
**Internal combustion engines —
Piston rings —**

Part 2:
Half keystone rings made of cast iron

Moteurs à combustion interne — Segments de piston —

Partie 2: Segments de demi-trapézoïdaux fabriqués en fonte moulée

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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.

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 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

This second edition cancels and replaces the first edition (ISO 6624-2:2003), which has been technically revised.

ISO 6624 consists of the following parts, under the general title *Internal combustion engines — Piston rings*:

- *Part 1: Keystone rings made of cast iron*
- *Part 2: Half keystone rings made of cast iron*
- *Part 3: Keystone rings made of steel*
- *Part 4: Half keystone rings made of steel*

Introduction

ISO 6624 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 6622,^{[6][7]} ISO 6623,^[8] ISO 6625,^[9] ISO 6626,^{[10][11][12]} and ISO 6627.^[13]

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Internal combustion engines — Piston rings —

Part 2: Half keystone rings made of cast iron

1 Scope

This part of ISO 6624 specifies the essential dimensional features of half keystone rings made of cast iron, types HK, HKB and HKBA, having nominal diameters from 38 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.

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

3 Overview

The half keystone ring types are specified in [Tables 1](#) and [2](#) and [Figures 1](#) to [3](#). Their common features and the dimensions of those features are specified in [Tables 3](#) and [4](#) and [Figures 4](#) to [9](#). [Tables 5](#) and [6](#) give the force factors for the different ring types, while [Table 7](#) gives the dimensions and forces of half keystone rings.

The common features and dimensional tables presented in this part of ISO 6624 constitute a broad range of variables and, in selecting a particular ring type, the designer shall 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 selection.

4 Ring types and designation examples

NOTE For the angle of half keystone rings, the same definition and measurement apply as for keystone rings (see ISO 6621-2).

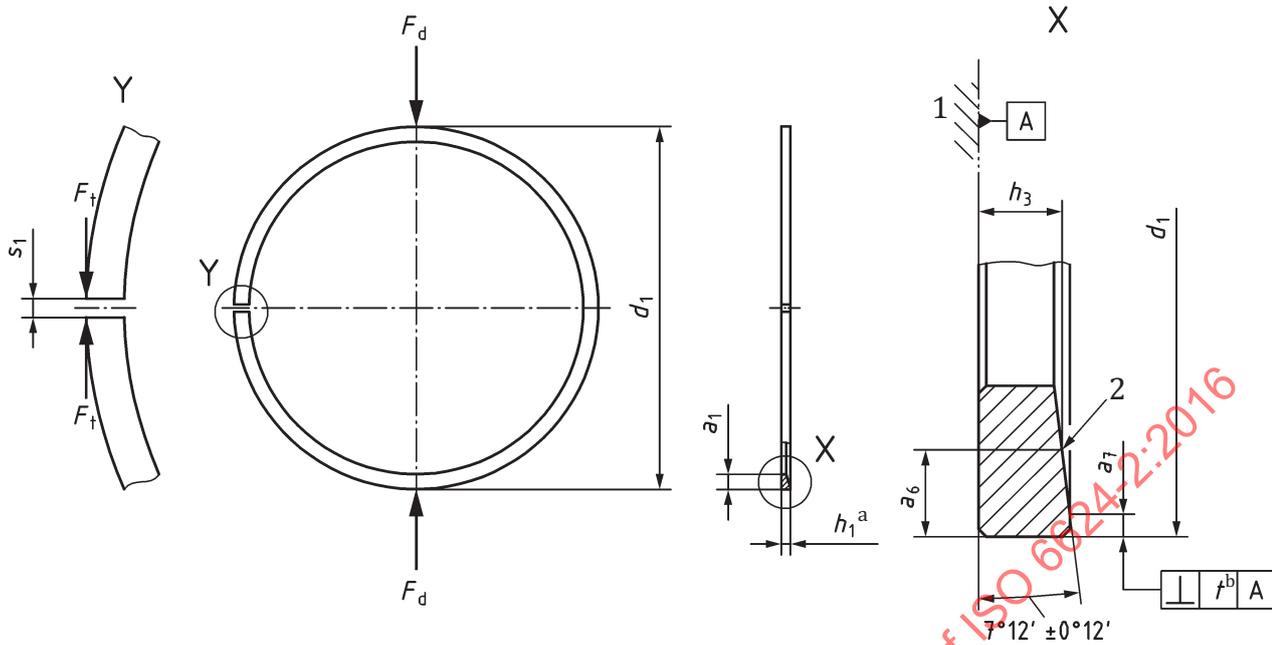
4.1 Type HK — Straight faced half keystone ring 7°

4.1.1 General features

[Figure 1](#) shows the general features of piston ring type HK.

See [Table 7](#) for dimensions and forces.

h_3 values are calculated based on [Annex A](#).



Key

- 1 reference plane (ring is positioned flat against datum A)
- 2 top side identification mark
- a Nominal.
- b $t = 0,006 \times h_1$.

Figure 1 — Type HK

4.1.2 Designation

EXAMPLE Designation of a piston ring complying with the requirements of ISO 6624-2, being a 7° half keystone ring made of cast iron, with a straight-faced peripheral surface (HK), of $d_1 = 90$ mm (90), of nominal ring width $h_1 = 1,5$ mm (1,5), made of heat treated martensitic spheroidal graphite cast iron, subclass 53 (MC53), and having a chromium plated peripheral surface with a minimum thickness 0,1 mm (CR2). Parameters in parenthesis are used in the ISO ring designation:

Piston ring ISO 6624-2 HK - 90 × 1,5 - MC53/CR2

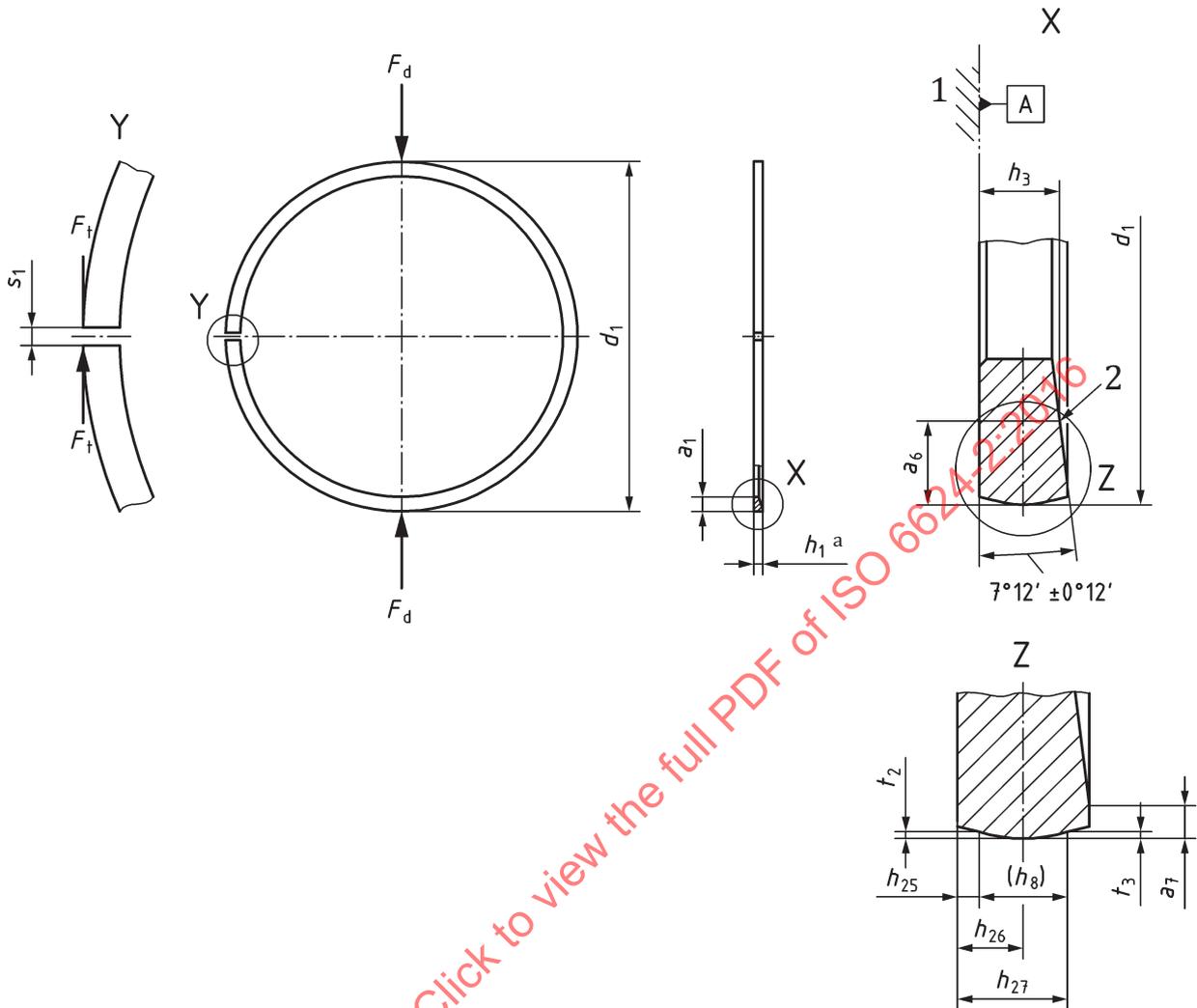
4.2 Type HKB — Barrel faced half keystone ring 7°

4.2.1 General features

Figure 2 shows the general features of piston ring type HKB.

See Table 7 for dimensions and forces.

h_3 values are calculated based on Annex A.



Key

- 1 reference plane (ring is positioned flat against datum A)
- 2 top side identification mark
- a Nominal.

Figure 2 — Type HKB

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
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	0,005...0,020	1,60
3,0	0,50	1,50	±0,50	2,50		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 the manufacturer and the customer.

4.2.2 Designation

EXAMPLE Designation of a piston ring complying with the requirements of ISO 6624-2, being a 7° half keystone ring made of cast iron, with a barrel faced peripheral surface (HKB), of $d_1 = 90$ mm (90), of nominal ring width $h_1 = 1,5$ mm (1,5), made of non-heat-treated grey cast iron, subclass 12 (MC12), and having a chromium plated peripheral surface with a minimum thickness of 0,1 mm (CR2). Parameters in parenthesis are used in the ISO ring designation:

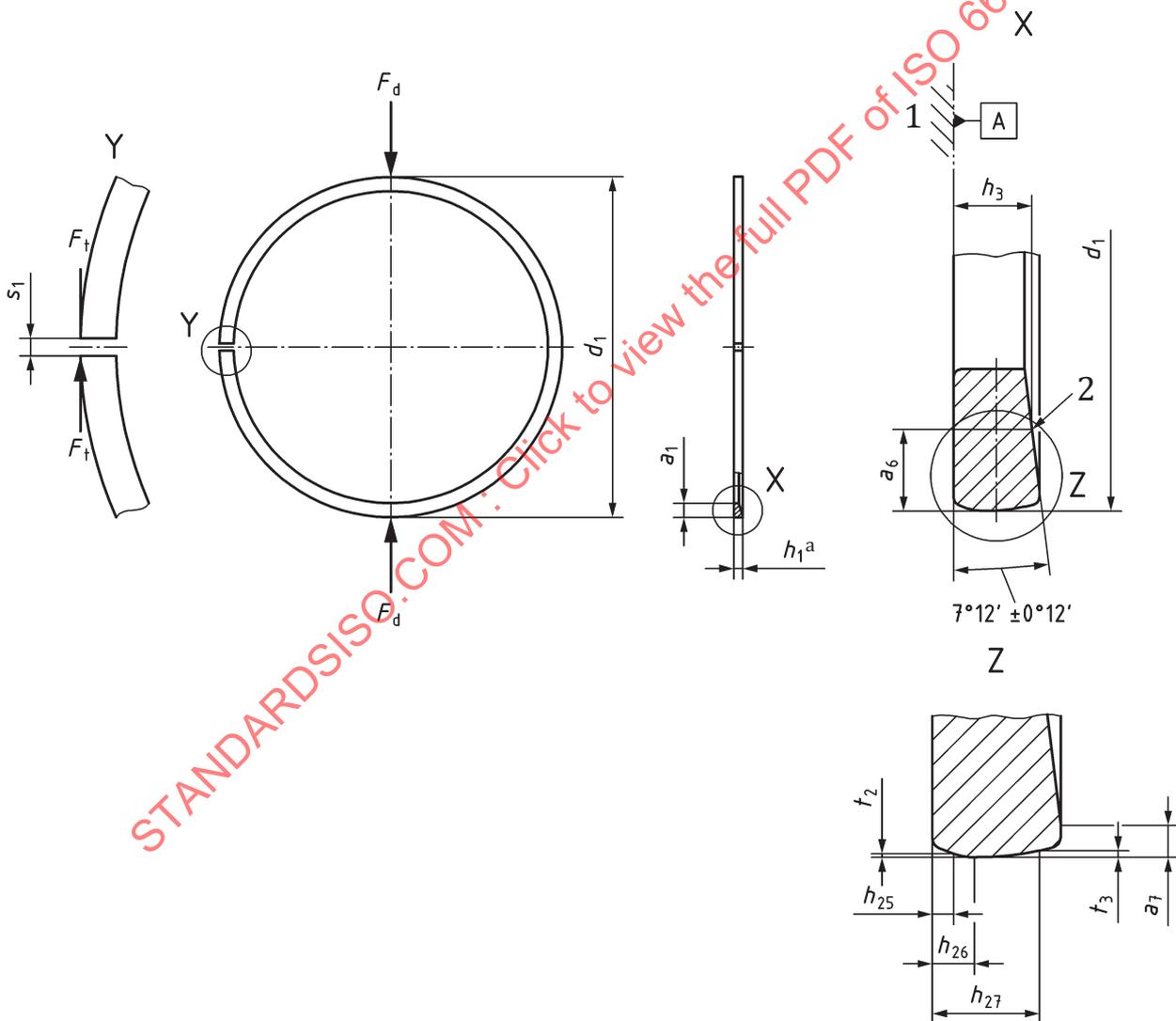
Piston ring ISO 6624-2 HKB - 90 × 1,5 - MC12/CR2

4.3 Type HKBA — Asymmetrical barrel faced half keystone ring 7° ($h_1 \geq 1,2$ mm)

4.3.1 General features

See Table 7 for dimensions and forces.

h_3 values are calculated based on Annex A.



Key

- 1 reference plane (ring is positioned flat against datum A)
- 2 top side identification mark
- a Nominal.

Figure 3 — Type HKBA

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	0,28	0,43	±0,15	0,90	0...0,005	0,005...0,016
1,5	0,35	0,50		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 the manufacturer and the customer.

4.3.2 Designation

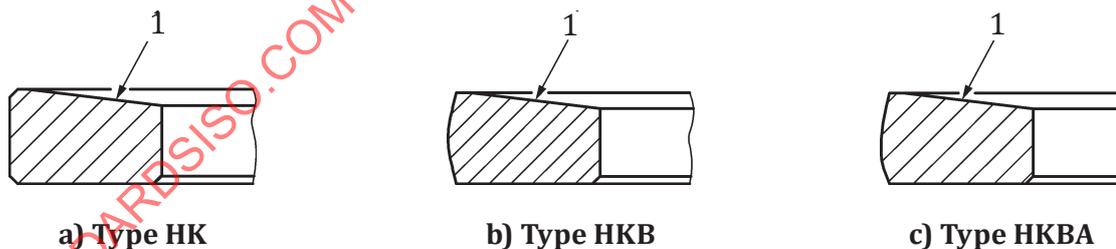
EXAMPLE Designation of a piston ring complying with the requirements of ISO 6624-2, being a 7° half keystone ring made of cast iron, with an asymmetrical barrel faced peripheral surface (HKBA), of $d_1 = 90$ mm (90), of nominal ring width $h_1 = 1,5$ mm (1,5), made of non-heat-treated grey cast iron, subclass 12 (MC12), and having a chromium plated peripheral surface with a minimum thickness of 0,1 mm (CR2). Parameters in parenthesis are used in the ISO ring designation:

Piston ring ISO 6624-2 HKBA - 90 × 1,5 - MC12/CR2

5 Common features

5.1 Type HK, HKB and HKBA — Half keystone ring

5.1.1 Uncoated rings



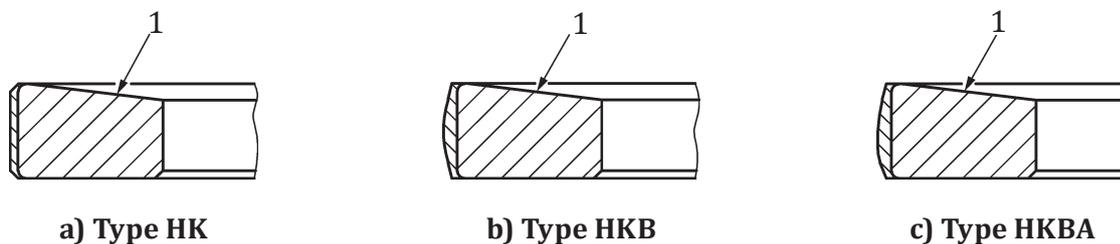
Key

1 top side identification mark

Figure 4 — Uncoated rings

5.1.2 Chromium plated or spray coated rings

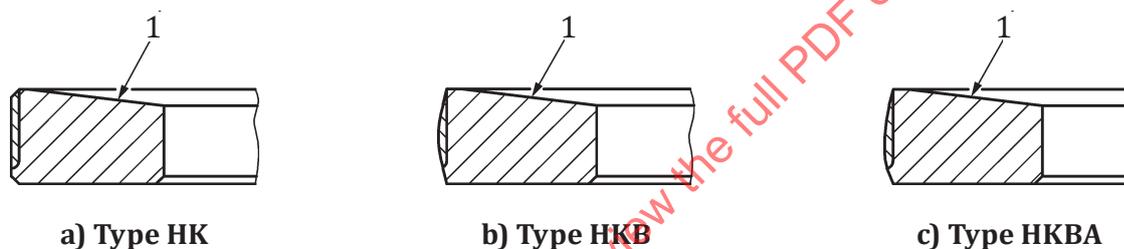
5.1.2.1 Fully faced



Key
1 top side identification mark

Figure 5 — Fully faced rings

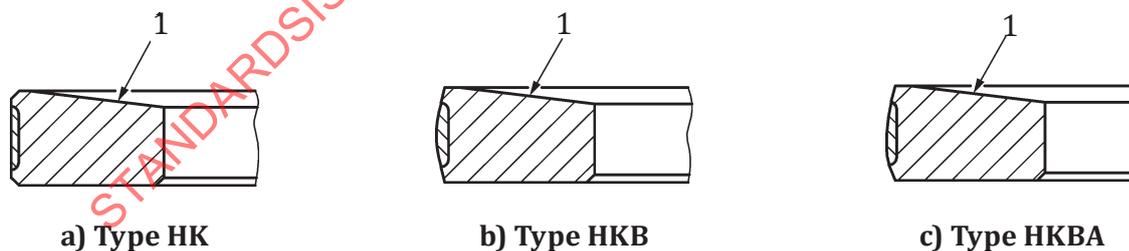
5.1.2.2 Semi-inlaid



Key
1 top side identification mark

Figure 6 — Semi-inlaid rings

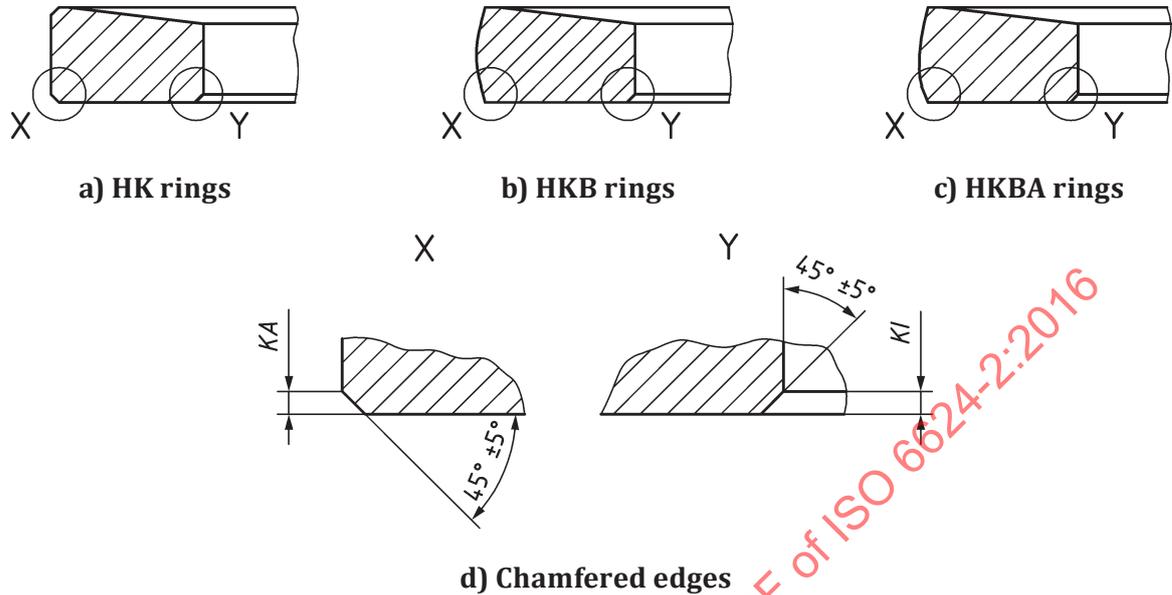
5.1.2.3 Inlaid (not recommended for chromium plated rings)



Key
1 top side identification mark

Figure 7 — Inlaid rings

5.2 Chamfered edges — Type HK, HKB and HKBA rings — Outside and/or inside chamfered edges (KA, KI)



Key

- 1 top side identification mark

Figure 8 — Details of chamfered edges (KA, KI)

Table 3 — KA and KI dimensions

Dimensions in millimetres

d_1	KA	KI
$38 \leq d_1 < 50$	0,2 max.	0,2 max.
$50 \leq d_1 < 125$	$0,3 \pm 0,1$	$0,3 \pm 0,15$
$125 \leq d_1 \leq 160$	$0,4 \pm 0,1$	$0,4 \pm 0,15$

5.3 Type HK, HKB and HKBA rings (fully faced, semi-inlaid) — Plating/coating thickness

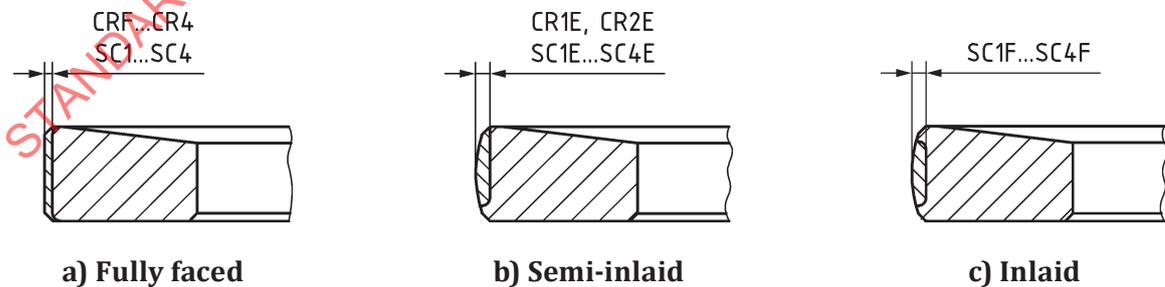


Figure 9 — Plating/coating thickness

Table 4 — Plating/coating thickness

Dimensions in millimetres

Chromium plating code	Spray coating code	Thickness min.
CRF	—	0,005
CR1	SC1	0,05
CR2	SC2	0,10
CR3 ^a	SC3 ^a	0,15
CR4 ^a	SC4 ^a	0,20

^a Not recommended for rings $h_1 \leq 1,5$.

6 Force factors

The tangential and diametral forces given in Table 7 shall be corrected when additional features or materials other than grey cast iron with a modulus of elasticity, E_n , of 100 GN/m², or both, are used.

For common features, multiplier correction factors given in Tables 5 and 6 and the force correction factors specified in ISO 6621-4 shall be used.

Table 5 — Force correction factors for HK, HKB and HKBA rings with features KA or KI

Factor	
KA	KI
0,98	0,98

Table 6 — Force correction factors for chromium plated and spray coated HK, HKB and HKBA rings (fully faced, semi-inlaid and inlaid type)

d_1 mm	Factor					
	CRF	CR1	CR2/SC1	CR3/SC2	CR4/SC3	SC4
$38 \leq d_1 < 50$	1	0,81	0,70	0,64	—	—
$50 \leq d_1 < 75$	1	0,90	0,85	0,81	0,75	0,71
$75 \leq d_1 < 100$	1	0,92	0,88	0,85	0,81	0,77
$100 \leq d_1 < 125$	1	0,94	0,91	0,88	0,86	0,83
$125 \leq d_1 \leq 160$	1	0,95	0,92	0,90	0,88	0,85

7 Dimensions and forces

See Table 7.

Table 7 — Dimensions and forces of HK, HKB and HKBA half keystone rings

Dimensions in millimetres

Nominal diameter	Radial wall thickness	Nominal value of ring width					a ₆	a ₇	Method A					Method B												
		h ₁							Measured value, h ₃ ^{ab}					h ₃ (ref.)					Measured value ^b							
		Column							For h ₁ shown in column					Column						a ₆						
d ₁	a ₁	1	2	3	4	5	Ref.	1	2	3	4	5	Tolerance	1	2	3	4	5	Tolerance							
38	1,6						0,6	1,169							1,16					0,69						
39	1,65																									
40	1,65																									
41	1,7																									
42	1,75																									
43	1,8																									
44	1,85		—																							
45	1,9						0,8	1,143						1,13						0,90						
46	1,9																									
47	1,95																									
48	2								0,5 max.																	
49	2,05																									
50	2,1																									
51	2,15																									
52	2,15																									
53	2,2																									
54	2,25	±0,15			—	—								0 -0,024			—	—		-0 0,19						
55	2,3	Within a ring: 0,15 max.	1,2					1,118	1,418					For phosphated PO surface: +0,01 -0,024	1,11	1,41				1,10	For phosphated PO surface: +0,08 -0,19					
56	2,35																									
57	2,4																									
58	2,4																									
59	2,45																									
60	2,5						1,0																			
61	2,55																									
62	2,6																									
63	2,65																									
64	2,65																									
65	2,7																									
66	2,75																									
67	2,8																									
68	2,85																									
69	2,9																									
70	2,9																									
71	2,95																									
72	3				1,75	2,0	1,5	0,7 max.	1,053	1,353	1,603	1,853		1,04	1,34	1,59	1,84		1,60							
73	3,05																									

Table 7 — (continued)

Closed gap		Tangential force						Diametral force						Nominal diameter		
s_1	Tolerance	F_t N					Tolerance	F_d N					Tolerance	d_1		
		For h_1 shown in column						For h_1 shown in column								
		1	2	3	4	5		1	2	3	4	5				
0,15	+0,2 0	—	—					7,3	—						38	
								7,7							39	
								7,3							40	
								7,5							41	
		—	—					8,0	—						42	
								8,4							43	
								8,6							44	
								8,8							45	
								8,4							46	
		—	—					8,6	—						47	
								8,8							48	
								9,2							49	
				4,4	5,6				9,5	12,0						50
				4,5	5,8				9,7	12,5						51
				4,3	5,5				9,2	11,8						52
				4,5	5,8	—	—		9,7	12,5	—	—				53
				4,6	5,9				9,9	12,7						54
				4,7	6,1				10,1	13,1						55
				4,8	6,2				10,3	13,3						56
		5,0	6,4				10,8	13,8						57		
		4,8	6,2				10,3	13,3						58		
		4,9	6,3				10,5	13,5						59		
0,2		5,0	6,5				10,8	14,0							60	
		5,2	6,6				11,2	14,2							61	
		5,3	6,8				11,4	14,6							62	
		5,4	7,0				11,6	15,1							63	
		5,2	6,7				11,2	14,4							64	
		5,3	6,9				11,4	14,8							65	
		5,4	7,0				11,6	15,1							66	
		5,6	7,2				12,0	15,5							67	
		5,7	7,4				12,3	15,9							68	
		5,8	7,5				12,5	16,1							69	
		5,6	7,3	8,6	10,0			12,0	15,7	18,5	21,5					70
		5,8	7,5	8,9	10,3			12,5	16,1	19,1	22,1					71
		5,9	7,6	9,1	10,5			12,7	16,3	19,6	22,6					72
6,0	7,8	9,2	10,7			12,9	16,8	19,8	23,0					73		

Table 7 — (continued)

Closed gap		Tangential force					Diametral force					Nominal diameter d_1	
s_1	Tolerance	F_t N					Tolerance	F_d N					
		For h_1 shown in column						For h_1 shown in column					
		1	2	3	4	5		1	2	3	4	5	
0,2	$^{+0,2}_0$	6,1	7,9	9,4	10,9			13,1	17,0	20,2	23,4		74
0,25		6,2	8,0	9,5	11,1	—		13,3	17,2	20,4	23,9		75
		6,0	7,8	9,3	10,8			12,9	16,8	20,0	23,2		76
		6,2	8,0	9,5	11,1			13,3	17,2	20,4	23,9		77
		6,3	8,1	9,7	11,2			13,5	17,4	20,9	24,1		78
		6,4	8,3	9,8	11,4			13,8	17,8	21,1	24,5		79
		6,4	8,4	10,0	11,6			13,8	18,1	21,5	24,9		80
		6,6	8,6	10,3	11,9			14,2	18,5	22,1	25,6		81
		6,4	8,4	10,0	11,6			13,8	18,1	21,5	24,9		82
		6,5	8,5	10,1	11,8			14,0	18,3	21,7	25,4		83
		6,6	8,6	10,3	12,0			14,2	18,5	22,7	25,8		84
		6,8	8,8	10,5	12,3			14,6	18,9	22,6	26,4		85
		6,8	8,9	10,7	12,4			14,6	19,1	23,0	26,7		86
		6,9	9,1	10,9	12,6			14,8	19,6	23,4	27,1		87
		6,8	8,9	10,6	12,3			14,6	19,1	22,8	26,4		88
6,9	9,0	10,8	12,6	14,8	19,4	23,2	27,1	89					
0,3	$^{+0,25}_0$	—	9,1	10,9	12,7	16,3	$\pm 30\%$ if $F_t < 10$ N	19,6	23,4	27,3	35,0	$\pm 30\%$ if $F_d < 21,5$ N	90
		—	9,2	11,0	12,9	16,5	$\pm 20\%$ if $F_t \geq 10$ N	19,8	23,7	27,7	35,5	$\pm 20\%$ if $F_d \geq 21,5$ N	91
		—	9,4	11,2	13,1	16,8	—	20,2	24,1	28,2	36,1	92	
		—	9,5	11,4	13,3	17,1	20,4	24,5	28,6	36,8	93		
		—	9,3	11,1	13,0	16,7	20,0	23,9	28,0	35,9	94		
		—	9,5	11,3	13,2	17,0	—	20,4	24,3	28,4	36,6	95	
		—	9,6	11,5	13,5	17,3	—	20,6	24,7	29,0	37,2	96	
		—	9,7	11,7	13,6	17,5	—	20,9	25,2	29,2	37,6	97	
		—	9,9	11,9	13,9	17,8	—	21,3	25,6	29,9	38,3	98	
		—	10,0	12,0	14,0	18,0	—	21,5	25,8	30,1	38,7	99	
		—	11,8	13,7	17,7	21,6	—	25,3	29,5	38,1	46,4	100	
		—	11,9	13,9	17,9	21,9	—	25,6	29,9	38,5	47,1	101	
		—	12,1	14,1	18,2	22,3	—	26,0	30,3	39,1	47,9	102	
		—	12,2	14,3	18,4	22,5	—	26,3	30,7	39,6	48,4	103	
—	12,0	14,0	18,1	22,1	—	25,8	30,1	38,9	47,5	104			
—	12,1	14,2	18,3	22,3	—	26,0	30,5	39,3	47,9	105			
—	12,2	14,3	18,5	22,6	—	26,3	30,7	39,8	48,6	106			
—	12,0	14,0	18,1	22,2	—	25,8	30,1	38,9	47,7	107			
—	12,1	14,2	18,3	22,4	—	26,1	30,5	39,3	48,2	108			
—	12,2	14,3	18,5	22,7	—	26,3	30,7	39,8	48,8	109			

Table 7 — (continued)

Closed gap		Tangential force					Diametral force					Nominal diameter d_1						
s_1	Tolerance	F_t N					Tolerance	F_d N										
		For h_1 shown in column						For h_1 shown in column										
		1	2	3	4	5		1	2	3	4	5						
0,35	±0,25 0	—	14,5	18,7	22,9	27,1	±30 % if $F_t < 10$ N ±20 % if $F_t \geq 10$ N	—	31,2	40,2	49,2	58,3	±30 % if $F_d < 21,5$ N ±20 % if $F_d \geq 21,5$ N	110				
			14,2	18,4	22,5	26,6			30,5	39,6	48,4	57,2		111				
			14,4	18,6	22,8	27,0			31,0	40,0	49,0	58,1		112				
			14,6	18,8	23,1	27,3			31,4	40,4	49,7	58,7		113				
			14,7	19,1	23,4	27,7			31,6	41,1	50,3	59,6		114				
		—	14,5	18,7	23,0	27,2		—	31,2	40,2	49,5	58,5		115				
			14,6	18,9	23,1	27,4			31,4	40,6	49,7	58,9		116				
			14,8	19,1	23,4	27,8			31,8	41,1	50,3	59,8		117				
			14,5	18,7	23,0	27,2			31,2	40,2	49,5	58,5		118				
			14,7	19,0	23,3	27,6			31,6	40,9	50,1	59,3		119				
		—	14,8	19,2	23,6	28,0		—	31,8	41,3	50,7	60,2		120				
			15,0	19,5	23,9	28,3			32,3	41,9	51,4	60,8		121				
			14,7	19,1	23,5	27,8			31,6	41,1	50,5	59,8		122				
			14,9	19,3	23,8	28,2			32,0	41,5	51,2	60,6		123				
			15,0	19,5	23,9	28,4			32,3	41,9	51,4	61,1		124				
		0,4	±0,25 0	—	14,7	19,1		23,5	27,9	±30 % if $F_t < 10$ N ±20 % if $F_t \geq 10$ N	—	31,6		41,1	50,5	60,0	±30 % if $F_d < 21,5$ N ±20 % if $F_d \geq 21,5$ N	125
					14,9	19,4		23,8	28,2			32,0		41,7	51,2	60,6		126
					15,1	19,6		24,1	28,6			32,5		42,1	51,8	61,5		127
					15,3	19,8		24,4	29,0			32,9		42,6	52,5	62,4		128
15,0	19,5				24,0	28,4	32,3	41,9	51,6			61,1	129					
—	19,6			24,2	28,7	—	42,2	51,9	61,7		—	130						
	19,9			24,4	29,0		42,7	52,6	62,4			131						
	19,5			24,0	28,5		41,9	51,6	61,3			132						
	19,7			24,2	28,7		42,3	52,0	61,7			133						
	19,9			24,5	29,1		42,8	52,7	62,6			134						
—	19,5	24,1	28,6	—	42,0	51,7	61,5	—	135									
	19,8	24,4	28,9		42,5	52,4	62,1		136									
	20,0	24,6	29,3		43,0	53,0	63,0		137									
	19,6	24,2	28,8		42,2	52,1	61,9		138									
	19,9	24,5	29,1		42,7	52,7	62,6		139									
—	20,1	24,7	29,4	—	43,1	53,2	63,2	—	140									
	20,2	25,0	29,7		43,5	53,7	63,9		141									
	19,9	24,5	29,2		42,8	52,7	62,8		142									
	20,1	24,8	29,5		43,1	53,3	63,4		143									
	20,3	25,1	29,8		43,7	53,9	64,1		144									
	20,0	24,6	29,3		42,9	53,0	63,0		145									
	20,1	24,9	29,6		43,3	53,5	63,6		146									
20,3	25,1	29,9	43,7	54,0	64,3	147												