

Extract from:

BMC
Australia
Mk. 1 Cooper S
Brakes, Steering & Suspension

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Suspension:**Hydroelastic (Overview)**

Dr. Moulton's revolutionary fluid suspension system was already in use with the Australian Mini Deluxe. Although not quite as civilised as Citroen's system, it was effective and extremely reliable. This was proven quite blatantly with the first figure-eight crossing of Australia in 1965. In which a standard, out of the showroom Austin 1800 and Morris Mini Deluxe were driven around and across Australia (Green, 1966., Journeys With Gelignite Jack). The unreliable reputation that the system is labelled with seems to stem more from later years and after multiple owners and miles.

Probably the only known drawback, is that the Mini's size does not complement Hydroelastic fully. Ride still tends to be firm and the wash effect can be unnerving, especially when trying to correct steer. Nevertheless, the system does work. The fascination with changing a car to 'dry' suspension is usually based on lack of information and hearsay. The only significant times when this would be an advantage, is for certain competition events and sustained towing.

The major drawback with this conversion today, is that good dry suspensions are virtually unobtainable. By time the average one is removed and repaired and yet still to be fitted to the 'wet' car, the owner may well have just repaired the car's existing system. Be warned, if you do fit dry suspension, don't use mystery brand rubber springs, insist on genuine only. Otherwise in a week or two, your Mini will be lower than any deflated Hydroelastic car.

Part numbers were stamped into the side of some Hydroelastic displacers (bags), but these were not usually visible once fitted. The primary means of identification was painted coloured ring/s or tape at the open end of the flexible hose and a painted ring and stencilled part number on the main casing in a matching colour. All displacers were painted in semi-gloss black with the steel (and later alloy) seat in place. The unpainted dust boot was then fitted to the seat and outer lip of the main casing. Vizard, in his first book, How to Modify Your Mini (1977), provides an accurate description and list of the main bags that were available for the Mini. Though these days, owners use what ever they can find.

Age now plays the more determining factor in the selection and use of bags. Either from hose failure at the recessed swage on top of the bag, or from the cars permanent weight deforming the large rubber spring inside the bag. Hose, or more correctly swage failure, can be rectified by many of the nation wide hydraulic hose repairers. The only difficulty with this method is that most repairers don't have an offset chuck to reach inside the lip of the main housing. This requires a threaded adaptor to be fitted before a new hose can be made. The fault is predominantly for front bags, as water and muck sits inside the recess and can't drain out.

The latter problem is identical to the failure of 'dry' suspension springs. One way around this is to swap bags from front to rear and left to right. As a consequence however, some rear hoses don't appreciate being bent to a new angle. Alternately, spacers can be fitted as with dry suspension, refer to BMC Svc. bulletin C39/67. Depending on which Australian shop manual or service notes you refer to, the S sits slightly lower than, or equal to the Deluxe but still retains

significant suspension travel. Although many owners insist on running their cars so low that they drag over every obstacle and provide a shocking ride.

There were several different Hydrolastic fluids available throughout the 1960s. Different consistencies for specific applications, usually identified by a specific colour. All were produced by or for BMC/A. These would eventually be rationalised to one fluid for all cars. Today, Penrite's green Hydrolastic fluid is No Longer Available (NLA). The mysterious brown 'Suspension Fluid Type B' with its high level of sediment has disappeared. Remaining MG Rover Australia dealers should but usually don't stock two genuine forms of fluid for the early MG-F. One is a DIY solution; just add water (AKF 1296M). The other is an alcohol based ready-mix. Personally, I opt for alcohol based only. There's enough potential corrosion in a forty year old system already.

Front

The front sub frame normally has MOWOG stencilled onto its forward rail. This tends to be crooked and upside down once in the car. Hydrolastic top arms are not painted in uniform black. For whatever reason they tend to be grey on the left hand side and red-oxide or black on the right. An additional engine mount support bracket is welded to the top of the left hand rail of the sub frame. This is a feature of all but the very first Australian Minis. Depending on which parts book you read, the bare sub frame for the S is allocated an Australian part number, no doubt due to the local content of this modification. I have not been able to establish whether sub frames were ever made locally.

Two to four small felt off cuts are glued to the upper part of the rear rail, presumably to eliminate any vibration between the sub frame and bulkhead. Unlike dry suspension, no spacers are fitted between the sub frame towers and the body

When fitting the front sub frame, the four tower bolts, two toe board and two floor bolts are secured first. At this point, a gap between the front edge of the sub frame and body may be evident. Instead of just over tightening the front bolts as most panel beaters seem to do, 'U' shaped factory spacers are available. These are fitted as required to fill the gap. No Australian Minis used the front towing eyes as seen in other markets.

From car number 1918, the S utilised tapered lower arms and bushes. These are durable, but the steel sleeve inside the bush tends to grow onto the pivot pin. A more viable option is to fit nylon bushes that don't have the steel sleeve. Nolathane manufacture an ideal substitute, however they only come in red. For the purist, a light coat of nickel anti-seize or copper-slip onto the steel sleeves prior to fitting should lesson future headaches. The popular pivot pin has a large safety boss to stop it pulling through the sub frame. This part is usually finished in bright (silver) zinc. Australian made bottom arms would eventually be introduced, but I do not believe this occurred until the arrival of the Mini K (Mk. 2) range.

Somewhere along the way Australia introduced a tie-bar (castor bar) with a safety pin hole. An 'R' clip was used to provide added security; however I'm unsure on which model this first appeared, possibly the Clubman. Rubber bushes for the tie bars are retained by a domed washer, a thick flat washer and Nyloc nut. Both washers must be fitted to each bar. Otherwise the nut can pull through, or the bushes spread. In the mid 1970s, a single thick domed washer was introduced to replace the two previous components. The Nyloc nut has a 7/16 UNF thread but is made from 11/16" AF hexagonal bar. These are still available as a genuine part (NY607041). Yet another item ignored by Mini 'specialists'. Generic Nylocs are 5/8 hex.

Owners and repairers often ignore the 'L' shaped rebound rubber which is found mounted on the sub frame, underneath each top arm. These parts are usually the worse for wear and buried under layers of grease and grime. Each bump stop is secured by either a coarse self-tapping screw, or a 10-32 UNF screw. Pop rivets fitted to the sub frame prior to painting act as the top anchor points.

Every New Old Stock (N.O.S.) wet top arm I have encountered has been painted in primer grey for left hand and red oxide for right. After noting this, the few original wet cars I've

since had to rebuild have at least confirmed the grey paint. Similarly, I have seen some N.O.S. left hand British lower arms also in grey. All Australian made lower arms (both sides) are black. Both top dry Mini arms are finished in black. Whereas both the original top big wheel Moke arms are grey.

Swivel hubs are similar to the Cooper and use Timken tapered wheel bearings. Inner seal spacers are often missing and ignored by repairers. They are considerably wider than those for drum brake models. Inner and outer hub seals were originally the same and most local bearing kits include only the cheapest available part. A better option is to fit the inner hub seal and plastic shield that was introduced in the mid 1970s. These parts are available genuine and after market and are often equal in price to reproductions of the earlier standard seal.

Ball joint dust boots are embossed with MOWOG and are usually still supplied with genuine ball joint kits. Disc brake cars use the same BJ. lock tab top and bottom, not the lower drum brake lock tab as still occasionally appears in some older kits.

CV.'s have undergone continual change since the 1960s. Most evident is the softer casings introduced in the late 70s. Only minimal areas are hardened which allows the rest of the CV. to be easily damaged when removing or refitting. With the introduction of the Mini Metro a revised mounting lip for the dust boot was created. An appropriate boot was created for the Metro outer CV. and this appears to have been later standardised for 1990's Mini production. With the arrival of the MG. Metro Turbo came a CV. joint with one split pin hole and a revised hub nut tension of 200 ft/lbs. This also became a later production and replacement part for the Mini.

The original style of Mini CV. boot has inverted bellows, all present replacements are external. Depending on the brand, year and origin of each CV. joint, a matching boot may be required, as the position and style of the mounting lip varies considerably. One boot doesn't fit all unless you're only into near-enough repairs. Boots were retained by crimped steel bands; tie wire being an approved method of in service repair.

Either of two styles of drive shaft may be fitted depending on the style of differential drive coupling used. Dunlop/Moulton rubber universal joints are fitted up to body number 1687 and Hardy Spicer steel universals from 1688 on, BMC (196?) Parts List PUB 1011M, The Mini and Morris 1100 Series. This body number change point varies depending on which section of the parts book you read, Differential or Drive shafts. The same dilemma appears in Parts List PUB 1056M, The Mini Series. I don't have both sections of Parts List HYL 3698/1 to make a further comparison. The Hardy Spicer steel universals and matching drive shafts are the same as those fitted to the Mini Matic and some 13" wheel Mokes. They are not the Quinten Hazel nylon and steel replacements for the rubber coupling, nor inboard CV.s. and not the same as those fitted to the Morris 1500.

Hardy Spicer axles have a tendency not to release their original CV joint. Once worn out these usually require some form of cutting tool to save the axle. This possibly explains why the original parts books only list the CV. and axle as an assembly, not as separate parts as with the Moulton version. There is a distinct length difference between axle styles and they should not be intermixed, otherwise axle rock or bottoming could occur.

Genuine Hardy Spicer couplings tend not to have grease nipple provision. If a replacement joint is used, a long nipple will be required for grease gun access. However, these will probably shear off in use if left in place. It is wiser to remove the nipple and fit a 1/4" UNF grub screw and hang onto the long nipple for servicing only. Top suspension arms use an electroplated inclined nipple whereas swivel hubs are generally fitted with short straights.

For today's owner and prospective purchaser, beware of what appears to be just wheel bearing play. Bearing failure is normally caused by improper tightening of the CV. nut. The usual result is a flogged drive flange, nut and collar. Lower ball joints have a spring for additional tension, if the top joint shows signs of play expect to replace the bottom. Separately, such parts are reasonably priced, but can quickly add up to a fortune in most instances. Other

problems involve the bearing race being loose in the swivel hub and flogged ball joint mounting faces. These faults usually result in the need for a brand new hub. Few effective and safe repairs can be performed on these areas. Callipers usually have pitting on the exposed portion the piston's chromed sealing face. Therefore, if buying used disc brakes, go looking for good swivel hubs and usable (repairable) callipers; expect to replace all else.

Rear

The rear sub frame normally has its part number stencilled in large characters onto its forward rail. This is accompanied by a blue pentacle in a broken roundel; not unlike the American Army's brand used throughout the Second World War. Both markings tend to be crooked and are obviously done in a hurry. Various other quality control markings are also present. Often in white, they usually signify that bolts have been tightened and brakes are operational. Presumably to eliminate vibration between the sub frame and body, two large half inch thick under felt pads are glued to the top of the sub frame. Some sub frames also have a felt pad glued to the middle of the front rail, just above the hand brake pivot.

The sub frame is rubber mounted at four corners. Although often appearing fine on the car, once removed, bushes usually display severe distortion at their centre. Replacement rubber bushes are cheap but nylon equivalents do exist. Nolathane's product tends to be in red, but I have purchased two sets of black on one occasion. Forward bushes sit on a plated, stepped, steel pin and are secured by a dimpled self locking nut or a Nyloc nut made from 11/16" bar (as per the front tie bars). Trailing arm pins are still secured by plain nuts and spring washers; Nyloc nuts not being introduced until approximately 1969, TP 759 A (May 1969). Rear wheel alignment is limited, but can be improved by shimming the trailing arm's outer mounting points, refer to TP 759 A (section h.1).

Rear wheel bearings were originally ball race as per the rest of the range. At an unknown point these were replaced by British made Timken tapers and secured with a small machined flat washer (refer Svc. bull. C30/68). Cars fitted with ball race bearings use a larger pressed steel washer. All Minis use an interchangeable bearing carrier with various length wheel studs appropriate to the model. The Mk. 1 S continued to use a British sourced part while a local equivalent was fitted to base models. Such items are easily distinguished by cast in part numbers. A complete locally made S type (long stud) assembly was present on the Clubman GT and probably later Mk. II S production. For tapered bearings, the standard rear hub seal is fitted back to front on the S, TP 759 A (section h). This method allows some grease out, but better prevents dirt from getting in. Genuine hub seals are slightly shallower (less depth) than non genuine replacements. Thicker parts will sit proud of the carrier and rub on the trailing arm.

Trailing arms, helper spring bushes and sundry Hydrolastic fittings including the American made Schrader valves with their unique stainless steel caps; all follow the same layout as the Deluxe. Conical rear bump stops with cast alloy spacers limit upward arm travel. These are not the later Australian made 'donut style' as found on the Mini K (Mk 2) range. Trailing arm drop out is limited by a teardrop shaped rebound buffer. This bolted to the front rail of the sub frame and usually buried under layers of road grime. Helper springs are secured to the stub axle by a special clip, not a hole and split pin. Another point often missed by repairers is that the stub axle is a simple press fit. This part is damaged occasionally, from owners trying to undo the one left hand thread, bearing failure, or rattling helper springs.

There are three types of helper spring fitted to the Australian S. The early type (21A 1566), fitted up to car number 1220. This has less coils and a longer, lower eye. The later type (21A 1806), fitted from car number 1221 onwards and a local equivalent of the later type (AYG 7060). This had an unknown introduction but also appears in the Clubman parts list (PUB 1052). There was supposed to be a concurrent change in the strut (between the bag and the knuckle joint) identified by a different colour marking. Every car I've worked on which still has its original markings, has a piece of orange tape around the strut and an orange plastic ring at

the base of the second type of helper spring. This orange marking seems to have been intended to identify the orange displacer in some non S models. However such parts were not relabelled for S use (refer BMC Svc. bulletin C39/67). The strut and its inner shaft are bright (silver) zinc or cadmium plated, though the inner spring is usually raw.

Other

With the exception of the top arms, front and rear end components are painted individually in semi-gloss black. No primer is used, just black paint on bare metal. Nuts, bolts and washers are usually zinc plated and are mixture of bright (silver) and gold (zinc yellow). Individual components and subassemblies are then fitted to their appropriate sub frames and mounted to the car. No doubt after being attacked by a few detailers, the sub frames appear to have been painted as a whole.

Displacers are interconnected on each side by steel pipes. These zigzag down the floors on early cars (as per equivalent British cars) and are more or less straight after the introduction of full length skid plates and a revised floor pressing in late 1967. Early cars had four small shields (front & rear, left & right) to protect the pipes. Shields are made from Galvabond and are secured by additional 5/16" bolts and internal star washers. Pipe to body vibration was eliminated by the use of several small lengths of green, spiral wrap, plastic tubing. Hydrolastic floor pressings of either type, have unique wide retaining tangs spot welded to the floor panel. Plus additional tangs welded to the underside of the boot floor. White plastic sleeves are fitted where the flexible hose passes through the front cross member and the rear sub frame. Two plates which double as lock tabs, secure these tubes inside the front cross member. Two steel rings and six pop rivets hold two tubes in the horizontal towers of the rear sub frame.

It is important to have a four wheel alignment after performing suspension repairs on a Mini. If done properly, this will improve the handling far more than could ever be achieved by lowering the car. Spacers can be used to reduce Hydrolastic operating pressures, similar to the method used to increase the ride height in dry suspension.

Suspension arms, front or rear, wet or dry, are disappearing rapidly. Either from pivot pins wearing through their bearings or more often, knuckle joints wearing through their plastic seat. Strangely, this repair is often ignored. Even though it can't be seen until removed, it is easy to predict, especially when assessing surrounding suspension components. Yet many Mini 'specialists' happily ignore this area, even when replacing knuckle joints. The result is an annoying squeak, low ride height and in severe instances, suspension collapse.

The same knuckle joint is used for front and rear. The genuine item has a special, moulded rubber dust boot with embossed moulding numbers. A reproduction of this boot is also available, minus the numbers. I haven't used a copy yet, so I am unsure whether they are as durable as the original. Some reproduction knuckle assemblies come with a generic tie rod end boot in place of the special moulded item. This style should be avoided as the boots often won't last six months. Whereas genuine boots will usually last the life of the vehicle. Genuine and most reproduction nylon cups are made from grey plastic. All knuckles are essentially the same, however there is a alternative with a slightly longer stem. This is intended for better engagement into the trumpet and can be found on non Australian Minis with twelve inch wheels. Such vehicles are factory equipped with spacers for additional suspension height. The pin length is an evolutionary change and not allocated a different part number. What came next and continued till end of Mini production is a joint with a thicker collar (an incorporated spacer ring if you prefer). This gives the owner a choice of two distinct genuine Mini knuckle joints.

Genuine and reproduction knuckle joints usually come with only a drop of cheap grease. This should be replaced with a generous amount of molybdenum disulphide grease for increased life.

All pivot arms suffer from lateral wear. Unipart exchange rear arms can sometimes be found with a machined plug/end cap fitted to compensate for such wear. Excessive lateral end float can also be increased by the use of mystery brand arm repair kits. Pin machining tolerances tend to be liberal if not erratic. Genuine parts are still readily available and worthwhile. Although there is a genuine parts kit for rear arms, there isn't a kit for the front. Something that should be noted before seeing what your parts supplier offers you as genuine.

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