BS 746:2014

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Specification for gas meter unions and adaptors

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 November 2014. It was prepared by Technical Committee GSE/25, *Gas meters*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

BS 746:2014 supersedes BS 746:2005+A1:2009, which is withdrawn.

Relationship with other publications

This standard specifies fittings to be used in conjunction with gas meters such as those specified by BS EN 1359 and BS EN 14236.

Information about this document

This is a full revision of the standard, and introduces the following principal changes.

- Dimensional changes have been made to ensure that the flat parts of the nuts engage directly on the flat parts of the liners such that even pressure is applied to the surfaces of the washers.
- The properties of the sealing washer have been redefined.
- Additional tests for fittings and washer performance have been added.
- Hexagonal nuts are now permitted as an alternative to octagonal nuts.

This document may be used in the procurement of fittings.

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.

1 Scope

This British Standard specifies requirements and test methods for unions and adaptors for the installation of low pressure gas meters. It is applicable to unions and adaptors for gas meters for use with 1st, 2nd and 3rd family gases at temperatures between –20 °C and +60 °C, up to a maximum operating pressure of 75 mbar [1)] and a maximum incidental pressure of 200 mbar. The gas tightness of the gas meter unions and adaptors is also specified.

*NOTE The tests specified in this standard are type tests, except for that specified in **4.2.3**.*

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 1936-1, *Undercuts and runouts for screw threads – Part 1: Inch screw threads*

BS 7371-6, *Coatings on metal fasteners – Part 6: Specification for hot dipped galvanized coatings*

BS EN 549, *Specification for rubber materials for gas appliances and gas equipment*

BS EN 1562, *Founding – Malleable cast irons*

BS EN 1652, *Copper and copper alloys – Plate, sheet, strip and circles for general purposes*

BS EN 1976, *Copper and copper alloys – Cast unwrought copper products*

BS EN 1982, *Copper and copper alloys – Ingots and castings*

BS EN 10088-3:2005, *Stainless steels – Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*

BS EN 10242, *Threaded pipe fittings in malleable cast iron*

BS EN 12164, *Copper and copper alloys – Rod for free machining purposes*

BS EN 12165, *Copper and copper alloys – Wrought and unwrought forging stock*

BS EN 12167, *Copper and copper alloys – Profiles and rectangular bar for general purposes*

BS EN 12168, *Copper and copper alloys – Hollow rod for free machining purposes*

BS EN 12329:2000, *Corrosion protection of metals – Electrodeposited coatings of zinc with supplementary treatment on iron or steel*

BS EN 12420, *Copper and copper alloys – Forgings*

BS EN ISO 27830, *Metallic and other inorganic coatings – Guidelines for specifying metallic and inorganic coatings*

PD 970, *Wrought steels for mechanical and allied engineering purposes – Requirements for carbon, carbon manganese and alloy hot worked or cold finished steels*

[1)] 1 bar = 105 N/m2 = 100 kPa.

3 Terms and definitions

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

3.1 adaptor
metal fitting for connecting a nut and liner to a boss of a different size

3.2 apparatus
construction of pipes, fittings, test points, etc., that is leak tight

3.3 boss
part of a fitting with an external screw thread

3.4 adaptor washer
elastomeric seal between a boss and an adaptor

3.5 liner
metal fitting with a flanged end to take union washer

3.6 nut
metal fitting with an internal screw thread

3.7 sealing disc
metal fitting fitted between a boss and a nut, with or without a liner, designed to close off the gasway

3.8 union
metal fitting comprising a boss and a liner using a washer and nut for gas tightness

3.9 union washer
elastomeric seal between a boss and a liner

4 Materials

4.1 Metal fittings

Metal fittings shall be made from one of the following materials:

a) brass for hot pressing, grade CW602N or CW617N to BS EN 12165 or BS EN 12420;

b) brass for casting, grade CC490K, CC491K, CC750S, CC754S or CC760S to BS EN 1982;

c) brass rod, grade CW602N, CW614N or CW617N to BS EN 12164, BS EN 12167 or BS EN 12168;

d) brass sheet and strip, grade CW508L to BS EN 1652;

e) copper, grade CR004A to BS EN 1976;

f) malleable cast iron to BS EN 1562;

g) carbon steel of any grade, with a content not exceeding 0.01% for lead, 0.06% for sulfur and 0.06% for phosphorous and which is suitable for welding, and forming or machining, as appropriate, to PD 970; or

h) austenitic stainless steel to BS EN 10088-3:2005, grades 1.4404 and 1.4541.

4.2 Elastomeric washers

4.2.1 General

Elastomeric washers shall be tested in accordance with BS EN 549. When tested in accordance with BS EN 549, the material from which elastomeric washers are made shall:

a) be of a hardness 91±3 IRHD [2)];

b) otherwise conform to BS EN 549, grade H3, A2.

4.2.2 Leak rate at low pressure

4.2.2.1 Leak rate

Each size of washer (see Table 8 and Table 9) shall be tested separately in accordance with **4.2.2.2**. When tested in accordance with **4.2.2.2**, the total leak rate of the assembly shall not exceed 0.2 L/h and the release torque of any union nut shall be not less than given in Table 1.

Table 1 **Initial and release torques**

Nominal size in	**Initial torque**	**Release torque**
½	—	—
¾	25	8
1	25	14
1¼	35	20
1½	45	28
2	100	37

4.2.2.2 Test method

4.2.2.2.1 Select 60 washers and divide these into four groups of 15. Erect four separate assemblies, each:

a) comprising 15 washers, nuts, liners and bosses, together with suitable apparatus that includes means of allowing the internal pressure of each assembly to be changed and measured; and

b) having an internal volume not exceeding 0.035 m^3.

Calculate the internal volume of each assembly.

4.2.2.2.2 Allow the apparatus, washers, nuts, liners and bosses to stabilize at (20 ±3) °C for a period of 1 h. Assemble the washers, nuts, liners and bosses and tighten each nut to the applicable torque given in Table 1.

[2)] International Rubber Hardness Degrees

4.2.2.2.3 Subject each assembly to the following environmental conditions, as applicable.

Assembly 1

Leave at room temperature of (20 ±3) °C for a period of not less than 4 h.

Assembly 2

Leave at room temperature of (20 ±3) °C for a period of 1 h, then place the assembly in an environmental chamber at a temperature of (–20 ±3) °C and leave for a period of not less than 4 h. Remove the assembly from the environmental chamber and leave the assembly at room temperature for a period of 2 h.

Assembly 3

Leave at room temperature of (20 ±3) °C for a period of 1 h, then place the assembly in an environmental chamber at a temperature of (60 ±3) °C and leave for a period of not less than 4 h. Remove the assembly from the environmental chamber and leave the assembly at room temperature of (20 ±3) °C for a period of 2 h.

Assembly 4

Leave at room temperature of (20 ±3) °C for a period of 1 h then place the assembly in an environmental chamber at a temperature of (–20 ±3) °C and leave for a period of not less than 4 h. Increase the temperature within the chamber to (60 ±3) °C, and once a temperature of (60 ±3) °C is reached maintain the temperature for a period of not less than 4 h. Remove the assembly from the environmental chamber; leave the assembly at room temperature of (20 ±3) °C for a period of 2 h.

NOTE If any of the groups are split into subgroups, due for example to the environmental chamber being unable to accommodate 15 samples, it is necessary to be able to show that the test conditions were the same for each subgroup.

4.2.2.2.4 After each assembly has undergone the environmental conditioning specified in **4.2.2.2.3**, set the pressure in the assembly to 75 mbar. Isolate the pressure supply, then observe a 1 min temperature stabilization. Take the pressure (P1) within the assembly and observe a test period of 2 min. Following this, take a second pressure reading (P2). Calculate the rate of leakage during the test period using the total volume of the assembly under test and the two pressures P1 and P2. The gauge used shall be a digital pressure gauge with a resolution of 2 dcp.

NOTE 1 When undertaking the gas tightness test, care has to be taken not to affect the gas tightness of the assembly, e.g. avoid tightening against it or otherwise clamping the joint.

NOTE 2 It is not necessary to test all groups simultaneously, only that 60 samples be tested in four groups.

4.2.3 One-off test for complete assembly with new washers

4.2.3.1 Each size of washer (see Table 8 and Table 9) shall be subjected separately, as part of a complete assembly, to the gas tightness test in **4.2.3.2.** When tested in accordance with **4.2.3.2**, no air bubbles shall be released from the assembly.

4.2.3.2 Select five new washers of each size and assemble the washers, nuts, liners and bosses. Tighten each nut to the applicable torque given in Table 1. Pressurize the assembly to 350 mbar and seal off the ends. Immerse the assembly in a water bath which is at ambient temperature and with a depth not exceeding 300 mm. Observe for a period of 30 s after any external trapped air has been dispersed.

5 Dimensions

5.1 General

Fittings shall conform to the appropriate dimensions specified in Table 3 to Table 10, as applicable.

NOTE Reference numbers have been added to Table 4 and Table 6 to Table 10 to assist the ordering and purchase of fittings.

5.2 Undercuts

The thread undercuts shall be Grade 1, Form A, Width 2*p* in accordance with BS 1936-1, except that undercut radius shall be ≤0.5 mm.

6 Machined surfaces

The machined surface of a fitting shall have:

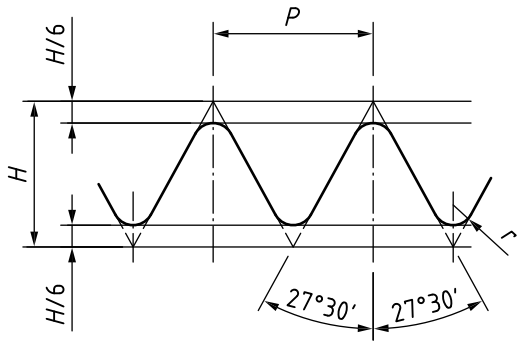
a) a concentricity tolerance on all threads and diameters of Ø 0.4 mm; and

b) a surface roughness of not more than 1.6 μm on the sealing faces.

7 Screw threads

Screw threads shall conform to the dimensions given in Table 11 and Table 12, and shall be of basic Whitworth form as illustrated in Figure 1.

Figure 1 **Basic Whitworth form**



Key

P Pitch

H 0.960491 *P*

r 0.137329 *P*

NOTE The Whitworth form of threads is one in which the angle between the flanks, measured in the axial plane, is 55°; one-sixth of the sharp triangle is truncated at top and bottom, the threads being rounded equally at crests and roots.

8 Strength of nuts and female adaptor ends

8.1 Nuts and adaptors shall be tested in accordance with **8.2.** When tested in accordance with **8.2**, nuts and the female ends of adaptors shall not fracture.

8.2 Screw a nut fitted with a liner or adaptor, but without the washer, onto a suitable boss component and tighten to the appropriate torque given in Table 2.

Table 2 **Torque for strength test**

Nominal size	Torque
in	N·m
½	125
¾	150
1	150
1¼	175
1½	200
2	200

9 Finish

Metal fittings shall be clean and free from scale.

Metal components, excluding meter bosses, conforming to **4.1**f) and **4.1**g) shall be protected from corrosion in accordance with a) and b), as applicable. The protective finish shall be such as to not affect the dimensional conformity of threads in Table 11 and Table 12 or the efficacy of sealing surfaces (as specified in Clause **10**).

a) Where a hot dipped zinc corrosion protection coating is applied to malleable cast iron conforming to **4.1**f), this shall conform to BS EN 10242 or BS 7371-6.

b) Where an electroplated zinc and chromate passivated corrosion protection coating is applied to carbon steel conforming to **4.1**g), the coating designation shall conform to BS EN 12329 and, as a minimum, be suitable for service condition 3, as defined in BS EN ISO 27830, or as agreed with the purchaser. The chromate conversion coating shall be trivalent, rather than hexavalent, and conform to the corrosion resistance test requirements for the corresponding chromate conversion code in BS EN 12329:2000, Table 2.

NOTE Requirements for the corrosion protection of meter bosses are given in gas meter standards, e.g. BS EN 1359 and BS EN 14236.

10 Marking

The nut, union, liner, boss and adaptor shall be marked with the following information.

a) The name, trade mark or other means of identification of the manufacturer.

b) The product reference and, where applicable, the batch of products to which it belongs.

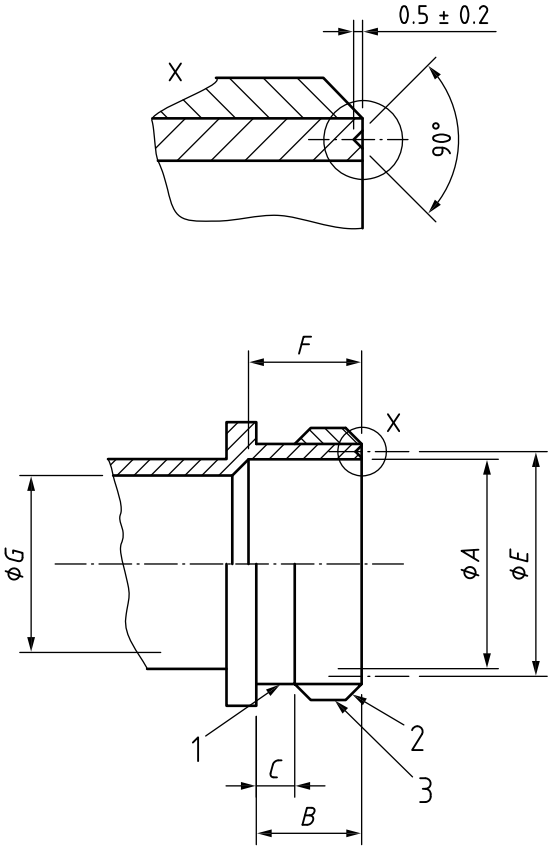
c) The number and date of this British Standard, i.e. BS 746:2014 [3)].

The washer shall be marked on either its internal or external surface, but not on the sealing surfaces, such that the washers' sealing properties are not affected. The marking shall be a permanent feature of the washer. The marking shall be obvious and be not less than 6 mm in width.

NOTE The marking is intended to distinguish washers conforming to BS 746:2014 from those made to earlier editions.

[3)] Marking BS 746:2014 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Table 3 **Boss dimensions**

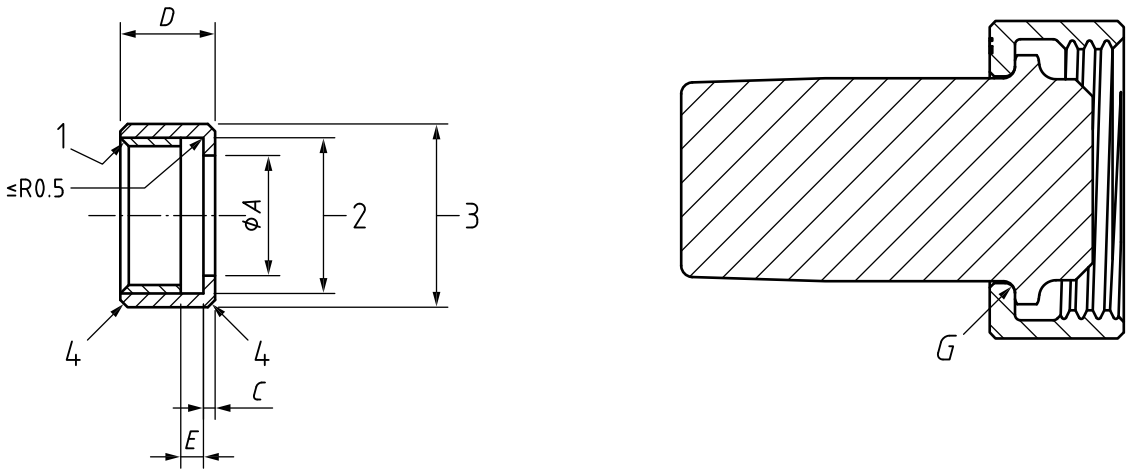


Key

1 ø *D* undercut
2 45° chamfer to remove threat start
3 Thread to Table 11

Nominal size	***A***	***B***	***C***	***D***		***E***	***F***	***G***	**Wall thickness**
in	mm ±0.2	mm ±0.4	mm ±0.4	max. mm	min. mm	mm ±0.3	min. mm	min. mm	min. mm
½	17.9	10.5	3	22.8	22.5	20.3	5	12.0	2.1
¾	21.4	12.5	4	26.1	25.8	23.7	5	17.5	2.1
1	27.0	14.5	5	33.5	33.1	30.2	5	22.0	2.8
1¼	36.5	16.5	5	42.8	42.4	39.6	6	30.0	2.8
1½	45.5	20.5	5	53.6	53.2	49.6	8	38.0	3.7
2	58.8	21.5	5	73.0	72.4	65.9	8	51.0	6.7

Table 4 **Nut dimensions**

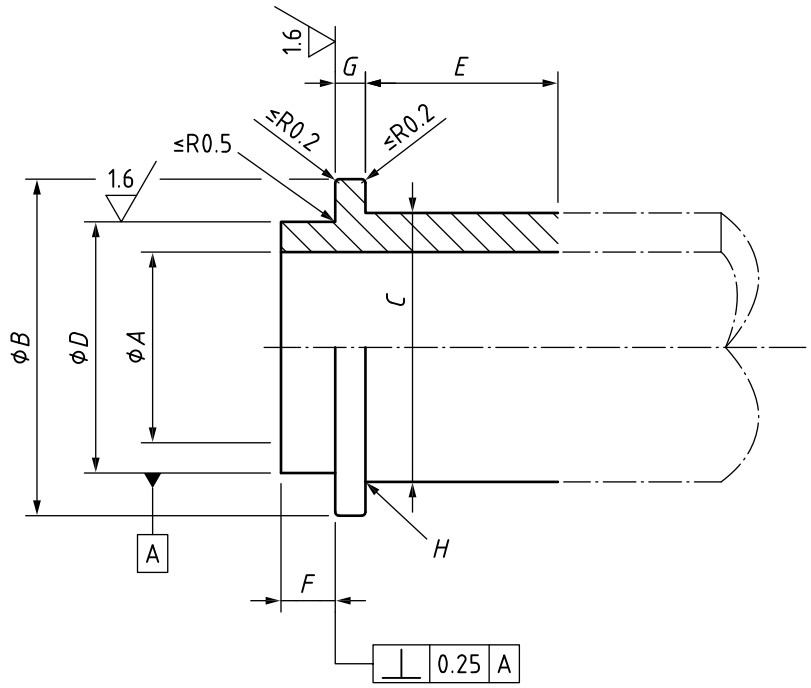


Key

1 45° chamfer to depth of thread
2 ø *F* undercut
3 *B AF* Hexagon/Octagon
4 Maximum chamfer 0.8 × 45°

Ref. no.	**Nominal size** in	***A*** mm +0.3 0	***B*** mm 0 –0.5	***C*** mm +0.5 0	***D*** mm ±0.4	***E*** Nominal mm ±0.4	***F*** max. mm	***F*** min. mm	***G*** *R* mm +0.15 0
101	½	19.6	30.5	2.3	14	3	25.4	25.1	—
102	¾	22.1	35.5	3.0	16	4	29.6	29.3	0.25
103	1	27.4	42.5	3.2	18	5	37.4	37.0	1.25
104	1¼	36.6	52.0	3.7	21	5	46.7	46.3	1.25
105	1½	46.4	65.5	3.7	25	5	57.6	57.2	1.25
106	2	61.9	85.5	4.5	28	5	77.2	76.6	1.25

Table 5 **Liner dimensions**

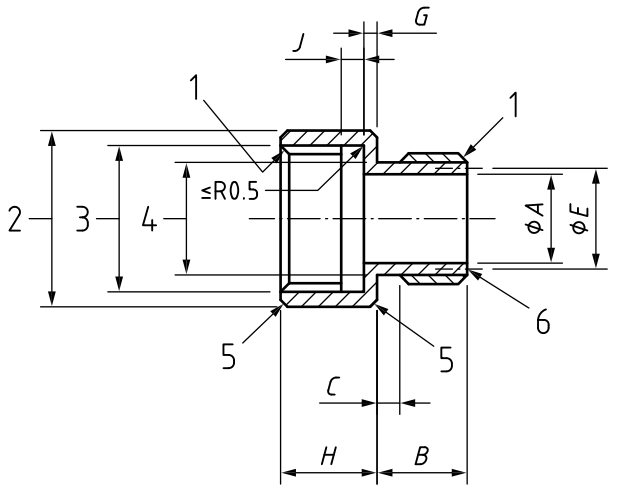


Nominal size in	***A*** mm ±0.4	***B*** mm 0 –0.3	***C*** mm 0 –0.3	***D*** mm 0 –0.2	***E*** [A)] min. mm	***F*** mm ±0.4	***G*** min. mm	***G*** max. mm	***H*** *R* max. mm
½	12	22.6	19.1	17.0	13	5	2.0	3.0	0.25
¾	17.5	25.9	21.6	20.5	15	5	2.0	3.5	0.5
1	22	33.3	26.9	26.1	17	5	2.0	4.0	1.5
1¼	30	42.6	36.1	35.6	20	6	2.5	4.5	1.5
1½	38	53.6	45.9	44.6	23	8	2.5	5.0	1.5
2	51	71.6	60.3	57.9	24	8	4.5	5.5	1.5

[A)] The maximum diameter *C* should be maintained for a minimum length *E* to enable the nut to be withdrawn to expose fully the washer.

Table 6 **Reducing adaptor dimensions**

Key
1 45° chamfer to depth of thread
2 *F AF* Hexagon/Octagon
3 ø *K* undercut
4 ø *D* undercut
5 Chamfer 0.8 × 45°
6 Groove as Table 3

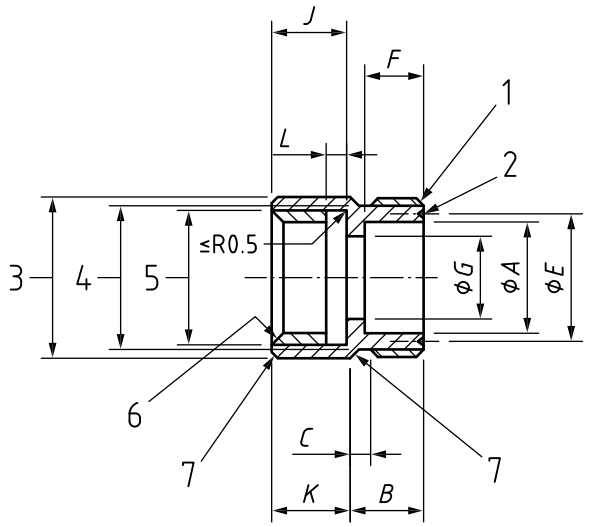


Ref no.	Nominal size Internal × External in	*A* mm ±0.4 0	*B* min. mm	*C* Nominal mm	*D* max. mm	*D* min. mm	*E* mm ±0.3	*F* max. mm	*F* min. mm	*G* mm +0.5 0	*H* mm ±0.4	*J* Nominal mm ±0.4	*K* mm +0.5 0
241	¾ × ½	17.9	10	3	22.9	22.6	20.3	35.3	34.8	3.0	13	4	29.3
242	1 × ½	17.9	10	3	22.9	22.6	20.3	42.5	41.8	3.2	16	5	37.0
243	1 × ¾	21.4	12	4	26.0	25.8	23.7	42.5	41.8	3.2	16	5	37.0
244	1¼ × ¾	21.4	12	4	26.0	25.8	23.7	52.0	51.5	3.7	18	5	46.3
245	1¼ × 1	27.0	14	5	33.5	33.1	30.2	52.0	51.5	3.7	18	5	46.3
246	1½ × 1¼	36.5	16	5	42.8	42.4	39.6	65.5	65.0	3.7	21	5	57.2
247	2 × ¾	21.4	12	4	26.0	25.8	23.7	85.8	84.7	4.5	24	5	76.7
248	2 × 1	27.0	14	5	33.5	33.1	30.2	85.8	84.7	4.5	24	5	76.7
249	2 × 1¼	36.5	16	5	42.8	42.4	39.6	85.8	84.7	4.5	24	5	76.7
250	2 × 1½	45.5	20	5	53.6	53.2	49.6	85.8	84.7	4.5	24	5	76.7

Table 7 **Increasing adaptor dimensions**

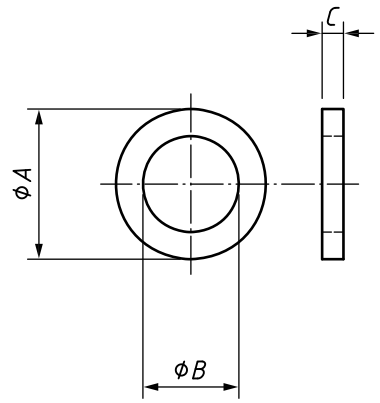
Key

1 45° chamfer to remove thread start
2 Groove as Table 3
3 *H AF* Hexagon/Octagon
4 ø *D* undercut
5 ø *M* undercut
6 45° chamfer to depth of thread
7 Chamfer 0.8 × 45°



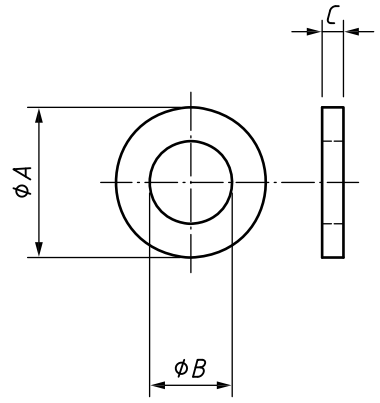
Ref. no.	Nominal size Internal × External in	*A* mm ±0.2	*B* min. mm	*C* Nominal mm ±0.4	*D* mm 0 –0.5	*E* mm ±0.3	*F* mm ±0.4	*G* mm ±0.4	*H* max. mm	*H* min. mm	*J* mm ±0.4	*K* mm ±0.5	*L* Nominal mm ±0.4	*M* max. mm	*M* min. mm
251	½ × ¾	21.4	12	4	26.0	23.8	8.7	17.9	30.1	29.6	10.0	13	3	25.4	25.1
252	½ × 1	27.0	14	5	33.5	30.2	10.3	17.9	30.1	29.6	10.0	10	3	25.4	25.1
253	¾ × 1	27.0	14	5	33.5	30.2	9.5	22.0	38.0	37.5	11.0	11	4	29.6	29.3
254	¾ × 1¼	36.5	16	5	42.8	39.6	9.5	22.0	47.0	46.5	11.0	11	4	29.6	29.3
255	1 × 1¼	36.5	16	5	42.8	39.6	9.5	27.0	47.0	46.5	13.5	11	5	37.4	37.0
256	1 × 1½	45.5	20	5	53.6	49.5	13.5	27.0	60.4	59.5	13.5	13	5	37.4	37.0
257	1¼ × 1½	45.5	20	5	53.6	49.5	13.5	37.0	60.4	59.5	15.0	13	5	46.6	46.2

Table 8 **Union washer dimensions**



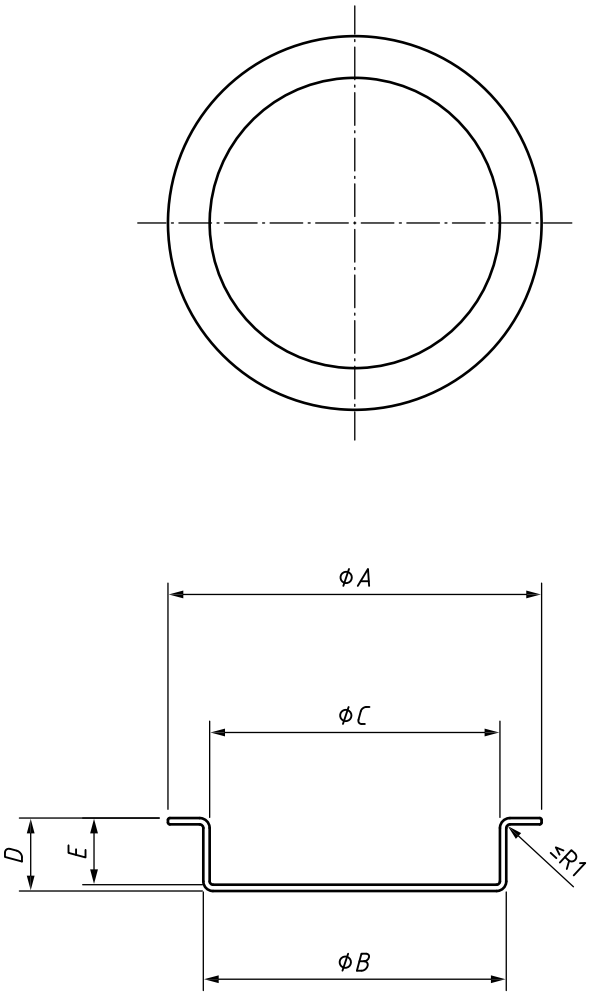
Ref no.	Nominal size in	*A* mm ±0.4	*B* mm ±0.3	*C* mm ±0.2
331	½	22.6	16.5	2.4
332	¾	25.8	20.0	2.4
333	1	32.3	25.6	2.4
334	1¼	42.5	35.1	2.4
335	1½	53.6	44.1	2.4
336	2	71.4	57.4	3.2

Table 9 **Adaptor washer dimensions**



Ref. no.	Nominal size in	*A* mm ±0.5	*B* mm ±0.5	*C* mm ±0.2
340	½	25.0	17.9	2.4
341	¾	29.0	21.4	3.2
342	1	36.5	27.0	3.2
343	1¼	45.5	36.5	3.2
344	1½	56.5	45.5	3.2
345	2	76.0	58.8	3.2

Table 10 **Sealing disc dimensions**



≥ø *C* shall be maintained for a length of ≥*E*. (From top of flange to centreline of bend radius.)
Minimum wall thickness shall be 0.3 mm.

Ref. no.	**Nominal Size** in	***A*** mm 0 –0.3	***B*** max. mm	***C*** min. mm	***D*** max. mm	***E*** min. mm
841	½	22.6	17.75	17.05	6.5	5.5
842	¾	25.9	21.25	20.55	6.5	5.5
843	1	33.3	26.85	26.15	6.5	5.5
844	1¼	42.6	36.35	35.65	7.5	6.5
845	1½	53.6	45.35	44.65	9.5	8.5
846	2	71.6	58.65	57.95	9.5	8.5

Table 11 **External thread dimensions**

Nominal size	Threads per inch	Pitch	Major diameter		Effective diameter		Minor diameter	
			max.	min.	max.	min.	max.	min.
in		mm	mm	mm	mm	mm	mm	mm
½	18	1.411	25.045	24.770	24.140	23.925	23.235	22.895
¾	12	2.117	29.235	28.925	27.880	27.640	26.520	26.135
1	11	2.309	36.905	36.565	35.425	35.170	33.950	33.535
1¼	11	2.309	46.230	45.890	44.750	44.495	43.270	42.855
1½	11	2.309	57.150	56.795	55.670	55.400	54.195	53.765
2	11	2.309	76.580	76.215	75.100	74.820	73.625	73.185

Table 12 **Internal thread dimensions**

Nominal size	Threads per inch	Pitch	Major diameter	Effective diameter		Minor diameter	
			min.	max.	min.	max.	min.
in		mm	mm	mm	mm	mm	mm
½	18	1.411	25.095	24.405	24.190	23.780	23.285
¾	12	2.117	29.335	28.220	27.980	27.225	26.625
1	11	2.309	37.010	35.785	35.530	34.735	34.050
1¼	11	2.309	46.330	45.105	44.850	44.060	43.375
1½	11	2.309	57.300	56.095	55.825	55.030	54.345
2	11	2.309	76.735	75.535	75.255	74.460	73.775

NOTE The fittings to which the above screw threads are applied are thin walled and of relatively large diameter. This table includes an allowance for possible distortion.

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

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