JIS

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 7738 : 2020

(JTM/JSA)

Calibration and verification of helical compression and extension springs testing machines

ICS 17.100 ; 21.160

Reference number : JIS B 7738 : 2020 (E)

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Full document details: JIS B 7738 2020

Date of Establishment: 1984-11-01

Date of Revision: 2020-11-20

Date of Public Notice in Official Gazette: 2020-11-20

Investigated by: Japanese Industrial Standards Committee

Standards Board for ISO area

JIS B 7738 : 2020, First English edition published in 2021-04

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

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Printed in Japan HT/HN

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Testing Machine Association (JTM)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS B 7738**:2001), which has been technically revised.

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Calibration and verification of helical compression and extension springs testing machines

Introduction

This Japanese Industrial Standard specifies the data of both “force” and “length” in the loading process of helical compression and extension springs, which are important elements for the basic performance evaluation of the said springs, and the calibration and verification methods for both of them.

No corresponding International Standard has been established at this point.

1 Scope

This Standard specifies the method for calibration and verification of the force-measuring system and length measuring instrument of the compression and tension testing machines (hereafter referred to as testing machines) used for evaluation of compressive and tensile characteristics of helical compression and extension springs.

This Standard addresses the static calibration and verification of the force-measuring systems and length measuring instruments. The calibration values are not necessarily valid for high-speed or dynamic testing applications.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 7506 *Gauge blocks*

JIS B 7517 *Vernier, dial and digital height gauges*

JIS B 7728 *Calibration of force-proving instruments used for the verification of uniaxial testing machines*

3 Terms and definitions

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

3.1

calibration

operation that establishes the relationship between the indicated value of the force indicator of the testing machine and the reference force value, and between the indicated value of the length indicator of the testing machine and the reference length value

3.2

verification

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confirmation, based on analysis of measurements in accordance with this Standard, that the performance properties of the testing machine achieve the limits given for a specified class

3.3

length

a) length between the coil end parts of the compression spring (see Figure 1)

b) centre-to-centre length of the hook of the extension spring (see Figure 2)

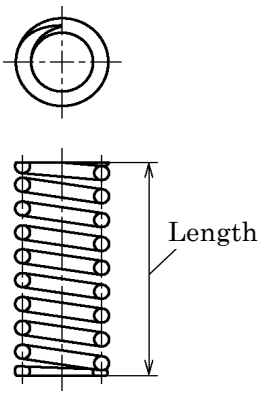


Figure 1 Compression spring

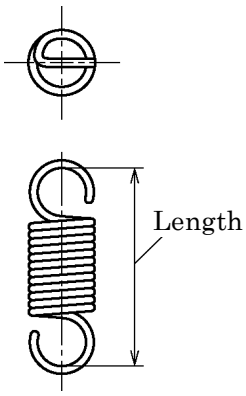


Figure 2 Extension spring

4 Symbols and definitions

For the purpose of this Standard, the symbols and definition given in Table 1 apply.

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Table 1 Symbols and definitions

Symbol	Unit	Definition
a	%	Relative resolution of the force indicator of the testing machine
b	%	Relative repeatability error of the force-measuring system of the testing machine
b_{al}	%	Allowable value of b for a specific class
ΔF	N	Error of the force
Δm	Kg	Error of the mass
Δg	m/s^2	Error of local acceleration due to gravity
f_0	%	Relative zero error of the force-measuring system of the testing machine
F	N	Reference force indicated by the force-proving instrument with increasing test force
F'	N	Reference force indicated by the force-proving instrument with decreasing test force
F_c	N	Reference force indicated by the force-proving instrument with increasing test force, for the complementary series of measurements for the smallest range used
F_i	N	Force indicated by the force indicator of the testing machine to be verified, with increasing test force
F_i'	N	Force indicated by the force indicator of the testing machine to be verified, with decreasing test force
$\overline{F_i}$, $\overline{F}$	N	Arithmetic mean of several measurements of F_i and F for the same discrete force
F_{ic}	N	Force reading on the force indicator of the testing machine to be verified, with increasing test force, for the complementary series of measurements for the smallest range used
F_{i0}	N	Residual indication of the force indicator of the testing machine to be verified after removal of force
F_N	N	Maximum value of the calibrated range of the force indicator of the testing machine
g	m/s^2	Local acceleration due to gravity
m	kg	Mass of dead weights used to generate a calibration force
q	%	Mean relative indication error of the force-measuring system of the testing machine
q_{al}	%	Allowable value of q for a specific class
q_{max}	%	The maximum value of q value at each calibration point
q_{min}	%	The minimum value of q value at each calibration point
q_{T1}	%	Relative indication error determined at a crossover point using force-proving instrument 1
q_{T2}	%	Relative indication error determined at a crossover point using force-proving instrument 2
r	N	Resolution of the force indicator of the testing machine
U_{T1}	%	Expanded uncertainty using force-proving instrument 1 at a crossover point
U_{T2}	%	Expanded uncertainty using force-proving instrument 2 at a crossover point
v	%	Relative reversibility error of the force-measuring system of the testing machine
ρ_{air}	kg/m^3	Density of air
ρ_m	kg/m^3	Density of the dead weights

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