



**Designation: ~~A 920/A920M-02a~~ Designation: A 920/A 920M - 07**

## Standard Specification for Steel Bars, Microalloy, Hot-Wrought, Special Quality, Mechanical Properties<sup>1</sup>

This standard is issued under the fixed designation A 920/A 920M; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

### 1. Scope\*

1.1 This specification covers hot-wrought, special quality microalloyed carbon steel bars intended for use in applications where as-rolled mechanical properties are desired. A typical end use is hydraulic cylinder shafts.

1.2 The bars shall be furnished to chemical composition and mechanical properties as provided herein. Chemical composition is based on standard carbon steel grades modified to include microalloying elements such as columbium (niobium), vanadium, or molybdenum. Three strength classes are available, designated 75 [520], 80 [550], and 100 [690], corresponding to the minimum yield strength in ksi.

1.3 Sections and sizes of bar steels available are covered in Specification A 29/A 29M/A29M-~~2~~.

1.4 Supplementary Requirements S1 to S5 are provided for use when additional controls or requirements are desired. These shall apply only when specified on the purchase order.

1.5 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text and tables, SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

1.6 Unless the order specifies the applicable "M" specification designation, the material shall be furnished to the inch-pound units.

### 2. Referenced Documents

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

~~A 29/A 29M—Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for~~  
Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 576 Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality<sup>2</sup>

~~E 45Practice— Test Methods for Determining the Inclusion Content of Steel~~

### 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 ~~microalloyed steels, n—microalloyed—carbon~~ steels are carbon steels to which small quantities of certain elements are added in order to enhance mechanical properties.

3.1.1.1 ~~Discussion—~~This enhancement of mechanical properties results from control of the temperature and cooling rate during the hot-rolling process.

### 4. Ordering Information

4.1 Orders for material supplied to this specification should include the following, as required, to describe adequately the desired material:

4.1.1 Quantity (weight or number of bars),

4.1.2 Name of material (hot-rolled microalloyed steel bars),

4.1.3 Dimensions,

4.1.4 ASTM specification number and date of issue,

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.15 on Bars.

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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* Vol 01-05 volume information, refer to the standard's Document Summary page on the ASTM website.

\*A Summary of Changes section appears at the end of this standard.

- 4.1.5 Grade designation or chemical composition limits (see Section 8),
- 4.1.6 Class,
- 4.1.7 Type (see 7.1) to designate grain refiner,
- 4.1.8 Additions to the specification and Supplementary Requirements, if required, and,
- 4.1.9 End use.

## 5. General Requirements

5.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 29/A 29M/A29M<sub>2</sub>, unless otherwise provided herein.

## 6. Materials and Manufacture

6.1 *Melting Practice*—The steel shall be produced in accordance with the applicable methods for primary and secondary melting outlined in Specification A 576.

6.2 The steel shall be killed. Supplementary Requirements S1 through S5 may be invoked upon agreement between producer and purchaser.

6.3 The bars shall be special quality.

6.4 The bars shall be hot-wrought, as wrought, unless otherwise specified.

## 7. Metallurgical Requirements

7.1 *Grain Size*—The steel shall conform to the fine grain size requirement of Specification A 29/A 29M/A29M<sub>2</sub>. The grain refining element may be specified according to one of the following types:

7.1.1 *Type A, Aluminum*—The total aluminum analysis shall be 0.020 % or greater, and shall be reported.

7.1.2 *Type B*—The grain refining element shall be specified in accordance with 5.1.2.3 of Specification A 29/A 29M/A29M<sub>2</sub>.

7.2 *Microstructure*—The microstructure shall consist of a minimum of 90 % ferrite-pearlite or 90 % bainite as agreed upon between the purchaser and producer.

## 8. Chemical Composition

8.1 Typical examples of chemical compositions are shown in Table 1. Other compositions may be specified using one of the following methods:

8.1.1 Base compositions selected from Table 1 of Specification A 576, with the addition of microalloying elements as provided in 8.3 to 8.5, or

8.1.2 Base compositions using the ranges and limits shown in Table 2 of Specification A 576, with the addition of microalloying elements as provided in 8.3 to 8.5.

NOTE 1—For improved machinability, alternative sulfur ranges may be specified upon agreement between the purchaser and the producer. Additional machinability-enhancing elements such as lead, bismuth, selenium, or tellurium may also be specified by agreement.

8.2 Silicon analysis shall be 0.15/0.35 %. Silicon content up to 0.80 % maximum may be furnished upon agreement between purchaser and producer.

8.3 Vanadium, columbium (niobium), or molybdenum may be specified singly or in combination, subject to the limits shown in Table 2. The elements and ranges specified shall be upon agreement between the purchaser and the producer.

8.4 Titanium shall be added when specified for refinement of the ferritic-pearlitic (or bainitic) or austenitic grain size. When titanium is specified, the titanium limits shall be as agreed upon between producer and purchaser. The titanium content shall be reported.

8.5 Nitrogen may be specified as a supplement to vanadium, columbium, or titanium. If specified, the nitrogen content shall not exceed 0.030 % and shall be reported.

8.6 Sampling for heat and product analysis shall be in accordance with the requirements of Specification A 29/A 29M/A29M<sub>2</sub>.

**TABLE 1 Typical Chemical Compositions of Microalloyed Carbon Steels**

NOTE—These compositions are identical to those in Specification A 576, with the exception of the addition of vanadium.

Base Grade Designation	Chemical Composition Limits, %				
	C	Mn <sub>n</sub>	P	S	V
10V40	0.37–0.44	0.60–0.90	0.040 max	0.050 max	0.02–0.20
10V45	0.43–0.50	0.60–0.90	0.040 max	0.050 max	0.02–0.20
11V37	0.32–0.39	1.35–1.65	0.040 max	0.08–0.13	0.02–0.20
11V41	0.37–0.45	1.35–1.65	0.040 max	0.08–0.13	0.02–0.20
15V24	0.19–0.25	1.35–1.65	0.040 max	0.050 max	0.02–0.20
15V41	0.36–0.44	1.35–1.65	0.040 max	0.050 max	0.02–0.20