

# Transmission overhaul

Version: 1.0

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## Introduction

Here is a short summary on how to remove & overhaul the (20B) automatic transmission. The Nissan Patrol (3.0 ZD30DDTi) and Cosmo FSMs will be frequently referenced so this is not a standalone guide. Obligatory disclaimer: I'm not a mechanic so take this as-is.

I'll focus on the difference from the manuals & how to do stuff in practice. The (translated) Cosmo FSM covers basics but does not include the "upper" side of the transmission at all. It does contain technical data, and data about the control valve body which is unique to Mazda (but it's the same between 13B, 20B and FDs). The tailshaft housing is unique to Mazda as well. The topside (with the clutches etc.) is mostly the same as the Patrol one, Jatco 4R03, however clutch counts can be different as there are multiple versions of the 4R03 with different clutch counts. If this doesn't make sense for you, it will later when reading the parts about High Clutch replacement / clutch specs.

Parts used: Patrol seal kit, R4A-EL aftermarket seal kit + whatever is damaged.

## Recommendations for specific symptoms that I encountered:

- Slips excessively under high power shifts or shifts roughly: Line pressure solenoid stuck open/closed. This controls the hydraulic pressure based on load. You can also mod this to shift faster (-> more roughly), start by disconnecting its connector under the hood (see Cosmo FSM).

The connector is at the resistor pack, adding in a bigger resistor will increase the pressure and makes shift faster & less smooth.

- Shifts roughly: old fluid & gunk

- Does not shift

- Electrical, measure the A/B solenoid output of ECU (as per Cosmo FSM)

- Hydraulic, pressure is leaking somewhere, see next chapter.

Note that the control valve body and accumulators can be removed without dropping the transmission.



Dirty valve body, note the accumulation of material on the magnet. This amount is definitely not normal.

### Testing clutches & hydraulic passages

The Cosmo FSM tells you about the hydraulic passages front and back. These include accumulators and clutch packs. The latter can be easily accessed after removing the control valve body. Get an air compressor, wrap the end in tape to not damage the holes, then apply pressure into the clutch holes. They should build pressure well. If you can't build the pressure up, you have a problem. Don't apply more than 50 psi.

### 1) Removal

First step is to remove the transmission. The Cosmo FSM is adequate for the purpose, you will need to get off the entire exhaust, drive shaft, heatshields etc. The torque converter unbolts from the flex plate with 4 short screws, after removing a small cover plate. You can rotate the engine with a screwdriver by the flex plate to get to all 4 screws. And yes, it is a pain to get to some of the bolts holding the transmission bellhousing onto the engine, there are 2 long ones on the bottom, 3 shorter on the top, and 1 on the left side. The starter is also painful to remove, but you don't have to get it out, just unbolt it and leave it hanging on the side.

What is of utmost importance is the jacking setup. It's heavy so I strongly recommend using a proper transmission jack. It can be done otherwise, but you should weld a frame that goes onto the oil pan, so you don't hold it by the oil pan. The pan's bottom is angled, and it WILL slide off! Ask how I know.

Apart of this it is not particularly hard if you do it properly. It is best to remove the pan & drain the oil first.

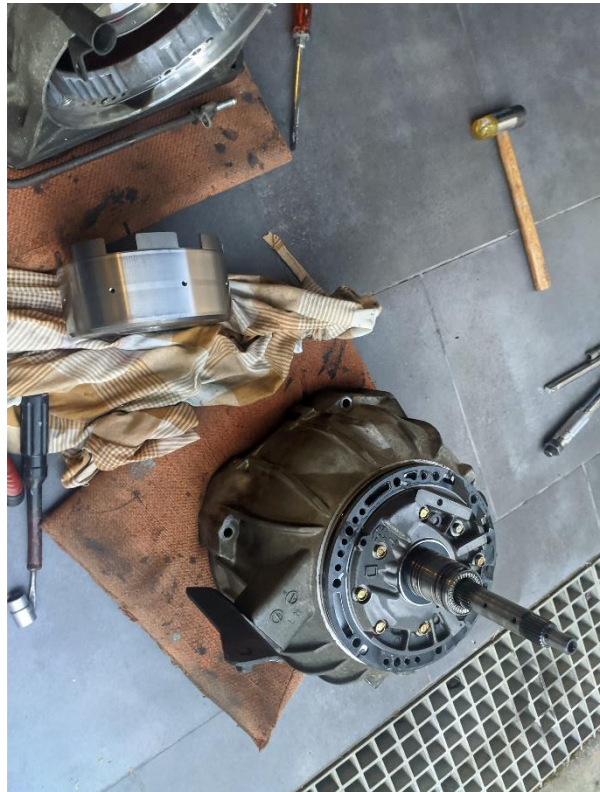
## 2) Disassembly

Start with removing torque converter (just keep yanking it backwards while turning a bit). Next get the bellhousing off. Here things will be a bit different, as on mine the oil pump body was held firmly in the bellhousing by RTV paste.

No worries, after removing the bolts (which are also RTV'd in place and will need a lot of torque, be careful to not strip them! The bolts from the Patrol are the same and can be ordered for a few bucks if you screw them up) the whole thing will come off: gently hit it with a mallet as there is a big O-ring that holds it in. Picture of the housing and oil pump to the right.

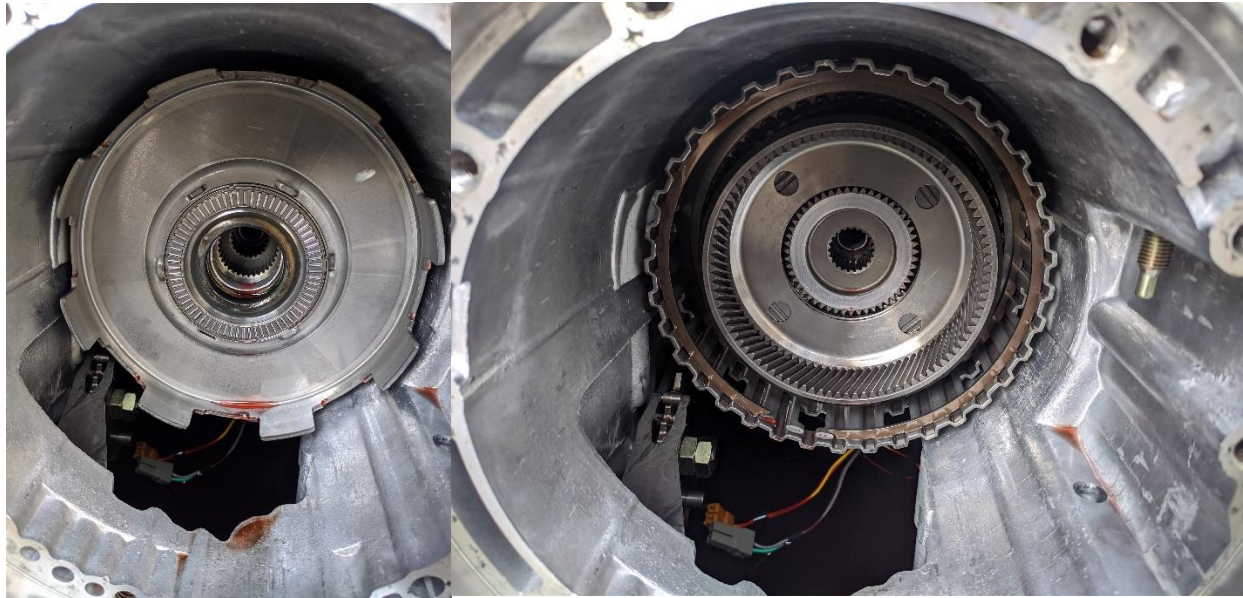
After the bellhousing, oil pump and from shaft comes off, remove the pan, control valve body, accumulators, band servo piston. Next, shore it up so it sits upright, tie the brake band (which is around the reverse clutch exposed and now just hanging around) with a wire so it doesn't expand, then remove it from the trans. Remove the reverse clutch assembly, then high clutch and front gear. FSM has this detailed; you can follow it until only the low/reverse brake is in.

Reverse & high clutch assembly removed & separated:

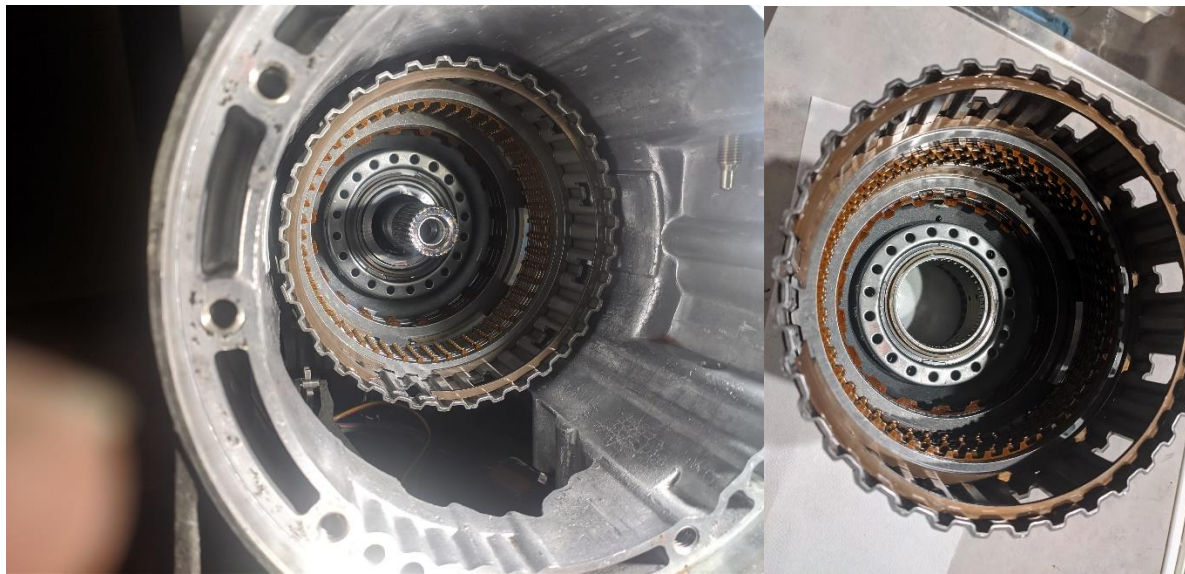


Front and rear sun gear assemblies, note the forward clutch drum in the second picture:





Forward and overrun clutch drum:



Low/Reverse brake can only be disassembled by unscrewing the bolts around the rear shaft, there are some O-rings in there that are worth changing if you are doing a full restoration. However, you WILL need a clutch pack spring compressor tool for this. Other clutch packs are self-contained at this point.

Congrats, the whole thing is apart! Onto component level repair.



### 3) Control Valve body

Note that the control valve body and accumulators can be removed without dropping the transmission.

The Patrol seal kit does not contain the gaskets for this. **DO NOT DAMAGE THE GASKET!** Some of it is exposed and is easily torn. Ask me how I know. You 100% need the gasket unless you want to file away some bits. Any R4A-EL rebuild kit can be used for this.

The valve body is slightly different, but you can use the Patrol FSM to clean it. If the oil was never changed it will likely have a lot of gunk, use petroleum to rinse everything. Don't forget to run it through the pipes as well.

Valves can be disassembled but do it 1-by-1 as there will be valves (3-2 control valve, that is blocked off in Cosmo) that are different from Patrol.

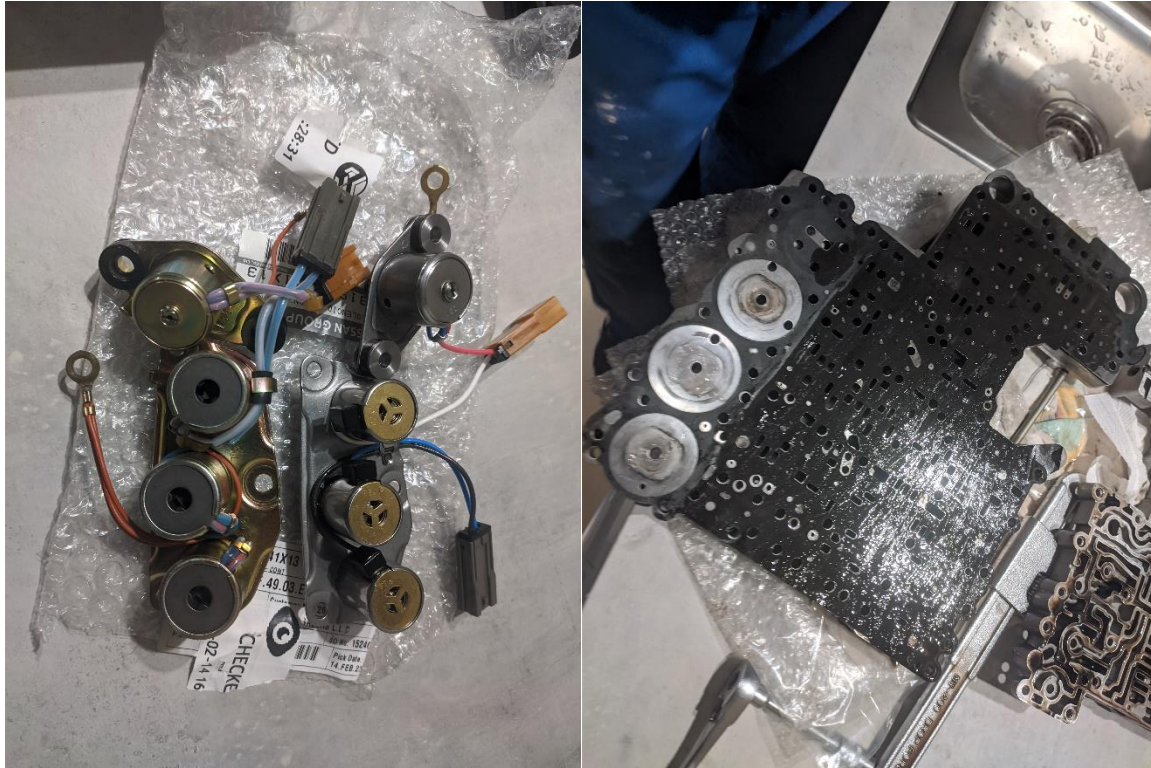
Look out for damage, wear etc. There are two filters inside you can clean (don't need new ones). Big filter that comes off first can also be cleaned in ultrasound & by running petroleum through in the reverse direction.

New ones are available aftermarket for R4A-EL. I should also mention, clean the pan thoroughly, including the magnet. Observe buildup too, it will be telling if you have any problems.



Solenoids. Patrol kit is good for A+B+Line-Pressure+Overrun solenoids. The other pack has an extra solenoid for the Mazda. Replace any O-Rings (new ones have them included).

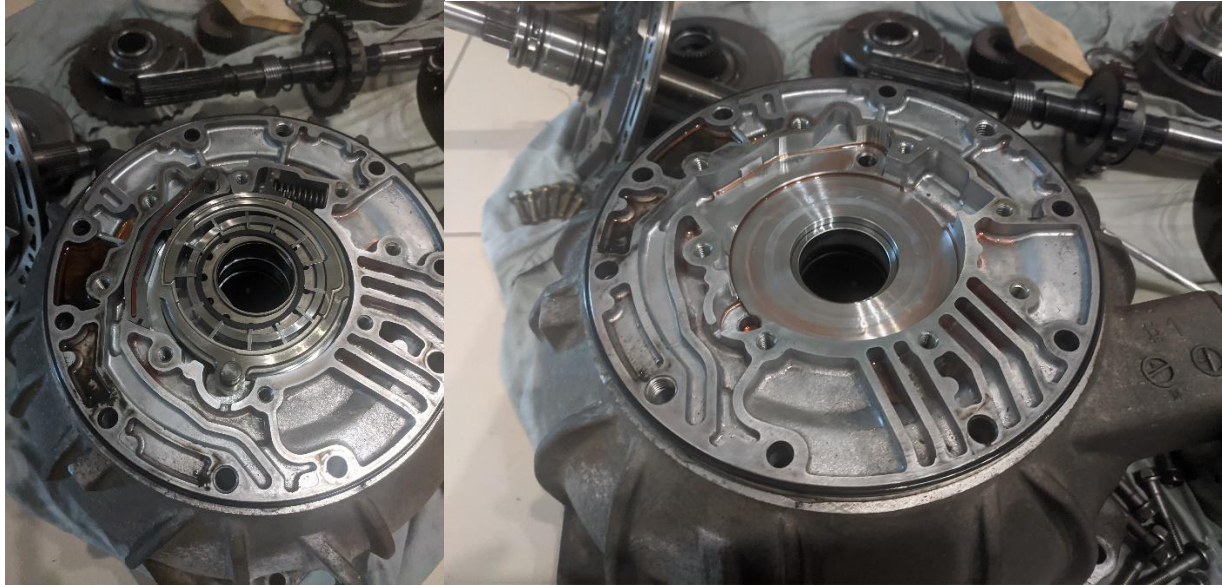
All bolts are 7-9 Nm on torque. Below are the Mazda & Nissan solenoids and the inside of the body:



#### 4) Oil pump, torque converter

Not much to say, follow FSM, Patrol seals are compatible. The converter needs to be cut apart and re-welded so that is probably transmissions hop territory, but any automatics shop should be able to handle it. If you don't have "catastrophic" damage, you don't need to change it. With old, caked oil it is probably worth it to clean it up properly.

Oil pump interior:

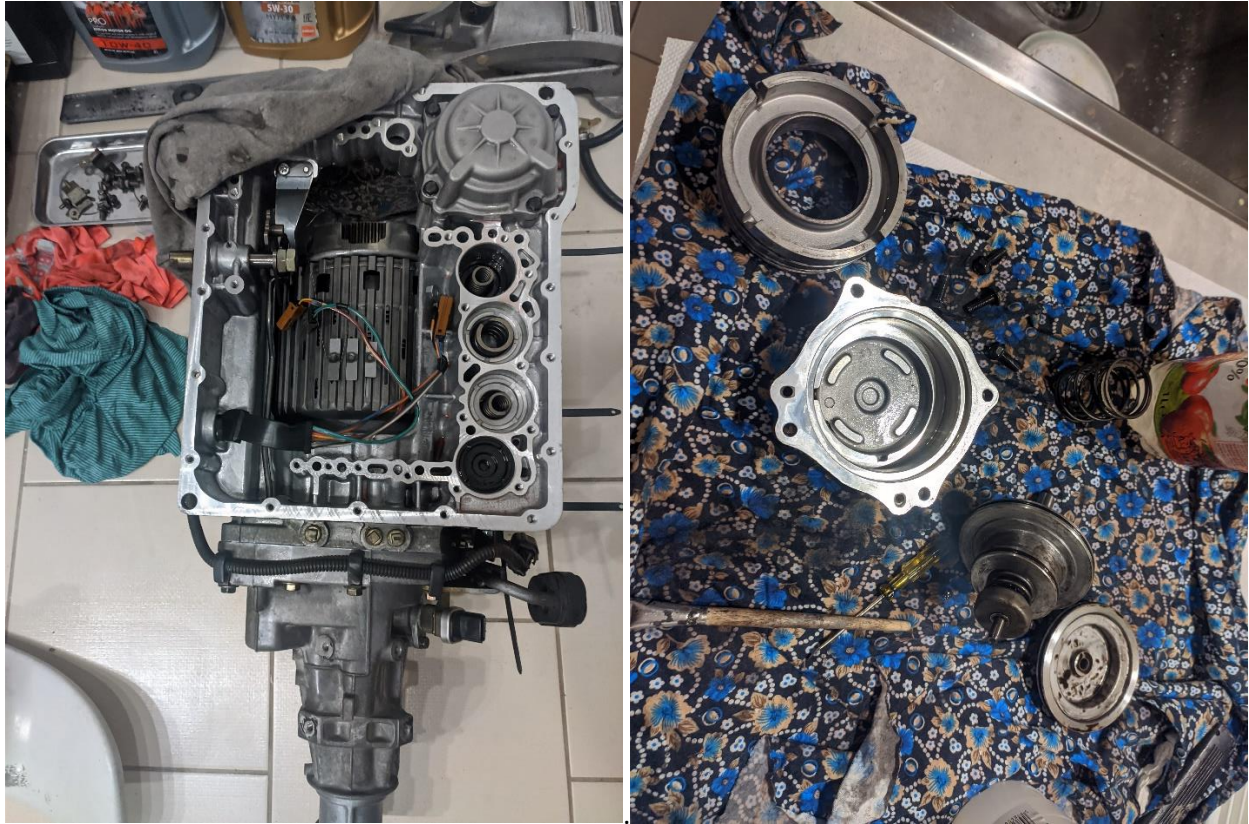


### 5) Accumulators, band servo

Accumulators are patrol-compatible, check all the O-rings for wear & damage. Band servo, disassembled as per FSM, however, be very careful about the D-rings. Some of them are different size from Patrol or R4A-EL, but these should be fine to reuse if they are not hard or damaged.

Installed band servo and four accumulators on the left, disassembled band servo on the right.





## 6) Clutches

First off, you have two parts to disassembled. The top bit has the clutches, bottom bit has the piston.

The clutches are simple, after they come off you can measure their thickness:

Clutch pack front to back (count)	Standard thickness (mm)	Minimum thickness (mm)
Reverse (3)	1.90 to 2.05	1.80
High (6)	1.52 to 1.67	1.40
Forward (8)	1.90 to 2.05	1.80
Overrun (3)	1.90 to 2.05	1.80
Low (8)	1.52 to 1.67	1.40

If you assemble with new plates, check clearance as per the Cosmo FSM. You want at least the new clearance (do not go less!), ideally within the new range but it is fine until the limit.

To get the piston off, you need a spring compressor tool. Compress the springs, remove the snap ring and it all comes apart. You might need to use compressed air to get the piston off, as per the Patrol FSM.

Patrol parts are compatible with all the pistons.

Clutch spring compressor (<https://www.ebay.com/itm/314215659209>) and freshly assembled high clutch:





### 7) New clutch plates for high clutch

Patrol parts are generally available OEM. I only changed the high clutch (no wear on anything else) so I can only talk about that in detail.

There are two things to consider about clutches:

- Clutch disc count
- Steel plate count & thickness

Clutch count is simple: More clutch plate, more torque it holds without slipping and the faster it engages. Things like forward clutch that only engage rarely, you basically only care about clutch disc count.

You can freely add more clutch discs for tuning, as long as your clearance (so your total pack height) stays the same. So thinner steels -> more clutch discs!

However, on the high clutch this is a compromise. That engages fairly violently, generating a lot of heat. That heat must go somewhere, and that somewhere is the steel plates. Thinner steels can take less heat, so if you go thinner, you will reach a point where it just warps.

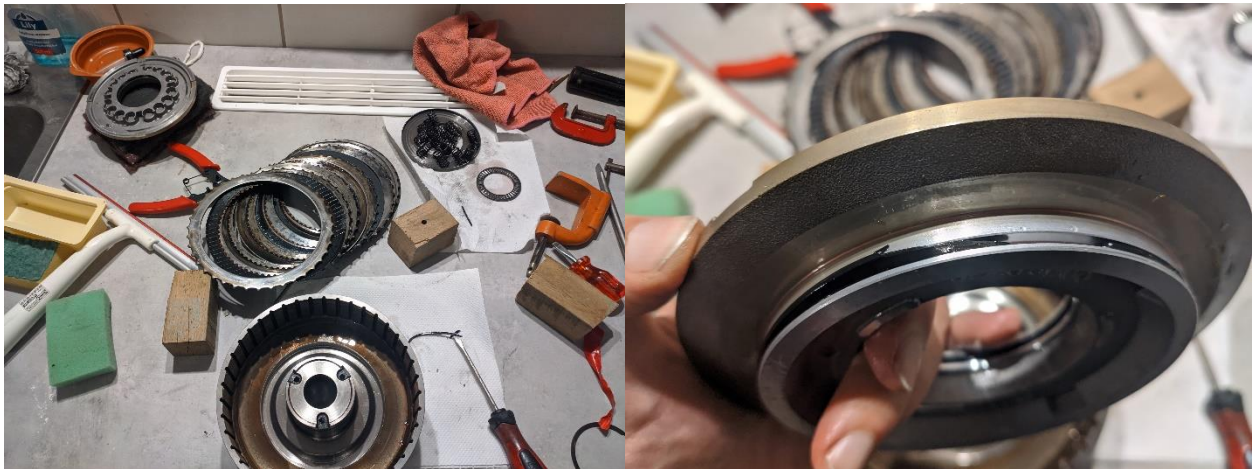
Here is the catch: Cosmo high clutch is 6 clutches, 3mm steel plates. Patrol 3mm plates are NLA, only 2mm (newer) plates are available. If your plates are toast like mine, you could assemble it with 6 clutches, 2mm plates and a LOT of spacers, but that will reduce what it can take. However, as I found, 8 clutches fit very nicely by using a single 3mm plate on the bottom (which I feel you NEED in the Cosmo, the splines wouldn't reach otherwise!), then 2mm plates, then around 2.8mm as the last plate (machine it down from a 3mm one). Luckily, I had 2 reusable 3mm plates.

8 clutches are better than 6, and the overall steel volume is the same so this should be a slight upgrade. Turns out it works just fine and shifts smoothly without issue.

High clutch drum after removing plates, note the broken D-ring sticking out from the piston:



Disassembled high clutch and the damage on the piston ring:



Note the steel plate and clutch disc discoloration and damage. Piston springs on the right, piston itself on the left.



## 8) Assembly

Follow Patrol FSM and your pictures of disassembly. One thing, the easiest way to get reverse/high clutch in is, assemble them both with the front gear outside then put the whole thing in as a single piece.

Align clutch plate teeth before assembly by aligning them on one side, then the opposite side, repeat until they are aligned all-around. For the rear clutches, you can put the transmission on its tail (this is before you put the rear shaft back), which makes it easier. And yes, it's kind of painful to get everything together. Use a lot of Vaseline :)

Low brake with new seal rings coated in Vaseline, with the whole thing re-assembled:



## 9) Installation

Add 2 litres of oil to the Torque Converter if it got replaced / repaired, otherwise as much as you took out of it. Install the converter carefully, make sure it really is in place (the bolt holes on the converter should be at least 18mm behind the bellhousing, but in practice I found them to be 22-24mm behind). The rest is just lifting it up and aligning it with the engine. Best to reinstall the cables and the left side oil line before completely lifting it as there is not much space there.

Transmission sitting on a totally safe frame to lift it into place. (The jack is volted to the steel frame.



Fill it up with oil, cooler could have a litre in it but including the 2 litre in the converter you'll need at least 11 litres. I filled to around full, ran it for a bit then repeated until the level didn't go much further down but you can probably just chuck in 10 litres for starter. Total capacity is 11.6. After initial fill, run the transmission through P-R-N-D-S-L staying in each for a few seconds, then fill to full in P while idle. Take it out for a ride, re-check level.

Note that it is hard to check the level after filling as the oil needs 10-15 mins to properly drain down and not coat the dipstick when inserted into the tube.



### Other things you can do

While the transmission is removed you can tidy up the bottom of the car and potentially add some noise insulating material as well.

Another good thing to do is to remove the shift position switch and clean the electrical contacts inside using alcohol and white Scotch-Brite. Be sure to apply generous amounts of dielectric grease to the surfaces. Swapping the spring to stronger ones might be needed if there is spotty contact after cleaning.

