INTERNATIONAL STANDARD

ISO 19690-1

First edition
2017-03

Disc springs —

Part 1: Calculation

Ressorts à disques —

Partie 1: Calcul

Reference number
ISO 19690-1:2017(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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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*.

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

Disc springs —

Part 1: Calculation

1 Scope

This document specifies design criteria and features of disc springs, whether as single disc springs or as stacks of disc springs. It includes the definition of relevant concepts, as well as design formulae, and covers the fatigue life of such springs.

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 16249, *Springs — Symbols*

ISO 26909, *Springs — Vocabulary*

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 www.iso.org/obp

— IEC Electropedia: available at www.electropedia.org

4 Symbols and units

For the purposes of this document, the symbols and units given in ISO 16249 and Table 1 apply.

Table 1 — Symbols and units for design calculation

Symbol	Unit	Parameter
C_1, C_2, C_3, C_4	—	coefficients
D	mm	external diameter of spring
D_0	mm	diameter of centre of rotation
d	mm	internal diameter of spring
E	N/mm^2	modulus of elasticity of material (carbon steel and carbon alloy steel: 206 000 N/mm^2) (other materials: respective modulus of elasticity of material)
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 load, $H_t = H_0 - 0{,}75\ h_0$
H_0	mm	free height of spring
h_0	mm	initial cone height of springs without flat bearings, $h_0 = H_0 - t$
$h_{0,f}$	mm	initial cone height of springs with flat bearings, $h_{0,f} = H_0 - t_f$
i	—	number of springs combined in series
k_1, k_2	—	coefficients
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	mm	chamfer radius at edge
s	mm	deflection of spring
s_G	mm	deflection of stack
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
W	N·mm	energy capacity of springs
α	—	ratio of external diameter to internal diameter
ν	—	Poisson's ratio of material
σ_{OM}	N/mm^2	stress at position OM
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 N/mm^2 = MPa		