

QQ-S-764B

January 6, 1970

SUPERSEDING

Fed. Spec. QQ-S-764A

January 3, 1966

FEDERAL SPECIFICATION

STEEL BAR, CORROSION RESISTING, FREE MACHINING

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 free machining corrosion
resisting steel bar (see 6.1).

1.2 Classification. Corrosion resisting bar shall be furnished in
the following types, conditions, forms, and finishes, as specified (see
6.2).

1.2.1 Types and conditions. The steel shall be furnished in the
types and conditions shown in table I (see 6.3).

Table I. Types and conditions

| Type | Condition A (annealed) | Condition T (intermediate temper) | Condition H (hard temper) |
|------------|---------------------------|--------------------------------------|------------------------------|
| 203 EZ | A | - | - |
| 303 | A | - | - |
| 303 SE | A | - | - |
| 303 Ma | A | - | - |
| 303 Pb | A | - | - |
| 303 Cu | A | - | - |
| 303 plus X | A | - | - |

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Table I. Types and conditions (con.)

| Type | Condition A (annealed) | Condition T (intermediate temper) | Condition H (hard temper) |
|------------|---------------------------|--------------------------------------|------------------------------|
| 416 | A | T | H |
| 416 Se | A | T | H |
| 416 plus X | A | T | H |
| 420 F | A | - | - |
| 420 F Se | A | - | - |
| 430 F | A | - | - |
| 430 F Se | A | - | - |
| 440 F | A | - | - |
| 440 F Se | A | - | - |

1.2.2 Forms and finishes. Form and finish of corrosion-resisting steel bars shall be as follows:

Forms.

Round
Square
Hexagon
Octagon
Flat

Finishes.

Scale not removed.
Rough turned (rounds only).
Pickled or blast cleaned and pickled.
Cold drawn or cold rolled.
Centerless ground (rounds only).
Polished (rounds only).

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.

Fed. Std. No. 183 - Continuous Identification Marking of Iron and Steel Products.

(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 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 established distribution points in their agencies.)

Military Standards:

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.)

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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:

E 10 - Brinell Hardness of Metallic Materials.

E 18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials.

(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.)

3. REQUIREMENTS

3.1 Chemical composition. Chemical composition for corrosion resisting steel bar shall be as specified in table II. When permitted, variations in the chemical composition shown in table II for the various elements shall be as specified by the procuring activity (see 4.5.1 and 6.3).

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 table II.

Table II. Chemical composition, percent ^{1/}

| Type | C | Mn | P | S ^{3/} | Si | Cr | Ni | Mo | Other elements |
|------------|----------|-----------|------|-----------------|------|-------------|------------|--------------------|-----------------------------|
| 203 Ez | 0.08 | 5.00-6.50 | 0.04 | 0.18-0.35 | 1.00 | 16.00-18.00 | 5.00-6.50 | 0.50 | Cu 1.75-2.25 |
| 303 | .15 | 2.00 | .20 | 0.15-0.40 | 1.00 | 17.00-19.00 | 8.00-10.00 | 0.60 ^{2/} | |
| 303 Se | .15 | 2.00 | .20 | 0.06 | 1.00 | 17.00-19.00 | 8.00-10.00 | - | Se 0.15 min. |
| 303 Ma | .15 | 2.00 | .05 | 0.11-0.16 | 1.00 | 17.00-19.00 | 8.00-10.00 | 0.40-0.60 | Al 0.60-1.00 |
| 303 Pb | .15 | 2.00 | .04 | 0.12-0.25 | 1.00 | 17.00-19.00 | 8.00-10.00 | 0.60 | Pb 0.12-0.30 |
| 303 Cu | .15 | 2.00 | .15 | 0.10-0.40 | 1.00 | 17.00-19.00 | 6.00-10.00 | - | Se 0.10, Cu 2.50-4.00 |
| 303 plus X | .15 | 2.50-4.50 | .20 | 0.15-0.40 | 1.00 | 17.00-19.00 | 7.00-10.00 | 0.60 ^{2/} | |
| 416 | .15 | 1.25 | .06 | 0.15-0.30 | 1.00 | 12.00-14.00 | - | 0.60 ^{2/} | |
| 416 Se | .15 | 1.25 | .06 | 0.06 | 1.00 | 12.00-14.00 | - | - | Se 0.15 min. |
| 416 plus X | .15 | 1.50-2.50 | .06 | 0.15 min. | 1.00 | 12.00-14.00 | - | 0.60 ^{2/} | |
| 420 F | .30-.40 | 1.25 | .06 | 0.15 min. | 1.00 | 12.00-14.00 | - | 0.60 | Zr or Cu 0.60 |
| 420 F Se | .30-.40 | 1.25 | .06 | 0.06 | 1.00 | 12.00-14.00 | 0.50 | 0.60 | Se 0.15, Zr or Cu 0.60 |
| 430 F | .12 | 1.25 | .06 | 0.15-0.30 | 1.00 | 14.00-18.00 | - | 0.60 ^{2/} | |
| 430 F Se | .12 | 1.25 | .06 | 0.06 | 1.00 | 14.00-18.00 | - | - | Se 0.15 min. |
| 440 F | .95-1.20 | 1.25 | .06 | 0.15 min. | 1.00 | 16.00-18.00 | 0.50 | 0.60 | Zr or Cu 0.60 |
| 440 F Se | .95-1.20 | 1.25 | .06 | 0.06 | 1.00 | 16.00-18.00 | 0.50 | 0.60 | Se 0.15 min., Zr or Cu 0.60 |

^{1/} Maximum, unless otherwise indicated.^{2/} Optional.^{3/} Sulphur content above the maximum limits may be permitted when agreed upon between the contractor and the procuring activity.

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3.1.2 Check analysis. The chemical composition as determined by check analysis by the purchaser 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 for check analysis tolerances in Fed. Std. No. 66.

3.2 Hardness. When specified in the contract or order, the steel bar material shall meet the hardness requirements shown in the contract or order or on the applicable drawings (see 4.5.2, 6.2 and 6.4).

3.3 Dimensions and tolerances. Bars shall be furnished in the size and form (see 1.2) as specified in the invitation for bids, contract or order. Dimensional tolerances shall be in accordance with Fed. Std. No. 48 as shown in table III.

Table III. Dimensional tolerances

| Dimension | Reference |
|------------------------------------------------------|-----------|
| Bars, hot-rolled: | |
| Diameter or distance across flats (round or square). | 1d1 |
| Distance across flats (hexagon or octagon). | 1d2 |
| Distance across flats (flat). | 1d3 |
| Straightness (machine straightened). | 1d5 |
| Bars, cold-finished: | |
| Diameter or distance across flats (round or square). | 2d1 |
| Diameter (round, ground or ground and polished). | 2b2 |
| Distance across flats (hexagon or octagon). | 2d2 |
| Distance across flats (flat). | 2d3 |
| Straightness (machine straightened). | 2d5 |
| Bars, general: | |
| Length (hot or cold cut), | 1d4 |
| Length (machine cut). | 1d4 |

3.4 Lead exudation (303Pb only). Unless otherwise specified (see 6.2), in the specimens representing the bars shall not evidence an exudation of lead greater than standard 3 (see Fig. 1), when tested in accordance with 4.5.3. When specified (see 6.2), a mill certificate stating that the bars meet the required standard will be acceptable.

3.5 Identification marking. Unless otherwise specified (see 6.2), bars shall be marked in accordance with Fed. Std. No. 183.

3.6 Workmanship. Bars shall contain no defects which may affect detrimentally the suitability of the bar for the intended use consistent with the quality specified.

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 utilize 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.

4.2.1 For examination. A lot for examination shall consist of all bars subjected to inspection at one time of the same heat, condition, and size.

4.2.2 For testing.

(a) Chemical composition. A lot for ladle analysis of chemical composition shall consist of one heat.

(b) Hardness. A lot for hardness testing shall be comprised as follows: (1) For heat treated material, all bars of the same heat subjected to the same heat treatment procedure; (2) For cold worked material, all bars of the same heat of the same size.

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4.3 Sampling.

4.3.1 Sample for Government check analysis. When specified or requested by the procuring agency, samples for check analysis shall be taken from bars selected at random in accordance with table IV. The sample from each bar selected shall be placed in a separate container and forwarded to a laboratory as designated by the procuring agency. Sampling of bars by the purchaser shall be made on the same basis.

Table IV. Samples for check analysis

| Lot size-tons | Number of samples |
|--------------------------|-------------------|
| Up to 5, inclusive | 3 |
| Over 5 to 10, inclusive | 4 |
| Over 10 to 15, inclusive | 5 |
| Over 15 | 6 |

4.3.2 When hardness requirements are specified, at least three samples shall be taken from each lot.

4.3.3 Lead exudation (303 Pb only). Lead exudation tests are to be made on billets rolled from ingots poured from the beginning, middle and end of the heat. One sample shall be taken from the bottom billet of each control ingot.

4.4 Examination.

4.4.1 Visual. A representative number of bars in each lot shall be examined to determine compliance with the requirements for identification marking and workmanship (see 3.5 and 3.6).

4.4.2 Dimensions and tolerances. A representative number of bars shall be measured to determine compliance with the requirements for dimensions and tolerances (see 3.3).

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

4.5 Test methods.

4.5.1 Chemical composition. Check analysis for chemical composition shall be performed in accordance with method 111 or 112 of Fed. Test Methods Std. No. 151 (see 3.1). In case of dispute, analysis by method 111 shall be the basis for acceptance or rejection.

4.5.2 Hardness. Hardness tests shall be conducted midway between the center and the surface in accordance with ASTM E 10, or ASTM E 18 (see 3.2).

4.5.3 Lead Exudation. The specimen shall be lightly coated with light oil over the fresh saw cut surface and placed in a furnace at heat of 1290°F. and held for a period of 10 minutes per inch of thickness at this heat. The specimen shall be removed and compared with the specified standard (see 3.4 and fig. 1). Comparison shall be visual. When the first test is unsatisfactory, the billet (or bloom) shall be cut back until a satisfactory test is obtained.

4.6 Rejection and retest. Unless a sampling plan covering retest provisions is 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.

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 for shipment shall be in accordance with 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. Steel bar material shall be packed for shipment in accordance with level A or C as specified (see 6.2).

5.2.1 Level A. Packing for shipment shall be in accordance with MIL-STD-163.

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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-163.

6. NOTES

6.1 Intended use. Bars of the types covered by this specification are intended for use in parts made in automatic screw machines or where seizing or galling is to be considered. They are used when the savings in the cost of machining because of the amount of stock removal will more than compensate for the increased cost of the material. The additions which make these steels free-machining generally result in the formation of more brittle chips resulting in longer tool life and reduced friction resulting in faster machining speeds. Better surface finishes, over comparable grades of standard quality cold finished bars, may also be obtained. The improved machinability is obtained at a sacrifice in ductility and fatigue properties, making these steels unsuitable for application to high strength or high reliability parts. In applications that are fatigue critical, these free machining steels should not be used.

6.1.1 Type 203 EZ. This type is an austenitic chromium-manganese nickel steel to which elements have been added to improve machining and nonseizing characteristics. This steel is nonmagnetic when annealed, but is slightly magnetic when cold worked.

6.1.2 Types 303, 303 Se, 303 Ma, 303 Pb, 303 Cu, 303 plus X. These types are austenitic chromium nickel steels to which elements have been added to improve machining and nonseizing characteristics. These steels are nonmagnetic when annealed, but are slightly magnetic when cold worked.

6.1.3 Types 416, 416 Se, and 416 plus X. These types are martensitic chromium steels to which elements have been added to improve machining and nonseizing characteristics. They are the most readily machinable of any of the types and are suitable for use in automatic screw machines. They are magnetic in all conditions.

6.1.4 Types 430 F and 430 F Se. These types are ferritic chromium free machining modifications of type 430 and are intended for applications where corrosive environments are not severe. They are subject to rusting and pitting in salt water and will rust in salt air. They are suitable for production of parts in automatic screw machines.

6.1.5 Types 420 F and 420 F Se. These types are martensitic chromium steels used mainly for machined parts requiring high hardness and good corrosion resistance. They are modifications of type 420 to which elements have been added to improve machinability and nonseizing characteristics.

6.1.6 Types 440 F and 440 F Se. These types are the martensitic chromium free-machining modifications of type 440 C. They are used for machined parts which require higher hardness values than possible with other free-machining grades.

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) Type and condition (see 1.2).
- (c) Finish (see 1.2).
- (d) Maximum hardness or hardness range if required (see 3.2).
- (e) Dimensions and form (see 3.3).
- (f) Whether mill certificate is acceptable for lead exudation requirement (see 3.4).
- (g) Identification marking (see 3.5).
- (h) Whether drillings are required for check analysis (see 4.3.1).
- (i) Levels of preservation and packing required (see 5.2).

6.3 Types 430 F and 430 F Se are modifications of regular 430; types 440 F and 440 F Se are modifications of regular 440 C. The rest of the types in table II are modifications of types 303 or 416 and may be substituted for types 303 and 416 provided that all requirements of this specification are met and the procuring activity is satisfied as to the suitability of the material for the purpose intended.

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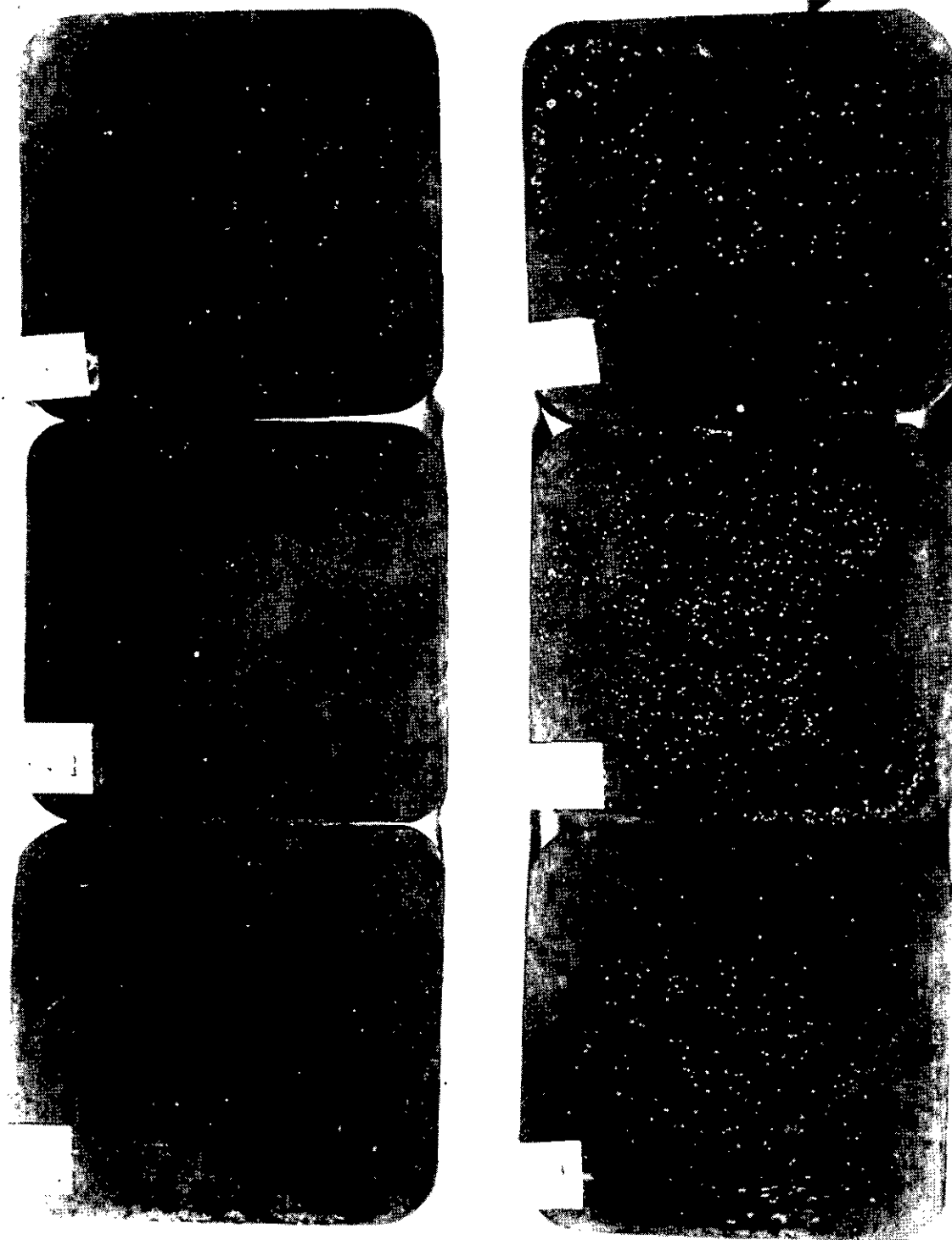


Figure 1 - Standards for Lead Exudation.

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6.4 Free-machining, corrosion resisting steel bar material should normally be capable of meeting the hardness values shown in table V. Specific hardness requirements will be as stated in the contract or order.

Table V. Brinell hardness

| Type | Condition | BHN |
|---------------------------|-----------|------------|
| All | A | 262 max. |
| 416, 416 Se, and 416 F Se | T | 248 to 293 |
| 416, 416 Se, and 416 F Se | H | 293 to 352 |

6.5 Types 303, 303 Se, 416, 416 Se, 430 F, and 430 F Se were previously covered under superseded specification QQ-S-763C.

MILITARY CUSTODIANS:

Army - MR

Air Force - 11

Preparing activity:

Army - MR

Review activities:

Army - MU, WC, MI

Air Force - 85

User activities:

Army - ME

Navy - SH

☆ U. S. GOVERNMENT PRINTING OFFICE : 1970 O - 395-528 (4408)

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