



BSI Standards Publication

Disc springs

Part 2: Technical specifications

National foreword

This British Standard is the UK implementation of ISO 19690-2:2018+A1:2025. It supersedes BS ISO 19690-2:2018, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to ISO text carry the number of the ISO amendment. For example, text altered by ISO amendment 1 is indicated by A1 A1.

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Disc springs — **Part 2:** **Technical specifications**

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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.

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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 227, *Springs*.

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.

A list of all parts in the ISO 19690 series can be found on the ISO website.

Disc springs —

Part 2: Technical specifications

1 Scope

This document specifies two different grades of disc springs.

Grade A defines basic requirements of disc springs for static applications with low and moderate performance. Springs manufactured according to Grade A are not used for dynamic applications.

Grade B defines requirements on disc springs especially used for dynamic applications and high performance static applications. Disc springs according to Grade B ensure a better quality by higher demands on manufacturing processes and tolerance requirements. Grade B includes graphs showing the guaranteed fatigue life such as a function of stress.

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 683-1, *Heat-treatable steels, alloy steels and free-cutting steels — Part 1: Non-alloy steels for quenching and tempering*

ISO 683-2, *Heat-treatable steels, alloy steels and free-cutting steels — Part 2: Alloy steels for quenching and tempering*

ISO 6507 (all parts), *Metallic materials — Vickers hardness test*

ISO 6508 (all parts), *Metallic materials — Rockwell hardness test*

ISO 16249, *Springs — Symbols*

ISO 26909, *Springs — Vocabulary*

EN 1654, *Copper and copper alloys — Strip for springs and connectors*

EN 10083-1, *Quenched and tempered steels — Technical delivery conditions for special steels*

EN 10083-2, *Quenched and tempered steels — Technical delivery conditions for unalloyed quality steels*

EN 10083-3, *Quenched and tempered steels — Technical delivery conditions for boron steels*

EN 10089, *Hot-rolled steels for quenched and tempered springs — Technical delivery conditions*

EN 10132-4, *Cold-rolled narrow steel strip for heat treatment — Technical delivery conditions — Part 4: Spring steels and other applications*

EN 10151, *Stainless steel strip for springs — Technical delivery conditions*

JIS G 3311, *Cold-rolled special steel strip*

JIS G 4801, *Spring steels*

JIS G 4802, *Cold-rolled steel strip for springs*

ASTM A240, *Standard specification for chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications*

ASTM A332, *Specification for nickel-chromium-molybdenum steel bars for springs*

ASTM A506, *Standard specification for alloy and structural alloy steel, sheet and strip, hot-rolled and cold-rolled*

ASTM A568, *Standard specification for steel, sheet, carbon, structural, and high-strength, low-alloy, hot-rolled and cold-rolled, General requirements for*

ASTM A666, *Standard specification for annealed or cold-worked austenitic stainless steel sheet, strip, plate, and flat bar*

ASTM A682, *Standard specification for steel, strip, high carbon, cold rolled, General requirements for*

ASTM A684, *Standard specification for steel, strip, high carbon, cold rolled*

ASTM A689, *Standard specification for carbon and alloy steel bars for springs*

ASTM A693, *Standard specification for precipitation-hardening stainless and heat-resistant steel plate, sheet, and strip*

ASTM B103, *Standard specification for phosphor bronze plate, sheet, strip, and rolled bar*

ASTM B194, *Standard specification for copper-beryllium alloy plate, sheet, strip, and rolled bar*

ASTM B196, *Standard specification for copper-beryllium alloy rod and bar*

GB/T 1222, *Spring steels*

BS 970-2, *Specification for wrought steels for mechanical and allied engineering purposes: Requirements for steels for the manufacture of hot-formed springs*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 26909 apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Symbols and units

For the purposes of this document, the symbols and units given in ISO 16249, [Table 1](#) and [Figure 1](#) apply.

Table 1 — Symbols and units for design calculation

Symbol	Unit	Parameter
b_r	mm	width of scar (see Figure 2)
D	mm	external diameter of spring
D_0	mm	diameter of centre of rotation
d	mm	internal diameter of spring
NOTE 1 N/mm ² = 1 MPa.		
^a r is not chamfered unless otherwise agreed between customer and supplier.		

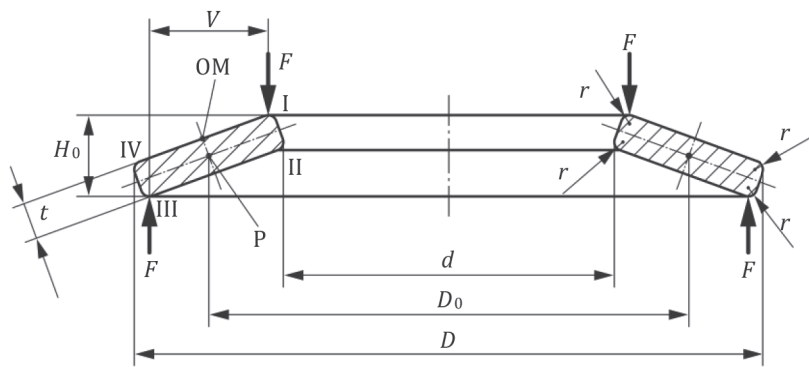
Table 1 (continued)

Symbol	Unit	Parameter
E	N/mm ²	modulus of elasticity of material (carbon steel and carbon alloy steel: 206 000 N/mm ²)
F	N	spring load
F_c	N	design spring load when spring is in the flattened position
F_G	N	spring load at the time of combining springs
F_t	N	spring test load at H_t
H_t	mm	height of spring when measuring spring test load, $H_t = H_0 - 0,75h_0$
H_0	mm	free height of spring
h_s	mm	clean cut (see Figure 2)
h_0	mm	initial cone height of spring without flat bearings, $h_0 = H_0 - t$
$h_{0,f}$	mm	initial cone height of spring with flat bearings, $h_{0,f} = H_0 - t_f$
i	—	number of springs combined in series
L_0	mm	free height at the time of combining springs
N	—	number of cycles for fatigue life
n	—	number of springs piled in parallel
OM	—	point at upper surface of the spring perpendicular to the centre line at point P
P	—	theoretical centre of rotation of disc cross section
R	N/mm	spring rate
r^a	mm	radius at edge
s	mm	deflection of spring
s_G	mm	deflection of stack
s_1	mm	deflection of spring preloaded
t	mm	thickness of spring
t_f	mm	reduced thickness of single disc spring with flat bearings
V	mm	length of lever arms
V_f	mm	length of lever arms with flat bearings
ΔF	N	spring load loss
Δh_0	mm	initial cone height loss of spring
ν	—	Poisson's ratio of material
σ_H	N/mm ²	alternative stress, $\sigma_H = \sigma_{\max} - \sigma_{\min}$
σ_{OM}	N/mm ²	stress at position OM
$\sigma_{\max}$	N/mm ²	maximum fatigue stress
$\sigma_{\min}$	N/mm ²	minimum fatigue stress
σ_I	N/mm ²	stress at position I
σ_{II}	N/mm ²	stress at position II
σ_{III}	N/mm ²	stress at position III
σ_{IV}	N/mm ²	stress at position IV
NOTE 1 N/mm ² = 1 MPa.		
^a r is not chamfered unless otherwise agreed between customer and supplier.		

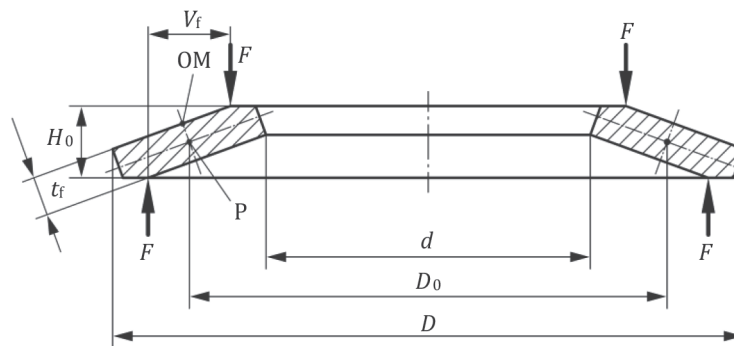
5 Dimensions and designation

5.1 General

Figure 1 illustrates a single disc spring, including the relevant positions of loading.



a) Without flat bearings — Group 1 and Group 2



b) With flat bearings — Group 3

Key

- D external diameter of spring
- D_0 diameter of centre of rotation
- d internal diameter of spring
- F spring load
- H_0 free height of spring
- OM point at upper surface of the spring perpendicular to the centre line at point P
- P theoretical centre of rotation of disc cross section
- r^a radius at edge
- t thickness of spring
- t_f reduced thickness of single disc spring with flat bearings
- V length of lever arms
- V_f length of lever arms with flat bearings
- I position I
- II position II
- III position III
- IV position IV
- ^a r is not chamfered unless otherwise agreed between customer and supplier.

Figure 1 — Single disc spring (sectional view), including the relevant positions of loading

5.2 Disc spring groups

[Table 2](#) shows the disc spring groups.

Table 2 — Disc spring groups

Group	t mm	With flat bearings and reduced thickness
1	$0,2 \leq t < 1,25$	No
2	$1,25 \leq t \leq 6,0$	No
3	$6,0 < t \leq 14,0$	Yes

5.3 Dimensional series

[Table 3](#) shows the dimensional series.

Table 3 — Dimensional series

Dimensional series	h_0/t	t_f/t	D/t
A	$\approx 0,40$	$\approx 0,94$	≈ 18
B	$\approx 0,75$	$\approx 0,94$	≈ 28
C	$\approx 1,30$	$\approx 0,96$	≈ 40

NOTE Refer to [Annex A](#) for typical disc spring dimensions.

6 Grade A — Basic performance requirements for static applications

6.1 Material

Unless otherwise agreed between customer and supplier, disc springs should be made from material conforming to [Table 4](#).

6.2 Manufacturing process

Unless otherwise agreed between customer and supplier, disc springs should be made by the manufacturing process shown in [Table 4](#).