The Saga of Rebuilding a Rotoflex Triumph Vitesse Independent Rear Suspension

My 1970 Vitesse Mk2 is one of only 3,472 rotoflex convertibles made between mid-1968 and 1971. I bought this car back in 1975 from a guy at my local pub in the UK.

Apart from the normal service items, every 10 years or so the rotoflex couplings or “donuts” on the driveshafts need replacing – you can start to feel these rubber joints “wind up” under acceleration. I knew mine were in a poor state, but replacing them for the 4th time was a job for when I retired. As parts for rotoflex cars (GT6+, early Mk3 GT6 and Vitesse) are getting scarce, the hunt for OEM parts began about 10 years ago. Recently retiring to North Carolina meant it was time to get this job done!

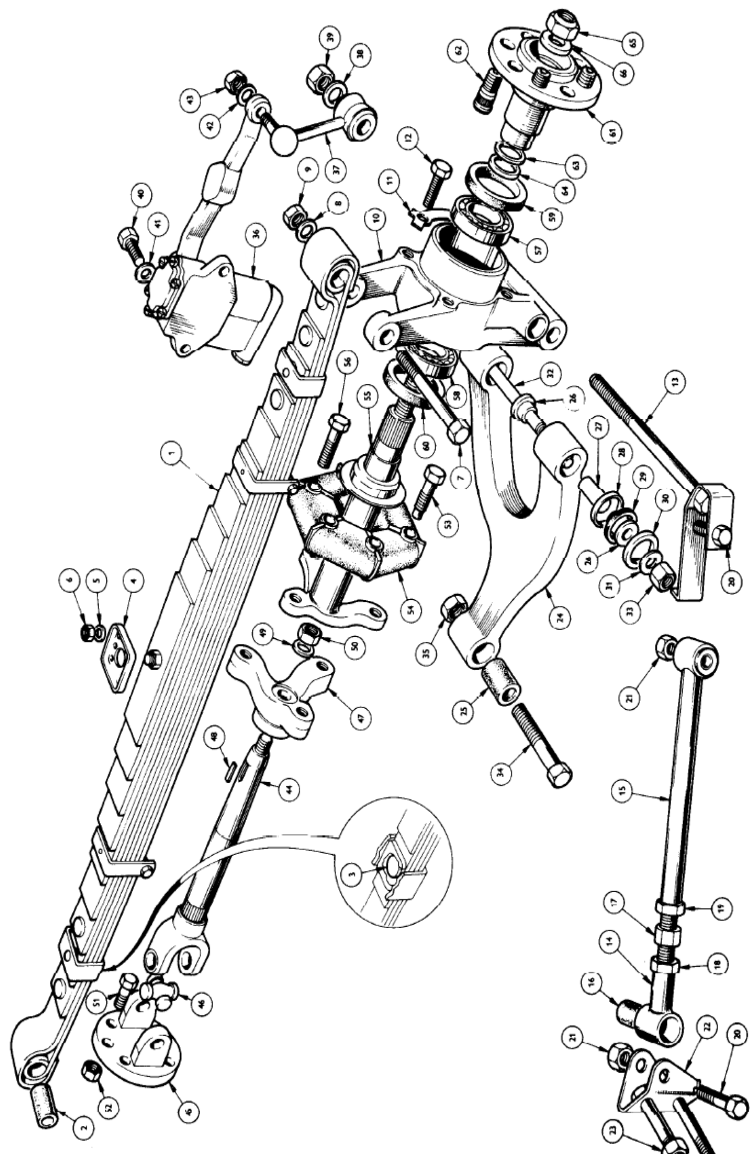

Fig.1

Figure 1 - British Leyland Dealer Training Manual for GT6+ #SST1

Removing the rear driveshafts is similar for any small chassis Triumph, but the bottom wishbone of rotoflex cars makes it trickier as the transverse spring has to be lifted and supported so the hub axle can be unbolted from the spring. This was done using a long prybar and a pair of shackles to lift the spring with the end of the prybar supported by blocks of wood.

Remove the driveshaft from the hub ideally using a Triumph specific puller (Photo 1). The bearings can then be removed and the outer tapered races driven out of the hub using a punch. The inner and outer driveshafts are separated by undoing the rotoflex coupling, however to remove the coupling both the splash guard and spacer on the inner driveshaft must be removed using a bearing puller (Photo 2)

Photo 1 - Remove driveshaft from hub

Photo 2 - Removing splashguard and spacer

The bottom wishbone is bolted to the hub axle with a ½ inch diameter 7½ -inch long bolt which was rusted solid inside the hub. After much banging and heating etc, the only solution to was to drill out the bolt, much easier said than done due to its length.

Looking at the hub axle casting, it was evident that the holes for the wishbone and the shock absorber mounting were machined at the same time, that is the two holes were parallel. The bolt for the shock mounting was placed between V-blocks to ensure the bolt was vertical on the mill – great, but where was the center of the bolt? As the bolt was rusted solid to the steel spacer upon which the wishbone nylon bushes rotate, (Figure 1) both ends of the bolt were cut off and filed to be flush with the spacer – the remains of the bolt being around 6 inches long. After prizing out the outer half of each nylon bush, a push-fit hat shaped guide with a 3/8inch center hole was made on the lathe which slipped over the top of the spacer. Now, it was possible to align the assembly on the mill, knowing the drill was both vertically aligned and centered on the rusted-in bolt. Let's drill! Not so fast – drilling from both ends of the bolt would halve any error if the drill did not run perfectly true and any error would be in the center of the hub axle, rather than at the more critical ends.

Photo 3 - Drilling out bolt

A 3/8inch hole was therefore drilled into the bolt to a depth of 2¾ inches and a stock 3/8 steel rod tapped in. This rod was then placed into the V-blocks on the mill and using the hat guide on the this end of the bolt, the drilling could start. The drill size was increased in stages from 3/8 to 31/64 inches (Photo 3). The assembly was then turned over and re-aligned on the shock absorber bolt. The same drilling operation was used with plenty of Tap Magic whilst watching the rust and swarf emerging from the hole. The depth was controlled so that a small piece of the bolt remained close to the center of the hub. Note that a piece of wood was used to support both the wishbone and the threaded rod placed through the hub axle spring mounting holes. This reduces any vibration while drilling and also protects the mill bed and vice. The wishbone was then removed and the “plug” of bolt in the center of the hub axle hammered out using a metal punch, the remains of the bolt largely disintegrated and the hole was cleaned out by hand using a ½ inch drill. Success!

When all was dismantled, 20 years of dirt was power washed off, followed by sandblasting the items back to bare metal, all bearing and mating surfaces were protected with tape during this process. After painting, each side was reassembled with new bearings, seals, donuts, UJs, bushes and bolts. Sounds simple, but once again it’s not – in order to get the bearing preload correct, it is necessary to shim the outer axle to meet the ½ to 2 thou inch bearing tolerance specified without any grease!

Although a factory Churchill tool exists to measure this, these are rarer than hen’s teeth. Without this tool, trial and error is the only way and at each step the hub and driveshaft have to be reassembled and torqued down to 100ft-lbs, before measuring the play with a dial gauge (Photo 4). This typically takes 3 or 4 tries to get it right and that assumes you have a set of shims laying around. Although I had collected a lot of shims, in the end the right size shim was made on the lathe. The relief is palpable when everything is in tolerance, and then you remember it has to be dismantled one last time in order to grease everything before the final assembly with very tired arms from torquing bolts to 100ft-lbs on the bench for the n^{th} time.

Photo 4 - Measuring bearing preload

Photo 5 - LHS completed, RHS still to do

Rear spring removal comes next, the 6 nuts and studs (4 in a Herald or Spitfire) that clamp the transverse spring to the top of the differential are removed. These studs are only accessible by removing the cover plate found under the rear seat. The spring was then dismantled by prying open the outer clamps (mild steel), removing the center bolt and the U-shaped bolts that hold the spring together. The spring leaves were sandblasted and painted. Why would anyone be crazy enough to dismantle the spring? Triumph in its wisdom, placed rubber buttons between the ends of the longest leaves on all transverse spring cars, allegedly to ensure silent operation but over the years these get squished flat which lowers the rear of the car. Fortunately, these buttons along with the bushes that mount the spring to the axle hubs are still available (Photo 7 - after rebuild). The spring center bolt is not, but as these were made of mild steel, one was fabricated on the lathe.

Photo 7 - Closing the outer spring clamps

Rebuilding the spring required the use of a vice to bend back the outer clamps while holding the spring together, in my case using woodworking clamps, I glued the buttons in place to prevent them falling out during this procedure.

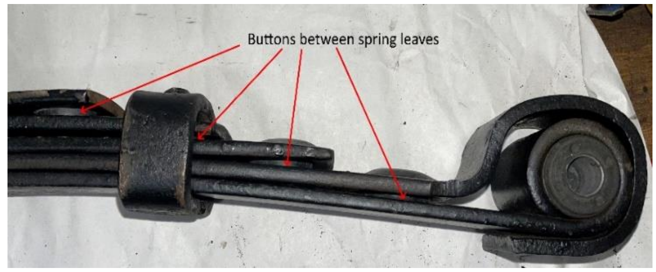

Photo 6 - Position of buttons

Photo 8 - Rebuilt IRS Rear

Having finished the rear suspension (Photo 8), it seemed that checking out the differential and its bushes might be a good idea so it was removed from the car for the first time. The weight of the differential is significant so my retired body (and my wife) decided I should invest in a transmission jack to avoid the possibility of dropping about 50lbs of steel on my chest.

The top of the differential was nasty (Photo 9) - covered in about ¼ inch of pure 1990s English mud and dirt, a large screwdriver was used to get rid of the worst of it and the pressure washer did the rest. The half-shafts were then removed from the differential by unscrewing the four Allen bolts and gently levering out the shafts. A bearing puller was used to take the bearings and leaking seals off the inner driveshafts. Both driveshaft seals and the bearings were replaced (Photo 10)

Photo 9 - Differential as removed

A tool was made to hold the input pinion drive plate so the pinion nut at the front of the differential could be removed. This gives access to the front oil seal which was replaced.
The differential cover was then removed and the old rear mounting bushes driven out and replaced using a suitable threaded rod (Photo 11)

Photo 10 - New seals and bearings

The front half of the differential was submerged in a bucket of kerosene for 24 hours, bushed clean and blown out with compressed air. The pinion preload was then checked using a torque gauge capable of measuring inch pounds. The specification from the factory is 12-16 in-lb, but this is not usually attainable when rebuilding the differential unless all the internals are reset or replaced. As my differential was still very quiet, this was not something I wanted to take on. Typically, in this situation, a reading of about half the original factory setting is acceptable. Mine came in at 7in-lb and has proven to be smooth and quiet in use

Photo 11 - Driving in the new bushes

Getting the differential back in the car using the transmission jack can be done by one person (Photo 12), but pushing the new bushes into the mounting brackets proved difficult. As the brackets for both the differential and lower wishbones are made from steel plate and are welded onto the chassis, the brackets were opened out slightly using a short, threaded rod (Photo 13). The welds between the chassis and the brackets were checked to confirm no cracking had occurred.

Photo 13 - Opening wishbone mounting

Photo 12 - Differential on transmission jack

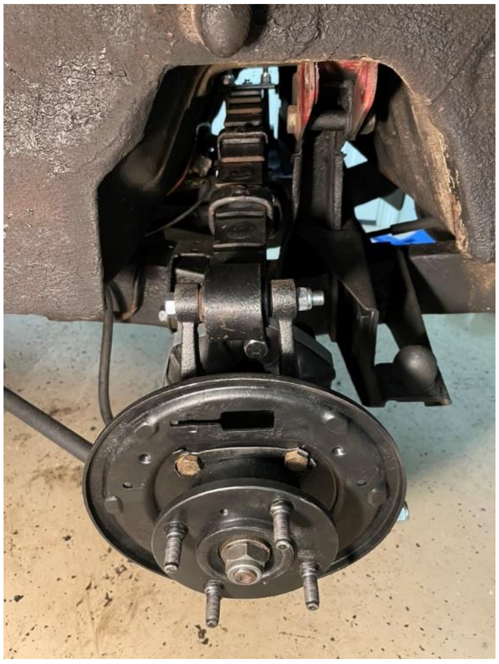

Photo 14 - The driveshaft in place

Putting the driveshafts back in a rotoflex car is difficult as the spring has to be lifted so the bolt between the transverse spring and the hub axle can be inserted (reverse of the removal) however with a new rotoflex coupling in place it is very difficult to pivot the top of the hub axle towards the center of the car sufficiently to line up the bolt holes.
The trick is to place a block of wood between the top of the rotoflex coupling and the underneath of the spring. The bottom of the hub axle is then jacked up. This forces the rotoflex coupling to bend pushing back the top of the axle hub. Trial and error has shown that a block of wood 1¼ inches high works well. By adjustment of the spring height using the pry bar and the height of the hub axle, the transverse spring bush and axle hub mounting can be aligned so the bolt slips in easily.

Only the shock absorbers, brakes, brake pipes, brake bleed and handbrake mechanism to be done. When all is complete, the steel bands around the rotoflex joints are cut off and then off for a test drive. The rear end feels and sounds like it did in 1975!

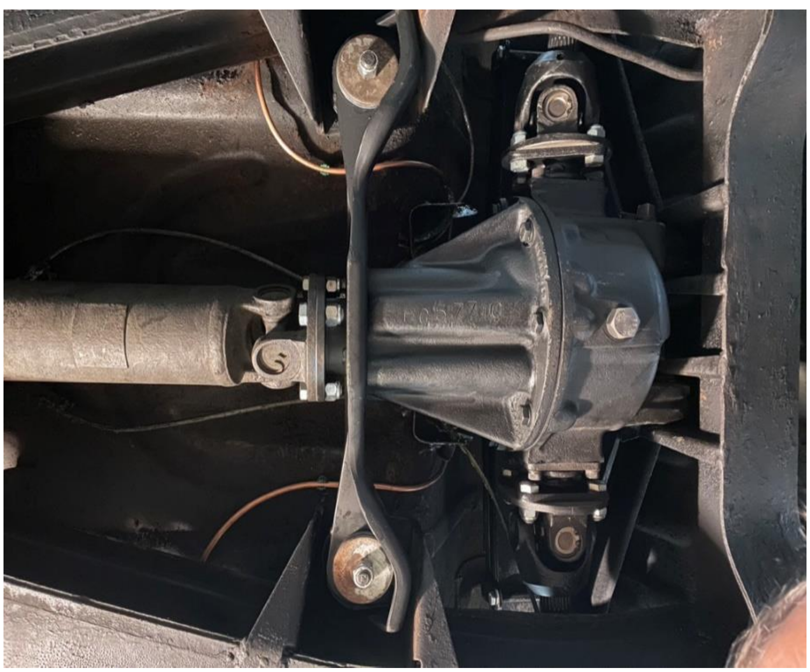

Photo 9 - Job completed

Note that the differential casting has a flat area for a drain plug, however this was deleted after the first Triumph Heralds were made. I added back this early feature to make it simple to drain the differential oil in future should the need arise.

David Brooks – 28th July 2022