SLOVENSKI STANDARD
kSIST FprEN 16984:2016

01-junij-2016

Krožnikaste vzmeti - Izračun

Disc springs - Calculation

Tellerfedern - Berechnung

Rondelles ressorts - Calculs

Ta slovenski standard je istoveten z: **FprEN 16984**

ICS:

21.160	Vzmeti	Springs

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FINAL DRAFT
FprEN 16984

April 2016

ICS 21.160

English Version

Disc springs - Calculation

Rondelles ressorts - Calculation

Tellerfedern - Berechnung

This draft European Standard is submitted to CEN members for unique acceptance procedure. It has been drawn up by the Technical Committee CEN/TC 407.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (FprEN 16984:2016) has been prepared by Technical Committee CEN/TC 407 "Project Committee - Cylindrical helical springs made from round wire and bar - Calculation and design", the secretariat of which is held by AFNOR.

This document is currently submitted to the Unique Acceptance Procedure.

This European Standard has been prepared by the initiative of the Association of the European Spring Federation ESF and is based on the German Standard DIN 2092 "Disc springs — Calculation", which is known and used in many European countries.

1 Scope

This standard 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, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

FprEN 16983:2016, *Disc springs - Quality specifications - Part 1: Dimensions*

EN ISO 26909, *Springs - Vocabulary (ISO 26909)*

3 Terms, definitions, symbols, units and abbreviated terms

3.1 Terms and definitions

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

NOTE Disc springs are annular coned elements that offer resistance to a compressive load applied axially. They may be designed as single disc springs or as disc springs stacked in parallel or in series, either singly or in multiples. They may be subjected to both static and fatigue loading, and may have flat bearings.

3.2 Symbols, units and abbreviated terms

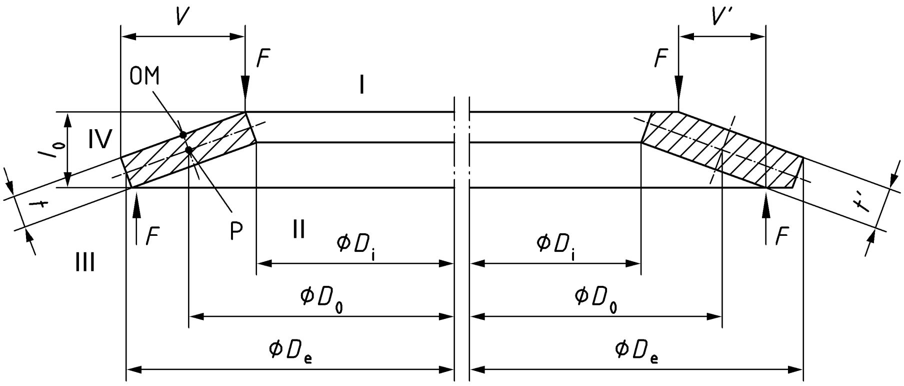
Table 1 — Symbols, units and abbreviated terms

Symbol	Unit	Description
D_e	mm	Outer diameter of spring
D_i	mm	Inner diameter of spring
D_0	mm	Diameter of centre of rotation
E	MPa	Modulus of elasticity (see FprEN 16983:2016)
F	N	Spring load
F_1, F_2, F_3 ...	N	Spring loads related to spring deflections s_1, s_2, s_3...
F_c	N	Design spring load when spring is in the flattened position
F_{ges}	N	Spring load of springs stacked in parallel, related to spring deflection s_{ges}
$F_{ges\ R}$	N	Spring load of springs stacked in parallel, allowance being made for friction
F_t	N	Test load for length L_t or l_t
K_1, K_2, K_3, K_4		Constants (see 5.3)
L_0	mm	Length of springs stacked in series or in parallel, in the initial position
L_1, L_2, L_3 ...	mm	Lengths of loaded springs stacked in series or in parallel, related to spring loads F_1, F_2, F_3...

Symbol	Unit	Description
L_t	mm	Test length of springs stacked in series or in parallel
L_c	mm	Design length of springs stacked in series or in parallel, in the flattened position
N		Number of cycles to failure
R	N/mm	Spring rate
W	N mm	Energy capacity of spring
h_0	mm	Initial cone height of springs without flat bearings, $h_0 = l_0 - t$
$h_0{}'$	mm	Initial cone height of springs with flat bearings, $h'_0 = l_0 - t'$
i		Number of disc springs or packets stacked in series
l_0	mm	Free overall height of spring in its initial position
l_1, l_2, l_3 ...	mm	Length of loaded spring related to spring loads F_1, F_2, F_3...
L_t	mm	Test length of spring
n		Number of single disc springs stacked in parallel
P		Theoretical centre of rotation of disc cross section (see Figure 1)
s	mm	Deflection of single disc spring
s_1, s_2, s_3 ...	mm	Spring deflections related to spring loads F_1, F_2, F_3...
s_{ges}	mm	Deflection of springs stacked in series or in parallel, no allowance being made for friction. Recommended maximum value: $s_{ges} = 0{,}75\ (L_0 - L_c)$
t	mm	Thickness of single disc spring
t'	mm	Reduced thickness of single disc spring with flat bearings (group 3)
w_M, w_R		Coefficients of friction (see Table 3)
$\delta = \dfrac{D_e}{D_i}$		Ratio of outer to inner diameter
μ		Poisson's ratio
σ	MPa	Design stress
$\sigma_{OM}, \sigma_{I}, \sigma_{II}, \sigma_{III}, \sigma_{IV}$	MPa	Design stresses at the points designated OM, I, II, III, IV (see Figure 1)
σ_o	MPa	Maximum design stress in springs subject to fatigue loading
σ_u	MPa	Minimum design stress in springs subject to fatigue loading
σ_h	MPa	Fatigue stress related to the deflection of springs subject to fatigue loading
σ_O	MPa	Maximum fatigue stress
σ_U	MPa	Minimum fatigue stress
$\sigma_H = \sigma_O - \sigma_U$	MPa	Permanent range of fatigue stress
V, V'	mm	Lever arms

4 Representation

4.1 Single disc spring



a) without flat bearings: group 1, group 2

b) with flat bearings: group 3

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

4.2 Disc springs stacked in parallel

The stack consists of *n* single disc springs stacked in parallel.

Figure 2 — Packet - Disc springs stacked in parallel

4.3 Disc springs stacked in series

The stack consists of *i* single disc springs stacked in series.

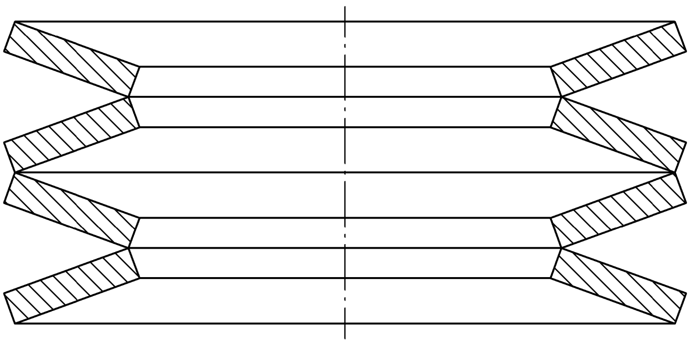


Figure 3 — Stack - Disc springs stacked in series