

# The Jaguar AJ-V8 engine

Strengths and weaknesses



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The Jaguar V8 has now been used in both supercharged and normally aspirated versions in the XK, XJ, and S type ranges for some 8 years. Designed wholly by Jaguar, the 4.0 litre V8 was first introduced in 1997 using the now infamous Nikasil lining for the bores. Now 8 years later with more conventional cast iron liners the Jaguar V8 has a capacity of 4.2 litres developing up to 400bhp and there have been a number of technical changes incorporated making the engine both stronger and more reliable.

The original format of the engine has changed relatively little in real terms: - four valves per cylinder, twin overhead camshafts per head, Nikasil bores, sintered fracture split con-rods, 2 plane crankshaft running simplex timing chains. The original 4.0 litre had a stroke and bore of 86mm and the stroke has been extended to 90.3 mm to create the current 4.2 litre derivative. Head design achieved a very compact combustion chamber with the angle between inlet and exhaust valves being 28 degrees and the valve train masses were reduced as much as possible to minimise cam loads. Valve stems are only 5mm which is a dramatic reduction when compared to earlier Jaguar cylinder head design. All in all it is a lightweight, compact and efficient V8.

The original Jaguar 4.0 litre V8 suffers from very few basic problems that we have seen over the years. The problem relating to Nikasil is discussed at some length later in this article but other more minor problems are discussed below. Fundamentally the engine is very strong and any weaknesses have been designed out by Jaguar.

Head gaskets are now beginning to show their age and any overheating, coolant hose failure or loss of coolant needs careful diagnosis to ensure that the source of the problem is resolved. Early water pumps were prone to impellers breaking up with consequential overheating problems so the coolant system does need to be checked with these weaknesses in mind. Chemical test for CO in the coolant fluid is to be recommended at this stage to clarify head gasket failure.

Timing chain tensioners are another source of problems with Jaguar having revised the design of these items on a number of occasions. The camshafts have uneven phasing of the cams and this gives rise to irregular loads on the timing chain which in turn compromises the life of the tensioners. This has clearly been understood by Jaguar as in the design of the new 4.2 litre, the chains, tensioners and lubrication system have been changed and this should result in the problem being virtually eliminated in the 4.2 models. The new timing chain design incorporates Morse chains to handle the loads that presented problems for the original simplex items.

Occasionally the lubrication system fails, the bearings of No.1 big end suffering starvation due to low oil level. For this reason alone it is sensible to check the engine oil level on a regular basis as even a slight lowering of the level can cause loss of oil pressure on cornering. The 4.2 has a totally redesigned oil system utilising a central pickup and incorporating piston and timing chain oil jets to further aid lubrication and cooling.

Racing Green Cars are now able to offer a full engine rebuilding service on the Jaguar 4.0 V8 and are also able to offer an upgrade to the new, more sophisticated 4.2 litre as an option should the original 4.0 litre engine require replacement. Rebuilt engines no longer utilise Nikasil bores but revert back to the traditional lined approach. It is possible to recreate the ceramic bores but only in conjunction with new steel liners.

It is not realistic to replace the Nikasil coating on the earlier 4.0 litre Jaguar V8 engines when they require rebuilding but instead the remaining Nikasil is machined out and new liners pressed in taking the engine back to the original dimensions. The engine is then fully rebuilt with new components as required, new gaskets and seals throughout and the finished unit is guaranteed for 1 year or 12000 miles.

Originally developed by piston manufacturer Mahle for use in the Wankel engine the Nikasil coating is a highly technical surface coating for cylinder bores and is still used extensively throughout the racing and aerospace industries due to its significant advantages.

The Nikasil process creates a layer of nickel-silicon carbide about 0.07mm thick, usually by electrolytic deposition, attached to the surface of the aluminium bores. This nickel matrix is exceptionally hard, yet it is relatively ductile. Dispersed through the nickel are particles of silicon carbide less than 4 microns in size. These extremely hard particles make up 4% of the coating and form a multitude of adhesion spots where oil can collect as well as providing a long wearing surface for the piston and rings. The silicon carbide particles contribute to longer engine life by ensuring good cylinder lubrication.

Nikasil offers superior lubrication, reduced friction, and improved wear characteristics when compared to traditional cast iron bores. Other benefits are that the Nikasil allied to aluminium provides substantial weight savings over cast iron liners and this combination is also very efficient at dissipating the heat generated during the combustion processes.

Where Nikasil was not fully tested, however, was in relation to cheaper fuels where the relatively high sulphur content allied to short periods of use of the engine caused the surface coating to break down. This breakdown in the Nikasil coating was due to acids being created through the combination of sulphur and water in the combustion process and was exacerbated if the engine did not achieve normal operating temperature. In severe examples the compression is lowered through leakage past the piston rings to the point that the engine will not start.

The Jaguar test to diagnose this problem involves measuring the combined blow-by of all 8 cylinders and should the blow-by be greater than 50 litres per minute with the engine at idle and correct temperatures then the engine will require replacing.

Once the problem became apparent Jaguar instigated dealer tests and replacement of the badly affected engines under warranty subject to service history and mileage. From 2000 model year on cars came equipped with the more traditional solution to bore construction and cast iron liners were again deemed the answer. This is the practical solution to the problem but the loss of the Nikasil lined engine and its clear advantages over the conventional approach is a great shame. Current fuels would probably have meant that this problem would never have become apparent.

The vehicles and chassis ranges that have Nikasil lined bores that may suffer from this problem are:-

XK series VIN range 001036-042775

XJ V8 series VIN 812256-878717

Note that Jaguar do not give chassis number ranges for the S Type but these were fitted with Nikasil lined V8s and as such it should be assumed that cars within the relevant time period may well have Nikasil liners. Racing Green Cars have seen problems with V8 engines in S types and on dismantling these engines the bores have turned out to be Nikasil lined.

It is highly likely that engines from this period that have not already suffered any breakdown in the Nikasil lining may go on to last for substantial mileages with negligible bore wear.

Racing Green Cars are now seeing Jaguar V8 engines having covered quite high mileages or having thrown a bearing. On dismantling these engines it is often found that the crankshaft is too badly worn to re-use with the bearings available from Jaguar. This is generally the case where the cars have been run with low oil levels at some stage in their lives. Oversize engine bearings are not available from Jaguar for this engine for reasons that are not known. Where a crankshaft is found to be excessively worn the only resolution up until now has been to purchase a new crankshaft and bearing kit from Jaguar as and when these have been available.

Racing Green Cars have now developed a range of oversize main and big-end bearings for the 3.2 and 4.0 litre Jaguar V8 engine to allow worn crankshafts to be reground. These bearings are available for the 3.2 and 4.0 litre V8 engine in standard, 0.25mm, 0.50mm, 0.75mm and 1.00mm oversize for both the mains and the big-ends. The main bearings are also suitable for the 4.2 litre Jaguar V8 engines but the big-end bearings are of a different size. Whilst big-end bearings for these engines are going to be developed they are not currently available. The main and big-end bearings for the 3.2 and 4.0 litre V8 Jaguar engine are now available in engine sets from Racing Green Cars. Please contact [enquiries@racinggreencars.com](mailto:enquiries@racinggreencars.com) for further details and availability.

Racing Green Cars are also able to offer piston ring sets, stem seals and a variety of other parts for the rebuilding of these Jaguar V8 engines.

