AEROSPACE MATERIAL SPECIFICATION

AMS5046™	REV. F
Issued 1985-10 Revised 2022-09 Superseding AMS5046E	

Carbon Steel, Sheet, Strip, and Plate
(SAE 1020 and 1025)
(Composition similar to UNS G10200 and G10250)

RATIONALE

AMS5046F is the result of a Five-Year Review and update of the specification. The revision prohibits unauthorized exceptions (3.6, 4.4.3, 5.1.1, 8.4), updates composition and allows for the reporting of additional elements (3.1, 3.1.2), updates microstructure/controlling chemistry requirements (3.1.1, 3.3.3, 4.2.1, 4.4.1), revises heat treatment spec (3.2), incorporates strain rate control (3.3.1.2), updates bending requirement (3.3.2), and allows prior revisions (8.5).

1. SCOPE

1.1 Form

This specification covers two types of carbon steel in the form of sheet, strip, and plate.

1.2 Application

These products have been used typically for use in fabrication of fittings, but usage is not limited to such applications. These products are not typically used for deep forming or cupping operations.

1.3 Classification

The steels covered by this specification are classified as follows:

Type 1: 0.17 to 0.23 carbon (SAE 1020)
Type 2: 0.22 to 0.28 carbon (SAE 1025)

1.3.1 Unless a specific type is ordered, either type may be supplied.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS5046F/

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2232 Tolerances Carbon Steel, Sheet, Strip, and Plate

AMS2259 Chemical Check Analysis Limits Wrought Low-Alloy and Carbon Steels

AMS2370 Quality Assurance Sampling and Testing Carbon and Low-Alloy Steel Wrought Products and Forging Stock

AMS2761 Heat Treatment of Steel Raw Materials

AMS2807 Identification Carbon and Low-Alloy Steels, Corrosion- and Heat-Resistant Steels and Alloys Sheet, Strip, Plate, and Aircraft Tubing

AS7766 Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A370 Mechanical Testing of Steel Products

ASTM A751 Chemical Analysis of Steel Products

ASTM E112 Determining Average Grain Size

ASTM E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

ASTM E290 Bend Testing of Material for Ductility

2.3 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM A751 or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Grade	1020	1020	1025	1025
Element	Type 1 Min	Type 1 Max	Type 2 Min	Type 2 Max
Carbon	0.17	0.23	0.22	0.28
Manganese	0.30	0.60	0.30	0.60
Phosphorus	--	0.040	--	0.040
Sulfur	--	0.050	--	0.050

3.1.1 Aluminum, vanadium, and columbium (niobium) are optional grain refining elements and need not be determined or reported unless used to satisfy the average grain size requirements of 3.3.3.

3.1.2 Producer may test for any element not listed in Table 1 and include this analysis in the report of 4.5. Reporting of any element not listed in the composition table is not a basis for rejection, unless limits of acceptability are specified by the purchaser.

3.1.3 Check Analysis

Composition variations shall meet the applicable requirements of AMS2259.

3.2 Condition

The product shall be supplied in the conditions as stated in 3.2.1 and 3.2.2; heat treating, when used, shall be performed in accordance with AMS2761 as specified for both Type 1 and Type 2.

3.2.1 Sheet and Strip

Hot or cold rolled, annealed, sub-critically annealed or normalized, and cold finished.

3.2.2 Plate

Hot rolled, annealed, sub-critically annealed or normalized, and descaled.

3.2.2.1 If allowed by the purchaser, cold rolled, annealed, sub-critically annealed or normalized, if necessary, and descaled as necessary, having hardness not higher than 25 HRC, or equivalent (see 8.2).

3.3 Properties

The product shall conform to the following requirements. Tensile tests shall be performed in accordance with ASTM A370.

3.3.1 Tensile Properties

Shall be as shown in Table 2:

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	55 ksi (379 MPa)
Yield Strength at 0.2% Offset	36 ksi (248 MPa)
Elongation in 2 Inches (50 mm) or 4D	22%

3.3.1.1 For each 2 ksi (14 MPa) in excess of 55 ksi (379 MPa) tensile strength, a reduction in elongation of 1% to a minimum of 10% is permissible.

3.3.1.2 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (0.002 mm/mm/min) through 0.2% offset yield strain. After the yield strain, the speed of the testing machine shall be set between 0.05 in/in and 0.5 in/in (0.05 mm/mm and 0.5 mm/mm) of the length of the reduced section (or distance between the grips for specimens not having a reduced section) per minute. Alternatively, an extensometer and strain rate indicator may be used to set the strain rate between 0.05 in/in/min and 0.5 in/in/min (0.05 mm/mm/min and 0.5 mm/mm/min).

3.3.2 Bending

Sheet and strip shall be tested in accordance with ASTM E290. Samples shall be nominally 0.75 inch (19.0 mm) in width and testing shall be performed at room temperature. Samples shall be tested with the axis of bending parallel to the direction of rolling. Samples shall withstand bending, without cracking, through the angle and bend radius shown in Table 3. In case of dispute, the results of tests using the guided bend test of ASTM E290 shall govern.

Table 3 - Bend requirements

Bend Angle Degrees	Bend Radius t = nominal thickness
180	1/2t

3.3.3 Average Grain Size

Average grain size shall be determined by either 3.3.3.1 or 3.3.3.2.

3.3.3.1 Shall be ASTM No. 5 or finer, determined in accordance with ASTM E112.

3.3.3.2 The product of a heat shall be considered to have an ASTM No. 5 or finer austenitic grain size if one or more of the following are determined by heat analysis (see 8.6):

3.3.3.2.1 A total aluminum content of 0.020 to 0.050%.

3.3.3.2.2 An acid soluble aluminum content of 0.015 to 0.050%.

3.3.3.2.3 A vanadium content of 0.02 to 0.08%.

3.3.3.2.4 A columbium (niobium) content of 0.02 to 0.05%.

3.4 Quality

The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.5 Tolerances

Shall conform to all applicable requirements of AMS2232.

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.3.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for producer's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

All technical requirements are acceptance tests and shall be performed on each heat or lot as applicable. If grain refining elements (3.3.3.2) are not present, the ASTM E112 grain size test (3.3.3.1) shall be conducted on each lot.

4.2.1 If grain refining elements (3.3.3.2) are present, the ASTM E112 grain size test (3.3.3.1) shall be conducted on a periodic basis and shall be performed at a frequency selected by the producer (not to exceed 1 year) unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2370 and the following:

4.3.1 When a statistical sampling plan has been agreed upon by purchaser and producer, sampling shall be in accordance with such plan in lieu of sampling as in 4.3, and the report of 4.4 shall state that such plan was used.