

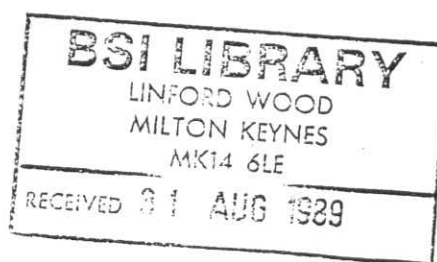
JIS

1 of 2
UDC 669.15-426:669.15'26'292-194:669.
14.018.27:621.785.72.065:621.43-46

JAPANESE INDUSTRIAL STANDARD

**Oil Tempered Chromium
Vanadium Alloy Steel
Wires for Valve Spring**

JIS G 3565—1988



Translated and Published

by

Japanese Standards Association

211

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

JAPANESE INDUSTRIAL STANDARD
Oil Tempered Chromium Vanadium Alloy Steel Wires for Valve Spring

JIS
G 3565-1988

1. Scope

This Japanese Industrial Standard specifies the oil tempered chromium vanadium alloy steel wire to be used for valve spring of internal combustion engine and for other similar springs, hereinafter referred to as the "wire".

Remark: The units and numerical values given in { } in this Standard are based on the International System of Units (SI) and are appended for informative reference.

Further, the traditional units accompanied by numerical values in this Standard shall be converted to the SI units and numerical values on Jan. 1, 1991.

2. Class and Symbol

The class and symbol thereof shall be only one and its symbol and applicable wire diameters shall be as specified in Table 1.

Table 1. Class, Symbol and Applicable Wire Diameters

Class	Symbol	Applicable wire diameter
Oil tempered chromium vanadium alloy steel wires for valve spring	SWOCV-V	2.00 mm or over up to and incl. 10.0 mm

3. Chemical Composition

The chemical composition of the materials to be used for the manufacture of the wire as obtained by ladle analysis shall be as specified in Table 2.

Table 2. Chemical Composition

Chemical Composition %							
C	Si	Mn	P	S	Cu	Cr	V
0.45 to 0.55	0.15 to 0.35	0.65 to 0.95	0.025 max.	0.025 max.	0.20 max.	0.80 to 1.10	0.15 to 0.25

Applicable Standards:

JIS G 3502-Piano Wire Rods

JIS K 1310-Hydrochloric Acid

JIS Z 2241-Method of Tensile Test for Metallic Materials

4. Mechanical Properties

4.1 Tensile Strength The wire shall be tested in accordance with 9.2 and the resulting tensile strength shall conform to Table 3-1 or Table 3-2.

Table 3-1. Tensile Strength
(Applicable till the end of 1990)

Standard wire diameter ⁽¹⁾ mm	Tensile strength N/mm ² {kgf/mm ² }
2.00	1570 to 1720{160 to 175}
2.30	1570 to 1720{160 to 175}
2.60	1570 to 1720{160 to 175}
2.90	1570 to 1720{160 to 175}
3.20	1570 to 1720{160 to 175}
3.50	1570 to 1720{160 to 175}
4.00	1520 to 1670{155 to 170}
4.50	1520 to 1670{155 to 170}
5.00	1470 to 1620{150 to 165}
5.50	1470 to 1620{150 to 165}
6.00	1470 to 1620{150 to 165}
6.50	1420 to 1570{145 to 160}
7.00	1420 to 1570{145 to 160}
8.00	1370 to 1520{140 to 155}
9.00	1370 to 1520{140 to 155}
10.00	1370 to 1520{140 to 155}

Note ⁽¹⁾ The standard wire diameters shall be as specified in 5.1.

Remark: For an intermediate diameter, the tensile strength specified for the nearest larger wire diameter shall be applied.

Table 3-2. Tensile Strength
(Applicable on and after Jan. 1, 1991)

Standard wire diameter ⁽¹⁾ mm	Tensile strength N/mm ²
2.00	1570 to 1720
2.30	1570 to 1720
2.60	1570 to 1720
2.90	1570 to 1720
3.20	1570 to 1720
3.50	1570 to 1720
4.00	1520 to 1670
4.50	1520 to 1670
5.00	1470 to 1620
5.50	1470 to 1620
6.00	1470 to 1620
6.50	1420 to 1570
7.00	1420 to 1570
8.00	1370 to 1520
9.00	1370 to 1520
10.00	1370 to 1520

Note ⁽¹⁾ The standard wire diameters shall be as specified in 5.1.

Remark: For an intermediate diameter, the tensile strength specified for the nearest larger wire diameter shall be applied.

4.2 Reduction of Area The wire shall be tested in accordance with 9.2 and the resulting reduction of area shall be not less than 45 % for the wire 3.50 mm or smaller in diameter, and, as a rule, not less than 40 % for the wire over 3.50 mm in diameter.

4.3 Torsion The wire 6.00 mm or smaller in diameter shall be subjected to the torsion test specified in 9.3, and the conditions of twist and fractured section of the wire shall conform to Table 4.

Table 4. Conditions of Twist and Fractured Section

Condition of twist	After fracture, the surface shall show no injurious flaw.
Condition of fractured section	The fractured section shall be perpendicular to the axis of the wire and shall show no flaw, crack, etc.

4.4 Winding The wire 6.00 mm or under in diameter shall be subjected to the winding test specified in 9.4 and shall not fracture nor produce any injurious flaw.

4.5 Bending The wire over 6.00 mm in diameter shall be subjected to the bending test specified in 9.5 and shall not fracture nor produce any injurious flaw.

5. Wire Diameter, Its Tolerances and Shape

5.1 Range of Wire Diameter The standard wire diameter shall be as specified in Table 5.

Table 5. Standard Wire Diameter

Unit: mm							
2.00	2.30	2.60	2.90	3.20	3.50	4.00	4.50
5.00	5.50	6.00	6.50	7.00	8.00	9.00	10.0

5.2 Tolerances on Wire Diameter and Ovality⁽²⁾ The tolerances wire diameter and ovality⁽²⁾ shall be as specified in Table 6.

Note ⁽²⁾ The term "ovality" means the difference between the largest and the smallest diameters measured in the same cross section of a wire.

Table 6. Tolerances on Wire Diameter and Ovality

Unit: mm		
Wire diameter	Tolerances	Ovality
2.00 or over up to and incl. 3.20	± 0.02	0.02 max.
Over 3.20 up to and incl. 6.00	± 0.03	0.03 max.
Over 6.00 up to and incl. 8.00	± 0.04	0.04 max.
Over 8.00 up to and incl. 10.00	± 0.05	0.05 max.

5.3 Waviness The wire shall show no injurious waviness in shape.

6. Surface Condition

6.1 Appearance The wire shall show no injurious flaw, scale, rust, etc.

6.2 Flaw The wire shall be tested in accordance with 9.7, and the depth of flaw shall be as specified in Table 7.

Table 7. Depth of Flaw

Wire diameter mm	Depth of flaw
2.00	0.01 mm or under
Over 2.00 up to and incl. 6.00	Within 0.5 % of wire diameter
Over 6.00 up to and incl. 10.0	Within 0.7 % of wire diameter (0.06 mm max.)

6.3 Decarburized Layer The wire shall be tested in accordance with 9.8 and no ferritic decarburized layer shall be found.

The total depth of the decarburized layer shall not exceed 1.5 % of the wire diameter with the maximum depth of 0.05 mm.

7. Material

The wire rod as material of the wire shall be as specified in JIS G 3502 for matters other than the chemical composition.

8. Manufacture

The wire shall be manufactured by cold working followed by oil tempering.

9. Test

9.1 Sampling of Test Piece Sampling of test pieces shall be carried out as follows:

- (1) Take each one test piece for (2) to (7) from one end of each length of wire.
- (2) A test piece for the tensile test shall be of a length suitable for the test of 9.2.
- (3) A test piece for the torsion test shall be of a length suitable for the test of 9.3.
- (4) A test piece for the winding test shall be of a length suitable for the test specified in 9.4.
- (5) A test piece for the bending test shall be of a length suitable for the test specified in 9.5.
- (6) A test piece for the flaw detection test shall be of a length suitable for the test of 9.7.
- (7) A test piece for the decarburization detection test shall be of a length suitable for microscopic observation of one spot on its cross section.

9.2 Tensile Test The test shall be carried out in accordance with JIS Z 2241 with the clamping interval spaced at approximately 200 mm.

When the test piece breaks at the clamped part, the test shall be invalidated and a further test shall be made afresh, with a test piece specified in 8.1 taken from the same length of wire.

9.3 Torsion Test Clamp both ends of the test piece firmly with the clamping distance 100 times as large as the wire diameter, and twist one end in one direction until it fractures while stretching the test piece just hard enough to keep it taut. The condition of twist at the time of fracture and the fractured section shall be examined.

9.4 Winding Test Wind at least two turns a test piece closely around a mandrel of a diameter as large as the diameter of the test piece for the wire 4.00 mm or smaller in diameter and around a mandrel twice the wire diameter for the wire over 4.00 mm. Then check for the existence of fracture and cracks.

9.5 Bending Test A test piece to an angle of 90° around an arc of the radius equal to the diameter of the test piece, and then check for the presence of fracture and cracks.

9.6 Determination of Wire Diameter To determine the wire diameter, measure the largest and smallest diameters at an arbitrary spot.

9.7 Flaw Detection Test Immerse the test piece by the length of about 200 mm in a boiling solution of hydrochloric acid and water of a proper concentration specified in JIS K 1310 and, when the wire diameter has been reduced by approximately 1 % without causing any spot corrosion of the wire, examine for the existence of flaws. Usually shave off the corroded portion to its end and then measure its depth with a micrometer.

9.8 Decarburization Detection Test Polish a cross section of the test specimen, etch it and examine the condition of decarburization with a microscope of 100 to 400 magnifications.

10. Inspection

- (1) Inspection of mechanical properties, wire diameter, shape and surface condition shall be carried out for every length of wire in accordance with 9. and the results shall conform to the requirements specified in 4. to 6.

Inspection of appearance shall be made by an appropriate method and the results shall conform to the requirements specified in 6.1.

- (2) When a tensile test result does not satisfy the specified value, a retest may be carried out with approval of the purchaser. In this case, two additional test pieces shall be taken, and both the test results shall comply with the requirements.

11. Marking

Each length of wire having passed the inspection shall be legibly marked with the following information:

- (1) Symbol of class
- (2) Wire diameter
- (3) Manufacturer's name or its abbreviation

Reference: In addition to the tests described above in this Standard, there exists another test described below for reference.

Fatigue Test

The wire shall be subjected to the rotary bending fatigue test and shall not fracture within the number of rotations of 10^7 . The stress (σ) applied in this test shall, as a rule, be $420 \text{ N/mm}^2 \{43.3 \text{ kgf/mm}^2\}$.

G 3565-1988
Edition 1

Japanese Text

Established by Minister of International Trade and Industry

Date of Establishment: 1963-03-01

Date of Revision: 1988-07-01

Date of Public Notice in Official Gazette: 1988-07-04

Investigated by: Japanese Industrial Standards Committee

Divisional Council on Iron and Steel

This English translation is published by:
Japanese Standards Association
1-24, Akasaka 4, Minato-ku,
Tokyo 107 Japan
© JSA, 1989

Printed in Tokyo by
Hohbunsha Co., Ltd.