Australian Standard™

Carbon steel spring wire for mechanical springs

Standards Australia

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Australian Building Codes Board
Australian Chamber of Commerce and Industry
Australian Industry Group
Australian Foundry Institute
Australian Institute of Steel Construction
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Carbon steel spring wire for mechanical springs

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee MT-001, Iron and Steel. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to specify requirements and tests for carbon steel spring wire of round cross-section for the manufacture of mechanical springs. Four types, or conditions, of spring wire are covered.

During revision of this Standard cognisance was taken of the three-part International Standard ISO 8458, *Steel wire for mechanical springs*. The Committee decided against its adoption as an Australian Standard because it does not cover the full range of mechanical spring wires used by Australian industry, and it imposes unacceptable restrictions on wire manufacturing practice.

Notable changes that have been introduced in the revised Standard relate to wire diameter tolerances, which have been rationalized, and to coil presentation and cast, which are now more clearly specified. The Standard has been expanded in respect of optional drawn metallic coatings and now includes zinc/aluminium-alloy coatings. The coating class, previously unspecified, for both zinc and zinc/aluminium-alloy coatings has been set at W02.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which is applies. An ‘informative’ appendix is only for information and guidance.

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Australian Standard
Carbon steel spring wire for mechanical springs

1 SCOPE

This Standard specifies requirements for carbon steel spring wire of round cross-section for mechanical springs, supplied in one of the following conditions:

(a) Hard-drawn.

(b) Drawn metallic coated, e.g. drawn-galvanized.

(c) Oil-hardened and tempered.

(d) Soft-drawn.

This Standard applies to wire supplied in the form of coils. It does not cover the testing of wire that is supplied in mechanically straightened cut-lengths, or wire that has been straightened by the user.

NOTES:

1 Spring wires for bedding and seating applications are covered by AS 2266.

2 In this Standard the term 'drawing', alone or in combination, or a variation of 'drawing', such as 'drawn', is intended to embrace any other technically feasible means, such as 'rolling', by which cold-working of steel feedstock enables wire of round cross-section to be achieved.

3 Mechanical straightening introduces small, but significant, changes in diameter and mechanical properties (e.g. tensile strength) of as-drawn spring wire, and the degree of change varies with the straightening technique employed.

4 Advice and recommendations on information to be supplied by the purchaser at the time of enquiry or order are contained in the purchasing guidelines set out in Appendix A.

5 Alternative means for determining compliance with this Standard are given in Appendix B.

2 REFERENCED DOCUMENTS

The documents below are referred to in this Standard:

AS	
1199	Sampling procedures and tables for inspection by attributes
1391	Methods for tensile testing of metals
1399	Guide to AS 1199—Sampling procedures and tables for inspection by attributes
1442	Carbon steels and carbon-manganese steels—Hot-rolled bars and semifinished products
2266	Carbon steel spring wire for bedding and seating
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HB 18.28	Guide 28—General rules for a model third-party certification scheme for products
AS/NZS	
1050	Methods for the analysis of iron and steel (all parts)
4534	Zinc and zinc/aluminium-alloy coatings on steel wire
AS/NZS ISO	
9001	Quality management systems—Requirements
9004	Quality management systems—Guidelines for performance improvement

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

3.1 Batch

A quantity of wire produced under conditions that are considered to be uniform.

NOTE: Each batch is assumed, as far as practicable, to consist of items of a single type or condition, grade, class, size and composition, and to have been manufactured under essentially the same conditions at essentially the same time.

3.2 Block

The capstan, specifically of a wire drawing machine, on which the coil of wire in its final (wire) diameter is enabled to be progressively accumulated and formed into the desired configuration, mass and dimensions for supply to the purchaser.

3.3 Cast

The form taken by the individual waps (rings, turns or circles) of a wire within a coil.

NOTE: When a wap is cut from a coil of spring wire, it may freely assume one of two geometrical shapes, or casts, namely—

(a) a cast, as exhibited, in general, by block-wound hard-drawn, soft-drawn and drawn metallic coated wires, and characterized by overall diameter of the wap and helical separation of its cut ends; or

(b) nominally a straight-line (or rectilinear) cast, this latter being a notable characteristic of oil-hardened and tempered wire, but also being a feature of certain groups of hard-drawn and drawn metallic coated wires.

3.4 Cast analysis

Analysis determined, for such elements as have been specified, on a test sample obtained during the pouring of the liquid steel; also known as heat analysis.

3.5 Coil

A continuous length of wire, neatly and compactly wound, and containing no mechanical joints (such as knots), but may contain electric resistance butt-welds; it may be supplied unsupported, being in the general form of a torus (quoit shape), or it may be supplied supported on a transportable carrier (see Clause 4.5).

3.6 Drawn metallic coated

Carbon steel wire cold-worked by drawing to final size, after metallic coating and with a minimum of 40% reduction of cross-sectional area, from a heat-treated (patented or similar process) base.

NOTE: The metallic coating to be applied at an intermediate stage of wire processing may be either zinc or zinc/aluminium alloy, as defined in Clauses 3.15 and 3.16 respectively.

3.7 Electrodeposited zinc coating

A coating of zinc of at least 98% purity, applied to the wire using a specialized continuous electrolytic process (see Clause 3.15 and Note to Clause 3.8).

3.8 Galvanized

Describes a protective coating obtained by dipping (immersing) prepared steel wire in a bath of molten zinc of purity not less than 98%.

NOTE: By definition, the terms 'galvanized' and, by extension, 'galvanizing' relate strictly to the hot-dip application of zinc. However, zinc coatings applied by alternative processes may also be referred to as 'galvanized', provided they are distinguished at all times by a distinctive, process-specific qualifier or prefix, such as 'electrolytic' or 'electro' (but not by cryptic abbreviations, such as 'e-' or 'el').

3.9 Hard-drawn

Carbon steel wire cold-worked by drawing with a minimum of 40% reduction of cross-sectional area from a heat-treated (patented or similar process) base.

3.10 Oil-hardened and tempered

Carbon steel wire heat-treated in line by first transforming into austenite, quenching in oil or other suitable medium, followed by tempering at an appropriate temperature.

NOTE: Oil-hardened and tempered wire is conventionally termed 'oil-tempered wire' within the wire industry.

3.11 Ovality

The difference between the maximum and minimum diameters of the wire, measured at the same cross-section; also known as out-of-roundness.

3.12 Patenting

A wire industry term for a continuous heat treatment process for either hot-rolled rod feedstock or wire at an intermediate stage of processing, whereby the rod or wire is held at austenitizing temperature (typically 850–950°C), followed by a controlled cooling operation involving essentially isothermal transformation (at typically 500–530°C) of the steel's microstructure to fine pearlite.

3.13 Soft-drawn

Wire drawn with a reduction of cross-sectional area of approximately 10% from a spheroidize-annealed base.

3.14 Wap

Individual ring, turn or circle, of wire within any coil, or an individual ring, turn or circle, cut from a block-wound coil.

3.15 Zinc coating

A coating composed essentially of zinc, with or without zinc/iron-alloy formation at the zinc/iron interface, and produced in a continuous operation by dipping (immersing) prepared and separated single strands of steel wire in a bath of at least 98% purity by mass of molten zinc (see Clause 3.8), or in an electroplating bath having zinc anodes and/or containing a solution of an appropriate zinc salt (see Clause 3.7);

NOTE: Small amounts of certain chemical elements or compounds may be added to the molten zinc or to the electroplating bath to impart special properties to the zinc coating.

3.16 Zinc/aluminium-alloy coating

A coating applied in a continuous operation by dipping (immersing) either uncoated or zinc-coated, separated single strands of steel wire in a bath of molten zinc/aluminium alloy containing between 4.5% and 50% aluminium, the most common aluminium content being nominally 5%.

4 MANUFACTURE

4.1 General

The wire manufacturer shall ensure that the combination of steel chemistry, heat treatment process and cold-working practice is appropriate for the achievement of the desired mechanical properties, specified or implied, of the wire, in a consistent fashion and in harmony with the known performance requirements of the intended end product and use.

4.2 Materials

The wire shall be manufactured from hot-rolled steel rods complying with the requirements of AS 1442 or other appropriate Standards, provided the chemical composition of the steel meets the requirements of Clause 4.3.

4.3 Chemical composition

4.3.1 *General*

The method of sampling for chemical analysis shall be in accordance with AS/NZS 1050.1. The chemical composition shall be determined by any procedures provided they are not less accurate than those in relevant parts of AS/NZS 1050.

4.3.2 *Cast analysis*

The chemical composition of the steel wire shall be based on cast analysis, and shall be within the limits give in Table 1 for hard-drawn and drawn metallic coated steel spring wire, Table 2 for oil-hardened and tempered steel spring wire, or Table 3 for soft-drawn steel spring wire.

TABLE 1

CHEMICAL COMPOSITION REQUIREMENTS FOR HARD-DRAWN AND DRAWN METALLIC COATED STEEL SPRING WIRE

Element	Cast analysis, percent	
	Min.	Max.
Carbon	0.45	0.85
Silicon	0.10	0.55
Manganese	0.40	1.10
Chromium	—	0.30
Vanadium	—	0.15
Phosphorus	—	0.030
Sulfur	—	0.030

TABLE 2

CHEMICAL COMPOSITION REQUIREMENTS FOR OIL-HARDENED AND TEMPERED STEEL SPRING WIRE

Element	Cast analysis, percent	
	Min.	Max.
Carbon	0.55	0.85
Silicon	0.10	0.55
Manganese	0.60	1.20
Chromium	—	0.30
Vanadium	—	0.15
Phosphorus	—	0.030
Sulfur	—	0.030

TABLE 3

CHEMICAL COMPOSITION REQUIREMENTS FOR SOFT-DRAWN STEEL SPRING WIRE

Element	Cast analysis, percent	
	Min.	Max.
Carbon	0.65	0.75
Silicon	0.10	0.55
Manganese	0.60	1.20
Chromium	—	0.30
Vanadium	—	0.15
Phosphorus	—	0.030
Sulfur	—	0.030

4.3.3 *Residual elements*

For steel complying with this Standard, percentages of residual elements up to the amounts specified in AS 1442 shall be considered as incidental.

4.3.4 *Product analysis*

Individual determinations of chemical composition of the steel spring wire may vary from the ranges or limits specified in Tables 1, 2 and 3 to the extent specified in AS 1442.

4.4 Welds

Unless specifically requested otherwise at the time of enquiry or order, electric butt-welds shall be permitted during wire processing, provided that—

(a) for hard-drawn and drawn metallic coated wires, they are inserted before the final two increments of reduction in area, or ‘passes’, in drawing; and

(b) for soft-drawn and oil-hardened and tempered wires, they are inserted before the final pass in drawing.

NOTE: With the exception of oil-hardened and tempered mechanical spring wire, and by agreement between manufacturer and purchaser, the actual position of welds may be identified in individual coils.

4.5 Coil presentation

Except by agreement between manufacturer and purchaser, coils shall be wound in the conventional direction.

NOTE: A conventionally wound coil is one which, when laid horizontally (i.e. central axis vertical) on a rotatable base, with its 'start' end uppermost, revolves in an anticlockwise direction as the wire is being consumed.

Unless otherwise agreed, the wire shall be supplied in coils that are safely and neatly secured, with the 'start' end of each coil being clearly indicated.

NOTES:

1 All mechanical spring wires are high tensile products, necessitating continual and consistent application of a high degree of caution and surveillance when handling them.

2 It is essential that a considerable level of caution be exercised when untying coils of oil-hardened and tempered mechanical spring wire, especially in larger wire diameters, since its straight-line cast presents a potential hazard to workers. It is important that the 'start' end, or any wap that is cut, be positively restrained or secured at all times.

By agreement between manufacturer and purchaser, individual coils may be supplied on transportable carriers, such as spools or tubular frames.

Unless otherwise agreed, the mass or length of wire in each coil shall be at the discretion of the manufacturer.

NOTE: The inside diameter of a block-wound coil is always smaller than the nominal block diameter.

5 REQUIREMENTS FOR WIRE

5.1 Freedom from defects

The wire shall be clean, smooth and free from defects detrimental to its subsequent processing and end use.

Notwithstanding that a delivery of wire has been accepted by the customer, if subsequent processing reveals that it contains defects found to be detrimental to its end use, and such end use has been notified to the manufacturer at the time of enquiry or order, it shall be deemed not to comply with this Standard, provided also that it has not been improperly treated after delivery.

NOTES:

1 Defects referred to in this Clause cannot be completely prescribed. Where the presence, size or frequency of any defect is considered to be of concern, arrangements should be made between the purchaser and the manufacturer at the time of enquiry or order. Such arrangements may include acceptable type samples or methods of test.

2 In general, wires that are supplied in the as-drawn condition, such as drawn-galvanized spring wire, carry a thin coating of stearate drawing lubricant that is lustrous and dry, while oil-hardened and tempered spring wire exhibits a thin, tenacious layer of iron scale resulting from the heat-treatment process, together with a light coating of oil.

5.2 Diameter and ovality tolerances

The wire shall be prepared and tested in accordance with Clauses 6.1 and 6.2, respectively.

The diameter and ovality tolerances shall be in accordance with Table 4.

Preferred diameters shall be as shown in Tables 6, 7 and 8, as appropriate.

NOTES:

1 Diameter and ovality tolerances other than those given in Table 4 may be negotiated between purchaser and manufacturer.

2 The preferred diameters shown in Tables 6, 7 and 8 are in accordance with the R20 series specified in AS 2338.

TABLE 4

DIAMETER AND OVALITY TOLERANCES

millimetres

Nominal diameter	Diameter tolerance	Ovality tolerance max.
≤ 0.80	± 0.01	0.01
> 0.80 ≤ 1.00	± 0.02	0.02
> 1.00 ≤ 4.00	± 0.03	0.03
> 4.00 ≤ 7.10	± 0.04	0.04
> 7.10 ≤ 10.00	± 0.05	0.05
> 10.00 ≤ 11.20	± 0.06	0.06

5.3 Cast

Hard-drawn and drawn metallic coated wires, when produced with a block-wound cast, shall be tested in accordance with Clause 6.3.

The wire in a block-wound coil shall be uniformly cast such that the cast diameter does not vary from the nominal value by more than 20% within a coil or within a batch. The helix (h) shall be positive (see Clause 6.3, Note 2) and shall not exceed the value given in Table 5.

NOTES:

1 These requirements do not apply to hard-drawn and drawn metallic coated wires, when manufactured to possess a nominally straight-line cast, nor oil-hardened and tempered wire (since it exhibits an inherent straight-line cast) and soft-drawn steel spring wire.

2 The nominal cast diameter usually corresponds to the diameter of the block, on which the coil is wound, but may be larger by negotiation between purchaser and manufacturer.

TABLE 5

HELIX REQUIREMENTS

millimetres

Nominal diameter	Helix (h) max.
≤ 0.80	40
> 0.80 ≤ 2.00	60
> 2.00 ≤ 3.50	80
> 3.50 ≤ 5.00	100
> 5.00 ≤ 7.00	120
> 7.00 ≤ 11.2	150

5.4 Tensile strength

The wire shall be prepared and tested in accordance with Clauses 6.1 and 6.4, respectively.

The tensile strength shall comply with the following requirements:

(a) For hard-drawn steel spring wire ..... within the limits of one of the three ranges specified in Table 6.

(b) For drawn metallic coated steel spring wire..... within the limits of one of the two ranges specified in Table 7.

(c) For oil-hardened and tempered steel spring wire ..... within the limits specified in Table 8.

(d) For soft-drawn steel spring wire ..... a maximum tensile strength of 930 MPa for all sizes.

Tensile strength values for diameters intermediate between the diameters shown in Tables 6, 7 and 8 shall be obtained by interpolation.

NOTE: Maximum tensile strength values differing from those shown in Tables 6, 7 and 8 may be negotiated between purchaser and manufacturer.

TABLE 6

PREFERRED DIAMETERS AND TENSILE STRENGTH REQUIREMENTS FOR HARD-DRAWN STEEL SPRING WIRE

Nominal diameter	Tensile strength, MPa					
	Range 1		Range 2		Range 3	
mm	Min.	Max.	Min.	Max.	Min.	Max.
≤0.56	1960	2250	2220	2490	2460	2780
0.63	1930	2220	2190	2460	2430	2750
0.71	1900	2190	2160	2430	2400	2710
0.80	1870	2160	2130	2400	2370	2680
0.90	1840	2130	2100	2370	2340	2640
1.00	1800	2070	2040	2310	2280	2570
1.12	1770	2040	2010	2270	2240	2530
1.25	1730	2000	1970	2230	2200	2480
1.40	1700	1960	1930	2180	2150	2430
1.60	1670	1920	1890	2130	2100	2370
1.80	1630	1880	1850	2080	2050	2320
2.00	1600	1840	1810	2040	2010	2270
2.24	1560	1800	1770	2000	1970	2230
2.50	1530	1760	1730	1950	1920	2170
2.80	1500	1720	1690	1910	1880	2120
3.15	1460	1680	1650	1870	1840	2080
3.55	1450	1670	1640	1850	1820	2060
4.00	1410	1630	1600	1810	1780	2010
4.50	1370	1590	1560	1760	1730	1960
5.00	1350	1560	1530	1730	1700	1920
5.60	1320	1520	1490	1680	1650	1860
6.30	1290	1490	1460	1650	1620	1830
7.10	1260	1460	1430	1620	1590	1790
8.00	1230	1420	1390	1570	1540	1740
9.00	1190	1380	1350	1530	1500	1700
10.00	1180	1360	1330	1510	1480	1670
11.20	1170	1340	1310	1480	1450	1640

TABLE 7

PREFERRED DIAMETERS AND TENSILE STRENGTH REQUIREMENTS FOR DRAWN METALLIC COATED STEEL SPRING WIRE

Nominal diameter	Tensile strength, MPa			
	Range 1		Range 2	
mm	Min.	Max.	Min.	Max.
≤ 0.56	1860	2160	2110	2410
0.63	1830	2130	2080	2380
0.71	1810	2110	2050	2350
0.80	1780	2080	2020	2320
0.90	1750	2050	1990	2290
1.00	1710	2010	1940	2240
1.12	1680	1980	1910	2210
1.25	1640	1940	1870	2170
1.40	1610	1910	1830	2130
1.60	1590	1890	1790	2090
1.80	1550	1850	1760	2060
2.00	1520	1820	1720	2020
2.24	1480	1780	1680	1980
2.50	1450	1750	1640	1940
2.80	1420	1720	1600	1900
3.15	1390	1680	1570	1870
3.55	1380	1670	1560	1850
4.00	1340	1630	1520	1810
4.50	1300	1590	1480	1760
5.00	1280	1560	1450	1730

TABLE 8

PREFERRED DIAMETERS AND TENSILE STRENGTH REQUIREMENTS FOR OIL-HARDENED AND TEMPERED STEEL SPRING WIRE

Nominal diameter	Tensile strength, MPa	
mm	Min.	Max.
0.80	1940	2150
0.90	1890	2100
1.00	1860	2070
1.12	1810	2020
1.25	1780	1990
1.40	1740	1950
1.60	1700	1910
1.80	1670	1880
2.00	1620	1830
2.24	1600	1810
2.50	1570	1780
2.80	1540	1750
3.15	1510	1720
3.55	1470	1640
4.00	1420	1590
4.50	1380	1550
5.00	1330	1500
5.60	1300	1470
6.30	1280	1450
7.10	1270	1440
8.00	1260	1430
9.00	1250	1420
10.00	1230	1400
11.20	1200	1370

5.5 Wrap test

The wire shall be prepared and tested in accordance with Clauses 6.1 and 6.5, respectively. The test piece shall show no signs of failure.

NOTES:

1 Failure of the test piece is indicated by complete or partial fracture of the wire, or a crack or cracks in the basis steel that are visible without magnification.

2 With drawn metallic coated wires, the presence of disruptions, such as a network of fine superficial cracks, limited to the coating itself, may be disregarded.

3 This test does not apply to soft-drawn steel spring wire.

5.6 Torsion test for hard-drawn wire and drawn metallic coated wire

When specifically requested by the purchaser (see Paragraph A2(h)), the wire shall be prepared and tested in accordance with Clauses 6.1 and 6.6 respectively. The test piece shall withstand the minimum number of turns specified in Table 9.

NOTES:

1 The manufacturer and purchaser should agree upon the acceptable mode of failure of the test piece.

2 This test does not apply to oil-hardened and tempered or soft-drawn steel spring wire.

5.7 Metallic coating

The metallic coating on drawn metallic coated spring wire shall comply in all respects with AS/NZS 4534, the required coating mass conforming to Class W02, unless a higher coating mass is agreed between manufacturer and purchaser.

TABLE 9

TORSION TEST REQUIREMENTS

Nominal diameter mm	Minimum number of turns in gauge length equivalent to 100 wire diameters
> 0.69 ≤ 2.00	20
> 2.00 ≤ 3.50	15
> 3.50 ≤ 6.00	10
> 6.00 ≤ 8.00	7
> 8.00 ≤ 10.00	5

6 TESTING

6.1 Test pieces

Samples taken from coils for testing, except for cast (see Clause 6.3), shall be of sufficient length to allow the preparation of the necessary test pieces.

These test pieces shall not be mechanically worked or heat-treated before testing, with the exception that minimal straightening is permitted in order to facilitate testing.

6.2 Diameter and ovality

The diameter of the wire shall be measured on a straight, or carefully straightened, length using an instrument accurate to at least 0.005 mm. The diameter value, for comparison with the specified nominal value and its tolerance, shall be the average of two readings taken at right angles to each other at the same cross-section.

The ovality of the wire shall be determined, being the difference between the maximum and minimum readings obtained in the diameter test.

6.3 Cast

The cast diameter shall be determined from a wap of wire cut carefully from an end (or ends) of the coil and placed on a flat, smooth surface, and shall be the average of two (wap) diameter measurements taken at right angles to each other.

The helix (h) shall be determined on a wap of wire cut carefully from the coil and freely suspended, and shall be measured by the axial displacement at the ends of the wire (see Figure 1 and Note 2).

NOTES:

1 This test applies only to hard-drawn and drawn metallic coated spring wires, when produced with a block-wound cast.

2 A positive helix (see Clause 5.3) means that, for coils wound in the conventional direction (see Clause 4.5), a freely suspended wap exhibits the form illustrated in Figure 1; that is, when a wap oriented as illustrated is inspected, the unobscured cross-section of the cut end (the one facing the viewer) should always be at the left, with the more-or-less hidden cut end at the right. (For non-conventionally wound coils, a positive helix is the opposite, or reverse, of this description.)

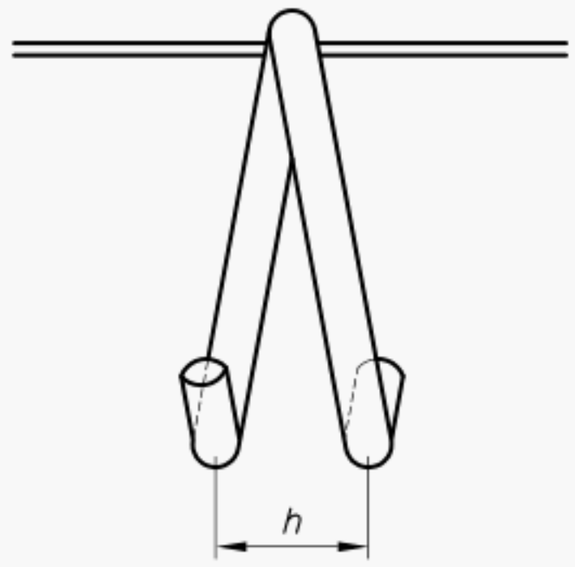

FIGURE 1 HELIX
(SHOWN FOR A CONVENTIONALLY WOUND COIL)

6.4 Tensile strength

The tensile strength shall be determined in accordance with AS 1391, and shall be calculated on the actual diameter value obtained from testing as described in Clause 6.2.

6.5 Wrap test

6.5.1 *For hard-drawn and drawn metallic coated wire*

The wrap test shall be conducted in accordance with AS 2505.6. The test piece shall be wrapped at least four turns around a mandrel having a diameter equal to the wire diameter.

6.5.2 *For oil-hardened and tempered wire*

The wrap test shall be conducted in accordance with AS 2505.6, as follows:

(a) *For wire up to and including 4 mm in diameter* The test piece shall be wrapped at least four turns around a mandrel having a diameter equal to the wire diameter.

(b) *For wire over 4 mm in diameter* The test piece shall be wrapped at least four turns around a mandrel having a diameter equal to twice the wire diameter.

6.6 Torsion test

A test length of 100 times the wire diameter shall be tested in accordance with AS 2505.5 until failure (fracturing) occurs. The number of turns to failure and mode of failure (i.e. ragged or straight) shall be recorded.

NOTES:

1 Test lengths of other than 100 times the wire diameter are permissible provided that the specified minimum number for 100 diameters is adjusted proportionately; the number of turns at which failure occurred is similarly adjusted for recording purposes.

2 During the test, part-turns at the time of failure are disregarded, irrespective of whether the test is conducted on the specified gauge length or on a proportionately adjusted gauge length.

7 MARKING

Each coil shall be marked or tagged in a legible and durable fashion and such marking shall include the following information:

(a) The name or registered trade mark of the wire manufacturer.

(b) Reference to this Standard (i.e. AS 1472).

(c) Nominal diameter of the wire.

(d) Wire quality or condition (e.g. drawn-galvanized mechanical spring wire).

(e) The tensile strength range, if appropriate (e.g. Range 2).

NOTE: No marking of tensile strength range is required for soft-drawn mechanical spring wire or oil-hardened and tempered mechanical spring wire.

(f) Coil number or package number.

NOTE: Manufacturers making a statement of compliance with this Australian Standard on a product, or on packaging or promotional material related to that product, are advised to ensure that such compliance is capable of being verified.

8 ROUNDING OF TEST RESULT NUMBERS

8.1 General

With the exception of the tensile test results, the observed or calculated values shall be rounded to the same number of figures as in the specified values and then compared with the specified values (see also AS 2706).

8.2 For tensile strength

The determined value of tensile strength shall be rounded off to the nearest 10 MPa.

APPENDIX A

PURCHASING GUIDELINES

(Informative)

A1 GENERAL

Australian Standards are intended to include the technical requirements for relevant products, but do not purport to comprise all the necessary provisions of a contract. This Appendix contains advice and recommendations on the information to be supplied by the purchaser at the time of enquiry or order.

A2 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser should supply the following information at the time of enquiry and order after making due reference to the explanation, advice and recommendations contained in this Appendix:

(a) Quantity and delivery instructions (dates, schedules, delivery point).

(b) Whether a specific chemical composition (cast analysis) is required for oil-hardened and tempered steel spring wire or soft-drawn steel spring wire (see Clause 4.3.2).

(c) Nominal diameter of wire and whether alternative tolerances are required (see Clause 5.2).

(d) Condition (e.g. drawn galvanized) and tensile range, as appropriate (see Clause 5.4).

(e) For drawn metallic coated wire, whether a higher coating mass is required than is offered by Class W02 (see Clause 5.7).

(f) Any limitations in regard to coil mass and dimensions (see Clause 5.3), and whether the coils are to be supplied on transportable carriers (see Clause 4.5).

NOTE: Prior to enquiry or order, purchasers should check their equipment to ensure that it can handle the coils ordered and, if any limitations exist in respect of the manufacturer's nominated coil mass or dimensions, or direction of winding, (see Clause 4.5), these should be stated.

(g) Whether a certificate covering the results of aspects, such as chemical analysis (cast analysis) and/or mechanical properties, is required.

(h) Whether a torsion test is required (see Clause 5.6).

(i) Any special or supplementary requirements, e.g. alternative maximum for tensile strength, special finishing, packing or handling.

(j) Whether the coils are to be protected against the elements (e.g. by oiling or wrapping) giving specific details of the protection desired.

(k) Whether it is the intention of the purchaser to inspect the wire, select and identify test samples, or witness any tests at the manufacturer's works.

(l) Any information concerning processing or end use that the purchaser considers would assist the manufacturer.

APPENDIX B

MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD

(Informative)

B1 SCOPE

This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

(a) Evaluation by means of statistical sampling.

(b) The use of a product certification scheme.

(c) Assurance using the acceptability of the supplier's quality system.

(d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

B2 STATISTICAL SAMPLING

Statistical sampling is a procedure which enables decisions to be made about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

(a) The sample needs to be drawn randomly from a population of product of known history. The history needs to enable verification that the product was made from known materials at essentially the same time, by essentially the same processes and under essentially the same system of control.

(b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer of given capability and product throughput may not be relevant to another manufacturer producing the same items.

In order for statistical sampling to be meaningful to the customer, the manufacturer or supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199, guidance to which is given in AS 1399.

B3 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the stated Standard.

The certification scheme should meet the criteria described in HB 18.28 in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective quality planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

B4 SUPPLIER'S QUALITY MANAGEMENT SYSTEM

Where the manufacturer or supplier can demonstrate an audited and registered quality management system complying with the requirements of the appropriate or stipulated Australian or international Standard for a supplier's quality management system or systems, this may provide the necessary confidence that the specified requirements will be met. The quality assurance requirements need to be agreed between the customer and supplier and should include a quality or inspection and test plan to ensure product conformity.

Information on establishing a quality management system is set out in AS/NZS ISO 9001 and AS/NZS ISO 9004.

B5 OTHER MEANS OF ASSESSMENT

B5.1 General

If the above methods are considered inappropriate, determination of compliance with the requirements of this Standard may be assessed by means of AS 3942 or from the results of testing coupled with the manufacturer's guarantee of product conformance.

Irrespective of acceptable quality levels (AQLs) or test frequencies, the responsibility remains with the manufacturer or supplier to supply products that conform fully to the requirements of the Standard.

B5.2 Retests

Should any test piece from a sample first selected not comply with the test requirements specified, both ends of the coil concerned should be sampled and retested.

NOTE: Only one end of the coil concerned need to retested in cases where the other end is inherently inaccessible, e.g. where the coil is on a spool.

If either of these samples fails, then all coils comprising the batch should be tested, and only those coils that pass tests are deemed to comply with this Standard.

Even if both samples pass tests, two further samples should be taken from other coils in the batch. If the test pieces from both of these additional samples comply with the test requirements, the production run represented by the samples is deemed to comply with this Standard. Should either or the test pieces from these additional samples not comply with the test requirements, all coils comprising the batch should be tested, and only those coils that pass the tests are deemed to comply with this Standard.

NOTES

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Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body.

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