International Standard

ISO 22705-3

First edition
2024-04

Springs — Measurement and test parameters —

Part 3: Cold formed cylindrical helical torsion springs

Ressort — Mesures et paramètres d'essai —

Partie 3: Ressorts à torsion cylindrique, enroulés à froid

Reference number
ISO 22705-3:2024(en)

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Published in Switzerland

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Foreword

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

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Springs — Measurement and test parameters —

Part 3:
Cold formed cylindrical helical torsion springs

1 Scope

This document specifies the measurement and test methods for general characteristics of cold formed cylindrical helical torsion springs made from round wire, excluding dynamic testing.

2 Normative references

There are no normative references in this document.

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
spring
mechanical device designed to store energy when deflected and to return the equivalent amount of energy when released

[SOURCE: ISO 26909:2009, 1.1]

3.1.2
torsion spring
spring that offers resistance to a twisting moment around the longitudinal axis of the spring

[SOURCE: ISO 26909:2009, 1.4]

3.1.3
coil spring
coil-shaped spring

[SOURCE: ISO 26909:2009, 3.11]

3.1.4
helical torsion spring
torsion spring normally made of wire of circular cross-section wound around an axis and with ends suitable for transmitting a twisting moment

[SOURCE: ISO 26909:2009, 3.14]

3.1.5
cold formed spring
spring formed at ambient temperature

[SOURCE: ISO 26909:2009, 1.12]

3.1.6
free angle
relative angle between both ends of a helical torsion spring when no load is applied

[SOURCE: ISO 26909:2009, 5.63]

3.1.7
torsional moment
torque
moment generated around the axis when external force is applied to a helical torsion spring

[SOURCE: ISO 26909:2009, 5.11]

3.1.8
spring characteristics
relationship between the load applied to a spring and the deflection caused by the load

[SOURCE: ISO 26909:2009, 5.1]

3.1.9
force
force exerted on or by a spring in order to reproduce or modify motion, or to maintain a system of forces in equilibrium

[SOURCE: ISO 26909:2009, 5.2]

3.1.10
test parameter
parameter with a tolerance for which there is an immediate conclusion after test (OK or not OK)

Note 1 to entry: Test can be done without measurement (i.e. with go/no-go gauges)

3.2 Symbols and abbreviated terms

Table 1 includes the symbols and abbreviated terms used throughout this document.

Table 1 — Symbols and abbreviated terms

Symbols	Units	Designations
c	mm	offset of leg (see Annex D)
D_e	mm	outside diameter of spring
D_i	mm	inside diameter of spring
d	mm	diameter of wire
d_{max}	mm	maximum diameter of wire
d_{wire}	mm	wire diameter after coiling
d_R	mm	diameter of loading pins
L_B	mm	body length in axis direction (excluding legs) when unloaded
l	mm	length of leg (without considering working effect) see Annex C
$l_1, l_2, \ldots$	mm	length of leg segments (without considering working effect)
l_w	mm	effective working length of leg
$l_{w,1}, l_{w,2}, \ldots$	mm	effective working length of legs

Table 1 *(continued)*

Symbols	Units	Designations
M	N·mm	spring torque or moment
M_n	N·mm	spring torque for the maximum test torsional angle and related leg length
$M_1, M_2, \ldots$	N·mm	spring torques for the specified spring loads
n	-	number of coils
p	mm	spring pitch
$R_M = \frac{\Delta M}{\Delta \alpha} = \frac{M_2 - M_1}{\alpha_2 - \alpha_1}$	N·mm/rad, N·mm/degree	angular spring rate (see Annex A)
r	mm	bending radius
$r_1, r_2, \ldots$	mm	inner bend radius on legs
r_w	mm	effective working radius
$r_{w,1}, r_{w,2}, \ldots$	mm	effective working radius of legs
u	mm	distance between the coils
α_h	rad, degree	angular deflection of spring (stroke) between two positions α_1, α_2
α_n	rad, degree	maximum permissible test torsional angle
γ_0	rad, degree	the position angle between two legs when unloaded
$\alpha_1, \alpha_2, \ldots$	rad, degree	torsional angles for the specified spring torques, M_1, M_2, ...
ε_0	degree	relative end fixture angle for unloaded spring
$\varepsilon_1, \varepsilon_2, \ldots$	degree	relative end fixture angle corresponding to $\alpha_1, \alpha_2, \ldots$
$\varphi_1, \varphi_2, \ldots$	rad, degree	angle of bend on legs

The symbols for unloaded torsion spring is shown in Figure 1. The torsion spring with tangential ends is shown in Figure 2. The torsion spring when loaded is shown in Figure 3.

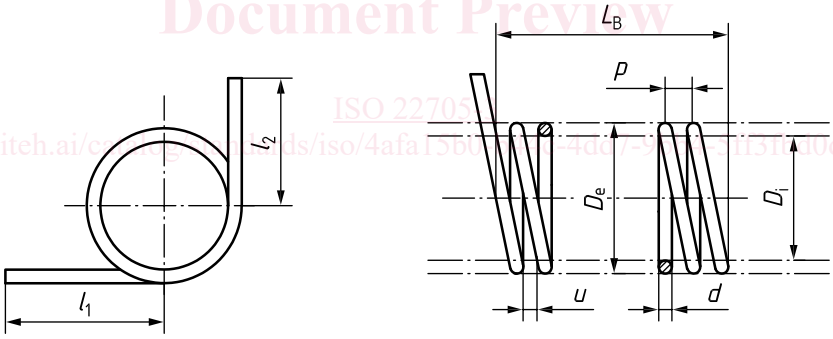

Figure 1 — Symbols for unloaded torsion spring

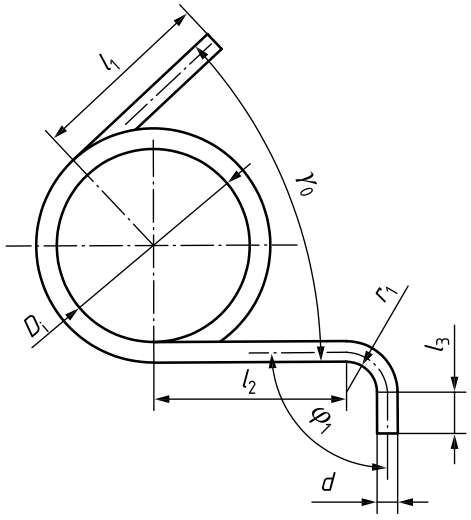

Figure 2 — Torsion spring with tangential ends

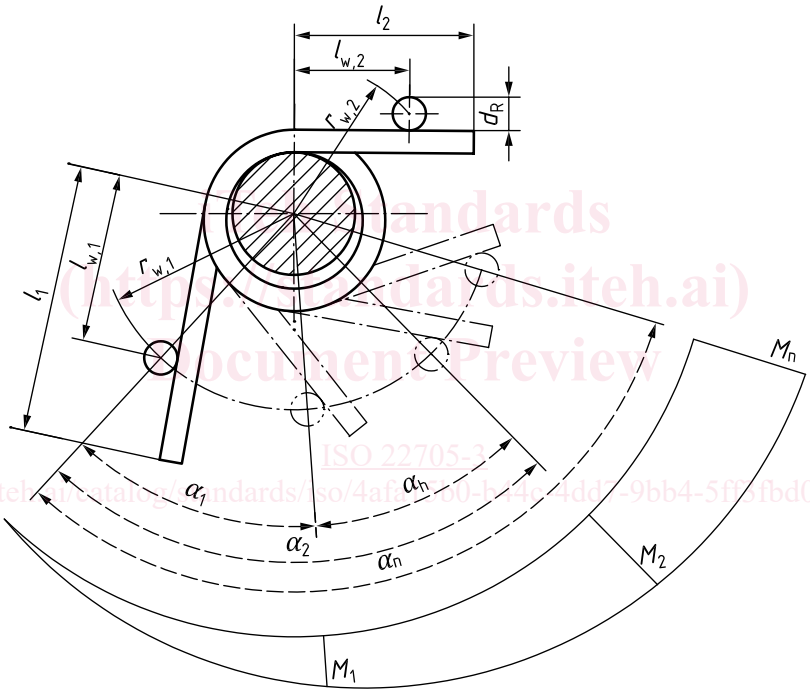

Figure 3 — Torsion spring when loaded

4 Environmental conditions

The spatial distribution and equipment of the facility shall permit a reliable implementation of the measurement and test.

Measurements and tests should be carried out at ambient temperature in a normal workshop environment.

Special tests (e.g. in air-conditioned rooms or other special environments) shall be agreed upon between the manufacturer and the customer.

Measuring and testing equipment should be subject to regular inspection.

5 Qualifications of the person(s) performing the work

The measurements and tests shall be carried out by a person who has been instructed/trained in the use of the measuring and testing equipment, as well as regarding methods and test requirements.

The qualifications or additional knowledge and skills shall be documented in appropriate qualification or training documents, depending on the requirements.

6 Geometries of guiding and supporting devices

If necessary, geometries of guiding and supporting devices (mandrels, guide sleeves, ring groove, etc.) shall be agreed upon between the manufacturer and the customer to include special cases such as snapping end coils, buckling, bulging. The alignment of guiding and supporting devices is aimed to improve the reproducibility of the measurements.

7 Measuring and testing equipment

Suitable measuring equipment shall be selected (standards such as ISO 3611 for micrometers and ISO 13385-1 for callipers can be used to ensure suitability).

8 Measurement and test parameter for technical cold formed cylindrical torsion springs

8.1 Body length (L_B)

8.1.1 General

The body length L_B is a measurement and test parameter.

8.1.2 Type of characteristic

The body length L_B is the body length in the axis direction (excluding legs) when no load is applied (see Figure 4); other case should be agreed upon between the manufacturer and the customer.

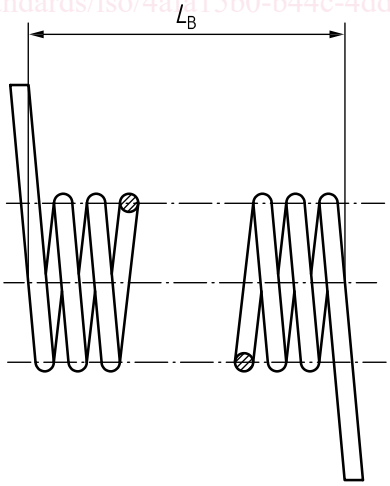

Figure 4 — Body length (L_B) of the unloaded torsion spring for open-coiled springs

8.1.3 Measuring and/or testing equipment

The following measuring equipment can be used:

— micrometer gauge;