



Specification for

Gas meters

Part 3. Unit construction meters of 6 cubic metres
(or 212 cubic feet) per hour rating

Spécification des compteurs à gaz

Partie 3. Compteurs de construction unitaire de capacité de
6 mètres cubes (ou 212 pieds cubes) par heure

Spezifikation für Gaszähler

Teil 3. Einheitsbauzähler mit einer Leistung bis auf 6 Kubikmeter
(oder 212 Kubitfuß) pro Stunde

BS 4161:Part 3:1977

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Foreword

BS 4161: Part 3 was first published in 1968 under the authority of the Gas Standards Committee as the third of a series relating to meters for gaseous fuels used for registering the volume of gas passed. The need for a complete revision has arisen through the advent of synthetic diaphragms and because of legislative changes. This Part now, therefore, contains the requirements of the Gas (Meter) Regulations 1974, Statutory Instruments 1974 No. 848, the EEC Council Directive No. 71/318/EEC and Technical Amendment Directive 74/331/EEC.

Although primarily intended for 1st and 2nd family gases, these meters may be used for other gases, but the suitability of a meter for such a purpose should be verified with the manufacturer.

A one-pipe connection is referred to in this Part of the standard but only requirements essential to its association with a meter are included.

This standard contains requirements for prepayment meter mechanisms intended for use with 50p and £1 coins.

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The other Parts of BS 4161 (already published or in course of preparation), covering temperature and pressure compensating devices and other types of gas meter, are as follows.

- Part 1 Meters of plate construction up to 1000 cubic feet per hour rating;
- Part 2 Meters of plate constructions above 1000 cubic feet (28 cubic metres) per hour rating;
- Part 4 Plate constructed positive displacement diaphragm meters for a pressure of 350 mbar (5 lbf/in²) and up to 170 cubic metres (6000 cubic feet) per hour rating;
- Part 5 Positive displacement diaphragm meters for pressures up to 7 bar;
- Part 6 Rotary displacement and turbine meters for gas pressures up to 100 bar;
- Part 7 Mechanical volume correctors.

Installation of these meters is the subject of CP 331: Part 2

Documents

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British Standard Specification for

Gas meters

Part 3. Unit construction meters of 6 cubic metres
(or 212 cubic feet) per hour rating

Section one. General

1. Scope

1.1 General. This Part of BS 4161 specifies requirements for the construction and performance of unit construction credit and prepayment meters with a badged rating of $6 \text{ m}^3/\text{h}$ (or $212 \text{ ft}^3/\text{h}$) for working pressures up to 30 mbar*. It refers to top connections complying with the requirements of BS 746 and includes certain requirements for one-pipe connections and for heat and fire resistance. The information to be supplied when ordering meters is included in appendix A.

The requirements for meters for pressures above 30 mbar are specified in Part 5 of this British Standard.

1.2 Coinage. The prepayment meter requirements relate to mechanisms suitable for use with 50p and £1 coins.

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

2. References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3. Definitions

For the purposes of this British Standard the definitions given in BS 746 and BS 1179 apply. In addition the following definitions also apply.

3.1 unit construction meter. A meter in which the measuring unit is a replaceable assembly in a case generally constructed in two parts sealed together.

3.2 coin ejection. The ejection of the coin from the coin carrier into the cash box.

3.3 quantity wheel. A toothed wheel that is attached to, and operates, the prepayment mechanism when it is engaged by the coin carrier. There may be one or two quantity wheels according to the prepayment attachment design.

4. Rating

4.1 Badged rating. The badged rating shall be $6 \text{ m}^3/\text{h}$ (or $212 \text{ ft}^3/\text{h}$) as ordered.

NOTE. The badged rating as defined in BS 1179 is determined on air.

Section two. Credit meter

5. Materials

5.1 General requirements. The meter shall be constructed of materials of good quality complying, where applicable, with the requirements of appropriate British Standards.

Materials before or after treatment shall be such that they are not affected adversely by operating conditions.

5.2 Tinning. All tinned steel components shall comply, as appropriate, with the requirements specified in 5.2.1 to 5.2.3.

5.2.1 Case and, where applicable, valve plate. Where pre-tinned steel plate is used the tinning shall be evenly applied on both sides, the two coatings having a combined mass of not less than 180 g/m^2 (a coat thickness each side of 0.012 mm).

Where steel plate is tinned after forming, the tinning shall be evenly applied on both sides, the two coatings having an average combined mass of 180 g/m^2 , with not less than 150 g/m^2 at any one place (a coat thickness each side of 0.012 mm and 0.010 mm respectively).

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

5.2.3 Other tinned steel components. Other tinned steel components, e.g. flag rods, shall have an equivalent coating of tin of not less than 45 g/m^2 of the surface area (a coat thickness of 0.006 mm).

5.3 Corrosion resistant painted surfaces. Where paint is applied directly to steel as corrosion protection for a meter casing or meter components, the following procedure shall be adopted.

(a) Subject the component to adequate pretreatment before painting. Suitable processes include:

- (1) oiling, degreasing, phosphating and rinsing;
- (2) bright annealing, oiling, degreasing, phosphating and rinsing; or
- (3) annealing, acid etching, rinsing, oiling, degreasing, phosphating and rinsing.

NOTE. Oiling is included as protection during storage prior to subsequent treatment.

(b) Apply the paint to both sides of sheet components to a thickness of $0.05 \pm 0.015 \text{ mm}$.

Mechanical and corrosion resistance tests shall be carried out and found satisfactory in accordance with appendix B.

*1 mbar = 10^2 N/m^2 = 0.1 kPa.

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The tests shall be carried out on the components themselves or on sample plaques made from the same grade and thickness of steel, pretreated and coated in the same manner as the components.

The paint shall be aged for the minimum time specified by the paint manufacturer before testing.

5.4 Diaphragms. Leather diaphragms shall comply with the requirements of BS 2797: 1976, type 1. The dressing shall be non-acid, covering the surface and filling the pores, and shall be suitable for the gas for which the meter is to be used. The dressed leather shall be impermeable to air at a differential pressure of 5 mbar.

Leather diaphragms are not suitable for 3rd family gases. Synthetic diaphragms shall have a performance and useful life not less than that of leather diaphragms and shall comply with the requirements of appendix C.

5.5 Index window. The index window shall be of plate glass, or materials of equivalent performance and useful life, and shall satisfy the requirements of appendix D.

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

5.7 Valves. The valve grids shall be made of material that is compatible with that of the valve covers.

Either the valve cover or the grids shall be made of material with self-lubricating properties, e.g. made of, or faced with, 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.

5.8 Gearing. The gearing shall be made of materials that are compatible, wear resistant and dimensionally stable.

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

5.10 Sealing gland. The sealing gland shall be made of a material that will satisfy the tests specified in appendix E.

NOTE. Yarn is not acceptable as a packing material.

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

5.12 Meter bosses. The two-pipe meter bosses shall be made of a material specified in BS 746.

5.13 Case joint. When a synthetic material is used to make the case joint, the material, when applied, shall be submitted to the test requirements of E.2, after which it shall comply with the requirements of 9.1.

5.14 Adhesive. Any adhesive used for fixing components shall have adequate bonding strength (also see 6.9). The adhesive shall be effective throughout the life of the meter and it shall not be affected by the gas for which the meter is intended to be used, or by any condensate.

6. Design and dimensions

6.1 Case. The meter case shall conform to the dimensions given in figure 1 and be designated U6. The inlet of a two-pipe meter shall be on the left-hand side when viewed from the front. The inlet of a coaxial one-pipe connection shall be through the annulus of the liner and the outlet through its centre.

Where steel sheet is used its minimum thickness after forming shall be not less than 0.8 mm.

When the meter is in an upright position it shall not be possible for liquid to be trapped on the outside of the case. It shall be possible to remove the measuring unit for repair purposes without damaging the case beyond further use.

6.2 Clearances. There shall be working clearance between moving components and stationary parts of the meter not intended to make contact. These clearances shall allow for full adjustment of the mechanism.

6.3 Pressure test point. A two-pipe meter shall be provided with a pressure test point in the form of a nipple, as specified in appendix F, for the temporary connection of a pressure test gauge. This nipple shall be fitted either in the outlet union boss or in the meter case. If in the meter case, it shall be on the outlet gas side positioned to minimize the risk of accidental damage and be easily accessible from the front of the meter. When so fitted the strength of the securing joint shall be such that it is capable of complying with the requirements of 9.1 after applying:

- (a) a torque of 4 N m;
- (b) a mass of 0.5 kg dropped from a height of 250 mm through a vertical tube on to the 10.3 mm diameter body band.

NOTE 1. Both tests need not be applied to the same sample.

NOTE 2. A pressure test point is not required on a one-pipe meter, as it is supplied with the associated one-pipe fitting.

6.4 Feet. The meter shall be supported on four feet firmly attached to the case and the method of attachment shall not be liable to corrosion. The feet shall be designed to accept an insulating cap, which shall be fitted.

6.5 Index

6.5.1 General. The index of the meter shall be sealed from the gas inside the meter. It may be vented to the atmosphere but the method of venting shall not allow 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 zero or the red portion of the visor as specified in 6.5.2 and 6.5.3) on a white background.

The index face and numerals shall not fade during the test described in D.2.2.1.

The recording numerals shall be arranged as shown in figure 3 or 4. They shall be of uniform size, shall have minimum dimensions of 4.5 mm height and 2.6 mm width. Except as specified in 6.5.2, 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 1/10th of its travel, i.e. from 9 to 0, cause the advance of the next higher drum by one unit.

The difference between the nominal value of the capacity per revolution, 2 dm³ (or 0.071 ft³), and the actual capacity per revolution shall not exceed 5 % of the former.

6.5.2 Cubic metre index. The index for a meter with a badged rating in cubic metres shall conform to figure 3(a) 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 and the interval between scale divisions shall be constant throughout and not less than 1 mm.

The value chosen for one complete revolution of the test drum shall be a multiple of the nominal volume passed in one working cycle of the meter.

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, figure 3(b)). For the application of photo-electric meter testing techniques, the test drum may have a clearly distinguishable reference mark that shall not conceal the subdivisions or interfere with the accuracy of reading.

The window for the test drum shall have a projection (as in figure 3(c)) or a reference mark sufficiently thin to permit accurate and easy reading.

The recording numerals for submultiples of m^3 shall be surrounded by a red visor and separated from recording numerals in m^3 by a clear decimal marker.

6.5.3 Cubic feet index. The index for a meter with a badged rating in cubic feet shall conform to figure 4 and shall have a test dial, the diameter and subdivisions of which shall enable accurate readings to be made when the meter is working at the badged rating. The diameter of the dial shall be such that the tip of the test dial hand moves a minimum of 4.5 mm per 0.1 ft³ of gas passed.

The value chosen for one complete revolution of the test dial hand shall be a multiple of the nominal volume passed in one working cycle of the meter.

NOTE. The test dial as shown in figure 4 is to indicate the type, not necessarily the range. Alternatives to the test dial that give equivalent performance are acceptable (not illustrated).

The direction of rotation of the test dial hand shall be indicated and may be either clockwise or anticlockwise. The hand shall be red and shall be of sufficient length to indicate between the two concentric circles.

The test dial hand shall be sharply pointed and shall lie as close to the dial as practicable.

The index face shall have one '0' in red on the white background in line with the recording numerals.

6.6 Sealing gland assemblies. When dressed wads are used without any additional sealing material other than washers, the length of the sealing space in the index gland and the internal glands between compartments shall be at least 19 mm and 6 mm respectively. They shall, on assembly, be filled with wads under compression.

The design of all sealing glands shall be such as to satisfy the durability test specified in appendix E. All seals within any sealing gland shall be capable of replacement.

The nut of an index sealing gland shall tighten in the direction of rotation of the spindle passing through it. The nut shall be accessible from the outside of the gas-carrying compartment of the meter.

When dressed wads are used the diameter of the spindle passing through this sealing gland shall not exceed 4 mm and this spindle shall rotate truly on the axis of the gland.

6.7 Gear assembly. All gears shall engage correctly, and shall be designed to minimize wear. The assembly shall be rigidly secured within the meter and may be of either of the following types.

- (a) *Self-lubricated type.* The gears shall be either enclosed or provided with a dust cover.
- (b) *Non-self-lubricated type.* The gears shall be enclosed within a housing and lubricated with a grease that complies with the requirements of 5.9. It shall be possible to apply the grease while the housing is still fitted in the meter.

6.8 Diaphragm assembly. Each diaphragm shall be held in its chamber, preferably between two flanges. The design of the diaphragm discs shall be such that there is no free movement of the diaphragm between the discs at their periphery. Enclosed measuring chambers shall be capable of being repaired.

6.9 Bonding. Where failure of any adhesive would cause mechanical failure or leakage, additional mechanical means shall be provided to secure components.

6.10 Valves. Where valves of the straight type are used they shall be driven indirectly from the crank through a link arm so that the valve movement will be effectively in a straight line.

Where sliding guide members are used to control the position of the valve covers on the grids, materials shall be chosen to minimize corrosion and wear and consequent increase in mechanical pressure loss (see 10.3).

The resistance power factor shall not exceed 1.2, i.e. the size of the valves shall not be excessive in relation to the capacity per revolution of the meter mechanism. The method of calculating this factor is given in appendix G.

The ribs of the valve grids in contact with the valve covers shall allow for regrinding without an appreciable increase in the resistance power factor or causing it to exceed the value of 1.2.

The drive to the valves shall be so designed that the valve covers will not tilt if their contact surfaces become contaminated with oil or other liquid. To reduce the possibility of tilt, this drive for the valve covers should preferably be placed centrally and low on the covers.

6.11 Adjustment. Facilities for adjusting the registration of the meter shall be incorporated and an effective means of locking the adjustments shall be provided. Adjustments shall be conveniently accessible for repair purposes and shall be designed for easy resetting.

6.12 Bearings. Where used, bushes shall be fitted in a manner to avert wear to their anchorages or housings.

6.13 Shocks. The meter shall be designed to withstand normal transit shock.

7. Assembly and workmanship

7.1 General. The interior of the meter shall be free from loose solder, swarf, grinding material and other foreign matter. Any surplus soldering flux or spirit shall be removed.

7.2 Diaphragm assembly

7.2.1 The diaphragm assembly shall be gas tight. The diaphragms shall be undamaged and be evenly assembled. Grease or similar sealing medium shall not be applied to the diaphragm pan or chamber before or after assembling the diaphragm.

7.2.2 When assembled, the free diaphragm material at the end of each stroke shall be equally divided to ensure no undue resistance to the movement of the mechanism.

7.3 Valves. Oil or other liquid shall not be applied to valve covers or grids.

7.4 Internal security. The flag bracket, diaphragm disc and associated parts, where manufactured as separate components, shall be securely fitted together and locked. The method of securing the flag to the flag rod shall give adequate mechanical strength.

7.5 Gearing and index drive. The gearing and all index drive shafts shall be aligned and coupled to reduce cyclic

errors. The test drum or test dial hand shall rotate smoothly.

7.6 Lubrication. Non-self-lubricated linkage pivot bearings shall be lubricated with grease that complies with the requirements of 5.9.

8. Connections

8.1 General. The connections shall be on the top of the meter and shall be either one-pipe or two-pipe, as ordered.

8.2 Two-pipe meter. A two-pipe meter shall have two 1 in size connecting bosses complying with the requirements of BS 746; the alternative dimensions allowed in 5.2 of BS 746: 1967 are permissible.

The bosses shall be set on a line parallel to the back of the meter (see figure 1).

The face of the bosses shall be within 2° of the horizontal plane of the meter.

8.3 One-pipe meter. A one-pipe meter shall be fitted with a nut and liner (see figure 1).

The thread in the nut shall be G2 as specified in BS 2779.

The length of the liner provided above the top of the meter case shall be such that its sealing surface is just showing above the union nut when the nut is resting on the case.

9. Leakage

9.1 External. When tested by one of the methods described in appendix H the meter shall not leak externally when subjected to an internal air pressure of 50 mbar.

9.2 Internal. The meter shall register when air is passed through it at $14 \text{ dm}^3/\text{h}$ (or $0.5 \text{ ft}^3/\text{h}$).

For the purpose of this test, the volume of air passed, as indicated by the test drum or the test dial hand, shall be not less than that equivalent to one working cycle of the diaphragms.

10. Performance

10.1 Accuracy of registration. The meter shall be accurate within the limits $\pm 2\%$ at all rates between one-fiftieth of the badged rating and the badged rating when tested with air using the method given in appendix J.

10.2 Total mean pressure loss. The total mean pressure loss of the meter when air is passed through it at the badged rating shall not exceed 2 mbar when measured using the method given in appendix K.

10.3 Mechanical pressure loss. The mechanical pressure loss of the meter when air is passed through it at 1% of the badged rating shall not exceed 0.6 mbar when measured using the method given in appendix K.

10.4 Noise. The meter shall be quiet in operation.

11. Type tests

11.1 Life test. A life test shall be carried out on a sample meter in accordance with appendix L. After every 14 days, and after 100 days, the meter shall satisfy the requirements of clause 9.

In order to satisfy the requirements of 10.1, the registration of the meter, determined using the method given in appendix J, shall not change by more than 2.5% from the reading

shown by the test drum or the test dial hand at the commencement of the test; this change shall fall within the band of 4% established by the limits given in 10.1.

11.2 Pressure cycling test. The assembled unit shall be subjected to 2000 cycles at 30 cycles/h at pressures varying from 0 mbar to 345 mbar.

11.3 Mechanical strength

11.3.1 Over pressure. Notwithstanding the requirements of 9.1, the meter shall withstand a static internal air pressure of 250 mbar without permanent distortion or external leakage.

11.3.2 Two-pipe meter. The two-pipe meter shall withstand a load of 80 kg applied for 1 min, without shock, to any 100 mm square on the top of the case.

When the load is removed the meter shall not be deformed; it shall also not leak externally when subjected to the test specified in 9.1.

11.3.2.1 Connections. The meter shall not leak (see appendix H) when subjected to an internal air pressure of 50 mbar during and after the following tests, and the connection shall not have a permanent deflection of more than 2° .

(a) With the meter held firmly, apply a torque of 80 N m to each boss in turn.

(b) With the meter supported by one connection, apply a force of 500 N at right angles to the centre line of the meter at 40 mm up from the base on the side of the meter remote from the connection (see figure 5).

Repeat the test on the other connection.

NOTE. If, for convenience, the tests specified in (b) and in 11.3.3.1 are carried out with the meter in the horizontal plane, allowance should be made for its mass.

11.3.3 One-pipe meter. The one-pipe meter shall withstand a load of 80 kg applied for 1 min, without shock, to the face of the one-pipe liner.

When the load is removed the meter shall not be deformed, and it shall also not leak externally when subjected to the test required in 9.1.

11.3.3.1 Connection. The meter shall not leak (see appendix H) nor shall the connection deflect more than 3° when subjected to an internal air pressure of 50 mbar and a force applied as follows. After removal of the force, the meter shall remain sound and the connection shall not have a permanent deflection of more than 2° .

With the meter supported vertically, and solely by its connection, apply, without shock, a horizontal force of 450 N to the meter front 40 mm up from its base (see note to 11.3.2.1).

11.4 Heat and fire resistance

11.4.1 Heat resistance. When suspended in an ambient temperature of $120 \pm 2^\circ\text{C}$ for 15 min the meter shall not leak externally while subjected to an internal air pressure of 50 mbar.

11.4.2 Fire resistance. When a meter is ordered as 'fire resistant' it shall be fire resisting to half hour standard when tested by a method based on the standard time/temperature curve specified in BS 476: Part 8 and given in appendix M. Throughout the test the leakage rate of the meter shall not exceed $140 \text{ dm}^3/\text{h}$ (or $5 \text{ ft}^3/\text{h}$).

12. Finish

The external finish of the meter shall be dark grey gloss paint in accordance with BS 4800, 18 B 25 or BS 381C, no. 632 (unless otherwise ordered) and if used as a finish over a corrosion resistant material, e.g. tinned steel, it shall meet the following requirements.

(a) After 7 days from the time of painting, the painted surface (or sample part thereof), when tested using the method given in appendix N, shall resist penetration. Any scratch mark shall be free from jagged edges of a width greater than 1 mm.

(b) Following the previous test, the painted meter (or parts thereof), when tested using the method given in appendix P, shall not show evidence of lifting, blistering or deterioration of the paint finish after a minimum of 4 days exposure.

NOTE. Test (b) may be carried out on a second sample or on the original sample with the original scratch protected.

(c) After the 24 h required by the test specified in P.2, the paint shall again resist penetration as required by (a).

13. Transit cap

13.1 Two-pipe meter. The bosses shall be provided with non-sealing screwed caps to protect the threads and prevent the entry of foreign matter during transit and storage.

13.2 One-pipe meter. The connection shall be provided with a non-sealing, non-brittle screwed disc that shall retain the union nut in position and prevent the entry of foreign matter during transit and storage. A slot or other means shall be provided in the disc for removal.

14. Marking

14.1 Two-pipe meter. The meter shall be clearly and permanently marked with the direction of flow either by an arrow between the connections or the word INLET as near as possible to the inlet connection.

14.2 Escape badge. Unless otherwise ordered all meters shall be supplied with an escape badge (see figure 6) that is readable from the front. This badge may be of a transfer or self adhesive type; the words ESCAPES and GAS SERVICE CENTRE shall be in red, the others in black, and the background shall be yellow.

14.3 Identity marking. All meters shall bear the following marking, readable from the front of the meter:

- (a) manufacturer's name;
- (b) manufacturer's number;
- (c) year of manufacture;
- (d) badged rating in m^3/h (or ft^3/h).
- (e) capacity per revolution in dm^3 (or ft^3).

The marking shall be shown either on the index or in the form of an embossed metal badge or badges firmly and securely attached to the meter.

14.4 Synthetic diaphragms. A meter provided with synthetic diaphragms, unless otherwise ordered, shall carry the letter 'S' in black, of minimum height 25 mm, on a yellow background.

14.5 Property marking. Meters, unless otherwise ordered, shall in addition be clearly and permanently marked with the words GAS CORPORATION PROPERTY.

14.6 Special conditions. Where a meter is required for use with a gas outside the scope of this specification its suitability shall be verified with the manufacturer and the meter shall be appropriately marked in a permanent manner.

14.7 Badge fixing. Any badge fixed to the meter case shall be sealed around its edges to prevent the ingress of water. Any means used for securing a badge shall not pierce the case.

Section three. Prepayment meter

15. General requirements

15.1 Compliance. The prepayment meter shall comply with the requirements of sections one and two in addition to those of section three, except that notwithstanding the requirement of 6.5.1, paragraph 5, where part of a prepayment attachment partially obscures one side of the index, the viewing angle of 15° need not apply to that side.

15.2 Materials

15.2.1 The prepayment attachment cover and the cash box shall be of tinned steel sheet, or shall be of corrosion resistant material or have a painted surface affording equivalent protection. Where the cover and box are of tinned steel sheet or are painted, they shall comply with the requirements of 5.2.2 or 5.3, as appropriate.

15.2.2 The prepayment valve pad, if of leather or synthetic material, shall comply with the appropriate requirements of 5.4.

16. Design and dimensions

16.1 External dimensions. The assembled meter and prepayment attachment shall conform to the dimensions given in figure 1.

16.2 Prepayment attachment. The prepayment attachment and the cash box shall be on, and operable from, the front of the meter.

The prepayment attachment shall be firmly and securely attached to the meter case but shall be readily removable for repair or exchange purposes.

The prepaid indicator shall be protected by a window and shall be easily readable from the front of the meter.

16.3 Prepayment valve. When the prepayment valve is on the inlet of the meter, means shall be provided to prevent foreign matter falling on to it.

When the valve pad is of synthetic material it shall be moulded.

16.4 Sealing glands. Notwithstanding the requirements of 6.6, when dressed wads are used without any additional sealing material other than washers, the minimum length of sealing space in the prepayment valve and the attachment drive sealing glands shall be 10 mm and 19 mm respectively.

The spindle passing through the attachment drive stuffing box shall not exceed 5 mm diameter.

16.5 Mechanism

16.5.1 The prepaid indicator scale shall be marked in divisions of 5 m^3 (or 100 ft^3) and (except as stated below) subdivisions of 1 m^3 (or 25 ft^3); and shall indicate when FULL.

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The prepaid indicator scale and the mechanism to which it is attached shall be such that it is possible to prepay for at least 15 m³ (or 500 ft³) except that when the meter is for use with gas having a calorific value substantially higher than 40 MJ/m³ (or 1000 Btu/ft³) the prepaid indicator scale subdivisions and the prepayable volume shall be by arrangement between the manufacturer and the purchaser.

16.5.2 While a coin is in the coin carrier it shall not be possible to ratchet the mechanism to add to the prepaid volume.

16.5.3 A clutch or other overload device shall be provided to prevent damage to, or malfunctioning of, the mechanism should the meter continue to register when the prepayment valve has closed and the prepaid indicator scale registers zero.

16.5.4 A stop device in the mechanism shall prevent the insertion of further coins when the prepaid indicator shows FULL.

If a coin is contained in the mechanism when the prepaid indicator shows FULL it shall be possible to complete the insertion, and, if the coin is accepted by the mechanism, the full value of gas shall be obtained.

16.5.5 It shall not be possible to operate the mechanism with any current British coins other than by the coin for which it is designed and then only when it is presented in the proper manner.

16.5.6 The overall length of the coining lever, centrally pivoted, shall be between 45 mm and 67 mm and the total maximum torque applied to the ends of the lever to turn it, excluding coin ejection, shall not exceed 0.7 N m. The coin ejection shall not increase this torque beyond 1 N m.

16.6 Coin plate and carrier

16.6.1 Prepayment mechanisms shall accept and be operated satisfactorily by either 50p or £1 coins, depending on the design of the mechanism. For this purpose, test coins of the limiting dimensions given in table 1 shall be used.

Table 1. Coin dimensions

Coin	Diameter	Thickness
	mm	mm
50p	29.92*	2.39
	30.08*	2.51
£1	22.075	2.95
	22.625	3.25

*Measured between parallels.

Table 2. Coinplate setting increments and ranges

Coinplate	Coinplate colour (See 19.2)	Setting increment per coin		Range			
		m ³	ft ³	From		To	
				m ³	ft ³	m ³	ft ³
50p	Yellow	0.2	6	0.6	18	4.0 min.	150 min.
£1	Dark blue	0.4	12	1.2	36	8.0 min.	300 min.
	Light blue	0.2	6	0.6	18	4.0 min.	150 min.

16.6.2 Table 2 details the setting increments and ranges of the coinplates.

Any other setting increments and ranges of coinplates may be the subject of an arrangement between the manufacturer and the purchaser in special circumstances, e.g. in the case of use with a gas of calorific value substantially higher than 40 MJ/m³ (or 1000 Btu/ft³).

16.7 Cash box. The cash box shall be designed to deter unauthorized entry. It shall be free from sharp edges. It shall be provided with a pocket for an internal lock. The dimensions of the internal lock pocket shall be such that it shall accept a lock having the dimensions shown in figure 7.

The pocket shall be so placed as to permit the bolt to lock on its parallel section. The lock shall be a slide-in fit in the pocket.

The cash box shall hold, at least once in the course of three attempts, £150 in 50p pieces or a minimum of £300 in £1 pieces, the coins being presented through the coinplate slot. It shall be possible to extract the box containing this value of coins.

A withdrawing ring or equivalent means shall be provided for the easy withdrawal of the cash box. Such a ring or its equivalent shall withstand a horizontal pull of 250 N without damage or detachment.

16.8 Attachment cover. The attachment cover, if of tinned steel sheet, shall have a thickness of not less than 0.56 mm. If of other material, it shall have comparable strength.

It shall be securely fitted to the meter and designed to deter unauthorized access to the prepayment mechanism and to the contents of the cash box.

17. Performance

17.1 General. Tests for compliance with the performance requirements for the prepayment attachment shall be carried out using air. The tests shall be carried out using the coin(s) for which the mechanism is designed. These coins shall be in accordance with table 1.

17.2 Accuracy of prepaid volume. For one complete revolution of the quantity wheel or wheels (as applicable) the accuracy obtainable shall be within $\pm 2\%$ of the volume indicated by the meter index. The tolerances shall not be cumulative.

17.3 Mean pressure loss. The coinplate setting for this test shall be in accordance with the lowest appropriate setting in table 2 and the prepayment valve is allowed to close by the normal operation of the mechanism. The prepayment valve shall open when the mechanism is operated by a single coin. The mean pressure loss of the meter shall not exceed 1.25 mbar at an air rate of 1.5 m³/h (50 ft³/h).

17.4 Valve closing warning period. When tested by the method given in appendix Q, the warning period shall be not less than 3 min and not more than 10 min, except when the meter is for use with gas having a calorific value substantially higher than 40 MJ/m^3 (or 1000 Btu/ft^3).

The warning period for a meter for use with gas having a calorific value substantially higher than 40 MJ/m^3 (or 1000 Btu/ft^3) shall be by arrangement between the manufacturer and the purchaser.

17.5 Prepayment valve soundness. After the prepayment valve is allowed to close by the normal operation of the mechanism, the leakage rate shall not exceed $14 \text{ dm}^3/\text{h}$. If the meter continues to register at a rate below $14 \text{ dm}^3/\text{h}$ (or $0.5 \text{ ft}^3/\text{h}$) with an inlet air pressure of 30 mbar, the prepayment valve shall continue to close.

17.6 Test of coin insertion force. The amount of force required to insert the coin into the coin mechanism shall not exceed 10 N. The test shall be carried out with the coin mechanism fitted to the prepayment meter and insertion of the coin shall be by thumb. The meter shall be constrained to move only in the forward and backwards direction and a spring balance shall be used to measure the coin insertion force.

18. Finish

18.1 Paint. The painted meter, including the exposed parts of the attachment cover and cash box, shall comply with the requirements of clause 12.

It is preferable that the meter case behind the cash box should be painted.

19. Marking

19.1 Cash box. The front of either the cash box or attachment cover shall be provided with a transfer or self adhesive prepayment meter badge similar to that shown in figure 8. The lettering shall be black on a yellow background.

19.2 Coinplate. The marking on the coinplate shall be permanent. The 50p version shall include the words 'cubic metres (or cubic feet) per 50p' and the £1 version shall include the words 'cubic metres (or cubic feet) per one pound'.

The 50p coinplate shall be coloured yellow, e.g. in accordance with BS 381C, No. 310 'Primrose'.

The £1 coinplate shall be coloured either dark blue, e.g. in accordance with BS 381C, No. 105 'Oxford blue', or light blue, e.g. in accordance with BS 381C, No. 112 'Arctic blue', as indicated in table 2.

19.3 Setting position. The coinplate setting position shall be clearly indicated.

19.4 Prepaid indicator. The prepaid indicator shall indicate gas prepaid in cubic metres (or cubic feet).