SAE The Engineering Resource For Advancing Mobility®
400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2371B
Superseding AMS 2371A

Issued 11-1-69
Revised 7-1-85

QUALITY ASSURANCE SAMPLING OF CORROSION AND HEAT RESISTANT STEELS AND ALLOYS
Wrought Products Except Forgings and Forging Stock

1. SCOPE: This specification covers quality assurance sampling procedures which may be used to determine conformance to applicable specification requirements of wrought corrosion and heat resistant steel and alloy products except forgings and forging stock.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2300 - Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
MAM 2300 - Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure, Metric (SI) Measurements
AMS 2303 - Aircraft Quality Steel Cleanliness, Martensitic Corrosion Resistant Steels, Magnetic Particle Inspection Procedure
AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E8 - Tension Testing of Metallic Materials

3. TECHNICAL REQUIREMENTS:

3.1 General:

3.1.1 Omission from this specification of confirmatory tests of certain material properties or attributes controlled by the applicable material specification does not relieve the vendor of responsibility for furnishing products which conform in all respects to the applicable material specification.

3.1.2 In the event of a conflict between the requirements specified herein and Ø the requirements of a particular material specification, requirements of the material specification shall take precedence.

3.2 Responsibility for Tests: The vendor of the product shall supply all Ø samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by the applicable material specification.

3.3 Detail Requirements:

3.3.1 Inspection Lot: An inspection lot shall be as defined in 3.3.1.1 or 3.3.1.2, the applicable definition being as specified in Table I for the type of test and type of product being tested.

3.3.1.1 An inspection lot shall consist of all product identifiable to a single heat.

3.3.1.2 An inspection lot shall consist of a mill form of one composition, shape, condition, and nominal dimensions from a single heat, heat treated as a batch or sequentially heat treated in a continuous furnace. In the case of sheet and strip produced on continuous mills and not subsequently heat treated, a lot shall be considered the individual coil or product thereof in straight lengths, prior to shearing to narrower widths or cutting to individual lengths.

3.3.2 Location of Sample: The location from which the sample is taken shall be as specified in 3.3.2.1 for composition and as in 3.3.2.2, 3.3.2.3, or 3.3.2.4 for other tests, the applicable location being as specified in Table I for the type of test and type of product being tested. The orientation with respect to direction of predominant grain flow shall be as specified in 3.3.3.

3.3.2.1 Composition:

3.3.2.1.1 The reported chemical composition of the steel or alloy subjected to a Ø single melting operation shall be that of a sample taken immediately before or during the pouring of a heat. Analysis results on the sample shall be within the composition limits established by the material specification, excluding any consideration of product check analysis.

3.3.2.1.1.1 If the sample of 3.3.2.1.1 is lost, a new sample shall be taken from Ø the semi-finished or finished product.

3.3.2.1.2 For remelted steels and alloys, analyses shall be obtained from the remelted ingot or product thereof in accordance with a sampling plan that will allow the reported chemical composition of the steel or alloy to conform to one of the following options: (1) the average of all ingots in the remelted heat; (2) the average of the ingots directly involved with the order; (3) the average of samples representing the first and last usable metal poured from the master heat; or (4) the analysis of each ingot involved with the order. If an average is reported, the analysis of each element shall fall within the compositional limits established by the material specification; the individual analyses may include the applicable product check analysis allowances but no average shall include analyses which are both above and below the compositional limits.

3.3.2.1.2.1 When the remelting method is vacuum arc remelting and the applicable material specification establishes minimum values for carbon or manganese, or both, these elements shall be determined and reported for each remelted ingot.

3.3.2.1.2.2 The master heat analysis may be used for reporting the analyses of those elements governed only by a maximum in the material specification if the analysis is within the compositional limits and the element routinely decreases or remains constant during remelting.

3.3.2.1.2.3 Analyses of samples made prior to discard need not be reported.

3.3.2.2 The sample shall consist of a section randomly selected from the product.

3.3.2.3 The sample shall consist of one or more sections of the product selected to represent a specific location or locations with respect to the order of pouring of the selected ingot or ingots and with respect to the location within the ingot, as agreed upon by purchaser and vendor.

3.3.3 Tensile, Stress-Rupture, and Creep Specimen Orientation, Location, and Size: Tensile specimens and stress-rupture, except notched and combination smooth-and-notched, specimens, and creep specimens conforming to ASTM E8 shall be cut from the product in the direction indicated below, and shall be cut from the locations and to the sizes specified.

3.3.3.1 Sheet, Strip, and Plate:

3.3.3.1.1 Orientation: Specimens shall be taken with the axis of the specimen perpendicular to the direction of rolling from widths 9 in. (225 mm) and over and parallel to the direction of rolling from widths under 9 in. (225 mm). When short-transverse tensile properties are specified in the applicable material specification and are to be determined, specimens shall be taken with the axis of the specimen parallel to the thickness direction of the product.

3.3.3.1.2 Location and Size:

3.3.3.1.2.1 Longitudinal and Long-Transverse Specimens: The standard 1/2 in. (12.5 mm) wide rectangular specimen or pin-loaded tensile specimen with 2 in. (50 mm) gage length shall be used for sheet and plate under 0.500 in. (12.5 mm) in nominal thickness. For plate 0.500 in. (12.5 mm) and over in nominal thickness the standard 1/2 in. (12.5 mm) round tensile specimen with 2 in. (50 mm) gage length or a smaller round specimen proportional to the standard shall be used. The tensile specimen shall be located midway between the faces of product 1-1/2 in. (37.5 mm) and under in nominal thickness and midway from center to surface for product over 1-1/2 in. (37.5 mm) in nominal thickness.

3.3.3.1.2.2 Short-Transverse Specimens: For plate 2-1/2 in. (62.5 mm) and over in nominal thickness, subsize round tensile specimens proportional to the standard shall be used when thickness is insufficient to accommodate standard 1/2 in. (12.5 mm) round tensile specimens with 2 in. (50 mm) gage length.

3.3.3.2 Bar, Rod, and Wire:

3.3.3.2.1 Orientation: Specimens shall be taken with the axis of the specimen in the longitudinal direction, except that, when long-transverse tensile properties are specified in the applicable material specification and are to be determined, specimens shall be taken with the axis of the specimen perpendicular to the rolling or extruding direction. When short-transverse tensile properties are specified for rectangular bar in the applicable material specification and are to be determined, specimens shall be taken with the axis of the specimen parallel to the thickness direction of the bar.

3.3.3.2.2 Location and Size:

3.3.3.2.2.1 Longitudinal and Long-Transverse Specimens: If the product size or shape makes it impractical to use full-section specimens, the standard 1/2 in. (12.5 mm) round tensile specimen with 2 in. (50 mm) gage length or a smaller round specimen proportional to the standard shall be used, except that for rectangular bar under 0.500 in. (12.50 mm) in nominal thickness the standard 1/2 in. (12.5 mm) wide rectangular specimen or pin-loaded tensile specimen with 2 in. (50 mm) gage length may be used. The tensile specimen shall be located at the center for product 1-1/2 in. (37.5 mm) and under in nominal diameter, thickness, or distance between flats and midway from center to surface for product over 1-1/2 in. (37.5 mm) in nominal thickness.

3.3.3.2.2.2 Short-Transverse Specimens: For bar 2-1/2 in. (62.5 mm) and over in nominal thickness, subsize round tensile specimens proportional to the standard shall be used when thickness is insufficient to accommodate standard 1/2 in. (12.5 mm) round tensile specimens with 2 in. (50 mm) gage length.

3.3.3.3 Tubing:

3.3.3.3.1 Orientation: Specimens shall be taken with the axis of the specimen in the longitudinal direction, except that, when long-transverse tensile properties of square or rectangular tubing are specified in the applicable material specification and are to be determined, specimens shall be taken with the axis of the specimen perpendicular to the drawing or extruding direction.

3.3.3.3.2 Longitudinal Specimens: Specimens from round and square tubing shall be the full section of the tubular product unless the limitations of the testing machine preclude the use of such specimens. Snug-fitting metal plugs shall be inserted into the ends of tubular specimens to a sufficient depth to permit the jaws of testing machine to grip the specimen properly without crushing. The plugs shall not extend into that portion of the specimen to be tested. Care shall be exercised to ensure that the load is applied axially. The length of full-section specimens shall be determined by the gage length specified for measuring elongation. For large-size tubing, or when it is not possible to test in full section, longitudinal specimens shall be obtained from strips cut from the tube. Either 1/2 in. (12.5 mm) wide rectangular or subsize round tensile specimens proportional to the standard (for thick walled tube) shall be machined from these strips. Longitudinal strip-type tensile specimens from welded tubing shall not include weld bead. For thicker walled tubing for which subsize round tensile specimens are used, when the nominal wall thickness is under 1-1/2 in. (37.5 mm), the specimens shall be taken midway between the inner and outer surface of the tubing; when the nominal wall thickness is 1-1/2 in. (37.5 mm) and over the specimens shall be taken at one-quarter wall thickness.

3.3.3.3.3 Long-Transverse Specimens: Rectangular specimens or subsize round specimens proportional to the standard shall be used for square or rectangular tubing. Rectangular or round tensile specimens of the largest possible dimensions shall be used when standard size specimens cannot be obtained. For thick walled tubing, the round tensile specimen shall be taken midway between the inner and outer surface of the tubing when the nominal wall thickness is under 1-1/2 in. (37.5 mm); when the nominal wall thickness is 1-1/2 in. (37.5 mm) and over, the specimens shall be taken at one-quarter wall thickness.

3.3.3.4 Shapes:

3.3.3.4.1 Orientation: Specimens shall be taken with the axis of the specimen in the longitudinal direction, except that when long-transverse tensile properties are specified in the applicable material specification and are to be determined, specimens shall be taken with the axis of the specimen perpendicular to the rolling or extruding direction. When short-transverse tensile properties of shapes are specified in the applicable material specification and are to be determined, specimens shall be taken with the axis of the specimen parallel to the thickness direction of the shape.

3.3.3.4.2 Location and Size:

3.3.3.4.2.1 Longitudinal Specimens: If the product size or shape makes it impractical to use full-section specimens, the standard 1/2 in. (12.5 mm) round tensile specimen with 2 in. (50 mm) gage length or smaller round specimen proportional to the standard shall be used, except that for shapes under 0.500 in. (12.50 mm) in nominal thickness having parallel surfaces, the standard 1/2 in. (12.5 mm) wide rectangular specimen or pin-loaded tensile specimen with 2 in. (50 mm) gage length may be used. For shapes from which these machined specimens cannot be obtained and which cannot be tested in full section, a round or rectangular specimen of the largest possible dimensions shall be used. For shapes not tested in full section, specimens shall be taken from the center of the predominant or thickest part of the shape when that predominant nominal dimension is under 1-1/2 in. (37.5 mm); for thicker cross-sections, the specimens shall be taken from a one-quarter thickness location.

3.3.3.4.2.2 Long-Transverse Specimens: The standard 1/4 in. (6.25 mm) round tensile specimen with 1 in. (25 mm) gage length or a smaller round specimen proportional to the standard shall be used for nominal thicknesses of 3/8 in. (9.5 mm) and over. For shapes under 3/8 in. (9.5 mm) in nominal thickness having parallel surfaces, the standard 1/2 in. (12.5 mm) wide rectangular specimen or pin-loaded tensile specimen with 2 in. (50 mm) gage length shall be used. For shapes from which these machined specimens cannot be obtained and which cannot be tested in full section, a round or rectangular specimen of the largest possible dimensions shall be used. For shapes not tested in full section, specimens shall be taken from the center of the predominant or thickest part of the shape when that predominant nominal dimension is less than 1-1/2 in. (37.5 mm); for thicker cross-sections specimens shall be taken from a one-quarter thickness location.

3.3.3.4.2.3 Short-Transverse Specimens: For shapes 2-1/2 in. (62.5 mm) and over in nominal thickness, subsize round specimens proportional to the standard shall be used.

3.3.3.4.2.4 Complicated Shapes: Size, location, and direction of tensile specimens shall be as agreed upon by purchaser and vendor.

3.3.3.5 Flash Welded Rings:

3.3.3.5.1 Specimens shall be taken from parent metal, not including the weld-heat-affected zone, with the axis of the specimen in the circumferential direction. Standard 1/2 in. (12.5 mm) round tensile specimen with 2 in. (50 mm) gage length or subsize round specimens proportional to the standard shall be used. The tensile specimen shall be located at the center for products 1-1/2 in. (37.5 mm) and under in nominal thickness, diameter, or distance between flats and midway from center to surface for products over 1-1/2 in. (37.5 mm).

3.3.4 Number of Samples or Specimens: Shall be in accordance with Table I; the numerals under "Number of Samples or Specimens" represent the minimum number to be tested to represent the inspection lot.

3.3.4.1 Only one value need be reported for composition.

3.3.5 Testing: Test methods shall be in accordance with requirements of the applicable material specification. If a test method is not specified, the method of test shall be as agreed upon by purchaser and vendor.

3.3.6 Resampling and Retesting: If any valid specimen (See 8.2) used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Except as permitted in 8.2, failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Except as permitted in 3.3.4.1 and 8.2, results of all tests shall be reported.

3.3.6.1 Single Melted Heat: Should resampling and retesting be required for macrostructure, microstructure, or magnetic particle testing of single melted steel, the additional specimens shall be taken from the product representing the same position in each of the two available ingots most immediately adjacent in pouring sequence to that from which the failed specimen was taken and one from the original nonconforming ingot after additional discard; should the latter specimen be unacceptable, resampling and retesting of the nonconforming ingot may be repeated after as many consecutive discards as necessary and desired to obtain sound material.

3.3.6.2 Multiple Melted Heat: Should resampling and retesting be required for macrostructure, microstructure, or magnetic particle testing of multiple melted quality steel, the additional specimens shall be taken from product representing the same remelt ingot after as many consecutive discards as necessary and desired to obtain sound material.