SAE Aerospace
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AEROSPACE STANDARD

SAE MA3375 REV. B

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Superseding MA3375A

Studs, Corrosion and Heat Resistant Steel, UNS S66286
Tensile Strength 900 MPa, Procurement Specification, Metric

FSC 5307

RATIONALE

This document has been reaffirmed to comply with the SAE 5-year Review policy.

1. SCOPE:

1.1 Type:

This document covers metric studs made from a corrosion and heat resistant, age hardenable iron base alloy of the type identified under the Unified Numbering System as UNS S66286. The following specification designations and their properties are covered:

MA3375	900 MPa minimum ultimate tensile strength at room temperature
MA3375-1	900 MPa minimum ultimate tensile strength at room temperature 480 MPa stress-rupture strength at 650 °C
MA3375-2	900 MPa minimum ultimate tensile strength at room temperature 590 MPa minimum ultimate shear strength at room temperature

1.1.1 Two types of studs are covered as follows:

Type I - Studs with stud end thread having special oversize pitch diameter and lead thread with undersize pitch diameter, while nut end thread is standard size

Type II - Studs with stud end thread and nut end thread standard size

1.2 Application:

Primarily for aerospace propulsion system applications where a good combination of strength and resistance to corrosion are required. MA3375 studs are intended for use where the coefficient of expansion of the stud is more compatible for use in aluminum or magnesium alloys. MA3375-1 studs are intended for use at elevated temperatures in corrosion resistant steel parts. MA3375-2 studs are intended for studs loaded in shear.

1.2.1 Type I studs are intended for torque driving into aluminum or magnesium alloy tapped hole by interference fit assembly of stud end thread in accordance with MAP1670 studding practice.

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1.2.2 Type II studs are intended for studding magnesium or aluminum alloys, and steel or corrosion resistant steel parts by locking the assembled stud end threads in the boss to resist rotation by an auxiliary method; for example:

a. By use of locking keys (individual or ring supported) driven into the assembled stud and boss threads parallel to thread axis.
b. By use of serrated lock ring driven into assembled studded boss so that internal serrations engage the stud serrated shank and external serrations broach the boss counterbore.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other documents shall be the issue in effect on the date of the purchase order.

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

AMS 2759/3	Heat Treatment of Precipitation Hardening, Corrosion Resistant and Maraging Steel Parts
AMS 5731	Steel Bars, Forgings, Tubing and Rings, Corrosion and Heat Resistant, 15Cr-25.5Ni-1.2Mo-2.1Ti-0.006B-0.30V, Consumable Electrode Melted, 1800 °F (982 °C) Solution Heat Treated
AMS 5732	Steel Bars, Wire, Forgings, Tubing, and Rings, Corrosion and Heat Resistant, 15Cr 25.5Ni 1.2Mo 2.1Ti 0.06B 0.30V Consumable Electrode Melted, 1800 °F (982 °C) Solution and Precipitation Heat Treated
AMS 5734	Steel Bars, Forgings, and Tubing, Corrosion and Heat Resistant, 15Cr 25.5Ni 1.2Mo 2.1Ti 0.006B 0.30V, Consumable Electrode Melted, 1650 °F (899 °C) Solution Heat Treated
AMS 5737	Steel Bars, Wire, Forgings, and Tubing, 15Cr 25.5Ni 1.2Mo 2.1Ti 0.006B 0.30V, Consumable Electrode Melted, 1650 °F (899 °C) Solution and Precipitation Heat Treated
MA1370	Screw Threads - MJ Profile, Metric
MA1518	Bolts, Screws and Nuts - External Wrenching, Metric MJ Threads, Design Parameters for
MA1520	Areas for Calculating Stress or Load for Metric MJ Externally Threaded Fasteners
MA1566	Gaging Practice and Gage Requirements for MJ Metric Screw Threads

2.1.1 (Continued):

MAP1670	Studs, Installation Practice for Interference Fit, Metric
AS3062	Bolts, Screws, and Studs, Screw Thread Requirements
AS3063	Bolts, Screws, and Studs, Geometric Control Requirements

2.1.2 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA, 19111-5094.

QQ-P-35	Passivation Treatments for Corrosion Resistant Steel
MIL-STD-1312-6	Fastener Test Methods, Method 6, Hardness
MIL-STD-1312-10	Fastener Test Methods, Method 10, Stress Rupture
MIL-STD-1312-12	Fastener Test Methods, Method 12, Thickness of Metallic Coatings
DOD-STD-1312-108	Fastener Test Methods, Method 108, Tensile Strength
DOD-STD-1312-113	Fastener Test Methods, Method 113, Double Shear Test

2.1.3 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E112	Determining Average Grain Size
ASTM E 139	Conducting Creep, Creep-Rupture, and Stress-Rupture Test of Metallic Materials
ASTM E 140	Standard Hardness Conversion Tables for Metals
ASTM E 1417	Liquid Penetrant Examination
ASTM D 3951	Commercial Packaging

2.1.4 ANSI Publication: Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI/ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)

2.2 Definitions:

BURR: A rough edge or ridge left on the metal due to a cutting, grinding, piercing or blanking operation.

TIGHT BURR: A burr closely compacted and binding in the periphery of a part without any loose ends and is within the dimensional limits of the part.

DEFECTIVE: A unit of product which contains one or more defects.

PRODUCTION INSPECTION LOT: Shall be all finished parts of the same part number, made from a single heat of alloy, heat treated at the same time to the same specified condition, produced as one continuous run, and submitted for vendor's inspection at the same time.

2.3 Unit Symbols:

°	degree, angular
°C	degree Celsius
°F	degree Fahrenheit
mm	millimeter
cm^3	cubic centimeter
g	gram (mass)
HRC	hardness, Rockwell C scale
%	percent (1% = 1/100)
kN	kilonewton (force)
MPa	megapascal (stress)
sp gr	specific gravity

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be AMS 5731 or AMS 5734 steel heading stock or AMS 5732 or AMS 5737 steel as specified on the part drawing.

3.2 Design:

Finished (completely manufactured) parts shall conform to the following requirements:

3.2.1 Dimensions: The dimensions of finished parts, after all processing, including plating or coating, shall conform to the requirements as specified on the part drawing. Dimensions shall apply after plating but before coating with dry film lubricants.

3.2.2 Surface Texture: Surface texture of finished parts, prior to plating or coating, shall conform to the requirements as specified on the part drawing, determined in accordance with ANSI/ASME B46.1.

3.2.3 Threads:

3.2.3.1 Type I Studs: Unless otherwise specified on the part drawing, the threads shall be as follows:

Nut end threads - Standard MJ metric screw threads in accordance with MA1370.
Stud end threads - Special MJ metric screw threads as follows:

a. MJ thread form in accordance with MA1370
b. Dimensions for major, pitch, and minor diameters as specified on part drawing
c. Undersized pitch diameter lead threads in accordance with AS3062
d. Form tolerances for stud full threads in accordance with AS3062

3.2.3.2 Type II Studs: Unless otherwise specified on the part drawing, the stud end threads and nut end threads shall be standard MJ metric screw threads in accordance with MA1370.

3.2.3.3 Incomplete Threads: Incomplete threads are permissible at the chamfered end and incomplete runout threads are permissible at the juncture of the unthreaded portion of the shank in accordance with AS3062 except Type I studs shall have lead threads on stud end as in 3.2.3.1.

3.2.3.4 Chamfer: The entering end of the thread shall be chamfered as specified on the part drawing.

3.2.4 Geometric Tolerances: Part features shall be within the geometric tolerances specified on the part drawing and, where applicable, controlled in accordance with AS3063.

3.3 Fabrication:

3.3.1 Blanks: Blanks shall be machined sufficiently to remove surface defects. Blanks may be produced by machining, upsetting, extruding, or a combination of these methods. Heading stock to be hot upset shall not be heated to a temperature higher than 1150 °C.

3.3.1.1 When a shoulder or shoulders are produced by upsetting, the metal removed from the bearing surface shall be as little as practicable to provide a clean, smooth surface.

3.3.2 Heat Treatment: Shall conform to the technical requirements and other provisions specified in AMS 2759/3 for A-286, 980 °C solution heat treatment for blanks made from AMS 5731, 900 °C solution heat treatment for blanks made from AMS 5734, and 720 °C aging treatment.

3.3.2.1 Solution Heat Treatment: Blanks shall be solution heat treated as in 3.3.2.

3.3.2.2 Aging Heat Treatment: Solution treated blanks shall be heat treated by aging as in 3.3.2.

3.3.3 Oxide Removal: Surface oxide and oxide penetration resulting from prior heat treatment shall be removed from the full body diameter and bearing surface of the shoulders, as applicable, of the solution heat treated and aged blanks prior to rolling the threads. The oxide removal process shall produce no intergranular attack or corrosion of the blanks.

3.3.4 Thread Rolling: Threads shall be formed on the heat treated and finished blank by a single cold rolling process after removal of oxide as in 3.3.3.

3.3.5 Passivation Treatment: Parts, after finishing, shall be degreased and then subjected to the passivation treatment and copper sulfate test in accordance with QQ-P-35.

3.4 Product Marking:

Each part shall be marked for oversize on the stud end thread and for material code on the nut end thread as specified by the part drawing. The markings may be formed by stamping, depressed 0.25 mm maximum, with rounded root form on depressed characters.

3.5 Plating:

Where required, surfaces shall be plated as specified on the part drawing. Thickness determined in accordance with MIL-STD-1312-12.

3.6 Mechanical Properties:

Where MA3375 is specified, parts shall conform to the requirements of 3.6.1 and 3.6.2. Where MA3375-1 is specified, parts shall conform to the requirements of 3.6.1, 3.6.2, and 3.6.4. Where MA3375-2 is specified, parts shall conform to the requirements of 3.6.1, 3.6.2, and 3.6.3. Threaded members of gripping fixtures for tensile and stress-rupture tests shall be of sufficient size and strength to develop the full strength of the part without stripping the thread. The loaded portion of the shank shall have a minimum of three full thread turns from the thread runout exposed between the loading fixtures during the tensile and stress-rupture tests.

MA3375 finished parts shall be tested in accordance with the following test methods:

a. Hardness: MIL-STD-1312-6
b. Ultimate Tensile Strength at Room Temperature: DOD-STD-1312-108

MA3375-1 finished parts shall be tested in accordance with the following test methods:

a. Hardness: MIL-STD-1312-6
b. Ultimate Tensile Strength at Room Temperature: DOD-STD-1312-108
c. Stress-Rupture Strength at 650 °C: MIL-STD-1312-10

MA3375-2 finished parts shall be tested in accordance with the following test methods:

a. Hardness: MIL-STD-1312-6
b. Ultimate Tensile Strength at Room Temperature: DOD-STD-1312-108
c. Ultimate Double Shear at Room Temperature: DOD-STD-1312-113

3.6.1 Ultimate Tensile Strength at Room Temperature:

3.6.1.1 Finished Parts: Parts shall have an ultimate tensile load not lower than that specified in Table 1 and shall be tested to failure in order to observe fracture location, first measuring and recording the maximum tensile load achieved. If the size or shape of the part is such that failure would occur outside the threaded section but the part can be tested satisfactorily, such as parts having a shank diameter equal to or less than the thread root diameter (smaller thread root diameter for studs with unequal size threads) or having an undercut, parts shall have an ultimate tensile strength not lower than 900 MPa; for such parts, the diameter of the area on which stress is based shall be the actual measured minimum diameter of the part.

3.6.1.2 Machined Test Specimens: If the size or shape of the part is such that a tensile test cannot be made on the part, tensile tests shall be conducted in accordance with ASTM E 8 on specimens prepared as in 4.4.6. Specimens may be required by the purchaser to perform confirmatory tests. Such specimens shall meet the following requirements:

a. Ultimate Tensile Strength, minimum:	900 MPa
b. Yield Strength at 0.2% Offset, minimum:	590 MPa
c. Elongation in 5D, minimum:	15% - AMS 5732, 12% - AMS 5737
d. Reduction of Area, minimum:	20% - AMS 5732, 15% - AMS 5737

3.6.1.2.1 When permitted by purchaser, hardness tests on the end of parts may be substituted for tensile tests of machined specimens.

3.6.2 Hardness: Shall be uniform and within the range 24 to 39 HRC (see 8.1), but hardness of the threaded section may be higher as a result of the thread rolling operations. Parts shall not be rejected on the basis of hardness if the tensile strength properties specified in 3.6.1 are met.

3.6.3 Ultimate Shear Strength: Finished parts having a close toleranced full shank as in MA1518 shall have an ultimate double shear load not lower than that specified in Table 1. The double shear test may be discontinued without a complete shear failure after the ultimate double shear load has been reached, first measuring and recording the maximum double shear load achieved. Shear studs having special shank diameters shall have the minimum ultimate double shear load based on 590 MPa minimum shear strength. Shear tests are not required for studs having a grip less than 2 times the nominal diameter. Shear test is not required for the following conditions:

a. Studs fully threaded
b. Studs having coarse toleranced full shank
c. Studs having a PD or relieved shank

3.6.4 Stress-Rupture Strength at 650 °C:

3.6.4.1 Finished Parts: Finished parts, maintained at 650 °C ± 2 °C while the tensile load specified in Table 1 is applied continuously, shall not rupture in less than 23 hours. If the shank diameter of the part is less than the maximum root diameter of the thread but the part can be tested satisfactorily, parts shall conform to the requirements of 3.6.4.1.1.

3.6.4.1.1 Parts having a shank diameter less than the maximum root diameter of the thread shall be tested as in 3.6.4.1 except that the load shall be as specified in 3.6.4.2. The diameter of the area on which stress is based shall be the actual measured minimum diameter of the part.

3.6.4.2 Machined Test Specimens: If the size or shape of the part is such that a stress-rupture test cannot be made on the part, a specimen prepared as in 4.4.7, maintained at 650 °C ± 2 °C while a load sufficient to produce an initial axial stress of 480 MPa is applied continuously, shall not rupture in less than 23 hours. Tests shall be conducted in accordance with ASTM E 139.

3.7 Quality:

Parts shall be uniform in quality and condition, free from burrs (tight burrs may be acceptable if part performance is not affected), foreign materials, and free from imperfections detrimental to the usage of the parts.

3.7.1 Macroscopic Examination: Parts or sections of parts, as applicable, shall be etched in a suitable etchant and examined at a magnification of approximately 20X to determine conformance to the requirements of 3.7.1.1 and 3.7.1.2.

3.7.1.1 Flow Lines: Flow lines in threads shall be continuous, shall follow the general thread contour, and shall be of maximum density at root of thread (see Figure 1). Below the thread roots, flow lines not affected by forming shall be parallel to the axis, except that on the nut end of parts formed by extruding, the flow lines may be oblique to the axis for a distance from the end of the larger diameter to the smaller diameter equal to 1.5 times the "B" dimension of Table 2 of AS3062.

3.7.1.2 Internal Defects: Examination of longitudinal sections of the parts shall reveal no cracks, laps, or porosity except thread imperfections as in 3.7.2.4 shall be examined in accordance with 3.7.2.

3.7.2 Microscopic Examination: Specimens cut from parts shall be polished, etched in Kalling's reagent [100 cm^3 of absolute ethyl alcohol, 100 cm^3 of hydrochloric acid (sp gr 1.19), and 5 g of cupric chloride], Marble's reagent [20 cm^3 of hydrochloric acid (sp gr 1.19), 20 cm^3 of water, and 4 g of cupric sulfate pentahydrate], or other suitable etchant, and examined at a magnification not lower than 100X to determine conformance to the requirements of 3.7.2.1, 3.7.2.2, 3.7.2.3 and 3.7.2.4.

3.7.2.1 Microstructure: Parts shall have microstructure of completely recrystallized material except in the area of the threads.

3.7.2.2 Grain Size: Shall be ASTM No. 5 or finer as determined by comparison method of the specimen with the chart in ASTM E 112. Up to 25% of the areas examined may exhibit a grain size as large as ASTM No. 2. Such areas shall be separated by at least 0.64 mm. Bands of fine or coarse grains are not permitted. In case of dispute, the intercept (Heyn) method shall be used.

3.7.2.3 Surface Hardening: Parts shall have no change in hardness from core to surface except as produced during rolling of threads. There shall be no evidence of carburization or nitriding. In case of dispute over results of the microscopic examination, microhardness testing shall be used as a referee method; a Vickers hardness reading of an unrolled surface which exceeds the reading in the core by more than 30 points shall be evidence of nonconformance to this requirement.

3.7.2.4 Threads:

3.7.2.4.1 Root defects such as laps, seams, notches, slivers, folds, roughness, and oxide scale are not permissible (see Figure 2).

3.7.2.4.2 Multiple laps on the flanks of threads are not permissible regardless of location.

3.6.2.4.3 Single Lap on Thread Profile: Shall conform to the following:

a. Rateable Lap: Shall have its length equal to or greater than three times its width. The minimum interpretable lap size is 0.013 mm in length or depth when viewed at 200X magnification.

b. Thread Flank Above the Pitch Diameter: A slight lap is permissible along the flank of the thread above the pitch diameter on either the pressure or nonpressure flank (one lap at any cross-section through the thread) provided it extends towards the crest and generally parallel to the flank (see Figure 3). The lap depth shall not exceed the limit specified in Table 2 for the applicable thread pitch. A lap extending toward the root is not permissible (see Figure 4).

c. Thread Flank Below the Pitch Diameter: A lap along the thread flank below the pitch diameter, regardless of direction it extends, is not permissible (see Figure 5).

d. Crest craters, crest laps, or a crest lap in combination with a crest crater are permissible provided that the imperfections do not extend deeper than the limit specified in Table 2 as measured from the thread crest when the thread major diameter is at minimum size (see Figure 6). The major diameter of the thread shall be measured prior to sectioning. As the major diameter of the thread approaches maximum size, values for depth of crest crater and crest lap imperfections listed in Table 2 may be increased by one-half of the difference between the minimum major diameter and actual major diameter as measured on the part.

3.7.3 Fluorescent Penetrant Inspection: Prior to any required plating or coating, parts shall be subject to fluorescent penetrant inspection in accordance with ASTM E 1417, Type I, Sensitivity Level 2.

3.7.3.1 The following conditions shall be cause for rejection of parts inspected.

3.7.3.1.1 Discontinuities transverse to grain flow (i.e., at an angle of more than 10° to the axis of the shank), such as grinding checks and quench cracks.

3.7.3.1.2 Longitudinal indications (i.e., at an angle of 10° or less to the axis of the shank) due to imperfections other than seams, forming laps, and nonmetallic inclusions.

3.7.3.2 The following conditions shall be considered acceptable on parts inspected.

3.7.3.2.1 Parts having longitudinal indications (i.e., at an angle of 10° or less to the axis of the shank) of seams and forming laps parallel to the grain flow that are within the limits specified in 3.7.3.2.2 through 3.7.3.2.5 provided the separation between indications is not less than 1.6 mm in all directions.

3.7.3.2.2 Sides of Shoulders: There shall be not more than three indications per shoulder. The length of each indication may be the full height of the surface but no indication shall break over either edge to a depth greater than 0.79 mm or the equivalent of the 2H/3 thread depth (see Table 2), whichever is less.

3.7.3.2.3 Shank or Stem: There shall be not more than five indications. The length of any indication may be the full length of the surface but the total length of all indications shall not exceed twice the length of the surface. No indication shall break into a fillet or over an edge.

3.7.3.2.4 Threads: There shall be no indications, except as permitted in 3.7.2.4. Rateable lap indications shall conform to 3.7.2.4.3(a).

3.7.3.2.5 End of Stem: The number of indications is not restricted, but the depth of any individual indication shall not exceed 0.25 mm, as shown by sectioning representative samples. No indication, except those of 3.7.3.2.2, shall break over an edge.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of parts shall supply all samples and shall be responsible for performing all required tests. Purchaser reserves the right to perform such confirmatory testing deemed necessary to ensure that the parts conform to the requirements of this specification.

4.2 Responsibility For Compliance:

The manufacturer's system for parts production shall be based on preventing product defects, rather than detecting the defects at final inspection and then requiring corrective action to be invoked. An effective manufacturing in-process control system shall be established, subject to the approval of the purchaser, and used during production of parts.

4.3 Production Acceptance Tests:

The purpose of production acceptance tests is to check, as simply as possible, using a method which is inexpensive and representative of the part usage, with the uncertainty inherent in random sampling, that the parts comprising a production inspection lot satisfy the requirements of this specification.

4.3.1 Tests for all technical requirements are acceptance tests and shall be performed on each production inspection lot. A summary of acceptance tests is specified in Table 3.

4.4 Acceptance Test Sampling:

4.4.1 Material: Sampling for material composition on each heat shall be in accordance with AMS 5731, AMS 5732, AMS 5734, or AMS 5737.

4.4.2 Nondestructive Tests, Visual and Dimensional: A random sample of parts shall be taken from each production inspection lot; the size of the sample to be as specified in Table 4. The classification of dimensional characteristics shall be as specified in Table 5. All dimensional characteristics are considered defective when out of tolerance.

4.4.3 Fluorescent Penetrant Inspection: A random sample shall be selected from each production inspection lot; the size of the sample shall be as specified in Table 4 and classified as in Table 5. The sample units may be selected from those that have been subjected to and passed the visual and dimensional inspection, with additional units selected at random from the production inspection lot as necessary.

4.4.4 Stress-Rupture Test: A random sample of a minimum of one part (or one test specimen where required) shall be selected from each production inspection lot.

4.4.5 Destructive Tests: A random sample shall be selected from each production inspection lot, the size of the sample shall be as specified in Table 6. The sample units may be selected from those that have been subjected to and passed the nondestructive tests and the fluorescent penetrant inspection, with additional units selected at random from the production inspection lot as necessary.

4.4.6 Acceptance Quality: Of random samples tested, acceptance quality shall be based on zero defectives.

4.4.7 Test Specimens: Specimens for tensile and stress-rupture testing of machined test specimens shall be of standard proportions in accordance with ASTM E 8M with either 6 mm diameter at the reduced parallel gage section or smaller specimens proportional to the standard when required. Specimens shall be machined from finished parts or coupons of the same lot of alloy and be processed together with the parts they represent. Specimens shall be machined from the center of parts 18 mm and under in nominal diameter, from the center of coupons 20 mm and under in nominal diameter or distance between parallel sides, and from mid-radius of larger size parts or coupons.

4.5 Reports:

The vendor of parts shall furnish with each shipment a report stating that the chemical composition of the parts conforms to the applicable material specification, showing the results of tests to determine conformance to the room temperature ultimate tensile property, hardness, double shear test (if required), and stress-rupture requirements, and stating that the parts conform to the other technical requirements. This report shall include the purchase order number, MA3375, lot number, contractor or other direct supplier of material, part number, nominal size, and quantity.

4.6 Rejected Lots:

If a production inspection lot is rejected, the vendor of parts shall perform corrective action to screen out or rework the defective parts, resubmit for acceptance tests inspection as in Table 3, or scrap the entire lot. Resubmitted lots shall be clearly identified as reinspected lots.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 Packaging shall be in accordance with ASTM D 3951.

5.1.2 Parts having different part numbers shall be packed in separate containers.

5.1.3 Each container of parts shall be marked to show not less than the following information:

METRIC STUDS, STEEL, CORROSION AND HEAT RESISTANT
MA3375 (or MA3375-1 or MA3375-2, as applicable)
PART NUMBER
LOT NUMBER
PURCHASE ORDER NUMBER
QUANTITY
MANUFACTURER'S IDENTIFICATION

5.1.4 Threaded fasteners shall be protected from abrasion and chafing during handling, transportation, and storage.

6. ACKNOWLEDGMENT:

A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

7. REJECTIONS:

Parts not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.

8. NOTES:

8.1 Hardness Conversion Tables:

Hardness conversion tables for metals are presented in ASTM E 140.

8.2 Key Words:

Studs, procurement specification

8.3 The change bar (|) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document.

PREPARED BY SAE COMMITTEE E-25,
GENERAL STANDARDS FOR AEROSPACE PROPULSION SYSTEMS

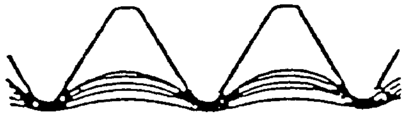


FIGURE 1 - Flow Lines, Rolled Thread

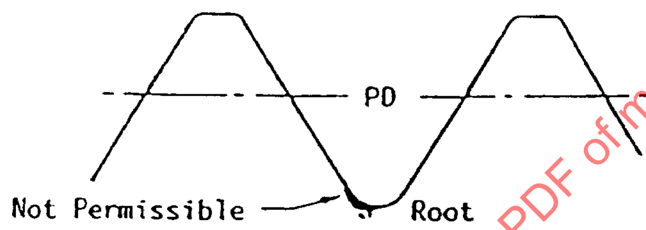


FIGURE 2 - Root Defects, Rolled Thread

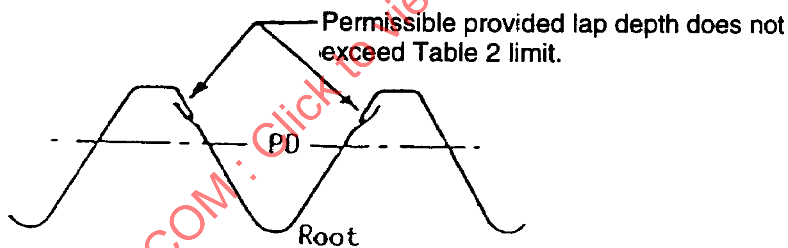


FIGURE 3 - Laps Above Pitch Diameter Extending Towards Crest, Rolled Thread

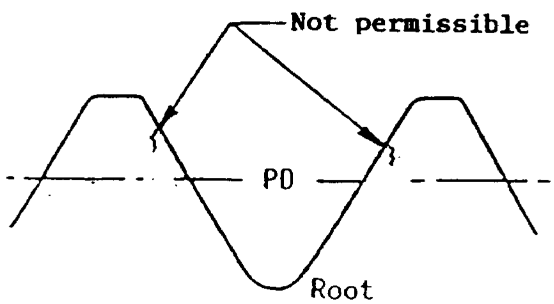


FIGURE 4 - Laps Above PD Extending Toward Root, Rolled Thread

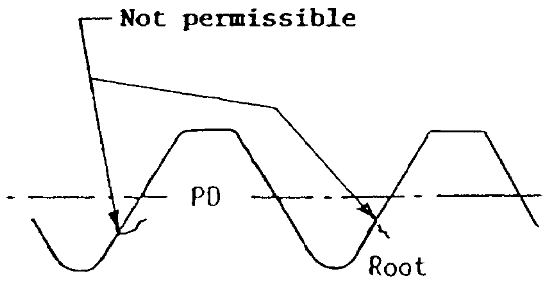
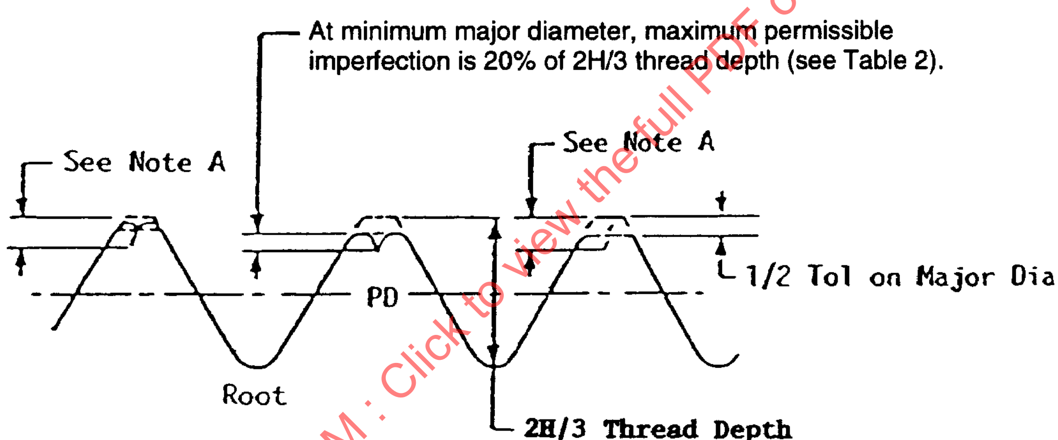


FIGURE 5 - Laps Below PD Extending in Any Direction, Rolled Thread



Note A: Maximum depth of imperfection equals 20% of 2H/3 thread depth plus 1/2 the difference of the actual major diameter and minimum major diameter.

FIGURE 6 - Crest Craters and Crest Laps, Rolled Thread

TABLE 1 - Test Loads

Nominal Thread Size mm	Ultimate Tensile Strength Test Load at Room Temp kN min	Stress-Rupture Strength Test Load at 650 °C kN	Ultimate Double Shear Test Load at Room Temp kN min
3 x 0.5	4.895	2.213	8.341
3.5 x 0.6	6.602	2.970	11.35
4 x 0.7	8.565	3.841	14.83
5 x 0.8	13.77	6.263	23.17
6 x 1	19.58	8.850	33.36
7 x 1	27.84	12.88	45.41
8 x 1	37.51	17.66	59.31
10 x 1.25	58.62	27.60	92.68
12 x 1.25	87.42	42.02	133.5
14 x 1.5	118.4	56.74	181.6
16 x 1.5	158.1	76.75	237.3
18 x 1.5	203.4	99.77	300.3
20 x 1.5	254.3	125.8	370.7
22 x 1.5	310.9	154.9	448.6
24 x 2	361.5	177.4	533.8

NOTE 1: Requirements above apply to parts with metric MJ threads to the sizes shown, to Class 4h6h tolerances. Area upon which stress for ultimate tensile strength test load requirements is based is the tensile stress area as defined in MA1520, for threads rolled after heat treatment, and calculated from Equation 1:

$$A_1 = 0.7854(d_3)^2 [2 - (d_3/d_2)^2] \quad \text{(Eq.1)}$$

where:

A_1 = tensile stress area in thread
d_2 = maximum pitch diameter
d_3 = maximum root diameter

Area upon which stress for ultimate double shear test load is based is at the nominal diameter of the close tolerance full shank stud, which equals the nominal thread major diameter and calculated from Equation 2:

$$A_2 = 0.7854(d)^2 \quad \text{(Eq.2)}$$

where:

A_2 = area at the nominal diameter of a close tolerance shank
d = nominal shank diameter equals nominal thread major diameter