

JIS

JAPANESE INDUSTRIAL STANDARD

General rules for piston rings

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In the event of any doubt arising,
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General rules for piston rings

B 8032-1993

1. Scope This Japanese Industrial Standard specifies the common items related to the piston rings for reciprocating internal combustion engines, hereafter referred to as "rings".

This Standard may also be applicable to the rings for compressors which are operated under the similar conditions.

Remarks: The corresponding International Standards to this Standard are as given in the following:

- ISO 6621-1 Internal combustion engines - Piston rings - Part 1: Vocabulary
- ISO 6621-2 Internal combustion engines - Piston rings - Part 2: Inspection measuring principles
- ISO 6621-4 Internal combustion engines - Piston rings - Part 4: General specifications
- ISO 6621-5 Internal combustion engines - Piston rings - Part 5: Quality requirements
- ISO 6622-1 Internal combustion engines - Piston rings - Part 1: Rectangular rings
- ISO 6623 Internal combustion engines - Piston rings - Scraper rings
- ISO 6624-1 Internal combustion engines - Piston rings - Part 1: Keystone rings
- ISO 6625 Internal combustion engines - Piston rings - Oil control rings
- ISO 6626 Internal combustion engines - Piston rings - Coil-spring-loaded oil control rings

2. Definitions For the purposes of this Standard, the following definitions apply:

- (1) single-piece ring A ring formed from one piece of material which is installed in a single groove on the piston.
- (2) multi-piece ring A ring comprising two or more component parts which are installed in a single groove on the piston.
- (3) compression ring A ring intended primary to prevent the leakage of gas from the combustion chamber.
- (4) scraper ring A ring which has a step on the lower peripheral edge of the ring to scrape oil from the cylinder wall. It functions also as a lower compression ring.

- (5) oil control ring A ring having oil return slots or an equivalent and intended to scrape oil from the cylinder wall.
- (6) tangential force The force necessary to close the ring until the specified butt-end clearance is attained by means of a tangential force on the butt-end.
- (7) diminution degree of tensile force. The ratio of decreased amount of the tensile force (F'_t) to the initial tensile force (F_t) of a ring, after closing the ring to its nominal diameter, maintaining it for a prescribed number of hours in the atmosphere of a prescribed temperature, and left cooling to an ordinary temperature.

$$\text{Diminution degree of tensile force} = \left(1 - \frac{F'_t}{F_t}\right) \times 100 \%$$

where, F_t : initial tension of ring (N)

F'_t : tensile force after heating (N)

- (8) contact pressure The mean pressure per unit area exerted on the inner wall of the cylinder assuming a ring contacts with a cylinder on full surface.

$$\text{Contact pressure } P = \frac{2 \cdot F_t}{h \cdot d_i}$$

where, P : contact pressure (MPa) or (N/mm²)

F_t : tensile force (N)

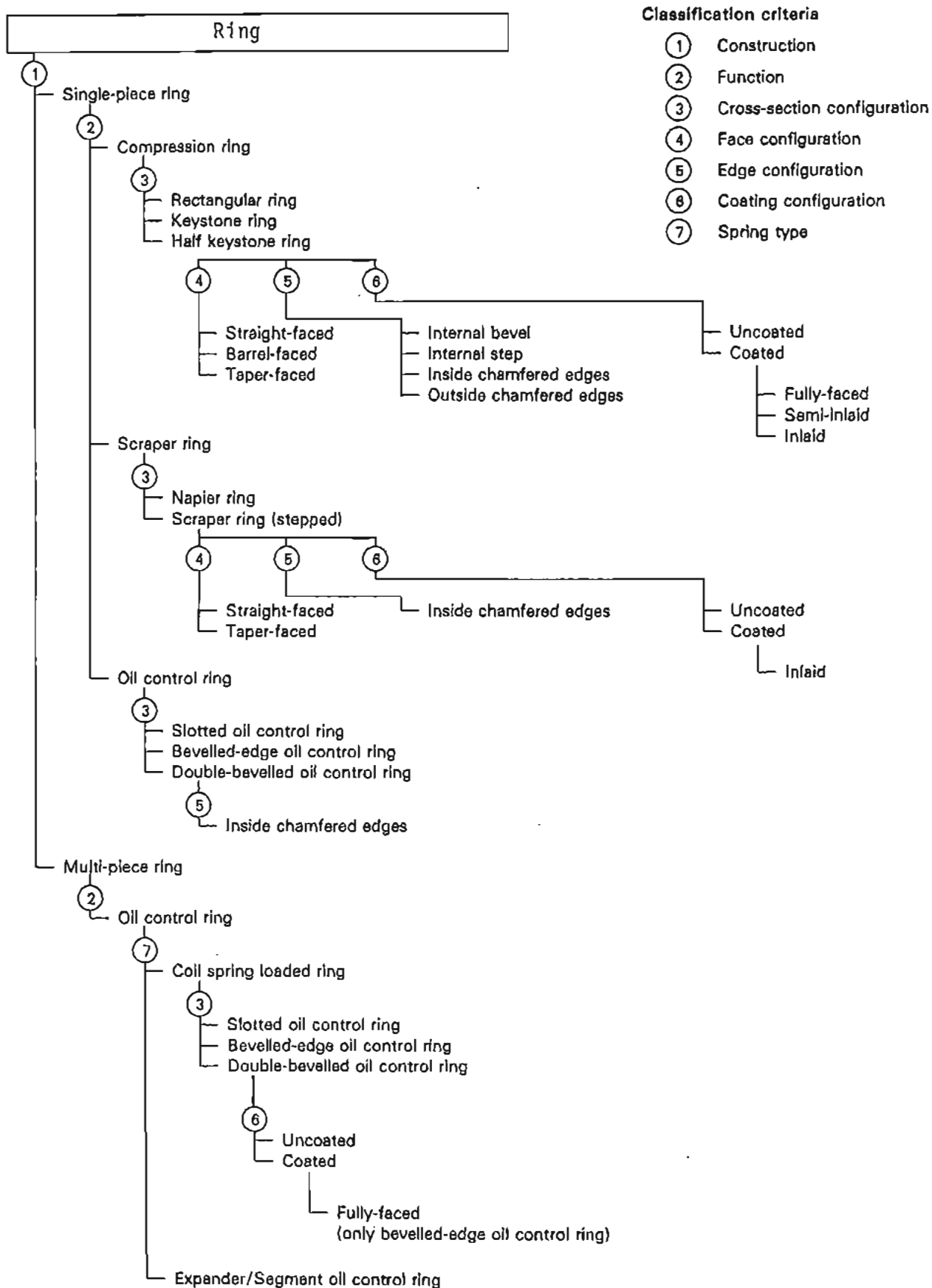
h : width assuming a ring contacts with inner wall of a cylinder (mm)

d_i : nominal diameter (mm)

- (9) light-tightness The shading characteristics of the contacting part of the outer peripheral face of the ring with the inner peripheral face of the circular gauge, when a ring is lighted from the back face, being put in a circular gauge which is the same in nominal diameter as of the ring.
- (10) free flatness The distance in axial direction between the ring of free state and the plane in parallel to the datum surface.

3. Types

3.1 Classification The classification of the rings, according to the constructions, functions and configurations, shall be as given in the following:

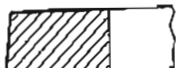


3.2 Configurations The configurations of the rings shall be as given in the following:

(1) Cross-section configurations The cross-section configurations of the rings shall be as follows:

Rectangular ring	
Keystone ring	
Half keystone ring	
Scraper ring (stepped)	
Napier ring (under-cut stepped)	
Slotted oil control ring	
Bevelled-edge oil control ring	
Double-bevelled oil control ring	
Coil spring loaded slotted oil control ring	 Coil spring
Coil spring loaded bevelled-edge oil control ring	
Coil spring loaded double-bevelled oil control ring	
Expander/segment oil control ring	 Side rail Spacer

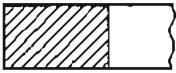
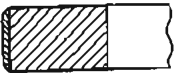
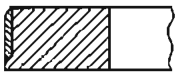
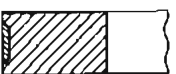
- (2) Face configurations The face configurations of the rings shall be as follows:

Straight-faced	
Barrel-faced	
Taper faced	

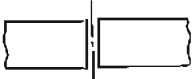
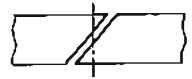
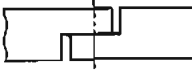
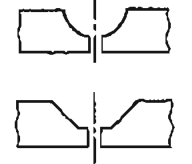
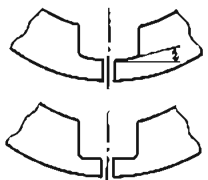
- (3) Edge configurations The edge configurations of the rings shall be as follows:

Internal bevel top (positive twist type)	
Internal step top (positive twist type)	
Internal bevel bottom (negative twist type)	
Internal step bottom (negative twist type)	
Inside edges chamfered	
Outside edges chamfered	
Inside and outside edges chamfered	

- (4) Coating configuration The coating configuration of the rings shall be as follows:

Uncoated	
Coated fully faced	
Coated semi-inlaid	
Coated inlaid	

- (5) Joint configuration The joint configuration of the rings shall be as follows:

Right-angle joint (straight)	
Oblique joint (angle)	
Stepped joint	
Joint with side notch	
Joint with internal notch	

3.3 Nomenclature and symbols for respective parts of rings The nomenclature and symbols for respective parts of rings shall be as given in Figs. 1 to 5.

Fig. 1. Nomenclature and symbols under free state

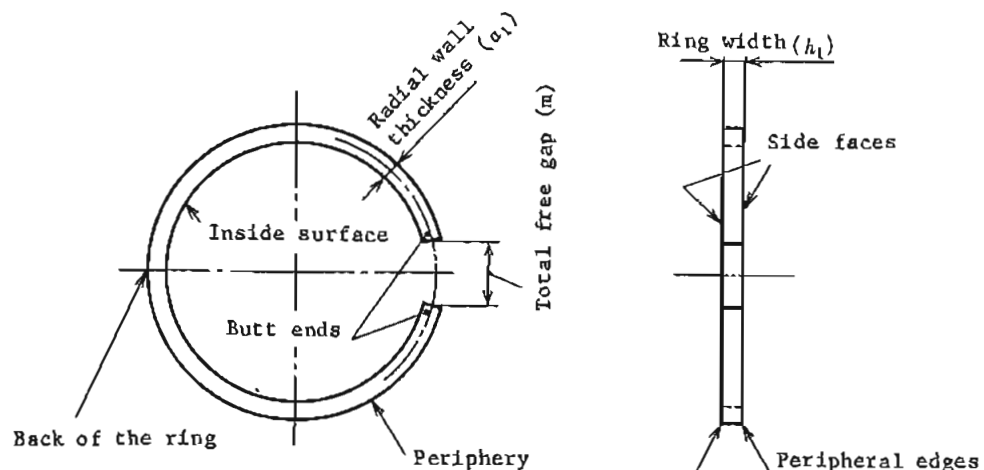


Fig. 2. Nomenclature and symbols under mounted state

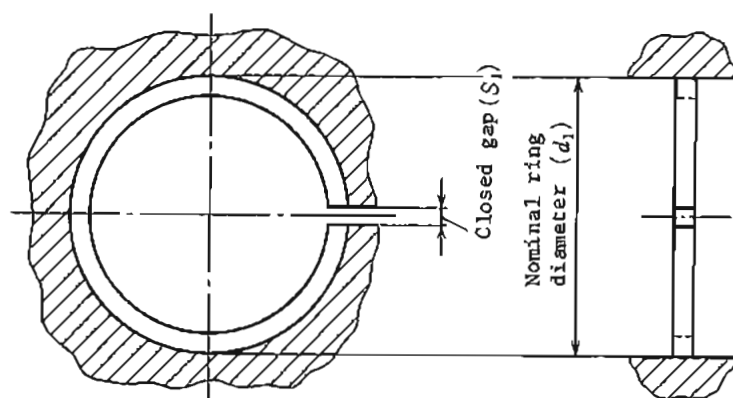
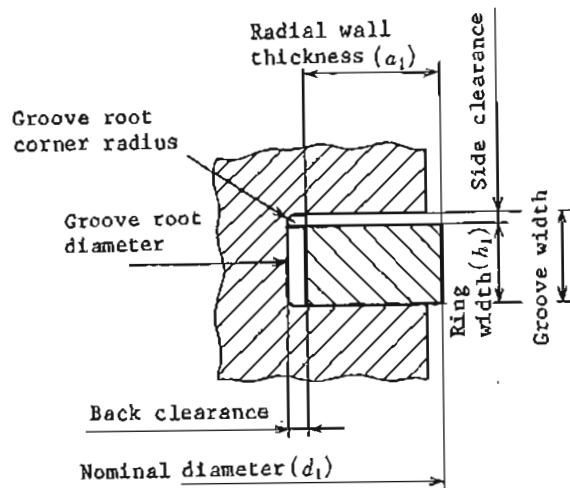


Fig. 3. Nomenclature and symbols relating to ring cross-section and groove width

(a) Rectangular ring



(b) Keystone ring

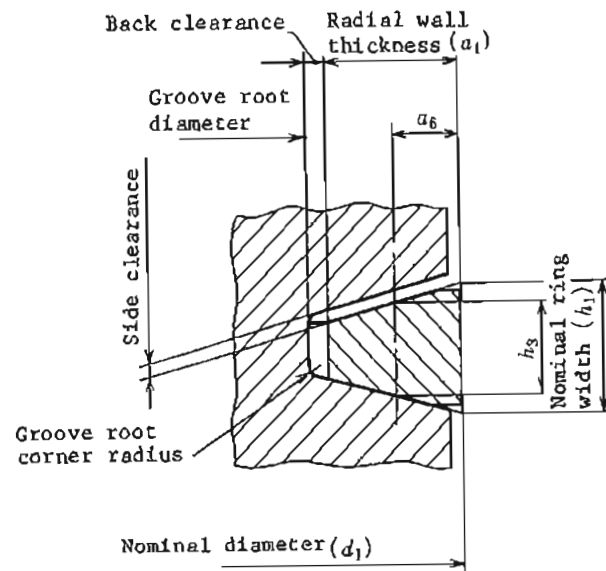


Fig. 4. Nomenclature of edges, inside and peripheral surfaces and side face

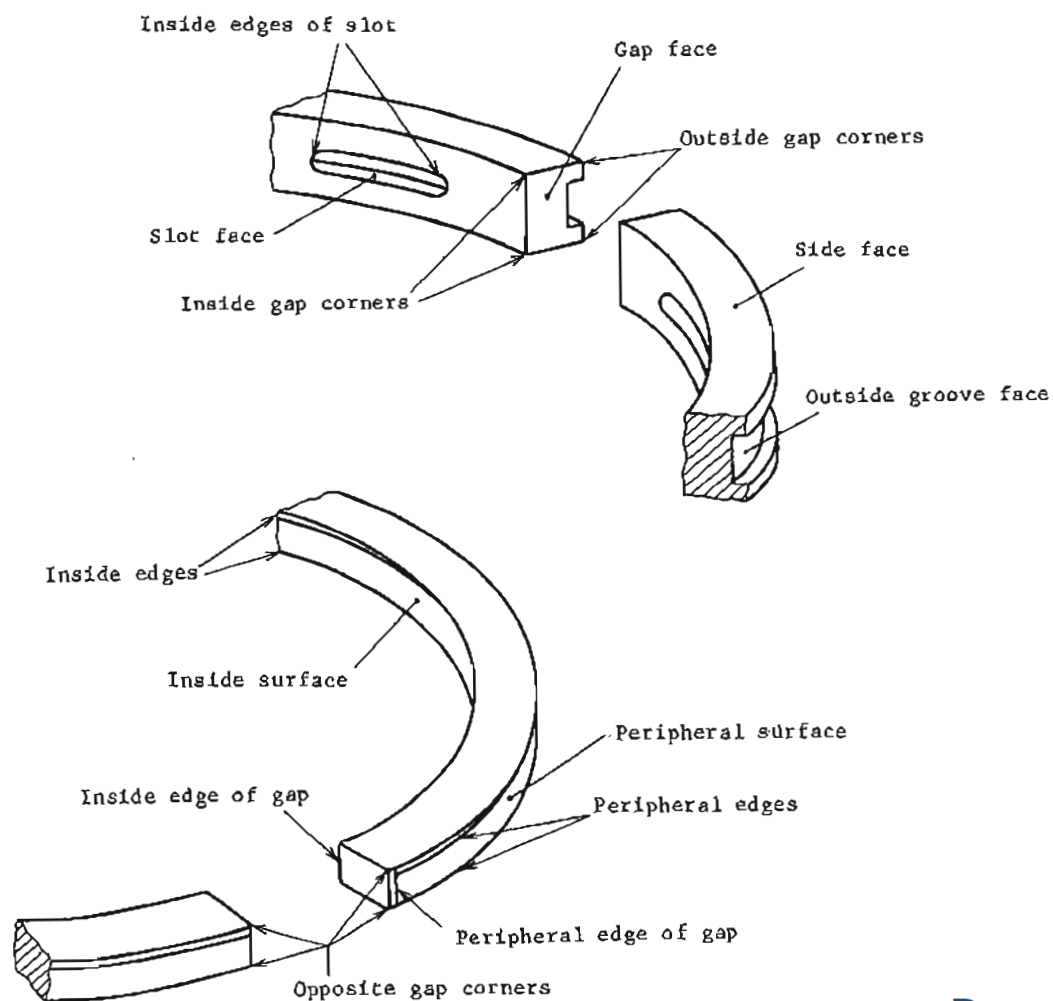
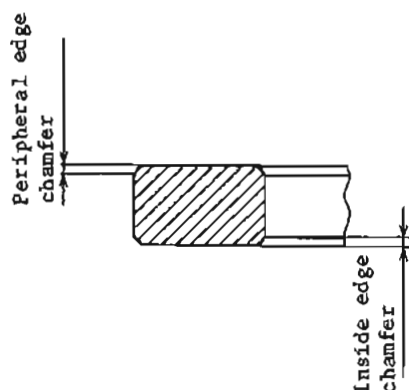
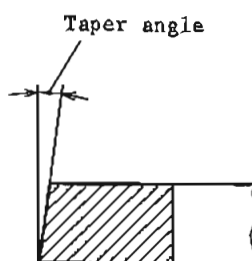


Fig. 5. Nomenclatures and symbols of cross-section

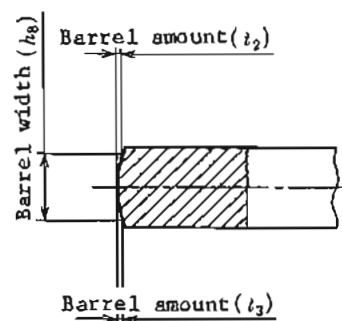
(a) Rectangular ring



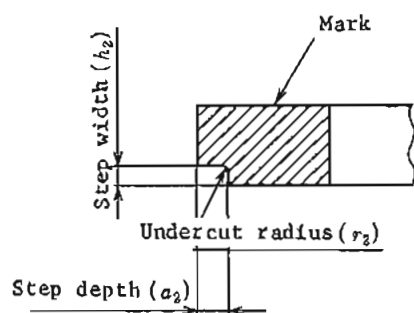
(b) Taper faced ring



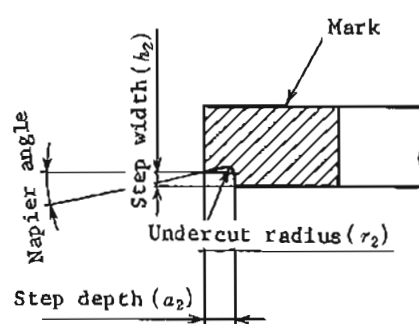
(c) Barrel faced ring



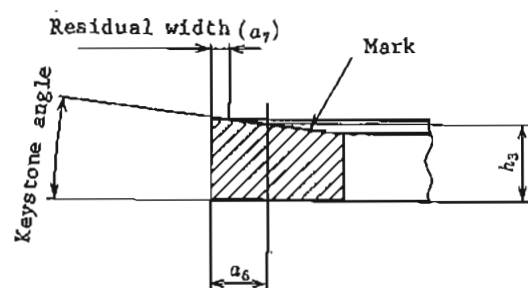
(d) Scraper ring



(e) Napier ring



(f) Half keystone ring



(g) Keystone ring

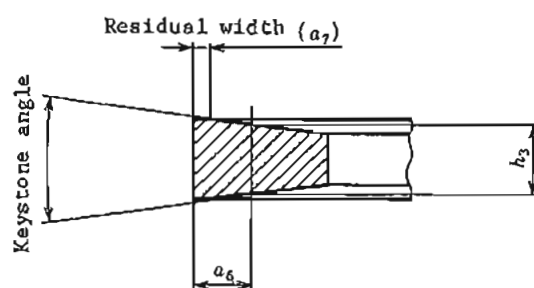
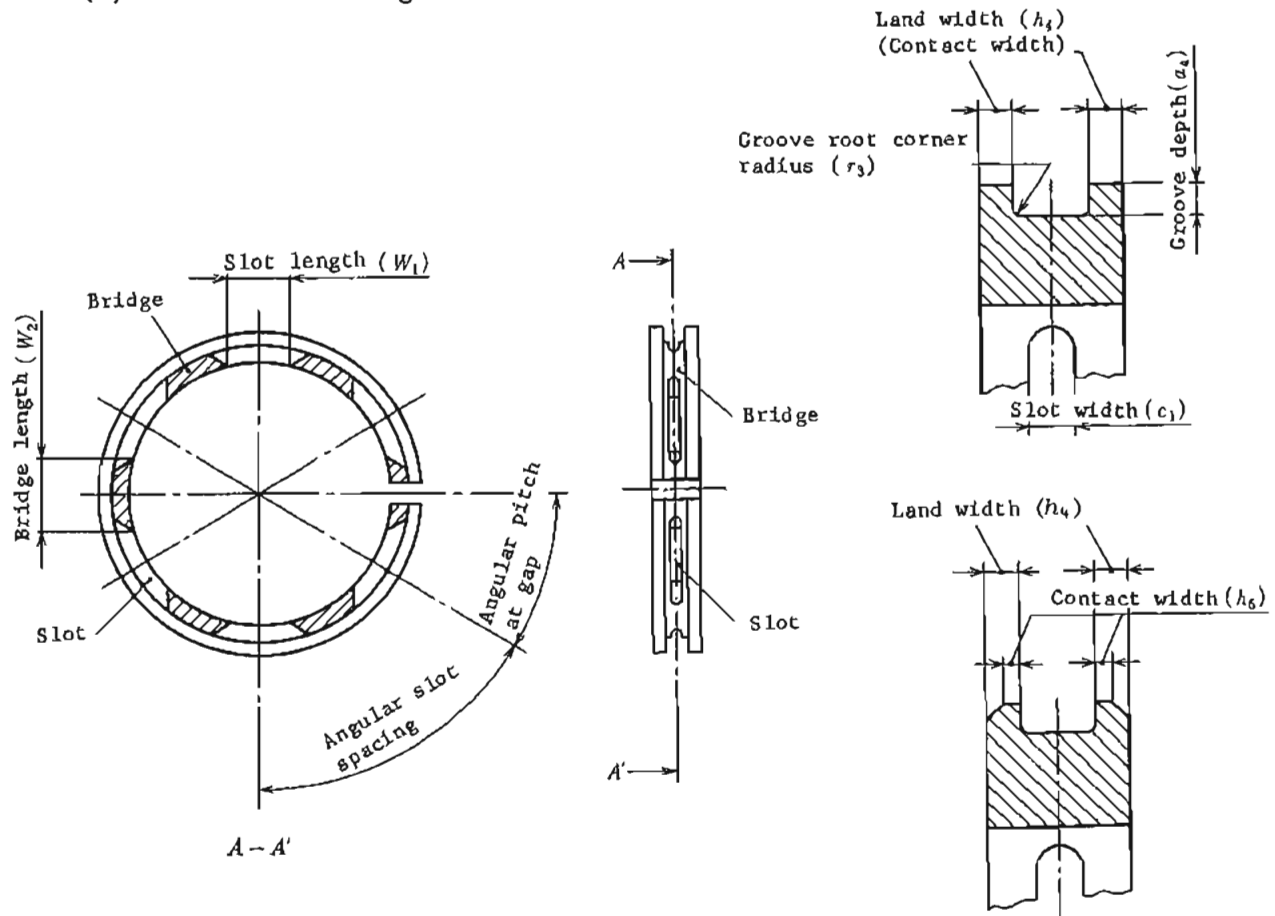


Fig. 5. (Continued)

(h) Oil control ring



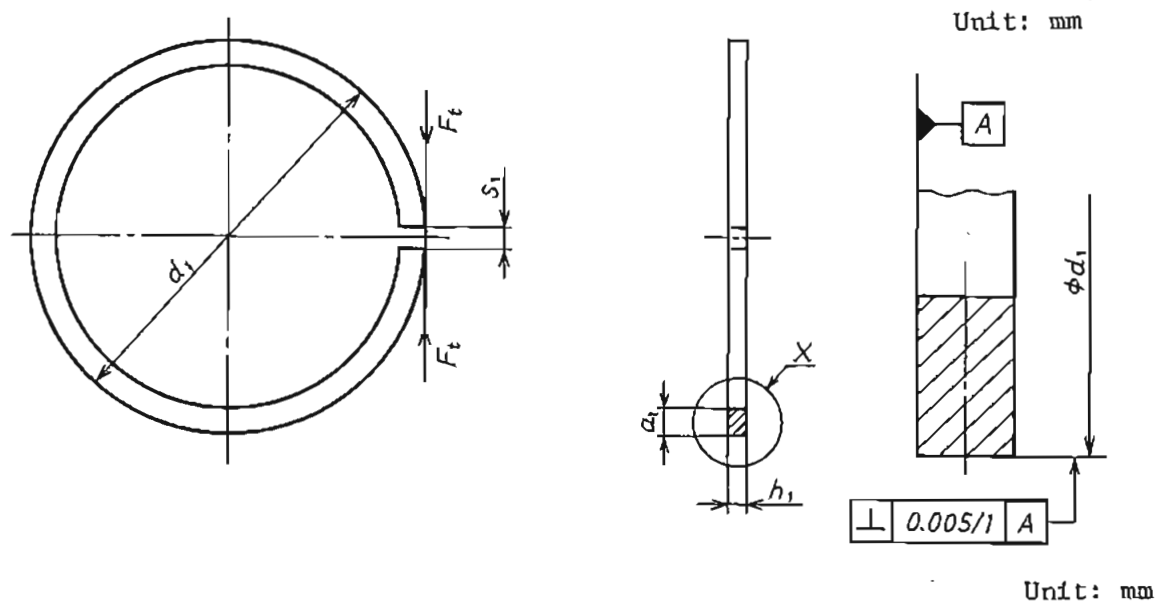
4. Qualities

4.1 Tolerances on dimensions and shapes of respective parts of rings

4.1.1 Tolerances on fundamental characteristics of rings The tolerances on fundamental characteristics of rings shall be in accordance with Table 1.

Table 1. Tolerances on fundamental characteristics of rings

Enlarged figure of X



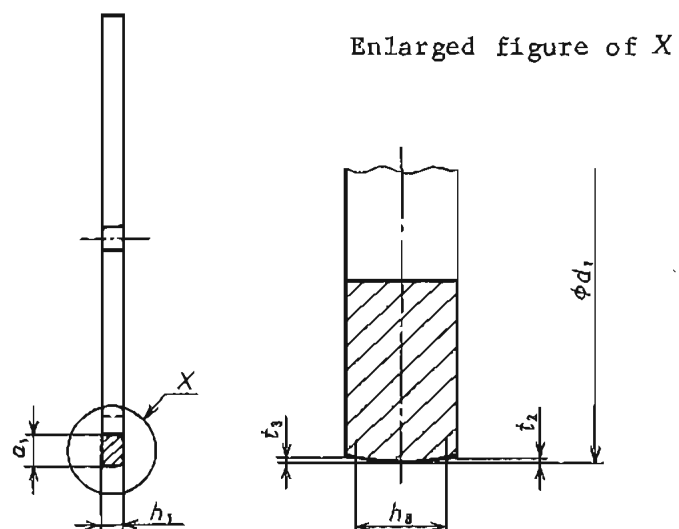
Nominal diameter d_1	Tolerances on thickness (a_1)	Tolerances on width (h_1)	Tolerances on closed gap (S_1)	Tolerances on tangential force (F_t)
$30 \leq d_1 < 75$	± 0.15 Error within one piece 0.15 max.	-0.010 -0.030	+0.2 0	When tension is under 10 N: $\pm 30 \%$ When tension is 10 N or over: $\pm 20 \%$
$75 \leq d_1 < 100$			+0.25 0	
$100 \leq d_1 < 150$	± 0.2 Error within one piece 0.20 max.	-0.010 -0.035	+0.3 0	
$150 \leq d_1 \leq 200$				

Remarks 1. Refer to ISO 6622-1, ISO 6622-2TR, ISO 6623, ISO 6624-1, ISO 6624-2TR and ISO 6625.

- The basic values of thickness a_1 , width h_1 and closed gap S_1 shall be subjected to the agreement between the purchaser and supplier.
- The tolerances for those of which nominal diameters exceed the values given in Table above shall be subjected to the agreement between the purchaser and supplier.

4.1.2 Dimensions and tolerances of barrel faced rings The dimensions and tolerances of barrel faced rings shall be in accordance with Table 2.

Table 2. Dimensions and tolerances of barrel faced rings



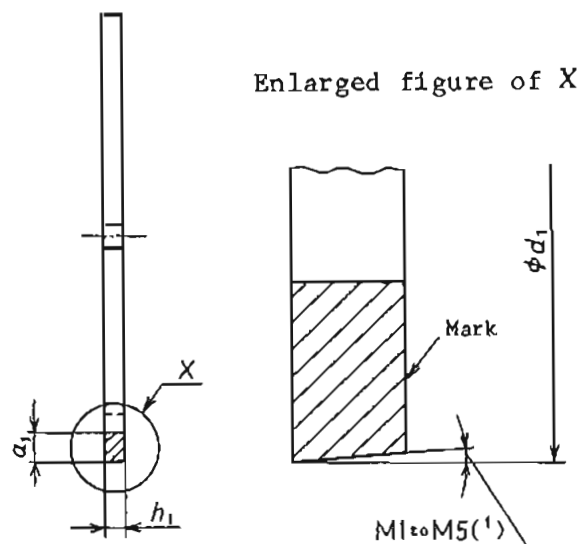
Unit: mm

Width h_1	Barrel width h_2	Barreled quantity $h_2 \cdot h_3$		Maximum peak off center
		Basic value	Tolerances	
1.5	0.8	0.009	± 0.006	0.25 max.
1.75	1.0			0.3 max.
2.0	1.2			
2.5	1.6			0.4 max.
3.0	2.0	0.012	+ 0.008 - 0.007	0.5 max.
3.5	2.4			
4.0	2.8	0.014	± 0.009	0.6 max.
4.5	3.2			

Remarks: The dimensional tolerances on thickness a_1 and width h_1 shall be in accordance with Table 1.

4.1.3 Taper angles and tolerances of taper faced rings The taper angles and tolerances of taper faced rings shall be in accordance with Table 3.

Table 3. Taper angles and tolerances of taper faced rings



Unit: min

Symbol ⁽¹⁾	Taper angle	Taper faced ring Tolerances ⁽²⁾	Internal bevelled ring Internal stepped ring Tolerances ⁽²⁾
M1	10 (Informative reference)	+40 0	+60 0
M2	30	+50 0	
M3	60		
M4	90		
M5	120 (Informative reference)		

Notes ⁽¹⁾ Refer to ISO 6621-4, ISO 6622-1 and ISO 6622-2TR.

⁽²⁾ For coated rings of which tapered outer peripheral faces are not ground, their tolerances shall be widened by 10 min (Example: For M3 = 60 min type +60 min).
0

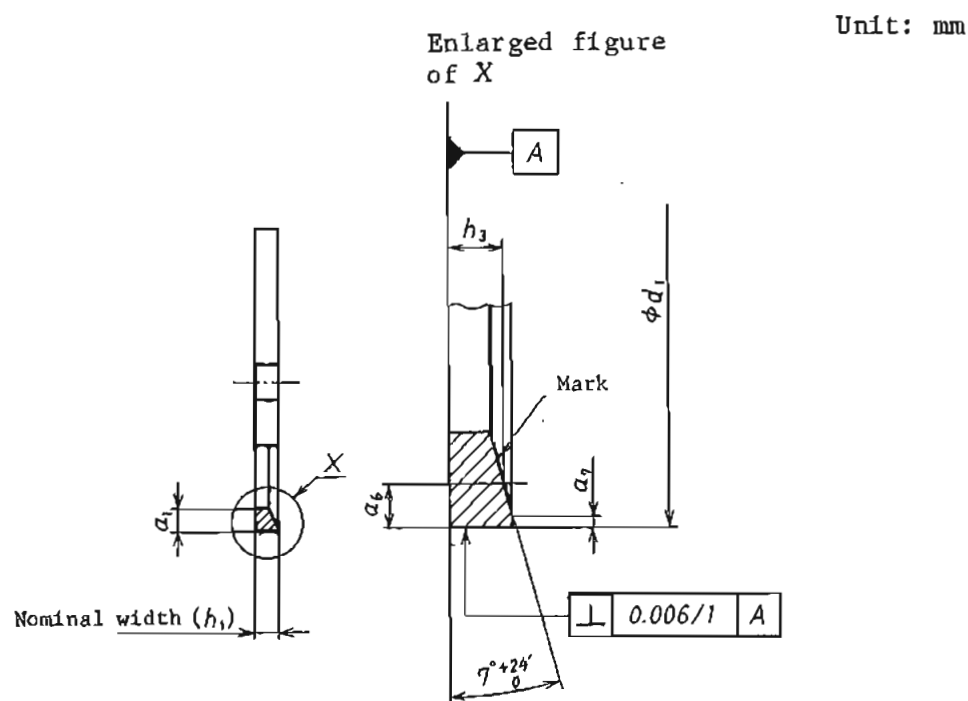
Remarks 1. These shall be used for uncoated and coated rings.

2. The dimensional tolerances on thickness a_1 and width h_1 shall be in accordance with Table 1.

4.1.4 Dimensions and tolerances of half keystone rings and keystone rings
The dimensions and tolerances of half keystone rings and keystone rings shall be as given in the following:

- (1) Half keystone rings The dimensions and tolerances of half keystone rings shall be in accordance with Table 4.

Table 4. Dimensions and tolerances of half keystone rings



Unit: mm

Nominal diameter d_1	Nominal width (h_1)		Method A(³)				Method B(³)				Residual width a_7
			a_6	h_3		Tolerances	h_3		a_3		
				Basic value			Basic value		Tolerances		
	I	II		I	II		Basic value	Tolerances			
$38 \leq d_1 < 40$	1.25	II	0.8	1.141	0 -0.025	1.13		0.89	0 -0.20	0.5 max.	
$40 \leq d_1 < 43$			1.0	1.116		1.11		1.04			
$43 \leq d_1 < 50$				1.416		1.41					
$50 \leq d_1 < 60$	1.55	II	1.2	1.09	1.39	1.08	1.38	1.28	0.6 max.		
$60 \leq d_1 < 70$											
$70 < d_1 < 90$			1.5	1.053	1.353	1.04	1.34	1.6			
$90 \leq d_1 \leq 100$			2.0	—	1.289		1.28	2.07			

Note ⁽³⁾ The Method A and Method B mean the Method A and Method B of the measuring methods stated in the clause of Width (b) Keystone ring of 5.2.1 in the Table of 5.2.

Remarks 1. Refer to Type HK of ISO 6624-2.

2. The tolerances for those of which nominal diameters and nominal widths exceed the values given in Table above shall be subjected to the agreement between the purchaser and supplier.