
**Springs — Measurement and test
parameters —**

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

Ressort - Mesures et paramètres d'essai —

Partie 1: Ressort hélicoïdal de compression cylindrique formé à froid

*iTeh Standards
(<https://standards.iteh.ai>)
Document Preview*

ISO 22705-1:2021

<https://standards.iteh.ai/catalog/standards/iso/82acdda6-3efc-4ce6-857d-357081e86c4d/iso-22705-1-2021>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO 22705-1:2021

<https://standards.iteh.ai/catalog/standards/iso/82acdda6-3efc-4ce6-857d-357081e86c4d/iso-22705-1-2021>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
1 Scope	1
2 Normative references	1
3 Terms, definitions, symbols and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Symbols and abbreviated terms	2
4 Environmental conditions	3
5 Qualifications of the person(s) performing the work	3
6 Geometries of guiding and supporting devices	4
7 Measuring and testing equipment	4
8 Measurement and test parameter for technical cold formed cylindrical compression springs	4
8.1 Free length (L_0)	4
8.1.1 General	4
8.1.2 Type of characteristic	4
8.1.3 Measuring and/or testing equipment	4
8.1.4 Conditions of measurement and testing	5
8.1.5 Method of measurement and testing	5
8.1.6 Test location on the product	6
8.2 Outside diameter (D_e)	6
8.2.1 General	6
8.2.2 Type of characteristic	6
8.2.3 Measuring and/or testing equipment	7
8.2.4 Conditions of measurement and testing	7
8.2.5 Method of measurement and testing	7
8.2.6 Test location on the product	9
8.3 Inside diameter (D_i)	10
8.3.1 General	10
8.3.2 Type of characteristic	10
8.3.3 Measuring and/or testing equipment	10
8.3.4 Conditions of measurement and testing	10
8.3.5 Method of measurement and testing	10
8.3.6 Test location on the product	12
8.4 Total number of coils (n_t), number of active coils (n) and coil direction	13
8.4.1 General	13
8.4.2 Type of characteristic	13
8.4.3 Measuring and/or testing equipment	15
8.4.4 Conditions of measurement and testing	15
8.4.5 Method of measurement and testing	15
8.4.6 Test location on the product	16
8.5 Applied end coils	16
8.5.1 General	16
8.5.2 Type of characteristic	16
8.5.3 Measuring and/or testing equipment	17
8.5.4 Conditions of measurement and testing	17
8.5.5 Method of measurement and testing	17
8.5.6 Test location on the product	17
8.6 Solid length (L_c)/solid force (F_c)	17
8.6.1 General	17
8.6.2 Type of characteristics	17
8.6.3 Measuring and/or testing equipment	18
8.6.4 Conditions of measurement and testing	18

8.6.5	Method of measurement and testing	18
8.6.6	Test location on the product	19
8.7	Spring load (F)	19
8.7.1	General	19
8.7.2	Type of characteristic	19
8.7.3	Measuring and/or testing equipment	19
8.7.4	Conditions of measurement and testing	19
8.7.5	Method of measurement and testing	20
8.7.6	Test location on the product	20
8.8	Spring pitch (p)/distance between the coils	20
8.8.1	General	20
8.8.2	Type of characteristic	20
8.8.3	Measuring and/or testing equipment	21
8.8.4	Conditions of measurement and testing	21
8.8.5	Method of measurement and testing	21
8.8.6	Test location on the product	21
8.9	Ground surface/angle	21
8.9.1	General	21
8.9.2	Type of characteristic	22
8.9.3	Measuring and/or testing equipment	22
8.9.4	Conditions of measurement and testing	23
8.9.5	Method of measurement and testing	23
8.9.6	Test location on the product	23
8.10	Perpendicularity (e_1)	23
8.10.1	General	23
8.10.2	Type of characteristic	23
8.10.3	Measuring and/or testing equipment	24
8.10.4	Conditions of measurement and testing	24
8.10.5	Method of measurement and testing	24
8.10.6	Test location on the product	25
8.11	Parallelism (e_2)	25
8.11.1	General	25
8.11.2	Type of characteristic	25
8.11.3	Measuring and/or testing equipment	25
8.11.4	Conditions of measurement and testing	26
8.11.5	Method of measurement and testing	26
8.11.6	Test location on the product	26
8.12	Shear-off burr	26
8.12.1	General	26
8.12.2	Type of characteristic	27
8.12.3	Measuring and/or testing equipment	27
8.12.4	Conditions of measurement and testing	27
8.12.5	Method of measurement and testing	27
8.12.6	Test location on the product	28
Annex A (informative) Calculation of spring rate (R)		29
Bibliography		30

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).

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 www.iso.org/iso/foreword.html.

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.

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, ΔF
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

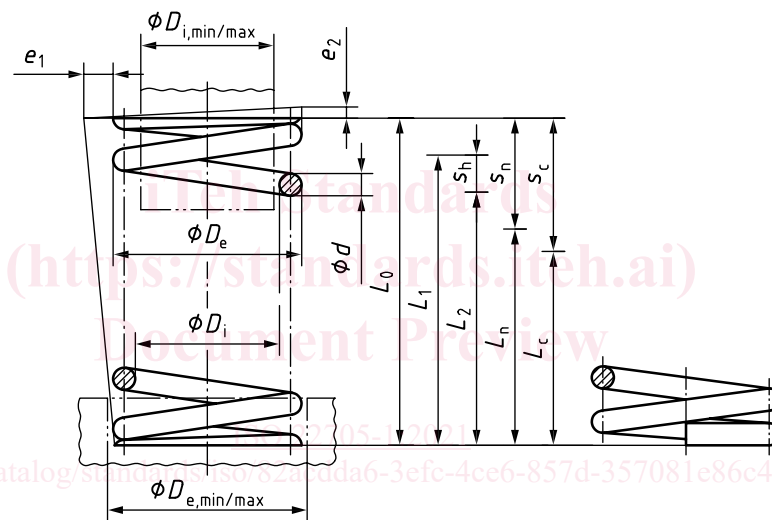


Figure 1 — Symbols for helical compression springs

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.

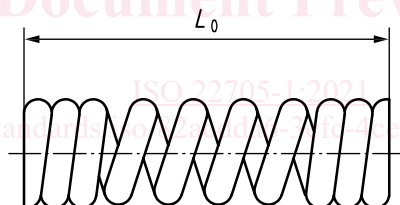


Figure 2 — Free length (L_0) where both ends are closed and ground

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.

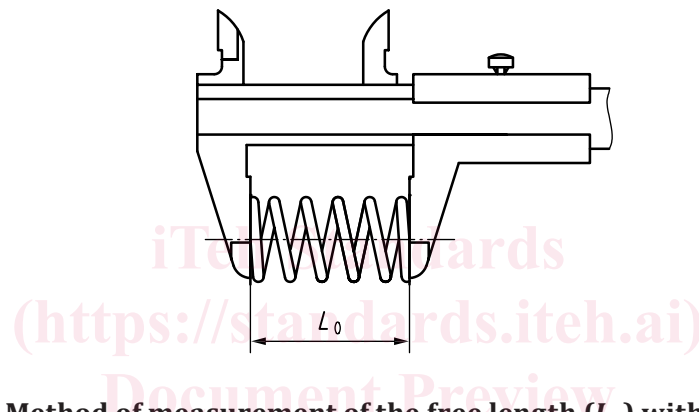


Figure 3 — Method of measurement of the free length (L_0) with calliper (example)

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](#))