

TECHNICAL NOTES SERIES

JOWETT JAVELIN – PA, PB, PC, PD & PE JOWETT JUPITER – SA & SC



Above: What we are up against – the part of the right-hand side crankcase-half, which generated the subject of these Technical Notes. In this photo, the horizontal crack was the crack that appeared two days after the cylinder head had been tightened. See Figure 1. The vertical crack aligned with the stud thread reveals a Recoil thread insert, a previous attempt at a thread repair.

– PART XI –

ENGINE CRANKCASE – CYLINDER HEAD STUD THREAD REPAIR TECHNIQUES

These Technical Notes Should Be Used In Conjunction With Part VIII.

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With assistance from Neil Moore, JCC (NZ).

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WARNING!
ASBESTOS COULD BE PRESENT IN
GASKETS AND FIBRE WASHERS



INTRODUCTORY COMMENT FOR TECHNICAL NOTES

These introductory notes should be read prior to reading Part XI of the Technical Notes Series.

The Jowett Technical Notes Series have been an ongoing activity for several years. That means that some techniques and specifications may have been superseded in later notes on the same, or associated topics in the series. Also be aware that some topics and recommendations may be specific to certain Engine Serial Number ranges. It appears that, in Australia, the various State Main Agents did not carry out Service Bulletin information during Jowett active times. A set of known Service Bulletins is in Part III.

Some of the notes are restorations of what was written by members of the Jowett Car Club (UK), the Jowett Car Club (NZ) and by members of the JCCA.

Over the years of involvement with matters Jowett, and with the dawning of the personal computer age, a personal decision was made to help members of the Jowett Car Club of Australia Inc. with technical information. Included with the Technical Notes are 'restored' versions of the Javelin and Jupiter Maintenance Manuals and the associated Spare Parts Catalogues. Future generations will prefer to flick through images on their personal device screens, rather than leafing through pages in a tattered and oil stained book to access information.

The term 'restored' has been used because it soon became apparent that, as with our efforts in restoring Jowett vehicles, we desire excellent quality of workmanship in the reproduction of Jowett related documentation. Not for us the crude, and crooked, photocopies that have been issued over the years. These have, even though accurate at their time, become partly out of date.

Hence the decision to 'restore' the publications and documents that have come to hand.

It should be noted that the Javelin and Jupiter Spare Parts Catalogue is a combination of all the catalogues that were to hand (from 1948 to 1953).

The Maintenance Manuals were originally written on the assumption that they would be used by skilled motor mechanics who had attended service training courses conducted by Jowett Cars Limited and after works closure, were made available for owners who had reasonable mechanical knowledge of motor car maintenance and overhaul.

Included with the Technical Notes Series is a Lucas Overseas Correspondence Course, which can be of great assistance when trouble-shooting electrical problems related to your Jowett, or any other British vehicle of the same period.

Please be aware that this is an ongoing project

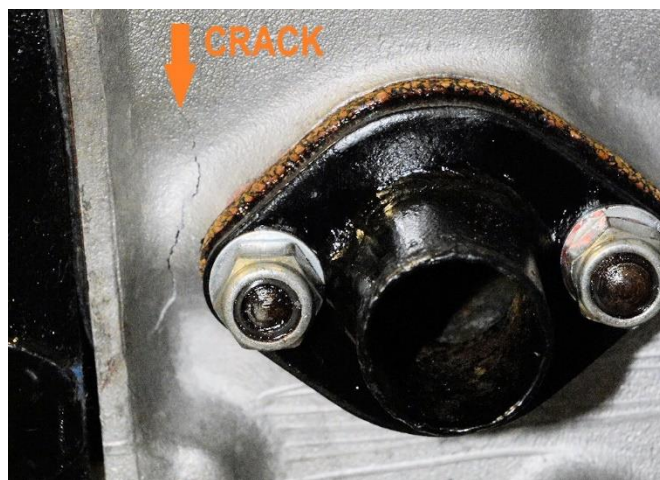
Mike Allfrey – February, 2024

SECTION 1.

Introduction

Right: Figure 1. R.H.S. crankcase cracked. Orange arrow indicates. Engine inverted for dismantling.

Shown in *Figure 1*, is the crack at the R.H.S. crankcase half that appeared two days after the cylinder head had been tightened in place. The cylinder liner protrusion had been set at 0.008-in. The coolant inlet tube weld assembly had been installed prior to the cylinder head studs' sequence of tightening in three stages. Note that the crack has appeared slightly below of where such cracks usually appear. At the time, this was mystifying.



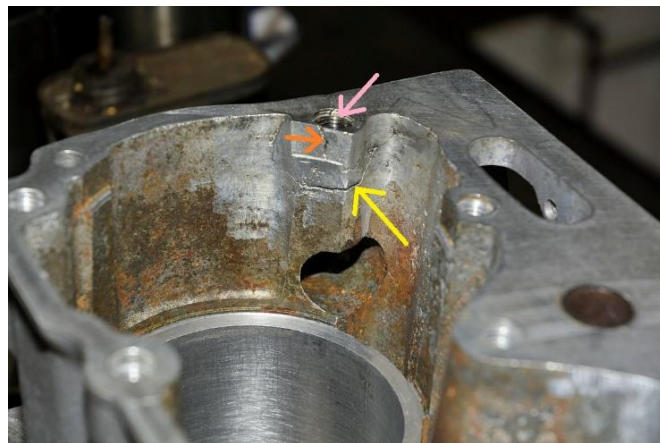
Crankcase Repair Preparation

First, an attempt was made to carry out a repair, with the cylinder head remaining in place. The crack, as revealed externally, was grooved out and the repair weld gave the impression that the welded area was sound. This was not so, because as soon as coolant water was poured into the

radiator, there was a cascade of leaking water at the cylinder head gasket area close to where welding had been carried out.

Right: Figure 2. Coolant jacket detail.

After the cylinder head was removed, an inspection light showed that damage due to cracking, was a great deal more than expected. *Figure 2* shows the extent of the crack damage, after scale had been cleared, with the yellow arrow indicating the initially visible crack. The orange arrow indicates a further crack aligned with the threaded stud hole. This crack went through both sides of the threaded hole. The pink arrow shows that a Recoil® thread insert had been poorly fitted at some time. A decision was quickly made to completely dismantle the engine so that appropriate repairs could be effected. It was



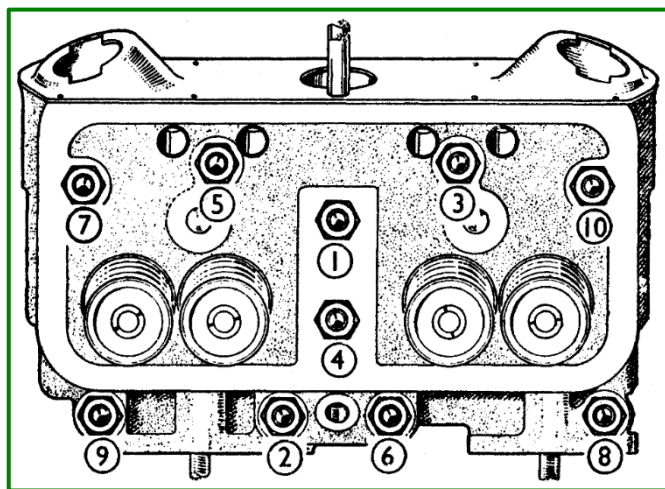
decided to make an entirely fresh start.

Before any repair work could commence, a set of new cylinder head studs were machined from stainless steel rod. During the engine's first assembly it had been noticed that the cylinder head studs protruded through the nuts by differing amounts.

Right: Figure 3. Cylinder head nut identification.

The extreme case was where a No. 4 stud finished up well below the outer surface of the nut. In an attempt to resolve this concern, cylinder head stud dimensions were carefully measured and given individual part numbers. The format used was, as per the example: **Part No. 50636-2L** where:

- 50636 The original Jowett part number.
- 2 The number of the stud as shown in the Maintenance Manual tightening order.
- L Indicates LHS crankcase half.



Using this method created an individual part number for each cylinder head stud, to successfully accommodate the differing lengths of the proposed studs. The reason for the different length requirement was due to the 1/8-in. deep counter-bore into the crankcase, that supports the stud shank, being at various depths due to stripped threads and poor Recoil thread insert installation. After calculating all of the stud lengths, except for the Number 1 oil feed stud, zip-top plastic bags were labelled with the appropriate identifying part number for each stud.

Right: Figure 4. Example of a new head stud. This example is the extended No. 7 or 10 stud.



A decision was made, early on, to adopt a Jowett Engineering Ltd. modification to the cylinder head studs at number 10 (L.H.S.) and number 7 (R.H.S.). The modification calls for an extension of the studs' length where they thread into the crankcase, right through the coolant inlet ports and into the inner sides of those ports. This calls for special studs with 3 1/8-in. total thread length that screws into the crankcase. At the point where the studs pass through the coolant ports, the threads are ground to the thread's root diameter to present less restriction for coolant flow into the engine. *Figure 4* shows a photo of such a cylinder head stud. The portion of the stud that screws into the crankcase is at RHS of *Figure 4*. These studs were used in late PE crankcases, and in those works reconditioned engines supplied by Jowett Engineering Ltd. until 1963.

Note: The writer has used stainless steel, as shown in *Figure 4*, for machining cylinder head studs with success. There are some in the Club who do not agree with this practice. Reader decide.

SECTION 2.

Commencing The Repair

Before taking the R.H.S. crankcase half to a machine shop, the Recoil thread insert had to be removed. This was not at all easy, because there were two Recoil thread inserts, one above the other with the outer insert being out of true position.

Right: Figure 5. Unwinding a thread insert.



The stud had been previously installed with Loctite Studloc 263 that had held the stud in place. It was necessary to remove the inserts in case of drama while cutting away the parent metal in preparation for weld build-up. Recoil do make a special tool for insert removal, however, the tool that is suitable for removing a $\frac{3}{8}$ -in. BSF insert, had to be modified to be able to be used inside the counter-bore in the crankcase which meant that it had to be modified to suit $\frac{3}{8}$ -in. and lesser sized inserts only. Once modified and a tail end of the insert had been exposed, it was gripped securely with slim pointed self-lock pliers and both were wound out of the crankcase.

The Machining Operation

It was decided that a new boss for the stud should be created with new weld material. The crankcase half was set up on the table of a large milling machine. Once located in position, *Figure 6*, it was clamped in place so that milling away the cracked metal could commence. A large cutter was fed into the affected area until there was clean, original metal.

Right: Figure 6. Setting up the milling machine.



This is where matters became interesting. Located in a portion where the original crack had one end, there was an enclosed chamber, about the size of a small pea, that most likely resulted from the original pouring of the casting. It was probably a starting point for the crack. The gaseous chamber can be seen, to the right of, and above the mill cutter in *Figure 7*, towards the push rod port.

Right: Figure 7. Cutting away the thread boss.

As metal was removed, it was observed that the crack (*Figure 1*), had been partially cracked before the external crack appeared. The yellow arrow in *Figure 2*, shows the crack and while machining the area, it was found that there was scale inside the crack with clean aluminium towards the outer part of the crack. The crankcase had been stressed prior to our work commencing on the engine. In addition to this concern, the crankcase set had been extensively weld repaired.



Parent metal was carefully removed with different shaped mill cutters, until there was only clean metal for the weld repair to begin.

Once the inside of the coolant jacket wall had been cleaned up, attention was concentrated on the crack where it was revealed at the outside the crankcase. The material was cut away from the original, unsuccessful, weld repair along the threaded hole, see *Figure 8*. Once the weld preparation had been completed, the weld material was laid down larger than was strictly necessary, to allow machining for the cylinder liner and its lip to pass through and into its home position.

Final Machining Operations

After the welding task had been completed, the crank-case half was again set up on the milling machine table and a fly-cutter was used to machine the clearance diameter recess for the outer lip of the cylinder liner. Then the rest of the excess weld material was machined so that the liner could be seated in its bore in the crankcase half. Once this operation was completed, the mill table was positioned so that, after fitting the cylinder head on four studs and tightening down, a drilling jig sleeve could be inserted to guide the tapping size drill.

Right: Figure 8. Unsuccessful weld grooved out.



For this operation, we had to assume that the cylinder head stud holes (threaded) were drilled at right angles to the crankcase joint face. A long series $21/64$ -in. diameter drill was used to deep drill through the coolant inlet port into the parent metal beyond the port opening. Then, the $3/8$ -in. BSF long-series tap was employed to cut the deep thread, using copious amounts of cutting fluid. A small tap wrench was placed over the square drive end of the tap and a centre pilot was used in the mill head's collet holder, to engage with the counter bore in the end of the thread tap's shank, to hold it vertical while the thread was being cut. The new tap worked perfectly. After the thread cutting had been completed, a $3/8$ -in. mill bit was used to cut the 0.125-in. counter bore for the stud's shank. Thus we had what appeared to be a successful repair.

Modifying The L.H.S. Crankcase Half

The plan was to conduct the modification for the extended stud in the home workshop. This required a degree of patient work for preparing for the deep drilling operation. First of all, the bench drill had to be accurately set up so that the drill table was in a level plane and at a right angle to the drilling machine's post. The table face required a degree of adjustment to set it up correctly.

Right: Figure 9. Setting the drilling machine.

On this drill, the arm assembly for the table features an adjustable $1/2$ -in. locking bolt so that the level can be set. In the lower face of the arm there is a $1/4$ -in. adjustable setscrew that facilitates the adjustment for true square, i.e. a try square sitting on the table and positioned on the table, so the drill's pedestal pillar is at an exact right angle to the table – in both planes. See Figure 9. The set-up involves a fair amount of trial and error at the radial clamping bolt and the adjuster setscrew, while maintaining the table in a level position. A very small adjustment for final fine tuning was required. After initial set up, it is best to leave and come back later for a final check and, maybe, further adjustment is required.

The L.H.S. crankcase half did not require welding and, therefore, was a good candidate for the home workshop to save some costs. There was a snag that had to be overcome. It was soon discovered that the commercial tap size drill for the $3/8$ -in. BSF thread, $21/64$ -in. diameter, was not able to pass through the existing thread, so that a deeper hole could be drilled. Investigation soon revealed that a Recoil thread insert had been installed to repair yet another stripped thread. This was all very well, but a slightly smaller thread diameter, 0.3181-in.



suggested that the tapping size drill, at 0.3281-in. diameter would act as a broach entering the Recoil thread insert. This would have caused serious problems. This situation left just two options and, because the parent metal was aluminium the deeper thread was being tapped into, meant that a slightly smaller drill could be used. The first option would be to use an 8 mm long-series drill bit, thus providing 0.003-in. (or three-thou) running clearance. The other option would have been a letter 'O' size drill bit that would have provided 0.002-in. running clearance, likely a bit tight with drill flutes rotating inside a Recoil thread insert.

A new, second cut, $\frac{3}{8}$ " BSF thread tap was carefully run through the Recoil insert's thread, very carefully using the quarter turn to cut and then half a turn backwards using copious amounts of cutting fluid. Great care needs to be taken with such a task, too much haste could result in the insert continuing on through the hole. Finally the insert was finished, ready for an 8 mm drill bit to pass through. All through this exercise, a stud could be threaded into the hole, a bit disconcertingly tight at first, but nice and snug at the finish. It was a good feeling to have a good result for a change.

Deep Drilling And Thread Cutting The Crankcase

First, and most important, a good quality long series drill bit must be used. A suitable drill bit can be obtained from a good industrial supplies type of shop. A & A Industrial Supplies in Bayswater, Victoria are a very good shop for such engineering needs. Do not be tempted by cheap imitations from places like Bunnings Warehouses. Only use drill bits from a well-known brand, such as Sutton – for accuracy and long work life.

Right: Figure 10. Deep drilling operation.

The long series thread tap must also be of good quality. Fortunately, the store could obtain one off the shelf from their supplier. A most pleasant surprise indeed. The expectation was that a special tap would need to be made for the customer, at great expense. The cost of the $\frac{3}{8}$ -in. BSF long-series tap, from Sutton, was just \$80.00.

After the 8 mm diameter drill bit breaks through into the coolant inlet port, as shown in *Figure 10*, great care must be taken while feeding the drill into the far side of the port. Very gently apply enough feed pressure to allow the drill bit to establish a round hole in the parent metal, ensure that the drill bit does not 'run-off'. Once the drill bit is established and is making a clean cut, continue drilling until it breaks through the side of the coolant inlet flange.

The reason for allowing the hole to break through, is to permit thorough cleaning away of drill and tap swarf. It also prevents air being compressed as the extended stud is installed.

Figure 11, shows the long series tap being used to cut the $\frac{3}{8}$ -in. BSF thread into the far side of the coolant port. Note that the thread of the tap is still engaged with the outer portion of the crankcase, thus forming a continuous thread for the studs to follow into their home position.

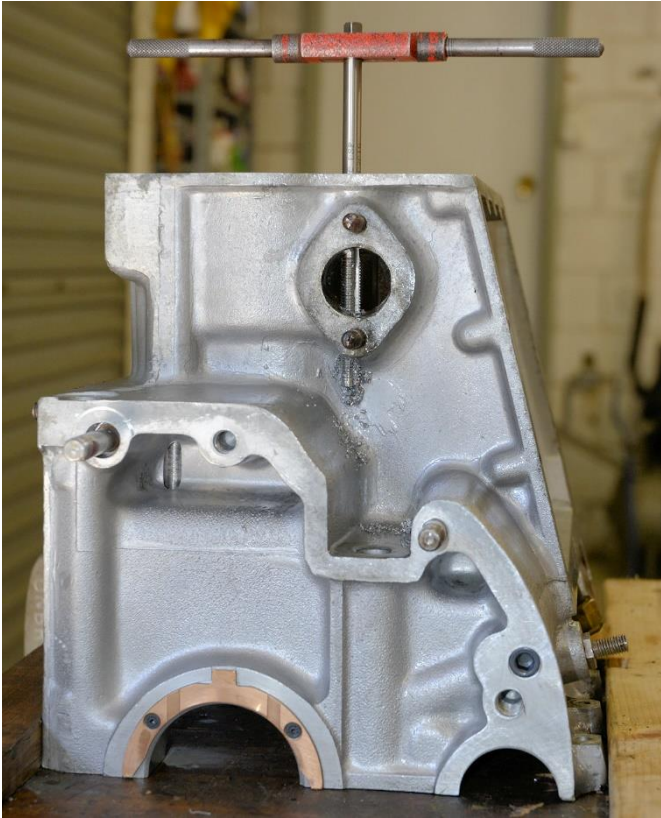
Figure 12, shows a stud being installed. This was a very satisfying experience.

Note: The crankcase half, is shown in *Figure 11*, placed on a wooden work surface, this is important to help prevent damage to the crankcase joint face and, also note that the crankcase half is located by two pieces of scrap dressed timber clamped to the work bench to prevent the crankcase half from sliding during the thread cutting process.

These extended studs will be final-installed using Loctite 518 as the sealant/retainer to prevent coolant migration. Once the studs are installed, excess Loctite 518 should be wiped away with a rag soaked in methylated spirits, the end of the stud, where it protrudes, can then be sealed with a covering



formed from Permatex Cold Weld. The exclusion of air from the area will allow the Loctite 518 to properly cure for perfect sealing and stud retention.



Above: Figure 11. Using the long-series tap.



Right: Figure 12. Installing the extended stud.

SECTION 3.

Cylinder Head Stud Thread Warning

Referring to Figure 3, cylinder head stud Nos. 2, 3, 5, 6, 7, 8, 9 and 10 are the most at risk for concerns should repairs using the Recoil (Helicoil) thread insert method, for the following reasons:

- The stud bosses (the parts of the casting that the cylinder head studs screw into) are too slender for the Recoil thread tap, to successfully enlarge the thread diameter without breaking through into the coolant wet area.
- Should such a repair have been previously attempted and found to be out of position, a repair will be very difficult, if not impossible.
- When a Recoil tap does break through into coolant wet areas, the appropriate action would be to completely dismantle the engine so that the affected stud boss(es) can be rebuilt as shown on Pages 5 and 6, in preparation for an entirely new thread to be created.
- At stud Nos. 3 and 5 a Recoil tap can break through into oil wet *and* coolant wet areas.
- At stud Nos. 3 and 5 the thread hole cannot be drilled deeper into the crankcase, the original thread is very close to breaking through into the tappet chest.
- The claims that coiled thread inserts result in a stronger thread for the stud may not necessarily be true, depending on the condition of the metal that they are installed in.
- All types of thread repair can be rather difficult.

Thread-Coil Insert Repairs

Most commonly, repairs using thread coil inserts such as Recoil and Helicoil brands are typically used to repair stripped threads in aluminium. In general, these coil inserts (that have been supplied with an installation kit) have been significantly shorter than the depth of threads in the crankcase halves. Meaning that all of the tension applied at the stud is withstood by a short length of thread in the aluminium and can be pulled out. The term 'Recoil' has been used for convenience.

Crankcases have been found with poorly installed single short coil thread inserts, or sometimes with two short coil inserts to make up the depth of the original thread. This practice can be disastrous, because as a stud is threaded into the pair of coils, should there be any resistance to the stud, the inner end of the outer coil insert can climb over the lead coil's trailing edge, thereby making a very effective obstruction for the stud being screwed home. Attempting to unscrew the stud can be made very difficult due to the self-locking effect of the two partially overlapping coils.

In situations where two short coils may be required to provide sufficient purchase thread length, for the stud, called 'stacking', adopt the following procedure:

1. Assuming the Recoil tap has *not* broken through into wet areas (coolant and oil), clean all traces of swarf and dirt from the thread. Check with a pencil torch in darkened room.
2. Using the Recoil installation tool, wind in the first thread coil until it just reaches resistance at the blind end of the thread. For cylinder head studs Nos. 2, 6, 8 and 9 the first insert coil must be flush where the holes break through.
3. Using a snug fit flat end parallel punch, use a light hammer blow to break off the coil's tang. Remove the broken off tang.
4. Count the thread pitches from the coil's tail end and, keeping the counterbore depth in mind, count the coil pitches on the second coil insert. At the corresponding pitch, use sharp side cutters to cut off the surplus from the coil.
5. Using the Recoil installation tool, wind in the second thread coil with great care until it makes gentle contact with the tail of the first coil. Do not force!
6. As in Step 3, carefully break off the tang and remove it. The stud should screw in and reach the home position, with the shank seated $\frac{1}{8}$ -in. into the crankcase.

Recoil were contacted about the procedure described. The response was that it is not a recommended procedure, but has been carried out successfully, with due diligence.

Fortunately for us, longer thread $\frac{3}{8}$ -in. BSF coils are available from Recoil suppliers, that can be suitable for cylinder head stud installations. They may have to be ordered in by the store.

In cases where two short coils have been installed, and the lead edge has ridden over the first coil's tail, it is advisable to extract the two thread coils using sharp instruments and a good pair of pointed nosed pliers to wind the coils out of the crankcase, see *Figure 5*. Attempts to 'clean-up' the coil overlap with a $\frac{3}{8}$ -in. BSF thread cutting tap, easily end up with a broken tap, mostly due to the self-locking action of the thread coils.

By far the easiest option is to winkle out a short thread coil and, providing the Recoil's thread is deep enough, simply install a longer coil using the supplied tool. It is a good idea to count the thread pitch (20 threads per inch) in the hole, and then count the same number on the Recoil thread-coil, and if necessary, use a sharp pair of side cutters to nip off the excess coils. If the thread is deep enough to accommodate a full length thread-coil with room to spare, care must be taken to ensure that there is the required 0.125-in. counter-bore, as the coil is wound into place. With $\frac{1}{8}$ -in. counter-bores the original cylinder head studs should be of consistent height above the cylinder head gasket surface.

A Second Thread Repair Option

There is another approach that can be taken, Carry out the repair as follows:

1. Use the Recoil tap, in the kit, to cut the new (larger diameter) thread.
2. Carefully clean out any swarf or debris that may have lodged in the hole.
3. In a darkened room, shine a pencil torch into the hole. At stud Nos, 3 and 5, particularly, look for light escaping into both the tappet chest and into the coolant wet areas.
4. Should there be pin-pricks of light being emitted, in size less than one millimetre square, take the next step. If the light escapes through larger openings, it will be best to rebuild the stud boss by weld buildup.
5. When the light emissions are small, it is calculated that a large percentage of the enlarged thread will remain effective. With fine emery tape, clean the stud boss surface back to bare metal. Wipe clean with methylated spirit (or brake cleaning fluid) and allow to dry.
6. Apply a small build up at the stud boss using Permatex Cold Weld, a two-pack product.

7. Allow to fully cure for 24-hours.
8. The hardened material can then be filed to shape so that the cylinder liner can pass into its home position.
9. Some of the Cold Weld material may have squeezed through into the thread. Use the Recoil tap to clear the thread.
10. Wind in the thread insert, ensuring that there is the 1/8-in counterbore to support the stud shank.
11. Wash out the repaired thread with Loctite 7471 Cleaner/Activator and allow to dry.
12. Apply Loctite 263 at the thread and install the stud.
13. Tighten the stud to 15 – 18 lb. ft.
14. At the counterbore, press in Cold Weld to fill any gaps there may be. Keep the material flush with the cylinder head gasket surface.
15. The repair may be successful.

A repair technique as described above can work, provided the Permatex Cold Weld is not used in large quantities, however, minimal amounts used carefully can be an effective repair method.

All thread repairs rely on the full thread on the cylinder head stud's full thread length being used in the repaired thread. It is the longer thread on the stud that screws into the crankcase.

The Use Of Permatex Cold Weld

Permatex Cold Weld should be mixed and applied by adhering to the following instructions:

- a) Before starting, make sure the work area is protected from accidental spills. Surfaces must be clean, bare metal, dry and free of grease and oil.
- b) Roughen smooth surfaces to be repaired with emery cloth.
- c) Apply in ventilated area. Vapours may irritate eyes and nose.
- d) Squeeze out equal amounts of bonding agent and curing agent (tubes with grey and white caps). Do not swap the caps.
- e) Using a spatula, mix together thoroughly until colour is uniform.
- f) Apply immediately to surfaces and gently press into voids. Remove excess paste at once.
- g) Allow build up to set for 10 minutes before moving or handling.
- h) After 24-hours, Cold Weld is fully cured. Cure time will be slower in colder weather.

A face mask should be worn when filing and smoothing Cold Weld material after curing.

Stripped No. 4 Cylinder Head Stud Thread Repair

This is the easiest stripped cylinder head stud thread to repair. It can be repaired as described under Thread-Coil Insert Repairs beginning on Page 8. On the other hand, there is plenty of parent metal available for drilling deeper and creating a new thread for a longer new stud.

ACKNOWLEDGMENTS

These *Technical Notes* were developed with the assistance of Neil Moore (JCC-NZ) and Brian Holmes (JCCA) for which grateful thanks are due.

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