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Superseding AS7473

**Bolts and Screws
Roll Threaded
Procurement Specification For**

FSC 5306

1. SCOPE:

1.1 Types:

This procurement specification covers bolts and screws made from carbon steels, high expansion steels, or corrosion and heat resistant steels of the type identified under the Unified Numbering System as follows:

- a. UNS K00802 - carbon steel (AMS 5061)
- b. UNS K91505 - high expansion steel (AMS 5624)
- c. UNS K91456 - high expansion steel (AMS 5625)
- d. UNS S32100 - corrosion and heat resistant steel (AMS 5645)
- e. UNS S34700 - corrosion and heat resistant steel (AMS 5646)

1.2 Application:

Primarily for parts of carbon and low alloy steels, corrosion and heat resistant steel and alloys, and high expansion steels not subjected to heat treatment during manufacture. Parts of steels such as AMS 5061 are generally for use where stresses are low at moderate temperatures. Parts of corrosion and heat resistant steels and alloys such as AMS 5645 or AMS 5646 are generally for use at elevated temperatures where stresses are low. Parts of high expansion steels such as AMS 5624 or AMS 5625 are generally for use at lower temperatures where expansion approaching that of aluminum and magnesium alloys is required.

- 1.2.1 This specification may also be used to control the manufacture, characteristics, and quality of parts subjected to heat treatment during manufacture but the stage of manufacture at which heat treatment shall be performed, the actual heat treatment, and the mechanical properties of such parts are to be specified, where required, on the part drawing.

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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 2640	Magnetic Particle Inspection
AMS 2645	Fluorescent Penetrant Inspection
AMS 5061	Steel Bars and Wire, Low Carbon
AMS 5624	Steel Bars, High Expansion, 12.5Ni 4.5Mn 4.0Cr (0.50-0.60C)
AMS 5625	Steel Bars, High Expansion, 5.5Mn 9.5Ni (0.55-0.65C), Cold Finished
AMS 5645	Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant 18Cr 10Ni 0.40Ti, Solution Heat Treated
AMS 5646	Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant 18Cr 11Ni 0.60(Cb + Ta), Solution Heat Treated
AS1132	Design Parameters for Bolts and Screws, External Wrenching, Unified Thread Inch Series
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 Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-S-8879	Screw Threads, Controlled Radius Root With Increased Minor Diameter; General Specification For
MIL-STD-1312	Fasteners, Test Methods
MIL-STD-2073-1	DoD Materiel, Procedures for Development and Application of Packaging Requirements

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2.1.3 ANSI Publication: Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

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

2.1.4 ASTM Publication: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 8 Tension Testing of Metallic Materials

2.2 Definitions:

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:

A - ampere

° - degree, angle

°F - degree Fahrenheit

cm³ - cubic centimeter

g - gram

in² - square inch

% - percent (1% = 1/100)

ksi - kips (1000 pounds) per square inch

sp gr - specific gravity

HRC - hardness, Rockwell C scale

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Unless otherwise specified on the part drawing, the material shall be as selected from Table 1 and 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, shall conform to the part drawing. Dimensions 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.

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- 3.2.3 Threads: Screw thread UNJ profile and dimensions shall be in accordance with MIL-S-8879, unless otherwise specified on the part drawing.
- 3.2.3.1 Incomplete Threads: Incomplete threads are permissible at the chamfered end and the juncture of the unthreaded portion of the shank or adjacent to the head as specified in AS3062.
- 3.2.3.2 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: AMS 5061, AMS 5645, and AMS 5646 heads shall be formed by hot forging, cold forging, or machining. AMS 5624 and AMS 5625 heads shall be formed by hot forging or machining. Lightening holes may be produced by any suitable method. Wrenching recesses may be forged or machined. Flash or chip clearance in machined recesses shall not cause recess dimensions to exceed the specified limits.
- 3.3.2 Oxide and Decarburization Removal: Surface oxide and oxide penetration, and decarburization resulting from prior heat treatment shall be removed from the full body diameter and bearing surface of the head prior to cold working the fillet radius when specified and rolling the threads. The oxide and decarburization removal process shall produce no intergranular attack or corrosion of the blanks. The metal removed from the bearing surface of the head and the full body diameter of the shank shall be as little as practicable to obtain a clean, smooth surface and in no case, shall be so great as to produce more cutting of flow lines in the head-to-shank junction than shown in Figure 1B.
- 3.3.3 Cold Working of Fillet Radius: After removal of oxide and decarburization as in 3.3.2, the head-to-shank fillet radius of headed parts having the radius complete throughout the circumference of the part shall, when specified, be cold worked sufficiently to remove all visual evidence of grinding or tool marks. Distortion due to cold working shall conform to Figure 2, unless otherwise specified on the part drawing. It shall not raise metal more than 0.002 inch above the contour at "A" or depress metal more than 0.002 inch below the contour at "B" as shown in Figure 2; distorted areas shall not extend beyond "C" as shown in Figure 2. In configurations having an undercut connected with the fillet radius, the cold working will be required only for 90° of fillet arc, starting at the point of tangency of the fillet radius and the bearing surface of the head.
- 3.3.4 Thread Rolling: Threads shall be formed on the finished blanks by a single rolling process after removal of oxide and decarburization as in 3.3.2 and after heat treatment if performed.

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3.3.5 Cleaning: Parts of AMS 5061, AMS 5624 and AMS 5625, after finishing shall be degreased and cleaned in a suitable solvent. Parts of AMS 5645 and AMS 5646 shall be degreased and immersed in one of the following solutions for the time and temperature shown:

- a. One volume of nitric acid (sp gr 1.42) and 9 volumes of water for not less than 20 minutes at room temperature.
- b. One volume of nitric acid (sp gr 1.42) and 4 volumes of water for 30 to 40 minutes at room temperature.
- c. One volume of nitric acid (sp gr 1.42) and 4 volumes of water for 10 to 15 minutes at 140 to 160 °F.

3.4 Product Marking:

Each part shall be identification marked as specified on the part drawing. The markings may be formed by forging or stamping, raised or depressed 0.010 inch maximum, with rounded root form on depressed characters.

3.5 Plating:

Where required, any protective treatment shall be as specified on the part drawing.

3.6 Mechanical Properties:

Parts shall conform, as applicable, to the requirements of 3.6.1, 3.6.2, and 3.6.3. Threaded members of gripping fixtures for tests requiring tensile loads 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 test wherein tensile loading is applied. Finished parts shall be tested for the following requirements in accordance with the following applicable test methods:

- a. Hardness: MIL-STD-1312-6
- b. Room Temperature Ultimate Tensile Strength: MIL-STD-1312-8

3.6.1 For AMS 5061, AMS 5645, and AMS 5646 mechanical properties shall be as specified on the part drawing.

3.6.2 Ultimate Tensile Strength at Room Temperature: AMS 5625 finished parts shall have an ultimate tensile load not lower than that specified in Table 3 and shall be tested to failure, 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 or having an undercut, parts shall conform to only the tensile strength requirements of 3.6.2.1; for such parts, the diameter of the area on which stress is based shall be the actual measured minimum diameter of the part.

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3.6.2.1 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 as in 4.4.6. Specimens may be required by purchaser to perform confirmatory tests. Specimens shall meet the following requirements:

- a. Ultimate Tensile Strength, minimum: 125 ksi
- b. Yield Strength at 0.2% Offset, minimum: 100 ksi
- c. Elongation in 2 inches or 4D, minimum: 15%
- d. Reduction of Area, minimum: 20%

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

3.6.3 Hardness: Hardness at mid-radius of unthreaded shank cross-section for AMS 5624 and AMS 5625 parts shall be as follows:

- a. AMS 5624: 27 to 38 HRC
- b. AMS 5625
 - (1) Nominal diameter up to 1.0 inch, incl: 25 to 36 HRC
 - (2) Nominal diameter over 1.0 inch: 24 to 36 HRC

3.7 Quality:

Parts shall be uniform in quality and condition, clean, sound, smooth, and free from burrs and foreign materials, and 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 solution consisting of approximately 50% hydrochloric acid (sp gr 1.19) and 50% water, or other suitable etchant, for sufficient time to reveal flow lines but not longer than 15 minutes, and then be 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:

3.7.1.1.1 Head-to-Shank: If parts have forged heads, examination of a longitudinal section through the part shall show flow lines in the shank, head-to-shank fillet, and bearing surface which follow the contour of the part as shown in Figure 1A, except that slight cutting of flow lines by the oxide and decarburization removal process of 3.3.3 is permissible, as shown in Figure 1B; excessive cutting of flow lines in the shank, head-to-shank fillet, and bearing surface, as shown in Figure 1C, is not permissible except when an undercut is connected with the fillet radius. The head style shown in Figures 1A through 1C is for illustrative purposes only but other symmetrical head styles shall conform to the above requirements. Flow lines in upset heads on parts having special heads, such as Dee- or Tee-shaped heads or thinner than AS1132 standard heads, shall be as agreed upon by purchaser and vendor.

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- 3.7.1.1.2 Threads: 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 3).
- 3.7.1.2 Internal Defects: Examination of longitudinal sections of the head and shank and of the threads shall reveal no cracks, laps, or porosity except laps in threads as permitted in 3.7.2.3.3 and 3.7.2.3.4. The head and shank section shall extend not less than $D/2$ from the bearing surface of the head and the threaded section shall extend not less than $D/2$ beyond the thread runout where "D" is the nominal diameter of the shank after heading. If the two sections would overlap, the entire length of the part shall be sectioned and examined as a whole.
- 3.7.2 Microscopic Examination: Specimens cut from parts shall be polished, etched and examined at a magnification not lower than 100X to determine conformance to the requirements of 3.7.2.1, 3.7.2.2, and 3.7.2.3; the etchant shall be 2% Nital for parts made of carbon or low alloy steels, and Kalling's reagent [100 cm³ of absolute ethyl alcohol, 100 cm³ of hydrochloric acid (sp gr 1.19), and 5 g of cupric chloride], Marble's reagent [20 cm³ of hydrochloric acid (sp gr 1.19), 20 cm³ of water, and 4 g of cupric sulfate pentahydrate), or other suitable etchant for parts made of corrosion and heat resistant steels and alloys.
- 3.7.2.1 Surface Hardening: Except for parts whose strength is obtained only by cold working, parts shall have no change in hardness from core to surface except as produced during cold working of the head-to-shank fillet radius when specified and during rolling of threads. Parts shall show no evidence of carburization, or nitriding. In case of dispute over results of the microscopic examination, microhardness testing in accordance with MIL-STD-1312-6 shall be used as a referee method; a Vickers hardness reading within 0.003 inch of an unrolled surface which exceeds the reading in the core by more than 30 points shall be evidence of nonconformance to this requirement.
- 3.7.2.2 Decarburization: Parts made of carbon or low alloy steels shall not be decarburized more than the following:
- 3.7.2.2.1 The bearing surface of the head, the head-to-shank fillet radius, the shank, and the threads shall be free from decarburization.
- 3.7.2.2.2 Depth of decarburization on those surfaces of the head which are the original surfaces of the bar shall be not greater than that permitted by the applicable material specification.
- 3.7.2.2.3 Depth of decarburization on OD of the head of cylindrical head parts made by upsetting is not restricted.
- 3.7.2.2.4 Depth of decarburization at any point on the surface not covered by 3.7.2.2.1, 3.7.2.2.2, or 3.7.2.2.3 shall not exceed 0.002 inch.

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3.7.2.3 Threads:

- 3.7.2.3.1 Root defects such as laps, seams, notches, slivers, folds, roughness, and oxide scale are not permissible (see Figure 4).
- 3.7.2.3.2 Multiple laps on the flanks of threads are not permissible regardless of location. Single laps on the flanks of threads that extend toward the root are not permissible (see Figures 5 and 6).
- 3.7.2.3.3 There shall be no laps along the flank of the thread below the pitch diameter (see Figure 7). A single 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 toward the crest and is generally parallel to the flank (see Figure 7).
- 3.7.2.3.4 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 20% of the basic thread height (see Table 1) as measured from the thread crest when the thread major diameter is at minimum size (see Figure 8). 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 the actual major diameter as measured on the part.

3.7.3 Nondestructive Inspection:

- 3.7.3.1 Parts shall be subject to nondestructive inspection in accordance with the following procedures, as applicable:
 - 3.7.3.1.1 Magnetic Particle Inspection: Parts of magnetic material shall be inspected in accordance with AMS 2640; any method may be used but resolution of disputed rejections shall be based upon the wet, continuous, fluorescent suspension method using amperages specified in 3.7.3.1.1.1 and 3.7.3.1.1.2.
 - 3.7.3.1.1.1 Circular Magnetization: 800 to 1000 A per in² of contact area passed through the part longitudinally.
 - 3.7.3.1.1.2 Longitudinal Magnetization: Sufficient to product 5000 A-turns per inch of shank diameter with the part placed in a standard solenoid of appropriate size.
 - 3.7.3.1.2 Fluorescent Penetrant Inspection: Parts of nonmagnetic material shall be fluorescent penetrant inspected in accordance with AMS 2645; any required plating shall be removed for this inspection.
- 3.7.4 Nondestructive Inspection Criteria: 3.7.4.1 Nonacceptable Conditions: The following conditions shall be cause for rejection of parts inspected by either magnetic particle or fluorescent penetrant inspection procedures:

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- 3.7.4.1.1 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.
- 3.7.4.1.2 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.
- 3.7.4.2 Magnetic Particle Inspection Criteria: Parts inspected by magnetic particle inspection shall be considered acceptable if longitudinal indications (i.e., at an angle of 10° or less to the axis of the shank) of seams, forming laps, and nonmetallic inclusions parallel to the grain flow that are within the following limits, provided that the separation between indications in all directions is not less than 0.062 inch.
- 3.7.4.2.1 Sides of Head: There shall be not more than six surface or subsurface indications per head. 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 0.031 inch or the equivalent of the basic thread height (see Table 2), whichever is less.
- 3.7.4.2.2 Shank or Stem: There shall be not more than 10 subsurface and hairline surface 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.
- 3.7.4.2.3 Threads: There shall be no indications, except as permitted in 3.7.2.3:
- 3.7.4.2.4 Top of Head and End of Stem: The number of indications is not restricted, but the depth of any individual indication shall not exceed 0.010 inch, as shown by sectioning representative samples. No indication, except those of 3.7.4.2.1, shall break over an edge.
- 3.7.4.3 Fluorescent Penetrant Inspection Criteria: Parts inspected by fluorescent penetrant inspection shall be considered acceptable if 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 are within the following limits, provided the separation between indications is not less than 0.062 inch in all directions.
- 3.7.4.3.1 Sides of Head: There shall be not more than three indications per head. 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 0.031 inch or the equivalent of the basic thread height (see Table 2), whichever is less.
- 3.7.4.3.2 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.
- 3.7.4.3.3 Threads: There shall be no indications, except as permitted in 3.7.2.3.

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3.7.4.3.4 Top of Head and End of Stem: The number of indications is not restricted, but the depth of any individual indication shall not exceed 0.010 inch, as shown by sectioning representative samples. No indication, except those of 3.7.4.3.1, 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 as 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 4.

4.4 Acceptance Test Sampling:

4.4.1 Material: In accordance with the applicable material specification.

4.4.2 Nondestructive Test - 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 5. The classification of dimensional characteristics shall be as specified in Table 6. All dimensional characteristics are considered defective when out of tolerance.

4.4.3 Nondestructive Inspection: A random sample shall be selected from each production inspection lot; the size of the sample shall be as specified in Table 5 and classified as in Table 6. 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.

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- 4.4.4 Destructive Tests: A random sample shall be selected from each production inspection lot; the size of the sample shall be as specified in Table 7. The sample units may be selected from those that have been subjected to and passed the nondestructive tests and the nondestructive inspection, with additional units selected at random from the production inspection lot as necessary.
- 4.4.5 Acceptance Quality: Of random samples tested, acceptance quality shall be based on zero defectives.
- 4.4.6 Test Specimens: Specimens for tensile testing of machined test specimens shall be of standard proportions in accordance with ASTM E 8 with either 0.250 inch 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 0.750 inch and under in nominal diameter, from the center of coupons 0.800 inch 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 mechanical properties and stating that the parts conform to the other technical requirements. This report shall include the purchase order number, AS7473, 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 may perform corrective action to screen out or rework the defective parts, and resubmit for acceptance tests inspection as in Table 4. Resubmitted lots shall be clearly identified as reinspected lots.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

- 5.1.1 Parts having different part numbers shall be packed in separate containers.
- 5.1.2 Each container of parts shall be marked to show not less than the following information:

FASTENERS, ROLL THREADED
AS7473
PART NUMBER
LOT NUMBER
PURCHASE ORDER NUMBER
QUANTITY
MANUFACTURER'S IDENTIFICATION

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- 5.1.3 Threaded fasteners shall be suitably protected from abrasion and chafing during handling, transportation, and storage.
- 5.1.4 Containers of parts shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery.
- 5.1.5 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-2073-1, industrial packaging, unless Level A is specified in the request for procurement.

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 Direct U.S. Military Procurement:

Purchase documents should specify the following:

Title, number, and date of this specification
Part number of parts desired
Quantity of parts desired
Level A packaging, if required (see 5.1.5)

8.2 Key Words:

Bolts, Screws, 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.

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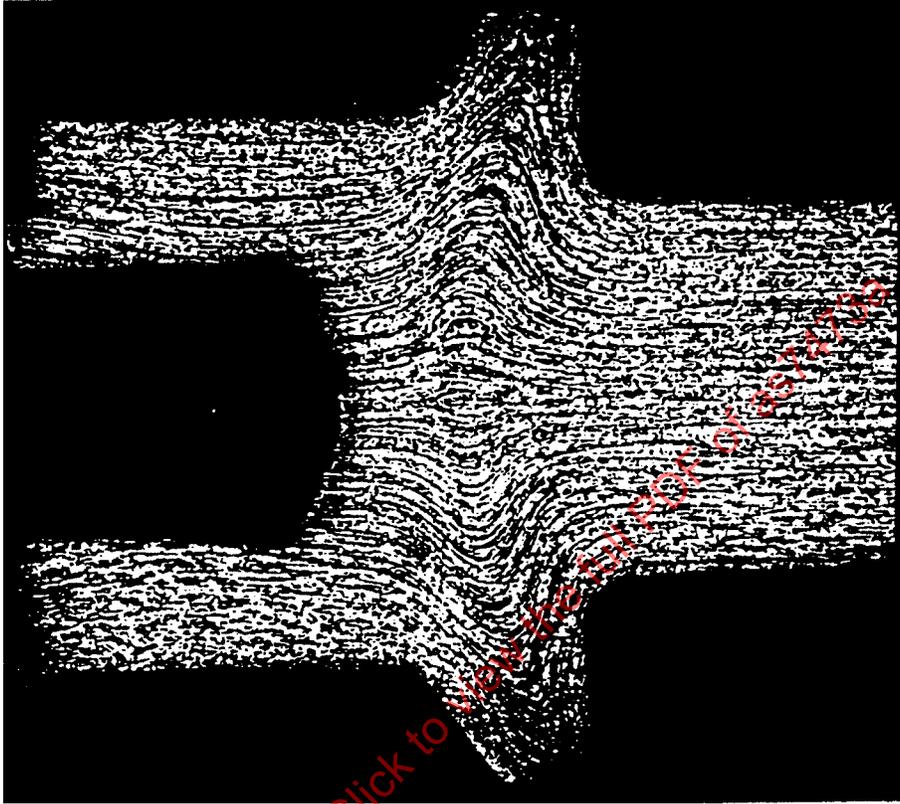


FIGURE 1A - Satisfactory Grain Flow

Showing a smooth, well formed grain flow following the contour of the under head fillet radius.

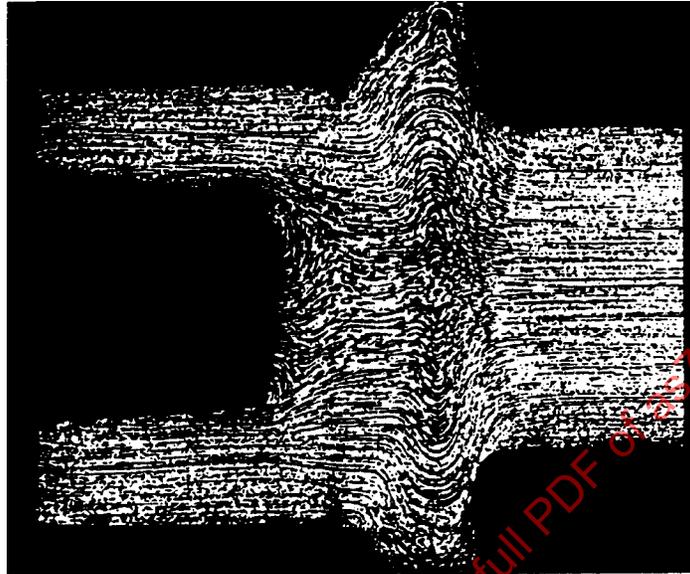


FIGURE 1B - Minimum Acceptable Standard

Showing maximum permissible cutting of grain flow after machining to remove contamination oxide.

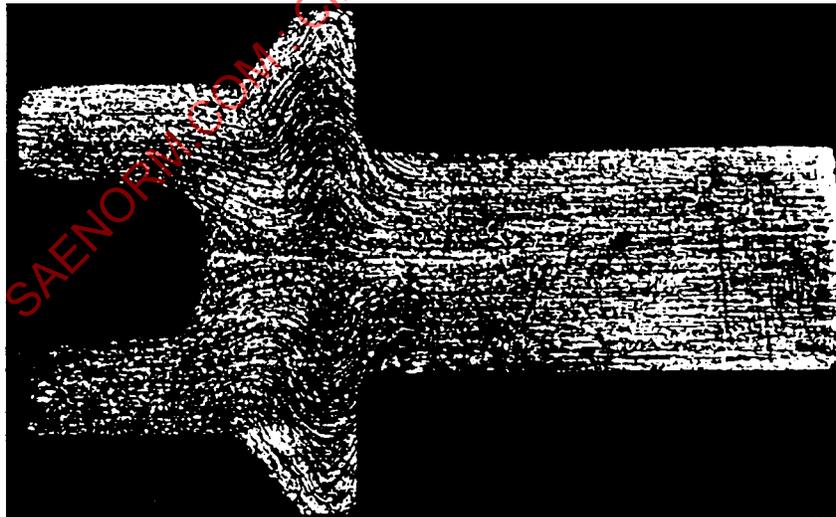
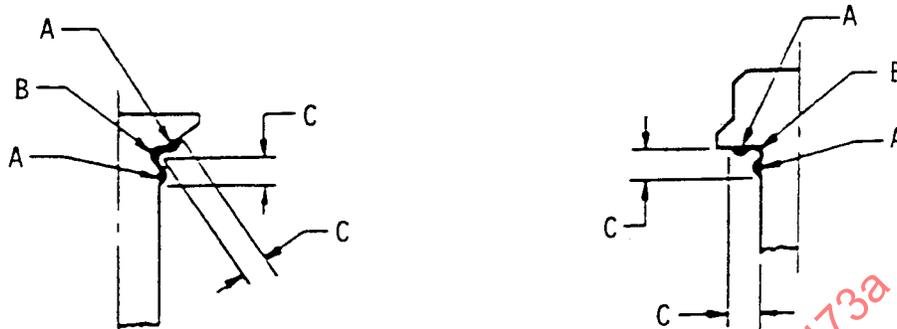


FIGURE 1C - Unacceptable Grain Flow

Showing excessive cutting of grain flow in the shank, fillet and bearing surface which is not permissible.

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Nominal Bolt Diameter, inch	C max inch
Up to 0.3125, excl	0.062
0.3125 and 0.375	0.094
0.4375 to 0.625, incl	0.125
0.750 to 1.000, incl	0.156
Over 1.000	0.188

FIGURE 2 - Permissible Distortion From Fillet Working



FIGURE 3 - Flow Lines, Rolled Thread

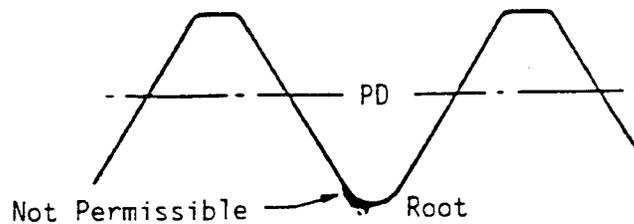


FIGURE 4 - Root Defects, Rolled Thread

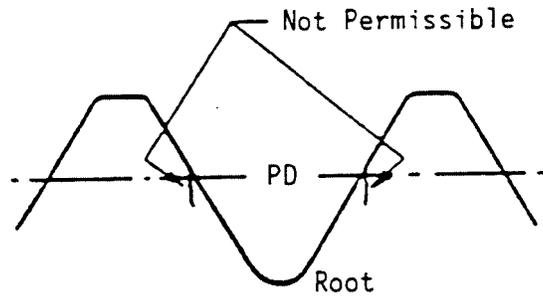


FIGURE 5 - Laps Below PD Extending Toward Root, Rolled Thread

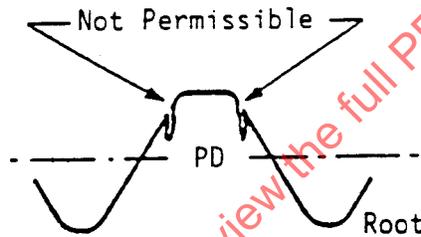


FIGURE 6 - Laps Above PD Extending Toward Root, Rolled Thread

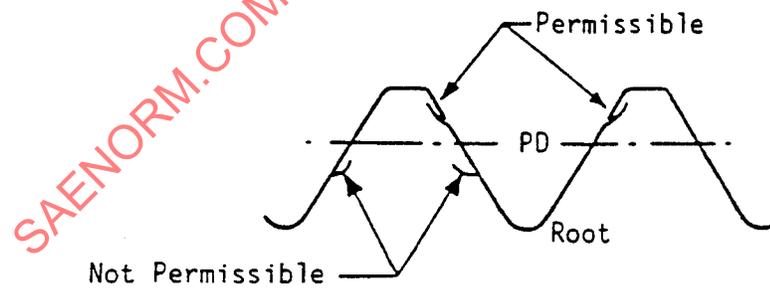
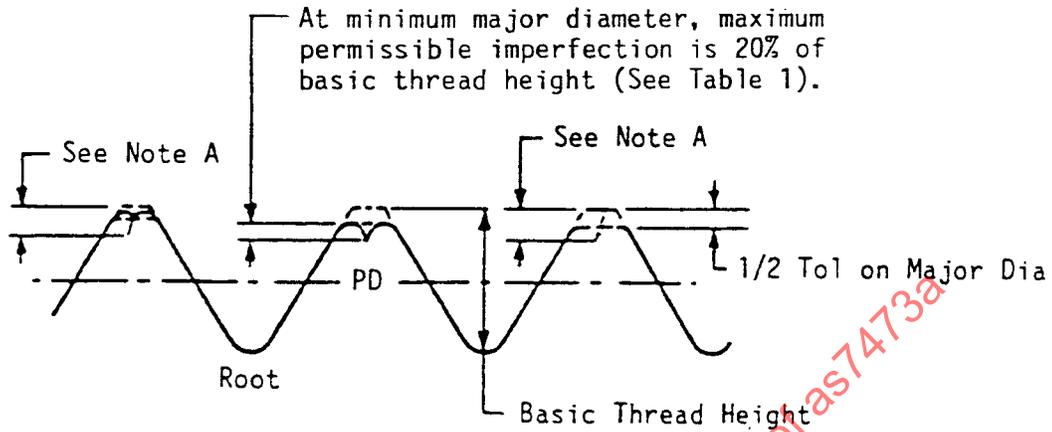


FIGURE 7 - Laps Extending Towards Crest, Rolled Thread

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

FIGURE 8 - Crest Craters and Crest Laps, Rolled Thread