SAE Aerospace
An SAE International Group

# AEROSPACE MATERIAL SPECIFICATION

SAE AMS-S-18728B

Issued DEC 1998
Noncurrent SEP 2002
Cancelled JUN 2006

Superseding AMS-S-18728A

## Steel Plate, Sheet and Strip, Alloy 8630, Aircraft Quality

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of June, 2006 and has been superseded by the applicable AMS specification listed in Figure 1 below. The requirements of the latest issue of the AMS listed in Figure 1 shall be fulfilled whenever reference is made to the cancelled AMS-S-18728 for those materials. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, noting that it has been superseded by the applicable AMS.

Figure 1

| AMS-S-18728 Condition | Superceding AMS Specification |
|---|---|
| Condition "A"<br><br>or<br><br>Condition "MA" | AMS 6350, Steel Sheet, Strip, and Plate 0.95Cr 0.20Mo (0.28-0.33C) (SAE 4130)<br><br>AMS 6351, Steel, Sheet, Strip, and Plate 0.95Cr 0.20Mo (0.28 0.33C) (SAE 4130) Spheroidized |
| Condtion "N" | AMS 6345, Steel, Sheet, Strip, and Plate 0.95Cr 0.20Mo (0.28 - 0.33C) Normalized or Otherwise Heat Treated |

Cancelled specifications are available from SAE.





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NOTICE

This document has been taken directly from U.S. Military Specification MIL-S-18728D and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-S-18728D. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this technical report.

1. SCOPE:

1.1 Scope:

This specification covers chrome-nickel-molybdenum steel, 8620, plate, sheet, and strip of thicknesses to and including 1.50 inches.

1.2 Classification:

Materials covered by this specification shall be of the following physical conditions, as specified (see 6.2)

| | |
|---|---|
| A | Annealed. |
| MA | Modified annealed. |
| NORM | Normalized or otherwise heat-treated by the producer. |

2. APPLICABLE DOCUMENTS:

The following publications, 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.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

| | |
|---|---|
| AMS 2252 | Tolerances, Low-Alloy Steel Sheet, Strip, and Plate |
| AMS 2301 | Magnetic Particle Inspection Procedure, Aircraft Quality Steel Cleanliness |
| AMS 2806 | Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion Resistant Steels and Alloys |

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

| | |
|---|---|
| ASTM E 8 | Tension Testing of Metallic Materials |
| ASTM E 18 | Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials |
| ASTM E 112 | Estimating the Average Grain Size of Metals |
| ASTM E 290 | Semi-Guided Bend Tests for Ductility of Metallic Materials |

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

| | |
|---|---|
| MIL-I-6868 | Inspection Process, Magnetic Particle |
| FED-STD-151 | Metals, Test Method |
| FED-STD-183 | Continuous Identification Marking of Iron and Steel Products |
| MIL-STD-163 | Steel Mill Products, Preparation for Shipment and Storage |

3. REQUIREMENTS:

3.1 Material:

The steel shall be manufactured by the electric furnace process. Sufficient discard shall be taken from each ingot to insure freedom from injurious piping and undue segregation.

3.2 Quality:

The Steel shall be of aircraft quality, suitable for the fabrication by appropriate commercial procedures of reliable parts which may be inspected by magnetic methods. Materials may be inspected by magnetic particle methods conforming to MIL-I-6868 with maximum frequency and severity ratings, computed as specified by AMS 2301, not greater than 0.80 and 0.67, respectively.

3.3 Chemical composition:

The chemical composition shall be as specified in table I.

3.4 Mechanical properties:

The transverse mechanical properties shall be as specified in table II.

3.5 Transverse bending requirements, materials under 0.75 inch in thickness:

Materials shall withstand bending, without cracking, at room temperature, with the axes of bending transverse to the direction of rolling, through an angle as indicated by table III. Condition A material shall be bent around a diameter equal to the thickness of the sample. Conditions MA and NORM material shall be bent around a diameter equal to three times the thickness of the material.

3.6 Grain size:

The grain size of the steel shall be predominantly No. 5 or finer, with grains as large as No. 3 permissible in small, isolated areas.

3.7 Response to thermal treatment:

Materials 0.250 inch or less in nominal thickness shall develop a hardness of Rockwell C 26 minimum when heat-treated as specified in 4.9.2.1. Material from 0.251 inch to 1.50 inch in nominal thickness shall develop the applicable center hardness of table IV when heat-treated as specified in 4.9.2.2.

3.8 Surface condition:

Surfaces of all materials shall be descaled and oiled. Sheet and strip materials shall receive a final cold pass to ensure smoothness.

3.9 Decarburization:

Materials shall be free from any zone of complete decarburization as determined microscopically on prepared sections. Partial decarburization shall be acceptable provided that the increase in hardness from the surface to any point below the surface of an oil-hardened specimen does not exceed two points on the Rockwell A scale. This test is not applicable to materials less than 0.025 inch in thickness.

3.10 Dimensional tolerances:

The variation between measured and ordered dimensions shall not exceed the respective tolerance limits of AMS 2252, except that the width and length tolerances for sheared and gas-cut plate shall comply with tables contained in the sections entitled “Hot Rolled or Thermally Treated Plate, Sheared or Gas Cut” and “Hot Rolled or Cold Rolled Sheet” of AMS 2252, respectively.

3.11 Identification of product:

3.11.1 Plate, sheet and strip: Plate, sheet and strip shall be legibly marked in accordance with FED-STD-183 and shall include the following:

MIL-S-18728D
Applicable physical condition designator (see 1.2).

3.11.2 Coiled sheet and strip: The coiled sheet and strip shall be marked near the outer end of the coil with the same information as specified in 3.11.1. In addition, the coiled sheet and strip shall be suitably tagged with the same information as specified in 3.11.1 on an oilproof tag in accordance with AMS 2806, so that identification may be made after the outer end is removed.

3.12 Workmanship:

Materials shall be sound, of uniform quality and condition, free from scale and injurious defects such as cracks, seams, tears, grooves, laminations, pits and blisters. Slight surface imperfections, which are completely removable without reducing the section thickness below the minimum applicable dimensional tolerance limits, shall not be considered as injurious defects.

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 supplies and services conform to prescribed requirements.

4.2 Classification of inspection:

The inspection requirements specified herein are classified as quality conformance inspection.

4.2.1 Inspection conditions: Unless otherwise specified, 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.

4.3 Quality conformance inspection:

4.3.1 Inspection of product: Sheet, strip and plate shall be visually inspected to determine conformance to this specification with respect to surface condition (3.8), dimensions (3.10), identification of product (3.11) and workmanship (3.12). Sample units shall be randomly selected to represent each lot of material of the same heat and thickness in accordance with table V. Inspection of coils for thickness and crown shall consist of measurements at the center and 1/2 inch in from the edge at each end of the coil and 1/2 inch in from the edge at three other locations along the coil. Inspection for thickness and crown of cut lengths of sheet and strip and of plate, shall consist of measurements at five locations distributed along and 1/2 inch in from the edge, and at the center of the cut ends. Nonconforming material shall be rejected. Reworking of rejected material is permitted provided reinspection is carefully conducted so that all of the nonconforming product is removed.

4.3.2 Packaging, packing and marking: Packaging, packing and marking shall be inspected for conformance to section 5.

4.4 Chemical analysis:

4.4.1 Sampling: Samples for check chemical analysis shall be selected in accordance with method 111.2 or 112.2 of FED-STD-151 to represent each heat in the shipment. The sample shall consist of not less than 2 ounces of material.

4.4.1.1 Waiving of chemical analysis: Samples for check chemical analysis may be waived provided that all of the material under inspection can be identified as being made from a heat previously analyzed and found to be in accordance with the chemical composition specified herein.

4.4.2 Method: Chemical analysis shall be performed as specified in method 111.2 or 112.2 of FED-STD-151. In the event of dispute, analysis shall be by wet chemical analysis.

4.5 Sampling for mechanical tests:

4.5.1 When sheet or strip is furnished in coil form, at least two (2) samples for mechanical tests shall be cut from each end. When material is furnished in cut sheet, strip or plate form, at least four (4) samples shall be selected from each 100 or less sheets, strips or plates of the same heat and conditioning, of the same thickness, and submitted for inspection at one time. However, no more than one (1) sample may be taken from a sheet, strip or plate.

4.5.2 When material cannot be identified as to heat, at least four (4) samples shall be selected from each 500 pounds of material of one condition and thickness and presented for inspection at one time.

4.5.3 A tension test specimen and a bend test specimen shall be taken from each sample. Hardness tests may be made on the grip end of the tension test specimens before they are subjected to the tension test.

4.6 Tension tests:

4.6.1 Specimens: Tension test specimens shall be obtained in accordance with 4.5, except that not less than four (4) specimens of the same heat and condition and of the same thickness shall be submitted for inspection at one time.

4.6.2 Preparation of specimen: Tension test specimens shall be cut from each sample and shall conform to ASTM E 8, section 6. When the width of the material permits, test specimens shall be prepared with the longitudinal axis transverse to the direction of rolling.

4.6.3 Method: Tension tests shall be conducted in accordance with ASTM E 8. Yield strength shall be determined by the offset or extension-under-load method.

4.7 Bend tests:

4.7.1 Specimens: Bend test specimens shall be obtained in accordance with 4.5. A minimum of three (3) specimens shall be submitted for testing at one time.

4.7.2 Preparation of specimens: When possible, strip specimens shall be cut from each sample with the longitudinal axis transverse to the direction of rolling. Specimens shall conform with ASTM E 290, section 7.

4.7.3 Method: Specimens shall be tested in accordance with ASTM E 290, as applicable. For controlled-bend (V-block) test specimens shall be bent cold by means of V-blocks or mating punch-and-die having an included angle of 45 degrees and with proper curvature of surfaces at the bend areas to impart the desired shape and diameter of the bend specimen.

4.8 Grain size:

4.8.1 Sampling: One sample shall be selected to represent each heat of steel from which material is submitted for acceptance.

4.8.2 Method: Specimens shall be sectioned and polished to appropriate fineness by metallographic methods and suitably etched to reveal the grain structure. The austenitic grain size shall be determined in accordance with ASTM E 112.

4.9 Response to thermal heat treatment:

4.9.1 Sampling: Two samples shall be selected to represent each heat of alloy from which materials are submitted for acceptance. In the event the heat number is not known, one sample shall be selected from each 200 sheets or 100 plates or from each roll of product of the same thickness and submitted for acceptance at one time.

4.9.2 Method:

4.9.2.1 Material 0.250 inch or less in thickness: Specimens measuring 1 by 2 inches shall be cut from the samples quenched in oil from 871° ± 5.6 °C (1600° ± 10°F) and tempered at not less than 482 °C (900 °F) for 30 minutes at temperature. Hardness tests shall be conducted in accordance with ASTM E 18.

4.9.2.2 Material between 0.250 inch and 1.50 inch in nominal thickness: Specimens 1 inch wide by 3 inches long shall be quenched in oil from 871° ± 5.6 °C (1600° ± 10°F). They shall then be sectioned at the midpoint of and normal to the longitudinal axis. Hardness tests shall be taken at the center of the section in accordance with the applicable requirements of ASTM E 18.

4.10 Decarburization:

4.10.1 Sampling: Two specimens for decarburization tests shall be selected from each 200 flat plates, sheets, or strips, or from each coil of material, or from each 10 plates from the same heat of the same thickness, and submitted for inspection at one time.

4.10.2 Preparation: Specimens shall be austenitized for 30 minutes at 871° ± 5.6 °C (1600° ± 10°F) and water quenched.

4.10.3 Method: Rockwell A hardness shall be determined by ASTM E 18. The average hardness (surface or subsurface) shall be the average of three tests made adjacent to each other on the same specimen. Surface hardness tests shall be made on a clean but unground and unpolished surface. Subsurface hardness tests shall be made in a depression, ground to a depth of approximately 0.020 inch or 1/3 the thickness of the specimen, whichever is less.

4.11 Quality:

Heats from which sheet, strip or plate are to be rolled shall be subjected to magnetic particle inspection tests on semifinished mill products prior to rolling to finished size. Samples shall be taken from the product at a location representing the top and bottom of the first, middle and last usable ingot from each heat. Specimens shall be prepared for inspection by cutting longitudinal sections through the thickness of samples at off center locations and finish machining the sections to a roughness height rating of not more than 40 microinches. Magnetic particle tests shall be conducted in accordance with MIL-I-6868 and the frequency and severity rated in accordance with AMS 2301 (see 3.2).

4.11.1 Unspecified heat(s): Plates from an unspecified heat(s) shall be randomly sampled in accordance with table VI and longitudinal specimens shall be cut from the sample units, as specified (see 4.11).

4.12 Rejection and retest:

Failure of a specimen to meet the test requirements shall be cause for rejection of the lot. At the discretion of the contractor/supplier retest will be permitted after the lot has been screened and defectives removed. A retest sample of five specimens shall be tested to replace each failed specimen of the original sample. If one of the retest specimens fail, the lot shall be rejected with no further retesting permitted.

5. PACKAGING:

5.1 Preservation, packaging and packing:

Materials shall be properly separated by size, thickness and condition when prepared for delivery. Preservation, packaging and packing shall be level A, B, C or commercial, as specified (see 6.2), conforming to MIL-STD-163.

5.2 Marking:

Marking and labeling shall be in accordance with MIL-STD-163 and shall include the following:

Steel Plate, Sheet and Strip, Alloy 8630, Aircraft Quality.
MIL-S-18728D.
Size, thickness and condition.
Heat no.
Quantity contained (as defined in the contract or order for each size, thickness and condition).
Name of manufacturer.
Name of contractor (if different from manufacturer).
Contract or order no.

6. NOTES:

6.1 Intended use:

Materials conforming to this specification are intended for use in applications requiring moderate mechanical properties and in which welding may be required. In thicknesses of 0.187 inch and less, a minimum tensile strength of 180,000 psi can be obtained by proper heat-treatment; lower strengths can be obtained in greater thicknesses. The hardenability of the steel does not assure through hardening to a uniform structure in sizes greater than 0.500 inch in thickness or in diameters of equivalent roundness.

6.1.1 Condition A: More time at annealing temperature is required to obtain condition A than condition MA. Condition A material possesses more desirable forming properties.

6.1.2 Condition MA: The modified annealed condition is intended to provide a more favorable base for quench-and-temper heat-treatment than condition A.

6.1.3 Condition NORM: Condition NORM material is primarily intended for use without further heat-treatment.

6.2 Ordering data:

Acquisition documents should specify the following:

a. Title, number and date of this specification.
b. Physical condition, size and thickness to be furnished (see 1.2).
c. Selection of applicable levels of preservation, packaging and packing (see section 5).



TABLE I - Chemical Composition

| Elements | Analysis Percent | Check analysis tolerance 1/ Percent |
|---|---|---|
| Carbon | 0.27 - 0.33 | +0, -0.02 |
| Manganese | 0.70 - 0.90 | +0.03 |
| Phosphorus | 0.040 (max) | +0.005 |
| Sulfur | 0.040 (max) | +0.005 |
| Silicon | 0.20 - 0.35 | +0.02 |
| Nickel | 0.40 - 0.70 | +0.03 |
| Chromium | 0.40 - 0.60 | +0.03 |
| Molybdenum | 0.15 - 0.25 | +0.02 |

1/ The average of all the separate determinations shall be within the limits specified in the “analysis” column. Individual determinations may vary to the extent shown in the “tolerance” column, except that several determinations of a single element in any one heat shall not vary both above and below the specified range.