

QQ-S-700D
December 8, 1977
SUPERSEDING
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FEDERAL SPECIFICATION

STEEL SHEET AND STRIP, MEDIUM AND HIGH CARBON

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 medium and high carbon sheet and strip steel for general fabrication purposes.

1.2 Classification. Steel sheet and strip shall be furnished in accordance with the following classification (see 6.1).

1.2.1 Hot rolled sheet and strip

- (a) Hot rolled.
- (b) Hot rolled stress-relief annealed.
- (c) Hot rolled and annealed.
- (d) Hot rolled and spheroidized annealed.

1.2.2. Cold rolled sheet

- (a) Cold rolled annealed last.
- (b) Cold rolled spheroidized annealed.
- (c) Cold rolled, annealed, and skin passed (temper rolled).
- (d) Cold rolled full hard.

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2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on the 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. 66 - Steel: Chemical Composition and Hardenability
 Fed. Std. No. 123 - Marking for 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 supplements as issued is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other product 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, DC, Atlanta, Chicago, Kansas City, MO, Ft. Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(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 Standard:

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 suppliers 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 568 - General Requirements for Steel, Carbon and High-Strength Low-Alloy Hot-Rolled Sheet, Hot-Rolled Strip, and Cold-Rolled Sheet
 E 8 - Tension Testing of Metallic Materials
 E 18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

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E 290-68 - Semi-Guided Bend Test for Ductility of Metallic Materials

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

National Motor Freight Traffic Association, Inc., Agent

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Association, Inc., Traffic Department, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

3. REQUIREMENTS

3.1 Type of steel. Steel shall be fully silicon killed unless otherwise specified in the contract or order (see 6.1). Aluminum may be added in sufficient amounts to control grain size.

3.2 Chemical composition. Chemical composition is specified either to ranges and limits, or to steel grade designations (see 6.2.1 for commonly used steels). In both cases, the specified composition shall satisfy the requirements of "Ranges and Limits for Alloy Steel Sheet and Strip" specified in Fed. Std. No. 66.

3.2.1 Heat analysis. The supplier shall furnish a heat analysis of each heat of steel.

3.2.2 Product analysis. When specified by the purchaser (see 6.1), the steel shall be subject to product analysis. The chemical composition determined shall be within the ranges specified by the procuring agency. Individual determinations may vary from the specified ranges to the extent specified in Fed. Std. No. 66, but the several determinations of any element in a heat may not vary both above and below the range.

3.3 Mechanical properties.

3.3.1 Tensile or hardness properties. When tensile or hardness property requirements are specified in the contract or order (see 6.1), the test specimens representing the steel sheet or strip shall meet the requirements specified.

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3.3.2 Cold bending. When specified in the contract or order (see 6.1), the specimens representing the steel sheet or strip shall withstand cold bending without cracking on the outside of the bent portion at room temperature, as indicated in table I except that sheet and strip as hot rolled, hot rolled stress-relief-annealed, and cold rolled full hard shall be exempt from the cold bending requirement.

TABLE I. Cold bending requirement

Degree of bend	Ratio inside radius to thickness	Relation of bend to rolling direction
180	3t	Longitudinal
180	4t	Transverse

3.4 Spheroidization and decarburization. Unless otherwise specified in the contract or order (see 6.1), cold rolled steel sheet and strip, specified spheroidized annealed, shall be free of lamellar pearlite. Hot rolled steel sheet and strip, specified spheroidized annealed, shall be spheroidized to meet the requirements of blanking and forming as indicated by the manufacturing requirements. Manufacturing details should be made known to the steel producer at the time of order entry. Decarburization limits, as agreed upon between the supplier and the procuring agency, may be specified (see 6.1).

3.5 Size and dimensional tolerances. Steel sheet and strip shall be furnished to the sizes specified (see 6.1), and shall meet the applicable tolerance requirements of ASTM A 568.

3.6 Edges.

3.6.1 Hot-rolled sheet and strip. Unless a particular edge is specified in the contract or order (see 6.1), hot rolled sheet and strip shall be furnished with either mill edges, or cut or slit edges, at the option of the supplier.

3.6.2 Cold-rolled sheet. Unless otherwise specified in the contract or order (see 6.1), cold-rolled sheet shall be furnished with sheared edges.

3.7 Finish.

3.7.1 Hot-rolled sheet and strip. Unless otherwise specified in the contract or order (see 6.1), hot-rolled sheet and strip shall be furnished pickled. The surfaces of the pickled material shall be commercially free of scale.

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3.7.2 Cold-rolled sheet. Cold-rolled sheet shall be furnished with a No. 1, dull finish (see 6.3); and, unless otherwise specified in the contract or order (see 6.1), shall be oiled.

3.8 Identification marking. Marking for identification shall be as specified in the invitation for bids, contract, or order (see 6.1).

3.9 Workmanship. Sheet and strip shall be clean and free from injurious defects such as pipe and laminations. Surface defects and segregation shall be consistent with commercial practice for this quality of sheet and strip.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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 that supplies and services conform to prescribed requirements.

4.2 Lot. Unless otherwise specified (see 6.1), a lot shall consist of all sheet or strip of the same heat, the same condition and finish, the same thickness, and when heat treated, subjected to the same heat treatment procedure. For product analysis, a lot shall be defined as one heat.

4.3 Sampling.

4.3.1 For chemical composition. When specified (see 6.1), at least one sample shall be taken from each lot for product analysis in accordance with method 111 or 112 of Fed. Test Method Std. No. 151.

4.3.2 For mechanical properties.

4.3.2.1 Tension test. When tensile properties are specified (see 6.1), one tension-test sample shall be taken for each 60,000 pounds or fraction thereof in a lot.

4.3.2.2 Hardness tests. When hardness requirements are specified (see 6.1), one hardness determination shall be made for each 10,000 pounds or fraction thereof in each lot, for sheet and strip in cut lengths. For material in coils, hardness determinations shall be taken at both the front and back end of 5 percent of the coils in the lot, but not less than 2 coils in each lot.

4.3.2.3 Cold-bending test. One sample from each 60,000 pounds or fraction thereof shall be taken from each lot for the cold bending test, but not less than 5 tests shall represent each lot. For material in coils, samples for cold bending tests shall be taken from the front and back end of 5 percent of the coils in the lot except that not less than 2 coils shall be tested in each lot.

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4.3.3 For spheroidization. For material ordered spheroidized annealed, at least one sample shall be taken from each lot of sheet or strip for microscopic examination.

4.3.4 For decarburization. When decarburization limits are specified in the contract or order (see 6.1), at least one sample for each lot shall be taken for microexamination.

4.4 Examination.

4.4.1 Visual. Unless otherwise specified in the contract or order (see 6.1), all sheet, strip, or coils in each lot shall be examined for conformance with the requirements for edge (see 3.6), finish (see 3.7), identification marking (see 3.8), and workmanship (see 3.9).

4.4.2 Dimensions and tolerances. A representative number of measurements or weights shall be taken on each lot to determine compliance with the size, weight, and dimensional tolerances.

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

4.5 Tests.

4.5.1 Chemical analysis. Specimens for chemical check analysis shall be prepared and tested in accordance with method 111 or 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 Mechanical properties.

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

4.5.2.2 Hardness tests. Specimens for hardness testing shall be prepared and tested in accordance with ASTM E 18.

4.5.2.3 Cold bending. Specimens for cold bending shall be prepared and tested in accordance with ASTM E 290.

4.5.2.4 Spheroidization and decarburization. Specimens for microexamination for spheroidization shall have a prepared surface at least one-half inch long and shall represent the full thickness of the material. The specimen shall be taken perpendicular to the rolling direction and shall be obtained from a location one-quarter of the width from the edge of the material. Spheroidization and decarburization examination shall be conducted at sufficient magnification to give reliable results and shall be compared to the standards furnished by the procuring agency.

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4.6 Rejection and retest. Unless otherwise specified in the contract or order (see 6.1), rejection and retest shall be conducted in accordance with the general section of Fed. Test Method Std. No. 151.

5. PACKAGING

5.1 Preservation and packaging. Preservation and packaging shall be level A or C as specified (see 6.1).

5.1.1 Level A. Preservation 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. Sheet and strip shall be packed for shipment in accordance with level A or C as specified (see 6.1).

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

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 (see 6.1), 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 (see 6.1), marking for shipment shall be in accordance with MIL-STD-129.

6. NOTES

6.1 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) Classification (see 1.2).
- (c) When other than fully silicon killed steel is required (see 3.1).
- (d) Chemical composition (see 3.2).
- (e) When product analysis is required (see 3.2.2).
- (f) Tensile or hardness properties, if required and specified (see 3.2, 4.3.2.1, and 4.3.2.2).
- (g) Bend test, if required (see 3.3.2).
- (h) Decarburization limits, if required and specified (see 3.4 and 4.3.2).

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- (i) Size, thickness, width, and length and if special tolerances are required (see 3.5).
- (j) Edge requirements, if other than as specified herein (see 3.6.1 and 3.6.2).
- (k) Finish requirements, if other than as specified herein (see 3.7.1 and 3.7.2).
- (l) Identification marking required (see 3.8).
- (m) When a lot size other than as specified herein is required (see 4.2).
- (n) When sampling for chemical analysis is required (see 4.3.1).
- (o) When visual examination other than as specified herein is required (see 4.4.1).
- (p) When rejection and retest other than as specified herein is required (see 4.6).
- (q) Level of preservation and packing (see 5.2).
- (t) Special marking, when required (see 5.3.1 and 5.3.2).

6.2 Selection of chemical composition.

6.2.1 Steel grade designation numbers. While it is not common practice to specify to numerical designations indicating chemical composition, designations covering compositions (product analysis) commonly produced to this specification are shown in table II and may be used as a guide in procurement.

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TABLE II. Chemical composition - cast or heat analysis: percent^{a/}

UNS Number ^{b/}	SAE Number	Carbon	Manganese	Phosphorus (max.)	Sulfur (max.)
G10250	1025	0.22 to 0.28	0.30 to 0.60	0.040	0.050
G10300	1030	.27 to .34	.60 to .90	.040	.050
G10350	1035	.31 to .38	.60 to .90	.040	.050
G10450	1045	.42 to .50	.60 to .90	.040	.050
G10500	1050	.47 to .55	.60 to .90	.040	.050
G10550	1055	.52 to .60	.60 to .90	.040	.050
G10650	1065	.59 to .70	.60 to .90	.040	.050
G10740	1074	.69 to .80	.50 to .80	.040	.050
G10800	1080	.74 to .88	.60 to .90	.040	.050
G10840	1084	.80 to .94	.60 to .90	.040	.050
G10850	1085	.80 to .94	.70 to 1.00	.040	.050
G10860	1086	.80 to .94	.30 to 0.50	.040	.050
G10950	1095	.90 to 1.04	.30 to .50	.040	.050

^{a/}When silicon is required, the following ranges and limits are commonly used:

	Per Cent
1025	0.10 max., 0.10-0.25 or 0.15-0.30
Over 1025	0.10-0.25 or 0.15-0.30

^{b/}See 6.4.

6.2.2 Minimum and maximum limits and ranges. Chemical composition ranges or limits are customarily based on heat analysis unless otherwise specified using the limits and ranges for heat analysis in table III. The elements comprising the desired chemical composition can be specified in one of three ways:

- (a) By a maximum limit.
- (b) By a minimum limit.
- (c) By minimum and maximum limits termed the range. By common usage, the range is the arithmetical difference between the two limits (e.g., 0.60 to 0.72 is a 0.12 range).

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TABLE III. Cast or heat chemical ranges and limits

Element	Standard chemical ranges and limits, per cent		
	When maximum of specified element is	Range	Lowest maximum
Carbon ^{a/}	To 0.15 incl.	0.05	0.08
	Over 0.15 to 0.30 incl.	.06	
	Over .30 to .40 incl.	.07	
	Over .40 to .60 incl.	.08	
	Over .60 to .80 incl.	.11	
	Over .80 to 1.35 incl.	.14	
Manganese	To 0.50 incl.	0.20	0.40
	Over 0.50 to 1.15 incl.	.30	
	Over 1.15 to 1.65 incl.	.35	
Phosphorus	To 0.08 incl.	0.03	0.04
	Over 0.08 to 0.15 incl.	.05	
Sulphur	To 0.08 incl.	0.03	0.05
	Over 0.08 to 0.15 incl.	.05	
	Over .15 to .23 incl.	.07	
	Over .23 to .33 incl.	.10	
Silicon	To 0.15 incl.	0.08	0.10
	Over 0.15 to 0.30 incl.	.15	
	Over .30 to .60 incl.	.30	

Copper When copper is required 0.20 minimum is commonly specified.

^{a/}The carbon ranges shown in the column headed "Range" apply when the specified maximum limit for manganese does not exceed 1.00 per cent. When the maximum manganese limit exceeds 1.00 per cent, add 0.01 to the carbon ranges shown above.

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6.3 Finish. Standard commercial finish available for cold-rolled sheets is as follows: No. 1 (dull finish) is a finish without luster produced by rolling on rolls roughened by mechanical or chemical means.

6.4 UNS numbers. Unified Numbering System (UNS) numbers were developed jointly by the Society of Automotive Engineers (SAE) and the American Society for Testing and Materials (ASTM) and will apply to all metals and alloys manufactured in the United States. In table II, SAE numbers are converted to UNS numbers by adding the prefix letter "G" and the suffix number "0".

MILITARY CUSTODIANS:

Army - MR
Air Force - 11

Preparing activity:

Army - MR

Review activities:

Army - EA, WV, MR, MI
DGA - IS

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA - FSS
JUSTICE - FPI
NASA - JFK
VA - VOC

User activities:

Army - AT, ME
Navy - YD