

Grain Flow Pattern for Bolts, Screws and Studs

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1. SCOPE:

This specification covers the grain flow pattern requirements in headed bolts, screws, and studs. The heading practice in the manufacture of the bolt, screw, or stud sets the grain flow pattern, but it is also greatly influenced by the fastener design.

2. TEST PROCEDURE:

2.1 Testing for grain flow shall be done after heading, prior to heat treatment and subsequent processing of parts. After heat treatment the determination of the acceptability of grain flow is very subjective and shall not be used

Note: After etching, a light "reveal" polish on a diamond wheel has the effect of knocking back some of the raised areas on the flow line ridges. This process improves the contrast between the darker root of the etch flow line, and the lightened or polished crests to improve evaluation.

2.2 The head and shank shall be sectioned approximately on the centerline, with the shank having a minimum length of 1.0 X the diameter of the shank.

2.3 Macroetch the sectioned head and shank sufficient to reveal the grain flow pattern, using etching practice based upon ASTM E340, and shown in the manufacturer's control plan. Grain flow samples shall be viewed at sufficient magnification to allow for adequate resolution of the grain flow lines.

2.4 The sample size and frequency for the above testing shall be identified in the manufacturer's control plan.

3. GRAIN FLOW PATTERN REQUIREMENTS:

3.1 Grain flow throughout the product shall be continuous and uninterrupted except in those instances where a flash trim line has been determined to be acceptable. A continuous and uninterrupted grain flow must be maintained around the fillets and radii, but may be compressed. Grain flow lines terminating in head to shank fillets, radii, or onto the shank surface are not acceptable. In upset parts, the entire material compression zone in the head shall be above the head to shank radius. Figures #1 and #2 show the acceptable grain flow pattern typical in flange heads. Figures #3 and #4 show the unacceptable grain flow pattern typical in flange heads for comparison. All Figures represent a flange headed product. However, the grain flow principles and requirements apply to all head shapes.

4. REVERIFICATION:

Changes in design or processing that effect grain flow pattern require re-verification.

5. REFERENCES:

ASTM E340

6. KEY WORDS:

End Grain, Compression Zone, Grain Flow.

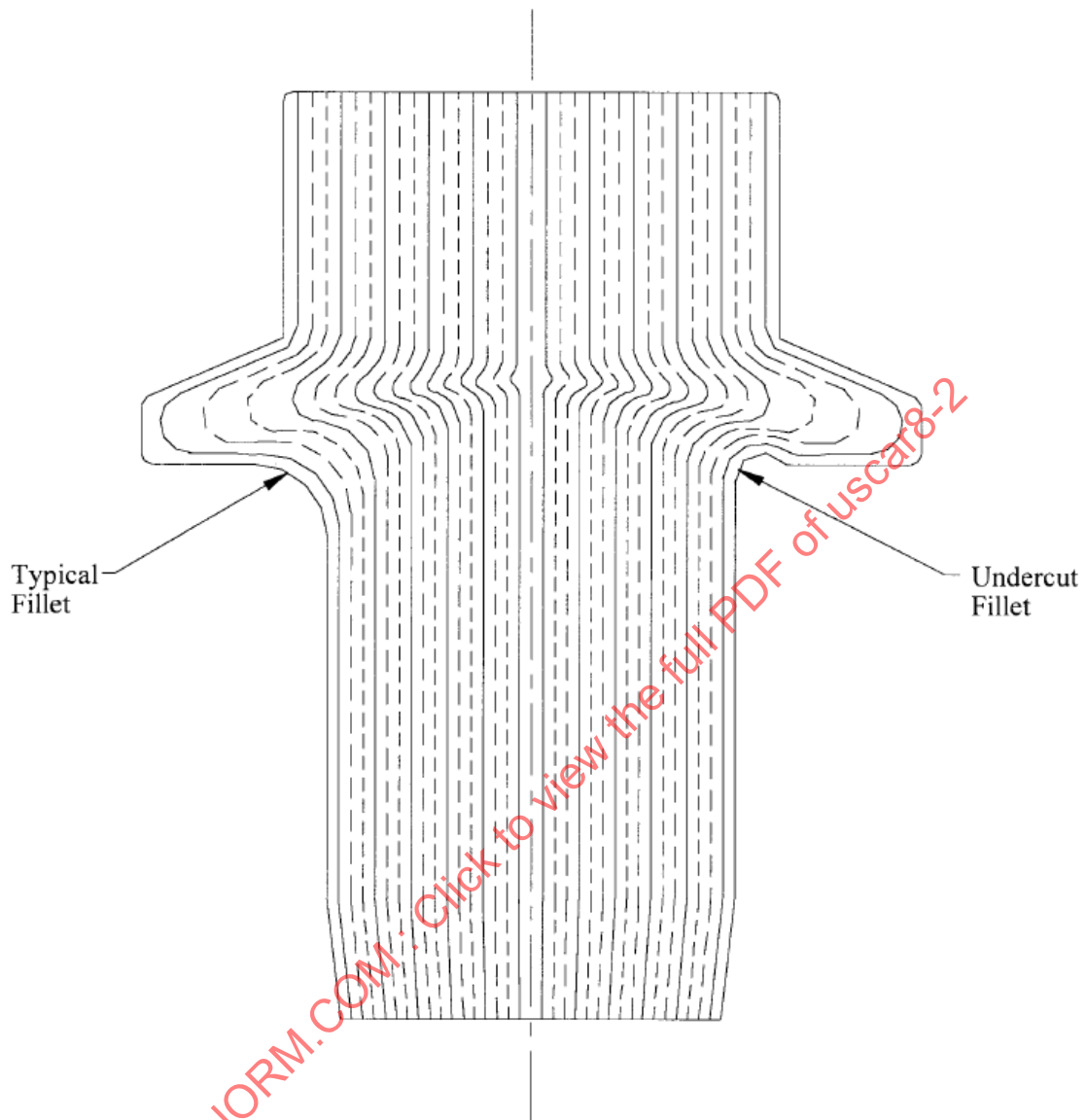


FIGURE 1 - Acceptable Grain Flow Pattern



FIGURE 2 Acceptable Grain Flow Photograph