
**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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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6622-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

This first edition of ISO 6622-2 cancels and replaces ISO/TR 6622-2:1988, 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: Rectangular rings made of steel*

Introduction

ISO 6622 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]} and ISO 6627^[14] (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 before completing his selection.

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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 diameters of from 30 mm up to and including 160 mm, used in reciprocating internal combustion piston engines. It is also applicable to piston rings of compressors working under similar conditions.

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.

ISO 6621-4, *Internal combustion engines — Piston rings — Part 4: General specifications*

3 Overview

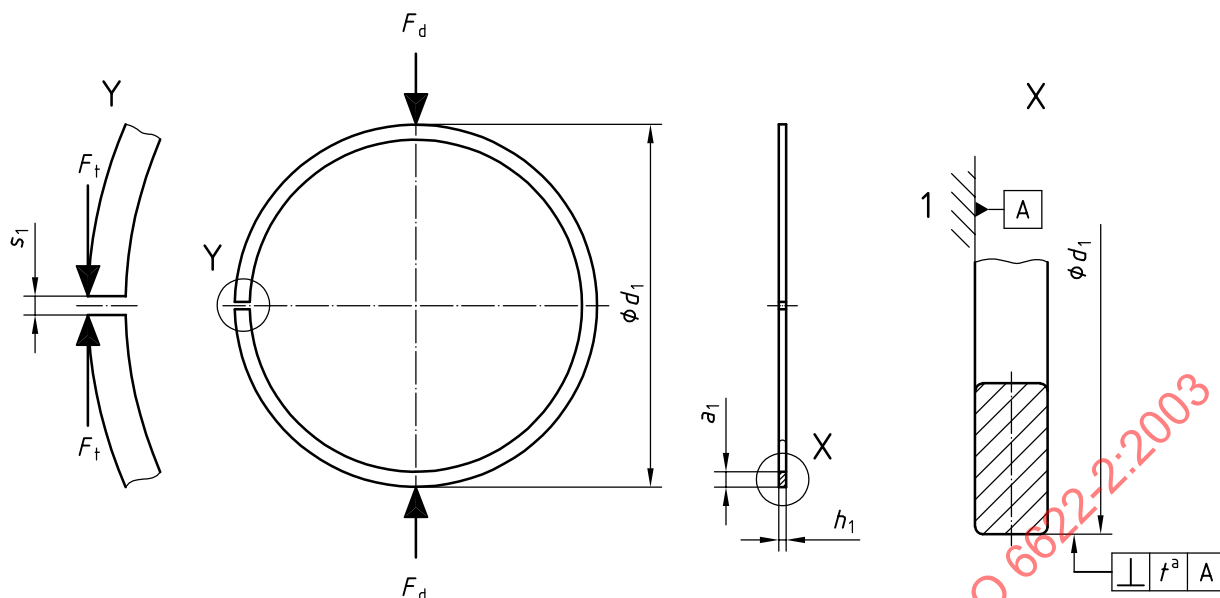
The rectangular ring types are specified in Tables 1 to 3 and Figures 1 to 4. Their common features and the dimensions of those features are specified in Tables 4 to 9 and Figures 5 to 22. Tables 10 and 11 give the force factors for the different ring types, while Table 12 gives the dimensions and forces of the rectangular rings.

4 Ring types and designation examples

4.1 Type R — Straight faced rectangular ring

4.1.1 General features

See Table 12 for dimensions and forces.



Key

1 reference plane

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

Figure 1 — Type R

4.1.2 Designation

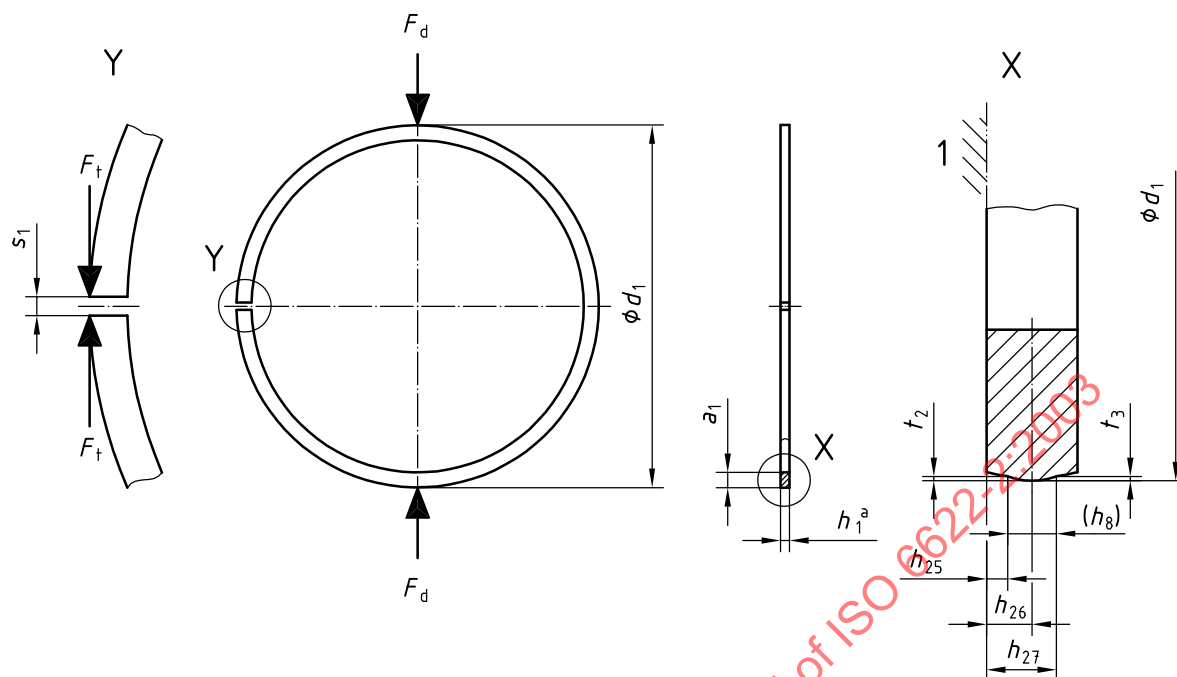
EXAMPLE Designation of a piston ring complying with the requirements of ISO 6622-2, being a steel, rectangular ring with a straight faced peripheral surface (R), of nominal diameter $d_1 = 60$ mm (60), of nominal ring width $h_1 = 1,2$ mm (1,2), made of CrSi alloyed steel, subclass 62 (MC62), and with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

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 12 for dimensions and forces.

**Key**

1 reference plane

^a See Table 1.**Figure 2 — Type B****Table 1 — Gauge width (h_8) and barrel dimensions for symmetrical barrel faced compression rings**

Dimensions in millimetres

h_1	h_{25}	h_{26}	h_{26} tol.	h_{27}	t_2, t_3	h_8^a
1,0	0,25	0,50	$\pm 0,15$	0,75	0,003...0,012	0,50
1,2	0,30	0,60	$\pm 0,20$	0,90		0,60
1,5	0,35	0,75	$\pm 0,25$	1,15	0,003...0,015	0,80
1,75	0,35	0,85	$\pm 0,30$	1,35		1,00
2,0	0,40	1,00	$\pm 0,30$	1,60		1,20
2,5	0,45	1,25	$\pm 0,40$	2,05		1,60
3,0	0,50	1,50	$\pm 0,50$	2,50	0,005...0,020	2,00
3,5	0,55	1,75	$\pm 0,50$	2,95		2,40

^a Gauge width (h_8) only informative; may be used only if agreed between manufacturer and client.**4.2.2 Designation**

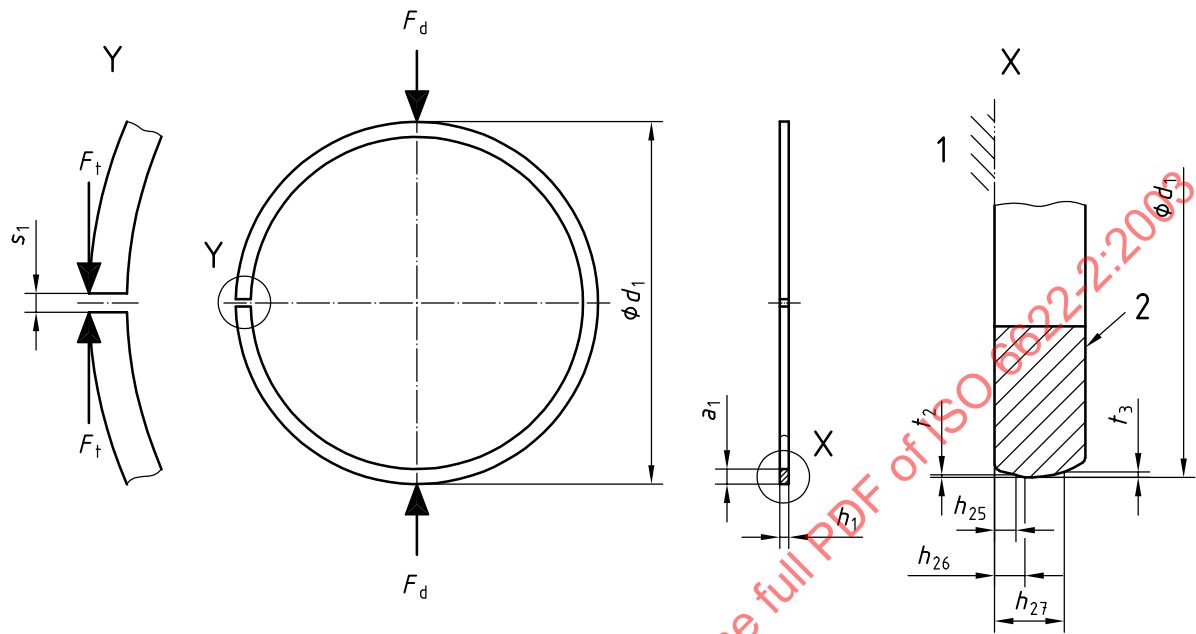
EXAMPLE Designation of a piston ring complying with the requirements of ISO 6622-2 being a steel, rectangular ring with barrel faced peripheral surface (B), of nominal diameter $d_1 = 60$ mm (60), of nominal ring width $h_1 = 1,5$ mm (1,5), made of martensitic steel (17 % Cr), subclass 66 (MC66), nitrided 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.:

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

4.3 Type BA — Asymmetrical barrel faced rectangular ring $h_1 \geq 1,5 \text{ mm}$

4.3.1 General feature

See Table 12 for dimensions and forces.



Key

- 1 reference plane
- 2 mark

Figure 3 — Type BA

Table 2 — Barrel dimensions

Dimensions in millimetres

h_1	h_{25}^a	h_{26}	$h_{26} \text{ tol.}$	h_{27}	t_2^b	t_3^b
1,5	0,35	0,50	$\pm 0,15$	1,15	0...0,005	0,007...0,022
1,75	0,35	0,55	$\pm 0,20$	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	$\pm 0,25$	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	$\pm 0,30$	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 client.						

4.3.2 Designation

EXAMPLE Designation of a piston ring complying with the requirements of ISO 6622-2 being a steel, rectangular ring with an asymmetrical barrel faced peripheral surface (BA), of nominal diameter $d_1 = 80$ mm (80) and 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.:

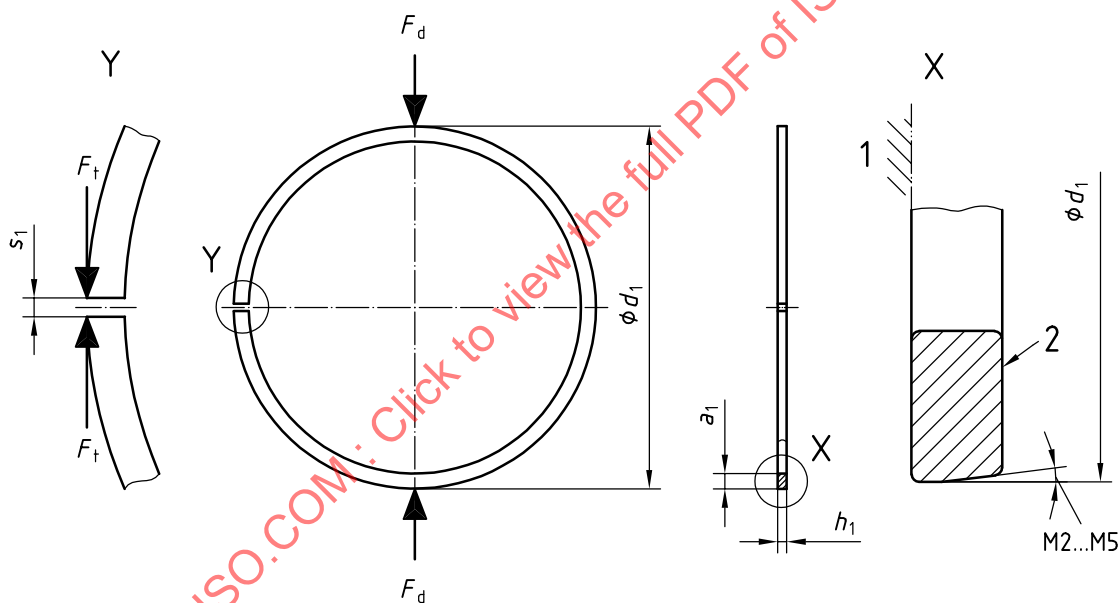
Piston ring ISO 6622-2 BA - 80 × 1,5 - MC66/NT050

4.4 Type M — Taper faced rectangular ring

NOTE Taper M1 excluded.

4.4.1 General features

See Table 12 for dimensions and forces.



Key

- 1 reference plane
- 2 mark

Figure 4 — Type M

Table 3 — Taper

Dimensions in minutes

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	$\begin{smallmatrix} +50 \\ 0 \end{smallmatrix}$	30	$\begin{smallmatrix} +60 \\ 0 \end{smallmatrix}$	—	—
M3	60		60		60	$\begin{smallmatrix} +60 \\ 0 \end{smallmatrix}$
M4	90		90		90	
M5	120		120		120	

^a IF and IFU are explained in Figures 18 and 19.

^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: $\begin{smallmatrix} +60 \\ 0 \end{smallmatrix}$ for M rings or $\begin{smallmatrix} +70 \\ 0 \end{smallmatrix}$ for M rings with IF or IFU).

^d IFU not recommended for rings $h_1 \leq 1,2$ mm

4.4.2 Designation

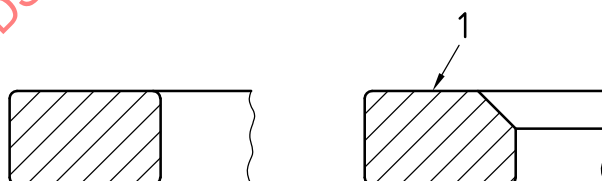
EXAMPLE Designation of a piston ring complying with the requirements of ISO 6622-2, being a steel, rectangular ring with 60' taper faced peripheral surface (M3), of nominal diameter $d_1 = 60$ mm (60) and of nominal ring width $h_1 = 1,5$ mm (1,5), made of alloyed steel (CrSi), subclass 62 (MC62), with a chromium plated peripheral surface of a minimum thickness of 0,1 mm (CR2):

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 rings



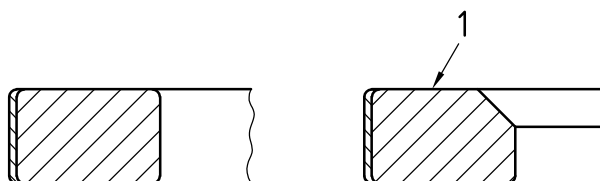
Key

1 mark

Figure 5 — Nitrided type R rings

5.1.2 Chromium plated or spray coated rings

5.1.2.1 Fully faced

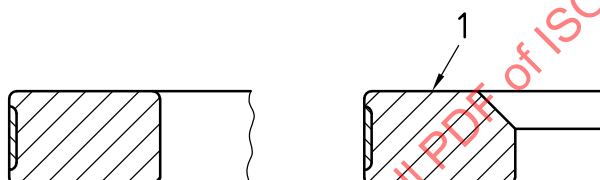


Key

1 mark

Figure 6 — Fully faced type R rings

5.1.2.2 Inlaid $h_1 \geq 1,2$ mm (not recommended for chromium plated rings)



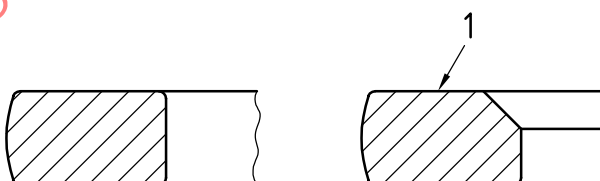
Key

1 mark

Figure 7 — Inlaid type R rings

5.2 Type B — Barrel faced rectangular ring

5.2.1 Nitrided rings



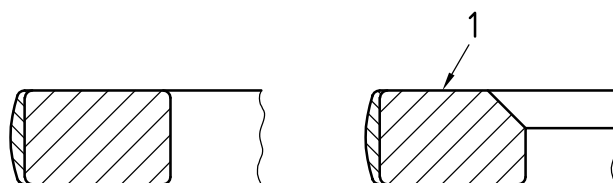
Key

1 mark

Figure 8 — Nitrided type B rings

5.2.2 Chromium plated or spray coated rings

5.2.2.1 Fully faced

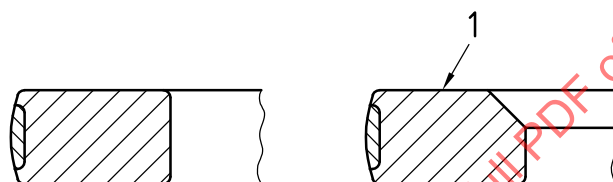


Key

1 mark

Figure 9 — Fully faced type B rings

5.2.2.2 Inlaid $h_1 \geq 1,2$ mm (not recommended for chromium plated rings)



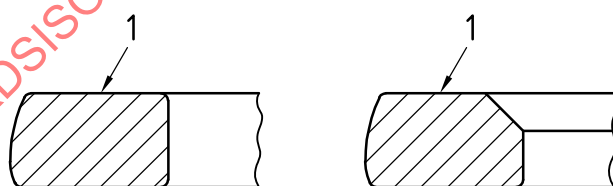
Key

1 mark

Figure 10 — Inlaid type B rings

5.3 Type BA — Asymmetrical barrel faced rectangular ring $h_1 \geq 1,5$ mm

5.3.1 Nitrided rings



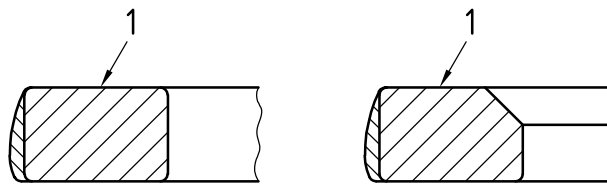
Key

1 mark

Figure 11 — Nitrided type BA rings

5.3.2 Chromium plated or spray coated rings

5.3.2.1 Fully faced

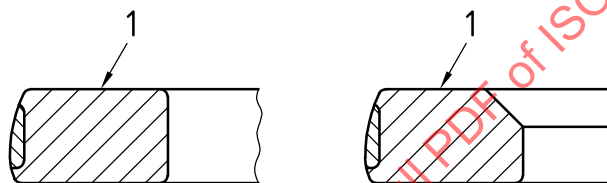


Key

1 mark

Figure 12 — Fully faced type BA rings

5.3.2.2 Inlaid $h_1 \geq 1,2$ mm (not recommended for chromium plated rings)



Key

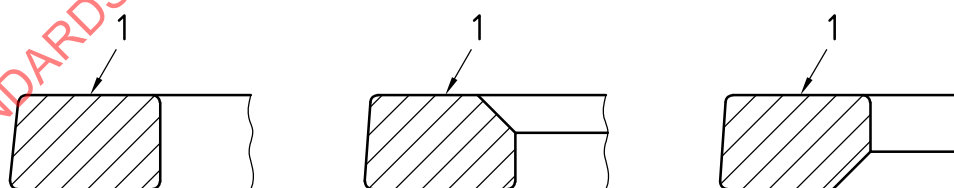
1 mark

Figure 13 — Inlaid type BA rings

5.4 Type M — Taper faced rectangular ring

5.4.1 Fully tapered

5.4.1.1 Nitrided rings



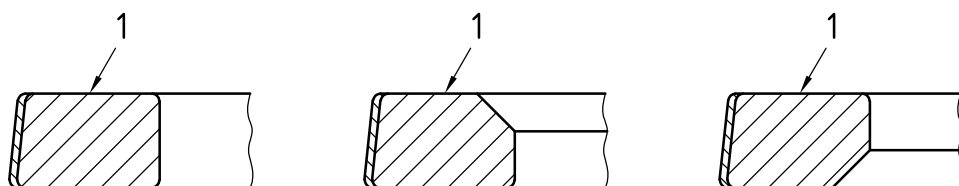
Key

1 mark

Figure 14 — Nitrided type M rings

5.4.1.2 Chromium plated or spray coated rings

5.4.1.2.1 Fully faced

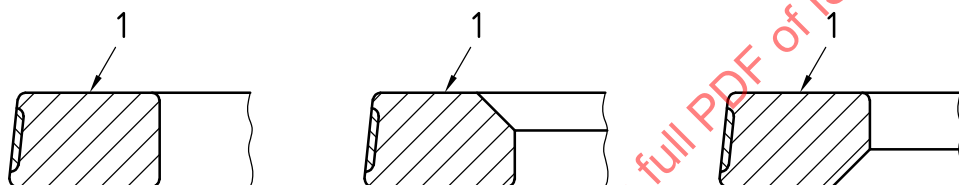


Key

1 mark

Figure 15 — Fully faced type M rings

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

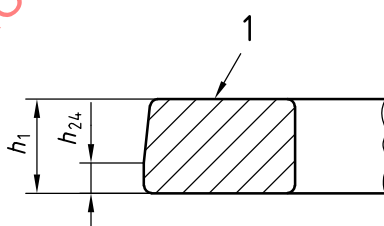


Key

1 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 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

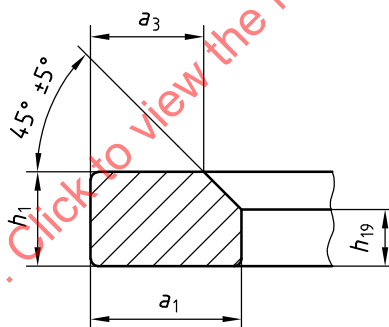
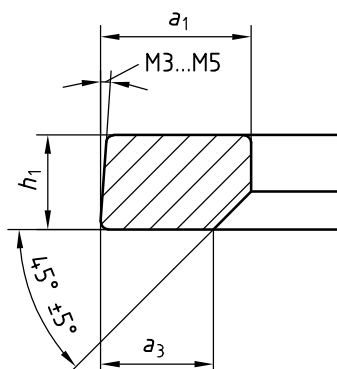


Figure 18 — Internal bevel (IF)

5.6 Type M rings (negative twist type), taper M3 to M5 — Internal bevel bottom side, $h_1 \geq 1,5$ mm

NOTE See Table 3.

Figure 19 — Internal bevel bottom side (IFU)

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

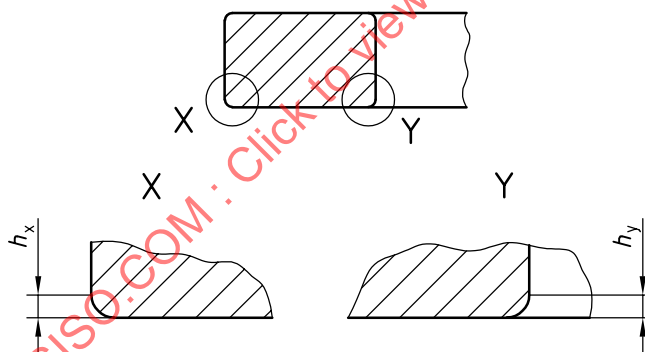
Dimensions in millimetres

d_1	h_{19}	Tolerance
$30 \leq d_1 \leq 100$	$0,6 \times h_1$	$\begin{smallmatrix} 0 \\ -0,25 \end{smallmatrix}$

Table 6 — a_3 dimensions for rings $h_1 \geq 1,5$ mm

Dimensions in millimetres

d_1	a_3	Tolerance
$30 \leq d_1 < 80$	$0,8 \times a_1$	$\begin{smallmatrix} 0 \\ -0,2 \end{smallmatrix}$
$80 \leq d_1 \leq 160$	$0,8 \times a_1$	$\begin{smallmatrix} 0 \\ -0,3 \end{smallmatrix}$

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.
$1,0 \leq h_1 < 1,5$	0,25	0,30
$1,5 \leq h_1 < 2,5$	0,30	0,35
$h_1 \geq 2,5$	0,30	0,40

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

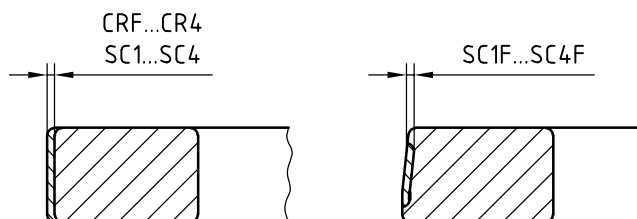


Figure 21 — Plating/coating thickness

Table 8 — Plating/coating thickness

Dimensions in millimetres

Chromium plating code	Spray coating code	Thickness min.
CRF	—	0,005
CR1	SC1	0,05
CR2	SC2	0,1
CR3 ^a	SC3 ^a	0,15
CR4 ^a	SC4 ^a	0,2

^a Not recommended for rings $h_1 \leq 1,2$.

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

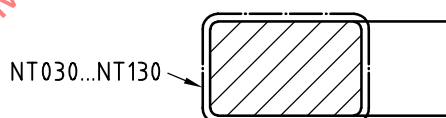


Figure 22 — Nitrided case depth

Table 9 — Nitrided case depth

Dimensions in millimetres

Code	Nitrided case depth min.	
	Peripheral surface	Side faces
NT030	0,03	0,01
NT050	0,05	0,015
NT070	0,07	0,02
NT090	0,09	0,02
NT110	0,11	0,03
NT130	0,13	0,03

6 Force factors

The tangential and diametral forces given in Table 12 shall be corrected when additional features are being used. For common features, the multiplier factors given in Tables 10 and 11 shall be used.

Table 10 — 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 11 — Force correction factors for nitrided and coated R, B, BA and M rings
(fully faced and inlaid type)**

d_1 mm	Factor							
	CRF	CR1	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

See Table 12.

Table 12 — Dimensions 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		h_1 shown in column						Tolerance	F_t shown in column					Tolerance	F_d shown in column					Tolerance								
		1	2	3	4	5	6	7		1	2	3	4	5	6	7		1	2	3	4	5	6	7						
30	1,1																	5,4	6,5									30		
31																		5,4	6,5									31		
32													—					5,4	6,5	—								32		
33																		5,2	6,2									33		
34																		6,0	7,3									34		
35	1,3																	6,2	7,3									35		
36																		6,2	7,3									36		
37																		6,2	7,5	—								37		
38																		6,0	7,3									38		
39																			7,1	8,4								± 30 % if $F_d < 21,5 \text{ N}$	39	
40	1,5	1,0	1,2	—	—	—	—	—		+0,2 0								7,1	8,4									± 20 % if $F_d \geq 21,5 \text{ N}$	40	
41																		7,1	8,4										41	
42																			7,1	8,4	—									42
43																			7,1	8,4										43
44																			6,9	8,4										44
45	1,7																	8,2	9,7										45	
46																		8,2	9,7										46	
47																		8,0	9,7										47	
48																		8,0	9,7										48	
49																			8,0	9,7										49
50	1,9																	8,0	9,5	12,0									50	
51																			9,2	11,0	13,8								51	

Table 12 (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_d N							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	
52	1,9								+0,2 0	4,2	5,1	6,4					9,0	11,0	13,8					52
53										4,2	5,1	6,4					9,0	11,0	13,8					53
54										4,2	5,0	6,3					9,0	10,8	13,5					54
55	2,1								For phosphated PO surface: 0,15 -0,005 -0,025	4,2	5,0	6,3					9,0	10,8	13,5					55
56										4,1	5,0	6,2					8,8	10,8	13,3					56
57										4,8	5,7	7,2					10,3	12,3	15,5					57
58										4,7	5,7	7,1					10,1	12,3	15,3					58
59										4,6	5,6	7,0					9,9	12,0	15,1					59
60	± 0,15 Within a ring: 0,15 max.								-0,010 -0,030	4,6	5,5	6,9					9,9	11,8	14,8					60
61										4,5	5,4	6,8					9,7	11,6	14,6					61
62										5,2	6,2	7,8					11,2	13,3	16,8					62
63										5,1	6,2	7,7					11,0	13,3	16,6					63
64										5,1	6,1	7,7					11,0	13,1	16,6					64
65	2,3								For phosphated PO surface: 0,2 -0,005 -0,030	5,0	6,1	7,6					10,8	13,1	16,3					65
66										5,0	6,0	7,5					10,8	12,9	16,1					66
67										4,9	5,9	7,4					10,5	12,7	15,9					67
68										5,7	6,8	8,6					12,3	14,6	18,5					68
69										5,6	6,8	8,5					12,0	14,6	18,3					69
70	2,5								+0,2 0	5,6	6,7	8,4	9,8	11,2	14,1		12,0	14,4	18,1	21,1	24,1	30,2		70
71										5,5	6,6	8,3	9,7	11,1	13,9		11,8	14,2	17,8	20,9	23,9	29,9		71
72										5,4	6,5	8,2	9,6	11,0	13,7		11,6	14,0	17,6	20,6	23,7	29,6		72
73										5,4	6,5	8,1	9,5	10,8	13,6		11,6	14,0	17,4	20,4	23,2	29,2		73