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British Standard Specification for  
**Bourdon tube pressure  
and vacuum gauges**

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Manomètres et vacuomètres à tube de Bourdon — Spécifications

Röhrenfedermanometer und Vakuummeter

## Foreword

This revision of BS 1780 has been prepared under the direction of the Industrial-process Measurement and Controls Standards Committee. It supersedes both BS 1780 : 1960 and BS 1780 : Part 2 : 1971, which are withdrawn.

This standard specifies nominal size, construction, marking and packaging requirements and pressure and vacuum ranges for bourdon tube pressure and vacuum gauges in general industrial use. It includes a number of tables of dimensions and graduations, the principal of which is to achieve interchangeability of gauges of a similar size and type.

This present revision extends the emphasis on safety and specifies compliance to a SAFETY PATTERN for gauges above 25 bar for use with gases, while in the 1971 edition only gauges above 60 bar had to comply with these requirements. For gauges with ranges 25 bar or less for use on gases these are now required to have a blow-out device.

In addition, gauges for use with steam have to meet the safety requirements laid down for gauges for use with gases.

Requirements for connecting nuts and tailpipes are no longer covered, as these are not considered to constitute part of the gauge.

In preparing this standard particular consideration was given to the choice of units for expressing pressure especially with regard to marking the dials of pressure gauges. For this purpose it is considered that the bar is a more practical pressure unit than the SI unit, the pascal. This standard accordingly gives first preference to the use of the bar, but does not preclude the usage, if so desired, of the pascal (Pa), kilopascal (kPa), megapascal (MPa), or imperial units.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

**Amendment No. 1**  
published and effective from 31 July 1989  
to BS 1780 : 1985

**Specification for bourdon tube pressure  
and vacuum gauges**

**Revised text**

**AMD 6124**  
July 1989

**Foreword**

In paragraph 3, line 5, after 'less' insert 'and with a dial diameter of 100 mm or more'.

**AMD 6124**  
July 1989

**Clause 1. Scope**

In paragraph 5 delete the second sentence and substitute 'These gauges are covered in BS 6752.'

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**Clause 2.3 combined pressured and vacuum gauge**

In the heading delete 'pressured' and substitute 'pressure'.

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**Clause 5.11.2 Gauges with a maximum scale value of 25 bar or less**

In paragraph 1, line 4, after 'device' insert the following:

'which shall operate at 0.3 bar or less, unless the case is of a liquid filled type when it shall operate at 1 bar or less'.

In note 2, line 5, after 'device', insert 'which will operate at 1 bar or less'.

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**Clause 6.2 Mounting of circular surface mounting gauges**

In line 4 delete '3' and substitute '4'.

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**Table 5. Dimensions for shank with preferred parallel thread**

At the end of the title insert '(see figure 8)'.

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**Table 6. Screwed threads for screwed connections**

In columns 2, 3 and 4 insert class reference 'B' in all cases as follows:

G<sup>1/8</sup>B, G<sup>1/4</sup>B, G<sup>3/8</sup>B and G<sup>1/2</sup>B.



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### Clause B.11.2 Gauges with parallel threads

Insert the following as paragraph 5.

'Where a compression fitting adaptor is used it is essential that a normal parallel, female stud coupling or connector is not used to connect a spigoted shank gauge because the internal machining of the female threaded stud end of the coupling may not be compatible with the seating and spigot of the shank. This could cause a matched, seating washer to be extruded into the bore of the gauge shank.'

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### Clause B.11.3 Gauges with taper threads

In paragraph 2, line 3, delete 'threads only' and substitute 'external threads only, none being applied to the internal threads'.

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### Clause B.11.5 Surface and flush mounted gauges

After paragraph 2 insert the following note:

'NOTE. For compression fitting adaptor see B.11.2.'

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### Clause C.1

In line 2 after 'ordered' insert 'with threads'.

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### Clause C.2

Delete lines 2, 3 and 4 and substitute the following:

'surface mounted may be ordered with threads to ¼-18 NPT.EXT. Gauges of nominal size 100 mm and above may be ordered with threads to ½-14 NPT.EXT, and flush mounted gauges with threads to ¼-18 NPT.EXT.'

In note 1 delete line 1 and substitute the following:

'NOTE 1. NPT.EXT is screwed USA standard taper pipe external thread.'

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### Appendix D. Conversion factors

In paragraph 1, line 3, delete 'F.1' and substitute 'F.2'.

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### Figure 8. Shank with preferred parallel thread

At the end of the title insert '(see table 5)'.

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### Publications referred to

Delete references to BS 2871 and BS 3059.

At the end of the list insert the following.

'BS 6752 Specification for bourdon tube pressure gauges used in welding, cutting and related processes'



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# Specification

## 1 Scope

This British Standard specifies requirements for indicating pressure gauges, vacuum gauges and combined vacuum and pressure gauges (compound gauges), of the bourdon tube type (with C, helical or spiral tube forms) from 50 mm to 300 mm nominal size with ranges up to 1000 bar\*.

Gauges specified are either circular dial industrial gauges with concentric scales or circular dial test gauges with concentric scales.

The standard applies to gauges suitable for industrial and marine use with common industrial fluids, such as air, oil, water and steam. It applies to test gauges, gauges for high pressure gases and gauges for use with oxygen and acetylene. It does not apply to gauges without a calibrated scale which have a lower degree of accuracy than specified in this standard.

The standard includes methods of test for performance to be applied to every gauge, but does not include type tests. The standard does not apply to pressure gauges for welding processes. A specification for such gauges is in preparation. It does not specify requirements for ranges and scales of test gauge dials as these are normally required for purposes where the specified requirements for industrial gauges may be inapplicable.

No requirements are specified for the material and finish to be used for the case and bezel of gauges.

## 2 Definitions

NOTE 1. The inclusion of the following definitions of component parts does not imply that each or all of them necessarily forms part of a gauge to comply with this standard; neither does it imply that the use of components other than those defined here is precluded.

NOTE 2. The nomenclature of the component parts is illustrated in figures 9 and 10.

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

**2.1 pressure gauge.** An instrument for giving a visual indication, by means of a pointer relative to a scale (see figure 1), of the amount by which the pressure of a fluid applied to it exceeds the pressure of the surrounding atmosphere.

**2.2 vacuum gauge.** An instrument for giving a visual indication, by means of a pointer relative to a scale (see figure 1), of the amount by which the pressure of a fluid applied to it is less than the pressure of the surrounding atmosphere.

**2.3 combined pressured and vacuum gauge.** An instrument for giving a visual indication, by means of a single pointer relative to a scale, of the amount by which the pressure of a fluid applied to it exceeds, or is less than, the pressure of the surrounding atmosphere. The scale is continuous, with two sets of graduations having a common zero at atmospheric pressure.

**2.4 bourdon tube gauge.** A gauge in which the pressure-responsive element is a bourdon tube.

**2.5 test gauge.** A gauge for checking industrial gauges where a higher degree of accuracy is required than can be achieved with industrial gauges.

NOTE. For degree of accuracy see 7.1.1.

**2.6 industrial gauge.** A gauge of a specified order of accuracy, intended for general industrial use.

NOTE. For degree of accuracy see 7.2.1.

**2.7 safety pattern gauge.** A gauge incorporating safety features specified in 5.11.1 and suitable for gases at high pressure.

**2.8 concentric scale gauge.** A gauge in which the scale forms the major part of a circle (embracing an angle of approximately 270°) with the pointer spindle at the centre and the pointer radial to the scale.

**2.9 direct mounting gauge.** A gauge which is mounted and supported by its screwed connection.

NOTE 1. See figures 2 and 3.

NOTE 2. The screwed connection may be at the bottom of the periphery of the case (direct mounting gauge with bottom connection) or at the back of the case (direct mounting gauge with back connection).

**2.10 surface mounting gauge.** A gauge for mounting on the surface of a panel, the whole of the gauge projecting forward from it, and which is mounted and supported by means of a flange at the rear of the case.

NOTE 1. See figure 4.

NOTE 2. The screwed connection is usually at the bottom of the periphery of the case (surface mounting gauge with bottom connection).

**2.11 flush mounting gauge.** A gauge for mounting in a panel, the greater portion of the case being recessed in the panel so that the front of the gauge, after mounting, is virtually flush with the panel.

NOTE 1. The screwed connection is usually at the back of the gauge.

NOTE 2. The gauge may be mounted and supported by means of a flange at the front of the gauge (flush mounting gauge with three-hole flange fixing and back connection) (see figure 5) or by means of a clamp attached to the back of the case and acting against the back of the panel (flush mounting gauge with clamp fixing and back connection) (see figure 6).

**2.12 case.** The outer casing that contains the pressure responsive element and the movement.

NOTE. The term 'case' does not include the bezel ring and spacer, nor the window, nor the back plate if this is removable.

**2.13 removable back plate.** A plate at the back of the case, that is removable for the purpose of giving access to the interior.

NOTE. A removable back plate should not be confused with a blow-out device.

**2.14 bezel ring.** The ring fitted to and removable from the case, which holds or retains the window.

NOTE. In flush mounting gauges the bezel ring may incorporate the flange.

\*1 bar = 10<sup>5</sup> Pa, A reading of zero bar is atmospheric pressure.

**2.15 spacer.** The distance piece, ring, or collar separating the window from the dial.

**2.16 window.** The transparent front through which the dial is observed.

**2.17 dial.** The plate upon which the scale is marked.

**2.18 scale.** The array of marks, together with any associated figuring, in relation to which the position of the pointer is observed (see figure 7).

**2.19 pointer.** The index, the position of which in relation to the scale, indicates the value of the measured pressure or vacuum.

**2.20 pointer stop.** A screw, stud, or other projection, fitted to limit the travel of the pointer.

NOTE. It is not the function of a pointer stop to act as an overload stop.

**2.21 blow-out device.** A safety device incorporated in the case or back plate to permit the rapid and safe dissipation of internal pressure in the event of a leakage or burst in the pressure responsive element.

**2.22 baffle wall.** A barrier between the pressure responsive element and the dial, so disposed that, in the event of a leakage or burst in the pressure responsive element, the blast would be dissipated away from the front.

**2.23 shank.** The part of the gauge that includes the screwed connection, the spanner flats, square or hexagon, the spigot, and the inlet orifice.

**2.24 screwed connection.** The threaded portion of the shank (see figures 8 and 9).

**2.25 bourdon tube.** A type of pressure-responsive element in the form of a curved tube which tends to straighten under internal pressure.

**2.26 tube end piece.** The plug, cap or other attachment for sealing the free end of the bourdon tube.

**2.27 tube anchorage.** The part to which the fixed end of the bourdon tube is attached, and which may be integral with the shank or may be directly or indirectly connected with the shank by a pressure conducting system.

**2.28 movement.** The assembly by which the motion of the

free end of the bourdon tube is shown in a multiplied form at the end of the pointer.

**2.29 connecting link.** The part of the movement that is connected to the free end of the bourdon tube.

### 3 Nominal size

The nominal sizes of gauges shall be as given in table 1.

| Table 1. Nominal sizes of gauges        |                   |
|-----------------------------------------|-------------------|
| Nominal size of gauge                   |                   |
| Test gauges                             | Industrial gauges |
| mm                                      | mm                |
| —                                       | 50                |
| —                                       | 63                |
| —                                       | 80                |
| —                                       | 100               |
| 150                                     | 150               |
| 200                                     | 200               |
| 250                                     | 250               |
| —                                       | 300               |
| NOTE. See tables 3 to 7 for dimensions. |                   |

### 4 Pressure and vacuum ranges

Where the unit of pressure used is the bar, pressure and vacuum ranges for industrial gauges shall be as given in table 2 (see also figure 1).

Table 2. Ranges for industrial gauges

| Service                                                                                                                                                                                                                                                                                                                     | Range          | Maximum working pressure for which the gauge is suitable |                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------|---------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                             |                | Steady pressure up to approx. 75 % full scale range      | Fluctuating pressure up to approx. 65 % full scale range (see appendix B) |
| Vacuum                                                                                                                                                                                                                                                                                                                      | bar<br>-1 to 0 | bar                                                      | bar                                                                       |
| Combined vacuum and pressure                                                                                                                                                                                                                                                                                                | -1 to +1.5     | 1.1                                                      | 1                                                                         |
|                                                                                                                                                                                                                                                                                                                             | -1 to +3       | 2.2                                                      | 2                                                                         |
|                                                                                                                                                                                                                                                                                                                             | -1 to +5       | 4                                                        | 3.2                                                                       |
|                                                                                                                                                                                                                                                                                                                             | -1 to +9       | 7                                                        | 6                                                                         |
| Pressure                                                                                                                                                                                                                                                                                                                    | 1              | 0.8                                                      | 0.6                                                                       |
|                                                                                                                                                                                                                                                                                                                             | 1.6            | 1.2                                                      | 1                                                                         |
|                                                                                                                                                                                                                                                                                                                             | 2.5            | 1.8                                                      | 1.6                                                                       |
|                                                                                                                                                                                                                                                                                                                             | 4              | 3                                                        | 2.6                                                                       |
|                                                                                                                                                                                                                                                                                                                             | 6              | 4.5                                                      | 4                                                                         |
|                                                                                                                                                                                                                                                                                                                             | 10             | 7.5                                                      | 6.6                                                                       |
|                                                                                                                                                                                                                                                                                                                             | 16             | 12                                                       | 10                                                                        |
|                                                                                                                                                                                                                                                                                                                             | 25             | 18                                                       | 16                                                                        |
|                                                                                                                                                                                                                                                                                                                             | 40             | 30                                                       | 26                                                                        |
|                                                                                                                                                                                                                                                                                                                             | 60             | 45                                                       | 40                                                                        |
|                                                                                                                                                                                                                                                                                                                             | 100            | 75                                                       | 65                                                                        |
|                                                                                                                                                                                                                                                                                                                             | 160            | 120                                                      | 100                                                                       |
|                                                                                                                                                                                                                                                                                                                             | 250            | 180                                                      | 160                                                                       |
|                                                                                                                                                                                                                                                                                                                             | 400            | 300                                                      | 260                                                                       |
|                                                                                                                                                                                                                                                                                                                             | 600            | 450                                                      | 400                                                                       |
|                                                                                                                                                                                                                                                                                                                             | 1000           | 750                                                      | 650                                                                       |
| <p>NOTE 1. It should not be assumed that all the ranges in this table are available in all the sizes of gauges given in table 1.</p> <p>NOTE 2. Examples of scale ranges in kilopascals and megapascals are given in table 9.</p> <p>NOTE 3. Examples of suitable scale ranges in imperial units are given in table 10.</p> |                |                                                          |                                                                           |

## 5 Materials and construction

NOTE. For gauges for use in corrosive environments or with corrosive fluids, the purchaser should consult with the manufacturer.

### 5.1 Case and bezel

Where the gauge is sealed for the purpose of liquid filling, a blow-out device shall be fitted.

NOTE. As far as is practicable the gauge should be dust-protected and splash-proof and when requested the manufacturer should state the degree of protection in accordance with BS 5420.

### 5.2 Shank

**5.2.1 Material for shank.** The shank shall be either of non-ferrous metal or of ferrous metal and shall be stamped, cast or machined from the bar.

NOTE. If the shank is required to withstand conditions corrosive to non-ferrous metal, ferrous metal should be used.

**5.2.2 Construction of shank.** Where the shank is constructed from more than one piece, the joint or joints shall have a mechanical strength at least equal to that of the materials jointed and shall be leak tight.

### 5.3 Tube anchorage

**5.3.1 Material for tube anchorage.** The tube anchorage shall be either of non-ferrous metal or ferrous metal and shall be stamped, cast or machined from the bar.

NOTE. If the tube anchorage is required to withstand conditions corrosive to non-ferrous metals, ferrous metal should be used.

**5.3.2 Construction of tube anchorage.** The tube anchorage shall be either integral with the shank or connected with the