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**Springs — Measurement and test  
parameters —**

**Part 1:  
Cold formed cylindrical helical  
compression springs**

**iTeh STANDARD PREVIEW** —  
*Ressort - Mesures et paramètres d'essai —*  
*(standards.iteh.ai)* **Partie 1: Ressort hélicoïdal de compression cylindrique formé à froid**

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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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

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

A list of all parts in the ISO 22705 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

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# Springs — Measurement and test parameters —

## Part 1:

# Cold formed cylindrical helical compression springs

## 1 Scope

This document specifies the measurement and test methods for the general characteristics of cold formed helical compression 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 terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://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 compression spring

spring that offers resistance to a compressive force applied axially

Note 1 to entry: In the narrow sense, a compression spring indicates a helical compression spring.

[SOURCE: ISO 26909:2009, 1.2]

#### 3.1.3 coil spring

coil-shaped spring

[SOURCE: ISO 26909:2009, 3.11]

#### 3.1.4 helical compression spring

compression spring made of wire of circular cross-section, wound around an axis with spaces between its coils

[SOURCE: ISO 26909:2009, 3.12, modified — limited to wires with circular cross-section]

3.1.5

**cold formed spring**

spring formed at ambient temperature

[SOURCE: ISO 26909:2009, 1.12]

3.1.6

**active coils**

total number of coils less the inactive coils

Note 1 to entry: This is the number of coils used in computing the total deflection of a spring.

[SOURCE: ISO 26909:2009, 5.70, modified — extended to all inactive coils]

3.1.7

**test parameter**

parameter with a tolerance for which there is an immediate conclusion after the test (within tolerance or out of tolerance)

Note 1 to entry: Test can be performed 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
$D_e$	mm	outside diameter of spring
$D_{e,max}$	mm	maximum outside diameter of spring
$D_{e,min}$	mm	minimum outside diameter of spring
$D_i$	mm	inside diameter of spring
$D_{i,max}$	mm	maximum inside diameter of spring
$D_{i,min}$	mm	minimum inside diameter of spring
$d$	mm	diameter of wire
$d_{max}$	mm	maximum diameter of wire
$d_{wire}$	mm	actual wire diameter
$e_1$	mm	perpendicularity
$e_2$	mm	parallelism
$F$	N	spring load or force
$F_c$	N	spring load at solid length, $L_c$
$F_{max}$	N	maximum specified spring load
$F_{min}$	N	minimum specified spring load
$F_n$	N	spring load for the minimum test length, $L_n$
$F_1, F_2, \dots$	N	specified spring loads for the specified spring lengths, $L_1, L_2, \dots$
$L_c$	mm	solid length
$L_{max}$	mm	maximum specified spring length
$L_{min}$	mm	minimum specified spring length
$L_n$	mm	minimum acceptable test length for $F_n$
$L_0$	mm	free length
$L_{0,max}$	mm	maximum free length
$L_{0,min}$	mm	minimum free length
$L_1, L_2, \dots$	mm	specified spring lengths for the spring loads, $F_1, F_2, \dots$



Table 1 (continued)

Symbols	Units	Designations
$n$	-	active coils
$n_t$	-	total number of coils
$p$	mm	spring pitch
$R = \frac{\Delta F}{\Delta L} = \frac{\Delta F}{\Delta s}$	N/mm	spring rate (see Annex A)
$s$	mm	deflection of spring
$s_c$	mm	deflection of spring for the solid length, $L_c$
$s_h$	mm	deflection of the spring (stroke) between two loads, $\Delta F$
$s_n$	mm	maximum test spring deflection for the spring load, $F_n$
$s_1, s_2, \dots$	mm	specified spring deflections for the specified spring loads, $F_1, F_2, \dots$
$u$	mm	distance between the coils

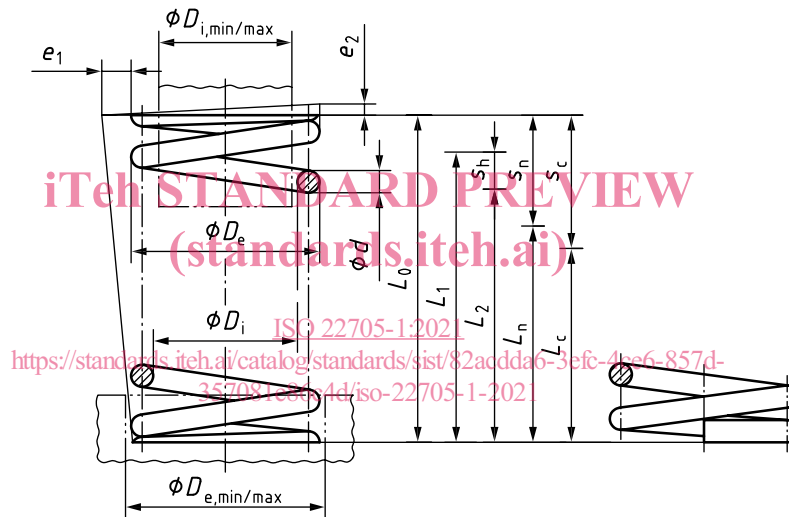


Figure 1 — Symbols for helical compression springs

#### 4 Environmental conditions

The spatial distribution and equipment of the facility shall permit a reliable implementation of the measurements and tests. 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 should be documented in appropriate qualification or training documents, depending on the requirements.

## 6 Geometries of guiding and supporting devices

If guiding and supporting devices (e.g. test pins, guide sleeves, ring grooves) are used, the properties (e.g. geometry, material) shall be agreed upon between the manufacturer and the customer to include special cases such as snapping end coils, buckling or 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. Measuring equipment shall conform to ISO standards, if such are available (e.g. ISO 3611 and ISO 13385-1).

If there is a customer requirement, the methods and measuring equipment shall be agreed on separately.

## 8 Measurement and test parameter for technical cold formed cylindrical compression springs

### 8.1 Free length ( $L_0$ )

#### 8.1.1 General

The free length  $L_0$  is a measurement and test parameter.

#### 8.1.2 Type of characteristic

$L_0$  is the length across the entire spring body when no load is applied and only when both ends are ground (see [Figure 2](#)); other cases should be agreed upon between the manufacturer and the customer.

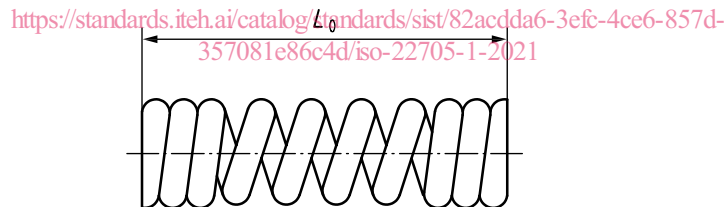


Figure 2 — Free length ( $L_0$ ) where both ends are closed and ground

#### 8.1.3 Measuring and/or testing equipment

The following measuring equipment can be used:

- micrometer gauge;
- calliper;
- dial gauge/indicating calliper;
- electronic measuring sensor;
- manual/automatic force gauge;
- optical measuring instruments/protractor/measurement microscope/camera systems.

The following testing equipment can be used:

- attributive gauges (GO/NO-GO gauges).

### 8.1.4 Conditions of measurement and testing

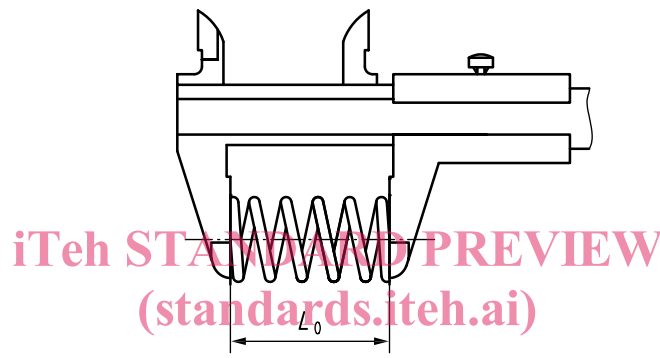
The free length  $L_0$  shall be evaluated at ambient temperature as delivered.

### 8.1.5 Method of measurement and testing

#### a) Variable measurement

The measurement can be carried out without contact using optical procedures, capacitive or electrically by contact (with minimal force) or by contact with the measuring surfaces (at a known/unknown measuring force). Preferably, the measurement should be carried out over the entire face (see [Figure 3](#)). If this is not possible, then a second measurement can be carried out with a 90° offset. In this case, it shall be clarified whether the maximum value, the minimum value or the average value is to be specified.

When there is a spring self-weight effect, the measurement of free height should be agreed upon between the manufacturer and the customer.

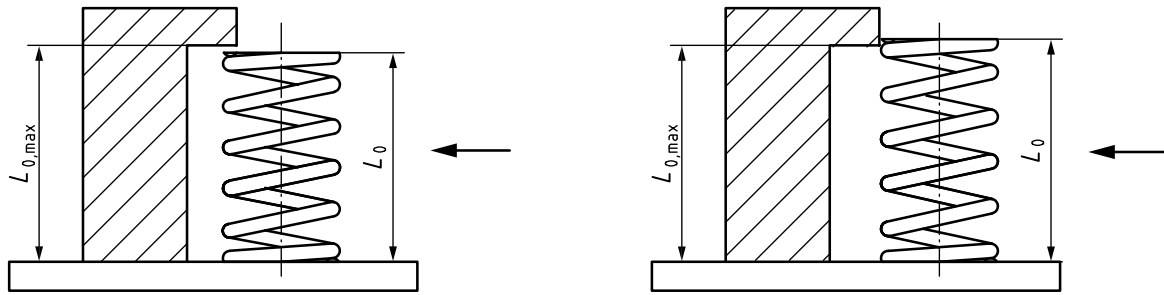


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**Figure 3 — Method of measurement of the free length ( $L_0$ ) with calliper (example)**

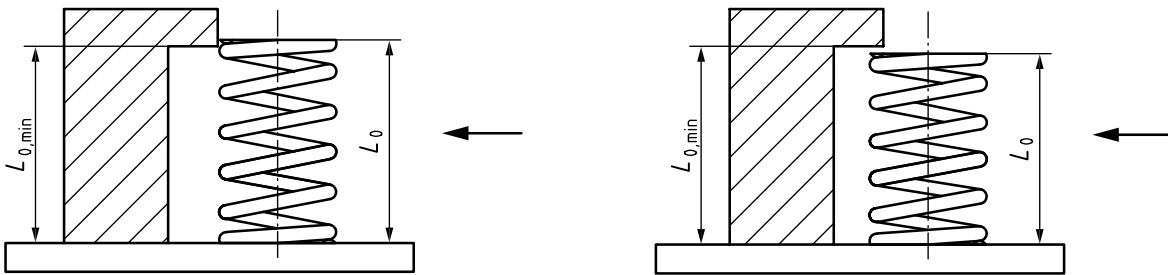
If the customer specifies a setting length for the test spring, the setting conditions for the test spring shall be agreed upon between the manufacturer and the customer.

Unless otherwise specified, springs that are not pre-set shall only be measured after the spring load test. If no spring load or force is specified, measurement can be done without any preliminary test.

#### b) Attributive testing (with GO/NO-GO gauges, see [Figure 4](#))



a) Tolerance upper limit check with gauge ( $L_0 \leq L_{0,max}$ ) (GO/within tolerance)      b) Tolerance upper limit check with gauge ( $L_0 > L_{0,max}$ ) (NO GO/out of tolerance)



c) Tolerance lower limit check with gauge ( $L_0 \geq L_{0,min}$ ) (NO GO/within tolerance)      d) Tolerance lower limit check with gauge ( $L_0 < L_{0,min}$ ) (GO/out of tolerance)

Figure 4 — Method of testing the free length ( $L_0$ ) with gauges (examples)

8.1.6 Test location on the product

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The test direction is in the axial direction to the finished spring. When measuring equipment is used that induces a measuring force, then the applied force should not deflect the spring.

When optical measuring equipment (camera systems) is used, the measurement axis is perpendicular to the spring axis.

8.2 Outside diameter ( $D_e$ )

8.2.1 General

The outside diameter  $D_e$  is a measurement and test parameter.

8.2.2 Type of characteristic

$D_e$  is the value of the outside diameter through the whole spring body (see Figure 5).

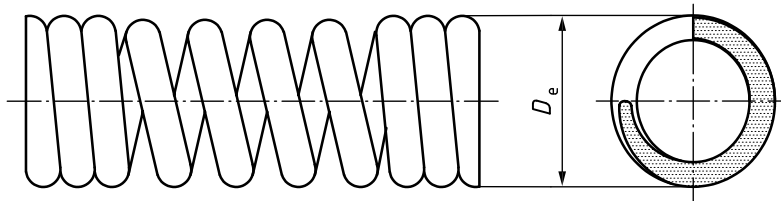


Figure 5 — Outside diameter ( $D_e$ )