SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1061 | REV. FEB2008

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Surface Discontinuities on General Application Bolts, Screws, and Studs

RATIONALE

Clarify Section 1.1 regarding sampling plans. First sentence appeared contradictory to what is included in Section 5. Removed second sentence as it was not necessary and didn't add anything to this particular recommended practice.

Section 4.9 modified to effectively increase the allowable torque for inspection of nicks and gouges on larger fasteners. These fasteners can be more susceptible to thread damage during bulk handling processes, but are also typically tightened to greater torque specifications with tightening tools offering greater torque capability.

Section 5.1 modified to clarify inspection sampling for nicks and gouges.

FOREWORD

The characteristics covered in SAE J1061 Section 4 are also covered in ISO 6157-1. The specified limits are similar, but not necessarily equivalent, in the two documents.

1. SCOPE

This SAE Recommended Practice defines, illustrates, and specifies allowable limits for various types of surface discontinuities that may occur during the manufacture and processing of bolts, screws, and studs in sizes through 24 mm or 1 in diameter inclusive with lengths to 150 mm or 6 in inclusive, having specified minimum tensile strengths of 900 MPa or 120 000 psi and greater, which are primarily intended for use in automotive assemblies.

1.1 The recommended practice does not include inspection sampling requirements other than for referee purposes.

2. REFERENCES

2.1 Applicable Publication

The following publication forms a part of this specification to the extent specified herein.

2.1.1 ASTM Publication

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

ASTM E 3 Standard Guide for Preparation of Metallographic Specimens

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3. TYPES OF SURFACE DISCONTINUITIES

For the purpose of this document, surface discontinuities on bolts, screws, and studs are divided into nine "types", defined as follows:

3.1 Crack

A crack is a clean (crystalline) fracture passing through or across the grain boundaries without inclusion of foreign elements. Cracks are normally caused by overstressing the metal during forging or other forming operation, or during heat treatment. Where parts are subjected to significant reheating, cracks usually are discolored by scale.

3.1.1 Quench Cracks

Quench cracks may occur during heat treatment due to excessively high thermal and transformation stresses. They usually traverse an irregular and erratic course on the surface of the fasteners. Typical quench cracks are shown in Figure 1.

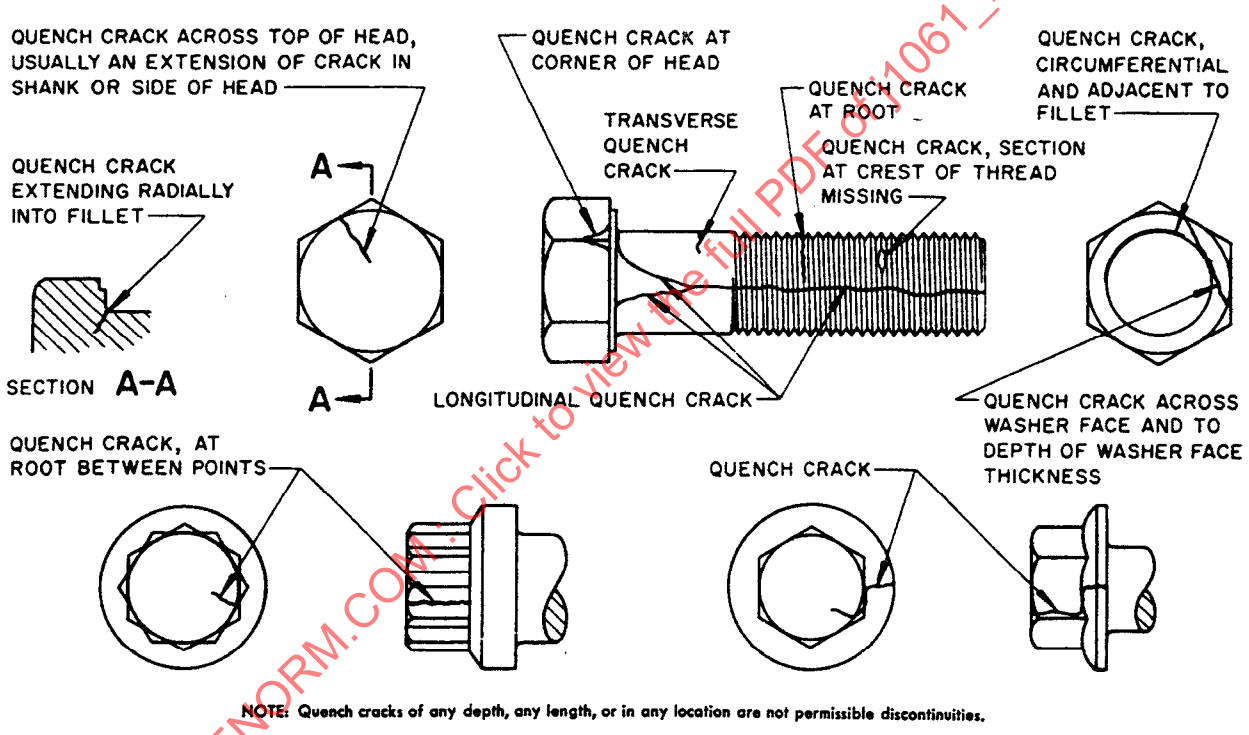
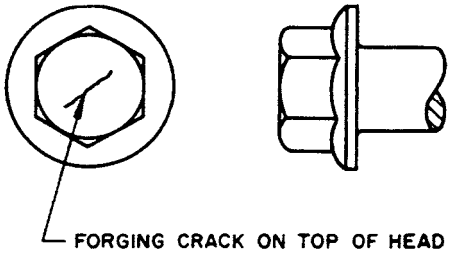


FIGURE 1 - TYPICAL QUENCH CRACKS

3.1.2 Forging Cracks

Forging cracks may occur during the cutoff or forging operations and are located on the top of the heads of screws and bolts. Typical forging cracks are shown in Figure 2.

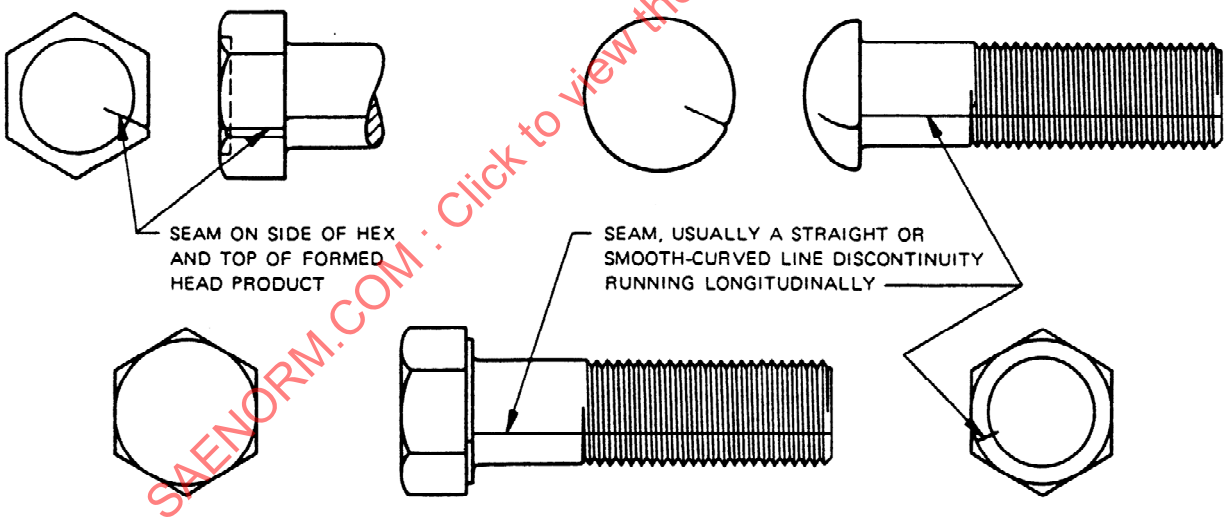


NOTE—Forging cracks are permissible discontinuities if with the limits specified in 4.4.

FIGURE 2 - TYPICAL FORGING CRACKS

3.2 Seam

Seams are generally inherent in the raw material from which fasteners are manufactured. They are narrow, generally straight or smooth-curved line discontinuities, running longitudinally, on the shank and/or thread. Seams may extend onto the tops of the heads of circular head products as well as being present at the periphery of the head. Seams may also extend into the chamfer circle, washer face, and wrenching flats of hex head products. Typical seams are shown in Figure 3.

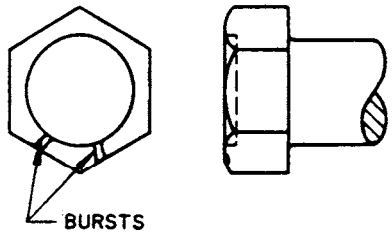


NOTE—Seams are permissible discontinuities if within the limits specified in 4.5.

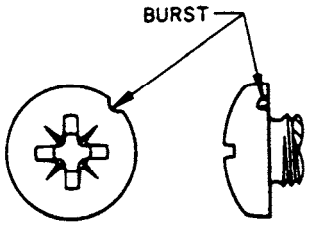
FIGURE 3 - TYPICAL SEAMS

3.3 Burst

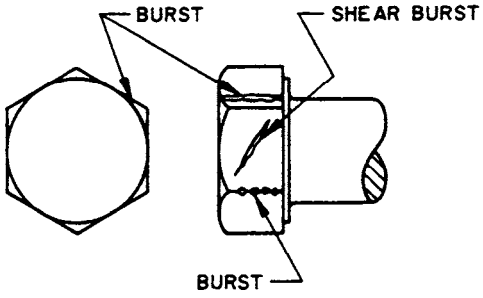
A burst is an open break in the metal (material). Bursts may occur on the flats or corners of the heads of bolts and screws, at the periphery of flanged or circular head products, or on the raised periphery of indented head bolts and screws. Typical bursts are shown in Figure 4.

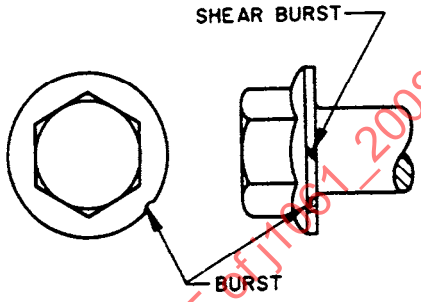


NOTE—Bursts in raised periphery of indented head bolts and screws are permissible discontinuities if within the limits specified in 4.6.3.



NOTE—Bursts in circular head products, with or without recess, are permissible discontinuities if within the limits specified in 4.6.2.





NOTE—Bursts and shear bursts are permissible discontinuities if within the limits specified in 4.6.

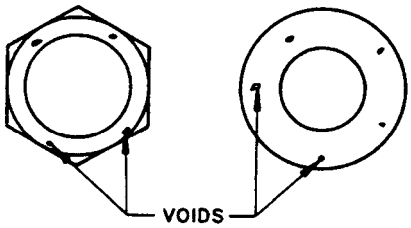
FIGURE 4 - TYPICAL BURSTS AND SHEAR BURSTS

3.4 Shear Burst

A shear burst is an open break in the metal, occurring most frequently at the periphery of products having circular or flanged heads and are generally located at approximately 45 degrees to the product axis. Shear bursts may also occur on the sides of hex head products. Typical discontinuities of this type are shown in Figure 4.

3.5 Void

A void is a shallow pocket or hollow on the surface of the bolt or screw due to nonfilling of metal during forging or upsetting. Typical voids are shown in Figure 5.

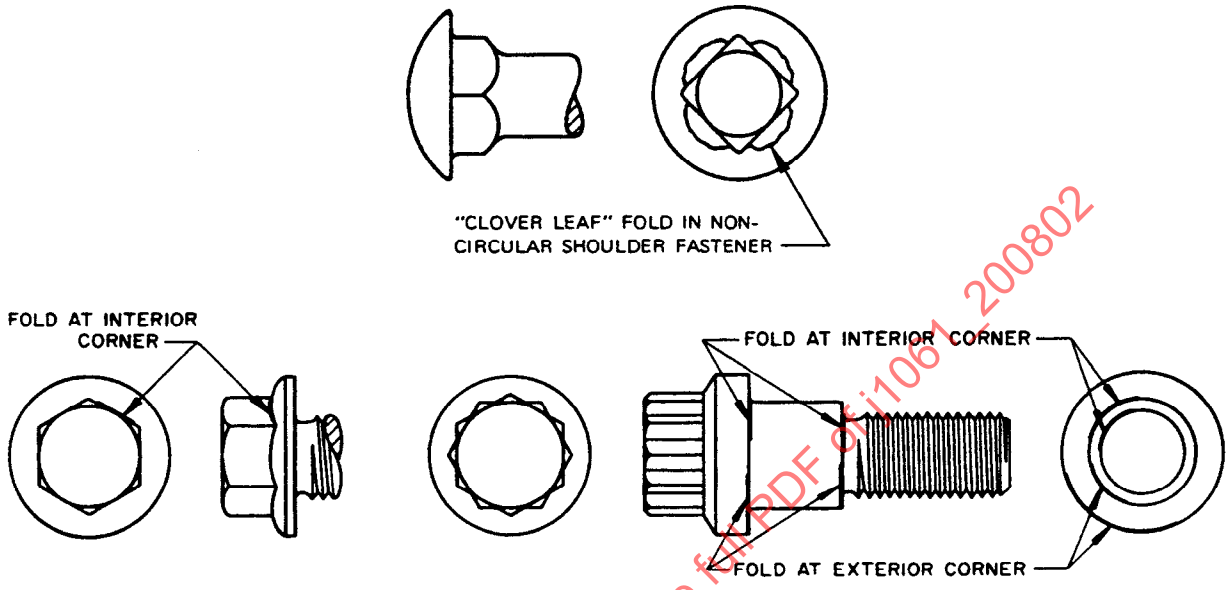


NOTE—Voids are permissible discontinuities if within the limits specified in 4.7.

FIGURE 5 - TYPICAL VOIDS ON BEARING SURFACE

3.6 Fold

A fold is a doubling over of metal which may occur during the forging operation. Folds may occur at or near the intersection of diameter changes, and are especially prevalent with noncircular necks, shoulders, and heads. Typical folds are shown in Figure 6.

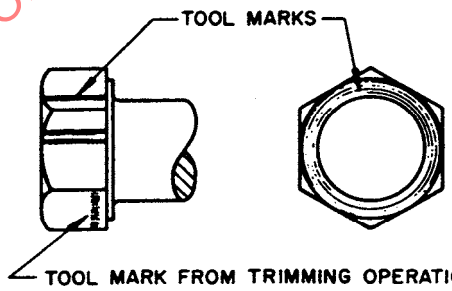


NOTE—Folds in interior corners at or below the bearing surface are non-permissible discontinuities. Folds at exterior corners are permissible discontinuities if within the limits specified in 4.3.

FIGURE 6 - TYPICAL FOLDS

3.7 Tool Marks

Tool marks are longitudinal or circumferential grooves of shallow depth produced by the movement of manufacturing tools over the surface of the fastener. Typical tool marks are shown in Figure 7.



NOTE—Tool marks are permissible discontinuities if within the limits specified in 4.8.

FIGURE 7 - TYPICAL TOOL MARKS

3.8 Nick or Gouge

A nick or gouge is an indentation on the surface of the fastener, produced by forceful abrasion or the impact of product coming into contact with other product or manufacturing equipment during manufacture.

4. LIMITS FOR SURFACE DISCONTINUITIES

4.1 Letter Definitions

Throughout the following requirements D designates the nominal size (basic major diameter of thread) of bolts, screws, and studs, except for bolts and screws with shoulders, in which case D designates the largest shoulder diameter. F designates the nominal flange diameter or head diameter of products having circular heads. For metric-series products, use millimeter; for inch-series products use inch.

4.2 Quench Cracks

Quench cracks of any depth, any length, or in any location, are not permitted. (See 3.1.1 and Figure 1.)

4.3 Folds

Folds located in internal corners at or below the bearing surface, for example, in the fillet at the junction of head and shank, are not permitted. (See 3.6 and Figure 6.)

4.4 Forging Cracks

Forging cracks on the top of heads of bolts and screws shall not exceed a length of 1 D or a width or depth of 0.040 D or 0.25 mm (0.010 in), whichever is greater.

4.5 Seams

Seams in the shanks of bolts, screws, and studs shall not exceed a depth of 0.030 D or 0.20 mm (0.008 in), whichever is greater. Seams extending into the heads and flanges of fasteners which do not open beyond the limits specified for bursts are acceptable. (See 3.2 and Figure 3.)

4.6 Bursts and Shear Bursts

4.6.1 No burst in the flats of hex bolts and screws shall extend into the top crown of head surface (chamfer circle) or the under head bearing surface. In addition, bursts occurring at the intersection of two wrenching flats shall not reduce the width across corners below the specified minimum.

4.6.2 Flanges of bolts and screws and peripheries of circular head products may have two or more bursts or shear bursts, providing that only one has a width greater than 0.040 F; in addition, this one burst shall not have a width exceeding 0.080 F.

4.6.3 Bursts in the raised periphery of indented head bolts and screws shall not exceed a width of 0.060 D or 0.40 mm (0.015 in), whichever is greater, or have a depth extending into the indented portion. (See 3.3 and Figure 4.)

4.7 Voids on Bearing Surface

Voids on the bearing surface of bolts and screws shall not exceed a depth of 0.25 mm (0.010 in), and the combined area of all voids shall not exceed 10% of the specified minimum area of the bearing surface. The method for determining area of voids shall be as agreed upon by purchaser and producer. (See 3.5 and Figure 5.)

4.8 Tool Marks

Tool marks on the bearing surface shall not exceed surface roughness measurement of 2.8 μm (110 μin) determined as the arithmetic average deviation from the mean surface. (See 3.7 and Figure 7.)