INTERNATIONAL STANDARD

ISO 6626-2

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Internal combustion engines — Piston rings —

Part 2: Coil-spring-loaded oil control rings of narrow width made of cast iron

Moteurs à combustion interne — Segments de piston —

Partie 2: Segments racleurs régulateurs d'huile étroits, en fonte, mis en charge par ressort hélicoïdal

Reference number
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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 6626-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

ISO 6626 consists of the following parts, under the general title *Internal combustion engines — Piston rings*:

— *Part 2: Coil-spring-loaded oil control rings of narrow width made of cast iron*

Coil-spring-loaded oil control rings is to form the subject of a future part 1, revising and replacing ISO 6626:1989.

This corrected version of ISO 6626-2:2003 incorporates the following corrections:

— bibliographical information has been added;

— in Figures 10 and 11, item 2 of the legend to each figure has been corrected from “8 times” to “0,8 times” the diameter of the wire;

— Tables 5 to 8 have been corrected and clarified.

Introduction

ISO 6626 is one of a series of International Standards dealing with piston rings for reciprocating internal combustion engines. Others are ISO 6621[1], [2], ISO 6622[3], ISO 6623[4], ISO 6624[5], ISO 6625[6] and ISO 6627[8].

The common features and dimensional tables presented in this part of ISO 6626 constitute a broad range of variables and, in selecting a particular ring type, the designer must 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 and ISO 6621-4 before completing a selection.

Internal combustion engines — Piston rings —

Part 2: Coil-spring-loaded oil control rings of narrow width made of cast iron

1 Scope

This part of ISO 6626 specifies the essential dimensional features of coil-spring-loaded oil control rings made of cast iron, types DSF-C, SSF, GSF, DSF and SSF-L. It is applicable to those piston rings in sizes 60 mm to 110 mm, inclusive, for reciprocating internal combustion engines, as well as to those for compressors working under analogous 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 6621-3, *Internal combustion engines — Piston rings — Part 3: Material specifications*

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

ISO 6621-5, *Internal combustion engines — Piston rings — Part 5: Quality requirements*

3 Overview

The coil-spring-loaded oil control ring types are specified in Figures 1 to 6. Their common features and the features' dimensions are specified in Tables 1 and 2 and shown in Figures 7 and 8. Essential features of coil-springs are shown in Figures 9 to 13. Tables 3 and 4 specify different classes of contact pressure, while Tables 5 to 8 give the dimensions and forces of coil-spring-loaded oil control rings.

For the cast iron part the recommended material is Class 10 in accordance with ISO 6621-3. For special applications, material Classes 20 to 50 may be used.

Variation from these in face design and spring groove may be used, as recommended by individual manufacturers, in plain or chromed versions.

The tangential forces of coil-spring-loaded control rings can be varied over a wide range. For explanations and recommendations, see Clause 7.

4 Piston ring types and designation

4.1 Types DSF-C, SSF, GSF, DSF and SSF-L

4.1.1 General features and dimensions

See Figure 1 and Tables 5, 6, 7 and 8.

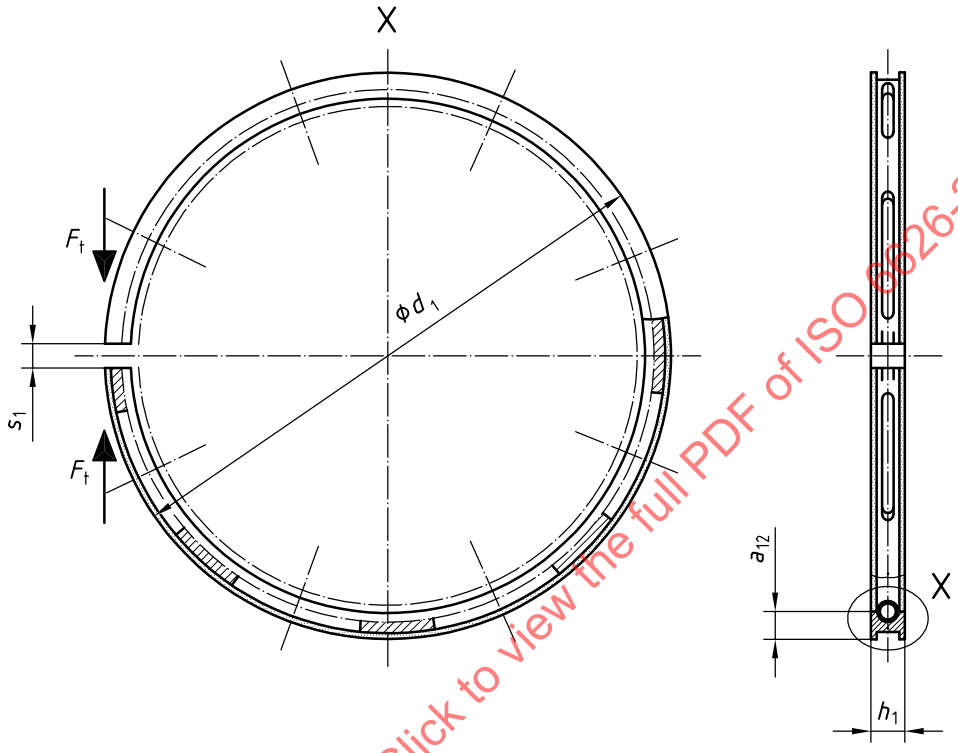


Figure 1 — Types DSF-C, SSF, GSF, DSF and SSF-L

4.2 Type DSF-C, coil-spring-loaded bevelled edge oil control ring, chromium plated and profile ground

4.2.1 General features and dimensions

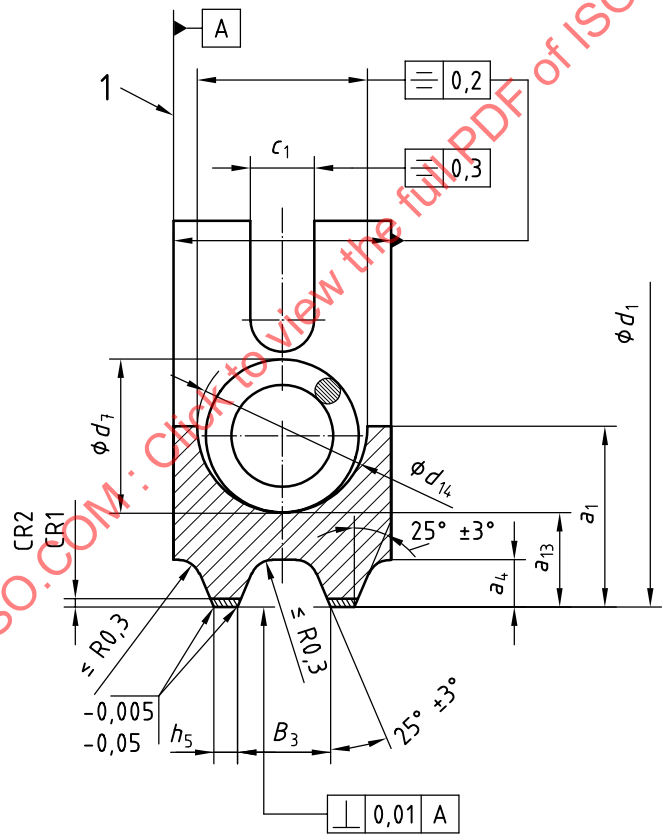
See Figure 2 and Table 5.

4.2.1 Designation of a Type DSF-C piston ring in accordance with ISO 6626-2

EXAMPLE Coil-spring-loaded bevelled edge oil control ring, chromium plated and profile ground (DSF-C), of nominal diameter $d_1 = 80$ mm (80), nominal ring width $h_1 = 2{,}5$ mm (2,5), made of grey cast iron, non-heat treated, material subclass 11 (MC11), having a selected closed gap of 0,20 mm min. (SO2), a chromium layer thickness on the lands of 0,10 mm (CR2), reduced slot length (WK), a coil spring with reduced heat set (WF), and a variable pitch with coil diameter d_7 ground (CSE), with tangential force F_t in accordance with the medium nominal contact pressure class (PNM) and the ring marked with the manufacturer's mark (MM):

Piston ring ISO 6626-2 DSF-C - 80 × 2,5 - MC11 / S02 CR2 WK WF CSE PNM MM

Dimensions in millimetres



Key

1 reference plane

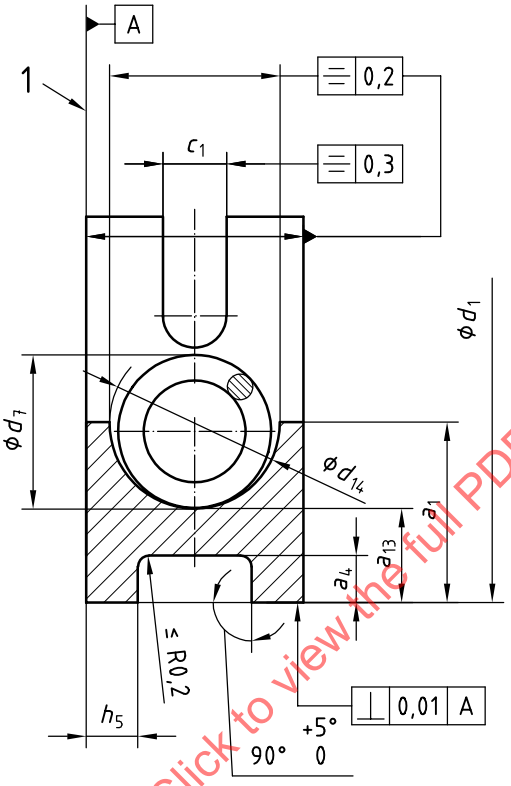
Figure 2 — Type DSF-C

4.3 Type SSF, coil-spring-loaded slotted oil control ring

4.3.1 General features and dimensions

See Figure 3 and Table 6.

Dimensions in millimetres



Key

1 reference plane

Figure 3 — Type SSF

4.3.2 Designation of a Type SSF piston ring in accordance with ISO 6626-2

EXAMPLE Coil-spring-loaded slotted oil control ring (SSF) of nominal diameter d_1 = 80 mm (80), nominal ring width h_1 = 2,5 mm (2,5), made of grey cast iron, non-heat treated, material subclass 12 (MC12), constant spring pitch (CSN) and tangential force F_t in accordance with the low nominal contact pressure class (PNL):

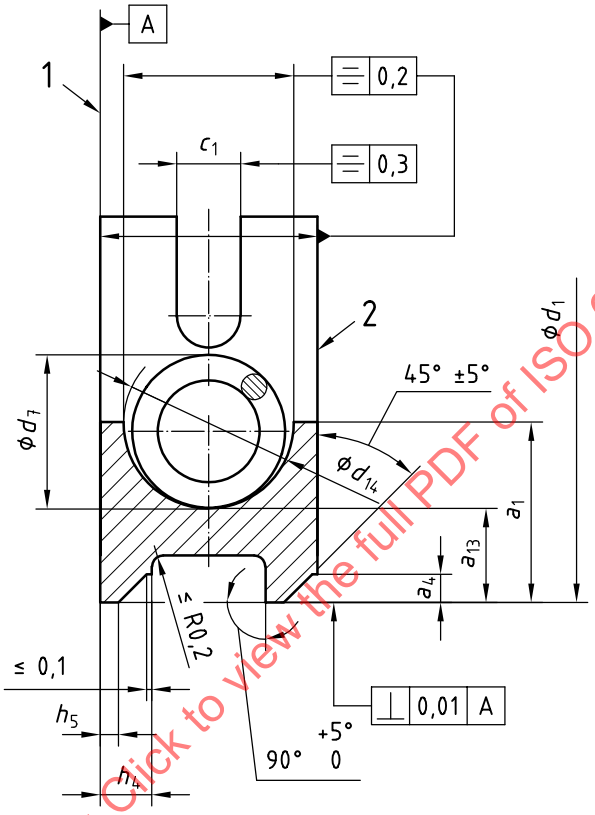
Piston ring ISO 6626-2 SSF- 80 × 2,5 - MC12 / CSN PNL

4.4 Type GSF coil-spring-loaded double bevelled oil control ring

4.4.1 General features and dimensions

See Figure 4 and Table 7. Top-side marking is mandatory in accordance with ISO 6621-4.

Dimensions in millimetres



Key

1 reference plane
2 mark

Figure 4 — Type GSF

4.4.2 Designation of a Type GSF piston ring in accordance with ISO 6626-2

EXAMPLE Coil-spring-loaded double bevelled oil control ring (GSF) of nominal diameter d_1 = 75 mm (75), nominal ring width h_1 = 2,5 mm (2,5), made of grey cast iron, non-heat treated, material subclass 12 (MC12), with constant spring pitch (CSN) and tangential force F_t in accordance with the low nominal contact pressure class (PNL):

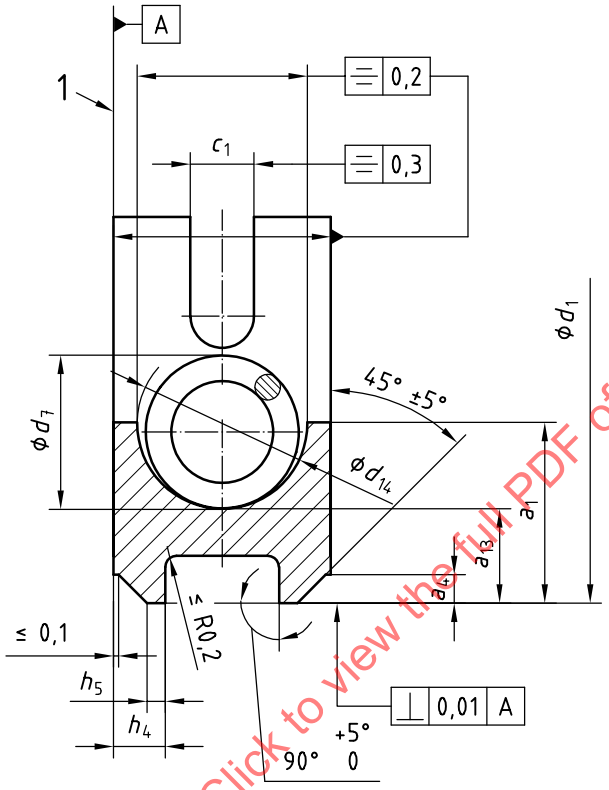
Piston ring ISO 6626-2 GSF- 75 × 2,5 - MC12 / CSN PNL

4.5 Type DSF coil-spring-loaded bevelled edge oil control ring

4.5.1 General features and dimensions

See Figure 5 and Table 7.

Dimensions in millimetres



Key

1 reference plane

Figure 5 — Type DSF

4.5.2 Designation of a Type DSF piston ring in accordance with ISO 6626-2

EXAMPLE Coil-spring-loaded double bevelled oil control ring (DSF) of nominal diameter d_1 = 90 mm (90), nominal ring width h_1 = 2,5 mm (2,5), made of grey cast iron, non-heat treated, material subclass 12 (MC12), with constant spring pitch (CSN) and tangential force F_t in accordance with the reduced nominal contact pressure class (PNR):

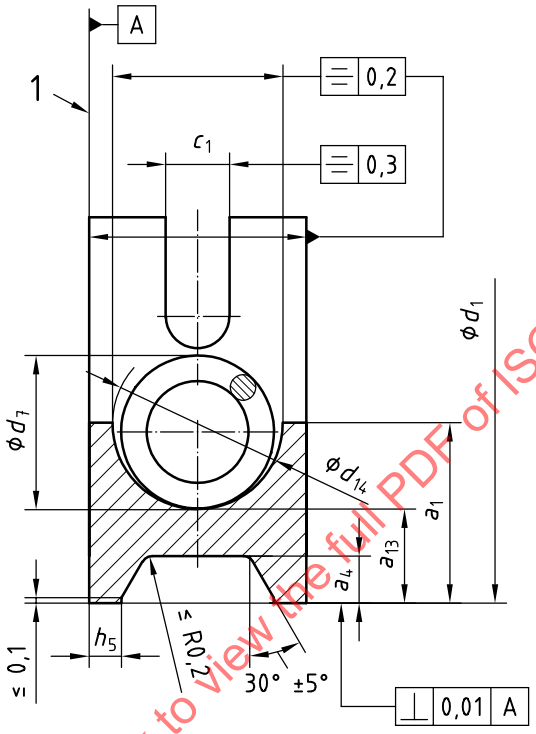
Piston ring ISO 6626-2 DSF- 90 × 2,5 - MC12 / CSN PNR

4.6 Type SSF-L coil-spring-loaded slotted oil control ring with 0,6 mm nominal land width

4.6.1 General features and dimensions

See Figure 6 and Table 8.

Dimensions in millimetres



Key

1 reference plane

Figure 6 — Type SSF-L

4.6.2 Designation of a Type SSF-L piston ring in accordance with ISO 6626-2

EXAMPLE Coil-spring-loaded slotted oil control ring (SSF-L) of nominal diameter d_1 = 80 m (80), nominal ring width h_1 = 2,5 mm (2,5), made of grey cast iron, non-heat treated, material subclass 12 (MC12), constant spring pitch (CSN) and tangential force F_t in accordance with the reduced nominal contact pressure class (PNR):

Piston ring ISO 6626-2 SSF-L - 80 × 2,5 - MC12 / CSN PNR

5 Common features

5.1 Arrangement of slots

See Figure 7.

5.2 Slot length

5.2.1 Standard slot length

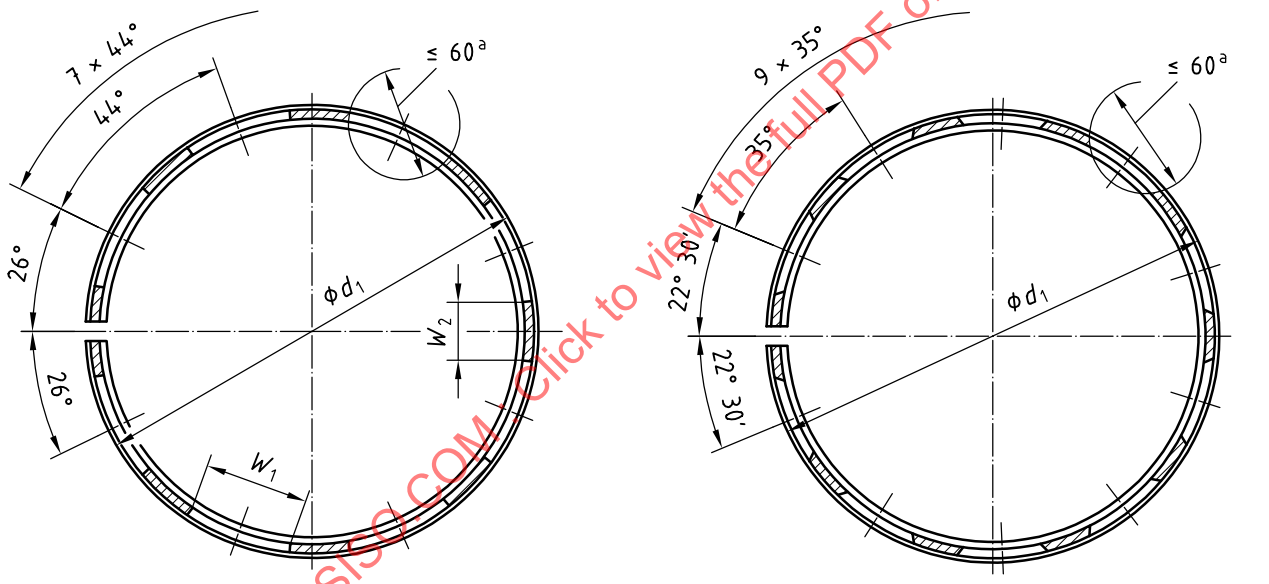
Slot length, w_1, shall be equal to bridge length, w_2.

The tolerance on the difference between w_1 and w_2 shall be 4 mm.

5.2.2 Reduced slot length (retaining same number and spacing) — Code WK

See Table 1.

Dimensions in millimetres



a) 8 slots for $60 \leqslant d_1 < 80$

b) 10 slots for $80 \leqslant d_1 \leqslant 110$

[a] cutter diameter

Figure 7 — Arrangement of slots

Table 1 — Reduced slot length

Dimensions in millimetres

d_1	w_1
$60 \leqslant d_1 < 80$	6 ... 11
$80 \leqslant d_1 \leqslant 110$	8 ... 13

5.3 Plating thickness — DSF-C (coil-spring-loaded bevelled edge oil control ring, chromium plated and profile ground)

See Figure 8 and Table 2.

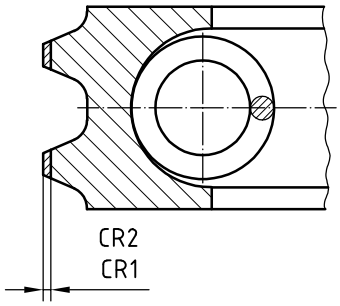


Figure 8 — Plating thickness

Table 2 — Plating thickness

Code	Thickness[a] min.
CR1	0,05
CR2	0,10
[a] For plating thickness tolerances, see ISO 6621-4.	

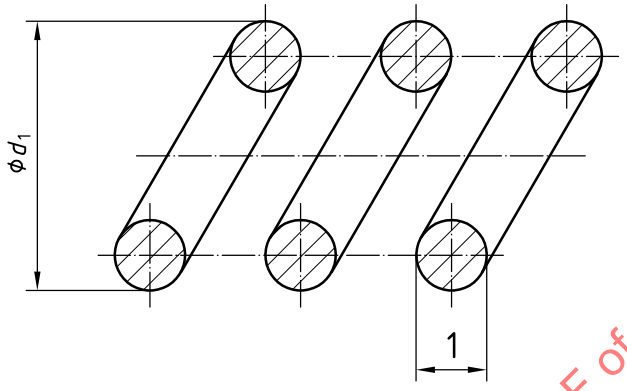
5.4 Peripheral edges at gap of chromium plated oil control rings

For features and their dimensions, see ISO 6621-4.

6 Coil springs

6.1 Types of coil spring

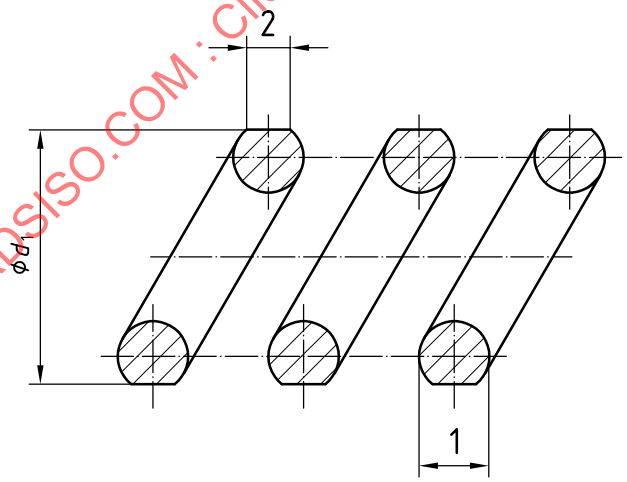
All values in the dimensional tables of Clause 8 are based on cylindrical coil springs made of round wire. The three designs shown in Figures 9 to 11 are common. The use of different springs designs may be agreed between manufacturer and client. Changed spring groove configurations and dimensions could then be necessary.



Key

1 diameter of wire

Figure 9 — Type CSN coil spring with constant pitch

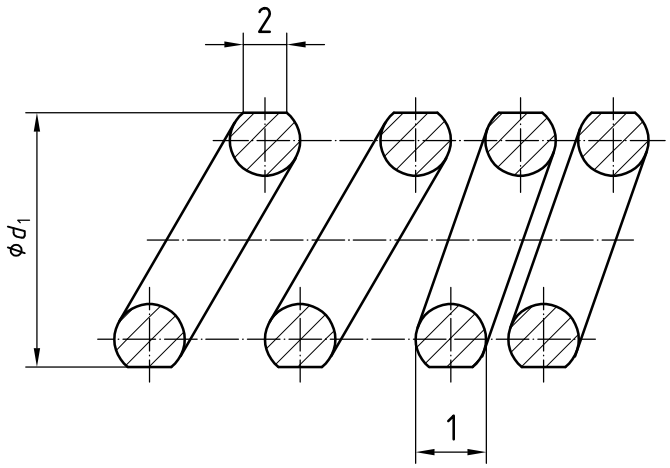


Key

1 diameter of wire

2 approx. 0,8 × diameter of wire

Figure 10 — Type CSG coil spring with constant pitch (coil diameter, d_7, ground)



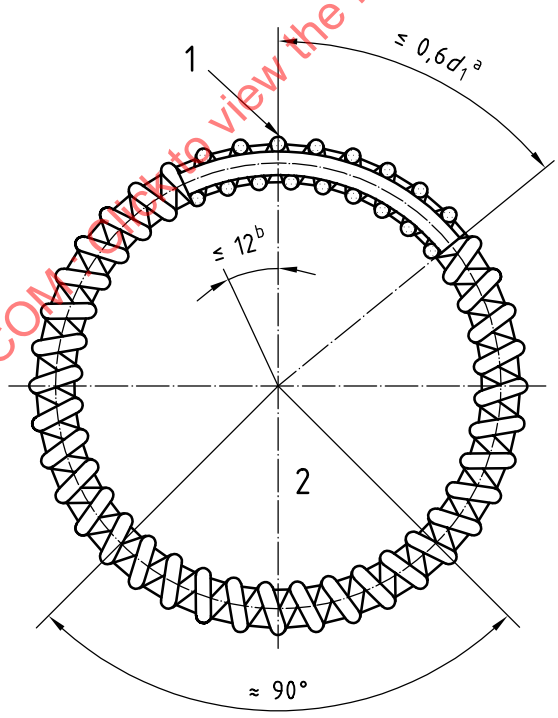
Key

1 diameter of wire

2 approx. 0,8 × diameter of wire

Figure 11 — Type CSE coil spring with variable pitch (coil diameter, d_7, ground)

Dimensions in millimetres



Key

1 spring gap

2 area with small pitch

[a] Latch pin free length

[b] Latch pin fixed length

Figure 12 — Position of area with small pitch

6.2 Excursion, f_1

Coil spring excursion, f_1, is the distance between the gap ends of the ring in the free unstressed status, measured at the centre of the coil spring groove (see Figure 13). The maximum value of f_1 shall not exceed 0,13 d_1.

6.3 Position of coil spring gap and fixing

The spring gap shall be approx. 180° from the gap and the spring gap ends fixed with a connecting or latch pin.

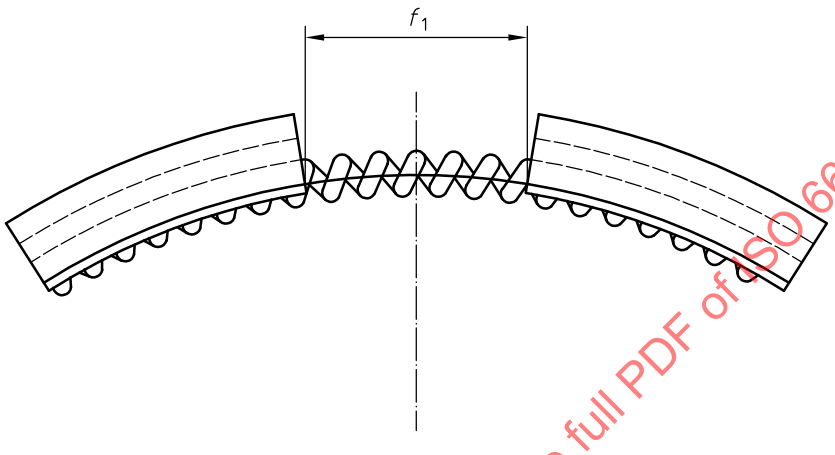


Figure 13 — Coil spring excursion

6.4 Material

Coil springs are made of valve spring wire, oil heat-treated. A suitable material for coil spring expanders is Subclass 62 in accordance with ISO 6621-3.

Springs are available with two different heat set resistance levels (loss of tangential force under load and temperature):

— standard heat resistance;

— reduced heat set, code WF.

For test conditions and the permissible loss of tangential forces, see ISO 6621-5.

7 Tangential force and nominal contact pressure

7.1 Tangential force

The tangential force of coil-spring-loaded oil control rings is mainly determined by the force of the spring. The cast iron part itself has a very small tangential force due to its low radial wall thickness and the decreased ratio “total free gap/nominal diameter”.

The tangential force measurement only can be used because of the flexible design of the cast iron part of the coil-spring-loaded oil control rings.

7.2 Force factors

Because of the small contribution of the cast iron part in the tangential force, force factors are not necessary when additional features, materials or both — other than grey cast iron with modulus of elasticity of 100 GN/m^2 — are being used.

7.3 Tangential force, F_t

7.3.1 General

The tangential force, F_t, of a spring-loaded oil control ring is determined by

a) nominal diameter, d_1, in millimetres,

b) land width, h_5, in millimetres, and

c) required nominal contact pressure, p_o, in newtons per square millimetre, calculated from the equation:

$$F_t = ½ \times d_1 \times 2h_5 \times p_o$$

The land width, h_5, depends on the ring type, nominal diameter and ring width. The nominal contact pressure, p_o, can be selected over a wide range to suit the application and the required oil scraping effect.

7.3.2 Specific tangential force, F_{tc}

The specific tangential force, F_{tc}, is that required to maintain a spring-loaded oil control ring at a unit contact pressure, p_{ou}, of 1 N/mm^2:

$$F_{tc} = ½ \times d_1 \times 2h_5 \times p_{ou}$$

In Clause 8, F_{tc} is tabulated for every ring type.

7.3.3 Actual tangential force, F_t, and tolerance

The actual tangential force of a spring-loaded oil control ring can be calculated with the F_{tc} value and the required nominal contact pressure from the equation:

$$F_t = \frac{p_o \times F_{tc}}{p_{ou}}$$

The tolerance on F_t is the actual value $F_t \pm 20$ %. Actual values of tangential force should be rounded up or down in accordance with ISO 6621-4.

7.4 Classes of nominal contact pressure, p_o

The range of the nominal contact pressure has been subdivided into six classes, according to Table 3.

Table 3 — Classes of nominal contact pressure, p_o

Value PNM	Code	Meaning
1,60	PNV	Very High
1,25	PNH	High
1,00	PNM	Medium
0,80	PNR	Reduced
0,60	PNL	Low
0,45	PNE	Very low

The nominal contact pressure, p_o, normally decreases with increasing nominal diameter. Figure 14 shows characteristic values of p_o depending on d_1.

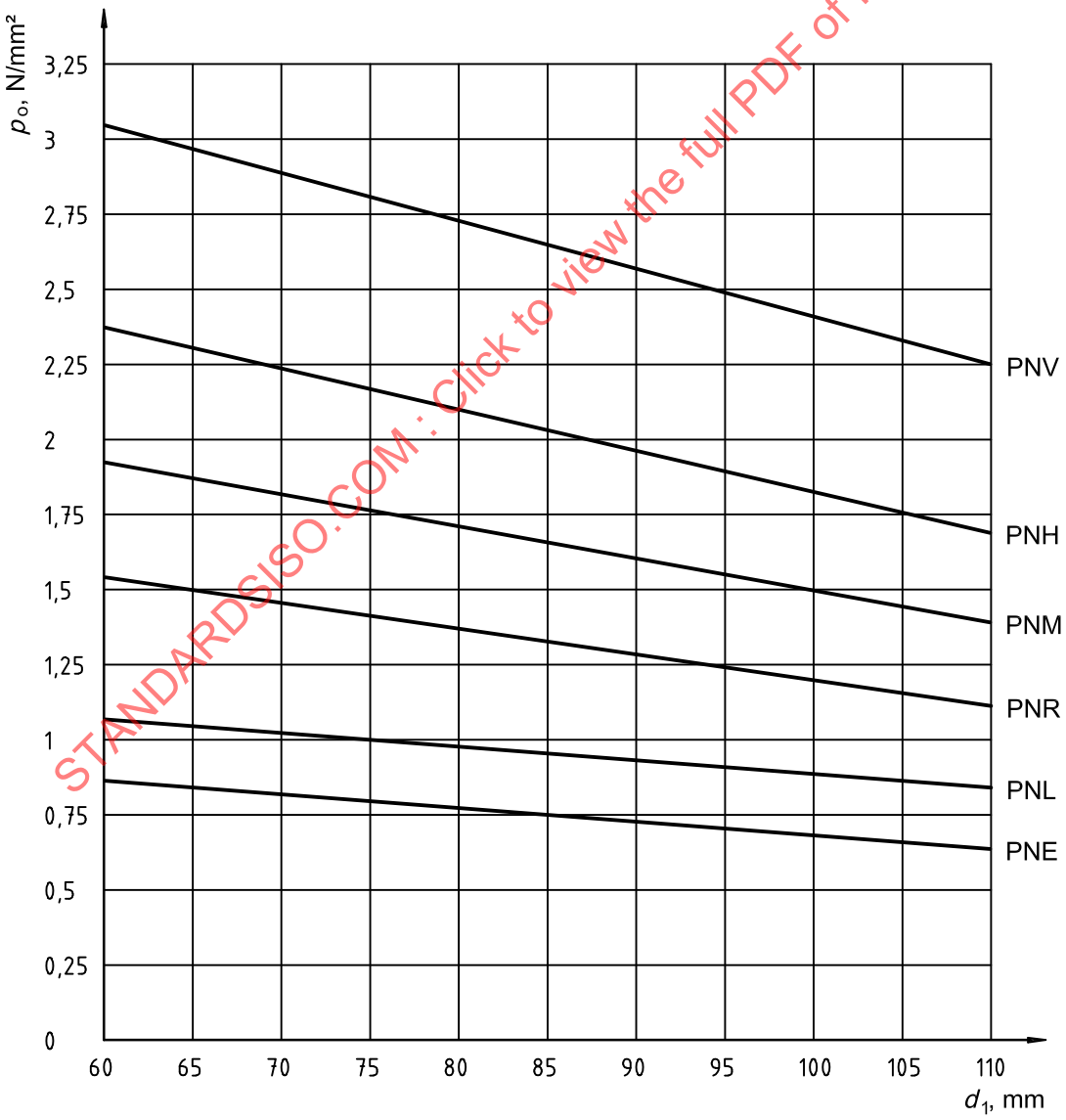


Figure 14 — Characteristic values of p_o depending on d_1

The range possible for the nominal contact pressure, p_o, varies according to the ring type, ring dimensions and features of the contact lands (if plain or chromium plated).

The classification given in Table 4 is taken from the dimensional tables in Clause 8, where p_o values are given in the following three categories for every nominal diameter:

a) *low* category — low-friction design oil control rings.

b) *mean* category — normal-friction design oil control rings.

c) *high* category — high-contact-pressure oil control rings for high oil-scraping effect.

Table 4 — Oil control ring pressure classes

Ring type	PNE	PNL	PNR	PNM	PNH	PNV
DSF-C	—[a]	Low	Mean	Mean	High	X
SSF	Low	Mean	High	X[b]	—[a]	—[a]
GSF	X[b]	Low	Mean	High	X[b]	—[a]
DSF	X[b]	Low	Mean	High	X[b]	—[a]
SSF-L	Low	Mean	High	—[a]	—[a]	—[a]

[a] This pressure class is not used with this ring type.

[b] For special applications.

8 Dimensions

Table 5 — Dimensions of DSF-C coil-spring-loaded oil control rings of narrow ring width

Dimensions in millimetres

Nominal diameter	Radial thickness over coil spring	Ring width		Closed gap	Radial wall thickness		Land width	Land spacing	Groove depth	Groove depth and bridge	Number of slots	Slot width	Coil spring groove diameter	Coil spring diameter	Tangential force (N)[a]	Rec. class of nominal contact pressure N/mm²		
d_1	a_{12}	h_1	Tol.	s_1	a_1	Tol.	h_5	b_3	a_4	a_{13}		c_1	d_{14}	d_7	F_{tc}	PNL Low	PNM Med.	PNH High
60															18,0	1,14	1,90	2,38
61															18,3	1,13	1,89	2,36
62															18,6	1,13	1,88	2,35
63															18,9	1,12	1,87	2,34
64				0,20 +0,20 0	2,20										19,2	1,12	1,86	2,33
65															19,5	1,11	1,85	2,31
66															19,8	1,10	1,84	2,30
67															20,1	1,10	1,83	2,29
68											8				20,4	1,09	1,82	2,28
69															20,7	1,09	1,81	2,26
70			-0,010 -0,030 For phos-phated PO surface: -0,005 -0,030												21,0	1,08	1,80	2,25
71															21,3	1,07	1,79	2,24
72															21,6	1,07	1,78	2,23
73															21,9	1,06	1,77	2,21
74	3,00 0 -0,25	2,5			2,30	± 0,15 within a ring 0,15 max.	0,30 ± 0,07	1,40	0,4 ± 0,10	1,40 0 -0,15		0,60 ± 0,10	1,70 +0,10 0	1,60 0 -0,10	22,2	1,06	1,76	2,20
75															22,5	1,05	1,75	2,19
76															22,8	1,04	1,74	2,18
77															23,1	1,04	1,73	2,16
78															23,4	1,03	1,72	2,15
79															23,7	1,03	1,71	2,14
80				0,25 +0,25 0							10				24,0	1,02	1,70	2,13
81															24,3	1,01	1,69	2,11
82															24,6	1,01	1,68	2,10
83															24,9	1,00	1,67	2,09
84					2,40										25,2	1,00	1,66	2,08
85															25,5	0,99	1,65	2,06
86															25,8	0,98	1,64	2,05
87															26,1	0,98	1,63	2,04
88															26,4	0,97	1,62	2,03
89															26,7	0,97	1,61	2,01
90	3,1			0,3						1,5					27,0	0,96	1,60	2,00
91	0 -0,25			+0,25 0	2,50					0 -0,15					27,3	0,95	1,59	1,99
92															27,6	0,95	1,58	1,98

Table 5 (*continued*)

Dimensions in millimetres

Nominal diameter	Radial thickness over coil spring	Ring width		Closed gap	Radial wall thickness		Land width	Land spacing	Groove depth	Groove depth and bridge	Number of slots	Slot width	Coil spring groove diameter	Coil spring diameter	Tangential force (N)[a]	Rec. class of nominal contact pressure N/mm²		
d_1	a_{12}	h_1	Tol.	s_1	a_1	Tol.	h_5	b_3	a_4	a_{13}		c_1	d_{14}	d_7	F_{tc}	PNL Low	PNM Med.	PNH High
93															27,9	0,94	1,57	1,96
94															28,2	0,94	1,56	1,95
95															28,5	0,93	1,55	1,94
96					2,50										28,8	0,92	1,54	1,93
97															29,1	0,92	1,53	1,91
98			-0,010 -0,030												29,4	0,91	1,52	1,90
99															29,7	0,91	1,51	1,89
100	3,10		For	0,30		± 0,15	0,3	1,4	0,4	1,50		0,6	1,7	1,6	30,0	0,90	1,50	1,88
101	0 -0,25	2,5	phos-phated PO surface:	+0,25 0		within a ring 0,15 max.	± 0,07		± 0,10	0 -0,15	10	± 0,10	+0,1 0	0 -0,1	30,3	0,89	1,49	1,86
102															30,6	0,89	1,48	1,85
103			-0,005 -0,030												30,9	0,88	1,47	1,84
104															31,2	0,88	1,46	1,83
105					2,55										31,5	0,87	1,45	1,81
106															31,8	0,86	1,44	1,80
107															32,1	0,86	1,43	1,79
108															32,4	0,85	1,42	1,78
109															32,7	0,85	1,41	1,76
110															33,0	0,84	1,40	1,75

NOTE 1 For intermediate sizes (e.g. repair sizes), the radial thickness of the next smaller nominal diameter applies.

NOTE 2 Values of specific tangential force F_{tc} are calculated with mean land width (h_5).

a Tangential force F_{tc} (in newtons) for unit pressure p_{ou} = 1 N/mm².

Table 6 — Dimensions of SSF coil-spring-loaded oil control rings of narrow ring width

Dimensions in millimetres

Nominal diameter	Radial thickness over coil spring	Ring width		Closed gap	Radial wall thickness		Land width	Groove depth	Groove depth and bridge	Number of slots	Slot width	Coil spring groove diameter	Coil spring diameter	Tangential force (N)[a]	Recommended class of nominal contact pressure (N/mm^2)		
d_1	a_{12}	h_1	Tol.	s_1	a_1	Tol.	h_5	a_4	a_{13}		c_1	d_{14}	d_7	F_{tc}	PNE Low	PNL Med.	PNR High
60														30,0	0,86	1,14	1,52
61														30,5	0,85	1,13	1,51
62														31,0	0,85	1,13	1,50
63														31,5	0,84	1,12	1,50
64					2,20									32,0	0,84	1,12	1,49
65				0,20 +0,20 0										32,5	0,83	1,11	1,48
66														33,0	0,83	1,10	1,47
67														33,5	0,82	1,10	1,46
68			-0,010 -0,030							8				34,0	0,82	1,09	1,46
69														34,5	0,81	1,09	1,45
70			For phos-phated PO surface:											35,0	0,81	1,08	1,44
71														35,5	0,81	1,07	1,43
72														36,0	0,80	1,07	1,42
73														36,5	0,80	1,06	1,42
74	3,00		-0,005 -0,030		2,30	± 0,15 within a ring 0,15 max.			1,40 0 -0,15		0,60 ± 0,10	1,70 +0,10 0	1,60 0 -0,10	37,0	0,79	1,06	1,41
75	0 -0,25													37,5	0,79	1,05	1,40
76														38,0	0,78	1,04	1,39
77														38,5	0,78	1,04	1,38
78														39,0	0,77	1,03	1,38
79														39,5	0,77	1,03	1,37
80				0,25 +0,25 0										40,0	0,77	1,02	1,36
81														40,5	0,76	1,01	1,35
82														41,0	0,76	1,01	1,34
83														41,5	0,75	1,00	1,34
84														42,0	0,75	1,00	1,33
85		2,50			2,40		0,50	0,45						42,5	0,74	0,99	1,32
86							± 0,10	± 0,10						43,0	0,74	0,98	1,31
87														43,5	0,73	0,98	1,30
88														44,0	0,73	0,97	1,30
89										10				44,5	0,72	0,97	1,29
90														45,0	0,72	0,96	1,28
91	3,1			0,3					1,5					45,5	0,72	0,95	1,27
92	0 -0,25			+0,25 0	2,5				0 -0,15					46,0	0,71	0,95	1,26
93														46,5	0,71	0,94	1,26
94														47,0	0,70	0,94	1,25

Table 6 (*continued*)

Dimensions in millimetres

Nominal diameter	Radial thickness over coil spring	Ring width		Closed gap	Radial wall thickness		Land width	Groove depth	Groove depth and bridge	Number of slots	Slot width	Coil spring groove diameter	Coil spring diameter	Tangential force (N)[a]	Recommended class of nominal contact pressure (N/mm^2)		
d_1	a_{12}	h_1	Tol.	s_1	a_1	Tol.	h_5	a_4	a_{13}		c_1	d_{14}	d_7	F_{tc}	PNE Low	PNL Med.	PNR High
95														47,5	0,70	0,93	1,24
96														48,0	0,69	0,92	1,23
97					2,5									48,5	0,69	0,92	1,22
98			-0,010 -0,030											49,0	0,68	0,91	1,22
99						± 0,15								49,5	0,68	0,91	1,21
100			For			within								50,0	0,68	0,90	1,20
101			phos-	0,3		a ring								50,5	0,67	0,89	1,19
102	3,10	2,5	phated	-0,00 +0,25		0,15	0,5	0,45	1,50	10	0,6	1,7	1,6	51,0	0,67	0,89	1,18
103	0 -0,25		PO			max.	± 0,10	± 0,10	0 -0,15		± 0,10	+0,1 0	0 -0,10	51,5	0,66	0,88	1,18
104			surface:											52,0	0,66	0,88	1,17
105					2,55									52,5	0,65	0,87	1,16
106			-0,005 -0,030											53,0	0,65	0,86	1,15
107														53,5	0,64	0,86	1,14
108														54,0	0,64	0,85	1,14
109														54,5	0,63	0,85	1,13
110														55,0	0,63	0,84	1,12

NOTE 1 For intermediate sizes (e.g. repair sizes), the radial thickness of the next smaller nominal diameter applies.

NOTE 2 Values of specific tangential force F_{tc} are calculated with mean land width (h_5).

a Tangential force F_{tc} (in newtons) for unit pressure $p_{ou} = 1$ N/mm^2.