SAE INTERNATIONAL

AEROSPACE STANDARD

AS7475™ REV. E

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Revised 2020-11

Superseding AS7475D

(R) Bolts, Cobalt-Chromium-Nickel Alloy, UNS R30159, Tensile Strength 260 ksi, Procurement Specification

FSC 5306

RATIONALE

AS6416 added, many paragraphs updated or deleted, specs updated, photo of bolt head deleted, figures redrawn, notes updated, usage note added.

1. SCOPE

This procurement specification covers bolts made from a corrosion-resistant, work-strengthened, cobalt-chromium-nickel alloy of the type identified under the Unified Numbering System as UNS R30159.

1.1 Type

The following specification designations and their properties are covered:

AS7475 260 ksi minimum ultimate tensile strength at room temperature
205 ksi minimum ultimate tensile strength at 1100 °F
140 ksi stress-rupture strength at 1100 °F
135 to 13.5 ksi tension fatigue at room temperature

AS7475-1 260 ksi minimum ultimate tensile strength at room temperature
132 ksi minimum ultimate shear strength at room temperature

1.2 Application

Primarily for use in aerospace propulsion system bolt applications where an excellent combination of strength, creep, fatigue, and relaxation resistance is required.

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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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For more information on this standard, visit
https://www.sae.org/standards/content/AS7475E

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

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

AMS5842	Cobalt-Nickel Alloy, Corrosion and Heat Resistant, Bars, 19Cr - 36Co - 25Ni - 7.0Mo - 0.50Cb (Nb) - 2.9Ti - 0.20Al - 9.0Fe, Vacuum Induction Plus Vacuum Consumable Electrode Melted Solution Heat Treated and Work Strengthened
AS1132	Bolts, Screws, and Nuts - External Wrenching UNJ Thread, Inch - Design Standard
AS3062	Bolts, Screws, and Studs, Screw Thread Requirements
AS3063	Bolts, Screws, and Studs, Geometric Control Requirements
AS3658	Bolt, Machine - Double Hexagon Extended Washer Head, Close Tolerance Shank, Cobalt-Nickel Alloy, UNS R30159, 260 ksi Min
AS3659	Bolt, Machine - Double Hexagon Extended Washer Head, Drilled, Close Tolerance Shank, Cobalt-Nickel Alloy, UNS R30159, 260 ksi Min
AS6416	Bolts, Screws, Studs, and Nuts, Definitions for Design, Testing, and Procurement
AS8879	Screw Threads - UNJ Profile, Inch, Controlled Radius Root with Increased Minor Diameter

2.1.2 ASTM Publications

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

ASTM D3951	Standard Practice for Commercial Packaging
ASTM E8/E8M	Standard Methods for Tension Testing of Metallic Materials
ASTM E21	Elevated Temperature Tension Tests of Metallic Materials
ASTM E112	Determining Average Grain Size
ASTM E139	Conducting Creep, Creep-Rupture, and Stress-Rupture Tests in Metallic Materials
ASTM E140	Standard Hardness Conversion Tables for Metals
ASTM E1417/E1417M	Standard practice for Liquid Penetrant Examination

2.1.3 AIA/NAS Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NASM1312-6 Fastener Test Methods, Method 6, Hardness

NASM1312-8 Fastener Test Methods, Method 8, Tensile Strength

NASM1312-10 Fastener Test Methods, Method 10, Stress-Rupture

NASM1312-11 Fastener Test Methods, Method 11, Tension Fatigue

NASM1312-13 Fastener Test Methods, Method 13, Double Shear Test

NASM1312-18 Fastener Test Methods, Method 18, Elevated Temperature Tensile Strength

2.1.4 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

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

2.2 Definitions

Refer to AS6416.

2.3 Unit Symbols

°F degree Fahrenheit

% percent (1% = 1/100)

lbf pounds force

ksi kips (1000 pounds) per square inch

sp gr specific gravity

HRC hardness, Rockwell C scale

3. TECHNICAL REQUIREMENTS

3.1 Material

Shall be AMS5842 alloy heading stock.

3.2 Design

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

3.2.1 Dimensions

The dimensions shall conform to the part drawing, unless otherwise stated. Dimensions apply after plating but before lubrication.

3.2.2 Surface Texture

Surface texture of finished parts, prior to plating or coating, shall conform to the part drawing, determined in accordance with ASME B46.1.

3.2.3 Threads

Threads and dimensions shall be in accordance with AS8879, unless otherwise specified on the part drawing.

3.2.3.1 Incomplete Lead and Runout Threads

Incomplete runout and lead threads are permissible as specified in AS3062.

3.2.3.2 Chamfer

Bolts 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, in accordance with AS3063.

3.3 Fabrication

3.3.1 Blanks

Heads shall be formed by hot or cold forging; machined heads are not permitted, except lightening holes and wrenching recess 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 Heat Treatment

Before finishing the shank and bearing surface of the head, cold working the head-to-shank fillet radius, and rolling the threads, headed blanks shall be aged by heating to a temperature within the range 1200 to 1250 °F, holding at the selected temperature within ±25 °F for 4 to 4.5 hours, and cooling at a rate equivalent to air cooling.

3.3.3 Oxide Removal

Surface oxide resulting from prior heat treatment shall be removed from the full body diameter, thread roll diameter and bearing surface of the head of the solution heat treated, work-strengthened, and aged blanks prior to cold working the fillet radius and rolling the threads by a method such as centerless grinding. The oxide removal process shall produce no intergranular attack or corrosion of the blanks.

3.3.4 Cold Working of Fillet Radius

After removal of oxide as in 3.3.3, the head-to-shank fillet radius of headed parts having the radius complete throughout the circumference of the part shall be cold worked. The fillet shall be cold worked sufficiently to remove all visual evidence of grinding or tool marks. If there is no visual evidence of grinding or tool marks prior to cold working, the fillet shall still be cold worked. Distortion due to cold working shall conform to Figure 1, 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 1; distorted areas shall not extend beyond “C,” as shown in Figure 1.

3.3.4.1 Undercut Bolt Heads

In configurations having an undercut connected with the fillet radius, the cold working will be required only for 90 degrees of fillet arc, starting at the point of tangency of the fillet radius and the bearing surface of the head.

3.3.4.2 Shouldered Bolts

For shouldered bolts, having an unthreaded shank diameter larger than the thread major diameter and having an undercut connected with a fillet between the threaded shank and the shoulder of the unthreaded shank, the cold working will be required only for 90 degrees of the fillet arc, starting at the point of tangency of the fillet radius and the shouldered surface of the unthreaded shank.

3.3.4.3 Close Tolerance Bolts

The shank diameter on full shank close tolerance bolts shall not exceed its maximum diameter limit after cold rolling the head to shank fillet radius.

3.3.5 Thread Rolling

Thread shall be formed on the finished blanks by a single cold rolling process after removal of oxide as in 3.3.3.

3.3.6 Cleaning

Parts, after finishing, shall be cleaned in one of the following solutions for the time and temperature shown and then thoroughly rinsed.

a. One volume of nitric acid (sp gr 1.42) and nine volumes of water for not less than 20 minutes at room temperature.

b. One volume of nitric acid (sp gr 1.42) and four volumes of water for 30 to 40 minutes at room temperature.

c. One volume of nitric acid (sp gr 1.42) and four volumes of water for 10 to 15 minutes at 140 to 160 °F.

d. ASTM A967, ASTM A380, or AMS2700 for cleaning parts only, excluding any additional verification requirements (such as salt spray).

3.4 Plating or Coating

Where required, bolts shall be plated or coated as specified by the part drawing. Where coating with solid film lubricants is required, the underhead bearing surface, the unthreaded shank, and the threads shall be coated as specified on the part drawing; other surfaces are optional to coat, unless otherwise specified. Plating or coating thickness shall be determined in accordance with the requirements in the applicable plating or coatings specification.

3.5 Mechanical Properties

Bolts for tensile tests and fatigue tests shall be of sufficient size to develop the full strength of the bolt without stripping the thread. The loaded portion of the shank shall have two to three full threads from the thread runout exposed between the loading fixtures during tensile test.

AS7475 finished parts shall be tested in accordance with the following test methods:

a. Hardness: MIL-STD-1312-6 in accordance with NASM1312-6.

b. Ultimate tensile strength at room temperature: MIL-STD-1312-8 in accordance with NASM1312-8.

c. Ultimate tensile strength at 1100 °F: MIL-STD-1312-18 in accordance with NASM1312-18.

d. Stress-rupture strength at 1100 °F: MIL-STD-1312-10 in accordance with NASM1312-10.

e. Fatigue strength at room temperature: MIL-STD-1312-11 in accordance with NASM1312-11.

AS7475-1 finished parts shall be tested in accordance with the following test methods:

a. Hardness: MIL-STD-1312-6 in accordance with NASM1312-6.

b. Ultimate tensile strength at room temperature: MIL-STD-1312-8 in accordance with NASM1312-8.

c. Ultimate double shear at room temperature: MIL-STD-1312-13 in accordance with NASM1312-13.

3.5.1 Ultimate Tensile Strength at Room Temperature

3.5.1.1 Finished Parts

Tension fasteners with either standard double hexagon or spline drive heads having a minimum metal condition in the head equal to the design parameters specified in AS1132 (260 ksi configuration) shall not fracture in the head-to-shank fillet radius, except when this radius is connected with an undercut or with a shank diameter less than the minimum pitch diameter of the thread.

3.5.1.2 Machined Test Specimens

If the size and the 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 E8/E8M on specimens prepared as in 3.5.4.2. Specimens may be required by the purchaser to perform confirmatory tests. Such specimens shall meet the following room temperature requirements:

a. Ultimate tensile strength, minimum: 260 ksi

b. Yield strength at 0.2% offset, minimum: 230 ksi

c. Elongation in 4D, minimum: 6%

d. Reduction of area, minimum: 22%

3.5.2 Ultimate Tensile Strength at 1100 °F

3.5.2.1 Finished Parts

Tension bolts, such as double hexagon and spline drive heads, heated to 1100 °F, held at heat for 20 minutes before testing, shall have an ultimate tensile load not lower than that specified in Table 2 and shall be tested to failure in order to observe fracture location, first measuring and recording the maximum tensile load achieved. If size and shape of the part is such that failure would occur outside the threaded section but 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 have an ultimate tensile strength not lower than 205 ksi; for such parts, the diameter of the area on which stress is based shall be the actual measured minimum diameter of the part. Tension fasteners with either standard double hexagon or spline drive heads having a minimum metal condition in the head equal to the design parameters in AS1132 shall not fracture in the head-to-shank fillet radius, except when this radius is connected with an undercut or with a shank diameter less than the minimum pitch diameter of the thread.

3.5.2.2 Machined Test Specimens

If the size and the 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 E21 on specimens prepared as in 3.5.4.2. Specimens may be required by the purchaser to perform confirmatory tests. Such specimens shall meet the following requirements when heated to 1100 °F ± 10 °F, held at heat for 20 minutes before testing, and tested at 1100 °F ± 10 °F.

a. Ultimate tensile strength, minimum: 205 ksi

b. Yield strength at 0.2% offset, minimum: 190 ksi

c. Elongation in 4D, minimum: 5%

d. Reduction in area, minimum: 15%

3.5.3 Hardness

Shall be not lower than 44 HRC (see 8.1), but hardness of the threaded section and of the head-to-shank fillet area may be higher than other areas as a result of the cold working operations. Bolts shall not be rejected on the basis of hardness if the tensile strength properties are met.

3.5.4 Stress-Rupture Strength at 1100 °F

3.5.4.1 Finished Parts

Finished tension bolts, maintained at 1100 °F ± 3 °F while the stress rupture load load specified in Table 2 is applied continuously, shall not rupture in less than 23 hours. If the shank diameter of the bolt is less than the maximum minor (root) diameter of the thread but the bolt can be tested satisfactorily, bolts shall conform to the requirements of 3.5.4.1.1.

3.5.4.1.1 Bolts having a shank diameter less than the maximum minor (root) diameter of the thread shall be tested as in 3.5.4.1, except that the load shall be as specified in 3.5.4.2. The diameter of the area on which the stress is based shall be the actual measured minimum diameter of the bolt.

3.5.4.2 Machined Test Specimens

If the size and shape of the bolt is such that a stress-rupture test cannot be made on the bolt, a test specimen prepared as in 3.5.4.2, maintained at 1100 °F ± 3 °F while a load sufficient to produce an initial stress of 140 ksi is applied continuously, shall not rupture in less than 23 hours. Tests shall be conducted in accordance with ASTM E139. Specimens may be required by purchaser to perform confirmatory tests.

3.5.5 Fatigue Strength

Finished tension bolts tested in tension-tension fatigue at room temperature with maximum load specified in Table 2 and minimum load equal to 10% of the maximum load shall have an average life of not less than 65000 cycles with no part having life less than 45000 cycles. Tests need not be run beyond 130000 cycles. Life of parts which do not fail in less than 130000 cycles shall be taken as 130000 cycles for purposes of computing average life. If the shank diameter of the bolt is less than the minimum pitch diameter of thread, bolts shall withstand fatigue testing as above using loads sufficient to produce a maximum stress of 135 ksi and a minimum stress of 13.5 ksi. The above requirements apply to tension bolts, such as double hexagon and spline drive heads per design parameters specified in AS1132, 0.190 inch and larger in nominal thread size, having a head-to-shank fillet radius equal to or larger than that specified in AS1132, and not having an undercut; for all parts to which the above requirements do not apply, fatigue test requirements shall be as specified on the part drawing. Fatigue testing not required for bolts having a nominal grip length of less than two times the nominal diameter or threads with lockwire holes.

3.5.6 Ultimate Shear Strength

Finished bolts having a close toleranced full shank as in AS1132 shall have an ultimate double shear load no lower than that specified in Table 2. The double shear test may be discontinued after the ultimate double shear load has been reached, recording the load achieved. Shear bolts having special shank diameters shall have the double shear load based on 132 ksi shear strength. Shear tests are not required for the following conditions:

a. Bolts threaded to head.

b. Protruding head bolts having coarse toleranced full shank.

c. Protruding head bolts having PD or relieved shank.

3.6 Quality

Parts shall be uniform in quality and condition, free from burrs, foreign materials, and from imperfections detrimental to the usage of the parts.

3.6.1 Macroscopic Examination, Headed Blanks

A specimen from a headed blank shall be etched and examined at a magnification of 20X or greater to determine conformance to the requirements of 3.6.1.1 and 3.6.1.2.

3.6.1.1 Flow Lines

After heading, examination of an etched section taken longitudinally through the blank shall show flow lines or heat pattern in the shank, head-to-shank fillet, and the bearing surface, which are representative of a forging process and follow the head contour.

3.6.1.2 Internal Imperfections

Examination of longitudinal sections of the head and shank shall reveal no cracks, laps, or porosity.

3.6.2 Microscopic Examination, Finished Parts

Specimens from finished parts shall be polished, etched in Kalling's reagent, Marble's reagent, or other suitable etchant, and examined at 100X magnification to determine conformance to the requirements of 3.6.2.1, 3.6.2.2, 3.6.2.3, 3.6.2.4, and at 200X magnification to determine conformance to the requirements of 3.6.2.4.

3.6.2.1 Internal Imperfections

Examination of longitudinal sections shall reveal no cracks, laps, or porosity. Thread imperfections shall conform to the requirements of 3.6.2.4.

3.6.2.2 Microstructure

Parts shall have distorted grain structure indicative of cold worked material free from recrystallization in the areas other than the head.

3.6.2.3 Grain Size

The grain size in areas other than the head, shall be ASTM No. 4 or finer, with up to 15% of the area as large as ASTM No. 2, as determined by comparison of a polished and etched specimen with the charts in ASTM E112. In case of disagreement on the average grain size by the comparison method, the intercept (Heyn) procedure shall be used.

3.6.2.4 Threads

3.6.2.4.1 Root imperfections such as laps, seams, notches, slivers, folds, roughness, and oxide scale are not permissible (see Figure 3).

3.6.2.4.2 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 4 and 5).

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 0.0005 inch length or depth when viewed at 200X magnification.

3.6.2.4.4 There shall be no laps along the flank of the thread below the pitch diameter (see Figure 4). A single lap is permissible along the flank of the thread above the pitch diameter on either the pressure or non-pressure flank (one lap at any cross-section through the thread), provided it extends towards the crest and generally parallel to the flank (see Figure 4).

3.6.2.4.5 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 7). 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 1 may be increased by 1/2 of the difference between the minimum major diameter and the actual major diameter as measured on the part.

3.6.3 Fluorescent Penetrant Inspection

Prior to any required coating, parts shall be subject to fluorescent penetrant inspection in accordance with ASTM E1417/E1417M Type 1, Sensitivity Level 2 minimum for 100% of parts. Any discontinuity to be reviewed by a metallurgist or skilled metallographer.

3.6.3.1 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 2H/3 thread depth (see Table 1), whichever is less.

3.6.3.2 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.

3.6.3.3 Threads

There shall be no indications, except as permitted in 3.6.2.4. Rateable lap indications shall conform to 3.6.2.4.3.a.

3.6.3.4 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, 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 Classification of Tests

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.

4.3 Acceptance Test Sampling

4.3.1 Material

Sampling for material composition on each heat shall be in accordance with AMS5842.

4.3.2 Nondestructive Test - Visual and Dimensional

A random sample 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 non-conforming when out of tolerance.

4.3.3 Fluorescent Penetrant Inspection

All parts to be tested by fluorescent penetrant inspection.

4.3.4 Stress-Rupture Tests

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

4.3.5 Macroscopic Examination

A random sample shall be selected from eachproduction Inspection lot; the size of the sample shall be as specified in Table 6.

4.3.6 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.

4.3.7 Acceptance Quality

Of random samples tested, acceptance quality shall be based on zero non-conformances.

4.3.8 Test Specimens

Specimens for tensile testing of machined specimens shall be of standard proportions in accordance with ASTM E8/E8M. 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 less than 0.800 inch in nominal diameter, or from mid-radius of larger parts or coupons.

4.4 Periodic Test Sampling

As agreed upon by purchaser and vendor.

4.5 Reports

The vendor of parts shall furnish with each shipment a report for all teats. This report shall include the purchase order number, AS7475 and revision letter, lot number, contractor or other direct supplier of material, part number, nominal size, and quantity.

4.6 Rejected Lots

Failure of a non-destructive test requirement as specified in Table 3 will require vendor of parts to perform corrective action to screen out or rework the non-conforming parts and resubmit for acceptance tests inspection as in Table 3. 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 D3951.

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:

BOLTS, UNS R30159, 260 ksi
AS7475B (or AS7475-1B as applicable)
PART NUMBER
LOT NUMBER
PURCHASE ORDER NUMBER
QUANTITY
MANUFACTURER'S IDENTIFICATION

5.1.4 Threaded fasteners shall be protected from damage 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.

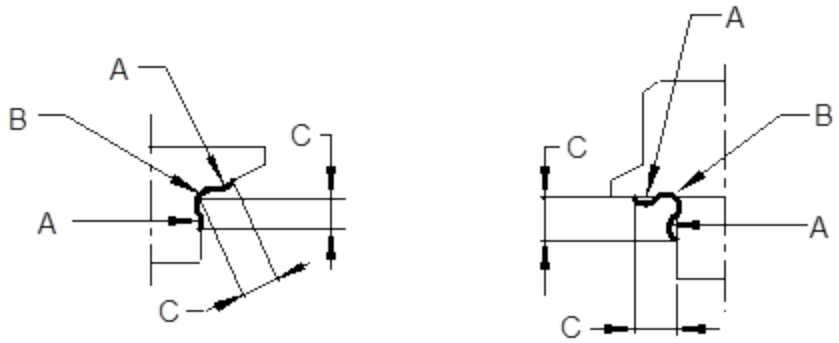
8. NOTES

8.1 Hardness Conversion Tables

Hardness conversion tables for metals are presented in ASTM E140.

8.2 Revision Indicator

A 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, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.



Nominal Bolt Diameter	C Max Inch
Up to .3125	.062
.3125 to .375	.094
.4375 to .625	.125
.750 to 1.000	.156
Over 1.000	.188

Figure 1 - Permissible distortion from fillet working

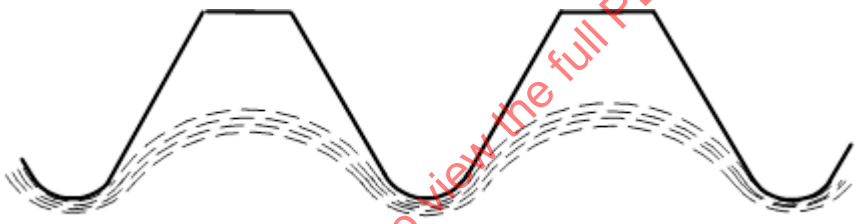


Figure 2 - Flow lines, rolled thread

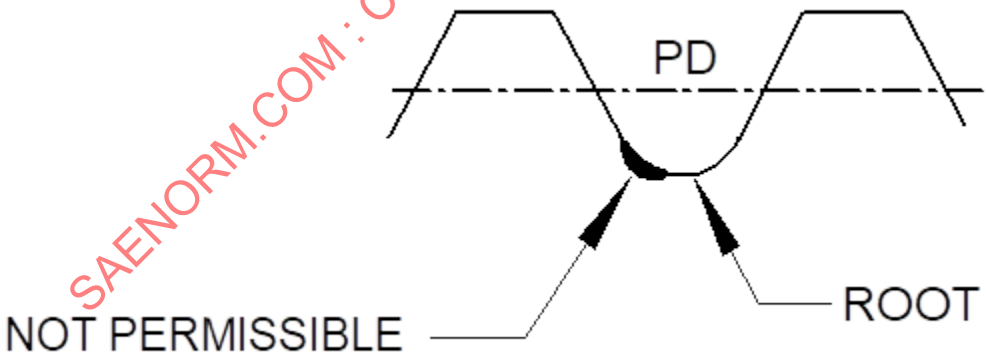


Figure 3 - Root defects, rolled thread

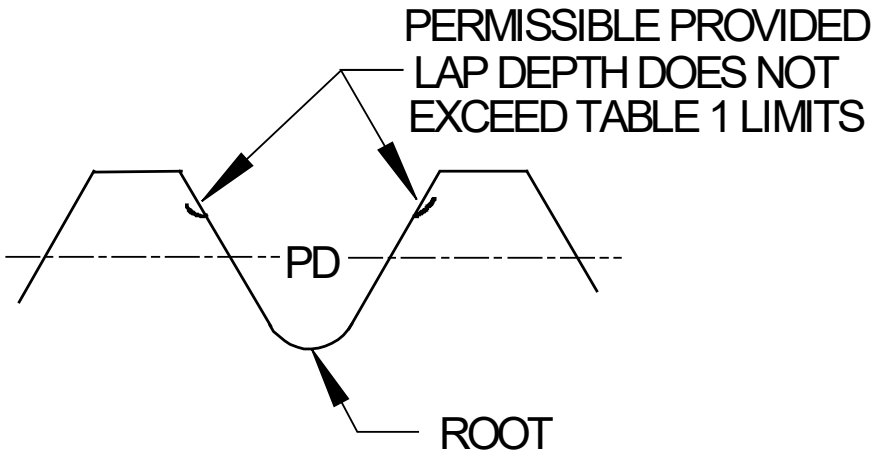


Figure 4 - Laps above pitch diameter extending towards crest, rolled thread

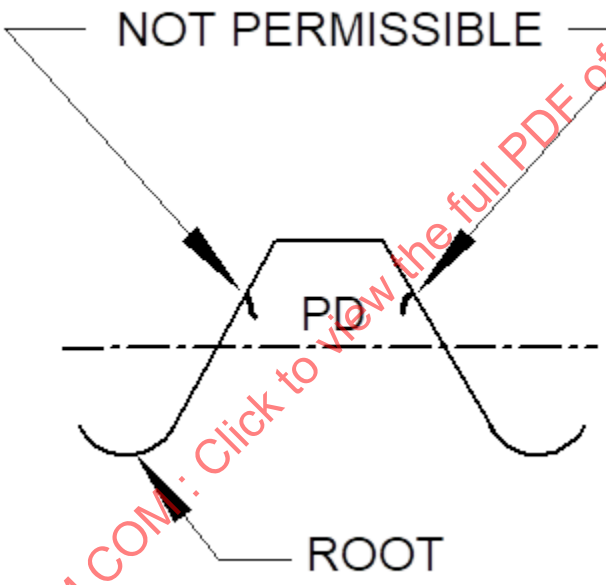


Figure 5 - Laps above pitch diameter extending towards root, rolled thread

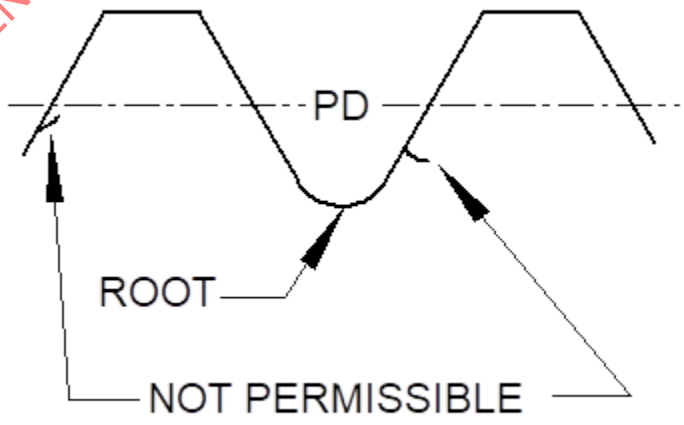
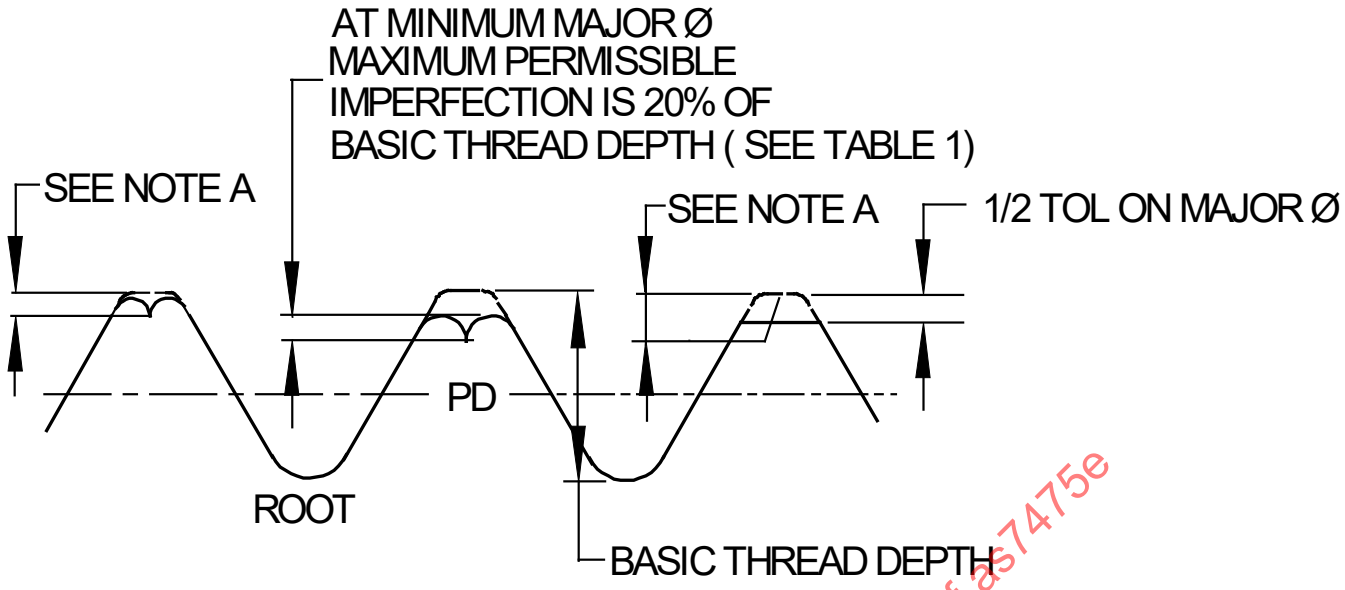


Figure 6 - Laps below pitch diameter extending in any direction, rolled thread



NOTE A
MAXIMUM DEPTH OF IMPERFECTION EQUALS 20% OF 2H/3 BASIC THREAD DEPTH PLUS 1/2 THE DIFFERENCE OF THE ACTUAL MAJOR DIAMETER AND MINIMUM MAJOR DIAMETER

Figure 7 - Crest craters and crest laps, rolled thread

Table 1 - UNJ external thread depth at 2H/3 and allowable thread lap depth

Thread Pitches Per Inch n	External Thread Depth at 2H/3 Ref inch	Allowable Thread Lap Depth /1/ inch
80	0.0072	0.0014
72	0.0080	0.0016
64	0.0090	0.0018
56	0.0100	0.0021
48	0.0120	0.0024
44	0.0131	0.0026
40	0.0144	0.0029
36	0.0160	0.0032
32	0.0180	0.0036
28	0.0206	0.0041
24	0.0241	0.0048
20	0.0289	0.0058
18	0.0321	0.0064
16	0.0361	0.0072
14	0.0412	0.0082
13	0.0444	0.0089
12	0.0481	0.0096
11	0.0525	0.0105
10	0.0577	0.0115
9	0.0642	0.0128
8	0.0722	0.0144

Note 1: Allowable lap depth is based on 20% of UNJ external thread depth at 2H/3 in accordance with AS8879, and is calculated as follows:

External thread depth = 2H/3 = (2/3) (cos 30°)/n = 0.57735/n

Lap depth = 0.2(2H/3) = 0.2(2/3) (cos 30°)/n = 0.11547/n