SLOVENSKI STANDARD
SIST EN 13906-2:2009

01-julij-2009

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Cylindrical helical springs made from round wire and bar - Calculation and design - Part 2: Extension springs

Zylindrische Schraubenfedern aus runden Drähten und Stäben - Berechnung und Konstruktion - Teil 2: Zugfedern

Ressorts hélicoïdaux cylindriques fabriqués à partir de fils ronds et de barres - Calcul et conception - Partie 2: Ressorts de traction

Ta slovenski standard je istoveten z: **EN 13906-2:2001**

ICS:

21.160	Vzmeti	Springs

SIST EN 13906-2:2009 **en,fr,de**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13906-2

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ICS 21.160

English version

Cylindrical helical springs made from round wire and bar - Calculation and design - Part 2: Extension springs

Ressorts hélicoïdaux cylindriques fabriqués à partir de fils ronds et de barres - Calcul et conception - Partie 2: Ressorts de traction

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This European Standard was approved by CEN on 5 January 2001.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36   B-1050 Brussels

EN 13906-2:2001 (E)

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Foreword

This European Standard has been prepared by CMC.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2002, and conflicting national standards shall be withdrawn at the latest by June 2002.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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 2089-2 - "Helical springs made from round wire and rod; Extension springs; Calculation and design" edition 1992-11, which is known and used in many European countries.

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EN 13906-2:2001 (E)

1 Scope

This standard specifies the calculation and design of cold and hot coiled helical cylindrical helical extension springs made from round wire and bar with values according to Table 1, loaded in the direction of the spring axis and operating at normal ambient temperatures.

Table 1

Characteristic	Cold coiled extension springs	Hot coiled extension springs
Wire or bar diameter	$d \leq 17$ mm	10 mm $\leq d < 35$ mm
Coil diameter	$D \leq 160$ mm	$D \leq 300$ mm
Number of active coils	$n \geq 3$	$n \geq 3$
Spring index	$4 \leq w \leq 20$	$4 \leq w \leq 12$

NOTE 1   In cases of substantially higher or lower working temperature, it is advisable to seek the manufacturer's advice.

NOTE 2   Quality Standards for cold coiled extension springs will be developed later.

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2 Normative references

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This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 13906-1, *Cylindrical helical springs made from round wire and bar - Calculation and design - Part 1: Compression springs*.

EN 10270-1:2001, *Steel wire for mechanical springs – Part 1: Patented cold drawn unalloyed spring steel wire*.

EN 10270-2:2001, *Steel wire for mechanical springs - Part 2: Oil hardened and tempered spring steel wire*.

EN 10270-3:2001, *Steel wire for mechanical springs - Part 3: Stainless spring steel wire*.

EN 12166, *Copper and copper alloys - Wire for general purposes*.

EN ISO 2162-1:1996, *Technical product documentation - Springs - Part 1: Simplified representation (ISO 2162-1:1993)*.

EN ISO 2162-3:1996, *Technical product documentation - Springs - Part 3: Vocabulary (ISO 2162-3:1993)*.

prEN 10089:1998, *Hot-rolled steels for quenched and tempered springs – Technical delivery conditions*.

3 Terms and definitions, symbols, units and abbreviated terms

3.1 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

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3.1.1
spring
mechanical device designed to store energy when deflected and to return the equivalent amount of energy when released [2.1 from EN ISO 2162-3:1996]

3.1.2
extension spring
spring that offers resistance to an axial force tending to extend its length, with or without initial tension [2.6 from EN ISO 2162-3:1996]

3.1.3
helical extension spring
extension spring normally made from wire of circular cross-section wound around an axis with or without spaces between its coils (open - or close -wound) [2.10 from EN ISO 2162-3:1996]

NOTE   In the following text of this Standard the term spring is used with the meaning of helical extension spring

3.2   Symbols, units and abbreviated terms

Table 2 contains the symbols, units and abbreviated terms used in this standard.

Table 2

Symbols	Units	Terms
$D = \dfrac{D_e + D_i}{2}$	mm	mean diameter of coil
D_e	mm	outside diameter of the spring
D_l	mm	inside diameter of the spring
D	mm	nominal diameter of wire (or bar)
E	N/mm²	modulus of elasticity (or Young's modulus)
F	N	spring force (including F_0)
$F_1, F_2....$	N	spring forces, for the spring lengths $L_1, L_2....$ (at ambient temperature of 20ºC)
F_n	N	maximum permissible spring force for the maximum permissible spring length L_n
F_0	N	initial tension force
G	N/mm²	modulus of rigidity
k	-	stress correction factor (depending on D/d)
L	mm	spring length
L_0	mm	Nominal free length of spring
$L_1, L_2....$	mm	spring lengths for the spring forces $F_1, F_2 ....$
L_H	mm	distance from inner radius of loop to spring body
L_K	mm	body length when unloaded but subject to initial tension force
L_n	mm	maximum permissible spring length for the spring force F_n
m	mm	hook opening
N	-	Number of cycles up to rupture
n	-	number of active coils
n_t	-	total number of coils

Table 2 (Concluded)

Symbols	Units	Terms
R	N/mm	spring rate
R_m	N/mm²	minimum value of tensile strength
s	mm	spring deflection
$s_1, s_2 \ldots$	mm	spring deflections, for the spring forces F_1, F_2 ....
s_h	mm	deflection of spring (stroke) between two positions
s_n	mm	spring deflection, for the spring force F_n
W	N.mm	spring work
$w = \dfrac{D}{d}$	-	spring index
ρ	kg/dm³	Density
τ	N/mm²	uncorrected torsional stress (without the influence of the wire curvature being taken into account)
τ_0	N/mm²	uncorrected torsional stress, for the initial tension force F_0
$\tau_1, \tau_2 \ldots$	N/mm²	uncorrected torsional stress, for the spring forces F_1, F_2 ...
τ_k	N/mm²	corrected torsional stress, (according to the correction factor k)
$\tau_{k1}, \tau_{k2} \ldots$	N/mm²	corrected torsional stress, for the spring forces F_1, F_2 ...
τ_{kh}	N/mm²	corrected torsional stress range, for the stroke s_h
τ_{kn}	N/mm²	corrected torsional stress, for the spring force F_n
τ_n	N/mm²	uncorrected torsional stress, for the spring force F_n
τ_{zul}	N/mm²	permissible torsional stress

4 Theoretical extension spring diagram

The illustration of the extension spring corresponds to Figure 5.1 from EN ISO 2162-1:1996. The theoretical extension spring diagram is given in Figure 1.
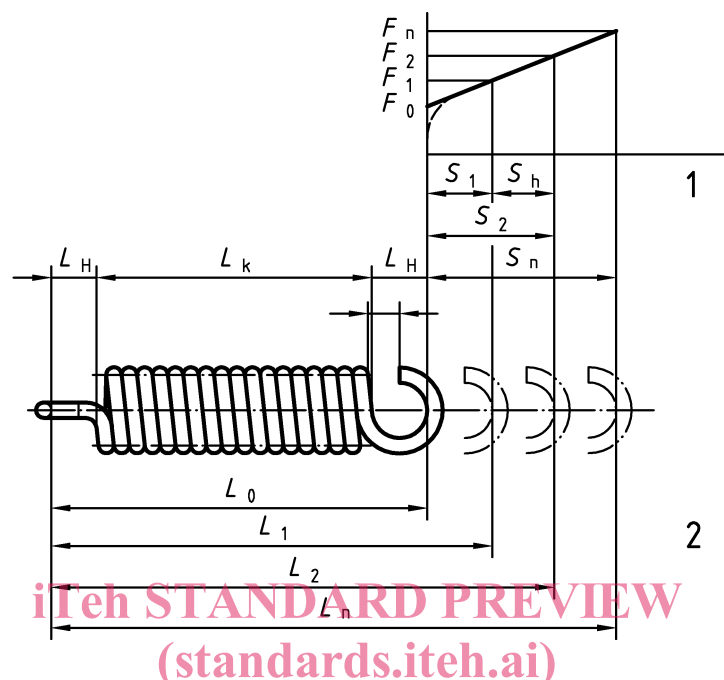
Key

1 spring deflection
2 spring lengths

Figure 1 — Theoretical extension spring diagram

5 Types of loading

NOTE   Before carrying out design calculations it should be specified whether they will be subjected to static loading, quasi-static loading, or dynamic loading.

5.1 Static and/or quasi-static loading

A static loading is:

— a loading constant in time

A quasi-static loading is:

— a loading variable with time with a negligibly small torsional stress range (stroke   stress)(e.g. torsional stress range up to $0,1 \times$ fatigue strength)

— a variable loading with greater torsional stress range but only a number of cycles of up to 10^4

5.2 Dynamic loading

In the case of extension springs dynamic loading is loading variable with time with a number of loading cycles over 10^4 and torsional stress range greater than $0,1 \times$ fatigue strength at:

a)   constant torsional stress range;