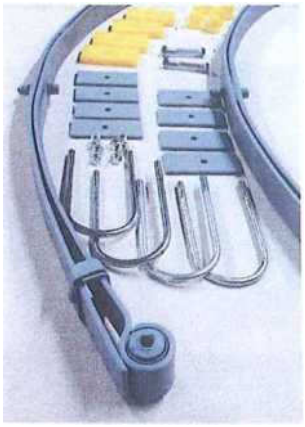
Parabolic Springs

The New Generation of improved Rear Suspension
For all MGB, C, & V8 MODELS.



Right from the very first MG, Old No.1, through to the end of production in 1981 every road going sportscar produced at the MG factory used multi leaf springs as the rear suspension solution. By the time the first of the new generation MGs rolled off the production line in the form of the well equipped and very powerful MG RV8 in 1992, a better solution was used. A pair of parabolic rear springs brought the suspension up to date whilst retaining empathy with the original classic concept.
When you consider that the same system had been used for over sixty years with no discernible difference in design or operation, this has to be regarded as very successful. Perhaps the best way of realising the period when the system was at its best was when MGs were winning in rallies and at prestigious international races such as Le Mans, continuing from early production through to the late sixties. However by the time the seventies arrived, a greater number of independent rear suspension cars were on the market and performing well. Car production at British Leyland was in the doldrums and in order to develop new suspension systems a radical redesign or new car would be needed and in short the money and confidence in the marque was not there to provide it! During the last ten years of production MG was by no means alone in using multi leaf rear spring suspension, and notably, Ford continued their Capri, Cortina, and escort models but with one principal difference. They had started experimenting with single leaf parabolic springs to, on the Mk ll Escorts in 1977 and later fitted them to the Capri 2.8 injection models. So what might well have been introduced if MGB had continued? The 'O' series engine almost certainly to replace the solid, reliable but outdated B series, and (as BL were already doing with the Ital), parabolic springs!

What's the difference?

The standard MG leaf spring is a collection of steel leaves which are centred at the axle but reduce in length from the widest at the top (this one has the eye connections that attach to the car,) to the narrowest at the bottom, They are clamped together at various points using steel bands with rubber sheathing and at the centre a bolt is mounted to give additional clamping plus location of the spring to axle positioning. Collectively they form an arch, which is a very strong and rigid structure, capable of carrying significant loading. However constructing a multi leaf spring viably means that the individual leaves will each act slightly differently creating different flex characteristics within the structure. This makes it very difficult to create a multi leaf spring that will flex predictably and evenly.

The degree of force used in binding together the leaves will impact the overall performance causing differences in friction generated within the length of leaf movement. Finally corrosion will occur in time causing sections of the leaves to "weld" together, whilst rust will cause expansion and at the binding points movement will be further restricted. Of course interleaving, the thin metal shims placed between the spring leaves, assist overall movement and regular lubrication of the leaves is also beneficial. Nevertheless a huge force is needed to break the inertia of the spring when static, and cause it to continue flexing over uneven roads. This is why the standard MG leaf spring gives such a hard ride. When travelling over a small bump the force needed to flex the spring is high therefore instead of flexing it stays rigid, and the force is transmitted through the car body to the passengers themselves.

How do Parabolic Springs work?

The principal difference is that parabolic springs have a taper rolled into them so that the centre is the thickest part and they taper evenly down to their thinnest part at either end. The thickness and degree of tapering is calculated proportionately to its length, the load It will carry, and the maximum amount of travel ie. flexing. The parabolic shape makes the spring flexible but able to carry the load of the vehicle and provide precise stress

distribution throughout its length. The individual parabolic leaves are technically advanced, manufactured from high quality, chrome vanadium steel using modem techniques and heat treatments. This creates a flexing characteristic that can be engineered far more precisely, with wider operating parameters to allowing progressive flexing from lesser road impacts whilst retaining maximum load bearing capability for extreme conditions.
The design used for MGB,C,V8 models uses two parabolic springs. To avoid the interleaf friction that occurs in the standard spring, an extra crank is formed into the lower parabolic spring, to steer it away from the upper mounting spring. The lower spring moves freely and only contacts the upper spring at either end where it sits beneath the shackle mounting eye.
Therefore interleaf friction is eliminated allowing the spring to compress and flex far more easily and evenly.
What is now happening is that the response of the spring to the road surface is now far quicker and smoother. The spring is working much harder in reacting to bumps and dips, and correspondingly the body is isolated more from these shocks in direct proportion.
It is important to note that as these springs work faster, telescopic shock absorbers must be used for the reason that their improved efficiency of operation is required to match the pace of the parabolics.
The result is a smoother, more comfortable ride with improved handling through the greater road contact.

Fitting New Road Springs

The procedure for fitting parabolic rear springs is virtually the same as for standard springs. Use a spring fitting kit.
Jack the car up on the body and rest it securely on stands. Remove road wheels.Taking one spring at a time, place a jack under the axle to take the weight of the side being worked on. Undo the four nuts at the U bolts. Undo the two nuts securing the rear end shackle plates and remove the shackle allowing the spring to lower. Remove the front eye bolt from the front shackle. The old spring can now be removed.
Fitment of the new parabolic spring is basically a reverse of this procedure. Locate the spring front eye into position. Copperslip or grease the eye bolt and carefully drift into position. Fit the nut but do not fully tighten.
Insert new rubber or urethane bushes into the chassis leg and rear eye of the spring. Raise the spring into position and locate the shackle. Again fit the nuts but do not full tighten.
Fit the spring's top pad and plate and drop the new U bolts with rebound platform over the axle and into position. Using the jack, lower the axle into position on the spring, taking care to locate the spring centre bolt into the axle recess.
Locate the U bolts through the lower spring pad and bottom plate, then locate the shock absorber link plate and fit the U bolt nuts, tightening them evenly to full contact plus half a turn whilst making sure the axle is located properly in place on its pads. Remember that the U bolts must be fully tightened when the car is lowered to the ground to place the weight of the vehicle fully on the U bolts.
Repeat the process on the other side.
Once both springs have been fitted, refit the wheels and lower the car to the ground. Bounce the rear of the car to make sure everything is fully settled. Finally tighten all nuts and bolts and after a few hundred miles recheck all the nuts for tightness.

With spong leaves clamped, the centre bolt can be removed and the spacer shims filled

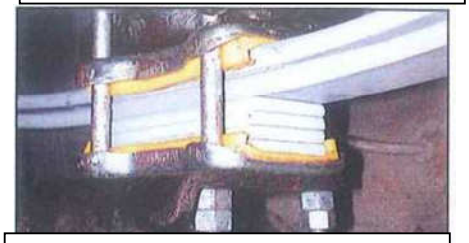
A special feature of parabolic springs is that in having only the thickness of approximately two springs, shim plates are used above and below the spring to make up the overall thickness of the original multi leaf springs that are usually six or seven leaves in total.The reason for this is to preserve the distance of the bottom plate where the shock absorber bottom mounting shackle is sited, thereby allowing the full range of shock absorber travel. To assist In correcting any leaning of the car which is sometimes present for no apparent reason in some MGs, it is possible to remove any shims from above the leaves of the spring and put them below. The overall thickness is kept the same but the inclination of the car is improved.

Parabolic Springs offer lateral levelling facility

Here the shims are fitted below the spring giving maximum ride height

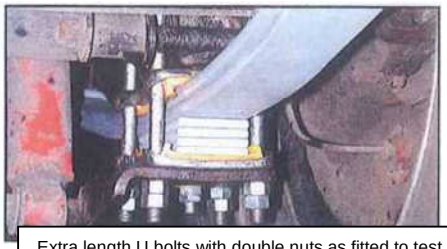
Yellow urethane spring pads improve comfort and durability

Shims fitted two above and two below on one side of car to level lateral height



Close up of yellow Urethane pads fully installed on V8 test car

Yellow urethane spring pads improve comfort and durability



Extra length U bolts with double nuts as fitted to test car. Standard U bolts with nyloc nuts are fitted as standard.

Yellow Urethane shackle bushes. Note free space between spring leaves

Complete installation showing telescopic shock absorber in position and visible clear gap between spring leaves

MGB GT V8 1973 CHROME BUMPER

Driving Impressions

Martin Bentley

This car is mechanically fairly well sorted out, regularly maintained and has until now has been fitted with standard leaf springs and Koni telescopic rear dampers. Yellow urethane bushes are also fitted and the soft compound Yokohama tyres all make for a softer and better than average ride.

With the parabolic springs installed the improvements are immediately noticeable. The car glides over small bumps, potholes and manhole covers that are now virtually undetectable and it is evident that the parabolic springs are absorbing even the smallest shock. Previously with standard leaf springs I would have steered around small potholes to avoid the inevitable shock transfer from the multi-leaf

spring that would jolt both me and passenger upward. Handling has also improved, with the rear tyres seeming to have improved their grip when cornering hard on our local country lanes. This is as a result of the road wheels maintaining contact with the road surface. The initial increased ride height has now settled down since driving for about one hundred miles, to the previous ride height level. My overall impression is that the parabolic springs have improved my rear suspension that was already softer and more comfortable than most others.
The most noticeable improvement and gain will be for those MG owners with the standard and notorious MG "cart-spring ride". I drive across seven "sleeping policemen" twice a day and I don't wince as I drive over them anymore. MG parabolic springs are a great idea, we should have had them years ago!

Roger Parker

Semi elliptic springs as fitted to many classic MG cars, are known as Cart springs for more than one good reason. Having a direct lineage to springs that supported carts of previous centuries. Certainly some degree of progress has been made, such as the RV8, but then any development time has been spent looking at ways of replacing the leaf springs with coils, often with a new independent system, usually at a very significant cost.

Recently I have had the opportunity to drive an MGBGTV8 fitted with the new parabolic design of steel rear springs. The design of these is discussed elsewhere but having been bounced around familiar roads with standard sprung MGBs, especially the firmer sprung V8's, then appreciating the benefits when using fibreglass composite springs, the results with the steel Parabolic springs are interesting and positive.

With the standard sprung axle there is a degree of crudity and harshness in all areas, with the exception when on 'glass finished' surfaces. This sort of surface is rare today so the more common roughness, especially near road edges, really doesn’t do the MGB any favours. This was one reason I changed to fibreglass composite springs some years ago, and have no regrets in that move. The fluidity and smoothness of suspension movement with these was a revelation after the standard steel springs. It was against this background that I drove the MGBGTV8 fitted with the new parabolic springs.

My first observation was that the ride height looked right, not artificially jacked up, so common with normal leaf springs before they 'settle'. Within the first few yards of setting off there was an immediate feeling of similarity with the fibreglass composite springs in the fluidity of the rear axle movement over the far from smooth surface. This was supported by a feeling of control, helped by the telescopic dampers, which gave a clear indication of the tyres being able to follow the road surface undulations rather than bouncing between bumps. Inside there was also a greater degree of insulation from the road surface, which provided a smoother more comfortable ride. Usefully there was also a greater feeling of control. At higher speeds the advantages continued, although now the considerable MGB unsprung weight limits what can be achieved with the original axle.

Overall I came away with a general feel that these springs provide much of what can be achieved with fibreglass composite springs but with the obvious cost advantages.