

QQ-S-624C
May 26, 1970

SUPERSEDING

Fed. Spec. QQ-S-624B
August 14, 1961

FEDERAL SPECIFICATION

STEEL BAR, ALLOY, HOT ROLLED AND

COLD FINISHED (GENERAL PURPOSE)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers standard and H-steel alloy bars for general fabrication purposes. These bars are procured to compositions defined by AISI and Federal Standard No. 66 steel numbers with provisions for the specification of additional requirements in the procurement document.

1.2 Classification.

1.2.1 Descriptive requirement.

1.2.1.1 Composition. Standard alloy steel bars are furnished to chemical composition in accordance with the steel numbers and compositions of Federal Standard No. 66 (see 6.3). H-steel alloy bars are furnished to the steel numbers and chemical composition and minimum and maximum hardness values in accordance with the steel numbers, composition, and hardenability bands of Federal Standard No. 66 (see 6.3 and 6.4).

FSC 9510

QQ-S-624C

1.2.2 Additional descriptive requirements. Standard and H-steel alloy bars may be specified to one or more, unless technically incompatible, additional descriptive requirements:

Mechanical properties.

Austenite grain size.

1.2.3 Condition. Alloy steel bars are furnished as hot rolled or cold finished in the following conditions, as specified (see 6.2):

Hot rolled bars:

As hot rolled (HR).

Annealed (A).

Normalized (N).

Normalized and tempered (NT).

Quenched and tempered (QT).

Stress relieved (SR).

Cold finished bars:

As cold finished (CF), either as cold drawn (CD) or cold rolled (CR).

Annealed and cold finished (ACF).

Normalized and cold finished (NCF).

Normalized, cold finished, and stress relieved (NCFSR).

Normalized, tempered, and cold finished (NTCF).

Turned and polished (TP).

Turned, ground and polished (TGP).

Annealed, cold finished, and stress relieved (ACFSR).

Quenched and tempered and cold finished (QTCF).

Drawn at elevated temperatures (DET).

Drawn at elevated temperatures and stress relieved (DETSR).

Cold finished and stress relieved (CFSR).

Cold drawn, ground, and polished (CDGP).

1.2.4 Forms. Alloy steel bars are furnished in the following forms, as specified (see 6.2):

Hot rolled bars:

- Rounds.
- Squares.
- Round-cornered squares.
- Flats.
- Hexagons
- Octagons.
- Special bar shapes.

Cold finished bars:

- Rounds.
- Squares.
- Hexagons
- Flats.
- Special bar shapes.

1.2.5 Size. Alloy steel bars are commonly furnished in the following size ranges, as specified:

Hot rolled bars:

- Rounds, up to 9-1/2 inches, inclusive.
- Squares, up to 5-1/2 inches, inclusive.
- Round-cornered squares, up to 7-1/2 inches, inclusive.
- Hexagons, up to 3-1/2 inches, inclusive.
- Flats, thicknesses over 0.203 inch for widths up to 6 inches inclusive, and thicknesses 0.230 and over for widths over 6 to 8 inches inclusive.

Cold finished bars:

- Rounds, up to 9 inches, inclusive.
- Squares, up to 4 inches, inclusive.
- Hexagons, up to 3-1/8 inches, inclusive.
- Flats, 1/8 inch and over in specified thickness, and up to 12 inches in specified width.

QQ-S-624C

Cold finished bars (coiled):

Rounds, up to 7/8 inch, inclusive.

Hexagons and squares, up to 5/8 inch, inclusive.

Flats up to 9/16 by 5/8 inch, or other sections having cross-sectional area not more than 0.30 square inch.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Standards:

- Fed. Std. No. 48 - Tolerances for Steel and Iron Wrought Products.
- Fed. Std. No. 66 - Steel: Chemical Composition and Hardenability.
- Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).
- Fed. Test Method Std. No. 151 - Metals; Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly monthly supplements, as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

(Single copies of this specification and other Federal specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, D. C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles and Seattle, Washington.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from the established distribution points in their agencies.)

QQ-S-624C

Military Standards:

MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-163 - Steel Mill Products Preparation for Shipment and Storage.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring 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 a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

A 255 - Method of End-Quench Test for Hardenability of Steel
E 8 - Tension Testing of Metallic Materials
E 10 - Brinell Hardness of Metallic Materials
E 18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
E 92 - Method of Test for Vickers Hardness of Metallic Materials
E 112 - Estimating Average Grain Size of Metals

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

National Classification Board:

National Motor Freight Classification.

(Application for copies shall be addressed to the American Trucking Association, Inc., Attn: Tariff Order Section 1616 P Street, N.W. Washington, D.C. 20036.)

Uniform Classification Committee:

Uniform Freight Classification.

(Application for copies shall be addressed to the Uniform Classification Committee, 202 Union Station, Chicago, Illinois 60606.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among groups and using Federal agencies.)

QQ-S-624C

3. REQUIREMENTS

3.1 Chemical composition. Chemical composition for standard and H-steel alloy bars shall be specified by the identifying alloy steel number in accordance with Federal Standard No. 66. The chemical composition for the specified steel number shall meet the requirements of Federal Standard No. 66 (see 6.2).

3.1.1 Ladle analysis. A ladle analysis of each heat of steel shall be furnished by the supplier showing the percentage of each element designated in Federal Standard No. 66 for the composition of the specified steel number.

3.1.2 Check analysis. The chemical composition as determined by check analysis shall meet the requirements for the specified composition, provided that in a heat of steel the individual tolerances do not vary above or below the ranges shown for check analysis tolerances in Federal Standard No. 66.

3.2 H-steel hardenability limits. The minimum and maximum hardenability limits for the specified steel number shall be selected from the hardenability bands in Federal Standard No. 66 by the procuring agency. H-steel bars furnished to the specified hardness values shall meet the requirements of Federal Standard No. 66 when tested in accordance with 4.5.3 (see 6.2 and 6.3)

3.3 Mechanical properties. When specified in the contract or order, standard and H-steel alloy bars may be specified to mechanical properties. The mechanical properties shall be as agreed upon between the supplier and procuring activity, consistent with the composition and processing capabilities of the specified steel number.

3.3.1 Heat treatment. The supplier may determine the detailed heat treating procedure required to produce the specified mechanical properties. Bars which are straightened following heat treatment may be stress relieved to minimize internal stresses.

3.4 Austenite grain size. When specified in the contract or order, standard steel bars may be specified to coarse or fine grain size although normally alloy steel bars are produced to fine grain practice. H-steel bars are produced to fine grain practice. Unless otherwise specified, at least 70 percent of the grains shall comply with the ordered size.

3.5 Condition. Hot-rolled bars shall be furnished in the condition specified in the contract or order (see 6.2).

3.6 Finish.

3.6.1 Hot-rolled and hot-rolled, heat-treated bars. Bars shall be commercially free from flat spots, deep rolling marks, and excessive and loose scale.

3.6.1.1 Descaled bars. When specified in the contract or order, bars shall be descaled by pickling or by other approved methods (see 6.2).

3.6.2 Cold finished and cold finished, heat treated bars. Cold finished steel bars shall have a smooth unoxidized surface. Cold finished and heat-treated or stress-relieved bars shall be free from scale, but may have the characteristic oxidized surface.

3.7 Dimensions. Bars shall be furnished in the sizes specified in the contract or order or on the applicable drawing. Dimensional tolerances from specified size shall be in accordance with Federal Standard No. 48 as shown in table I.

Table I. Dimensional tolerance references to Fed. Std. No. 48

| Form | Dimensional tolerance | Federal Standard No. 48 Paragraph reference | |
|-----------------------|------------------------|---|---------------|
| | | Hot rolled | Cold finished |
| Rounds | Diameter, out-of-round | 1b1 | 2b1, 2b2 |
| Squares | Width, out-of-square | 1b1 | 2b1 |
| Flats | Thickness and width | 1b3 | 2b1 |
| Hexagons and octagons | Size, out-of-hexagon | 1b2 | 2b1 |
| Bars | Length | 1b4 | 2b3, 2b4 |
| | Straightness | 1b5 ^{1/} | 2b5 |

^{1/} Hot rolled bars ordered to special straightness tolerances shall be straight within 1/8 inch in any 5 feet of length, or within 1/8 inch times the number of feet of length divided by 5, in the entire length.

QQ-S-624C

3.8 Identification marking. Bars shall be marked for identification as specified in the contract or order. For Defense Supply Agency procurement, marking for identification shall be in accordance with Fed. Std. No. 183 and should include heat number, condition, and specification number.

3.9 Workmanship. The material shall be free from pipe, flakes, and heat checks, and shall not contain any other defects which may affect detrimentally the suitability of the bars for their intended use consistent with the quality specified.

3.9.1 Each bar length shall consist of one continuous piece as cut from the full length bar as rolled. Bars joined by welding shall not be furnished.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may use his own facilities or any commercial laboratory acceptable to 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 that supplies and services conform to prescribed requirements.

4.2 Lot. Unless otherwise specified in the contract or order, a lot shall consist of all bars submitted for inspection at the same time of the same heat, condition, finish, size or shape. For bars specified in the quenched and tempered condition, when heat treated in batch type furnaces, a lot shall consist of all bars from the same heat, of the same prior condition, the same size and subjected to the same heat treatment in one tempering charge. For bars specified by the quenched and tempered condition, when heat treated without interruption in a continuous type furnace, a lot shall consist of all bars from the same heat, of the same prior condition, of the same size and subjected to the same heat treatment.

4.3 Sampling.

4.3.1 For chemical analysis. Sampling for check analysis shall be taken from bars selected at random in accordance with table II.

Table II. Samples for check analysis^{1/}

| Lot size | Number of samples |
|-------------------|-------------------|
| 15 tons and under | 4 |
| Over 15 tons | 6 |

^{1/} In case the number of bars in a heat is less than the number of samples required, one sample from each heat shall be considered sufficient.

4.3.2 For mechanical properties.

4.3.2.1 Tension tests. When mechanical property requirements are specified, at least one sample shall be selected for each 10,000 pounds of material or fraction thereof in each lot, provided that not fewer than two samples shall be taken from each lot and not more than ten samples shall be taken for any lot. In case of bars specified in the quenched and tempered condition, if more than one quenching charge is represented in a tempering charge, each quenching charge shall be represented in the material selected for testing; when heat treated without interruption in continuous type furnaces and subjected to the same heat treatment, no fewer than two test samples shall represent a lot selected on the basis of one sample for each 10,000 pounds of bars or fraction thereof. Test samples shall be taken from location as shown in table III.

QQ-S-624C

Table III. Location of tension test samples

| Form | Size (Diameter or thickness of bar; width of flat) | Location of axis of test specimen |
|-------------|---|---|
| Bars, Flats | Not over 1-1/2 inches | Coincides with central axis of piece |
| Bars | Over 1-1/2 inches | One-fourth the diameter or thickness from the surface, and parallel to the direction of rolling |
| Flats | Over 1-1/2 inches | Test bars located at one-fourth width, and parallel to direction of rolling |

4.3.2.2 Hardenability tests. At least one sample for end-quench hardenability testing shall be selected from each heat of H-steel.

4.3.2.3 Hardness tests. When hardness requirements are specified, at least three samples shall be selected from each lot.

4.3.3 For austenite grain size. When samples for austenite grain size are required, one or more representative samples shall be selected to represent each heat or lot as specified by the procuring activity (see 6.2).

4.4 Examination.

4.4.1 Visual. Unless otherwise specified in the contract or order, all bars in each lot shall be examined to determine compliance with the requirements for condition (see 3.5), finish (see 3.6), identification marking (see 3.8), and workmanship (see 3.9).

4.4.2 Dimensions. Unless otherwise specified in the contract or order, all bars in each lot shall be measured to determine compliance with the requirements for size and tolerances (see 3.7).

4.4.3 Preparation for delivery. Prior to shipment, examination shall be made of the preservation, packaging, packing and marking for shipment to determine compliance with section 5.

4.5 Test methods.

4.5.1 Chemical composition. Samples for check analysis shall be prepared and tested in accordance with method 111 or method 112 of Fed. Test Method Std. No. 151. In case of dispute, analysis by method 111 shall be the basis for acceptance or rejection.

4.5.2 Tension tests. Specimens for tensile testing shall be prepared and tested in accordance with ASTM E 8.

4.5.3 Hardenability tests. Specimens for hardenability tests shall be prepared and tested in accordance with ASTM A 255.

4.5.4 Hardness tests. Specimens for hardness testing shall be prepared and tested in accordance with ASTM E 10, E 18, or E 92 as applicable. Hot-rolled bars are commonly tested in accordance with ASTM E 10.

4.5.5 Austenite grain size. Specimens for austenite grain size testing shall be prepared and tested in accordance with ASTM E 112.

4.6 Rejection and retest. Unless otherwise specified in the contract or order, rejection and retest shall be conducted in accordance with the general section of Fed. Test Method Std. No. 151 (see 6.2).

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C as specified (see 6.2).

5.1.1 Level A. Preservation and packaging shall be in accordance with the applicable requirements of MIL-STD-163.

5.1.2 Level C. Cleaning, drying, preservation, and packaging shall be in accordance with the manufacturer's commercial practice.

5.2 Packing. Bars shall be packed for shipment in accordance with levels A or C as specified (see 6.2).

5.2.1 Level A. Bars shall be packed in accordance with the applicable requirements of MIL-STD-163.

QQ-S-624C

5.2.2 Level C. Packing shall be in accordance with commercial practice adequate to ensure acceptance and delivery by the carrier for the mode of transportation employed. Containers shall comply with the requirements of the Uniform Freight Classification Rules or National Motor Freight Classification Rules, as applicable to the mode of transportation.

5.3 Marking.

5.3.1 Civil agencies. In addition to any special marking specified in the contract or order, marking for shipment shall be in accordance with Fed. Std. No. 123.

5.3.2 Military activities. In addition to any special marking specified in the contract or order, marking for shipment shall be in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Alloy steel bars procured under this specification are intended for general fabricating purposes.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Chemical composition (see 1.2.1.1 and 3.1).
- (c) Condition (see 1.2.3 and 3.5).
- (d) Form and size (see 1.2.4, 1.2.5, and 3.7)
- (e) Hardenability values when H-steel is specified (see 3.2)
- (f) Mechanical properties, if specified (see 3.3).
- (g) Austenitic grain size, if specified (see 3.4 and 4.3.3).
- (h) Finish required (see 3.6).
- (i) Identification marking required (see 3.8).
- (j) When lot size other than shown in 4.2 is required.
- (k) Visual and dimensional requirements when necessary (see 4.4).
- (l) When different rejection and retest requirements should be applied (see 4.6).
- (m) Level of preservation and packaging and level of packing required (see Section 5)
- (n) Special marking when required (see 5.3)

6.3 Relation to commercial material. Hot rolled and cold finished standard alloy steel bars specified to chemical composition only, subject to check analysis under this specification are similar to ASTM A 322 for hot rolled bars and ASTM A 331 for cold finished bars. H-steel alloy bars specified to chemical composition and hardenability values are similar to ASTM A 304. Provisions are made in this specification for specifying additional requirements.

6.4 Definition of H-steels. H-steels are those alloy steels, identified by the suffix letter "H" to the steel number, which may be designated by a combination of hardenability limits (hardness values) and composition.

6.4.1 The hardenability data for each of these steels has been derived from extensive standard (Jominy) end-quench hardenability testing and subsequently incorporated into composite graphs. Each graph has two curves, plotted from the maximum and minimum hardness values reported for 1/16-inch distances from the quenched end of a standard 1-inch diameter specimen. The band created by these two curves defines the hardness limits for that composition. Hardenability bands, in both graphic and tabular form together with directions for their use in specifying H-steels, are given in Federal Standard No. 66.

6.4.2 To permit producers to meet common standards of hardenability with differing facilities and techniques, the ranges and limits of chemical composition for the H-steels have been made slightly wider than those of the standard alloy steels having the same identification number. However, the modifications in composition are not great enough to alter the general characteristics of the original composition.

6.5 Guidance and general information. Department of Defense, Supply and Logistics Handbook, Standardization H-8, Steel and Iron Wrought Products, may be consulted for guidance, general information, and definitions. The handbook is not intended for use in procurement and is limited to informational purposes only.

6.6 Quenched and tempered and cold finished bars. Manufacturers normally furnish quenched and tempered and cold finished alloy steel bars in any of six combinations of physical condition and surface finish:

Quenched and tempered, and turned and polished (QTTP).

Quenched and tempered, turned and polished, and stress relieved after cold finishing and straightening (QTTPSR).

Quenched and tempered and cold drawn (QTCD).

Quenched and tempered, cold drawn, and stress relieved after cold finishing and straightening (QTCD SR).

Quenched and tempered, and turned, ground, and polished (QTGTP).

Quenched and tempered, turned, ground, and polished; and stress relieved after cold finishing and straightening (QTGTPSR).

QQ-S-624C

MILITARY CUSTODIANS:

Army - MR
Navy - SH

Review activities:

Army - MI, ME, MU, WC
DSA - IS

User activities:

Army - AT
Navy - OS, YD

Preparing activity:

Army - MR

CIVIL AGENCY INTEREST:

GSA
INT
AGR
COM
JUS
PO
DC
HEW

Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See Section 2 of this specification to obtain copies and other documents referenced herein. Price 15 cents each.

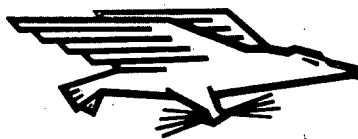
| SPECIFICATION ANALYSIS SHEET | | Form Approved Budget Bureau No. 119-R004 |
|---|----------------------------|--|
| INSTRUCTIONS | | |
| This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. | | |
| SPECIFICATION QQ-S-624C, Steel Bar, Alloy, Hot Rolled and Cold Finished (General Purpose) | | |
| ORGANIZATION | | CITY AND STATE |
| CONTRACT NO. | QUANTITY OF ITEMS PROCURED | DOLLAR AMOUNT \$ |
| MATERIAL PROCURED UNDER A | | |
| <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT | | |
| 1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING. | | |
| B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES. | | |
| 2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID | | |
| 3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY? | | |
| 4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity) | | |
| SUBMITTED BY (Printed or typed name and activity) | | DATE |

DD FORM 1426
APR 63

REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

FOLD

DEPARTMENT OF THE ARMY
Army Materials and Mechanics Research Center
Watertown, Massachusetts 02172



POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Director
Army Materials and Mechanics Research Center
ATTN: AMXMR-QS
Watertown, Massachusetts 02172

FOLD