The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J1997

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Superseding J1997 OCT92

Submitted for recognition as an American National Standard

Internal Combustion Engines—Piston Rings—Rectangular Rings

This SAE Standard is equivalent to ISO Standard 6622/1.

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

This SAE Standard specifies the essential dimensional features of R, B, and M rectangular piston ring types.

Dimensional Tables 8 and 9 offer the choice of two radial wall thicknesses:

a. Radial wall thickness "regular" (Table 8)
b. Radial wall thickness "D/22" (Table 9)

The requirements of this document apply to rectangular rings for reciprocating internal combustion piston engines up to and including 200 mm diameter. They may also be used for piston rings of compressors working under similar conditions.

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2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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	66621/5	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
		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
	1101	TECHNICAL DRAWINGS—GEOMETRICAL TOLERANCING—TOLERANCING OF FORM, ORIENTATION, LOCATION AND RUN-OUT—GENERALITIES, DEFINITIONS, SYMBOLS INDICATIONS ON DRAWINGS

1. TR refers to Technical Report

3. Ring Types and Designation Examples

3.1 **Type R—**Straight Faced Rectangular Ring

3.1.1 GENERAL FEATURES

NOTE—See Table 8 or 9 for dimensions and forces.

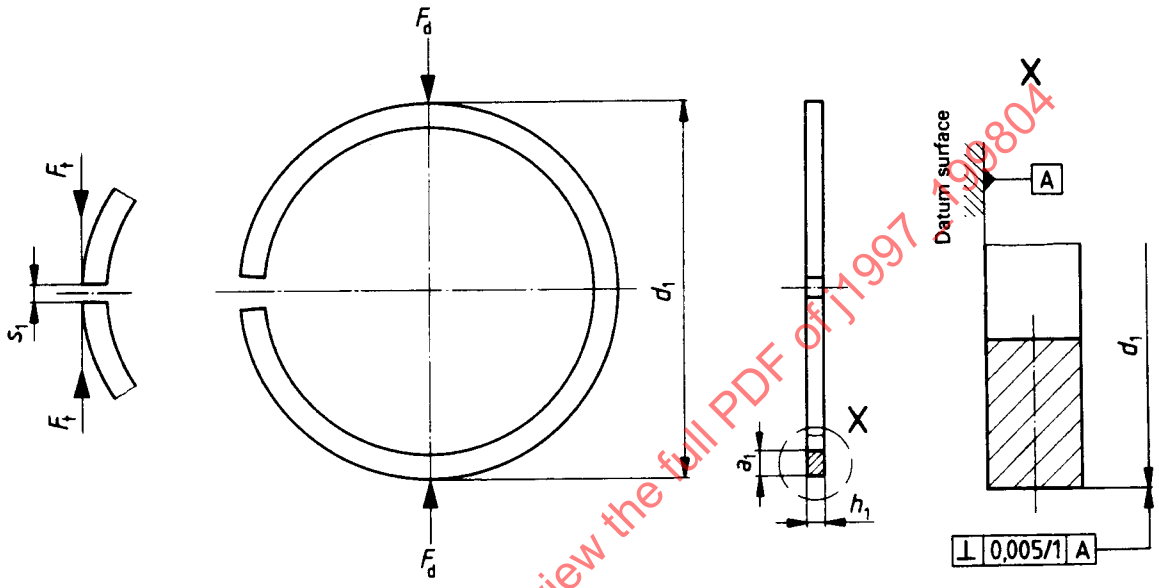


FIGURE 1—TYPE R

3.1.2 DESIGNATION EXAMPLE—Designation of a straight faced rectangular ring of d_1 = 90 mm nominal diameter, radial wall thickness "regular", 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 phosphated all over.

3.2 **Type B—Barrel Faced Rectangular Ring**

3.2.1 GENERAL FEATURES

NOTE—See Table 8 or 9 for dimensions and forces.

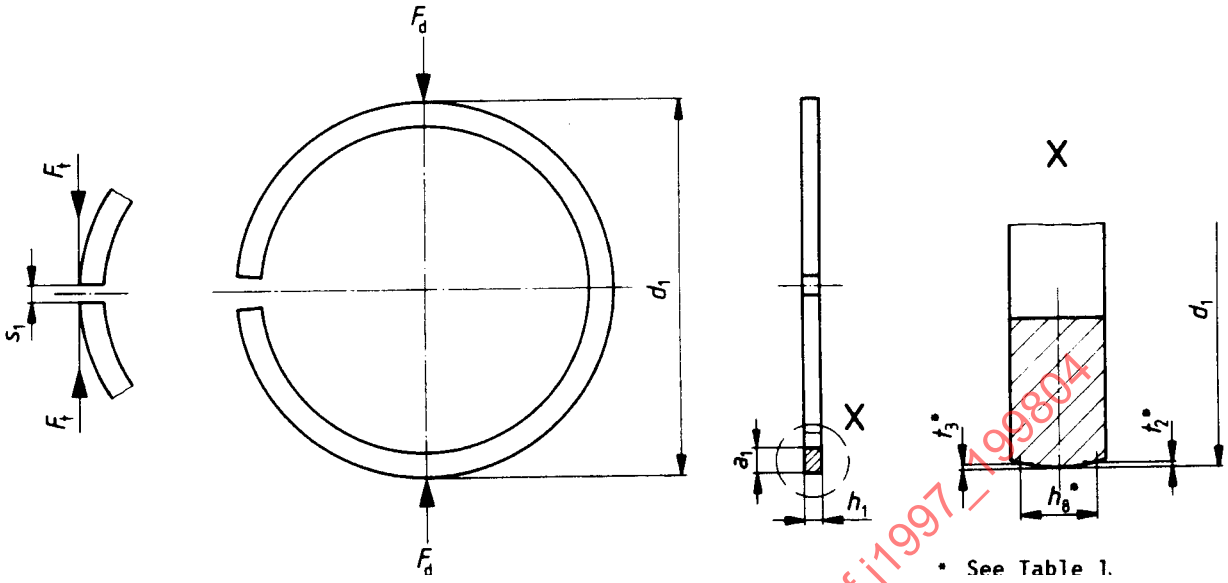


FIGURE 2—TYPE B

TABLE 1—GAUGE WIDTH (h_S) AND BARREL DIMENSIONS

Dimensions in millimeters

h_1	h_8	t_2, t_3	Maximum Peak Off Center
1.5	0.8		0.25
1.75	1.0	0.002/0.016	0.3
2.0	1.2		
2.5	1.6		0.4
3.0	2.0	0.005/0.020	0.5
3.5	2.4		
4.0	2.8	0.005/0.023	0.6
4.5	3.2		

3.2.2 DESIGNATION EXAMPLE—Designation of a barrel faced rectangular ring of d_1 = 90 mm nominal diameter, radial wall thickness "regular", h_1 = 2.5 mm ring width, made of spheroidal graphite cast iron (material subsclass 51), general features as shown in Figure 2, and periphery chromium coated fully faced design, 0.15 mm minimum thickness.

3.3 Type M—Taper Faced Rectangular Ring

3.3.1 GENERAL FEATURES

NOTE—SeeTable 8 or 9 for dimensions and forces.

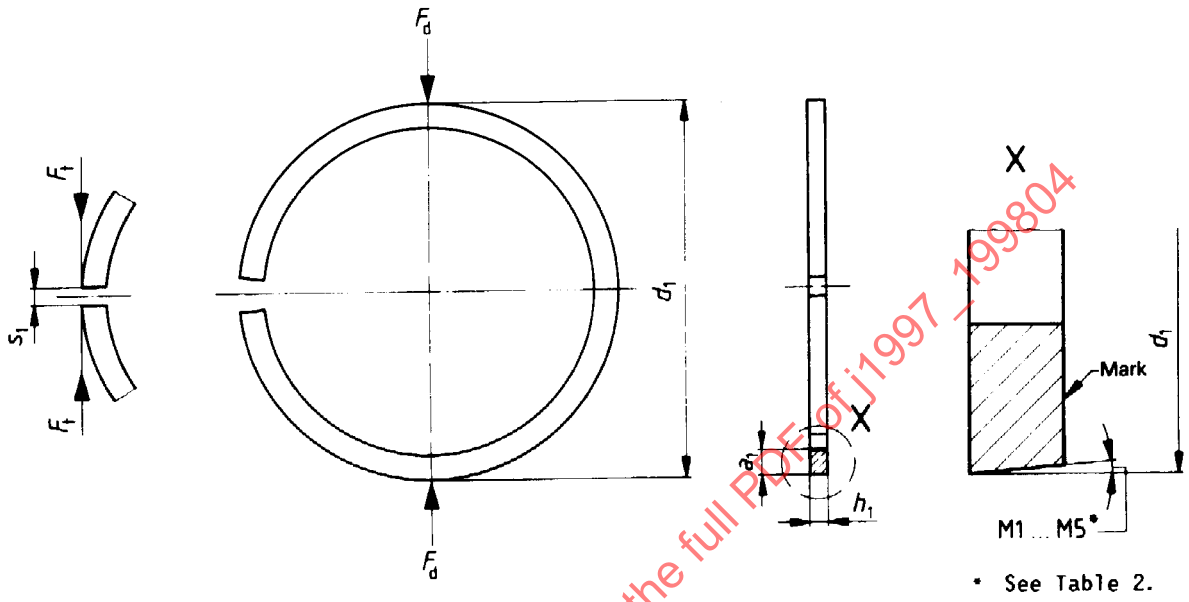


FIGURE 3—TYPE M

TABLE 2—TAPER

Taper	Uncoated and Coated Rings (Molybdenum or Chrome With Tapered Periphery Ground)	Uncoated and Coated Rings (Molybdenum or Chrome With Tapered Periphery Ground) Tolerance[1]	Uncoated and Coated Rings (Molybdenum or Chrome With Tapered Periphery Ground) With IF or IW[2] (Top Side)	Uncoated and Coated Rings (Molybdenum or Chrome With Tapered Periphery Ground) With IF or IW[2] (Top Side) Tolerance[1]	Uncoated and Coated Rings (Molybdenum or Chrome With Tapered Periphery Ground) With IFU or IWU[2] (Bottom Side)[3]	Uncoated and Coated Rings (Molybdenum or Chrome With Tapered Periphery Ground) With IFU or IWU[2] (Bottom Side)[3] Tolerance
M1	10'	+40' 0	10'		-	-
M2	30'		30'		-	-
M3	60'		60'		60'	
M4	90'	+50' 0	90'	+60' 0	90'	+60' 0
M5	120'		120'		120'	

1. For coated rings with tapered periphery not ground, the tolerance shall be increased by 10' (for example, M3 = 60': $+^{60'}_{0}$ for M-rings or $+^{70'}_{0}$ for M-rings with IF or IW).
2. IF, IW, IFU, and IWU are explained in Figures 16 to 19.
3. For M-rings (negative twist type) M3, M4, and M5, the twist angle should not exceed 90% of the minimum taper angle.

3.3.2 DESIGNATION EXAMPLE—Designation of a taper faced rectangular ring of d_1 = 90 mm nominal diameter, radial wall thickness "regular", h_1 = 2.5 mm ring width, made of grey cast iron, heat-treated (material subclass 23), general features as shown in Figure 3, with taper M1 = 10', and periphery molybdenum coated inlaid design, 0.10 mm minimum thickness.

4. Common Features

4.1 Type R—Straight Faced Rectangular Ring

4.1.1 UNCOATED RINGS

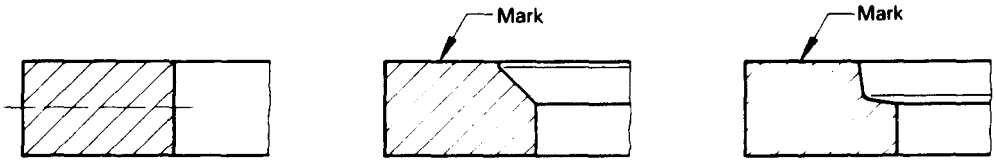


FIGURE 4—UNCOATED TYPE R RINGS

4.1.2 COATED RINGS (CHROMIUM OR MOLYBDENUM)

4.1.2.1 Fully Faced

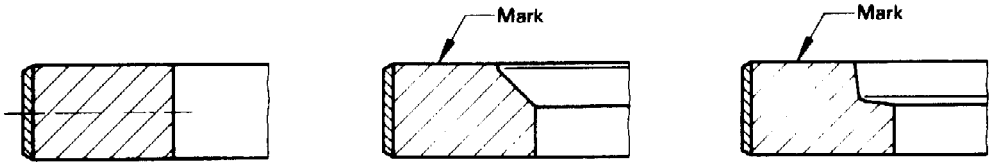


FIGURE 5—FULLY FACED COATED TYPE R RINGS

4.1.2.2 Semi-Inlaid

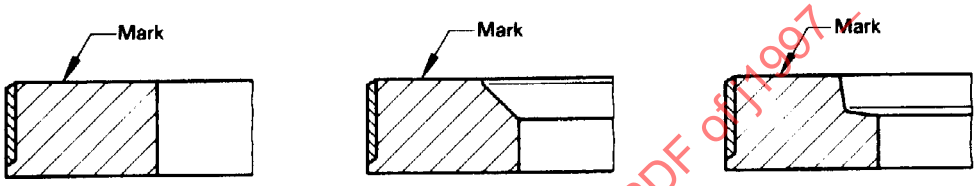


FIGURE 6—SEMI-INLAID COATED TYPE R RINGS

4.1.2.3 Inlaid

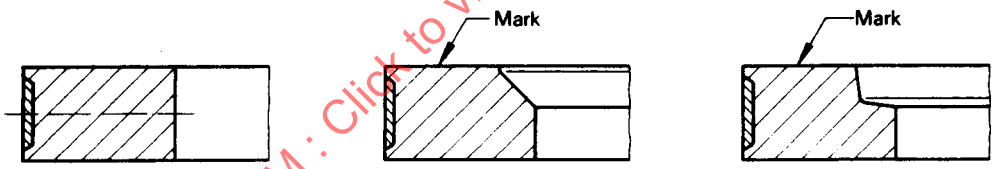


FIGURE 7—INLAID COATED TYPE R RINGS

4.2 Type B—Barrel Faced Rectangular Ring

4.2.1 UNCOATED RINGS

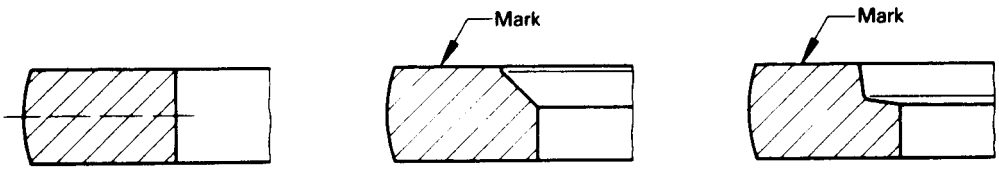


FIGURE 8—UNCOATED TYPE B RINGS

4.2.2 COATED RINGS (CHROMIUM OR MOLYBDENUM)

4.2.2.1 Fully Faced

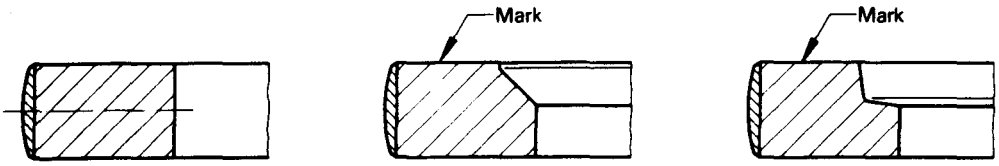


FIGURE 9—FULLY FACED COATED TYPE B RINGS

4.2.2.2 Semi-Inlaid

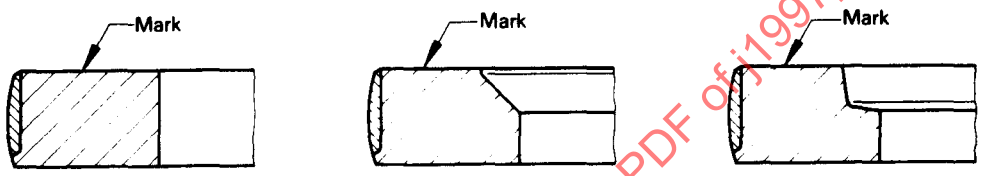


FIGURE 10—SEMI-INLAID COATED TYPE B RINGS

4.2.2.3 Inlaid

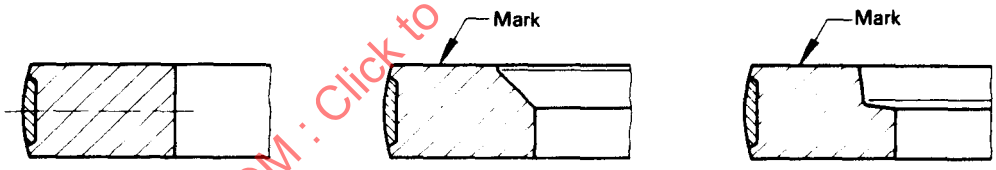


FIGURE 11—INLAID COATED TYPE B RINGS

4.3 Type M-Taper Faced Rectangular Ring

4.3.1 UNCOATED RINGS

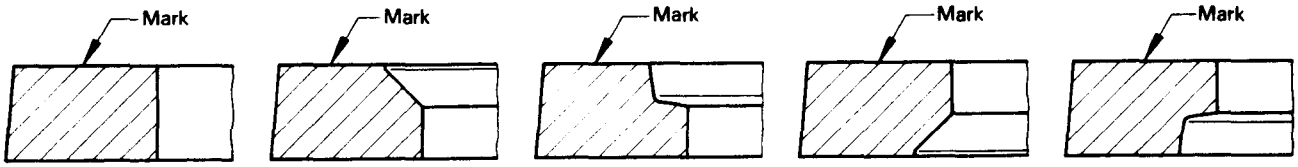


FIGURE 12—UNCOATED TYPE M RINGS

4.3.2 COATED RINGS (CHROMIUM OR MELYBDENUM)

4.3.2.1 Fully Faced

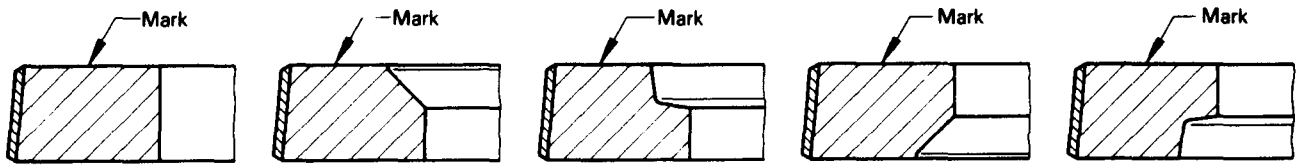


FIGURE 13—FULLY FACED COATED TYPE M RINGS

4.3.2.2 Semi-Inlaid

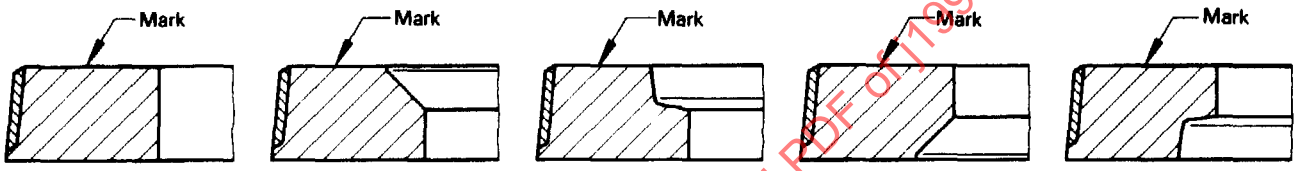


FIGURE 14—SEMI-INLAID COATED TYPE M RINGS

4.3.2.3 Inlaid

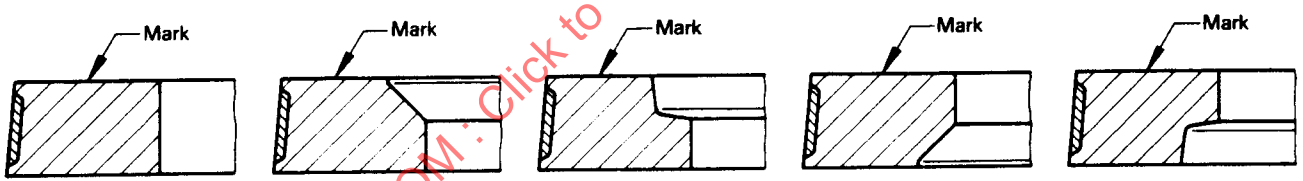


FIGURE 15—INLAID COATED TYPE M RINGS

4.4 R, B, and M Rings (Positive Twist Type)—Internal Bevel or Internal Step Top Side

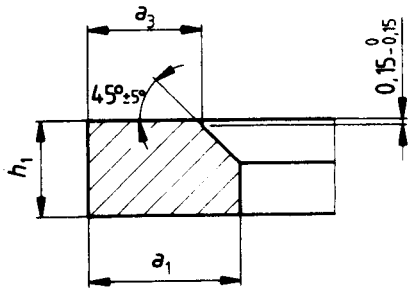


FIGURE 16—INTERNAL BEVEL TOP SIDE (IF)

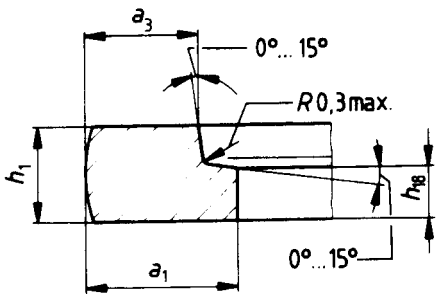


FIGURE 17—INTERNAL STEP TOP SIDE (IW)

4.5 M Rings (Negative Twist Type), Tapers M3 to M5—Internal Bevel or Internal Step Bottom Side

NOTE—See Table 3 for dimensions.

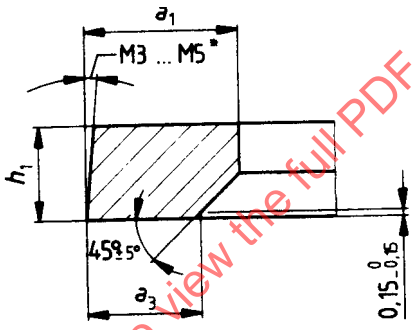


FIGURE 18—INTERNAL BEVEL BOTTOM SIDE (IFU)

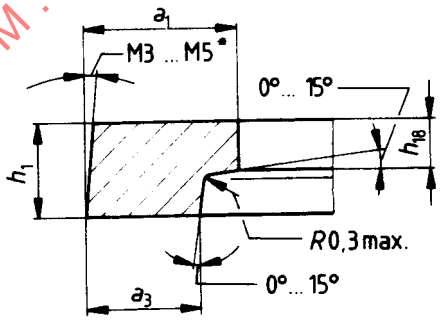


FIGURE 19—INTERNAL STEP BOTTOM SIDE (IWU)

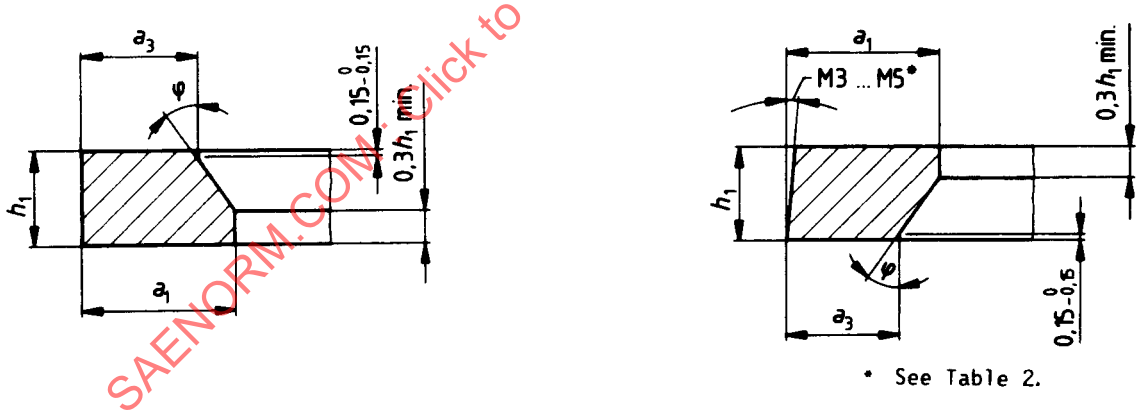
TABLE 3—a_3 AND h_{18} DIMENSIONS(1)

Dimensions in millimeters

d1	a_3 Tolerance	a_3 Tolerance	h_{18} Tolerance	h_{18} Tolerance
$30 \le d_1 < 80$	$0.8 \times a_1$	0 –0.2	$0.6 \times h_1$	0 –0.25
$80 \le d_1 < 100$	$0.8 \times a_1$	0 –0.3	$0.6 \times h_1$	0 –0.25
$100 \le d_1 < 150$	$0.8 \times a_1$	0 –0.3	$0.6 \times h_1$	0 –0.35
$150 \le d_1 \le 200$	$0.8 \times a_1$	0 –0.4	$0.6 \times h_1$	0 –0.45

1. In the case of negative twist type rings, a_3 and h_{18} dimensions are for reference only and are secondary to the twist requirements as shown in 4.6.

4.6 R, B, and M Rings (Positive Twist Type) and M-Rings (Negative Twist Type)—Variable Internal Bevel— When the standard twist of 0.01/0.05 for rings ≤2 mm axial width and 0.01/0.04 mm for rings >2 mm axial width per 2 mm of radial ring thickness is specified, the dimension a_3, the angle φ and the width of the bevel are at the discretion of the manufacturer. In such cases, the design should correspond to the design shown in Figure 20, a) or b).



a) Positive twist type

b) Negative twist type

FIGURE 20—VARIABLE INTERNAL BEVEL

4.7 R and B Rings—Outside Chamfered Edges (KA)

FIGURE 21—OUTSIDE CHAMFERED EDGES (KA)

4.8 R, B, and M Rings—Inside Chamfered Edges (KI)

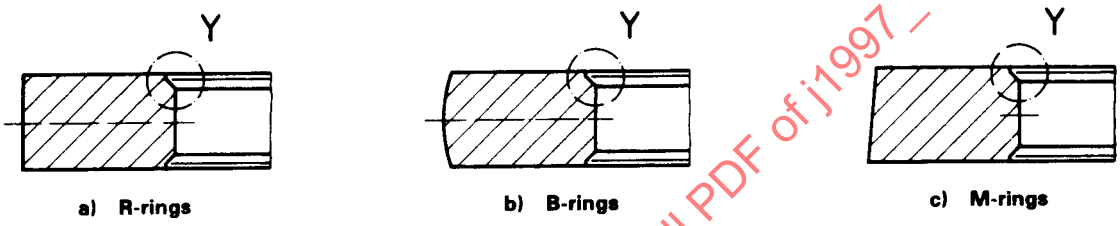


FIGURE 22—INSIDE CHAMFERED EDGES (KI)

4.9 R and B Rings—Outside and Inside Chamfered Edges (KA + KI) (KA Applies to Uncoated Rings Only)

NOTE—See Table 4 for dimensions.

FIGURE 23—OUTSIDE AND INSIDE CHAMFERED EDGES (KA + KI)

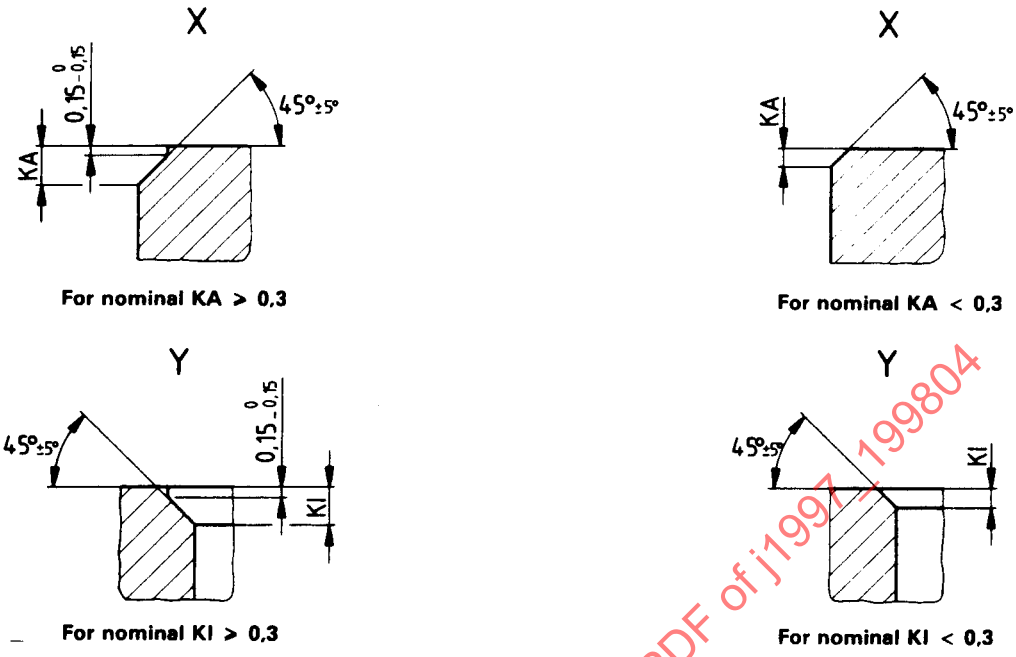


FIGURE 24—DETAILS OF Figures 21, 22, AND 23

TABLE 4—KA AND KI DIMENSIONS

Dimensions in millimeters

d_1	KA	KI
$30 \le d_1 < 50$	0.2 max	0.2 max
$50 \le d_1 < 125$	0.3 ± 0.1	0.3 ± 0.15
$125 \le d_1 < 175$	0.4 ± 0.1	0.4 ± 0.15
$175 \le d_1 \le 200$	0.5 ± 0.1	0.6 ± 0.2

4.10 R, B, and M Rings (Fully Faced, Semi-Inlaid, and Inlaid)—Layer Thickness

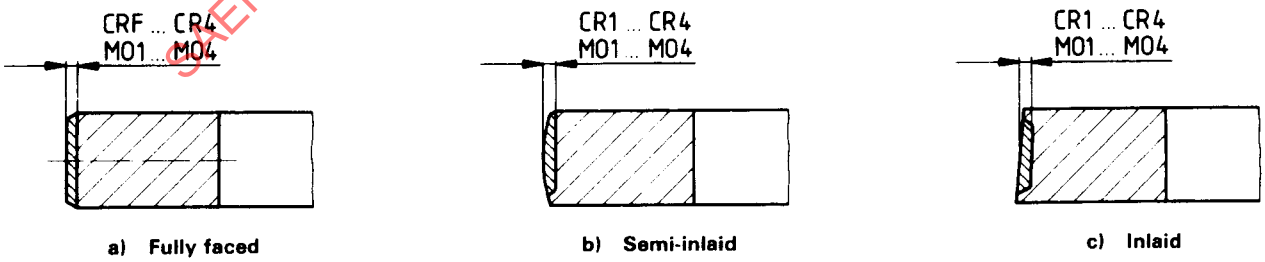


FIGURE 25—LAYER THICKNESS (SEE Table 5 FOR DIMENSIONS)

TABLE 5—LAYER THICKNESS

Dimensions in millimeters

Chromium	Molybdenum	Thickness min
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 8 and 9 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 6 and 7 and the force correction factors given in ISO 6621/4 shall be used.

The factors of Table 7 have been calculated with mean coating thickness.

TABLE 6—FORCE CORRECTION FACTORS FOR R, B, AND M RINGS WITH FEATURES KA, KI, IF, AND IW

d_1 mm	KA	KI	Taper M2 or M3	Taper M4 or M5	IF	IW	KA and KI	KI and taper M2 or M3	KI and taper M4 or M5	KA and IF	KA and IW
$30 \le d_1 < 50$	1	1	0.97	0.93	0.88	0.75	1	0.97	0.93	0.88	0.75
$50 \le d_1 \le 200$	0.97	0.97	0.98	0.96	0.88	0.78	0.94	0.95	0.93	0.85	0.76

TABLE 7—FORCE CORRECTION FACTORS FOR COATED R, B, AND M RINGS (FULLY FACED, SEMI-INLAID, AND INLAID TYPE)

d_1 mm	CRF	CR1	CR2/MO1	CR3/MO2	MO3	MO4
$30 \le d_1 < 50$	1	0.81	0.70	0.64	—	—
$50 \le d_1 < 100$	1	0.90	0.85	0.81	0.75	0.71
$100 \le d_1 < 150$	1	0.94	0.91	0.88	0.86	0.83
$150 \le d_1 \le 200$	1	0.96	0.93	0.91	0.89	0.87

6. *Dimensions*

TABLE 8—DIMENSIONS OF R, B, AND M RECTANGULAR RINGS (RADIAL WALL THICKNESS "REGULAR")

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness "regular" a_1		Ring width h_1 Column					Closed gap s_1		Tangential force F_t, N For h1 shown in column					Diametral force F_d, N For h1 shown in column				
		Tolerance	1	2	3	4	Tolerance		Tolerance	1	2	3	4	Tolerance	1	2	3	4	Tolerance
30	1,25														7,5	8,6	9,9	12,5	
31	1,3														8,0	9,2	10.5	13,1	
32	1,35									—	—	—	—		8,2	9,7	11	13,8	
33	1,4														8,6	10,1	11,6	14,6	
34	1,4														8,2	9,5	11	13,8	
35	1,45														8,6	10,1	11,4	14,4	
36	1,5														9	10,5	12	15,1	
37	1,55									—	—	—	—		9,5	11	12,7	15,7	
38	1,6														9,9	11,4	13,1	16,6	
39	1,65														10,3	12	13,8	17,2	
40	1.65						–0,010								9,7	11.4	13,1	16,3	
41	1,7						–0,030								10,1	11,8	13,5	17	
42	1,75						For			—	—	—	—		10,5	12,3	14,2	17,6	
43	1,8						phos-								11	12,9	14,6	18,3	
44	1,85						phated								11,4	13,3	15,3	19,1	
45	1,9						PO		+0,2						11,8	13,8	15,7	19,6	
46	1,9						surface:	0,15	0						11,2	13,1	15,1	18,7	
47	1,95						–0,005			—	—	—	—		11,6	13,5	15,5	19,4	
48	2						–0,035								12	14	16,1	20,2	
49	2,05														12,5	14,6	16,6	20,9	
50	2,1									6	7	8	10		12,9	15,1	17,2	21,5	
51	2,15									6,2	7,2	8,3	10,3		13,3	15,5	17,8	22,1	
52	2,15									5,9	6,9	7,9	9,9		12,7	14,8	17	21,3	
53	2,2	±0,15								6,1	7,2	8,2	10,3		13,1	15,5	17,6	22,1	±30% if
54	2,25	Within								6,3	7,4	8,5	10,6		13,5	15,9	18,3	22,8	F_d < 21,5 N
55	2,3	a ring:	1,5	1,75	2	2,5				6,5	7,6	8,7	10,9		14	16,3	18,7	23,4	±20% if
56	2,35	0,15								6,7	7,8	9	11,2		14,4	16,8	19,4	24,1	F_d > 21,5 N
57	2,4	max.								6,9	8,1	9,2	11,6		14,8	17,4	19,8	24,9	
58	2,4									6,7	7,8	8,9	11,2		14,4	16,8	19,1	24,1	
59	2,45									6,9	8	9,2	11,5		14,8	17,2	19,8	24,7	
60	2,5									7	8,2	9,4	11,7		15,1	17,6	20,2	25,2	
61	2,55									7,2	8,4	9,6	12,1		15,5	18,1	20,6	26	
62	2,6									7,4	8,6	9,9	12,4		15,9	18,5	21,3	26,7	
63	2,65									7,6	8,9	10,1	12,7	±30% if	16,3	19,1	21,7	27,3	
64	2,65									7,3	8,6	9,8	12,3	F_t < 10 N	15,7	18,5	21,1	26,4	
65	2,7									7,5	8,8	10,1	12,6	±20 % if	16,1	18,9	21,7	27,1	
66	2,75								+0,2	7,7	9	10,3	12,9	F_t > 10 N	16,6	19,4	22,1	27,7	
67	2,8							0,2	0	7,9	9,3	10,6	13,3		17	20	22,8	28,6	
68	2,85									8,1	9,5	10,9	13,6		17,4	20,4	23,4	29,2	
69	2,9									8,3	9,7	11,1	13,9		17,8	20,9	23,9	29,9	
70	2,9									8,1	9,4	10,8	13,5		17,4	20,2	23,2	29	
71	2,95									8,3	9,7	11,1	13,8		17,8	20,9	23,9	29,7	
72	3									8,5	9,9	11,3	14,2		18,3	21,3	24,3	30,5	
73	3,05									8,6	10,1	11,6	14,5		18,5	21,7	24,9	31,2	
74	3,1									8,8	10,3	11,8	14,8		18,9	22,1	25,4	31,8	
75	3,15									9	10,5	12	15,1		19,4	22,6	25,8	32,5	
76	3,15								+0,25	8,8	10,2	11,7	14,7		18,9	21,9	25,2	31,6	
77	3,2							0,25	0	8,9	10,5	12	15		19,1	22,6	25,8	32,3	
78	3,25									9,1	10,7	12,2	15,3		19,6	23	26,2	32,9	
79	3,3									9,3	10,9	12,5	15,6		20	23,4	26,9	33,5	

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

TABLE 8—DIMENSIONS OF R, B, AND M RECTANGULAR RINGS (RADIAL WALL THICKNESS "REGULAR") (CONTINUED)

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness "regular" a_1		Ring width h_1 Column					Closed gap s_1		Tangential force F_t, N For h1 shown in column					Diametral force F_d, N For h1 shown in column				
		Tolerance	1	2	3	4	Tolerance		Tolerance	1	2	3	4	Tolerance	1	2	3	4	Tolerance
80	3,35									9,5	11,1	12,7	16		20,4	23,9	27,3	34,4	
81	3,4									9,7	11,4	13	16,3		20,9	24,5	28	35	
82	3,4									9,5	11,1	12,7	15,9		20,4	23,9	27,3	34,2	
83	3,45									9,7	11,3	12,9	16,2		20,9	24,3	27,7	34,8	
84	3,5								±0,25	9,9	11,5	13,2	16,5		21,3	24,7	28,4	35,5	
85	3,55		1,5	1,75	2	2,5		0,25	±0	10,1	11,8	13,5	16,8		21,7	25,4	29	36,1	
86	3,6						–0,010			10,3	12	13,7	17,2		22,1	25,8	29,5	37	
87	3,65	±0,15					–0,030			10,4	12,2	14	17,5		22,4	26,2	30,1	37,6	
88	3,65	Within					For			10,2	11,9	13,6	17,1		21,9	25,6	29,2	36,8	
89	3,7	a ring:					phos-			10,4	12,2	13,9	17,4		22,4	26,2	29,9	37,4	
90	3,75	0,15					phated			12,3	14,1	17,6	21,2		26,4	30,3	37,8	45,6	
91	3,8	max.					PO			12,5	14,3	18	21,6		26,9	30,7	38,7	46,4	
92	3,85						surface:			12,8	14,6	18,3	22		27,5	31,4	39,3	47,3	
93	3,9						–0,005			13	14,9	18,6	22,4		28	32	40	48,2	
94	3,9						–0,035			12,7	14,5	18,2	21,9		27,3	31,2	39,1	47,1	
95	3,95		1,75	2	2,5	3				12,9	14,8	18,5	22,3		27,7	31,8	39,8	47,9	
96	4									13,2	15,1	18,8	22,6		28,4	32,5	40,4	48,6	
97	4,05									13,4	15,3	19,2	23		28,8	32,9	41,3	49,5	
98	4,1								+0,25	13,6	15,6	19,5	23,4		29,2	33,5	41,9	50,3	
99	4,15							0,3	0	13,8	15,8	19,8	23,8		29,7	34	42,6	51,2	
100	4,15										15,5	19,4	23,3			33,3	41,7	50,1	
101	4,2										15,7	19,7	23,7			33,8	42,4	51	
102	4,25									—	16	20	24		—	34,4	43	51,6	
103	4,25										16,2	20,3	24,4			34,8	43,6	52,5	
104	4,3										15,9	19,9	23,9			34,2	42,8	51,4	
105	4,35		—	2	2,5	3					16,1	20,1	24,2	±30% if		34,6	43,2	52	±30% if
106	4,4										16,3	20,4	24,6	F_t < 10 N		35	43,9	52,9	F_d < 21,5 N
107	4,4									—	16	20	24,1	±20% if	—	34,4	43	51,8	±200% if
108	4,45										16,2	20,3	24,4	F_t > 10 N		35,3	43,6	52,5	F_d > 21,5 N
109	4,5										16,4	20,6	24,8			35,3	44,3	53,3	
110	4,55										20,8	25	29,2			44,7	53,8	62,8	
111	4,55										20,4	24,5	28,6			43,9	52,7	61,5	
112	4,6									—	20,7	24,9	29		—	44,5	53,5	62,4	
113	4,65										21	25,2	29,4			45,2	54,2	63,2	
114	4,7										21,3	25,6	29,8			45,8	55	64,1	
115	4,7	±0,2									20,9	25,1	29,3			44,9	54	63	
116	4,75	Within									21,1	25,4	29,7			45,4	54,6	63,9	
117	4,8	a ring:								—	21,4	25,8	30,1		—	46	55,5	64,7	
118	4,85	0,20									21	25,3	29,5			45,2	54,4	63,4	
119	4,85	max.							+0,30		21,3	25,6	29,9			45,8	55	64,3	
120	4,9							0,35	0		21,6	25,9	30,3			46,4	55,7	65,1	
121	4,95										21,9	26,3	30,7			47,1	56,5	66	
122	4,95		—	2,5	3	3,5				—	21,5	25,8	30,1		—	46,2	55,5	64,7	
123	5										21,8	26,1	30,5			46,9	56,1	65,6	
124	5,05										22	26,5	30,9			47,3	57	66,4	
125	5,05						–0,010				21,6	26	30,4			46,4	55,9	65,4	
126	5,1						–0,040				21,9	26,3	30,7			47,1	56,5	66	
127	5,15						For			—	22,2	26,7	31,1		—	47,7	57,4	66,9	
128	5,2						phos-				22,5	27	31,5			48,4	58,1	67,7	
129	5,2						phated				22,1	26,5	31			47,5	57	66,7	
130	5,25						PO				22,3	26,8	31,3			47,9	57,6	67,3	
131	5,3						surface				22,6	27,1	31,6			48,6	58,3	67,9	
132	5,3						–0,005			—	22,2	26,6	31,1		—	47,7	57,2	66,9	
133	5,35						–0,045	0,4	+0,035		22,4	27	31,5			48,2	58,1	67,7	
134	5,4								0		22,7	27,3	31,9			48,8	58,7	68,6	

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

TABLE 8—DIMENSIONS OF R, B, AND M RECTANGULAR RINGS (RADIAL WALL THICKNESS "REGULAR") (CONTINUED)

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness "regular" a_1		Ring width h_1 Column					Closed gap s_1		Tangential force F_t, N For h1 shown in column					Diametral force F_d, N For h1 shown in column				
		Tolerance	1	2	3	4	Tolerance		Tolerance	1	2	3	4	Tolerance	1	2	3	4	Tolerance
135	5,4										22,3	26,8	31,3			47,9	57,6	67,3	
136	5,45										22,6	27,2	31,7			48,6	58,5	68,2	
137	5,5		—	2,5	3	3,5				—	22,9	27,5	32,1		—	49,2	59,1	69	
138	5,5						–0,010				22,5	27	31,6			48,4	58,1	67,9	
139	5,55						–0,040				22,8	27,3	31,9			49	58,7	68,6	
140	5,6						For				27,7	32,3	36,9			59,6	69,4	79,3	
141	5,65						phos-		+0,35		28	32,7	37,4			60,2	70,3	80,4	
142	5,65						phated	0,4	0	—	27,5	32,2	36,8		—	59,1	69,2	79,1	
143	5,7						PO				27,8	32,5	37,2			59,8	69,9	80	
144	5,75						surface:				28,2	32,9	37,6			60,6	70,7	80,8	
145	5,75						–0,005				27,7	32,4	37			59,6	69,7	79,6	
146	5,8						–0,045				28	32,7	37,4			60,2	70,3	80,4	
147	5,85									—	28,3	33,1	37,9		—	60,8	71,2	81,5	
148	5,85										27,9	32,6	37,3			60	70,1	80,2	
149	5,9										28,2	33	37,7			60,6	71	81,1	
150	5,95										28,3	33,1	37,8			60,8	71,2	81,3	
152	6									—	28,2	32,9	37,7		—	60,6	70,7	81,1	
154	6,05										28,1	32,8	37,5			60,4	70,5	80,6	
155	6,1		—	3	3,5	4					28,4	33,2	37,9			61,1	71,4	81,5	
156	6,15									—	28,7	33,5	38,3		—	61,7	72	82,3	
158	6,2										28,6	33,4	38,2			61,5	71,8	82,1	
160	6,25	±0.2							+0,4		28,5	33,2	38	±30% if		61,3	71,4	81,7	±30 % if
162	6,35	Within						0,5	0	—	29	33,9	38,8	F_t < 10 N	—	62,4	72,9	83,4	F_d < 21,5 N
164	6,4	a ring:									28,9	33,8	38,7	±20 % if		62,1	72,7	83,2	±20 % if
165	6,4	0,20									28,5	33,3	38,1	F_t > 10 N		61,3	71,6	81,9	F_d > 21,5 N
166	6,45	max.								—	28,8	33,7	38,5		—	61,9	72,5	82,8	
168	6,5										28,7	33,5	38,4			61,7	72	82,6	
170	6,6										29,3	34,2	39,1			63	73,5	84,1	
172	6,65									—	29,2	34,1	39		—	62,8	73,3	83,9	
174	6,7										29,1	34	38,8			62,6	73,1	83,4	
175	6,75										34,1	39	44			73,3	83,9	94,6	
176	6,8									—	34,5	39,4	44,4		—	74,2	84,7	95,5	
178	6,85										34,3	39,3	44,2			73,7	84,5	95	
180	6,9										34,2	39,1	44,1			73,5	84,1	94,8	
182	6,95									—	34,1	39	43,9		—	73,3	83,9	94,4	
184	7,05										34,7	39,7	44,7			74,6	85,4	96,1	
185	7,05										34,3	39,2	44,2			73,7	84,3	95	
186	7,1								+0,45	—	34,6	39,6	44,6		—	74,4	85,1	95,9	
188	7,15		—	3,5	4	4,5		0,6	0		34,5	39,5	44,4			74,2	84,9	95,5	
190	7,2										34,4	39,3	44,3			74	84,5	95,2	
192	7,25									—	34,3	39,2	44,2		—	73,7	84,3	95	
194	7,35										34,9	39,9	44,9			75	85,8	96,5	
195	7,35										34,5	39,5	44,4			74,2	84,9	95,5	
196	7,4									—	34,8	39,8	44,8		—	74,8	85,6	96,3	
198	7,45										34,7	39,7	44,7			74,6	85,4	96,1	
200	7,5									—	34,6	39,6	44,5		—	74,4	85,1	95,7	

NOTE—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. However, for rings up to 50 mm, the ratio F_d/F_t shall be determined between the manufacturer and client.

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