International Standard

ISO 6626-2

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

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

This third edition cancels and replaces the second edition (ISO 6626-2:2013), which has been technically revised.

The main changes are as follows:

— classes of nominal contact pressure moved to ISO 6626-1:2024, Annex A and introduced normalized tangential force;

— verification and correction of figures;

— update of dimension in Tables 8 to 16.

A list of all parts in the ISO 6626 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 6626 series is one of a series of International Standards dealing with piston rings for reciprocating internal combustion engines. Others are the ISO 6621 series, ISO 6622, ISO 6623, ISO 6624, ISO 6625, the ISO 6626 series and ISO 6627.

The common features and dimensional tables presented in this document constitute a broad range of variables and, in selecting a particular ring type, the designer should be aware of the conditions under which it will be required to operate.

Internal combustion engines — Piston rings —

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

1 Scope

This document specifies the essential dimensional features of coil-spring loaded oil control rings made of cast iron, types DSF-C, SSF, GSF, DSF, SSF-L, DSF-NG and DSF-CNP. It is applicable to those piston rings in sizes 60 mm up to 160 mm, inclusive for reciprocating internal combustion engines for road vehicles and other applications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Overview

The coil-spring loaded oil control ring types are specified in Figures 1 to 8. Their common features and the features' dimensions are specified in Tables 1 to 5 and shown in Figures 9 to 11. Essential features of coil springs are shown in Figures 12 to 16. Tables 8 to 16 give the dimensions of coil-spring loaded oil control rings.

The common features and dimensional tables presented in this document constitute a broad range of variables and, in selecting a particular ring type, the designer shall bear in mind the conditions under which it will be required to operate.

The designer shall refer to the specifications and requirements of ISO 6621-3 and ISO 6621-4 before completing a selection.

For the cast iron part, the recommended material is class 10 and shall be 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.

5 Piston ring types and designation

5.1 Types DFS-C, DFS-CNP, SSF, GSF, DSF, DSF-NG, and SSF-L — General features and dimensions

See Figure 1 and Tables 8 to 16. Figure 1 is applicable to Figures 2 to 8. Figures 2 to 8 show detailed cross sections corresponding to Figure 1.

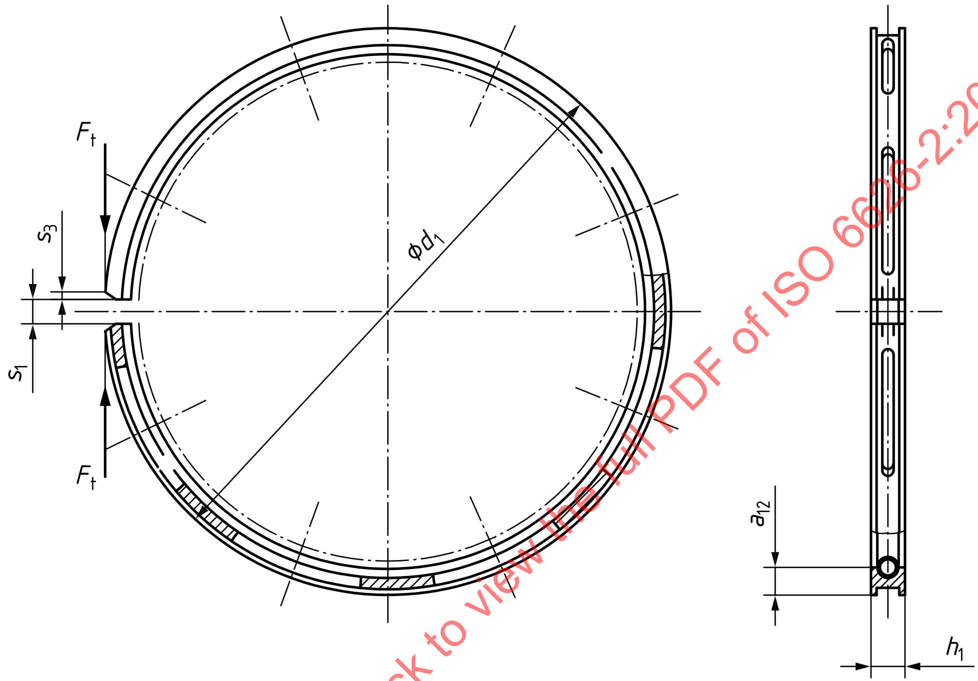


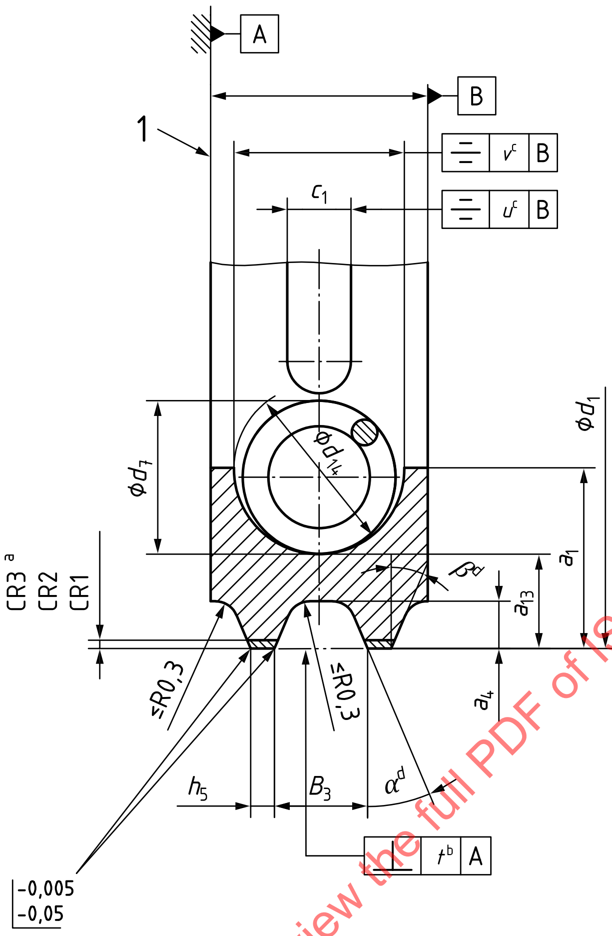
Figure 1 — Types DSF-C, SSF, GSF, DSF, SSF-L, DSF-NG and DSF-CNP

5.2 Type DSF-C — Coil-spring loaded bevelled edge oil control ring, chromium plated and profile ground

5.2.1 General features and dimensions

See Figure 2 and Tables 6 and 7.

Dimensions in millimetres



Key

1 reference plane

a See Table 3.

b See Table 4.

c See Table 5.

d Angle α and β to be agreed between manufacturer and customer, angles can be different (historical value is 35°).

Figure 2 — Type DSF-C

5.2.2 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), land width h_5 = 0,25 mm (0,25), made of grey cast iron, non-heat treated, material subclass 11 (MC11), having a selected closed gap of 0,20 mm min. (S020), 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 nominal contact pressure p_0 = 1,0 N/mm^2 (PN1,0) and the ring marked with the manufacturer's mark (MM). Parameters in parenthesis are used in the ISO ring designation:

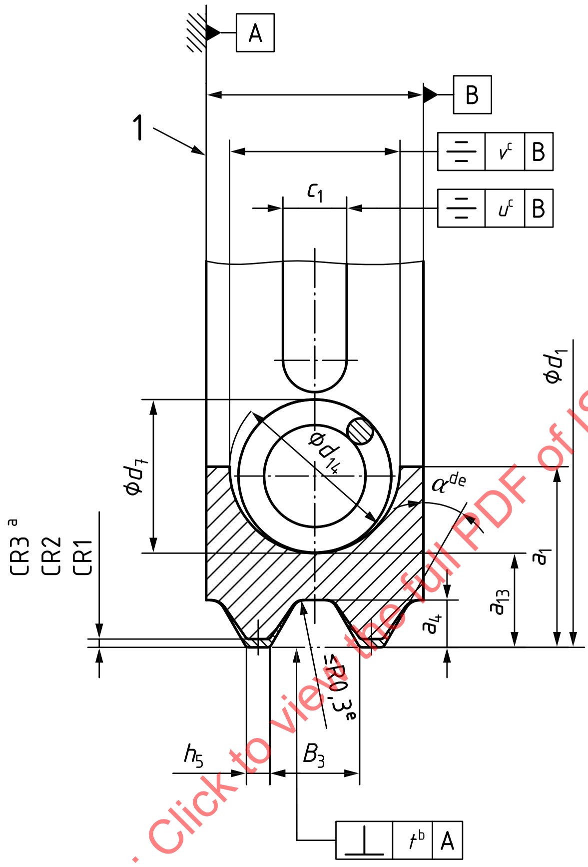
Piston ring ISO 6626-2 DSF-C - 80 × 2,5 × 0,25 - MC11 / S020 CR2 WK WF CSE PN1,0 MM

5.3 Type DSF-CNP — Coil-spring loaded bevelled edge oil control ring, chromium plated not profile ground

5.3.1 General features and dimensions

See Figure 3 and Tables 8 and 9.

Dimensions in millimetres



Key

1 reference plane

a See Table 3.

b See Table 4.

c See Table 5.

d Angle α and β to be agreed between manufacturer and customer, angles can be different (historical value is 35°).

e Before plating.

Figure 3 — Type DSF-CNP

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

EXAMPLE Coil-spring loaded bevelled edge oil control ring, chromium plated not profile ground (DSF-CNP) of nominal diameter d_1 = 100 mm (100), nominal ring width h_1 = 2,0 mm (2,0), land width h_5 = 0,25 mm (0,25), 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 nominal contact pressure p_0 = 1,0 N/mm^2 (PN1,0). Parameters in parenthesis are used in the ISO ring designation:

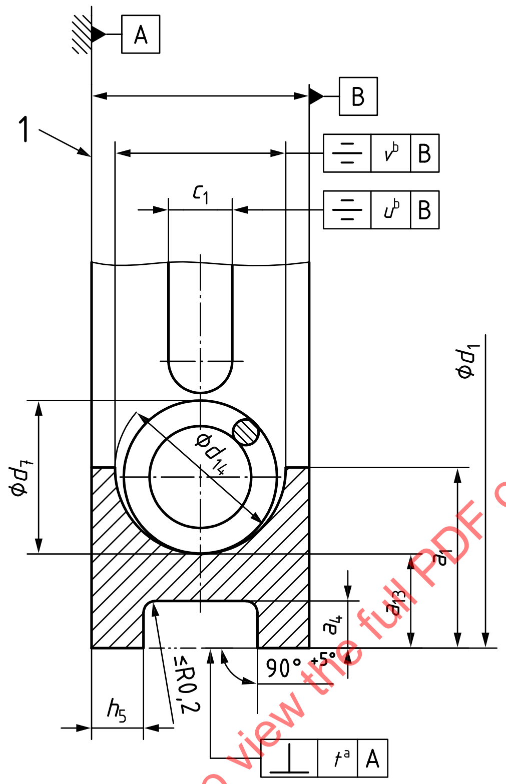
Piston ring ISO 6626-2 DSF-CNP- 100 × 2 × 0,25 - MC12 / CSN PN1,0

5.4 Type SSF — Coil-spring loaded slotted oil control ring with rectangular groove

5.4.1 General features and dimensions

See Figure 4 and Table 10.

Dimensions in millimetres



Key

1 reference plane

a See Table 4.

b See Table 5.

Figure 4 — Type SSF

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

EXAMPLE Coil-spring loaded slotted oil control ring with rectangular groove (SSF) of nominal diameter d_1 = 80 mm (80), nominal ring width h_1 = 2,5 mm (2,5), land width h_5 = 0,50 mm (0,50), 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 nominal contact pressure p_0 = 1,0 N/mm^2 (PN1,0). Parameters in parenthesis are used in the ISO ring designation:

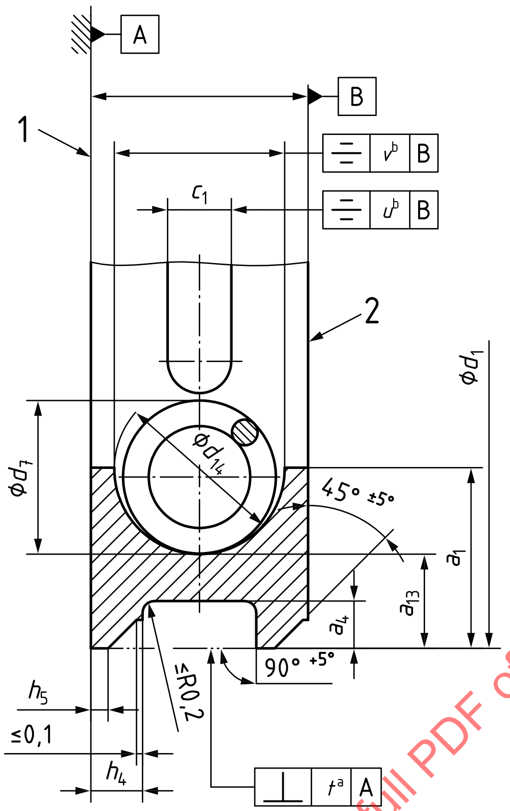
Piston ring ISO 6626-2 SSF- 80 × 2,5 × 0,50 - MC12 / CSN PN1,0

5.5 Type GSF — Coil-spring loaded double bevelled oil control ring

5.5.1 General features and dimensions

See Figure 5 and Table 11. Top side marking is mandatory in accordance with ISO 6621-4.

Dimensions in millimetres



Key

1 reference plane

2 top side identification mark

a See Table 4.

b See Table 5.

Figure 5 — Type GSF

5.5.2 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), land width h_5 = 0,30 mm (0,30), 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 nominal contact pressure p_0 = 1,0 N/mm^2 (PN1,0). Parameters in parenthesis are used in the ISO ring designation:

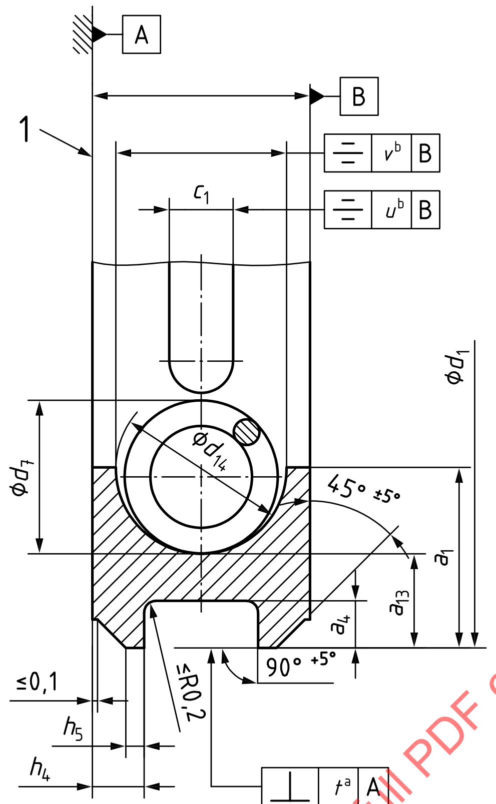
Piston ring ISO 6626-2 GSF- 75 × 2,5 × 0,30 - MC12 / CSN PN1,0

5.6 Type DSF — Coil-spring loaded bevelled edge oil control ring

5.6.1 General features and dimensions

See Figure 6 and Table 11.

Dimensions in millimetres



Key

1 reference plane

a See Table 4.

b See Table 5.

Figure 6 — Type DSF

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

EXAMPLE Coil-spring loaded bevelled edge oil control ring (DSF) of nominal diameter d_1 = 90 mm (90), nominal ring width h_1 = 2,5 mm (2,5), land width h_5 = 0,30 mm (0,30), 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 nominal contact pressure p_0 = 1,0 N/mm^2 (PN1,0). Parameters in parenthesis are used in the ISO ring designation:

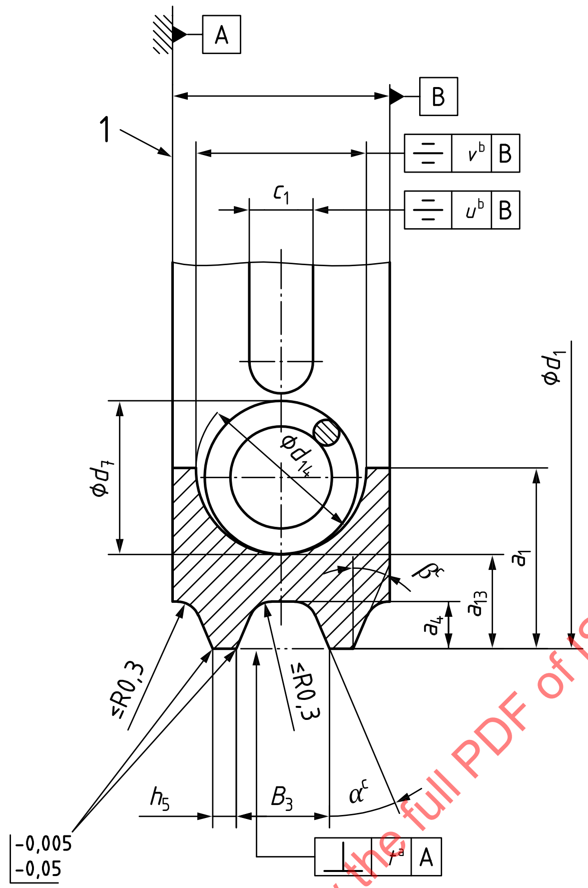
Piston ring ISO 6626-2 DSF- 90 × 2,5 × 0,30 - MC12 / CSN PN1,0

5.7 Type DSF-NG — Coil-spring loaded bevelled edge oil control ring (face geometry similar to type DSF-C or type DSF-CNP)

5.7.1 General features and dimensions

See Figure 7 and Tables 12 and 13.

Dimensions in millimetres



Key

1 reference plane

a See Table 4.

b See Table 5.

c Angle α and β to be agreed between manufacturer and customer, angles can be different (historical value is 35°).

Figure 7 — Type DSF-NG

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

EXAMPLE Coil-spring loaded bevelled edge oil control ring (DSF-NG) (face geometry similar to type DSF-C or type DSF-CNP) of nominal diameter d_1 = 80 mm (80), nominal ring width h_1 = 2,0 mm (2,0), land width h_5 = 0,25 mm (0,25), 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 nominal contact pressure p_0 = 1,0 N/mm^2 (PN1,0). Parameters in parenthesis are used in the ISO ring designation:

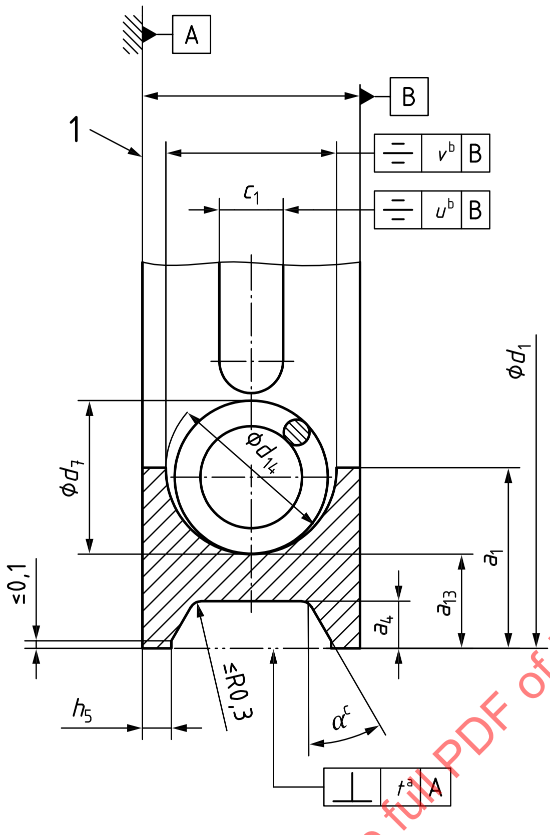
Piston ring ISO 6626-2 DSF-NG - 80 × 2,0 × 0,25 - MC12 / CSN PN1,0

5.8 Type SSF-L — Coil-spring loaded slotted oil control ring with rectangular groove at periphery and V-shaped groove beneath

5.8.1 General features and dimensions

See Figure 8 and Table 14.

Dimensions in millimetres



Key

1 reference plane

a See Table 4.

b See Table 5.

c Angle α and β to be agreed between manufacturer and customer, angles can be different (historical value is 35°).

Figure 8 — Type SSF-L

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

EXAMPLE Coil-spring loaded slotted oil control ring with rectangular groove at periphery and V-shaped groove beneath (SSF-L) with 0,4 mm nominal land width of nominal diameter d_1 = 80 mm (80), nominal ring width h_1 = 2,5 mm (2,5), land width h_5 = 0,40 mm (0,40), 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 nominal contact pressure p_0 = 1,0 N/mm^2 (PN1,0). Parameters in parenthesis are used in the ISO ring designation:

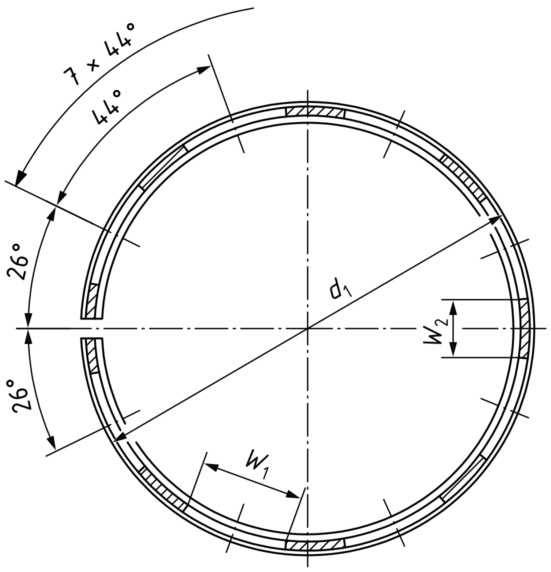
Piston ring ISO 6626-2 SSF-L - 80 × 2,5 × 0,40 - MC12 / CSN PN1,0

6 Common features

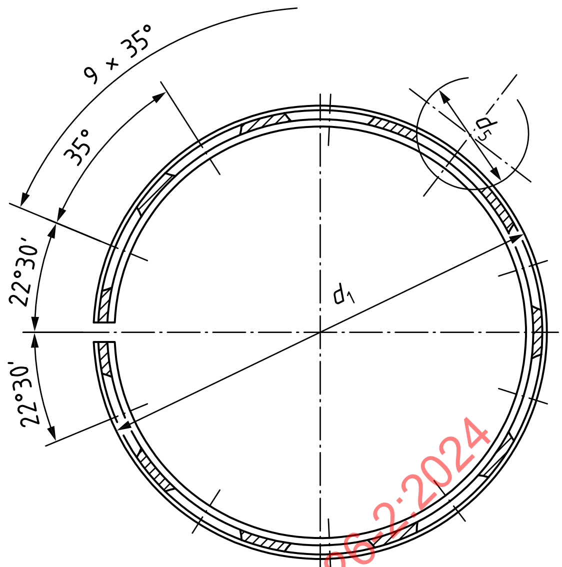
6.1 Oil drainage by slots or holes

6.1.1 Arrangement of slots

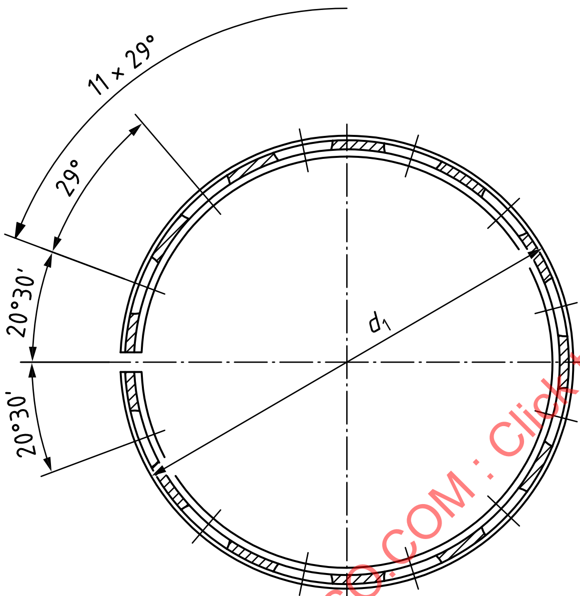
Figure 9 shows the arrangement of oil drainage slots and Table 1 gives the cutter diameter.



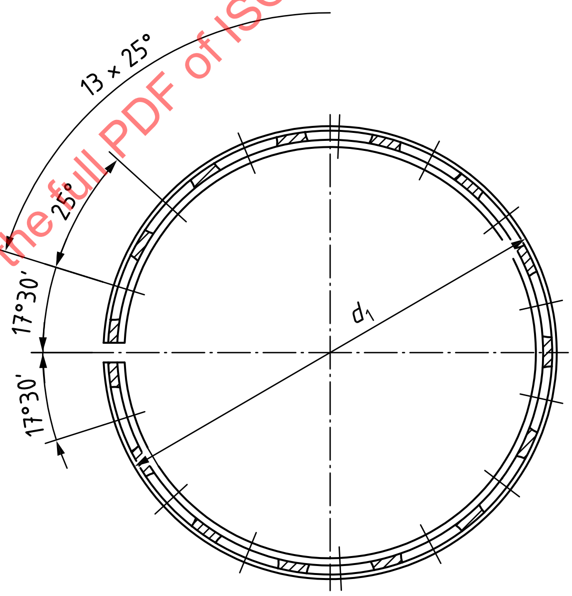
a) 8 slots for 60 mm ≤ d_1 < 80 mm



b) 10 slots for 80 mm ≤ d_1 < 115 mm



c) 12 slots for 115 mm ≤ d_1 < 150 mm



d) 14 slots for 150 mm ≤ d_1 ≤ 160 mm

Figure 9 — Arrangement of slots

Table 1 — Cutter diameter

Dimensions in millimetres

Nominal diameter d_1	Cutter diameter d_5 max.
60 ≤ d_1 < 150	60
150 ≤ d_1 ≤ 160	75

6.1.2 Slot length

6.1.2.1 Standard slot length

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

The maximum difference between w_1 and w_2 shall be 4 mm.

6.1.2.2 Reduced slot length — Code WK

Oil control rings with reduced slot length will retain the same number of slots and the same angular spacing. The maximum difference between w_1 and w_2 for the standard slot length does not apply.

See Table 2.

Table 2 — Reduced slot length

Dimensions in millimetres

d_1	w_1 (range of nominal values)
$60 \leq d_1 < 80$	6 ... 11
$80 \leq d_1 < 115$	8 ... 13
$115 \leq d_1 < 150$	10 ... 15
$150 \leq d_1 \leq 160$	12 ... 18

6.1.3 Arrangement of holes

Arrangement of holes is shown in Figure 10. Deviating arrangements shall be agreed between manufacturer and customer.

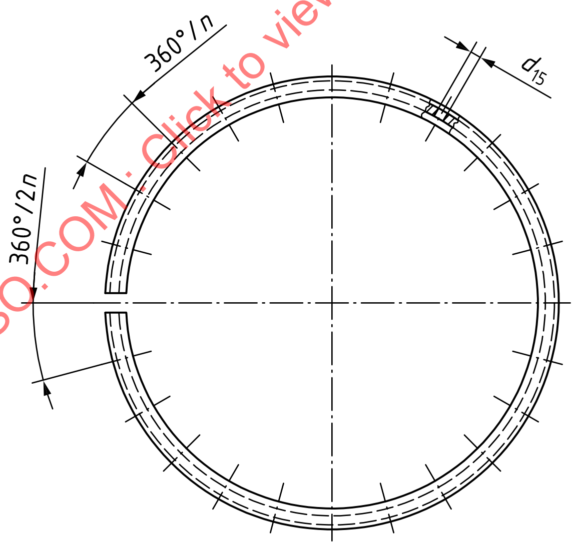


Figure 10 — Arrangement of holes

6.1.4 Diameter and number of holes

The diameter (d_{15}) and number (n) of holes shall be agreed between manufacturer and customer.

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

See Figure 11 and Table 3.

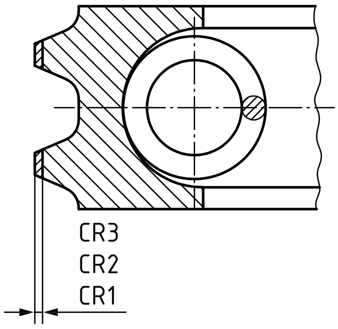


Figure 11 — Plating thickness

Table 3 — Plating thickness

Dimensions in millimetres

Code	Thickness[a] min.
CR1	0,05
CR2	0,10
CR3	0,15

[a] For plating thickness tolerances, see ISO 6621-4.

6.3 Peripheral edges at gap of chromium plated oil control rings

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

6.4 Spring groove, slot, and land offsets

See Figures 2 to 8 and Tables 4 and 5.

Table 4 — Permitted land offset

Dimensions in millimetres

Ring width h_1	t
$1{,}5 \leq h_1 < 2{,}5$	0,015
$2{,}5 \leq h_1$	0,025

Table 5 — Permitted spring groove and slot offset

Dimensions in millimetres

Ring width h_1	v	u
$1{,}5 \leq h_1 < 2{,}5$	0,2	0,3
$2{,}5 \leq h_1 < 3{,}5$	0,3	0,4
$3{,}5 \leq h_1$	0,4	0,4

7 Coil springs

7.1 Types of coil spring

All values in the dimensional tables of Clause 9 are based on cylindrical coil springs made of round wire. The three designs shown in Figures 12 to 14 are common. The use of different spring designs may be agreed between manufacturer and customer. Changed spring groove configurations and dimensions could then be necessary.

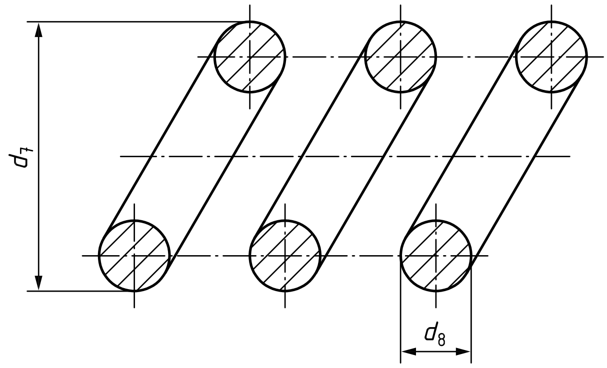
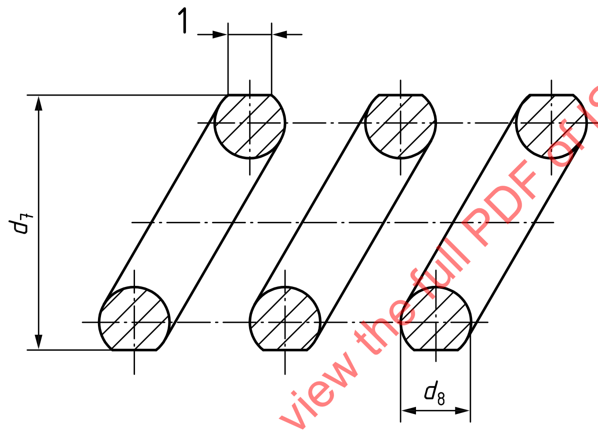


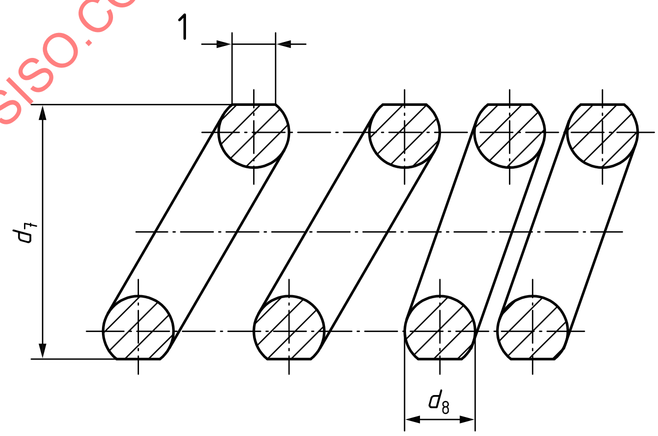
Figure 12 — Type CSN coil spring with constant pitch



Key

1 approximately 0,8 × d_8

Figure 13 — Type CSG coil spring with constant pitch (coil diameter, d_7, ground)



Key

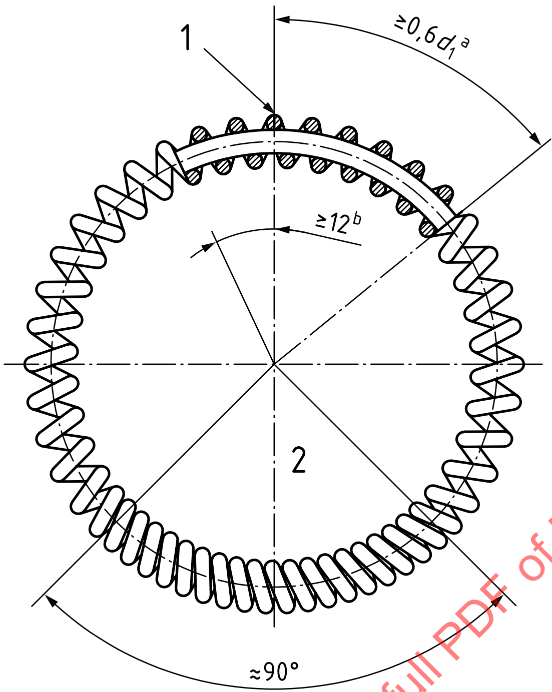
1 approximately 0,8 × d_8

Figure 14 — Type CSE coil spring with variable pitch (coil diameter, d_7, ground)

7.2 Latch pin and location of small pitch in the coil spring

Figure 15 illustrates the location of the small pitch area of the coil spring relative to the spring gap.

Dimensions in millimetres



Key

1 spring gap
2 area with small pitch
a Latch pin free length.
b Latch pin fixed length.

Figure 15 — Position of area with small pitch

7.3 Coil spring excursion (extended gap)

Coil spring excursion, f_1, is the distance between the ends of the ring gap, with unstressed ring, measured in the middle of the spring groove (see Figure 16). The maximum value of f_1 is given in Table 6.

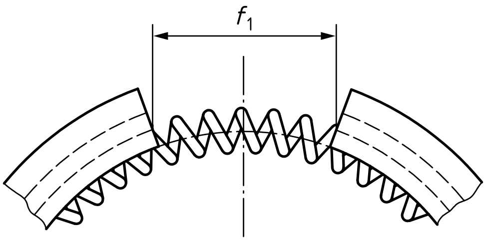


Figure 16 — Coil spring excursion

Table 6 — Coil spring excursion

Dimensions in millimetres

Nominal diameter d_1	f_1 max.
$60 \leq d_1 < 125$	$0{,}13 \times d_1$
$125 \leq d_1 \leq 160$	$0{,}12 \times d_1$

7.4 Position of coil spring gap and fixing

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

7.5 Material

Coil springs are made of materials as shown in ISO 6621-3, subclasses MC62 (valve spring wire), MC64 (chromium-silicon steel), MC67 (stainless steel) and MC68 (piano wire).

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.

Test conditions and the permissible loss of tangential forces shall be as specified in ISO 6621-5.

8 Tangential force and nominal contact pressure

8.1 Tangential force, F_t

The tangential force, F_t, 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.

8.1.1 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.

8.1.2 General tangential force, F_t

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_0, in N/mm^2, calculated from the formula:

$$F_t = \frac{1}{2} \cdot d_1 \cdot 2 \cdot h_5 \cdot p_0$$

The land width, h_5, depends on the ring type, nominal diameter and ring width. Recommended values for land width, h_5, are mentioned for every ring type in Clause 9. Other values may be agreed between manufacturer and customer.

8.1.3 Actual tangential force, F_t, and tolerance

The actual tangential force of a spring-loaded oil control ring can be calculated with the tabulated normalized tangential force, F_t/d_1, given in Table 5 according to the required nominal contact pressure, p_o, from the formula:

$$F_t = F_N \cdot d_1$$

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

8.1.4 Normalized tangential force, F_N

The normalized tangential forces, F_N (=F_t/d_1), for different nominal contact pressure, p_0, are tabulated in Table 7.

Table 7 — Normalized tangential forces, F_N

Code	P_0 [N/mm^2]	h_5 [mm]													
		0,20	**0,25**	**0,28**	**0,30**	**0,35**	**0,40**	**0,50**	**0,60**	**0,70**	**0,80**	**0,90**	**1,10**	**1,30**	**1,60**
PN2,5	**2,5**	0,50	0,63	0,70	0,75	0,88	1,00	1,25	1,50	1,75	2,00	2,25	2,75	3,25	4,00
PN2,0	**2,0**	0,40	0,50	0,56	0,60	0,70	0,80	1,00	1,20	1,40	1,60	1,80	2,20	2,60	3,20
PN1,5	**1,5**	0,30	0,38	0,42	0,45	0,53	0,60	0,75	0,90	1,05	1,20	1,35	1,65	1,95	2,40
PN1,0	**1,0**	0,20	0,25	0,28	0,30	0,35	0,40	0,50	0,60	0,70	0,80	0,90	1,10	1,30	1,60
PN0,5	**0,5**	0,10	0,13	0,14	0,15	0,18	0,20	0,25	0,30	0,35	0,40	0,45	0,55	0,65	0,80

8.2 Nominal contact pressure, p_0

New contact pressure classes are introduced and have replaced the classes of nominal contact pressure used in ISO 6626:1989, which are shown in ISO 6626-1:2024, Annex A for reference.

The nominal contact pressure, p_0, shall be chosen to suit the application and requirements regarding oil consumption and friction losses. The range of the usual nominal contact pressure, p_0, is given in Table 7. Other values may be agreed between manufacturer and customer.

9 Dimensions

The dimensions are shown in Tables 8 to 16. Land spacing B_3 shall be agreed between manufacturer and customer.

Table 8 — Width dimensions of DSF-C narrow oil control rings

Dimensions in millimetres

Nominal diameter	Radial thickness over coil spring a_{12}		Ring width h_1			Closed gap	Radial wall thickness a_1			Land width h_5 for all h_1
d_1	1	2	1	2	Tolerance	s_1	1	2	Tolerance	
60≤ d_1 <65	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,20 +0,20 0	2,15	2,20	±0,15 within a ring 0,15 max.	0,25 ±0,07
65≤ d_1 <70	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,20 +0,20 0	2,15	2,20	±0,15 within a ring 0,15 max.	0,25 ±0,07
70≤ d_1 <75	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,20 +0,20 0	2,25	2,30	±0,15 within a ring 0,15 max.	0,25 ±0,07
75≤ d_1 <80	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,25 +0,25 0	2,25	2,30	±0,15 within a ring 0,15 max.	0,25 ±0,07
80≤ d_1 <85	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,25 +0,25 0	2,35	2,40	±0,15 within a ring 0,15 max.	0,25 ±0,07
85≤ d_1 <90	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,25 +0,25 0	2,35	2,40	±0,15 within a ring 0,15 max.	0,25 ±0,07
90≤ d_1 <95	2,85 0 − 0,25	3,10 0 − 0,25	2,0	2,5	-0,01 -0,03 For phosphate PO surface: -0,005 -0,030	0,30 +0,25 0	2,45	2,50	±0,15 within a ring 0,15 max.	0,25 ±0,07

Table 8 *(continued)*

Nominal diameter	Radial thickness over coil spring a_{12}		Ring width h_1			Closed gap	Radial wall thickness a_1			Land width h_5 for all h_1
d_1	1	2	1	2	Tolerance	s_1	1	2	Tolerance	
95≤ d_1 <100	2,85 0 − 0,25	3,10 0 − 0,25	2,0	2,5	-0,01 -0,03 For phosphated PO surface: − 0,005 − 0,030	0,30 +0,25 0	2,45	2,50	±0,15 within a ring 0,15 max.	0,25 ±0,07
100≤ d_1 <105	2,85 0 − 0,25	3,10 0 − 0,25	2,0	2,5	-0,01 -0,03 For phosphated PO surface: -0,005 − 0,030	0,30 +0,25 0	2,50	2,55	±0,20 within a ring 0,20 max.	0,25 ±0,07
105≤ d_1 <110	2,85 0 − 0,25	3,10 0 − 0,25	2,0	2,5	-0,01 -0,03 For phosphated PO surface: -0,005 − 0,030	0,30 +0,25 0	2,50	2,55	±0,20 within a ring 0,20 max.	0,25 ±0,07
110≤ d_1 <115	3,1 0 − 0,25	3,35 0 − 0,25	2,5	3,0	-0,01 -0,03 For phosphated PO surface: -0,005 -0,030	0,35 +0,30 0	2,55	2,6	±0,20 within a ring 0,20 max.	0,25 ±0,07
115≤ d_1 <120	3,1 0 − 0,25	3,35 0 − 0,25	2,5	3,0	-0,01 -0,03 For phosphated PO surface: -0,005 − 0,030	0,35 +0,30 0	2,55	2,6	±0,20 within a ring 0,20 max.	0,25 ±0,07
120≤ d_1 <125	3,15 0 − 0,25	3,4 0 − 0,25	2,5	3,0	-0,01 -0,03 For phosphated PO surface: -0,005 − 0,030	0,35 +0,30 0	2,6	2,65	±0,20 within a ring 0,20 max.	0,25 ±0,07
125≤ d_1 <130	3,15 0 − 0,25	3,4 0 − 0,25	3,0	3,5	-0,01 -0,03 For phosphated PO surface: -0,005 − 0,030	0,35 +0,30 0	2,6	2,65	±0,20 within a ring 0,20 max.	0,25 ±0,07

Table 8 *(continued)*

Nominal diameter	Radial thickness over coil spring a_{12}		Ring width h_1			Closed gap	Radial wall thickness a_1			Land width h_5 for all h_1
d_1	1	2	1	2	Tolerance	s_1	1	2	Tolerance	
130≤ d_1 <135	3,5 0 − 0,25	3,8 0 − 0,25	3,0	3,5	-0,01 -0,03 For phosphated PO surface: -0,005 − 0,030	0,4 +0,30 0	2,75	2,85	±0,20 within a ring 0,20 max.	0,25 ±0,07
135≤ d_1 <140	3,5 0 − 0,25	3,8 0 − 0,25	3,0	3,5	-0,01 -0,03 For phosphated PO surface: -0,005 − 0,030	0,4 +0,30 0	2,75	2,85	±0,20 within a ring 0,20 max.	0,25 ±0,07
140≤ d_1 <145	3,7 0 − 0,25	4,0 0 − 0,25	3,0	3,5	-0,01 -0,03 For phosphated PO surface: -0,005 − 0,030	0,4 +0,30 0	2,95	3,05	±0,20 within a ring 0,20 max.	0,25 ±0,07
145≤ d_1 <150	3,7 0 − 0,25	4,0 0 − 0,25	3,0	3,5	-0,01 -0,035 For phosphated PO surface: -0,005 − 0,030	0,4 +0,30 0	2,95	3,05	±0,20 within a ring 0,20 max.	0,25 ±0,07
150≤ d_1 <155	3,7 0 − 0,25	4,0 0 − 0,25	3,0	3,5	-0,01 -0,035 For phosphated PO surface: -0,005 − 0,035	0,45 +0,35 0	3,15	3,25	±0,20 within a ring 0,20 max.	0,25 ±0,07
155≤ d_1 ≤160	3,7 0 − 0,25	4,0 0 − 0,25	3,0	3,5	-0,01 -0,035 For phosphated PO surface: -0,005 − 0,035	0,45 +0,35 0	3,15	3,25	±0,20 within a ring 0,20 max.	0,25 ±0,07

Table 9 — Groove and spring dimensions of DSF-C narrow oil control rings

Dimensions in millimetres

Nominal diameter	**Groove depth** a_4		**Groove depth and bridge** a_{13}		**Coil spring groove diameter** d_{14}		**Coil spring diameter** d_7	
d_1	1	2	1	2	1	2	1	2
60≦ d_1 <90	0,35 ±0,10	0,4 ±0,10	1,35 0 − 0,15	1,40 0 − 0,15	1,50 +0,10 0	1,70 +0,10 0	1,40 0 -0,10	1,60 0 -0,10
90≦ d_1 <110	0,35 ±0,10	0,4 ±0,10	1,45 0 − 0,15	1,50 0 − 0,15	1,5 +0,1 0	1,7 +0,1 0	1,4 0 -0,1	1,6 0 -0,1
110≦ d_1 <120	0,4 ±0,10	0,45 ±0,10	1,5 0 − 0,15	1,55 0 − 0,15	1,7 +0,1 0	1,9 +0,1 0	1,6 0 -0,1	1,8 0 -0,1
120≦ d_1 <125	0,4 ±0,10	0,45 ±0,10	1,55 0 − 0,15	1,6 0 − 0,15	1,7 +0,1 0	1,9 +0,1 0	1,6 0 -0,1	1,8 0 -0,1
125≦ d_1 <130	0,40 ±0,10	0,45 ±0,10	1,55 0 − 0,15	1,6 0 − 0,15	1,7 +0,1 0	1,9 +0,1 0	1,6 0 -0,1	1,8 0 -0,1
130≦ d_1 <140	0,45 ±0,10	0,50 ±0,10	1,7 0 − 0,15	1,8 0 − 0,15	1,9 +0,1 0	2,1 +0,1 0	1,8 0 -0,1	2,0 0 -0,1
140≦ d_1 <150	0,45 ±0,10	0,50 ±0,10	1,9 0 − 0,15	2,0 0 − 0,15	1,9 +0,1 0	2,1 +0,1 0	1,8 0 − 0,1	2,0 0 − 0,1
150≦ d_1 ≦160	0,45 ±0,10	0,50 ±0,10	1,9 0 − 0,15	2,0 0 − 0,15	1,9 +0,1 0	2,1 +0,1 0	1,8 0 − 0,1	2,0 0 − 0,1

Table 10 — Width dimensions of DSF-CNP narrow oil control rings

Dimensions in millimetres

Nominal diameter	**Radial thickness over coil spring** a_{12}		**Ring width** h_1			**Closed gap**	**Radial wall thickness** a_1			**Land width** h_5 for all h_1 recommended range
d_1	1	2	1	2	**Tolerance**	s_1	1	2	**Tolerance**	
60≦ d_1 <65	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,20 +0,20 0	2,15	2,20	±0,15 within a ring 0,15 max.	0,25 – 0,30 ±0,12
65≦ d_1 <70	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,20 +0,20 0	2,15	2,20	±0,15 within a ring 0,15 max.	0,25 – 0,30 ±0,12
70≦ d_1 <75	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,20 +0,20 0	2,25	2,30	±0,15 within a ring 0,15 max.	0,25 – 0,30 ±0,12
75≦ d_1 <80	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,25 +0,25 0	2,25	2,30	±0,15 within a ring 0,15 max.	0,25 – 0,30 ±0,12
80≦ d_1 <85	2,75 0 − 0,25	3,00 0 -0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,25 +0,25 0	2,35	2,40	±0,15 within a ring 0,15 max.	0,25 – 0,30 ±0,12
85≦ d_1 <90	2,75 0 − 0,25	3,00 0 − 0,25	2,0	2,5	− 0,010 − 0,030 For phosphated PO surface: − 0,005 − 0,030	0,25 +0,25 0	2,35	2,40	±0,15 within a ring 0,15 max.	0,25 – 0,30 ±0,12
90≦ d_1 <95	2,85 0 − 0,25	3,10 0 − 0,25	2,0	2,5	-0,01 -0,03 For phosphated PO surface: − 0,005 − 0,030	0,30 +0,25 0	2,45	2,50	±0,15 within a ring 0,15 max.	0,25 – 0,30 ±0,12

Table 10 *(continued)*

Nominal diameter	Radial thickness over coil spring a_{12}		Ring width h_1			Closed gap	Radial wall thickness a_1			Land width h_5 for all h_1 recommended range
d_1	1	2	1	2	Tolerance	s_1	1	2	Tolerance	
95≦ d_1 <100	2,85 0 − 0,25	3,10 0 − 0,25	2,0	2,5	-0,01 -0,03 For phosphated PO surface: − 0,005 − 0,030	0,30 +0,25 0	2,45	2,50	±0,15 within a ring 0,15 max.	0,25 – 0,30 ±0,12
100≦ d_1 <105	2,85 0 − 0,25	3,10 0 − 0,25	2,0	2,5	-0,01 -0,03 For phosphated PO surface: − 0,005 − 0,030	0,30 +0,25 0	2,50	2,55	±0,20 within a ring 0,20 max.	0,25 – 0,30 ±0,12
105≦ d_1 ≦110	2,85 0 − 0,25	3,10 0 − 0,25	2,0	2,5	-0,01 -0,03 For phosphated PO surface: − 0,005 − 0,030	0,30 +0,25 0	2,50	2,55	±0,20 within a ring 0,20 max.	0,25 – 0,30 ±0,12

Table 11 — Groove and spring dimensions of DSF-CNP narrow oil control rings

Dimensions in millimetres

Nominal diameter	Groove depth a_4		Groove depth and bridge a_{13}		Coil spring groove diameter d_{14}		Coil spring diameter d_7	
d_1	1	2	1	2	1	2	1	2
60≦ d_1 <90	0,35 ±0,10	0,4 ±0,10	1,35 0 − 0,15	1,40 0 − 0,15	1,50 +0,10 0	1,70 +0,10 0	1,40 0 -0,10	1,60 0 -0,10
90≦ d_1 ≦110	0,35 ±0,10	0,4 ±0,10	1,45 0 − 0,15	1,50 0 − 0,15	1,5 +0,1 0	1,7 +0,1 0	1,4 0 -0,1	1,6 0 -0,1

Table 12 — Width dimensions of SSF narrow oil control

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	Coil spring groove diameter	Coil spring diameter
d_1	a_{12}	h_1	Tolerance	s_1	a_1	Tolerance	h_5	a_4	a_{13}	d_{14}	d_7
$60 \leq d_1 < 65$	3,00 0 -0,25	2,50	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,20 +0,20 0	2,20	±0,15 within a ring 0,15 max.	0,50 ±0,10	0,45 ±0,10	1,40 0 -0,15	1,70 +0,10 0	1,60 0 -0,10
$65 \leq d_1 < 70$	3,00 0 -0,25	2,50	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,20 +0,20 0	2,20	±0,15 within a ring 0,15 max.	0,50 ±0,10	0,45 ±0,10	1,40 0 -0,15	1,70 +0,10 0	1,60 0 -0,10
$70 \leq d_1 < 75$	3,00 0 -0,25	2,50	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,20 +0,20 0	2,30	±0,15 within a ring 0,15 max.	0,50 ±0,10	0,45 ±0,10	1,40 0 -0,15	1,70 +0,10 0	1,60 0 -0,10
$75 \leq d_1 < 80$	3,00 0 -0,25	2,50	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,25 +0,25 0	2,30	±0,15 within a ring 0,15 max.	0,50 ±0,10	0,45 ±0,10	1,40 0 -0,15	1,70 +0,10 0	1,60 0 -0,10
$80 \leq d_1 < 85$	3,00 0 -0,25	2,50	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,25 +0,25 0	2,40	±0,15 within a ring 0,15 max.	0,50 ±0,10	0,45 ±0,10	1,40 0 -0,15	1,70 +0,10 0	1,60 0 -0,10
$85 \leq d_1 < 90$	3,00 0 -0,25	2,50	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,25 +0,25 0	2,40	±0,15 within a ring 0,15 max.	0,50 ±0,10	0,45 ±0,10	1,40 0 -0,15	1,70 +0,10 0	1,60 0 -0,10
$90 \leq d_1 < 95$	3,1 0 -0,25	2,50	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,3 +0,25 0	2,5	±0,15 within a ring 0,15 max.	0,50 ±0,10	0,45 ±0,10	1,5 0 -0,15	1,70 +0,10 0	1,60 0 -0,10

Table 12 *(continued)*

Nominal diameter	Radial thickness over coil spring	Ring width		Closed gap	Radial wall thickness		Land width	Groove depth	Groove depth and bridge	Coil spring groove diameter	Coil spring diameter
d_1	a_{12}	h_1	Tolerance	s_1	a_1	Tolerance	h_5	a_4	a_{13}	d_{14}	d_7
95≦ d_1 <100	3,10 0 -0,25	2,5	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,3 +0,25 0	2,5	±0,15 within a ring 0,15 max.	0,5 ±0,10	0,45 ±0,10	1,50 0 -0,15	1,7 +0,1 0	1,6 0 -0,10
100≦ d_1 <105	3,10 0 -0,25	2,5	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,3 +0,25 0	2,55	±0,20 within a ring 0,20 max.	0,5 ±0,10	0,45 ±0,10	1,50 0 -0,15	1,7 +0,1 0	1,6 0 -0,10
105≦ d_1 ≦110	3,10 0 -0,25	2,5	-0,010 -0,030 For phosphated PO surface: -0,005 -0,030	0,3 +0,25 0	2,55	±0,20 within a ring 0,20 max.	0,5 ±0,10	0,45 ±0,10	1,50 0 -0,15	1,7 +0,1 0	1,6 0 -0,10