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AEROSPACE MATERIAL SPECIFICATION

SAE MAM 2355C

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Superseding MAM 2355B

Quality Assurance, Sampling and Testing
Aluminum Alloys and Magnesium Alloys
Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings

1. SCOPE:

This specification covers quality assurance sampling and testing procedures used to determine conformance to applicable specification requirements of wrought aluminum alloy and wrought magnesium alloy mill products, except forging stock, including rolled, forged, and flash welded rings, specified in metric (SI) units. Definitions of rings, as applicable to this specification, are presented in 8.3 (Definitions).

1.1 AMS 2355 is the inch/pound version of this MAM.

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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM B 557M	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)
ASTM B 594	Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM B 645	Plane Strain Fracture Toughness Testing of Aluminum Alloys
ASTM B 646	Fracture Toughness Testing of Aluminum Alloys
ASTM E 9	Compression Testing of Metallic Materials at Room Temperature
ASTM E 10	Brinell Hardness of Metallic Materials
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 34-72	Chemical Analysis of Aluminum and Aluminum-Base Alloys

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
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SAE WEB ADDRESS: http://www.sae.org

2.1 (Continued):

ASTM E 35	Chemical Analysis of Magnesium and Magnesium Alloys
ASTM E 55	Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition
ASTM E 227	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique
ASTM E 290	Bend Testing of Material for Ductility
ASTM E 399	Plane-Strain Fracture Toughness of Metallic Materials
ASTM E 561	R-Curve Determination
ASTM E 607	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere
ASTM E 716	Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis
ASTM E 1004	Determining Electrical Conductivity Using the Electromagnetic (Eddy-Current) Method
ASTM E 1251	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Argon Atmosphere, Point-to-Plane, Unipolar Self-Initiating Capacitor Discharge
ASTM E 1304	Plane-Strain (Chevron Notch) Fracture Toughness of Metallic Materials
ASTM G 34-72	Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO TEST)
ASTM G 47	Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

2.2 U.S. Government Publications:

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

MIL-STD-1537	Electrical Conductivity Test for Measurement of Heat Treatment of Aluminum Alloys, Eddy Current Method

2.3 Aluminum Association Publications:

The Aluminum Association, Inc., 900 19th Street N.W., Washington, DC 20006.

Aluminum Standards and Data

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 specification for a product does not relieve the vendor of responsibility for furnishing products which conform in all respects to the applicable material specification.

3.1.2 In event of conflict between requirements specified herein and requirements of a particular material specification, the following rules shall apply:

3.1.2.1 When requirements of the material specification are more stringent, they shall take precedence.

3.1.2.2 When requirements of this MAM are more stringent, they shall take precedence except as noted in 3.1.2.3.

3.1.2.3 If any tests mentioned in 3.3.2 are not required by the material specification, they shall not be considered a requirement.

3.1.2.4 When instructions are issued by purchaser regarding quality assurance sampling procedures, such instructions shall take precedence over requirements of either this specification or the particular specification in which this specification is invoked.

3.1.3 Properties of the delivered product shall meet those of the specified (ordered) product.

3.2 Responsibility for Tests:

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for the performance of all specified tests.

3.3 Detail Requirements:

3.3.1 Inspection Lot:

3.3.1.1 Wrought Alloy Products Including Forged or Rolled Rings, but Excluding Die and Hand Forgings and Flash Welded Rings:

3.3.1.1.1 Heat Treated Tempers: An inspection lot shall be an identifiable quantity of product of the same mill form, alloy, temper, section, and size traceable to a heat treat lot (See 8.3.3), and submitted for vendor's inspection at one time. All sheet and plate of the same thickness is considered to be of the same size.

3.3.1.1.2 Non-Heat-Treated Tempers: An inspection lot shall be an identifiable quantity of material of the same mill form, alloy, temper, section, and size submitted for vendor's inspection at one time.

3.3.1.2 Die, Hand, and Ring Forgings: An inspection lot shall be all forgings of the same alloy and nominal cross-section and configuration heat treated in the same batch furnace or quenched from a continuous furnace consecutively during an eight-hour period. Maximum lot size for forgings heat treated in a continuous furnace and charged consecutively during continuous furnace operation shall be 1000 kg for forgings weighing 2.5 kg and under, and shall be 3000 kg for forgings weighing over 2.5 kg.

3.3.1.3 Flash Welded Rings: An inspection lot shall consist of all rings of the same alloy, cross-sectional configuration, size, and heat treated in the same batch furnace load or in a continuous furnace during a period of eight consecutive hours, and presented for vendor's inspection at one time.

3.3.2 Sampling and Testing:

3.3.2.1 Chemical Analysis: Sampling shall be in accordance with ASTM E 55 and/or ASTM E 716.

3.3.2.1.1 Cast Unit: Producer shall take at least one control sample before and at least one additional sample during the casting of each cast unit (units, if cast simultaneously from the same molten metal source). Complete analysis records shall be available for review at producer's plant (See 8.2). Analysis is required for those elements having specified limits.

3.3.2.1.2 Finished Product (Excluding Forgings and Flash Welded Rings): When compliance with 3.3.2.1.1 cannot be established, sampling shall be as follows: one sample shall be taken for each 1000 kg, or fraction thereof, of each cast unit in an inspection lot; however, not more than one sample is required from a piece.

3.3.2.1.3 Forgings and Rolled Rings: When compliance with 3.3.2.1.1 cannot be established, sampling shall be as follows: one sample shall be taken for each 1000 kg, or fraction thereof, in a lot of forgings having a nominal weight of 2.5 kg and under; one sample shall be taken for each 3000 kg, or fraction thereof, in a lot of forgings having a nominal weight greater than 2.5 kg.

3.3.2.1.4 Flash Welded Rings: Unless a report showing conformance of chemical composition to the applicable material specification is available on stock used for flash welded rings, one sample shall be taken for each 3000 kg, or fraction thereof, in a lot; however, not more than one sample is required from a piece.

3.3.2.2 Tensile Properties: The location from which the sample is taken shall be as specified in 3.3.3 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 the applicable material specification or shall be taken from randomly selected pieces of the product. A minimum of one tensile specimen shall be taken in any one direction from any one piece when more than one piece is available. The number of samples shall be as specified herein for the type of product being tested.

3.3.2.2.1 Sheet: One sample shall be taken from each end of each parent coil but not more than one sample for each 1000 kg, or fraction thereof, in a lot shall be required.

3.3.2.2.2 Plate: One sample shall be taken from each end of each parent plate but not more than one sample for each 2000 kg, or fraction thereof, in a lot shall be required.

3.3.2.2.3 Wire, Rod, Bar, Shapes, Tube, and Pipe: For products having a nominal of 1.5 kg per linear meter, one sample shall be taken for each 500 kg, or fraction thereof, in a lot. For products having a nominal weight of 1.5 kg or greater per linear meter, one sample shall be taken for each 300 meters, or fraction thereof, in a lot.

3.3.2.2.4 Die Forgings: For die forgings having a nominal weight of 2.5 kg and under, one sample shall be taken in each specimen orientation specified for each 1000 kg, or fraction thereof, in a lot. For die forgings having a nominal weight over 2.5 kg, one sample shall be taken similarly for each 3000 kg, or fraction thereof, in a lot.

3.3.2.2.5 Hand Forgings: One sample shall be taken for each 3000 kg, or fraction thereof, in a lot in each grain direction for which properties are specified.

3.3.2.2.6 Flash Welded Rings: One sample shall be taken from parent metal, not including the heat-affected zone of the weld, of a flash welded ring representing the lot.

3.3.2.2.7 Forged or Rolled Rings: One sample shall be taken from one ring or prolongation ring representing the lot. For multi-lot production of large rings, one ring from the run may be cut into segments and one such segment, if heat treated with the production lot, shall be considered to be the sample for that lot.

3.3.2.2.7.1 For multiple lot production of large rings, when mechanical stress relief is not required, one ring from the forged or rolled run may be cut into segments and one such segment, if heat treated with the production lot, shall be considered to be the sample from that lot.

3.3.2.2.7.2 For multiple lot production of large rings, when mechanical stress relief is required after solution treatment, a sample shall be removed from one ring representing the lot after final heat treatment.

3.3.2.2.8 Response to Heat Treatment: When demonstration of response to heat treatment is specified, material produced in the as-fabricated (-F), annealed (-O) or high temperature annealed (-O1) tempers, shall have additional samples, equal in number to those specified for the product herein. The additional samples shall be heat treated and their tensile properties determined. For 2xxx and 7xxx alloy products, samples and specimen orientation and location in samples shall conform to the following:

3.3.2.2.8.1 Bar, Rod Extrusion, Tube, Hand/Ring Forgings, 13 mm and Over in Thickness: At the time of solution heat treatment, the sample material cross-section shall be that of the product and the length shall be at least 3 times the thickness of the product. Sample material may be cut from tube or hand/ring forgings, providing the "width" and length at the time of solution heat treatment are at least 3 times the thickness of the product.

3.3.2.2.8.2 Plate, 13 mm and Over in Thickness: At the time of solution heat treatment, the sample material thickness shall be that of the product and the length and width shall be at least 3 times the thickness of the product.

3.3.2.2.8.3 If 3.3.2.2.8.1 or 3.3.2.2.8.2 requires a sample heavier than 3.2 kg, it is permissible to excise a smaller sample from the center of the product's thickness, providing that its thickness and length are at least 50 mm and 150 mm, respectively, and its width is either that of the product or 150 mm, whichever is less.

3.3.2.2.8.4 Product Under 13 mm in Thickness: At the time of solution heat treatment, the sample thickness shall be that of the product and the minimum width shall be, insofar as possible, 3 times the thickness of the product plus 13 mm.

3.3.2.2.8.5 Tensile specimen orientation shall be long transverse for sheet and plate and longitudinal for other forms.

3.3.2.2.8.6 Tensile Specimen Location: With respect to width and length, the tensile specimen shall be excised from the center of the sample. Tensile specimen location with respect to sample thickness shall be full thickness under 13 mm and at the center for thicker material.

3.3.2.3 Examination:

3.3.2.3.1 Dimensional and Workmanship Inspection: Each piece shall be inspected to determine conformance to the applicable material specification with respect to workmanship, dimensional tolerances, and identification marking. Alternatively, the vendor may use a system of statistical quality control to ensure compliance with dimensional, marking, and workmanship requirements.

3.3.2.4 Conductivity Testing: When measurement of electrical conductivity is required as part of the acceptance criteria for resistance to corrosion, it shall be performed on the same samples from which tensile property specimens are obtained. The electrical conductivity measurements shall be performed at the locations noted in Aluminum Standards and Data Book, table "Location for Electrical Conductivity Measurements", unless otherwise specified by purchaser or material specification.

3.3.2.5 Stress-Corrosion and Exfoliation-Corrosion Testing: Sampling for stress-corrosion and exfoliation-corrosion testing shall initially consist of two samples for each 2000 kg or fraction thereof from each of the first three production lots for each size range listed in the table of tensile properties in the applicable material specification. Thereafter, testing shall be performed in accordance with frequency requirements of the applicable material specification.

3.3.2.6 Fracture Toughness Testing: Unless specified in the applicable material specification, sampling for fracture toughness testing shall be in the location(s) and at the frequency agreed upon by purchaser and vendor. The direction(s) of test shall be as specified in the material specification and as defined in ASTM E 399 (See 3.3.5.10).

3.3.3 Tensile Specimen Orientation, Location, and Size: Tensile specimens shall be cut from the product to meet the orientation, location, and size requirements defined below for each product form.

3.3.3.1 Sheet and Plate:

3.3.3.1.1 Orientation:

3.3.3.1.1.1 Aluminum: For non-heat-treatable aluminum alloys, tensile specimens shall be taken parallel to the direction of rolling. For heat-treatable aluminum alloys, tensile specimens shall be taken perpendicular to the direction of rolling from widths 225 mm and over and parallel to the direction of rolling from widths under 225 mm. When short-transverse tensile properties are specified, specimens shall be taken with the axis of the specimen parallel to the thickness dimension of the product, such that the mid-point of the specimen's axis lies on the plate mid-thickness (T/2).

3.3.3.1.1.2 Magnesium: For magnesium alloys, tensile specimens shall be taken parallel to the direction of rolling. When short-transverse tensile properties are specified, tensile specimens shall be taken with axis of the specimen parallel to thickness dimension of the product, such that the mid-point of the specimen's axis lies on the plate mid-thickness (T/2).

3.3.3.1.2 Location and Size of Tensile Specimen:

3.3.3.1.2.1 Longitudinal and Long-Transverse Specimens: The standard 12.5 mm wide rectangular tensile specimen or pin-loaded tensile specimen with 50 mm gage length of ASTM B 557M shall be used for sheet and plate under 12.50 mm in thickness. For plate 12.50 mm and over in thickness, the standard 12.5-mm round tensile specimen with 62.5-mm gage length of ASTM B 557M or a smaller round specimen proportional to it may be used. Tensile specimens shall be taken midway between the two surfaces (T/2) of the plate for nominal thicknesses 12.50 to 40.00 mm, inclusive. For plate over 40.00 mm in nominal thickness, the tensile specimen shall be taken midway between center and surface (T/4) of the plate.

3.3.3.1.2.2 Short-Transverse Specimens: For plate 40.00 mm and over in thickness, sub-size specimens as specified in 3.3.4.3 shall be used. The specimen shall be centered midway between the two surfaces of the plate such that the midpoint of the specimen axis lies on the plate mid-thickness (T/2).

3.3.3.2 Wire, Rod, and Bar:

3.3.3.2.1 Orientation:

3.3.3.2.1.1 Aluminum and Magnesium: Tensile specimens shall be taken in the longitudinal direction, except that when long-transverse tensile properties are specified, specimens shall be taken perpendicular to the rolling or extruding direction. When short-transverse tensile properties are specified, specimens shall be taken with the axis of the specimen parallel to the thickness direction of the rod or bar, such that the midpoint of the specimen axis lies on the midpoint of the thickness (T/2) of the rod or bar.

3.3.3.2.2 Location and Size of Tensile Specimens:

3.3.3.2.2.1 Longitudinal Specimens: If size or shape of product makes it impractical to use full-section tensile specimens, the standard 12.5 mm round tensile specimen with 62.5 mm gage length of ASTM B 557M or a smaller round specimen proportional to it shall be used, except that for rectangular bar under 12.5 mm in thickness, the standard 12.5 mm wide rectangular tensile specimen or pin-loaded tensile specimen with 50 mm gage length of ASTM B 557M shall be used. For product not tested in full section, the tensile specimen shall be taken from locations specified in Table 1. Elongation and yield strength requirements of material specifications do not apply to wire 3.20 mm and under in diameter or thickness.

TABLE 1 - Location of Axis of Longitudinal Tensile Specimen in Rod and Bar

Section Thickness or Width, Millimeters	Thickness (T)	Width (W)
Up to 40.00, inclusive	T/2	W/2
Over 40.00	T/4	W/4

3.3.3.2.2.2 Long-Transverse Specimens: The standard 12.5 mm wide rectangular tensile specimen or pin-loaded tensile specimen with 50 mm gage length of ASTM B 557M shall be used for bar under 12.5 mm in thickness and 200 mm and over in width. For bar 12.5 mm and over in thickness, the standard 12.5 mm round tensile specimen with 62.5 mm gage length of ASTM B 557M or a smaller round specimen proportional to it shall be used. The axis of the tensile specimen shall fall in the plane midway between the two surfaces (T/2) of bar 12.50 to 40.00 mm, inclusive, in nominal thickness and midway between the center and surface of bar (T/4) over 40.00 mm in nominal thickness.

3.3.3.2.2.3 Short-Transverse Specimens: For rectangular bar 40.00 mm and over in thickness, sub-size specimens as specified in 3.3.4.3 shall be taken at the center of the bar with respect to both thickness (T/2) and width (W/2).

3.3.3.3 Tubing:

3.3.3.3.1 Orientation:

3.3.3.3.1.1 Drawn Aluminum and Extruded Aluminum and Magnesium: Tensile specimens shall be taken in the longitudinal direction, except that when long-transverse tensile properties are specified for square or rectangular tubing, tensile specimens shall be taken perpendicular to the direction of drawing or extrusion.

3.3.3.3.2 Location and Size of Tensile Specimens:

3.3.3.3.2.1 Longitudinal Specimens: Tensile specimens from round tube 50.00 mm and under in nominal OD and from square tubing 40.00 mm and under on a side shall be the full-section of the tube unless limitations of the testing machine preclude the use of such a specimen. For tubing of larger size, or when it is not possible to test the full-section, the standard 12.5 mm wide rectangular tensile specimen or pin-loaded tensile specimen with 50 mm gage length; or standard 12.5 mm round tensile specimens with 50 mm gage length; or standard 12.5 mm longitudinal tensile specimen of ASTM B 557M may be used for large-diameter tubular products. When size of the product makes it impractical to use any of these specimens, round specimens proportional to the standard 12.5 mm round tensile specimen of ASTM B 557M shall be used. For tube having a nominal wall thickness of 40.00 mm and under not tested in full section, the tensile specimen shall be taken from the center of the wall (T/2). For tube having a nominal wall thickness over 40.00 mm, the specimen shall be taken midway between the center of the wall thickness and the inner or outer surface of the tube (T/4).

3.3.3.3.2.2 Long-Transverse Specimens: The standard 12.5 mm round tensile specimen with 62.5 mm gage length of ASTM B 557M or a smaller round specimen proportional to it shall be used for thicknesses of 10 mm and over and having widths of 60 mm and over, except that for square or rectangular tubing 12.50 mm and under in thickness, the standard 12.5 mm wide rectangular tensile specimen or pin-loaded tensile specimen with 50 mm gage length of ASTM B 557M may be used. For tube from which these machined specimens cannot be obtained, a round or rectangular specimen of the largest possible dimensions shall be used. For tube having a wall thickness of 40.00 mm and under, the tensile specimen shall be taken from the center of the wall (T/2). For tube having a wall thickness over 40.00 mm, the specimen shall be taken midway between the center of the wall thickness and the inner or outer surface of the tubing (T/4).

3.3.3.4 Shapes:

3.3.3.4.1 Orientation:

3.3.3.4.1.1 Aluminum and Magnesium: Tensile specimens shall be taken in the longitudinal direction except that when long-transverse tensile properties are specified, tensile specimens shall be taken perpendicular to the extruding direction. When short-transverse tensile properties are specified for shapes, short-transverse tensile specimens shall be taken with axis of specimen parallel to the thickness direction of the shape.

3.3.3.4.2 Location and Size of Tensile Specimens: Shall be as specified in 3.3.3.4.2.1 through 3.3.3.4.2.3 except that size, location, and orientation of tensile specimens from complicated shapes shall be as agreed upon by purchaser and vendor.

3.3.3.4.2.1 Longitudinal Specimens: If the size or shape of the product makes it impractical to use full-section tensile specimens, the standard 12.5 mm round tensile specimen with 62.5 mm gage length of ASTM B 557M or smaller round specimen proportional to it shall be used, except that for shapes 12.50 mm and under in thickness having parallel surfaces, the standard 12.5 mm wide rectangular tensile specimen or pin-loaded tensile specimen with 50 mm gage length of ASTM B 557M 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. The tensile specimen shall be taken from the predominant section of the shape and from the location which most nearly complies with Table 2. Elongation requirements do not apply to specimens from shapes under 1.60 mm in thickness or to round or rectangular specimens of non-standard proportions.

TABLE 2 - Location of Axis of Longitudinal Tensile Specimen in Extruded Shapes

Section Thickness or Width, Millimeters	Thickness (T)	Width (W)
Up to 40.00, inclusive	T/2	W/2
Over 40.00	T/4	W/4

3.3.3.4.2.2 Long-Transverse Specimens: The standard 12.5 mm round tensile specimen with 62.5 mm gage length of ASTM B 557M or a smaller round specimen proportional to it shall be used for thicknesses of 10 mm and over and having widths of 60 mm and over, except that for shapes 12.5 mm and under in thickness having parallel surfaces, the standard 12.5 mm wide rectangular tensile specimen or pin-loaded tensile specimen with 50 mm gage length of ASTM B 557M may be used. For shapes from which these machined specimens cannot be obtained, a round or rectangular specimen of the largest possible dimensions shall be used. The tensile specimens shall be taken from the center of the predominant section of the shape with respect to both thickness (T/2) and width (W/2). Elongation requirements do not apply to specimens from shapes under 1.60 mm in thickness or to round or rectangular specimens of non-standard proportions.

3.3.3.4.2.3 Short-Transverse Specimens: For shapes 40.00 mm and over in thickness, sub-size specimens as specified in 3.3.4.3 shall be used. The tensile specimens shall be taken from the center of the predominant section with respect to both thickness (T/2) and width (W/2).

3.3.3.5 Die Forgings:

3.3.3.5.1 Orientation:

3.3.3.5.1.1 Aluminum and Magnesium: Tensile specimens shall be taken parallel to the direction of grain flow, except that when tensile properties are required to be determined in other directions, the tensile specimens shall be taken in the specified direction. Unless otherwise specified, tensile specimens may be taken from a prolongation on the forging or from coupons separately forged from the same stock used to produce the forgings. Separately-forged coupons and prolongations shall have reduction not greater than that of the least reduced section of the forging. If prolongations are used, the relationship of mechanical properties of the prolongation to properties of the forging shall be established by statistically valid methods acceptable to purchaser.

3.3.3.5.2 Location and Size of Tensile Specimens:

3.3.3.5.2.1 Specimens Parallel to Grain Flow: The standard 12.5 mm round tensile specimen with 62.5 mm gage length of ASTM B 557M or a smaller round specimen proportional to it shall be used for section thicknesses 12.50 mm and over. Smaller round specimens proportional to the standard 12.5 mm tensile specimen or rectangular tensile specimens of ASTM B 557M shall be used for section thicknesses 8.00 to 12.50 mm, inclusive. Rectangular tensile specimens of ASTM B 557M shall be used for section thicknesses under 8.00 mm. The tensile specimen shall be taken at the center of the predominant section with respect to both thickness (T/2) and width (W/2).

3.3.3.5.2.2 Specimens Not Parallel to Grain Flow: Sub-size specimens as specified in 3.3.4.3 may be used if full size specimens cannot be obtained at the specified location. Tensile specimens shall be taken from the location specified on the engineering drawing or otherwise specified by purchaser.

3.3.3.6 Hand Forgings:

3.3.3.6.1 Orientation:

3.3.3.6.1.1 Aluminum and Magnesium: Tensile specimens shall be taken in the long-transverse direction, except that when longitudinal tensile properties are specified, tensile specimens shall be taken parallel to the forging direction. When short-transverse tensile properties are specified, short-transverse tensile specimens shall be taken with axis of the specimen parallel to the thickness direction of the hand forging.

3.3.3.6.2 Location and Size of Tensile Specimens:

3.3.3.6.2.1 Longitudinal Specimens: The standard 12.5 mm round tensile specimen with 62.5 mm gage length of ASTM B 557M or a smaller round specimen proportional to it shall be used. The tensile specimen shall be taken so that its axis coincides with the longitudinal center line of the hand forging and the distance from midpoint of its axis to end of the hand forging is at least one-half the thickness (T/2) of the hand forging.

3.3.3.6.2.2 Long-Transverse Specimens: The standard 12.5 mm round tensile specimen with 62.5 mm gage length of ASTM B 557M or a smaller round specimen proportional to it shall be used. The tensile specimen shall be taken so that the midpoint of its axis lies on the longitudinal center line of the hand forging at a distance from the end of the hand forging of at least one-half the thickness (T/2) of the hand forging.

3.3.3.6.2.3 Short-Transverse Specimens: For hand forgings 50.00 mm and over in thickness, sub-size specimens as specified in 3.3.4.3 shall be used. The tensile specimens shall be taken so that the midpoint of its axis lies on the longitudinal center line of the hand forging at a distance from the end of the hand forging of at least one-half the thickness (T/2) of the hand forging.

3.3.3.7 Flash Welded Rings: Tensile specimens shall be taken in the circumferential direction and from a location in respect to cross-section as applicable to the flash welded stock size as specified in 3.3.3.2.2.1.

3.3.3.8 Forged or Rolled Rings: Tensile specimens shall be taken in the circumferential (tangential) direction, but when cross-sectional size is adequate, axial and radial orientations may also be specified. Test specimens shall be located as specified in 3.3.3.2.2 except that tangential shall be equivalent to longitudinal, axial shall be equivalent to short-transverse, and radial shall be equivalent to long-transverse directions for forged rings; and for rolled rings, tangential shall be equivalent to longitudinal, axial shall be equivalent to long-transverse, and radial shall be equivalent to short-transverse directions.

3.3.3.8.1 Location and Size of Tensile Specimens: Standard or subsize round machined specimens (see 3.3.4) shall be taken in the tangential, axial and radial orientations as specified. All specimens shall be taken from the center of the wall. For tangential specimens the distance of the axis to the nearest end of the ring shall be at least one-half of the thickness of the wall. For axial specimens the distance from the midpoint of its axis to the nearest end of the ring shall be at least one-half the thickness of the wall. For radial specimens the specimens shall be taken such that the midpoint of the axis lies at the center of the wall and the distance from the nearest end of the ring is at least one-half the thickness of the wall.

3.3.4 Tensile Specimen Types: Tensile specimens may be substantially the full cross-section of the product being tested or they may be machined.

3.3.4.1 Full-Section Specimens: Tensile specimens of substantially the full cross-section of the product may be used for wire, rod, bar, tube, and shapes. The section may be reduced slightly throughout the test section to ensure fracture within the gage marks. The gage length shall be five times the diameter for solid round specimens and 50 mm for all other specimens.

3.3.4.2 Machined Specimens: Standard machined specimens for tensile specimens are of two types: round and rectangular with a gage length of 62.5 mm and a width or diameter of 12.5 mm. These standard specimens are shown in ASTM B 557M.

3.3.4.3 Sub-Size Specimens: Smaller round specimens proportional to the standard 12.5 mm diameter round specimen shall be used when a standard specimen cannot be prepared. Examples are shown in ASTM B 557M. Other sizes of small round specimens may be used if the gage length for measurement of elongation is five times the diameter of the reduced section of the specimen.

3.3.5 Test Methods: Unless otherwise specified, the following test methods shall apply:

3.3.5.1 Chemical Analysis: Shall be performed in accordance with ASTM E 34, ASTM E 35, ASTM E 227, ASTM E 607, ASTM E 1251, or other analytical method acceptable to purchaser.

3.3.5.2 Tensile Testing: Shall be performed in accordance with ASTM B 557M.

3.3.5.3 Conductivity: Shall be determined in accordance with ASTM E 1004 using equipment calibrated in accordance with MIL-STD-1537.

3.3.5.4 Brinell Hardness: Shall be determined in accordance with ASTM E 10 when Brinell hardness is specified.

3.3.5.5 Rockwell Hardness: Shall be determined in accordance with ASTM E 18 when Rockwell hardness or superficial hardness is specified.

3.3.5.6 Bend Testing: Shall be performed in accordance with ASTM E 290 when bend testing is specified. For magnesium, the minimum width of the specimen shall be 150 mm when practical.