



Designation: A752M – 04 (Reapproved 2010)

## Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Alloy Steel (Metric)<sup>1</sup>

This standard is issued under the fixed designation A752M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers general requirements for alloy steel rods and uncoated coarse round alloy wire in coils that are not required to meet hardenability band limits.

1.2 In case of conflict, the requirements in the purchase order, on the drawing, in the individual specification, and in this general specification shall prevail in the sequence named.

NOTE 1—This specification is the metric counterpart of Specification A752.

### 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Shipment

A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

A919 Terminology Relating to Heat Treatment of Metals<sup>3</sup>

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E112 Test Methods for Determining Average Grain Size

2.2 *Military Standard*:

MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage<sup>4</sup>

2.3 *Federal Standard*:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)<sup>4</sup>

2.4 *AIAG Standard*:

AIAGB-5 02.00 Primary Metals Identification Tag Application Standard<sup>5</sup>

### 3. Terminology

3.1 *Definitions of Terms Specific to This Standard*:

3.1.1 *alloy steel*—steel is considered to be alloy steel when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: manganese 1.65 %, silicon 0.60 %, copper 0.60 %; or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: chromium up to 3.99 %, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying elements added to obtain a desired alloying effect.

3.1.1.1 Boron treatment of alloy steels, which are fine grain, may be specified to improve hardenability.

3.1.1.2 Other elements, such as lead, selenium, tellurium, or bismuth, may be specified to improve machinability.

3.1.2 *coarse round wire*—from 0.90 to 25 mm in diameter, inclusive, wire produced from hot-rolled wire rods or hot-rolled coiled rounds by one or more cold reductions primarily for the purpose of obtaining a desired size with dimensional accuracy, surface finish, and mechanical properties. By varying the amount of cold reduction and other wire mill practices, including thermal treatment, a wide diversity of mechanical properties and finishes are made available. Suggested wire diameters are shown in Table 1.

3.1.3 *straightened and cut wire*—wire produced from coils of wire by means of special machinery that straightens the wire and cuts it to a specified length.

3.1.3.1 The straightening operation may alter the mechanical properties of the wire, especially the tensile strength. The straightening operation may also induce changes in the diameter of the wire. The extent of the changes in the properties of the wire after cold straightening depends upon the kind of wire and also on the normal variation in the adjustments of the straightening equipment. It is therefore not possible to forecast

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Withdrawn. The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

<sup>5</sup> Available from Automotive Industry Action Group (AIAG), 26200 Lahser Rd., Suite 200, Southfield, MI 48033, <http://www.aiag.org>.

**TABLE 1 Suggested Diameters for Alloy Steel Wire, mm**

|      |      |
|------|------|
| 0.90 | 6.0  |
| 1.00 | 6.5  |
| 1.10 | 7.0  |
| 1.20 | 7.5  |
| 1.30 | 8.0  |
| 1.40 | 8.5  |
| 1.60 | 9.0  |
| 1.80 | 9.5  |
| 2.0  | 10.0 |
| 2.1  | 11.0 |
| 2.2  | 12.0 |
| 2.4  | 13.0 |
| 2.5  | 14.0 |
| 2.6  | 15.0 |
| 2.8  | 16.0 |
| 3.0  | 17.0 |
| 3.2  | 18.0 |
| 3.5  | 19.0 |
| 3.8  | 20.0 |
| 4.0  | 21.0 |
| 4.2  | 22.0 |
| 4.5  | 23.0 |
| 4.8  | 24.0 |
| 5.0  | 25.0 |
| 5.5  | ...  |

the properties of straightened and cutwire. Each kind of wire needs individual consideration. In most cases, the application of straightened and cut wire is not seriously influenced by these changes.

3.1.4 *wire rods*—rods that are hot rolled from billets into an approximate round cross section and into coils of one continuous length. Rods are not comparable to hot-rolled bars in accuracy of cross section or surface finish and as a semi-finished product are primarily for the manufacture of wire.

3.1.4.1 **Table 2** shows the nominal diameter for hot-rolled wire rods. Sizes are shown in 0.5-mm increments from 5.5 to 19 mm.

#### 4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for hot-rolled wire rods under this specification. Such requirements include, but are not limited to, the following:

- 4.1.1 Quantity (kilograms),
- 4.1.2 Name of material (wire rods),
- 4.1.3 Diameter (**Table 1**),
- 4.1.4 Chemical composition grade number (**Table 3**),

**TABLE 2 Sizes of Alloy Steel Wire Rods, mm**

|      |      |
|------|------|
| 5.5  | 12.5 |
| 6    | 13   |
| 6.5  | 13.5 |
| 7    | 14   |
| 7.5  | 14.5 |
| 8    | 15   |
| 8.5  | 15.5 |
| 9    | 16   |
| 9.5  | 16.5 |
| 10   | 17   |
| 10.5 | 17.5 |
| 11   | 18   |
| 11.5 | 18.5 |
| 12   | 19   |

- 4.1.5 Packaging (Section 14),
- 4.1.6 Heat analysis report, if requested (Section 6),
- 4.1.7 Certification or test report, or both, if specified (Section 13),
- 4.1.8 ASTM designation and date of issue, and
- 4.1.9 Special requirements, if any.

NOTE 2—A typical ordering description is as follows: 50 000 kg Steel Wire Rods, 5.5 mm, Grade G 41400 W approximately 600 kg coils to ASTM A752M dated-XX.

4.2 It shall be the responsibility of the purchaser to specify all requirements that are necessary for coarse round wire under this specification. Such requirements include, but are not limited to, the following:

- 4.2.1 Quantity (kilograms),
- 4.2.2 Name of material (alloy steel wire),
- 4.2.3 Diameter (**Table 2**),
- 4.2.4 Length (straightened and cut only),
- 4.2.5 Chemical composition (**Table 3**),
- 4.2.6 Packaging (Section 14),
- 4.2.7 Heat analysis report, if requested (Section 6),
- 4.2.8 Certification or test report, or both, if specified (Section 13),
- 4.2.9 ASTM designation and date of issue, and
- 4.2.10 Special requirements, if any.

NOTE 3—A typical ordering description is as follows: 15 000 kg Alloy Steel Wire, 3.8 mm diameter, Grade 4135 in 1000-kg Coils on Tubular Carriers, to ASTM A 752M-XX, or 2500 Pieces, Alloy Steel Wire, 9.5 mm diameter, Straightened and Cut, 0.76 m, Grade G 41400 in 25-Piece Bundles on Pallets to ASTM A 752M-XX.

#### 5. Manufacture

5.1 The steel may be produced by any commercially accepted steel making process. The steel may be either ingot cast or strand cast.

#### 6. Chemical Composition

6.1 The chemical composition for alloy steel under this specification shall conform to the requirements set forth in the purchase order. The grades commonly specified for alloy steel wire rods and alloy steel wire are shown in **Table 3**. For specified compositions not contained in **Table 3** the ranges and limits expressed in **Table 4** shall apply unless other such ranges and limits shall have been agreed upon between the purchaser and the manufacturer.

6.2 *Heat Analysis*—An analysis of each heat shall be made by the producer to determine the percentage of the elements specified. The analysis shall be made from a test sample preferably taken during the pouring of the heat. The chemical composition thus determined shall be reported, if required, to the purchaser or his representative.

6.3 *Product Analysis*—A product analysis may be made by the purchaser. The analysis is not used for a duplicate analysis to confirm a previous result. The purpose of the product analysis is to verify that the chemical composition is within specified limits for each element, including applicable permissible variations in product analysis. The results of analyses taken from different pieces of a heat may differ within permissible limits from each other and from heat analyses.

**TABLE 3 Alloy Steels—Chemical Composition Ranges and Limits for Heat Analysis**

NOTE 1— Grades shown in this table with prefix letter E are normally only made by the basic electric furnace process. All others are normally manufactured by the basic open hearth or basic oxygen processes but may be manufactured by a basic electric furnace process. If the electric furnace process is specified or required for grades other than those designated above, the limits for phosphorus and sulfur are respectively 0.025 % max.

NOTE 2— Small quantities of certain elements, which are not specified or required, are present in alloy steels. These elements are considered as incidental and may be present to the following maximum amounts: copper, 0.35 %, nickel, 0.25 %, chromium, 0.20 %, molybdenum, 0.06 %.

NOTE 3—Where minimum and maximum sulfur content is shown it is indicative of resulfurized steel.

NOTE 4—The chemical ranges and limits shown in Table 4 are produced to product analysis tolerances shown in Table 5.

NOTE 5—Standard alloy steels can be produced with a lead range of 0.15 to 0.35 %. Such steels are identified by inserting the letter “L” between the second and third numerals of the Grade number, for example, 41L40. Lead is reported only as a range of 0.15 to 0.35 % since it is added to the mold as the steel is poured.

| UNS Designation       | Grade No. | Chemical Composition, Ranges and Limits, % |              |                 |                         |              |               |               |                              |
|-----------------------|-----------|--------------------------------------------|--------------|-----------------|-------------------------|--------------|---------------|---------------|------------------------------|
|                       |           | Carbon                                     | Manganese    | Phosphorus, max | Sulfur, max             | Silicon      | Nickel        | Chromium      | Molybdenum                   |
| STANDARD ALLOY STEELS |           |                                            |              |                 |                         |              |               |               |                              |
| G13300                | 1330      | 0.28 to 0.33                               | 1.60 to 1.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | ...           | ...                          |
| G13350                | 1335      | 0.33 to 0.38                               | 1.60 to 1.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | ...           | ...                          |
| G13400                | 1340      | 0.38 to 0.43                               | 1.60 to 1.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | ...           | ...                          |
| G13450                | 1345      | 0.43 to 0.48                               | 1.60 to 1.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | ...           | ...                          |
| G40120                | 4012      | 0.09 to 0.14                               | 0.75 to 1.00 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | ...           | 0.15 to 0.25                 |
| G40230                | 4023      | 0.20 to 0.25                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | ...           | 0.20 to 0.30                 |
| G40240                | 4024      | 0.20 to 0.25                               | 0.70 to 0.90 | 0.035           | 0.035 to 0.050<br>0.040 | 0.15 to 0.35 | ...           | ...           | 0.20 to 0.30<br>0.20 to 0.30 |
| G40270                | 4027      | 0.25 to 0.30                               | 0.70 to 0.90 | 0.035           |                         | 0.15 to 0.35 | ...           | ...           |                              |
| G40280                | 4028      | 0.25 to 0.30                               | 0.70 to 0.90 | 0.035           | 0.035 to 0.050<br>0.040 | 0.15 to 0.35 | ...           | ...           | 0.20 to 0.30<br>0.20 to 0.30 |
| G40370                | 4037      | 0.35 to 0.40                               | 0.70 to 0.90 | 0.035           |                         | 0.15 to 0.35 | ...           | ...           |                              |
| G40470                | 4047      | 0.45 to 0.50                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | ...           | 0.20 to 0.30                 |
| G41180                | 4118      | 0.18 to 0.23                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.40 to 0.60  | 0.08 to 0.15                 |
| G41300                | 4130      | 0.28 to 0.33                               | 0.40 to 0.60 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | 0.15 to 0.25                 |
| G41370                | 4137      | 0.35 to 0.40                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | 0.15 to 0.25                 |
| G41400                | 4140      | 0.38 to 0.43                               | 0.75 to 1.00 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | 0.15 to 0.25                 |
| G41420                | 4142      | 0.40 to 0.45                               | 0.75 to 1.00 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | 0.15 to 0.25                 |
| G41450                | 4145      | 0.43 to 0.48                               | 0.75 to 1.00 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | 0.15 to 0.25                 |
| G41470                | 4147      | 0.45 to 0.50                               | 0.75 to 1.00 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | 0.15 to 0.25                 |
| G41500                | 4150      | 0.48 to 0.53                               | 0.75 to 1.00 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | 0.15 to 0.25                 |
| G41610                | 4161      | 0.56 to 0.64                               | 0.75 to 1.00 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.70 to 0.90  | 0.25 to 0.35                 |
| G43200                | 4320      | 0.17 to 0.22                               | 0.45 to 0.65 | 0.035           | 0.040                   | 0.15 to 0.35 | 1.65 to 2.00  | 0.40 to 0.60  | 0.20 to 0.30                 |
| G43400                | 4340      | 0.38 to 0.43                               | 0.60 to 0.80 | 0.035           | 0.040                   | 0.15 to 0.35 | 1.65 to 2.00  | 0.70 to 0.90  | 0.20 to 0.30                 |
| G43406                | E4340     | 0.38 to 0.43                               | 0.65 to 0.85 | 0.025           | 0.025                   | 0.15 to 0.35 | 1.65 to 2.00  | 0.70 to 0.90  | 0.20 to 0.30                 |
| G44190                | 4419      | 0.18 to 0.33                               | 0.45 to 0.65 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | ...           | 0.45 to 0.60                 |
| STANDARD ALLOY STEELS |           |                                            |              |                 |                         |              |               |               |                              |
| G46150                | 4615      | 0.13 to 0.18                               | 0.45 to 0.65 | 0.035           | 0.040                   | 0.15 to 0.35 | 1.65 to 2.00  | ...           | 0.20 to 0.30                 |
| G46200                | 4620      | 0.17 to 0.22                               | 0.45 to 0.65 | 0.035           | 0.040                   | 0.15 to 0.35 | 1.65 to 2.00  | ...           | 0.20 to 0.30                 |
| G46210                | 4621      | 0.18 to 0.23                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | 1.65 to 2.00  | ...           | 0.20 to 0.30                 |
| G46260                | 4626      | 0.24 to 0.29                               | 0.45 to 0.65 | 0.035           | 0.040                   | 0.15 to 0.35 | 0.70 to 1.00  | ...           | 0.15 to 0.25                 |
| G47180                | 4718      | 0.16 to 0.21                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | 0.90 to 1.20  | 0.35 to 0.55  | 0.30 to 0.40                 |
| G47200                | 4720      | 0.17 to 0.22                               | 0.50 to 0.70 | 0.035           | 0.040                   | 0.15 to 0.35 | 0.90 to 1.20  | 0.35 to 0.55  | 0.15 to 0.25                 |
| G48150                | 4815      | 0.13 to 0.18                               | 0.40 to 0.60 | 0.035           | 0.040                   | 0.15 to 0.35 | 3.25 to 3.75  | ...           | 0.20 to 0.30                 |
| G48170                | 4817      | 0.15 to 0.20                               | 0.40 to 0.60 | 0.035           | 0.040                   | 0.15 to 0.35 | 3.25 to 3.75  | ...           | 0.20 to 0.30                 |
| G48200                | 4820      | 0.18 to 0.23                               | 0.50 to 0.70 | 0.035           | 0.040                   | 0.15 to 0.35 | 3.25 to 3.75  | ...           | 0.20 to 0.30                 |
| G50150                | 5015      | 0.12 to 0.17                               | 0.30 to 0.50 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.30 to 0.50  | ...                          |
| G51200                | 5120      | 0.17 to 0.22                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.70 to 0.90  | ...                          |
| G51300                | 5130      | 0.28 to 0.33                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | ...                          |
| G51320                | 5132      | 0.30 to 0.35                               | 0.60 to 0.80 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.75 to 1.00  | ...                          |
| G51350                | 5135      | 0.33 to 0.38                               | 0.60 to 0.80 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.05  | ...                          |
| G51400                | 5140      | 0.38 to 0.43                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.70 to 0.90  | ...                          |
| G51450                | 5145      | 0.43 to 0.48                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.70 to 0.90  | ...                          |
| G51470                | 5147      | 0.46 to 0.51                               | 0.70 to 0.95 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.85 to 1.15  | ...                          |
| G51500                | 5150      | 0.48 to 0.53                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.70 to 0.90  | ...                          |
| G51550                | 5155      | 0.51 to 0.59                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.70 to 0.90  | ...                          |
| G51600                | 5160      | 0.56 to 0.64                               | 0.75 to 1.00 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.70 to 0.90  | ...                          |
| ...                   | E51100    | 0.98 to 1.10                               | 0.25 to 0.45 | 0.025           | 0.025                   | 0.15 to 0.35 | ...           | 0.90 to 1.15  | ...                          |
| ...                   | E52100    | 0.98 to 1.10                               | 0.25 to 0.45 | 0.025           | 0.025                   | 0.15 to 0.35 | ...           | 1.30 to 1.60  | ...                          |
| Vanadium              |           |                                            |              |                 |                         |              |               |               |                              |
| G61180                | 6118      | 0.16 to 0.21                               | 0.50 to 0.70 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.50 to 0.70  | 0.10 to 0.15                 |
| G61500                | 6150      | 0.48 to 0.53                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | ...           | 0.80 to 1.10  | 0.15 min                     |
| Molybdenum            |           |                                            |              |                 |                         |              |               |               |                              |
| G86150                | 8615      | 0.13 to 0.18                               | 0.70 to 0.90 | 0.035           | 0.040                   | 0.15 to 0.35 | 0.040 to 0.70 | 0.040 to 0.60 | 0.15 to 0.25                 |