
**Disc springs —
Part 1:
Calculation**

*Ressorts à disques —
Partie 1: Calcul*

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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*.

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

[ISO 19690-1:2017](http://www.iso.org/iso/19690-1:2017)

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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*

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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:

<https://standards.iteh.ai> ISO Online browsing platform: available at www.iso.org/obp ISO 19690-1:2017

— 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/mm² = MPa