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ENGINES for M.G's

Their Story after 1935.

By Neil Cairns.

Covering the XPAG series,
BMC 'A' Series,
BMC 'B' Series,

With their relative units such as the Twin Cam,
BMC 'C' series, Rover V8, some early Morris units, the
'O', 'R', 'S' and 'K' series till 2003.

Engines for M.G's.

Contents

"Remember, all an engine does is push a car along"
Anon.

Foreword and Bibliography

With such excellent books on M.G. history about, it would be utterly pointless trying to retell it all. If that is what you are after, then obtain 'M.G. by McComb', 'Magic of the Marque', 'McComb, Maintaining the Breed', all by F. Wilson McComb; 'Tuning and Maintenance of MG's' by Phillip H. Smith; 'The Magic of MG' , 'MG, Magic of the Marque' by Mike Allison; and 'MG The Untold Story' by David Knowles. Once you have absorbed these, you are an 'expert'. This book is a collection of information and stories I have collected over about 30 years, with obvious reference to MG history books. It is not a workshop manual, even though there are hints and tips from experience of working on them, on the XPAG, 'A', 'B' and 'C' series, and the V8, all of which I have owned and run for a number of years, (especially the XPAG and 'B'.) It is not a history book, even though the chapters and models are in order. It is an information book for an enthusiast by an enthusiast, who saw something somewhere about M.G. engines, and needs it all in one book. The political infighting and hard commercialism of production and profits does not interest me, so I have deliberately avoided it. Contained within these pages are information and my views, about the engines that M.G. used after the company had come under firm control of Morris Motors Ltd.

Other reference matter, some read a long time ago I might add, was 'M.G. Cars', by C.P. Davidson; ‘The Book of the Austin A40', by Ellison Hawks; 'Wolseley Cars' and 'Morris Engines', by D.V.W. Francis; 'BMC 'B' Series' by Lindsay Porter; 'Tuning the 'A' Series', by David Vizard; 'Post War Baby Austins, by Barry Sharratt; 'Morris Bullnose and Flatnose', by Peter J. Seymour; 'Y type Saloons and Tourers' by John Lawson; 'The Morris Story', by Brian Whittle, 'The Rover Story' and 'Triumph Spitfire' by Graham Robson; 'British Leyland', by Jeff Daniels; 'The Breakdown of Austin Rover', by Williams, Williams and Haslam; ''Metro', by Mark Steward; 'Lord Nuffield', by Peter Hull; 'The Private Motor Car', a collection of the Crompton–Lanchester Lectures to the IME in 1960; and many, many road tests found in the 'Brooklands Books' collection, from 'Autocar', 'Motor', 'the Light Car'; articles in the MGCC magazine '*Safety Fast'*; articles in the MGOC magazine ' Enjoying MG'; articles in the MG Octagon CC magazine, 'Bulletin'; my own experiences since 1960, and items that I have forgotten from whence they came.

**Note that this IS NOT an engine tuning book. NC.

Quote: – *“In more than 60 years there have been many M.G.s, some of them remarkably good cars and some of them really very bad, but the vast majority have been honest in design and execution."*
F.W. Wilson McComb. 1984

This includes their engines, of course.

**A special thank you must go to Malcolm Taylor of the MGOCC, and John Lawson of the 'Y' Register, for their help with this rather involved book.

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Introduction

There are lots of pretty M.G. books about, full of excellent photographs and text that gloss over important technical parts, or simply do not mention them. Others go too deep and lose the reader in a morass of figures and graphs. The simple aim of this book is to get round the difficulty of finding out that odd bit of information you know you saw somewhere. The mechanical components of an M.G. such as its engine, has to be looked at with the view that after 1935 M.G. used and developed Morris, and later, BMC/BL, then Rover, parts for their own use. Some enthusiasts either forget, or choose to ignore this.

The excellent engine drawings included are those of Motor, Autocar, Sphere, and Light Car magazine technical artists, and are shown as an 'art' of their times. This is not a historical epistle, nor is it a story of M.G., but if you like engines, and those of M.G. cars in particular, and their roots, read on.

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An Engine

Do you remember the first time you ever started up a car's engine? The fact that it started just because you pushed a button, pulled a knob, or turned a key? Your Dad's car perhaps, in the garage, or on the drive, when he was not about. It burst into life from its comatose state, and you heard the noise and felt its power through the seat and your foot on the accelerator. Then there was the day you actually first drove a car, or in my case a small Ferguson tractor. This thing with an engine in it, the feeling of power, it scared you that you would have to control this energy. The feeling you had as the car lurched forward, assuming you chose first gear! It did not take long to be able to control the engine; you quickly learned how to use a clutch and accelerator, then hopefully, the brakes. That feeling you had, is it still there?

Today's cars are just bits of technology to use, from A to B. Their reliability is marvellous, but there is no fun anymore. The risks and excitement has gone. To start up an engine in an old M.G. is to recapture that first thrill, to feel you want to control it. This is true of any old car of course, but M.G. does fire the imagination. M.G. are after all only 'Safe and Fast' cars that rely on well proven parts from others, be it either Morris or later BMC/BL. They are not super–fast cars, nor very large, nor expensive when made, (though some can be today as people try to recapture their youth or that first thrill.) Ancient bits of hot steel and aluminium spinning, reciprocating, vibrating, and producing power, under your control.

It matters not which model you drive, leave the worrying over whether it is a 'real M.G.' to others, the thrill is there in any M.G. saloon or sports car.

We are a very lucky generation, in that we have the motor car for pleasure. It cannot continue forever, let us enjoy them whilst we can. Let us now look under the bonnet and find out about the engines story, why it is there, where it came from, and to whom it is related. Engines from Austin, Morris, Triumph, and Rover were fitted to M.G's over the years. An old saying goes that Morris are cars that stop but do not go, and Austin are cars that go but do not stop, a reference to the immediate pre–war pairs competitors models; one had good brakes, the other good engines. They were to join forces as the British Motor Corporation, (BMC) after the war, in 1952, then British Leyland, (BL), in 1968, then the Rover Group in 1986.

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Chapter One

M.G. Engines, Care of Morris. **(1935 to 1955)**

THE PRE–WAR and IMMEDIATE POST WAR ERA.

The internal combustion engine (ICE) has now been with us for some considerable time, and it must now be under the bonnets of millions upon millions of vehicles worldwide. The M.G. motor car comes into the picture in approximately 1923/24, evolved by Cecil Kimber, in the early days of the Automobile. The engines used before then were purchased from outside the main Morris Company, but as the Morris Empire grew and grew, so he began to buy up his suppliers. The company of Hotchkiss in Gosford Street, Coventry were purchased in 1923 to be renamed Morris Engines Branch. They supplied Morris with the engines for the later model of the Bull Nose (and M.G.) saloon cars. Hotchkiss et Cie had moved to the United Kingdom from France in WW1 to escape the Germans, to continue making armaments, and carried on using their original machine tools and equipment. They had never made an engine until they met William Morris, but had excellent machine shop facilities and a very experienced workforce, and were looking about for work after the war.

The machinery and tools had come over from France, and this included the thread cutting dies and taps used on their guns. These threads of an unusual French Metric size were used up until 1956 in the last 'X' series engine in the Wolseley 4/44, having been used in virtually all Morris and M.G. engines till then. These metric threads are not quite the same as those used today. The last M.G. to use such threads was the TF1500 in 1955. Such nuts and bolts have British BSW/BSF head sizes, so that the average British DIY owner or motor mechanics tool kit could still be used, but with these odd metric threads. From then on, starting with the M.G. 'Z' Magnette in 1953, Austin engines were used under the umbrella of the British Motor Corporation, or BMC for short. These BMC engines used American based Unified Fine (UNF) and course (UNC) threads, (ANF and ANC in the USA) in the 'A','B' and 'C' series M.G. used. Such nuts and bolt heads had to be used with spanners that are termed "A/F", indicating the distance Across the Flats, a common size for instance, being 1/2" AF. Later still, standardised ISO metric sizes took over with the 'A' Plus, 'O','R','S', and 'K' series engines of Austin/Rover.

Other items used with the Morris engine were made by outside contractors, and they too were taken over one by one, so that Osberton Radiators became Morris Radiators in 1922 as Morris was their only customer. Skinners Union who made SU carburettors for Morris were purchased in 1926. The next year the first M.G. factory was built at Cowley, and then M.G. moved to Abingdon in 1929.

The Hotchkiss 'side valve' (sv) and Morris/Wolseley 'overhead camshaft' (ohc) engines used by M.G. before WW2 are well documented. This book is about those used by M.G. from 1935/36 when M.G. became part of The Nuffield Organisation, from the little TA Midget right up to the latest Rover/M.G. MGF sports car.

Like all things, a car engine is a compromise. It would be nice to be able to use the best materials, and hand assembles the accurately machined components to the 'Blue Print'. A blue print is a 'working copy' of the drawing of the engine from the design office. They were blue because of the method of copying such large drawings in those days. In reality the manufacturer has to use metals that are cheap, hard wearing, will machine easily, and take up complicated cast shapes. The engine must be designed for an assembly line as well as a long life. As M.G. was originally a small part of a huge motor manufacturer, Morris, they were limited to using parts that were available from the huge corporate parts bin. As a mass produced component for millions of cars, an engine has to have tolerances, meaning that a cylinder bore will be between two sizes, the variation often between two–thousandths of an inch, (0.002"), and the piston being made to similar limitations. So a new engine piston could have up to 4 thou' "play" if assembly was not checked for quality. To limit this, pistons would be graded so the assembler could select a set that would not be so slack. Camshafts and crankshafts would be under similar tolerances, (i.e. a half to one thou' plus or minus) simply because machines did not exist that could turn out thousands of parts without tiny differences. Experienced assembly line workers, worth their weight in gold, at Morris Engines, could select the correct parts to fit together within the tolerances. Morris paid good wages and had a large staff of Quality Inspectors, and used the best materials. So unlike Rolls Royce, cars for the masses like Morris and M.G. are not perfect, but as close as possible within a price.

Like other manufacturers, parts that failed the 'go, no–go' gauges were then machined to the next size for 'exchange engines', i.e. becoming an under-size crankshaft, or a re-bored block. Nothing was wasted. A 'go, no–go' gauge is used to check the dimensions of items, giving the limits for an operator to use easily and quickly.

Company Policy.

Motor manufacturers are companies, and companies exist to make money, not cars. Often the management are not all enthusiasts, but businessmen and women, and a good idea in business is to use common base components. This keeps prices down, allows more choice within a range, and can keep quality up, because of mass–production. In M.G's case it meant they had access to massive investment that was not for only them, but all the other marques as well. Under BMC this meant they could use new engines first that on their own they could never have afforded to develop and produce. Under Nuffield it was a similar case. It is no good being a self–contained unit in a company if you cannot call on its larger resources or help. If the bits you use, like engines and other mechanics, are suitably modified to suit your needs, i.e. engines tuned for sports cars, but backed by long reliable service in more mundane cars, a car can still have dignity and quality. For instance M.G. produced 524,862 MGB's, but no one noticed that BMC produced 900,000 Farina saloons; both have the 'B' series. Or that between 1953 and 1955 M.G. made 9,600 TF Midgets, but Wolseley made 30,000 4/44 saloons, both have late versions of the Morris 'XP' series engine. Or that M.G. made 150,496 'A' series engined Midgets, but in the Morris Minor there were 1,293,331 alone.

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PRODUCTION.

The Beginnings of an Engine.

Any engine begins life as an idea, (often tempered by the need to re–use parts of the old one due to costs) then a drawing, then this is transferred into the three dimensional wooden 'pattern' that will be used to make the moulds it will be cast in. The Morris engine design office and pattern makers shop was at Coventry, as was the iron foundry. Later the Ward End premises of Wolseley would be involved in engines as well. The wooden mould will be given a number, often the items part number, taken from the design offices drawing number. This number will follow the item through to the spares book sometimes. For instance the XPAG TC/YA cylinder block is pattern number 24146, the MGB 1798cc five main bearing cylinder block is 12H3503, the same as the Marina 1800 and the Sherpa 1800 diesel. The 1800 Marina cylinder head is 12H2709, and the Midget 1098cc cylinder head 12G206. These numbers are cast onto the metal and easily seen and rough looking; do not mistake them for serial numbers, (the engines individual identity number) that are stamped in much later during production. The medium used for the engine block and cylinder head, is often grey cast iron, as this flows very easily and will make intricate castings, and if cooled slowly will form graphite flakes in the metal. Graphite assists easy machining and makes the casting hard wearing, and partially self–lubricating. Grey cast iron also has a very small shrinkage rate after casting, unlike aluminium. Cast iron cylinder heads cannot withstand lead–free petrol on the exhaust valve seats, unless they are modified by fitting hardened steel inserts. The Pattern Maker who cut and carved the wooden pattern, will have had to make an outer pattern, and one that is in fact the hollow innards of the engine, such as the water spaces, called a 'core'. These are in the 'negative' so to speak, as the casting is done in special sticky sand, hence the term 'sand–casting'. A negative sand mould is made of the engine block, or head, then a 'core' mould is made in sand and baked, then suspended inside the first, via 'core holes'. Once the iron is poured in under gravity, it solidifies around the sand shapes. It is then broken open and the cooled casting carefully cleaned of all sand, both externally and from the 'core', the waterways and ports, etc. The holes that once supported the core are then machined, and core–plugs fitted, thin discs of concaved steel sprung into place, in the machine shop after. Grey cast iron was used almost universally for car engines, until aluminium supplanted it in modern cars once costs dropped. A sand casting has a natural 'sandy' finish; you can almost make out the grains.

After the foundry where the casting takes place, the block and head will be fed onto transfer machines, simply meaning that after each machining it is automatically transferred to the next stage of machining, many times over. This automation saves labour, is quicker and more accurate, often just one operator watching many machines. In the early days, the rough castings were taken from the foundry to Coventry for machining. Areas such as the cylinder bore; camshaft and main bearing in–line boring need to be very accurate. To locate parts accurately with their neighbour, dowels are used, on such parts as flywheels and big end caps. A dowel is a short piece of round metal bar that fits into a hole in each half of the two bits that need to fit together. Another method is to use a key that fits into a slot between parts, such as a camshaft gear or sprocket, so the 'timing' is accurate. A key is used where the two bits 'drive' one another, and is often square in cross section. Such methods allow accurate, fast assembly, on production lines.

Pistons were made of aluminium alloy, just as they are today, but carefully ground oval and tapered to cope with the thermal expansion when in use. Some pistons had steel inserts to control their expansion cast inside them, others are forged from good quality alloys. To seal up the cylinder bore from oil loss one way and compression loss the other, piston rings are used. Connecting rods, camshafts and crankshafts were forged from good quality carbon steel. Casting is using melted metal poured into a mould; forging is forcing very hot and pliant metal into the required shape, using very powerful machine hammers, into dies. A 'die' is a steel former, usually in two halves and often very large. Because of their accuracy and special steel, they cost a fortune. Forging keeps the 'grain' of the metal in the components, giving great strength after heat treatment. Because the steel parts need to be hardened and tempered for use in the engine, they are ground into shape, on grinding machines working at very great accuracy. Areas like the big ends, main bearings, camshaft bearings and lobes, also need very highly polished finishes, as well as accuracy.

Morris Engines Ltd. engines were well made. They used not only cast iron heads and blocks, but often had cast aluminium ribbed sumps, clutch and timing chain covers, with big brass threaded oil fillers and sump plugs. When BMC arrived in 1953 such expensive parts were replaced by pressed steel sumps and covers painted engine colours, often red for M.G. and green for the others. Rover went back to ribbed alloy covers and sumps, but their whole engines were aluminium alloy castings.

It is easy to see why the engine, gearbox, and axles are often the major costing in any car. There are inlet and exhaust manifolds to cast in iron, some inlets in alloy, sumps and timing chain covers cast in aluminium, all bearings surfaces need machining and an expensive journal to rotate in, lined with white metal or other alloy. Inlet and exhaust valves to machine and grind, timing gears and oil pumps to be gear–cut, oil ways to be drilled, and so on. Great care and cleanliness is needed during assembly, as any sand or metal swarf (bits of metal left over after machining) will quickly ruin an engine.

Because machining of metal surfaces is again a compromise, to ensure there is an oil tight seal, or compression tight seal, gaskets are used. This is an asbestos or paper based sheet, sometimes with copper surfaces, and is there to take up all the tiny imperfections the machine tools left. The sealing of crankshafts at both ends of the engine, was not a good point of British Engineering in those early days. The front end relied on a felt (compressed woollen waste) seal and the rear a 'reverse scroll seal' based on the method the Egyptians used to lift water from the River Nile 3000 years ago. As the engine rotates the reverse 'thread' is supposed to 'roll' back in any escaping oil that the 'oil–thrower' missed, (an oil–thrower is a disc designed to spin oil away from the seal area.) The XPAG, 'A' and 'B' series engines used this system, until BMC fitted neoprene sprung lip–seals in the early 1960's. Morris were also clever with their pre–war sv units, putting a 'cover' on the top similar to a rocker cover, but was in fact an air silencer/fume collector for the carburettors. This has caught out a few 'experts' who assumed they were ohv engines.

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M.G. Engines from the TA Midget onwards

The pedigree of the Morris Engines Division included not only the background of Hotchkiss, but that of Wolseley, of Ward End, Coventry, whom Morris had purchased in 1927. He was after the Wolseley engines of advanced design, as well as wanting to outbid his competitor Herbert Austin. The overhead camshaft engines (ohc) of Wolseley had found their way into many M.G. cars including the tiny M–type Midget. However, these ohc engines based on Wolseley's WW1 experience of building Hispano–Suiza aircraft engines under licence, had proved to be expensive to produce and complex to keep running. So most Morris cars were fitted with humble side valve (sv) engines, and the Wolseley using a cheap overhead valve (ohv) conversion of the same engines. For by 1935 Wolseley's had become an up–market Morris, though after WW2 there was a short return to the ohc six cylinders for a while for big Wolseley cars. In 1938 Nuffield purchased Riley Motors, who had their own well designed four cylinder high–camshaft engine, but this engine never affected M.G. as Riley were left to run themselves for some time.

The PA/PB ohc Midgets were the last model to use that engine, the ohc Morris Minor reverting to a side valve back in 1932, and had been the source of many of the Midgets components. When the tiny ohc 'M'–based Midgets engine stopped production, in the upheaval of Leonard Lords thinning out of the numerous models M.G. and Morris/Wolseley were building in 1935, M.G. had to look into the Morris cupboard of engines for a successor to the nice ex–Wolseley units.. From the rather empty shelves they found the ohv conversion of the pedestrian Morris 10/4 Series 2 sv unit, (10hp four cylinder.) This was fitted to the Series 3 Morris 10/4 and Series 2 Wolseley Ten/40, (10hp rating with 40 brake–horse power, or bhp) in 1935, being termed a 'MPJW' in the Wolseley and a 'MPJM' in the Morris, and was of 1292cc, with a bore of 63.5mm and a 102mm stroke. This 102mm stroke can be traced back to the early Bull Nose Morris engines as well. The rather out of date 1910 RAC rules on Horse Power (hp) still had effect, and were used by the government for levying road tax tolls. This rule relied on only the bore of the engine for its formula, in this case giving these Nuffield four cylinder cars a rating of 10hp. After 1936 all the Morris firms were combined into The Nuffield Organisation, (Morris becoming Lord Nuffield in 1935) to get around super–tax problems, as one or two were the personal and private property of William Morris. There were other parts from the Morris Ten/Four series 3 that were to be used on the 'M'–type Midgets replacement, the 'TA', such as hydraulic brakes, gearbox, axles, etc.

Do not confuse "hp" with "bhp". The old Horse Power (hp) was just that, the power of one horse. The RAC designed a system whereby cars engines power could be worked out by a formula, using the diameter of the bore. This was all right in the early 1920's, but as 'power measurement' became more accurate, a machine called a 'Brake' was used. The engine was bolted to it, run up to speed, and its output measured in Brake Horse Power (bhp). The old RAC system became a joke; a 10hp car would produce over three times that by the 1930's, for instance a 10hp Morris producing 37bhp. But the Excise/ Transport Ministry, in the ways of British–red tape, kept the old 1910 RAC system to use for cars to pay their road tax on, little cars low annual tax, big cars more. It was abandoned after WW2, as it had held back engine development by restricting bore sizes, hence the large number of old British cars with long strokes and tiny bores!!

<u>VA One and a Half Litre Saloon Engine. (1937 – 39)</u>
The TA sports car was not the only M.G. to inherit a Morris/Wolseley ohv engine; the big M.G. saloon cars used similar ironwork. The VA was an M.G. saloon car, the smallest of a range. The VA used an engine of 1549cc, with a 69.5mm bore by the now famous 102mm stroke version of the Series 2 Wolseley Twelve/48, (in fact a big Series 2 Ten/40, [TA] engine) itself a ohv conversion of

the Series 2 Morris Twelve/four sv unit. The 12hp engines size was why the VA was called the *'One and a Half Litre M.G.*' This was a four cylinder engine and a very close relative to that used in the TA Midget, being of the same Morris family of units. It had a nice ribbed aluminium alloy sump. Like the 'TA' the car had coil ignition, the distributor having a Vernier adjustment for fine tuning. Cooling relied on thermo–syphon with pump assistance. Both 10hp and 12hp cars used virtually the same gearbox so swapping about was made easy. In the VA the engine was called a 'TPBG'. The rather staid unit had a surprise in it, as part way through production there were modern steel backed shell bearings on the crankshaft, replacing the direct cast white metal. Morris Engines were updating as they went, as this engine had two crankshafts in its short life. There must have been plenty of metal in the VA engine, as it was bored out to 73mm to give 1705cc, and using Morris 18hp/ Wolseley 18/85 pistons, fitted to the TA "Cream Cracker" team cars, (a 'TPDG'!) Cecil Kimber had such a unit in his own VA it is rumoured, this may be true because the Police specification VA did use a bored out engine, to 1705cc, to give it better performance. The VA of 1937 to 1939 produced 55bhp at 4,800rpm, on a 6.5 to 1 compression ratio. Unlike the TA, the VA had been able to adopt the dry clutch of the 12hp Morris and Wolseley Twelve/48, as they gained it during production. The first VA engines still had 'wet' cork clutches, like the TA. The later VA engines revved more easily with the lighter flywheel of the dry clutch. The late 1930's saw many improvements to Morris engines. MG made 2407 VA saloons.

SA Two Litre Saloon Engine. (1935 – 38)

The SA was the next model up the M.G. saloon car range with a six cylinder engine, a more elegant car than the VA. The SA had the ohv engine from the Wolseley Super Six of 2062cc, of 16hp, with 75bhp, an in–line six cylinder, and the reason the car was originally called the *'M.G. 2 litre*'. In the M.G. it used twin downdraft SU carburettors and had the early Morris 'wet' cork clutch. A modern feature was its counterbalanced crankshaft. It was also used as a side–valve engine in the 1933 Morris Oxford Six, 16hp saloon. Oil pressure was a high 80 lbf/in, and was fed to the pump from a floating mesh filter in the ribbed aluminium sump, to reduce the chance of sucking up any sludge in the bottom. Again the coil ignition had a Vernier adjustment on the distributor, perhaps a sign of the varying fuel qualities available at the time. As in the 'VA', cooling was pump assisted thermo–syphon. Tappets held in by circlips are carried in removable 'tables' of four to each set, (three tables for a six cylinder) as they all are on this family of engines. The exhaust was twin three branch manifolds with 'MG' cast in, and the sump a ribbed alloy casting. To cope with the heavy M.G. SA saloon body, the engine was bored out to 2288cc using a 69mm bore, (17.7hp) which just happened to be half a millimetre under the size of the Morris sv 18hp, and Wolseley 18hp ohv engines. The inlet valves were 33mm, and the exhaust valves 30mm diameter. With main bearings of 55mm diameter and big ends of 48mm diameter the connecting rods had pinch–bolt little ends. Piston design changed after engine No. QPHG1165, formerly they had four rings, after they had just three above the gudgeon pin, in the Aerolite forged items. Oil capacity was 2 1/2 gallons, with a hot running pressure of 40 – 60 lbf. The six cylinder Morris engines were virtually a 'four' with two extra cylinders; many parts were interchangeable to keep production costs down, not an unusual reason for a mass producer of components such as cars. Later this engine was again enlarged, bored out to 2322cc in 1938, with a 69.5mm bore, so that aligned it with the ‘QPHW’ Wolseley 18hp, the M.G. version being the 'QPHG', and to increase power to compete with the new SS Jaguar models. The Nuffield system of engine prefixes is explained later. The SA engine of 1936 to 1939 in 2322cc form with 6.5 to 1 compression, produced 80bhp at 4,800rpm, and had that 102mm stoke. It was a bit pointless still calling it the '2 litre' at that capacity, and was replaced by the 'WA' 2.6 M.G. SA’s ran from SA0251 to SA2988.

WA Two Point Six Saloon Engine. (1938 – 39)

The bigger WA 2561cc in–line six cylinder ohv QPJG engine with 73mm bore, again had the 102mm stroke of the family of Morris engines, but was an improved version with a counter–balanced crankshaft, being built after some engineering improvements to the products, including thin wall steel backed white metal shell bearings located by dowels, and a dry clutch. It replaced the SA. The WA was an even grander M.G. saloon car almost in the small Rolls Royce tradition, and the top of the range of these late 1930's saloons. Pistons were modern controlled expansion type. It had a two gallon alloy ribbed sump, with a six branch cast exhaust manifold, covered in cooling ribs. There was a full flow oil filter, and the oil was fed via a coiled copper pipe, from the pump, through the water jacket, to the bearings. This heated the oil up on starting, and cooled it once too hot. The engine was rubber mounted for insulation, and sported a nice aluminium alloy rocker cover. The engine's cubic capacity was why the WA was called the *'M.G. Two–point–Six'*. Again a sv version of the same 2561cc was used in the Morris 18hp, and a similar ohv unit in the Wolseley 18/85. The M.G had twin semi–downdraft SU carburettors, and was rated at 19.2hp for road tax. The WA ran from WA0251 to WA0619.

These were all push rod ohv units in the TA, VA, SA, and WA from the Morris stables, a very unexciting bunch of saloon car side valve engines converted to overhead valve operation. The SA/WA engine was also shared in various forms with the Morris Fourteen, Sixteen, and Eighteen. The Eighteen used the same engine as the SA, though the MG SA and Wolseley Sixteen versions were converted to ohv. All had proper water pumps with a complex thermostat in its own housing with a by–pass, not completely relying on thermo–syphon circulation, coil ignition, and a distributor with automatic advance and retard by centrifugal weights. All used the then 'new' smaller diameter 14mm spark plugs, and a timing chain with 'bright' "T" links to assist in camshaft timing on assembly. M.G. was a division of Nuffield now, not virtually autonomous anymore; it had to follow corporate company policy. For the first time M.G. engines had air silencers on in the saloons, M.G. wanting to refine their models, and the saloons had a lot of the big Wolseley saloons in their mechanics. Only the SA and WA had a counter balanced crankshaft and all were long stroke, narrow bore units. The WA of 1938 to 1939 produced 100bhp at 4,800rpm, on a compression ratio of 7.25 to 1, both good figures for then. For comparison, Humber had a huge sv 4139cc 'Blue Ribband' engine that only produced 113bhp, in their Snipe, during the same years, and it was popular with the Metropolitan Police. The engines in use by M.G. in the late 1930's were from the parent companies stocks. Abingdon had the choice of those power units fitted to various side valve Morris saloon cars, from a 918cc 8hp up to 3,485cc 25hp, and their overhead valve conversions used in the up market Wolseley cars of identical cylinder dimensions, six of which were six cylinder engines, and nearly all with .019" tappet clearances though the ' *Two Litre' and* 'TA' having .015" clearances. One of these engines was to lead to a very famous line, and that was the 'MPJG' four cylinder 1292cc one fitted to the 'TA', ex–sv Morris Ten/Four conversion.

Odd information...the TA, SA, VA and WA dynamo/tacho reduction ratio is 7:15.

THE 'TA' MIDGET "MPJG" ENGINE. ('MPJW in Wolseley, 'MPJM' in Morris.)

The 'TA' Midget was a much bigger car than the tiny ohc 746/847/939cc, 'P' and 'Q' types it replaced, and thus heavier. It has the 1936 – 37 Series 2 Wolseley Ten/40 engine, (also used in the 1935 Morris Series 2 Ten/4 and 1938 Series 3) but with twin SU HV3 1 1/8" carburettors fitted and a camshaft with 11:59:56:24 valve timing, 8mm lift, producing 45bhp in this M.G. Considering this was a developed ohv version of the 1932 Series 2 sv Morris Ten/Four this power output was excellent, but it was as far as this unit could be developed or economically go. Whilst more power could be wrung from it, its long stroke of 102mm bore of only 63.5mm, and un–counterbalanced crankshaft, along with its siamesed inlet and exhaust ports, limited its revving range. The family of the then current Morris engines used siamesed ports, (two valves being fed from one hole) and on the 'TA' whilst No.1 and No.4 exhausts had their own port, there were only two inlet ports each feeding two valves. The centre port was for No.2 and No.3 exhaust, (a design to be repeated in the BMC 'A' and 'B' series years later!) The inlet valves were 33mm diameter, with the exhaust at 31mm, both with triple valve springs. Oil pressure 'hot' is 60 psi at 30mph, sump capacity being 11 pints. It was a 'slow' engine, with a huge flywheel and a cork lined clutch running in engine oil, (dating back to the Bullnose Morris) real vintage stuff from the Bull Nose era. It did have lots of pulling power, good torque, but not really a sports car unit. However, because it was much bigger than the tiny ohc 'M' engines, in the TA it gave similar performance. A bit ahead perhaps, but it pre–dated the Triumph Spitfire engine that the Spridget inherited after the excellent 1275cc 'A' series, the 1493cc Triumph unit, and the seven main bearing 'C' series in the MGC, having similar faults to the 'MPJG' engine. Not all M.G. engines were good.

However, a good point of this bread and butter 'TA' engine was the full–flow oil filter that cleaned all the oil before it arrived at the bearings. It was common for some manufacturers to fit by–pass oil filters that just took a dribble of oil off the main feed gallery, filtered it then dropped it into the sump. Such a system could take many miles to filter all the oil, and bearings were fed with unfiltered lubricant direct from the oil pump. (The early BMC Austin engines did just this.) The gear type oil pump fitted to these Morris engines were very good, well–engineered and built to last, unlike the early 'A' series cheap items. The oil was sucked from the sump to the pump via a mesh filter that 'floated' on the oil. The ribbed aluminium alloy sump held 12 pints of oil, and had an external, pressure full–flow oil filter, running pressure hot being 60 lbf. From the MPJM/MPJW the TA engine inherited white metal, directly cast onto the big end, bearings, simple steel backed shells were in the future, on the 'X' series of engines to come. Big ends were 52mm diameter by 38mm long, with 45mm dia. main bearings 28mm long. Only two undersizes were available, –.010" and –.020", just like the 1275cc 'A' series later. Piston design changed after MPJG696, the early plain aluminium type had four rings, with the stepped–scraper oil ring on the skirt, those fitted MPJG697 after having three above the gudgeon pin. The oil control was by a slotted–ring. Water was pumped around the cooling system, with a thermostat to control temperature, when most run of the mill cars relied on thermo–syphon circulation. Unlike today’s cars, the water pump had its own grease nipple. A sign of things to come is shown in the 'TA' having an air silencer that also consumed the engine fumes via a vent pipe. Ignition was by coil, magnetos now being old fashioned, but still used on many motorcycles.

Many car companies of those days had taken the same economical path to update their engines, by converting a current sv unit to ohv. SS Jaguar did this with David Blacks 'Standard ' six cylinder sv, using it as an ohv in their SS90 and SS100, real 'hairdressers' cars. Humber went one better and used a two litre sv designed in 1929 for its Hawk model, for the new owners, the Rootes Brothers. This engine lasted up until 1954 in the current Humber Hawk saloon, and then it was updated to an ohv unit. They put it into new 'Hawk' of 1955, and the Sunbeam 'Talbot' sports saloon. It lasted up to the last four cylinder Hawk and Commer van in 1967. That is getting your money's worth from a design indeed! Morris were just as canny, the 1549cc sv engine from the Morris Twelve/Four, (used as an ohv in the M.G. VA and Wolseley 12/48) had its 102mm stroke cut down to 87mm to improve rpm, giving 1476cc, fitted with a dry modern clutch, shell bearings, and called a 'VS15M', and used in the post war Cowley up until 1954, and as the 'VS15C' in the Morris 'J' Type vans until 1956. The BMC 1200cc 'B' series ohv was then fitted to replace it, having a similar forward sump to the 'Z' Magnettes, to clear the solid front leaf sprung axle on the J type van.

The 'MPJG' engine had component designs that would continue right up until the last 1622cc BMC 'B' series engine, such as a pinch bolt on the little end gripping the gudgeon pin. Used in the small early 'A' and 'B' series as well, this method of locating the piston is not good for continuous high rpm.

So the TA engine was 'state of the art' for its time, and 3,003 of the models were sold between July 1936 and August 1939, not bad for a tiny firm like M.G. The larger series 2 Wolseley 12hp engine of 1549cc, (the VA engine) could be fitted to a TA, as well as the four speed gearbox of the Morris 10/4 series 3, Wolseley Ten/40 series 2, Morris 12/4 s3, and Wolseley Twelve/48 s2, if the M.G. remote gear–change was used and clutch adapted. If a dry clutch, late VA unit was used, it was not difficult to adapt. Such was the inter–changeability of the Nuffield components. To give the TA better acceleration, the axle ratio was changed from 4.875:1 to 4.375:1 at MPJG684.

Oil Leaks.

For all their faults, these Morris engines had good oil feed to most of their working parts. The 'X' series had a particularly good feed to its ohv rocker shaft and followers, inherited from the MPJM/MPJG series. The feed came up from the rear end of the main oil gallery, via a copper pipe, and fed under full pump pressure into the hollow rocker shaft. Because MG and Morris were worried over rocker wear, the feed was ample, and it assisted cooling of the top of the valves and their springs, via a tiny hole in the rocker itself, spraying out oil. Even today the two bolts that are for holding on the 'Y' air silencer weep oil if a fibre washer is not used.

One weekend I needed my ancient car to go home on a 24hr pass, from my RAF station in Oxfordshire. The rocker cover gasket leaked, so I made a new gasket up from suitable sheeting in the stores, used on the RR Dart Turbo–Prop engine of the Argosy. If it is good enough for RR, its good enough for MG. Home I went to see the fiancée, fifty mile away in North Bucks. It was a sunny weekend, so we went for a run all the way over to the Malvern Hills, and back. Oh, such days of traffic free roads in the late 1960's! It was apple picking time in Worcestershire, so we stopped by a stall in a lay–by and brought some. I noticed the back of the car look dirty, and on close examination, found it was covered in oil.

Upon opening the bonnet, I was to discover that gasket material suitable for the synthetic OX38 oil used in Turbo–Prop Jet Engines was no good for SAE30 Mineral Oil using MG Piston Engines. The gasket material had literally melted, and oil was everywhere. I screwed down the two cover nuts as far as I could, and crept to the next garage to fill up with cheap 'Commercial Oil' from an oil drum, then drove home.

With the technology of the 1930's in the Morris based engines used by MG till 1955, one had to accept they would leak a bit of oil as the sealing was not perfect. That is what I told my lady friend, (now my wife) and she seemed to accept it. I do wonder about those cars that followed me, once they switched on their windscreen wipers when it rained, and everything all smeared up. Would they suspect me?

One Nuffield engine that nearly came back to life in 1952, was the ohv Wolseley Eight, (a smaller X series engine unit) of just 918cc. It was destined for the Morris Minor that was currently using a 918cc side valve. When the Minor was fitted with four doors, the performance was so poor, a better engine was needed. Two things stopped the engines new life, a) the 803cc Austin engine from BMC was used upon amalgamation, and b) no one wanted to renew all the machines to change the engine over from metric to UNF threads. Had this engine been used, the MG Midget may well have used it instead of the 948/1098/1275cc ‘A’ series. Another pre–war engine and ohv version of the 102mm stroke sv ‘TK’ series used in the Morris MO series was fitted to the Wolseley Oxford taxi. This had a dry sump arrangement, and was called a TPDW–T of 1802cc. This size is identical to the Bull Nose Morris engine, but was still being made in the early 1950’s. Only 12 are known to now exist.

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The 'X' Series of Morris Engines.

As Morris found in 1938, by reducing the stroke the rpm range could be increased of the 1140cc 10hp MPJM, fitting a dry clutch and by getting rid of the heavy cork clutch it could rev faster. Redesigning the crankshaft and including counterbalances, (big weights opposite the crankshaft 'throw' for each cylinder) reduced the vibration and smoothed out the power at the higher rev range. This also increased the life and reduced the stress on the crank itself, which now had up to date steel backed white metal, or Babbitt, big ends and main bearings, located by dowels. Then redesigning the cylinder head to have six ports and angling the valves towards the manifolds, gave excellent breathing with lots of room for future development. Morris did this in 1938, and called the result the 'X' series of engines, and produced the new 1140cc 10hp, 63mm bore and 90mm stroke, for their new 10hp 'M' series saloon. It proved a lively, tough little unit. The Morris version was the 'XPJM', with a 6.6 to1 compression ratio, producing 37bhp at 4600rpm. The Series 3 Wolseley Ten version arriving in 1939 with the 'XPJW', both with a valve timing of 5;45;45;5. This very modified, virtually a redesign, of the TA – Morris s3 Ten/4 engine, was a winner. M.G. was very pleased, and developed this 1140cc unit to suit their needs by enlarging it and making internal parts stronger. This was to be the 'XPAG' once bored out to 1250cc, with the now new shorter 90mm stroke and a 66.5mm bore, 7.2/7.4 to 1 compression, with its own camshaft with timings of 11;57;52;24, and bigger valves, producing 54bhp at 5200rpm. Morris Engines termed this unit the 'short–stroke Morris Ten 'M' engine'. The 1140cc XPJM was designed by one Claude Baily, who was later involved in the Jaguar XK series. Because of the bigger pistons of the 1250cc version of the 'X' series of engines, and its good rev–ability, the connecting rods were stronger on the M.G. cars than on the 1140cc unit. The 'TA' chassis was fitted with this lively engine, with an improved version of the 10hp Morris series 'M' gearbox, with synchromesh on the upper ratios, and renamed the 'TB'. The TA engine mounting system was used, the new XPJM front mounting being adapted to suit. Note that such things as synchromesh was introduced to give quiet gear changes, not necessarily faster selection, something worth remembering if you are used to modern fwd cars, and then try driving an old M.G.

Do not under estimate the TA; it was the first of the world famous 'T' series of sports cars that took the world by storm after WW2. It will be remembered by many whom themselves were not even thought of during its time, as that car chosen by many RAF pilots, and USAF personnel, for the thrill of driving. The engine that powered it was a simple conversion of a saloon car engine that could trace its ancestry back to the 11.9hp Bull Nose Morris, and in 13.9hp size to the M.G. 14/28 and 14/40, all with that 102mm stroke.

WW2 cut short the life of the TB Midget, the only modification the 1250cc engine gained was an oil pressure powered timing chain tensioner after engine number 883. Some were fitted with a nice polished alloy rocker cover, from engine number 2020 to 2966, which expands into the post war TC Midget as only 379 TB's were made. The engine fitted to the 'TB' was now very up to date and was to survive until 1956. The redesign had resulted in its power increasing from 45bhp to 54bhp at 5200rpm, in a much livelier package with an unburstable feeling to it, a sports car engine.

The 'X' series of engine has the sump face one eighth of an inch below the centre line of the crankshaft, easily noticed on the front timing cover/sump asbestos string seal, the two 'halves' are in fact different lengths. Like most four cylinder, three main bearing engines, the side thrust is taken on the centre main bearing flanges. The fact the block is bolted to the cast aluminium sump, and both bolt to the clutch bell housing, makes the engine and gearbox unit very rigid. The, initially, split skirt later solid skirt, Aerolite aluminium pistons, have two cast iron compression rings, and one slotted oil scraper ring. On the M.G. XPAG the valves had double springs. The cylinder head carried the major water flow for cooling, being fed into the rear of the head, via a waterway along the offside under the manifolds. A water pump assisted the water from the radiator to the rear of the head. The cylinder block relied on internal thermo–syphon for its cooling. The engine had a very complex thermostat in its own housing.

Variations in the 'X' Series of Engines.

M.G. really took the little XPAG to heart, and it found its way into many M.G. models, as well as some Morris and Wolseley's. Study the chart to follow its use.

Model	bore/stroke	type	cc	Made
Morris 10/4 s2	63.5 by 102 sv		1292	1935 – 37
Morris 10/4 s3	63.5 by 102 ohv	MPJM	1292	1937 – 38
Morris 10/4 s3	63.5 by 102 ohv	MPJM	1292	1937 – 38
Wolseley 10/40 s2	63.5 by 102 ohv	MPJW	1292	1937 – 38
M.G. TA Midget	63.5 by 102 ohv	MPJG	1292	1936 – 39
Morris 10/4 s 'M'	63.5 by 90 ohv	XPJM	1140	1938 – 48
Morris 10/4 Utility		XPJM/U	1140	1939 – 45
Wolseley Ten s3		XPJW	1140	1939 – 48
M.G. TB Midget	66.5 by 90 ohv	XPAG	1250	1939
M.G. TC Midget		XPAG		1945 – 49
M.G. TD Midget		XPAG/TD		1949 – 52
M.G. TD mk2		XPAG/TDC		1949 – 52
M.G. TD 8" clutch		XPAG/TD2		1952 – 53
M.G. TD Mk2 8" clutch		XPAG/TD3		1952 – 53
M.G. YA		XPAG/SC		1947 – 52
M.G. YA 8" clutch		XPAG/SC2		1952
M.G. YB		XPAG/SC2		1952 – 53
M.G. YT lhd		XPAG/TL		1948 – 50
M.G. YT rhd		XPAG/TR		1948 – 50
M.G. TF Midget		XPAG/TF		1953 – 55
Wolseley 4/44		XPAW		1953 – 56
M.G. TF 1500	72 by 90	XPEG	1466	1953 – 55

The TC was the first with a timing chain tensioner, the earlier engines had a 7 1/4" clutch, and the Wolseley 4/44 (change of system now, four cylinder with 44 bhp) engine is really an SC/2 with a different sump casting. The 'type' will appear on the round brass disc in the centre of the engine number plate.

Production numbers of the 'X' series of engines	
Morris s'M'	80,000 plus,
Wolseley 10/40	12,000 estimate,
M.G. TA Midget	3,003
M.G. TB	379
M.G. TC	10,000
M.G. TD	28,643
M.G. TD Mk2	1,022
M.G. TF	6,200
M.G. TF 1500	3,400
M.G. YA	6,158

M.G. YB	1,301
M.G. YT	877
Wolseley 4/44	30,000
Total 182,604	

This Figure does not include the many thousands of the Morris 10/4 Utility cars and vans made during WW2 with the 1140cc XPJM/U, Solex carburettor engine, or those fitted to petrol/electric sets and pumps as the 1140cc XPJM/U for the war effort. These 1140cc engines can be bored out to 1250cc, but there is no Octagon cast into the block, see Archaeology section on how to identify one.

The models that used the 1250cc XPAG engine can be seen in the list. For normal production use variations were kept low, and the modifications made during its life with M.G. can be seen under that heading. It is very comprehensive, because it is a popular engine. Should you want to know this much about the BMC 'B' series, I would guide you to the excellent book by Lindsay Porter, see Bibliography. In the 'T' types the engine has twin SU H1 1 1/4" carburettors (TA 1 1/8") with no hot–spot, as the inlet and exhaust manifolds are separate castings. On the saloon car, the 'Y's, there is a single SU H2 1 1/4" carburettor with a huge air silencer above, with a single piece inlet and exhaust manifold giving a hot–spot to assist vaporisation of the mixture. Such a system is not good for efficiency, as it heats up the incoming charge, but does give a nice smooth tick–over and quick engine warm up. The Internal Combustion Engine (ice) is a heat engine, and relies on getting air as hot as possible for maximum expansion. Cold air in with maximum heat produces more power. If you pre–heat the air, you lose out on efficiency. Good cool mixture is best, and this may help towards the 54bhp the 'T' types produce over the lesser 46bhp of the 'SC' engines. Otherwise, as the modifications list shows, they are very similar units. The Wolseley 4/44 has the SC2 engine, in this specification, but with a manifold that faces out over the starter motor and an export oil–bath air filter, whereas the M.G's exhaust manifold faces down centrally. The 4/44 cast aluminium sump is completely different, with its reservoir at the front, rather prone to hitting kerbs, a fault of the 'B' series in the sister car, the 'Z' Magnettes, (see 'B' Series.) The introduction of the 'Y' type also meant modifications to the sump of the TC engine it used. It remained the same 5 litre (9 pints) shape, but had bosses cast into both sides to cope with the LHD and RHD clutch relay levers. Later both TD and Y types had bigger 6ltr (10 1/2 pint) sumps, with cooling ribs. Other obvious modifications were the fitting of a bigger clutch, 7 1/4" growing to an 8". This also affected the flywheel and the gearbox first motion shaft and bell–housing making inter–changeability difficult. For instance I run a replacement 'SC' Gold Seal engine with the old type filter canister, in an early 'YB' that has the correct later SC2 gearbox with the larger first motion shaft and bell housing. This means the engine will only take a 7 1/4" clutch plate, but it needs a 3/4" centre. The M.G. 7 1/4" clutch plate has a 5/8" centre, but one from a 1950 Hillman Minx fits I am pleased to say, as it uses a similar 7 1/4" clutch plate but with a 3/4" centre. You just have to be prepared to search about autojumbles. Whilst the gearboxes all look similar, the sports cars version have the remote gear change coming off the 'top cover' of the 'M' Morris unit, whereas the 'Y' has its remote gear change coming off a rear extension tail shaft.

Note that SU carburettors, (Skinners Union) use 'H' for horizontal, (or semi–downdraft) carbs, with numbers after, i.e. H2. The number refers to the numbers of 'eighths of an inch', i.e. H2 is a 1 1/14", H4 is 1 1/2" etc.

For those interested, it is quite easy to fit hardened steel inserts to the exhaust valve seats of the XPAG/XPEG/XPAW to enable the engine to use lead free petrol. Most conversions use the bigger valves of the TF and with a bit of cleaning up of the ports, thus you gain a few BHP. XPAG/XPAW inlet valve head diameters are 33mm, exhaust 31mm; XPEG inlet 36mm, exhaust 34mm. It is best if the exhaust valve guides are replaced with phosphor–bronze ones, the normal cast iron versions not liking the lack of lubricating lead, and the valves being of good quality heat resistant steel, if you can afford it a Nimonic Alloy.

Nuffield System of Engine Identification and Numbering.

The Nuffield (Morris Engines) system of engine identification lasted well into the post BMC merger, so some early 'A' and 'B' series engines used it, (in Morris, Wolseley and MG models) slightly modified. Prior to 1936 a two letter code has been used, the four letter one follows: –

First letter – Model	Second – Valves	Third – Bore and HP	Fourth – Make
U, Morris Eight	S, side valve	H, 57mm 8hp	M, Morris
M, Morris 10/4	P, Pushrod ohv	J, 63.5mm 10hp	G, M.G.
X, Morris 'M' 10hp	C, overhead cam	A, 66.5mm 11hp	W, Wolseley
T, Morris 12/4		B, 69.5mm 12hp	C, Commercial
Q, 2ltr 6 cylinder		E, 72mm 13hp	
O, 3 1/2ltr 6 cylinder		D, 73mm 13hp	
A, 'A' series (A30)		D, 61.5mm 14hp	
V, Post–war Morris/Wolseley,		H, 69.5mm 18hp (6 cylinder.)	
B, 'B' series, (Z Magnette, etc.)		E, 82mm 25hp, (6 cylinder.)	
		12, 1200cc ; 15, 1489cc,	
		22, 2200cc ; 26, 2693cc,	

For instance reading 'XPAG' equates to" Morris 10/4 engine, OHV, 66.5mm bore 11hp, used in M.G." and 'BP15GA' was " 'B' series, pushrod ohv, 1489cc, M.G. ZA". Some were never used by M.G. such an 'O' and 'V'. The 'V', 'A', and the 'B' were used after the war, and dropped the 'HP' part, as the RAC rating was out dated by then, replacing it with the cubic capacity, such as the side valve Morris Cowley VS15M, the 15 being 1500cc,(actually 1476cc.) The system is not bomb proof as 'E' equates to 72mm bore for 13hp as a four cylinder, but jumps to an 82mm bore for a six cylinder 25hp engine! The 'X' engines were called short–stroke Morris 'M' series, (Engine 102mm stroke M series; not the car, the Morris Ten Series 'M'.) In the engine prefix BP15GA, the end 'A' refers to the model, in this case a M.G. ZA Magnette, BP15GB to the ZB, and so on.

Where do you find the all–important engine number? On early XPAG units it is on an octagon brass plate riveted to the bell housing, just aft of the oil pipe to the valve gear. On early 4/44 engines it is in the same place, but this time it is a square brass plate. On the TD, TF, Y, and later 4/44's it is on a similar plate riveted to the offside (driver’s side) of the cylinder block, under the front core plug under the manifolds. It is on a raised portion of the casting, and some engines have their number repeated, stamped into the actual casting just above this plate. Reconditioned engines have an extra square plate just aft of this identity plate, see Archaeology.

Power, RPM, and Models.

Year	Model	Cylinders	BHP	RPM	Bore/Stroke	comp.
1936/39	TA Midget	4	45	4800	69.5 102.0	6.5:1
1936/39	SA 2 litre	6	80	4800	69.5 102.0	6.5:1
1937/39	VA 1 1/2 litre	4	55	4800	69.5 102.0	6.5:1
1938/39	WA 2.6 litre	6	100	4800	73.0 102.0	7.25:1
1938/48	Morris 10 s'M'	4	37	4600	63.9 90.0	6.6:1
1939	TB Midget	4	54	5200	66.5 90.0	7.25:1
1945/50	TC Midget	4	54	5200	66.5 90.0	7.2/7.4:1
1947/52	YA 1 1/4 litre	4	54	4800	66.5 90.0	7.2/7.4:1
1950/53	TD Midget	4	54	5200	66.5 90.0	7.2/7.4:1

Year	Model	Cylinders	BHP	RPM	Bore/Stroke	comp.
1950/53	TD Mk2 Midget	4	60	5500	66.5 90.0	9.2:1
1952/53	YB 1 1/4 litre	4	46	4800	66.5 90.0	7.2/7.4:1
1953/55	TF Midget	4	58	5500	66.5 90.0	8.1:1
1954/55	TF 1500 Midget	4	63	5000	72.0 90.0	8.3:1
1953/56	Wolseley 4/44	4	46	4800	66.5 90.0	7.25:1

Just by looking at the bore/stroke the families of engines can easily be seen. 63bhp from 1466cc for 1954 was an excellent power to engine size ratio. The BMC 'B' only put out 60 bhp from 1489cc in the first Z Magnette in 1953, (later improved to 68bhp.)

Odd information....The XPAG engines dynamo/tacho reduction ratio gearbox is 6:15 that of the TA, SA, VA, and WA is 7:15.

XPAG Modifications During Production.

TB, TC, TD, TF, and 'Y' types, Plus Wolseley!

Before you read through this list, I emphasise that these mods were during production of the engine, anything could have been done since to the unit. Also, items like cylinder heads do not carry unique identity numbers, and are often swapped about.

1) First XPAG fitted into the TB Midget, August 1939. WW2 intervened, and model updated in 1945 and called the TC. Using two 1 1/4" SU carbs.

2) Up to XPAG 883 (TC) there was no timing chain tensioner. One was fitted from 884, and the aluminium alloy cover has a bulge in it to accommodate this oil pressure fed, hydraulically damper, spring loaded tensioner. The oil is fed from No1 main bearing feed.

3) From 2020 to 2966 a nice alloy rocker cover was fitted as standard. It must have proved expensive, as it was soon deleted and the pressed steel one reinstated.

4) In 1947 M.G. introduced the 'Y' series saloon, with a single SU H2 1 1/4"carb XPAG engine. This and the softer cam produced 46bhp. There had been no suffix to the XPAG engine types up until now as there was only the TC using it. In the 'Y' the engine became the XPAG/SC, and began at SC/10001. It was both a saloon now termed the YA, and a tourer called the YT, and sold in RHD and LHD. To clear the LHD steering column the dip stick and its guide grew by two and a half inches at SC/13404. Whereas the TB and TC had a ribbed alloy sump, the 'Y' type was smooth.

5) In 1949 the TC was replaced by the TD, based on the excellent but modified YA chassis and running gear. The first TD engine was XPAG/TD/501. With the new model a new C45Y dynamo, M418G starter and flywheel starter gear ring were fitted, at TD/501 and SC/14023. The new starter only has two bolts, not three. TD engine numbers very quickly catch up the YA, then overtake it. TD used the Y sump.

6) At SC/14083 the oil pump to filter pipe changed from a two bolt fixing to a banjo bolt. This required the end cover of the pump changing, and a new pipe. It was done to clear the steering column of the LHD cars. The XPAG/TL and TR engines were in the normal numbering system of the SC units, not separate (SC means single carb.)

7) At SC/15405 and TD/2985 the oil filter type changed, and its support straps made stronger. The strap fixing bolts to the block were increased from two to three, and the straps made wider, one inch to one and half inches. Anti–crush ends were fitted to stop overtightening and crushing the filter

canister. The pattern for this casting changed to accommodate the three bolts, and hence the casting number changed to 24445. At this time the engine number plate moved from the bell housing to the offside front of the cylinder block, onto a ready cast in raised portion. See Archaeology.

8) At SC/15576 the pistons in the YA were commonised with the solid skirt type of the TD. It is very doubtful if many Y's still have their original split skirt pistons prior to this modification in about mid–1950. Solid skirt pistons are stronger, but not as quiet.

9) At SC/16463 and TD/6482 the water pump gland seal was improved. Old and new pumps look identical. At SC/16769 dynamo changed to a C39PV type.

10) The oil pump pick up was to the left hand side of the sump, and it appears that on fast cornering it could cause oil starvation, (in a 'Y'? Must have been on racing TD's.) The pick-up was moved to the centre of the sump at SC/16729 and TD/7576.

11) On the Y only, at SC/16831, (see 12 below as well) the camshaft timing was altered to that of the Morris Ten series 'M' / Wolseley Ten s3 XPJM/XPJW engines, 5;45;45;5 but with the 8mm lift of the TD. It had been 6.6mm lift with the TD timing of 11;57;52;24. The TD always had 8mm lift. Tappet clearance remained at the clattery 0.019". This was supposed to improve mid–range torque for the saloon.

12) But on both the YA and TD the rocker gear was modified. At SC/16831 and TD/9008 the exhaust rockers had their bushes made longer to increase life, (Nos 1, 4, 5, and 8.) Washers were added between them and the spacing springs, and the rocker shaft made longer to suit, the old one was 356mm and the new one 376mm. Inlet rockers remained unchanged.

13) Modification to the drive chain meant that the engines suffixes were to change to SC2 and TD2 (Note a TD mk2* has a TD3 engine!).The clutch was enlarged to an 8" unit, replacing the 7 1/4", along with the first motion shaft in the gearbox growing to 3/4" from 5/8". The clutch face on the flywheel was enlarged to cope, as was the clutch cover. This moved the starter ring out a little, but it was so machined that its outer diameter did not change. The gearbox release bearing shaft was thicker and slightly higher up the slightly wider bell housing. This all occurred at SC2/16916 and TD2/9408, simply continuing the normal numbers sequence. This was prior to the YB so SC2 engines can be found in late YA's.

* TD Mk2 was a special version Midget with a little more power, a bit like today's limited editions! It uses two 1 1/2" SU carbs, as does the later TF.

14) The old disposable, separate oil filter and its associated pipe work were deleted, and a modern for 1952 disposable element type fitted. This used the same element that a huge number of British cars were to use in the 1950's, to the 1980's. This entailed a new oil pump casting that has the filter bowl integral with it, held on by a long bolt. The oil pipe holes in the cylinder block were left undrilled. The old oil bypass hole in the block became the oil feed from the pump into the main oil gallery. A bypass was incorporated into the filter housing itself to relieve excess high pressure with cold oil. If the oil filter itself became blocked due to lack of servicing, it could be lifted off its seating and pass dirty oil, a large spring inside the bowl allowing this. The filter straps were deleted, and holes left undrilled on the block face. This later oil pump CAN be fitted to earlier engines if the bypass valve is removed, and the old oil filter feed to the rear of the gallery is plugged up, (by the rocker gear oil pipe.) It is a much neater arrangement, no pipes to leak. SC2/17293 and TD2/14224 onwards were so modified.

15) The un-ribbed 9 pint (5 litres) aluminium alloy TC sump was recast as a 10 1/2 pint (6 litres)

sump with cooling fins for the new YB due out in 1952, at SC2/17383. It was also fitted to the TD to commonise the engines, at TD2/14948. The oil suction mesh filter pipe was improved, but see SC2/18097, TD2/24489.

16) At SC2/17432 and TD2/17298 the pushrods were shortened to accommodate longer rocker adjusting set screws. The threads were longer, and both rods and adjusters were only supposed to go with each other, not be mixed with earlier parts.

17) For the more powerful Midget TD Mk2 the engine had its waterways improved to help cooling. Whilst the TD Mk2 had both the new head and block, the normal TD and YB had to use up existing stocks. The new items are termed 'round–hole' blocks or heads, and carry casting numbers for the head of 168422 head and 168421 block. There is no octagon cast into these blocks, as they were also used on the Wolseley 4/44, and have an extra boss for the 4/44 dipstick. This was undrilled on the M.G. 'oval hole' heads are casting number 22952, and M.G. XPAG oval hole blocks are 24146 and 24445 with octagons. (See casting number identity for more.) The round hole cylinder blocks were now being fed onto the production line, the oval hole ones all used up. Alas there were still lots of oval hole heads left. At SC2/17463 and TD2/17969 the round hole block was fitted to the YB and TD, note how the TD numbers are now ahead of the YB, the TD was selling rather well. With an oval hole head and a round hole block, or visa–versa, an oval hole head gasket must be used, part number X24481. Round hole head gasket is part number 168423. See also item 21 below.

18) The specification for the steel used in the exhaust valves was improved, very doubtful if any old type now remain in use. SC2/17500 and TD2/18291 gained them.

Note that like the YT engines in the SC – sequence, the TD Mk2 engines also carried on inside the normal TD sequence, no separate numbering.

19) The distributor clamp changed to a cotter bolt, from a simple clamp, at SC2/17670 and TD2/20942. Careful about that distributor at an autojumble, will it fit your car?

20) Once the sump was drained, there had been problems with priming the oil pump. So at SC2/17670 and TD2/20972 the oil pump gained a priming plug. You could fill up the oil pump, and get oil pressure and not heart attack!

21) At last the stocks of ready to fit oval hole cylinder heads had run out. The other M.G's could now have a cooling system like the TD Mk2, with a block and head that matched. The heads were fed into the production line, (casting number 168422). This has long reach plug holes (3/4"), so if you have long reach plugs, it is a round hole head. If you have short reach plugs, (1/2"), you have an oval hole head. Again if a round hole head is fitted to a round hole block, use the correct gasket, 168423. Old heads use Champion L10S plugs, the new one Champion N8B. This happened at SC2/17994 and TD2/22753. At TD2/22251 the clutch cable became a rod.

22) To improve the mid–range torque of the TD, it gained the YB camshaft, part No AAA3096, at TD2/24116. However, it was not quite the same identical camshaft, see item 23 below. (Old TD camshaft was AAA5776.)

23) Whilst the 'new' cam had the same 5;45;45;5 timings of the YB, it was in fact a more modern profile with wider lobes to improve life. The shape of the lobe profile enabled the tappet clearance to be reduced to 0.012" from 0.019", hence it was a lot quieter. It is called the 230 degree cam, with 8.3mm lift. The plate on the rocker cover gave the new clearance, and this was SC2/18097 and the TD2/24116 above. Today we now have the problem of identifying which cam is fitted, see XPAG Camshaft. The XPAG is one of the more audible engines one hears, it lets you know its tappet

clearances are a wide .019", and even the later .012" is not so quiet.

24) At SC2/18097 the YB gained a new distributor, 40058F type, and the TD gaining a similar version at TD2/24489, type 40367. These had high lift – short duration cams, and the point's gap was 0.014" to 0.016" instead of the earlier 0.012". On the same engines the sump had yet another modification, as oil had been backing up at the longer forward end under braking. So a longer oil pick up was fitted. As it was heavier, it had four bolts fixing it instead of two, and these can be seen on the nearside of the sump. Previous sumps should be so modified, if not already done.

25) The oil level in the oil pump was raised to assist priming, the idea being that if it remained full on draining the sump, it would self–prime on starting the engine, (but see item 30.) This was on SC2/18120 and TD2/26635.

26) From SC2/18272 and TD2/27551 the crankshaft was forged out of E.N. 100 ton carbon steel, a stronger material, part number 168537. Had some TD's broken a few of the old ones racing?

27) At SC2/18122 on the YB only, the spark plugs were changed to Champion N8, the N8B deleted.

28) In October 1952 the Wolseley 4/44 with its version of the SC2 engine was in production, called the XPAW. Because of the new camshaft timings it was found the springs could become coil bound so the valve spring faces were reduced by 0.5mm on all 'X' series engines. This occurred at SC2/19037, TD2/27867, and XPAW/1308. Heads will have been swapped all over the place by now, but they will be round hole heads. This modification was done in early 1953, and records show the SC2 engine ended at 18460, rather odd!! The valve guides were now 24.5mm above the head.

29) At TD2/281167 the rocker pillar bolts were drilled and wire locked, as per normal aircraft and racing practice. The 4/44 remained with spring washers, the YB had gone, the ZA Magnette replacing it with its BMC 1489cc ohv bypass oil filter engine.

30) At last, by drilling a small air hole up inside the oil pump, the oil pump was made self–priming. The TD had by now been replaced by the TF so the Midgets suffix changed but the numbering system continued on. This was at TF/31263 and XPAW/5142. Changing the oil was no problem, oil pressure was instant on starting up afterwards. Both the TF and 4/44 had pressurised cooling systems, at all of 4psi.

The TF 1250cc engine was in fact the TD Mk2 slightly more powerful version, with an extra 4bhp over the standard TD unit. This block had been re-cord to enable it to be bored out to 72mm, giving 1466cc, and becoming the XPEG, the TF becoming the 'TF 1500'. The TF 1500 head was the TD2 one, with bigger valves, inlet 36mm, (TD 33mm), exhaust 34mm, (TD 31mm.) The TD had used a 7.25 to 1 compression ratio, but in the TD2 this became 8 to 1, with 60bhp. The TF 1250cc produced 57bhp.

31) To reduce oil feed to the rockers, the banjo bolt at the oil gallery on the rocker feed pipe, had its internal diameter reduced to 0.055". This was at TF/31943 and XPAW/5300.

32) On the 4/44 only, at XPAW/6809, the water outlet angle at the thermostat was changed to face the offside, in readiness for the BMC 'B' series to be fitted as the Wolseley 15/50 (1500cc, 50bhp) radiator was being fitted. This outlet looks just like a TF one to me, and I suspect it was to commonise parts, as the 4/44 carried on for another 23,000 cars!! Or was the 'B' series in short supply?

33) Again, the 4/44 had a completely different sump casting to its M.G. cousins, with a floating oil

pick up. Air leaks had occurred, so it was improved with a four bolt fixing instead of two. These can be seen on the outside of the sump under the oil pump, from XPAW/7642.

34) The TF had gone, the 4/44 the sole user of the 'X' series of engines, with the BMC 'A' and 'B' series taking over. On XPAW/20901 the timing chain oil thrower was enlarged from 2.6" to 2.812" to try to reduce oil leaks at the front end.

35) We are into 1956, the front asbestos rope seal on the crankshaft is replaced with a modern neoprene sprung lip seal, at XPAW/24110, part number AEG133, (a Morris part number, not BMC.) Sump and timing cover were machined to suit, and the sump gasket modified. Watch out at autojumbles that you buy the right sump gasket for your engine, the late 4/44 one is too short at the front end, for your M.G.

36) Last 'X' series engines off the line, October 1956 in a 4/44. The 4/44 ran for 34,000 units, and had just a few engine modifications, perhaps it was well sorted by then. However the column change gearbox fitted with its selector rods entering the casting under the oil level line, adapted from the YB, was another story. It leaked till the end. Both the TF and 4/44 used the later crankshaft part number 168557.

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Known 'X' Engine Casting Numbers.

Casting numbers, as already mentioned, are those of the pattern, and sometimes carry through the system to become a part number of the item in the spares book. But, if an item is modified after the casting of the item, such as threads changing size, or holes being bigger, or similar, the actual pattern number will not change, but the part numbers on the spares list will, so beware. Also, in later years when restoring a car, an item may be used that was once a Morris/Wolseley part and you modify it to M.G. specification. There is nothing wrong in this it is good use of otherwise scrap. I have 'cast' octagons in Araldite from a mould made in plasticine, off a M.G. 24146 cylinder block, to re–araldite to a Wolseley 4/44 168421 block. This was many, many years ago, and I see it is still on that engine, the owner none the wiser. I know others have also done this. For the perfectionist though, only the right bit works.

Model/Item	Casting Number
Early Morris/Wolseley Ten 1140cc 'X' cylinder block, oval,	22500
Later post war 1140cc cylinder block, oval water holes,	24144
Early M.G. 1250cc 'X' block, octagon cast in, oval water holes,	24146
Later post war 1250cc M.G. block, octagon cast in, oval holes,	24445
4/44, later TD, and TF block, no octagon, round water holes,	168421
Early 1140cc cylinder head, no centre oil drain, oval water holes,	22812
Early pre–war 1140cc head, with round holes.	22952
Later post war 1140cc head, same as early 'T' type, oval holes.	22952
Later TD, and Y oval hole cylinder head, short reach plug,	22952
4/44, TD and TF head, round water holes, long reach plugs,	168422
Late 4/44 head, round water holes,	168425

Note that the 22952 head's use, MG one had bigger valves.

Casting numbers are often quite rough, the pattern getting knocked about with use and age, numbers can be difficult to see. On the block it is under the tappet cover, behind the dynamo, above the octagon if the block has one. See Block Identity. On the head it is easy to see on the top, though often not fully clear, casting 'flash' obscuring it.

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XPAG Camshaft Checking.

This is the most important part of the engine in terms of performance and drive–ability, though good cylinder head design does help. As years pass, people modify their cars, or fit replacement items that have been improved by the manufacturer. One problem that often occurs is trying to decide which camshaft your XPAG has fitted, without stripping it down. Many cars have the 0.012" clearance camshaft, but some still have the older 0.019" clearance version. By far the best method I have seen was in the MGCC *Safety Fast* magazine, sent in by David Clark of Westminster, Vermont, USA. It relies on the fact that only the later cars had 5;45;45;5 cam timing, known as equal overlap, or split overlap if you speak American. That is both inlet and exhaust cam have the same timing, but in 'mirror' fashion. The earlier 'T' types had 11;57;52;24, very unequal. The first pair of numbers read as inlet opens BTDC, closes ABDC, then exhaust opens BBDC and closes ATDC. The XPAG is not a quiet engine anyway, and one to worry about is one with no tappet clatter, as it is better to hear it than not. In today's lead free petrol age, no noise means the valves are pocketing, i.e. eating away the seats, and closing up the clearance.

If David Clark's check is carried out, and you decide you have a 12 thou cam, but performance is awful, you actually have one of the midway 5;45;45;5 1140cc timed and ground camshafts, but with an 8mm lift at the valve for the M.G. 1250cc XPAG. See modification list. This cam still has a 0.019" tappet clearance. Conversely, running a 0.012" cam at the 0.019" clearances sounds almost like a diesel engine.

" I would like to share with you a cheap and cheerful method for making an accurate determination of high verses low camshaft with your feeler gauge, a screwdriver, and a five–sixteenth BSF spanner.

Because of the equal overlap of the valve timing, of the 0.012" clearance XPAG 5;45;45;5, they are split evenly about top dead centre (TDC) and bottom dead centre (BDC). This is called split overlap.

Now, to check the valve timing, adjust the valves to the recommended valve clearance, in this case 0.012". Turn the engine on the starting handle until the fan belt pulley on the engine indicates TDC for number one cylinder, with the valves ROCKING. This means we are at the end of the exhaust stroke and beginning of the inlet stroke, with both valves partially open. At this TDC loosen the locknuts and turn the tappet adjusting screws all the way up and then down again until there is exactly no clearance at the valve. The valve will now be shut, and the adjusting screw just touching it. Now turn the engine one more crankshaft revolution ONLY, (till you are now at the top of the compression stroke) turn until the TDC marks on the pulley once again align exactly. Using your feeler gauges measure the resulting valve clearance. If the clearances match, you have a split overlap camshaft, possibly with 0.012" design. If you are out five to ten thou, with the differences being from keyway tolerances, etc., it is still a split overlap cam. If it is an earlier or fast cam, the clearances will differ a lot."

Camshaft lobe design is a very precise art, and the shape is very important. Morris and M.G. strove to get the best with silence, but a compromise was the result. The .012" gap was it. The gap is part of the camshafts design and has to do with the 'ramp' and its acceleration of the valve lifting gear. Stick to the clearances given.

Model	Cam Timings	Lift	Part No, (if known.)
SA 2 litre Saloon,	11;59;56;24	8mm	
VA 1 1/2ltr Saloon,	11;59;56;24 (later 11;57;52;24)	8.4mm	
WA 2.6 litre Saloon,	11;59;56;24	8mm	
1147cc 10hp engine	5;45;45;5	6.5mm	
TA Midget,	11;59;56;24	8mm	X24084, MG862/171, AAA5776
TB and TC Midget,	11;57;52;24	8mm	MG862/171, X24084, AAA5576.
TD Midget and YT	11;57;52;24	8mm	MG862/171,168552, AAA3096.
TD after TD2/24116	5;45;45;5	8.3mm	AAA3096, 168553.
YA 1 1/4ltr Saloon	11;57;52;24	6.5mm	MG900/106.
YA after SC/16831	5;45;45;5	8.3mm	AAA3096, 168553.
YB 1 1/4 litre Saloon	5;45;45;5	8.3mm	AAA3096, 168553.
TF 1250 and 1500	5;45;45;5	8.3mm	MG862/171, AAA3096, 168553.
Wolseley 4/44	5;45;45;5	8.3mm	AAA3096, 168553.

half–race; 13;59;50;22 – 8.3mm, AEG122, full race; 32;58;60;30 – 8.3mm AAA3095.

The XPAG engine was also fitted by other sports car builders, in tiny quantities. People like Cooper and Lotus put them into their specialist cars, and of course it went racing in many forms, being capable of quite some development. Considering the engine was an improvement of an old Morris sv unit, the MPJM, in the Morris Ten series 'M', the XPJM 1140cc 10hp version with just 37bhp, then being uprated for M.G. to 1250cc with either 46bhp or 54bhp, it is amazing to think that Syd Enever, MG's chief designer, obtained 213bhp at 7000rpm with a supercharged version, pushing a car up to 210mph, from the same simple XPAG! Outside specialists often offer tuning equipment for sports car engines, and today the cross–flow alloy head for the 1798cc 'B' series is on offer by Webcon Ltd in Middlesex giving 120bhp. In the 1950's people like Laystall also offered an alloy cylinder head for the XPAG, with polished larger ports and balanced combustion chambers. More information of this type is in 'Tuning and Maintaining MG's', by Phillip H. Smith, Haynes.

Distributors and Camshafts.

Distributor DKY4A/40048 with camshaft MG862/171 were fitted to TB and TC engines, (later changing to X24084 and AAA5576, superseded by DKY4A/40162.)

DKY4A/40089 with cam MG900/106 were fitted to the YA up to engine 14022, super ceded by DKY4A/40197.

DKYH4A/40058 with cams MG900/106 and 22326 in the YB to engine17669.

DKY4A/40162 with cam MG862/171 was used in the TD and TD Mk2 to engine 20941, as well as in the YT saloon with cam MG900/106.

D2A4/40367 was used in the TD Mk2 from 20942, and TF, using the cotter bolt lock, with cams MG862/171 and 168553, (later AAA3096.)

D2A4/40368 was in the TD from engine 20942 with MG862/171 and 168553 cams.

D2A4/40369 was in the YB from 17670, (cotter bolt) used with cams MG862/171 and 168553.

Distributors used for high comp and AEG122 cam were DYKH4A/40115 and D2A4/40441.

DKY4A/40197 replaced DKY4A/40058.

If you have a DKY4A/40058A, you have a Morris /Wolseley 10/40 1140cc dist.

Reconditioned Engines. (Traps for the unwary.)
Chapter Four goes into identifying Morris Engines, and later BMC Gold Seal, reconditioned engines. The information on the engines data plate does not give the entire story. As mentioned earlier, parts that were faulty could be re–machined for use on a replacement engine. The part would be machined to fit the re–machined worn bit of the engine being reconditioned. So it is as well to note that components such as Camshaft Followers can be .010" oversize, something that has caught out a lot of owners building up a good engine from two units. Only a micrometer will tell you this information, and the fact that a +.010" follower will not go into a standard hole! You cannot re–machine a follower, as the lobe end is hardened. To reclaim cylinder heads it is common engineering practice to cut out the valve seats, and press in steel inserts. Today we think of this as modifying a cylinder head for unleaded simply because we now use hardened steel inserts. Such practices are as old as the ICE itself. This should not cause problems, if your engine was once so repaired. Trouble will arise once the head is to be made lead free, as the inserts put in all those years ago may now mean your head is useless, i.e., the holes are bigger than present available inserts. It is also common to leave in the valve guides, and ream them out and press in phosphor–bronze liners for lead free

***A very good article on engine numbers, part numbers and casting numbers on the XPAG can be seen at http://www.mgcc.co.uk/t–register/wp–content/uploads/sites/31/2016/02/Roger–Wilson–head–and–block–casting–numbers–20–12–2017–v7.pdf

Second–hand Bodges.
Another car I became involved in, an ancient YB, had been on the parade square for ages for sale for £20, in 1970 at an RAF station in Morayshire. I spotted its owner one day 'servicing' the engine. Then a mate asked me to go with him to check the car out. It ran reasonably well, but I was very suspicious over the excellent oil pressure of 55psi considering the mileage and general condition, and that I had seen the car being 'serviced' recently. It was sold for a reduced £15 to my mate, after I had told him of my suspicions, and I asked if I could check out a few things. He agreed, and I found two washers behind the oil pump pressure relief valve spring, and NO oil filter element in the filter bowl. Removing the washers and fitting an element dropped the hot pressure down to 35psi. I replaced the grooved ball bearing in the relief valve, obtaining a ball from an old ball race, tapping it in hard to 'seat' it, and we had 40psi, an honest oil pressure. Whilst the washers simply hid the engine's wear, removing the filter element was stupid, as this would ruin the engine very quickly. The seller wanted to get the oil pressure up on the gauge. Such bodges were (and still are) common on old second hand cars. Do you like the prices of these cars? Shows my age, but you have to accept they were just old bangers of their day then.

As bangers, old M.G.s in the 1960's got little servicing. One friend ran such a car, and never carried out tappet clearance adjustments. Eventually I bought the car from him, as he was posted overseas, to simply sell on again for profit. I could not quieten the engine, it sounded like a diesel with the .019" standard gap. I reduced it to .012", with no change. I drove the car for a few days before selling it, just to sort out any running faults, and noted the performance was awful, but it was a wreck. The lad who brought it, (for £15) complained to me, so I promised to fix it if he paid for the bits. He agreed. I eventually sourced the camshaft, it had two inlet lobes that were virtually non–existent, hardly opening the valves at all. One new camshaft with eight followers, and the car almost flew, and was quieter. I still have the cam, and often show it to people to prove that to miss oil changes is false economy, as the filter was a solid lump of gunge on replacing it. Years later I had a V8 with the same fault!

XPAG Cylinder Head Gaskets.

The oval hole and round hole head gaskets are to suit the types of cooling holes in the head and block. Elsewhere this is dealt with quite comprehensively, under 'Modifications during Production', and 'Casting Numbers. At the time the cars were assembled, the change actually came on the YA at engine number SC2 17463, and TD2 17969. With head swaps over the intervening years, you need to go by the casting numbers, or look at the holes themselves, to fit a suitable gasket.

TUNING THE XPAG.

As mentioned, this is not a tuning book, but the Special Tuning booklet issued by MG for the XPAG engine is reproduced in the June 1998 issue of the MGCC monthly magazine, *Safety Fast* on pages 7 to 14. Back issues are available from the club – phone number is +44 (0)1235 555552.

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STATE OF THE ART of the XPAG Engine.

What is fitted to my MG?

Archaeology of Replacement Engines. XPAG.
Here we go into an area not well researched by the experts. The following notes include my own observations of engines in cars at M.G. meetings. Some owners wish to trace their block, to see if it is an original one, often a problem if a reconditioned unit. The first two sketches show the normal octagonal identity plate, with a disc at the centre, found on early engines on the flywheel housing extension, (bell housing) and after SC/15405 and TD/2985 on the offside front end of the block, under a core plug on a raised platform on the casting. Both are held on with just one rivet. The engines with the number on the bell housing have casting number 24146, and those with it on the offside, casting number 24445. On this last unit the oil filter mounting altered to three bolts. The blocks for the 4/44/ late TD/YB/TF are similar, with a dip stick lug adjacent, casting number 168421.

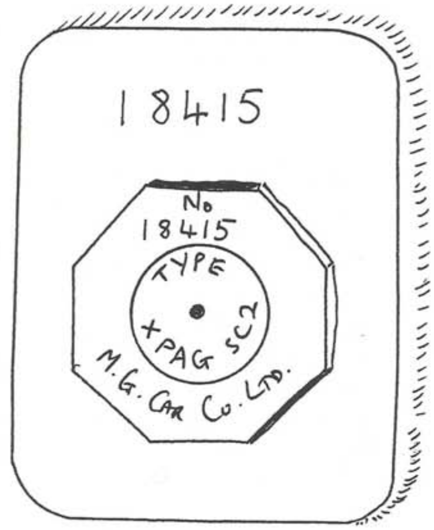
The plates were of brass, with all common information stamped in from the back of the plate, to give raised letters and figures, here "MG CAR Co. Ltd." and "No." will be raised. Only the unique engine number was stamped in from the front, giving indented numbers. It is done quite neatly, though possibly by hand. So the first sketch shows engine number 18415 that will be stamped in from the front. Above the brass octagon the original engine number may be stamped again into the block metal surface, though as the cast iron is hard it can be difficult to see. In this sketch a raised platform is shown as on the later blocks. Some engines I looked at did not have the number repeated on the casting. The plate will be held on by one central rivet, and this same rivet securing a small disc with the engine type on. This again will be in raised letters, and as shown is "TYPE XPAG SC2", on a YB. The second sketch shows another similar identification plate, this time engine number 33006, on a "TYPE XPAG TD". All examples here are from real existing vehicles. From this it can be seen it is not hard to decide what an original engine is from, if it is fitted to the right vehicle, and if it matches the Guarantee Plate on the dash. The problems arise when it is a 'reconditioned unit'.

If an engine is rebuilt by its owner, or his friend, nothing will be recorded on any plate riveted to the engine. The engine will retain its identity. But, when it was done by using an exchange engine, i.e. you send yours back to the factory and another different unit is fitted in exchange, Morris Motors will give each a new identity. Because of demand, a SC2 may not go out as one, but may be stamped up as a TD2, if for instance demand for TD engines is high. Each engine was given a new number. This time the plate was a square one replacing the M.G. octagonal one, still with embossed numbers and letters raised for all common information, except the number itself. The same central rivet held the disc at the centre with the type on, just as the original unit. Sketch No.3 shows the square plate and disc, as an engine for a "TYPE XPAG TD", with the number B98546. The letters "REPLACEMENT ENGINE" with "No." at the bottom leave you in no doubt this is a reconditioned unit. Careful checking above may reveal the original number, in this case 13542, but was it a TD, YB, or a 4/44?

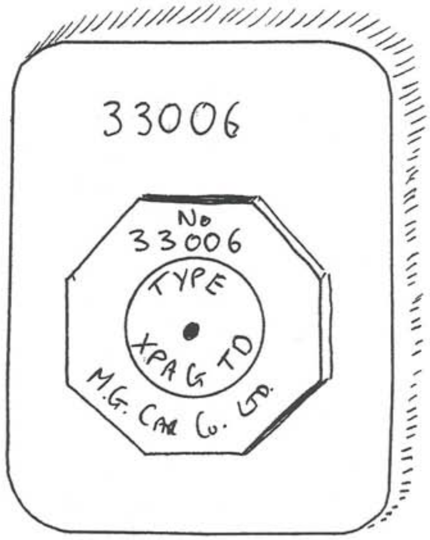
Next to the new identity plate, just aft of it, (and further under the manifolds) is the reconditioning plate, with bore and crank sizes on. This has the firm's name on, "MORRIS MOTORS Ltd. REPLACEMENT ENGINE", again embossed from the rear so in raised letters. Stamped in from the front by hand will be the bore and crank size. This plate is often brass, but some I saw were aluminium alloy, and all were secured by two rivets, one each side. On sketch No.4 the "BORE

Archaeology of Replacement XPAG Engines.

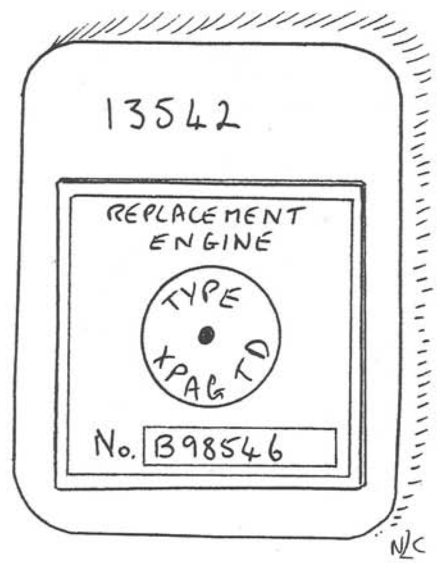
Sketch One, normal 'Y' type XPAG SC2 engine identity plate, No. 18415.



Sketch Two, normal XPAG TD engine identity plate, for No. 33006.

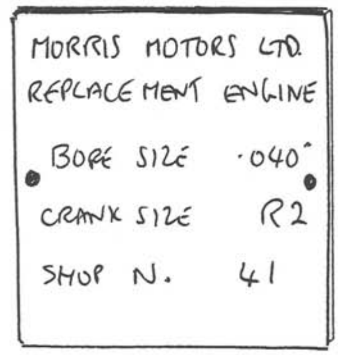


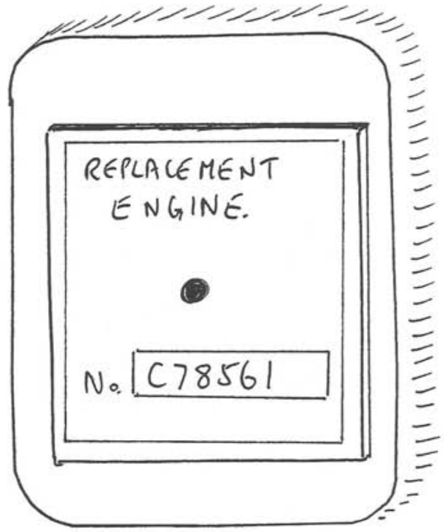
Sketch Three, Morris Engines, replacement engine plate, for a XPAG TD, No. B98546. Old engine number above of 13542.



Archaeology of Replacement XPAG Engines.

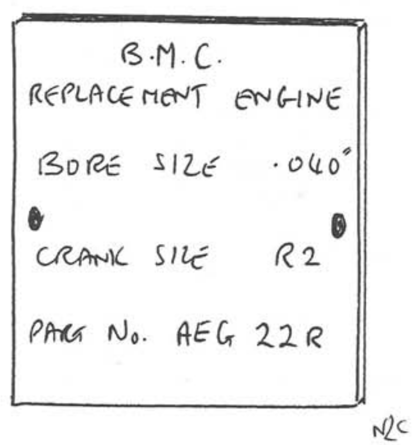
Sketch Four, found with sketch three, rivetted just aft of it, the reconditioning plate for Morris Motors, with relevant sizes.





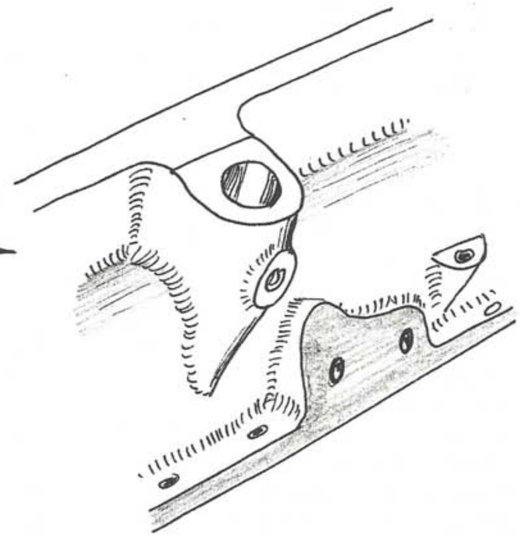
Sketch Five, the later BMC XPAG replacement engine plate, no disc, just a number. "Gold Seal Engine".

Sketch Six, the reconditioning plate for the BMC identity plate, for C78561, giving the sizes.

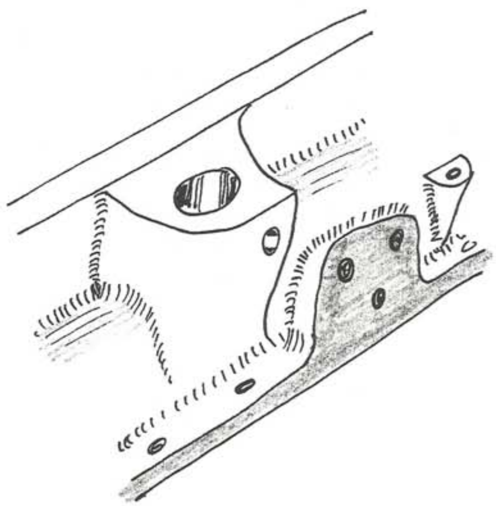


XPAG Cylinder Block Identity.

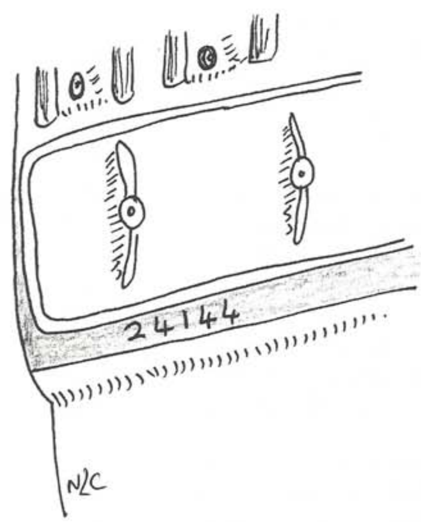
Sketch One. Early block.



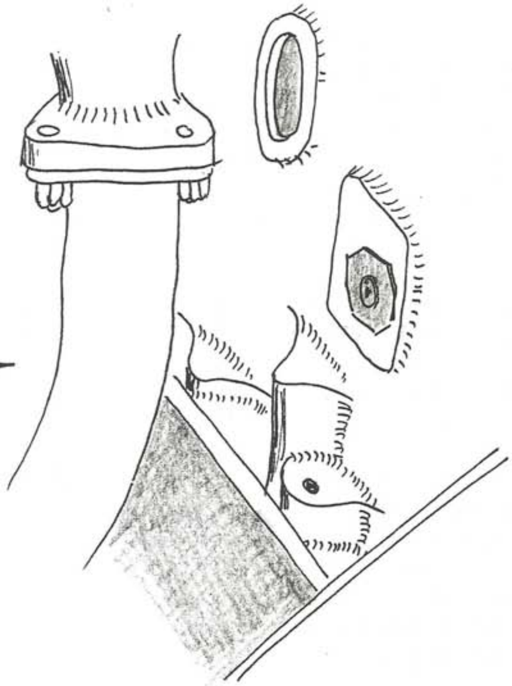
Sketch Two, later clamp.



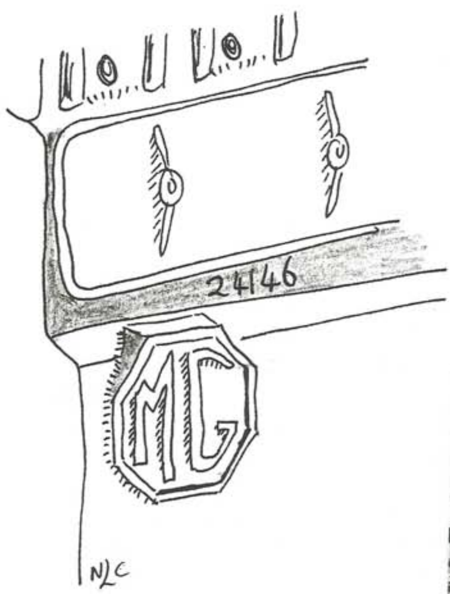
Sketch Three, casting number.



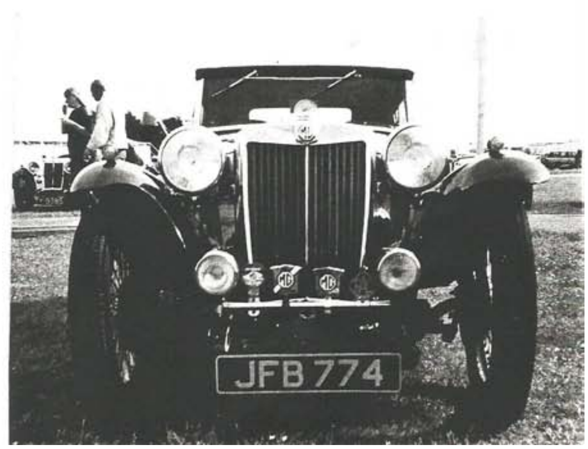
XPAG Cylinder Block Identity.



Sketch Four, later engine number platform.



Sketch Five, the Octagon.



SIZE .040" refers to the re-bore size of the cylinders, and "CRANK SIZE R2" to a .020" regrind of the crankshaft. I only ever saw R2 and R4, indicating .020" and .040" undersize cranks. The shop number must refer to just that, the place the engine was built up at Morris Engines.

Some blocks have no original numbers stamped above the plates, on the later blocks, and often there was no central disc, indicating it may have been a re-bored 'new' block, rejected from a new car, but satisfactory for a recon–unit. Or Morris were feeding in new unused blocks after the models using them ceased. I suspect the engine numbers on the recon–units are in fact job numbers, one in and one out so to speak ... the fact that no bits were on it originally was meaningless. They simply assembled the next available block with the next available crank, then head, and so on. After all it was only the camshafts that differed for a while, until the bigger XPEG valves, and siamesed bores. As long as the right head gasket was used to suit the cooling holes shapes in the various heads and blocks, they could put an engine together. I saw one Morris Engines replacement unit with the later oil pump and filter, with the old oil feed holes from the pipes plugged up, and oil filter clamp bolt holes unused.

Sketch No.5 shows a plate I saw with no type disc, or original engine number. As BMC took over it seems the central disc was not always fitted, just a square plate and the replacement engine information plate. BMC started up their GOLD SEAL Replacement Engine/Gearbox scheme in 1958, which included the still reconditioned XPAG units, (my YB has one from 1963.) Red or green paint gave way to lurid gold. The two plates changed a little. The square plate in the old octagonal plate position was simpler, as at sketch No.5. It had "REPLACEMENT ENGINE" embossed, held on by one rivet, and the number underneath, here C78561, (my engine again.) This plate is still brass with the number hand stamped from the front. The BMC recondition plate that sits behind sketch No.5 is shown in sketch No.6. It has the same information as the Morris Engines version, except their name is replaced by "BMC REPLACEMENT ENGINE" embossed in, and is of aluminium alloy. This information plate is again held on by two rivets, but the shop number has been replaced with what appears to be the engine part number, in my case as shown, " AEG 22R". This is a Morris part number, on an engine rebuilt by BMC in 1963!! On another MG 'Y' type I looked at with a Gold Seal engine, its plate gave the part number of "AEG 12R AD." A 'short block' recon perhaps? A short block is the term for just a reconditioned cylinder block, less head and flywheel. Anders Ditlev Clausager of BMIHT, Gaydon, tells me that from his records, the TF1250 had a new engine as part number "SA 2445/3", a new half engine, (i.e. short block) as "AEG 4"; and for the TF1500 engine as "AEF 4" and half engine as "AEF 21".

From my extensive past experience in aircraft engineering, anything with an "R" suffix usually means a reconditioned unit. The BMC engine number plate is a little longer than the Morris Engines one, covering the area of the platform where the original unit’s number would have been. The reconditioning data plate is larger as well.

There are other ways of giving a partial identity to a cylinder block, though fraught with detail difficulties. An engine without a bulge in its timing chain cover is a very early unit, pre XPAG 883, so no TB's had a tensioner. If the water drain tap on the offside of the block is central under the manifolds, then it is an early T series or YA unit. By the YB it had moved to the forward end of the block under the front inlet port, possibly a SC2/TD2 block modification, casting number 168421? This casting number does have the Wolseley 4/44 dip stick boss, just under the engine number platform on the off side, but I have seen this boss on earlier blocks with the central water drain tap in YA's. After SC2/17293 and TD2/14224, the oil pump had an integral filter. This means the oil pipe and the filter strap bolt holes were left undrilled on the rear nearside. Blank bosses here and you have one of these later blocks, 24445 or 168421. If the water holes where the cylinder head bolts to, are round, it’s a post SC2/17463, TD2/17969, or you have a TD Mk2. You should be able to confirm this with the casting number of 168421, and no octagon under the dynamo.

If the oil filter strap has only two bolts holding it to the block, you have a 24146 block, pre SC/15405, TD/2985. At SC2/17670 and TD2/20942 the distributor lost its locking clamp and gained a cotter bolt that is at the side of the distributor location. If you can make out the original engine number stamped into the bell housing on early engines or above the platform on later units, this will deny or confirm your engines origin. Numbers ran from 10001 to 18460 for the 'Y' series SC engines, and from 501 to past 38500 for the 'T' series. Obviously one with a square plate with "WOLSELEY MOTORS" on it and a 4/44 dip stick hole should confirm it is not an M.G. engine, though with a sump swap it will fit one. At autojumbles, measure the bore, if a cylinder block is on sale, a 63.5mm will be a 1140cc Morris/Wolseley block, confirm this by checking its casting number, (see Casting Numbers.) Even so a 1140cc can be bored out to 1250cc.

Block Identity XPAG.
The first sketch is the early cylinder block with the distributor located by a clamp, the clamp held onto the block by one bolt, its threaded hole central to the boss that holds the distributor shaft. Also shown is the early two bolt oil filter strap bracket fixing. See the descriptions and modifications section.

The second sketch, (none are to scale) shows the later distributor fixing arrangement using a cotter bolt. Its hole is offset to the shaft's centre line. The three bolt fixing for the wider oil filter clamp is also shown. Again see modifications.

Both the first and second sketches are of the 'nearside' of the cylinder block, as is the third. This time the third sketch shows the location of the block casting number. It is actually under the dynamo, but you can feel it with a finger, and see it with a mirror if you do not want to remove the dynamo. It is well up under the tappet chest cover, and may be masked by the cork gasket edge, or good old oily dirt. If the cover is removed it can easily be read.

The fourth sketch shows the later engine number position and the boss for the undrilled 4/44 dip stick hole. The SC2 and TD2 blocks are said to carry the relevant boss for the Wolseley 4/44 dip stick, on the front offside of the engine, the opposite side to the normal M.G. position nearside rear, actually shown in the first and second sketch behind the oil filter strap bolt holes. The M.G. exhaust pipe is very close to this, but on the 4/44 the exhaust pipe goes out over the starter motor and gearbox, so the area is quite free. The 4/44 hole is undrilled in the M.G. application, but as it is threaded it is a simple task to unscrew the pipe and fit a blank.

The last and fifth sketch is that of the M.G. octagon found on the early blocks, (see modifications) and again this is located under the dynamo, rather hidden for any effect. Both casting numbers 24146 and 24445 have the M.G. octagon cast in. If it is any other number, you might have found my or another's 'addition'. See XPAG Casting Numbers.

The XPAG/XPEG/XPAW is an early ohv design. It does wear and generates a good old clatter, especially in .019" tappet clearance guise. Oil feeds to the valve gear need to be kept clear, and worn parts replaced as required. Short journeys will ruin the rocker's hollow shaft very quickly. Worn rocker pads can be built up with special weld that can be hardened, some firms do a replacement/exchange service. Cam followers also wear badly, as can the camshaft lobes, leaving little lift but a noise like a diesel engine.

NOTE that the 'round hole' block distributors have a 1/8" spacer under them.

FUTURE of the XPAG?

If the merger of BMC had not taken place, the XPAG would have been fitted to the then new M.G. ZA Magnette, possibly in its XPEG 1566cc form with 63bhp. The Wolseley did get the 1250cc version in the Gerald Palmer designed 4/44 of 1952, but as a nice new engine was in the offering, the 'Z' was delayed a little to 1953 to gain it.

The 'X' series of Morris engines served M.G. very well indeed, and was tuned by many owners to well above its designed power limits. It was indeed a tough little unit, evolved out of a long line of saloon car engines, not exactly designed. Of all the engines used by M.G. it must be the best known world–wide, closely followed by the everlasting BMC 'B' series. A whole industry now exists to cope with the classic car market, much of it includes those models powered by the XPAG.

Morris actually went back to sv engines for the Cowley, the 10hp post war replacement of the Series 'M'. It was not until 1956 that the model saw the 1200cc 'B' series. The Oxford has the 1498cc 'B' series, but M.G. got there first with its new saloon in 1953, see 'Z' Magnette.

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AUSTIN and MORRIS MERGE 1953 – 1981.

Austin Engines in M.G's.

BMC 'A' SERIES IN M.G.

Potted History.
By the time a M.G. model had an 'A' series under its bonnet in 1961, the engine was quite old, being a scaled down version of the 1947 Austin A40 1200cc unit, the same engine that was scaled up for the 1489cc 'B' series. To the eye both the 'A' and 'B' series are obviously of the same family, and are Austin designs. The design was the brain child of Bill Appleby, Eric Bareham and Jimmy Rix, whose job it was to provide a new, small, compact power unit for the new Austin Seven to be released in May 1952. The A30 was a clever design in itself, using stressed skin like an aircraft, with a monocoque hull. The tiny ohv engine that eventually arrived was of only 803cc, (BMC type 2A) having hit the drawing board in 1947. Austin termed it the AS3 engine, (AS3 being the code for the A30) or the 7hp unit. It had a bore of 58mm with a stroke of 76mm, and shared components with its bigger brother the BMC 'B' series, such as starter motor, distributor, dynamo, crankshaft timing sprocket, camshaft sprocket, the cover, to name a few. With the later much bigger 'C' series it shared the timing sprockets, with a duplex chain. Later items like camshaft followers would be commonised, on all three engine types,(you might call these bucket type followers.) The cylinder head was developed by consultant Harry Weslake, with a heart shaped combustion chamber leading to more efficient burning of the mixture.

The type 2A engine was not known as the 'A' series initially, not until the 'B' series arrived in 1953, and the 'A' was to be fitted to other small saloon cars as well as the little Austin A30 Seven.

All the electrical items were one side of the engine, and the manifolds the other, keeping fuel away from sparks. An unusual item was the method of driving the oil pump, and still causes some people to be surprised when they remove the sump, as they cannot see any visible signs of an oil pump. It is not until the flywheel is removed does one see the oil pump under a cover on the tail end of the camshaft. This pump was satisfactory until Alex Issigonis put the 'A' series gearbox into its sump, for the Mini in 1959, (type 8A for Austin, 8MB for Morris engine.) The oil filter was well ahead of its time as a screw on/off canister, but was only in a bypass system. This means it bled oil from the main feed, filtered it, then dropped it into the sump, this was to be improved later, to a full flow. The cylinder head had only five ports, only No.1 and No.4 cylinders having a single port for their exhausts. The inlets were siamesed as was the two centre exhausts. For the use the engine was to be put to, this was ideal, but those two middle exhaust valves could have a rough and hot time, so only the best steel was used. Cheap replacements would burn out eventually. It was to have had an aluminium cylinder head, and some development engines were so fitted, but the production engines were grey cast iron, as was the cylinder block. To keep costs down further, the timing chain cover, the sump, and the rocker cover were all pressed steel stampings. The early small 'A' series camshaft runs direct in the cast iron of the cylinder block, only the front bearing has a white metal lined steel backed bearing. The first engine ran in an A30 prototype in November 1950, and performed very well, with its 7.2 to 1 compression ratio, producing 28bhp at 4,800rpm, hence A30! However, further tests showed the three crankshaft main bearings were too small so were increased in diameter for the production engine. The steel flywheel with a dry clutch, was secured to the crankshaft with four bolts. An ohv engine in a small mass produced car was very up to date for

Austin, who were very conservative normally. Morris still had their USHM 918cc sv unit in the Morris Minor 'MM'. Ford were to carry on using their 10hp 1172cc sv for another ten years, and Hillman their 1265cc sv until 1955. The 803cc engine was also put into the heavy Morris Minor series 2, as the APHM, where it had its work cut out, in July 1952.

The Austin Empire was different to the Nuffield (Morris) one, Austin had everything made in–house at Longbridge, and used few outside contractors. They were more of a big firm, whereas Morris had lots of small ones dotted all over the country. The merger in 1952 was inevitably an Austin led one, and they controlled the BMC Empire, via one Leonard Lord, ex–employee of Morris (another story).

In 1956, along with a general tidy up and updating of the whole BMC range, the 'A' series grew to 948cc, the famous size that gave the Morris 1000 the '1000' name, (type APJM or 9M.) The unit was toughened up somewhat, the spindly crankshaft of the 803 had big ends of just 1.43"dia. These were now 1.625" diameter. The 1.75" main bearings were the same. A35, A40, and Morris 1000 had this unit that the first Sprite was also to see later. The 803 and 948cc had very strong, but expensive, cast malleable iron rockers, and these gave way to pressed steel heavier, but cheaper, items with the arrival of the 1098cc engine. The 803 and 948 used a pinch bolt on its piston gudgeon pins, a cheap system dating to before the XPAG Morris unit.

One wonders if they ever realised when the first little A30 rolled off the production line, that the 'A' series was to be so important to Austin, then BMC, BMH, BL, Austin Morris, Austin Rover, and finally Rover, including such cars as the A30, A35, A40 Farina, Morris 1000, Austin Healey Sprite, M.G. Midget, 1100/1300 fwd, Allegro, Mini, Marina, Metro, and the smaller Maestro and Montego: from 1952 till 2000 – 40 years.

Our interest is in the first 'A' series that M.G. used, in the Midget of 1961, and the front wheel drive ADO16 1100/1300 M.G's of 1962, and the 'A' Plus units in the much later M.G. Metro, of 1982. Before we look at these units, just soak up the massive use BMC put the engine to in the following list.

**Note that the BMC engine numbering chart following applies to all the BMC family of engines, A, B, and C, series. For 'A Series' tuning, buy the book Tuning BL A Series by David Vizard, ISBN 0 85429 414 7. It is heavy with masses of good technical information.

ENGINE NUMBERING.

BMC System for both 'A','B', and 'C' series engines.

Whilst the Morris Engines system carried on for a while under BMC, BMC developed their own as below by 1956.

Engine number prefix.	Capacity	Make	Type	Ancillaries	Comp
8	803cc	A, Austin	A to Z	A, Automatic	H, high comp
9	948cc	M, Morris		M, Manumatic	L, low comp
10	1098cc	W, Wolseley		P, police spec	
12	1275cc	B, BMC industrial		U, central gear change	
15	1489cc	G, M.G.		O, overdrive,	
16	1588cc	H, special		N, column change	
16	1622cc	J, Commercial			

Engine number prefix.	Capacity	Make	Type	Ancillaries	Comp
18	1798cc	R, Riley		'D' diesel version	
22	2200cc	V, Vanden Plas			
25	2500cc				
26	2600cc				
29	2912cc				

In the 'B' series, the Type – "A to Z" part is shown well under the MGB, that used many variations. The first MGB's were 18G, but as modifications were fitted, they became 18GA, 18GB, 18GC, etc. See MGB section for more. The 'A' series did not suffer the same North American mania for emission controls of various types, so had far less 'types' per model, often as few as only two.

USE OF THE 'A' SERIES.

Car Model	Engine cc.	Prefix Number
Austin A30	803cc	2A
Austin A35	948cc	9A
Austin A35 Van, (optional)	848cc	8AG (post 1962, most GPO.)
Austin A40 mk1	948cc	9A or 9D
Austin A40 mk2	948cc	9DB
Austin A40 mk2	1098cc	10D or 10DD
Austin Healey Sprite mk1	948cc	9CG or 9CC
Sprite Mk2/ M.G. Midget mk1,	1098cc	10CG
Sprite mk3/ Midget mk2	1098cc	10CC (2" main bearings.)
Sprite Mk4/ Midget mk3	1275cc	12CC or 12CE home market or 12CD or 12CJ North America after Oct. '72 12V/586F/H home market or 12V/671Z/L N. America
Austin Allegro	1275cc	12H (same as Metro)
Austin Mini	848cc	8A
Morris Mini	848cc	8MB
Austin/Morris Mini after '62	848cc	8AM
Austin/Morris Mini automatic	848cc	8AH floor change, closed circuit breather 8AJ, automatic, closed circuit breather 8AK
Mini GPO saloon and van,	848cc	85H restrictor in carb.
Mini Clubman	1098cc	10H
Mini 1000 / Metro 1 litre	998cc	99H
Mini 1000 automatic	998cc	9AG
Mini 1275 GT	1275cc	12H
Mini Moke	848cc	8AC
Wolseley Hornet/Riley Elf mk1	848cc	8WR
Wolseley Hornet/Riley Elf mk2	998cc	9WR
Mini Cooper	997cc and 1070cc(S)	9F/SA/H 9:1 comp
Mini Cooper	997cc	9F/SA/L 8:3 comp
Mini Cooper	970cc (S)	9F/SA/X 10:1 comp
Mini Cooper	1275cc (S)	9F/SA/Y 9.75:1 comp
Mini Cooper	998cc	9FA/SA/H 9:1 comp

Car Model	Engine cc.	Prefix Number
Mini Cooper	998cc	9FA/SA/L 8:3 comp
Mini Cooper	970cc (S)	9FC/SA/H 9:1 comp
Mini Cooper	998cc	9FD/SA/H 9:1 comp
Mini Cooper	1070cc (S)	9FD/SA/H 9:1 comp (engine 33661 to 33948)
Mini Cooper	998cc	9FD/SA/L 8.3:1 comp
Mini Cooper	970cc (S)	9FD/SA/X 10:1 comp
Mini Cooper	1275cc (S)	9FD/SA/Y 9.75:1 comp
Mini Cooper	970cc (S)	9FE/SA/X 10:1 comp
Mini Cooper	1275cc (S)	9FE/SA/Y 9.75:1 comp
Mini Cooper	1070cc (S)	10F 8.3:1 comp
Morris Minor series 2	803cc	APHM, (Morris numbering)
Morris Minor 1000 s3	948cc	APJM, changing to 9M in 1956.
Morris Minor 1000 s4	948cc	9M
Morris Minor 1000 s5	1098cc	10MA
Morris Minor 1000 s5 closed circuit breather	1098cc	10ME
Morris GPO van	948cc	8AG post 1962
Morris 1000 Van	1098cc	10AB low compression
Morris 1000 Van closed circuit breathing	1098cc	10V
Gold Seal exchange for all in–line 'A' series		8G
Austin, Morris, Wolseley 1100	1098cc	10AMW, 10H.
Austin, Morris, Wolseley 1100	1098cc Automatic	10AG, floor change closed circuit breather 10AH, automatic, closed circuit breather 10AJ
M.G. 1100 Mk1 and Mk2	1098cc	10GR
Riley 1100	1098cc	10GR
Vanden Plas 1100	1098cc	10GR or 10V
M.G. 1300 Mk1	1275cc	12G
M.G. 1300 Mk2	1275cc	12GR after April '68.
Riley 1300	1275cc	12GR
1300 fwd Automatic	1275cc	12A
Vanden Plas 1300	1275cc	12GR or 12V
Marina 1300	1275cc	12V
Austin 1300 'S' mk1 and mk2	1275cc	12FA
Austin 1300 'S' mk3	1275cc	12H
Marina Van 1.1	1098cc	10V
Marina Van 1.3	1275cc	12V Low compression
Marina Ital	1275cc 'A' plus	12V
Metro 1 litre	998cc 'A' plus	9H
Austin Metro 1300	1275cc 'A' plus	12H/D
M.G. Metro 1300	1275cc 'A' plus	12H/D24
M.G. Metro 1300 lead free	1275cc 'A' plus	12H/F01
M.G. Metro 1300 Turbo	1275cc 'A' plus	12H/F01
Austin Metro Sport	1275cc 'A' plus	12H/F02
Austin Metro GTa	1275cc 'A' plus turbo	12H/F02
Austin/Rover Metro 1.3	1275cc 'A' plus	12H/F **

Car Model	Engine cc.	Prefix Number
Austin Maestro 1300	1275cc 'A' Plus	12H (Marina type sump and oil filter.)
BMC Mini Tractor	948cc diesel	9T/........../D

**Unleaded Austin Metro 1.3 engines; 12H/E24, 35, 39, 40, 41, 42, 67 up to 75.

After about 1970 BMC/BL had reduced the prefix to just the engine size and its alignment in the car, i.e. 'V' meant vertical for rwd, and 'H' meant horizontal for fwd.
Using the engine numbering and fitment charts, you should find that a M.G. Midget with a 1098cc engine with a prefix of " 10CG/U/H/ " has an early 1098cc small main bearing unit (made between October 1962 and March 1964) with a central floor gear change, of a high compression ratio (i.e. 9 to 1, the lower 8.3 to 1 being optional for overseas).

The 'A' Series Through The Years.

Model	year	cc	bhp @ rpm	torque	comp	type	bore/stroke
Austin A30	1952	803	28 @ 4800	40 lb/ft	7.2	2A	58mm/76mm
Austin A35	1955	948	34 @ 4750	50	8.3	9A	63mm/76mm
Austin A40 mk1	1958	948	37 @ 4750	50	8.3	9D,9DB	63mm/76mm
Austin Mini	1959	848	34 @ 5500	44	8.3	8A,8MB	63mm/68mm
Austin A40 mk2	1961	1098	47 @ 5100	60	8.3	10D	64.5mm/84mm
MG Midget mk1	1961	948	46 @ 5500	55	8.3	9CC	63mm/76mm
Mini Cooper	1961	997	55 @ 6000		9	9F	63mm/81mm
MG Midget mk1	1962	1098	52 @ 5500	57	8.9	10CG	64.5mm/84mm
MG 1100	1962	1098	55 @ 6000	61	8.9	10GR	64.6mm/84mm
Mini Cooper	1963	1071	70 @ 6000	62	9	9F	70.5mm/68mm
MG Midget mk2	1964	1098	59 @ 5700	60	8.9	10CC	64.5mm/84mm
Mini Cooper	1964	1275	76 @ 5900	79	9	9F	70.5mm/81mm
MG Midget mk3	1966	1275	65 @ 6300	65	9	12CC,12V	70.5mm/81mm
MG 1300	1969	1275	70 @ 6300	70	9.97	12G, 12GR	70.5mm/81mm
Marina 1.3	1971	1275	65 @ 5750	65	8.8	12V	70.5mm/81mm
Morris Ital 'A' plus	1980	1275	67 @ 5750	69	8.8	12V	70.5mm/81mm
MG Metro 1300	1982	1275	72 @ 6000	73	10.5	12H	70.5mm/81mm
MG Metro Turbo	1982	1275	93 @ 6150	85	9.4	12H	70.5mm/81mm

28bhp to 93 bhp in 30 years, from 803cc to 1275cc, 4800 rpm to 6150rpm, that's some improvement. Excellent torque figures (turning force) as well, 40 lb/ft to 80 lb/ft, this gives a better picture as it is this mid–range power which is used for acceleration and top gear performance. Note that *eight* M.G. models used this engine.

A point of difference between 'A' series is the method of driving the oil pump from the rear of the camshaft. At first there was a pin drive, then a slot drive, and in the later 1275cc a spider drive. The slot drive has two pumps, the 1275c has a longer nose as the block is thicker. To make life easy, the numbers of bolts holding them on differ. Another point is that all except the 1275cc engine have diagonally split big ends, so the con rod can be withdrawn up through the bore. The 1275cc has horizontally split big ends, a stronger design, as the bore is bigger and allows removal. Bearing shell lining material differs depending upon the use the engine is put to. M.G. use steel backed copper–lead alloy, later lead–indium, as the bearing lining. Compression ratios were easy to swap about on the 'A' and the 'B' series, as this was controlled by the piston crown height, all the cylinder head combustion chambers capacity within that model range being the same.

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M.G. Fit the 'A' Series to a Sports Car.

M.G. Midget Mk1 Engine, (1961 – 62)

This is a bit of a lie, as it was Austin Healey who first did it within BMC, using the A30/35 suspension, gearbox and rear axle, the 948cc 'A' series engine with twin 1 1/8" SU HS1 carbs, useless wire mesh pancake air filters, Morris Minor rack and pinion steering and full hydraulic brakes. (The A30/35/40 mk1 had awful hydraulic front brakes, with cable rear brakes.) The 948cc engine (9CC) was little changed from the Morris Minor/A40 unit, even down to the standard BMC cam timings of 5;45;45;5 with .312" lift at the valves, but the compression ratio was raised from 8.3 to 1 to 9 to 1 producing 43bhp at 5200rpm. The easier breathing engine, and the rev limit raised from 4750 in the Minor/A40 to 5200 in the Austin Healey Sprite Mk1 of 1958 gave the extra 9bhp, (34bhp in the saloons) giving the Frogeye good performance in its day. There were also stronger valve springs to allow higher revving, with stellite faced exhaust valves and harder copper/lead main bearing shells. The Healey designed chassis–less body was light and strong, (and a bit short for people like me of 6ft and over.) The A30/35/40 legacy carried on its four bolt secured flywheel, and its exhaust manifold, it was the same item, with the hot–spot for the Austin's Zenith single carburettor blanked off. To fit the 'A' series into the engine bay, the engine oil filter had to be raised by 1", or it sat on the offside chassis leg. There is a plate between the filter and housing and the block to accommodate this 1" rise. In 1956 the 948cc 'A' series had gained a full–flow oil filter at last, using a similar (Unipart GTE103) throw away paper/felt element the later XPAG and 'B' series used. Now all the oil went through the filter before it arrived at any bearings, something all 'X' series engines had done from 1936. The camshaft had a shell bearing on all three journals now, on the 948cc engines; and these, and those on the crankshaft, needed better filtration, being unable to absorb tiny bits as white metal does. All M.G. cars using the 'A' series have stronger springs in the oil pressure relief valve. The 948cc cars had a 6 1/4" clutch. The Mk1 sprite had inlet vales of 1.09" diameter, and exhaust valves of 1" diameter.

By 1961 M.G. and Healey had got together as the Sprite was being assembled at Abingdon, and the engine gained a better 63mm bore by 76mm stroke, 948cc unit (9CG) with an improved camshaft and bigger SU HS2 1 1/4" carbs, with a properly designed cast iron exhaust manifold and bigger alloy inlet manifold, with no hot–spot. Two nice large paper element air filters sat on the air intakes. The cylinder head gained a bigger inlet valve, of 1.15" diameter, the exhaust remained at 1". The power went up to 52bhp, on a compression ratio of 8.9 to 1, (optional 8.3) but as the new Mk1 MG Midget, (released in June 1961) with the similar Mk2 Sprite, putting on weight with a new skin on its body, performance was similar to the Frogeye. Note that M.G. used the prefix of a letter 'C' for the Midget engines, in 10CC or 10CG, not a 'G', as the fwd ADO16 used an identical sized engine, it was the fwd car who used the 10'G' prefix on its engine. ADO16 was about in 1960 in the ADO.

M.G. Midget Mk 1 1/2 Engine, (1962 – 64)

The same engine carried on the Midget, but in October 1962 there was an improvement in the power, from a 1098cc windfall from the new 1100cc ADO16 front wheel drive models recently introduced. This Midget is nicknamed the Midget Mk1 1/2. The Morris Minor and the A40 Farina gained the new 1098cc 'A' series engine, but this extra cc had been gained by lengthening the stroke to 84mm with a small increase in the bore to 64.5mm. The main bearings were still those of the first A30 803cc 2A engine, of 1.75" diameter. The big ends has been enlarged to 1.652" in 1956 in the 948cc 9M unit. In the staid saloon cars this did not matter, but it meant the same engine in the harder driven Midget would have crankshaft problems, as this had not been strengthened at all, keeping the same size bearings. It was a long stroke unit with greater reciprocating stresses for the poor crankshaft. The 1098cc unit with 8.9 to 1, (optional 8.1) with the same valves as the 948cc Midget, gave 56bhp in the Midget, 47bhp in the saloons. There was also some internal company competition, in that one of the new ADO16 models was a M.G. saloon, the MG 1100. Its 1098cc engine (10GR) produced 57bhp, which was shared with the 1100 Riley Kestrel. It was from these models the Midgets engine grew to 1098cc, BMC wanting to keep the variations of the 'A' as few as possible. The Midgets version being prefixed 10CG. The camshaft timing for these engines was 5.45.51.21 still with .312" lift. To cope with the greater torque, like the saloons, the clutch grew from 6 1/4" to a 7 1/4" diameter. The bell housing on the gearbox grew to accommodate the bigger clutch, and also had ribs cast into its casing for strength. If you grind away the starter bendix cover part of the earlier gearbox, and carry out a few trial fits to check for rubbing, the bigger clutch, with its flywheel, can be fitted to earlier cars, with the 'smooth' gearbox. To fit a 1275cc engine to an early 1098cc Midget, using the earlier cars four bolt flywheel, will require it being drilled accurately to cope with the six bolts of the 1275cc crankshaft. Rather luckily the two holes left over will locate on the 1275cc engines two dowels.

<u>M.G. Midget Mk2 Engine,(1964 – 66)</u>

By March 1964 MG had convinced BMC to improve the Midget 1098cc engine, so it gained its own cylinder block, and crankshaft from the Cooper 'S', now with 2" main bearings,(old size 1.75") and the Cooper 998cc cylinder head. So much for common parts! This led the Midget to be called a Mk2, (Sprite Mk3.) Austin had always used mechanical, engine driven off the camshaft, fuel pumps. The pump changed to a SU electrical one in the boot, and the boss the mechanical one used to occupy gained a blanking plate, ideal to bolt the tappet chest vent pipe to. The stronger engine has a prefix of 10CC, as well as a lip on the crankshaft boss for the flywheel to locate on. The earlier Midgets and the normal saloon rwd cars had flat faces for the flywheel to bolt to, using the outer edge of the crankshaft flywheel boss rim to locate on. It was in the front wheel drive cars that the rotating vane oil pump wore badly, as those tiny bits of worn gears could be sucked up into it, and rapidly wear away the small vanes as they rubbed around inside their aluminium alloy case. This led to Mini's having low pressure oil lights on at idle rpm, too early in their lives. So the eccentric lobed rotor type was fitted to the 1098cc engines throughout the range, as this has a rolling motion, not rubbing, and it lasts much longer. About now the North American market had dictated an engine should ingest its own vent air and fumes from the crankcase, so the first type of emission control was added. This consisted of a valve with a rubber diaphragm, that kept the crankcase just below outside ambient air pressure, venting into the inlet manifold. If the diaphragm split, the engine could drink all its oil in a short journey! This vent system needs a new oil filler cap, that allows an air bleed inwards to the rocker cover. All the 1098cc and 998cc engines onwards had rid themselves of the pinch bolt gudgeon pin, now having fully floating pins, (wrist pin in America.) The con–rod was thus much stronger, and less likely to let go of a piston, we can thank the Coopers again, for this. 1964 was also the year the cable driven tachometer was changed to an electronic impulse type, whose innards were shared with the MGB and Riley 4/72, and later the Marina 1800TC.

<u>M.G. Midget Mk3 Engine, (1966 – 74)</u>

The ADO16 needed more power, as did the now ageing Midget, so the 'A' series was redesigned as a 1275cc engine, (12CC or 12CE home market Midget) for October 1966, and called the Mk3. The block was a lot stronger, the tappet chest covers were deleted, and the timing chain improved to a duplex, (two rows). The bore was 70.5mm with a stroke of 81mm, 2mm shorter than the 1098cc engine. Camshaft timing remained at the 5;45;51;21 with a slight increase of lift to .318". Compression ratio was 8.8 to 1 (optional 8 to 1) with bigger valves of inlet 1.3" and exhaust of 1.15", giving 65bhp, at 6300 rpm, the higher rev limit allowed by the shorter stroke, and 65 lb/ft torque at 3400rpm. That improved crankshaft of the 1098cc Midget, with its 2" main bearings, could cope with 1275cc power, but to be safe the big ends were enlarged to 1.75", though the MG 1300 12G engine kept the 1.625" size for a while. A consequence of expanding a 803cc design to 1275cc meant the designed in safety margin grew less, this is shown by the fact that the 1275cc crankshaft can only be reground once to –.010" undersize, otherwise heat treatment is required, and only re–bored to +.020". The flywheel now had six bolts to hold it on, as well as two dowels to locate it accurately, with a diaphragm spring clutch. As the reciprocating weights had increased with the bigger 1275cc pistons, the crankshaft nose was fitted with a heavy damper that doubled up as the fan belt pulley. An improved crankcase vent system was introduced to replace the earlier problematical inlet manifold valve. This simply vented into the carburettor bodies via a small drilling by the throttle butterfly, from the timing chain cover oil trap. The system must have the correct oil filler cap, as this controls the air entry, to run without it will give a very weak mixture. The 1275cc cylinder head is longer, and which exits its water at a different angle to the 1098cc and earlier heads, the three studs are differently placed. The 12CE units (12CD in North America) have a bigger water pump with a larger inlet diameter pipe, requiring a bigger water hose.

This 1275cc engine gave the Midget a much needed boost in power, but it did put its performance dangerously near to that of the MGB, its bigger stable mate, with a 1798cc 'B' series engine. Both cars power to weight ratio was similar, a bit more power to the Midget would mean it would embarrass the bigger car. The 1275cc 'A' series was fitted to the MG 1300, and here gave 70bhp with 70 lb/ft torque, whistling up to 60mph in just 14 seconds. The ADO16 was the reason for the 1275 engine, and in it the saloon was close on the heels of the Midget, and could beat the smaller engine versions of the sports car. The Midget continued with its 12CC engine, until BMC changed the system of numbering, and it became the 12V, identical to the other, though painted black. All 1275 engines had solid skirt pistons with gudgeon pins a press fit into the connecting rods. Early 12G engines had four piston rings, later ones had three losing a compression ring. All Midgets with both the BMC 'A' series and Triumph 1500 engine can have hardened steel valve inserts fitted to the exhaust valve seats so they can use lead free fuel.

The costs of trying to keep the North American cars within the safety and pollution controls of that continent meant the management of BL had to choose between the 'A' series Midget engine, or the Triumph Spitfire 1500 unit. As Leyland ruled the day, the Triumph engine won, and in October 1974 a M.G. had an ex–Triumph Herald engine fitted from the opposition, the Spitfire. The 'A' series was not beaten, it would rise like a phoenix from the ashes, in the M.G. Metro in 1982, but that is later.

It is worth mentioning that the Morris Marina 1300 was produced from 1971, but its 1275cc 'A' series 12V engine differs a lot from that of the Midget. Its crankshaft is cast as is the 1800 Marina's, in a special production facility for this model. The term is 'flow–cast' and is nearly as strong as the forged one of the M.G's, but much cheaper. Its cylinder block is just as tough, but has the oil filter at the rear, over the starter motor, behind the distributor, and it uses the same throw away canister as the Metro's. The later Marina 1300 has an 8" diaphragm clutch, the pre–1275cc Midget a 7 1/4" spring clutch. To stop the wrong flywheel being fitted, as the Marinas is much larger than the Midgets, to fit its Triumph sourced, cast iron gearbox, the 1275cc Midget crank has two dowels, with a smaller diameter boss by about .020" . The Marina has one dowel, and its boss is larger, so if you tried to fit a Midget flywheel, it will go over the one dowel, but will not pull up flush onto the boss; whereas the Marina one cannot be put over the two dowels. Should you want to use a Marina block, especially the later 'A' Plus Ital engine, you need to swap over the front plate, rear plate, and a six bolt flywheel from a 1275cc Midget, (or drill a 1098cc one) with the flywheel centre turned out a little to enable it to bolt up flush. The Marina side front mountings can be thrown away, but do put the bolts back in the holes, some go through into the crankcase, and you will lose a lot of oil otherwise.

<u>A Standard Triumph Engine M.G. – M.G. Midget Mk3 1500 Engine. 1974 – 79.</u>

October 1974 saw the M.G. Midget roll out of Abingdon with a different engine, one commonised with the Triumph Spitfire for the North American market, the main sports car sales area. This engine has as long a history as the 'A' series. It too started life as a 803cc unit, for the Standard 8hp of September 1953, and the 10hp and deluxe Pennant of May 1954. These were Austin A30 and A35 competition, and even had similar styling, as well as very similar sized engines. The Standard

Eight was 803cc, (A30 size) and the Standard Ten was 948cc, (A35 size.) The Eights engine was of grey cast iron with pressed steel sump, timing cover, and rocker cover, with a bore of 58mm and a stroke of 76mm. If ever there was a copy, this was it, as the A30 engine has the same dimensions, rather similar to William Morris copying the Ford 8hp side valve engine in 1935 that became the USHM of the Morris Eight in 1936. It was not identical, as the 'A' series has its oil pump on the end of the camshaft, the Standard engine has its oil pump in the sump, driven off the same skew–gear as the distributor. With 7.25 to 1 compression ratio the 803cc engine in the Standard developed 26bhp at 4500rpm, with 40 lb/ft torque at 2800rpm. This power is fed through a 6 1/4" clutch. The Ten of 948cc was the same stroke, but the bore was 63mm, (A35?) It developed 35bhp at 4500rpm, and 46 lb/ft torque at 2500rpm, with a compression ratio of 7 to 1, and could do 65mph; not bad for 1954.

By April 1959 the models gave way to the Standard Triumph 'Herald' saloon, Standard and Triumph having merged, this using the 948cc engine of the Ten. The engine was uprated to 8.5 to 1 compression ratio with twin SU carbs, producing a healthy 45bhp at 5500rpm for the Herald Coupe for May 1959. This twin carb engine was bored out to 1147cc for the Herald 1200 and a new sports car, the Spitfire, based on the saloon components for 1962. The 1147cc had been gained by offsetting the bores, siamesing them, and boring out to 69.3mm. With 9 to 1 compression, two SU HS2 carbs in the Spitfire mk1, it produced 63bhp at 5750rpm and 67 lb/ft torque. The Spitfire Mk2 raised this to 67bhp in December 1964. By January 1967 the Mk3 version of the Spitfire with a 1296cc version of the engine was on sale. The bore was now 73.7mm with the same 76mm stroke, and 9 to 1 compression and this uses two SU HS2 carbs. The power rose to 75bhp at 6000rpm with 75 lb/ft torque. A Mk4 version appeared in November 1970, with the 1296cc engine, but it was cheapened with only 63bhp being produced at 6000rpm, the reason for this was standardisation of the fleet's engines. There was now a 1296cc used in the Spitfire, Toledo, and Dolomite 1300, and a 1493cc engine, used in the 1500, 1500TC, and Dolomite 1500.

The 1493cc had been gained by lengthening the stroke: there was no more room to bore the cylinders any wider, after all, it was only a Standard Eight/Ten/Pennant block of 1953. A longer throw crankshaft was also needed for this bigger engine that only had three main bearings. At 73.7mm bore and 87.5mm stroke it had 9 to 1 compression in the Spitfire 1500 of December 1974, introduced for the American market with the M.G. Midget 1500 following in October of that year. British Leyland had grouped a lot of competing British firms under one roof, and were not disposed to the ailing ex–BMC companies. They had a large market in the USA for sports cars.

In 1973 a de–toxed engine had been produced for the USA market by Triumph, this had put the mockers on the poor 'A' series, as it was financially foolish to have two similar sized sports car in the same company, with different engines for the same market. The 1493cc engine was identical in both models, but not perhaps the ideal choice, with hindsight. It was a case of the MPJM of 1936 again, a slow revving engine with a long stroke. With a compression ratio of 9 to 1 (7.5 to 1 for the USA) it produced 66bhp at 5500rpm and 82 lb/ft torque at 3000rpm in the Mk3 Midget 1500, less than the M.G. Metro 1300's 72bhp. The cam timing was 18;58;58;18 and the engine bolted to a Morris Marina gearbox with synchromesh on all four forward gears. It had full flow oil filtration, and fully floating gudgeon pins like the 1098cc 'A' series. The crankshaft had main bearing sizes of 2.3" and big ends of 1.875", both bigger than the 1275cc 'A' engine. This allowed regrinding up to –030" undersize. The 1500 performed well enough, its capacity giving the light Midget some go. The 7 1/4" clutch was the diaphragm type and very smooth. The version used for the USA had terrible power sapping items fitted, like air pumps, exhaust gas recirculation valves, and so on. However, in the USA it did use the electronic Lucas 45/DE4 distributor.

There is a tale that design management at Standard Triumph wanted to move the bore centres out so the engine could be enlarged. The machine minder who had been there for donkeys' years, said they could not be moved, the machine would not adjust. One night a technically minded manager stole down from his office, and saw they could be moved, the machine being like all other boring machines, being adjustable by undoing a few locking bolts. The 'jobs–worth' machine minder was amazed, he had been telling many managers for many years it could not be done. Goes to prove the best managers are those who can do the job as well, not just businessmen/women.

From personal memories of running a 1098cc Midget, a 1275cc Midget, and a Triumph Spitfire, I seem to remember the Spitfire engine was difficult to keep oil tight. Both BMC and Triumph engines leak oil, that I am afraid is part of their engineering heritage, but the Triumph does have some odd joints in its block. I found the vent system hoses would clog up with solid carbon on the controlled breathing engines, causing crankcase compression, oil consumption and oil leaks. The pipe need regular cleaning out, or renewing, the cause being short journeys.

The Midget faded away in November 1979.

Oops!!

On the 'A' and 'B' series, the distributor is driven off a skew gear on the opposite side of the engine, requiring a short 'jackshaft'. This locates in a hole one side, and drives the distributor using a 'D' drive, the other. To lift it out requires a 5/16" UNF stud, those of the rocker cover being ideal, as they will screw into the threaded end provided for this. People who do not know this get it out without trouble, but have been known to drop it into the sump when trying to refit it in the correct position.

In the export 850cc Mini for Japan, the 'A' series was made unleaded. This led to many miles of testing, 500 per day. After only 3 days on unleaded the Mini's cylinder head was ruined by valve regression. Japan has never used tetra–Ethyl–Lead, so all its vehicles have always been 'unleaded'.

The 'A' Series in a M.G. Saloon.

M.G. 1100 Engine.(1962 – 67)

Due to the success of the ADO15 Mini in 1959, this had been followed by a similar but bigger car, the ADO16, known as the 1100/1300 front wheel drive range. It was this model BMC had developed the 1098cc engine for. One of the six models was marketed as an M.G. in 1962, the MG 1100, as a two and four door. The 'A' series under the bonnet was pure Mini design, but bigger capacity. The cylinder block was not interchangeable with the similar sized 1098cc MG Midget, as the rear main bearing was very different, and the crankshaft had a longer tail for the reversed dry clutch with a gear behind to drive the gearbox underneath via an idler–gear between. This idler–gear did get a reputation for rapid wear, giving out a characteristic loud rattle if idle rpm was too slow. The 1098cc MG 1100 still had the 1.75" main bearings of the early 10CG Midget. Otherwise it was very like the sports car unit, with twin SU HS2 carburettors, on a 64.5 bore by 84mm stroke, 8.9 to 1 compression, 10GR engine. The standard 1100 saloon had 8.5 to 1 compression with 48bhp at 5100rpm, with 60 lbs torque. For 1967 only the USA MG 1100 had a single SU HS4.

The cam timing was the same as the Midget 1098cc at 5.45.52;21 with .312" lift, producing 55bhp at 5800rpm and 61 lb/ft torque. At 5800rpm the engine certainly let the driver know it was there. The 12G206 cylinder head used the larger 1.21" inlet valves of the Mini Cooper, and the MG 1100 and Riley Kestrel that shared the unit, had a free flowing exhaust system. It did not use the mechanical fuel pump, but an SU electrical one. Oil consumption and oil pump wear were a problem early on, but as in the Mini, the pump was changed from a rotating vane type to a Holbourn–Eaton eccentric rotor. The vane one was not up to the bigger 'A' series. Oil control rings were improved by fitting Duraflex versions, these are three–piece items with two rails separated by an expander, now common. Better quality control on pistons also helped, each bore being stamped with a code for its size, and a matching piston fitted in sets.

M.G. 1300 Mk1 Engine,(1967 – 68) MG 1300 Mk2 (1968 – 71)

The car sold well, but it took until 1967 for BMC to fit the 1275cc version of the 'A' series for the UK, a 12G,(or later 12GR engine, making it common with the Riley Kestrel.) The American market was soaking up the 1275cc engined cars. The 1275cc 12GR engine gained the advantages of the 1300 group, in that the main bearings grew to the 2" of the later 10CC Midget. Some early 12G engines had the 948/1098 big end size of 1.625", but as the steel quality of the crankshaft, soon to be used on the Marina 1300, was not so good, so to retain the strength the big ends grew to 1.75" diameter. This Mk1, 12G engine only had a single SU HS4 carburettor, producing 60bhp. The camshaft was still the 5;45;51;21 timed item. Valves head sizes were inlet 1.3" and exhaust 1.15", as on the 1275cc Midget. The Riley Kestrel and Vanden Plas 1300 shared the engine. The more powerful post April 1968, MG 1300 Mk2, had 70bhp at 5250rpm with 70 lb/ft of torque, once fitted with twin SU HS2 carburettors, now being a 12GR unit, with a 11 stud head. This made it quite a nippy car: one that could keep on the heels of a 1275 Midget for instance, (0 to 60 in 14.5 seconds.) 95mph with 0 to 60 in 14 seconds was excellent then. This also embarrassed the MGB (13 seconds) and left the other saloon, the Mk4 Magnette (19.5seconds) standing at the traffic lights.

There was also an automatic MG 1300, that used a single SU HS4 on the 1275cc engine, producing 58bhp, it was the same unit all the 1300 fwd automatic cars had fitted, and very similar to the 12G engine. Not many were sold, and it died late 1968.

Oil consumption was noticeable on the 1098cc at speed when worn a little, and this was traced to the poor sealing of the inlet valve stem, easily diagnosed by lifting your foot right off the throttle on a long downhill run, letting the car drive the engine. When you accelerate again at the bottom, watch in the rear view mirror, lots of blue smoke may well be just worn inlet valve guides, and/or valve stem seals. The old rubber ring under the collets did not stop the inlet manifold sucking oil down the guide, fitted since the 803cc. So it was changed to an improved neoprene cap–seal that gripped the stem, and sat over the top of the inlet valve guide, and was fitted on all the 998, 1098, and 1275cc engines from then onwards. With a little tuning the MG 1300 would out handle and beat the Midget. Both 1098cc and 1275cc ADO16 engines can be modified for lead free fuel, buy fitting hardened steel exhaust valve seats. In 1971 the model was discontinued after 143,067 cars, as Austin wanted to sell their Austin 1300GT, that used the same engine.

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Identifying 'A' Series Engines using Archaeology.

The simplest way is to use the prefix to the engine's number, stamped on a small oblong plate riveted to the offside of the top/front of the cylinder block, just above the dynamo. On both rwd and fwd, if you have just a block, then it should have the cubic capacity on a small triangular plate riveted near to the mechanical fuel pump, or its blanking plate. This should say 850, 948, 1100, 1275, etc. If neither are there, you will have to measure the bore and stroke, and even then check on main bearing sizes.

A quick method to reduce the odds is to look at the oil filter. If it is an early round canister screwed at right angles to the block, under the dynamo, it is an 803cc, rwd. If it is the paper/felt element type in a bowl facing down, with a pipe from the rear feeding to it, it is a 949/1098/1275cc. If this bowl has a plate between it and the block to raise it 1", you have a Sprite/Midget block. A damper on the front of the crankshaft may indicate a 1275cc. No side covers for the push rods is certainly a 1275cc. If the oil filter is above the starter motor, and is a throw away can, it is a Marina/Ital 1275cc rwd block. Note that the Marina Van carried on with the old 1098cc engine.

Early engines relied on two rubber rings on the camshaft sprocket to tension the chain, which did not last very long, and got a nickname of the 'A' series death rattle when worn. The 1275cc gained a decent chain tensioner, and the bulge in the cover can be seen. A few extra holes drilled will allow earlier engines to retro–fit this, though they will need to have the duplex chain and sprockets as well, and two bolts on the front main bearing/front face of the front engine plate countersunk to miss the wider chain.

Fwd engines are easy to recognise I hope. Again it is the same with the engine number and the triangular plate, though all have the oil filter bowl, aluminium on early Minis, steel later. Also the damper on the crankshaft, and no push rod side covers means a 1275cc. A crankcase vent from the tappet chest will indicate a 1098cc engine, whereas a vent from the timing chain cover a 1275cc. This is true on later rwd blocks as well. The Metro/Montego has a throw away oil filter, as well as a differently formed engine number from the old BMC system. A bare block will have no scroll at the rear for the rear main bearing. Second hand engine numbers are often chiselled off for unknown reasons!!

The bit that causes problems is the cylinder head, as these will fit any engine, except the Coopers with their two extra studs. The method used has to be the casting number, under the rocker cover and usually well drowned in oily black muck.

Model	Casting number	Combustion cc	inlet/exhaust size
803cc and 848cc	2A 628,12A 1456,2A 629	24.5cc	1.06inch/1inch
997cc and 1098cc	12G 202	26.1cc	1.15inch/1inch
998cc and 1098cc MG	12G 206, 12G 295	28.3cc	1.21inch/1inch
1275cc	12G 940	21.4cc	1.31inch/1.15inch
1275 MG1300 and 1300GT)	12G 940	21.4cc	1.4inch/1.15inch
All Cooper 'S'	12A 185, AFG 163	21.4cc	1.4inch/1.15inch
MG Metro Turbo	12G 940	21.4cc	1.31 inch/1.15 inch

Note that casting numbers were the same for different finished items, this number is that of the wooden pattern only, the casting can be machined for different uses after, ending up with a different part number in the spares book. 12G940 could be drilled for 9 or 11 studs. The Cooper 'S' heads all had 11 studs.

After Abingdon, 'A' Series after 1981.

M.G. Metro 1300 Engine. (1982 – 90)

Still on the 'A' series, well worthy of a mention, is the M.G. Metro and its sister car the Turbo. The M.G. Metro came just two years after the last MGB, in 1982. For this model BL took a hard look at the 'A' series, and decided to give it further life. They spent a fortune on renewing worn out machinery, and improving the engine. The Marina Ital gained as well, as both were fitted with the better 'A Plus' unit, 12V, 10H and 12H engines, with its better flowing ports and manifolds. The Metro is very Mini in design, but bigger, with cast iron head and block, with an aluminium alloy sump containing the gearbox. The M.G. Metro 1300 updated and mildly tuned engine producing 72bhp at 6000rpm, and 73 lbs torque, from the 1275cc, giving any Midget a very rough and embarrassing time indeed, and most MGB's. A 0 to 60mph in just 11 seconds and a top speed of 101mph were just what was needed to keep the name of MG alive. This all from a single SU carb, but very much improved in gas–flow, and with 10.3 to 1 compression ratio. A normal Metro 998cc 10H engine had 9.6 or optional 8.3. The exhaust was a cast iron three–into–two–into–one system, and much better than the usual restrictive BMC earlier manifolds. The inlet manifold was a nicely shaped water heated one, for a single large SU HIF 44, 1 1/2", complete with a huge paper element air filter. The 1275 'A Plus' still used the 2" main bearings and 1.75" big ends of the 'A' series 1275.

Camshaft timing had the wide overlap of the Cooper 'S' at 16;56;59;29 with .318" lift at the valve, 35mm inlet and 29mm exhaust valves. From 1985 all Metro 1300's had Ducellier electronic ignition. 142,165 MG Metro 1300s were made.

The MG Metro Turbo has an exhaust powered, Garratt T3 Turbo–charger, and 9.4 to 1 compression. A waste gate on the turbo, and the standard Metro compression ratio, combine to eliminate most turbo lag, being solenoid operated, permitted power up to 93bhp at 6150 rpm and 85lb/ft torque at just 2650 rpm, the most powerful production 'A' series ever. It was designed in conjunction with Lotus Cars, Colin Chapman's empire. This gave the little car a top speed of 113mph, the fastest MG saloon up to then. It had Ducellier electronic ignition, oil cooler, modified head, and uprated nitrided crankshaft, double valve springs, stronger pistons, big end and main bearings. The Turbo used stronger pistons, (20484 type, standard Metro ones are 21253) the standard Metro camshaft, 29mm exhaust valves and 33mm inlet. There were problems with a thinner head casting block face, of the first few Turbos, using the 12G 940 head. It blew head gaskets, cured only by going back to the original metal thickness. The waterways had been enlarged to improve cooling of the exhaust valve seat area. The clutch centre plate was solid (like a diesel) no damping spring fitted, and the engine mountings were stiffer. 21,968 MG Metro Turbo's were made.
The Austin Metro Sport in 1988 shared the MG Metro 1300 engine, and the Austin Metro GTa both at a lower price.

The MG Metro 1300 became lead free in 1989, with an engine prefix of 12H/F01. By 1990 the car had a Rover K series engine, so not many were made. The leaded 'A' series is prefixed '12H/D'. BL and Austin/Rover made 142,165 MG Metros between 1982 and 1990. BL actually made 1,600,000 'A' series powered Metros, up to 1991. The cylinder head, manifolds and carb are a good swap onto any 1275cc car, and the camshaft is quite sporting, ex–Mini Cooper 'S' timing. Metros do suffer from oil leaks. Over 50,000 miles the gear selection rod into the back of the gearbox, which is below the sump oil level, may leak. The seals on the timing chain case, and both drive shafts will eventually leak, again reasonably easy to replace, especially the drive shaft ones compared to a Mini. 12H is the engine type as in the list above, followed by 996 indicates a MG Metro unit with a standard gear box, with single rod change. AA is the version with temperature control in the crankcase breather.

M.G. Metro 6R4 Engine, (1984 – 89.)
Very little of this special production of 200 cars was Metro, built by British Leyland and Williams Racing. It was an out and out rally car, the title meaning V**6** cylinder – **R**ally – **4** Wheel Drive. In 1983 a Rover V8 was cut down to a 2495cc V6, as the V8 was just too big to fit. This was a twelve valve engine with six carburettors producing 250bhp. In 1985 it was redesigned by David Wood of Austin/Rover into the 2991cc V64V, (**V6**, **4 V**alves) an all–aluminium V6 engine with twin–belt driven dohc per head, four valves per cylinder, at 3 litres capacity. With Lucas Micos fuel injection adapted from the Jaguar XJR – 6 V12 racing car, electronic ignition, tuned intake bell–mouths and exhaust system, it produced 380bhp initially, later 410bhp and was fitted amidships, with a five speed gearbox driving all four wheels. It eventually produce 400bhp, but was detuned for reliability for Autocross, to just 250hp. The fuel metering and ignition timing was carried out by an Intel 8032 Microprocessor. The spark was produced by a Lucas AB14–type ignition amplifier using two Lucas 35C6 coils. In 1987 some were bored out to 3.8 litres, and tuned to 550bhp, normally aspirated, (no help with the inlet stroke). Some were also reduced to 2.3 litres and fitted with two exhaust powered turbo–chargers and flew about with 750bhp on tap, getting from zero to 60mph in just 3 seconds. Approximately 233 cars were produced. Jaguar took over the engine and Tom Walkinshaw reworked it into the V6 used in the XJR – 11 sports–racer of 1990, and eventually the supercar XJ220 of 1992.

'A' Series Camshafts fitted in M.G's

There are many aftermarket tuning kits and camshafts for the 'A' series. This lists those camshafts fitted to production cars only. The 1500 Midget is included. Early camshafts had 3/8" wide lobes, later versions have 1/2" lobes. Beware of comparing cam timing between different engine types. Things like valve sizes, port shapes, cars use, all affect performance.

Model	Cam Timings	Lift	Part Number (if known)
948cc Midget	5;45;45;5	.312"	12G 165, AEA 630, 12G 726.
1098cc Midget	5;45;51;21	.312"	AEG577, AEG323, AEG538
1275cc Midget	5;45;51;21	.318"	AEG577, AEG323, AEG538.
1493cc Midget	18;58;58;18		
M.G. 1100		.312"	12G 165, AEA 630, 12G726
M.G. 1300	5;45;51;21	.318"	AEG577, AEG323, AEG538
M.G. Metro 1300 (Mini Cooper cam)	16;56;59;29	.318"	AEG567, CAM6648
M.G. Metro Turbo	9;41;49;11	.318"	

The large bearings of the 'A' and 'B' series camshafts often leads to them not requiring renewal on reconditioned engines. A look at an Austin 8hp camshaft of 1935, that the 'A' camshaft is a clone of, shows it with huge bearings, whereas the Morris 'X' series has smaller ones. The XPAG's camshaft looks like a bit of bent wire in comparison.

A twin camshaft cylinder head was built for the 'A' series, in the early 60's, now on display at Gaydon Motor Museum. It was driven by a toothed belt, and designed by Eric Bareham. It never reached production, but would have made a tidy Midget. It produced 80bhp at 6750rpm, and was based on the Mini Cooper 998cc and 1275cc engines. It was never used, but it did lead to the 'A' Plus engine. A twin ohc kit for the 'A' series is available by Jack Knight and KAD, from the larger Mini specialists these days, toothed belt driven, should you want one.

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BMC 'B' Series M.G. Engines.
1953 to 1980.

Potted History.
A New Engine for M.G.
The BMC Austin designed 1489cc 'B' series engine was first seen in an M.G. in October 1953. It was shown at the 1953 Motor Show, and caused a bit of a rumpus among some who called themselves enthusiasts. The model was the air–smooth M.G. 'Z' Magnette saloon car. It replaced the 'Y' type with its 1250cc XPAG engine, an engine the company's Wolseley 4/44 would still be using three years later, till 1956.

The source of the 'B' series goes a lot further back in motoring history, as does its little sister the 'A' series, both being born from a 1200cc ohv Austin engine of 1947. This 1200cc unit was one of a pair that Bill Appleby, Eric Bareham, and Jimmy Rix, at the ADO (Austin Design Office) is supposed to have cribbed from a lorry engine. The original unit was in fact a ohv six cylinder Chevrolet engine that Vauxhall were building to fit in their pre–war Bedford lorry. It was very successful, and Austin got hold of an example, and made his own slightly altered version. It was also very successful so the Engine Design Department cloned it into two smaller four cylinder versions, for use in the cars. One was a 2199cc 16hp engine, used in the post–war 1945 Austin Sixteen saloon, 25cwt van, and early A90 Atlantic, and bored out to 2660cc in the later A90 Atlantic, Austin Taxi, the Champ, and Austin Healey 100 sports car. The other was a very tidy unit of 1200cc, not unlike the 'B' series, but with a gear type oil pump and by pass oil filter, using the crankshaft, connecting rods, pistons, camshaft, and bore centres from the pre–war Austin 10/4 of 1932, of 65.5mm bore and 89mm stroke. It produced 40bhp at 4300rpm, with its Zenith carburettor. This was a good example of tying a designer down to a price. It is NOT an ohv conversion of the Austin 10hp side valve engine, it was done so the same boring machine could be used to make the 'new' engine. It was fitted to the four door A40 Devon and two door Dorset models, in 1947, the same year the M.G. 'Y' type saloon was introduced.

In 1953 it was redesigned into the 1200cc and 1489cc 'B' series by Eric Bareham and Jimmy Rix, and this engine went into the A40 Somerset in 1954, (same A40 new body.) The 1947 – 1953 Austin 1200cc engine is **not** a 'B' series, though it looks similar. The new redesigned engine was of conservative design, in grey cast iron, with a pressed steel sump, timing chain cover, and rocker cover. Its mechanical petrol pump was driven off a lobe on the camshaft, and it was a push–rod ohv unit with heart shaped 'bath chamber' combustion chambers, developed by the same consultant Harry Weslake who had a hand in the 'A' series. The cylinders were further apart than the original A40 1200cc engine, and the crankshaft was of EN16 carbon steel. The 89mm stroke meant the counterweights of the crank actually went within one sixteenth of an inch of the camshaft, something that limited any lengthening of the stroke in later life. It was only designed for a five year production life after all. All 'A' and 'B' series engines had their compression ratios altered, within that engine's model range, by the differing dish in the piston. This made production easier as only one cylinder head was required, and should you have an engine with a flat piston, this would be a high compression version. The cylinder head had five ports, all four inlets were siamesed into two, and the two centre exhaust shared a port, just as in the MPJG Midget engine of 1936. This central exhaust port would mean the exhaust valves would run very hot, so only the best steel was used in them. Even so, many larger 'B' series developed a name for running on after switching the ignition off, easily cured today by fitting an anti–run–on valve from a Metro, to the inlet manifold. The camshaft design ensured the cam lasted a lot longer than the XPAG versions. The camshaft was slightly offset from the centreline of the followers above, so as the cam lobe rotated and lifted the follower; being offset, it rotated the follower as well inside its bore. This reduced wear of both parts considerably, as not just one area took all the stress, and stopped pocketing of the follower's lower face.

Like the 'A' series, it was all the electric's on one side of the block, and fuel the other, for safety. The 'B' series had a paper/felt element oil filter in a bolt on steel bowl, but it was still only a bypass version, taking 10 miles to filter all the oil just once. Early engines have no oil pipe to this filter, which assists identification. The oil pump was an eccentric three lobe type, by Holbourne–Eaton, driven from a skew gear off the camshaft, with the distributor drive coming off the same gear via a jack shaft that sits between the cylinders. This means the distributor is at an angle on the other side. Connecting rods (con–rods) had the pinch bolt gudgeon pin and diagonally split big ends so they could be withdrawn up via the cylinder. On old long stroke sv engines it was common to drop the sump, undo the big ends, and wriggle the piston down past the crankshaft; ohv engines usually have pistons that are too big for this having broader bores. The 89mm stroke was to give the engine good mid–range torque, but would limit rpm, and development; not that the designer had any idea his engine would still be about in 1980's. It had three main bearings on its counterbalanced crankshaft that were a larger diameter than the A40 1200 unit of 1947. The timing chain had a tensioner, which the earlier engines before 1954 did not. The 1200cc version only lasted until 1957, but the 1489cc '1500' was still in use in the Wolseley 1500 as late as 1965. Of all engines in this book the 'B' is the easiest to identify, as they have their capacity cast in numbers on the nearside front of the block, under the dynamo, '1200' for 1200cc, and '1500' for 1489cc, for these early units; and '1600' for 1588cc, '1622' for 1622cc, and '1800' for 1798cc. It is one of the heaviest engines about for its size, 370lbs for a 1489cc, less gearbox; 520lbs for a 1798cc with gearbox. (Make sure that garage roof is strong enough.)

As Austin and Morris had amalgamated, both had huge engineering capacity, and the 'A' and 'B' were built by Morris Engines and at Longbridge, now the BMC Engines Division. Austin also used good quality metals in his cars and mechanics, both firms had excellent reputations for good service and long life of their engines. Austin's for instance could go for 100,000 miles whilst current Fords of the time were often worn out at 35,000. The 'B' series was just that, a hard–working, long lasting unit, a name that became a byword for reliability, if not high power. The 'B' does leak oil, especially early units that have the felt front timing cover seal, and the rear reverse–scroll seal. Slight crankcase compression, and a bit of wear, will allow this rear seal to weep, and leave you a little signature on the clean drive via the bell housing drain hole. Later engines had a modern front seal, but it was not until the 1800 five main bearing engine did we get a decent neoprene sprung rear seal. M.G. were once again to take a bread and butter engine, and use it to advantage in their sports car and saloons.

In the 'B' series, the Type – "A to Z" part is shown well under the MGB, that used many variations. The first MGB's were 18G, but as modifications were fitted, they became 18GA, 18GB, 18GC, etc. See MGB section for more. The 'A' series did not suffer the same North American mania for emission controls of various types, so had far less 'types' per model, often as few as only two.

USE OF THE 'A' SERIES.

Car Model	Engine cc.	Prefix Number
Austin A30	803cc	2A
Austin A35	948cc	9A
Austin A35 Van, (optional)	848cc	8AG (post 1962, most GPO.)
Austin A40 mk1	948cc	9A or 9D
Austin A40 mk2	948cc	9DB
Austin A40 mk2	1098cc	10D or 10DD

Car Model	Engine cc.	Prefix Number
Austin Healey Sprite mk1	948cc	9CG or 9CC
Sprite Mk2/ M.G. Midget mk1	1098cc	10CG
Sprite mk3/ Midget mk2	1098cc	10CC (2" main bearings.)
Sprite Mk4/ Midget mk3	1275cc	12CC or 12CE home market or 12CD or 12CJ North America after Oct. '72 12V/586F/H home market or 12V/671Z/L North America
Austin Allegro	1275cc	12H (same as Metro)
Austin Mini	848cc	8A
Morris Mini	848cc	8MB
Austin/Morris Mini after '62	848cc	8AM
Austin/Morris Mini automatic	848cc	8AH, floor change, closed circuit breather 8AJ, automatic, closed circuit breather 8AK
Mini GPO saloon and van	848cc	85H restrictor in carb.
Mini Clubman	1098cc	10H
Mini 1000 / Metro 1 litre	998cc	99H
Mini 1000 automatic	998cc	9AG
Mini 1275 GT	1275cc	12H
Mini Moke	848cc	8AC
Wolseley Hornet/Riley Elf mk1	848cc	8WR
Wolseley Hornet/Riley Elf mk2	998cc	9WR
Mini Cooper	997cc and 1070cc(S)	9F/SA/H 9:1 comp
Mini Cooper	997cc	9F/SA/L 8:3 comp
Mini Cooper	970cc (S)	9F/SA/X 10:1 comp
Mini Cooper	1275cc (S)	9F/SA/Y 9.75:1 comp
Mini Cooper	998cc	9FA/SA/H 9:1 comp
Mini Cooper	998cc	9FA/SA/L 8:3 comp
Mini Cooper	970cc (S)	9FC/SA/H 9:1 comp
Mini Cooper	998cc	9FD/SA/H 9:1 comp
Mini Cooper	1070cc (S)	9FD/SA/H 9:1 comp (engine 33661 to 33948)
Mini Cooper	998cc	9FD/SA/L 8.3:1 comp
Mini Cooper	970cc (S)	9FD/SA/X 10:1 comp
Mini Cooper	1275cc (S)	9FD/SA/Y 9.75:1 comp
Mini Cooper	970cc (S)	9FE/SA/X 10:1 comp
Mini Cooper	1275cc (S)	9FE/SA/Y 9.75:1 comp
Mini Cooper	1070cc (S)	10F 8.3:1 comp
Morris Minor series 2	803cc	APHM, (Morris numbering)
Morris Minor 1000 s3	948cc	APJM, changing to 9M in 1956.
Morris Minor 1000 s4	948cc	9M
Morris Minor 1000 s5	1098cc	10MA
Morris Minor 1000 s5 closed circuit breather	1098cc	10ME
Morris GPO van	948cc	8AG post 1962
Morris 1000 Van	1098cc	10AB low compression
Morris 1000 Van closed circuit breathing	1098cc	10V

Car Model	Engine cc.	Prefix Number
Gold Seal exchange for all in–line 'A' series		8G
Austin, Morris, Wolseley 1100	1098cc	10AMW, 10H
Austin, Morris, Wolseley 1100	1098cc	Automatic 10AG, floor change closed circuit breather 10AH, automatic, closed circuit breather 10AJ
M.G. 1100 Mk1 and Mk2	1098cc	10GR
Riley 1100	1098cc	10GR
Vanden Plas 1100	1098cc	10GR or 10V
M.G. 1300 Mk1	1275cc	12G
M.G. 1300 Mk2	1275cc	12GR after April 1968
Riley 1300	1275cc	12GR
1300 fwd Automatic	1275cc	12A
Vanden Plas 1300	1275cc	12GR or 12V
Marina 1300	1275cc	12V
Austin 1300 'S' mk1 and mk2	1275cc	12FA
Austin 1300 'S' mk3	1275cc	12H
Marina Van 1.1	1098cc	10V
Marina Van 1.3	1275cc	12V Low compression
Marina Ital	1275cc 'A' plus	12V
Metro 1 litre	998cc 'A' plus	9H
Austin Metro 1300	1275cc 'A' plus	12H/D
M.G. Metro 1300	1275cc 'A' plus	12H/D24
M.G. Metro 1300 lead free	1275cc 'A' plus	12H/F01
M.G. Metro 1300 Turbo	1275cc 'A' plus	12H/F01
Austin Metro Sport	1275cc 'A' plus	12H/F02
Austin Metro GTa	1275cc 'A' plus turbo	12H/F02
Austin/Rover Metro 1.3	1275cc 'A' plus	12H/F **
Austin Maestro 1300	1275cc 'A' Plus	12H (Marina type sump and oil filter.)

**Unleaded Austin Metro 1.3 engines; 12H/E24, 35, 39, 40, 41, 42, 67 up to 75.

After about 1970 BMC/BL had reduced the prefix to just the engine size and its alignment in the car, i.e. 'V' meant vertical for rwd, and 'H' meant horizontal for fwd.

Using the engine numbering and fitment charts, you should find that a M.G. Midget with a 1098cc engine with a prefix of " 10CG/U/H/ " has an early 1098cc small main bearing unit, (made between October 1962 and March 1964) with a central floor gear change, of a high compression ratio, (i.e. clear steering columns!

There is a lot of the 'B' series in early Nissan – Datsun cars, as they assembled CKD export Austin 1200cc A40 Devon's and 1489cc A50 Cambridge's in the early 1950's. Later they too cribbed the 'B' series design, fitting it into many of their models, but it was a 'mirror' image, everything on opposite sides.

<u>Known Modifications During Production.</u>

Because of the <u>massive</u> number of vehicles the B series engine was fitted to, over such a long period, only an overview is given. Use your own car's manual for accurate information.

Date		Model	Modification
October	1953	M.G. ZA Magnette	New 1489cc 'B' series engine.
January	1954	All	Reynolds timing chain tensioner fitted
October	1954	Austin A40 and A50, Oxford s2 and Cowley S2	Gain the 1200 and 1489cc engines
	1955	All	Oil pump output increased
	1956	All	Full flow oil filter fitted
	1956	Austin and Morris	1200 discontinued, but it did carry on in Eire in the A50 till 1959
	1958	All	Vent pipe from crankcase given a swan neck to stop oil loss
	1958	M.G. MGA	1489 bored out to 1588cc for use in MGA Twin Cam and MGA 1600
November	1958	All	Exhaust manifold improved, and Austin's lose their Zenith carbs for S.U. increasing power by 2bhp
	1959	BMC Australia	Try out the 1622cc engine
	1960	Austin and Morris	1489cc Diesel version
September	1961	Farina models and MGA	1622cc introduced in UK, bigger valves, stronger engine
June	1962	MGB 1800	1798cc three main bearing, 18G and 18GA fitted to new MGB
February	1964	MGB – export	Closed circuit breather system
October	1964	FWD Austin 1800	1798cc engine used in fwd transverse location. Five main bearings on crankshaft
October	1964	MGB	Five main bearing engine, 18GB, Rear oil seal on crankshaft, and fully floating gudgeon pins
October	1964	Riley 1.5 and Wolseley 1500	Last 1489 in saloon car, but it carried on in the vans until 1969
November	1966	Farina and MGB	Bits of 1622 and 1798cc engines commonised, water pump, sump, and larger capacity oil pump. Now 16AA and 16GF.
	1968	1800 'S'	Biggest inlet valve head fitted, 1.625" dia, 12H2708. Smaller combustion chamber, most powerful standard 'B'
August	1970	MGB North America	Emission Control fitted
August	1970	MGB and Austin/Morris 1800	Closed circuit breather now fed into carb body, for UK market
	1971	MGB and Marina 1800	Engines commonised, now 18V
April	1971	Farina and MGB	Last 1622 engine
	1975	MGB	Gains a catalytic converter for

Date	Model	Modification
		USA market
1978	Marina 1800	Last Morris car with a 'B'
1978	Princess s2	First use of 'O' series
October 1980	MGB	Last MGB
1980	Sherpa	Last 'B' series

'B' Series Camshafts in M.G. Engines.

Model	Cam Timing	Lift	Part Number	Inlet and Valves	Exhaust
ZA Magnette to 18101	5;45;40;10	.312"	48G184	1.375"	1.28"
ZA and ZB Magnette	5;45;40;10	.312"	48G184	1.5"	1.28"
All MGA	16;56;51;21	.355"	88G252	1.5"	1.28"
MGA Twin Cam	20;50;50;20	?		1.6"	1.44"
Mk 3 Magnette to 8067	5;45;40;10	.312"	48G184	1.5"	1.28"
Mk3 and Mk4 Magnette	tdc;50;35;15	.312"	12H76	1.5"	1.28"
MGB, MGB GT	16;56;51;21	.355"	88G303	1.56"	1.34"
MGB after Oct 1967	16;56;51;21	.355"	12H2746	1.625"	1.34"

The lift on the chart is at the valve, as the rockers act at a ratio of 1.4, the actual lift on the cam lobe is .220" for a .312" lift, and .250" for a .355" lift. The part numbers of BMC change at lot for the same item, depending upon the supplier hence a 12H76 is also a 12H34. A 48G184 is also a 1H603, 1G2591, 1H1066, and a 88G252 can be a 88G303, 12H2746, 1H1435, 1H729, 12H1647, and 12H1656. Clear now?

The 'big' inlet valve head of the post 1967 MGB is the one commonised with the Austin 1800 'S'. Cylinder heads are like those of the 'A' series, any 'B' head will fit any 'B' series engine, from 1200cc in 1953 to 1798cc in 1980. This sounds good until you note the valve and combustion chamber sizes, some swaps produce vintage compression ratios, other cause the inlet valve to hit the block with serious results. An easy check point of a 1798cc cylinder block (with the head off) is the small scalloped out radii in the side of the bore, there to give clearance to that inlet valve. This scallop is required if fitting a 1800 head to any other engine. An 1800 cylinder head has the number "18" cast at the rear end, behind the rocker cover to assist you identify it, and like the 1275cc head, it is slightly longer than the smaller engines.

'B' Cylinder Heads.
Only a general picture is given here, using the combustion chamber capacity.

Engine Size	Chamber cc	Compression ratio	Part No (if known.)
1200cc saloons	38cc	8.3 or 7.2	?
1489cc saloons	39cc	8.3 or 7.2	48G241
1489cc commercials	39cc	7.2	48G241
1489cc M.G./Riley	39cc	9.0 or 8.3 or 7.2	12H1670
1622cc saloons	43cc	8.3 or 7.2	12H1670
1622cc M.G. /Riley	43cc	8.9 or 8.3	12H1670
1622cc commercials	43cc	8.3 or 7.2	12H1670
1798cc MGB	43cc	9.0 or 8.1	12H1326
1798cc M.G./Marina	43.5cc	9.0 or 8.1	12H2706, 12H2709
1798cc commercials	43.5cc	9.0 or 6.9	12H2709
1798cc 18V and 18H	43.5cc	9.0 or 8.0	12H4735 offset oil

Engine Size	Chamber cc	Compression ratio	Part No (if known.)
			feed.
1798cc 1800 'S'	37cc	9.5*	12H2708

* Bigger 1.625" diameter inlet valve. The last shown, on the Austin 1800'S', with its smaller 37cc combustion chamber is very hard to source. Part number is cast into the head, under the rocker cover, between the valve springs. Remember, the compression ratio is controlled by the piston crown in 'B' series engines. As early engines had tiny valves, I cannot imagine anyone wanting to fit one to a MGB! The five main bearing heads have better combustion chamber shapes, very wide and little valve masking.

'B' Series Through The Years.

This shows how the power rose, and bores got larger and larger as years passed, and their centres were put further and further apart, siamesing the cylinder block bores, and offsetting the big end journals to the bores.

Model	Year	BHP	Max Speed	Bore/Stroke
Austin A40	1954	42	65mph	65.5mm 89mm
M.G. Magnette ZA	1954	60	81	73
MGA 1500	1955	72	99	73
Austin A55 Cambridge	1957	51	80	73
Wolseley 1500	1957	50	80	73
Morris Cowley	1957	42	65	65.5
Morris Oxford	1957	55	74	73
M.G. Magnette ZB	1958	68	87	73
Austin A55 Mk2	1959	53	79	73
Riley 4/68	1959	68	85	73
MGA 1600	1959	80	101	75.4
MGA Twin Cam	1960	108	113	75.4
MGA 1600 Mk2	1961	93	103	76.2
MG Magnette Mk4	1962	72	88	76.2
Austin A60	1962	61	81	76.2
MGB	1964	95	106	80.26
Morris Marina 1.8	1972	85	95	80.26
Morris Marina 1800 TC	1973	95	101	80.26
Austin 1800 'S'	1974	96	102	80.26

(Note, the year quoted is that of the road test giving the maximum speed.)

M.G. Magnette ZA Engine, (1953 – 56), M.G. Magnette ZB Engine, (1956 – 58)

Interestingly, the arrival of the ZA with its shiny new BP15GA engine at the 1953 London Motor Show also saw the TF Midget with its 1250cc XPAG. The TF later gained a 1466cc XPEG producing 63bhp, whereas the 'B' series in the ZA only produced 60bhp from 1489cc at first. In many ways the engine in the Magnette saloon was very different to that most M.G. enthusiasts know, as in the MGA and MGB. This very early 'B' had a bypass oil filter, a real retrograde step considering the tradition of the 'X' series of the saloon it replaced, in the 'YB'. Because of the construction of the ZA with its forward mounted engine, and suspension cross member, the pressed steel sump stuck right out the front, as it did on the sister car of later years in the Wolseley 15/50, and the 'J' type Morris half ton van. The ZA engine had a bore of 73mm and the standard stroke of all 'B' series, 89mm, with just 7.15 to 1 compression ratio, indicating the poor petrol quality about in those days. With its two SU H2 1 1/4"carburetters and large MG octagon on the polished air filter to carb aluminium casing, and camshaft valve timings of 5;45;40;10 with .322" lift, it produced the 60bhp at 4600rpm and 76 lb/ft torque at 3000rpm. The air duct had a huge air silencer on it, dominating the engine. Export versions had an oil bath type. There was a cast iron exhaust manifold, with an aluminium inlet bolted to it to give two hot spots. Inlet valves were 1.375" diameter and exhaust 1.28", and the dry clutch was 8" diameter. 1956 saw the full flow oil filter fitted, and a pipe had to be run from the rear oil gallery to the filter, so it could feed back into the main oil gallery. This pipe is an obvious afterthought, but did assist in fitting an oil cooler later. All the oil was now filtered all the time, before reaching any bearings. In May 1953 a better Weslake cylinder head developed by Harry Weslake, was fitted to the ZA, with improved ports. Early ZA's may not have this fitted. M.G. complained over the rocker adjusters in May 1954, and these were lengthened and of better quality.

By ZA car number 18101, the petrol quality must have improved, or M.G. were looking towards their new MGA sports car, because M.G. had the compression ratio raised to 8.3 to 1. Larger SU H4 1 1/2" carbs were fitted, and power rose to 68bhp at 5200rpm. M.G. had quite a hand in the 'B' series. Eric Bareham the designer was often asked for modifications to them for use in M.G. cars. Larger inlet valves were fitted of 1.5" diameter, along with thinner piston rings, double valve springs, and solid skirt stronger pistons. It was fitted to the new MGA then this improved engine continued in the more flamboyant ZB that followed as the BP15GC, from 1956 to 1958. At the same time as the ZB, the Wolseley 4/44 with its XPAW engine was updated to the Wolseley 15/50 in June 1956, with a 1489cc 'B' series, now almost a single carb ZB. 68bhp was a good power to weight ratio for the mid 1950's, and this was not lost on the M.G. sports car enthusiasts. 'Z' Magnette production was 36,601.

Fitting the 1622cc or 1798cc engine to a ZA/ZB is involved, for more information see under Mk4 Magnette later. Additional complications on these 'Z' cars is the need to use its sump and oil pick up, not too much problem on the 1622cc engines as these are very similar to the 1489cc 'B', and only the sump and oil pick up swap is required, though extra holes need drilling in the sump flange if it is a later 16AA or 16GF engine. For the 1798cc swap the sump off the 1798's rim needs welding to the lower half of the 'Z's sump pan. You can make the forward 'Z', (J Morris van, or Wolseley 15/50) sump fit a 1798cc engine, (I have in the past) but there are some close corners where only about 1/16" of sump sits on the gasket. 1798cc five main bearing crankshafts have different spacing for the six bolt holes that hold the flywheel on, so you cannot use your 1489/1622 flywheel. The 'Z' sump also has an oil drain welded to the rear face of the sump, which the 1622/1798cc engines rear crankshaft web will hit if you do not 'flatten' it a little, (proving cylinder bore centres did move outwards!).
The starter motor on the Z's sits higher up than on the 1622cc or 1798cc engines, to clear the chassis frame. A 1798cc water pump has a longer shaft than a 1489cc one.

MGA 1500 Engine,(1955 – 59)

The ZA generously gave its engine and running gear to the car M.G. had been trying to get out and sell for a few years, in August 1955. The 1489cc 'B' series BP15GB, was a similar engine but with pancake air filters, and was the M.G. improved unit above specially produced for the MGA, having used the ZA Magnette as a test bed. A major difference was the MGA 'normal' sump, sitting behind the suspension cross member, and requiring a new oil pick up, that it gained from the run of the mill Austin and Morris cars. It produced 68bhp at 5200rpm, later to rise to 5500 as the BP15GD with 72bhp at 6000rpm in 1956, with its improved crankshaft. In the low slung sports car it performed well, giving 0 to 60 in about 14 seconds, better than that of 16.5 for the TF it replaced. The 68bhp version was fitted to the ZA Magnette in 1956, and in 1957 to the Morris Minor based Riley 1.5. The crankshaft was very strong, made of EN16 steel, with 1.875" diameter big ends and 2" diameter main bearings, of generous length, being counterbalanced with shell bearings, now located by lugs at the cap joints. The valve springs had been beefed up on the power increase in the MGA and ZA, and were double, to permit higher rpm, whereas on the lower revving Austin/Morris there were single springs. Normal BMC cars used a 7.2 compression ratio, for M.G. this was increased to 8.3 to

1. All MGA's use the same camshaft, with a skew gear on the rear end to drive a mechanical tachometer, valve timings are 16;56;51;21, with a lift of .355". This camshaft continued with the early MGB. The only two other cars that used this tacho–drive was the Riley 1.5 (15R, RA, RB engine) and Riley 4/68 Farina (15RA and RB) and 4/72 until 1966, (16RA) both using a close copy of this MGA 1489cc engine in 68bhp trim.

EX182, Le Mans 24 hour Engine,1955.

Used a balanced 'B' series engine of 1489cc as in the ZA Magnette, standard 8" clutch, with a modified cylinder head as per BP15GD, two SU fuel pumps, twin SU 1.75" H6 carburettors, fitted with trumpets (ram stacks) not air cleaners, with a cold air feed, oil cooler, mildly tuned to give 82bhp on a 9.4 to 1 compression ratio. The special Weslake cylinder head was lapped onto the block, so no head gasket was required. Rather a bland engine when you consider how famous the car is, possibly built for reliability rather than speed, i.e. to finish the 24 hour course. Two of the cars finished, 5th and 6th in their class. Alas no one remembers this, as a Mercedes crashed into the crowd killing many spectators.

MGA 1600 Engine, (1959 – 61).

By April 1958 the MGA needed a boost in power, and the M.G. 'B' series was re–cored giving the cylinders thicker walls, allowing it to be bored out to 1588cc with a 75.4mm bore and the 89mm stroke. The engine was otherwise unchanged from the 1489cc BP15GD, now being called a 16GA. This gave 80bhp at 5600rpm with 87lb/ft torque. It was called the MGA 1600, and the cylinder block was bored to this 1588cc size for the MGA twin camshaft engine, and this capacity is unique to M.G. as no other marque used it. See also Twin Cam.

MGA 1600 Mk2 Engine, (1961 – 62)

April 1961 saw the introduction of a full redesign of the 'B' series. Long runs at high rpm on the new motorways, the M1 opening in 1959, had shown the normal saloon car's engines were having problems. This 1622cc 16GC engine was again first fitted to a M.G. It updated the MGA and gave it quite a boost in power, up from 72bhp to a massive 93bhp at 5500rpm with 97lb/ft torque, from an 8.9 to 1 compression ratio. The stroke remained at 89mm, the bore opened out to 76.2mm, by re–coring the cylinders centres further apart and off–setting the bores to the big end journals, requiring new con rods. This was a much stronger block than the 1489/1588 one. It had a new crankshaft with the same diameter main and big ends as the original 1200/1489cc engines, but the main bearings were now narrower, down from 1.375" to just 1.25", to get the bigger bores in. The bearing material was improved copper–lead alloy to cope with the extra power, though when the engine was opened up to 1798cc the narrower main bearings would cause trouble. A new cylinder head with improved ports, larger valves and stronger springs with an improved distributor, completed the engine. Inlet valves were now 1.562" diameter, and the exhaust 1.343". Like the Midget, the gearbox gained outer ribs to strengthen it. This engine gave the MGA cracking performance.

The MGA cylinder head was modified to improve airflow, but be warned that the engine numbers quoted relate to the cylinder block, and heads can easily be swapped about. From BP15GB 4045 the exhaust ports were enlarged a little. BP15GA 17151 onwards had larger inlet ports as well.

In June1962 the MGA bowed out to the new, bigger MGB, after a total of 98,970.

A Record Breaking Engine MGA. (EX179.) MGA Twin Camshaft Engine, (1958 – 60) (Originally meant for the ZA Magnette!!)

M.G. were up to their tricks again, the idea of using common components had been circumnavigated by 1958, and both Morris Engines and the Austin Design Office had a go at a twin overhead camshaft engine for the MGA, and that chosen was of the ADO, in July 1958. A twin–Cam engine was the idea of Gerald Palmer, and had been thought of initially as an engine to offer with the MG

ZA Magnette. This would have been the 'GT' version in modern parlance. The Morris version was designed from first principles, on a clean sheet of paper, but Austin had kept costs down by using an in–house cylinder block, that of the 1498cc 'B' series. Breathing was always the limit on any engine's power output, so to improve the 'B' series it gained a completely new dohc cross–flow cylinder head of aluminium alloy. To fit the dohc head to the 'B' series cylinder block, the studs were slightly repositioned. So successful was the design that it would rev quicker that some people could take their foot off the power, and it was very easy to over–rev it and damage the internals. The engine required 100 octane fuel or it pinked, or worse, overheated, and the correct grade of cooler running spark plug for fast driving, N7YC, (was N58RS.) In normal use with 100 octane petrol, a Champion N3 would suffice. If fuel of less than 100 octane is used, Lodge RL47 plugs were recommended, and the engine will run on. The engine got itself a bad name for melting pistons, but this was more to do with inexperienced drivers and mechanics that did not understand the meaning of accurate timing, correct plug grades, or rpm limit red lines, etc. The 9.9 to 1 compression ratio did not help, and the last few engines were found to last longer and behave better when it was dropped to the normal M.G. ratio of 8.3:1, (from engine number 2251.) The 8.3 compression ratio dropped the power figures from 108bhp to 100bhp @ 6700rpm. Nought to 60mph in 11.5 seconds in 1958 in a car of the price of the MGA Twin Cam was fabulous, (factory figure, Motor says it was 9.1 seconds, Autocar says 13.3.) Zero to 100mph took 30 seconds. The oil consumption of 1500mpg mirrored that of the early 1950's Jaguar XK120's, i.e. awful. The car did an average of 21mpg.

The engine used a normal 1489cc cylinder block, with the water passages re-cord to allow bigger bores of 75.414mm, with the 88.9mm stroke giving 1588cc capacity. It was fitted with a ribbed cast aluminium alloy sump, cylinder head, and front casing carrying the new position for the distributor. The 'camshaft' of the old block now fulfilled the use of a jack shaft (called a half–speed–shaft by MG) to drive the oil pump only. This is gear driven, not chain driven, so rotates in the opposite direction to the old cam. The engine has fully floating gudgeon pins in solid skirt pistons and a 9.9 to 1 compression. The head carried two cast iron camshafts, with 20;50;50;20 valve timings, .375" lift, the inlet valves being 1.6" diameter and exhaust valves 1.44" dia., (sodium cooled for racing) both set at 45 degree angle in the head, with double valve springs. Both cams are identical, apart from the timing slot; and both have a hexagon cast in to enable them to be turned when timing. The head, with renewable steel valve seat inserts cast in, was a cross–flow hemispherical combustion chamber head, (hemi–head.) The exhaust was on the normal 'B' side, but with two huge SU H6 1 3/4" carburettors with pancake air filters and a cold air feed duct on the other side. Interestingly, one of the inlet manifold securing nuts lives INSIDE the manifold. To feed fuel to the two carbs it had a high capacity SU electric fuel pump. To hold the solid skirt aluminium alloy, convexed head piston in it had 'H' section forged steel con–rods with angled split big ends from the ohv engine. The fan was of five blades unlike the normal two or four of other cars. The engine was a BC16GB in BMC engine numbering. All you could see under the open bonnet was two massive polished alloy rocker covers, it must have been a swine to work on.

Early cars used the MGA/ZA Magnettes 4psi pressurised cooling system, but later this rose to 7psi. Again the distributors had a vacuum advance from the MGA/ZA, (40510B) but this was soon deleted due to ignition timing wander, not a good thing on such a fussy engine, very prone to melting pistons! The later distributor (40718A) was retro fitted to many earlier cars. From engine No.1523 the ignition marking were on the distributor, (22 – 26 degree advance @ 3000rpm.)

At engine 1587 cast iron tappet bore liners were introduced, due to the buckets picking up on the original aluminium bores. These liners were secured by a grub screw. MG had some fun with the tappets themselves, as the original 1 1/4" long version could tilt in their bores at high rpm, and locking up. This broke the camshaft, then leading to a blown up engine! From engine number 1087 they were lengthened to 1 1/2" long. The camshafts were chain driven off the 'half–speed–shaft', itself driven by a gear on the crankshaft nose. It was a long chain, and could misbehave if not tensioned/timed correctly. MG went to great lengths to ensure all owners/mechanics knew this, and issued a four page 'service memorandum' on the procedure, written by Bob Seymour, MG's Twin–Cam running expert in the field.

The little end bushes were modified at engine No.710, to improve the oil ways. MG did not trust the pinch bolt little end arrangement on the ohv 'B' series. Engines up to No. 445 had rough turned chromed top rings, with a cast iron oil–scraper ring, with drain holes directly underneath in the piston skirt. From No.446 to 605, the oil control ring was improved to a twin segmented (twin rail) oil ring, with no drain holes. From No.606 a new piston was fitted, with a chromed top ring, and the segmented oil control ring, but the spacing's differed. From engine No.2060, expanders were fitted behind the oil control segments. All this was to try to control the high oil consumption. At engine No.315, the gear ratios on the half–speed–shaft drive to the oil pump were altered, to speed up the pump.

There were quite a few niggly things with the Twin Cam. On early cars, Nos 504 to 531, the starting handle dog could foul the steering rack. Dynamo brackets would crack, MG issued stronger cast iron items. The gearbox breather ran very hot, and if the breather blocked, oil leaks were the result. If you eventually decided the twin–cam engine was too much trouble, MG would fit an ohv 1588cc engine for you.

The Twin Cam production ended in April 1960, after 2111 cars. A 1588cc development engined Twin Cam had beaten a 2639cc 'C' series engined prototype Healey 100/6 in the USA in August 1956, in a record attempt. The M.G. EX179 did 170mph, and the Healey did just 152mph.

<u>Crompton–Lanchester Lecture, by W.V. Appleby, 1960.</u>
This lecture by Bill Appleby of the ADO, and responsible for the 'B' series, tells us a lot about this engine, and particularly that for the MGA. The cylinder block is made of cast iron to the British Standard, (BS) 1452–17, with the water jacket down to just below the track of the piston rings in the bore. Two locating holes are machined first, in the sump flange of the casting, and reamed accurately, and from then on they are used to locate the block for all further machining. You can see these holes they seemed to have little use when the engine was in service, now we know! Bores are not honed, but wire brushed by machine, then rolled to flatten the ridges. A scroll rear crankshaft oil seal was thought satisfactory for the engine's use, and runs with a .008" clearance. Camshaft bearings are lined with babbitt in the steel backed shells, as unlike the early 'A' series, it does not run direct in the block iron.

Cylinder heads are made of the same metal, with a patent Weslake shape combustion chamber and porting. The chamber is heart shaped, so that incoming mixture is directed at the central spark plug. The wall is brought round between the inlet and exhaust to protect the inlet gases from the hot exhaust valve, and reducing the amount of ignition advance required. The crankshaft is made of EN16, 55 ton steel with a safety factor of 4 to 1. Radii on journals must be kept free of tool marks, or stress can be induced and the shaft will break. Two holes per bearing are drilled for oil delivery. Con–rods are of 55 ton alloy steel of 'H' cross section, with a clamped gudgeon pin. Big end shell bearings are of steel backed copper–lead alloy, with a thin lining of tin or lead–indium, capable of loads up to 9000 lb/in sq. The 'B' series has a loading of 3000 lb/in sq. The touring engines have split skirt Lo–ex aluminium pistons, but MG use solid skirt pistons that need an extra 'half–thou' running clearance, and the rings are thinner than the touring engine. Oil rings are designed to give 6000 miles per gallon (mpg) of oil at 40 mph, and 500 mpg of oil at 80 mph, later improved to 2000mpg at 80 mph. The top ring is chrome plated for longer life.

The camshaft lobe shape is based on the sine curve, with complex hardening of the lobes, journals and sprockets. The cam followers are chilled cast iron, and their centre is slightly out of line with the lobe, with a .002" dome, to ensure rotation and even wear. Tappet and lobe maximum loads are in the region of 190,000 lb/in sq. Pushrods are solid, but can deflect up to 5/64" on the MGA at 6100 rpm, with a load of 560lb, (400 lb on touring engines.) The rockers have a ratio of 1.406:1, increasing lift a little. There is a load of 960lb per rocker on the MGA engine, (700lb on the touring unit) and they are made from malleable cast iron.

Inlet valves are made from Silchrome (EN52) and exhaust from XB (EN59). For high performance in the Twin Cam these are stellited XB, or KE956 steel. Inlet valve steel has a tensile strength of 4 ton/in sq.; XB 5 ton/in sq.; and KE965 16 ton/in sq.

The oil pump of the MGA delivers 3 gallons of oil per minute at 1000rpm, and is driven at half engine speed. The water pump moves 8.8 gallons per minute at 4000 rpm. The flywheel is 17 ton cast iron. Interestingly the dynamo is a 22 amp/hr type, runs at 1.698 engine speed, but with all services running 22.6 amps are required, a net loss!

Tuning the MGA.

The MGCC MGA Register has a 'BMC Special Tuning' leaflet for this model, full of good information, number C–AKD 819E.

Valve Seat Inserts before Unleaded?

In about 1966 I assisted a friend to get a very tatty MGA 1500 up and running. Such cars in those days were worth little money, and neither of us, as young RAF servicemen, had any spare cash. He had paid £10 for it, as a non–runner, and he wanted it to impress the girl he was courting. It would not fire up at all, and having flattened the battery twice, he called me in. I checked for fuel and a spark, and found both. So we charged up his battery, then I towed him around the RAF station with my Series 'E' 1940 Morris 8hp. Round and round we went, with no sign of any life. I then checked over his work, he having fitted new points, etc. The age old trick of simply putting all the plug leads on wrong, 180 degrees out, was the fault. I corrected this, and off we went again. Within 20 yards the engine burst into life, then, a split second later there was a huge bang. As the cloud of dust settled around the now roaring MGA, I saw the entire exhaust system had split wide open, covering one and all in black soot. The system had filled up with petrol as we drove round, and once the engine fired up, BOOM!! The story does not end there as he found a good system on another abandoned car, and had it all adapted and fitted for the weekend run to see the young lady. He had even cleaned the car and screwed the floorboards back down. On the Sunday I had a call to tow him in. He had conked out about 3 miles up the A1 on his return. The car refused to start, so in the end a compression check showed NIL on all cylinders. On removing the head, there I saw a set of exhaust valve seat inserts jingling loose on their valves, on what was obviously a reconditioned head, once! He had run out of water, boiled, kept going, raised the engines temperature so high, and they had all fallen out. We fitted a cylinder head from a dumped 1489cc Morris Oxford, and off he went on his next adventure.

Back to Large M.G. Saloons.

M.G. Magnette Mk3 Engine, (1958 to 61)

The 'B' series was in use in lots of cars, one being perhaps a controversial M.G. model. No matter what your views, the car is part of M.G. history and was part of a range of M.G's for the public. This model has the 1489cc 15GE engine, a very close relative to the MGA 1500 engine of 68 bhp, the engine being shared with a sister car, the Riley 4/68, and a tiny Riley 1.5 model based on a Morris Minor floor pan, (with huge drum brakes.) The Mk3 has two SU HD4 1 1/2" carburettors on an engine that is identical to the ZB Magnette, the carbs being the only difference, and have a rubber diaphragm for mixture and choke control, not fitted to any other M.G. (But fitted in a HD6 size to

Jaguar, Rover and Rolls Royce cars.) It has a 8.3 to 1 compression and the 68bhp is at 4800 rpm, and 85lb/ft torque at 3300rpm, the camshaft being a bit softer for saloon use, and of 5;45;40;10 valve timings, with a lift of .322". The normal Austin A60 versions have the standard BMC cam of 5;45;45;5 with .0312" lift, and 60bhp. The inlet valve is 1.5" diameter, and the exhaust 1.28". The engine has to work very hard indeed to pull the 23cwt saloon, a bit like the VA One and a Half Litre. At engine number 15GE 8067 the camshaft timing was altered to TDC;50;35;15, which was moving it all along five degrees to improve torque, something they did with the standard M.G. Midget cam timing on the M.G. Metro 1300 later. Oil pressure was 75psi, not the normal 50psi of the single carb models. The Mk3 did not use the tachometer drive off the cam, so it was left undrilled. The Riley cars did use it. 2889 'Di Tella' Farina Magnette 1622's were built in Argentina between 1960 and 1967. These were either single or twin carburetted, with plastic dash boards.

M.G. Magnette Mk4 Engine, (1961 – 68)

In October 1962 the Mk4 Magnette gained the MGA 1600 Mk2 engine, but detuned to 72bhp in the interests of longer life and mid–range torque. Camshaft, valve sizes and carburettors remained as the Mk3. With bore and stroke of 76.2mm and 89mm, and a 8.3:1 compression, the engine produced 72bhp at 5200rpm with 89 lb/ft. torque. The fan had four blades fitted from November 1964, two previously. In November 1966 the 1622cc engines had common parts from the MGB/Marina 1800 fitted to cut down costs and stocks. The sump was enlarged to one side to accommodate the bulge in the block that now housed the bigger MGB oil pump, and was in fact a MGB sump, and the MGB water pump was fitted. The engine was prefixed 16GF. The Riley 4/72 lost its camshaft/cable driven MGA/early MGB tacho on its 16RA engine, and had an electronic impulse unit fitted. It too then had the common 16GF engine, now fitted to both Farinas. Both cars benefit from a 88 degree thermostat, as they tend to run cool on the standard 82 degree one. The 1622cc engine gave the large saloon a decent performance, and it could touch 95mph if you were brave! If you wish to fit a MGB 1798cc engine to a Farina Magnette, (or to a MGA come to that) try to locate a 18G or 18GA MGB three main bearing engine. These will bolt directly onto the Farina/MGA's gearbox. The later five main bearing unit requires the smaller car's rear engine plate turning out on a lathe to take the rear neoprene, (and much improved) crankshaft oil seal, and the old oil drain on the plate brazing up, and the smaller car's gearbox first motion shaft shortening by 3/4", and, a small 1622/1498cc engines sintered bronze bush fitting into the spigot bearing hole in the rear of the crank. The flywheels of the smaller engines have different fixing bolt spacings to the later five main bearing 1798cc, so the MGB flywheel has to be used, with it drilled accurately to take the 8" Farina clutch cover. Use a Farina clutch plate, so it will match the gearbox splined first motion shaft. Yes, quite a bit of modification.

When the other single carburettor Farinas gained the MGB engine parts, they were called 16AA engines. The Mk3 and Mk4 Magnette produced 30,996 cars, very few survive. Some were automatic cars, using the Borg Warner type 35 autobox, the same unit as in the MGB automatic. Only 300 were made in their last year of production.

Almost Fitted to M.G's.

1622cc Compliments of BMC Australia, and the Blue Streak.

1959, the year that BMC introduced the Mini, saw the engine design department produce an updated 'B' of 1622cc. It was built by the Australian BMC Company, as they thought the 1489cc too small for their needs. The engine was thoroughly tested down under, but they went one stage further, by adding two cylinders to the block and calling it the 2433cc Blue Streak Six, keeping the same 1622cc bore centres, cylinder bore, and stroke. This unit was what they needed to fit the Farina A60 Austin and Wolseley’s they assembled there. Moving the engine back a bit, and the front suspension cross member forward 1", to improve weight distribution, the six cylinder sold against the big American 'economy' sixes, and vee eights, as the Austin Freeway and Wolseley 12/80. BMC in the UK did not want to know, having tried the same idea with a six from 1489cc earlier. So it became a small six peculiar to Australia, producing 80bhp at 4800rpm on a single SU HS2 carburettor: a 'B' that never officially got into an M.G. This six cylinder is **not** a 'C' series, but one was borrowed and used in the MGC in the prototype for measurements, and road testing the new torsion bar ifs. M.G. called this 2433cc the 'light–six' 'B' series.

Very Nearly a 2 litre MGB.

For the MGB in 1972, an 'O' series SOHC engine had been developed to fit the car. It was later in use as a 1700cc and a 1994cc single ohc in the Morris Marina, so only a rear engine plate and flywheel to suit the MGB gearbox was needed. Work had been done on this 'B' series special, to 'Federalise' it to maintain the USA sports car market. See 'O' series later. A version of the 'O' series became the Rover M16 engine.

Valve Recession.

The plethora of valves available for the 'B' series once caused a friend with a Mk3 Magnette problems. He de–coked his engine, and used spare valves from his box of second hand valves to replace those of poor condition. Once ground in, all appeared well. He came to me as he seemed to be constantly having to adjust the exhaust tappet clearances, they kept closing up. He had used four, softer, inlet valves as exhaust valves! The word parsimonious comes to mind.

Melted Wires

A friend with a Mk3 Magnette was doing an early morning service of his car. With some friends he was off on holiday that afternoon. He changed the oil, oil filter, fan belt, points, plugs, and condenser. For good measure he even greased the king pins. All gaps were correct, and he went to try to start the car. It just wound over on the starter, with nothing else happening. He wound it over so long oil pressure came up on the gauge! My help was requested, and I guessed he had left the rotor arm out, a common trick we have all fallen for. But no, it was in–situ. Simple things were checked first, fuel, yes, spark, NO. No spark at all. Then I touched the spade terminal on the coil to check for the old problem of the terminal on the coil coming loose on its rivet. Ow! The wire was hot, and the plastic sheathing melted onto my skin, and burnt. There was a dead short somewhere, so he switched off the ignition.

On older types of Lucas points, there is a fibre washer separating the two halves of the ignition points in the distributor. If you forget to fit it on the pivot, the two halves have metal to metal contact. He had forgotten it, (it was still in the little box.) The ignition system simply ran to earth, no wonder there was no spark, and a melted wire. I ended up making a new coil to distributor wire for him, and fitting the washer in its correct location. On later points, the quick fit type, owners often put the wire connection under the nut on the pole, and not under the nylon insulator. If you do this, the system is earthed.

Oily Mess.

The 1200cc, 1489cc, 1588cc, and 1622cc 'B' series with the full–flow oil filter can cause problems. To get the full oil flow through the filter, an extra pipe was run from the rear oil gallery to the filter bowl. You see it above the starter motor. What many owners do not realise is, the pipe actually connects to a small alloy casting above the steel bowl holding the element. It too has an 'O' ring oil seal between it and the cylinder block. So on a filter change, two seals are provided in the replacement filter box. The thin one goes above the steel bowl, the other above the pipe connector. Some filters have three seals, a thick one is for the early cars with the bypass filter.

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Chapter Seven

A Big 'B' Series Engine.

MGB and MGB GT Mk1 Engine, (1962 – 67)

In 1960, the same year that Austin developed a diesel version of their 1489cc 'B' series, the design office had been busy enlarging the 1622cc version as it was realised the 1622cc MGA 1600 Mk2 engine might have its work cut out pulling the new, bigger, more roomy, and somewhat softer MGB sports car. In October 1962 the MGB Mk1 was introduced with a three main bearing engine, 18G; main bearings that were of a larger diameter. The main bearings were 2.125" and the big ends 1.875", both one eighth of an inch bigger than the 1622cc engine, and had copper/lead linings. The bores were of 80.26mm and the same stroke of 89mm, and it produced 95bhp at 5400rpm, with 110lbs/ft. torque at 3000rpm. To get the cylinders in, the block was again re–cored, and the cylinders siamesed so that no water could get between Nos. 1and2, or 3and4. The distance between those cylinders was tiny, and a good quality head gasket is needed to seal the small 'lands'. Again this new engine was first in an M.G., as a similar unit was to be fitted to the ADO17, Austin 1800 fwd saloon, itself delayed until October 1964. The engine had twin SU HS4 carburettors, with 8.8 to 1 compression ratio, and the early diagonally split big end bearings. Valve sizes were 1.56" inlet and 1.34" exhaust, camshaft valve timing was that of the MGA, 16;56;51;21 with .365" lift. Later the inlet valve size was enlarged in the 1971 18V engine, meaning the side of the cylinder block it lived above, had to be machined out a tiny bit to clear the valve head when it was fully open. It had paper element air filters, one per carburettor that also acted as air intake silencers to improve the car's image. By February 1964 the USA market had begun to have its effect on the car, as a closed circuit breather system was fitted, using a diaphragm valve as in the 'A' series Midget, and the engine became an 18GA unit. Solid skirt pistons were fitted. The tachometer was cable driven off the camshaft.

1963 nearly saw a 'Healey 1800' version of the MGB. The idea fell on stony ground.

October 1964 brought along the five main bearing 18GB engine, commonising it with the Austin/Morris 1800 Landcrab ADO17 model 18AMW engine, (later 18H). The extra two main bearings needed a bigger oil pump, and were 1 1/8" wide at front, centre and rear, with the intermediates at 7/8" wide. The diameter was 2.125". This produced a crankshaft with lots of overlap between journals and counterweights, and almost unbreakable. For overseas markets a low compression version was available at 8 to 1. In the five main bearing engines, the pinch bolt gudgeon pin was removed, and press–fit pins fitted, with horizontally split and stronger big ends. The re–engineering into the extra bearings had produced a very heavy engine, and could not have been easy. It weighs in at 520lbs with gearbox. An oil cooler became standard equipment, a good use of the pipe work the improved oil filter had generated back in 1956. The mechanically driven tachometer off the camshaft was discontinued in 1964 on the 1798cc block, (along with the only other car to use this now on a 'B' series, the Riley 4/72 Farina in late 1966) and an electronic impulse tacho was fitted. The M.G. Midget was also a recipient. The open crankcase vent had by now become closed circuit breathing.

The 'B' series was a very old design by the middle of the 1960s: it did date back to 1953! There had been some two litre (1994cc) 'B' series developed with a 83.24mm bore, for the MGB, but nothing came of them. In the early 1960's BMC were looking at a 1500cc and 2000cc V4 engine to replace the ageing 'B'. They copied the Lancia narrow V4 engine, building two 1500cc V4 and three 2000cc V4 engines, putting the 1500cc ones into Austin A40 Farinas, two 2000cc V4's into two Austin A60 Cambridge saloons, and one 2000cc V4 into a MGA then an early MGB. Rumour has it the MGB topped 120 mph on a road test. It is not recorded how the Farinas coped! The two litre 1994cc four cylinder in–line 'B' however was not wasted, as much later the re–cored block with all cylinders siamesed went into the 'O' series engine.

<u>MGB and MGB GT Mk2 Engine, (1967 – 71.)</u>
October 1967: The MGB Mk2 18GD and 18GG UK engines, and USA spec 18GF, the rear engine plate was changed to fit a new stronger all synchromesh gearbox, or an automatic gearbox. To take the larger diameter nose end of the first motion shaft, the 'spigot' bearing in the flywheel end of the crankshaft was much larger. Engines were now not interchangeable with the smaller Farinas without a lot of machining! From 1970 the modifications to the cylinder head were bigger inlet valves, at 1.625" diameter, (18GF units.) Ignition timings and carb needles become a nightmare from now on, use a workshop manual to sort them out. A Lucas 16AC (18GD) or 16ACR, (18GG), alternator was fitted and cars altered to negative earth, to suit. The bolt holes in the block for its bracket were already there, dating from 1966! October 1969 brought 18GH Federalised engines with exhaust emission control, and this American Clean Air Law was to sap the MBG's power as the years passed. (Eventually the North American California Spec cars only produced about 70bhp.)

<u>MGB and MGB GT Mk3 Engine, (1971 – 80)</u>
October 1971: MGB Mk3, now with SU HIF4 carburettors, 18V engine, power down to 84bhp, 102 lb torque for UK markets, and 82bhp 97lb torque for the USA. All USA cars now required pollution control systems. Twin SU HIF4 carburettors were now fitted, similar to the Morris Marina 1800TC, and the later M.G. Metro 1300 single unit. The 18V variations in ignition timing alone needs its own book. The USA market must have taken up hours of the M.G. company's time to keep up with legislation. The good point on the 18V is the fitment of a throw–away oil filter canister, just spin on a new one, a 'spin–off' from the Marina 1800!! It is the 1798cc 18V cylinder block that has the cut out for the exhaust valve clearance on each cylinder.

1971 also saw another car that was to use the MGB 1800 engine in 18V form, (with single valve springs, not double as previously.) In April that year the Morris Marina 1800TC was on sale, it lasted until April 1978, when the 'O' series ousted it, a 'B' series with a single ohc! The Marina 1800 sump has a half litre less oil capacity than the MGB. At least the arrival of the Marina 1800 saloon meant BMC would spend a few bob on sorting out the terribly worn out Transfer Machines that turned out the 'B' series. The poor old 'B' series engine kept getting another couple of years grace, but these odd years were adding up to a very long production run. The 1800TC 1798cc Marina engines were very similar to the MGB unit. It differed in its manufacture in that it used a flow–cast–iron crankshaft (copying Fords system) with the same five main bearings, and a slightly different 12H4735 cylinder head, the oil feed to the rear rocker was moved a little, needing a modified rocker pillar with an extra 'foot' on it, (known as an offset feed.) Otherwise it was the same unit, and gave the Marina quite good performance, (in a straight line.) Half a million Marinas were made up to 1978, the car carried on with the 1300 'A' Plus series Ital and 1700 'O' series until 1981. Over 1,500,000 Marinas were made in total. The 'Marina' 12H4735 cylinder head eventually fed into the MGB production line, in about mid–1975, commonising parts. It had better cooling with wider internal waterways, (cores) and all the 18V and 18H (fwd and rwd) engines had decent inlet valve stem seals, like little caps over the valve guide replacing the 'O' rings. This better oil control was necessary because of catalytic converters that dislike burnt oil. Pistons had their oil control rings improved for the same reason. The Marina 1800TC even had the MGB impulse tachometer, but neither used a catalyst in UK or European specification. The 1971 MGB had an air pump for the USA market, and the export 1800 "Austin" Marina underwent the same USA power sapping modifications. (Morris was an unknown name in the USA.)

1973 saw a Federalised ohc 'O' series developed for the MGB, but the lack of decision over the TR7 soaked up funds, and BL wanted the MGB replaced anyway, so why invest in it? The 'O' Series went elsewhere.

1975, Smaller inlet valves were again used (from the Austin A60/Morris Oxford series six, 1.562" dia.) For the North American market it was fitted with the single Zenith 175 CD5T (Stromberg) carburettor with an automatic choke, and catalytic converter. The USA had been using lead free fuel for some years, now it was mandatory. All USA spec MGB and Marinas were now unleaded. These cars had electronic ignition, in a Lucas 45DE4 distributor. The UK spec cars now had the 45D4 distributor with a single piece 'quick–fit' points set and no adjustment on the vacuum advance unit. Those terrible carbon string ignition leads were fitted.

1976 saw the engine driven cooling fan on the water pump being replaced with a thermostatically controlled plastic fan, two for USA cars. October 22nd 1980 saw the last MGB, total production 512,880 cars.

After the 'B' series engine got to the 18GH series, the second letter in the numbering, (18GH–'**U**') was given more meaning, As normally, the 'U' meant central gear change, then 'RU' meant overdrive, 'We' all synchromesh gearbox, 'RWe' all synchro with overdrive, 'Rc' automatic gearbox. Once the standardised 18V unit came, in October 1971, there followed a set of numbers that indicated the market the car was meant, for instance in 1972 18V/582F was the UK; 18V/581Y Europe; and 18V/672Z North America. This system became quite complex, see the list on MGB engines below.

If you have read so far, but only on the MGB, you will think it a bit slim. But the 'B' series engine in the use of M.G. entails the whole chapter. By the time the MGB was fitted with its first 1798cc engine in 1962, over two and a quarter million engines in this series had already been made, so it is acceptable to understand it was well sorted, and would need little modification. Only the North American market caused it problems, here in the UK the car romped away as a success, but this is not about the evergreen MGB, but its engine. The engine feels almost un–burstable, and gives good performance, and is easy to tune, the tuning after–market is full of goodies. It is so reliable it will run in an awfully neglected state, but will use oil and drink petrol when well overdue a reconditioning. If the servicing periods are kept to, and using good quality oil, it will run well past 100,000 miles, and longer if pampered. Talking of neglect, the opposite is true of the lovely restored cars seen at M.G. meetings, but one wonders at the technical ability of the few who put the cooling fan on the wrong way round so it blows towards the radiator. I pointed this out to a lovely BRG pull–handle cars owner once, who had his immaculate engine on display with the bonnet open, and he took some convincing! Faults other than wear and neglect, can be in the vent pipe system. The USA market led to the engine having to ingest its own crankcase vent air and fumes. Often plastic junctions and rubber hoses split after years in the heat of the engine compartment, giving weak mixtures, or oil consumption problems. The rubber hoses of the 'Closed Breathing System' can block up with solid carbon deposits, causing crankcase compression, oil leaks and oil consumption. The main cause of this is short journeys. Note that any engine with a 'Controlled Breathing' system needs a special metered vent oil filler cap, which needs its filter cleaning every 10,000 miles, or renewing. The diaphragm inside the vent valve fitted to some engines, on the inlet manifold, can split with age. If this splits oil consumption goes up, and the engine runs roughly on a weak mixture. Later cars used a more sensible vent direct into the body of each carb. It is easy to convert to lead free, cylinder heads already modified are available off the specialists' shelf on an exchange basis at competitive prices. A cross–flow cylinder head kit is available, in aluminium, putting the carbs over the distributor, for the power freak.

A OHC 'B' Series. The 'O' Series.

A short mention of an engine developed in 1973 for the MGB, is the belt driven, single ohc development of the 'B' series, called the 'O' series. That just what it was, a sohc 'B' Series, that produced less power that its former ohv unit, from 1700cc initially, (later 1994cc for the automatic

Marina.) In 1972 the engine design team management at British Leyland had given Geoffrey Johnson a task of designing a new ohc engine, but tied them to using the ‘B’ series block and crankshaft, (with a longer nose.) There were two versions of 75mm stroke giving 1695cc, and 89mm stroke giving 1994cc. It first saw use in 1978 in the fwd Princess Mk2 then the Morris Marina Mk2, (called an Ital) though 11 MGB's had been trial fitted. Like the MGA Twin Cam it used the same 'B' series cylinder block, this time a 18V version. The camshaft became a jackshaft for the oil pump, and the crankshaft nose carried a toothed belt drive to the single ohc, running in a ribbed aluminium cover. This cover had the mechanical petrol pump on, and the distributor in the middle, facing to the offside. The petrol pump location became a good area for oil leaks, keeping up a good old British tradition. The oil pump had eleven lobes. It was a 17V engine. Surprise, surprise, all dimensions below the aluminium alloy cylinder head are identical to the 1798cc MGB/Marina 1.8 engine, except the bore was 84.5mm and the stroke 75.8mm in the 1700cc, and 84.5mm bore with good old 89mm stroke in the 1994cc version. It was of course, the SAME block. Valve timings were 15;45;50;10 for the 1700, and 19;41;61;15 for the 2.0 litre, with .360" lift. With a single SU HIF6 it was fitted to Morris Itals. It was re–developed into the 'E' series, a four cylinder 17H, and a six cylinder 23H engine. Not used as a rwd unit, with chain driven single ohv, SU HIF6 carb, and a 76.2mm bore with just 81.3mm stroke, ... but we are well out of 'B' series territory here, though the late MGB's nearly had the 'O' in Federalised state, but Abingdon was closed in 1980 just as some cars had been fitted out and road tested! (See Montego/Maestro, Chapter 9.)

Like the 2ltr V4 in 1964, the 'O' series MGB was never heard of again, except in a failed venture to build the MGB by Aston Martin of Newport Pagnell in 1980. The 'O' and 'E' series inward vented via their flywheel housings, and thence into the carburettors from the camshaft case. Both are full of metric threads and bolt heads. A six cylinder 'E' series MGB sounds nice though, with 2227cc, twin SU HIF6 carbs, 125lb/ft torque, 112bhp.The 'E' was fitted to the BL Maxi, Allegro, Maestro, and six cylinder fwd Princess. The 'E' series led to the 'R' and 'S' series of the M.G. Maestro, see later, as the 'O' series is to return in an M.G. The 'O' series was to have been twin carburetted, or fuel injected, or turbo–charged, depending upon its market, in the MGB. A little of the 'B' series has lasted a lot longer, as the 'O' series was developed from it, going into the later M.G. Maestro and Montego in 1994cc form. From this 'O' engine was developed the 'O2' version, which with a shorter block and other modifications was produced as the M16 engine that is used in the Rover 800 series in the 1990's. This eventually became the 'T' series in the Rover 820.

MGB 'B' Series Engines.

Prefix	Main Bearings	Model	Market	Date if known
18G	Three	Mk1, GHN3/D3	All	Oct 1962/64
18GA	Three	Mk1, GHN3/D3	All	April 1964/Oct 64
18GB	Five	Mk1, GHN3/D3	All	Oct 1964/67
18GD	Five	Mk2, GHN4/D4	UK/Europe	Oct 1967/69
18GF	Five	Mk2, GHN4/D4	USA	Oct 1967/69
18GG	Five	Mk2, GHN5/D5	UK/Europe	Oct 1969/71
18GH	Five	Mk2, GHN5/D5	Europe	Oct 1969/70
18GJ	Five	Mk2, GHN5/D5	USA	Oct 1969/70
18GK	Five	Mk2, GHN5/D5	USA	Oct 1970/71
18V	Five	Mk3, GHN5/D5***		Oct 1971 onwards

***18V was followed by a code which indicates such things as exhaust emission control, evaporative loss control, etc., for the USA market; overdrive, carburettor crankcase ventilation, etc. for the UK and Europe markets. If there is a 'Y' in the prefix, it is a Europe spec engine; if a 'F' a UK spec engine; if a 'Z' a North American spec engine, and if an 'AE' (after 1975) this indicates a catalytic converter, Californian spec engine. You need to see the workshop manual, as it gets very complex. Luckily, the UK spec hardly changed from the 18GG, through the black painted 18V, to the end. 18V engines have casting number 12H3503 on the block.

MGB Cylinder Heads.(UK Specifications only.)

1962 to 1970	part number 12H1326, 18G, 18GA,18GB,18GD, 18GG all with double valve springs, and inlet valve 1.562" dia.
1970 to 1975	part number 12H2708, 18V 581, 582, 584, 779, 780 all with single valve springs, and inlet valve 1.625" dia.
Oct 1975 on	part number 12H4735, 18V 846, 847, all with single valve springs, 1.562" inlet valve, and offset oil feed hole to the rockers

Note that the BL 1800, from 1968 to 1975, used a 1.625" dia inlet valve, and that its equivalent 18H (to the MGB/Marina 18V) used double valve springs, and is identical to that used on the MGB 1971 to 1974. The 12H1326 heads are prone to cracking between ports, inspect carefully. The small inlet valve was re–introduced in 1975 to make the engine comply with EEC 15 Exhaust Emission Regulations.

The 'B' Series Limit!

The distance of the camshaft from the crankshaft limited the crankshafts throw, initially designed for just 1200cc and 1489cc. This 'throw' was the now legendary '88.9mm', (or 89mm for short) stroke. Look at the Triumph engine fitted to the later Midget 1500, (in the Standard Eight drawing) the distance between camshaft and crankshaft is much larger. Fitting pollution controls to the 'B' series for the North American market seriously affected the MGB's power output. The lowest state was the single Zenith fitted engine for California, where it was reduced from 95bhp to just 70bhp. Some other figures will show the story, 1971 we still had 95bhp at 5,500rpm, with 105 lbf torque at 2500rpm. By 1973 bhp was 94; by 1974 it was 87, with 103lb torque; by 1975 it was 85 with 100lbf.

Marina 1800TC and MGB 18V Engines.

You have a Marina engine you want to put into your MGB? These two engines look identical, and the actual castings virtually are. However, there were some differences, and these were the flywheel and clutch, Triumph sourced items. Also the crankshaft was 'flow–cast' and not forged, on the Morris; the timing chain was single row, not double as on the MGB; the engine mountings were at the centre of the block each side, so the front plate has no lugs for the MGB front mounts. The Marina drillings for the mounting bolts break through into the crankcase, so if the bolts are left out, you can have a huge oil leak. The rear plate is very different, as the gearbox is the old three rail Triumph Herald unit, updated. The fan is a large multi–bladed plastic moulding on the Morris, not the three bladed steel one on the MGB. The cylinder head oil feed to the rockers is mentioned later, but this necessitated a different pillar for the rocker shaft. The sump pressing has two large lugs welded on, to brace the gearbox to the engine, on the Morris, and the sump capacity is a little less. Most of these differences can be cured by bolting on MGB engine parts.

Engine Mechanic on 'L' Plates.

Another RAF story, but this time in Germany. A fellow airman, (an Avionics Technician) of some younger years than I, (an Engine Technician) had purchased a very tidy MGB from a chap returning to the UK. This tidy white MGB had been driven hard, had been through three owners at the same station from new, and the engine rattled ominously. The fault was declared as worn main bearings, it was an early three main bearing car, and Europe has lots of nice fast autobahns. To save trouble the owner purchased an exchange/reground crank from a BMC garage in Roermond, Holland. He had seen me tightening nuts and bolts on engines, using my experience to judge torque. He fitted his crankshaft, and alas after a few weeks there was that terrible rumble again, with low oil pressure.

When asked what torque he pulled the caps up to, he said "Torque, what’s that?"

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Chapter Eight

Those Other MGB's. (and MGF.)

MGC Engine, (1967 – 69).
The MGC has a special place in the post–BMC M.G. world, as it is a M.G. that uses a Morris engine, a tradition lost when BMC was born back in 1952. Whilst the 'A' and 'B' series engines are ADO designs, that of the 'C' series is that of Morris Engines at Coventry. There are similarities to the other two, but the unit does follow old practice. The engine in the MGC is a redesign of the 2912cc six cylinder fitted in the top of the range luxury saloons of Austin, the A99 and A110,and Wolseley, the 6/99 and 6/110. The 99 and 110 refer to the bhp. To find its roots we need to go further back. The 'C' is **not** a big 'B' series: that was the Blue Streak engine of BMC Australia, and it was one of these that was used for measurements for the engine bay and torsion bar ifs layout in the design stage. The 'B' and 'C' camshafts are on opposite sides of the engine for a start.

After the demise of the big Wolseley six cylinder ohc engines, and the high camshaft four cylinder 2.5ltr of Riley, in the BMC tidy up to sort out its many engines and multitude of bodies, a six cylinder in line ohv engine was born. It was completely traditional, following the 'A' and 'B' to be the third corporate engine in the family. Very conservative in its design, it was for big saloon car use, dignity and quality, and better made and longer lasting than the Vauxhall or Ford under–square sixes of the time. Being a Morris design, it was first fitted to the Morris Isis, (an Oxford with a longer bonnet) and then Wolseley 6/90 saloons for the 1954 London Motor Show, for delivery in 1955. The engine was cast iron, with the inlet manifold cast integrally with the cylinder head, which also had the head studs passing through, seen before on Morris engines in the Wolseley 8hp 918cc ohv . The Morris had one SU H4 and the Wolseley two SU H4, giving 85bhp at 4000rpm in the Morris and 95bhp at 4500rpm in the Wolseley. The bore and stroke were 79.4mm and 89mm. Notice the stroke was common with the 'B' series, as the engines were of a family group, this gave 2693cc. It had the diagonally split big ends like the 'B', and pinch bolt gudgeon pins. Unlike the 'B' the camshaft was on the other side of the engine, but it did use the same timing sprockets as the 'A' and 'B', in duplex chain form, and the later 'B' Reynolds chain tensioner. Valve timings were conservative at 5;45;40;10, and that inlet manifold did nothing for power. An Austin was fitted with the same engine in late 1954, this having a single Zenith and produced 85bhp like the Isis. The Wolseley became very popular with Police Forces, as it drove well, was fast, and handled well, as did the Riley 2.6, the Pathfinder replacement that was otherwise identical with the Wolseley, having lost its controversial coil sprung rear axle.

In 1956 a tuned version of the A99 with twin Zenith carbs and improved manifolding, produced 105bhp at 4600rpm, it was called the A105, and was also sold as a Vanden Plas in low numbers. Similar improvements were made to the A90 of 1956, with one carb, power up to 92bhp, changing its name to the Austin A95 Westminster. The Morris Isis was a flop, as was the Riley 2.6, and were both discontinued. The Wolseley and Austin sold strongly.

The engine was used in the Austin Healey 100–Six in 1956, with the 102bhp A105 version and twin SU H4 carbs of the Wolseley. Racing improves the breed, and Healey quickly fitted an improved cylinder head and proper inlet manifold, this increased power to 117bhp at 4750rpm at a stroke. In 1959 the engine was bored out to 2912cc, with a 88.3mm bore, and the big Healey was shoved along by a massive 124bhp, topping 114mph. In 1961 the engine was again improved with bigger valves and power was up to 132bhp at 4750rpm with 117mph. The big six had not finished yet, as in 1963 Healey extracted 150bhp from the engine, at 5250rpm, producing 121mph top speed. Carburettors were now twin SU HS6 1 3/4". The Healey 3000 Mk3 was nearly a Healey 4 litre GT, as it was to have the aluminium Rolls Royce industrial B60 engine that eventually went into the

Vanden Plas Princess 4litre 'R' saloon instead. Instead the 3000 Mk3 kept the 'C' series, with even more bhp.

So there was a precedent to use the BMC six cylinder in a sports car, and some think that was what the MGC was to be, a Healey 3000 replacement. The following shows the use of the BMC six cylinder engine, more than you might have suspected at first:

Model	cc	Prefix	Power (bhp)
4 main bearings			
Austin A90	2693	26	85
Morris Isis	2693	26M	85
Wolseley 6/90	2693	26W	95
Riley 2.6	2693	26R	95
Austin A105	2693	26	102
Austin A95 Westminster	2693	26	92
Austin Healey 100–Six	2693	26AH	102
Austin Healey 3000 Mk1	2912	29AH	124
Austin Healey 3000 Mk2	2912	29AH	132
Austin Healey 3000 Mk3	2912	29AH	150
Austin A99 Westminster	2912	29	103
Wolseley 6/99	2912	29W	103
Vanden Plas Princess Mk1	2912	29V	103
Austin A120 Westminster	2912	29A	120
Wolseley 6/110 Mk1 and 2	2912	29WA	120
Vanden Plas Princess Mk2	2912	29VA	120
7 main bearing			
Austin Three Litre	2912	29V	145
M.G. MGC	2912	29G	145
BMC Reconditioned unit	2912	68G	145

In 1959 the Wolseley 6/99 had the bigger Healey 'C' series engine of 2912cc, with its twin carbs, with 103bhp at 4750rpm. 1959 was also the year BMC went 'Farina' in styles. The same engine was fitted to the Austin A99 Westminster, now with twin SU carbs, as Austin had dumped the Zeniths. A Vanden Plas version, with its own grill and trim, now appeared, later to gain a Rolls Royce four litre B60 aluminium version of an industrial engine, NOT the 'RR' car engine, another BMC disaster. A really hefty crankshaft underpinned this 'C' series engine, counterbalanced, with main bearings of 2.375" and big end journals of 2". There were only four main bearings, but ample. The better camshaft of the Healey was fitted to the 1961 cars, now a Austin A110, Wolseley 6/110 and Vanden Plas Mk2, though they never gained the Healey's better cylinder head and inlet manifold, using that cast into the head to the end. The camshaft timing was 5;45;51;21 that of the MGA and MGB, but with a lower .314" lift. Power leaped to 120bhp at 4750rpm. Inlet valves were now 1.69" diameter, and exhaust 1.42". A large 10" dry clutch took the drive, though an automatic gearbox was on offer.

1959 also saw the development of a six cylinder from the 1489cc 'B' series, that was not continued, but did live on to be used based on the 1622cc 'B' series, for BMC Australia. This engine is **not** a 'C' series, and only built down under as the Blue Streak Six.

Like the 'B' series, the engine was destined for further use, as BMC sought to improve their FWD range, except that the biggest car was not fwd, but the 'Austin 3 Litre' that looked like a big ADO17 1800. The 'C' series was to be updated like the 5 main bearing 18GB MGB 1798cc engine had been, to have a main bearing each side of each cylinder giving seven, for extra smoothness. The poor old

Austin 3 Litre lost out to the cash problems of the company, and flopped terribly. But that engine could be used in a replacement for the defunct Austin Healey 3000, an old design dating back to the Austin Atlantic, the Healey contract soon to finish. What better than to fit it to a modified MGB, and badge it as a Healey?

July 1967 saw a six cylinder MGB, now called a MGC, for sale. It had the redesigned seven main bearing BMC 'C' series six cylinder engine meant for the 3 litre. There were differences, as the Austin version has its oil pump at the front, and a different sump to suit. It produced 145bhp at 5250rpm, similar to the last Healey 3000 Mk3 though 5bhp less, with 170lb/ft torque at 3400rpm, with its 2912cc engine of 83.3mm bore and famous 89mm stroke. The compression ratio was 9 to 1, with twin SU HS6 1 3/4" carburettors with paper element air filters in an air intake silencer. The camshaft timing was that of the last 4 main bearing engines, 5;45;51;21 as were valve sizes. One wonders how BMC lost 5 bhp from that Healey engine, but they did it as well with the ZB Magnettes 68bhp in 1958 to the 66bhp of the Mk3 Magnette in 1959, and that was the SAME engine. High oil consumption can be down to the inlet valve seals, an early 'B' series problem as well. Using the 1800 inlet valve cap seals can cure the problem of oil being sucked down the valve guide into the inlet manifold. The engine had an oil cooler as a standard fitting. It was a nice 'lazy six', but road testers complained it lacked mid–range torque, poor camshaft timing perhaps? September 1969 saw the last MGC after a production run of 8,999 cars. In 1968 a few aluminium alloy MGC engines were made for use in the racing version, the MGC GTS.

Because of the new six cylinder engines poor performance, M.G. did consider using the Rolls Royce B6 industrial unit from the big Westminster based Princess 'R'. The MGC's new engine simply was not designed for a sports car, and its seven main bearing crankcase was very massive, and of cast iron. To use the 2433cc Blue Streak Australian engine would have meant this was unique to M.G. in the UK, so the company was forced to use the BMC Austin Three Litre component. Alas, the Blue Streak in the Farinas for the Australian market did not sell very well either, and were soon dropped. This 2433cc engine only produced 80bhp with its single SU carburettor.

The power output could be improved with attention by Downton Tuning, who sold three stages of improvement, a mild stage two to 149bhp at 5,500 rpm, with stage three and three SU carbs giving 174bhp at 5,500 rpm. The much later Rover V8 engine in the MGB GT V8 of 1973 produced 137bhp with 193lbs torque, from a massive 3528cc. In comparison that MGC engine was not too bad , it just did not like revving. TA MPJM engine, and Midget 1500 engine trouble again? Performance of 120mph and 0 to 60 in 10 seconds is still good today. Has anyone ever tried a M.G. Metro Turbo 1300 up against a MGC on a race track?

Rover Engines in M.G's.

MGB GT V8 Engine. (1973 – 76)

The MGB GT V8, the longest title yet on an M.G, has a fascinating engine. The story is that….
…Once upon a time the managing director of Rover Cars Ltd. went over to the USA to try to sell his company's wares to the Americans. On visiting Mercury Marine who make power boats, in 1964, he saw a second hand aluminium 155bhp 90 degree V8 engine sitting on the floor. Mercury were to trial fit it into a boat. William Martin–Hurst, the managing director from Rover, asked about it, as it looked very small for an American automobile engine. This particular unit had been taken out of a scrap Buick Skylark car, it was of 215 cu. inch (3531cc) and had been designed in the early 1950's for the 'compact' market. In 1952 it was up and running, and by 1960 in full production, and was a copy of a post war BMW V8. But like BMC the huge company of General Motors, (GM) were commonising their engines, and the expensive alloy V8 was dropped in 1964 after 750,000 had been made. The engine was out of production. A similar 3244cc cast iron V8 had taken its place using the same machinery and lasting until 1967. Everyone was copying Fords system of 'thin–wall'

casting, and grey cast iron is half the price of cast aluminium, and does not need cylinder liners. Martin–Hurst contacted GM and offered to buy the manufacturing rights. GM thought he was joking and ignored him. But, he did take that engine off the garage floor back to Blighty, and had it fitted into a Rover 2000. Martin–Hurst then drove this car to London, and picked up Spencer Wilks, a retired Managing Director of Rover Ltd. (The Wilks Brothers WERE Rover.) This was in early 1965. Wilks could not believe how this Rover could go, and demanded to see under the bonnet. Rovers' were traditionally rather staid, solid, good quality, long lived, saloon type motor cars, hence the nickname 'Aunties'. Things began to move faster after that. Rover contacted GM again, who took up their offer, sending over the drawings, the designer of the V8, one Joe Turley, for 18 months, and 39 completed engines. Rover's old inlet–over–exhaust (ioe) engines were very old, and needed replacing. The Rover 2000 sohc had been introduced, but the bigger P6 Three Litre saloons needed an update as well. This car gained its V8 in 1967, being the P5B, and then the Rover 2000 was so fitted in 1968, being the P6B ('B' is for Buick). The Buick V8 had been the first mass–produced all aluminium V8 in the USA, and had been announced as the "Aluminium Fireball". It first ran with no cylinder liners, but this proved difficult as when the engine was cold scuffing of the bores occurred. Cast iron liners were then fitted.

The P5B was much improved, as its old 2995cc six cylinder engine only did 15.6mpg, whereas this new to Rover 3528cc V8 did 19.2mpg in the massive body. Rover produced the engine in a slightly different way to GM, in that Rover sand cast the cylinder block, machined it and press fitted the cast iron cylinder liners. The cylinder head was a gravity die casting, and sumps and covers were pressure die cast, all by Birmingham Aluminium Company. In this USA spec. it carried a high 10.5 to 1 compression ratio, requiring 5 star petrol, turned out 184 bhp at 5200rpm, and could push the P6B up to 125mph with the later manual gearbox, and do 24mpg normal driving. Initially the engine was fitted to a Borg Warner strengthened Type 35 automatic gearbox, no manual gearbox being available to take the huge torque it produced, of 215 lb/ft. A reinforced Rover 2000 gearbox with taper roller bearings, new casing, and with its own oil pump, eventually arrived in 1971.

The Morgan Company of Malvern Link, Worcestershire, were the first sports car firm to fit this engine in 1968, called the Morgan Plus 8, it had neck jarring acceleration if you were not careful. With the successful P5B and P6B there followed the Range Rover in 1970 and a Land Rover Series 3 version in 1971, both using a low compression 8.25 to 1, 140bhp engine. The Rover SD1 had the engine at its launch in 1976, (the same year the millionth Land Rover came off the lines.) Rover had produced 90,000 V8 engines by 1980! Alas it was not until the late 1980's the steel inserts to the combustion chamber was modified to take lead free petrol, Rover do not recommend lead free fuel for the early engines, (though experience says they can withstand lead free fuel!!) In 1998 a 4 litre version is still in production with Land Rover, who to complete the circle, now belong to BMW. The 1966 – 67 3–litre engine fitted to the Brabhams Formula 1 winner, used the Buick V8 block.

As Rover, Leyland, and Austin Morris had all merged by the 1970's, this engine came within the remit of M.G. Ken Costello, had shown BL how to get a V8 Rover into a MGB, and he was doing well. So in April 1973 M.G. pushed their very own V8 version off the production line. The all–aluminium alloy V8 engine has a bore of 89mm and a stroke of 71mm, giving 3532cc, there were push rod ohv with self–adjusting hydraulic cam followers. The camshaft valve timings were 30;75;68;37 with .390" lift. A gear type oil pump moved the oil about at a disconcertingly low pressure for M.G. enthusiast, 30 to 40psi being good. Most other M.G. engines use 50 to 75psi, but Americans go for a good flow in wide oil galleries, as opposed to high pressures. Like the 1798cc 'B' and 1275cc 'A', the gudgeon pins were a press fit into the connecting rod little end. The short, very stout crankshaft had wide big ends of 2" diameter, and five wide main bearings of 2.29" diameter. All bearings were steel back shell bearings with lead–indium alloy lining. The 90 degree V8 fitted to the MGB and GT body was the lower powered unit from the Range Rover/Land Rover, so it had a 8.25 to 1 compression ratio, giving 137bhp at 5000 rpm and 193 lb/ft torque. A special inlet manifold that took the two SU HIF6 1 3/4" carburettors to the rear of the engine was fitted, to clear the bonnet, and two large frying pan paper air filter elements finish the job. The lazy V8 allowed the MGB GT V8 to idle along at just 23.4 mph per 1000rpm, and 28.5 mph in overdrive. Maximum speed even with low compression, was 124mph, and to 60 was in 8.6 second. It did 24 mpg! The V8 was virtually the same weight as the rather corpulent 1798cc cast iron 'B' series. British Leyland were never lucky with good cars, as by September 1976, production was stopped to promote a competitor, the Triumph Stag, cast iron V8, sports car disaster, after just 2591 cars.

Again, having experience of this engine, it does not take kindly to short cold journeys. The oil has large areas of cold aluminium surface to flow over, and generates a lot of sludge if not boiled off on a good fast 25 mile run often. This off–white sludge called mayonnaise, (oil mixed with water) plays havoc with the hydraulic cam followers, causes internal corrosion, and blocks oil ways. Later Rover SD1 engines had solid followers, which also permit higher rpm as hydraulic follower's oil can foam if over–revved. Camshafts, the most highly stressed bit of any engine, suffer badly, often lobes being ground off to just a little bump. The camshaft is case–hardened, a thin hard surface on a softer steel centre. This is quite a strong structure, but once you wear off the few thousandths of an inch of hard surface, they wear rapidly. Use it often, change the oil often, change the filter often, and in fact service it often and it will last forever.

M.G. RV8 Engine.

The M.G. RV8 used a similar V8 unit, but of 3950cc with a 94mm bore, 71mm stroke, and 9.35 to 1 compression ratio, producing 190ps (184bhp) at 4750rpm, with torque of 318nm (Newton/Meters) giving 0 to 60 in 6 seconds and 135mph. It has electronic ignition and a ECU engine management system with multi–point fuel injection, and was from the top of the range 'Range Rover 4.0i V8'. It was a limited production vehicle of 2000. Sometimes I wonder if things are leaving me behind, what is a ps?

The Buick 215 cu.in. engine was often bored out to 4400cc in the USA for competition use, and tuned to give 350bhp.

Use of the Rover/Buick V8.

Model	From – To	
GM Buick Skylark Compact	1960 – 1964	750,000 made
GM Buick Special	1960 – 1964	
GM Pontiac Tempest	1960 – 1964	
GM Oldsmobile F85 Cutlass	1960 – 1964	
Rover P5B 3 1/2 Litre saloon	1967 – 1973	
Rover P6B 3500/3500S saloon	1968 – 1975	
Range Rover 4wd off road	1970 – 1993	
Range Rover 4.0i V8	1994 – to date	
Landrover 4wd Discovery	1980 – 1993	
Landrover Discovery V8i	1993 – to date	
Rover SD1 3500	1977 – 1982	
Rover SD1 3.5 Vanden Plas	1980 – 1986	
Rover SD1 Vitesse	1982 – 1986	
Series 3 Landrover and variants	1971 – to date	
101 inch Forward Control Rover	1975 – 1977	
LDV Sherpa	1990 – to date	
Morgan Plus 8	1968 – 1980	
Triumph TR8	1980 – 1981	
MGB GT V8	1973 – 1976	
MG RV8	1992 – 1996	

Many were used in specialist cars like TVR, Westfield, Marcos, Lister, and Ginetta.

MODERN M.G. Sports Cars.
M.G. MGF 1.8i, and VVC Engine.(1995 – still in production in 1998.)

The Rover four cylinder 'K' series was first used in 1990. It was fitted in the fwd Rover 100 (Metro) sohc 1.1litre '111', and 1.4litre (1396cc) '114'; and the sohc 1.4 litre '214'. By 1995/6 it had become the main engine of the company, and included the dohc 1.8 litre (1796cc) '218 VVC' and '218 TD' tourer; and dohc '618i' and '618Si' ranges, all with a belt driven camshafts. For the 1.8 litre MGF it has a toothed belt drive dohc with sixteen valves, new connecting rods and crankshaft, with lightweight pistons, with a cast aluminium sump, with the VVC model having a special inlet manifold. It was designed at BL Canley as a very efficient saloon car engine, to take Rover into the next millennium, and is no relation to the fwd units of BMC/BL, or Honda. This is no engine for the tinkering enthusiast, and heralds a new type of M.G. owner, one with clean hands!

The engine had started life in the early 1980's as a plastic sandwich, designed to last 150,000 miles and then be scrapped. The bolts holding it together run from the main bearing lower casting, right to the cylinder head, clamping it all as one, and the bolts taking all the tensile stresses as the engine in under compression. There are four valves per cylinder with twin camshafts in the MG, with a pent–roof combustion chamber promoting plenty of swirl for efficient combustion. The first one was running in 1985 and first used in the Rover 200 of 1989. It was available as both a single ohc and dohc unit, the cylinder head being the main difference. There was a sohc 8 valve 1100cc 'K8' with 63mm stroke and 75mm bore being very oversquare; and a 1400cc sohc 8 valve or dohc 16 valve 'K16'with a 79mm stroke and 75mm bore. The 1.1 was first used in the Rover Metro in 1990, and the reason the MG Metro disappeared. A 1600cc version was developed for the Rover 400, but then enlarged to 1800cc by using the damp cylinder liners from the V6 engine of the Rover 800.

This two seater sports car, with its mid–engine–configuration has the Rover 'K16' series all aluminium engine fitted, of 1796cc, 89mm bore, 80mm stroke, and four cylinders, with double overhead camshafts, (dohc), and four valves per cylinder, two inlet and two exhaust. All engine functions are controlled electronically via a Rover/Motorola, Modular Engine Management System, (MEMS). This was the first model to get the 1.8 litre, 120ps (118bhp) at 5500rpm, version of this engine, which is well hidden from view. It is available in two power options; as above, or with the same engine but with a variable valve control, that hydraulically and mechanically alters the camshafts inlet valve timings, termed the 1.8i VVC, 145ps (143bhp) at 7000rpm.The camshaft timing is carried out by slowing down or speeding up the lobe's travel across the valve bucket, (cam follower) so keeping the valve open for a shorter or longer period, depending what is demanded of the engine, i.e. under acceleration, valves open longer for more power; cruising, open less for economy. The control unit is in the cylinder head. At 4500rpm the 1.8i engine produces 165nm torque, 0 to 60mph in 8.5 seconds; and the 1.8i VVC 174nm, 0 to 60 in 7 seconds. They both have three–way, closed loop catalytic converters, with the exhaust gasses monitored by an oxygen sensor, (Lambda) so can only run on lead free petrol, and spark plugs are said to last 60,000 miles. The five speed gearbox is related to the Rover 200 and 400.

The all alloy engine has 4 replaceable steel, wet–cylinder liners, in direct contact with the coolant. The K8 version in the saloon cars indicates just 8 valves, the term K16 indicates 16 valves. The construction consists of three major castings, the cylinder head, cylinder block, and crankshaft main bearing ladder. The head comes with a camshaft carrier. All of it is tied together by ten long through bolts, which fulfil the task of main bearing *and* cylinder head fastening. Ten smaller bolts hold the block to the crankcase, so the head can be removed separately. The long bolt holes in the engine act as breather and oil return passages. There are five main bearings. Hydraulic tappets are used under the two camshafts.

It must be difficult to open the bonnet and show off a clean tidy MGF engine! In 1998 MG intend to run EX255, a very special MGF derivative, to regain the land speed record for that class of car, on Bonneville Salt Flats, USA. This 'MGF' has a 4.8 litre MG/Rover V8 of 94mm bore and 86.4mm stroke, producing 900bhp at 8000rpm, and torque of 590lbs.ft. With a reinforced V8 block, 2.1" dia big ends, 2.25" dia main bearings, inlet valves of 1.9" dia and exhaust valves of 1.6" dia, self–learning fuel injection system feeding into twin superchargers, a dry sump lubrication system, and a 150 litre cooling system with no radiator. All in a much modified MGF frame, it hopes to be the fastest MG ever, 300mph plus. The latest model to use the 'K' series will be the MG MX10 due out in 2001, with 150mph on tap, based on the current Rover 75. It will be turbo/supercharged, and may be a V6 development.

'K' Series Worries.

(This was written for a Rover Metro Club, but the thread applies to all cars fitted with the K series engine including the MGF, MGTF, ZR, ZS and ZT. Sadly this excellent engine that won design awards developed problems that MG Rover refused to address.)

As anyone who has looked under the bonnet of the Rover version of the Metro, not only did the front end get a completely re–engineered make–over, a new engine was also slotted in. In the Metro the all–alloy Rover K series engine was mounted on a Peugeot designed gearbox and was available in 1.1 and 1.4 litre versions. Added to that, the 1.4 was also available with a twin ohc cylinder head. It did not take long for someone to fit a 1.8 engine from the bigger Rover cars though this was not an option from the manufacturer. The 1.6 and 1.8 K Series was used within the Rover/MG group saloons and a 1.8 version found its way in the Landrover Freelander.

All seemed to be going well until the larger engines began to have problems with cylinder head gaskets. Alas Rover turned a blind eye to this and simply told garages that "the engine's cooling system was not being bled properly". Anyone who has had to refill their Metro will know what a real pain it is to bleed to coolant correctly. I have had to do it up to four times sometimes, until I get hot water flowing through the radiator. If your temperature gauge show hot and your radiator is cold, you have an airlock. Sadly the temperature gauge can also show cool whilst the engine is boiling, again caused by airlocks. I always double–double check now. If you ignore it, the engine quickly overheats and the gasket will blow. By 2005 the Rover K Series engines head gasket problems were becoming legendary and affecting sales. Rover continued to deny there was a problem and continued to use the steel/silicon gasket. Even though people sent in their old head gaskets with the silicon peeling off, Rover ignored it all. Many a good car went to the scrap yard because the owners refused to buy yet another new engine for it.

But the little K Series is also a very cunning engine. Due to the cylinder head gasket it uses with a silicon lip around the vital areas, it will wait about six or seven years then begin to leak oil into the water or visa–versa. On our 1995 Kensington I noted little oil globules in the coolant expansion tank after 55,000 miles. The engine performed perfectly, but the head gasket had gone where the oil feed up one of the long 'head bolt holes. Yes, the engine uses the bolt holes as part of the oil feed to the head. Once the silicon had begun to fragment due to 'old age' this water contamination with engine oil is common. It is also a big 'red flag' warning because you MUST change that head gasket ASAP or you will wreck the engine.

So once again, if you get oil in the coolant expansion tank, OR your engine oil is turning milky and seems to be filling the sump, get that gasket seen to **ASAP.** Once the gasket goes the oil and water will mix freely and turn the insides of the water jacket and the innards into a swamp of mushy mucky mayonnaise. This will neither cool the engine nor lubricate it. The head gasket will blow and the crankshaft seize. This happens in about 500 meters at 70mph. No, you get no other warning other than when it is too late. The car just grinds to a halt in a cloud of steam. If you were lucky, you spotted the oil being deposited onto the sides of your expansion tank early on, and caught the problem quickly enough. A new head gasket will probably last another 50,000 miles or 5 to 6 years. Notes the failing of the silicon sealer is age related. You may well have to clean out the engine internals if the water gets into the oil. You will most certainly have to renew the rubber hoses in the cooling system as oil rots rubber (or the modern equivalent of rubber).

This problem refers to the 1.1 and the 1.4 Metro engines. The bigger 1.8 and especially the 1.8 twin ohc engine suffer an even more catastrophic end. So if you have one in your Metro you need to be very alert as to its condition. The problem with the bigger sizes of the 'K' series is that they overheat anyway. The design of the cylinder head is not very good around the exhaust valve area. Too little coolant gets to the very hot bit. The coolant temperature masks this as it appears to be OK, but the metal around the exhaust valves get so hot it can anneal the alloy head. Even aluminium alloy has a certain 'hardness' so it can clamp the head gasket and not leak. If the alloy is 'annealed' this means it is softened by the action of the heat. This allows the head to 'dent in' where the head gasket is gripped and so the gasket is not held tightly enough and so blows. This appears to happen at about the 60,000 mile point on Rover cars. But on the Landrover Freelander it was happening before 40,000 miles! Once the head is soft, it is useless. Trying to fit a new head gasket will only cause a deeper dent in the soft area. You can buy a gasket set with a steel shim that spreads the load, but the basic fault is in the head design. This 'annealing' does not seem to happen to the single ohc Metro engines as they do not get hot enough. Again, do not go by the coolant temperature gauge as this will appear normal. It is the thick metal around the valves that cannot shift the heat quickly enough to the coolant, so the metal rises well above the temperature required to anneal it. Add to this the problem with the ageing of the silicon sealer on the head gasket and you can now see why there are not now many Rover cars seen on the roads!

The MGF sports car uses the 1.6 and 1.8 versions of the twin ohc K Series engine. They all suffer the annealing and gasket problems. Landrover, who used the engine in their Freelander, have developed a better longer lasting head gasket. It does not fail with age but cannot cure the basic design fault in the bigger twin ohc 1.8 engines.

If you are running a 1.1 or 1.4 single ohc Metro, you only need to worry about fitting a new head gasket every 50,000 miles of five to six years. Of course there will be exceptions, some Metro's will go 20 years with no head gasket problem, but the big majority will require action sooner or later. Later usually means a wrecked engine. Many a Metro has blown up because the owner had never cleaned the insides of the coolant expansion tank so could not see the oil! Water levels have dropped as it drained into the sump, but unseen because the 'stain' inside the coolant tank made things look as if the level was alright. Remember, oil in the coolant tank in the tiniest quantities, or the engine oil level rising and turning milky, STOP the car, do not drive it an inch further. Fit a new head gasket.

<u>'K' Series Engine Uses.</u>

Rover Metro 1.1	1990
Rover Metro 1.4	1990
Rover Metro 1.4 Si	1991
Rover 200 1.4	1989
Rover 218 vvc	1995
Rover 218 td	1995
Rover 618i,	1995
Rover 618 Si	1995
MGF 1.8	1995

'K' Series Engine Uses.

MGF vvc 1.8	1995
MGTF 1.8	
Rover 200 1.8	1996
Land Rover 1.8 Freelander	1998
MG MX10	2001
MG ZR	
MG ZS	
MG ZT	

V8 Oil Worry.

Having just spent a small fortune on rebuilding a V8 engine, upon turning over the massive power unit, the oil gauge failed to register anything. Panic!! Checking the dip stick to see if I had put any oil in showed a nice green level of Duckhams best 20/50. I dare not run the engine again, so decided to check the oil pump. It had oil in it, but not the huge dollop one would expect had it been pumping oil. I never run an engine until I KNOW the oil is circulating, and have almost wound my arm off on 'B' series, using a starting handle before now. A check with the manual mentioned filling the oil pump with Vaseline, an old trick I had forgotten, I had done this many years before on aircraft engines to get the pump to 'lift'. One tin of Vaseline later, and the oil flowed beautifully. I fitted the rotor, and fired her up, and oil pressure needle moved round the gauge, much to my relief. I always assemble an engine using STP, as it remains in the bearings on start up.

Simply carrying out an oil and filter change can drain an oil pump, which is why some, like early XPAG engines, have priming plugs. The Midget 1500 engine, and those 'B' series with upright canister filters, must have an oil filter with an anti–drain down valve in it, or the engine can start up every time with an empty oil pump. Early Heralds and Spitfires developed noticeable big–end rattle because owners fitted any cheap old filter, any engine is at its most vulnerable starting cold.

There is nothing like 'no oil pressure' to give anyone a heart failure, the only other instance I can compare it with is shoving on the brake pedal to find there is a fluid leak … and it goes to the floor!

Leaded or Unleaded?

Since about 1984, all Rover V8 engines have hardened steel exhaust valve seats, so can run on unleaded petrol. The earlier cars use steel inserts for all the valve seats, as the engine is an aluminium alloy casting, but these are not guaranteed to cope with unleaded fuel. The Landrover model is exported all over the world, so it was an obvious move to update the engine to use a fuel now mandatory in many countries. Such later cylinder heads should fit the earlier M.G. engines for an easy conversion.

The RV8 and MGF are modern unleaded engines, with catalytic converters, and must NOT use leaded fuel as this destroys the catalytic lining in the unit. It is also important not to park one of these models at a meeting/rally, over dry grass, after a long run. The heat off the cat' will set fire to the grass, not a very smart party trick.

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1980 to 1990 B/L and Austin Rover.

Four Cylinder SOHC fwd M.G. Saloons.

The 1300 M.G. Metro belongs here, but it fitted nicely onto the end of the 'A' series, so it is in that engine's chapter. 'O', 'R', and 'S' series of engines all have cast iron cylinder blocks, with alloy cylinder head and gearbox sumps. For the older enthusiast they are full of modern metric threads with metric bolt and nuts heads. BL tried the R and S engine out, but it was not really a raging success, so the trusty 'B' series based 'O' engine was resurrected, as you will see. Part of the Geoffrey Johnson re–designed 'O' series story is under the MGB chapter, as it was the MGB's 2 litre engine stretch the series now used in these, cars grew from. It was to be produced in two versions of 75mm and 89mm stroke, both over–square. It had been in service since 1978 in the fwd Princess 1700, (1994cc in the automatic Ital) and 1982 Austin Ambassador but using the BL designed gearbox in the sump. For the MG the engine block was revised, it was recast and rotated through 180 degrees so as to use a Honda designed five speed gearbox built under licence. The cylinder head was also revised, and recast to put the manifolds back to the rear, with better porting. The Maestro is a shorter version of the Montego, by just two inches in the wheelbase, and without the 16" extra length of the boot, otherwise they are virtually the same car. It is in this modern area that the DIY enthusiast begins to lose control. On the XPAG and 'A', 'B', and 'C' series you could fix virtually everything yourself. But can you “re-chip” a Montego? The engines of modern cars look after themselves, they 'think'. These fwd engines have electric fans that have sensors to measure water temperature, sensors to check ambient air temperature, and even rpm, air density, and throttle angle for the Turbo powered versions. They need modern oils, no good putting 20/50 in these close tolerance units, they need good 10/40 quality oil, often a synthetic. If you are of an age where you went to the local handy garage, and wound a handle on an oil pump to get a pint of commercial oil from a 45 gallon oil drum, and serviced your own car, then a modern fwd M.G. would astound you. The oil filter is so easy to remove and throw away, the engine oil is separate from the gearbox oil, not 'Issigonis in the sump' as in the Mini and Metro. Plugs screw into an alloy head, and need torque setting to be correct on their tapered seats, and to set a plug to .040", when you thought .025" a large gap. Electronic ignition is the reason for the powerful spark, with no ignition points, but a transducer (phonic sensor) on the flywheel housing that actually counts the rpm of the flywheel, using a tiny LED and a photo–electric cell. When the correct gap at the correct degrees flashes by, POW! out goes the spark, modified to suit the rpm and load. Like the V8, only correct coolant must be used in this part–aluminium alloy/iron engine; forget and it corrodes. Sparks plugs were 16mm, not 14mm, in the 'O' series.

<u>Maestro 'R' Series Engine.(March 1983 – April 1984)</u>

In March 1983 the LM10. (now Leyland Motors design office note) was put onto the competitive car market in the UK, and BL hoped it would save its flagging sales record. The car was a success, and was powered by a distant relative of that 'O' series that some MGB's once had fitted back in 1972. The 1598cc 'R' series engine had been developed from the 'E' series, chain driven single ohc (sohc) 1700cc engine of the five speed Maxi, in its front wheel drive layout, (fwd.) The M.G. Metro was out on the streets, keeping the M.G. name alive, and the LM10 was to provide an up market M.G. saloon. This smart up to date vehicle had a 16H 1598cc 'R' series engine, of four cylinders, with a chain driven single ohc, cast iron cylinder block and aluminium alloy cylinder head, with twin choke Weber 40DCNF carburettors, bore of 76.2mm and a stroke of 87.6mm. MG had modified the six ports of the standard car, having a head with enlarged ports and a 9.6 to 1 compression ratio. Camshaft timings were 20;52;55;17. It produced 103 bhp at 6000rpm, with 100ft/lbs torque at 4000 rpm. The standard Austin 1.6 Maestro produced just 81 bhp. The MG car used a licence built Volkswagen Golf fwd five speed gearbox, where the Maxi had used an Issigonis gearbox–in–the–sump design. The block required re–designing for use with the VW gearbox, along with manifolding thus putting the carburettors at the front. The ‘R’ also had a new crankshaft with 1598cc with a 87mm stroke, (Maxi was 81mm with 1485cc.) It was not a good engine and was replaced in 1984.

M.G. Maestro 1600 'S' Series Engine. (April 1984 – Oct 1984)

In July 1984 the engine was improved and redesigned into the 1600cc 'S' series, 16HE series, of 1598cc, with a toothed belt drive sohc, new balanced crankshaft, better cylinder head and porting, thin–wall cast iron cylinder block lighter than the 'R' series, with modified water pump, oil pump, and distributor drives. Carburettors and equipment was as the 'R' series, with the head on the other way around. Inlet valves were 1.5" dia, exhaust 1.218" dia. on both the R and S engines. Only 2,762 made before it was discontinued. The 'R' and 'S' series developed a bad name for problematical hot starting in warm weather. The 'S' series was intended for the Montego as a better engine than the 'R' series to which it was very closely related, but the Montego had the 1994cc 'O' series. The 'R' and 'S' must have an oil filter fitted that incorporates an anti–drain down valve, akin to Unipart number GFE180. Some cheap versions do not have this valve, and the engine can be started 'dry' of oil, leading to rapid wear.

As mentioned in the MGB 'B' series chapter, the 'O' series was developed for use in that sports car. It was to have been a SOHC version of the engine, with twin SU carburettors, or Lucas/Bosche Jetronic fuel injection, with or without an exhaust powered turbo–charger. With fuel injection it produced 112bhp. As early as 1964 MG were looking at the 'B' series to make it a two litre. The 1994cc block, gained by siamesing all the cylinders, went on to become the 'O' series by 1973 and MG carried out its development for the USA market for the MGB. The 'O' used the crankshaft and a slightly redesigned block of the 'B' series, partially because the 'new' engine had to fit the existing fwd 1800 Landcrab and later Princess models. These had the 1798cc 'B' fitted. The Morris Marina was to gain the new engine as well, so a 1700cc version, as well as the 1994 version, was developed. The 'O' series had more ribbing than the old unit, to stiffen the cast iron block, and an aluminium head with cast camshaft cover. The cover also had the cam bearings upper half, the actual valve clearances adjusted by shims. The SOHC was driven by a toothed belt, and the combustion chambers had sintered steel valve seats, though Rover say these are not compatible with unleaded fuel. The 'O' weighed in less than the 'B' series, with no rockers, push rods, or cast iron head; 108lbs compared to 127lbs. The 'O's crankshaft was as the Marina 1.8, made of spheroidal graphite cast iron. Con rods were still forged with press fit gudgeon pins. Pistons were die–cast with steel inserts to control expansion. The cylinder head was a gravity die–casting, with a flat surface, no combustion chambers. The chambers were in the pistons, now called a 'Heron–Head', (as in the Jaguar V12 engine.)

Like the crankshaft, the camshaft was also of cast iron but ran in three bearings. The lobes bore directly onto the upturned bucket type tappets. Oil pump, oil filter, and oil pressure relief valve were all on an aluminium alloy die casting at the front of the engine. The pump fed into a single oil gallery, not two as on the 'B' series. Both fuel pump and distributor were driven off the SOHC, mounted on its cover. All nuts and bolts are ISO metric threads. Ignition timing was by a disc on the crankshaft, with a slot at two points, being read by a light emitting diode watched by a photo–electric cell. The DIY owner would not like the shims in the valve gear. Special equipment is required to set the gaps, as the cover is the upper bearing as well.

As the MGB only saw two of these 'O' series, and neither was sold, it was down to the Austin Princess to use it first, followed by the Marina. Initially the 'O' was less powerful than the similar sizes 'B' series, but by the time it had been fitted to the 1982 Rover SDI 2000, with a twin SU HIF44 set up, there was 101bhp at 5,250rpm, and 120 lb/ft torque at 3,250rpm, on a 9 to 1 compression ratio. An electric cooling fan and electric fuel pump kept power losses down, and the engine found its way into the MG Montego by 1984, replacing the 'R' and 'S' units. The engine gained Lucas fuel injection as in the Vanden Plas EFi, and the MG used this as well. Rovers own single point EFi and a twin OHC cylinder head followed, but this 1987 118bhp engine went into the 800 Rover series as the M16, and not a MG.

The 'O' series was modified into a diesel, used in the Sherpa van, and still built by Perkins of Peterborough, now called the Perkin's Prima.

M.G. Maestro 2.0 EFi litre 'O' Series Engine.(Oct 1984 – 1991), M.G. 2.0i Montego Engine,(1984 – 90)

October 1984 saw a 1994cc M.G. Maestro, and Montego (LM11) with the 5 main bearing 'O' series engine in a fwd layout. (See MGB for full 'O' series history.)The Electronic Ignition distributor was on the nearside, (rear) end of the camshaft, on this 'O' series, not half way along as on the Marina version. It was termed a 20H till 1989, then a 20HE99, and had a cast iron block with alloy cylinder head. This better unit was a 1994cc belt drive sohc, with a bore of 84.5mm and stroke of 89mm (AGAIN!!) of 9.0 to 1 comp. ratio, with Lucas Electronic 'L' type 11CU multi–point fuel injection, (Bosch L–Jetronic built under licence) and fully mapped Lucas engine management system, (called an ECU, engine control unit, all from the Rover Vitesse) producing 117bhp at 5500 rpm and 134lb/ft torque at 2800 rpm, (180Nm.). Inlet valves were 1.575" dia. of EN52 steel; exhaust 1.339" dia. of 21–4–NS steel; and camshaft timings were 19;41;61;15. This version had a licence built, five speed Honda PGM gearbox. In 1986 the camshaft cover had a cast in 'MG' motif and details engine modifications. The Maestro was called the 'EFi', but changed its name to 2.0i in October 1987. Zero to 60mph was in 8.5 seconds. Like most modern cars, its fwd under bonnet was a mass of pipes and ducts. Some of these models were lead free, but not until late 1989, (after chassis 595500, engine type 20HD15) as Leyland Motors were going the way of the 'Lean–Burn' engine, but governments were swayed by the 'unleaded' lobby, catching quite a few manufacturers out, (i.e., Ford for another.) Unleaded MG cars used a Lucas MEQ 10072 for the unleaded petrol injection.

M.G. Maestro 2.0 Turbo Engine. (1989 – 90) M.G. Montego Turbo Engine,(1985 – 90)

In October 1988 500 examples of an in–house developed turbo series of the 20H engine were fitted, (the MG Metro Turbo was Lotus developed) with a Garrett T3 turbocharger and intercooler, single electronic controlled HIF44E carburettor with variable choke, and a lowered 8.5 to 1 compression. It was as the 20H, later 20HE15, with sodium cooled exhaust valve stems, it produced 152bhp at 5100rmp and 169 lb/ft torque at 3500 rpm, close to the 'C' series and V8! Camshaft timings were 13;47;55;21, and gudgeon pins were fully floating, unlike the other versions with press fit in the connecting rod. Piston rings were different on the Turbo, as were the valve collet arrangement. The turbo ran at a maximum of 10psi, and used an intercooler before the carburettor. Zero to 60mph took just 6.7 seconds.

Due to oil consumption on the Turbos, the valve stem oil seals were changed from VIN 554319, (chassis number) the new seal being combined with the seating. Inlet valves are flash–chromed for this seal, and only later valves must be used, part No. UAM7713. Do not mix early and late valves and seals. During 1985 the 20HB engines on, had larger diameter crankshaft and camshaft, a shorter cylinder block, (termed the 'O2', used on the later Rovers) repositioned oil filter, oil pressure valve, and alternator. It also had a modified water pump and cam timing belt tooth profile, and slightly different belt tensioner. Not the easiest turbo car to drive alas.

Oil emulsification was a problem on all these models, the cold air hit a large side expanse, causing the vent system to clog up with 'mayonnaise'. Austin/Rover dealers issued parts to affect a cure, though lagging the affected pipes helped. Other little things to give you grief were earthing the battery accidentally to the airflow meter body, with a loose spanner perhaps. This simple action can ruin the circuit board in the Engine Control Unit, (ECU).

The Rover 620 and 820 (Sterling) 'T' series Turbo engine is often 'borrowed', for the later MG Montego and Maestro. This 'super' O2 series is called the 'T' series in the Rover, being the last version of the 'O'. There were 45,368 M.G. Montego's, of these 7,355 were Montego Turbo models; and 33,230 M.G. Maestro's made. Interestingly, if you add up the totals of production give, you find that 33% of all M.G's ever made are saloons.

Use of the 'O' series.

Make and Model	date introduced
Original MGB installation, (two only)	September 1972–ish. development engines.
1700cc Morris Marina/ Ital	September 1978
2.0 Morris Ital Automatic	September 1978
Austin Princess 2, 1700 (wedge)	July 1978
Austin Princess 2, 2000	July 1978
Austin Ambassador 1700	July 1982
Austin Ambassador 2000	July 1982
Sherpa van	1980, (also as a diesel)
Rover SD1 2000cc	1982
M.G. Maestro 2.0	October 1990
M.G. Montego 2.0i	1984
M.G. Maestro EFi	October 1984
M.G. Maestro 2.0i	October 1987
M.G. Maestro Turbo	October 1988
M.G. Montego Turbo	1985
Rover 820 series in 1987,dohc cylinder head as the M16, then improved to 'T' series.	

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Chapter Ten

GEARBOXES and AXLES.(An overview only.)

It would be unfair not to at least mention these important components, as they put the engines power onto the road. Under each model mention is made of the various clutches used, and on the pre–WW2 cars this fed the power into a standard Morris gearbox, with slightly modified ratios. Luckily the MG used the four speed versions, as many Morris cars only ran on three speed gearboxes until the Morris 10/4 series 2. The TA for instance used the Morris 10/4 series 3 gearbox with a lever extension, and Morris 'banjo', all welded tube back axle, so called because with the differential (diff) removed, it looked just like that instrument. These Morris rear axles are easy to identify, as the brakes are single leading shoe,(sls) with a large nut for each brake shoe wear adjustment, and have five studs per wheel. For the TA an adapter was fitted to use wire spoked wheels .The S,V,W, saloons simply used the gearbox and rear axle from the similar sized Morris/Wolseley saloon, with bigger brakes and wire wheel adapters. Also at the same time the TB gained the XPAG engine, it had an improved version of the new Morris 10/4 Series 'M' four speed gearbox, with a selector extension from the top cover. The same rear axle was used. On the heavy Morris saloon cars, this axle gained a bad reputation for breaking half–shafts. The YA gearbox is similar to the TB, but has a rear extension for the gear lever. The Wolseley 4/44 and sv Morris Oxford/Cowley used the same gearbox, but adapted for column change.

It was not until the arrival of the TD in 1952 that M.G. adopted the new Nuffield rear axle that split lengthways, and used a tapered half–shaft end to locate the hub on. This was fitted to the YB saloon, (five studs) the Wolseley 4/44, early 15/50, and all the Morris, Riley saloons, and small commercial vehicles,(all with four studs) some up to 1958, and was designed for pressed steel wheels. Adapters were again needed for wire wheel conversions. At the same time this Nuffield rear axle was introduced, Austin were using their new all welded tube 'banjo' rear axle, introduced for the Austin A40 in 1947, and the M.G. Magnette ZA has this fitted, along with the cast aluminium Austin gearbox BMC adopted. This axle was for pressed steel wheels, if wire wheels were to be fitted, half shafts and adapters were needed. The gearbox of the ZA onwards dates back to the Austin 12hp of 1935, with its three synchromesh gears on 2nd, 3rd, and top. Second and third synchromesh is very weak, and often wears out in 6000 to 7000 miles. This gearbox and rear axle was fitted to all 'B' series M.G.s (i.e. MGA, MGB, and Farina) until the MGB adopted the stronger Sherpa van four synchromesh gearbox in 1967. All except the Farina could have an overdrive fitted. The BMC banjo rear axle was used till 1967 on the MGB roadster, when it was replaced by a stronger Salisbury axle, again from the commercial half of BMC. The MGB GT had this axle from new, in 1965. Note the MGB wire wheel rear axle case is slightly narrower than that for pressed steel wheels.

The 'A' series M.G.s used the Austin A30 gearbox, itself dating to the Austin Eight of 1935, and adopted by BMC. It was fitted with a smaller banjo rear axle again coming from the A30 of 1952. The A30 gearbox was put into the sump of the Mini in 1959, and so saw use in the ADO16 1100/1300 M.G.s. Luckily it was improved for the M.G. Metro 1300. On the rwd Midgets, the filler and level plug moved about, so it is possible to have an axle with a drain plug, and no filler plug, or two filler plugs and a drain plug, if you swap bits over. Early differentials had the filler on the nose casting, later on the rear banjo cover. The Midget 1500 uses the Marina cast iron four synchromesh gearbox, its design coming from the same car the engine came from, the Standard Eight of 1952, via the Herald and Spitfire. For those looking for second hand parts, the Marina 1100 Van used the BMC 'A' series gearbox and banjo rear axle, but the Marina 1300/1800 used all Triumph sourced parts.

Automatic cars such as that available on the Mk4 Magnette, Marina 1.8, the 1800 MGB, and the

MGC, use the Borg–Warner type 35 gearbox, with a fluid–flywheel, (torque converter) instead of a clutch. The flexi–plate that bolts the torque converter to the rear of the crankshaft has been known to crack up, spares are scarce.

About mid 1962 BMC swapped over from eight 'square' splines on its gearbox first motion shafts and axle half shafts, to twelve 'star' splines which are stronger and wear less. Hence check half shaft ends carefully, and fit the correct clutch centre plate. The MGC and MGB V8 used heavier gearboxes and rear axles for obvious reasons, adapted from the bigger BL/Rover saloon car/commercial range. The major differences between the M.G. use of the Morris, and later BMC axles, is the ratios AND the half shaft lengths.

During some production runs, M.G. changed specifications, like the VA changing from cork–in–oil clutch to a dry clutch, or the YA clutch being enlarged along with first motion shafts just before the YB, on the introduction of the TD. The Midget/Sprite gained a diaphragm clutch when it went to the 1275cc engine, having earlier had the stronger ribbed gearbox fitting, itself following a clutch change. This causes problems with clearance in the early cars bell housing if a later clutch is fitted. The 1500 Midget has a huge bell housing on its Marina 1300 gearbox, as the same gearbox is used on the Marina 1800 and 1800TC, with a big clutch. The Farina owner can be caught out by the clutch centre splines, changing to star splines on introduction of the MGB. Anyone with problematical synchromesh on his MGA, ZA, Mk3 Magnette, can do no better than obtain the later Mk4 Magnette steel cones that last a lot longer than the brass ones originally fitted.

The Longbridge M.G.s as they are termed, the fwd Maestro and Montego, use either Volkswagen Golf, or Honda Accord/Triumph Acclaim based gearbox/drive units. The MGF uses that based on the Rover 200 series, on the end of the engine, not in the sump.

No detail of modifications has been entered into, and there were lots of them. See your workshop manual, or write a book on them.

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Chapter Eleven

Conclusion.

Where To From Here?

Inside the MG story are engines that never made it to the public. Others eventually were used, but not many knew from whence the engine came. The V4 engines were just BMC copying other people like Ford, (whose UK V4 was a terrible engine, and even the German Ford V4 used a counter–shaft because of balance problems). The 'O' series was made for the MGB, to give the car further life. This single ohc c engine would have improved the car, especially with the fuel injection and turbo offered as well. Abingdon was closed the year this engine was ready for the USA pollution–free market. The 'O' went to the Morris Marina, then the Montego and Maestro. The 'O' has the DNA of the 'B' series, and the Rover M16 engine is a twin ohc version.

Was the M.G. 1275cc Midget engine deliberately kept 5 bhp less than the 1275cc M.G. 1300's 70 bhp so as not to seriously embarrass the MGB? Or did BMC simply not invest any more to improve the cars? The last MGBs, Midget, and MG1300 were all within about 2 seconds of each other’s 0 to 60mph times during the late 60's and early 70's.

Engines used in M.G. cars are varied and often unexpected by the uninitiated: a TA Midget with a Series 3 Morris Ten/4 engine indeed; an M.G. Midget with a Morris Minor engine, or a Triumph Spitfire engine and Marina gearbox indeed; or a MGB with an Austin Westminster engine, (MGC); or another MGB with a Landrover V8 engine; or a MG Maestro with a Mk2 Marina engine. This is not the real case as we know, often M.G. were used to test a new engine and develop it for future reliable use in millions of other cars, then going on to improve it for MG use and racing success.

The 1275cc MG Midget 'A' series and Midget 1500, the 1498cc, 1588cc and 1622cc MGA 'B' series, as well as the 1798cc MGB 'B' series are all available as fully reconditioned 'exchange' unit from the big M.G. Suppliers. These can be had leaded or lead free, or even bored out to 1340cc for the Midget, and 1980cc for the MGB, in various stages of tune. They are not cheap, but show how popular these BMC/BL engines still are, as those for the Morris Minor, Austin A40 Farina, and A35 can still be found from the specialists, as can those for the Farina family saloons. All good news, not simply because the engines were used by so many for so long, but because they were also well made. The more specialised engines MG used, like the 'C' series and Rover V8, are available on order, and a warning, they are not cheap at all. But all of the engines in this book can be DIY restored, as most machine shops will be able to source the necessary new pistons, shell bearings, etc. All other parts are easily found at the specialist suppliers. Only the three main bearing 1798cc MGB engine suffers from difficulty of supply, and that is in its slightly larger steel backed shell bearings, low demand not producing a supply. If we do not use them bits will not wear out, then no one will make new bits. Then when we do need something …

Long engine life relies on regular servicing and usage, and things like oil and oil filter changes must be carried out. Austin FX series London Taxis are started up one morning, and can be run for ages, only being stopped to fill the fuel tank and check oil levels, then off again, for months at a time. They last for 250,000 miles or more sometimes, without repair, always being hot. If the car is little used, halve the servicing periods to stop corrosion, as short cold runs build up acids and water in the oil, which will eat away important metal surfaces. It is best to get everything really hot, cover the radiator to impede air flow to speed up the warming up, use the choke as little as possible, and run it for at least 30 minutes if you are doing a 'winter start up' in the garage. To reduce noise pollution for my neighbours, I put an old motorcycle silencer over the exhaust pipe, it cuts down the noise considerably in a small place. Have plenty of ventilation, Carbon Monoxide from the exhaust is odourless and tasteless, you cannot see it, and it kills.

We are told that by the year 2000 lead free fuel will be all that is available. Beware the confidence trickster who will try to sell you 'tin balls' to put into your fuel tank, or any other 'instant' additive that purports to cure valve recession. They are all rubbish, and if they did work ALL manufacturers would have fitted them years ago. Either, as I have done, fit hardened steel inserts to your cylinder head, or hope the large petrol companies come up with a cheap additive that WORKS. If you need a lead free head, all specialists do exchange lead free, at reasonable prices. If you are poor, have just the inserts fitted by a machine shop, and re–cut. Then buy a set of exhaust valves and phosphor–bronze valve guides, assemble your head yourself, at about half the above cost, (i.e. use Metro lead free exhaust valves in your Midget head, from your Rover Garage; or USA spec MGB ones from most MG Specialists.) Long fast runs on lead free petrol, in an unmodified engine, will ruin exhaust valve seats, you might just get away with creeping about at 30mph for a few years, but eventually the seats will just burn way. Grey cast iron valve seats were never meant to be used without tetra–ethyl–lead in the petrol. It was first added to boost the 'octane' rating in the 1930's, but was quickly found to also protect exhaust valve seats, and lubricate valve stems, allowing the use of cheaper materials. Any car that can run on lead free fuel, can use a two–way catalyst. Good news if the EEC insist all cars are to be so fitted, only the high price of the little stainless steel, precious metal lined, ceramic centred, tiny silencer box item is the problem. Over use of the choke, or a worn engine burning oil, will ruin a catalyst in seconds. Interestingly, piston engined aircraft **still** use high octane, 100/130 gasoline, with tetra–ethyl–lead (TEL added.

The cost of rebuilding the common engines, like the XPAG, 'A' and 'B' series is rising. Old stock items are being used up, and MG Specialists have to re–manufacture parts, so costs will have to rise to cover the investment required. If you are lucky, keep your eyes open at garage sales and auto jumbles. Look at the engine numbers on everything. For instance if you see 48G 430 on an engine, you have found a Gold Seal rebuilt Mk4 Magnette 1622cc engine, that will fit a 1600 mk2 MGA. Or 8G 205R that shows a Gold Seal MG ZA 1489cc engine, good for a 1500 MGA as well. (8G was first used for ALL reconditioned engines, till about 1956, when 8G meant 'A' series, 48G meant 'B' series, and 68G meant 'C' series.)

Every book has a deliberate mistake, in this one it is the rounding up of the 'B' Series stroke at 89mm. It was actually 88.9mm. Did you notice?

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