

Piston rings up to 200 mm diameter for reciprocating internal combustion engines

**Part 8. Designs, dimensions and designations for
multi-piece oil control rings**

**Section 8.1 Specification for
coil-spring-loaded oil control rings**

Committees responsible for this British Standard

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- Association of Consulting Engineers
- British Railways Board
- Ministry of Defence
- Society of Motor Manufacturers and Traders Limited

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Contents

	Page
Committees responsible	Inside front cover
National foreword	iii
Specification	
0 Introduction	1
1 Scope and field of application	1
2 References	1
3 Piston ring types and designation examples	2
4 Common features	9
5 Coil spring	11
6 Tangential force and nominal contact pressure	12
7 Dimensions	16
Tables	
1 Cutter diameter	9
2 Reduced slot length	10
3 Layer thickness	10
4 Land offset tolerance	10
5 Spring groove offset tolerance	10
6 Coil-spring excursion	12
7 Classes of nominal contact pressure	13
8 Oil control ring pressure classes	15
9 Dimensions for DSF-C coil-spring-loaded oil control rings	16
10 Dimensions for DSF-CNP coil-spring-loaded oil control rings	20
11 Dimensions for SSF coil-spring-loaded oil control rings	24
12 Dimensions for GSF and DSF coil-spring-loaded oil control rings	28
13 Dimensions for DSF-NG coil-spring-loaded oil control rings	32
14 Dimensions for SSF-L coil-spring-loaded oil control rings	36
15 Dimensions for DSF-C coil-spring-loaded oil control rings with special ring width $h_1 = 4,75 \text{ mm (3/16 in)}$	40
16 Dimensions for DSF-CNP coil-spring-loaded oil control rings with special ring width $h_1 = 4,75 \text{ mm (3/16 in)}$	42
17 Dimensions for SSF coil-spring-loaded oil control rings with special ring width $h_1 = 4,75 \text{ mm (3/16 in)}$	44
18 Dimensions for GSF and DSF coil-spring-loaded oil control rings with special ring width $h_1 = 4,75 \text{ mm (3/16 in)}$	46
19 Dimensions for DSF-NG coil-spring-loaded oil control rings with special ring width $h_1 = 4,75 \text{ mm (3/16 in)}$	48
20 Dimensions for SSF-L coil-spring-loaded oil control rings with special ring width $h_1 = 4,75 \text{ mm (3/16 in)}$	50

	Page
Figures	
1 Type DSF-C	2
2 Type DSF-CNP	3
3 Type SSF	4
4 Type GSF	5
5 Type DSF	6
6 Type DSF-NG	7
7 Type SSF-L	8
8 Arrangement of slots	9
9 Layer thickness	10
10 Type CSN coil spring	11
11 Type CSG coil spring	11
12 Type CSE coil spring	11
13 Position of area with small pitch	11
14 Coil-spring excursion	12
15 Characteristic values of p_o depending on d_1	14

National foreword

This Section of BS 5341 has been prepared under the direction of the Machinery and Components Standards Policy Committee and is identical with ISO 6624 : 1989 'Internal combustion engines — Piston rings — Coil-spring-loaded oil control rings' published by the International Organization for Standardization (ISO).

Full requirements for piston rings for internal combustion engines are given in the following Parts and Sections of BS 5341 which are identical with ISO standards as indicated:

Part 6. Vocabulary, inspection methods and generic specifications

Section 6.1	Vocabulary (Identical with ISO 6621-1)
Section 6.2	Inspection measuring principles (Identical with ISO 6621-2)
Section 6.3	Material specifications (Identical with ISO 6621-3)
Section 6.4	General specifications (Identical with ISO 6621-4)
Section 6.5	Quality requirements (Identical with ISO 6621-5)

Part 7. Designs, dimensions and designations for single piece rings

Section 7.1	Rectangular compression rings
Subsection 7.1.1	Specification for rectangular rings (Identical with ISO 6622-1)
¹ Subsection 7.1.2	Specification for rectangular rings with narrow ring width
Section 7.2	Specification for scraper rings (Identical with ISO 6623)
Section 7.3	Keystone and half keystone compression rings
Subsection 7.3.1	Specification for keystone rings (Identical with ISO 6624-1)
² Subsection 7.3.2	Specification for half keystone rings
Section 7.4	Specification for oil control rings (Identical with ISO 6625)

Part 8. Designs, dimensions and designations for multi-piece oil control rings

Section 8.1	Specification for coil-spring-loaded oil control rings (Identical with ISO 6626)
³ Section 8.2	Specification for expander/segment oil control rings

BS 5341 : Parts 6 to 8 supersede BS 5341 : Part 1 : 1976, Part 2 : 1977, Part 3 : 1976 and Part 4 : 1976 which are withdrawn.

¹) It is envisaged that this Subsection will be identical with ISO 6622-2 when the international standard is published. The technical report ISO/TR 6622-2 is published in the UK as a Draft for Development, DD 208.

²) It is envisaged that this Subsection will be identical with ISO 6624-2 when the international standard is published. The technical report ISO/TR 6624-2 is published in the UK as a Draft for Development, DD 209.

³) It is envisaged that this Section will be identical with ISO 6627 when the international standard is published. ISO/TR 6627 will shortly be published in the UK as a Draft for Development.

Cross-reference (additional to those listed above)

The Technical Committee has reviewed the provisions of ISO 1101 to which normative reference is made in the text and has decided that they are acceptable for use in conjunction with this standard.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Internal combustion engines — Piston rings — Coil-spring-loaded oil control rings

0 Introduction

ISO 6626 is one of a series of International Standards dealing with piston rings for reciprocating internal combustion engines:

ISO 6621, *Internal combustion engines — Piston rings —*

Part 1: Vocabulary.

Part 2: Measuring principles.

Part 3: Material specifications.

Part 4: General specifications.

Part 5: Quality requirements.

ISO 6622, *Internal combustion engines — Piston rings —*

Part 1: Rectangular rings.

*Part 2: Rectangular rings with narrow ring width.*¹⁾

ISO 6623, *Internal combustion engines — Piston rings — Scraper rings.*

ISO 6624, *Internal combustion engines — Piston rings —*

Part 1: Keystone rings.

*Part 2: Half keystone rings.*¹⁾

ISO 6625, *Internal combustion engines — Piston rings — Oil control rings.*

ISO 6626, *Internal combustion engines — Piston rings — Coil-spring-loaded oil control rings.*

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 refers to the specifications and requirements of ISO 6621-3 and ISO 6621-4 before completing his selection.

1 Scope and field of application

This International Standard specifies the essential dimensions of piston ring types DSF-C, DSF-CNP, SSF, GSF, DSF, DSF-NG and SSF-L coil-spring-loaded oil control rings.

For the cast iron part the recommended material is class 10 according to ISO 6621-3. For special applications material classes 20 to 50 may be used.

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

The tangential forces of coil-spring-loaded oil control rings can be varied over a wide range. Explanations and recommendations are given in clause 6.

The normal range for axial width of coil-spring-loaded oil control rings (3 to 8 mm inclusive) is divided into 0,5 or 1,0 mm steps. In tables 15 to 20 dimensions are given for coil-spring-loaded oil control rings with an axial width of 4,75 mm (i.e. 3/16 in) for existing applications in inch units.

This International Standard applies to coil-spring-loaded oil control rings up to 200 mm inclusive for reciprocating internal combustion engines. It may also be used for piston rings of compressors working under analogous conditions.

2 References

ISO 1101, *Technical drawings — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.*

ISO 6621, *Internal combustion engines — Piston rings —*

Part 3: Material specifications.

Part 4: General specifications.

Part 5: Quality requirements.

¹⁾ Part will be published as a Technical Report (ISO/TR 6622-2 and ISO/TR 6624-2).

3 Piston ring types and designation examples

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

3.1.1 General features

NOTE — Dimensions and forces: see tables 9 and 15.

Dimensions in millimetres

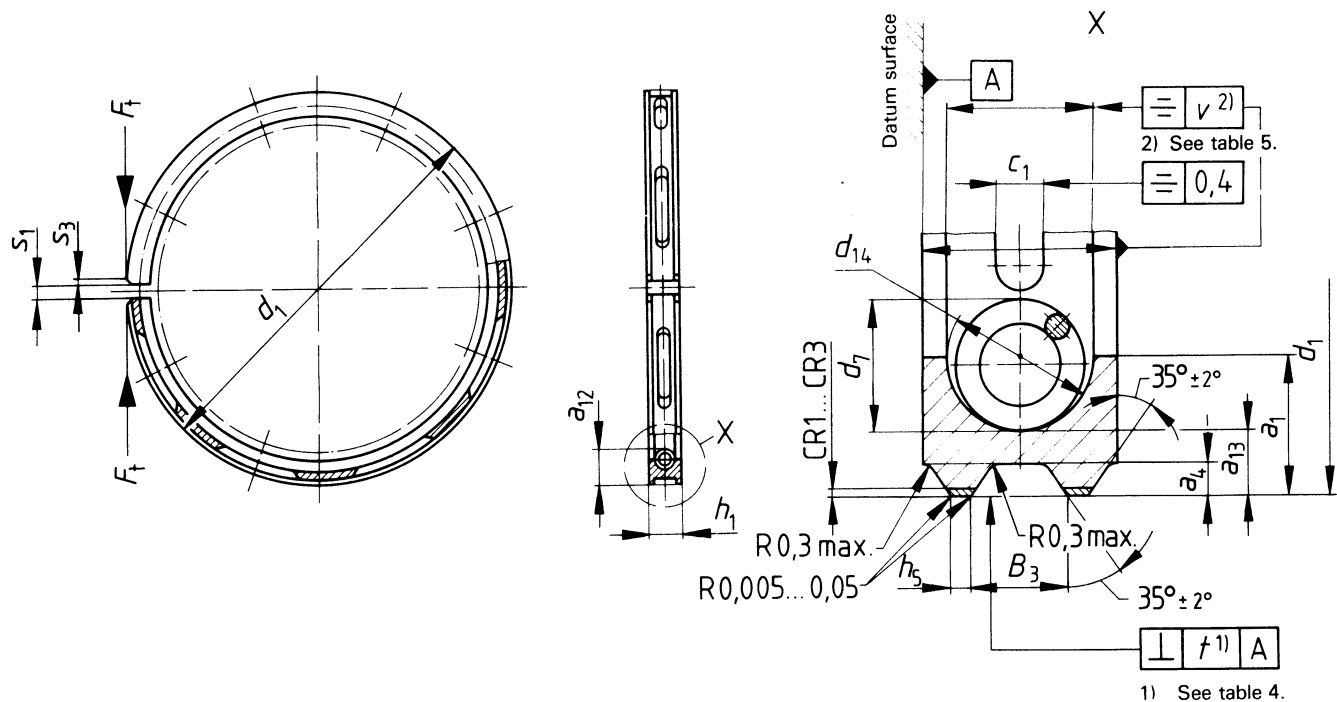


Figure 1 — Type DSF-C

3.1.2 Designation example

Designation of a piston ring complying with the requirements of ISO 6626, being a coil-spring-loaded bevelled-edge oil control ring, chromium-plated and profile ground (DSF-C), of nominal diameter $d_1 = 125$ mm (125), a nominal ring width $h_1 = 5$ mm (5), made of grey cast iron, non-heat-treated, material subclass 11 (MC 11). A selected closed gap of 0,2 mm (S02), a chromium layer thickness on the lands of 0,15 mm min. (CR3) phosphated on all cast iron surfaces to depth of 0,002 mm min. (PO), reduced slot length (WK), coil-spring with reduced heat set (WF), and variable pitch with coil diameter d_7 ground (CSE), tangential force F_t according to the medium nominal contact pressure class (PNM) and the ring marked with manufacturer's mark (MM):

Piston ring ISO 6626-DSF-C-125 x 5-MC11/S02 CR3 PO WK WF CSE PNM MM

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

3.2.1 General features

NOTE — Dimensions and forces: see tables 10 and 16.

Dimensions in millimetres

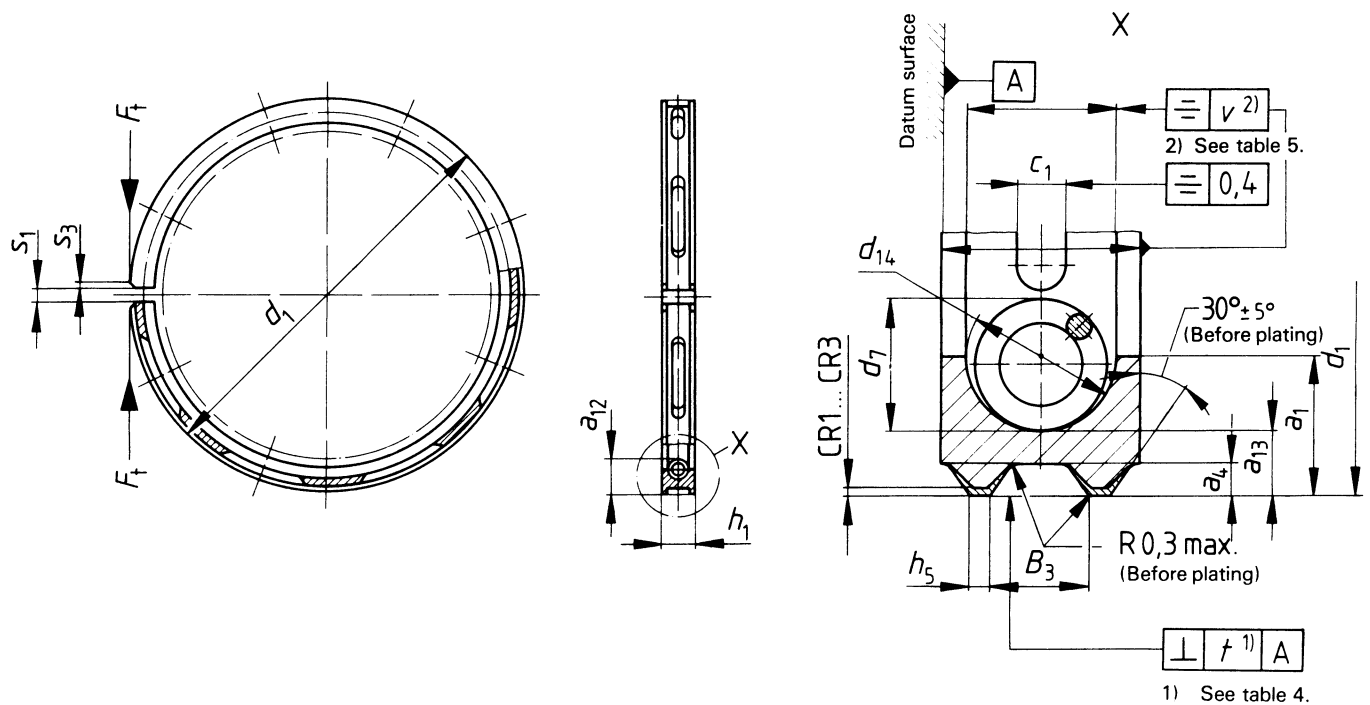


Figure 2 — Type DSF-CNP

3.2.2 Designation example

Designation of a piston ring complying with the requirements of ISO 6626, being a coil-spring-loaded bevelled-edge oil control ring, chromium-plated not profile ground (DSF-CNP), of nominal diameter $d_1 = 180$ mm (180) and nominal ring width $h_1 = 8$ mm (8), made of grey cast iron, non-heat-treated, material subclass 12 (MC12), a chromium layer thickness on the lands of 0,05 mm min. (CR1), constant pitch spring (CSN) and tangential force F_t according to the high nominal contact pressure class (PNH):

Piston ring ISO 6626-DSF-CNP - 180 × 8 - MC12/CR1 CSN PNH

3.3 Type SSF — Coil-spring-loaded slotted oil control ring

3.3.1 General features

NOTE — Dimensions and forces: see tables 11 and 17.

Dimensions in millimetres

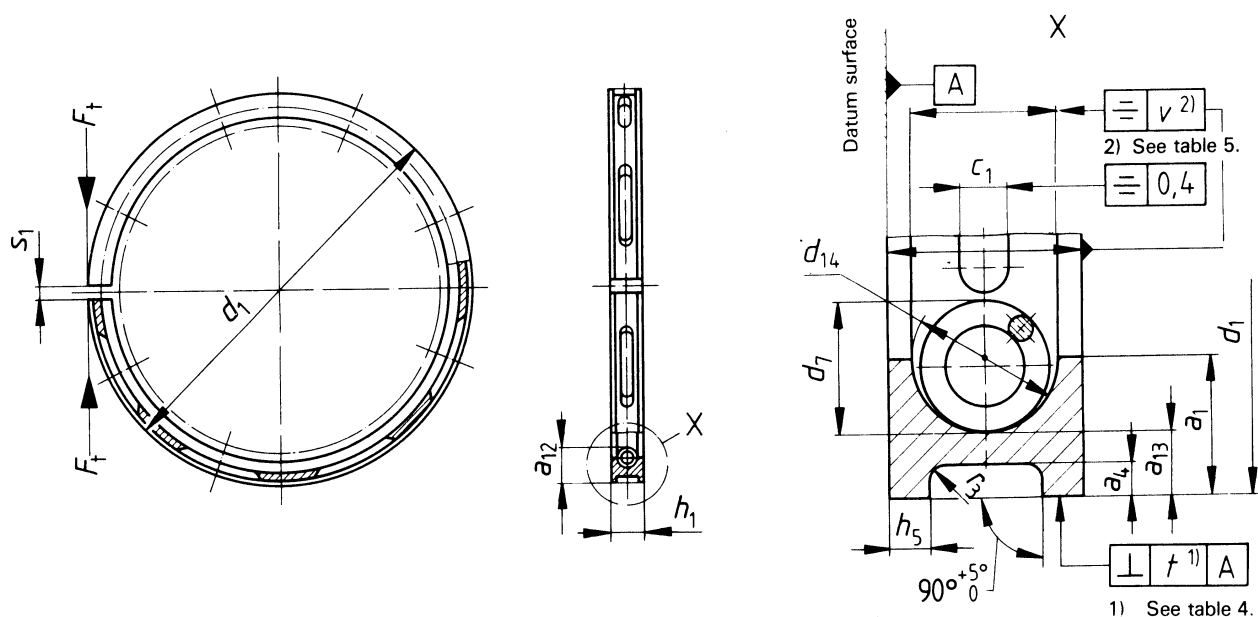


Figure 3 — Type SSF

3.3.2 Designation example

Designation of a piston ring complying with the requirements of ISO 6626, being a coil-spring-loaded slotted oil control ring (SSF), of nominal diameter $d_1 = 80$ mm (80) and nominal ring width $h_1 = 4$ mm (4), made of grey cast iron, non-heat-treated, material subclass 12 (MC12), constant pitch spring (CSN) and tangential force F_t according to the low nominal contact pressure class (PNL):

Piston ring ISO 6626-SSF-80 × 4-MC12/CSN PNL

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

3.4.1 General features

NOTE — Dimensions and forces: see tables 12 and 18.

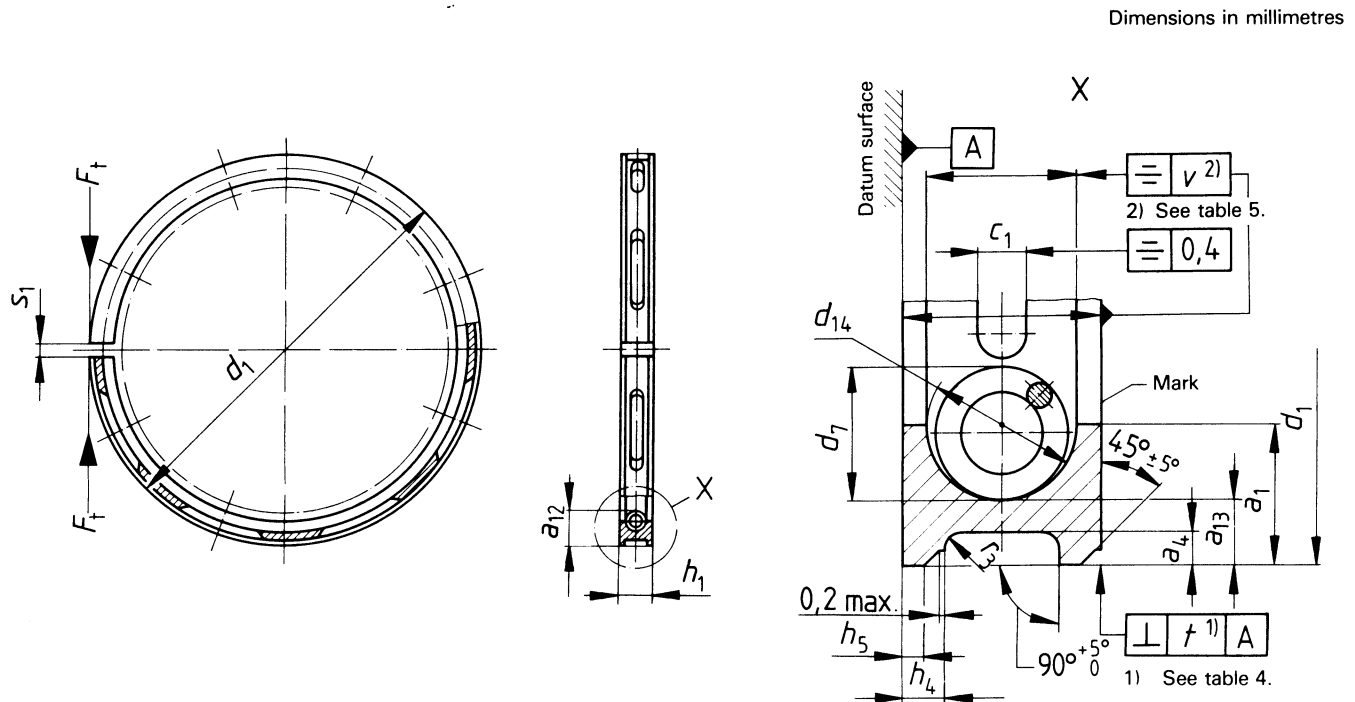


Figure 4 — Type GSF

3.4.2 Designation example

Designation of a piston ring complying with the requirements of ISO 6626, being a coil-spring-loaded double-bevelled oil control ring (GSF), of nominal diameter $d_1 = 75$ mm (75), a nominal ring width $h_1 = 3$ mm (3), made of grey cast iron, non-heat-treated, material subclass 12 (MC12), constant pitch spring (CSN) and a tangential force F_t according to the low nominal contact pressure class (PNL):

Piston ring ISO 6626-GSF-75 × 3-MC12/CSN PNL

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

3.5.1 General features

NOTE — Dimensions and forces: see tables 12 and 18.

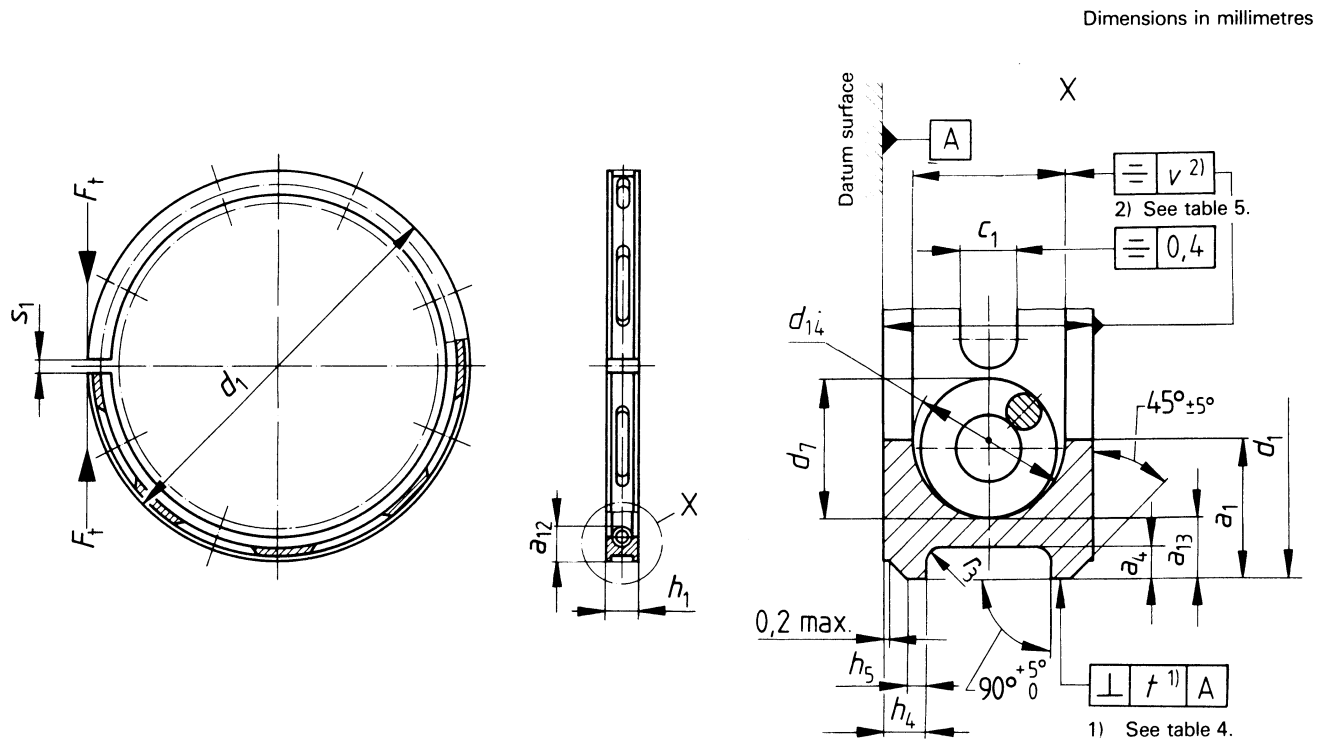


Figure 5 — Type DSF

3.5.2 Designation example

Designation of a piston ring complying with the requirements of ISO 6626, being a coil-spring-loaded bevelled-edge oil control ring (DSF), of nominal diameter $d_1 = 90$ mm (90) and nominal ring width $h_1 = 3,5$ mm (3,5), made of grey cast iron, non-heat-treated, material subclass 12 (MC12), constant pitch spring (CSN) and tangential force F_t according to the reduced nominal contact pressure class (PNR):

Piston ring ISO 6626-DSF-90 × 3,5-MC12/CSN PNR

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

3.6.1 General features

NOTE — Dimensions and forces: see tables 13 and 19.

Dimensions in millimetres

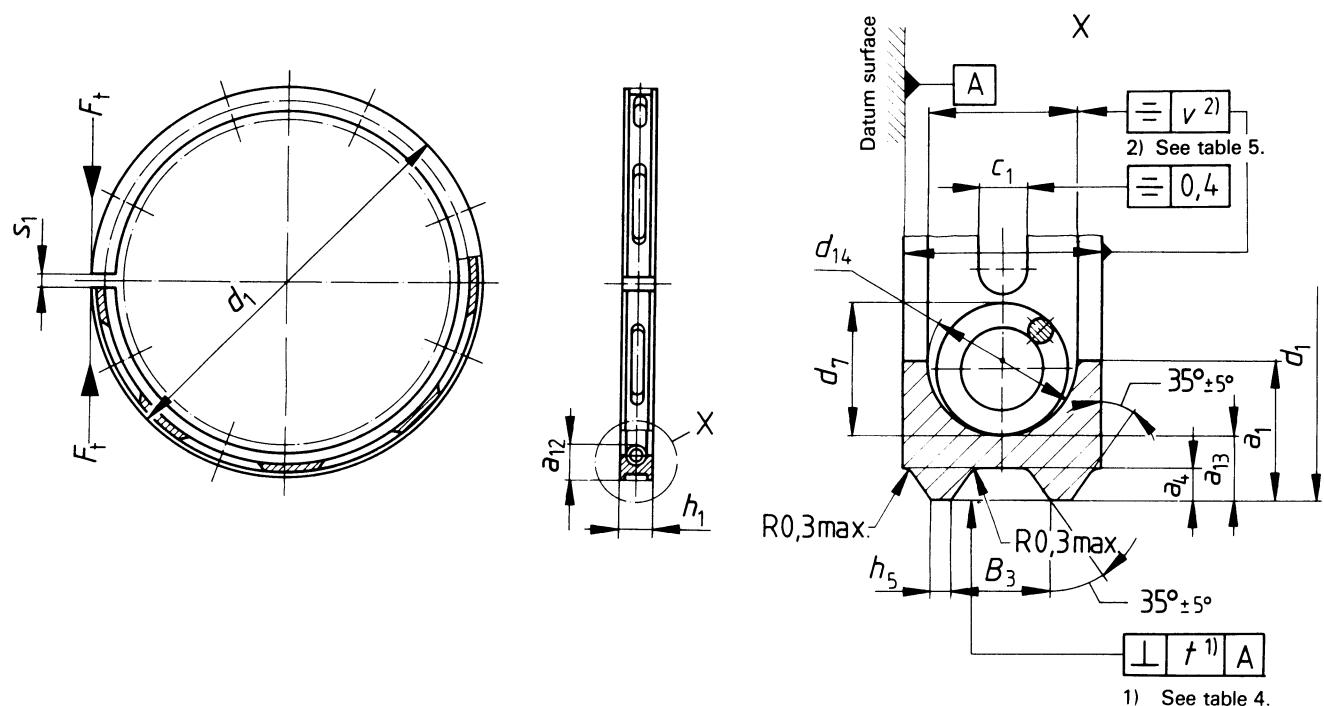


Figure 6 — Type DSF-NG

3.6.2 Designation example

Designation of a piston ring complying with the requirements of ISO 6626, being a coil-spring-loaded bevelled-edge oil control ring (DSF-NG) of nominal diameter $d_1 = 140$ mm (140) and nominal ring width $h_1 = 6$ mm (6), made of grey cast iron, non-heat-treated, material subclass 12 (MC12), constant pitch spring (CSN) and a tangential force F_t according to the medium nominal contact pressure class (PNM):

Piston ring ISO 6626-DSF-NG-140 × 6-MC12/CSN PNM

3.7 Type SSF-L — Coil-spring-loaded slotted oil control ring with 0,6 mm nominal land width

3.7.1 General features

NOTE — Dimensions and forces: see tables 14 and 20.

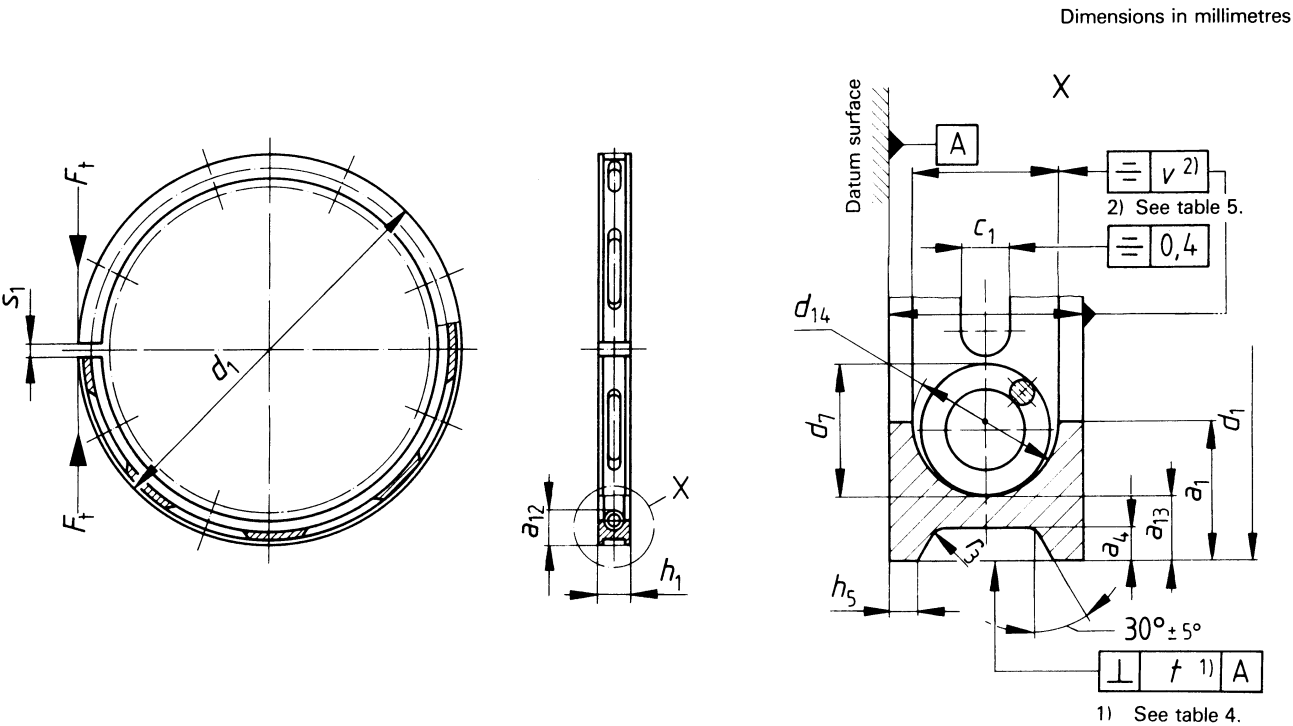


Figure 7 — Type SSF-L

3.7.2 Designation example

Designation of a piston ring complying with the requirements of ISO 6626, being a coil-spring-loaded slotted oil control ring with 0,6 mm nominal land width (SSF-L), of nominal diameter $d_1 = 100$ mm (100) and nominal ring width $h_1 = 4,5$ mm (4,5), made of grey cast iron, non-heat-treated, material subclass 12 (MC12), constant pitch spring (CSN) and tangential force F_t according to the reduced nominal contact pressure class (PNR):

Piston ring ISO 6626-SSF-L-100 × 4,5-MC12/CSN PNR

4 Common features

4.1 Arrangement of slots

Dimensions in millimetres

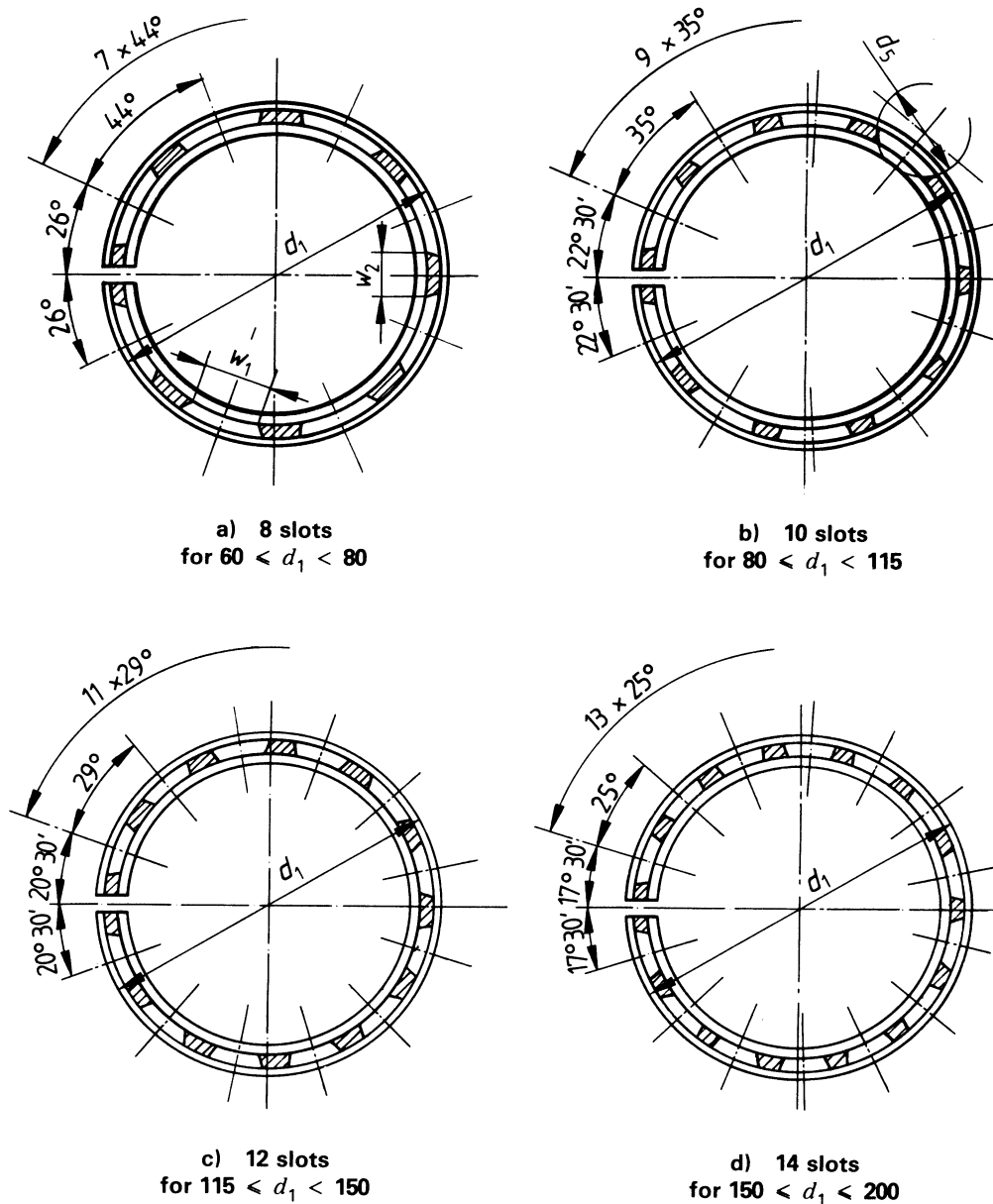


Figure 8 — Arrangement of slots

Table 1 — Cutter diameter

Dimensions in millimetres

Nominal diameter d_1	Cutter diameter d_5 max.
$60 < d_1 < 150$	60
$150 < d_1 < 200$	75

4.2 Slot length

4.2.1 Standard slot length

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

Tolerance on difference between w_1 and w_2 : 4 mm.

4.2.2 Reduced slot length (retaining same number and spacing)

Table 2 — Reduced slot length

Dimensions in millimetres

d_1	w_1
$60 < d_1 < 80$	$8,5 \pm 2,5$
$80 < d_1 < 115$	$10,5 \pm 2,5$
$115 < d_1 < 150$	$12,5 \pm 2,5$
$150 < d_1 < 200$	15 ± 3

4.3 DSF-C and DSF-CNP — Layer thickness

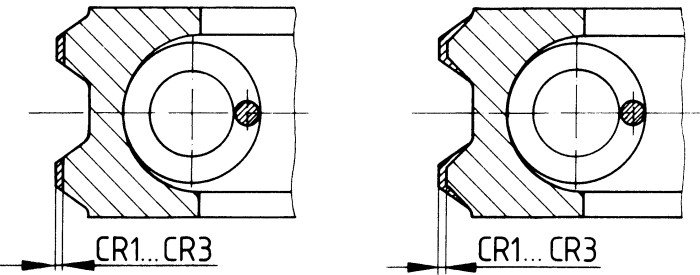


Figure 9 — Layer thickness

Table 3 — Layer thickness

Dimensions in millimetres

Chromium	Thickness min.
CR1	0,05
CR2	0,1
CR3	0,15

4.4 Tolerances of spring groove offset and land offset

Table 4 — Land offset
tolerance

Dimensions in millimetres

h_1	t
$3 < h_1 < 5$	0,015
$5 < h_1 < 8$	0,025

Table 5 — Spring groove
offset tolerance

Dimensions in millimetres

h_1	v
$h_1 < 3,5$	0,3
$h_1 \geq 3,5$	0,4

5 Coil spring

5.1 Types

All values in the dimensional tables are based on cylindrical coil springs made of round wire. The three designs shown in 5.1.1 to 5.1.3 are common.

5.1.1 Type CSN — Coil spring with constant pitch

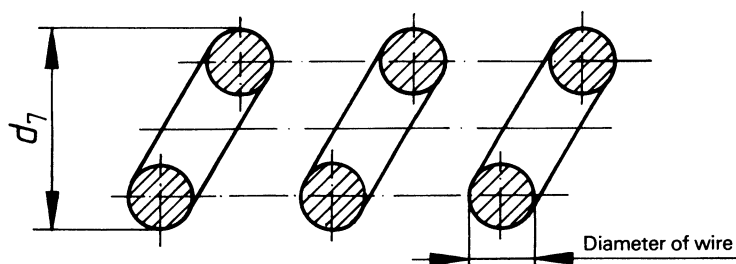


Figure 10 — Type CSN coil spring

5.1.2 Type CSG — Coil spring with constant pitch (coil diameter, d_7 , ground)

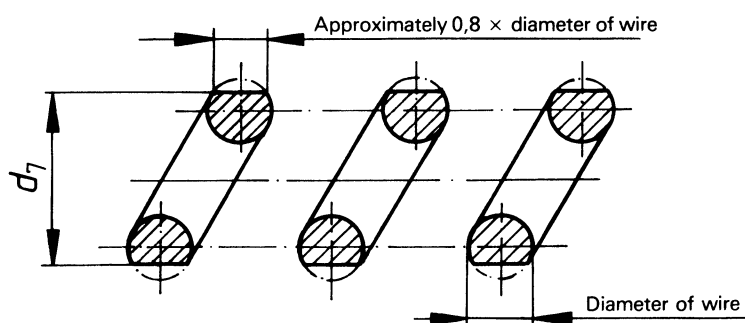


Figure 11 — Type CSG coil spring

5.1.3 Type CSE — Coil spring with variable pitch (coil diameter, d_7 , ground)

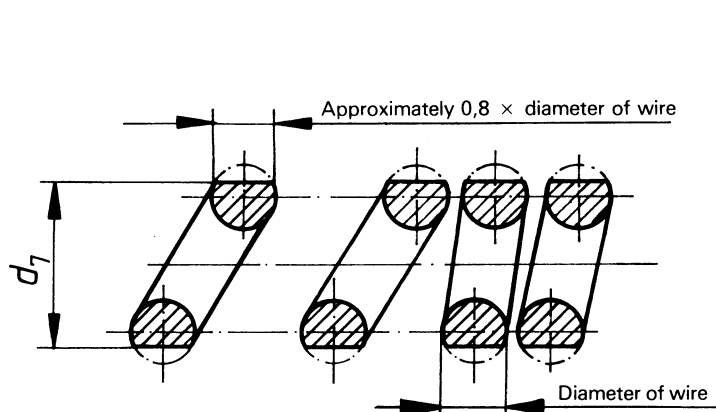


Figure 12 — Type CSE coil spring

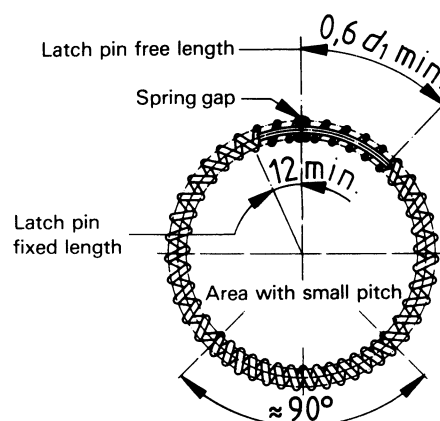


Figure 13 — Position of area with small pitch

NOTE — The use of different spring designs can be agreed between manufacturer and client. Changed spring groove configurations and dimensions may then be necessary.

5.2 Excursion

Coil-spring excursion is the distance between the ends of the ring gap with unstressed ring, measured in the middle of the spring groove (see figure 14).

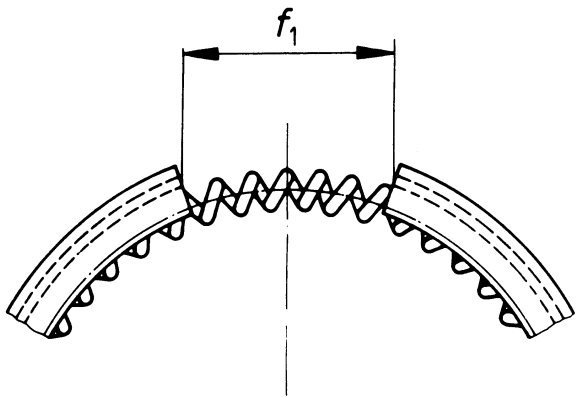


Figure 14 — Coil-spring excursion

5.3 Position of coil-spring gap and fixing

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

5.4 Material

Coil springs are made of valve spring wire, oil heat-treated. A suitable material for coil-spring expanders is subclass 63 (see 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.

The test conditions and the permissible loss of tangential forces are given in ISO 6621-5, table 10.

6 Tangential force and nominal contact pressure

6.1 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 coil-spring-loaded oil control rings.

Table 6 — Coil-spring excursion

Dimensions in millimetres

d_1	f_1 max.
$60 < d_1 < 125$	$0,13 \times d_1$
$125 < d_1 < 200$	$0,12 \times d_1$

6.2 Force factors

Because of the small contribution of the cast iron part in the tangential force, force factors are not necessary when additional features and/or materials other than subclass 12 are being used (see ISO 6621-3).

6.3 Tangential force, F_t

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

- nominal diameter, d_1 , in millimetres;
- land width, h_5 , in millimetres;
- required nominal contact pressure, p_o , in newtons per square millimetre;

and can be calculated from the equation

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

The land width, h_5 , depends on 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.

6.3.1 Specific tangential force, F_{tc}

F_{tc} is the specific tangential force required to maintain a spring-loaded oil control ring at a unit contact pressure p_{ov} of 1 N/mm²:

$$F_{tc} = \frac{1}{2} \cdot d_1 \cdot 2h_5$$

In clause 7, F_{tc} is tabulated for every ring type.