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SUPERSEDING
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MILITARY SPECIFICATION

STEEL BAR, REFORGING STOCK, AND MECHANICAL TUBING, LOW ALLOY, PREMIUM QUALITY

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers premium quality, multiple vacuum melted, low alloy steel bars, reforaging stock, and mechanical tubing intended for use at tensile strength levels of 260,000 psi (1795 MPa) and above.

1.2 Classification. Material shall be of the following compositions and conditions, as specified (see 6.2):

1.2.1 Composition (see 6.5).

Class 1 - 4340 (UNS G43406)
Class 2 - 300M (UNS K44220)

1.2.2 Physical condition.

- (A) As forged
- (B) As rolled or drawn
- (C) Annealed
- (D) Normalized
- (E) Normalized and tempered
- (F) Hardened and tempered

1.2.3 Surface conditions.

- (1) Black as forged or rolled
- (2) Descaled
- (3) Rough turned
- (4) Cold drawn
- (5) Turned, ground, and polished
- (6) As drawn

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Engineering Center, Systems Engineering and Standardization Department, Lakehurst, NJ 08733-5100 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 9510

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

MILITARY

MIL-H-6875 Heat Treatment of Steels, Process for.

STANDARDS

FEDERAL

FED-STD-48 Tolerances for Steel Wrought Products, and for Centrifugally Cast Steel.

FED-STD-151 Metals: Test Methods.

FED-STD-183 Continuous Identification Marking of Iron and Steel Products.

MILITARY

MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage

MIL-STD-1949 Inspection, Magnetic Particle.

MIL-STD-2154 Inspection, Ultrasonic, Wrought Metals, Process for.

(Copies of specifications, standards, and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

• 2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are indicated as DoD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 255 End-Quench Hardenability of Steel.

ASTM A 604	Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets.
ASTM A 700	Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment.
ASTM E 3	Metallographic Specimens, Preparation Of.
ASTM E 8	Tension Testing of Metallic Materials.
ASTM E 10	Brinell Hardness of Metallic Materials.
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials.
ASTM E 45	Recommended Practice for Determining the Inclusion Content of Steel.
ASTM E 112	Estimating Average Grain Size of Metals.
ASTM E 384	Microhardness of Materials.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

AMS 2300	Premium Aircraft - Quality Steel Cleanliness - Magnetic Particle Inspection Procedure
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(Application for copies should be addressed to SAE, 400 Commonwealth Drive, Warrendale, PA 15096.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Material quality. Steel shall be premium quality and shall conform to the requirements of AMS 2300 except that the maximum average frequency rating of 0.10 and a maximum average severity rating of 0.20 shall apply for all sizes and products. Unless otherwise specified in the contract or purchase order, material shall be multiple melted employing the consumable electrode vacuum process in the final remelt cycle.

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3.2 Chemical requirements. The chemical composition shall comply with the limits specified in Table II.

3.3 Surface and physical condition.

3.3.1 Bars and reforcing stock. Unless otherwise specified, bars 1-1/2 inches (3.8 cm) or less in diameter or thickness shall be furnished in physical-surface condition C-4 and bars over 1-1/2 inches (3.8 cm) in diameter or thickness shall be furnished in physical-surface condition E-2 (see 6.2). Reforcing stock shall be as ordered.

3.3.2 Tubing. Tubing shall be supplied in a machinable condition, as drawn.

3.4 Heat treatment. All heat treatment of material supplied to this specification shall be performed in accordance with MIL-H 6875, including samples for verification of response to heat treatment.

3.4.1 Verification of response to heat treatment. All steel supplied under this specification shall be capable of developing the transverse and longitudinal mechanical properties listed in Tables III and IIIa when heat treated in accordance with 4.4.4 for the respective compositions.

3.5 Grain size. The austenitic grain size shall be predominately No. 6 or finer, with occasional grains as large as No. 4 permissible.

3.6 Micro-inclusion rating. The size and frequency of micro-inclusions shall not exceed the worst field severity limits and frequency limits specified in Table VIII, determined in accordance with ASTM E 45, Method D.

3.6.1 Rateable fields. A rateable field is defined as one which has a type A, B, C, or D inclusion rating of at least No. 1.0 thin or heavy in accordance with the Jerkontoret chart, Plate III, ASTM E 45.

3.7 Macrostructure. Visual examination of deep-acid-etched transverse sections shall be equal to or better than the macrostructures defined by the following macrographs of ASTM A 604:

<u>Class</u>	<u>Condition</u>	<u>Severity</u>
1	Freckles	A
2	White spots	A
3	Radial segregation	B
4	Ring pattern	B

3.8 Hardenability. Minimum end-quench hardenability shall be as follows:

Class 1:	Rockwell C-53 at 12/16 inch Rockwell C-50 at 20/16 inch
Class 2:	Rockwell C-55 at 8/16 inch Rockwell C-53 at 20/16 inch

3.9 Decarburization. When materials are not specifically ordered for reforging purposes or surface condition (1), the depth of decarburization shall be not greater than the limits specified in Tables IVa and IVb. When determining the depth of decarburization, it is permissible to disregard local areas provided that the decarburization of such areas does not exceed the limits of Tables IVa and IVb by more than 0.005 inch (0.013 cm) and the width is 0.065 inch (0.165 cm) or less (see 6.2).

3.10 Hardness limits.

3.10.1 Condition (C). The hardness of material supplied in physical condition (C) shall be not more than Rockwell C-27, except that tubing in the annealed condition shall have a hardness not greater than Rockwell B-99.

3.10.2 Conditions other than physical condition (C). Unless otherwise specified (see 6.2), the hardness of materials in conditions other than physical condition (C) shall be not greater than Rockwell C-33, except the hardness of material in physical condition (F) shall be within the specified strength range.

3.11 Identification of product. The material shall be identified and marked in accordance with FED-STD-183.

3.12 Tolerances. Tolerances shall conform to the applicable limits of FED-STD-48, except when bars are specifically intended for reforging purposes.

3.13 Workmanship. Material shall be sound, of uniform quality and condition, free from pipes, and shall not contain laps, cracks, twists, seams, or other defects detrimental to the fabrication or performance of parts. Steel melting practice shall produce metal complying with all requirements of this specification.

3.13.1 Cold drawn bars. Cold drawn bars shall be free from scale. Drawing shall be accomplished after all heat-treating operations have been completed; however, stress relieving, at a maximum temperature not exceeding 50°F(10°C) below the tempering temperature, may be accomplished after drawing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements

in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, whether indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspections. All the inspections specified herein are classified as quality conformance inspections.

4.3 Inspection conditions. Unless otherwise specified in the contract or purchase order, all inspections shall be performed in accordance with the test conditions specified in the applicable test method document or applicable paragraph(s) in the specification.

4.4 Quality conformance inspection.

4.4.1 Inspection lot. An inspection lot shall include all mill forms of one heat, condition, and size presented for acceptance at one time, and when heat treated, from the same process and the same batch.

4.4.2 Examination of product. Samples selected at random in accordance with Table VI shall be examined for compliance with surface condition, identification, dimensional, marking, workmanship, and preparation for delivery requirements.

4.4.3 Chemical analysis.

4.4.3.1 Sampling. Chemical analysis shall be determined on specimens from each remelt ingot.

4.4.3.2 Specimens. Samples for chemical analysis shall be taken parallel to the axis of the billet selected, at a point midway between the center and surface, except that material less than 1-1/4 inches (3.18 cm) thick shall be sampled through the entire cross-section. The sample shall consist of not less than 2 ounces (57 g) of material.

4.4.3.3 Test method. Samples shall be prepared in accordance with Method 111.2 of FED-STD-151, and shall be tested by wet chemical, spectrographic, or other analytical methods. In the event of dispute, analysis shall be by wet chemical methods.

• 4.4.4 Response to heat treatment.

4.4.4.1 Sampling. Samples shall be selected from the top and bottom of the consumable electrode melted ingots representing the first and last ingots from the original air melted heat or vacuum induction melted heat. From the test ingot or test billet, bars shall be forged or rolled in accordance with Tables Va and Vb, heat treated per 3.4 and 4.4.4.1, and tested to determine conformance to Tables III and IIIa.

4.4.4.2 Ingot quality. For each ingot from a heat not tested in accordance with 4.4.4.1, test billets or bars representing the top and bottom positions in the ingot shall be forged or rolled, or forged and rolled to not less than 5 inches square or thickness of minimum section or 6 inches diameter of round. Transverse slices for testing shall be cut from the ends of the billets or bars corresponding to the top and bottom of the ingot.

4.4.4.3 Bar quality. For individual bars or billets from a heat not previously tested, transverse slices shall be cut from one end of each bar or billet.

4.4.4.4 Preparation of test specimens. From the mid-radius positions of each sample size or section, duplicate tensile test coupons shall be removed in the transverse direction (short transverse from rectangular sections) relative to the longitudinal axis of the original ingot, for heat treatment and test as specified.

4.4.4.4.1 Heat treatment. Prior to machining or grinding to final size, test coupons shall be heat treated as follows:

Class 1:

- (a) Normalize at $1650^{\circ}\text{F} \pm 25$ ($900^{\circ}\text{C} \pm 14$) for 1 hour.
- (b) Austenitize at $1550^{\circ}\text{F} \pm 25$ ($815^{\circ}\text{C} \pm 14$) for 1/2 hour.
- (c) Quench in oil at 75°F to 140°F (24°C to 60°C).
- (d) Double temper at $475^{\circ}\text{F} \pm 15$ ($246^{\circ}\text{C} \pm 8$) for 2 plus 2 hours.

Class 2:

- (a) Normalize at $1700^{\circ}\text{F} \pm 25$ ($927^{\circ}\text{C} \pm 14$) for 1 hour.
- (b) Austenitize at $1600^{\circ}\text{F} \pm 25$ ($871^{\circ}\text{C} \pm 14$) for 1 hour.
- (c) Quench in oil at 75°F to 140°F (24°C to 60°C).
- (d) Double temper at $575^{\circ}\text{F} \pm 15$ ($302^{\circ}\text{C} \pm 5.6$) for 2 plus 2 hours.

4.4.4.4.2 After the heat treatment specified in 4.4.4.4.1, test specimens shall be machined or ground to final size to conform to ASTM E 8, and stress relieved for 1 hour at a maximum temperature not exceeding 50°F (10°C) below the tempering temperature.

4.4.4.5 Test method. Specimens shall be tested in accordance with ASTM E 8.

4.4.5 Steel cleanliness inspection. The material shall be magnetic particle inspected in accordance with MIL-STD-1949 to comply with the steel cleanliness requirements of AMS 2300 and 3.1.

4.4.6 Ultrasonic inspection. When specified (see 6.2), inspection shall be in accordance with MIL-STD-2154. Surface roughness shall not exceed 125 roughness height rating (RHR) at 5 megahertz (mhz) and 250 RHR at 2.25 mhz and lower frequencies. The surface roughness of the reference standards shall not vary more than plus or minus 25 RHR from the surface roughness of material being tested.

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4.4.7 Grain size.

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

4.4.7.2 Test method. Specimens shall be metallographically prepared in accordance with ASTM E 3 conforming to 3.7. The austenite grain size shall be determined in accordance with ASTM E 112 and shall conform to 3.5.

4.4.8 Micro-inclusions.

4.4.8.1 Sampling. At least six (6) samples shall be obtained from each remelt ingot in accordance with ASTM E 45.

4.4.8.2 Preparation of specimens. Specimens shall be prepared in accordance with ASTM E 45.

4.4.8.3 Test method. Specimens shall be inspected in accordance with Method D of ASTM E 45 and shall conform to 3.6.

4.4.9 Macrostructure.

4.4.9.1 Sampling. Two or more sample slices at least 1/4 inch (0.64 cm) thick shall be selected to represent the top and bottom of each remelt ingot from which material is submitted for acceptance.

4.4.9.2 Specimen preparation and inspection. The samples shall be prepared and inspected in accordance with ASTM A 604. The etched samples shall meet the requirements of 3.7.

4.4.10 Hardenability.

4.4.10.1 Sampling. One or more samples for end-quench hardenability test shall be selected from each heat of steel.

4.4.10.2 Preparation of specimens. Specimens for the end-quench hardenability test shall conform to ASTM A 255. The steel shall be normalized prior to machining the test specimen by heating to the applicable temperature of 4.4.4.4.1, holding at this temperature for 1 hour and cooling in still air.

4.4.10.3 Test method. End-quench hardenability test shall be conducted in accordance with ASTM A 255. Specimens shall be austenitized to the applicable temperature of 4.4.4.4.1. Tests shall establish compliance with 3.8.

4.4.11 Decarburization.

4.4.11.1 Sampling. With exception of material specifically ordered for reforging purposes or physical condition (1), one sample shall be selected to represent each size and configuration of product of the same processing condition and delivered at one time.

4.4.11.2 Test method. The depth of decarburization shall be determined by making a microhardness traverse per ASTM E 384 using not less than 250X magnification and recording hardness versus depth below surface. The boundary of the decarburization shall be at the depth at which the hardness rises to the equivalent of 20 points Knoop below the core hardness.

4.4.12 Hardness of bars in physical conditions (C) and (E).

4.4.12.1 Sampling. Not less than five bars of each condition and size shall be tested to determine conformance with hardness values of 3.10. When less than five bars are ordered, each bar shall be tested.

4.4.12.2 Test method. Hardness testing shall conform to ASTM E 10 or ASTM E 18.

4.4.13 Conformance test results. Results of the conformance tests specified in 4.4 shall be retained for a period of six months by the contractor. The results shall be readily available to the Government quality assurance representative.

4.4.14 Rejection and retest. Failure of a specimen to comply with specified requirements in Table I shall cause rejection of the materials represented. However, at the discretion of the contracting activity, retest will be permitted. A retest sample of five specimens from samples selected in accordance with Table VI shall be tested to replace each failed specimen of the original sample. If one retest specimen fails, the materials represented shall be rejected with no further retesting permitted.

4.5 Packaging. Packaging shall be examined for conformance to section 5.

5. PACKAGING

5.1 Preservation. The preservation shall be level A or commercial as specified (see 6.2).

5.1.1 Level A. The bars shall be preserved in accordance with MIL-STD-163.

5.1.2 Commercial. Commercial preservation shall be in accordance with ASTM A 700.

5.2 Packing. The packing shall be level A or commercial as specified (see 6.2).

5.2.1 Level A. The material shall be packed in accordance with MIL-STD-163. The material shall be properly separated by condition and size when prepared for delivery.

5.2.2 Commercial. Commercial packing shall be in accordance with ASTM A 700.

5.3 Marking. Marking and labeling shall be in accordance with MIL-STD-163.

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6. NOTES

6.1 Intended use. Steel covered by this specification is intended for use in the manufacture of highly stressed aircraft parts requiring high hardenability. Class I steel is subject to potential embrittlement when tempered between 500°F (260°C) and 750°F (400°C) and is therefore, not recommended for use within this temperature range.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Composition, physical and surface conditions. (see 1.2.1, 1.2.2, and 1.2.3).
- c. Size and shape.
- d. When bars are intended for reforging purposes, it should be so stated. (see 3.3.1)
- e. If decarburization limits closer than those specified in 3.9 are desired.
- f. Exact lengths and length tolerances, if mill lengths are not acceptable.
- g. If special levels of packaging are required (see section 5).
- h. Whether ultrasonic inspection is required and, if so, state acceptance level (class), see 4.4.6.

6.3 Material cross reference. Below is a cross reference detailing the relationship between compositions in this and previous revisions of this specification.

Composition	MIL-S-8844A	MIL-S-8844B	MIL-S-8844B Amendment I	MIL-S-8844C	MIL-S-8844D
4340	Class 1	Class 1	Class 1	Class 1	Class 1
STRUX	Class 2	(deleted)	---	---	---
300M	Class 3	Class 2	Class 3	Class 3	Class 3

6.4 Heat, definition of. A heat shall be the usable product of steel processed as a single furnace charge in the first melt cycle.

6.5 UNS designations. The parenthetical unified numbering system (UNS) designations in section 1.2.1 are listed for informational purposes only and shall not be considered as substitutes unless they meet all of the other requirements in this specification.

6.6 SI units. Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

6.7 Subject term (key word) listing.

Bar, steel
Stock, reforging
Tubing, mechanical

6.8 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Army - MI
Navy - AS
Air Force - 20

Preparing activity:
Navy - AS

Project No. 9510-0402

TABLE I Quality conformance tests.

	Requirement	Test method
Chemical composition	3.2	4.4.3
Response to heat treatment	3.4	4.4.4
Ultrasonic inspection	6.2	4.4.6
Grain size	3.5	4.4.7
Micro-inclusions	3.6	4.4.8
Macrostructure	3.7	4.4.9
Hardenability	3.8	4.4.10
Decarburization	3.9	4.4.11
Hardness	3.10	4.4.12

TABLE II Chemical composition.

Element	Class 1 (4340)	Class 2 (300M)	Tolerance
Carbon	0.38 - 0.43	0.40 - 0.45	± 0.02 ^{1/}
Manganese	0.65 - 0.90	0.65 - 0.90	± 0.04
Phosphorous	0.010 ^{2/}	0.010 ^{2/}	---
Sulfur	0.010 ^{2/}	0.010 ^{2/}	---
Silicon	0.15 - 0.35	1.45 - 1.80	± 0.05
Nickel	1.65 - 2.00	1.65 - 2.00	± 0.05
Chromium	0.70 - 0.90	0.70 - 0.95	± 0.05
Molybdenum	0.20 - 0.30	0.35 - 0.50	± 0.03
Vanadium	-----	0.05 - 0.10	± 0.003
Copper	0.35 ^{2/}	0.35 ^{2/}	---

^{1/} For Class 2: +0.02, -0.00.^{2/} Maximum.

TABLE III Transverse mechanical properties. 1/

Class	Test Section Size (in ²)	Yield Strength <u>2/</u> , <u>3/</u> (psi)	Tensile Strength <u>3/</u> (psi)	Elongation <u>4/</u> (percent)	Reduction in Area (percent)	
					Individual	Average
1	Less than 100	217,000	260,000	6	25	30
	100 - 144, incl.	"	"	5	20	25
	Over 144	"	"	4	15	20
2	Less than 100	230,000	280,000	6	25	30
	100 - 144, incl.	"	"	5	20	25
	Over 144	"	"	4	15	20

Table III (SI) Transverse mechanical properties. 1/

Class	Test Section Size (cm ²)	Yield Strength <u>2/</u> , <u>3/</u> (MPa)	Tensile Strength <u>3/</u> (MPa)	Elongation <u>4/</u> (percent)	Reduction in Area (percent)	
					Individual	Average
1	Less than 645	1495	1795	6	25	30
	645 to 930, incl.	"	"	5	20	25
	Over 930	"	"	4	15	20
2	Less than 645	1586	1931	6	25	30
	645 to 930, incl.	"	"	5	20	25
	Over 930	"	"	4	15	20

1/ Minimum.2/ 0.2 percent offset method.3/ For all sizes.4/ In a gage length of 2 inches or a gage length equal to 4 times the diameter.

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TABLE IIIa Longitudinal mechanical properties.1/

Class	Test Section Size (in ²)	Yield Strength <u>2/</u> , <u>3/</u> (psi)	Tensile Strength <u>3 /</u> (psi)	Elongation <u>4/</u> (percent)	Reduction in Area (percent)
1	<u>3/</u>	217,000	260,000	10	30
2	<u>3/</u>	230,000	280,000	7	25

TABLE IIIa (SI)Longitudinal mechanical properties.1/

Class	Test Section Size (cm ²)	Yield Strength <u>2/</u> , <u>3/</u> (MPa)	Tensile Strength <u>3 /</u> (MPa)	Elongation <u>4/</u> (percent)	Reduction in Area (percent)
1	<u>3/</u>	1495	1795	10	30
2	<u>3/</u>	1586	1931	7	25

1/ Minimum.2/ 0.2 percent offset method.3/ For all sizes.4/ In a gage length of 2 inches or a gage length equal to 4 times the diameter.

TABLE IVa. Decarburization limits for bars & reforcing stock.

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.	0.012
Over 0.500 to 0.625, incl.	0.014
Over 0.625 to 1.000, incl.	0.017
Over 1.000 to 1.500, incl.	0.020
Over 1.500 to 2.000, incl.	0.025
Over 2.000 to 2.500, incl.	0.030
Over 2.500 to 3.000, incl.	0.035
Over 3.000 to 5.000, incl.	0.045

TABLE IVa. (SI) Decarburization limits for bars & reforcing stock.

Nominal diameter or distance between opposite faces (millimeters)	Maximum depth of decarburization (millimeters) 1/
Up to 9.52, incl.	0.38
Over 9.52 to 12.70, incl.	0.43
Over 12.70 to 15.88, incl.	0.48
Over 15.88 to 25.40, incl.	0.56
Over 25.40 to 38.10, incl.	0.64
Over 38.10 to 50.80, incl.	0.76
Over 50.80 to 63.50, incl.	0.89
Over 63.50 to 76.20, incl.	1.02
Over 76.20 to 127.00, incl.	1.14

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

TABLE IVb. Decarburization limits for tubing.

Nominal wall thickness (inches)	Depth of decarburization (inches)	
	ID	OD
Up to 0.109, incl.	0.008	0.015
Over 0.109 to 0.203, incl.	0.010	0.020
Over 0.203 to 0.400, incl.	0.012	0.025
Over 0.400 to 0.600, incl.	0.015	0.030
Over 0.600 to 1.000, incl.	0.017	0.035
Over 1.000	0.020	0.040

TABLE IVb. (SI) Decarburization limits for tubing.

Nominal wall thickness (millimeters)	Depth of decarburization (millimeters)	
	ID	OD
Up to 2.77, incl.	0.20	0.38
Over 2.77 to 5.16, incl.	0.25	0.51
Over 5.16 to 10.16, incl.	0.30	0.64
Over 10.16 to 15.24, incl.	0.38	0.76
Over 15.24 to 25.40, incl.	0.43	0.89
Over 25.40	0.51	1.02

TABLE Va. Billet sizes. 1/

Billet size (reforging stock only)	Test billet size
15 inches and over	9-inch square or 10-inch round or larger
12 to 15 inches	8-inch square or 9-inch round or larger
10 to 12 inches	6-inch square or 7-inch round or larger
Under 10 inches	5-inch square or 6-inch round or larger

.1/ In the case of stock which will not be reformed, the section size of the test billets or bars shall be no smaller than the size to be delivered to the contracting activity. Transverse slices shall be cut from the ends of those test billets or bars corresponding to the top and bottom of the original ingot.

TABLE Vb. SI Billet sizes. 1/

Billet size (reforging stock only)	Test billet size
40 centimeters and over	23-cm square or 26-cm round or larger
30 to 40 centimeters	20-cm square or 23-cm round or larger
25 to 30 centimeters	15-cm square or 18-cm round or larger
Under 25 centimeters	13-cm square or 15-cm round or larger

1/ In the case of stock which will not be reformed, the section size of the test billets or bars shall be no smaller than the size to be delivered to the contracting activity. Transverse slices shall be cut from the ends of those test billets or bars corresponding to the top and bottom of the original ingot.

TABLE VI. Sampling for examination of product.

Lot Size	Sample Size	Acceptance number (sample failures)
1 to 65	4	0
66 to 110	5	0
111 to 300	7	0
301 to 500	10	0
501 to 800	15	0
Over 800	25	0

TABLE VII. Detailed Retest Plan

Property in question (Failure of specimen from original sample)	Plan Code	Detailed plan
Chemical analysis	A	PLAN A One sample from each five product items from the same heat.
Grain size	A	PLAN B One sample from a slice adjacent to that which previously failed, plus one from each of four billets representing the top positions of four ingots, respectively, from the same heat.
Response to heat treatment	B	PLAN C One from each of five items of the respective size, configuration, and processing condition, from the same heat.
Quality (inclusion count)	B	
Decarburization	C	
Hardness	C	
Visual inspection	C	

TABLE VIII. Micro-inclusion size and frequency limits

	A		B		C		D	
	Thin	Heavy	Thin	Heavy	Thin	Heavy	Thin	Heavy
Worst Field Severity	1.5	1.0	1.5	1.0	1.5	1.0	2.0	1.5
Worst Field Frequency <u>1/</u>	*	1	*	1	*	1	3	1
Total Rateable Fields/ Frequency <u>1/</u>	**	1	**	1	**	1	8	1

1/ Maximum

* Combined A+B+C, not more than three (3) fields.

** Combined A+B+C, not more than eight (8) fields.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

MIL-S-8844D

2. DOCUMENT TITLE

STEEL BAR, REFORGING STOCK, AND MECHANICAL TUBING, PREMIUM QUALITY

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

☐

VENDOR

☐

USER

☐

MANUFACTURER

☐

OTHER (Specify): _____

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

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