BS ISO 6622-2:2013

BSI Standards Publication

Internal combustion engines — Piston rings

Part 2: Rectangular rings made of steel

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National foreword

This British Standard is the UK implementation of ISO 6622-2:2013. It supersedes BS ISO 6622-2:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/14/-/10, RIC engines - Cylinders, pistons and rings.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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BS ISO 6622-2:2013

INTERNATIONAL STANDARD

ISO 6622-2

Second edition
2013-11-01

Internal combustion engines — Piston rings —

Part 2: Rectangular rings made of steel

Moteurs à combustion interne — Segments de piston —

Partie 2: Segments rectangulaires en acier

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 22, *Road vehicles*.

This second edition cancels and replaces the first edition (ISO 6622-2:2003), which has been technically revised.

ISO 6622 consists of the following parts, under the general title *Internal combustion engines — Piston rings*:

— *Part 1: Rectangular rings made of cast iron*

— *Part 2: Regular rings made of steel*

Introduction

The ISO 6622 series is one of a number of series of International Standards dealing with piston rings for reciprocating internal combustion engines. Others are ISO 6621,[2] [3] [4] [5] ISO 6623,[6] ISO 6624,[7] [8] [9] [10] ISO 6625, ISO 6626,[12] [13] [14] and ISO 6627[15] (see Bibliography for details).

The common features and dimensional tables presented in this part of ISO 6622 constitute a broad range of variables and, in selecting a particular ring type, the designer must bear in mind the conditions under which it will be required to operate.

It is also essential that the designer refer to the specifications and requirements of ISO 6621-3[4] and ISO 6621-4[16] before completing his selection.

INTERNATIONAL STANDARD ISO 6622-2:2013(E)

Internal combustion engines — Piston rings —

Part 2: Rectangular rings made of steel

1 Scope

This part of ISO 6622 specifies the essential dimensional features of rectangular rings made of steel, types R, B, BA, and M having nominal diameters from 30 mm up to and including 160 mm, used in reciprocating internal combustion piston engines for road vehicles and other applications.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

3 Overview

The rectangular ring types are specified in Tables 1 to 5 and Figures 1 to 6. Their common features and the dimensions of those features are specified in Tables 6 to 11 and Figures 7 to 22. Tables 12 and 13 give the force factors for the different ring types, while Table 13 gives the dimensions and forces of the rectangular rings.

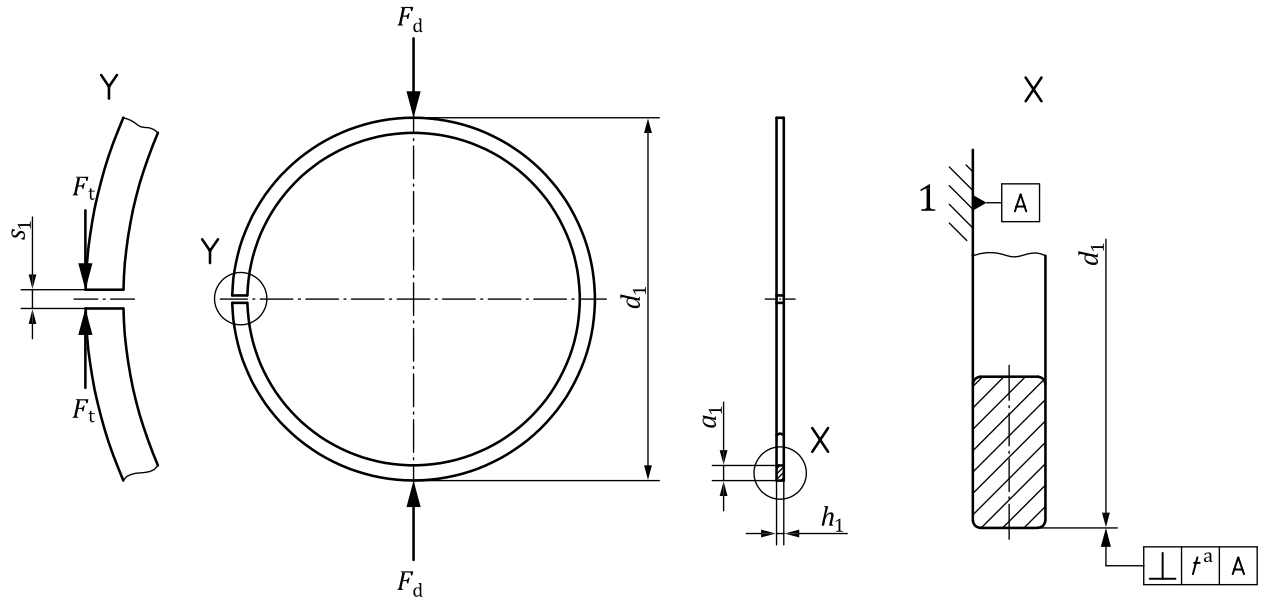
4 Ring types and designation examples

4.1 Type R — Straight-faced rectangular ring

4.1.1 General features

Figure 1 shows the general features of piston ring type R.

See Table 13 for dimensions and forces.



Key

1 reference plane

a $t = 0{,}005 \times h_1$.

Figure 1 — Type R

4.1.2 Designation

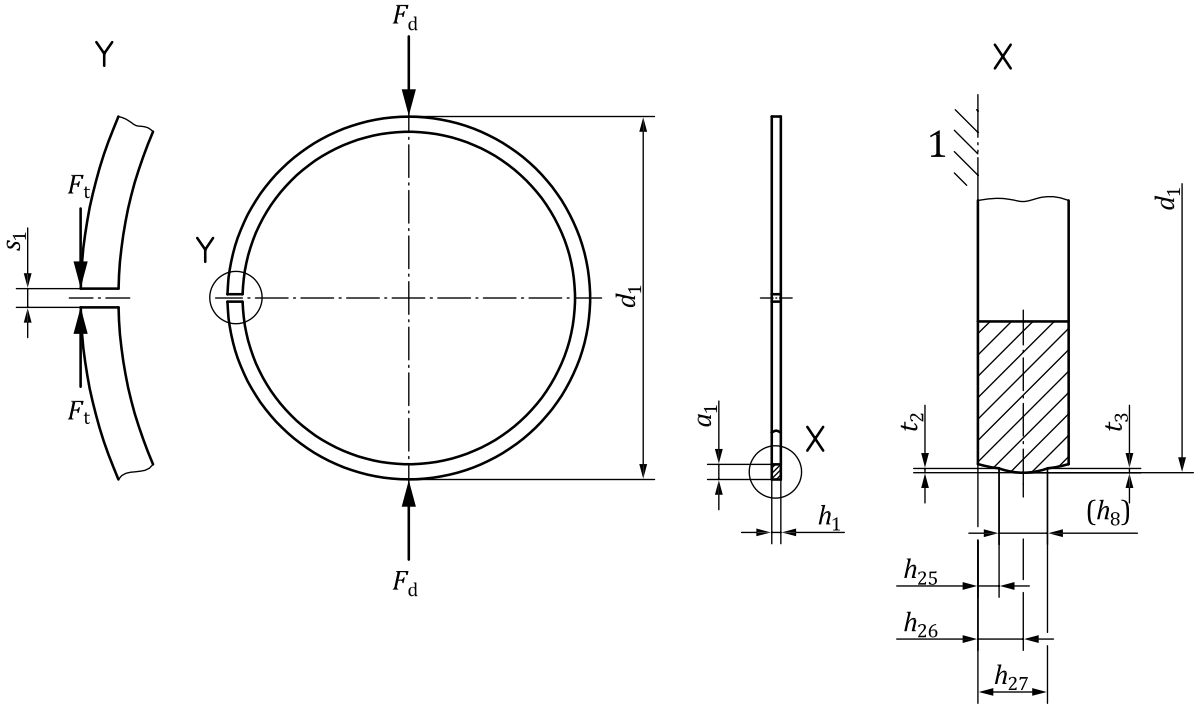
EXAMPLE Designation of a piston ring complying with the requirements of this part of ISO 6622 (i.e. ISO 6622-2) being a steel, rectangular ring with a straight-faced peripheral surface (R), of nominal diameter d_1 = 60 mm (60), of nominal ring width h_1 = 1,2 mm (1,2), made of CrSi alloyed steel, subclass 62 (MC62), and with a chromium-plated peripheral surface of a minimum thickness 0,1 mm (CR2). Parameters in parenthesis are used in the ISO ring designation:

Piston ring ISO 6622-2 R - 60 × 1,2 - MC62/CR2

4.2 Type B — Barrel-faced rectangular ring

4.2.1 General features

See Table 13 for dimensions and forces.



Key

1 reference plane

Figure 2 — Type B

Table 1 — Symmetrical barrel dimensions and gauge width (h_8)

Dimensions in millimetres

h_1	h_{25}	h_{26}	h_{26} tol.	h_{27}	t_2, t_3	h_8[a]
0,8	0,20	0,40	± 0,15	0,60	0,001...0,010	0,40
1,0	0,25	0,50	± 0,15	0,75	0,001...0,011	0,50
1,2	0,30	0,60	± 0,20	0,90	0,002...0,012	0,60
1,5	0,35	0,75	± 0,25	1,15	0,003...0,015	0,80
1,75	0,35	0,85	± 0,30	1,35		1,00
2,0	0,40	1,00	± 0,30	1,60		1,20
2,5	0,45	1,25	± 0,40	2,05		1,60
3,0	0,50	1,50	± 0,50	2,50	0,005...0,020	2,00
3,5	0,55	1,75	± 0,50	2,95		2,40

[a] Gauge width (h_8) only informative; may be used only if agreed between manufacturer and customer.

4.2.2 Designation

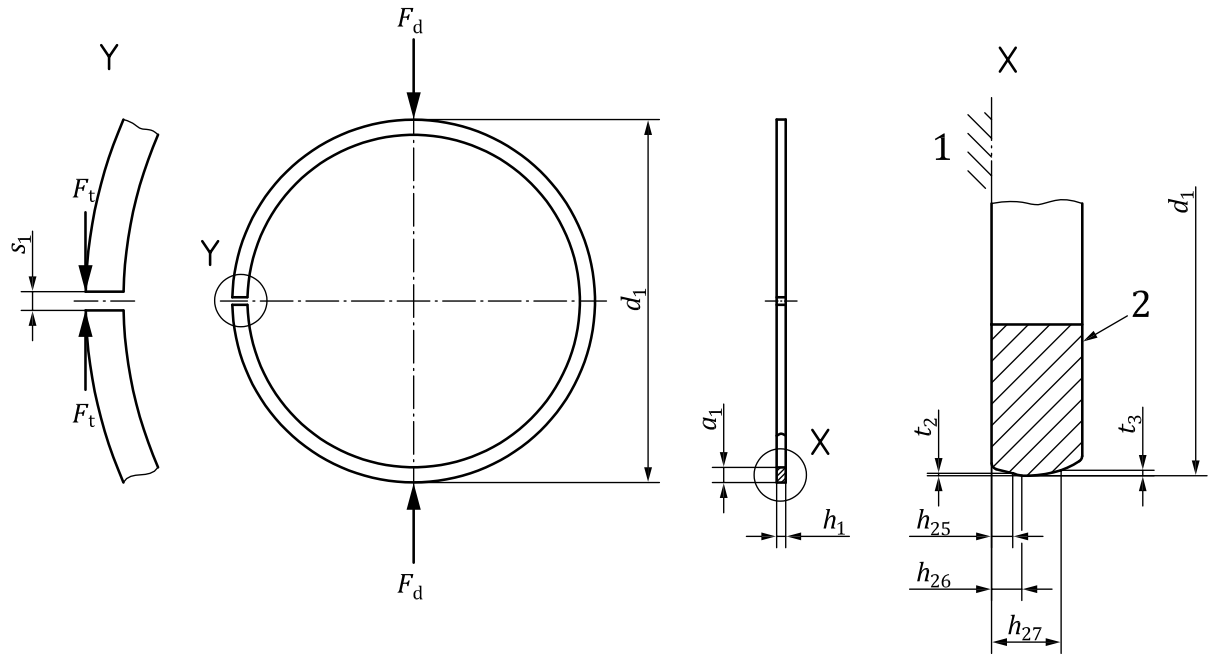
EXAMPLE Designation of a piston ring complying with the requirements of this part of ISO 6622 (i.e. ISO 6622-2) being a steel, rectangular ring with a barrel-faced peripheral surface (B), of nominal diameter d_1 = 60 mm (60), of nominal ring width h_1 = 1,5 mm (1,5), made of martensitic steel (17 % Cr), subclass 66 (MC66), nitrided on the peripheral surface and side faces (NT), to a depth of 0,03 mm min. on the peripheral surface (030), and with an associated side face depth of 0,010 mm min. Parameters in parenthesis are used in the ISO ring designation:

Piston ring ISO 6622-2 B - 60 × 1,5 - MC66/NT030

4.3 Type BA — Asymmetrical barrel-faced rectangular ring, h_1 ≥ 1,2mm

4.3.1 General features

See Table 13 for dimensions and forces.



Key

1 reference plane

2 top side identification mark

Figure 3 — Type BA

Table 2 — Asymmetrical barrel dimensions

Dimensions in millimetres

h_1	h_{25}[a]	h_{26}	h_{26} tol.	h_{27}	t_2[b]	t_3[b]
1,2	0,20 [c]	0,35 [c]	± 0,15	0,80 [c]	0...0,005	0,005...0,016
	0,28	0,43		0,90		
1,5	0,35	0,50	± 0,15	1,15	0...0,006	0,007...0,022
1,75	0,35	0,55	± 0,20	1,35	0...0,007	0,008...0,025
2,0	0,40	0,60		1,50		0,009...0,030
2,5	0,45	0,70	± 0,25	1,80	0...0,008	0,011...0,035
3,0	0,55	0,80		2,10		0,012...0,038
3,5	0,60	0,90	± 0,30	2,40	0...0,009	0,012...0,040

[a] h_{25} may be lowered for rings with reduced edge dimensions.

[b] t_2 and/or t_3 may be varied as agreed between manufacturer and customer.

[c] Recommended for bottom edge smaller than 0,2 mm.

4.3.2 Designation

EXAMPLE Designation of a piston ring complying with the requirements of this part of ISO 6622 (i.e. ISO 6622-2) being a steel, rectangular ring with an asymmetrical barrel-faced peripheral surface (BA), of nominal diameter d_1 = 80 mm (80), of nominal ring width h_1 = 1,5 mm (1,5), made of martensitic steel (17 % Cr), subclass 66 (MC66), nitrided on the peripheral surface and side faces (NT) to a depth of 0,05 mm min. on the peripheral surface (050), and with an associated side face depth of 0,015 mm min. Parameters in parenthesis are used in the ISO ring designation:

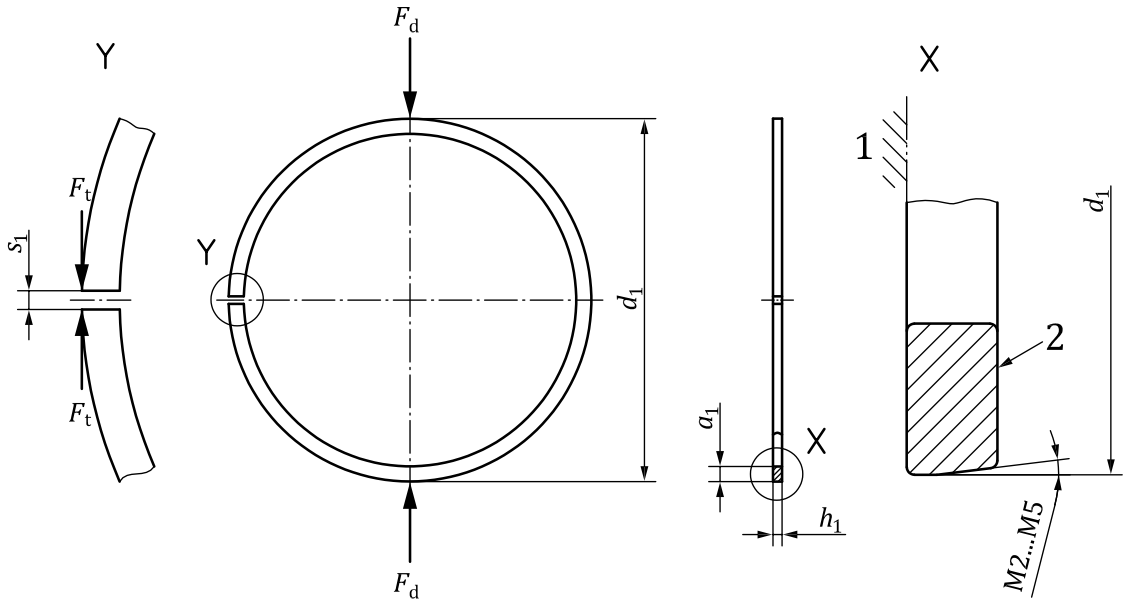
Piston ring ISO 6622-2 BA - 80 × 1,5 - MC66/NT050

4.4 Type M — Taper-faced rectangular ring

NOTE Taper M1 excluded.

4.4.1 General features

See Table 13 for dimensions and forces.



Key

1 reference plane

2 top side identification mark

Figure 4 — Type M

Table 3 — Taper

Dimensions in millimetres

Code	Nitrided rings and chromium-plated or spray-coated rings with peripheral surface ground[c]					
	Taper	Tolerance	with IF[a] (top side)		with IFU[a d] (bottom side)	
			Taper	Tolerance	Taper	Tolerance[b]
M2	30	$^{+60}_{0}$	30	$^{+60}_{0}$	—	—
M3	60		60		60	$^{+60}_{0}$
M4	90		90		90	
M5	120		120		120	

[a] IF and IFU are explained in Figures 24 and 25.

[b] For M rings (negative twist type) M3, M4, and M5, the twist angle should not exceed 90 % of the minimum taper angle.

[c] For chromium plated rings with tapered peripheral surface not ground, the tolerance shall be increased by 10 (e.g. M3 = 60: $^{+60}_{0}$ for M rings or $^{+70}_{0}$ for M rings with IF or IFU).

[d] IFU not recommended for rings with $h_1 \leq 1{,}2$ mm.

4.4.2 Designation

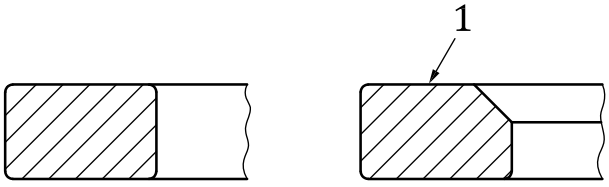
EXAMPLE Designation of a piston ring complying with the requirements of this part of ISO 6622 (i.e. ISO 6622-2) being a steel, rectangular ring with 60′ taper-faced peripheral surface (M3), of nominal diameter d_1 = 60 mm (60), of nominal ring width h_1 = 1,5 mm (1,5), made of alloyed steel (CrSi), subclass 62 (MC62), with a chromium-plated peripheral surface of a minimum thickness of 0,1 mm (CR2). Parameters in parenthesis are used in the ISO ring designation:

Piston ring ISO 6622-2 M3 - 60 × 1,5 - MC62/CR2

5 Common features

5.1 Type R — Straight-faced rectangular ring

5.1.1 Nitrided/PVD rings



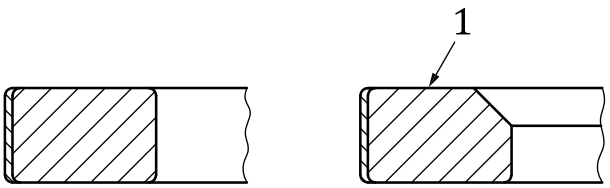
Key

1 top side identification mark

Figure 5 — Nitrided/PVD type R rings

5.1.2 Chromium-plated or spray-coated rings

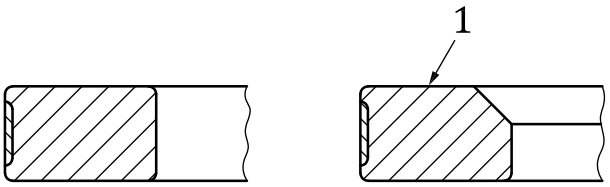
5.1.2.1 Fully faced



Key
1 top side identification mark

Figure 6 — Fully faced type R rings

5.1.2.2 Inlaid, h_1 ≥ 1,2 mm (not recommended for chromium-plated rings)

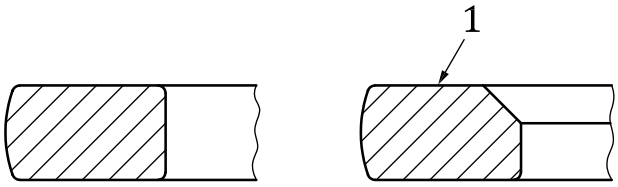


Key
1 top side identification mark

Figure 7 — Inlaid type R rings

5.2 Type B — Barrel-faced rectangular ring

5.2.1 Nitrided/PVD rings

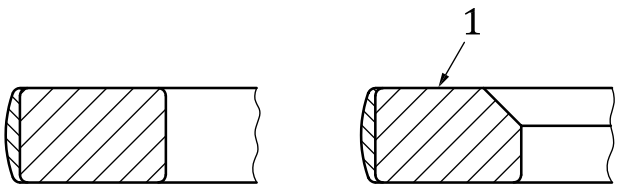


Key
1 top side identification mark

Figure 8 — Nitrided/PVD type B rings

5.2.2 Chromium-plated or spray-coated rings

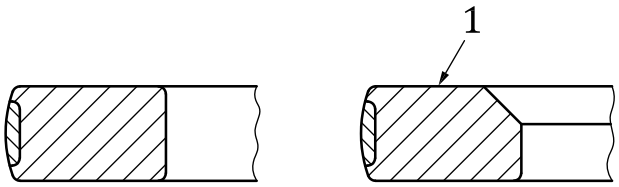
5.2.2.1 Fully faced



Key
1 top side identification mark

Figure 9 — Fully faced type B rings

5.2.2.2 Inlaid, h_1 ≥ 1,2 mm (not recommended for chromium-plated rings)

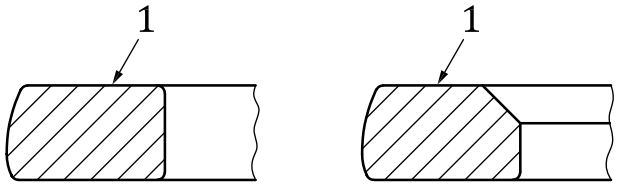


Key
1 top side identification mark

Figure 10 — Inlaid type B rings

5.3 Type BA — Asymmetrical barrel-faced rectangular ring, h_1 ≥ 1,2 mm

5.3.1 Nitrided/PVD rings

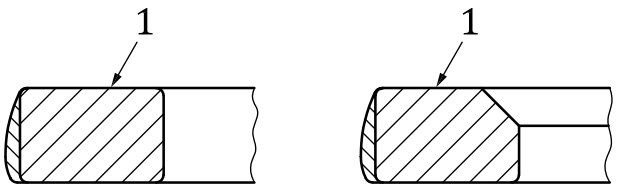


Key
1 top side identification mark

Figure 11 — Nitrided/PVD type BA rings

5.3.2 Chromium-plated or spray-coated rings

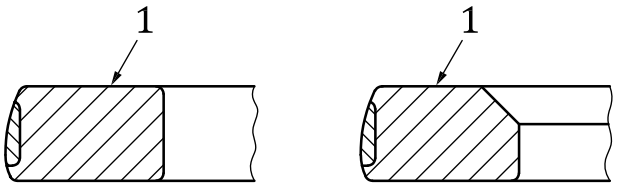
5.3.2.1 Fully faced



Key
1 top side identification mark

Figure 12 — Fully faced type BA rings

5.3.2.2 Inlaid, h_1 ≥ 1,2 mm (not recommended for chromium-plated rings)



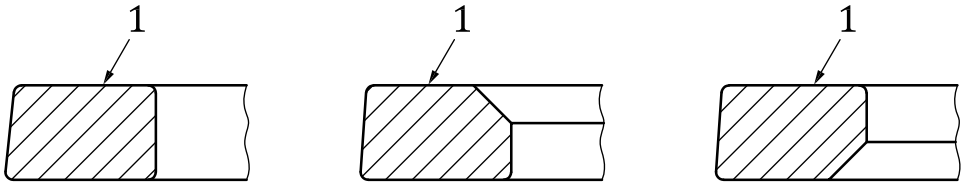
Key
1 top side identification mark

Figure 13 — Inlaid type BA rings

5.4 Type M — Taper-faced rectangular ring

5.4.1 Fully tapered

5.4.1.1 Uncoated/Nitrided/PVD rings

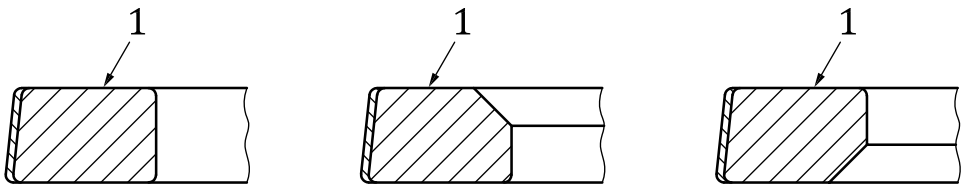


Key
1 top side identification mark

Figure 14 — Uncoated/Nitrided/PVD type M rings

5.4.1.2 Chromium-plated or spray-coated rings

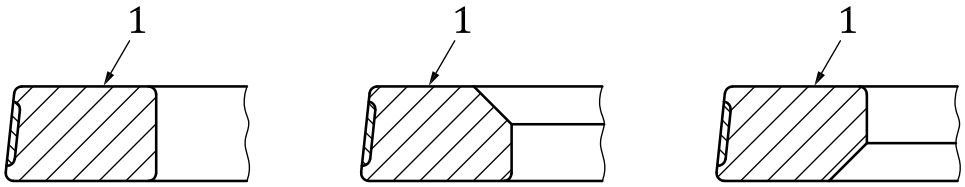
5.4.1.2.1 Fully faced



Key
1 top side identification mark

Figure 15 — Fully faced type M rings

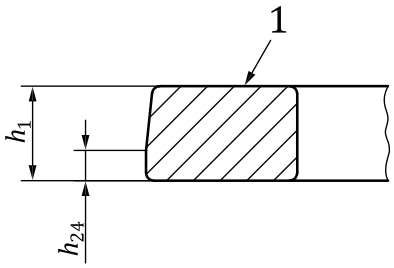
5.4.1.2.2 Inlaid, $h_1 \geq 1{,}2$ mm (not recommended for chromium-plated rings)



Key
1 top side identification mark

Figure 16 — Inlaid type M rings

5.4.2 Taper-faced rectangular ring with partly cylindrical machined (LM) or lapped (LP) peripheral surface



Key
1 top side identification mark

Figure 17 — Partly cylindrical or lapped type M rings

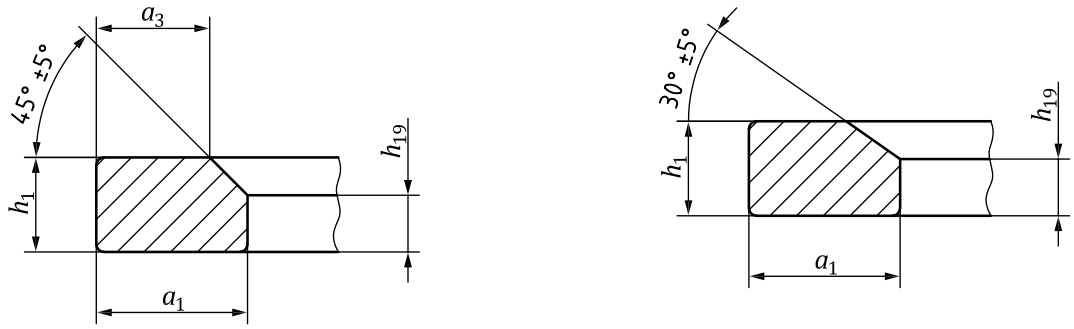
Table 4 — Axial dimensions of the cylindrical part of peripheral surface h_{24}

Dimensions in millimetres

h_1	h_{24}[a] **max.**	h_{24} **max. each side of gap up to 30°**
1,0	0,4	0,7
1,2	0,4	0,8
1,5	0,5	1,0
1,75	0,6	1,2
2,0	0,7	1,4
2,5	0,8	1,6
3,0	1,0	2,0
3,5	1,2	2,3

[a] Partly cylindrical peripheral surface shall be visible.

5.5 Type R, B, BA, and M rings (positive twist type) — Internal bevel top side



a) Commonly used in rings with $h_1 \geq 1{,}2$ mm **b) Commonly used in rings with $h_1 < 1{,}2$ mm**

Figure 18 — Internal bevel (IF)

5.6 Type M rings (negative twist type), taper M3 to M5 — Internal bevel bottom side

See Table 3.

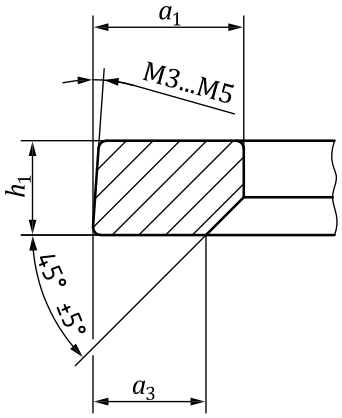


Figure 19 — Internal bevel bottom side (IFU)

Table 5 — h_{19} dimensions for rings h_1 < 1,5 mm

Dimensions in millimetres

d_1	h_{19}	
		Tolerance
$30 \le d_1 \le 100$	$0{,}6 \times h_1$	$^{0}_{-0{,}25}$

Table 6 — a_3 dimensions for rings h_1 ≥ 1,5 mm

Dimensions in millimetres

d_1	a_3	
		Tolerance
$30 \le d_1 < 80$	$0{,}8 \times a_1$	$^{0}_{-0{,}2}$
$80 \le d_1 \le 160$	$0{,}8 \times a_1$	$^{0}_{-0{,}3}$

5.7 Type R, B, BA, and M rings — Outside and inside rounded edges

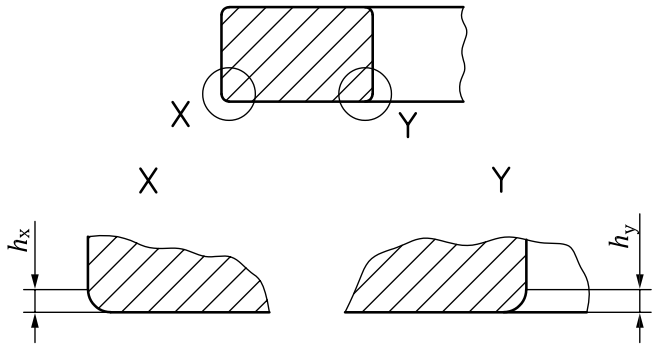


Figure 20 — Outside and inside rounded edges

Table 7 — h_x and h_y dimensions

Dimensions in millimetres

h_1	h_x **max.**	h_y **max.**
$0{,}8 \le h_1 < 1{,}5$	0,25	0,30
$h_1 \ge 1{,}5$	0,30	0,40

5.8 Type R, B, BA, and M rings (fully faced and inlaid) — Plating/coating thickness

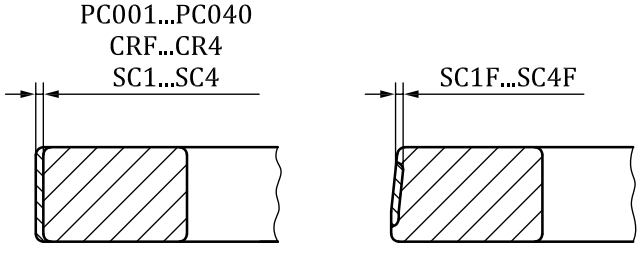


Figure 21 — Plating/coating thickness

Table 8 — Chromium plating/spray coating thickness

Dimensions in millimetres

Chromium plating code	Spray coating code	Thickness min.
CRF	—	0,005
CR1	**SC1**	0,050
CR2	**SC2**	0,100
CR3[a]	**SC3**[a]	0,150
CR4[a]	**SC4**[a]	0,200
[a] Not recommended for rings with $h_1 \leq 1{,}2$.		

Table 9 — PVD coating thickness

Dimensions in millimetres

Code	Peripheral surface min.
PC001	0,001
PC003	0,003
PC006 [a]	0,006
PC010 [a]	0,010
PC020 [a]	0,020
PC030 [a]	0,030
PC040 [a]	0,040
[a] Not applicable to diamond-like carbon (DLC) coatings.	

5.9 Type R, B, BA, and M rings — Nitrided case depth

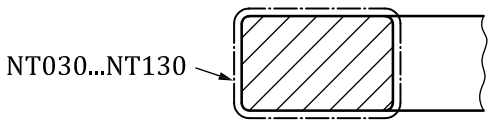


Figure 22 — Nitrided case depth

Table 10 — Nitrided case depth

Dimensions in millimetres

Code	Nitrided case depth min.	
	Peripheral surface	Side faces
NT030	0,03	0,010
NT050	0,05	0,015
NT070	0,07	0,020
NT090	0,09	0,020
NT110	0,11	0,030
NT130	0,13	0,030

6 Force factors

The tangential and diametral forces given in Table 13 shall be corrected when additional features are being used. For common features, the multiplier factors given in Tables 12 and 13 shall be used.

Table 11 — Force correction factors for R, B, BA, and M rings with features IF and taper

Factor		
M2 or M3	**M4 or M5**	**IF**
0,98	0,96	0,88

Table 12 — Force correction factors for chromium-plated, spray-coated, PVD–coated, and nitrided R, B, BA, and M rings (fully faced and inlaid type)

d_1 **mm**	Factor							
	CRF/PC001... PC030	**CR1/ PC040**	**CR2/SC1**	**CR3**	**SC2**	**CR4/SC3**	**SC4**	**NT030...NT130**
$30 \leq d_1 < 50$	1	0,80	0,71	—	0,63	—	—	1,03
$50 \leq d_1 < 75$	1	0,87	0,81	0,75	0,75	0,69	0,64	1,03
$75 \leq d_1 < 100$	1	0,91	0,86	0,82	0,82	0,78	0,74	1,03
$100 \leq d_1 < 125$	1	0,93	0,89	0,86	0,86	0,82	0,79	1,03
$125 \leq d_1 \leq 160$	1	0,94	0,91	0,89	0,89	0,86	0,83	1,03

7 Dimensions and forces

See Table 13.

Table 13 — Dimensions and forces of R, B, BA, and M rectangular rings made of steel

Dimensions in millimetres

Nominal diameter d_1	Radial wall thickness a_1		Ring width h_1								Closed gap s_1		Tangential force F_t [N]								Diametral force F_d [N]								Nominal diameter d_1
		Tolerance	1	2	3	4	5	6	7	Tolerance		Tolerance	For h_1 shown in column							Tolerance	For h_1 shown in column							Tolerance	
													1	2	3	4	5	6	7		1	2	3	4	5	6	7		
30															3,0						4,3	5,4	6,5						30
31	1,1														3,0						4,3	5,4	6,5						31
32													—	—	3,0						4,3	5,4	6,5						32
33															-						4,2	5,2	6,2						33
34															3,4						4,8	6,0	7,3						34
35														-	3,4						5,0	6,2	7,3						35
36	1,3													-	3,4						5,0	6,2	7,3						36
37													—	-	3,5						5,0	6,2	7,5						37
38														-	3,4						4,8	6,0	7,3						38
39		±0,15				—				−0,010 −0,025				3,3	3,9					±30 % if F_t < 10 N	5,7	7,1	8,4					±30 % if F_d < 21,5 N	39
40		Within a ring:								For phosphated PO surface:				3,3	3,9						5,7	7,1	8,4						40
41		0,15 max.												3,3	3,9					±20 % if F_t ≥ 10 N	5,7	7,1	8,4					±20 % if F_d ≥ 21,5 N	41
42	1,5		0,8	1,0	1,2		—	—	—	−0,005 −0,025	0,15	+0,2 0	—	3,3	3,9						5,7	7,1	8,4						42
43														3,3	3,9						5,7	7,1	8,4						43
44														3,2	3,9	—	—	—	—		5,5	6,9	8,4	—	—	—	—		44
45													3,1	3,8	4,5						6,6	8,2	9,7						45
46													3,1	3,8	4,5						6,6	8,2	9,7						46
47	1,7												-	3,7	4,5						6,4	8,0	9,7						47
48													-	3,7	4,5						6,4	8,0	9,7						48
49													-	3,7	4,5						6,4	8,0	9,7						49
50						1,5							3,0	3,7	4,4	5,6					6,4	8,0	9,5	12,0					50
51	1,9												3,4	4,3	5,1	6,4					7,4	9,2	11,0	13,8					51

Table 13 — *(continued)*

Dimensions in millimetres

Nominal diameter d_1	Radial wall thickness a_1		Ring width h_1								Closed gap s_1		Tangential force F_t [N] For h_1 shown in column								Diametral force F_t [N] For h_1 shown in column								Nominal diameter d_1
		Tolerance	1	2	3	4	5	6	7	Tolerance		Tolerance	1	2	3	4	5	6	7	Tolerance	1	2	3	4	5	6	7	Tolerance	
52													3,4	4,2	5,1	6,4					7,2	9,0	11,0	13,8					52
53										−0,010 −0,025			3,4	4,2	5,1	6,4					7,2	9,0	11,0	13,8					53
54	1,9									For phosphated PO surface: 0 -0,025			3,4	4,2	5,0	6,3					7,2	9,0	10,8	13,5					54
55													3,4	4,2	5,0	6,3					7,2	9,0	10,8	13,5					55
56											0,15	+0,2 0	3,3	4,1	5,0	6,2					7,0	8,8	10,8	13,3					56
57													3,8	4,8	5,7	7,2					8,2	10,3	12,3	15,5					57
58													3,8	4,7	5,7	7,1					8,1	10,1	12,3	15,3					58
59	2,1						—	—	—				3,7	4,6	5,6	7,0	—	—	—		7,9	9,9	12,0	15,1	—	—	—		59
60													3,7	4,6	5,5	6,9					7,9	9,9	11,8	14,8					60
61													3,6	4,5	5,4	6,8				± 30 % if F_t < 10 N	7,8	9,7	11,6	14,6				± 30 % if F_d < 21,5 N	61
62		± 0,15 Within a ring: 0,15 max.											4,2	5,2	6,2	7,8					9,0	11,2	13,3	16,8					62
63													4,1	5,1	6,2	7,7				± 20 % if $F_t \geq$ 10 N	8,8	11,0	13,3	16,6				± 20 % if $F_d \geq$ 21,5 N	63
64			0,8	1,0	1,2	1,5							4,1	5,1	6,1	7,7					8,8	11,0	13,1	16,6					64
65	2,3									−0,010 −0,030			4,0	5,0	6,1	7,6					8,6	10,8	13,1	16,3					65
66													4,0	5,0	6,0	7,5					8,6	10,8	12,9	16,1					66
67										For phosphated PO surface: 0 -0,030	0,2	+0,2 0	3,9	4,9	5,9	7,4					8,4	10,5	12,7	15,9					67
68													4,6	5,7	6,8	8,6					9,8	12,3	14,6	18,5					68
69													4,5	5,6	6,8	8,5					9,6	12,0	14,6	18,3					69
70	2,5												4,5	5,6	6,7	8,4	9,8	11,2	14,1		9,6	12,0	14,4	18,1	21,1	24,1	30,2		70
71													4,4	5,5	6,6	8,3	9,7	11,1	13,9		9,4	11,8	14,2	17,8	20,9	23,9	29,9		71
72							1,75	2,0	2,5				4,3	5,4	6,5	8,2	9,6	11,0	13,7		9,3	11,6	14,0	17,6	20,6	23,7	29,6		72
73													4,3	5,4	6,5	8,1	9,5	10,8	13,6		9,3	11,6	14,0	17,4	20,4	23,2	29,2		73

Table 13 — *(continued)*

Dimensions in millimetres

Nominal diameter d_1	Radial wall thickness a_1		Ring width h_1									Closed gap s_1		Tangential force F_t [N] For h_1 shown in column									Diametral force F_d [N] For h_1 shown in column									Nominal diameter d_1
		Tolerance	1	2	3	4	5	6	7	8	Tolerance		Tolerance	1	2	3	4	5	6	7	8	Tolerance	1	2	3	4	5	6	7	8	Tolerance	
74												0,2	$^{+0,2}_{0}$	5,0	6,2	7,4	9,3	10,9	12,5	15,6			10,6	13,3	15,9	20,0	23,4	26,9	33,5			74
75														4,9	6,1	7,3	9,2	10,7	12,3	15,3			10,5	13,1	15,7	19,8	23,0	26,4	33,0			75
76	2,7		0,8											4,8	6,0	7,2	9,0	10,5	12,0	15,1			10,3	12,9	15,5	19,4	22,6	25,8	32,4			76
77														4,6	5,8	7,0	8,8	10,3	11,8	14,8			10,0	12,5	15,1	18,9	22,1	25,4	31,8			77
78														4,6	5,7	6,9	8,7	10,1	11,6	14,5			9,8	12,3	14,8	18,7	21,7	24,9	31,2			78
79														5,3	6,6	7,9	9,9	11,6	13,3	16,7			11,4	14,2	17,0	21,3	24,9	28,6	35,8			79
80															6,5	7,8	9,8	11,5	13,1	16,5				14,0	16,8	21,1	24,7	28,2	35,4			80
81															6,4	7,7	9,7	11,4	13,0	16,3				13,8	16,6	20,9	24,5	28,0	35,0			81
82	2,9									—					6,3	7,6	9,6	11,2	12,8	16,1				13,5	16,3	20,6	24,1	27,5	34,5			82
83											$^{-0,010}_{-0,030}$	0,25	$^{+0,25}_{0}$		6,3	7,5	9,5	11,1	12,7	15,8				13,5	16,1	20,4	23,9	27,3	34,1			83
84		± 0,15 Within a ring: 0,15 max.									For phosphated PO surface: 0 -0,030				6,2	7,4	9,3	10,9	12,5	15,6		± 30 % if $F_t < 10$ N		13,3	15,9	20,0	23,4	26,9	33,6		± 30 % if $F_d < 21,5$ N	84
85															7,1	8,5	10,7	12,5	14,3	17,9				15,3	18,3	23,0	26,9	30,7	38,5			85
86															7,0	8,4	10,6	12,3	14,1	17,7		± 20 % if $F_t \geq 10$ N		15,1	18,1	22,8	26,4	30,3	38,1		± 20 % if $F_d \geq 21,5$ N	86
87															6,9	8,3	10,4	12,2	14,0	17,5				14,8	17,8	22,4	26,2	30,1	37,6			87
88	3,1		—											—	6,8	8,2	10,3	12,0	13,8	17,2			—	14,6	17,6	22,1	25,8	29,7	37,1			88
89															6,7	8,1	10,1	11,9	13,6	17,0				14,4	17,4	21,7	25,6	29,2	36,5			89
90															6,6	8,0	10,0	11,7	13,4	16,7	20,1			14,2	17,2	21,5	25,2	28,8	35,9	43,2		90
91															7,6	9,1	11,4	13,4	15,3	19,2	23,1			16,3	19,6	24,5	28,8	32,9	41,3	49,6		91
92															7,4	9,0	11,2	13,1	15,0	18,8	22,6			16,0	19,4	24,1	28,2	32,3	40,4	48,6		92
93	3,3									3,0			$^{+0,25}_{0}$		7,3	8,8	11,0	12,9	14,7	18,5	22,2			15,7	18,9	23,7	27,7	31,6	39,8	47,7		93
94															7,1	8,6	10,8	12,6	14,4	18,1	21,7			15,3	18,5	23,2	27,1	31,0	38,9	46,7		94
95															7,0	8,4	10,5	12,3	14,1	17,7	21,2			15,0	18,1	22,6	26,4	30,3	38,1	45,6		95
96	3,5														8,0	9,6	12,1	14,1	16,2	20,2	24,3			17,2	20,6	26,0	30,3	34,8	43,4	52,3		96

Table 13 — *(continued)*

Dimensions in millimetres

Nominal diameter d_1	Radial wall thickness a_1	Tolerance	Ring width h_1							Tolerance	Closed gap s_1	Tolerance	Tangential force F_t [N] For h_1 shown in column							Tolerance	Diametral force F_d [N] For h_1 shown in column							Tolerance	Nominal diameter d_1
			1	2	3	4	5	6	7				1	2	3	4	5	6	7		1	2	3	4	5	6	7		
97													7,9	9,5	11,9	13,9	15,9	20,0	24,0		17,0	20,4	25,6	29,9	34,2	43,0	51,6		97
98			1,0										7,8	9,4	11,7	13,7	15,7	19,7	23,7		16,7	20,2	25,2	29,5	33,8	42,4	50,9		98
99	3,5												7,7	9,2	11,6	13,5	15,5	19,4	23,3		16,5	19,8	24,9	29,0	33,3	41,7	50,1		99
100														8,5	11,4	13,3	15,2	19,1	22,9			18,3	24,5	28,6	32,7	41,1	49,2		100
101														8,3	11,2	13,1	15,0	18,8	22,6			17,9	24,1	28,2	32,3	40,4	48,6		101
102														9,7	12,8	15,0	17,2	21,5	25,8			20,8	27,5	32,3	37,0	46,2	55,5		102
103				1,2	1,5	1,75	2,0	2,5	3,0		0,3	$+0,25$ 0		9,5	12,7	14,8	16,9	21,2	25,5			20,4	27,3	31,8	36,3	45,6	54,8		103
104	3,7		—											9,3	12,5	14,6	16,7	20,9	25,1		—	20,0	26,9	31,4	35,9	44,9	54,0		104
105													—	9,1	12,3	14,4	16,4	20,6	24,7			19,5	26,4	31,0	35,3	44,3	53,1		105
106										$-0,010$ $-0,030$				8,9	12,1	14,1	16,2	20,2	24,3	± 30 % if		19,1	26,0	30,3	34,8	43,4	52,2	± 30 % if	106
107		± 0,20 Within a								For phos-				8,8	11,9	13,9	15,9	19,9	23,9	$F_t < 10$ N		18,9	25,6	29,9	34,2	42,8	51,4	$F_d < 21,5$ N	107
108		ring:								phated PO surface:				10,1	13,6	15,9	18,2	22,8	27,4	± 20 % if		21,7	29,2	34,2	39,1	49,0	58,9	± 20 % if	108
109		0,20 max.								0				9,9	13,3	15,6	17,8	22,3	26,8	$F_t \geq 10$ N		21,3	28,6	33,5	38,3	47,9	57,6	$F_d \geq 21,5$ N	109
110	3,9									-0,030			15,2	17,4	21,8	26,2	30,6				32,7	37,4	46,9	56,3	65,8				110
111													14,9	17,0	21,3	25,6	29,9				32,0	36,6	45,8	55,0	64,3				111
112													14,5	16,6	20,8	25,0	29,2				31,2	35,7	44,7	53,8	62,8				112
113													16,6	19,0	23,8	28,6	33,4				35,7	40,9	51,2	61,5	71,8				113
114			1,75	2,0	2,5	3,0	3,5	—	—		0,35	$+0,25$ 0	16,4	18,7	23,5	28,2	32,9	—	—		35,2	40,2	50,5	60,6	70,7	—	—		114
115	4,1												16,1	18,4	23,1	27,8	32,4				34,6	39,6	49,7	59,8	69,7				115
116													15,9	18,1	22,7	27,3	31,9				34,1	38,9	48,8	58,7	68,6				116
117													15,6	17,8	22,3	26,8	31,4				33,5	38,3	47,9	57,6	67,5				117
118													15,3	17,5	21,9	26,4	30,8				32,9	37,6	47,1	56,8	66,2				118

Table 13 — *(continued)*

Dimensions in millimetres

Nominal diameter d_1	Radial wall thickness a_1		Ring width h_1								Closed gap s_1		Tangential force F_t [N]								Diametral force F_t [N]								Nominal diameter d_1
		Tolerance	1	2	3	4	5	6	7	Tolerance		Tolerance	For h_1 shown in column 1	2	3	4	5	6	7	Tolerance	For h_1 shown in column 1	2	3	4	5	6	7	Tolerance	
119													17,5	20,0	25,1	30,1	35,2				37,6	43,0	54,0	64,7	75,7				119
120													17,2	19,7	24,7	29,7	34,7				37,0	42,4	53,1	63,9	74,6				120
121	4,3												17,0	19,4	24,3	29,2	34,1				36,5	41,7	52,2	62,8	73,3				121
122													16,7	19,1	23,9	28,7	33,5				35,8	41,1	51,4	61,7	72,0				122
123													16,4	18,8	23,5	28,2	33,0				35,2	40,4	50,5	60,6	71,0				123
124			1,75	2,0							0,35	$+0,25$ 0	16,1	18,4	23,1	27,7	32,4				34,6	39,6	49,7	59,6	69,7				124
125													18,4	21,0	26,4	31,7	37,0				39,5	45,2	56,8	68,2	79,6				125
126													18,0	20,6	25,8	31,0	36,2				38,7	44,3	55,5	66,7	77,8				126
127	4,5												17,6	20,1	25,2	30,3	35,4				37,8	43,2	54,2	65,1	76,1				127
128		± 0,20								$-0,010$ $-0,030$			17,2	19,6	24,6	29,6	34,5			± 30 % if $F_t < 10$ N	36,9	42,1	52,9	63,6	74,2			± 30 % if $F_d < 21,5$ N	128
129		Within a ring: 0,20 max.			2,5	3,0	3,5	—	—	For phosphated PO surface: 0 -0,030			16,7	19,2	24,0	28,8	33,7	—	—		36,0	41,3	51,6	61,9	72,5	—	—		129
130															27,4	32,9	38,5			± 20 % if $F_t \geq 10$ N			58,9	70,7	82,8			± 20 % if $F_d \geq 21,5$ N	130
131															27,0	32,4	37,8						58,0	69,7	81,3				131
132	4,7														26,5	31,9	37,2						57,0	68,6	80,0				132
133															26,1	31,3	36,6						56,0	67,3	78,7				133
134															25,6	30,7	35,9						55,0	66,0	77,2				134
135			—	—							0,4	$+0,25$ 0	—	—	25,1	30,2	35,2				—	—	54,0	64,9	75,7				135
136															28,7	34,4	40,2						61,6	74,0	86,4				136
137															28,2	33,9	39,6						60,6	72,9	85,1				137
138	4,9														27,7	33,3	38,9						59,6	71,6	83,6				138
139															27,2	32,7	38,2						58,6	70,3	82,1				139
140															26,7	32,1	37,5						57,5	69,0	80,6				140

Table 13 — *(continued)*

Dimensions in millimetres

Nominal diameter d_1	Radial wall thickness a_1		Ring width h_1								Closed gap s_1		Tangential force F_t [N] For h_1 shown in column								Diametral force F_d [N] For h_1 shown in column								Nominal diameter d_1
		Tolerance	1	2	3	4	5	6	7	Tolerance		Tolerance	1	2	3	4	5	6	7	Tolerance	1	2	3	4	5	6	7	Tolerance	
141	4,9														26,2	31,5	36,8							56,4	67,7	79,1				141
142															29,9	36,0	42,0							64,4	77,4	90,3				142
143										−0,010 −0,030					29,4	35,4	41,3							63,3	76,1	88,8				143
144	5,1														28,9	34,8	40,6							62,2	74,8	87,3				144
145										For phosphated PO surface: 0 -0,030	0,4	+0,25 0			28,4	34,1	39,9							61,1	73,3	85,8				145
146															27,9	33,5	39,1							59,9	72,0	84,1				146
147															27,3	32,9	38,4							58,8	70,7	82,6				147
148															31,2	37,5	43,8							67,1	80,6	94,2				148
149		± 0,20	—	—	—	3,0	3,5	—	—				—	—	30,5	36,6	42,8	—	—	± 30 % if F_t < 10 N	—	—	65,5	78,7	92,0	—	—	± 30 % if F_d < 21,5 N	149
150	5,3	Within a ring: 0,20 max.														35,8	41,8								77,0	89,9				150
151																34,9	40,7			± 20 % if F_t ≥ 10 N					75,0	87,5			± 20 % if F_d ≥ 21,5 N	151
152																34,0	39,7								73,1	85,4				152
153										-0,010 -0,035						38,8	45,3								83,4	97,4				153
154																38,1	44,5								81,9	95,7				154
155	5,5									For phosphated PO surface: 0 -0,035	0,5	+0,3 0			—	37,4	43,7						—	80,4	94,0				155
156																36,7	42,9								78,9	92,2				156
157																36,0	42,1								77,4	90,5				157
158																35,3	41,2								75,9	88,6				158
159	5,7															40,3	47,0								86,6	101,1				159
160																39,3	45,9								84,5	98,7				160

NOTE 1 For intermediate sizes (for example repair sizes), the radial wall thickness of the next smaller nominal diameter should be applied.

NOTE 2 The values for F_t and F_d, given in Table 13, apply to steel with a typical modulus of elasticity (E_n) of 210 GN/m². Mean forces are calculated for nominal radial wall thickness (a_1) and mean ring width (h_1).

NOTE 3 For the sole purpose of this part of ISO 6622, the assumed average ratio F_d/F_t is 2,15. However, for rings up to 50 mm, the ratio F_d/F_t shall be determined between manufacturer and customer.

Bibliography

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