TECHNICAL REPORT 6624-2

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Internal combustion engines — Piston rings —

Part 2: Half keystone rings

Moteurs à combustion interne — Segments de piston —

Partie 2: Segments demi-trapézoïdaux

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.

The main task of ISO technical committees is to prepare International Standards. In exceptional circumstances a technical committee may propose the publication of a technical report of one of the following types:

— type 1, when the necessary support within the technical committee cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development requiring wider exposure;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical reports are accepted for publication directly by ISO Council. Technical reports types 1 and 2 are subject to review within three years of publication, to decide if they can be transformed into International Standards. Technical reports type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 6624-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

The reasons which led to the decision to publish this document in the form of a technical report type 2 are explained in the Introduction.

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Contents

0 Introduction

This Technical Report, part 2 of ISO 6624, is one of a series of International Standards dealing with piston rings for reciprocating internal combustion engines:

ISO 6621, *Internal combustion engines — Piston rings —*

Part 1: Vocabulary.

Part 2: Measuring principles.

Part 3: Material specifications.

Part 4: General specifications.

Part 5: Quality requirements.

ISO 6622, *Internal combustion engines — Piston rings —*

Part 1: Rectangular rings.

Part 2: Rectangular rings with narrow ring width. [1)]

ISO 6623, *Internal combustion engines — Piston rings — Scraper rings.*

ISO 6624, *Internal combustion engines — Piston rings —*

Part 1: Keystone rings.

Part 2: Half keystone rings. [1)]

ISO 6625, *Internal combustion engines — Piston rings — Oil control rings.*

ISO 6626, *Internal combustion engines — Coil-spring-loaded oil control rings.*

Half keystone rings with narrow ring width are, in most countries, still under development and little used. Specifications are therefore still liable to change: publication of a Technical Report was consequently agreed on, before finalising an International Standard.

The common features and dimensional tables presented in this Technical Report (ISO/TR 6624-2) constitute a broad range of variables, and the designer, in selecting a particular ring type, shall bear in mind the conditions under which it will be required to operate.

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

1) Part published as a Technical Report (ISO/TR 6622-2 and ISO/TR 6624-2).

1 Scope and field of application

This Technical Report specifies the essential dimensional features of HK- and HKB-half keystone rings with narrow ring width types.

Dimension tables 6 and 7 allow for the use of cast iron (table 6) or steel (table 7). Since the modulus of elasticity of steel rings is higher than that of cast iron rings, the fluctuation in the surface pressure will become greater if the free gap is set as the reference for forces. Therefore forces are set using the surface pressure as the reference, in order to minimize the effect of the fluctuation.

The requirements of this Technical Report apply to half keystone rings of reciprocating internal combustion piston engines, up to and including 70 mm diameter for cast iron rings and up to and including 100 mm diameter for steel.

2 References

ISO 1101, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.*

ISO 6621, *Internal combustion engines — Piston rings —*

Part 2: Measuring principles.

Part 3: Material specifications.

Part 4: General specifications.

3 Ring types and designation examples

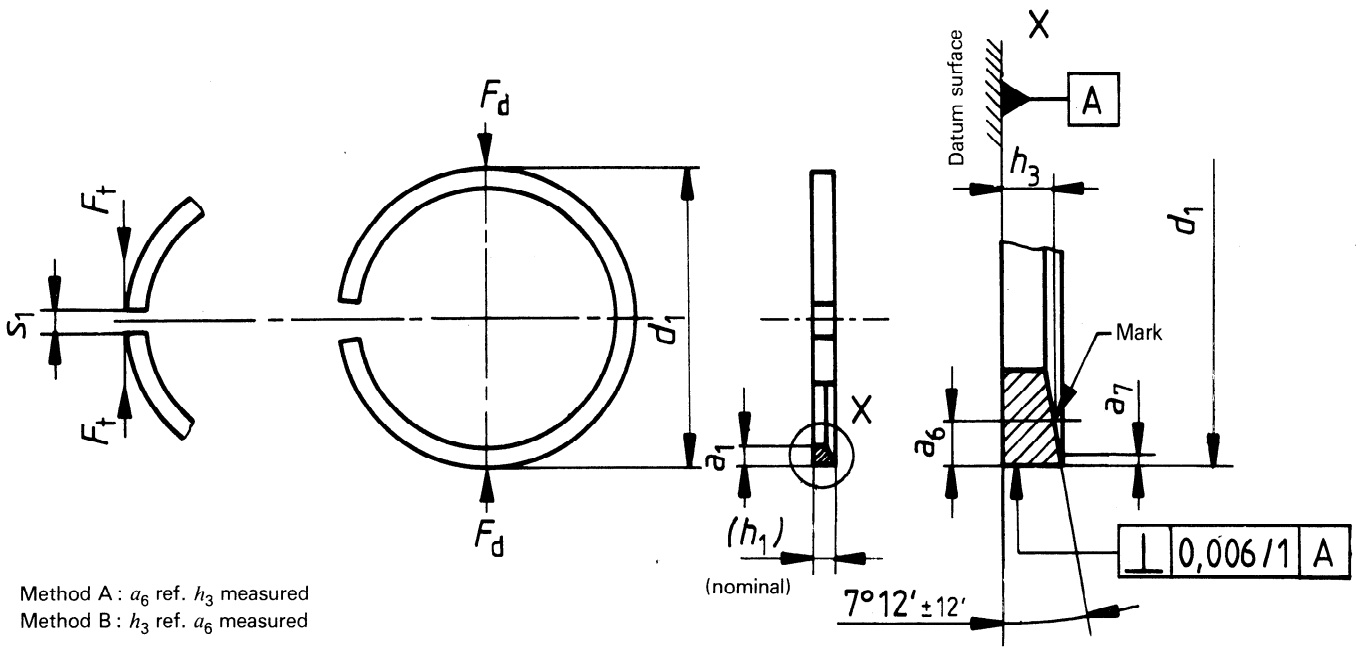
NOTE — For the angle of half keystone rings, the same definition and measurement apply as for keystone rings: see ISO 6621-2.

3.1 Type HK — Straight-faced half keystone ring 7°

3.1.1 General features

NOTE — See table 6 or 7 for dimensions and forces.

Dimensions in millimetres



Method A : a_6 ref. h_3 measured
Method B : h_3 ref. a_6 measured

Figure 1 — Type HK

3.1.2 Designation example

Designation of a straight-faced half keystone ring 7° of d_1 = 60 mm nominal diameter, h_1 = 1,25 mm ring width, made of steel (material subclass 62), general features as shown in figure 1, and periphery chromium-coated fully faced design 0,1 mm minimum thickness:

Piston ring ISO/TR 6624-2 HK-60 × 1,25-MC62/CR2

3.2 Type HKB — Barrel-faced half keystone ring 7°

3.2.1 General features

NOTE — See table 6 or 7 for dimensions and forces.

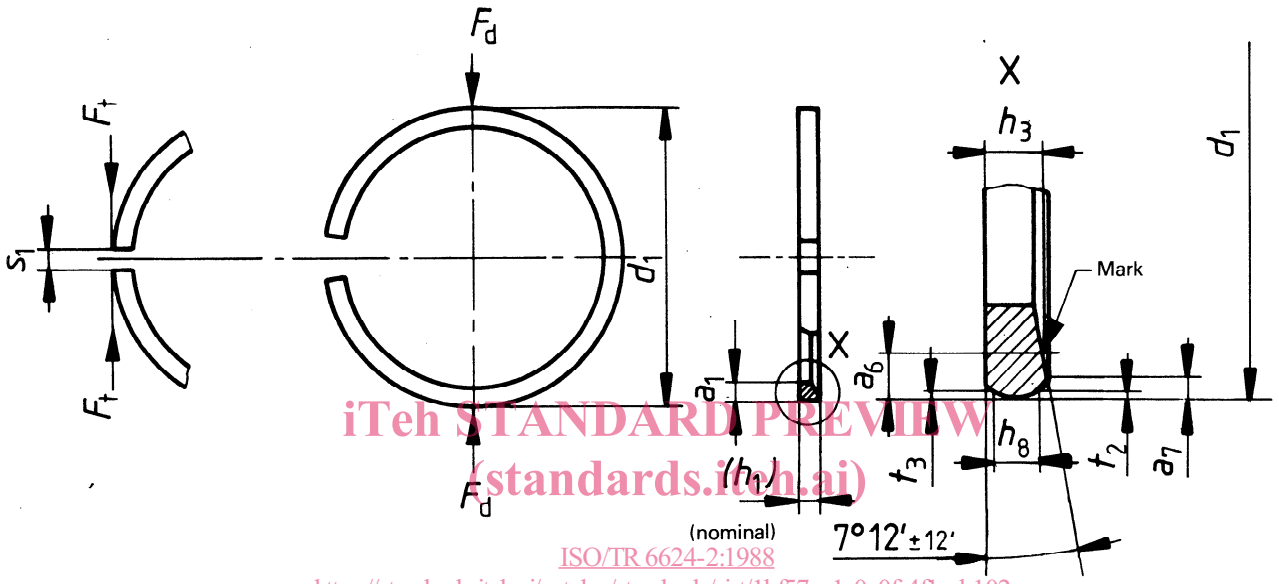


Figure 2 — Type HKB

Table 1 — Gauge width (h_8) and barrel dimensions

Dimensions in millimetres

(h_1)	h_8	t_2, t_3		Maximum peak off centre
1,25	0,6	0,002	0,012	0,2
1,55	0,8	0,003	0,015	0,25

3.2.2 Designation example

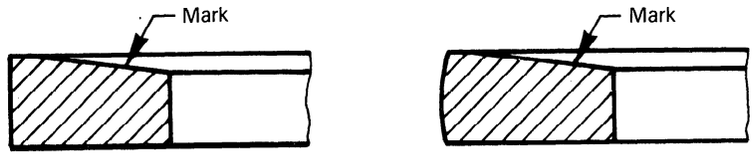
Designation of a barrel-faced half keystone ring 7° of d_1 = 60 mm nominal diameter, h_1 = 1,25 mm ring width, made of steel (material subclass 62), general features as shown in figure 2, and periphery molybdenum-coated inlaid design 0,1 mm minimum thickness:

Piston ring ISO/TR 6624-2 HKB-60 × 1,25-MC62/MO2

4 Common features

4.1 Types HK and HKB — Half keystone ring

4.1.1 Uncoated rings



a) Type HK b) Type HKB

Figure 3 — Uncoated rings

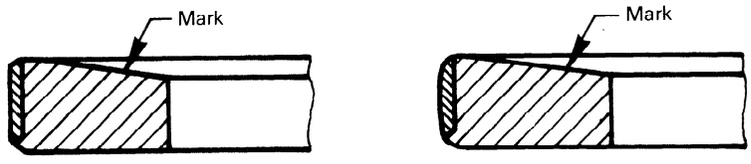
4.1.2 Coated rings (chromium or molybdenum)

4.1.2.1 Fully faced

a) Type HK b) Type HKB

Figure 4 — Fully faced coated rings

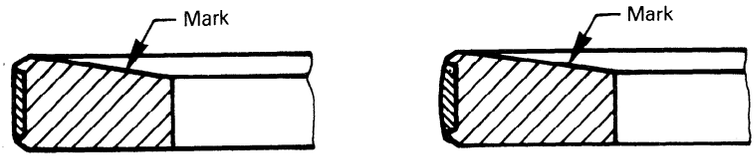
4.1.2.2 Semi-inlaid



a) Type HK b) Type HKB

Figure 5 — Semi-inlaid coated rings

4.1.2.3 Inlaid

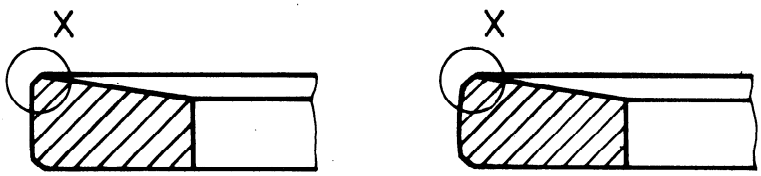


a) Type HK b) Type HKB

Figure 6 — Inlaid coated rings

4.2 Chamfered edges (cast iron rings)

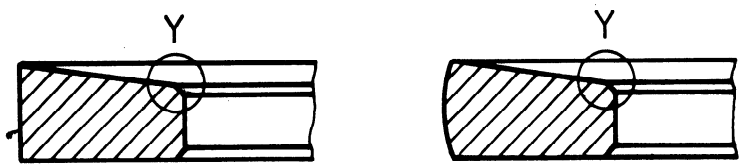
4.2.1 HK- and HKB-rings — Outside chamfered edges (KA)



a) HK-rings b) HKB-rings

Figure 7 — Outside chamfered edges (KA)

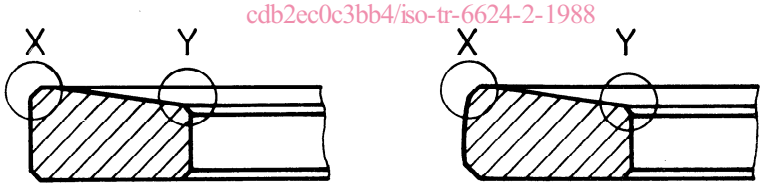
4.2.2 HK- and HKB-rings — Inside chamfered edges (KI)



a) HK-rings b) HKB-rings

Figure 8 — Inside chamfered edges (KI)

4.2.3 HK- and HKB-rings — Outside and inside chamfered edges (KA + KI)



a) HK-rings b) HKB-rings

Figure 9 — Outside and inside chamfered edges (KA + KI)

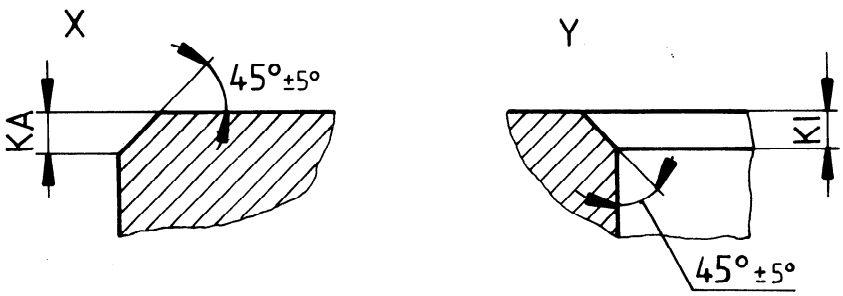


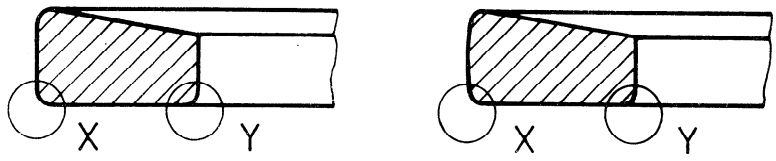
Figure 10 — Details of figures 7, 8 and 9

Table 2 — KA and KI dimensions

Dimensions in millimetres

KA	KI
0,15 ± 0,1	max. 0,2

4.3 HK- and HKB- steel rings — Outside and inside rounded edges



a) HK-rings b) HKB-rings

Figure 11 — Outside and inside rounded edges

Dimensions in millimetres

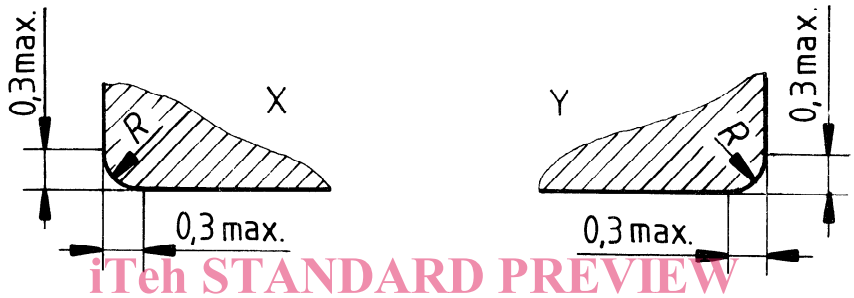
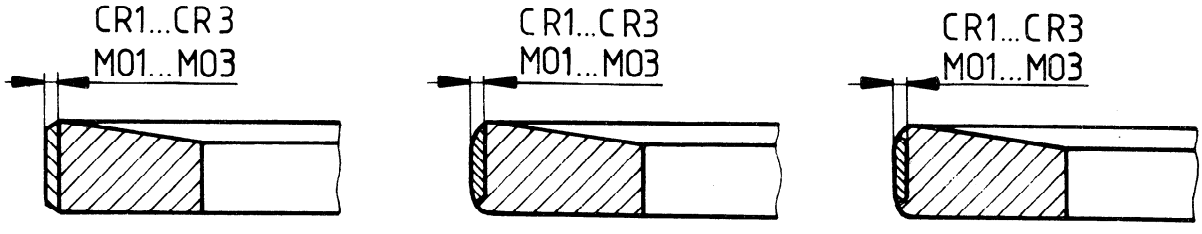


Figure 12 — Details of figure 11

4.4 HK- and HKB-rings (fully faced, semi-inlaid and inlaid) — Layer thickness



a) Fully faced b) Semi-inlaid c) Inlaid

Figure 13 — Layer thickness

Table 3 — Layer thickness

Dimensions in millimetres

Chromium	Molybdenum	Thickness min.
CR1	M01	0,05
CR2	M02	0,1
CR3[1)]	M03[1)]	0,15

1) CR3 and M03 apply to rings with nominal diameters of 50 mm or greater.

5 Force factors

The tangential and diametral forces given in table 6 shall be corrected when additional features and/or materials other than grey cast iron with a modulus of elasticity of 100 GN/m^2 are being used.

For common features, multiplier correction factors given in tables 4 and 5 and the force correction factors given in ISO 6621-4 shall be used. Also the tangential and diametral forces given in table 7 shall be corrected when additional features are being used.

Table 4 — Force correction factors for HK- and HKB-rings with features KA and KI

Factor		
KA	KI	KA and KI
0,98	0,98	0,96

Table 5 — Force correction factors for coated HK- and HKB-rings (fully faced, semi-inlaid, and inlaid types)

d_1 (reference coating) mm	Factor				
	CR1	CR2/M01	CR3	M02	M03
$38 < d_1 < 50$	0,81	0,7	—	0,64	—
$50 < d_1 < 100$	0,9	0,85	0,81	0,81	0,75

6 Dimensions

Table 6 — Dimensions of HK-and HKB-half keystone rings with narrow ring width made of cast iron

Dimensions in millimetres

Nominal diameter d_1	Radial wall thickness a_1		Ring width nominal value For h_1 shown in column		Method A a_6 (ref.)	a_7	Measured value For h_3 shown in column			Method B h_3 (ref.) Column		Measured value a_6		a_7	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		
		Tolerance	1	2			1	Tolerance	2	1	2		Tolerance			Tolerance	1	2	Tolerance	1	2	Tolerance
38	1,6	± 0,15 Within a ring: 0,15 max.	1,25	1,55	0,8	0,5 max.	1,143	0 −0,024 For phosphated PO surface: +0,01 −0,024	0 −0,024 For phosphated PO surface: +0,01 −0,024	1,13	1,41	0,91	0 −0,19 For phosphated PO surface: +0,08 −0,19	0,5 max.	0,15	+0,2 0			± 30 %	7,2		± 30 %
39	1,65																			7,6		
40	1,65				1		1,118		1,418	1,11		1,06								7,2		
41	1,7																			7,6		
42	1,75																			7,8		
43	1,8																			8,2	10,5	
44	1,85																			8,3	10,8	
45	1,9																			8,5	11,2	
46	1,9																			8,3	10,6	
47	1,95																			8,5	10,9	
48	2																			8,9	11,4	
49	2,05																			9	11,8	
50	2,1				1,2		1,093		1,393	1,08	1,38	1,3					4,4	5,6		9,4	12,1	
51	2,15																4,5	5,8		9,6	12,5	
52	2,15																4,3	5,5		9,2	11,9	
53	2,2																4,5	5,7		9,6	12,3	
54	2,25																4,6	5,9		9,7	12,7	
55	2,3																4,7	6		10,1	13	
56	2,35																4,9	6,2		10,4	13,4	
57	2,4																4,9	6,4		10,5	13,8	
58	2,4																4,7	6,2		10,1	13,4	
59	2,45																4,9	6,4		10,5	13,8	
60	2,5																5	6,5		10,7	14	
61	2,55																5,1	6,7		10,9	14,4	
62	2,6																5,3	6,9		11,3	14,8	
63	2,65																5,4	7		11,7	15	
64	2,65																5,3	6,7		11,3	14,4	
65	2,7																5,3	6,9		11,5	14,8	
66	2,75																5,5	7,1		11,7	15,3	
67	2,8																5,5	7,3		11,9	15,6	
68	2,85																5,7	7,5		12,3	16	
69	2,9																5,7	7,6		12,4	16,2	
70	2,9				1,5		1,053		1,353	1,04	1,34	1,6					5,6	7,3		12	15,7	

NOTES

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

2 The values for F_t and F_d, given in table 6, apply to as-cast grey cast iron with a typical modulus of elasticity (E_n) of 100 GN/m². Multiplying factors for materials having a different modulus of elasticity (E_n) are given in ISO 6621-4. Mean forces are calculated for nominal radial wall thickness (a_1) and mean ring width (h_1).

3 For the sole purpose of this Technical Report, 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 client.