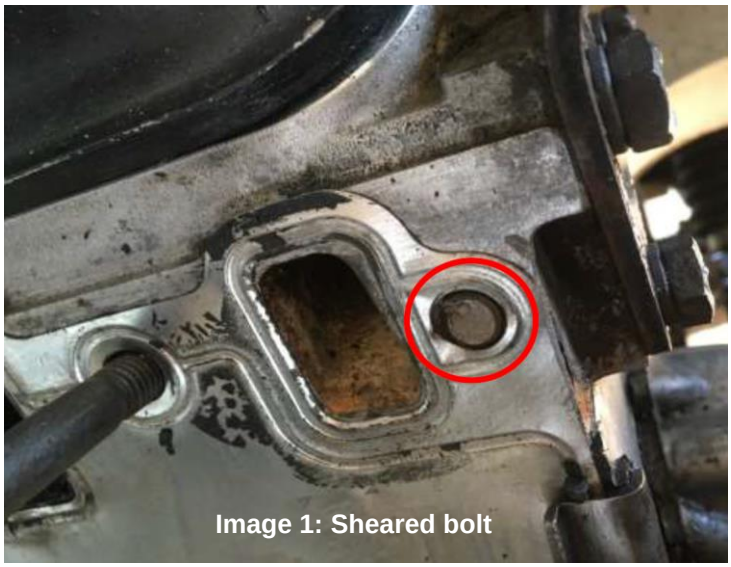

Image 1: Sheared bolt

MGBGTV8 – Strategy for Dealing with a Sheared Engine Fastener

It is every engine dismantler's nightmare. The fracture of a fastener and the realisation that what started as a simple job has just become complicated and time consuming. Threaded fasteners in aluminium tappings have a disconcerting tendency to seize through electrochemical reaction between the metals and this seizure is frequently enough to prevent normal removal of the fastener. When planning the overhaul of the V8 engine in an MGBGT the prudent dismantler will consider a recovery strategy for such eventualities.

The purpose of this note by Jim Livingstone is to **outline some of the available options**. Recurrence prevention is beyond the scope of this article and is suggested as the subject of a more comprehensive V8NOTE in the future. By way of historical perspective, the Leyland counter-measure at the time when the MGB V8 was in production was to coat the threads of fasteners in aluminium castings with a **3M Lubricant-Sealant EC776**. This measure appears to have been dropped from later builds of the engine and replaced with a recommendation to apply a sealant (**Loctite 242**) only to the timing cover bolts and to lightly oil the remainder.

Repair Strategy

The bolt, failure of which prompted the writing of this article, is one of the 12 inlet manifold to cylinder head fasteners – see **Image 1**. The bolts are 3/8″ UNC with the front two on each bank being 2″ long while the remainder are 1½″ long. The installation is unusual in that the tapping axis is not at right angles to the joint face which complicates the repair process – see **Image 2**. The front and rear bolts seal water passages which makes them more susceptible to corrosion damage should the seal fail. The bolt sheared flush with the cylinder head surface with no opportunity to grip a projecting stub for removal.

The first steps in the strategy are targeted at reclaiming the original tapping undamaged and comprise several techniques for removing the remnants of the bolt. If these fail, the repairer will have to resort to the more drastic measure of drilling and tapping the hole oversize and fitting a threaded insert. The repair techniques are presented in their order of complexity with the first three being preliminary processes:

1. **Application of penetrating oil**. It is advisable that this is included in the preparation for any dismantling process but penetrating oil should certainly be applied liberally once failure has occurred.
2. **Application of heat**. The differential expansion of iron and aluminium caused by heating may loosen the grip of the casting on the fastener or at least encourage the passage of penetrant.
3. **Application of a shock load**. An axial shock loading on the threads of the fastener should have a similar effect to the application of heat. The shock needs to be applied judiciously and before drilling the fastener.
4. **Drifting with a centre punch or chisel**. This is frequently cited as an extraction technique but the author is sceptical about its effectiveness. If the seizure was sufficient to cause torsional failure of the fastener then it is unlikely that the limited torque from a hammer blow at an insignificant radius will overcome its grip. The technique involves engaging a punch or chisel in the rim of the stub and trying to encourage anticlockwise rotation with a series of tangential blows from a hammer. In the case in question the author merely succeeded in cratering the exposed surface.
5. **Drilling the stub with a left-handed drill**. This process relies on the torque reaction from drilling to release the stub.
6. **Drilling the stub to insert an extractor**. Extractor sets are available for this purpose and usually include a chart of drill and extractor sizes appropriate for each fastener. The extractors range from those with coarse tapered left-hand threads to those with self-cutting splines. The risk with them all is, being manufactured from hardened steel, if an extractor should break in the stub your problems have redoubled.
7. **Drilling the stub** to the core diameter of the thread and picking out the remains. If the original thread is not to be damaged the accuracy of the drilling is critical. Ideally machine shop facilities should be used but if a suitable drill jig or equivalent is available the process may be possible with portable equipment.
8. **Drilling and tapping the original hole oversize** to accommodate a threaded insert.

This list is restricted to the techniques employed by the author and is by no means exhaustive. An obvious omission is the application of welding to attach an extension to the stub, resources for which the author does not possess.

Preparation

A common feature of the techniques which follow is the use of a **drill bush** located in the hole in the inlet manifold where the failed bolt came from. The purpose of this is to ensure that the drilling of the stub follows the original axis and does not wander into the material of the cylinder head. It assumes, of course, that Rover were diligent in their manufacture and produced holes in the manifold which are coaxial with the mating tappings in the cylinder head. The process is to follow techniques 6, 7 and 8 in succession until extraction is achieved and, if not, to proceed to tap oversize and fit a threaded insert.

Procure a ½″ bolt and cut it to length - 1″ is suitable for the front bolt hole of the manifold. A 12mm bolt may be used but the fit in the inlet manifold will be less precise. If possible, mount the bolt in a lathe and drill with a 6.4mm bit, this being the size of the author's first left-hand drill. Otherwise, carefully mark the centre of the hexagon head and drill. It is important that the drilling is coaxial with the bolt shank if technique 7 is to be successful. The author made several attempts using a pillar drill before an acceptable bush was produced. For the resulting bush see **Image 3**.

An alternative to machining your own bushes is to use those from a commercially available wood dowelling jig (see **Image 4**). These are conveniently proportioned at 12mm outside diameter and are

produced with inside diameters of 6mm, 8mm and 10mm. The bushes are shorter than ideal at 13mm but with care accurate drilling should be possible. If you purchase the set with wood drills a useful set of depth stops is included.

Procedure

The breakage occurred at the stage when the inlet manifold was being removed and the procedure picks up at that point.

1. **Remove the inlet manifold** and ensure that the manifold (valley) gasket around the sheared bolt is well sealed to the cylinder head and crankcase to avoid ingress of swarf.
2. **Remove the distributor** and seal the openings in the timing cover – see **Image 5**.
3. **Replace the inlet manifold and lightly tighten the bolts** – the manifold is not dowel located and more accurate positioning is achieved by sleeving a couple of opposing bolts – see **Image 6**.
4. **Fit the drill bush in the bolt hole** over the sheared stub – see **Image 6**.
5. Drill using the 6.4mm left-hand drill until the stub is loose or drilled through – see **Image 7**. If not loosened, proceed to the next step.
6. **Insert the ¼″ extractor into the stub** and try to rotate anti-clockwise – do not use excessive force as a sheared extractor is to be avoided at all costs - see **Images 8 & 9**. If this is not successful proceed to the next step.
7. **Remove the drill bush and enlarge its hole** to 7.8 mm (.3071″) [the core diameter of 3/8″ UNC is .3073″]. If you have any doubts about the concentricity of the bush or the accuracy of the original tapping, select a smaller drill.
8. **Drill through the stub**.
9. **Remove the remains of the stub thread** and clean up the tapping by running a greased tap down it. If this is not successful proceed to the next step.
10. **Remove the drill bush and enlarge its hole** to 9.9mm (the tapping drill size for a 3/8″ UNC insert) – see insert kit **Image 10**.
11. **Chamfer the hole**.
12. **Using the drill bush drill the hole to its original depth** using the drill provided in the insert kit
13. **Insert a long 3/8″ UNC bolt in the adjacent bolt hole** to aid alignment and carefully tap the hole with the insert tap – see **Image 11**.
14. **Remove all debris and check the thread**.
15. Fit a 3 x D (= 1.1/8″) 3/8″ UNC insert to the insertion tool and wind into the tapping until it is a half turn under flush – see **Image 12**.
16. **Recommendation** - it is recommended that all the manifold bolts are renewed and assembled using a reputable anti-seize/sealant. Care should also be taken to ensure that the water passages in the manifold to head joint are well sealed.

Note:

At first sight it might be assumed that the lack of clear access to the bolt hole between the inlet ports of cylinders 2 and 4 would prevent application of this technique to that hole's repair. However, by a fortuitous consequence of symmetry the inlet manifold can be reversed to provide an accessible guide hole for the drill bush.

Images

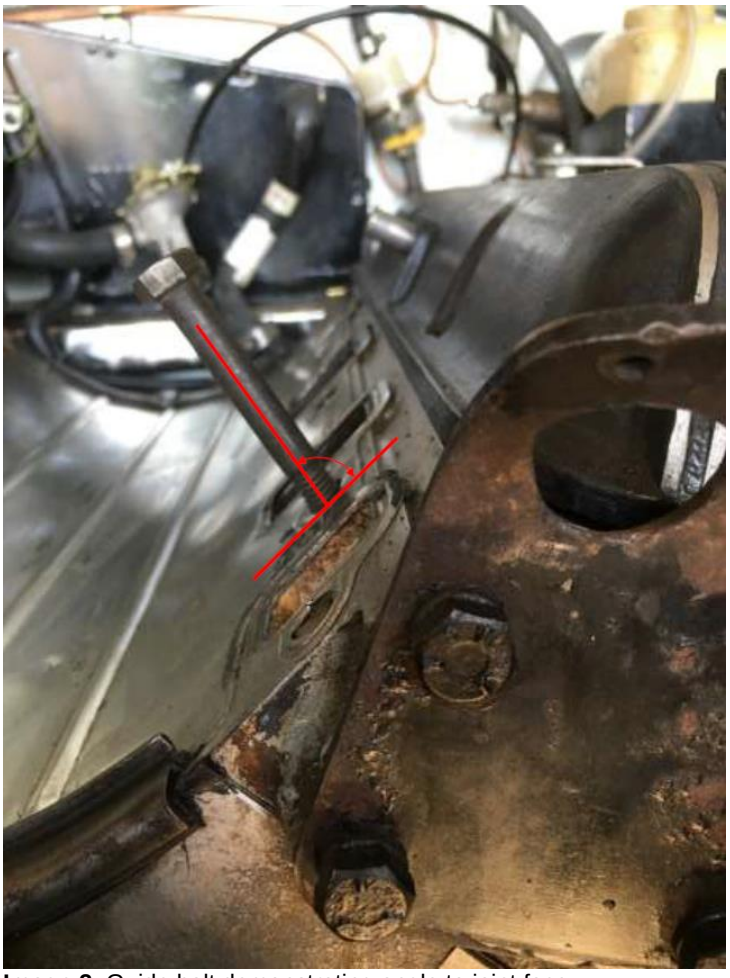

Image 2: Guide bolt demonstrating angle to joint face

Image 3: Drill bush manufactured from ½" setscrew

Image 4: Wood dowelling jig

Image 5: Sealing the distributor aperture

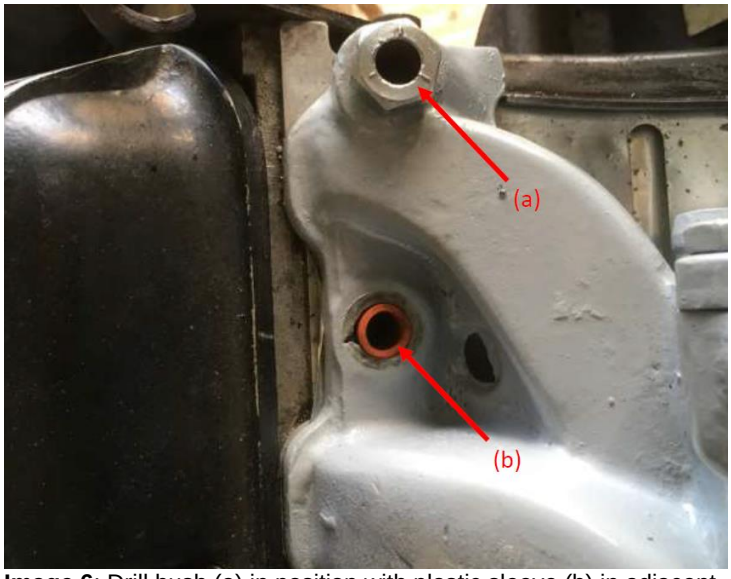

Image 6: Drill bush (a) in position with plastic sleeve (b) in adjacent hole

Image 7: Drilling through the bush (with wrench to prevent rotation)

Image 8: Extractor set with (from left to right) drills, extractors and drill guides

Image 9: ¼" extractor in position

Image 10: Insert kit with (from left to right) drill, tap, inserts, insertion tool and tang break off tool

Image 11: Tapping for insert using guide bolt to aid alignment

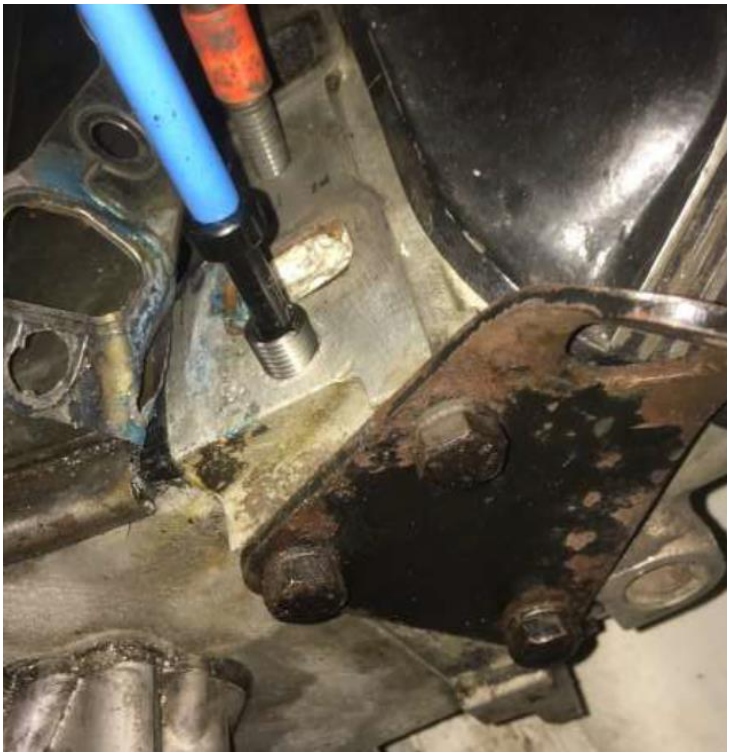

Image 12: Installing the insert

Explaining some of the terms in the article

Tapping
The tapped (threaded) hole into which the bolt is screwed. So named after the fluted cutting tool (tap) which replicates the bolt and forms the internal threads.

Tap

Drill bush
The component which guides the drill. In this case it locates in the 1/2" clearance bolt hole in the inlet manifold and ensures that the drill follows the path of the original tapping.

Drill bushes manufactured from ½" setscrews

Drill bush in position in the inlet manifold

Wire thread insert
The generic term for a coil of wire with a diamond shaped cross section used to repair a threaded hole when the thread is damaged. The hole is drilled and tapped to remove the damage and then the wire thread insert is screwed in to restore the original size. Helicoil is probably the best known manufacturer but there are many imitators.

Wire thread inserts (showing driving tang)

Wire thread insert installed