J Type Overdrive, Part III - Reassembly

Everything was disassembled and cleaned and the parts needed for the rebuild were determined in Part II. The reassembly is described in this part. The annulus was installed in the rear casting first. The clutches and epicyclic gears were dealt with next. The final steps were to reassemble the hydraulic components in the main casting and then mate the main casting to the rear casting.

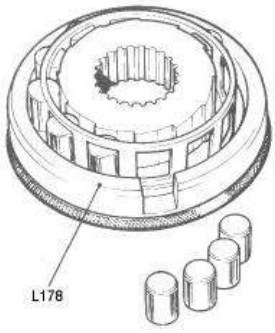
Rear Casting

Installing Annulus: The first step was to press the annulus head bearing onto the annulus shaft as shown in the left photo below. I used a plastic block and then an aluminum block to avoid damaging the inside of the annulus. Next, the annulus with head bearing and speedometer drive gear were slid into the rear casting. I spread a little grease on the casting where the bearings fit to ease the next step. The annulus was positioned in the casting and then placed in the press. A couple 2X4 blocks were positioned under the annulus to avoid the damaging the front edge during the pressing operation. The tail bearing was then slid over the tail end of the annulus and into the casting. A punch was used to tap the outer race of the bearing into the casting. Once everything was positioned the rear flange was used to simultaneously press the head bearing into the casting and the annulus into the tail bearing as shown in the center photo. Next, the front edge of the rear seal was greased and pressed home using a pipe fitting as shown in the right photo. Those of you that have had to deal with the A type OD annulus end float measurements and adjustments will appreciate that we're now done with the annulus bearing. What an improvement!

The area of the rear flange that mates with the rear seal was polished with 400 grit Emory cloth and oil. This can be done on the workbench. I spun the flange in the lathe as shown in the photo on the right. That made the polishing job go fast. The flange was then slid onto the annulus shaft. A little Hylomar sealer was smeared on the underside of the rear flange washer and then the nut was screwed on and tightened to a torque of 80 to 130 ft pounds. The same steel bar used to hold the flange when removing the nut was used to hold the flange here.

Assembling the Unidirectional Clutch: The parts of the unidirectional clutch are shown on the right. The first step in the assembly process was to make sure the one end of the spring was in the hole in the cage. The hooked end of the spring was then inserted into the hole in the free wheel (the part with the little ramps) and the free wheel slid into the cage. With the orientation shown, it was possible to rotate the freewheel clockwise a small amount; it returned to the prior position when released. The next step was to get the little rollers into the cage and hold them while the clutch was slipped into the annulus. One way to do this is to warp the cage with a thick rubber band and then lift the rubber band and slide in the rollers one at a time.

Tool L178: Another way is to use L178 as shown in left photo below. I made a similar tool from plastic pipe fittings for use on the A type ODs and it works fine here (center photo below). The tool is shown in use in the right photo below. The cage is rotated clockwise after each roller is inserted



The tool with the fully assembled uni-directional clutch is shown in the left photo below. Before proceeding I secured the rear casting to the OD stand I made for working on the A type ODs. The stand, shown in the center photo below, is made from scrap 2X4s and 2X6s. The OD is secured with a couple 3/8" bolts through the rear flange. If the small mainshaft support bushing had been removed, it must be inserted before proceeding past this point. The uni-directional clutch thrust washer was positional as shown in right photo below.

The L178 tool wanabe with uni-directional clutch inside was positioned open side down over the thrust washer and the clutch was then pushed out into the recess in the annulus, left photo below. The process works the same if the rollers were secured by rubber bands and the rubber bands should slide off as the clutch is slid into position. The brass oil thrower was positioned next. If everything is correct, the clutch should look like the middle photo below. It should be possible to rotate the clutch counter clockwise. However, if clockwise rotation is attempted, the clutch should engage to prevent rotation. If the clutch fails to move counterclockwise and to lock clockwise, it has been assembled incorrectly and must be removed and reassemble correctly. The final step after everything checks out is to install the circlip as shown in right photo below.

Speedometer Driven Gear: I choose to replace the seal in the speedometer driven gear housing (bush). I've has several gearboxes/ODs that leaked oil past this seal. This seal, like the OD rear seal and the gearbox front seal is designed to be inserted and never removed. I was able to hook the sharp point of the bent end of a scribe under the rear lip of the seal and, by prying at different spots around the lip, work it out. I guess I was lucky this time. The new seal was then tapped into place and the O-Ring on the outside of the housing replaced. The speedometer driven gear was inserted in the housing and then housing with gear slid into the rear casting. The speedometer cable connector was then positioned and secured with clip and bolt.

Thrust Ring, Clutch & Epicyclic Gear

Thrust Bearing & Clutch: This process can be skipped if the bearing wasn't removed. The first step was to inset the bearing into the thrust ring. I used a pin punch around the outer race to seat the bearing. The punch should be moved from side to side to keep the bearing straight as it goes into the thrust ring. The circlip was then inserted to retain the bearing (left photo below). The bearing with thrust ring was then pressed onto the clutch as shown in the center photo below. The pipe fitting concentrates the pressure on the bearing inner race. The circlip was then installed as shown on the right. Care should be taken to assure that the circlips are seated properly; a friend had his OD fail after several 10K miles when one of these clips worked loose and the bearing came out. Fortunately, no damage was done but it's 8 hours plus to remove and reinstall the gearbox.

Epicyclic Gear: The planet gears rotate on needle bearings within the planet carrier. The planet gears were found to rotate smoothly so the planet carrier was not disassembled. The first reassembly step was to insert the sun gear into the the clutch-thrust ring combination and secure it with a circlip as shown in the left photo below. The planet carrier with planet gears was then inserted into ring gear in the annulus (center photo). No matching up the dots as with the A type OD; the carrier can be inserted with the gears in any position. The clutch-thrust ring-sun gear combination was then lowered over the annulus with the sun gear meshing with the planet gears as shown on the right. The white marks on the sun gear are the remains of Whiteout used in the photos in Part I.

Main Casting Hydraulics

The hydraulics can be deal with either before or after the two castings are joined. In fact, most of hydraulics can be accessed while the gearbox and OD are still installed on the car. One of gaskets for the brake ring hadn't arrived and I was anxious to get the little parts back in place before leaving town for a few weeks so I did the hydraulics first. The following photos show the main casting setting on the rear casting. It's just setting there for convenience and was later pulled apart to install the brake ring and gaskets.

Before assembling the hydraulics I installed all the O-Rings. I opened the zip loc bag that I had stored each group of parts, removed the part with O-Ring, removed the O-Ring, found a duplicate from the O ring kit (Victoria British # 2-3344), installed the new O-Ring. I then applied a little petroleum jelly to each O-Ring and put the part together with the old O-Ring back in it's zip loc bag.

The kit had 12 O-Rings. The 3 for the inside of the operating valve were not included in the kit, so only 11 were used. The extra O-Ring was 3/4 ID - 15/16 OD with 3/32 CS (cross section). This was the only 3/32 CS O-Ring and I found no application for it.

Cleaning Main Casting: The main casting was degreased again. The last bit of the gaskets were scrapped off it was then scrubbed with soap and hot water. All passages were blown dry with compressed air. Special care was taken to make sure the control orifice between the dashpot sleeve and operating valve was clear (photo on right). This should **not** be cleaned with a wire, small drill, etc. because the calibration might be changed.

Several of the photos show my hands --- note that they are very clean. Everything should be very clean when dealing with the hydraulics because very small particle can plug that control orifice or keep one of the valves from closing. Once the hydraulics are closed up, the filters do a good job of keeping everything clean.

Operating Pistons: The operating pistons were merely pushed into their cylinders (left photo). These received a thick coat of petroleum jelly to make sure they moved freely without damaging the O-Rings

High Pressure Filter: The filter was inserted followed by the washer and plug. The plug was then tightened to 16 lbf ft (192 lbf in).

Pump: A little petroleum was smeared bottom of the pump body and the non-return valve ball and the the pieces are pushed together. The jelly holds everything together. These parts were then inserted into the main casting as shown in the left photo below. I pulled on the top with one hand and pushed on the bottom with a finger. After the pump body was seated, the non-return valve ball was verified to still be in position and then the plug with non-return valve spring inside was screwed in (center photo) The pump piston with cam follower attached was slid into the pump body (right photo). The plug was then tightened to 16 lbf ft (192 lbf in). The repair manual says to tighten all three of the plugs to 16 lbf ft. The pump plug was considerably tighter than the other two when disassembled so I gave it a little extra twist after it reached 16 lbf ft.

Relief Valve: A little petroleum jelly was smeared on the end of the residual spring to hold it in place and it was then positioned in the end of the relief valve. The valve was inserted into the valve body and the combination inserted into the main casting (left photo below). I used my finger to wiggle the end of the valve as I pushed it to the bottom of the cylinder. The dashpot sleeve was inserted next (center photo). The dashpot thimble-spring-piston combination was then inserted into the dashpot sleeve (right photo below). The plug was then installed and tightened to 16 lbf ft (192 lbf in).



Suction Filter: The suction filter was then positioned with the tube in the pump input channel as shown below.

Sump: Both sides of the sump gasket were coated with Hylomar sealer and the sump cover was then installed. See photos below. The six bolts were tightened to 6 lbf ft (72 lbf in). (I don't know the origin of the rust colored stain on the bottom of the sump cover --- maybe rusty water had laid in it for a while.)

Installing Brake Ring & Mating Castings

Brake Ring: The gaskets on the two sides of the brake ring are different. The correct position of the brake ring is with the cone pointing into the main casting. Both sides of the gasket between the brake ring and main casting were coated with Hylomar sealer and then the gasket was slipped onto the brake ring. The photo on right shows the brake ring with gasket and Hylomar sealer. The brake ring was flipped over and then slipped on the studs and lowered onto the main casting and driven home with a hammer on a block of wood.

The gasket between the brake ring and the rear casting was then coated both sides with Hylomar sealer and the gasket slipped over the studs onto the brake ring.

Mating the two castings: The release springs were installed on the thrust ring bolts and the main casting was lowered onto the rear casting that was still bolted to the stand. The trust ring bolts were positioned as the casting was lowered so that the bolts went through the holes on each side on the main casting. The two upper studs use copper washers. The J type OD in my '76 TR6 leaked around these copper washers because the lock washers distorted the copper washers. I purchased copper washers from Lowe's that were a little thicker than the standard. I used internal tooth lock washers over the copper washers hoping that they are less prone to distorting the copper washer. Hylomar sealer was applied to the copper washers before installation. The other four studs use only lock washers. The release springs kept the two castings apart so that it was difficult to install both the nuts and lock washers. One of the studs that uses a copper washer is extra long so no trouble there. I temporarily screwed one of the nuts on the short stud opposite the long stud and tightened both nuts enough to compress the springs so that the other nuts with lock washers could be started. I then tightened the nuts a little, removed the nut without the lock washer and installed lock washer. The six nuts were then tightened progressively drawing the brake ring into the rear casting and compressing the release springs. The nuts were tightened to 15 lbf ft (180 lbf in).

Bridge Pieces: The bridges pieces were slipped over the thrust ring bolts and secured with the four self locking nuts. The part of the bolt just under the head is knurled to keep the bolt from turning when the nut is tightened. If the knurled part slips out of the thrust ring, the bolt might turn when the nut is tightened, especially when the nut is threaded on to the point where it becomes hard to turn because of the self locking feature. A screwdriver blade can be placed under the nut and used to pry the nut up as it is tightened. This will cause the knurled part of the bolt to enter the thrust ring far enough to stop the turning. The four nuts were tightened 6 to 8 lbf ft (72 to 96 lbf in).

Attaching OD to Gearbox: The OD adaptor casting was reattached to the gearbox using a gasket and Hylomar sealer between the gearbox and adaptor. The pump cam key was inserted in the slot in the mainshaft and the cam slid into position and secured with the wire circlip. The top photo on the right shows the mainshaft with cam.

A gasket with Hylomar sealer was slipped over the studs on the OD unit. Next, a screwdriver and flashlight were used to align the splines on the inside of the planet carrier and the unidirectional clutch. The planet carrier is locked to annulus by the sliding clutch so it can't move relative to the annulus. The rear set of splines are in the unidirectional clutch and can be rotated counterclockwise as required to achieve alignment.

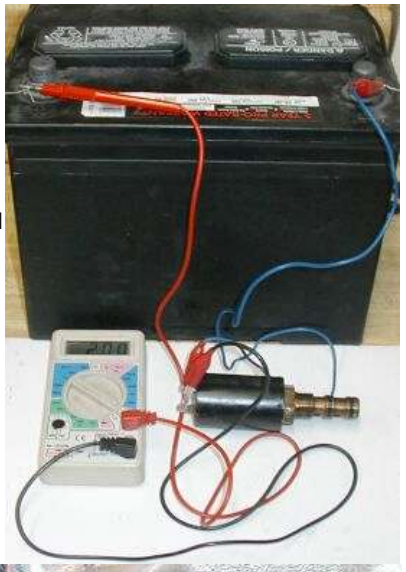
The mainshaft was positioned with the lobe down and the pump piston pushed to the down position in preparation to mating the OD to the gearbox. The OD was then slid over the mainshaft and pushed toward (offered up to) the gearbox. The mainshaft was rotated slightly to engage the splines. On the first attempt the OD wouldn't go in the last half inch or so indicating the splines were misaligned. The OD was pulled back off and the splines aligned again. The OD slipped into place on the second attempt. The OD was then secured to the adaptor casting with the 8 nuts and lock washers.

This procedure to attach the J type OD to the adaptor is much simpler that A type where pump piston must be pushed down and temporarily secured with a wire and the OD must be drawn onto the mainshaft against the force of the 8 release springs.

Solenoid: New O rings were installed the end of the solenoid, the valve stem and the valve end. The valve stem was then slipped into the solenoid followed by the end cap with spring. The end cap was then secured with the circlip. The photo below shows the solenoid and valve components.

The solenoid was tested before installation using the setup on the right. The meter is an inexpensive (<$5) multimeter with a 10 ampere current range. The meter was connected in series with the solenoid. That is:

- The blue clip lead connects one solenoid terminal to the negative battery terminal. (Note: the solenoid is not polarized, either terminal can be connected to negative.)
- The black lead connects from the meter common terminal to the other solenoid terminal
- The red lead connects from the meter 10-Ampere terminal to the positive battery terminal.



The meter should read about 2 amperes. In this case it reads exactly 2.00 amperes. A few minutes earlier it read 2.20 amperes --- the coil must have warmed up. The valve was also observed to move out of the solenoid when power was applied, as it should.

The solenoid was then screwed into the main casting and tightened with the modified wrench discussed earlier and the ground wire installed as shown on the right. The OD wiring consisting of a wire between solenoid and the 3rd/4th gear isolator switch and a second wire between the isolator switch and a bullet connect just outside the gearbox cover were missing so clip leads were used in subsequent tests.

Lubrication& Cleanup: About 1.75 quarts 80W90 gear lube was added to the gearbox through the top before the gearbox top cover was attached. I use the factory recommended GL4 in all my gearboxes and ODs. (See the separate note on Gearbox Lubricants.) The final assembly step was to cleanup the Hylomar that oozed out from the seams. The Hylomar stays sticky for months and can get over everything in the workshop including the cat if not cleaned up at once. The excess Hylomar can be removed with a paper towel dampened with mineral spirits or lacquer thinner.

This completes the Part III - Reassembly. Testing and troubleshooting the OD is discussed in Part IV.