
**Internal combustion engines — Piston
rings — Scraper rings made of cast iron**

*Moteurs à combustion interne — Segments de piston — Segments
racleurs mixtes en fonte moulée*

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Foreword

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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6623 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

This second edition cancels and replaces the first edition (ISO 6623:1986), which has been technically revised.

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Introduction

ISO 6623 is one of a number of series of International Standards dealing with piston rings for reciprocating internal combustion engines. Others are ISO 6621 [2], [3], [4], [5], ISO 6622 [6], [7], ISO 6624 [8], [9], [10], [11], ISO 6625 [12], ISO 6626 [13], [14] and ISO 6627 [15] (see Bibliography for details).

The common features and dimensional tables presented in this International Standard 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 refer to the specifications and requirements of ISO 6621-3 [4] and ISO 6621-4 before completing his selection.

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Internal combustion engines — Piston rings — Scraper rings made of cast iron

1 Scope

This International Standard specifies the essential dimensional features of scraper rings made of cast iron, types N, NM, E and EM, having diameters of from 30 mm up to and including 200 mm, used in reciprocating internal combustion engines. It is also applicable to piston rings of compressors working under similar conditions.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6621-4, *Internal combustion engines — Piston rings — Part 4: General specifications*

3 Overview

The scraper ring types are specified in Tables 1 and 2 and Figures 1 to 5. Their common features and the dimensions of those features are specified in Tables 3 to 5 and Figures 6 to 9. Tables 6 and 7 give the force factors for the different ring types, while Tables 8 and 9 give the dimensions and forces of the scraper rings.

Tables 8 and 9, respectively, offer a choice between two radial wall thicknesses:

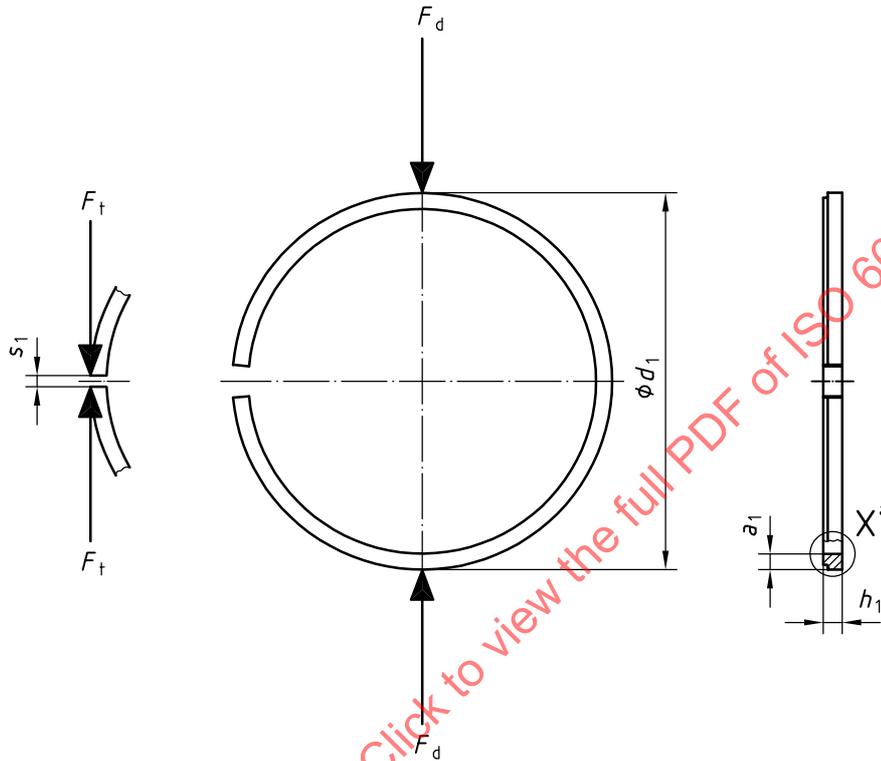
- radial wall thickness “regular”;
- radial wall thickness “D/22”.

4 Ring types and designation examples

4.1 Types N, NM, E and EM Scraper rings — General features

The general features of type N, NM, E and EM scraper rings are shown in Figure 1.

NOTE See Tables 8 and 9 for dimensions and forces.



Key

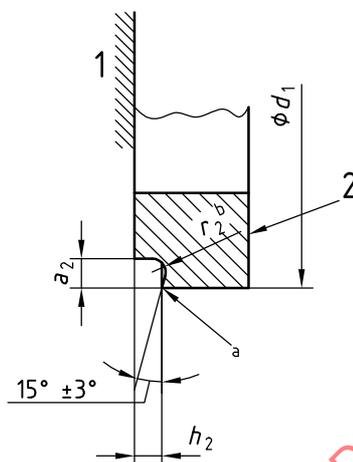
^a See 4.2, 4.3, 4.4 and 4.5, and Figures 2, 3, 4 and 5, for Detail X of N, NM, E and EM respectively.

Figure 1 — Types N, NM, E and EM

4.2 Type N

4.2.1 Napier ring (undercut step)

The general features of type N Napier rings with undercut step shall be in accordance with Figures 1 and 2, except for rings $h_1 < 1,5$ mm.



Key

- 1 reference plane
- 2 mark
- a When the ring is closed, this edge shall be in contact with the cylinder bore.
- b See Table 1.

Figure 2 — Type N (Detail X of Figure 1)

Table 1 — r_2 dimensions

Dimensions in millimetres

d_1	r_2 max.
$30 \leq d_1 < 175$	0,3
$175 \leq d_1 \leq 200$	0,7

4.2.2 Designation

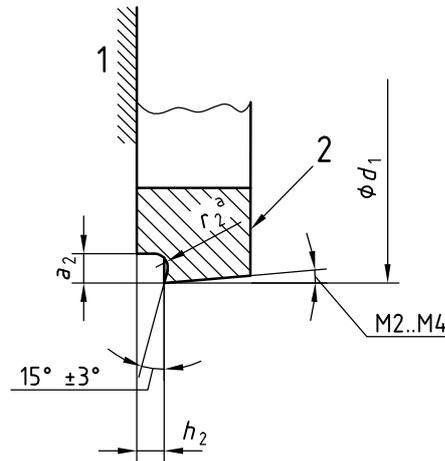
EXAMPLE Designation of a piston ring complying with the requirements of ISO 6623, being a cast iron Napier ring with straight faced peripheral surface (N), of nominal diameter $d_1 = 90$ mm (90), of radial wall thickness "regular", of nominal ring width $h_1 = 25$ mm (2,5), made of non-heat-treated grey cast iron subclass 12 (MC12), with chamfered internal edges (KI):

Piston ring ISO 6623 N - 90 × 2,5 - MC 12/K I

4.3 Type NM

4.3.1 Napier ring (undercut step) taper faced

The general features of type NM Napier rings with undercut step, taper faced, shall be in accordance with Figures 1 and 3, except for rings $h_1 < 1,5$ mm.



Key

- 1 reference plane
- 2 mark
- ^a See Table 1.

Figure 3 — Type NM (Detail X of Figure 1)

Table 2 — Taper

Dimensions in minutes

Code	Uncoated rings and chromium plated or spray coated rings with peripheral surface ground	
	Taper	Tolerance ^a
M2	30	+60
M3	60	
M4	90	0

^a For chromium plated rings with a tapered peripheral surface that is not ground, the tolerance shall be increased by 10 (e.g. M3 = 60⁺⁷⁰₀)

4.3.2 Designation

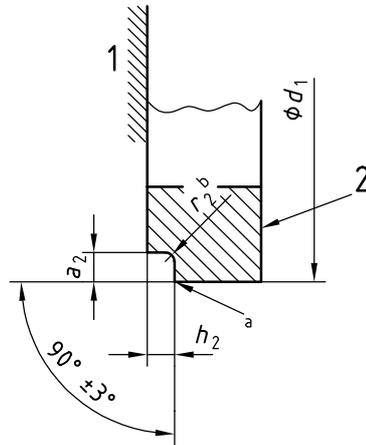
EXAMPLE Designation of a piston ring complying with the requirements of ISO 6623, being a cast iron Napier ring with a 90° taper faced peripheral surface (NM4), of nominal diameter $d_1 = 90$ mm (90), of radial wall thickness “regular”, of ring width $h_1 = 2,5$ mm (2,5), made of heat-treated grey cast iron, subclass 21 (MC21), phosphated on all sides (PO):

Piston ring ISO 6623 NM4 - 90 × 2,5 - MC21/PO

4.4 Type E

4.4.1 Scraper ring (stepped)

The general features of type E stepped scraper rings shall be in accordance with Figures 1 and 4.



Key

- 1 reference plane
- 2 mark

- a When the ring is closed, this edge shall be in contact with the cylinder bore.
- b See Table 1.

Figure 4 — Type E (Detail X of Figure 1)

4.4.2 Designation

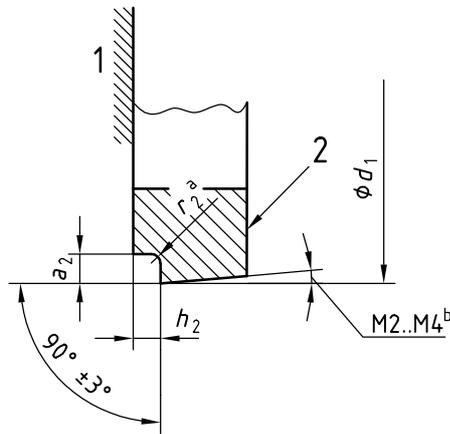
EXAMPLE Designation of a piston ring complying with the requirements of ISO 6623, being a cast iron scraper ring with straight faced peripheral surface (E), of nominal diameter $d_1 = 90$ mm (90), of nominal ring width $h_1 = 2,5$ mm (2,5), radial wall thickness "regular", made of non-heat-treated grey cast iron, subclass 12 (MC12), with an inlaid spray coating on the peripheral surface, and minimum thickness 0,1 mm (SC2F):

Piston ring ISO 6623 E - 90 × 2,5 - MC12/SC2F

4.5 Type EM

4.5.1 Scraper ring (stepped) taper faced

The general features of type EM scraper rings stepped and taper faced shall be in accordance with Figures 1 and 5.



Key

- 1 reference plane
- 2 mark
- a See Table 1.
- b See Table 2.

Figure 5 — Type EM (Detail X of Figure 1)

4.5.2 Designation

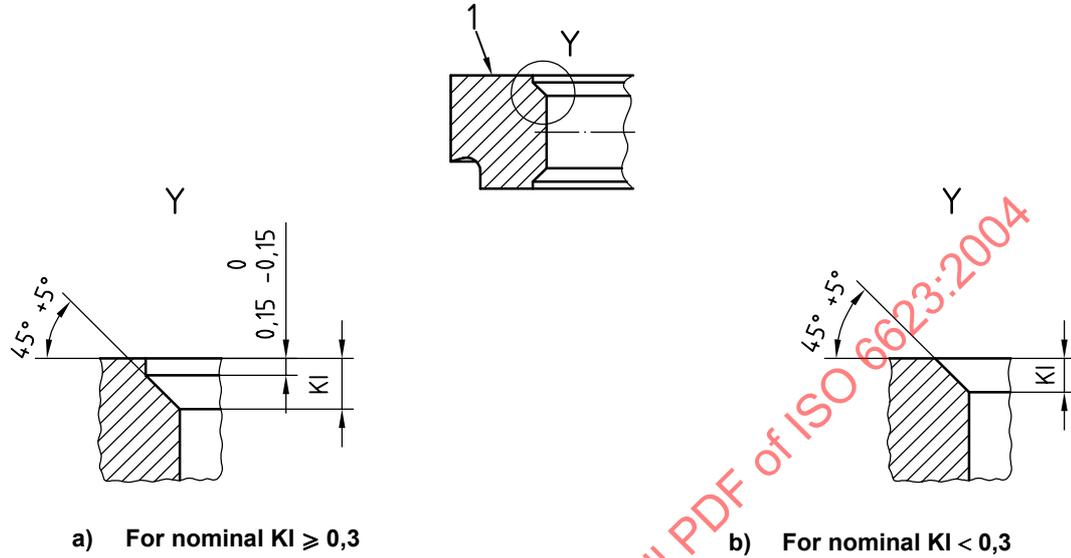
EXAMPLE Designation of a piston ring complying with the requirements of ISO 6623, being a cast iron scraper ring with a 30° taper faced peripheral surface (EM2), of nominal diameter $d_1 = 90$ mm (90), of nominal ring width $h_1 = 2,5$ mm (2,5), of radial wall thickness “regular”, made of heat-treated grey cast iron, subclass 22 (MC22), with inside chamfered edges (KI):

Piston ring ISO 6623 EM2 - 90 × 2,5 - MC22/KI

5 Common features

5.1 Type N, NM, E and EM rings — Inside chamfered edges KI

Dimensions in millimetres



Key

1 mark

Figure 6 — Inside chamfered edges KI

Table 3 — KI dimensions

Dimensions in millimetres

d_1	KI
$30 \leq d_1 < 50$	0,2 max.
$50 \leq d_1 < 125$	$0,3 \pm 0,15^a$
$125 \leq d_1 < 175$	$0,4 \pm 0,15$
$175 \leq d_1 \leq 200$	$0,6 \pm 0,15$
^a KI = 0,2 max for rings $h_1 < 1,5$ and $50 < d_1 < 60$.	

5.2 Type NM and EM rings with a partly cylindrical machined (LM) or lapped (LP) peripheral surface at the bottom running edge



a) Feature: machined = Code: LM

b) Feature: lapped = Code: LP

Figure 7 — NM and EM rings with partly cylindrical peripheral surface

Table 4 — Axial dimensions of cylindrical part of peripheral surface h_{24}

Dimensions in millimetres

h_1	h_{24}^a max.	h_{24}^a each side of the gap up to 30° max.
1,2	0,4	0,6
1,5	0,5	0,8
1,75	0,6	1,0
2,0	0,7	1,2
2,5	0,9	1,4
$3 \leq h_1 \leq 4$	1,1	1,8

^a Partly cylindrical peripheral surface shall be visible.

5.3 Type N, NM, E and EM rings chromium plated/spray coated

5.3.1 Chromium plated NM and EM rings



Figure 8 — Plating thickness

5.3.2 Spray coated (inlaid design) N, NM, E and EM rings

NOTE Not recommended for rings $h_1 < 1,5$ mm.

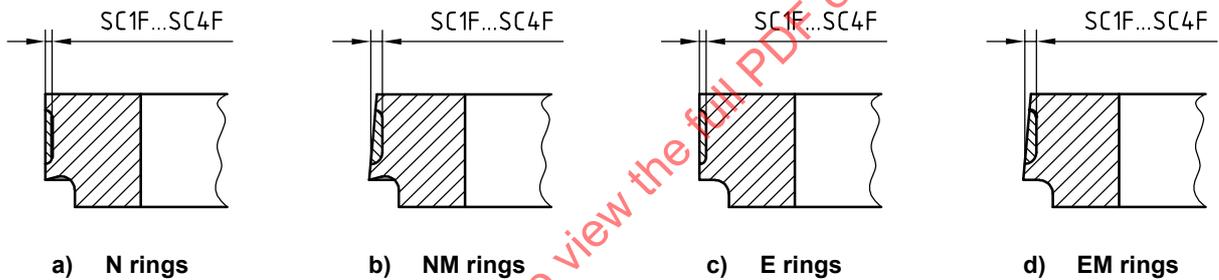


Figure 9 — Coating thickness

Table 5 — Plating/coating thickness

Dimensions in millimetres

Code		Thickness min.
Chromium plating	Spray coating	
CRF	—	0,005
CR1	SC1F	0,05
CR2	SC2F	0,1
—	SC3F	0,15
—	SC4F	0,2

6 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 GN/m² are being used.

For general features, the multiplier factors given in Tables 6 and 7 and the force correction factors according to ISO 6621-4 shall be used.

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

Table 6 — Force correction factors for N, NM, E and EM rings with feature KI

d_1 mm	Factor
$30 \leq d_1 < 50$	1
$50 \leq d_1 \leq 200$	0,97

Tableau 7 — Force correction factors for N, NM, E and EM rings chromium plated (fully faced type) and spray coated (inlaid type)

d_1 mm	Factor						
	CRF	CR1	CR2	SC1F	SC2F	SC3F	SC4F
$30 \leq d_1 < 50$	1	0,84	0,77	0,89	0,85	—	—
$50 \leq d_1 < 75$	1	0,91	0,85	0,92	0,90	0,87	0,86
$75 \leq d_1 < 100$	1	0,94	0,92	0,94	0,92	0,90	0,87
$100 \leq d_1 < 125$	1	0,97	0,94	0,94	0,93	0,91	0,89
$125 \leq d_1 < 150$	1	0,98	0,96	0,95	0,93	0,91	0,90
$150 \leq d_1 \leq 200$	1	1	0,97	0,95	0,94	0,93	0,91

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7 Dimensions

Table 8 — Dimensions for Type N, NM, E and EM scraper rings (radial wall thickness “regular”)

Nominal diameter d_1 mm	Radial wall thickness “regular” a_1 mm	Ring width h_1 mm							Closed gap s_1 mm	Axial width of step h_2 mm (Tolerance $\pm 0,15$) for h_1 shown in Column											
		Column					Tolerance	Tolerance													
		1	2	3	4	5				1	2	3	4	5							
30	1,25																				
31	1,3																				
32	1,35																				
33	1,4																				
34	1,4																				
35	1,45																				
36	1,5																				
37	1,55																				
38	1,6																				
39	1,65																				
40	1,65																				
41	1,7																				
42	1,75																				
43	1,8																				
44	1,85	$\pm 0,15$ Within a ring: $\leq 0,15$																			
45	1,9		1,2	1,5	1,75	2	2,5														
46	1,9																				
47	1,95																				
48	2																				
49	2,05																				
50	2,1																				
51	2,15																				
52	2,15																				
53	2,2																				
54	2,25																				
55	2,3																				
56	2,35																				
57	2,4																				
58	2,4																				
59	2,45																				

Table 8 (continued)

Radial depth of step						Tangential force					Diametral force						
a_2 mm						F_t N					F_d N						
for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance
1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
0,3	0,3	0,3	0,3	0,3	$\pm 0,15$	—	—	—	—	—	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	5,2	6,5	7,7	8,8	11,0	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
												5,4	6,9	8,2	9,2	11,6	
												5,8	7,3	8,6	9,9	12,3	
												6,0	7,7	9,0	10,3	12,9	
												5,6	7,3	8,4	9,7	12,3	
0,3	0,35	0,35	0,35	0,35	$\pm 0,15$	—	—	—	—	—	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	5,8	7,5	8,8	10,1	12,7	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
												6,2	8,0	9,2	10,5	13,3	
												6,5	8,2	9,7	11,2	14,0	
												6,9	8,6	10,1	11,6	14,6	
												7,1	9,0	10,5	12,3	15,3	
0,4	0,4	0,4	0,4	0,4	$\pm 0,15$	—	—	—	—	—	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	6,7	8,4	9,9	11,4	14,4	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
												6,9	8,8	10,3	11,8	15,1	
												7,3	9,2	10,8	12,5	15,7	
												7,5	9,7	11,2	12,9	16,3	
												8,0	9,9	11,6	13,3	17,0	
0,45	0,45	0,45	0,45	0,45	$\pm 0,15$	—	—	—	—	—	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	8,2	10,1	12,0	13,8	17,4	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
												7,7	9,7	11,4	13,1	16,6	
												8,0	10,1	11,8	13,8	17,2	
												8,4	10,5	12,3	14,2	17,8	
												8,6	11,0	12,9	14,6	18,5	
0,5	0,5	0,5	0,5	0,5	$\pm 0,15$	4,1	5,2	6,1	7,0	8,8	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	8,8	11,2	13,1	15,1	18,9	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
						4,3	5,3	6,3	7,2	8,1		9,2	11,4	13,5	15,5	19,6	
						4,1	5,1	6,0	7,0	8,8		8,8	11,0	12,9	15,1	18,9	
						4,2	5,3	6,3	7,2	9,1		9,0	11,4	13,5	15,5	19,6	
						4,4	5,5	6,5	7,4	9,4		9,5	11,8	14,0	15,9	20,2	
0,55	0,55	0,55	0,55	0,55	$\pm 0,15$	4,5	5,6	6,6	7,6	9,6	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	9,7	12,0	14,2	16,3	20,6	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
						4,6	5,8	6,8	7,8	9,9		9,9	12,5	14,6	16,8	21,3	
						4,8	6,0	7,0	8,1	10,2		10,3	12,9	15,1	17,4	21,9	
						4,6	5,8	6,8	7,8	9,8		9,9	12,5	14,6	16,8	21,1	
						4,7	5,9	7,0	8,0	10,1		10,1	12,7	15,1	17,2	21,7	

Table 8 (continued)

Nominal diameter d_1 mm	Radial wall thickness "regular" a_1 mm	Tolerance	Ring width h_1 mm					Tolerance	Closed gap s_1 mm	Tolerance	Axial width of step h_2 mm (Tolerance $\pm 0,15$) for h_1 shown in Column				
			Column												
			1	2	3	4	5				1	2	3	4	5
60	2,5	$\pm 0,15$ Within a ring: $\leq 0,15$	1,2	1,5	1,75	2	2,5	- 0,01 - 0,03 For phos- phated PO surface: - 0,005 - 0,03	0,2 + 0,2 0	0,35	0,4	0,45	0,5	0,6	
61	2,55														
62	2,6														
63	2,65														
64	2,65														
65	2,7														
66	2,75														
67	2,8														
68	2,85														
	2,9														
70	2,9														
71	2,95														
72	3,00														
73	3,05														
74	3,1														
75	3,15	$\pm 0,15$ Within a ring: $\leq 0,15$	1,2	1,5	1,75	2	2,5	- 0,01 - 0,03 For phos- phated PO surface: - 0,005 - 0,03	0,25 + 0,25 0	0,35	0,4	0,45	0,5	0,6	
76	3,15														
77	3,2														
78	3,25														
79	3,3														
80	3,35														
81	3,4														
82	3,4														
83	3,45														
84	3,5														
85	3,55														
86	3,6														
87	3,65														
88	3,65														
89	3,7														
90	3,75	$\pm 0,15$ Within a ring: $\leq 0,15$	1,5	1,75	2	2,5	3	- 0,01 - 0,03 For phos- phated PO surface: - 0,005 - 0,03	0,3 + 0,25 0	0,4	0,45	0,5	0,6	0,75	
91	3,8														
92	3,85														
93	3,9														
94	3,9														

Table 8 (continued)

Radial depth of step						Tangential force					Diametral force						
a_2 mm						F_t N					F_d N						
for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance
1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
0,6	0,7	0,7	0,7	0,7	$\pm 0,15$	4,8	5,8	6,9	8,0	10,1	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	10,3	12,5	14,8	17,1	21,7	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
						5,0	6,0	7,1	8,2	10,4		10,8	12,9	15,3	17,6	22,4	
						5,1	6,2	7,3	8,4	10,7		11,0	13,3	15,7	18,1	23,0	
						5,2	6,4	7,5	8,7	11,0		11,2	13,8	16,1	18,7	23,7	
						5,1	6,2	7,3	8,4	10,6		11,0	13,3	15,7	18,1	22,8	
						5,2	6,3	7,5	8,6	10,9		11,2	13,5	16,1	18,5	23,4	
						5,4	6,5	7,7	8,9	11,2		11,6	14,0	16,6	19,1	24,1	
						5,5	6,7	7,9	9,1	11,5		11,8	14,4	17,0	19,6	24,7	
						5,6	6,9	8,1	9,4	11,8		12,0	14,8	17,4	20,2	25,4	
						5,8	7,1	8,3	9,6	12,1		12,5	15,3	17,8	20,6	26,0	
						5,6	6,8	8,1	9,3	11,8		12,0	14,6	17,4	20,0	25,4	
						5,8	7,0	8,3	9,6	12,1		12,5	15,1	17,8	20,6	26,0	
						5,9	7,2	8,5	9,8	12,4		12,7	15,5	18,3	21,1	26,7	
						6,1	7,4	8,7	10,0	12,7		13,1	15,9	18,7	21,5	27,3	
						6,2	7,6	8,9	10,3	13,0		13,3	16,3	19,1	22,1	28,0	
0,6	0,7	0,7	0,8	0,8	$\pm 0,15$	6,3	7,7	9,1	10,3	13,0	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	13,5	16,6	19,6	22,1	28,0	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
						6,1	7,5	8,8	10,0	12,6		13,1	16,1	18,9	21,5	27,1	
						6,3	7,7	9,0	10,2	12,9		13,5	16,6	19,4	21,9	27,7	
						6,4	7,8	9,2	10,5	13,2		13,8	16,8	19,8	22,6	28,4	
						6,6	8,0	9,5	10,7	13,5		14,2	17,2	20,4	23,0	29,0	
						6,7	8,2	9,7	10,9	13,8		14,4	17,6	20,9	23,4	29,7	
						6,9	8,4	9,9	11,2	14,1		14,8	18,1	21,3	24,1	30,3	
						6,7	8,2	9,6	10,9	13,8		14,4	17,6	20,6	23,4	29,7	
						6,8	8,3	9,8	11,1	14,1		14,6	17,8	21,1	23,9	30,3	
						7,0	8,5	10,0	11,4	14,4		15,1	18,3	21,5	24,5	31,0	
						7,1	8,7	10,3	11,6	14,7		15,3	18,7	22,1	24,9	31,6	
						7,3	8,9	10,5	11,8	15,0		15,7	19,1	22,6	25,4	32,3	
						7,4	9,1	10,7	12,1	15,3		15,9	19,6	23,0	26,0	32,9	
						7,3	8,9	10,4	11,8	14,9		15,7	19,1	22,4	25,4	32,0	
						7,4	9,0	10,7	12,0	15,2		15,9	19,4	23,0	25,8	32,7	
0,7	0,8	0,8	1	1	$\pm 0,15$	9,2	10,6	12,2	15,1	18,0	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	19,8	22,8	26,2	32,5	38,7	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
						9,4	10,8	12,5	15,4	18,4		20,2	23,2	26,9	33,1	39,6	
						9,6	11,0	12,7	15,6	18,8		20,6	23,7	27,3	33,5	40,4	
						9,7	11,3	13,0	15,9	19,1		20,9	24,3	28,0	34,2	41,1	
						9,5	11,0	12,7	15,6	18,7		20,4	23,7	27,3	33,5	40,2	

Table 8 (continued)

Nominal diameter d_1 mm	Radial wall thickness "regular" a_1 mm	Ring width h_1 mm					Closed gap s_1 mm	Axial width of step h_2 mm (Tolerance $\pm 0,15$) for h_1 shown in Column							
		Tolerance	Column					Tolerance	Tolerance						
			1	2	3	4				5	1	2	3	4	5
95	3,95	$\pm 0,15$ Within a ring: $\leq 0,15$	1,5	1,75	2	2,5	3			0,4	0,45	0,5	0,6	0,75	
96	4,00														
97	4,05														
98	4,1														
99	4,15														
100	4,15	$\pm 0,2$ Within a ring: $\leq 0,2$	1,75	2	2,5	3	3,5	- 0,01 - 0,03 For phosphated PO surface: - 0,005 - 0,03	0,3 + 0,25 0	0,45	0,5	0,6	0,75	0,9	
101	4,20														
102	2,25														
103	4,30														
104	4,30														
105	4,35														
106	4,40														
107	4,40														
108	4,45														
109	4,50														
110	4,55	$\pm 0,2$ Within a ring: $\leq 0,2$	2	2,5	3	3,5	4	- 0,01 - 0,03 For phosphated PO surface: - 0,005 - 0,03	0,35 + 0,25 0	0,5	0,6	0,75	0,9	1	
111	4,55														
112	4,60														
113	4,65														
114	4,70														
115	4,70														
116	4,75														
117	4,80														
118	4,80														
119	4,85														
120	4,90														
121	4,95														
122	4,95														
123	5,00														
124	5,05														
125	5,05														
126	5,10														
127	5,15														
128	5,20														
129	5,20														

Table 8 — (continued)

Radial depth of step						Tangential force					Diametral force						
a_2 mm						F_t N					F_d N						
for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance
1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
0,7	0,8	0,8	1	1	$\pm 0,15$	9,7	11,2	12,9	15,9	19,1	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	20,9	24,1	27,7	34,2	41,1	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$
						9,9	11,4	13,2	16,2	19,4		21,3	24,5	28,4	34,8	41,7	
						10,1	11,6	13,4	16,5	19,8		21,7	24,9	28,8	35,5	42,6	
						10,3	11,9	13,7	16,8	20,1		22,1	25,6	29,5	36,1	43,2	
						10,4	12,1	13,9	17,1	20,5		22,4	26,0	29,9	36,8	44,1	
0,8	1,0	1,0	1,2	1,2	$\pm 0,15$	11,8	13,2	16,7	19,6	22,9		25,4	28,4	35,9	42,1	49,2	
						12,0	13,4	17,0	19,9	23,2		25,8	28,8	36,6	42,8	49,9	
						12,2	13,6	17,3	20,2	23,6		26,2	29,2	37,2	43,4	50,7	
						12,4	13,9	17,6	20,6	24,0		26,7	29,9	37,8	44,3	51,6	
						12,1	13,6	17,2	20,1	23,5		26,0	29,2	37,0	43,2	50,5	
						12,3	13,8	17,5	20,5	23,9		26,4	29,7	37,8	44,1	51,4	
						12,5	14,0	17,7	20,8	24,2		26,9	30,1	38,1	44,7	52,0	
						12,3	13,7	17,4	20,4	23,7		26,4	29,5	37,4	43,9	51,0	
						12,5	13,9	17,6	20,7	24,1		26,9	29,9	37,8	44,5	51,8	
						12,7	14,1	17,9	21,0	24,5		27,3	30,3	38,5	45,2	52,7	
0,9	1,1	1,1	1,3	1,3	$\pm 0,15$	14,5	17,9	21,5	24,5	28,3	31,2	38,5	46,2	52,7	60,8		
						14,2	17,6	21,1	24,0	27,7	30,5	37,8	45,4	51,6	59,6		
						14,4	17,8	21,4	24,4	28,1	31,0	38,3	46,0	52,5	60,4		
						14,7	18,1	21,7	24,8	28,6	31,6	38,9	46,7	53,3	61,5		
						14,9	18,3	22,0	25,1	29,0	32,0	39,3	47,3	54,0	62,0		
						14,6	18,1	21,6	24,6	28,4	31,4	38,7	46,4	52,9	61,1		
						14,8	18,3	21,9	25,0	28,8	31,8	39,3	47,1	53,8	61,9		
						15,0	18,5	22,2	25,4	29,2	32,3	39,8	47,7	54,6	62,8		
						14,7	18,2	21,8	24,9	28,7	31,6	39,1	46,9	53,6	61,7		
						15,0	18,4	22,1	25,2	29,1	32,3	39,6	47,5	54,2	62,6		
						15,2	18,7	22,4	25,6	29,5	32,7	40,2	48,2	55,0	63,4		
						15,4	19,0	22,7	26,0	29,9	33,1	40,9	48,8	55,9	64,3		
						15,1	18,6	22,3	25,5	29,4	32,5	40,0	47,9	54,8	63,2		
						15,3	18,9	22,6	25,8	29,8	32,9	40,6	48,6	55,5	64,1		
						15,5	19,1	23,0	26,2	30,2	33,3	41,1	49,5	56,3	64,9		
1	1,2	1,2	1,4	1,4	$\pm 0,15$	15	18,6	22,3	25,5	29,4	32,3	40,0	47,9	54,8	63,2		
						15,2	18,8	22,6	25,8	29,8	32,7	40,4	48,6	55,5	64,1		
						15,4	19,1	22,9	26,2	30,2	33,1	41,1	49,2	56,3	64,9		
						15,6	19,3	23,2	26,5	30,6	33,5	41,5	49,9	57,0	65,8		
						15,4	19,0	22,8	26,1	30,1	33,1	40,9	49,0	56,1	64,7		

Table 8 (continued)

Nominal diameter d_1 mm	Radial wall thickness "regular" a_1 mm	Ring width h_1 mm					Closed gap s_1 mm	Axial width of step h_2 mm (Tolerance $\pm 0,15$) for h_1 shown in Column																			
		Tolerance	Column					Tolerance	Tolerance																		
			1	2	3	4				5	1	2	3	4	5												
130	5,25	$\pm 0,2$ Within a ring: $\leq 0,2$	—	2,5	3	3,5	4	—	0,4 + 0,25 0	—	0,6	0,75	0,9	1													
131	5,30																										
132	5,30																										
133	5,35																										
134	5,40																										
135	5,40																										
136	5,45																										
137	5,50																										
138	5,50																										
139	5,55																										
140	5,6														$\pm 0,2$ Within a ring: $\leq 0,2$	—	3	3,5	4	—	—	0,5 + 0,3 0	—	0,75	0,9	1	—
141	5,65																										
142	5,65																										
143	5,70																										
144	5,74																										
145	5,75																										
146	5,80																										
147	5,85																										
148	5,85																										
149	5,90																										
150	5,95																										
152	6,25																										
154	6,05																										
155	6,10																										
156	6,15																										
158	6,20																										
160	6,25																										
162	6,35																										
164	6,40																										
165	6,40																										
166	6,45																										
168	6,50																										

Table 8 — (continued)

Radial depth of step						Tangential force					Diametral force						
a_2 mm						F_t N					F_d N						
for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance
1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
—	1,2	1,2	1,4	1,4	$\pm 0,15$	19,2	23,0	26,3	30,4	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	41,3	49,5	56,5	65,4	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$		
						19,5	23,3	26,7	30,8		41,9	50,1	57,4	66,2			
						—	19,1	23,0	26,2		30,3	—	41,1	49,5		56,3	65,1
						19,4	23,3	26,6	30,7		41,7	50,1	57,2	66,0			
						19,6	23,6	26,9	31,1		42,1	50,7	57,8	66,9			
						19,3	23,2	26,5	30,5		41,5	49,9	57,0	65,6			
						19,5	23,5	26,8	30,9		41,9	50,5	57,6	66,4			
						—	19,8	23,8	27,2		31,3	—	42,6	51,2		58,5	67,3
						19,5	23,4	26,7	30,8		41,9	50,3	57,4	66,2			
						19,7	23,7	27,1	31,2		42,4	51,0	58,3	67,1			
—	1,3	1,3	1,5	1,5	$\pm 0,15$	23,7	27,7	31,3	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	51,0	59,6	67,3	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$				
						24,0	28,0	31,7		51,6	60,2	68,2					
						—	23,6	27,6		31,2	—	—		50,7	59,3	67,1	—
						23,9	27,9	31,6		51,4	60,0	67,9					
						24,2	28,3	32,0		52,0	60,8	68,8					
						23,8	27,8	31,5		51,2	59,8	67,7					
						24,1	28,1	31,9		51,8	60,4	68,6					
						—	24,4	28,5		32,2	—	—		52,5	61,3	69,2	—
						24,0	28,0	31,7		51,6	60,2	68,2					
						24,3	28,4	32,1		52,2	61,1	69,0					
—	1,4	1,4	1,6	1,6	$\pm 0,2$	24,2	28,2	32	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	52,0	60,6	68,8	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$				
						—	24,1	28,1		31,9	—	—		51,8	60,4	68,6	—
						24	28	31,8		51,6	60,2	68,4					
						—	24,3	28,4		32,1	—	—		52,2	61,1	69,0	—
						—	24,6	28,7		32,5	—	—		52,9	61,7	69,9	—
						24,5	28,6	32,4		52,7	61,5	69,7					
—	1,5	1,5	1,7	1,7	$\pm 0,2$	24,2	28,2	32	$\pm 30\%$ if $F_t < 10\text{ N}$ $\pm 20\%$ if $F_t \geq 10\text{ N}$	52,0	60,6	68,8	$\pm 30\%$ if $F_d < 21,5\text{ N}$ $\pm 20\%$ if $F_d \geq 21,5\text{ N}$				
						—	24,7	28,9		32,8	—	—		53,1	62,1	70,5	—
						24,6	28,8	32,7		52,9	61,9	70,3					
						—	24,3	28,4		32,2	—	—		52,2	61,1	69,2	—
						—	24,6	28,7		32,6	—	—		52,9	61,7	70,1	—
						24,5	28,6	32,5		52,7	61,5	69,9					

Table 8 (continued)

Nominal diameter d_1 mm	Radial wall thickness "regular" a_1 mm	Ring width h_1 mm					Closed gap s_1 mm	Axial width of step h_2 mm (Tolerance $\pm 0,15$) for h_1 shown in Column							
		Tolerance	Column					Tolerance	Tolerance						
			1	2	3	4				5	1	2	3	4	5
170	6,60	$\pm 0,2$ Within a ring: $\leq 0,2$	—	3	3,5	4	—	0,5 + 0,3 0	—	0,75	0,9	1	—		
172	6,65														
174	6,70														
175	6,75														
176	6,80														
178	6,86														
180	6,90														
182	6,95														
184	7,05														
185	7,05														
186	7,10														
188	7,15														
190	7,20														
192	7,25														
194	7,35														
195	7,35														
196	7,40														
198	7,45														
200	7,50														

For the sole purpose of this part of ISO 6623, 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 agreed between the manufacturer and the client. For intermediate sizes (for example repair sizes), the radial wall thickness of the next smaller nominal diameter should be applied.

NOTE The values for F_t and F_d given in Table 8 apply to grey cast iron with a typical modulus of elasticity (E_n) of 100 GN/m².

Multiplying factors for materials having a different modulus (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).

Table 8 (continued)

Radial depth of step						Tangential force					Diametral force						
a_2 mm						F_t N					F_d N						
for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance	for h_1 shown in Column					Tolerance
1	2	3	4	5		1	2	3	4	5		1	2	3	4	5	
—	1,5	1,5	1,7	1,7	± 0,2	—	25	29,2	33,2	—	± 30 % if $F_t < 10$ N ± 20 % if $F_t \geq 10$ N	—	53,8	62,8	71,4	± 30 % if $F_d < 21,5$ N ± 20 % if $F_d \geq 21,5$ N	
—	—	—	—	—		—	25	29,2	33,1	—		—	53,8	62,8	71,2		—
—	—	—	—	—	± 0,2	—	24,9	29	32,9	—	± 30 % if $F_t < 10$ N ± 20 % if $F_t \geq 10$ N	—	53,5	62,4	70,7	± 30 % if $F_d < 21,5$ N ± 20 % if $F_d \geq 21,5$ N	
—	—	—	—	—		—	25,1	29,3	33,3	—		—	54,0	63,0	71,6		—
—	—	—	—	—		—	25,1	29,3	33,2	—		—	54,0	63,0	71,4		—
—	—	—	—	—		—	25	29,2	33,1	—		—	53,8	62,8	71,2		—
—	—	—	—	—		—	24,9	29,1	33	—		—	53,5	62,6	71,0		—
—	—	—	—	—		—	25,4	29,7	33,7	—		—	54,6	63,9	72,5		—
—	—	—	—	—		—	25,1	29,3	33,2	—		—	54,0	63,0	71,4		—
—	—	—	—	—		—	25,4	29,6	33,6	—		—	54,6	63,6	72,2		—
—	—	—	—	—		—	25,3	29,5	33,5	—		—	54,4	63,4	72,0		—
—	—	—	—	—		—	25,2	29,5	33,4	—		—	54,2	63,4	71,8		—
—	—	—	—	—		—	25,2	29,4	33,3	—		—	54,2	63,2	71,6		—
—	—	—	—	—		—	25,7	30	34	—		—	55,3	64,5	73,1		—
—	—	—	—	—	—	25,4	29,6	33,6	—	—	54,6	63,6	72,2	—			
—	—	—	—	—	—	25,6	29,9	33,9	—	—	55,0	64,3	72,9	—			
—	—	—	—	—	—	25,5	29,8	33,8	—	—	54,8	64,1	72,7	—			
—	—	—	—	—	—	25,5	29,7	33,7	—	—	54,8	63,9	72,5	—			

Table 9 — Dimensions for type N, NM, E and EM scraper rings (radial wall thickness “D/22”)

Nominal diameter d_1 mm	Radial wall thickness “D/22” a_1 mm	Ring width h_1 mm					Closed gap s_1 mm	Axial width of step h_2 mm (Tolerance $\pm 0,15$) for h_1 shown in Column						
		Tolerance	Column					Tolerance	Tolerance					
			1	2	3	4			5	1	2	3	4	5
50	2,25	$\pm 0,15$ Within a ring: $\leq 0,15$	1,2	1,5	1,75	2	2,5	- 0,01 - 0,03 For phosphated PO surface: - 0,005 - 0,03	0,2 + 0,2 0	0,35	0,4	0,45	0,5	0,6
51	2,3													
52	2,35													
53	2,4													
54	2,45													
55	2,5													
56	2,55													
57	2,6													
58	2,65													
59	2,7													
60	2,75													
61	2,75													
62	5,8													
63	2,86													
64	2,9													
65	2,95	$\pm 0,15$ Within a ring: $\leq 0,15$	1,2	1,5	1,75	2	2,5	- 0,01 - 0,03 For phosphated PO surface: - 0,005 - 0,03	0,2 + 0,2 0	0,35	0,4	0,45	0,5	0,6
66	3													
67	3,05													
68	3,1													
69	3,15													
70	3,2													
71	3,25													
72	3,25													
73	3,3													
74	3,35													
75	3,4													
76	3,45													
77	3,5													
78	3,55													
79	3,6													
80	3,65	$\pm 0,15$ Within a ring: $\leq 0,15$	1,2	1,5	1,75	2	2,5	- 0,01 - 0,03 For phosphated PO surface: - 0,005 - 0,03	0,25 + 0,25 0	0,35	0,4	0,45	0,5	0,6
81	3,7													
82	3,75													
83	3,75													
84	3,8													