

# Specification for Gas meters —

**Part 4: Plate constructed positive  
displacement diaphragm meters for a  
pressure of 350 mbar (5 lbf/in<sup>2</sup>) and up  
to 170 cubic metres (6000 cubic feet)  
per hour rating**

# Co-operating organizations

The Gas Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government department and scientific and industrial organizations:

- Gas Council\*
- Heating and Ventilating Contractors' Association
- Institution of Gas Engineers\*
- Liquefied Petroleum Gas Industry Technical Committee\*
- Ministry of Technology\*
- Society of British Gas Industries\*

The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

British Non-ferrous Metals Federation

This British Standard, having been approved by the Gas Industry Standards Committee, was published under the authority of the Executive Board on 31 March 1970

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# Foreword

This standard makes reference to the following British Standards:

BS 10, *Flanges and bolting for pipes, valves and fittings.*

BS 21, *Pipe threads.*

BS 143 & BS 1256, *Malleable cast iron and cast copper alloy screwed pipe fittings for steam, air, water, gas and oil.*

BS 381C, *Colours for specific purposes.*

BS 746, *Gas meter unions and adaptors.*

BS 1179, *Glossary of terms used in the gas industry.*

BS 1250, *Domestic appliances burning town gas — Part 1: General requirements.*

BS 1387, *Steel tubes and tubulars suitable for screwing to BS 21 pipe threads.*

BS 1452, *Grey iron castings.*

BS 2045, *Preferred numbers.*

BS 2660, *Colours for building and decorative paints.*

BS 2782, *Methods of testing plastics — Part 5: Miscellaneous methods.*

BS 2797, *Leather for gas meter diaphragms — Part 1: E.L. sheep skin leather. Part 2, Split hide leather.*

BS 3900, *Methods of test for paints — Part F2: Resistance to humidity under condensation conditions.*

This British Standard is the fourth of a series relating to meters for gaseous fuels for registering the volume of gas passed.

These meters may be used for metering gases other than gaseous fuels, but the suitability of a meter for this purpose should be verified with the manufacturer.

As higher pressures are being adopted for piped supplies a demand is created for a meter to withstand these higher pressures. This standard is based on the meters specified in Parts 1 and 2, sizes P.6 to P.60, which are for pressures up to 50 mbar<sup>1)</sup>, and suitably strengthened for a working pressure of 350 mbar<sup>1)</sup> (5 lbf/in<sup>2</sup>).

Although at the time of publication legislation did not permit the use of metric units as a basis for charging for gas consumed the committee prepared this standard for reading in cubic metres in anticipation of legislation being granted. Cubic feet indexes have also been included to comply with the current legislation.

Temperature and pressure compensating devices are not generally required for meters working at a constant inlet pressure of 350 mbar<sup>1)</sup>, therefore no details for such devices are included in this standard. If a device is required it is anticipated that some guidance will be given in a separate standard to follow.

The method of ordering meters adopted in earlier Parts has been extended to these high pressure meters and is explained in Appendix A. Further Parts covering other pressures and types of gas meter are envisaged. Those already published are:

- *Part 1: Meters of plate construction up to 1 000 cubic feet per hour rating;*
- *Part 2: Meters of plate construction above 1 000 cubic feet per hour rating;*
- *Part 3: Unit construction meter of 6 cubic metres (212 cubic feet) per hour rating.*

NOTE 1 Factors for the conversion of metric into imperial units are given in Appendix M. More comprehensive conversions will be found in BS 350, "Conversion factors and tables".

NOTE 2 These meters are considered to be a product which is not dimensionally related to those products for which dimensional co-ordination is essential and thus come within the category of Item 6 in PD 6030, "Programme for the change to the metric system in the construction industry".

<sup>1)</sup> 1 mbar = 10<sup>2</sup> N/m<sup>2</sup>.

**Obsolescent** (by Amendment No. 1)

The need for the equipment covered by this Part of this British Standard has been reviewed and although it was decided not to amend or revise the text, the standard should be regarded as obsolescent and not therefore used for new designs. The standard will be withdrawn in due course.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

**Summary of pages**

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 21 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.



## 1 Scope

**1.1 General.** This part of BS 4161 covers the construction and performance of plate constructed high pressure positive displacement diaphragm meters for a working gas pressure of 350 mbar <sup>2)</sup> and case sizes 5P.6 to 5P.60 inclusive.

It includes the requirements for top connection bosses conforming to BS 746<sup>3)</sup> (for the 5P.6 size), flanges and connector sockets.

**1.2 Installation.** The installation of high pressure meters may later be dealt with in a British Standard Code of Practice<sup>4)</sup>.

**1.3 New developments.** Notwithstanding the requirements specified in this standard, any new designs, materials and methods of assembly giving at least equivalent results are acceptable.

## 2 Definitions

**2.1** The terms used in this British Standard are defined in BS 1179<sup>5)</sup>.

## 3 Ratings

**3.1** A meter shall be badged at one of the badged ratings shown in Table 1 or at another badged rating conforming to the R40 series of preferred numbers (see BS 2045<sup>6)</sup>) for m<sup>3</sup>/h or conforming to the R20 series, rounded to the nearest thousand ft<sup>3</sup>/h, for ft<sup>3</sup>/h meters.

NOTE The badged rating as defined in BS 1179<sup>5)</sup> is determined on air at low pressure.

## 4 Materials

**4.1 General requirements.** The meter shall be constructed of materials of good quality complying, where applicable, with British Standards. The materials used shall not be adversely affected by the conditions arising in that part of the meter in which they are used.

**4.2 Tinning.** All steel components, unless inherently corrosion resistant, shall be tinned as follows:

1) *Pretinned steel sheet for case and valve plate assembly.* The tinning shall be evenly applied on both sides, the two coatings having a combined weight of not less than 180 g/m<sup>2</sup> (a coat thickness each side of 0.013 mm).

2) *Internal mild steel sheet components.* The tinning shall be evenly applied on both sides, the two coatings having a combined weight of not less than 120 g/m<sup>2</sup> (a coat thickness each side of 0.008 mm).

3) *Other steel components*, e.g. flag rods which are tinned shall have an equivalent coating of tin of not less than 45 g/m<sup>2</sup> of the surface area (a coat thickness of 0.006 mm).

**4.3 Diaphragms.** Leather diaphragms shall comply with the requirements of BS 2797-1<sup>7)</sup> or BS 2797-2<sup>7)</sup> as appropriate. The dressing shall be non-acid, covering the surface and filling the pores and any stitches, and it shall be suitable for the gas for which the meter is to be used. The dressed leather, when fitted, shall be impermeable to air at a differential pressure of 5 mbar <sup>2)</sup>.

Synthetic or reinforced synthetic diaphragms shall have a performance and useful life not less than that of leather diaphragms and shall withstand the test requirements of Appendix B.

**4.4 Index window.** The index window shall be of 6 mm (minimum) plate glass, or materials of equivalent performance and useful life, and shall satisfy the requirements and tests in Appendix C.

**4.5 Bearings.** All linkage, pivot and other bearings shall be made of corrosion and wear resistant material.

<sup>2)</sup> 1 mbar = 10<sup>2</sup> N/m<sup>2</sup>.

<sup>3)</sup> BS 746, "Gas meter unions and adaptors".

<sup>4)</sup> Recommendations under consideration by the Institution of Gas Engineers.

<sup>5)</sup> BS 1179, "Glossary of terms used in the gas industry".

<sup>6)</sup> BS 2045, "Preferred numbers".

<sup>7)</sup> BS 2797, "Leather for gas meter diaphragms", Part 1, "E.I. sheep skin leather", Part 2, "Split hide leather".

**4.6 Valves.** The faces of the valve cover shall be made of phenolformaldehyde with an inert filler and graphite impregnated or of a material having equivalent properties, such as wear resistance, breakage resistance and low coefficient of friction.

The valve grids shall be made of a material compatible with that of the valve covers. A suitable combination is graphited phenolformaldehyde for the faces of the valve covers and an alloy of tin, antimony and lead for the valve grids.

**4.7 Gearing.** The gearing shall be made of materials which are compatible, wear resistant and dimensionally stable.

**4.8 Grease.** Where grease is used for lubricating bearings and gears it shall not contain solids unless the solids have lubricating properties. Metallic soap-base greases shall not be used.

**4.9 Sealing gland.** The gland seal shall be made of a material that will satisfy the tests specified in Appendix D.

**4.10 Motion wires and components.** Where motion wires are fitted, they and their guides and bearings shall be made of wear and corrosion resistant material.

**4.11 Bosses.** Meter bosses shall be made of a material specified in BS 746<sup>8)</sup>.

**4.12 Connector socket.** Sockets shall be made from cast iron to BS 1452<sup>9)</sup>, Grade 10, or of a material at least equivalent in mechanical strength and durability.

Longscrew material shall comply with the requirements of BS 1387<sup>10)</sup>.

**4.13 Flanges.** Flanges shall be made of a material complying with the requirements of BS 10<sup>11)</sup>.

## 5 Design and dimensions

**5.1 Case.** The meter shall have a case size conforming to Table 1.

When looked at from the front (see Figure 8) the inlet connection shall be located on the left-hand side of the meter and the outlet connection shall be on the right-hand side, both located on the vertical centre line of the side.

A 5P.6 meter shall be provided with inlet and outlet side pipes with bosses for top connection.

The meter case shall be made of pre-tinned steel sheet. The total thickness of the tinned steel sheet shall be not less than that shown in Table 2.

The seams shall be soft soldered to obtain a gas-tight joint and to permit removal of panels without damage for repair purposes. In addition all the panels shall be fixed mechanically.

The meter shall be supported on feet firmly attached to the case. The feet shall be sealed to prevent ingress of moisture. They shall not be positioned over a soldered seam and preferably not under a flag rod bearing.

There shall be adequate working clearance between moving components and stationary parts of the meter not intended to make contact. These clearances shall make allowance for readjustment of the mechanism.

When the meter is in an upright position it shall not be possible for liquid to be trapped on the case.

**5.2 Purging point.** A meter outlet flange, or socket fitted integral with the case, shall be provided with a purging plug. The internal thread for this plug shall be screwed ½ in BSP for a meter with a 3 in BSP outlet connection and screwed ¾ in for 4 in and larger BSP outlet connections (except where indicated in Figure 1, Table 5, Column 10). These threads shall conform to BS 21<sup>12)</sup>, and should be of taper form.

The purging plug shall be of malleable cast iron, complying with the requirements of BS 143<sup>13)</sup>, solid type, and shall be easily accessible.

NOTE A purging point for a 5P.6 meter is provided in the associated installation pipework.

<sup>8)</sup> BS 746, "Gas meter unions and adaptors".

<sup>9)</sup> BS 1452, "Grey iron castings".

<sup>10)</sup> BS 1387, "Steel tubes and tubulars suitable for screwing to BS 21 pipe threads".

<sup>11)</sup> BS 10, "Flanges and bolting for pipes, valves and fittings".

<sup>12)</sup> BS 21, "Pipe threads".

<sup>13)</sup> BS 143 & BS 1256, "Malleable cast iron and cast copper alloy screwed pipe fittings for steam, air, water, gas and oil".

Table 1 — Case dimensions and ratings

| 1                        | 2                 | 3                         | 4                                                     | 5                                                     | 6                                                                      | 7                                                                   | 8                 | 9             |
|--------------------------|-------------------|---------------------------|-------------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------|---------------|
| BS case reference number | Badged rating     | Alternative badged rating | Connection size BSP                                   |                                                       | Overall width (over connections or between boss centres <sup>a</sup> ) | Height of centre of connections (or to top of bosses <sup>a</sup> ) | Overall height    | Overall depth |
|                          |                   |                           | Flanges (or bosses <sup>a</sup> )                     | Connector sockets                                     |                                                                        |                                                                     |                   |               |
|                          | m <sup>3</sup> /h | ft <sup>3</sup> /h        | in                                                    | in                                                    | mm                                                                     | mm                                                                  | mm                | mm            |
| 5P.6                     | 20                | 700                       | <sup>a</sup> 2                                        | —                                                     | limits<br>+ 8, – 5<br><sup>a</sup> 430                                 | limits<br>+ 8, – 5<br><sup>a</sup> 570                              | max. see Column 7 | max. 380      |
| 5P.12                    | 34                | 1 200                     | 3                                                     | 3                                                     | limits<br>+ 0, – 12<br>610                                             | limits<br>+ 0, – 12<br>438                                          | 635               | 380           |
| 5P.18                    | 50                | 1 800                     | 3                                                     | 3                                                     | 692                                                                    | 515                                                                 | 737               | 432           |
| 5P.30                    | 85                | 3 000                     | 4                                                     | 4                                                     | 768                                                                    | 515                                                                 | 864               | 610           |
| 5P.60                    | 170               | 6 000                     | $\left\{ \begin{array}{l} — \\ 6 \end{array} \right.$ | $\left\{ \begin{array}{l} 4 \\ — \end{array} \right.$ | $\left\{ \begin{array}{l} 833 \\ 895 \end{array} \right.$              | 686                                                                 | 1 092             | 686           |

<sup>a</sup> Top connections to BS 746, "Gas meter unions and adaptors".

Table 2 — Case thickness

| BS case reference number       | Minimum thickness of tinned steel sheet |
|--------------------------------|-----------------------------------------|
|                                | mm                                      |
| 5P.6 up to and including 5P.18 | 0.90                                    |
| 5P.30 and 5P.60                | 1.20                                    |

### 5.3 Index

**5.3.1 General.** The index of the meter shall be sealed from the gas inside the meter by a sealing gland. The index window shall be sealed in its frame but the index may be vented to the atmosphere by a small hole in the frame, positioned to prevent the entry of water. The window and frame shall be designed to prevent unauthorized access to the index.

The index face shall have black printing (except the red noughts or the red portion of the visor; see **5.3.2** and **5.3.3**) on a white background.

The index shall not fade when used during the test in Appendix C.2.2.1.

The recording numerals shall be arranged as shown in Figure 2, Figure 3, Figure 4 or Figure 5. They shall be of uniform size, shall have minimum dimensions of 5 mm high and 2.6 mm wide. Except as specified in **5.3.2**, they shall be white in colour on a black background and surrounded by a black visor as shown in the appropriate Figure.

The numerals shall move in an upward direction and shall be clearly visible at an angle of 15° (to the normal) when viewed from any direction from the front of the meter.

A complete revolution of a drum shall, during the last  $\frac{1}{10}$  of its travel, i.e. from 9 to 0, cause the advance of the next higher drum by one unit.

**5.3.2 Cubic metre index.** The index for a meter with a badged rating in cubic metres shall conform to Figure 2 or Figure 3 and shall have a test drum. This drum shall move continuously while the meter is recording. It shall have a minimum diameter of 16 mm with subdivisions of uniform length 1 mm (minimum) apart.

The unit divisions commencing with a numeral 0, shall be distinguished from the subdivisions by longer lines. These graduation lines shall be fine, uniformly drawn and white in colour. (See enlarged view at Figure 2.) For the application of photo-electric meter testing techniques, a white line as thick as practicable shall be drawn across the drum and positioned between any recording numerals.

The window for the test drum shall have a projection, with a horizontal lower edge, projecting two-thirds of the way across the subdivisions of the test drum. (See enlarged view at Figure 3.)

The recording numerals for submultiples of m<sup>3</sup> shall be red in colour surrounded by a red visor and separated from recording numerals in m<sup>3</sup> by a clear decimal point.