# A Type Overdrive, Part II - Disassembly

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**Before we start:** The A type OD unit is very rugged and not prone to internal failure. I've had a half dozen open and discussed problems with friends on their OD units covering another half dozen. In all these only one has had a major failure, and that is the one that is in most of the pictures in the following. That unit was of the TR3 vintage so it was over 40 years old. It was taken from a junkyard about ten years ago and never used by the present owner. When we opened it up he was glad he never tried to use it as we will see later.

Because this unit had a failure that ground some parts into unrecognizable bits that were scattered throughout the unit, the unit was completely disassembled except for the planet carrier and everything was inspected. The large bearings were replaced as well as the broken parts.

On a unit that has been working or has not suffered a major failure (the typical situation) I do a partial disassembly and through cleaning. I don't do a bearing replacement unless they are found to be rough. There are no other wear components other than the clutch sliding member. I understand that the clutch material does wear after several 100K miles or, more likely, the OD has been slipping for an extended period. The springs tend to shrink with age so they require special attention as we found out.

I replace the rear seal unless I know it has been replaced recently and is not leaking. The only other required materials are the gaskets.

**Special Tools:** Several special tools are required to disassemble and assemble the OD. These tools are easily constructed from material readily available at the hardware store. Pullers of various sizes and a hydraulic press came in handy.

**Cleaning:** The OD and gearbox are removed from the car as one unit. Most Gearboxes and OD are covered with oil and grease. Either the engine or the gearbox is leaking oil (most likely both) that has covered the gearbox & OD and then dirt mixes with the oil making a black gooey mess. The whole unit should be cleaned thoroughly before it is opened. The spray degreasers stocked at the discount auto stores work pretty well. I spray the stuff on, let it set for 15 minutes or so and then use a stiff brush to loosen the difficult parts and then hose it off. In most cases some areas have to be degreased again and maybe a third time. (A couple cans of degreaser are usually required.) After all the grease is off I scrub the outside with hot water and dish detergent to get the film from the degreaser off. This process can make a real mess in the yard. I'm fortunate to have a rough wooded area to do this stuff in. If I lived in the city, I might haul it to a self serve car wash to clean it up. After everything is clean, the oil is drained from both the gear box and OD. The oil flows between the gearbox and the OD unit but it is difficult to drain the oil without removing the drain plugs from both units. The OD drain is the large brass plug.

**Gearbox Stand:** I use a gearbox stand made from scrap pieces of 2X4, 2X2 and a short piece of steel angle as seen in the photos below. The gearbox bolts to the angle at the front. The 2X2 near the rear of the main gearbox casting has a shim tacked to the top to adjust the gearbox so that it is horizontal. The stand took about 30 minutes to make and proved its worth in about 15 minutes of use.



**Remove the small parts:** It's convenient to remove several small parts from the OD unit before detaching the OD from the gearbox, starting with the solenoid. The solenoid sticks up and makes a nice handle. Unfortunately, using it for a handle nearly always breaks the bracket to which it attaches. At ~ $75 per bracket, an expensive handle. (That small aluminum casting is known both as the solenoid bracket and the cover plate. The term cover plate is used from here on.) It's best to get the solenoid off and in a protected place first thing. The following photos show the solenoid attachment screws being removed (left). The solenoid, plunger, actuating lever and collar are then removed. When new there was a rubber boot around the end of the solenoid to prevent debris from entering the cylinder in which the plunger slides. The boots have long since cracked and fell off on most these old units. Replacement boots are not available so we do without. I've operated several without boots for about 15 years with no problems.

As parts are removed they are thoroughly cleaned and inspected. To keep track of the parts, associated groups of parts are placed in small zip lock plastic bags. For example, the parts in the lower right photo were put in the same bag.


The cover that retains the humongous accumulator spring was removed next. It is secured by two bolts to the rear and two nuts on studs toward the front and must be removed properly so that it is not bent or distorted. **Caution, the operating valve must be operated and released a half dozen times using the lever or solenoid to relieve the pressure before removing the operating valve plug or the cover plate.** The nuts on the studs on the forward side of the bracket were removed first. Then the two bolts were unscrewed alternately a little at a time such that the plate comes off relatively straight (left photo below). The center photo shows the spring of the early style accumulator being removed. There was a bunch of metal parts in the sump under the accumulator, including several little ball bearings, an ominous sign. The right photo shows the removal of the spring and spring tube from a later style accumulator. (Another OD was setting nearby that is a future project. The accumulator was pulled from it from it to show a comparison. Later on you'll find we borrowed some parts from it.)



The speedometer bearing & pinion were removed next. This need be removed only if one plans to disassemble the rear casting to replace the two rear bearings. The retaining bolt was removed first, and then the nut from the end of an old speedometer cable was screwed onto the speedometer bearing and a large screwdriver was then used to pry against the lip of the speedometer nut to remove the bearing (left photo below). The parts in right photo were bagged together.

**Removing the rear casting:** I prefer to separate the rear casting from the main casting while the overdrive is still attached to the gearbox. Six studs hold the two castings together. The eight springs between the gearbox and the OD unit push against the annulus that helps separate the rear casting. This time, the castings didn't come apart when the nuts were removed. The ends of the studs were tapped with a punch to break the seal as shown in the middle photo below. The brake ring also came loose from the main casting so the hammer and punch were used to drive it back into the main casting. The brake ring can't be removed until the bridge pieces are removed from the thrust ring. The right photo shows the rear casting ready to slide off. Once the rear casting was off it was clear that the thrust bearing had failed --- more about that later.

After the rear casting was removed, the planet carrier with planet gears and then the sun gear were removed as shown below. The planet carrier was cleaned and the bearings in each planet gear were tested by rotating the gears. All three gears rotated smoothly and there seemed to be no play in the bearings. It was decided that the planet bearings would not be replaced so it was not necessary to disassemble the planet carrier further.

**Removing Main Casting:** The nuts and lock washers from the two bottom studs were removed first. Next, the nuts on the two top studs were loosened; these nuts can't be removed until the main casting is

separated from the OD adaptor plate (left photo below). The nuts on the two long studs were then backed off a quarter inch or so. The casting didn't separate so I tapped it with a hammer and wood block. Once the casting separated, there was sufficient clearance to remove the nuts from the two top studs. The nuts on the two long studs were then backed off together to keep the main casting straight as the springs pushed it toward the rear. After the nuts were removed the casting was slid off. The eight springs were pulled out and bagged.

**Adaptor:** Before leaving the gearbox the adaptor plate surface that mates with the main casting was cleaned and a straightedge used to check to see if it was bent or bowed. If the OD had been previously forced onto the adaptor by tightening the nuts on the studs it is possible that the adaptor is distorted. This will lead to leaks. A severely bent or distorted adaptor can't be used. There have been reports of some success filling minor low spots with epoxy based fillers. The adaptor plate was OK.

**Removing Bridge Pieces:** The nuts were removed from the bridge pieces next. These nuts were originally equipped with locking tabs. I prefer to not reuse these because the tabs usually break off after they have been bent once. These tabs are NA so both the tabs and nuts were discarded and replaced with 1/4-28 nyloc nuts. Once the four nuts were removed the bridge pieces were pulled off the thrust ring and the trust ring was slid out the rear of the main casting. A bronze thrust washer and an adjustment washer were also removed from a recess behind the main shaft bushing in the main casting.

As mentioned earlier, a bit of a disaster was discovered when the OD was dismantled. The thrust bearing, that large bearing between the thrust ring and the clutch sliding member failed --- the balls fell out and the two parts separated. The eight springs then forced the thrust ring (doesn't rotate) into the rotating clutch sliding member. It must have made a hell of a racket. The left photo below shows the back side of the thrust ring where much of the metal has been worn off. The circlip retaining the bearing outer race was also damaged. The center photo shows the front side of the clutch sliding member where again, much of the metal has been worn off. The dark area indicates that it got very

hot. The right photo shows the remains of the bearing. The pieces in the lower left hand corner of the right photo are the remains of the thrust washer between the sun gear and the planet carrier. It was decided to reuse the clutch sliding member since the clutch surfaces, the splines and the collar that mates with the bearing inner race were not damaged. The thrust ring was so heavily worn that the lip retaining the bearing outer race circlip was missing in some places. The thrust ring and circlips in addition to the destroyed thrust washer and bearing were replaced. Because some of these metal pieces were floating around the OD it was decided to also replace the two annulus bearings in the rear case.



**Removing Accumulator Piston:** This OD was an early model with the Accumulator cylinder machined into the main casting. The center of the piston has a hole threaded 3/8-24 (this was previously reported as 5/16 -24 - thanks to Dan Shockey for the spotting the error). A puller was made by turning down the end of a 1/2 inch treaded rod (had a stack of these left over from a church project ten years ago) and then threading 3/8-24. A length of 3/8-24 threaded rod would have worked just as well. Not much force was required to remove the piston. The photos below show the puller in action. After the piston was removed, the rings and the cylinder walls were examined for defects. We were lucky; the metal pieces from the bearing failure didn't seem to have made it to the accumulator.


The photos below show removing the later style accumulator. An extraction tool that expands an O ring into the end of the accumulator piston housing where the spring tube fits was fabricated. The tool and spring tube are shown in the left photo below. The O ring and tool outside diameter is 1.5 inches. The inner diameter of the end piece is 1.25 inches, the ID of the O ring. A 3/8 inch bolt extends the length of the tool. Tightening the wing nut pulls the end cap into the main piece and squeezes the O ring out to grasp the accumulator piston housing. Both the tool body and wing nut had to be grasped with pliers to tighten the nut sufficiently to grasp the housing. In the process, the plastic end piece cracked. (Next time I'll make the end piece of steel or aluminum). Once the housing was removed, the piston was easily pressed out the top of the housing. Everything was in order and no problems found. One interesting note, the washer in the right photo is a low quality hardware store type, obviously added well after manufacture. Putting a washer behind the spring is the accepted way to increase the accumulator pressure.

**Removing Non-Return Valve:** The pump non-return valve is located beside the accumulator cylinder as shown in the left photo below. After the plug was removed the spring, plunger washer, and ball were removed, cleaned, inspected and stored (right photo).

**Removing Pump:** The drain plug and screen filter must be removed to expose the pump.. The photos below were taken after the gearbox had been cleaned up. Much of the oil evaporated from the heat generated when the bearing failed. The outside of the screen was covered by black goo mixed with metal parts. (The later models use a larger plug and the screen is retained by the plug rather than the screw as shown in photos below.)

The pump is pressed into the case and requires quite a bit of force to remove. **Caution - the non-return valve must be removed before the pump body is extracted**. The two screws and plug shown in the middle photo below were removed first. A threaded rod screwed into plug hole was then used to pull the pump body. The threads are 7/16-20. The end of another one of those 1/2 threaded rods was turned down and threaded to make a puller --- right photo below. A length of 7/16-20 threaded rod would have worked just as well. A pipe fitting was used to provide a space to draw the pump into. The pump body came right out as the nut was tightened.

The extracted pump body is shown on the left and with the piston and spring on the right. The hole in the side of the pump body is the seat for the non-return valve ball. The pump components were examined for signs of wear and the valve seat for nicks. The free length of the spring was measured and found to exceed the 2 inch minimum spec.

**Removing Operating Pistons:** The operating pistons were removed by grasping the ends with pliers and rotating the pistons back and forth while pulling out. Upon inspection one of the piston rings was found to be broken. Quite possibly it was broken when initially installed. These rings are no longer available so the new style piston with O ring seal had to be purchased.

**Removing Operating Valve:** The last thing removed from the main casting was the operating valve. The valve plug is on the upper right-hand side of the casting. Unfortunately, the corners on the hex head of the plug had been rounded. A six point socket was tried first, and it slipped. There was no room to get another type of wrench on it. A 1/2 inch nut was driven over the top of the plug and welded. The nut and plug were then removed together. The plug with the large nut attached is shown at the right.

The operating valve components are shown below. The plug and copper washer are new replacements.

**Disassembling Clutch:** As was discussed earlier, the bearing was shattered in the clutch so it was only a matter of removing the races from the thrust ring and sliding member. The inner race was removed from the sliding member using the same spreader that was used on the annulus bearing shown later. An air die grinder was used to cut the outer race to get it out of the thrust ring.

A working bearing can be removed using the following procedure. Remove the circlip holding the inner race on the sliding member. Make two new longer bridge pieces from steel stock. The pieces should extend to each side of the thrust ring far enough so that they an be positioned on blocks in the hydraulic press. The press is then used to push the collar on the sliding member out of the inner race. Once the sliding member and thrust ring are separated, the circlip retaining the outer race in the thrust ring can be removed and pressure can be applied to the inner race to press the bearing out of the thrust ring. I'll update this section with photos the next time I replace one of these bearings.

**Removing Unidirectional Clutch:** The unidirectional clutch sets in a recess in the large end of the annulus in the rear casting (left photo). It is removed it by rotating the center part counterclockwise and

lifting up. The rollers came out of the cage so then we had a bunch of pieces as show in photo on right below. The bronze thrust washer is located behind the clutch.

**OD Stand:** A stable base to hold the OD on end during reassembly is very useful. The old piece of 2X12 used previously had disappeared so the new stand shown on the right was made from scrap lumber. A 1 1/2 inch hole in the center provides clearance for the end of the annulus shaft and nut. Two 3/8 inch holes provide for bolts to hold the rear flange.

**Annulus End Float:** The annulus end float was measured before the rear casting was disassembled. The end float is adjusted by changing the adjusting washer between the rear bearing and a shoulder on the annulus shaft. If the end float is within spec before disassembly, then it should be within spec even if new bearings are installed because the bearings are made to a very close tolerance.

The rear casting was secured to the stand and a dial indicator was positioned as shown with the point against the annulus. The casting was then pushed down for the first reading. The second reading is taken after the casting has been pulled up by placing one hand on each side the top of the casting and pulling up while pushing down on thumbs pressing against the outside of the annulus. The required end float is .005 to .010 inches. If the end float is out of spec, refer to the discussion near the beginning of Part III. This end float was right on .005 inches.

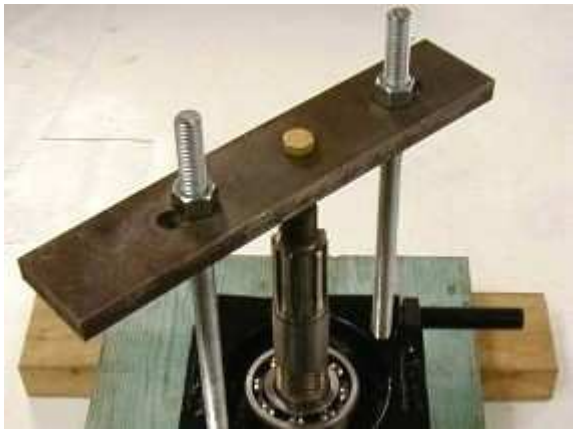
**Rear Flange Removal:** A "flange removal tool" made from a two foot length of 1/4 inch by 1 1/4 inch steel bar (a 1 inch bar will probably work as well) is used to hold the flange when removing the nut. A 3/8 inch hole is drilled close to the edge near the end for attachment to the rear flange. A second bolt is installed in the flange to rest against the edge of the tool to keep the flange from turning as shown in left photo below. This bar is also a "flange installation" tool. It can also be attached to the flywheel using one of the clutch pressure plate bolts to become a "flywheel removal or installation tool". The cotter pin was removed from the flange nut and then a breaker bar was used with the tool to loosen the nut.

A puller was used to remove the flange as shown in the right photo. The black object is one of the cats that live in the workshop. This is the dumb one; she is so dumb her fur should be blonde.

**Removing the Annulus:** The annulus was pressed out of the rear casting using the hydraulic press as shown on the right. The sides of the casting were blocked up off the press cross members. A scrap piece of 2X4 was placed under the casting to stop the annulus from slamming into the steel press cross member if it came loose with some velocity. This was a well behaved annulus that came out gently with minimum force applied. The annulus is shown in the photo below. The middle bearing must still be removed from the annulus shaft.

Note the watch cat sleeping in the background. The mice that live in the work shop must have kept her awake the the night before.

**Middle Bearing removal:** This bearing is also known as the annulus head bearing. A large bearing separator (available from Harbor Freight, ~$20) was used to first push the bearing away from the shoulder on the annulus by tightening the two black bolts in the left photo below. Next, the bearing was pulled along the shaft by tightening the nuts on the threaded rods. The right photo shows the bearing nearly off the shaft. The press fit is only on the shiny section very near the shoulder.




**Rear Bearing & Seal Removal:** A length of threaded rod, some washers and spacers were used to pull the rear bearing (aka annulus tail bearing) and seal from the rear casting. This is the same stuff used to press rear bearings and seals out of the gearbox extension of non OD gearboxes. The rod was secured in the vise as shown on the left. The rear casing and then a spacer and washer were slid over the rod and a nut threaded on and tightened. The lower washer on the rod pressed against the under side of the rear bearing. As the nut was tightened, the spacer pushed the casting down off the bearing. The freed bearing is shown on the right. The rear seal has been pushed up into the spacer; the bottom edge of the seal is visible.



**Setting Lever O Ring:** There is a small O Ring behind the setting lever on the right hand side of the main casting. The lever must be removed to get at the O Ring. The lever on the later units is secured by what the Brits call a spring dowel (roll, tension or expansion pin in the US) that can be easily driven out with a suitable size punch. The earlier units as that shown on the right have a solid dowel pin. I drilled it out using a sequence of 5/64 - 3/32 - 7/64 drills. The holes are 1/8 inch. The photo shows the lever pulled to the end of the shaft and the O ring pulled out of the recess. I used a sharp scribe to pry the O ring out of the recess The lever was pulled off, a new O ring slid into position and the lever reinstalled and secured with a 1/8 inch tension pin. The tension pin on the later units seems to be a little smaller, possibly 3/32 inch. I'll update this when I take one of those apart next time. This section was added on 10-9-01 after Mike Kitchener mentioned that these O rings were missing from the parts list. I then realized that hadn't replaced the O ring under the lever on the unit described here. The battery was dead on the hand drill when I first took it apart, so I deferred it and then forgot. I replaced it today on the fully assembled unit --- no problem.

**All the parts:** The photo below shows all the parts extracted from the OD unit after they had been cleaned up and packed with associated components.

**Parts List:** The following lists the parts used for various levels of maintenance plus the additional parts needed for this job.

For inspection and cleanup the following parts are required:

- Gasket, adapter to gearbox (if the adapter is removed
- Gasket, adaptor to OD (I buy 2 in case I have to tear it apart again)
- Gasket, cover plate to main casting (I buy 2 in case I have to tear it apart again)
- Washer, oil drain plug.
- Rear shaft seal (unless seal is not to be replaced).
- 2 Valve Operating Shaft O rings.
- 4 - 1/4 inch 28 nyloc nuts if the nuts securing the bridge pieces use locking tabs and the nuts are removed.
- Tube of Hylomar HPF Gasket & Flange Sealer by Permatex, available from local auto pasts store.
- 2 quarts of gear oil (see discussion in part IV)

For a major overhaul the following parts in addition to those listed above are required:

- Bearing, annulus head
- Bearing, annulus tail
- Bearing, thrust (between clutch sliding member and thrust ring)
- Unidirectional clutch roller set

Because the OD discussed here was damaged due to the bearing failure, the following parts in addition to the previous two lists were required:

- Thrust Ring
- Thrust bearing large circlip

- Thrust bearing small circlip
- Thrust washer between sun gear and planet carrier
- Operating valve plug (the one we welded a nut to so that it could be removed)
- Operating piston (broken ring)

Other parts that are subject to deterioration and may be required:

- non-return and operating valve balls
- non-return and operating valve springs
- Clutch return springs
- Accumulator spring
- Clutch sliding member

I usually buy parts from The Roadster Factory (TRF) because of a long relationship and good service. They obtained all the parts needed for this rebuild although some required a few weeks to get here. If they can't get the parts, I then try Moss or Victoria British, who have also given us good service.

Other sources of Overdrive parts are:

Moss of UK, 011 44 208 867 2020

Overdrive Repair Services (UK), 011 44 114 248 2632

Brian Schlorff of Power British Performance Parts Incorporated, 610-270-0505

John Esposito of Quantum Mechanics,800-274-1920

**This completes the Part II - Disassembly. Subsequent parts discuss reassembly, adjustment and troubleshooting.**

**Links to A Type Overdrive articles:** **Part I - Theory**
**Part II - Disassembly**
**Part III - Reassembly**
**Part IV - Final Assembly & Testing**
**Part V - Troubleshooting**

***Buckeye TRIUMPHS* Technical Page**