

MIL-S-7420B

28 FEBRUARY 1958

SUPERSEDING
MIL-S-7420A (ASG)
25 AUGUST 1953**MILITARY SPECIFICATION****STEEL BARS, ALLOY, CHROMIUM, HIGH CARBON E52100
(AIRCRAFT QUALITY)**

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force

1. SCOPE

1.1 Scope. This specification covers the requirements for high-carbon chromium alloy steel bars of aircraft quality, for bearing applications.

1.2 Classification. The bars shall be furnished in one of the following physical and surface conditions, as specified (see 6 2).

Physical condition:

- (A) As hot rolled or forged
- (B) Annealed.
- (C) Normalized.
- (D) Normalized and tempered
- (E) Spheroidized

Surface conditions

- (1) Black, as forged or rolled.
- (2) Pickled or blast cleaned.
- (3) Rough turned
- (4) Cold drawn or cold rolled
- (5) Turned, ground, and polished.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

SPECIFICATIONS**MILITARY**

MIL-I-6868—Inspection Process, Magnetic Particle

MIL-L-7870—Lubricating Oil, General Purpose, Low Temperature.

STANDARDS**FEDERAL**

FED-STD-48—Tolerances for Steel and Iron Wrought Products.

FED-STD-66—Steel Chemical Composition and Hardenability

Fed Test Method Std No. 151—Metals; Test Methods.

MILITARY

MIL-STD-129—Marking for Shipment and Storage

MIL-STD-163—Preparation of Steel Products for Domestic Shipment (Storage) and Overseas Shipment

MIL-STD-183—Continuous Identification Marking of Iron and Steel Products

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Material. The steel shall be of aircraft quality satisfactory for the fabrication of parts which may be subject to magnetic inspection in accordance with Specification MIL-I-6868.

3.1.1 Manufacturing process The steel shall be made by the electric-furnace or vacuum-melting process.

3.1.1.1 Sufficient discard shall be taken from each ingot to insure freedom from piping and undue segregation

3.2 Chemical composition. The chemical composition and check analysis tolerances of bars shall be in accordance with FED-STD-66 steel No E52100. For sizes over 200 sq in in cross sectional area, the chemical composition shall be negotiated (See 6 3)

3.3 Hardness.

3.3.1 As received Bars in the spheroidized condition shall be supplied with a hardness not higher than Brinell 207 (Rockwell B-94 5),

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except that if ordered cold finished, the hardness may be as high as Brinell 248 (Rockwell C-24) or equivalent.

3.3.2 Heat-treated The hardness of the material heat-treated and tested in accordance with 4 4 2 shall be not less than Rockwell C-63, or equivalent

3.4 Metallographic structure. Unless otherwise specified, the metallographic structure of material furnished in the spheroidized condition shall consist of spheroidized carbides in a ferritic matrix. The presence of a cementite network or excessive amounts of lamellar pearlite shall be cause for rejection

3.5 Macrostructure. Visual examination of deep-acid-etched specimens shall show no evidence of pipes, internal cracks, excessive segregation, or other injurious defects

3.6 Decarburization. Unless otherwise specified, the depth of decarburization of products in surface conditions (2) or (4) shall be not greater than the limits specified in table I

3.6.1 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the limits of table I by more than 0 005 in. and the width is 0 065 in. or less

3.6.2 Products furnished in surface conditions (3) and (5) shall be free from decarburization

3.7 Identification of product. Bars shall be marked in accordance with Standard MIL STD-183

TABLE I *Decarburization limits*

Nominal diameter or distance between opposite faces (inches)	Maximum depth of decarburization (inches) ¹
Up to 0 375 incl.	0 010
Over 0 375 to 0 500 incl.	0 12
Over 0 500 to 0 625 incl.	0 14
Over 0 625 to 1 000 incl.	0 17
Over 1 00 to 1 50 incl.	0 20
Over 1 50 to 2 00 incl.	0 25
Over 2 00 to 2 50 incl.	0 30
Over 2 50 to 3 00 incl.	0 35

¹ The value specified as the maximum depth of decarburization is the sum of the complete plus the partial decarburization

3.7.1 Bars smaller than ½ inch in diameter or ¾ inch in width of flat shall be bundled and tagged at each end with an extra tag included in the bundle

3.8 Tolerance. Unless otherwise specified, tolerances shall conform to the limits specified in Standard FED-STD-48

3.9 Workmanship. Material shall be sound, of uniform quality and condition, free from pipe, and shall not contain laps, cracks, twists, seams, and other defects detrimental to the fabrication or performance of parts

4. QUALITY ASSURANCE PROVISIONS

4.1 General. All the tests required herein for the testing of steel are classified as Acceptance tests, for which necessary sampling techniques and methods of testing are specified in this section

4.2 Examination of product. Sufficient spot checks will be made to assure compliance with the surface condition, identification, dimensional, and workmanship requirements

4.3 Chemical analysis.

4.3.1 Sampling Samples for check chemical analysis shall be selected as described in Fed Test Method Std No 151 to represent each heat in the shipment. The sample shall consist of not less than 2 ounces of material

4.3.1.1 Waiver Samples for check chemical analysis may be waived at the discretion of the Inspector, provided that all of the material under inspection can be identified as being made from a heat previously analyzed and found to be in accordance with the chemical analysis specified herein

4.3.1.2 Additional samples If the material is taken from stock and is not identified as to heat, or if the identity of any portion of the shipment is obscure in any respect, the Inspector shall select the necessary additional samples to determine conformance of all portions of the shipment to this specification

4.3.2 Method Chemical analysis shall be made by standard wet chemical, spectrographic, or other analytic methods. In the event of dispute, analysis shall be by standard wet chemical methods

4.4 Hardness.

4.4.1 Hardness as received

4.4.1.1 Sampling Not less than five bars from each lot shall be tested to determine

conformance with the allowable hardness limits.

4.4.1.2 Method. Hardness testing shall conform to the methods and requirements of Fed. Test Method Std No 151

4.4.2 Hardness as heat-treated. The specimen shall be $\frac{1}{2}$ inch in length and shall embody the full cross section of the material; however, bars or billets greater than 4 inches by 4 inches may be forged down to this size for tests. The specimens shall be austenitized at 1,525° to 1,575° F for 30 minutes and quenched in oil maintained between 75° and 140° F. One face of the specimen shall be prepared for a hardness test by careful grinding, using a coolant, to remove any decarburization. The Rockwell C hardness determined at any point on the ground face shall be not less than the value specified

4.5 Metallographic examination.

4.5.1 Sampling One or more samples shall be selected to represent each heat of steel from which material is submitted for acceptance

4.5.2 Method. Specimens shall be sectioned and polished to appropriate fineness by metallographic methods and suitably etched to reveal the carbide shape and distribution

4.6 Macrostructure (deep acid etch).

4.6.1 Sampling One specimen shall be selected from each 100 bars, or less, submitted for acceptance

4.6.2 Preparation of specimens Deep-acid-etched specimens shall be cut from the ends of the bars selected as samples and shall represent the entire cross section of the bar. The specimen shall measure $\frac{1}{2}$ inch or more in the direction of the axis of the bar. One of the faces of the specimen representing the cross section of the bar shall be finished flat and smooth by a fine machine cut, or by grinding. The finished face of the specimen shall be etched in an aqueous solution containing 50 percent hydrochloric acid by volume and maintained at a temperature approximately 71° C (160° F)

4.6.3 Method Specimens shall be examined by a competent metallographist for the presence of defects

4.7 Decarburization.

4.7.1 Sampling If the Inspector has reason to suspect that the decarburization limits specified herein may have been exceeded,

samples shall be selected for determination of the depth of decarburization.

4.7.2 Method. Depth of the zone of decarburization below a surface shall be determined by examination of representative metallographic specimens.

4.8 Rejection and retest. Material not conforming to this specification or to authorized modification shall be subject to rejection. Where failure of any lot of material to meet the requirements of this specification is due to inadequate heat treatment, the material may be reheat-treated and resubmitted for test. Only two such reheat treatments will be allowed.

5. PREPARATION FOR DELIVERY

5.1 Application. The requirements of section 5 apply only to direct purchases by or direct shipments to the Government

5.2 Preservation. Materials furnished in surface conditions (2) through (5), inclusive, shall be coated with a preservative conforming to Military Code P-3 of Standard MIL-STD-163, or oil conforming to Specification MIL-L-7870, or oil of equivalent preservative properties

5.3 Packaging. Materials preserved as specified in 5.2, and those in surface condition (1) shall be properly separated by size and condition when packed for shipment and shall be prepared for shipment in units convenient to handle at destination

5.4 Packing.

5.4.1 Level A. Materials, preserved as specified in 5.2 shall be prepared for shipment in accordance with the methods described in Standard MIL-STD-163

5.4.2 Level C Unless otherwise specified, materials in surface condition (2) through (5), inclusive, shall be packed in wooden boxes or crates. Materials in surface condition (1) shall be packed in secure lifts or in wooden boxes or crates. Shipping containers shall be so constructed as to insure acceptance by common or other carrier for safe transportation at the lowest rate to the point of delivery. Containers shall be able to withstand rehandling and re-shipment without the necessity of repacking

5.5 Marking of shipments. Shipping containers shall be marked in accordance with

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Standard MIL-STD-129. The nomenclature shall be as follows:

STEEL BARS, ALLOY, CHROMIUM, HIGH CARBON E52100

Size and shape *

Condition, physical and surface *

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*Information to be entered by manufacturer

6. NOTES

6.1 Intended use. The material covered by this specification is intended for use in ball or roller bearings and similar applications.

6.2 Ordering data. Procurement documents should state the following:

(a) Title, number, and date of this specification.

(b) Size and shape

(c) Physical and surface conditions, when conditions (C) (4), (condition (C) (2) for bars over 1½ inches) are desired

(d) Exact lengths and length tolerance if mill lengths are not acceptable

(e) Level of packing required (see 5.4.1 and 5.4.2).

6.3 The following chemistry for AISI E52100 steel is given for information and was correct at

the date of publication of this specification. If the correct current chemistry consult Federal Standard No. 66:

<i>Element</i>	<i>Percent</i>
Carbon.....	0.95-1.10
Manganese.....	0.25-0.45
Silicon.....	0.20-0.35
Phosphorus.....	0.025 max
Sulfur.....	0.025 max
Chromium.....	1.30-1.60
Iron.....	Remainder.

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