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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J2000 | REV. OCT92

Issued 1989-10
Revised 1992-10-20

Submitted for recognition as an American National Standard

Superseding J2000 OCT89

INTERNAL COMBUSTION ENGINES—PISTON RINGS—KEYSTONE RINGS

This SAE Standard is equivalent to ISO Standard 6624/1.

1. ***Scope and Field of Application***—Differences, where they exist, are shown in Appendix A.

This SAE Standard specifies the essential dimensional features of T, TB, TM, K, KB, and KM keystone piston ring types.

The requirements of this document apply to compression rings for reciprocating internal combustion engines up to and including 200 mm diameter.

(R) 2. ***References***

SAE DESIGNATION	ISO[1] EQUIVALENT	
		INTERNAL COMBUSTION ENGINES—PISTON RINGS
J1588	6621/1	Vocabulary
J1589	6621/2	Measuring principles
J1590	6621/3	Material specifications
J1591	6621/4	General specifications
J1996	6621/5	Quality requirements
		INTERNAL COMBUSTION ENGINES—PISTON RINGS
J1997	6622/1	Rectangular rings
J1998	6622/2 TR	Rectangular rings with narrow ring width
J1999	6623	INTERNAL COMBUSTION ENGINES—PISTON RINGS—SCRAPER RINGS

[1] TR refers to Technical Report

Printed in U.S.A.
90-1202B EG

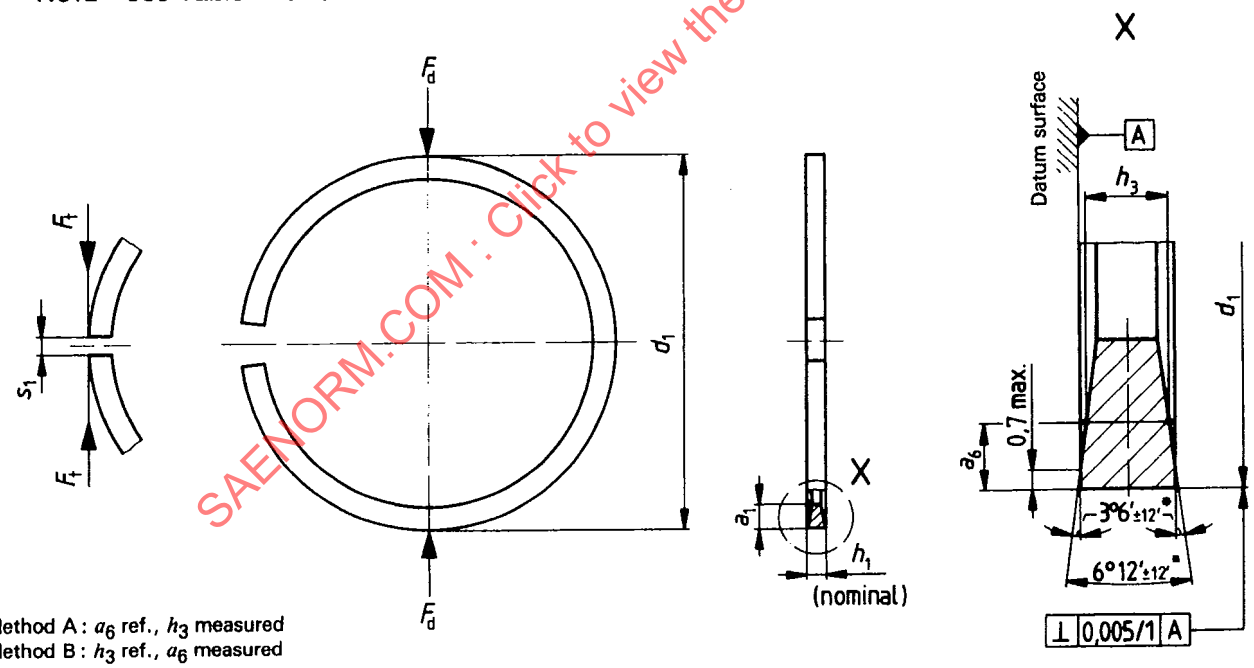
SAE DESIGNATION	ISO[1] EQUIVALENT	
		INTERNAL COMBUSTION ENGINES—PISTON RINGS
J2000	6624/1	Keystone rings
J2001	6624/2 TR	Half keystone rings
J2002	6625	INTERNAL COMBUSTION ENGINES—PISTON RINGS—OIL CONTROL RINGS
J2003	6626	INTERNAL COMBUSTION ENGINES—PISTON RINGS—COIL SPRING LOADED OIL CONTROL RINGS
J2004	6627 TR	INTERNAL COMBUSTION ENGINES—PISTON RINGS—EXPANDER/SEGMENT OIL CONTROL RINGS
J2226		INTERNAL COMBUSTION ENGINES—PISTON RINGS—STEEL RECTANGULAR RINGS

3. *Ring Types and Designation Examples*

3.1 Type T—Straight Faced Keystone Ring 6°

3.1.1 GENERAL FEATURES

NOTE—See Table 7 for dimensions and forces.



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

FIGURE 1—TYPE T

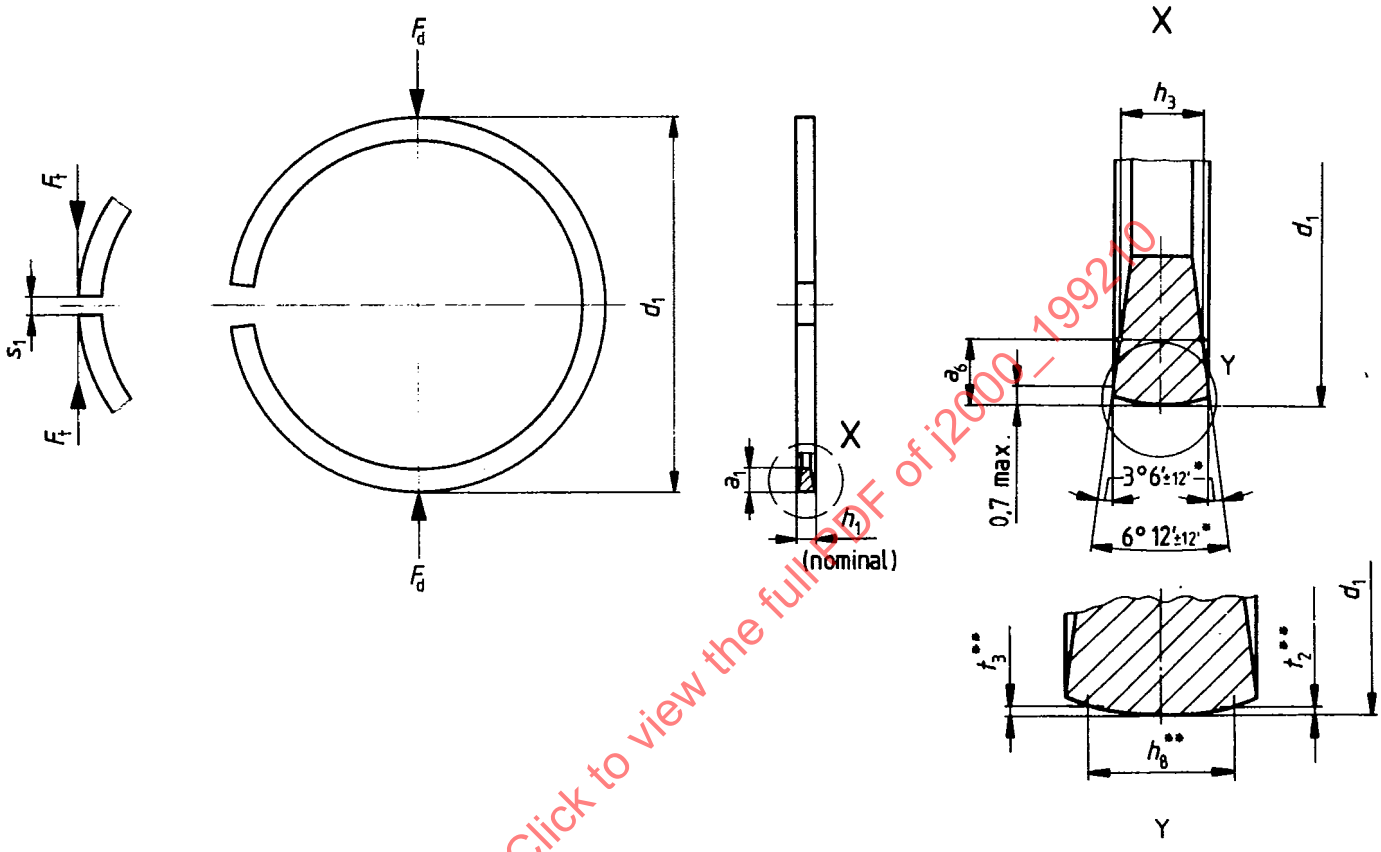
* Due to manufacturing processing, side angle tolerances are not cumulative.

3.1.2 DESIGNATION EXAMPLE—Designation of a straight faced keystone ring 6°, of d_1 = 90 mm nominal diameter, h_1 = 2.5 mm ring width, made of grey cast iron, nonheat-treated (material subclass 12), general features as shown in Figure 1, and periphery coated fully faced with chromium, 0.10 mm minimum thickness.

3.2 Type TB—Barrel Faced Keystone Ring 6°

3.2.1 General Features

NOTE—See Table 7 for dimensions and forces.



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

* Due to manufacturing processing, side angle tolerances are not cumulative.

** See Table 1.

FIGURE 2—TYPE TB

TABLE 1—GAUGE WIDTH (h_e) AND BARREL DIMENSIONS

Dimensions in millimeters

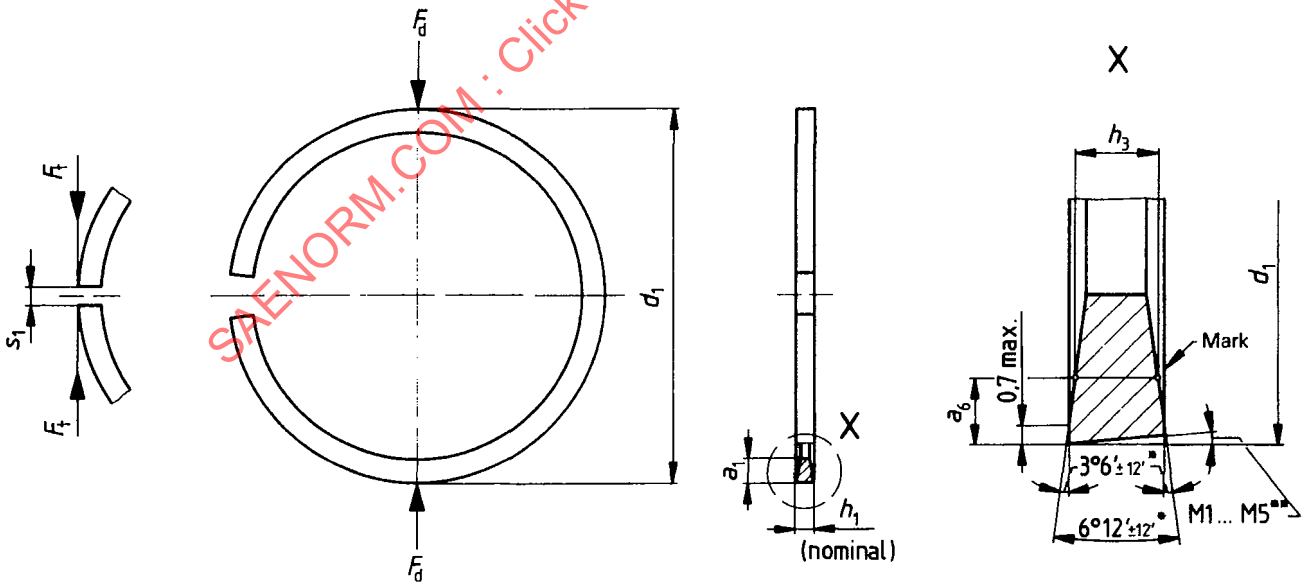
(h_1)	h_e	t_2, t_3	Maximum Peak Off Center
2.0	1.2	0.002/0.016	0.30
2.5	1.6		0.40
3.0	2.0	0.005/0.020	0.50
3.5	2.4		
4.0	2.8	0.005/0.023	0.60
4.5	3.2		

3.2.2 DESIGNATION EXAMPLE—Designation of a barrel faced keystone ring 6°, of d_1 = 90 mm nominal diameter, h_1 = 2.5 mm ring width, made of spheroidal graphite cast iron, heat-treated martensitic (material subclass 53), general features as shown in Figure 2, and periphery semi-inlaid coated with molybdenum, 0.2 mm minimum thickness.

3.3 Type TM—Taper Faced Keystone Ring 6°

3.3.1 GENERAL FEATURES

NOTE—See Table 7 for dimensions and forces.



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

* Due to manufacturing processing, side angle tolerances are not cumulative.

** See Table 2.

FIGURE 3—TYPE TM

TABLE 2—TAPER

Taper	Uncoated and Coated Rings (Molybdenum or Chrome)	Uncoated and Coated Rings (Molybdenum or Chrome) Tolerance[1]
M1	10'	+50' 0
M2	30'	
M3	60'	+60' 0
M4	90'	
M5	120'	

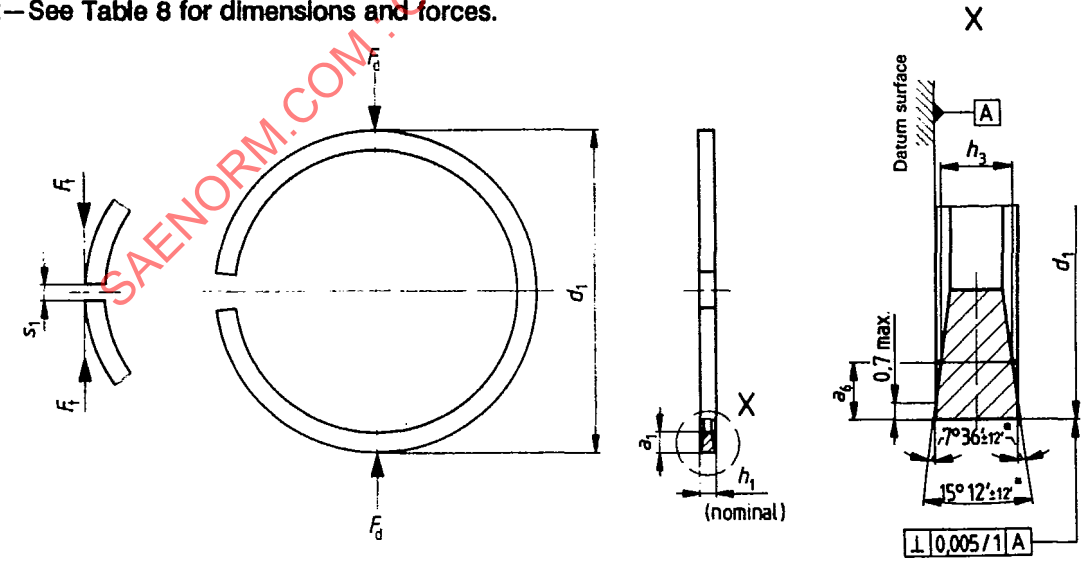
[1] For coated rings with tapered periphery not ground, the tolerance shall be increased by 10' (for example: M3 = 60' : +70' 0).

3.3.2 DESIGNATION EXAMPLE—Designation of a taper faced M1 = 10' keystone ring 6°, of d_1 = 90 mm nominal diameter, h_1 = 2.5 mm ring width, made of grey cast iron, heat-treated (material subclass 22), general features as shown in Figure 3, and phosphated all over.

3.4 Type K—Straight Faced Keystone Ring 15°

3.4.1 GENERAL FEATURES

NOTE—See Table 8 for dimensions and forces.



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

FIGURE 4—TYPE K

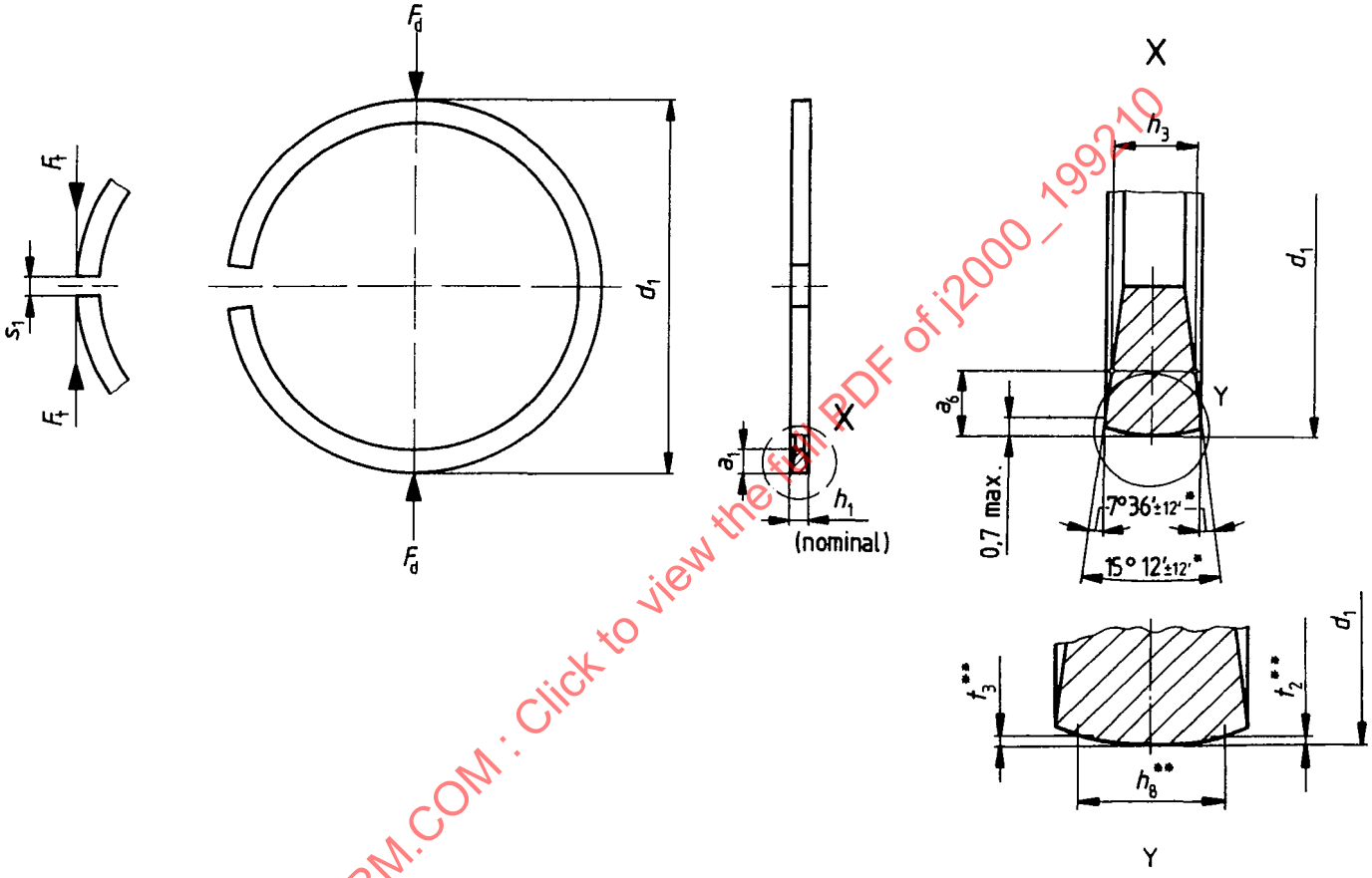
* Due to manufacturing processing, side angle tolerances are not cumulative.

3.4.2 DESIGNATION EXAMPLE—Designation of a straight faced keystone ring 15°, of d_1 = 90 mm nominal diameter, h_1 = 2.5 mm ring width, made of carbidic cast iron, heat-treated martensitic (material subclass 32), general features as shown in Figure 4, and ferroxide coated.

3.5 Type KB—Barrel Faced Keystone Ring 15°

3.5.1 GENERAL FEATURES

NOTE—See Table 8 for dimensions and forces.



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

* Due to manufacturing processing, side angle tolerances are not cumulative.

** See Table 1.

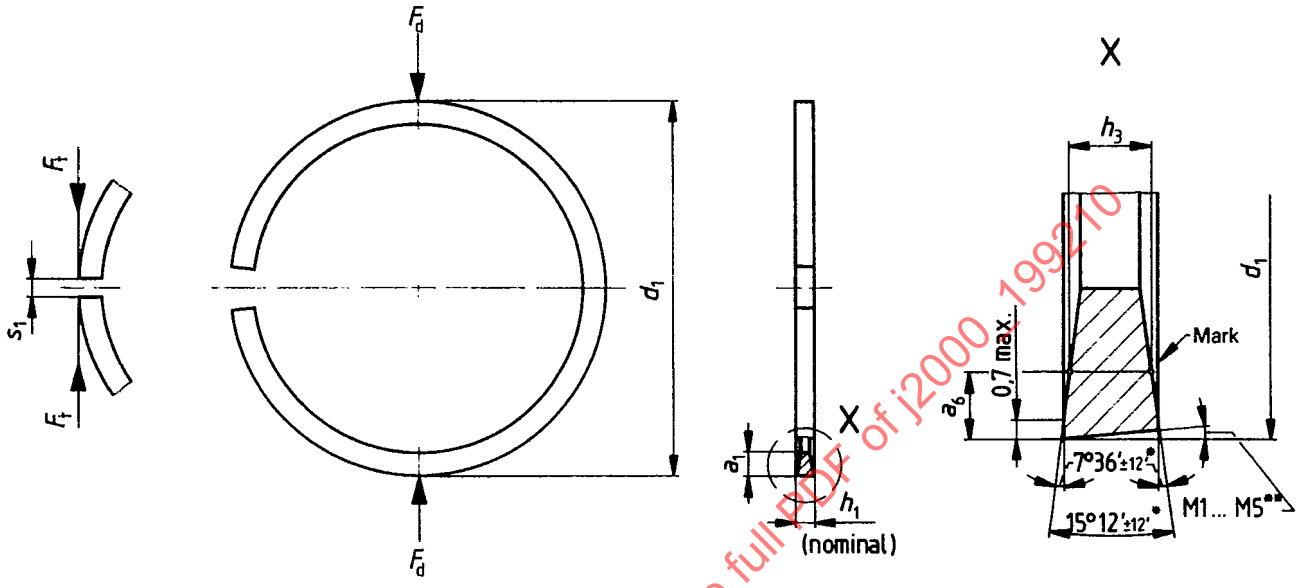
FIGURE 5—TYPE KB

3.5.2 DESIGNATION EXAMPLE—Designation of a barrel faced keystone ring 15°, of d_1 = 90 mm nominal diameter, h_1 = 2.5 mm ring width, made of malleable cast iron, heat-treated pearlitic (material subclass 41), general features as shown in Figure 5, and periphery fully faced, coated with molybdenum, 0.2 mm minimum thickness.

3.6 Type KM—Taper Faced Keystone Ring 15°

3.6.1 General Features

NOTE—See Table 8 for dimensions and forces.



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

* Due to manufacturing processing, side angle tolerances are not cumulative.

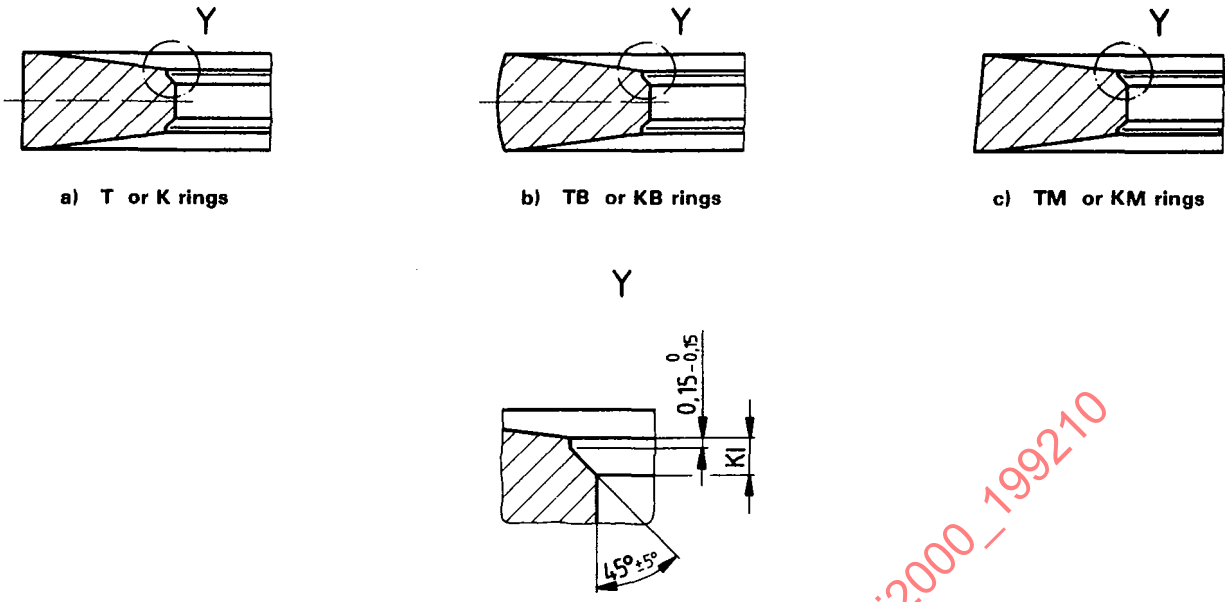
** See Table 2.

FIGURE 6—TYPE KM

3.6.2 Designation Example—Designation of a taper faced M1 = 10' keystone ring 15°, of d_1 = 90 mm nominal diameter, h_1 = 2.5 mm ring width, made of grey cast iron, nonheat-treated (material subclass 12); general features as shown in Figure 6.

4. Common Features

4.1 T, TB, TM or K, KB, KM Rings—Inside Chamfered Edges (KI)



a) T or K rings

b) TB or KB rings

c) TM or KM rings

FIGURE 7—INSIDE CHAMFERED EDGES (KI)

TABLE 7—INSIDE CHAMFERED EDGES (KI)

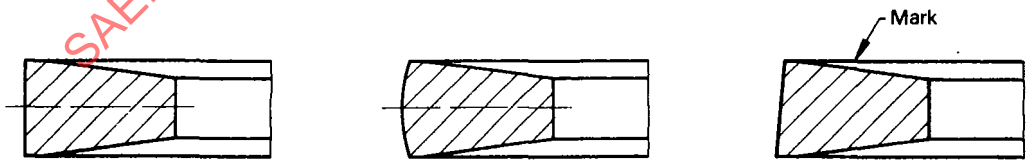
Dimensions in millimeters

d_1	KI
$70 \leq d_1 < 125$	0.3 ± 0.15
$125 \leq d_1 < 175$	0.4 ± 0.15
$175 \leq d_1 \leq 200$	0.6 ± 0.20

4.2 T, TB, TM or K, KB, KM Rings—Coating Configuration

NOTE—See Table 4 for dimensions.

4.2.1 UNCOATED RINGS



a) T or K rings

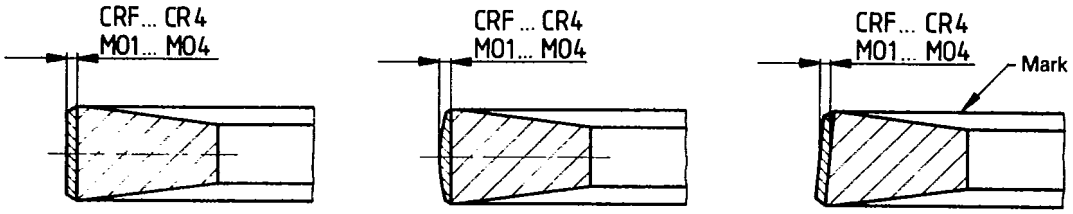
b) TB or KB rings

c) TM or KM rings

FIGURE 8—UNCOATED RINGS

4.2.2 COATED RINGS (CHROMIUM OR MOLYBDENUM)

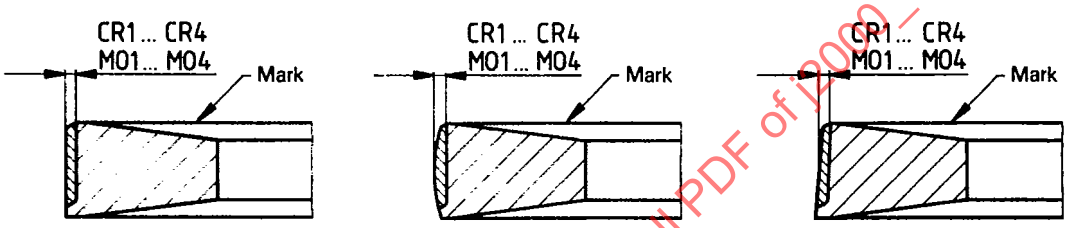
4.2.2.1 Fully Faced



a) T or K rings b) TB or KB rings c) TM or KM rings

FIGURE 9—FULLY FACED RINGS

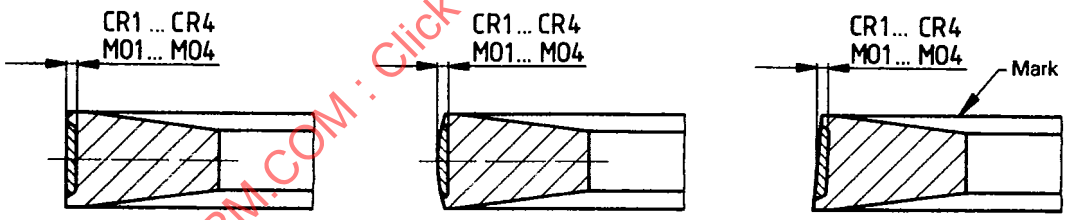
4.2.2.2 Semi-Inlaid



a) T or K rings b) TB or KB rings c) TM or KM rings

FIGURE 10—SEMI-INLAID RINGS

4.2.2.3 Inlaid



a) T or K rings b) TB or KB rings c) TM or KM rings

FIGURE 11—INLAID RINGS

TABLE 4—LAYER THICKNESS

Dimensions in millimeters

Chromium	Molybdenum	Thickness Minimum
CRF	-	0.005
CR1	MO1	0.05
CR2	MO2	0.10
CR3	MO3	0.15
CR4	MO4	0.20

5. *Force Factors*—The tangential and diametral forces given in Tables 7 and 8 shall be corrected when additional features and/or materials other than grey cast iron with a modulus of elasticity of 100 000 MPa are being used.

For common features, the multiplier correction factors given in Tables 5 and 6 and the force correction factors given in SAE J1591 shall be used.

The factors of Table 6 have been calculated with mean coating thickness.

TABLE 5—FORCE CORRECTION FACTORS FOR T, TB, TM, K, KB, AND KM RINGS WITH FEATURE KI

KI	Taper M2 or M3	Taper M4 or M5	KI and Taper M2 or M3	KI and Taper M4 or M5
0.96	0.98	0.96	0.94	0.92

TABLE 6—FORCE CORRECTION FACTORS FOR COATED T, TB, TM, K, KB, AND KM RINGS (FULLY FACED, SEMI-INLAID, AND INLAID TYPES)

CRF	CR1	CR2/MO1	CR3/MO2	CR4/MO3	MO4
1	0.94	0.91	0.88	0.85	0.83

6. Dimensions

TABLE 7—DIMENSIONS OF T, TB, TM KEYSTONE RINGS 6°

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness "regular" a_1	Tolerance	Nominal value of ring width (h_1) Column 1	Column 2	Method A a_6 (ref.)	Method A Measured value h_3 Column 1	Method A Measured value h_3 Column 2	Method B h_3 (ref.) Column 1	Method B h_3 (ref.) Column 2	Method B Measured value a_6	Closed gap s_1	Tolerance	Tangential force F_t, N For h_1 shown in column 1	For h_1 shown in column 2	Tolerance	Diametral force F_d, N For h_1 shown in column 1	For h_1 shown in column 2	Tolerance
70	2,90	±0,15 Within a ring: 0,15 max.	2,0	2,5	1,5	1,832 0 −0,024 For phosphated PO surface: +0,01 −0,024	2,332 0 −0,024 For phosphated PO surface: +0,01 −0,024	1,82	2,32	1,61 0 −0,22 For phosphated PO surface: +0,09 −0,22	0,20	+0,20 0	9,9	12,6		21,3	27,1	
71	2,95												10,1	12,9		21,7	27,7	
72	3,00												10,3	13,2		22,1	28,4	
73	3,05												10,5	13,4		22,6	28,8	
74	3,10												10,7	13,7		23,0	29,5	
75	3,15										0,25	+0,25 0	10,9	13,9		23,4	29,9	
76	3,15												10,6	13,6		22,8	29,2	
77	3,20												10,8	13,9		23,2	29,9	
78	3,25												11,0	14,1		23,7	30,3	
79	3,30												11,3	14,4		24,3	31,0	
80	3,35												11,5	14,7		24,7	31,6	
81	3,40												11,7	15,0		25,2	32,3	
82	3,40												11,4	14,6		24,5	31,4	
83	3,45												11,6	14,9		24,9	32,0	
84	3,50												11,8	15,2		25,4	32,7	
85	3,55												12,0	15,4		25,8	33,1	
86	3,60												12,2	15,7		26,2	33,8	
87	3,65												12,5	16,0		26,9	34,4	
88	3,65												12,2	15,6		26,2	33,5	
89	3,70												12,4	15,9		26,7	34,2	
90	3,75												16,1	19,6		34,6	42,1	
91	3,80												16,3	20,0		35,0	43,0	
92	3,85												16,6	20,3		35,7	43,6	
93	3,90												16,9	20,6	±30% if F_t < 10N	36,3	44,3	±30% if F_d < 21,5N
94	3,90												16,5	20,2		35,5	43,4	
95	3,95												16,8	20,5	±20% if F_t > 10N	36,1	44,1	±20% if F_d > 21,5N
96	4,00												17,1	20,9		36,8	44,9	
97	4,05												17,3	21,2		37,2	45,6	
98	4,10												17,6	21,5		37,8	46,2	
99	4,15												17,9	21,9		38,5	47,1	
100	4,15										0,30		17,5	21,4		37,6	46,0	
101	4,20												17,7	21,7		38,1	46,7	
102	4,25												18,0	22,0		38,7	47,3	
103	4,30												18,2	22,3		39,1	47,9	
104	4,30												17,9	21,9		38,5	47,1	
105	4,35												18,1	22,2		38,9	47,7	
106	4,40												18,3	22,5		39,3	48,4	
107	4,40												18,0	22,0		38,7	47,3	
108	4,45	±0,20 Within a ring: 0,20 max.	2,5	3,0	2,0	2,278 0 −0,024 For phosphated PO surface: +0,01 −0,024	2,778 0 −0,024 For phosphated PO surface: +0,01 −0,024	2,27	2,77	2,08 0 −0,22 For phosphated PO surface: +0,09 −0,22			18,2	22,3		39,1	47,9	
109	4,50												18,4	22,6		39,6	48,6	
110	4,55										0,35	+0,30 0	18,6	22,8		40,0	49,0	
111	4,55												18,2	22,4		39,1	48,2	
112	4,60												18,5	22,7		39,8	48,8	
113	4,65												18,7	22,9		40,2	49,2	
114	4,70												18,9	23,2		40,6	49,9	
115	4,70												18,6	22,8		40,0	49,0	
116	4,75												18,8	23,1		40,4	49,7	
117	4,80												19,0	23,4		40,9	50,3	
118	4,80												18,7	22,9		40,2	49,2	
119	4,85												18,9	23,2		40,6	49,9	

This table is shown in ISO format. Commas represent decimal points.

TABLE 7 (CONTINUED)

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness "regular" a_1	Tolerance	Nominal value of ring width (h_1) Column 1	Nominal value of ring width (h_1) Column 2	Method A a_6 (ref.)	Method A Measured value h_3 Column 1	Method A Measured value h_3 Column 2	Method B h_3 (ref.) Column 1	Method B h_3 (ref.) Column 2	Method B Measured value a_6	Closed gap s_1	Closed gap Tolerance	Tangential force F_t, N For h_1 shown in column 1	Tangential force F_t, N For h_1 shown in column 2	Tangential force F_t, N Tolerance	Diametral force F_d, N For h_1 shown in column 1	Diametral force F_d, N For h_1 shown in column 2	Diametral force F_d, N Tolerance
120	4,90	±0,20 Within a ring: 0,20 max.	2,5	3,0	2,0	2,278 0 −0,024 For phosphated PO surface: +0,01 −0,024	2,778 0 −0,024 For phosphated PO surface: +0,01 −0,024	2,27	2,77	2,08 0 −0,22 for phosphated PO surface: +0,09 −0,22	0,35	+0,30 0	19,1	23,5	±30 % if F_t < 10 N ±20 % if F_t > 10 N	41,1	50,5	±30 % if F_d < 21,5 N ±20 % if F_d > 21,5 N
121	4,95												19,3	23,8		41,5	51,2	
122	4,95												19,0	23,3		40,9	50,1	
123	5,00												19,2	23,6		41,3	50,7	
124	5,05												19,4	23,9		41,7	51,4	
125	5,05												23,4	27,8		50,3	59,8	
126	5,10												23,7	28,1		51,0	60,4	
127	5,15												24,0	28,5		51,6	61,3	
128	5,20												24,2	28,8		52,0	61,9	
129	5,20												23,8	28,3		51,2	60,8	
130	5,25												24,0	28,5		51,6	61,3	
131	5,30												24,3	28,9		52,2	62,1	
132	5,30												23,9	28,4		51,4	61,1	
133	5,35					2,724 0 −0,024 For phosphated PO surface: +0,01 −0,024	3,224 0 −0,024 For phosphated PO surface: +0,01 −0,024			2,63 0 −0,22 For phosphated PO surface: +0,09 −0,22			24,1	28,7		51,8	61,7	
134	5,40												24,4	29,0		52,5	62,4	
135	5,40												24,0	28,5		51,6	61,3	
136	5,45												24,3	28,8		52,2	61,9	
137	5,50												24,5	29,1		52,7	62,6	
138	5,50												24,1	28,7		51,8	61,7	
139	5,55												24,4	29,0		52,5	62,4	
140	5,60										0,40	+0,35 0	24,6	29,3		52,9	63,0	
141	5,65												24,9	29,6		53,5	63,6	
142	5,65												24,5	29,1		52,7	62,6	
143	5,70												24,7	29,4		53,1	63,2	
144	5,75		3,0	3,5	2,5			2,71	3,21				25,0	29,7		53,8	63,9	
145	5,75												24,6	29,3		52,9	63,0	
146	5,80												24,9	29,6		53,5	63,6	
147	5,85												25,1	29,9		54,0	64,3	
148	5,85												24,7	29,4		53,1	63,2	
149	5,90												25,0	29,7		53,8	63,9	
150	5,95												25,0	29,8		53,8	64,1	
152	6,00												24,9	29,7		53,5	63,9	
154	6,05					2,724 0 −0,029 For phosphated PO surface: +0,01 −0,029	3,224 0 −0,029 For phosphated PO surface: +0,01 −0,029			2,63 0 −0,26 For phosphated PO surface: +0,09 −0,27			24,8	29,5		53,3	63,4	
155	6,10												25,0	29,8		53,8	64,1	
156	6,15												25,2	30,1		54,2	64,7	
158	6,20												25,1	29,9		54,0	64,3	
160	6,25										0,50	+0,40 0	25,0	29,8		53,8	64,1	
162	6,35												25,4	30,3		54,6	65,1	
164	6,40												25,3	30,2		54,4	64,9	
165	6,40												25,0	29,8		53,8	64,1	
166	6,45												25,2	30,0		54,2	64,5	
168	6,50												25,1	29,9		54,0	64,3	
170	6,60					3,172 0 −0,029 For phosphated PO surface: +0,01 −0,029	3,672 0 −0,029 For phosphated PO surface: +0,01 −0,029			3,20 0 −0,27 For phosphated PO surface: +0,09 −0,27			30,4	35,4		65,4	76,1	
172	6,65												30,3	35,2		65,1	75,7	
174	6,70												30,2	35,1		64,9	75,5	
175	6,75		3,5	4,0	3,0			3,15	3,65		0,60	+0,45 0	30,3	35,2		65,1	75,7	
176	6,80												30,5	35,5		65,6	76,3	
178	6,85												30,4	35,4		65,4	76,1	

This table is shown in ISO format. Commas represent decimal points.

TABLE 7 (CONCLUDED)

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness "regular" a_1		Nominal value of ring width (h_1) Column		Method A a_6 (ref.)	Method A Measured value h_3 Column		Method B h_3 (ref.) Column		Method B Measured value a_6	Closed gap s_1		Tangential force F_t, N For h_1 shown in column		Tangential force F_t, N Tolerance	Diametral force F_d, N For h_1 shown in column		Diametral force F_d, N Tolerance
		Tolerance	1	2		1	2	1	2			Tolerance	1	2		1	2	
180	6,90	±0,20 Within a ring: 0,20 max.	3,5	4,0	3,0	3,172 0 −0,029 For phosphated PO surface: +0,01 −0,029	3,672 0 −0,029 For phosphated PO surface: +0,01 −0,029	3,15	3,65	3,20 0 −0,27 For phosphated PO surface: +0,09 −0,27	0,60	+0,45 0	30,3	35,2	±30 % if F_t < 10N ±20 % if F_t > 10N	65,1	75,7	±30 % if F_d < 21,5N ±20 % if F_d > 21,5N
182	6,95												30,1	35,1		64,7	75,5	
184	7,05												30,6	35,7		65,8	76,8	
185	7,05												30,3	35,2		65,1	75,7	
186	7,10												30,5	35,5		65,6	76,3	
188	7,15												30,4	35,4		65,4	76,1	
190	7,20												30,3	35,2		65,1	75,7	
192	7,25												30,1	35,1		64,7	75,5	
194	7,35												30,6	35,7		65,8	76,8	
195	7,35												30,2	35,2		64,9	75,7	
196	7,40												30,5	35,5		65,6	76,3	
198	7,45												30,4	35,4		65,4	76,1	
200	7,50												30,2	35,2		64,9	75,7	

NOTES

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

[2] For values for F_t and F_d, given in Table 7, apply to as cast grey cast iron with a typical modulus of elasticity (E_n) of 100 000 MPa. Multiplying factors for materials having a different modulus (E_n) are given in SAE J1591.

Mean forces are calculated for nominal radial wall thickness (a_1) and mean ring width (h_1).

[3] For the sole purpose of this document, the assumed average ratio F_d/F_t is 2.15.

This table is shown in ISO format. Commas represent decimal points.

TABLE 8—DIMENSIONS OF K, KB, KM KEYSTONE RINGS 15°

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness "regular" a_1	Tolerance	Nominal value of ring width (h_1) Column 1	Column 2	a_6 (ref.)	Method A: Measured value h_3 Column 1	Column 2	Method B: h_3 (ref.) Column 1	Column 2	Measured value a_6	Closed gap s_1	Tolerance	Tangential force F_t, N: For h_1 shown in column 1	2	Tolerance	Diametral force F_d, N: For h_1 shown in column 1	2	Tolerance
80	3,35	±0,15 Within a ring: 0,15 max.	2,5	3,0	1,5	2,097 0 −0,029 For phosphated PO surface: +0,01 −0,029	2,597 0 −0,029 For phosphated PO surface: +0,01 −0,029	2,10	2,60	1,49 0 −0,11 For phosphated PO surface: +0,04 −0,11	0,25	+0,25 0	12,8	16,0	±30 % if F_t < 10 N ±20 % if F_t > 10 N	27,5	34,4	±30 % if F_d < 21,5 N ±20 % if F_d > 21,5 N
81	3,40												13,0	16,3		28,0	35,0	
82	3,40												12,7	15,9		27,3	34,2	
83	3,45												12,9	16,2		27,7	34,8	
84	3,50												13,1	16,5		28,2	35,5	
85	3,55												13,3	16,7		28,6	35,9	
86	3,60												13,5	17,0		29,0	36,6	
87	3,65												13,7	17,3		29,5	37,2	
88	3,65												13,4	16,9		28,8	36,3	
89	3,70												13,6	17,1		29,2	36,8	
90	3,75												13,7	17,3		29,5	37,2	
91	3,80												13,9	17,6		29,9	37,8	
92	3,85												14,1	17,8		30,3	38,3	
93	3,90												14,3	18,1		30,7	38,9	
94	3,90												14,0	17,7		30,1	38,1	
95	3,95										0,30		14,1	17,9		30,3	38,5	
96	4,00												14,3	18,2		30,7	39,1	
97	4,05												14,5	18,5		31,2	39,8	
98	4,10												14,7	18,7		31,6	40,2	
99	4,15												14,9	19,0		32,0	40,9	
100	4,15	±0,20 Within a ring: 0,20 max.	3,0	3,5	2,0	2,463 0 −0,034 For phosphated PO surface: +0,01 −0,034	2,963 0 −0,034 For phosphated PO surface: +0,01 −0,034	2,45	2,95	2,05 0 −0,13 For phosphated PO surface: +0,04 −0,13			18,5	22,5		39,8	48,4	
101	4,20												18,8	22,8		40,4	49,0	
102	4,25												19,0	23,1		40,9	49,7	
103	4,30												19,2	23,3		41,3	50,1	
104	4,30												18,8	22,9		40,4	49,2	
105	4,35												19,0	23,1		40,9	49,7	
106	4,40												19,2	23,4		41,3	50,3	
107	4,40												18,8	22,9		40,4	49,2	
108	4,45												19,0	23,2		40,9	49,9	
109	4,50												19,2	23,5		41,3	50,5	
110	4,55										0,35	+0,30 0	19,4	23,6		41,7	50,7	
111	4,55												19,0	23,2		40,9	49,9	
112	4,60												19,2	23,4		41,3	50,3	
113	4,65												19,4	23,7		41,7	51,0	
114	4,70												19,6	24,0		42,1	51,6	
115	4,70												19,2	23,5		41,3	50,5	
116	4,75												19,4	23,7		41,7	51,0	
117	4,80												19,6	24,0		42,1	51,6	
118	4,80												19,2	23,5		41,3	50,5	
119	4,85												19,4	23,8		41,7	51,2	
120	4,90												19,6	24,0		42,1	51,6	
121	4,95												19,8	24,3		42,6	52,2	
122	4,95												19,4	23,8		41,7	51,2	
123	5,00												19,6	24,1		42,1	51,8	
124	5,05												19,8	24,3		42,6	52,2	
125	5,05		3,5	4,0	2,5	2,830 0 −0,034 For phosphated PO surface: +0,01 −0,034	3,330 0 −0,034 For phosphated PO surface: +0,01 −0,034	2,80	3,30	2,61 0 −0,13 For phosphated PO surface: +0,04 −0,13			23,9	28,3		51,4	60,8	
126	5,10												24,1	28,6		51,8	61,5	
127	5,15												24,3	28,9		52,2	62,1	
128	5,20												24,6	29,2		52,9	62,8	
129	5,20												24,1	28,7		51,8	61,7	
130	5,25										0,40	+0,35 0	24,3	28,9		52,2	62,1	
131	5,30												24,5	29,2		52,7	62,8	
132	5,30												24,1	28,7		51,8	61,7	
133	5,35												24,3	28,9		52,2	62,1	
134	5,40												24,5	29,2		52,7	62,8	

This table is shown in ISO format. Commas represent decimal points.

TABLE 8 (CONCLUDED)

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness "regular" a_1		Nominal value of ring width (h_1)		Method A a_6 (ref.)	Method A Measured value h_3		Method B h_3 (ref.)		Method B Measured value a_6	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	Column 1	Column 2		Column 1	Column 2	Column 1	Column 2			Tolerance	1	2	Tolerance	1	2	Tolerance
135	5,40	±0,20 Within a ring: 0,20 max.	3,5	4,0	2,5	2,830 0 −0,034 For phosphated PO surface: +0,01 −0,034	3,330 0 −0,034 For phosphated PO surface: +0,01 −0,034	2,80	3,30	2,61 0 −0,13 For phosphated PO surface: +0,04 −0,13	0,40	+0,35 0	24,1	28,7	±30 % if F_t < 10 N ±20 % if F_t > 10 N	51,8	61,7	±30 % if F_d < 21,5 N ±20 % if F_d > 21,5 N
136	5,45												24,4	29,0		52,5	62,4	
137	5,50												24,6	29,3		52,9	63,0	
138	5,50												24,2	28,8		52,0	61,9	
139	5,55												24,4	29,1		52,5	62,6	
140	5,60												24,6	29,3		52,9	63,0	
141	5,65												24,8	29,6		53,3	63,6	
142	5,65												24,4	29,1		52,5	62,6	
143	5,70												24,6	29,4		52,9	63,2	
144	5,75												24,8	29,6		53,3	63,6	
145	5,75												24,4	29,2		52,5	62,8	
146	5,80												24,6	29,4		52,9	63,2	
147	5,85												24,8	29,7		53,3	63,9	
148	5,85												24,4	29,2		52,5	62,8	
149	5,90												24,6	29,5		52,9	63,4	
150	5,95												24,7	29,5		53,1	63,4	
152	6,00												24,5	29,3		52,7	63,0	
154	6,05												24,3	29,1		52,2	62,6	
155	6,10												24,5	29,4		52,7	63,2	
156	6,15												24,7	29,6		53,1	63,6	
158	6,20												24,5	29,4		52,7	63,2	
160	6,25										0,50	+0,40 0	24,3	29,2		52,2	62,8	
162	6,35												24,6	29,7		52,9	63,9	
164	6,40												24,5	29,5		52,7	63,4	
165	6,40												24,1	29,1		51,8	62,6	
166	6,45												24,3	29,3		52,2	63,0	
168	6,50												24,1	29,1		51,8	62,6	
170	6,60												29,5	34,5		63,4	74,2	
172	6,65												29,3	34,3		63,0	73,7	
174	6,70												29,1	34,1		62,6	73,3	
175	6,75												29,2	34,2		62,8	73,5	
176	6,80												29,4	34,4		63,2	74,0	
178	6,85												29,2	34,2		62,8	73,5	
180	6,90												29,0	34,0		62,4	73,1	
182	6,95												28,8	33,9		61,9	72,9	
184	7,05												29,2	34,3		62,8	73,7	
185	7,05		4,0	4,5	3,0	3,191 0 −0,039 For phosphated PO surface: +0,01 −0,039	3,691 0 −0,039 For phosphated PO surface: +0,01 −0,039	3,20	3,70	2,98 0 −0,15 For phosphated PO surface: +0,04 −0,15	0,60	+0,45 0	28,8	33,9		61,9	72,9	
186	7,10												29,0	34,1		62,4	73,3	
188	7,15												28,8	33,9		61,9	72,9	
190	7,20												28,7	33,7		61,7	72,5	
192	7,25												28,5	33,6		61,3	72,2	
194	7,35												28,8	34,0		61,9	73,1	
195	7,35												28,5	33,6		61,3	72,2	
196	7,40												28,7	33,8		61,7	72,7	
198	7,45												28,5	33,6		61,3	72,2	
200	7,50												28,3	33,4		60,8	71,8	

NOTES

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

[2] The values for F_t and F_d, given in Table 8, apply to as cast grey cast iron with a typical modulus of elasticity (E_n) of 100 000 MPa. Multiplying factors for materials having a different modulus (E_n) are given in SAE J1591.

Mean forces are calculated for nominal radial wall thickness (a_1) and mean ring width (h_1).

[3] For the sole purpose of this document, the assumed average ratio F_d/F_t is 2.15.

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