

TECH: HOW TO

ANOTHER TURN OF THE SCREW

One of the lesser but still thoroughly irksome issues afflicting Porsche's M96 and M97 engines is the corrosion, seizure and breakage of the exhaust-manifold securing screws. It usually means drilling out their remains, with all of the difficulties and dangers that can bring, but a new jig from the US greatly simplifies the job – even with the engine still in the car. Story and photographs by Chris Horton



The Turn of the Screw is a well-known gothic ghost story, written by American-born novelist Henry James, and originally published in 1898. The phrase has since come to be used as an idiomatic description for a bad situation that is becoming even worse, but in this automotive context quite the opposite is the case. Stomski Racing's drilling jig makes quick and easy work of removing broken exhaust-manifold securing screws in Porsche's M96 and M97 water-cooled flat-sixes, and although for clarity and convenience we have shown the job being carried out on a separate cylinder head on a workbench, it was designed to allow simple in situ repair, too. It's fair to say that Northway technician Paul Stacey (left) was initially somewhat sceptical of the kit's value, but within literally just a few minutes was grinning broadly at its simplicity and effectiveness. It looks pretty good, as well!

Many engines with light-alloy cylinder heads suffer from issues with the mild-steel studs or screws securing the exhaust manifolds, but Porsche's M96 and M97 flat-sixes do seem to have become particularly notorious for it. Usually, the first problem is finding a socket wrench that will reliably fit the invariably corroded head of the screw(s) – although these reverse-fluted grippers/drivers by tool manufacturer Irwin (top row, far right) often do the trick. Trouble is, if the head of the screw is that badly rusted, then it will almost certainly break off when you attempt to undo it.

Heat helps, of course, but for it to be truly effective you need oxy-acetylene gear. End result is that you will have to drill out the remains of the screw, and cut a new thread, but that is awkward at the best of times, and requires pinpoint accuracy. New Stomski jig is designed to make the process as painless and as failsafe as possible, even with the engine still in the car. First task is to grind or finish the protruding stub flush with the surface of the head, and then lightly to abrade the area where the tool will locate – precision is understandably essential. Jig is secured using any 'surviving' holes – or even screw stubs, if that's all you have to work with – plus two special screws and threaded sleeves (although we can't help feeling that three would be better still). So it makes sense to clean out the threads with the appropriate M8 x 1.5 tap – and one of those is supplied with the kit. Smaller of the two drilling guides is then dropped into position and secured with a button-headed Allen screw. Before you start drilling in earnest, though, lightly mark the surface of the broken screw, and remove the sleeve – but obviously not the jig itself – to make sure that you really are absolutely central



The modern Porsche technician – and even the amateur enthusiast – today has at his disposal an almost implausibly broad range of high-tech tools and materials with which to service and repair Stuttgart's finest, and the like of which would have been unimaginable even just a couple of decades ago.

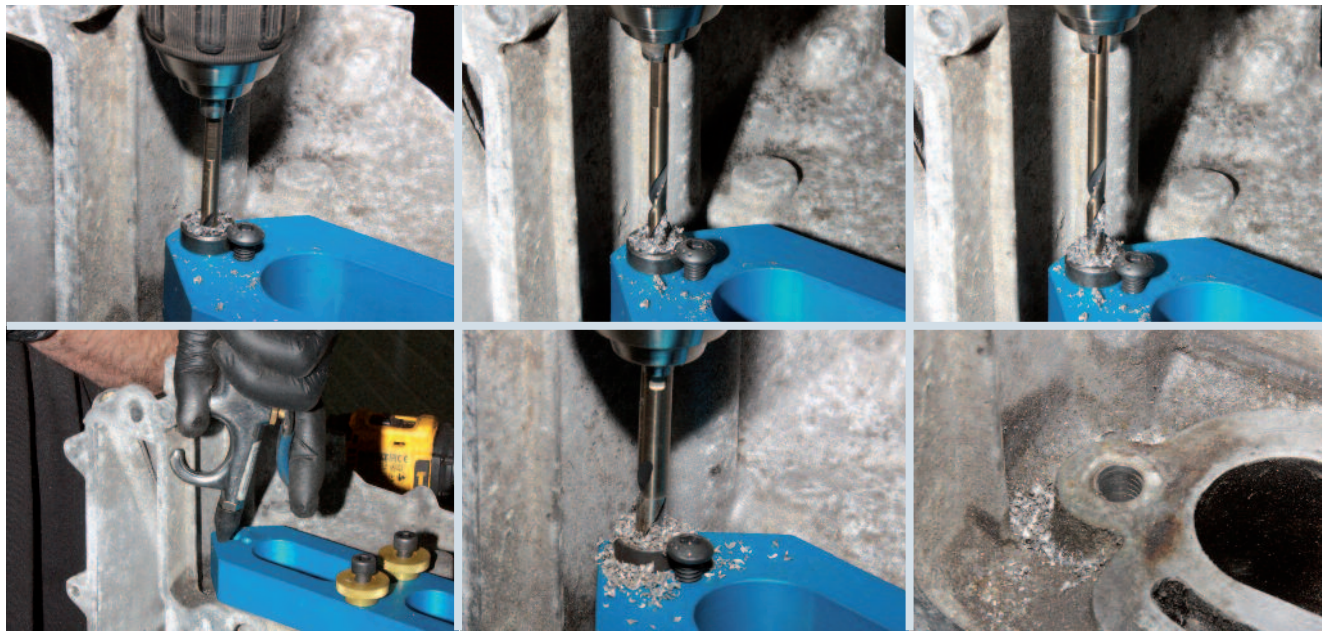
But arguably one of the most important and valuable of those materials is also one of the simplest and the most cost-effective: a tin, a tub or a tube of so-called assembly paste, or 'copperslip' as it is so often – but frequently incorrectly – referred to. (The *real* Copaslip, consisting of micro-sized particles of copper in a semi-synthetic base lubricant, was developed during the late 1950s, and

is today a brand owned – and zealously protected – by Molyslip Atlantic Ltd of Oxfordshire; more at www.molyslip.co.uk. In much the same way that only a genuine Hoover vacuum cleaner is a 'hoover', only genuine Copaslip is, well, copperslip.)

The logic of the stuff – which a caring and conscientious mechanic will put at least a dab of on anything and everything likely



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to benefit from it – will be obvious to anyone who has ever done more to their Porsche than, say, change the windscreen wiper blades. For reasons best known to itself – but almost certainly due to the minuscule cost it would have added to the manufacture of each vehicle – the company has always assembled its products completely ‘dry’, that is to say with no lubricating or corrosion-preventing grease on any of the hundreds of fixings. To a certain extent that is perfectly reasonable: a significant number don’t require it. But others – particularly those with dissimilar metals, ie steel and aluminium, in close proximity to each other, and also exposed to the elements – most certainly do, if only to stand the remotest chance of being disassembled again in the future without recourse to oxy-acetylene gear.

Which is all an arguably slightly petulant but we think none the less justifiable way of

suggesting that given just a little more foresight on the company’s part, and perhaps fractionally more investment, many thousands of Boxster, Cayman and water-cooled 911 owners would not today be facing the distressing and certainly hugely annoying and potentially expensive problem of badly corroded screws securing the exhaust manifolds to the cylinder heads. Making said screws, which are subject to a lifecycle of intense heating, cooling and then heating again, out of a metal with rather more torsional strength than puff pastry might have helped, too.

If you are lucky, and if your car is particularly well cared for, or has covered a very low mileage, then perhaps only one or two will break as you attempt to undo them. (And that assumes, of course, that their heads have not rusted to the point that no conventional socket wrench in the world is ever going to grip them satisfactorily.) If you

are unlucky, then the tally of breakages could soon be heading for double figures – and no doubt someone, somewhere, will have recorded a ‘full house’. In which case it is game over – and even one or two breakages could well mean calling in specialist help to get you out of trouble.

In truth, such help is not necessarily going to have to be *that* specialised – although experience and confidence are undoubtedly important. Drilling out a broken screw or stud, and perhaps then fitting an appropriately threaded insert for a new fixing to grip, is actually a pretty basic engineering skill. As always, however, overall success depends on absolute accuracy in every respect, and especially during the initial drilling process.

Unsurprisingly, the underside of the blunt end of a motor vehicle is hardly the best place in the world to achieve such precision without some kind of drilling jig – even if

Once you are satisfied that your ‘pilot’ drill is entering the broken screw bang in the centre, run it down to the appropriate depth. There will be a small air gap between the end of the original Porsche screw and the base of the hole, so stop when you feel the bit pass through into this space. Go any further and you run the very real risk of breaking through into an internal coolant passage, or even an oilway. Clear out the swarf with an air-line if you have one, or perhaps a powerful vacuum cleaner (needless to say, you should wear eye protection throughout any procedure such as this), and then fit the larger of the two drilling guide sleeves. Again, drill no further than is necessary to remove the full depth of the screw. If you’ve done it correctly you will be left with this (above, left): a nice, neat hole, ready to take that M8 tap. Indeed, such is the potential accuracy of the jig that by using a slightly smaller drill bit than the larger of the two in the kit you might even be able to pick the last vestiges of the screw threads out of the original hole. It will always be better to cut a new one, though: no point taking chances when you have successfully come this far!

Kit comes neatly packaged in a handy plastic carrying case. At its heart is that beautifully CNC-machined chunk of aluminium alloy, suitable for use on all mainstream M96 and M97 engines. (There is another set for the GT3 and Turbo.) Also provided are all the necessary fixings temporarily to secure the jig to the cylinder head – either on the workbench, as shown in this story, or else with the engine still in the car – and two drilling guide sleeves. It might sound too good to be true, but the fact is that it all works beautifully, and we highly recommend this kit – to professionals as well as to amateur enthusiasts, and perhaps particularly to the former, who will face this problem sufficiently often that the modest cost will be recouped many times over

A further sleeve, with a marginally larger internal diameter (right), guides the tap with which you will finally recut the thread for a new screw. Also supplied is an extension rod that will allow you to rotate the tap without parts of the cylinder head getting in the way (top row, far right). Get it right – as did our man Paul, of course – and this is what you will see at the end of the job: a perfectly formed M8-threaded hole, ready to take a new screw.

Note that the screw shown here (far right) is one of the jig securing screws, used purely for illustrative purposes. Shown near right are the drill, taps and special threaded inserts from a Würth Time-Sert kit: use those if because of the cylinder head’s local condition there remains any doubt about the possible longevity of the repair – or if you are likely to want/need to remove and refit manifolds on a regular basis

THE KNOWLEDGE

The Stomski kit shown here, which in the United States retails for \$342, provides literally all of the specialised tooling you should need successfully to drill out the remnants of a broken exhaust-manifold screw(s) on any mainstream M96 or gen 1 M97 engine. (There is, as we have said, a separate kit for the GT3 and Turbo variants.) In addition you will need the usual selection of workshop equipment, including a jack and axle-stands if you intend doing the job ‘on the floor’ – always make sure the car is safely supported before you venture beneath it – and not least a suitable drill, either electric or perhaps air-powered.

Such is the potential accuracy of the process that no additional threaded insert should be required, and so none is supplied – you simply recut an M8 x 1.5 thread in the ‘new’ hole using the tap supplied – but if necessary you’ll have to track down the appropriate Time-Serts from Würth. Find your nearest trade counter at www.wurth.co.uk. You will also need new exhaust-manifold screws, of course, and gaskets – and perhaps even manifolds, if that was your motivation for taking the old ones off in the first place. And don’t forget that dab of either Copaslip on the threads or, to take advantage of its almost unbelievable stickiness, the equivalent ‘Montagepaste’ (ie Assembly Paste) from Porsche itself – part number 000 043 004 00 and, even at £17.42 a tube plus VAT, well worth having in your toolkit.

Whether you tackle all six screws on one cylinder head (or the total of thus 12 per engine) in one hit will be down to your own preferences, and not least the time available to you, but plainly it makes sense to do so. They will all be in a similar condition, and once the castings have been rethreaded and fitted with good-quality screws (and some Copaslip, of course!) the installation should be good for the life of the

car. From Porsche new screws typically cost £1.28 apiece plus VAT (part numbers vary, so order against the vehicle’s VIN), but even equivalent stainless-steel items can cost as little as pennies apiece on the after-market.

You’ll find any number of fixing suppliers on-line, but ideally go for a specialist who will be able to provide not only exactly the right length and the best material, but also the correct tensile strength – we started with www.ukstainless.co.uk, but for anyone in the London/M25 area the well-known Southall-based F P Herting & Son (it’s pronounced ‘Harting’, by the way) is well worth a call: 020 8606 7000; www.hertings.com. Either way, make sure that you get a full complement of the best-quality parts available. As ever, you

want to do this job just the once.

Our thanks, of course, to Stomski Racing for its enthusiastic help with this story, and not least to technician Paul Stacey at independent specialist Northway Porsche in Beenham, Berkshire: 01189 714333; www.northway.co.uk. Interestingly, Paul was just a little sceptical when we first showed him the kit – for many years he and his colleagues have dealt with the problem by means of lots (and lots) of heat, MIG-welding a nut on the end of any broken stud (which obviously has the same effect), or even drilling and tapping free-hand – but within just a few minutes even he was smiling broadly at the ease and the speed with which he was now able to do the job. Result!



you have the luxury of raising the car to a more comfortable working height on a proper garage lift.

We were naturally interested, then, in precisely one such kit now being manufactured by US-based Stomski Racing. ‘With more and more broken exhaust bolts reported on the water-cooled engines,’ writes proprietor Steven Stomski, in the instruction leaflet that comes with the kit, ‘the headache of repairing them is becoming epidemic. Tasks ranging from a

simple exhaust-system update through to engine removal are consistently plagued by snapped, rusted and broken bolts. Rarely can accurate removal of the broken item be performed with the engine in the car, and even after removal the task is time-consuming, and if not done correctly can lead to either a faulty repair or even a damaged cylinder head.’

The company kindly sent us a kit to try, and the results, with the expert assistance of technician Paul Stacey at Northway

Porsche, are shown in the accompanying photos. Ideally, of course, we might have done the job on an engine in situ in a car, because the device is designed to facilitate just that, but that would have meant waiting for a suitable candidate to turn up – and suddenly, of course, there were none to be found. And besides, it would also have made the job that much harder to illustrate. Forgive us, then, a minor ‘fudge’ for the sake of speed and clarity. You will, as the saying goes, get the picture. **PW**



STOMSKI RACING

Some of the products that we encounter in what you might call this region of the Porsche world can fairly be argued to be solutions looking for problems, but that certainly does not apply here, or to any of the many other tempting goodies in the company’s 20-page A5 catalogue; see the cover image over on the right. (And all are showcased on-line, of course; more details at www.stomskiracing.com.)

Designed – and beautifully manufactured – to cater to genuine needs, they include both generic tools such as piston-ring compressors, dial gauges and TDC (top dead centre) indicators, but also innovative and frankly must-have gadgets such as a patented gudgeon-pin circlip ‘injector’, and ranges of specialised but essential assembly and maintenance aids for both air- and water-cooled Porsche engines.

Highlights from the former group include head-stud installers, designed to avoid the need to ‘double-nut’ a stud in order to wind it in to the casting, a head-stud height setter, and elegantly anodised threaded sleeves used temporarily to secure the cylinders in place during a rebuild. Or how about a dedicated camshaft-nut tool, a piston/crankcase oil-squirt cleaner, or purely mechanical and thus screw-adjustable camshaft-chain tensioners? Use those to help set the cam timing, or as a bullet-proof alternative to pressure-fed or hydraulic tensioners for racing. We particularly

like the valve-lash (ie tappet-clearance) adjuster, too, with its provision for a separate dial gauge for consistency and accuracy, and the similar device for accurate camshaft timing.

For the mainstream liquid-cooled engines there is both the exhaust-bolt drilling kit shown here and an equally useful heat-exchanger tester, and for the rather more specialised GT3/996 Turbo variants such delights as a cylinder press (to remove and fit the liners from and to the water jackets), a single camshaft-sprocket tool (to avoid having to buy the two that Porsche says you need), and again a full rig to help you set up the camshaft timing. There is a dedicated GT3 heat-exchanger tester, and another specific exhaust-bolt repair kit – and even camshaft profile plates to ‘rough in’ the shafts prior to precise timing.

Chassis-wise, the company offers a number of Rose-jointed control arms for the water-cooled cars, a front tie-rod and anti-bumpsteer kit, strut mounts, fixed and adjustable thrust bushings, solid and semi-solid engine mounts, several brake-caliper adaptor kits – one of which allows the fitting of 996 Turbo calipers to naturally aspirated cars – and even stainless-steel brake pistons. Indeed, about the only things we would question are the 911 piston and con-rod with a built-in dock, or the 911 cylinder wine chiller – although the rocker-arm wine-bottle stopper is actually rather appealing!



Stomski catalogue (left) is packed with must-have tools for anyone serious about doing as much as possible of their own M96/97 repairs and upgrades – including Turbo and GT3 variants. There is much for air-cooled enthusiasts, as well. Prices for UK buyers will naturally depend upon latest currency fluctuations, but if all the products are as good as this drilling jig – and we feel they must be – then that has to be a very minor consideration