SAE Aerospace
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AEROSPACE STANDARD

SAE AS3062 | REV. C

Issued 1970-03
Revised 1979-09
Reaffirmed 2012-11

Superseding AS3062B

Bolts, Screws and Studs, Screw Thread Requirements

RATIONALE

AS3062C has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE AND FIELD OF APPLICATION:

1.1 This standard establishes the rolled thread element tolerances for lead, half-angle, taper, and out-of-roundness for studs used in aerospace construction; it also establishes the requirements for lead threads and runout threads for these studs.

1.2 This standard defines the requirements for runout threads and lead threads for bolt and screw rolled threads used in aerospace construction; it also specifies a referee method, by optical projection, for establishing conformity with these requirements which agree with ISO 3353.

1.3 The bolt and screw lead and runout thread requirements are also applicable to other externally threaded products where the threads are produced by rolling.

2. DEFINITIONS:

2.1 Full Thread:

A fully formed thread has a profile that follows the design profile, within the tolerance band limits, over an axial distance of 1 pitch (points A, B, C). See Figure 1.

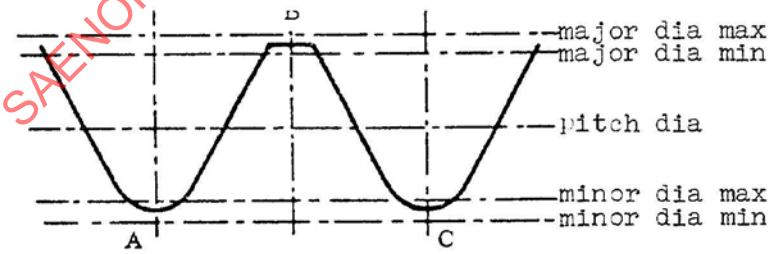

FIGURE 1

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http://www.sae.org/technical/standards/AS3062C

2.2 Thread Runout:

The thread runout is situated between the end of the plain portion of the shank (or the underhead fillet) and the first fully formed thread root, where the minor diameter is not greater than the maximum minor diameter. See Figures 2A and 2B.

2.2.1 For full shank fasteners, the runout X shall comprise the incomplete threads imparted by the thread rolling die plus an unrolled portion of the blank diameter from which the thread is rolled. See Figure 2A.

2.2.2 For pitch diameter shank fasteners, the runout X comprises only of incomplete threads, and will not extend into the underhead fillet radius. See Figure 2B.

2.3 Incomplete Lead Threads:

The incomplete lead threads are situated between the end of the fastener and the first fully formed thread, where the diameter at the crest is not less than the minimum major diameter. See Figure 3.

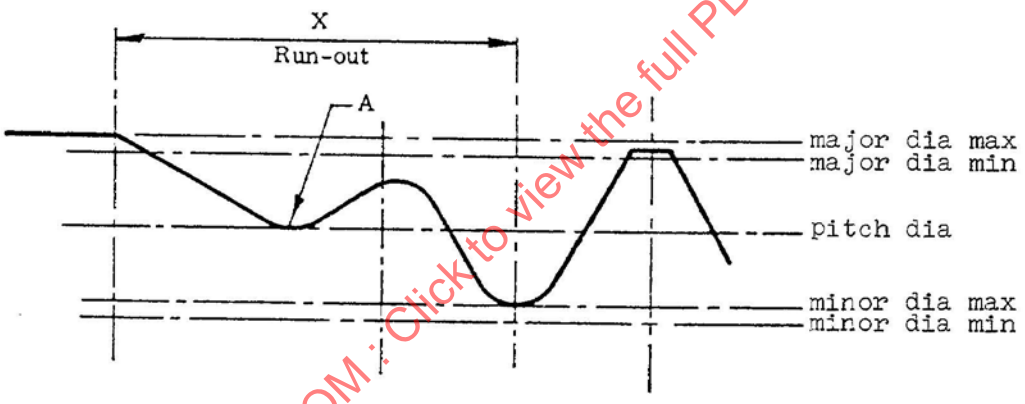

FIGURE 2A. Full Shank Fasteners

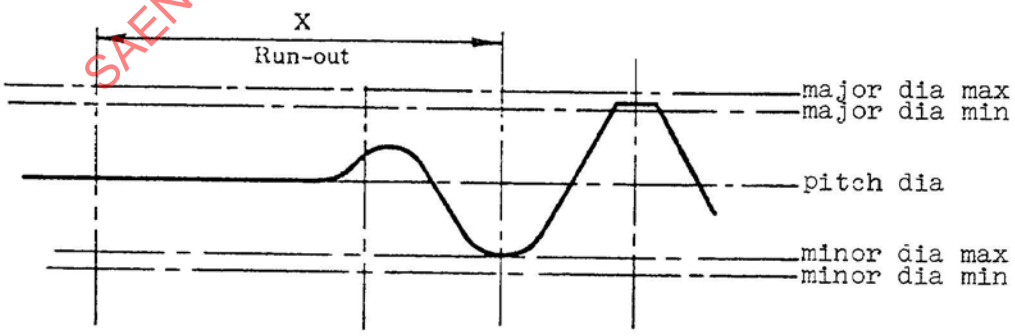

FIGURE 2B. Pitch Diameter Shank Fasteners

2.3.1 Ineffective Lead Threads: The ineffective lead threads are situated between the end of the fastener and the first effective thread, where the pitch diameter of the pressure flank of the thread corresponds with the minimum pitch diameter at that point. See Figure 3.

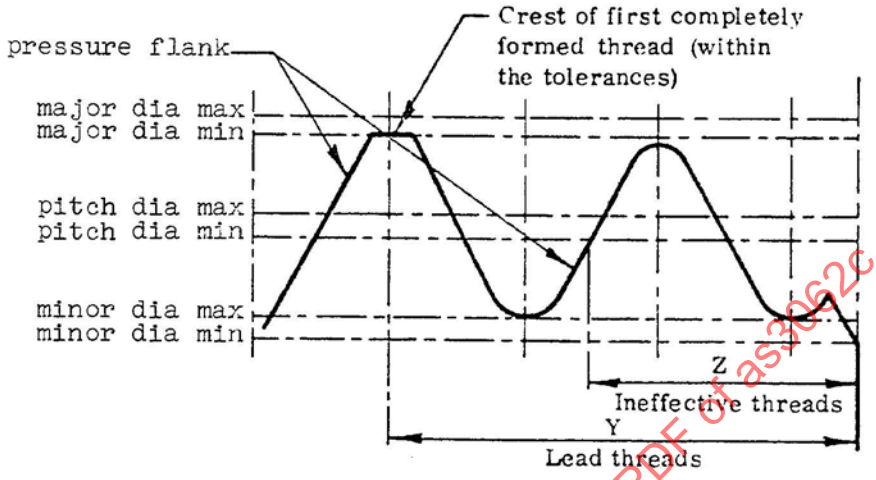

FIGURE 3

3. TECHNICAL REQUIREMENTS:

3.1 Threads shall be as specified on the part drawing. External rolled threads shall also meet the applicable requirements specified herein.

3.2 Special Stud End Threads:

The special stud end threads for interference fit, UN or UNJ inch thread forms and MJ metric thread form, shall meet the following requirements.

3.2.1 Stud Thread Element Tolerances: Pitch diameter limits of the full threads on the stud end shall be as specified on the part drawing.

3.2.1.1 Lead and Half-Angle Deviations: Where no tolerance class is specified on the part drawing, tolerances for lead and half-angle of the stud end threads shall be as specified in Table I.

TABLE I - Lead & Half-Angle Deviations

UN & UNJ Threads Per Inch	Lead Deviation (See Note 1)	Half-Angle Deviation		MJ Thread Pitch	Lead Deviation (See Note 1)	Half-Angle Deviation	
	Inch	Deg	Min	mm	µm	Deg	Min
32	0.0003	0	37	0.8	7	0	37
28	0.0003	0	35	1	8	0	33
24	0.0003	0	33	1.25	10	0	30
20	0.0004	0	30	1.5	11	0	30
18	0.0004	0	31	1.75	13	0	29
16	0.0005	0	29	2	15	0	28
14	0.0005	0	29	2.5	18	0	26
13	0.0005	0	28	3	20	0	25
12	0.0006	0	28				
11	0.0006	0	26				
10	0.0007	0	26				
9	0.0007	0	25				
8	0.0008	0	25				

Note 1. Lead deviation between any 2 threads not farther apart than the length of stud end thread including the lead threads.

3.2.1.2 Taper: The pitch cylinder of all full threads on the stud end (see Figure 4) shall not taper more than 0.0005 inch per inch for UN and UNJ threads and 13 µm per 25 mm for MJ threads and, if tapered, the smaller diameter shall be at the entering end of the stud. Taper variations shall fall within diameter limits specified on the part drawing.

3.2.1.3 Out-of-Roundness: Out-of-roundness of the pitch cylinder of the stud end full threads shall not exceed 0.0005 inch FIM for UN and UNJ threads and 13 µm FIM for MJ threads. Roundness variations shall fall within pitch diameter limits specified on the part drawing.

3.2.2 Stud Lead Threads: Where tapered lead threads are required, as illustrated in Figure 4, the pitch diameter of the lead threads on the stud end shall originate from the stud pitch diameter of full threads and continue, decreasing for a distance B specified in Table II. See Figure 5.

3.2.2.1 The minimum lead thread length on the stud end is controlled by the number of turns that the stud will enter a lead thread ring gage or gage of equivalent accuracy made to the maximum pitch diameter of the lead threads specified on the part drawing; the number of such turns shall be not less than 1 nor more than 2.

3.2.2.2 Any variation in lead (pitch) shall be in the same relative direction on the lead threads of the stud end as on the full threads of the stud end.

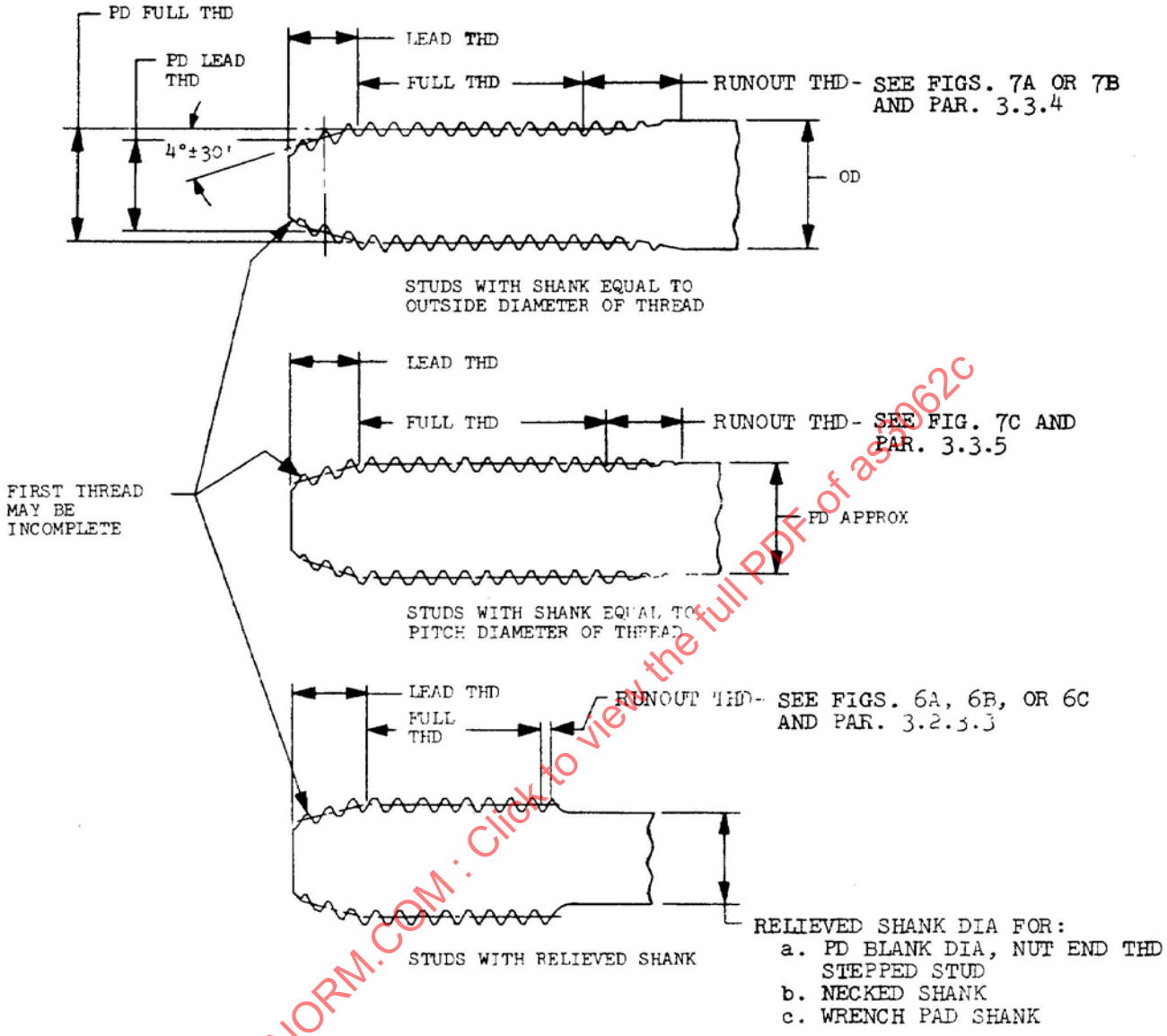

FIGURE 4. Stud End
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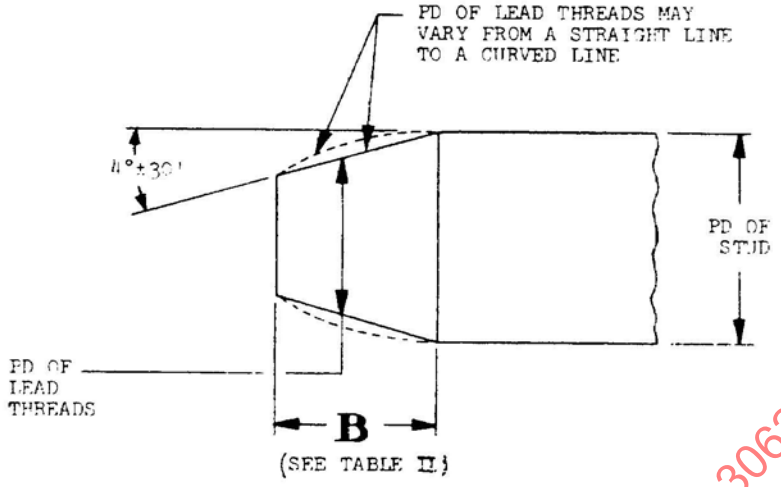

FIGURE 5
For Illustrative Purposes Only

TABLE II - Length of Lead Threads

UN & UNJ Threads Per Inch	B, Max	MJ Thread Pitch	B, Max
	Inch	mm	mm
32	0.09	0.8	2.4
28	0.11	1	3
24	0.13	1.25	3.75
20	0.15	1.5	4.5
18	0.17	1.75	5.25
16	0.19	2	6
14	0.21	2.5	7.5
13	0.23	3	9
12	0.25		
11	0.27		
10	0.30		
9	0.33		
8	0.38		

3.2.3 Stud Thread Runout: See Figure 4.

3.2.3.1 Full Shank Studs: The thread runout for full shank studs shall be as specified in 3.3.4.

3.2.3.2 Pitch Diameter Shank Studs: The thread runout, for studs having a shank diameter equivalent to the pitch diameter of the stud end full threads, shall be as specified in 3.3.5.

3.2.3.3 Relieved Shank Studs: The thread runout profiles for relieved shank studs are shown in Figures 6A, 6B, and 6C. The root diameter of the runout thread shall be equal to the root diameter of the full thread for an axial length equal to 1 pitch minimum and 2 pitches maximum; the remainder of the thread runout root shall gradually vanish within an axial length of 0.5 pitch. The crest of the runout thread shall taper towards the shank, starting from the end of the full thread.

3.3 Bolts, Screws and Stud Threads, UN, UNJ, & MJ Thread Forms:

Clearance fit stud end threads, having standard threads, shall have thread runout and lead thread requirements the same as for bolts.

3.3.1 Crest Deviations: Slight deviations from thread contour on bolts, screws and stud threads are permissible at the crest of the thread within the major diameter limits as shown in Figure 7 and at the incomplete thread at each end of the threaded section. The general "break edge" note on drawings does not apply to the crest of the thread; sharp edges (without burrs and feather edges) at this location are permissible. Any operation to remove burrs from the thread should not break the edge more than 0.003 inch radius for UN and UNJ threads and 0.08 mm radius for MJ threads.

3.3.2 Locking Holes: Parts having holes for locking devices are permitted to have slight ovalization of the hole and the countersink and slight flattening of the crest of the thread at the countersink, provided the diameter of the hole is within specified tolerances.

3.3.3 Incomplete Lead Threads: Except for lead threads on the stud end thread as in 3.2.2, the incomplete lead threads Y shall not be greater than 2 thread pitches from the end of the fastener including chamfers. See Figure 3.

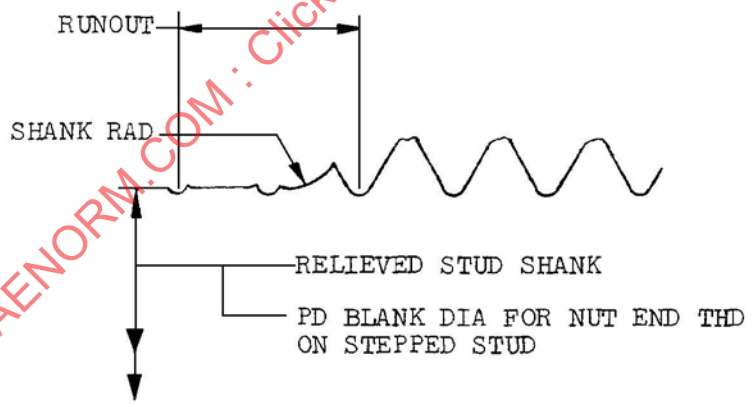

FIGURE 6A

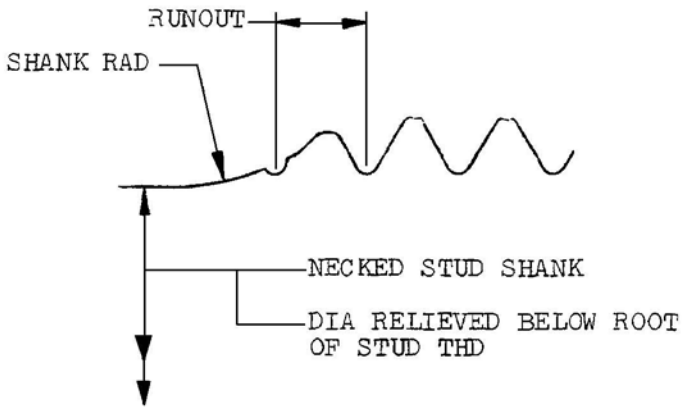

FIGURE 6B

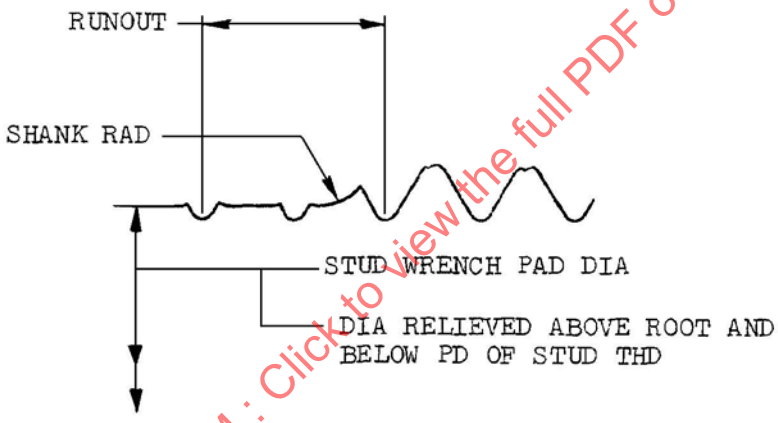

FIGURE 6C

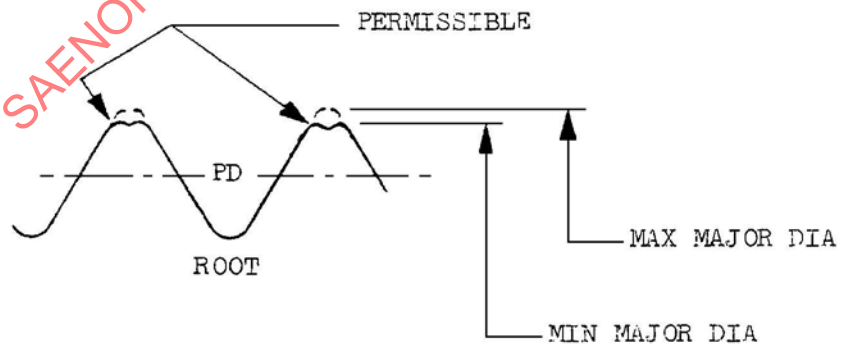

FIGURE 7 - Rolled Thread

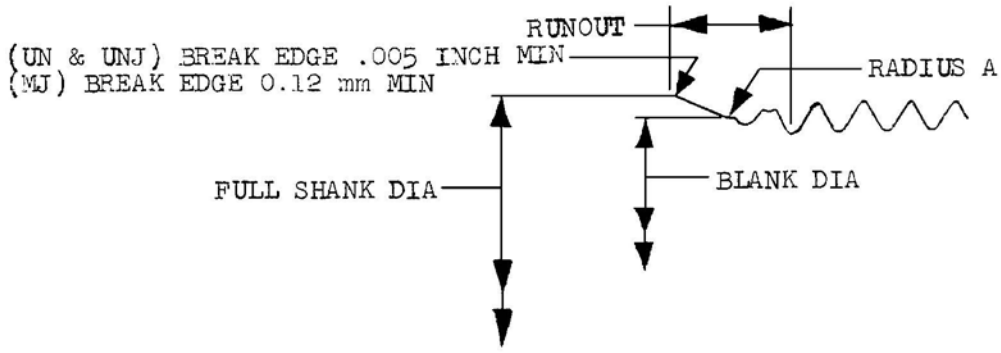

FIGURE 7A

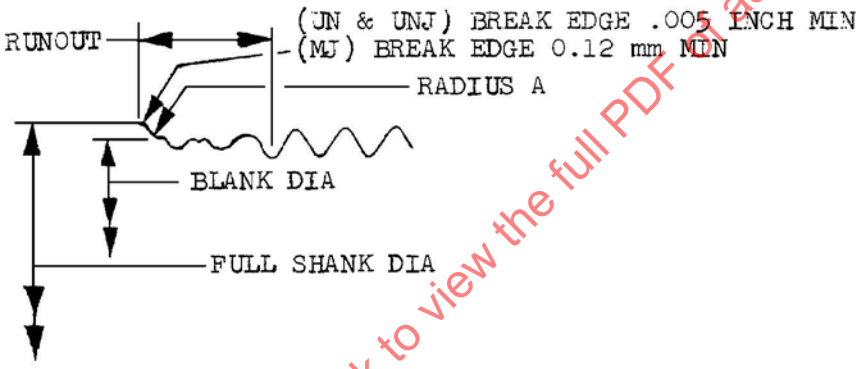

FIGURE 7B

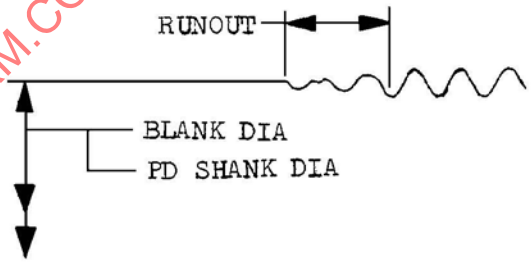

FIGURE 7C

3.3.3.1 Ineffective Lead Threads: The ineffective lead threads Z shall not be greater than 1.5 thread pitches from the end of the fastener including chamfer. See Figure 3.

3.3.3.2 The length of chamfer shall be as specified on the part drawing. Where the chamfer is specified by a diameter and angle, then the length of chamfer shall meet the requirements in 3.3.3.

3.3.3.3 The chamfer diameter at the end of the thread shall be concentric with the thread within an amount that permits the chamfer to be eccentric up to the minor diameter.

3.3.4 Thread Runout, Full Shank Fastener: For those fasteners having a nominal shank diameter equivalent to the nominal thread size, the runout, Figures 7A and 7B, shall be between 2 thread pitches maximum and 1 thread pitch minimum. The incomplete thread part of the runout shall be not less than 0.6 thread pitch.

3.3.4.1 The transition between the blank diameter and the full shank diameter shall consist of a radius "A" and either a taper as in Figure 7A or a shoulder as in Figure 7B. The radius "A" shall be not less than the amount specified below; for parts having only a radius, with no taper, between the runout threads and the full shank diameter, as shown in Figure 7B, the incomplete thread shall not encroach upon radius "A".

TABLE III

UN & UNJ Threads Per Inch	Radius "A" Inch	MJ Thread Pitch, mm	Radius "A" mm
32 and finer	0.005	1 and finer	0.12
28 thru 14	0.010	1.25 thru 1.75	0.25
13 thru 10	0.015	2 and 2.5	0.40
9 and 8	0.020	3	0.50

3.3.5 Thread Runout, PD Shank Fastener: PD shank parts, having a shank diameter equivalent to the blank diameter from which the thread is rolled, shall have a minimum thread runout of 0.6 thread pitch and a maximum of 2 thread pitches. See Figure 7C.

3.3.6 Thread Runout, Threaded to Head Fasteners: For parts threaded to the head, having a head bearing surface perpendicular to the thread axis, the dimension X, Figures 8A and 8B, between the end of the full thread and the bearing surface shall be as follows, unless otherwise specified on the part drawing:

X min = 1.5 thread pitches + B max head-to-shank fillet radius*
X max = X min + 0.5 thread pitch

X is rounded to 3 decimal places for inch dimensions and 2 decimal places for millimetre dimensions.

* Use the formula given in Figure 9 for B max where compound head-to-shank fillet is specified.

The runout shall be as defined in 3.3.4 for the full shank condition and as defined in 3.3.5 for the PD shank condition, but shall not encroach upon the head-to-shank fillet radius "B", or the compound fillet length B max shown in Figure 9.

3.3.6.1 For parts threaded to the head having a conical bearing surface as in Figure 8C, the runout shall be between 2 thread pitches maximum and 0.6 thread pitch minimum, and shall comprise only of incomplete threads, but shall not encroach upon the head-to-shank fillet radius.

3.3.7 Thread Runout, Shoulder Bolt: The transition between the shank diameter and end of the runout X in a shoulder bolt having an increased shank diameter and an undercut shoulder to the minor diameter of the thread shall have a radius A as in 3.3.4.1 at the junction of the shoulder and the undercut and incomplete threads as shown in Figure 8D.

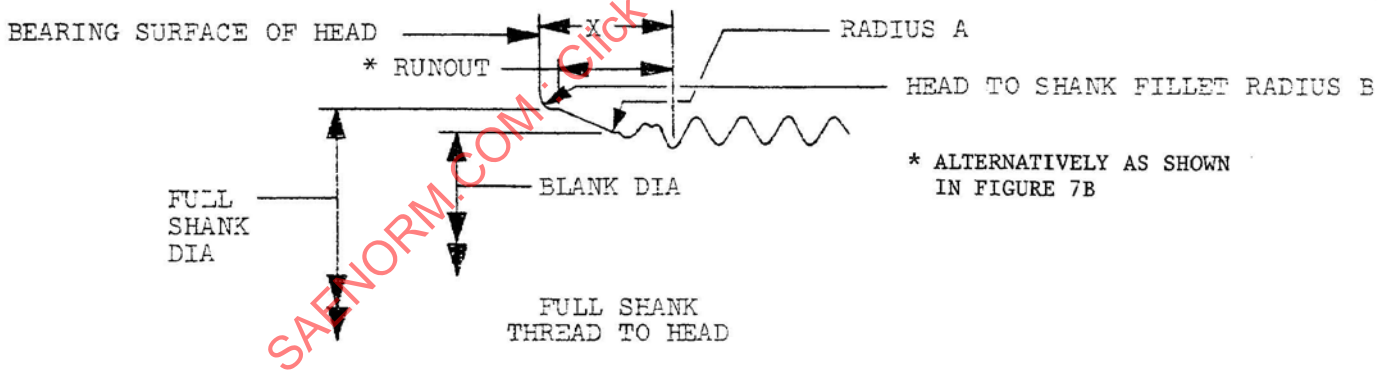

FIGURE 8A

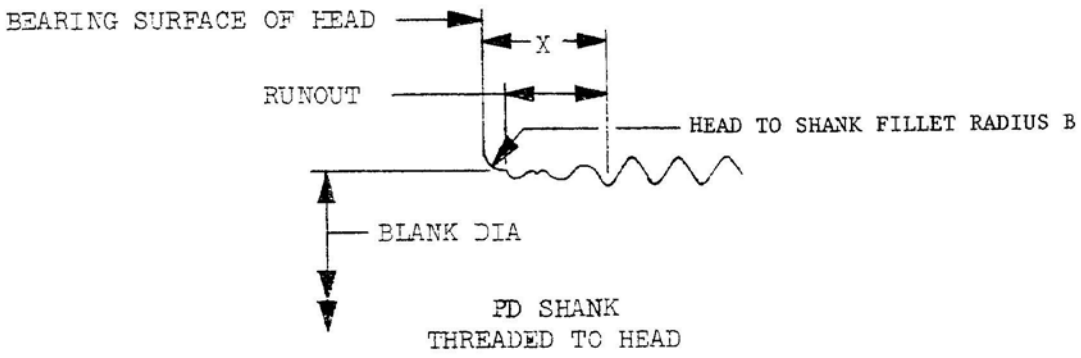

FIGURE 8B

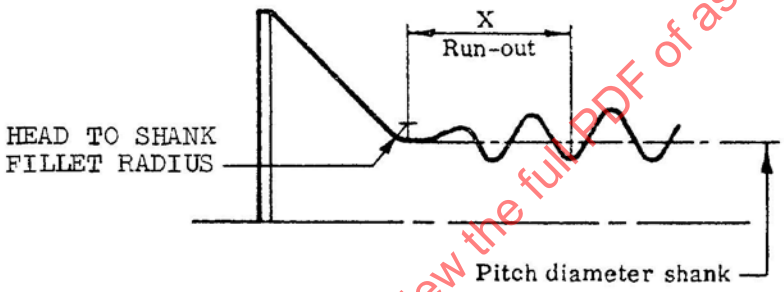

FIGURE 8C

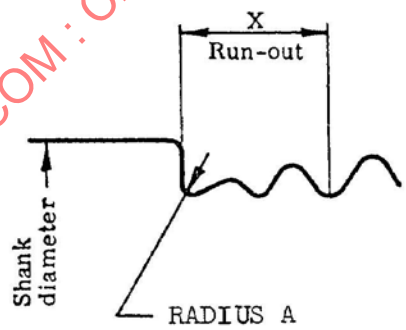

FIGURE 8D - Shoulder Bolt

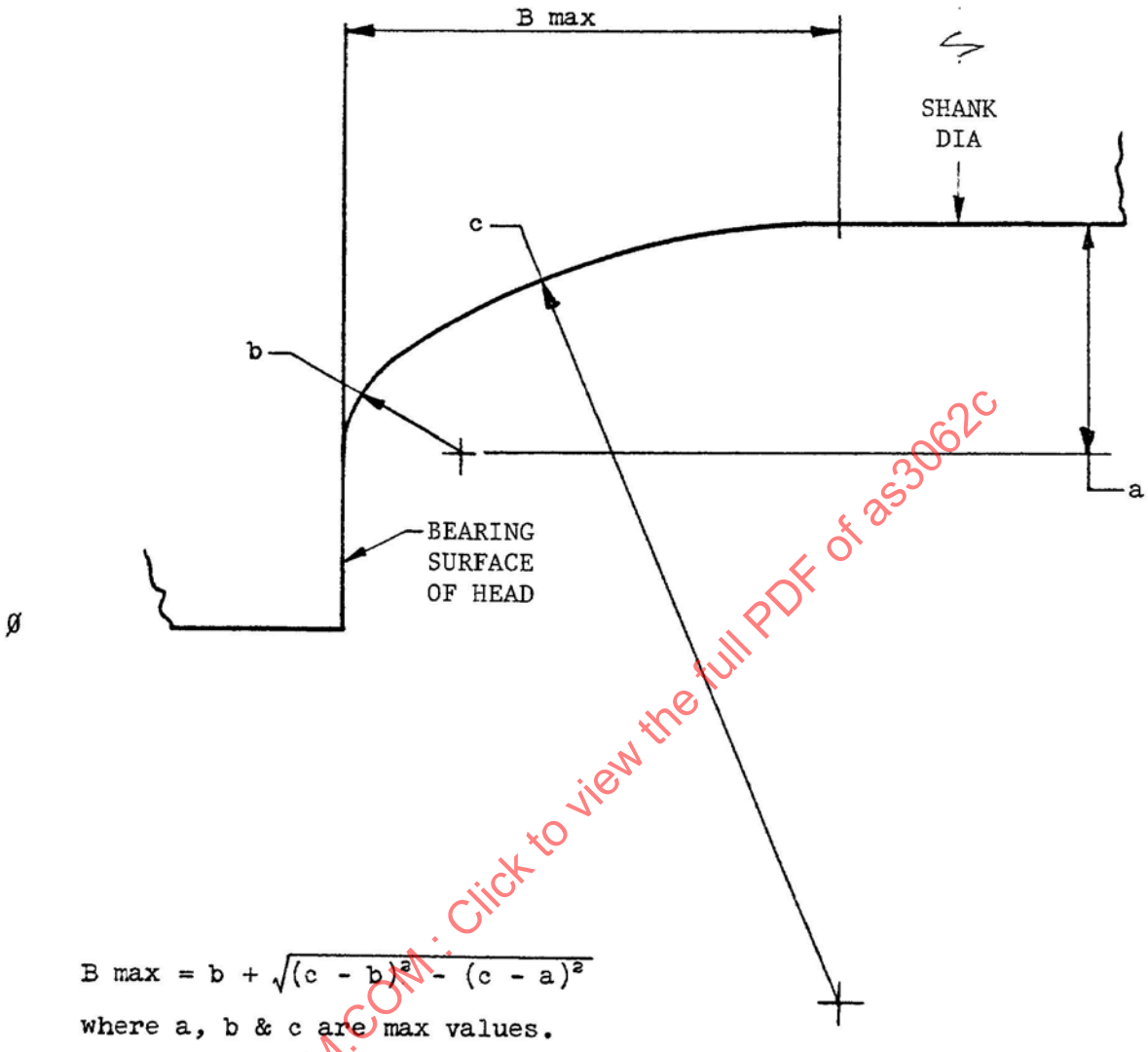

FIGURE 9 - Max Length of Head-to-Shank Compound Fillet, B Max

3.3.8 Thread Runout, Oversize Shank Bolts: The transition between the blank diameter and the oversize shank diameter shall consist of a radius and a taper as shown in Figure 10 with increased length of runout Z as follows:

$$Z = X + (D_o - D_{nom}) / \ 2 \tan \theta \text{ min}$$

where

D_o = oversize shank diameter
D_{nom} = nominal full shank diameter
θ = angle of shank taper
X = full shank runout as in 3.3.4

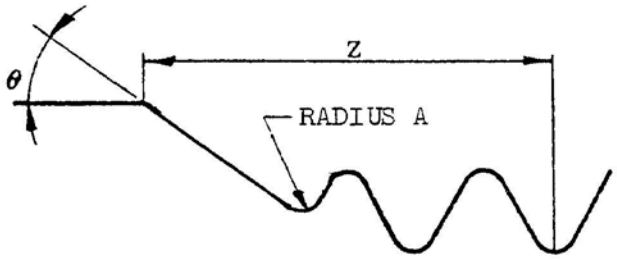

FIGURE 10 - Oversize Shank Bolts

3.3.9 Radius Runout: For UNJ and MJ threads, the flanks at the root of the incomplete thread shall be joined by a radius or two radii and a flat that are smooth and devoid of abrupt tool stop marks (See Figures 11, 12, 13, 14, and 15); this radius or radii shall be not less than the minimum root radius specified for the complete threads. The incomplete thread shall gradually decrease in depth within an axial length not less than 0.6 thread pitch and shall blend smoothly with the blank diameter from which the thread is rolled.

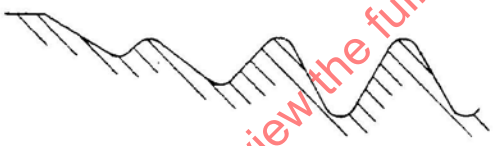

FIGURE 11

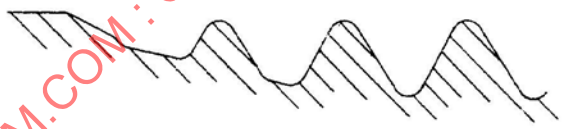

FIGURE 12

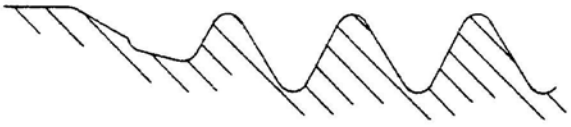

FIGURE 13