

STEERING RACK REBUILD

by Terry Hunt

The Rack comprises two basic parts, the rack and the control. Rebuilding is usually a matter of replacing the seals in them, but this does rely on the parts being in reasonable condition. The most important being the rack itself.

I am not going to do a step by step here as the ROM has a good description of the actions, rather some hints and tips from my experiences. The ones I have done are all Alford and Adler but some of the info is also applicable to the Adwest Unit. When troubleshooting leaks keep in mind that any fluid leaking from one sides' bellows will make it to the other side via the connecting "air balance" pipe. So, drain both sides and check which side is really leaking.

The Stag's Rack is designed to run at around 800psi, The Saginaw pump it uses is a GM item and the GM racks generally run 1200-1400psi. Internally all of these pumps are basically the same, only the relief valve is different. Therefore, it's possible that a pump for a GM product has been installed. If your steering is light or prone to leaks it may be wise to check the pressure the pump is delivering.

Parts

The basic seal set is usually available from Rimmers but at the time of writing there are none available from the usual suppliers in the UK. The Stag Rack is pretty much the same as that used on the Jensen Interceptor Mk3, so Martin Robey in the UK does have a good selection of individual components not available elsewhere, including the backer ring and even a complete control, but unfortunately no racks.

The Rack

The tie rods need to be removed. Not so easy as the one line infers! These are usually pretty tight. There are two lock washers there, one secures the ball joint together and has three lugs, the other with either one or two lugs secures the tie rods to the rack, straighten the innermost lug, and remove the complete tie rod with ball joint from the rack. This may be difficult, and you may end up having to split the ball joint anyway. Use a wrench or even a vice with soft jaws on the flat provided by the toothed end of the rack to hold the rack as you try to undo the tie rod seats. Once off you will find some spacers on the ends, either alloy or plastic which limit the turn and once the tie rods are off just pull off. The end piece is held by a castellated ring threaded into it; a C-wrench can be tried but I found in most cases a drift and hammer are needed to get it started. Once the rack is withdrawn the sleeve can be pushed out towards the end cover end from the control end with a non-marking rod, e.g., wood or pvc pipe.

Inspection

The rack itself needs to be almost perfect, any rust, wear or breakdown of the chrome will cause the seals to fail in short order. There may be a few places that can re-chrome them, but the cost is probably prohibitive. Light rust in the toothed part can be tolerated as long as they can be cleaned up. The other thing to check is the inside of the tube of the housing, this should also be free of defects and made nice and clean. As you prise out the inner seals from the cylinder sleeve make sure the plastic backer ring behind the seal is not damaged and in good condition as



Rack seals as supplied in the kit

this backer ring also prevents the rack from rubbing inside the sleeve. The end piece has a linear bearing inside, check its condition.

Replacing the seals and re-installing

One thing to keep in mind is that the seals, including the main seals not only seal to the rack shaft but seal to the grooves they sit in. It is important to clean out those grooves and make sure they are OK. I use a Dremel with a Scotchpad disk to get inside the grooves to clean them.

The main seal at the sleeve and end



Cleaning out the main seal grooves

piece are installed with the lips towards the centre of the rack. I find that removing the backer ring in the sleeve helps to get the seal in, then it can be re-installed flat side towards the seal. As you slide the cylinder onto the rack the grooves for the piston seal and circlips on it could damage the seal lips, so cover the grooves with some 2-inch Sellotape and lubricate it before you slide it on. The tape can then be removed to install the piston into the housing. The ROM says that you cannot



Refurbished rack

replace the PTFE-type piston ring, but in fact it's easy, it just slips on with no issues.

Once you have inserted the rack into the housing and pushed the sleeve in until the holes line up, you can install the union with a smear of hydraulic sealant I use PTFE paste. When you install the end piece make sure the body mounts are aligned, or even do the final tightening with it loosely mounted on the car - if it's not aligned properly, you will be undoing it anyway.

Before you install the tie rods install the control without its hydraulic lines, and the "thrust plunger" and do the adjustment as per the ROM. This is difficult but very important. I found a small hex bolt



The plunger adjustment. Inset is the bolt I use

that went in the hole and its head provided a recess to keep the dial gauge tip steady (this is also useful when centring the rack, as the exhaust gets in the way of anything longer) The hardest thing is finding a secure mount for the dial gauge, I clamped mine in a vice and used the vice jaws for the dial's magnet.

I suspect that my messing with this setting after the rack was installed, (searching for "stiffness") caused the leaks I experienced, perhaps due to the rack moving around too much inside the sleeve, thus damaging the seal. Its only 3-7 thou, a tiny amount and since I set it and left it well alone, I have had no leaks. Run the rack from one side to the other to assure yourself that it has no stiff areas and leave it alone!

The Control

The inner components comprise five basic parts, an input shaft, output shaft

with gear and bearing, "bobbin" with the PTFE seals and a torque rod. After removing the hydraulic lines, the Control is removed by releasing the three nuts securing it to the rack, it will simply lift off but may offer some resistance so persevere. Once off you will find a large spacer ring left inside the rack, make sure you retrieve that. From there the inner components can be drifted out by using a soft mallet on



Mark the lug (circled) that aligns with the three slots

the input shaft, take care not to damage the shaft as you do that. The "bobbin" can be removed by releasing the wire circlip securing it to the output shaft, take note of how it is orientated as it can be installed 180 degrees out, but more on that later. Before going any further, mark the lug on the output shaft that is below the three slots in the input shaft as this needs to go back together in the same way.

In the input shaft at the knurled part there is a roll pin, drift that out and pull the input shaft upwards, again persevere, the torque rod and seal could resist, try twisting it a little. You will now have the output shaft with bearing and the torque bar sticking out, mark the end of the torque bar that was into the input shaft, again it needs to go back the same way. Remove the bearing circlip and use pullers to remove the bearing, or you can support the bearing and drift it off by hitting the gear end of the output shaft, again take care not to damage the end of the shaft. Drift the lower roll pin out that sits under the bearing, then the torque bar can be pulled/twisted out.

Finally, the body of the control, if you are lucky it still has a dust cover, remove that and you will find a circlip, remove that, the large nylon washer, the seal and the smaller nylon washer.



The disassembled control

Inspection

Check that the input shaft, where the top seal runs is in good condition, any scoring here could cause leaks. Some fine wet and dry will clean up any slight damage but a machine shop may need to be consulted if it's bad. Also check both of the roll pins and the holes in the shafts and torque bar. It is common for these roll pins to become loose causing slack in the steering, 5/32" solid dowel pins can be used if you feel appropriate. Also, check the inside surfaces of the housing, especially at the bottom where the lower seal runs, this seems prone to light corrosion; again, clean it up if possible. Hopefully the surfaces where the PTFE seals run will be Ok. Also check the small bearing at the input, but it should be Ok. Once you have the input shaft cleaned up check that the nylon washers from the housing are not too tight on the shaft, they seem to expand and can cause tightness and wear. Open up the holes in the washers if that's the case. Finally make sure that the two metal seats that are pressed into the body's hydraulic fitting holes are present and in good shape. It is also a good idea to



Control seals used for Alford & Adler controls

clean up the threads of the hydraulic connections at this stage.

Replacing the seals

The control has three sets of seals, at the top and bottom there are X-type seals to keep the fluid in and the "bobbin" has four PTFE seals. There are also two seals on the torque bar. Many do not replace the PTFE seals if they look Ok but it's not too difficult. In all cases use some type-F transmission fluid to lubricate them. The seal kit has many seals that are not used - pictured are the ones used for Alford & Adler controls.

The top seal in the housing is pretty simple, insert the small nylon washer, then the seal and then the larger washer. Finally install the circlip that holds the three together. The bottom seal is best done before you install the bearing, make sure the X-type seal is not twisted as you install it. It is basically a square shape and can twist as you install.

The Torque bar seals do not seem to be included in the seal kit, but I found that some #10 bueno O-rings, (1/4"x1/16") worked here. Clean up the end surfaces of the torque bar with some wet and dry but keep the mark you made to identify the input shaft end. Same for the holes in both input and output shafts where the torque bar is inserted. Clean the holes up as best you can, it will help on reassembly.

The bobbin seals need to be stretched and "resized" to install them. I found that dropping them in some hot water for a few minutes and stretching them over a narrow-necked wine bottle works well.



Stretching the heated PTFE seals over a wine bottle



"Resizing" the seals

Don't overstretch, just enough to get them over to the position. Once they are in place, they will be too loose. Get some clear plastic sheet, (I used an old windshield wash gallon container) and two wide hose clamps. Put some transmission fluid over them and wrap the plastic around the bobbin, with the hose clamps around that making sure the seals stay fully in their grooves, tighten fully and then back the clamps off a turn or so to hold the seals in compression. Leave this for an hour or more and when you release the clamps the seals will be compressed enough to insert into the housing.

Reassembly

It seems that in the factory the torque rods were drilled manually and at random places, not always exactly 90 degrees



Before inserting the roll pins, ensure the lug is centred

apart. This means that it's very important to have the torque rod and input/output shafts in the same orientation as original. It also means that the input shaft, output shaft and torque rods are basically a matched set. All four racks I have opened have had different drill orientations. From here reassembly is the reverse of the disassembly. Make sure that when you mate the input to the output that the lug marked earlier is aligned with the three slots and check that when the roll pins are inserted




Align the two holes in the bobbin with the three slots in the input shaft.

the lug in the input shaft is centered in the slot in the output shaft as per the picture. You may need to spin the torque bar 180 degrees to achieve this. It is best to insert something in the roll pin holes to check this before finally installing the roll pins.

The bearing can be pressed or drifted on now, then the bobbin which must be installed in the correct orientation as it can be put on 180 degrees out which has caused many an issue. Inside the bobbin there are two grooves which line up with the three large slots in the input shaft. Another check is that as you are installing if you orientate the input shaft to look at the large slots the bobbin will show two holes top and bottom, as in the picture. Once in place make sure the wire clip is installed to hold the bobbin in place.

The final operation is to insert the assembly into the control housing, a few taps with a soft mallet on the output shaft and the bearing will slip in. Don't worry too much about this as it only sits halfway in and the spacer will push it fully home as you secure the three nuts.

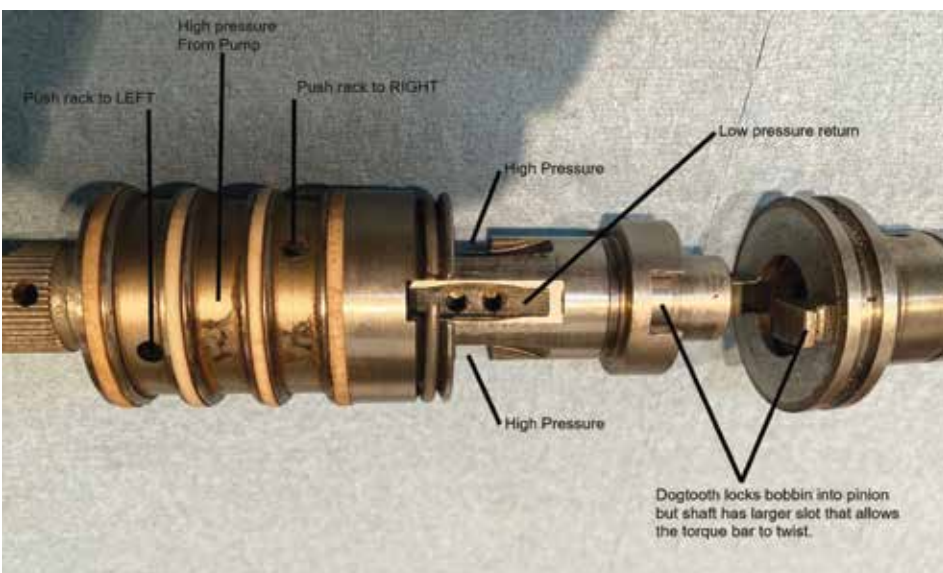
How does it work?

The key is that centered lug. It is held central by the torque rod. When you turn the steering wheel the torque rod gives way a little and one of the slots inside the bobbin aligns with an outside slot in the input shaft feeding high pressure to one side of the rack. At the same time the other bobbin slot opens a path to allow fluid to escape from the other side of the rack, through the centre slot back to the pump. 

BRITISH CAR DAY 2023



The 38th annual British Car Day® held by the Toronto Triumph Club at Bronte (Toronto), Ontario this year celebrated the hundredth anniversary of Triumph and MG car production as well as the 120th anniversary of Standard Motor Company together with the seventy-fifth anniversary of the first post-World War II Jaguar sports-car – the inimitable XK120. Six anniversary cars highlighted on the show field were the Triumph TR2 (70 years), MGF (70 years), Daimler Conquest (70 years), Austin Healey 100 (70 years), Marcos GT (60 years) and Austin Mini Cooper S (60 years). In addition, to celebrate the 100th year of Triumph, a special line up of Triumph cars represented by 30 different models spanning forty-five years of production from 1937 through to 1981, including examples of the TR2, TR3, TR3A, TR3B, TR4, TR4A, TR5, TR250, TR6, TR6 PI, TR7, TR8, Spitfire 4, Spitfire Mk II, Spitfire Mk III, Spitfire Mk IV, Spitfire 1500, GT6 Mk 1, GT6 Mk 2 (GT6+), GT6 Mk 3, Stag, Triumph 1800 Roadster, Triumph 2000 Roadster, Standard Vanguard Phase 1, Triumph 2000 Mk I, Triumph Herald 12/50 and Triumph Continental. Ex-Formula 1 driver, Johnny Herbert, specially visiting from the UK, acted as Grand Marshal for the event (below right). We had 12 Stags participating.



How the control works

