

FORGED FASTENERS EQUALS STRUCTURAL INTEGRITY

Structure

Grain-structure or grain-flow optimization can produce enhanced mechanical properties, impact strength and fatigue endurance limits over other manufacturing processes such as machining.

Applications

From automotive to mining to industrial machinery and fasteners, grain-flow control, one of the most important intrinsic benefits of forgings, delivers impressive component integrity.

Integrity

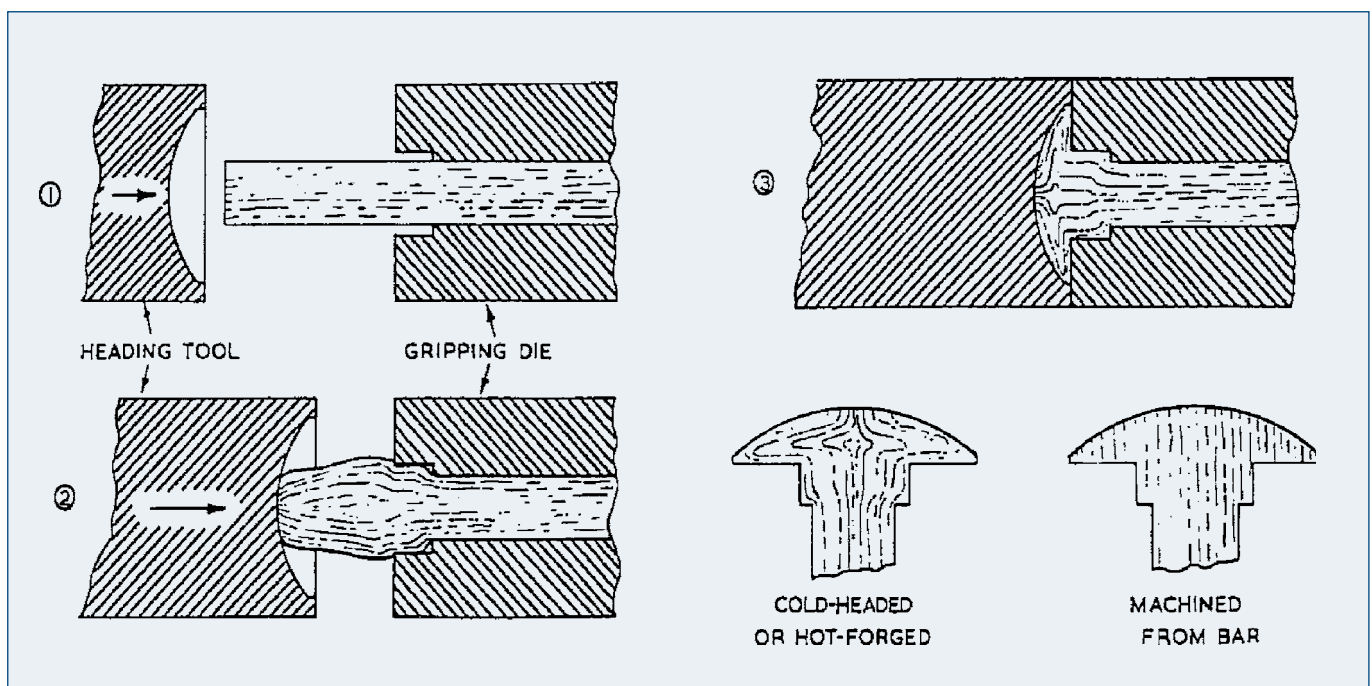
In critical load-bearing applications, the superior structural integrity of forgings makes them the preferred choice over components made by other metalworking processes.

Strength

Forgings deliver strength where most needed while maintaining a good balance of three dimensional properties. The ability to tailor directional strength by optimizing grain-flow during the forging process, permits forgings to meet the most stringent performance requirements.

The diagram below illustrates why a bolt formed by forging is much stronger than one which has been machined from a bar. Forging does not cut into the fibrous structure of the parent material and introduce planes of weakness in the finished bolt head.

Note: AS/NZS 2465:1999 states 'Hexagon bolts of strength grades 5 and 8 up to and including 3/4" diameter shall be cold headed. Bolts in larger sizes shall be hot or cold headed. Methods other than upsetting are permitted only by special agreement'.



Actual Samples of forged versus machined components showing structural differences

FORGED OVAL HEAD LINER BOLT **FORGED HEX HEAD BOLT (INSET)**

- Grain flow follows the shape of the component.
- Finer grain structure as a result of compressive forces.
- Uninterrupted grain flow.
- Increased structural integrity.
- Consistent radii in load bearing area (tapered section).
- No material wastage therefore potentially lower component cost.
- No machining component during manufacture.
- Three times the fatigue life of a machined component.



MACHINED OVAL HEAD LINER BOLT **MACHINED HEX HEAD BOLT (INSET)**

- No improvement in grain structure as it remains the same as original bar stock.
- Interrupted grain flow resulting in stress raisers and reduced structural integrity due to cutting across original material flow lines.
- Changing radii in load bearing area (taper section) due to machining operation.
- Material wastage determined by starting bar stock and required head size.
- High machining component during manufacture.



Above samples were sectioned, polished and macro-etched using a solution of Nitric Acid, Hydrochloric Acid and water and then photographed using a Nikon 950 Digital camera.