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SURFACE VEHICLE STANDARD

SAE J2226

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Superseding J2226 OCT92

An American National Standard

INTERNAL COMBUSTION ENGINES—PISTON RINGS—STEEL RECTANGULAR RINGS

1. ***Scope—***There is no standard equivalent to this SAE Standard. However, SAE J2226 is similar to and represents an extension of SAE J1998 (equivalent to ISO Standard 6622/2 TR).

This SAE Standard specifies the essential dimensional features of Type B barrel faced steel rectangular piston rings. Only fully faced and inlaid coated rings are included, consistent with current U.S. practice.

The requirements of this SAE Standard apply to steel piston rings of reciprocating internal combustion engines, up to and including 200 mm diameter and 4.5 mm width.

Tolerances specified in this document represent a six sigma quality level.

TO PLACE A DOCUMENT ORDER; (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS http://www.sae.org

2. References

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

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
		INTERNAL COMBUSTION ENGINES—PISTON RINGS
J2000	6624/1	Keystone rings
J2001	6624/2 TR	Half keystone rings
J2002	6625	INTERNAL COMBUSTION ENGINES—PISTON RING—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
	6507/3	METALLIC MATERIALS—HARDNESS TEST—VICKERS TEST—PART 3: LESS THAN HV 0.2

3. Ring Types and Designation Examples

3.1 Type B—Barrel Faced Rectangular Ring

3.1.1 GENERAL FEATURES

NOTE—See Table 4 for dimensions and forces.

1. TR refers to Technical Report

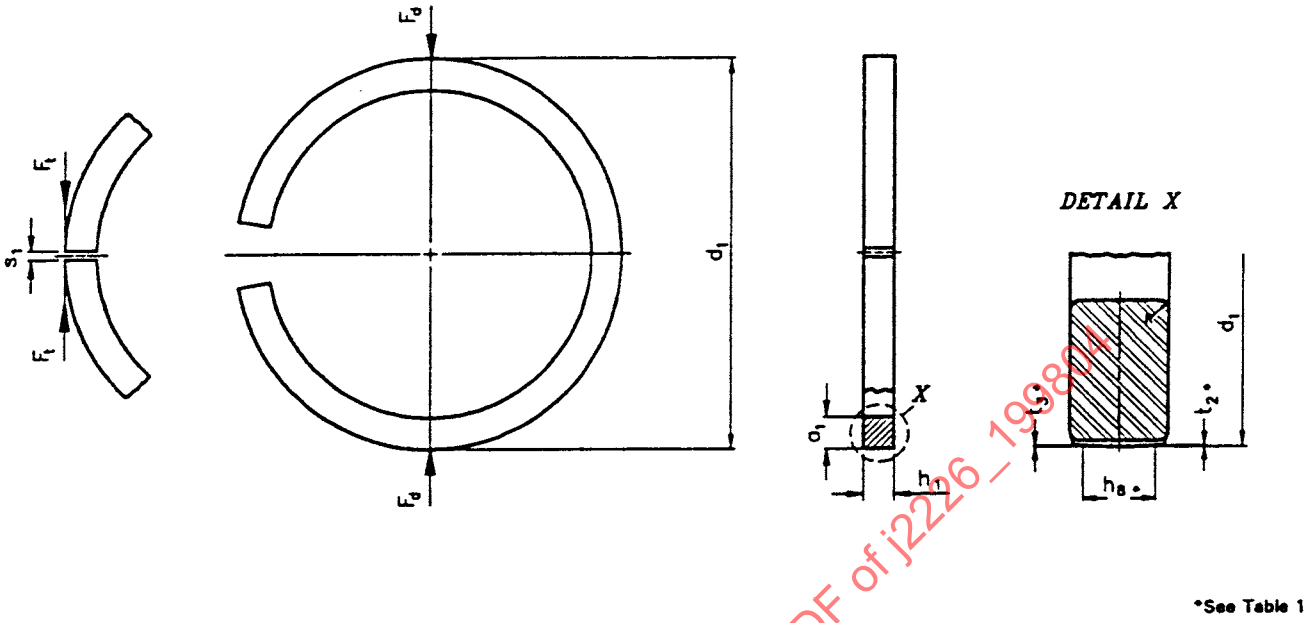


FIGURE 1—TYPE B

TABLE 1—GAUGE WIDTH (h_a) AND BARREL DIMENSIONS

Dimensions in millimeters

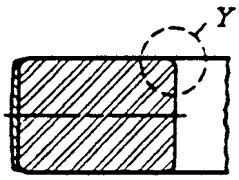
h_1	h_a	t_2, t_3	t_2, t_3	Maximum peak off center
1.2	0.6	0.001	0.013	0.2
1.5	0.8	0.002	0.016	0.25
2.0	1.2	0.002	0.016	0.4
2.5	1.6	0.002	0.016	0.4
3.0	2.0	0.005	0.020	0.5
3.5	2.4	0.005	0.020	0.5
4.0	2.8	0.005	0.023	0.6
4.5	3.2	0.005	0.023	0.6

3.1.2 DESIGNATION EXAMPLE—Designation of a barrel faced rectangular ring with narrow ring width of d_1 = 60 mm nominal diameter, h_1 = 1.2 mm ring width made of steel (material subclass 62), general features as shown in Figure 2, and periphery chromium coated fully faced design 0.1 mm minimum thickness:

Piston ring SAE J2226 B-60 x 1.2-MC62/CR2

4. *Common Features*

4.1 Type B Steel Rings—Inside Rounded Edges—(See Figures 2 and 3.)



Type B-rings

FIGURE 2—INSIDE ROUNDED EDGES

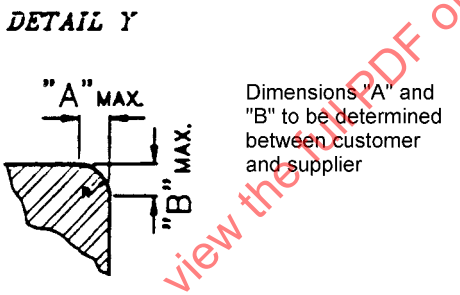


FIGURE 3—DETAIL OF FIGURE 2

4.2 Coated Rings (Fully Faced and Inlaid)—Layer Thickness

NOTE—See Table 2 for dimensions.

FIGURE 4—LAYER THICKNESS

TABLE 2—LAYER THICKNESS

Chromium	Molybdenum	Thickness min
CRF	—	0.005
CR1	MO1	0.05
CR2	MO2	0.1
CR3(1)	MO3(1)	0.15
—	MO4(1)	0.20

1. CR3 and MO3/MO4 apply to rings with nominal diameters of 50 mm or greater

TABLE 3—FORCE CORRECTION FACTORS FOR COATED TYPE B RINGS

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

TABLE 4—DIMENSIONS OF TYPE B RECTANGULAR RINGS MADE OF STEEL

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness s_1		Ring width h_1 Column					Closed gap s_1		Tangential force F_t, N For h, shown in column					Diametral force F_d, N For h, shown in column				
		Tolerance	1	2	3	4	Tolerance		Tolerance	1	2	3	4	Tolerance	1	2	3	4	Tolerance
30										—	—	—	—		6.8	8.5	11.3	14.2	
31	1.1														7	8.8	11.7	14.6	
32															7.3	9.1	12.2	15.2	
33															7.5	9.4	12.5	15.6	
34	1.3														8.2	10.5	13.7	17.1	
35										—	—	—	—		8.4	10.8	14	17.5	
36															8.6	11.1	14.3	17.9	
37															8.9	11.4	14.8	18.5	
38															9.2	11.7	15.3	19.2	
39	1.5														9.5	12	15.8	19.8	
40										—	—	—	—		9.7	12.3	16.2	20.2	
41															9.9	12.5	16.5	20.6	
42															10.1	12.9	16.8	21	
43									+0.2						10.3	13.1	17.2	21.5	
44	1.7						–0.010	0.15	0					—	10.5	13.3	17.5	21.9	
45							–0.025			—	—	—	—		11	13.5	18.3	22.9	
46							For								11.2	14	18.7	23.3	
47							Phos-								11.4	14.2	19	23.7	
48							phated								11.6	14.6	19.3	24.2	
49	1.9						PO								11.8	14.8	19.7	24.6	
50							Surface			5.6	7	9.3	11.6		12	15.1	20	25	
51										5.7	7.2	9.5	11.9		12.3	15.5	20.5	25.6	
52							–0.005			5.8	7.3	9.7	12.1		12.5	15.7	20.8	26	
53		±0,15					–0.030			6	7.5	10	12.5		12.9	16.1	21.5	26.9	± 30% if
54		Within								6.1	7.6	10.2	12.7		13.1	16.3	21.8	27.3	F_d < 21,5 N
55	2.1	a ring:	1.2	1.5	2.0	2.5				6.2	7.7	10.3	12.9		13.3	16.6	22.2	27.7	± 20% if
56		0,15								6.3	7.9	10.5	13.1		13.5	17	22.5	28.1	$F_d \geq$ 21,5 N
57		max.								6.4	8	10.7	13.4		13.8	17.2	23	28.7	
58										6.5	8.2	10.9	13.6		14	17.6	23.3	29.2	
59										6.6	8.3	11	13.8		14.2	17.8	23.7	29.6	
60	2.3									6.7	8.5	11.2	14		14.4	18.3	24	30	
61										6.9	8.6	11.5	14.3		14.8	18.5	24.7	30.8	
62										7	8.7	11.7	14.6		15.1	18.7	25.2	31.5	
63										7.1	8.9	11.9	14.8	± 30% if	15.3	19.1	25.5	31.9	
64										7.2	9	12	15	F_t < 10 N	15.5	19.4	25.8	32.3	
65	2.5									7.3	9.2	12.2	15.2	± 20 % if	15.7	19.8	26.2	32.7	
66									+0,2	7.4	9.3	12.3	15.4	$F_t \geq$ 10 N	15.9	20	26.5	33.1	
67								0.2	0	7.5	9.4	12.5	15.6		16.1	20.2	26.8	33.5	
68							–0.010			7.6	9.6	12.6	15.8		16.3	20.6	27.2	33.9	
69							–0.030			7.8	9.7	13	16.3		16.8	20.9	28	35	
70							For			7.9	9.9	13.2	16.5		17	21.3	28.3	35.4	
71	2.7						Phos-			8	10	13.3	16.7		17.2	21.5	28.7	35.8	
72							phated			8.1	10.1	13.5	16.9		17.4	21.7	29	36.2	
73							PO			8.2	10.3	13.6	17.1		17.6	22.1	29.3	36.7	
74							Surface			8.3	10.4	13.8	17.2		17.8	22.4	29.7	37.1	
75	2.9									8.4	10.6	14	17.5		18.1	22.8	30.2	37.7	
76							–0.005			8.5	10.7	14.2	17.7		18.3	23	30.5	38.1	
77							–0.035			8.7	10.8	14.5	18.1		18.7	23.2	31.2	38.9	
78										8.8	11	14.6	18.3		18.9	23.7	31.5	39.4	
79	3.1									8.9	11.1	14.8	18.5		19.1	23.9	31.8	39.8	
80										9	11.3	15	18.8		19.4	24.3	32.3	40.4	
81										9.1	11.4	15.2	19		19.6	24.5	32.7	40.8	

TABLE 4—DIMENSIONS OF TYPE B RECTANGULAR RINGS MADE OF STEEL (CONTINUED)

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness s_1		Ring width h_1 Column					Closed gap s_1		Tangential force F_t, N For h, shown in column					Diametral force F_d, N For h, shown in column				
		Tolerance	1	2	3	4	Tolerance		Tolerance	1	2	3	4	Tolerance	1	2	3	4	Tolerance
82	3.1									9.2	11.6	15.3	19.2		19.8	24.9	33	41.2	
83										9.3	11.7	15.5	19.4		20	25.2	33.3	41.7	
84								0.25		9.4	11.8	15.7	19.6		20.2	25.4	33.7	42.1	
85										9.6	12	16	20		20.6	26.8	34.3	42.9	
86	3.3									9.7	12.1	16.2	20.2		20.9	26	34.8	43.5	
87										9.8	12.3	16.4	20.4		21.1	26.4	35.2	43.9	
88										9.9	12.4	16.5	20.6		21.3	26.7	35.5	44.4	
89		±0.15								10	12.5	16.7	20.8		21.5	26.9	35.8	44.8	
90		Within								10.1	12.7	16.8	21		21.7	27.3	36.2	45.2	
91	3.5	a ring:	1.2	1.5	2.0	2.5			+0.25	10.2	12.8	17	21.2		21.9	27.5	36.5	45.2	
92		0.15							0	10.3	13	17.1	21.4		22.1	28	36.8	46	
93		max.								10.5	13.1	17.5	21.9		22.6	28.2	37.7	47.1	
94										10.6	13.2	17.7	22.1		22.8	28.4	38	47.5	
95										10.7	13.4	17.8	22.3		23	28.8	38.3	47.9	
96	3.7									10.8	13.5	18	22.5		23.2	29	38.7	48.3	
97										10.9	13.7	18.1	22.7		23.4	29.5	39	48.7	
98										11	13.8	18.4	23		23.7	29.7	39.5	49.4	
99								0.3		11.1	13.9	18.5	23.2		23.9	29.9	39.8	49.8	
100										14.2	18.9	23.6	28.4		30.5	40.7	50.8	61	
101										13.9	18.5	23.1	27.8		29.8	39.8	49.8	60.7	
102	3.9						–0.010			13.6	18.1	22.7	27.2		29.2	38	48.7	58.5	
103			1.5	2	2.5	3	–0.030			13.3	17.8	22.2	26.6		28.6	38.2	47.7	57.3	
104							For			13.1	17.4	21.8	26.1		28.1	37.4	46.8	56.1	
105							Phos-			12.8	17.1	21.3	25.6	± 30% if	27.5	36.7	45.8	55	± 30% if
106							phated			17	22.7	28.3	34	F_t < 10 N	36.6	48.7	60.9	73.1	F_d < 21,5 N
107							PO			16.7	22.2	27.8	33.3	± 20% if	35.8	47.8	59.7	71.7	± 200% if
108							Surface			16.3	21.8	27.2	32.7	$F_t \geq$ 10 N	35.1	48.8	58.6	70.3	$F_d \geq$ 21,5 N
109										16	21.4	26.7	32		34.5	45.9	57.4	68.9	
110							–0.005			21	26.2	31.4	36.7		45.1	56.3	67.6	78.8	
111	4.3						–0.035			20.6	25.7	30.8	36		44.2	55.2	66.3	77.3	
112										20.2	25.2	30.3	35.3		43.4	54.2	65	75.9	
113			2.0	2.5	3.0	3.5				19.8	24.7	29.7	34.6		42.6	53.2	63.8	74.5	
114										19.4	24.3	29.1	34		48.8	52.2	62.7	73.1	
115										19.1	23.8	28.6	33.4		41	51.3	61.5	71.8	
116		+0.2								24.7	30.9	37.1	43.3		53.1	66.4	79.7	93	
117		–0.2								24.3	30.3	36.4	42.5		52.2	65.2	78.3	91.3	
118		Within								23.8	29.8	35.8	41.7		51.2	64.1	76.9	99.7	
119		a ring:							+0.30	23.4	29.3	35.1	41		50.3	62.9	75.5	88.1	
120		0.2						0.35	0	23	28.7	34.5	40.2		49.4	61.8	74.2	86.5	
121		max.								22.6	28.2	33.9	39.5		48.6	60.7	72.9	85	
122	4.7									22.2	27.8	33.3	38.9		47.7	59.7	71.6	83.6	
123										21.8	27.3	32.7	38.2		46.9	58.7	70.4	82.1	
124										21.5	26.8	32.2	37.5		46.1	57.7	69.2	80.7	
125										21.1	26.4	31.6	38.9		45.3	56.7	68	79.4	
126										26.8	33.5	40.1	46.8		57.5	71.9	86.3	100.7	
127										26.3	32.9	39.5	46.1		56.6	70.7	84.9	99.0	
128										25.9	32.4	38.8	45.3		55.6	69.6	83.5	97.4	
129										25.5	31.8	38.2	44.6		54.7	68.4	82.1	95.8	
130										25	31.3	37.8	43.8		53.8	87.3	80.8	94.2	
131	5.1									24.6	30.8	37	43.1		53	66.2	79.5	92.7	
132										24.2	30.3	36.4	42.4		52.1	65.2	78.2	91.2	
133								0,4	+0.35	23.9	29.8	35.8	41.8		51.3	64.1	76.9	89.8	
134									0	23.5	29.4	35.2	41.1		50.5	63.1	76.7	88.4	
135	5.1									23.1	28.9	34.7	40.5		49.7	62.1	74.6	87	

TABLE 4—DIMENSIONS OF TYPE B RECTANGULAR RINGS MADE OF STEEL (CONTINUED)

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness s_1		Ring width h_1 Column					Closed gap s_1		Tangential force F_t, N For h, shown in column					Diametral force F_d, N For h, shown in column				
		Tolerance	1	2	3	4	Tolerance		Tolerance	1	2	3	4	Tolerance	1	2	3	4	Tolerance
136										28.8	36	43.2	50.4		61.9	77.4	92.9	108.4	
137			2.0	2.5	3	3.5				28.4	35.5	42.5	49.6		61	76.2	91.5	106.7	
138							–0.010			27.9	34.9	41.9	48.9		60	75.1	90.1	105.1	
139							–0.030			27.5	34.4	41.3	48.1		59.1	73.9	88.7	103.5	
140							For			33.9	40.6	47.4	54.2		72.8	87.4	101.9	116.5	
141							phos-		+0,35	33.4	40	46.7	53.4		71.7	86	100.4	114.7	
142	5.5						phated	0,4	0	32.9	39.4	46	52.6		70.6	84.8	98.9	113	
143							PO			32.4	38.8	45.3	51.8		69.6	83.5	97.4	111.4	
144			2.5	3.0	3.5	4.0	surface:			31.9	38.3	44.7	51		68.6	82.3	96	109.7	
145							–0.005			31.4	37.7	44	50.3		67.6	81.1	94.6	108.1	
146							–0.035			38.6	46.3	54	61.7		82.9	99.5	116.1	132.7	
147										38	45.6	53.2	60.8		81.7	98.1	114.4	130.8	
148										37.5	45	52.5	60		80.8	96.7	112.8	128.9	
149										36.9	44.3	51.7	59.1		79.4	95.3	111.2	127.1	
150										36.4	43.7	51	58.3		78.3	94	109.6	125.3	
151										35.9	43.1	50.3	57.4		77.2	92.6	108.1	123.6	
152	5.9									35.4	42.5	49.6	56.7		76.1	91.3	106.6	121.8	
153										34.9	41.9	48.9	55.9		75.1	90.1	105.1	120.1	
154										34.4	41.3	48.2	55.1		74	88.9	103.7	118.5	
155			—	3	3,5	4				34	40.8	47.6	54.4		73	87.6	102.2	116.9	
156										41.1	49.4	57.6	65.9		88.4	103.1	123.8	141.5	
157										40.6	48.7	56.8	64.9		87.2	104.7	122.1	139.6	
158							–0.010			40	48	56	64		86.1	103.3	120.5	137.7	
159							–0.040			39.5	47.4	55.3	63.2		84.9	101.9	118.9	135.9	
160		+0.2					For		+0,4	39	46.8	54.6	62.4	± 30% if	83.8	100.6	117.3	134.1	± 30 % if
161		–0.2					Phos-	0.5	0	38.5	46.2	53.8	61.5	F_t < 10 N	82.7	99.2	115.8	132.3	F_d < 21,5 N
162	6.3						phated			38	45.5	53.1	60.7	± 20 % if	81.6	97.9	114.3	130.6	± 20 % if
163		Within					PO			37.5	45	52.5	59.9	$F_t \geq$ 10 N	80.6	96.7	112.8	128.9	$F_d \geq$ 21,5 N
164		a ring:					Surface			37	44.4	51.8	59.2		79.5	95.4	111.3	127.2	
165		0.2					–0.005			36.5	43.8	51.1	58.4		78.5	94.2	109.9	125.6	
166		max.					–0.045			43.7	52.4	61.2	69.9		93.9	112.7	131.5	150.3	
167										43.1	51.8	60.4	69		92.7	111.3	129.8	148.4	
168										42.6	51.1	69.6	68.1		91.6	109.9	128.2	146.5	
169										42.1	50.5	68.9	67.3		90.4	108.5	126.6	144.7	
170										41.5	49.8	68.1	68.4		89.3	107.1	125	142.9	
171										41	49.2	67.4	65.8		88.2	105.8	123.5	141.1	
172	6.7									40.5	48.6	66.7	64.3		87.1	104.5	121.9	139.4	
173										40	48	66	64		86	103.2	120.4	137.7	
174										39.5	47.4	66.3	63.2		85	102	119	136	
175										46.9	54.7	62.5	70.3		100.8	117.5	134.3	151.1	
176										56.6	64.7	74	83.2		119.3	139.2	159.1	179	
177										54.8	64	73.1	82.2		117.9	137.5	157.2	176.8	
178			3.0	3.5	4.0	4.5				54.2	63.2	72.2	81.3		116.5	135.9	155.3	174.7	
179										53.6	62.5	71.4	80.3		115.1	134.3	153.5	172.6	
180										52.9	61.7	70.5	79.4		113.7	132.7	151.7	170.6	
181									+0.45	52.3	61	69.7	78.4		112.4	131.1	149.9	168.6	
182	7.1							0.6	0	51.7	60.3	68.9	77.5		111.1	129.6	148.1	166.7	
183										51.1	59.6	68.1	78.6		109.8	128.1	148.4	164.7	
184										50.6	68.9	67.3	75.7		108.6	126.7	144.7	162.8	
185										49.9	68.2	66.6	74.9		107.3	125.2	143.1	161	
186										58.6	68.3	78.1	87.8		125.9	146.9	167.9	188.9	
187										57.9	67.5	77.2	86.8		124.5	145.2	166	186.7	
188	7.5									57.2	66.8	78.3	85.9		123.1	143.6	164.1	184.6	

TABLE 4—DIMENSIONS OF TYPE B RECTANGULAR RINGS MADE OF STEEL (CONTINUED)

Dimensions in millimeters

Nominal diameter d_1	Radial wall thickness s_1		Ring width h_1 Column					Closed gap s_1		Tangential force F_t, N For h, shown in column					Diametral force F_d, N For h, shown in column				
		Tolerance	1	2	3	4	Tolerance		Tolerance	1	2	3	4	Tolerance	1	2	3	4	Tolerance
189										56.6	66	75.5	84.9		121.7	142	162.3	182.5	
190										56	65.3	74.6	84		120.3	140.4	160.5	180.5	
191	7.5						–0.010			55.4	64.6	73.8	83		119	138.8	158.7	178.5	
192							–0.040			54.7	63.9	73	82.1		117.7	137.3	156.9	176.5	
193							For			54.1	63.2	72.2	81.2		116.4	135.8	155.2	174.6	
194							Phos-			53.6	62.6	71.4	80.3		115.1	134.3	153.5	172.7	
							phated												
195		+0.2	3.0	3.5	4.0	4.5	PO	0.6	+0.45	53	61.8	70.6	79.5		113.9	132.9	161.8	170.8	
196		–0.2					Surface		0	61.6	71.9	82.2	92.4	± 30 % if	132.5	154.6	176.7	198.8	± 30 % if
197		Within					–0.005			61	71.1	81.3	91.4	F_t < 10 N	131.1	152.9	174.8	196.6	F_d< 21.5 N
198	7.9	a ring:					–0.045			60.3	70.4	80.4	90.5	± 20 % if	129.7	151.3	172.9	194.5	± 20 % if
199		0.2								59.7	69.6	79.6	89.5	F_t ≥ 10 N	128.3	149.7	171.1	192.4	F_d ≥ 21.5 N
200		max.								59	68.9	78.7	88.6		126.9	148.1	169.2	190.4	

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 4, apply to as-cast steel with a typical modulus of elasticity (E_n) of 200 000 MPa.

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.