

Specification for

Metric dimensions of toroidal sealing rings (**'O'**-rings) and their housings

ICS 21.140; 21.180

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This British Standard, having been prepared under the direction of the Mechanical Engineering Standards Committee, was published under the authority of the board of BSI and comes into effect on 30 April 1982

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Foreword

This British Standard is published by BSI Standards Limited, under licence from the British Standards Institution, and came into effect on 30 April 1982.

This British Standard has been prepared under the direction of the Mechanical Engineering Standards Committee. It revises and supersedes the 1974 edition which is now withdrawn.

BS 4518:1982+A2:2014 supersedes BS 4518:1982, incorporating Amendment No. 1:1984, which is withdrawn.

Text introduced or altered by Amendment No. 2 is indicated in the text by tags **A2** **A2**. Minor editorial changes are not tagged. Previous amendments are not indicated.

Amendment No. 2 introduces the following principal changes:

- a) Standards references have been updated.
- b) Some additional preferred sizes in accordance with BS ISO 3320 have been cross-referred to in Table 1, Table 7, Table 8 and Table B.1.

The first edition of the standard, published in 1969, introduced a new range of metric sizes for elastomeric toroidal sealing rings which were based upon European practices. In order to permit the introduction of additional sizes, a reference numbering system, based upon the “O”-ring internal diameter and section diameter, was adopted.

The first revision of the standard, published in 1974, introduced a further 4.1 mm diameter of “O”-ring section. The opportunity was also taken to improve the presentation of the information provided.

In this second revision, additional sizes have been introduced to cater for the preferred range of cylinder bores and piston rod diameters specified in BS ISO 3320. Groove dimensions for pneumatic applications have also been added. In addition, two charts have been included in Appendix A to aid selection of appropriate seals for given applications.

Previous editions of this standard contained information on the limits for surface imperfections of “O”-rings. These are now covered by BS ISO 3601-3.

Because of the lack of demand for the 4.1 mm section rings which were introduced in the 1974 edition, requirements for these rings are not included in this revision. However, details of the rings are given in Appendix B for information if required for replacement purposes.

It is stressed that the dimensions specified in this standard, although providing the necessary basis for standardization in the manufacture and application of “O”-rings, should not be regarded as providing all the information required for design purposes. Attention is drawn to the desirability of consultation between users and manufacturers of “O”-rings, when a particular application of this type of seal is being considered.

It is recognized that inch series “O”-rings will continue to be required. Requirements for such “O”-rings are specified in BS ISO 3601-1 and BS ISO 3601-2.

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.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 28, an inside back cover 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

This British Standard specifies the dimensions of elastomeric “O”-rings which are toroidal in shape and which are used for sealing components against ingress or egress of fluids under dynamic and static conditions.

The standard also specifies the shape and dimensions of five types of associated housing grooves for the rings when used at pressures not normally exceeding 100 bar¹⁾.

NOTE At pressures exceeding 100 bar, or when the diametral clearances of the grooves are in excess of those specified in this standard, it is recommended that these “O”-rings should be used in conjunction with anti-extrusion back-up rings. Spiral anti-extrusion back-up rings and their housings, the dimensions of which are specified in BS 5106, are suitable for pressures up to approximately 200 bar.

Two charts are provided in Appendix A to aid the selection of “O”-rings.

2 References

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

3 “O”-rings

3.1 Dimensions. The dimensions and the tolerances of the “O”-rings shall be in accordance with Table 1 ^{A2} (see Figure 1) ^{A2}.

3.2 Surface imperfections. The acceptable limits for surface imperfections shall be such that they do not affect the sealing properties of the sealing ring.

NOTE ^{A2} BS ISO 3601-3 ^{A2} specifies acceptable limits of defined and assessed imperfections on elastomeric toroidal sealing rings.

3.3 Material. “O”-rings shall be manufactured from elastomeric materials that are compatible with the fluid contained by the seal.

NOTE “O”-rings are normally supplied in nitrile rubber, but may also be produced in other elastomers, e.g. silicone, fluorocarbon.

3.4 Reference number. The “O”-rings shall be identified by a reference number consisting of the ring’s inside diameter followed by its section diameter, with the decimal points omitted.

4 Housing grooves

4.1 General. The profile, dimensions and tolerances of the grooves shall be as specified in Table 1 and the following, according to type of sealing application:

- static diametral sealing, hydraulic and pneumatic*, Figure 2 and Table 2;
- static face sealing, hydraulic and pneumatic*, Figure 3 and Table 5;
- static triangular housing sealing, hydraulic and pneumatic*, Figure 4 and Table 6;
- dynamic diametral sealing, hydraulic only*, Figure 2 and Table 3;
- dynamic diametral sealing, pneumatic only*, Figure 2 and Table 4.

4.2 Tolerance of nominal housing diameter. The tolerance associated with diameter d_1 or D_1 ²⁾ (Table 1) shall be chosen with respect to the tolerance specified for radial depth F (Table 2, Table 3 and Table 4) and an achievable tolerance for groove diameter d_3 or D_3 , in accordance with Figure 2.

4.3 Extrusion gap. To ensure that an acceptable extrusion gap is maintained the tolerance of the cylinder or shaft mating part diameter, d_2 or D_2 , shall be selected with respect to the tolerance of the nominal housing diameter, d_1 or D_1 , chosen in accordance with 4.2, and the maximum total diametral clearance G (Table 2, Table 3, Table 4 and Table 6), in accordance with Figure 2 and Figure 4.

4.4 Lead-in chamfer. To facilitate assembly and to prevent damage to “O”-rings, components over which the “O”-ring passes during fitting shall incorporate an adequate smooth lead-in chamfer. All associated corners shall be radiused.

Details are shown in Figure 2 and dimensions in Table 2, Table 3 or Table 4.

¹⁾ 1 bar = 10² kPa.

²⁾ ^{A2} ISO 4394-1 ^{A2} specifies tolerances and classes of surface texture for the inside diameter of tubular steel cylinder barrels.

4.5 Surface texture. The surface texture of the housing groove and associated surfaces³⁾ shall not exceed the values given below and shown in Figure 2, Figure 3 and Figure 4.

Dynamic sealing surfaces, $0.4 \mu\text{m } R_a^{3)}$

Static sealing surfaces, $0.8 \mu\text{m } R_a^{3)}$

Non-sealing surfaces, $1.6 \mu\text{m } R_a^{3)}$

NOTE Further information on recommendations for “O”-ring housing surface finishes can be found in BS ISO 3601-2.

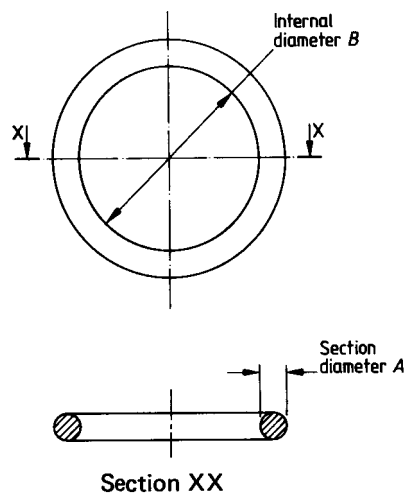


Figure 1 — Toroidal sealing ring (“O”-ring)

³⁾ Surface texture in accordance with BS 1134.

Table 1 — Dimensions of “O”-rings (see Figure 1) and related nominal housing diameters for diametral sealing (see Figure 2)

All dimensions in millimetres

“O”-ring ref. no (see note)	“O”-ring dimensions				Nominal housing dimensions (see Figure 2 and 4.1)	
	Internal diameter B	Internal diameter tolerance	Section diameter A	Section diameter tolerance	Shaft diameter d_1	Cylinder diameter D_1
0031-16	3.1	± 0.15	1.6	± 0.08	3.5	6
0041-16	4.1		1.6		4.5	7
0051-16	5.1		1.6		5.5	8 ^b
0061-16	6.1		1.6		6.5	9
0071-16	7.1		1.6		7.5	10 ^b
0081-16	8.1		1.6		8.5	11
0091-16	9.1		1.6		9.5	12 ^b
0101-16	10.1	± 0.2	1.6	± 0.08	10.5	13
0111-16	11.1		1.6		11.5	14
0121-16	12.1		1.6		12.5	15
0131-16	13.1		1.6		13.5	16 ^b
0141-16	14.1		1.6		14.5	17
0151-16	15.1		1.6		15.5	18
0161-16	16.1		1.6		16.5	19
0171-16	17.1		1.6		17.5	20 ^b
0181-16	18.1	± 0.25	1.6	± 0.08	18.5	21
0191-16	19.1		1.6		19.5	22
0221-16	22.1		1.6		22.5	25 ^b
0251-16	25.1		1.6		25.5	28
0271-16	27.1		1.6		27.5	30
0291-16	29.1		1.6		29.5	32 ^b
0321-16	32.1	± 0.3	1.6	± 0.08	32.5	35
0351-16	35.1		1.6		35.5	38
0371-16	37.1		1.6		37.5	40 ^b
0036-24 ^a	3.6	± 0.15	2.4	± 0.08	4 ^b	8 ^b
0046-24 ^a	4.6		2.4		5 ^b	9
0056-24 ^a	5.6		2.4		6 ^b	10 ^b
0066-24 ^a	6.6		2.4		7	11
0076-24 ^a	7.6		2.4		8 ^b	12 ^b
0086-24 ^a	8.6		2.4		9	13
0096-24 ^a	9.6		2.4		10 ^b	14
0106-24 ^a	10.6	± 0.2	2.4	± 0.08	11	15
0116-24 ^a	11.6		2.4		12 ^b	16 ^b
0126-24 ^a	12.6		2.4		13	17
0136-24 ^a	13.6		2.4		14 ^b	18
0146-24 ^a	14.6		2.4		15	19
0156-24 ^a	15.6		2.4		16 ^b	20 ^b
0166-24 ^a	16.6		2.4		17	21
0176-24 ^a	17.6		2.4		18 ^b	22
0186-24	18.6	± 0.25	2.4	± 0.08	19	23
0196-24	19.6		2.4		20 ^b	24
0206-24	20.6		2.4		21	25 ^b
0216-24	21.6		2.4		22 ^b	26
0246-24	24.6		2.4		25 ^b	29
0276-24	27.6		2.4		28 ^b	32 ^b
0296-24	29.6		2.4		30	34

NOTE Reference number consists of ring internal diameter followed by ring section diameter with decimal points omitted.

^a A_2 Recommended for dynamic sealing. A_2

^b Preferred size in accordance with A_2 BS ISO 3320 A_2 .

Table 1 — Dimensions of “O”-rings (see Figure 1) and related nominal housing diameters for diametral sealing (see Figure 2)

All dimensions in millimetres

“O”-ring ref. no (see note)	“O”-ring dimensions				Nominal housing dimensions (see Figure 2 and 4.1)	
	Internal diameter <i>B</i>	Internal diameter tolerance	Section diameter <i>A</i>	Section diameter tolerance	Shaft diameter <i>d</i> ₁	Cylinder diameter <i>D</i> ₁
0316-24	31.6	± 0.3	2.4	± 0.08	32 ^b	36
0346-24	34.6		2.4		35	39
0356-24	35.6		2.4		36 ^b	40 ^b
0376-24	37.6		2.4		38	42
0396-24	39.6		2.4		40 ^b	44
0416-24	41.6		2.4		42	46
0446-24	44.6		2.4		45 ^b	49
0456-24	45.6		2.4		46	50 ^b
0476-24	47.6		2.4		48	52
0496-24	49.6		2.4		50 ^b	54
0516-24	51.6	± 0.4	2.4	± 0.08	52	56
0546-24	54.6		2.4		55	59
0556-24	55.6		2.4		56 ^b	60 ^b $\sqrt{A_2}$
0576-24	57.6		2.4		58	62
0586-24	58.6		2.4		59	63 ^b
0596-24	59.6		2.4		60	64
0616-24	61.6		2.4		62	66
0626-24	62.6		2.4		63 ^b	67
0646-24	64.6		2.4		65	69
0676-24	67.6		2.4		68	72
0696-24	69.6		2.4		70 ^b	74
0195-30 ^a	19.5	± 0.25	3.0	± 0.1	20 ^b	25 ^b
0215-30 ^a	21.5		3.0		22 ^b	27
0225-30 ^a	22.5		3.0		23	28
0245-30 ^a	24.5		3.0		25 ^b	30
0255-30 ^a	25.5		3.0		26	31
0265-30 ^a	26.5		3.0		27	32 ^b
0275-30 ^a	27.5		3.0		28 ^b	33
0295-30 ^a	29.5		3.0		30	35
0315-30 ^a	31.5	± 0.3	3.0	± 0.1	32 ^b	37
0325-30 ^a	32.5		3.0		33	38
0345-30 ^a	34.5		3.0		35	40 ^b
0355-30 ^a	35.5		3.0		36 ^b	41
0365-30 ^a	36.5		3.0		37	42
0375-30 ^a	37.5		3.0		38	43
0395-30 ^a	39.5		3.0		40 ^b	45
0415-30 ^a	41.5		3.0		42	47
0425-30 ^a	42.5		3.0		43	48
0445-30 ^a	44.5		3.0		45 ^b	50 ^b
0495-30	49.5		3.0		50 ^b	55

NOTE Reference number consists of ring internal diameter followed by ring section diameter with decimal points omitted.

^a $\sqrt{A_2}$ Recommended for dynamic sealing. $\sqrt{A_2}$

^b Preferred size in accordance with $\sqrt{A_2}$ BS ISO 3320 $\sqrt{A_2}$.

Table 1 — Dimensions of “O”-rings (see Figure 1) and related nominal housing diameters for diametral sealing (see Figure 2)

All dimensions in millimetres

“O”-ring ref. no (see note)	“O”-ring dimensions				Nominal housing dimensions (see Figure 2 and 4.1)	
	Internal diameter <i>B</i>	Internal diameter tolerance	Section diameter <i>A</i>	Section diameter tolerance	Shaft diameter <i>d</i> ₁	Cylinder diameter <i>D</i> ₁
0545-30	54.5	± 0.4	3.0	± 0.1	55	^{A2} 60 ^b ^{A2}
0555-30	55.5		3.0		56 ^b	61
0575-30	57.5		3.0		58	63 ^b
0595-30	59.5		3.0		60	65
0625-30	62.5		3.0		63 ^b	68
0645-30	64.5		3.0		65	70
0695-30	69.5		3.0		70 ^b	75
0745-30	74.5		3.0		75	80 ^b
0795-30	79.5		3.0		80 ^b	85
0845-30	84.5	± 0.5	3.0	± 0.1	85	90
0895-30	89.5		3.0		90 ^b	95
0945-30	94.5		3.0		95	100 ^b
0995-30	99.5		3.0		100 ^b	105
1045-30	104.5		3.0		105	110
1095-30	109.5		3.0		110 ^b	115
1145-30	114.5		3.0		115	120
1195-30	119.5		3.0		120	125 ^b
1245-30	124.5	± 0.6	3.0	± 0.1	125 ^b	130
1295-30	129.5		3.0		130	135
1345-30	134.5		3.0		135	140
1395-30	139.5		3.0		140 ^b	145
1445-30	144.5		3.0		145	150
1495-30	149.5		3.0		150	155
1545-30	154.5		3.0		155	160 ^b
1595-30	159.5		3.0		160 ^b	165
1645-30	164.5		3.0		165	170
1695-30	169.5		3.0		170	175
1745-30	174.5		3.0		175	180
1795-30	179.5		3.0		180 ^b	185

NOTE Reference number consists of ring internal diameter followed by ring section diameter with decimal points omitted.

^a ^{A2} Recommended for dynamic sealing. ^{A2}

^b Preferred size in accordance with ^{A2} BS ISO 3320 ^{A2}.

Table 1 — Dimensions of “O”-rings (see Figure 1) and related nominal housing diameters for diametral sealing (see Figure 2)

All dimensions in millimetres

“O”-ring ref. no (see note)	“O”-ring dimensions				Nominal housing dimensions (see Figure 2 and 4.1)	
	Internal diameter <i>B</i>	Internal diameter tolerance	Section diameter <i>A</i>	Section diameter tolerance	Shaft diameter <i>d</i> ₁	Cylinder diameter <i>D</i> ₁
1845-30	184.5	± 0.8	3.0	± 0.1	185	190
1895-30	189.5		3.0		190	195
1945-30	194.5		3.0		195	200 ^b
1995-30	199.5		3.0		200 ^b	205
2095-30	209.5		3.0		210	215
2195-30	219.5		3.0		220 ^b	225
2295-30	229.5		3.0		230	235
2395-30	239.5		3.0		240	245
2445-30	244.5		3.0		245	250 ^b
2495-30	249.5		3.0		250 ^b	255
0443-57 ^a	44.3	± 0.3	5.7	± 0.12	45 ^b	55
0453-57 ^a	45.3		5.7		46	56
0493-57 ^a	49.3		5.7		50 ^b	60 ^b $\sqrt{A_2}$
0523-57 ^a	52.3	± 0.4	5.7	± 0.12	53	63 ^b
0543-57 ^a	54.3		5.7		55	65
0553-57 ^a	55.3		5.7		56 ^b	66
0593-57 ^a	59.3		5.7		60	70
0623-57 ^a	62.3		5.7		63 ^b	73
0643-57 ^a	64.3		5.7		65	75
0693-57 ^a	69.3		5.7		70 ^b	80 ^b
0743-57 ^a	74.3		5.7		75	85
0793-57 ^a	79.3		5.7		80 ^b	90
0843-57 ^a	84.3	± 0.5	5.7	± 0.12	85	95
0893-57 ^a	89.3		5.7		90 ^b	100 ^b
0943-57 ^a	94.3		5.7		95	105
0993-57 ^a	99.3		5.7		100 ^b	110
1043-57 ^a	104.3		5.7		105	115
1093-57 ^a	109.3		5.7		110 ^b	120
1143-57 ^a	114.3		5.7		115	125 ^b
1193-57 ^a	119.3		5.7		120	130
1243-57 ^a	124.3	± 0.6	5.7	± 0.12	125 ^b	135
1293-57 ^a	129.3		5.7		130	140
1343-57	134.3		5.7		135	145
1393-57 ^a	139.3		5.7		140 ^b	150
1443-57 ^a	144.3		5.7		145	155
1493-57	149.3		5.7		150	160 ^b
1543-57	154.3		5.7		155	165
1593-57	159.3		5.7		160 ^b	170
1643-57	164.3		5.7		165	175
1693-57	169.3		5.7		170	180
1743-57	174.3		5.7		175	185
1793-57	179.3		5.7		180 ^b	190

NOTE Reference number consists of ring internal diameter followed by ring section diameter with decimal points omitted.

^a $\sqrt{A_2}$ Recommended for dynamic sealing. $\sqrt{A_2}$

^b Preferred size in accordance with $\sqrt{A_2}$ BS ISO 3320 $\sqrt{A_2}$.

Table 1 — Dimensions of “O”-rings (see Figure 1) and related nominal housing diameters for diametral sealing (see Figure 2)

All dimensions in millimetres

“O”-ring ref. no (see note)	“O”-ring dimensions				Nominal housing dimensions (see Figure 2 and 4.1)	
	Internal diameter <i>B</i>	Internal diameter tolerance	Section diameter <i>A</i>	Section diameter tolerance	Shaft diameter <i>d</i> ₁	Cylinder diameter <i>D</i> ₁
1843-57	184.3	± 0.8	5.7	± 0.12	185	195
1893-57	189.3		5.7		190	200 ^b
1943-57	194.3		5.7		195	205
1993-57	199.3		5.7		200 ^b	210
2093-57	209.3		5.7		210	220
2193-57	219.3		5.7		220 ^b	230
2293-57	229.3		5.7		230	240
2393-57	239.3		5.7		240	250 ^b
2493-57	249.3		5.7		250 ^b	260
2593-57	259.3	± 1.0	5.7	± 0.12	260	270
2693-57	269.3		5.7		270	280
2793-57	279.3		5.7		280 ^b	290
2893-57	289.3		5.7		290	300
2993-57	299.3		5.7		300	310
3093-57	309.3	± 1.5	5.7	± 0.12	310	320 ^b
3193-57	319.3		5.7		320 ^b	330
3393-57	339.3		5.7		340	350
3593-57	359.3		5.7		360 ^b	370
3793-57	379.3		5.7		380	390
3893-57	389.3		5.7		390	400 ^b
3993-57	399.3		5.7		400 ^b $\sqrt{A_2}$	410
NOTE Reference number consists of ring internal diameter followed by ring section diameter with decimal points omitted.						
^a $\sqrt{A_2}$ Recommended for dynamic sealing. $\sqrt{A_2}$						
^b Preferred size in accordance with $\sqrt{A_2}$ BS ISO 3320 $\sqrt{A_2}$.						