

Morgan 4/4 Series 1

Technical Notes for Standard Special Motor, Burman-Douglas Steering Box, Moss Gearbox, History, Components & Suppliers

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The information collected herein has been assembled from various sources but in particular one person has generously made available his expertise. The sources are listed separately at the end of the document. John Merton has provided most of the material on the motor and was instrumental in the restoration of my own motor Q571E in 2008.

The Standard Special motor, as fitted to the Series 1 Morgan 4/4, is long out of production. Detailed technical information has been collected to assist with the continued operation and maintenance of the motor and various other components.

The information contained within has been collected in good faith and issued not for profit. Responsibility for the accuracy of information cannot be taken by any party involved in the presentation of the information. Corrections, additions, suggestions etc will be gratefully received and will be included for the benefit of other interested parties.

The information is not necessarily complete and is meant to supplement the Morgan Manuals and other available technical data with information that is pertinent today. Some original parts are no longer available but can be replaced with parts from other sources.

As this document developed, other information came to hand and has been added when specific to the Series 1 or the history of Morgan design in general.

1. Standard Special Motor – Introduction and History.

In 1937, Leonard P Lee, head of Coventry Climax Engines Ltd and the son of that company's founder took a decision that was to lead directly to the adoption of the Standard Special engine by the Morgan Motor Company.

Coventry Climax was a long-standing manufacturer and supplier of engines to the car and commercial vehicle industry. They built and supplied the 1122cc inlet-over-exhaust engine which had powered most production Morgan 4/4's since that car's introduction in late 1935. However, the car engine trade had become increasingly problematical for Coventry Climax. Several of its smaller customers including Swift (1931), Vale and Marendaz (1936) had gone out of business and Crossley ceased the car production side of its business in 1937.

Triumph, which had made its own 4 and 6 cylinder engines to Coventry Climax designs under a licensing arrangement, ceased this when it completed the move to its own in-house OHV designs from 1936. Faced with the vagaries of the car trade, Lee decided in 1937 to cease the manufacture of engines for the car trade, concentrating instead on a government contract for the manufacture and supply of fire pump trailers using two existing old engine designs, the smaller design being the side-valve unit from the defunct Swift.

Faced with the fact that its existing contract with Coventry Climax would not be renewed, Morgan was forced to look for another engine supplier. The Standard Special engine was the result.

Incidentally there is no truth whatever in the claims that surface from time to time that Triumph rather than Coventry Climax itself supplied these engines to Morgan. Nor is there any substance to the parallel stories that Triumph either owned or had some management control of Coventry Climax in the pre-war period.

2. Standard Special Motor - General Description.

The motor for this particular Morgan 4/4 is known as the 'Standard Special.' It is a purpose-built overhead valve motor (OHV) developed at the same time (around 1937) as the Standard Motor Company developed a range of side valve motors for its new cars, described as 'Flying' Standards because of some elementary streamlining.

The motor was used almost exclusively in Morgans because it was only ever used in one other car, the very first prototype Triumph Mayflower just after the war. They didn't proceed with its use in Mayflowers after that first car.

According to allocated engine numbers, only 700 'Standard Special' engines were ever made. The last, Q700E is fitted to Graeme Donaldson's car in Western Australia.

In May 1939 the Climax engine was replaced in the Series 1 4/4 by the 1,267cc 'Standard Special' engine. This engine was produced especially for Morgan and had the Morgan name cast into the rocker cover. There were 525 cars manufactured with the Standard Special engine and production restarted after WW2.

In 1947 the announcement by the Standard Motor Co. of their 'One Engine Policy' meant that no more 1,267 cc. units would be available after 1949 and Morgan found it necessary to consider alternative power units. My own car left the factory on 8 May 1950 so it seems that there were still a few motors left over at that time.

3. Relationship to Other Standard Motors.

The Standard Special motor is claimed variously to be descended from the Standard 9 (Morgan factory books), the Standard 10, to be an OHV conversion of the Standard 10 etc but it is really none of these things.

The block and head castings are unique and they are very rough and shoddy indeed despite which it is quite a strong little engine.

It has bearing sizes (big ends and mains) common to the 8, 9 and 10 hp engines plus the same bore/stroke dimensions as the 10, i.e. 63.5 mm by 100 mm.

It uses the pistons and connecting rods from the 10, the crankshaft from the 8 and the higher capacity oil pump from the 12/14 hp engines. In some respects it is quite modern, in others archaic.

The camshaft runs direct in the block as did early Vanguard engines, the bores are desaxed and there are springs at the bottom of the pushrods as well as the top.

Surprisingly perhaps, most replaceable parts i.e. bearings, thrusts, pistons, valves are readily available new. New timing chain tensioners aren't hard to come by while the chain itself can be modified from a Mazda chain.

There are no detailed manuals on the motor but the notes of John Merton that this part of the document is based on, have had a fairly wide circulation including a copy to George Proudfoot (UK) many years ago. The notes tell some of the various tricks and pitfalls.

The equivalent Standard motors of the time were all side valves. The ones they provided to the SS Jaguar were OHV but John does not know if there is any component interchangeability between these motors. This point may need further research.

The pulley may be Standard which is highly likely as they had the same oil thrower arrangement. It is worth checking a pre-war Flying Standard vehicle but any pulleys lying around are likely to have the same problem, i.e. they will be damaged.

The Standard 8, 10, 12 and 14 hp service manual for the years 1939-1946 has quite a deal of information on fixing the side valve engines and a lot of it overlaps with what John Merton has provided. The bore and tunnel dimensions therein are very slightly different to John's details, which he sourced from Repco bearing data. This manual was published by Scientific Magazine of Rockdale and is worth getting.

Power output went from 38.8 bhp at 4,500 rpm pre-war with compression of 6.8 to 1 to 40 bhp at 4,300 rpm post-war with a rise in compression to 7 to 1.

Torque quoted postwar is 61.6 lb ft at 2,500 rpm.

Spark Plugs are Champion N8, Points L10/GL10.

4. Design Antecedents.

The Morgan Company claimed that the Standard Special engine was based on the earlier Standard 9 side-valve unit. Given that engine's stroke of 100mm, this is more feasible than tracing its origins to the earlier 10 hp engine, which had a stroke of 106mm. However others have claimed it is an OHV version of the Standard Flying 10 engine or even an OHV conversion of that engine.

None of these claims is strictly correct. Laban claims that this engine was first offered to Morgan in 1937. If so its development appears to have paralleled the development by Standard of its new range of side valve engines for its 'Flying' series of cars. The offer also appears to coincide with Coventry Climax's decision to exit the car engine trade. Why Standard decided to develop this engine is unclear although they were producing OHV engines in larger sizes for SS Jaguar. Incidentally although Weslake has a claimed involvement in the development of the OHV cross flow cylinder heads for the Jaguar engines, it seems unlikely he was so involved in the Standard Special arrangement.

As far as I can determine, the engine was never used in any production vehicle other than Morgan. However apparently it did power the first Triumph Mayflower prototype after the War and it is tempting on this basis that it may have been tested earlier also in some of the Flying Standard prototypes. Perhaps we will never know.

The cylinder block casting is unique and is narrower than that used in either the Standard 8 or 10 hp engines. There are 10 head studs, each in two rows of five unlike the side valve

engines which had three rows of studs. As well as using the oil pump from the 12/14 hp engines, the 'Standard Special' engine uses the crankshaft from the contemporary Standard 8 with its oil light spigot bush rather than that from the 10 hp cars which had a roller bush. The reason for this is that both the 8 hp engine and the author is advised, the 10 hp engine had full water jacketing around the cylinder bores, whereas the 'Standard Specials' are siamised. This means that the cylinder centres on the 'Standard Special' engine are to the same spacings as the 8 hp engine rather than the 10 hp one whose centre two cylinders are at different spacings.

The 10 hp crankshaft can be fitted to the 'Standard Special' engine but the two centre connecting rods will require modification. Note that the flywheels for the 10 hp and 8 hp Flying Standard engines are the same, except the clutch pressure plate and driven plate are smaller in the 8 hp engine hence their attachment holes are at a smaller diameter.

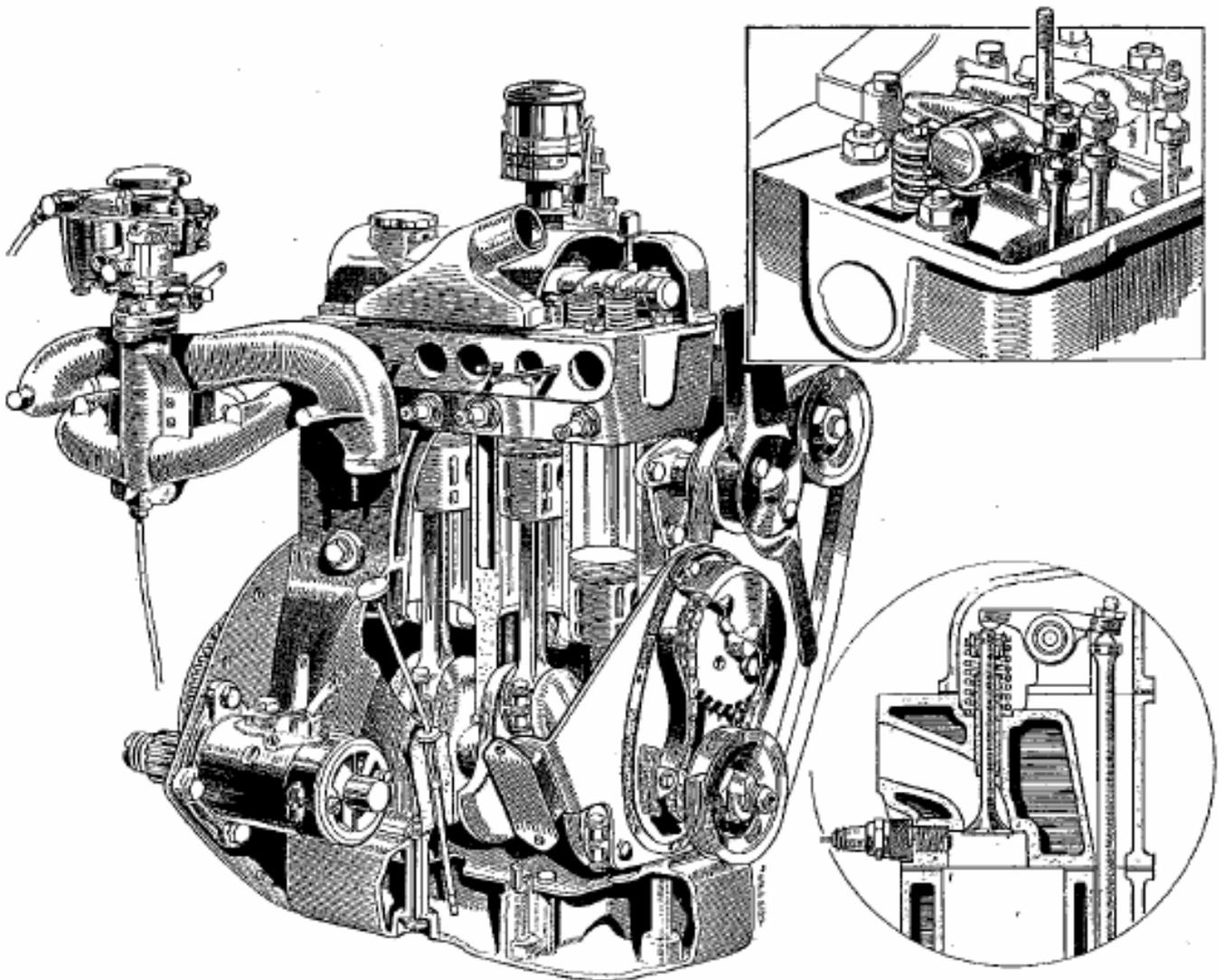


FIG 1B:1 Sectional view of Standard Special engine (1939) showing manifold and Solex carburettor. Top insert shows overhead rockers and pushrods. Bottom insert shows combustion chamber and position of valve.

5. Pricing and Quality Issues.

According to Laban's research, the price of the 'Standard Special' engine in November 1937 was around 25 pounds compared with Climax engines which had risen to 36 pounds from 29 pounds. When compared further, HRG were paying 34 pounds for the Meadows 4ED engine in 1935 (Dusseck).

This makes the 'Standard Special' engine seem a comparative bargain and even more so when contemporary reports indicate it was available as an option for an extra 5 pounds but 'there is no such thing as a free lunch.'

While it is quite a strong little engine (main bearing journals of 2" in diameter compared with the 1.75" in the Austin A40 for example which also had big end dimensions the same at 1.75") it is a shoddy piece of work. The block, head and manifold castings in particular are rough examples indeed of foundry practice. Expect to find left over casting ridges and dags in the porting and jacketing also left over bits of core wire in the water jackets. The cylinder head casting is so rough that I doubt whether Weslake would have wished association with it any way.

We have found considerable weight variations between connecting rods and some crankshafts have been well-nigh impossible to get in balance without the removal of considerable amounts of metal. In the case of the connecting rods, balance has been achieved several times by juggling big-end bolts and nuts with those from the Armstrong Siddeley 16/18 hp engines, which are waisted and a much superior design each weighing about 8 grams less than the Morgan ones.

The starter ring gear is cut into the circumference of the flywheel. The two centre studs on the water exit manifold are drilled through into the two centre exhaust ports. All of the head studs are tapped through into the water jacketing. The problem with rocker breakage when valve clearances are tightened appears to be as much due to shoddy finishing of the head, as much as anything else. The single row timing chain and the camshaft running direct in the block have been mentioned earlier.

Mind you, many of these comments also apply to the small Standard engines. HFS may have been a shrewd businessman but so was John Black, the head of Standard.

6. Design Features.

The 'Standard Special' engine is a reasonably conventional in-line 4 cylinder engine of 1,267 cc with a bore of 63.5mm and a stroke of 100mm. The crankshaft is De-Saxed, the offset being to the left or camshaft side of the engine. Consequently there is a small cut-out at the right-hand bottom of each bore to allow clearance for the connecting rods.

One, two, three and four cylinders are siamised (more later). The crankshaft runs in three main bearings and together with the big-end bearings are of the shell type. The thrust is taken by washers on each side of the rear main bearing. The big ends of the connecting rods will not pass down through the bore and the pistons have to be inserted from underneath. There is a

lead at the bottom of each bore to assist this. There are alloy sealing blocks and filling pieces covering the two end main bearing caps to ensure a flat surface for the sump to bolt onto. These are held to the block with two 5/16" BSF set-screws.

At the rear there are also two horizontal set-screws through this block into the rear oil retainer. The bolts attaching the sump at these two points are Whitworth thread rather than the BSF used for the other sump attachment bolts and the threads into the alloy blocks are all too easy to strip if these are over tightened

The camshaft is on the left side of the motor and generally runs direct in the block (the author has seen one engine with one-piece shell bearings). There are four journals that bear on the block and these are 1 11/16", 1 15/32", 1 7/16" and 1 13/32" going from front to rear. Supposedly the camshaft has been ground to a greater degree of overlap than those in either the Flying 8 or 10 hp side-valve engines but on measurement the author has found no discernable difference between the Morgan camshaft and that from an 8 hp engine.

There is a single row timing chain and a spring steel tensioner blade which is attached to the inside of the timing cover, not to the block. Timing gear alignment is via shims under the timing gear on the crankshaft. Distributor drive is via a vertical shaft from a cogwheel at the centre of the camshaft, this shaft continuing downward to activate the oil pump. Camshaft location and end float are via a steel plate (the camshaft locating plate) at the front which has a half moon cut-out and is fastened to the block with two bolts.

The pistons can be of either the three or four ring variety although most replacement these days seem to be the latter. The top ring has a tendency to break on the former. The pistons and connecting rods are as for the Standard 10 hp engine. The connecting rods from the 8 hp engine are similar but have a smaller gudgeon pin diameter.

There is a steel plate bolted to the front of the engine which incorporates the feet for the engine mounts. At the rear there is another steel plate or engine cover, which provides the mounting base for the bell housing and also the starter motor, which is at the bottom right hand rear of the engine block.

The generator is attached to two brackets off the top left of the engine block.

7. Motor Details

7.1 Pistons and Bore.

All the engine replacement parts are better sourced in Australia than from UK. The new pistons for this engine are made by JP Engineering in South Australia and the valves are Ford Laser/Mazda. These are also unleaded compatible.

Contact details for the JP Group are as follows: -

JP Pistons
25 Innes Rd Windsor Gardens, South Australia 5087

Phone (08) 8261 7222
Email pistons@iweb.net.au

Fax (08) 8261 9171
Web Page www.jp.com.au

The bores are Siamese twinned, i.e. 1 to 2 and 3 to 4. This means that the bore centres are the same as the Standard Flying 8 which, like the Flying 10, has fully water jacketed bores. It also means the Flying 10 centres are a bit further apart than the Standard Special engine. The 10 crank can be fitted but the two centre conrods have to be modified to get the offsets correct. The bore and stroke dimensions are 63.5 mm by 100 mm.

Pistons for the Standard Special are JP 0459

Pistons are occasionally available at auto jumbles or obsolete parts specialists, e.g. Wellworthy (Ref231), Specialloid (M5), Repco (HX 1602). They are commonly marked for the Flying Standard 10 engine, 1937-on.

These pistons are almost always of the 4-ringed variety with a plug in the bottom land to stop the bottom ring rotating and potentially fouling on the hole tapped through into the cylinder for the retaining bolts for the camshaft follower housings. The Repco (HX1602) piston does not have this plug however and no damage would appear to ensue from its deletion.

The pistons came with either three or four rings. The three ring ones haven't been around for a long time and were faulty in that the top rings were prone to breakage. With the four ring pistons, fitting is a bit complicated as the big end will not pass down the bore. You can fit from below if you are good but with the spring inherent in new rings it is sometimes very problematical.

What it means is that the process takes a bit longer than usual, i.e. put the bottom ring on, noting that some pistons have a plug in the middle of the land, push it in from below, up out of the block - the bottom ring won't come out because the big end will catch - fit the top three rings and lower down.

The NOS pistons were generally extremely well made but care should be exercised in selecting and using them now because of possible rust pitting on the rings and the gudgeon pin. Mild rust on the rings can sometimes be removed by soaking in deoxidene (phosphoric acid) followed by careful cleaning with steel wool but gudgeon pins should always be discarded if pitted.

Gudgeon pins in these engines are held in place with wire clips which can usefully be replaced with modern circlips. New JP pistons come with rings and gudgeon pins.

7.2 Pushrods and Valves.

The pushrods have a spring at the bottom to provide a 15 thou clearance at the cam/tappet. The valve clearance at the top end is 22 thou. The problem in reducing this is that the head casting is so crappy that you may well exceed the compressibility of the top valve springs as a result, leading to broken rockers and/or compacted pushrods.

Valves for the Standard Special are 2131 ST from the E3ES Mazda engine and require only slight modification to fit.

Valve Seats were originally cut to a 30 degree angle. With the new Mazda and Ford Laser in Australia for replacements, the angle is normally re-cut to 45 degrees.

Both inlet and exhaust valve clearances should be set to 0.022". A feature of this engine is that an additional spring is fitted to the bottom of each pushrod to maintain 0.015" clearance between the follower and the back of the cam. Never discard these springs or otherwise reduce the valve clearances. This may well lead to compacting of the valve springs, i.e. the movement is greater than their compressibility, resulting in broken rockers and/or impact damage to the pushrods.

In cases where the valve gear is unduly noisy with correctly set clearances, the reason is almost certainly that the oil ways in the valve rockers which commonly have a felt or wire wick to provide a drip feed to the valve stems etc have become clogged.

7.3 Bearings.

The Main bearing is 3M 2212 which is a BMC B-series specification. For Morgan use, the centre shells have to be machined to a width of 1.187" and the oil holes checked.

The Big End bearing is 4K/B 3071 which is for the Austin A40. Each top shell requires a new offset oil hole drilled to match that in the connecting rod.

The Thrust bearing is Federal Mogul 2056BF which is the specification for the Nissan J13 and J15 engines and is also listed for the Ford 100E engine.

Bearings are also sometimes available from obsolete parts suppliers or autojumbles including mains (Repcos 3k3064, Vandervell VP412, VP48272 etc), big-ends (3063, VP1369, VP411, VP226 etc)

'Standard Special' bearings were as fitted to the Flying Standard 8/9/10hp cars from 1937 and some NOS bearings will be marked thus. Big-end bearings fitted to the early post-war Austin A40 are the same size and can be easily modified to suit. Once again, any NOS bearings should be checked carefully for rust/moisture damage.

7.4 Timing Chain and Tensioner.

The timing chain is a Rolon SR901 but it does require removal of several links. If a competitor product is purchased, ensure it has a removable link.

The timing chain tensioner is a T42425 which is a single row Triumph type.

7.5 Rocker Gear.

The rockers are worth a mention. They use a split bush, i.e. in two halves, the space between forming an oil passage. Most likely the pad end has been soldered over. If this is unsoldered you will find a small plug, about one eighth of an inch both in diameter and length which covers the oil way drilled from the pad to the centre where it bears on the shaft.

There is a ball and spring type oil pressure relief valve.

Oil return at the ends of the crankshaft is by scroll thread arrangements. At the front the thread is machined onto the alloy fan pulley, assisted by a dished thrower just inside the timing case. At the rear both the crankshaft and the one piece alloy covering plate (the rear oil retainer) have scrolls machined on them. It is critical that both the rear oil retainer and the front pulley be centred correctly on reassembling one of these engines otherwise some awfully funny noises may result and also the thread on the pulley and rear oil retainer plate ground off.

Lubrication of the bores and gudgeon pins is assisted by a small hole drilled through the big end of each connecting rod, offset to the right hand side. Although superficially the connecting rods look identical, they are in fact matched pairs, the more pronounced big end flange on No 1 connecting rod facing that on No 2 and similarly for 3 and 4. Likewise, the big end bearing shells do not have the centre oil hole common to most these days but two holes offset either side of centre. If using modern replacements, a suitable hole may need to be drilled in each top shell.

The sump is alloy. It has heavy internal baffling and there is a flat horizontal steel plate bolted to the top of these baffles to help control oil surge. This plate has a cut-out at left centre to allow oil pump access. There is a much smaller cut-out opposite this for the dipstick. The oil pump is a compact design (more later) with a fixed gauze filter. It does not have a floating filter and pick up, as claimed in several publications and as was used in the Standard 8 and 10hp engines. This error appears to have originated in an article in 'The Light Car' of May 26 1939.

In fact the design of the sump is such that it would not be possible to fit a pump with a floating gauze uptake.

The actual pump used is the higher capacity one from the Standard 12/14 hp engines, not that from the 8/10hp engines.

Valve gear lubrication is via the pipe from the gallery to the left rear of the cylinder head, up through the rear rocker support pillar into the centre of the rocker shaft and hence to each rocker. The bushes in the rockers are two piece, straddling and forming a central channel which conveys oil down a shaft drilled down the rocker to the pads bearing on the valve stems. These shafts have a felt wick or a piece of twisted wire in them to control oil feed and would almost certainly have clogged up over time and will need to be cleaned out.

The pushrods have a spring at their bottoms where they bear on the tappets with a .015" clearance. This is as well as the return springs on the valves themselves where the specified clearance is .022". While there have been cases where the valve clearance has been reduced, this practice is fraught with danger. In a number of cases it has led to the springs binding, i.e. being forced beyond their limits of compressibility with rocker breakage and/or impacting of the pushrods resulting (more on this later).

8.1 Oil Ways.

The aluminium plugs in the horizontal oil way on the L/H block side are (from memory) 1/2" BSF. Take these out to clean the oil ways and make new plugs out of an aluminium stick, cutting it off flush when screwed home.

8.2 Oil Change Intervals.

The original service recommendations were for oil changes at 2,500 mile intervals and the sump removed and cleaned out every 10,000 miles. Some authorities have suggested that with modern oils these oil change intervals can be extended. This is inadvisable.

The difficulty, especially in dusty conditions is the engine design itself. The oil return arrangements at the front and rear of the crankshaft are via scroll threads machined on to the pulley shaft at the front and the crankshaft at the rear. These are effective at returning the oil but the front one especially is even more effective at drawing dust and other muck into the engine.

Neither the by-pass filter normally fitted nor the full-flow modification which some owners have carried out can cope adequately with this. British cars from around the 1950's period used in Australia had a propensity for main bearing wear, particularly the front main for this reason.

It is recommended for this reason that the oil change intervals for this engine be reduced to 1,000 miles or 6 months, whichever the sooner.

9. Manifold.

There is a one piece cast iron manifold for both inlet and exhaust. It has a hotspot. The exhaust section runs over the top of the inlet, towards the front of the car, whence it curves downward and joins an exhaust pipe that exits through a hole in the chassis rail. The manifold is on the right hand side of the engine, unlike those on its side-valve Standard contemporaries which are on the left.

Carburetion is via a single Solex downdraft model 30 FAI.

10. Cooling.

Water cooling on all engines was by the thermosyphon principle assisted by a two blade fan. The triangular boss and shaft on which this fan and its associated pulley are mounted is bolted with three 5/16" BSF bolts to the right-hand front of the block and covers a 3/4" diameter access hole to the water jacketing. These bolts will work loose over time leading to coolant loss and should be checked for tightness periodically, say at 5,000 mile intervals

These engines were never fitted with a water pump. This is an error in a number of books and articles which appears to have originated in an 'Autocar' article of July 5 1946 which incorrectly referred to a 'water impeller unit'.

11. Timing.

The engine is designed to fire at top dead centre at rest. There is a timing arrow on the flywheel and another at the top of the rear engine cover plate. Timing is 1, 3, 4, 2 from the rear cylinder. With the engine in the car it is easier to centre the timing arrow on the flywheel in the bottom hole in the bell housing and to time off number 2 cylinder.

The distributor is of a type common to many British light cars of the time. A sleeve is pinned to its shaft, this engaging with the end of the vertical driveshaft from the cam. This can have a tendency to wear the base of the distributor over time causing the shaft to ride up and the rotor button to grind into the distributor cap. The only spark advance provided is by bob weights – vacuum advance and retard was not fitted. For hawkeyed originality freaks, the flat side of the distributor body will have month and year of manufacture stamped on it, e.g. 2 49. An arrow will point to this.

Another issue to watch is that the driven cogwheel on the distributor driveshaft can sometimes come loose on the shaft and ride up, e.g. if the engine backfires and jumps out of mesh with the camshaft gear. This can be remedied with a snug-fitting thin wall brass tube over the driveshaft to bridge the distance between the driven gear and the distributor's drive sleeve.

12. Condition of Motor Q571E.

This motor is the original motor for my Series 1 that I was able to buy back. The motor had been kept as a spare for another car and John Merton began to sort out and clean various bits when the owner delivered the motor to him. All the major bits are there but it will probably need new studs and bolts for the sump etc. The bits are in Canberra until delivery to Melbourne can be arranged.

The motor is short a starter and generator. There is a bell housing for it and a steering box in good condition as part of the purchase. Some other parts are with me in Melbourne.

What happened was that the motor was dismantled by John Pettit and left lying around for some time and not always well protected from the weather. The rocker gear was frozen and corroded up but John managed to get it free and working again. He advises that it is generally in good order. The rocker shaft is a little worn but in better condition than any of his spare ones.

The front pulley is in very poor condition as is the only spare that John has. The problem is that the scroll oil return thread has been worn away, simply because the front timing case cover wasn't centred properly. On these engines incidentally, if this or the alloy back cover are not done, you will get a noise on the overrun indicative of bad bearing trouble.

John has just about sorted things out on my engine side now except he'll have to make up a new oil thrower washer, get a new front crank nut and get a broken distributor mounting base (cast iron) welded up. There is a rocker cover with the engine and the engine is actually pretty well complete, except the front crankshaft pulley is bugged. It will also need a jackshaft.

The motor is generally in recoverable condition. One stud has snapped at the back - it's one of the ones that attach the back plate which carries the bell housing but should be removable

and is not really critical anyway. Most of the other bolts came out easily but are badly rusted and will need replacing. Interestingly the engine has been bored and sleeved at some stage and the job was done properly.

13. Moss Gearbox.

The Moss gearbox in the Series 1 is considerably different and smaller than the one in the Plus 4/Jaguars which were basically but not quite entirely the same. As far as John Merton can make out, the gearboxes were unique to Morgans. It is a smaller box and uses herringbone gears, a system quite common in the British industry in the 1930's. Spares are pretty well impossible aside from bearings and seals..

The box itself has the Continental shift pattern also quite common in the 20's and 30's, as does the earlier Meadows gearbox. This puts 3rd and top in the plane where first and second normally are and vice versa. This arrangement is commonly but wrongly referred to as 'back to front' by people who should know better and who haven't done their homework properly. Unlike the Morgan books, except perhaps for Alderson from memory, left over Meadows gearboxes were fitted to quite a number of post-war cars. The Jowett Javelin also used a Meadows box but I don't think this would be the same.

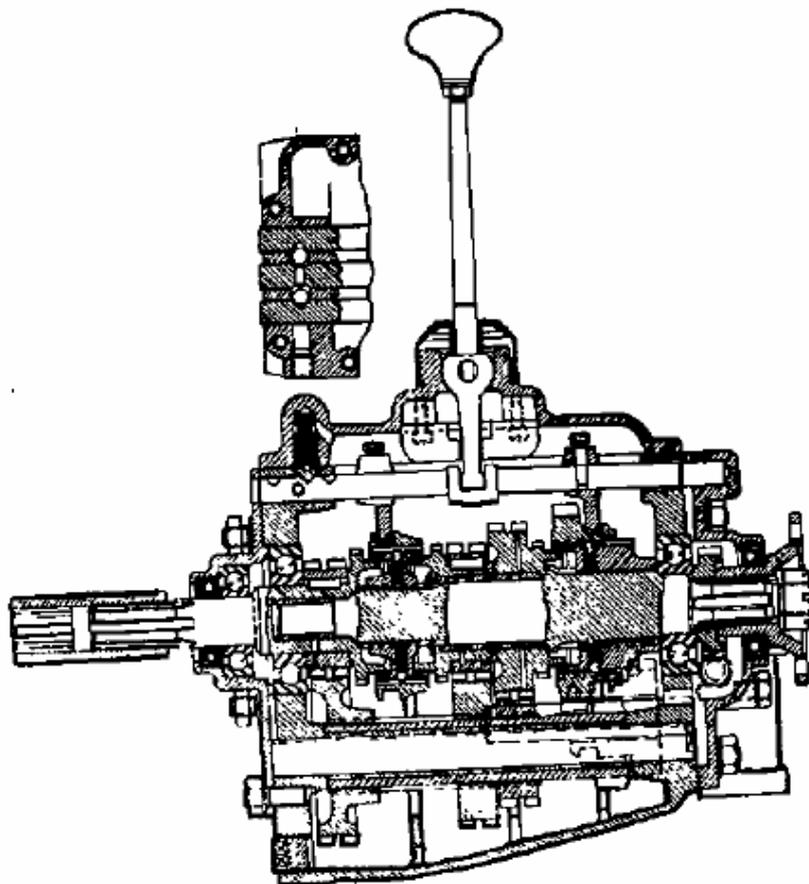


FIG 6:4 Section through early Moss gearbox 4/4 Series 1

14. Burman-Douglas Steering Box.

14.1 Steering Components.

Morgan has had three or four different steering arrangements. The first 4/4's were similar to that of the trikes and simply had a reduction gear mounted on the steering column. This was quickly changed and a Burman-Douglas worm and nut box was installed that Morgan used until about the 1954 season. This box was then dropped for a much cruder Bishop Cam design made by Cam Gears Ltd. This was the box used up until the +8's when the steering box was changed to a Gemmer box. A rack and pinion system was used later.

The old Burman box is no longer available and has almost no adjustments. As it wears it has to be rebuilt. There are no known sources of parts for these boxes. A serious drawback to the system is that it does not collapse as it has a single old type shaft steering column that can impale the driver in a front end collision.

It is essential that smooth driving habits are employed. Do not 'yank' at the steering wheel and do not try to operate the steering while the car is stationary.

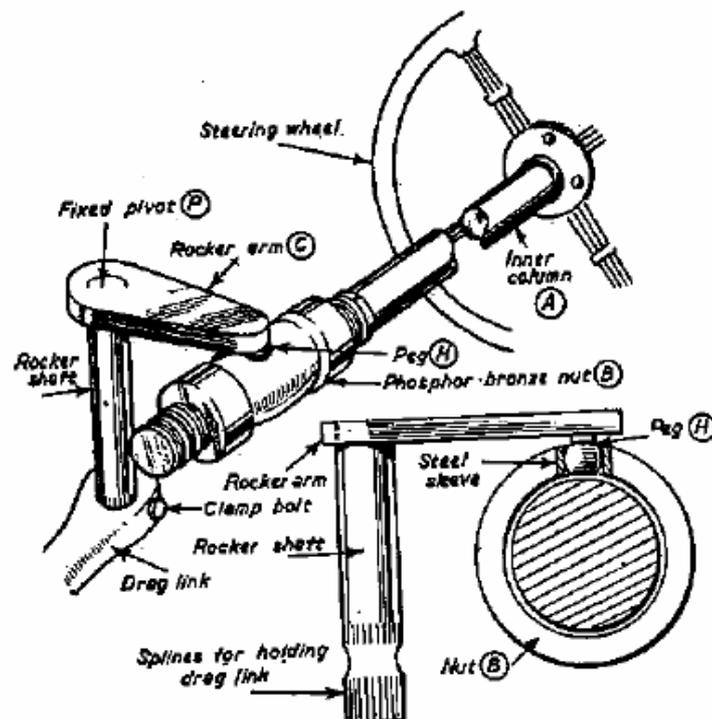


FIG 9:1 Diagram of Burman Steering Gear

14.2 Adjustment for Worm Loading.

The Burman box has an adjustment for loading the worm. The bolts on top of the steering box should also be checked to ensure they haven't vibrated loose.

To check the worm loading it is necessary to jack up the car and disconnect the Pittman arm which is the heavy steel arm coming out from the bottom of the box, from the drag link which is the cross bar connecting to the tie rod.

Carefully turn the steering wheel from lock to lock. There should be a very slight (12 in. pounds) increase in the force required to move the steering wheel through centre. If there is no increase, loosen the locking nut on the screw adjuster located at the top of the steering box. Turn the adjusting screw slightly, tighten the locking nut and re-test. Once there is some resistance felt, no further adjustment is required.

14.2 Steering Box Description.

Apart from a few early cars that had a reduction gear mounted halfway down the steering column, all Series 1 cars were fitted with a Burman-Douglass worm and nut steering box. Variations to this steering box were fitted to many different makes of contemporary British cars.

The system involves a thread, usually a six start but sometimes five on mainly left-hand drive cars, machined on the end of the inner column carrying the bronze nut. Right hand drive cars have a left hand thread and vice versa. There is a hardened steel bush screwed into the top of the nut using a special process.

A peg at the end of the 'L' shaft at the top of the rocker arm transmits motion via the rocker arm shaft to the steering drop arm at the bottom of the box, attached to the rocker arm via a splined shaft and pinch bolt. It should be noted that some cars may have been subsequently modified so a check is required before too much work is carried out. The shaft of the rocker arm rides in two bronze bushes, the top of which has a diagonal cut for about three quarters of its length to provide clearance for the nut.

The only provision for adjustment is for the end float in the column via two large thin nuts under the steering wheel. The inner column is supported at the top by a ball race. At the bottom it is free floating. The location is provided by the nut which is a sliding fit inside the box casing. The system provides one and three quarter turns lock to lock.

This steering box also continued in use on early +4's with minor differences up to 1953/54. the Burman box was then abandoned for Cam Gears, a cam and peg design used on the +4's until replaced by the Gemmer and rack and pinion systems. The Cam Gears is quite a different box to the Burman although externally there are superficial similarities.

The Burman box can only be tested properly for wear on the car, i.e. under load conditions when it is connected up and the car has all wheels on the ground. The steps are as follows: -

1. Make sure there is no end float and the box is securely fastened.
2. Remove the top and end covers and have an assistant jiggle the steering wheel while you check for play between the worm and nut, i.e. wear in the thread, and between the nut and the side of the box.
3. Check for wear in the bushes, i.e. movement in the shaft.

It is unlikely there will be wear between the peg and the hardened steel bush in the top of the nut. If you are desperately unlucky, the bush may be loose in which case you will need to look for another nut as there is not an established method to make these stay permanently tight again.

The drop arm must also be tight on the bottom of the rocker of course and note there is an oil seal above this. The seal is usually rope or felt held in place with a washer with the box housing peened over to hold it in place. This seal can be replaced with a modern neoprene seal.

14.2 Repairing the Steering Box.

The wear in the thread can be addressed as follows: -

1. Clean the nut thoroughly with Prepsol or similar then tin the inside of the nut lightly with solder.
2. Grease the thread on the shaft with a good axle grease but not WD40 or similar as it may flash then screw the nut on about half way along the thread.
3. Melt babbitt metal, heat up the nut and pour the metal down the bush hole rotating the shaft until the metal appears at the ends of the nut.
4. Keep rotating the shaft as it cools to prevent binding.

This will get rid of the play in the thread but the effectiveness of the repair may be limited if the thread on the shaft has much 'hourglass' wear in it.

Play between the nut and the side of the box is addressed similarly, ie by building up the nut with babbitt metal and machining it to a tight sliding fit in the box. Addressing other areas of wear, eg in the bushes should be straight forward.

On reassembly 'work' the bits together using a moly compound and clean up thoroughly by removing all metal dags and filings. Assemble and disassemble several times to ensure everything is scrupulously clean.

This procedure is effective in reducing play at the steering wheel from around 8" to around ¾". There are other measures to improve the steering but these are not included here.

15. MSCC Spares.

4/4 SERIES 1 SPARES PRICE LIST
STANDARD SPECIAL ENGINE

Part No	Description	Cost
SS 001	Cylinder head	£ 1,850.00
SS 002	Cylinder head stud	£ 3.25
SS 003	Cylinder head nut	
SS 004	Cylinder head gasket	£ 48.00
SS 005	Core plug	£ 0.50
SS 006	Engine mount	£ 14.00
SS 007	Engine bearings - big end set	£ 25.00
SS 008	Engine bearings - mains set	£ 25.00
SS 009	Exhaust down pipe (mild steel)	
SS 010	Exhaust tail pipe (stainless steel)	£ 55.00
SS 011	Exhaust silencer (stainless steel)	£ 110.00
SS 012	Exhaust valve set	£ 70.00
SS 013	Exhaust valve guide	£ 1.75
SS 014	Exhaust valve springs (set of 4)	£ 8.00
SS 015	Exhaust manifold gasket	£ 4.95
SS 016	Inlet valve set	£ 63.00
SS 017	Inlet valve guide	£ 1.75
SS 018	Inlet valve springs (set of 4)	£ 8.00
SS 019	Oil filter conversion plate	£ 19.50
SS 020	Pistons - ask for details	
SS 021	Radiator hose	£ 4.00
SS 022	Rocker arm set (4 LH, 4 RH)	£ 385.00
SS 023	Starter Motor Pinion and Sleeve	£ 29.00
SS 024	Starter Motor Pinion Spring	£ 3.00
SS 025	Starter Motor Bush	£ 0.75
SS 026	Dynamo Bush	£ 4.00
SS 027	Armature Pulley nut	£ 1.15
SS 028	Coupe' Wiper Motor	£ 65.00
SS 029	Coupe' Wiper Shafts and Switch	£ 13.00
SS 030	Wiper Arm Securing Nut - Chrome finish	£ 2.00
SS 031	Distributor Plate o/w soldered Condenser	£ 11.00
SS 032	Distributor Cap Carbon Bush and Spring	£ 0.60
SS 033	Distributor Lower Bush	£ 0.85



4/4 SERIES 1 SPARES PRICE LIST
MEADOWS GEARBOX

No parts are in stock at present

MOSS GEARBOX

No parts are in stock at present

MOSS REAR AXLE

Part No.	Description	Cost
RA 001	Crownwheel and pinion - BA8	£ 360.00
RA 002	Crownwheel and pinion - BA8A	£ 360.00
RA 003	Half Shafts - 8 splined	out of stock
RA 004	Half Shafts - 10 splined	out of stock
RA 005	Half Shaft bearing adaptor (both axles) pair	£ 29.02
RA 006	Planet gears - BA8	£ 180.00

TRANSMISSION/SUSPENSION

Part No.	Description	Cost
TS 001	Drive shaft	£ 156.00
TS 002	Drive shaft coupling	£ 37.00
TS 003	Silent Bloc bush - bellhousing/front engine mount	£ 47.00
TS 004	Silent Bloc bush - rear springs	£ 14.00
TS 005	Trunnion (rear springs)	£ 30.00
TS 006	U' Bolt set	£ 15.00

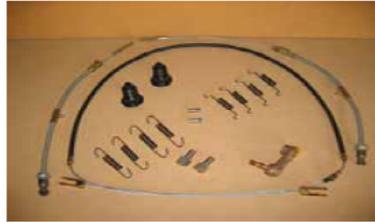


STEERING

Part No.	Description	Cost
BB 001	Steering Box Nut	£ 88.12

**4/4 SERIES 1 SPARES PRICE LIST
BRAKES**

Part No.	Description	Cost
BR 001	Hand Brake cable	£ 44.00
BR 002	Front Brake cables (pair)	£ 66.00
BR 003	Front Brake cable distance bolt	£ 9.00
BR 004	Front Brake compensator	£ 18.00
BR 005	Rear Brake Rod connecting sleeve	£ 7.00
BR 006	Rear brake Rod Rubber Boots (pair)	£ 8.00
BR 007	Shoe Spring	£ 2.25
BR 008	Brake Light Spring	£ 3.00



WHEELS

Part No.	Description	Cost
RW 001	Doomed Wheel Nut (Stainless)	£ 2.50
RW 002	Hub Cap - Early	£ 18.00
RW 003	Hub Cap - Late	£ 18.00
RW 004	Wheel Spinner (threaded for hub)	£ 32.00
RW 005	Wheel Spinner (for spare wheel)	£ 32.00



BODY/DASH

Part No.	Description	Cost
BD 001	Dash Board (wooden)	£ 80.00
BD 002	Instrument Panel (steel)	£ 20.00
BD 003	Choke Cable	£ 24.00
BD 004	Starter Cable	£ 24.00
BD 005	Speedo Cable - Early Head	£ 42.00
BD 006	Speedo Cable - Late Head	£ 42.00
BD 007	Slow Running outer cable	£ 7.00
BD 008	Panel Switch (marked 'P')	£ 11.00
BD 009	Windscreen Pillar Pads (pair)	£ 8.60



**4/4 SERIES 1 SPARES PRICE LIST
LIGHT ACCESSORIES**

Part No.	Description	Cost
LA 001	D' Lamp Side Window	£ 2.00
LA 002	Pork Pie Lamp Side window	£ 2.50
LA 003	Pork Pie Lamp Bulb Holder	£ 6.00
LA 004	Front Side Light Red Glass Lens	£ 3.00
LA 005	Headlight Glass Clips	£ 0.25
LA 006	Dynamo Terminal Cover	£ 3.18



16. Standard in India.

The Standard name lasted into the 1980s in [India](#) where Standard Motor Products of Madras manufactured the [Triumph Herald](#) with the basic 948 cm³ engine as the Standard Herald in the 1960s.

After 1970 Standard Motor Products split with British Leyland and introduced a restyled four-door saloon based on the Herald called the Standard Gazel in 1971 using the same 948 cm³ engine but with a different rear axle as the Herald's 'swing-arm' one was not liked much by Indian buyers and mechanics alike. The Gazel was built in small numbers until 1977.

Production of Standard cars ceased until the Standard 2000, a rebadged [Rover SD1](#) was launched in 1985. The car had a slightly modified old 1,991 cm³ Standard Vanguard engine, as the company could not procure the license to use the original Rover engine on this car and was thus not successful. It ceased production in 1987 and was the last car to bear the Standard name.

17. Morgan Front Suspension History.

As far as John Merton can determine, the earliest use of sliding pillar independent front suspension was in 1873. The actual vehicle still exists in Paris.

The first use in a conventional petrol engined car was Decauville in 1898. These cars were also made under licence as the Eisenach in East Germany by a company which was a forerunner of BMW. This was a rather crude device which had the stubs fixed to the bottom of a kingpin (pillar) which slid through a single bushing at the end of a transverse axle attached to the front of the chassis. The tops of the pillars were sprung by a transverse leaf spring. Several Decauvilles have survived and there is an Eisenach in the Henry Ford Museum. This system was adopted virtually unchanged by Sizaire Naudin in around 1906 and was pretty well a suspension dead-end.

The real breakthrough was around 1903/4 by the New Jersey inventor, J Walter Christie, who combined front wheel drive with a vertical pillar sliding through fixed supports. Springing was provided by a helical coil at the top surrounding the pillar and a smaller snubber or rebound spring at the bottom.

This was copied virtually holus bolus in the Lancia Lambda of 1922, except Lancia also built in an hydraulic shock absorber into the pillar. The principle was also largely followed by Morgan, except Morgan made the innovation of having the pillar fixed and the separate stub axle sliding pillar sliding up and down on it.

The Morgan approach is not a sliding pillar design at all but is actually better because it potentially means less unsprung weight.

John is now investigating when the Morgan system was first erroneously labelled sliding pillar. It is still only early days but it looks as if it could have been as late as around 1951.

It also seems that the British journalists do not acknowledge that the invention was American or that the Europeans ever got anything important from the Yanks.

18. References.

- a. John Merton, Australia has provided the bulk of technical information contained herein including information already included on 'Gomog' that has been further revised to only include references to the 'Standard Special' motor. John also provided the instructions for rebuilding the steering box which I followed successfully in the early 2000's.
- b. MSSC website.

4/4 Series I Technical Advisor & Spares
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Tel:01329 236217
Workshop & Fax: 01329 826246
- c. Gomog website. There is a lot of technical information here, mainly for later models. The emog and NBC email discussion groups are also excellent sources of assistance and information.
- d. Indian site for Standards as Triumph Herald (948cc motor) and later models with 2.0 litre motors.

<http://www.standardmotorclub.org/>
- e. Hari's Motor World for Indian Standard parts.

<http://www.geocities.com/greatkalam/index.html>
- f. 'Morgan Four Owners Workshop Manual' OWM 796 published by Brooklands Books for reproduction of the illustrations of the motor, gearbox and steering.
- g. Anthony Browne, Australia for collation of information provided and listing of Australian sources for components. My car was originally fitted with a 'Standard Special' motor which was repurchased in 2007. The plan is to rebuild this motor and refit it to my car. A radiator, bell housing, generator and starter motor, drive shaft, a manifold and few other parts are already on hand for this. A gearbox is required to complete the assembly and when this has been collected and fixed will be refitted to the car.