main scale and vernier scale graduated to read to 0.02 mm. It also applies to imperial depth gauges that measure from zero up to 24 in using a main scale and vernier scale graduated to read to 0.001 in.

NOTE Attention is drawn to the fact that the imperial dimensions are not necessarily direct conversions of the metric dimensions. For instance, the vernier division of 0.02 mm marked on the metric gauge corresponds to a 0.001 in vernier division on the imperial gauge, whereas the actual conversion is 0.001 in = 0.0254 mm.

Annex A gives recommended minimum dimensions for the beam section, whilst methods of testing are specified in Annex B.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 817, *Specification for surface plates*

3 Terms and definitions

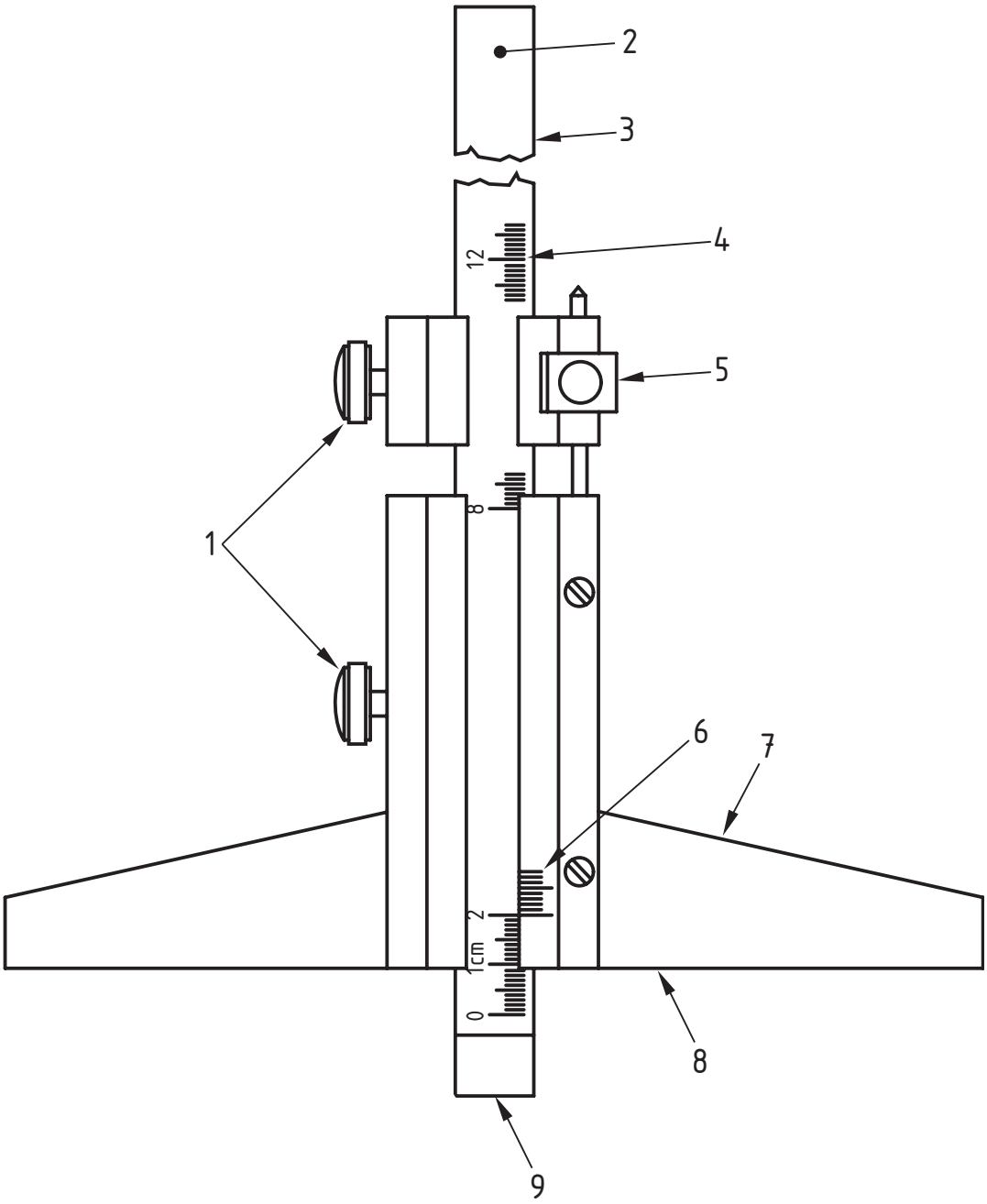
For the purposes of this British Standard the following terms and definitions apply.

NOTE The components of a precision vernier depth gauge are illustrated in Figure 1, which also gives the nomenclature.

3.1 deviation of reading
difference between the vernier depth gauge reading and the length between two surfaces, one contacted by the gauge datum face, the other by the measuring face of the beam

3.2 measuring range
range of depths that the gauge can be used to measure without the vernier scale extending beyond the main scale

Figure 1 **Example and nomenclature of a precision vernier depth gauge**



Key

1	Locking screws	6	Vernier scale
2	Beam	7	Body
3	Guiding edge	8	Datum face
4	Main scale	9	Measuring face
5	Fine adjustment		

NOTE The illustrations are not intended to specify details of design.

4 Construction

4.1 Material

The body, beam and vernier blade shall be of carbon steel or stainless steel. The coefficient of thermal expansion in the temperature range of 10 °C to 30 °C shall be within (11.5 ± 1.0) × 10^{-6}/°C. The measuring face and datum face shall be hardened to not less than 700 HV for carbon steel and not less than 550 HV for stainless steel. Finished depth gauges shall be free from internal stresses.

4.2 Measuring ranges

The measuring ranges shall be as specified in Table 1 or Table 2.

Table 1 **Measuring ranges and size of datum face – Metric** (see Figure 1)

Measuring ranges	**Datum face minimum length and width**
mm	mm
0 to 150	76 × 8
0 to 250	76 × 8
0 to 300	150 × 10
0 to 450	150 × 10
0 to 600	150 × 10

Table 2 **Measuring ranges and size of datum face – Imperial** (see Figure 1)

Measuring ranges	**Datum face minimum length and width**
in	in
0 to 6	3 × 0.312
0 to 10	3 × 0.312
0 to 12	6 × 0.375
0 to 18	6 × 0.375
0 to 24	6 × 0.375

4.3 Body

The body shall be of such proportions as to ensure stability of the gauge in use. The minimum cross section of the datum face shall be as specified in Table 1 or Table 2 for the appropriate measuring range. The datum face shall have a surface finish no coarser than 0.1 µm *Ra* or 4 µin *Ra* at a cut-off value of 0.8 mm or 0.032 in. When tested in accordance with **B.3**, any departure from flatness shall be of a concave nature and shall not exceed 0.005 mm or 0.000 2 in as measured over the total span. The body shall be finished all over and all sharp edges removed. The body shall be a good sliding fit over the length of the beam. A fitting shall be incorporated to enable fine adjustment to be made of the beam relative to the body. A clamp shall be incorporated

that will enable the beam to be locked to the body in such a manner that the fine setting of the vernier scale relative to the main scale is not visibly altered.

4.4 Beam

The beam shall be long enough to prevent overhang of any part of the body assembly at the maximum nominal measuring depth.

NOTE A suggested minimum section for each measuring range is shown in Annex A.

The measuring face shall either have the cross section of the beam or be chisel-edged by means of a bevel. When tested in accordance with **B.4.1**, the full section measuring face shall be flat and parallel to the datum face within 0.008 mm or 0.000 3 in. When tested in accordance with **B.4.2**, the chisel-edged face shall be straight and parallel to the datum face within 0.008 mm or 0.000 3 in.

5 Scales

5.1 General

The layout of the main scale and vernier scale shall be as specified in Table 3 or Table 4. The graduated length of the beam shall be the nominal measuring range of the depth gauge plus the length of the vernier.

Provision shall be made for re-setting the zero position.

NOTE It is recommended that, for ease of reading, the surfaces of the beam and vernier should have a dull finish and the graduation lines should be black.

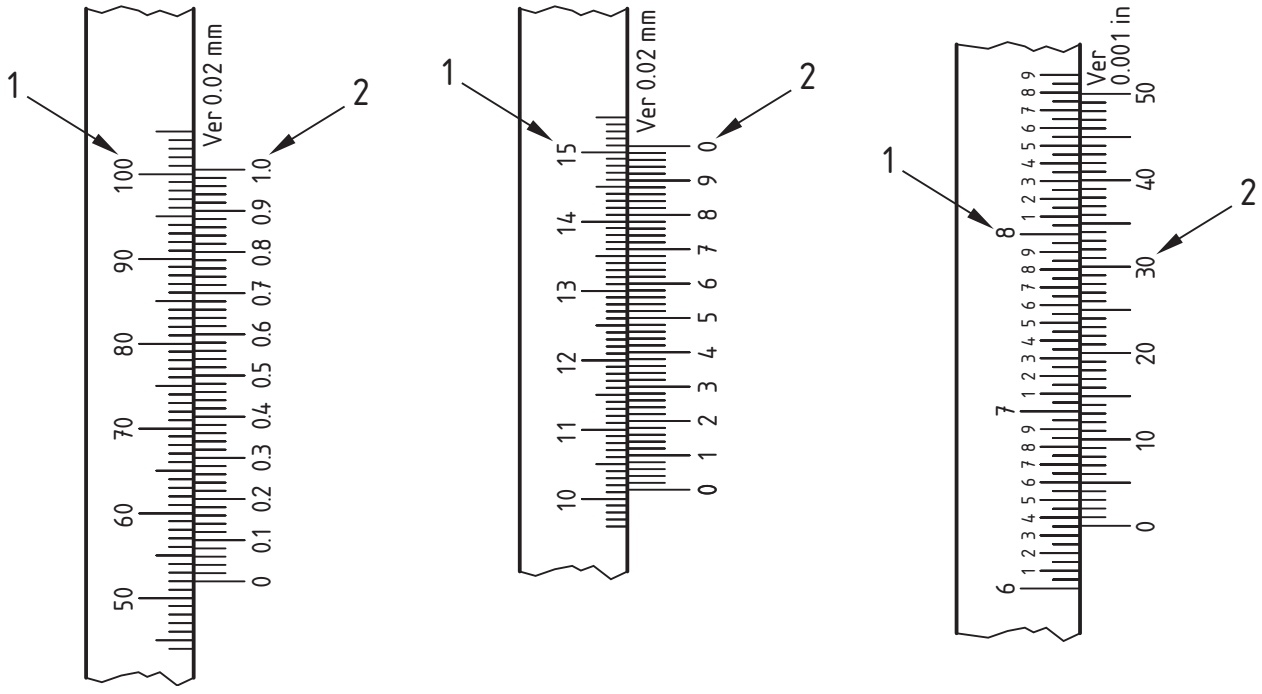
Table 3 **Layout of scales – Metric scales**

Main scale		Vernier scale			
Graduations	**Graduations and numbering**	**Number of divisions**	**Length**	**Graduations and numbering**	**Other marking**
1 mm intervals [see Figure 2 a)]	Each 5 mm line extended. Zero and each 10 mm line extended and numbered: 0 mm 10 20 30 40 50 etc.	50	49 mm	Zero and each 5th line extended and numbered: 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0	VER 0.02 mm
1 mm intervals [see Figure 2 b)]	Each 5 mm line extended. Zero and each 1 cm line extended and numbered: 0 1 cm 2 3 4 5 6 etc.	50	49 mm	Zero and each 5th line extended and numbered: 0 1 2 3 4 5 6 7 8 9 0	VER 0.02 mm

Table 4 **Layout of scales – Imperial scales**

Main scale		Vernier scale			
Graduations	**Graduations and numbering**	**Number of divisions**	**Length**	**Graduations and numbering**	**Other marking**
0.050 in intervals [see Figure 2 c)]	Zero and each inch line extended and numbered: 0 1 in 2 3 4 5 6 7 etc. Each 0.1 in line extended	50	2.450 in	Each 5th line extended. Zero and each 10th line extended and numbered: 0 10 20 30 40 50	VER 0.001 in

Figure 2 **Enlarged view of vernier scales**



a) with main scale engraved in millimetres

b) with main scale engraved in centimetres

c) with main scale engraved in inches

Key

1 Main scale

2 Vernier scale

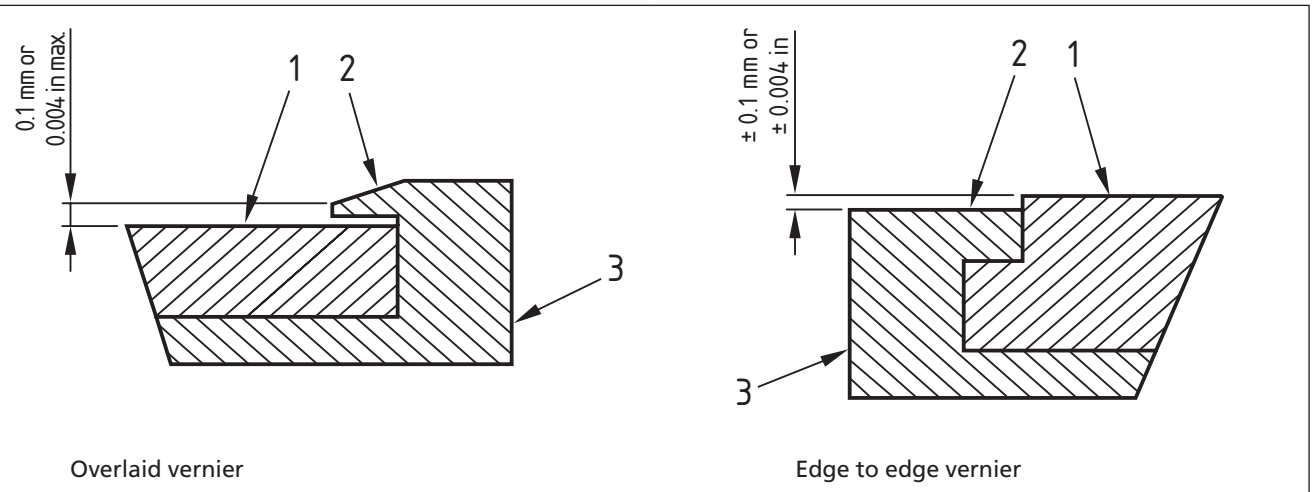
5.2 Graduation marks

The beam and vernier graduation marks shall be clear and perpendicular to the edge of the beam, and the width of the marks shall be not less than 0.08 mm or 0.003 in and not more than 0.18 mm or 0.007 in. The variation of the line thickness shall not exceed 0.05 mm or 0.002 in.

5.3 Fitting of vernier scale with main scale

The distance from the graduated face of the beam to the edge of the graduated face of the vernier shall not exceed 0.1 mm or 0.004 in (see Figure 3).

Figure 3 **Distance of vernier from main scale**



Overlaid vernier

Edge to edge vernier

Key

1 Beam
2 Vernier
3 Body

5.4 Marking (other than graduation marks)

The beam shall be marked with the unit symbol of the main scale figures, i.e. either a) mm or cm, or b) in.

NOTE Figuring in millimetres is preferred for depth gauges of up to 300 mm range.

The vernier scale shall be marked with the value of a vernier division, i.e. VER 0.02 mm or VER 0.001 in.

Each depth gauge shall have clearly and permanently marked upon it, in characters not less than 1 mm high, the manufacturer's name or trade mark.

6 Accuracy of reading

The deviation of reading at any position within the measuring range of the depth gauge shall be not greater than that specified in Table 5 or Table 6 when tested in accordance with the method specified in **B.2**.

Table 5 **Deviation of reading – Metric**

Measured depth	Maximum deviation of reading
mm	mm
> 0 ⩽ 300	± 0.02
> 300 ⩽ 600	± 0.04

Table 6 **Deviation of reading – Imperial**

Measured depth	**Maximum deviation of reading**
in	in
> 0 ⩽ 12	± 0.001
> 12 ⩽ 24	± 0.001 5

7 Protection

Each vernier depth gauge shall be supplied in a protective case and, as a protection against climatic conditions, shall be coated with a thin, non-corrosive oil and securely wrapped.

Annex A (informative) Recommended dimensions

The recommended minimum section for the beam for each measuring range is given in Table A.1 or Table A.2.

Table A.1 **Beam sections – Metric**

Measuring range	**Recommended minimum section of beam**
mm	mm
0 to 150	8 × 3
0 to 250	8 × 3
0 to 300	9 × 4.5
0 to 450	12.5 × 6.5
0 to 600	12.5 × 6.5

Table A.2 **Beam sections – Imperial**

Measuring range	**Recommended minimum section of beam**
in	in
0 to 6	0.312 × 0.125
0 to 10	0.312 × 0.125
0 to 12	0.375 × 0.187
0 to 18	0.500 × 0.250
0 to 24	0.500 × 0.250

Annex B (normative) Methods of test

B.1 Datum plane

Throughout the tests the datum plane shall be a Grade 0 surface plate conforming to BS 817.

B.2 Deviation of reading

Check the deviation of reading against end gauges at a minimum of five approximately equally spaced positions covering the measuring range of the main and vernier scales.

For this purpose support the depth gauge on its datum face by equal end bar and gauge block combinations placed on the datum plane surface plate, then make settings of the measuring face on gauge blocks on the surface plate with the gauge blocks still supporting the depth gauge.

In addition, take a "zero" check with the measuring face when the datum face is in contact with the surface plate.

B.3 Flatness of the datum face

Check the flatness of the datum face with an optical flat, or by comparison with the surface plate by means of a dial test indicator (see BS 2795).

B.4 Measuring face

B.4.1 Test the full section measuring face for flatness using the method described for the datum face in **B.3**. Test the full section measuring face for parallelism by a dial test indicator on the measuring face when the datum face is supported by equal end gauges on the surface plate.

B.4.2 Test the chisel measuring face for straightness by viewing its contact with a gauge block against an illuminated background. Test the chisel measuring face for parallelism either as described in **B.4.1** or by supporting the datum face by equal end gauges on the surface plate and viewing the contact of the measuring face with a gauge block on the same surface plate.

Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 2795*, Specification for dial test indicators (lever type) for linear measurement*

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