

Specification for

Dimensions of toroidal sealing rings ("O"-rings) and their housings (inch series)

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- British Compressed Air Society
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- British Hydromechanics Research Association
- British Industrial Truck Association
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Foreword

This revised British Standard has been prepared under the direction of the Machinery and Components Standards Policy Committee. It revises and supersedes BS 1806:1962 which is now withdrawn.

In view of the continued strong demand for an inch series of “O”-rings it has been decided to revise this standard rather than prepare an extensive amendment of the 1962 edition. Inch dimensions have been retained throughout and metric conversions should be based on BS 350.

In this revision the range of “O”-rings has been extended to embrace all the seals listed in British Standard M 48 and also a majority of the sizes listed in SAE Aerospace Standard AS 568A:1984¹⁾. The dimensional tolerances on the internal diameter *B* have in many cases also been increased to reflect current manufacturing practice.

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.

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.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, 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⁾ Aerospace size standard for “O”-rings, published by the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096, USA.

1 Scope

This British Standard specifies the dimensions of elastomeric “O”-rings which are toroidal in shape and 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 1 500 lbf/in² (100 bar²⁾). Limits for imperfections are not specified in this standard but information is given in the note to clause 2.

NOTE 1 At pressures exceeding 1 500 lbf/in², or when the diametral clearances of the grooves are in excess of those specified in this standard, it is recommended that “O”-rings should be used in conjunction with anti-extrusion back-up rings.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 “O”-rings

NOTE **Surface imperfections.** It is important that “O”-ring surface imperfections should be such that they do not affect the sealing properties. Acceptable limits of defined and assessed imperfections on elastomeric toroidal sealing rings are specified in BS 6442.

2.1 Dimensions

The dimensions and the tolerances of the “O”-rings shall be in accordance with Table 1 to Table 5.

2.2 Material

“O”-rings shall be manufactured from elastomeric materials that are compatible with the fluid contained by the seal, i.e. that the properties of the material are not altered by chemical interaction.

NOTE 1 Means of assessing the compatibility of hydraulic fluids with elastomeric materials are specified in BS 4832.

NOTE 2 “O”-rings are normally supplied in nitrile rubber but may also be produced in other elastomers, e.g. silicone, fluorocarbon.

2.3 Seal size number

“O”-rings shall be identified by the seal size numbers given in Table 1 to Table 5.

3 Housing grooves

3.1 General

The profiles, dimensions and tolerances of the housing grooves shall be according to the type of sealing application as follows:

- a) *diametral sealing*, Figure 2(a) and Figure 2(b) and Table 6;
- b) *static face sealing*, Figure 3 and Table 7;
- c) *triangular housing of static face sealing*, Figure 4 and Table 8.

3.2 Tolerances of nominal housing diameter

The tolerances associated with diameter C or D ³⁾ shall be calculated with respect to the tolerance specified for radial depth F given in Table 6 and an achievable tolerance for the groove diameters c and d , in accordance with Figure 2(a) and Figure 2(b).

3.3 Extrusion gap

To maintain an acceptable extrusion gap, the tolerances of the diameter of the mating parts shall be selected with respect to the following:

- a) tolerance of the nominal diameter, C or D ³⁾, calculated in accordance with 3.2;
- b) the maximum total diametral clearance G (see Table 6), in accordance with Figure 2(a) and Figure 2(b).

3.4 Lead-in chamfer

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

NOTE Details are shown in Figure 2(a) and Figure 2(b) and dimensions are given in Table 6.

3.5 Surface texture

The surface texture of the housing groove and associated surfaces, in accordance with BS 1134-1, shall not exceed the following values:

- | | |
|-----------------------------|-------------------------|
| a) dynamic sealing surfaces | 0.4 μm R_a |
| b) static sealing surfaces | 0.8 μm R_a |
| c) non-sealing surfaces | 1.6 μm R_a |

²⁾ 1 bar = 10⁵ N/m² = 10² kPa.

³⁾ BS 5242-1 specifies tolerances and classes of surface texture for the surfaces of tubular steel cylinder barrels.

Table 1 — Dimensions of “O”-rings of nominal cross section $\frac{1}{16}$ in and less

“O”-ring size no.	Actual diameters ^a			Nominal diameters	
	Cross section, $A \pm 0.003$	Internal, B		C^b	D^c
	in	in		in	in
001	0.040	0.029	} ± 0.004	d	d
002	0.050	0.042		d	d
003	0.060	0.056		d	d
004	0.070	0.070	} ± 0.005	$\frac{5}{64}$	$\frac{13}{64}$
005	0.070	0.101		$\frac{7}{64}$	$\frac{15}{64}$
006	0.070	0.114		$\frac{1}{8}$	$\frac{1}{4}$
007	0.070	0.145		$\frac{5}{32}$	$\frac{9}{32}$
008	0.070	0.176		$\frac{3}{16}$	$\frac{5}{16}$
009	0.070	0.208		$\frac{7}{32}$	$\frac{11}{32}$
010	0.070	0.239		$\frac{1}{4}$	$\frac{3}{8}$
011	0.070	0.301		$\frac{5}{16}$	$\frac{7}{16}$
012	0.070	0.364		$\frac{3}{8}$	$\frac{1}{2}$
013	0.070	0.426		$\frac{7}{16}$	$\frac{9}{16}$
014	0.070	0.489		$\frac{1}{2}$	$\frac{5}{8}$
015	0.070	0.551	± 0.007	$\frac{9}{16}$	$\frac{11}{32}$
016	0.070	0.614	} ± 0.009	$\frac{5}{8}$	$\frac{3}{4}$
017	0.070	0.676		$\frac{11}{16}$	$\frac{13}{16}$
018	0.070	0.739		$\frac{3}{4}$	$\frac{7}{8}$
019	0.070	0.801		$\frac{13}{16}$	$\frac{15}{16}$
020	0.070	0.864		$\frac{7}{8}$	1
021	0.070	0.926		$\frac{15}{16}$	$\frac{1}{16}$
022	0.070	0.989	} ± 0.010	1	$\frac{1}{8}$
023	0.070	1.051		$\frac{1}{6}$	$\frac{1}{16}$
024	0.070	1.114		$\frac{1}{8}$	$\frac{1}{4}$
025	0.070	1.176	} ± 0.011	$\frac{1}{16}$	$\frac{1}{16}$
026	0.070	1.239		$\frac{1}{4}$	$\frac{3}{8}$
027	0.070	1.301		$\frac{5}{16}$	$\frac{7}{16}$
028	0.070	1.364	} ± 0.013	$\frac{3}{8}$	$\frac{1}{2}$
029	0.070	1.489		$\frac{1}{2}$	$\frac{5}{8}$
030	0.070	1.614		$\frac{5}{8}$	$\frac{3}{4}$
031	0.070	1.739	} ± 0.015	$\frac{3}{4}$	$\frac{7}{8}$
032	0.070	1.864		$\frac{7}{8}$	2
033	0.070	1.989	} ± 0.018	2	$\frac{2}{8}$
034	0.070	2.114		$\frac{2}{8}$	$\frac{2}{4}$
035	0.070	2.239		$\frac{2}{4}$	$\frac{3}{8}$
036	0.070	2.364		$\frac{2}{8}$	$\frac{2}{2}$
037	0.070	2.489		$\frac{2}{2}$	$\frac{2}{8}$
038	0.070	2.614	} ± 0.020	$\frac{2}{8}$	$\frac{2}{4}$
039	0.070	2.739		$\frac{2}{4}$	$\frac{2}{8}$
040	0.070	2.864		$\frac{2}{8}$	3
041	0.070	2.989	} ± 0.024	3	$\frac{3}{8}$
042	0.070	3.239		$\frac{3}{4}$	$\frac{3}{8}$
043	0.070	3.489		$\frac{3}{2}$	$\frac{3}{8}$
044	0.070	3.739	} ± 0.027	$\frac{3}{4}$	$\frac{3}{8}$
045	0.070	3.989		4	$\frac{4}{8}$
046	0.070	4.239	} ± 0.030	$\frac{4}{4}$	$\frac{4}{8}$
047	0.070	4.489		$\frac{4}{2}$	$\frac{4}{8}$
048	0.070	4.739		$\frac{4}{4}$	$\frac{4}{8}$
049	0.070	4.989	} ± 0.037	5	$\frac{5}{8}$
050	0.070	5.239		$\frac{5}{4}$	$\frac{5}{8}$

NOTE 1 The full range of sizes given are suitable for static sealing.

NOTE 2 For dynamic sealing select only “O”-ring size nos. 004 to 012.

^a See Figure 1.^b See Figure 2(b), Figure 3 and Figure 4.^c See Figure 2(a) and Figure 3.^d Since “O”-ring sizes nos. 001,002 and 003 are extremely small special care should be taken in the selection of housing sizes to achieve an adequate squeeze.

Table 2 — Dimensions of “O” -rings of nominal cross section $\frac{3}{32}$ in

“O”-ring size no.	Actual diameters ^a			Nominal diameters	
	Cross section, $A \pm 0.003$	Internal, B		C^b	D^c
	in	in		in	in
102	0.103	0.049	} ± 0.005	$\frac{1}{16}$	$\frac{1}{4}$
103	0.103	0.081		$\frac{3}{32}$	$\frac{9}{32}$
104	0.103	0.112		$\frac{1}{8}$	$\frac{5}{16}$
105	0.103	0.143		$\frac{5}{32}$	$\frac{11}{32}$
106	0.103	0.174		$\frac{3}{16}$	$\frac{3}{8}$
107	0.103	0.206		$\frac{7}{32}$	$\frac{13}{32}$
108	0.103	0.237		$\frac{1}{4}$	$\frac{7}{16}$
109	0.103	0.299		$\frac{5}{16}$	$\frac{1}{2}$
110	0.103	0.362		$\frac{3}{8}$	$\frac{9}{16}$
111	0.103	0.424		$\frac{7}{16}$	$\frac{5}{8}$
112	0.103	0.487		$\frac{1}{2}$	$\frac{11}{16}$
113	0.103	0.549	± 0.007	$\frac{9}{16}$	$\frac{3}{4}$
114	0.103	0.612	} ± 0.009	$\frac{5}{8}$	$\frac{13}{16}$
115	0.103	0.674		$\frac{11}{16}$	$\frac{7}{8}$
116	0.103	0.737		$\frac{3}{4}$	$\frac{15}{16}$
117	0.103	0.799	} ± 0.010	$\frac{13}{16}$	1
118	0.103	0.862		$\frac{7}{8}$	$\frac{1}{16}$
119	0.103	0.924		$\frac{15}{16}$	$\frac{1}{8}$
120	0.103	0.987		1	$\frac{3}{16}$
121	0.103	1.049		$\frac{1}{16}$	$\frac{1}{4}$
122	0.103	1.112		$\frac{1}{8}$	$\frac{5}{16}$
123	0.103	1.174	} ± 0.012	$\frac{3}{16}$	$\frac{3}{8}$
124	0.103	1.237		$\frac{1}{4}$	$\frac{7}{16}$
125	0.103	1.299		$\frac{5}{16}$	$\frac{1}{2}$
126	0.103	1.362		$\frac{3}{8}$	$\frac{9}{16}$
127	0.103	1.424		$\frac{7}{16}$	$\frac{5}{8}$
128	0.103	1.487		$\frac{1}{2}$	$\frac{11}{16}$
129	0.103	1.549	} ± 0.015	$\frac{9}{16}$	$\frac{3}{4}$
130	0.103	1.612		$\frac{5}{8}$	$\frac{13}{16}$
131	0.103	1.674		$\frac{11}{16}$	$\frac{7}{8}$
132	0.103	1.737		$\frac{3}{4}$	$\frac{15}{16}$
133	0.103	1.799		$\frac{13}{16}$	2
134	0.103	1.862	} ± 0.017	$\frac{7}{8}$	$\frac{2}{16}$
135	0.103	1.925		$\frac{15}{16}$	$\frac{2}{8}$
136	0.103	1.987		2	$\frac{2}{16}$
137	0.103	2.050		$\frac{2}{16}$	$\frac{2}{4}$
138	0.103	2.112		$\frac{2}{8}$	$\frac{5}{16}$
139	0.103	2.175		$\frac{3}{16}$	$\frac{3}{8}$
140	0.103	2.237		$\frac{2}{4}$	$\frac{7}{16}$

NOTE 1 The full range of sizes given are suitable for static sealing.

NOTE 2 For dynamic sealing select only “O”-ring size nos. 102 to 116.

^a See Figure 1.^b See Figure 2(b), Figure 3 and Figure 4.^c See Figure 2(a) and Figure 3.