

Australian Standard[®]

Hot-rolled spring steels



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The following are represented on Committee MT-001:

- Australasian Railway Association
 - Australian Building Codes Board
 - Australian Foundry Institute
 - Bureau of Steel Manufacturers of Australia
 - Materials Australia
 - New Zealand Heavy Engineering Research Association
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Hot-rolled spring steels

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australian/Standard New Zealand Committee MT-001, Iron and Steel, to supersede AS 1447—1991, *Hot-rolled spring steels*.

After consultation with stakeholders in both countries, Standard Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than an Australian/New Zealand Standard.

The objective of this Standard is to specify the general technical delivery requirements for carbon steels and carbon-manganese steels in the hot-rolled spring steels, including the requirements for sampling and testing.

The objective of this revision is to update the referenced documents and to apply current style.

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

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STANDARDS AUSTRALIA

Australian Standard

Hot-rolled spring steels

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for hot-rolled carbon, carbon-chromium, nickel-chromium-molybdenum and silicon-manganese spring steels which are in either the as-rolled, annealed or normalized condition. It specifies chemical composition and manufacturing tolerance requirements for all grades and end-quench hardenability requirements for hardenability grades. This Standard permits the addition of boron and micro-alloying elements for the achievement of special properties.

NOTES:

- 1 Advice and recommendations on information to be supplied by the purchaser at the time of enquiry and order are contained in the purchasing guidelines in Appendix A.
- 2 For a guide to a means of complying with the Standard refer to Appendix B.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|--------|--|
| 1171 | Non-destructive testing—Magnetic particle testing of ferromagnetic products, components and structures |
| 1199 | Sampling procedures for inspection by attributes |
| 1199.0 | Part 0: Introduction to the ISO 2859 attribute sampling system |
| 1199.1 | Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection |
| 1733 | Methods for determination of grain size in metals |
| 1770 | Steel—Hardenability test by end quench (Jominy test) |
| 2003 | Carbon and low alloy steel—Measurement of decarburization |
| 2062 | Non-destructive testing—Penetrant testing of products and components |
| 2084 | Non-destructive testing—Eddy current testing of metal tubes |
| 2338 | Preferred dimensions of wrought metal products |
| 2706 | Numerical values—Rounding and interpretation of limiting values |

AS/NZS

- | | |
|--------|---|
| 1050 | Methods for the analysis of iron and steel |
| 1050.1 | Part 1: Sampling iron and steel for chemical analysis |

AS/NZS ISO

- | | |
|----------|---|
| 9001 | Quality management systems—Requirements |
| 9004 | Quality management systems—Guidelines for performance improvements |
| HB 18.28 | Conformity assessment—Guidance on a third-party certification system for products |

1.3 DEFINITIONS

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

1.3.1 Bar

A finished product of solid section which may have rectangular, square, round or hexagonal cross-section, defined as follows:

- (a) *Flat bars (flats)*—bars of rectangular cross-section, supplied in straight lengths 3 mm or greater in thickness and less than 600 mm in width, and having edges of controlled contour.
- (b) *Round bars (rounds)*—bars of circular cross-section supplied in straight lengths or coils.
- (c) *Square bars (squares)*—bars of square cross-section supplied in straight lengths or coils.
- (d) *Hexagonal bars (hexagons)*—bars of regular hexagonal cross-section supplied in straight lengths or coils.

1.3.2 Hardenability

In a ferrous alloy, the property that determines the depth and distribution of hardness induced by quenching.

1.3.3 Out-of-round

The difference between the maximum and minimum diameters of the bar, measured at the same cross-section.

1.3.4 Out-of-square

The difference in the two dimensions measured at the same cross-section of a square bar, each dimension being the distance between opposite faces.

1.4 DESIGNATION OF GRADE

1.4.1 General

The steel designation shall consist of the following components:

- (a) The number of this Australian Standard, i.e. AS 1447.
- (b) The prefix letter 'K' to indicate that the steel is fully killed or deoxidized.
- (c) A series designation in accordance with Clause 1.4.2.
- (d) The prefix letter 'X' to indicate a major deviation in chemical composition of any grade from the corresponding AISI-SAE grade.
- (e) The letter 'B' placed midway in the series designation to indicate that the steel is boron-treated.
- (f) The letter 'M' placed midway in the series designation to indicate that the steel is micro-alloyed.
- (g) The suffix letter 'H' to indicate that the steel is subject to both composition and end-quench hardenability requirements.
- (h) The suffix letter 'S' to indicate that the steel is specially produced.

Examples of designations: AS 1447/K1082S, AS 1447/XK51B60S, AS 1447/K5160HS, AS 1447/XK51M60S.

1.4.2 Series designation

Whenever possible the following designations shall be used to identify each series, wherein the first two digits of the number indicate the type of steel and the last two digits indicate the approximate mean of the specified carbon range:

Series designation

10XX: Plain carbon steels

51XX: Chromium 0.80, 0.88, or 0.95

86XX: Nickel 0.55, chromium 0.50, molybdenum 0.20

92XX: Silicon 1.90 or 2.00, chromium residual or 0.20

1.5 STEELMAKING PROCESS

The steel shall be made by the open hearth, basic oxygen, or an electric process.

NOTES:

- 1 A basic oxygen process means the process of making steel in a basic converter blown with commercially-pure oxygen.
- 2 Additional refining by vacuum-arc-remelt (VAR), electro-slag-refining (ESR) or vacuum degassing is permitted.

1.6 CHEMICAL COMPOSITION

1.6.1 General

The method of sampling for chemical analysis shall be in accordance with AS 1199.1.

Chemical composition shall be determined by any procedures which are not less accurate than those given in AS/NZS 1050.1.

1.6.2 Cast analysis

Whenever possible a chemical analysis of the steel from each ladle shall be made to determine the proportions of the specified elements. In cases where it is impracticable to obtain samples from liquid steel, analysis on test samples taken in accordance with the requirements of AS 1199.1.

The reported cast analysis of the steel shall conform to the limits given in Tables 1.1 and 1.2 for the appropriate grade.

1.6.3 Residual elements

For steels complying with this Standard, percentages of elements unspecified in Tables 1.1 and 1.2, whether incidental or deliberately added, are acceptable up to the following amounts:

- | | | |
|-----|------------|--------------|
| (a) | Copper: | 0.35 percent |
| (b) | Nickel: | 0.35 percent |
| (c) | Chromium: | 0.30 percent |
| (d) | Molybdenum | 0.10 percent |

1.6.4 Product analysis

For steels supplied in accordance with the cast analysis requirements of Tables 1.1 and 1.2, the results of individual determinations carried out on the product shall be within the product analysis tolerance limits specified in Table 1.3. Where several determinations of a single element are carried out on products from any one cast, the spread of individual results shall not extend both above and below the range specified in Tables 1.1 and 1.2.

1.7 FREEDOM FROM DEFECTS

The steel shall be free from pipe, harmful segregation, surface flaws and other defects detrimental to its use. If, after acceptance of the steel and provided that it has been properly treated after delivery, subsequent processing reveals that it contains defects found to be detrimental, the steel shall be deemed not to comply with this Standard.

1.8 AUSTENITE GRAIN SIZE

Austenite grain size shall be determined in accordance with AS 1733.

1.9 HARDENABILITY TEST

1.9.1 General

Steel grades complying with the chemical composition requirements of Table 1.2 shall be subjected to the Jominy end-quench hardenability test.

1.9.2 Requirements

When determined in accordance with AS 1770, the hardness values obtained shall meet the requirements of Section 2 for the specified grade of steel.

NOTE: AS 1770 does not cover the hardenability testing of steel bars and sections which have cross-sectional dimensions less than 12.5 mm.

1.10 DIMENSIONAL TOLERANCES

The dimensional tolerances for bars supplied to this Standard shall conform to the limits given in Section 3.

1.11 ROUNDING OF TEST RESULT NUMBERS

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. For example, for specified maximum or minimum values of 2.5, 2.50, 2.500, the observed or calculated values would be rounded respectively to the nearest 0.1, 0.01, 0.001 (see also Appendix B of AS 2706).

1.12 MARKING

The steel as supplied by the manufacturer shall be legibly and durably marked or tagged (for bundles) as follows:

- (a) So that it can be traced to the ladle of steel from which it was made.
- (b) To indicate the grade of steel in terms of Clause 1.4.

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.