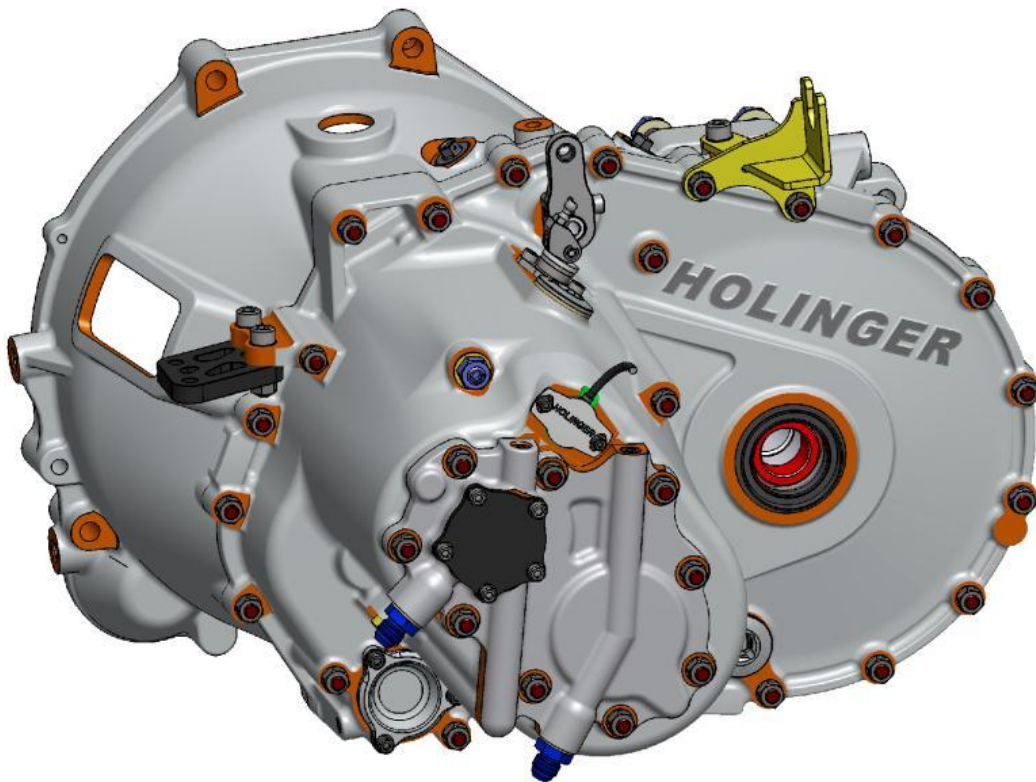


HOLINGER
ENGINEERING
Racecar Gearbox Manufacturers

HOLINGER MF-E9 GEARBOX MANUAL



Approved By: Leigh Nash

Date: 26/07/2011

FOREWORD

The Holinger MF-E9 is a sequential-shift transaxle designed for use in Mitsubishi Lancer Evolutions 4-9.

It is a complete gearbox, replacing the original Mitsubishi unit between the engine and the transfer case.

The transaxle is fitted with 6 forward gears, a reverse gear and a ring and pinion. All the forward gears are profile ground for increased efficiency and durability and have an extensive range of ratios available.

Features:

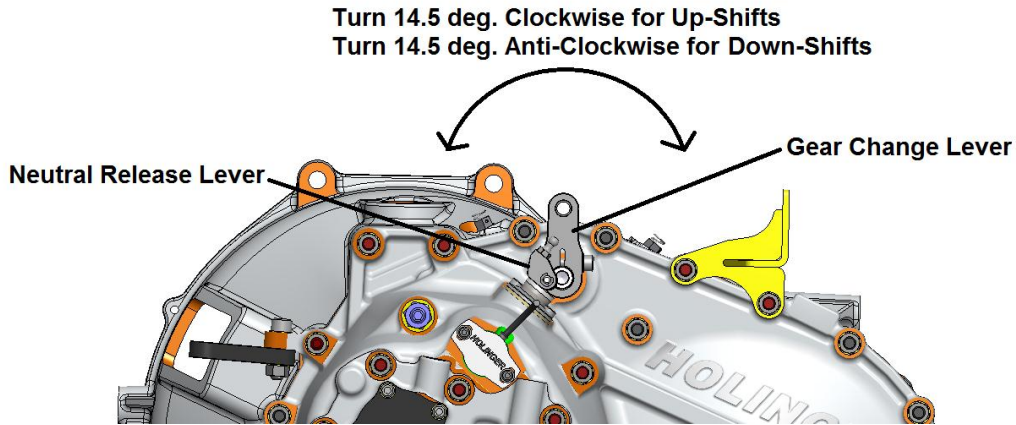
- Torque rating for endurance events is 700Nm (520ft.lb).
- The centre differential is included and compatible with all EVO 4-9 mechanical and active (ACD, AYC) systems / transfer cases.
- The internal lubrication system consists of a magnetic / paper element filter, an oil pump with provision for an external cooler, a spray bar to feed cooled oil directly onto the gears, through-shaft lubrication to all needle roller bearings and oil feed for the transfer case.
- The original speedometer system is compatible.
- Output is designed to work with the standard Mitsubishi tripods and drive-shafts. Holinger can supply optional stronger shafts if required.
- The original clutch, slave-cylinder and fork are compatible.
- The original front and rear mounts can be used. A new top mount is supplied with the gearbox.
- A stand-alone gear-lever system with an integral shift-cut trigger is available. Holinger can supply a complete floor mounted system with cables to interface with the gearbox.
- A gear position sensor is supplied for interfacing with an electronic dash display. Alternatively a stand-alone gear indicator display is available for cars not fitted with an electronic dash.
- A temperature sensor can be installed on the gearbox (M12x1.5).
- O-ring seals are used on all joint faces.
- Gearbox weight is ~47kg (100lbs).

CONTENTS

CHANGING GEARS	4
Gear Lever System	5
SUB ASSEMBLIES	6
Bell Housing	6
Gearbox Housing	8
Pinion Shaft.....	9
Input Shaft.....	11
Differential.....	12
Neutral Release.....	15
Reverse Gear Spindle	15
Oil Pump	16
SETUP	18
Bearing Height Setup	18
Cam Setup	20
GEARBOX ASSEMBLY	23
Gear Position Potentiometer Installation/Setup	31
DISASSEMBLY	33
BEARING END-FLOAT SETTINGS	40
TORQUE SETTINGS	40
LUBRICATION	40

CHANGING GEARS

The gear-change lever is positioned on the gearbox as shown in the following diagram (This diagram illustrates the gearbox when viewed from the outside “left” of the vehicle):



To change up and down between gears, the driver must shift using a remotely mounted “gear-lever” system. Typically this gear-lever would be floor mounted inside of the car, and attached to the gearbox via a cable or mechanical linkages.

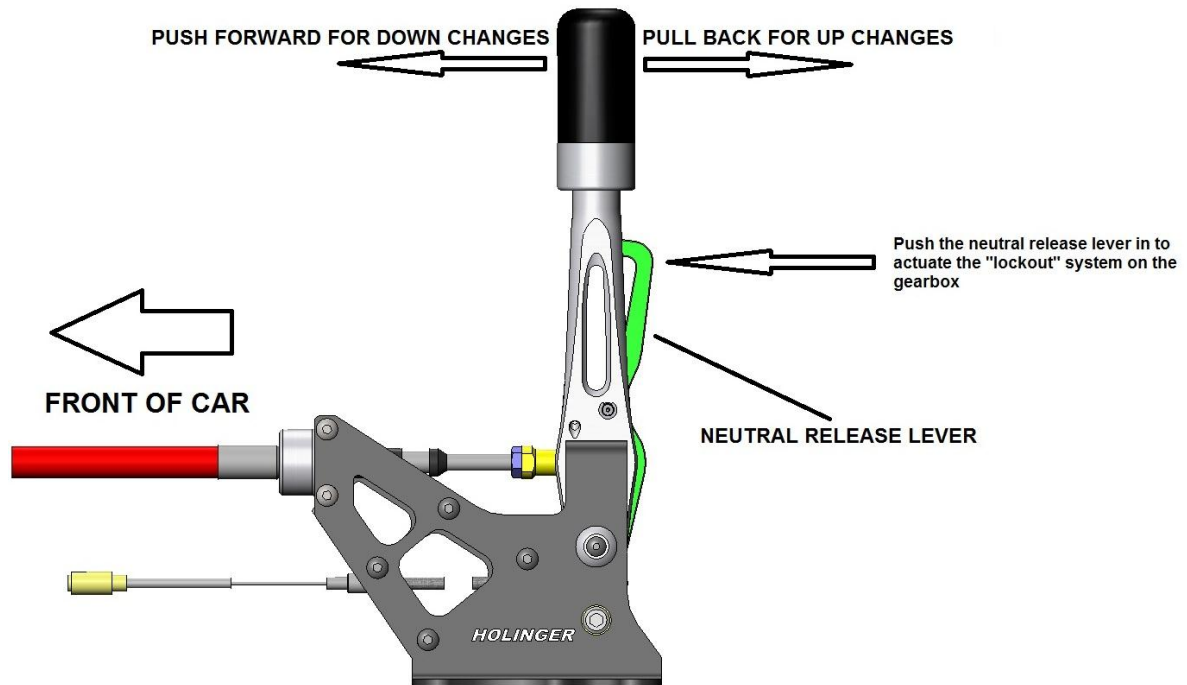
Shifting between gears is achieved by moving the Gear Lever forward or backward in a straight line. One movement in either direction (*generally a backward movement is for up-shifting and a forward movement is for down-shifting*) corresponds to one gear change, in sequence from Reverse-Neutral-1st-2nd-3rd-4th-5th-6th and back.

To avoid selecting Neutral or Reverse at an unwanted time, a Lock-Out system has been incorporated.

To engage Neutral when in 1st gear, the “Neutral Release Lever” must be actuated, while the driver simultaneously shifts “down” once more. From this position the driver can then select Reverse Gear with a single down-change or 1st gear with a single up-change as per normal.

Gear Lever System

The following diagram shows an example of a cable operated Gear Lever system which can be supplied by Holinger Engineering:



Each gear shift will require the gearbox mounted gear-change lever to turn 14.5 degrees in one direction and then return to its central position.

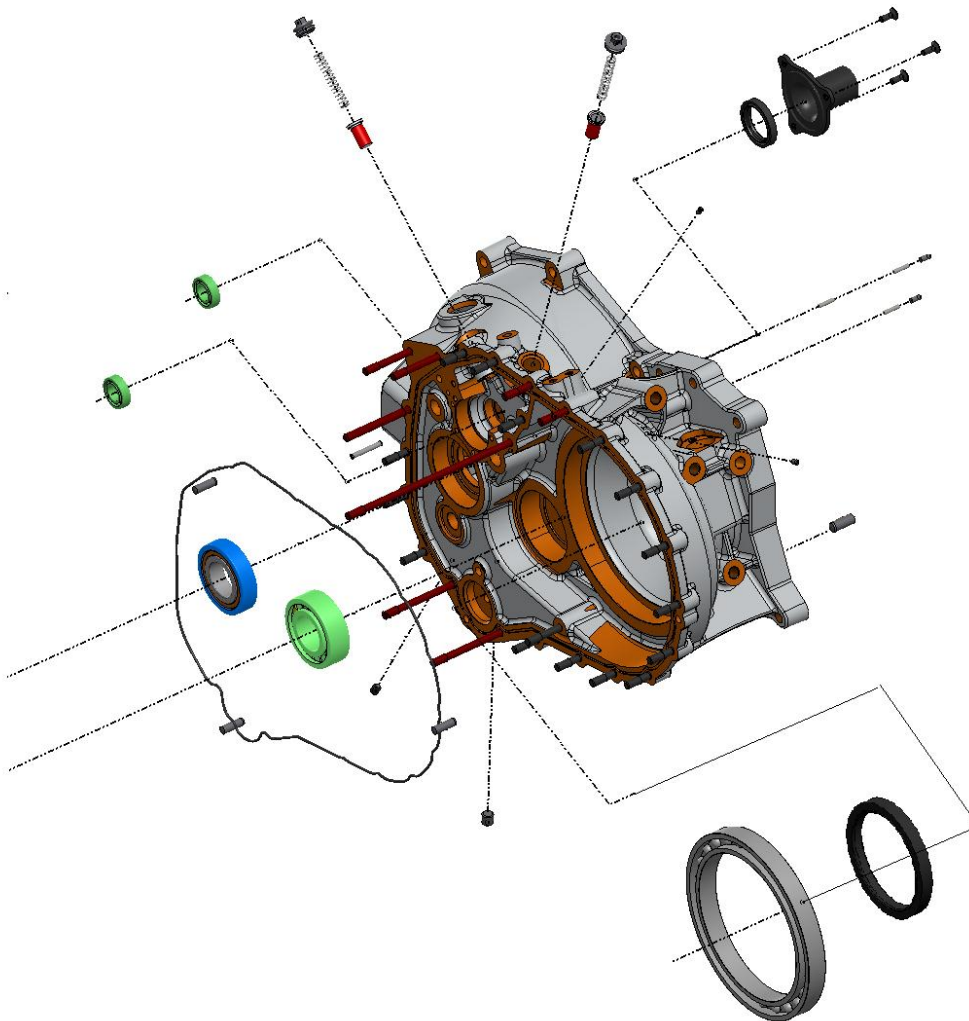
NOTE: 14.5 degrees is approximately 10.5mm of linear travel.

Use the MF-E9 exploded diagram in conjunction with this manual to assist in carrying out the following:

SUB ASSEMBLIES

NOTE: Ensure all parts are thoroughly cleaned before commencing any work. All threads that are to be secured with Loctite should first be sprayed with 7471 Loctite Primer.

Bell Housing



On the engine side of the housing insert three 102-0418 4mm rolls followed by two M5x10mm SHSS. Secure using Loctite 263.

Blank the oil galleries with grub-screws and secure using Loctite 263.

Fit the studs into the case, securing with Loctite 263:

-2 x M8x50mm studs into the case to suit the cable anchor mount, approximately 32mm should be protruding.

-15 x M8x45mm studs with 28mm protruding.

- 1 x M8x58mm stud with 41mm protruding.
- 2 x M8x73mm studs with 55mm protruding.
- 1 x M8x93mm stud with 73mm protruding.
- 2 x M8x100mm studs with 80mm protruding.
- 1 x M8x212mm stud with 193mm protruding.
- 5 x M6x35mm SHSS for the output bearing support. 17mm should be protruding.

Warm the case to 100°C and fit the bearings by hand then when the case has cooled, ensure the bearings are seated with a light press.

NOTE: Keep the inner-races of the NJ roller bearings together with their corresponding outer-race during assembly.

Once the case has cooled insert the 130-354507 lip seal, followed by the MF-020 Release Bearing Sleeve. Retain with M6x16mm FHCS and Loctite 263.

Fit the differential oil feed seal 130-607208.

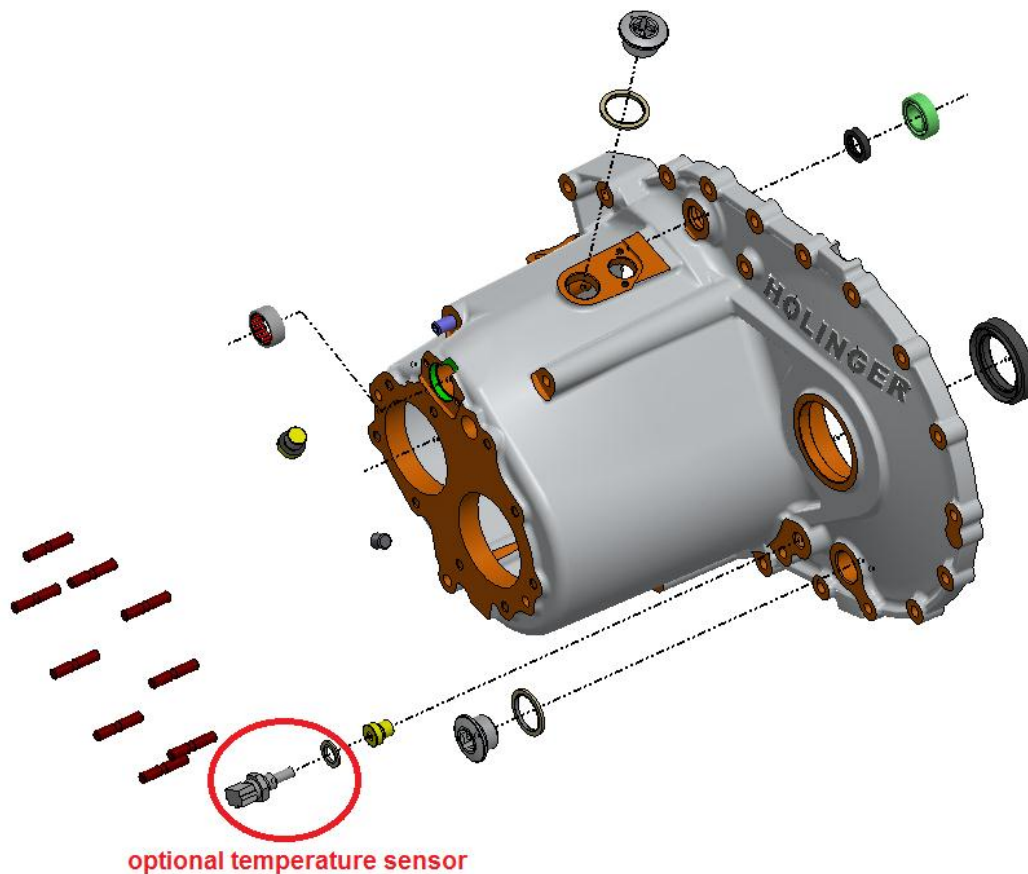
Then insert the MF-028 gasket o-ring into the mounting face.

Fit the M5x35mm rollpin into the case which acts as a spring reaction post.

Lubricate three M8x25mm dowels with grease and insert them into the case.

Fit two H6S-SEQ-015 plungers lubricated with oil, followed by two J6S-107 detent springs. Secure them with two RD6-122 plugs using Loctite 243. Make sure the thread is oil free and primed with Loctite 7471.

Gearbox Housing



Insert nine M8x39mm studs into the rear of the housing and secure using Loctite 263. Approximately 22mm should be protruding.

Insert one M10x45mm stud into case and secure using Loctite 263. Approximately 24mm should be protruding.

Insert a 7/16 UNF SHSS into the side oil gallery flush with the cast surface. Secure with Loctite 263.

Seal the oil level check holes with an M14 VSTI plug.

Insert a temperature sensor on the differential side of the case. If not using a temperature sensor seal the hole with an M12 VSTI plug.

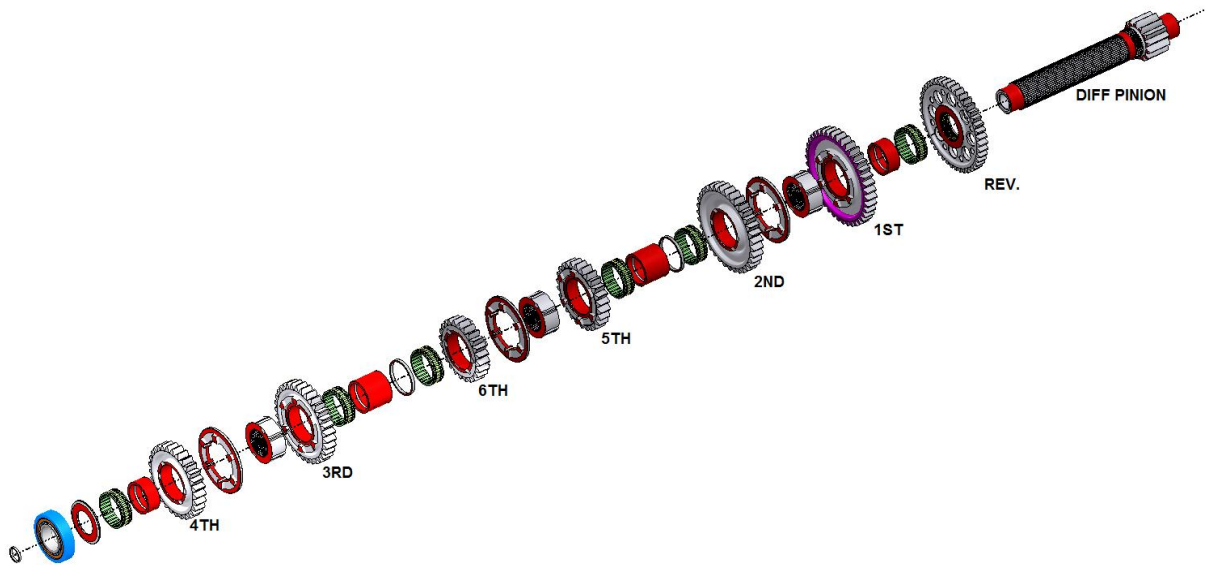
Support the case on a clean flat surface; then insert a 107-202610 HK roller bearing for the camshaft using an appropriate drift. Ensure the bearing has its ID number facing outwards and is well oiled.

Insert the axle seal (130-416109-13) and the gear-change seal (130-152405).

Warm the case and insert the 103-153209 bearing for the Gear Change Lever.

Fit the Drain and Fill plugs.

Pinion Shaft

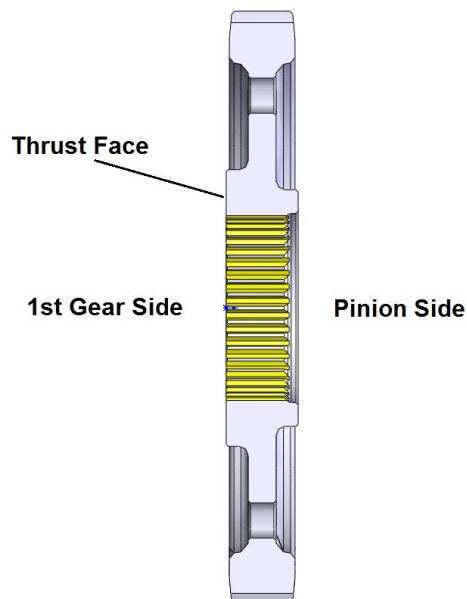


Before assembling the Pinion Shaft ensure the MF-034 oil weir is inserted into the end of the shaft.

NOTE: During this procedure, lubricate all Needle Roller bearings with oil.

Fit the MF-010 reverse spline-gear, followed by the MF-018 bearing sleeve, 106-475217 needle roller and the 1st dog-gear (MF-008).

NOTE: Ensure that the Reverse Gear is installed correctly with the thrust face facing 1st gear.



Place the *MF-011* selector hub and *MF-012* 1st/2nd selector ring onto the shaft.

Now place an *MF-019* bearing sleeve onto the shaft with a *106-475217* needle roller and the 2nd dog-gear (*MF-008*).

NOTE: The *106-475217* bearings between 2nd/5th and 6th/4th require an *MF-021* Needle Bearing Spacer between them.

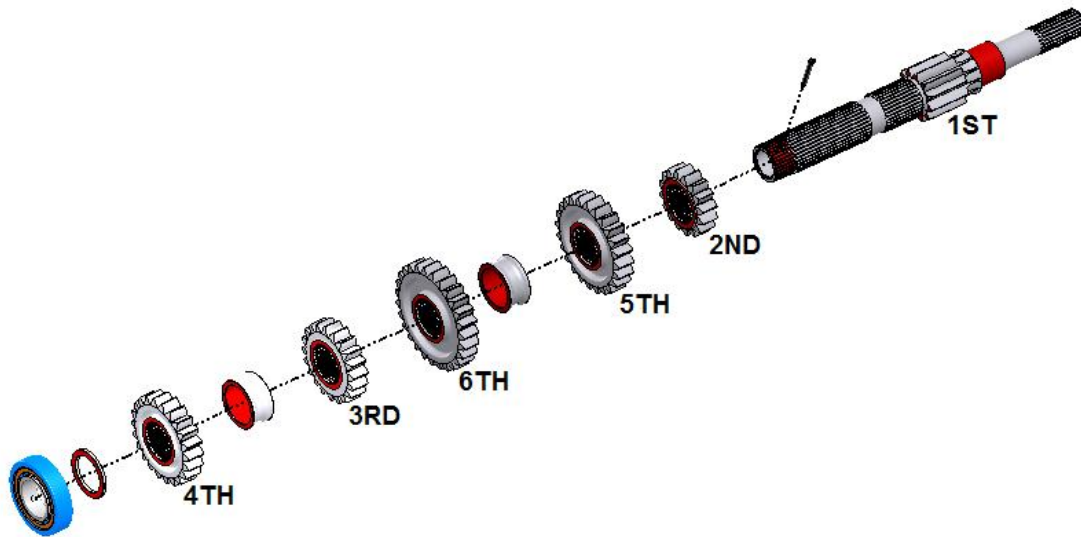
Follow this with the 5th dog gear, the 5th/6th selector ring/hub and the 6th dog gear along with their bearings, sleeves and spacers.

Finally slide on the 3rd dog gear, 3rd/4th selector ring and the 4th dog gear along with their bearings and sleeves.

Place the *104-357217NJ* (NJ207 E C3) inner-race on the end of the shaft, with an *MF-022* setup shim installed underneath.

NOTE: Keep the inner-race of the *104-357217NJ* with its outer-race. The bearing will require shimming for end float during gearbox assembly.

Input Shaft



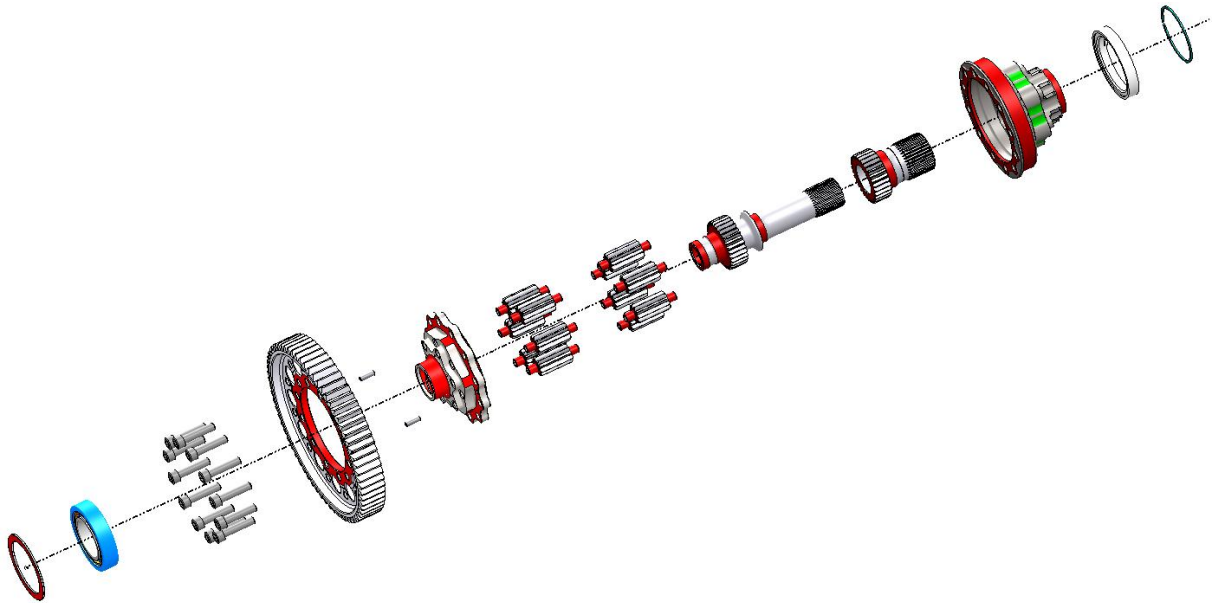
Fit an M5x35mm roll pin into the input shaft for the oil pump drive.

Slide the spline gears onto the shaft starting with the 2nd gear followed by 5th gear, a *MF-024* spacer, 6th gear, 3rd gear, another *MF-024* spacer and finally the 4th spline gear.

Then place the *104-357217NJ* (NJ207 E C3) inner-race on the end of the shaft, with an *MF-023* setup shim installed underneath.

NOTE: Keep the inner-race of the *104-357217NJ* with its outer-race. The bearing will require shimming for end float during gearbox assembly.

Differential



Description:

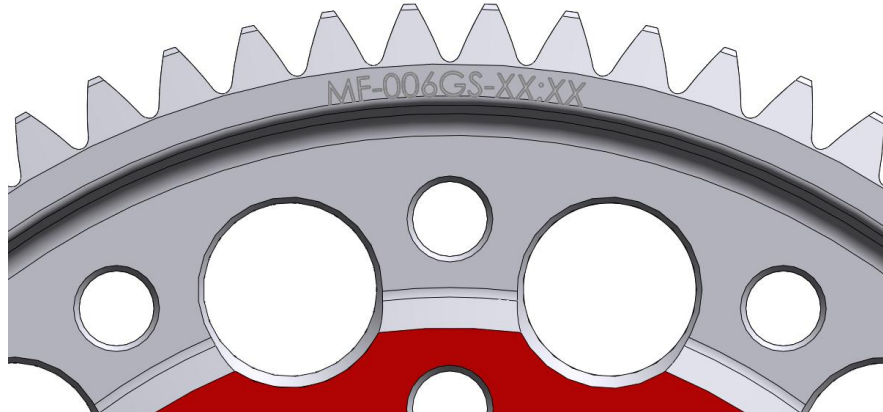
The differential contained within the MF-E transaxle is a straight cut spur gear type. It is the centre differential in the 4x4 system and works in conjunction with the standard Mitsubishi transfer unit, which contains the front differential and the clutch or friction plates for the centre differential.

To assemble the differential, first place both shafts and all the planetary gears into the *MF-502* right housing.

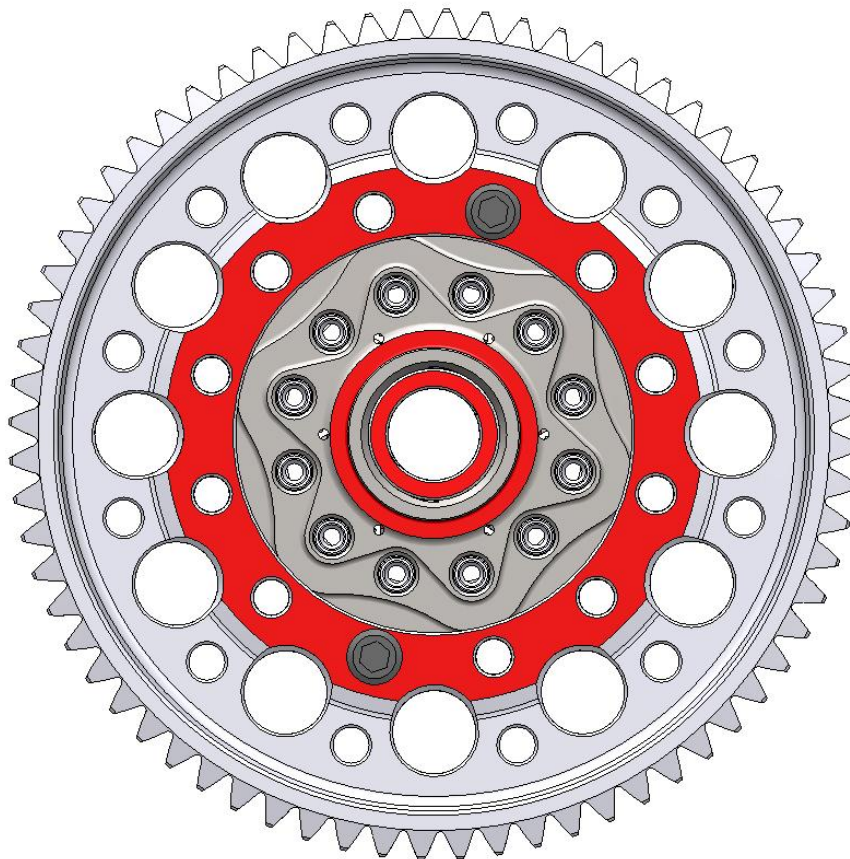
Place the *MF-501* left housing over the assembly and align the two halves together using two M10x45mm SHCS. Now insert the two M6x20 locating dowels with a drift.

Remove the two M10 bolts and place the *MF-006* ring gear onto the differential.

NOTE: Whilst the ring gear is geometrically symmetrical, it is recommended that it is always installed the same way in the gearbox to ensure extended gear life. Holinger recommend that it be placed onto the differential with the part number facing outwards from the diff centre. This illustrated in the following diagram:



Ensure the M10 threads are free of oil and clean. Prime the M10 screws and holes, with Loctite 7471.

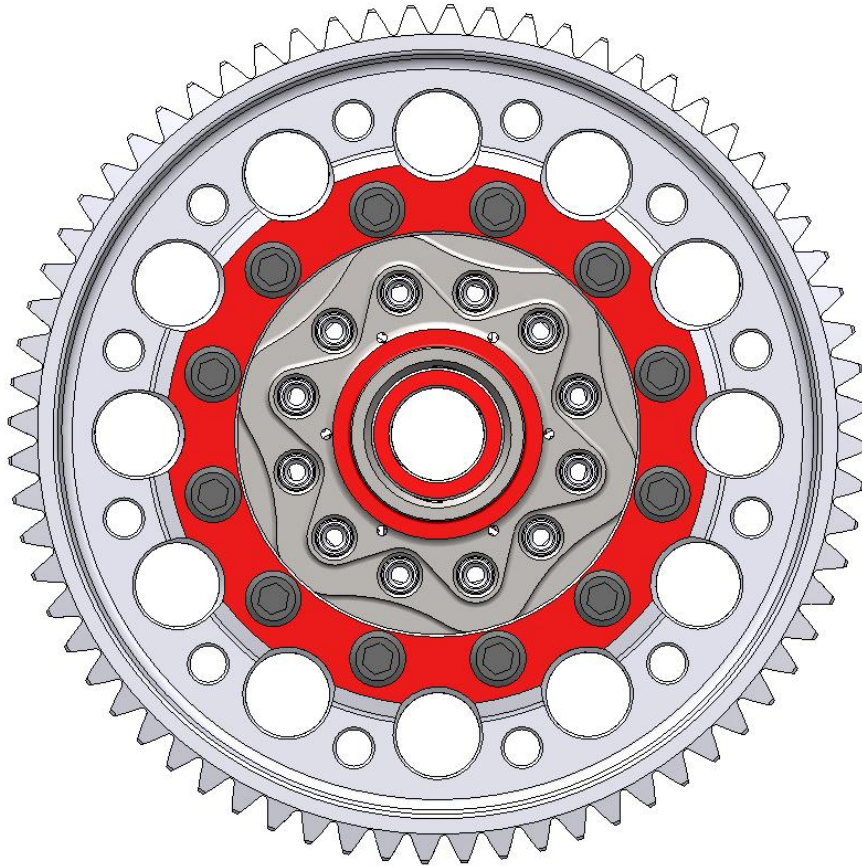


To seat the housings/gear, fit 2 bolts with no Loctite diagonally opposing, first tighten by hand, then tighten to 77Nm. *Mark these bolts, as they must be removed and re-fastened with Loctite later.*

Use your fingers to check the side gears have end float and back-lash.

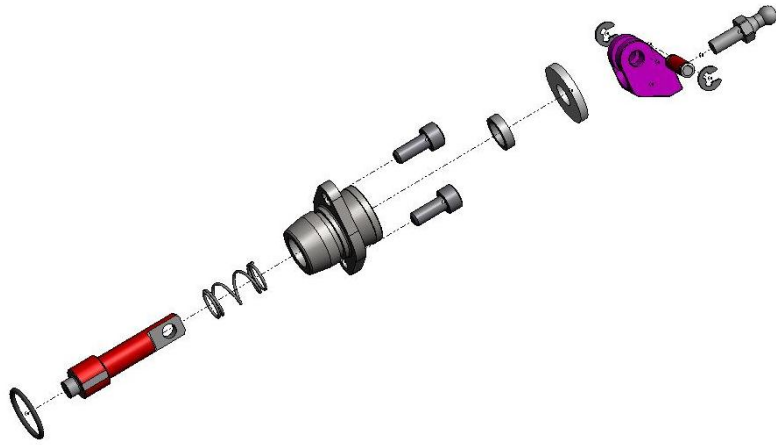
Fit the remaining bolts with Loctite 263, tighten to 77Nm.

Remove the two bolts with no Loctite, and refit with Loctite 263, 77Nm.



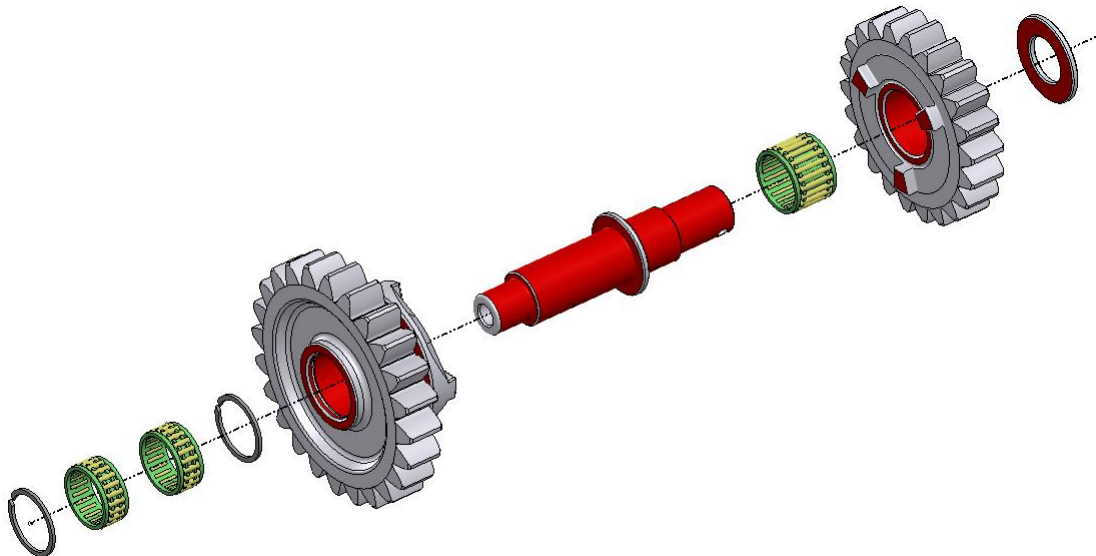
Complete the differential sub-assembly by installing the standard Mitsubishi speedo drive gear.

Neutral Release



Assemble the neutral release mechanism. First install the seal 133-081203, then the o-ring, followed by the remaining parts; lubricate the seal with rubber grease.

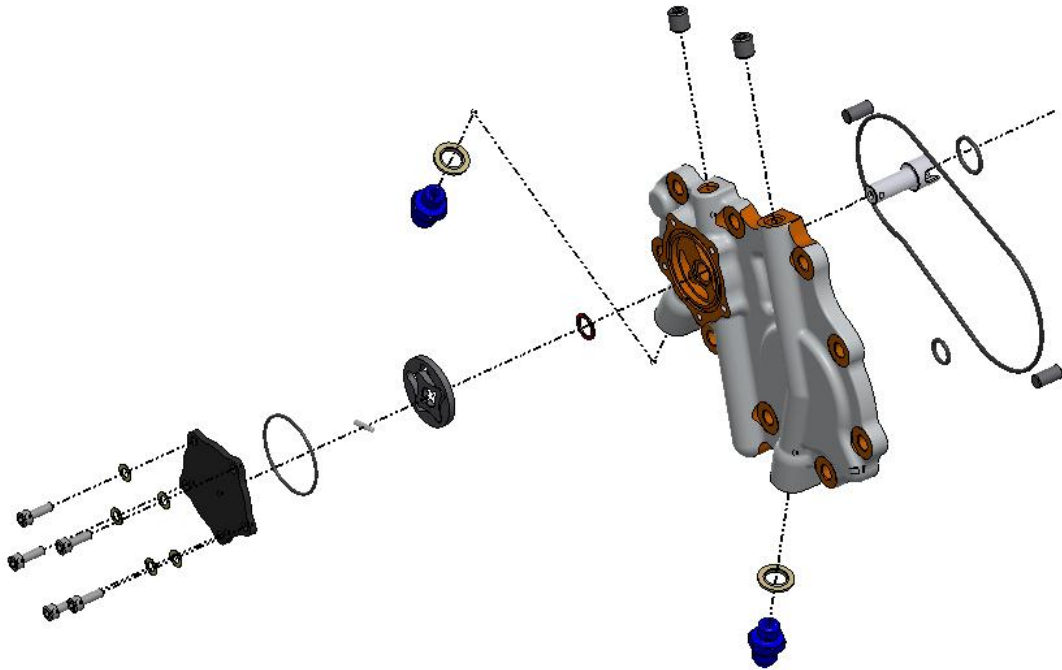
Reverse Gear Spindle



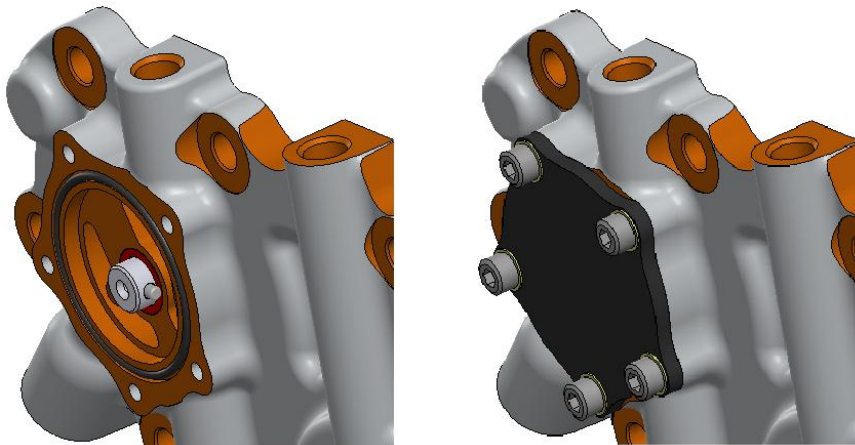
Assemble the two reverse dog gears with the needle rollers. The *MF-004* Reverse Dog Gear uses two circlips to secure the bearings, while the *MF-009* Reverse Idler relies on the spindle shoulder and a thrust washer to retain the bearing; ensure all bearings are lubricated with oil.

NOTE: The *MF-004* gear is ratio specific. Its ratio must match that of the 1st gear pinion (*MF-003-01-XX:XX*)

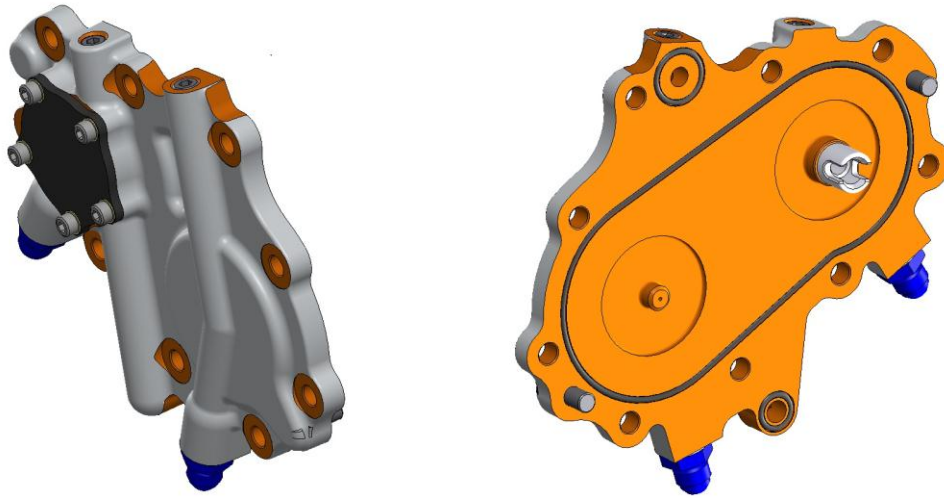
Oil Pump



Lubricate and assemble the oil pump drive spindle (*SF-027*) into the housing (*MF-014*), then place the thrust washer in the recess followed by the roll/drive pin. Now place the oil pump rotor assembly (*J6S-077*) over the spindle/pin, generously lubricate and cover with the blackened plate (*SF-029*):

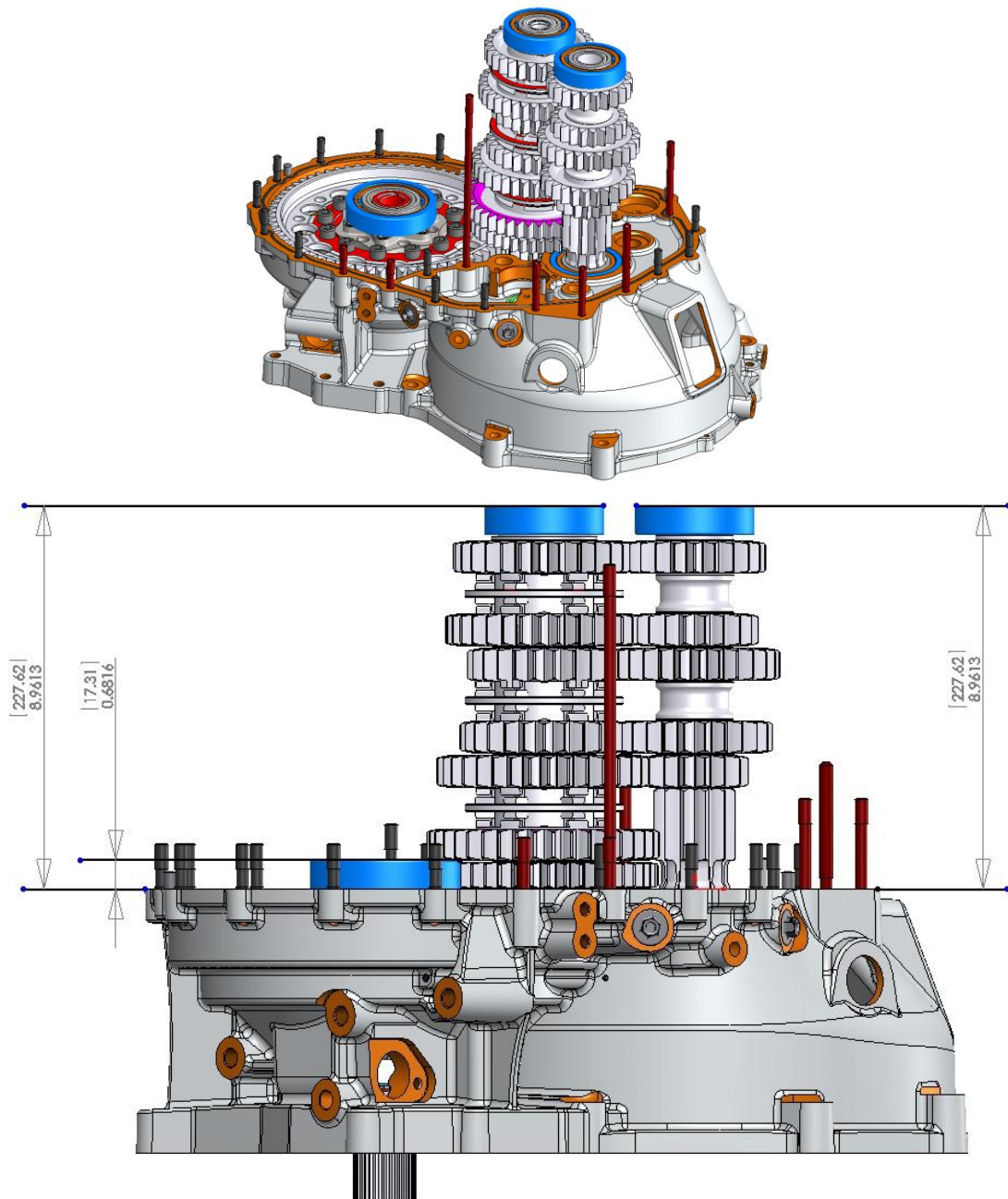


Finish by installing the oil fittings with dowty washers and 2 x 7/16UNF SHSS plugs to seal the oil galleries, then place two M8x16mm Dowels and three o-rings into the grooves on the back face.



SETUP

Bearing Height Setup



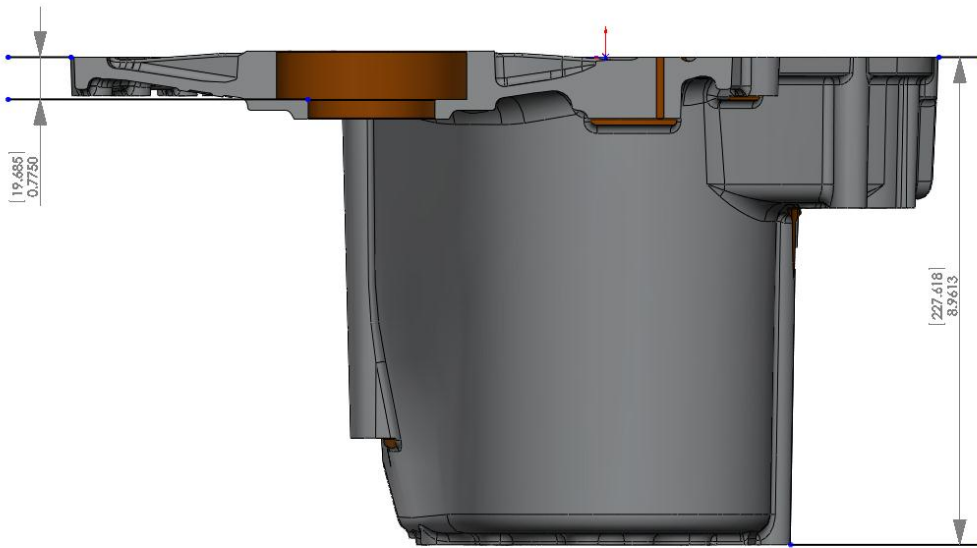
STEP 1

Fit both gearbox Shafts together with the Differential. The bearings should be fitted to the differential and both shafts.

Take three measurements as shown in the diagram above.

NOTE: The dimensions on the above diagram are only a guide. To setup the gearbox correctly these must be measured accurately on each individual unit.

STEP 2



Place the gearbox housing on a clean flat surface, such as a granite table. Measure the distance from the gasket surface of the gearbox housing to the bearing bore seats of the differential and also both gearbox shafts.

STEP 3

Compare the measurements in STEP 1 and STEP 2.

Calculate the shim thickness to leave 0.003"-0.005" (0.08-0.12mm) end float, for the differential and both shafts.

All shims are available, ground to the required size, from Holinger Engineering.

Diff shim: *MF-025*

Pinion shim: *MF-022*

Input shim: *MF-023*

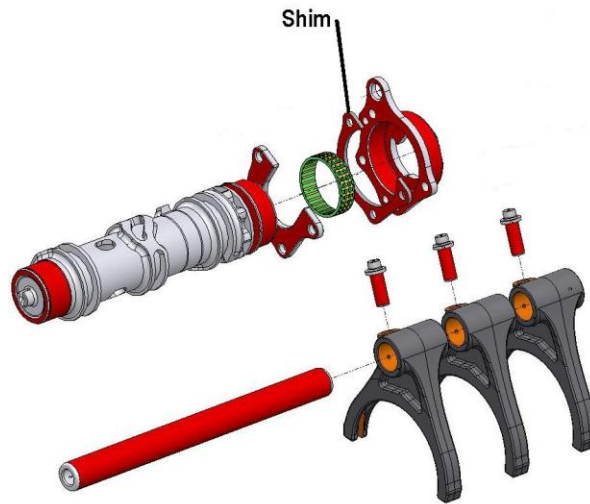
STEP 4

Check the Axle seal is fitted, and warm the gearbox housing to 100°C.

Fit the Differential Shim *MF-025*, and then fit the bearing by hand. At this time also insert the two shaft bearings into their respective bores, however ensure that the bearing faces are positioned slightly proud of the outside machined surfaced. They will be seated home when installing the oil pump.

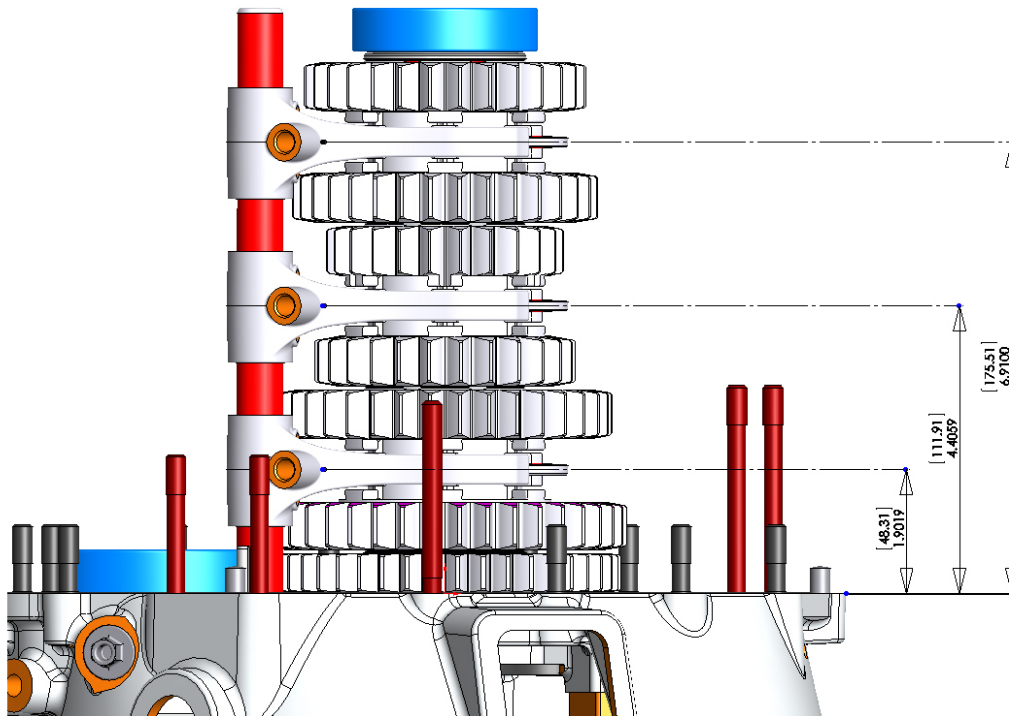
Allow the case to cool and ensure the differential bearing is seated properly.

Cam Setup



The axial position of the camshaft is matched to the gear set by adjusting the camshaft Shim.

STEP 1



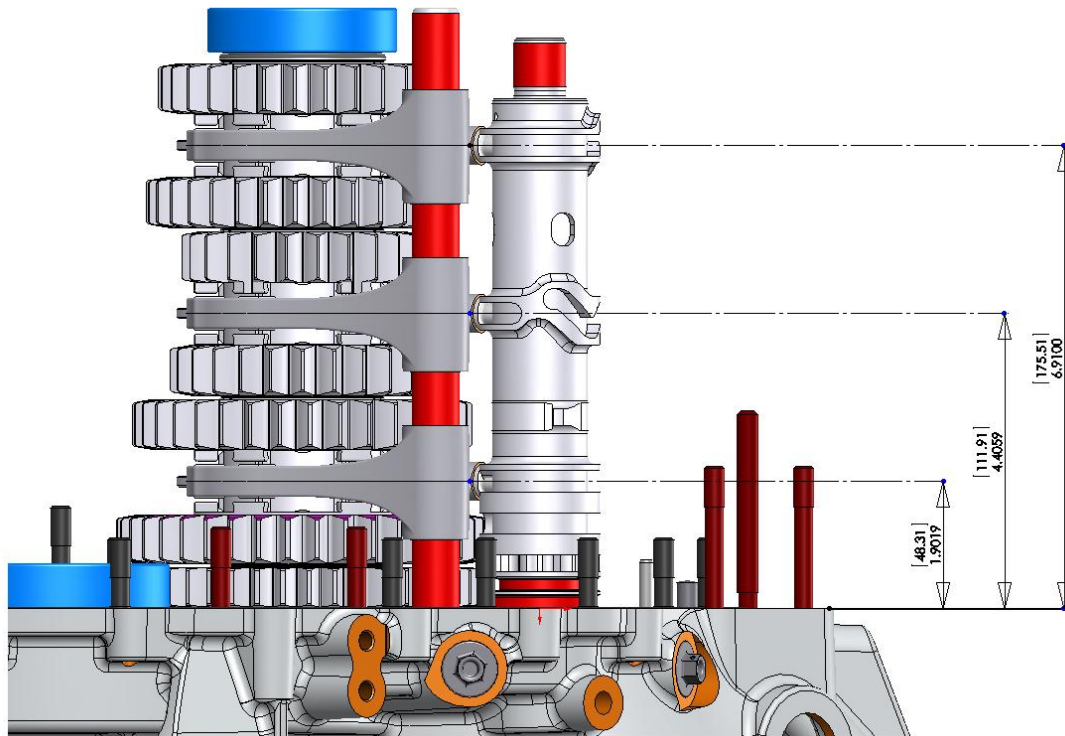
Fit the pinion shaft cluster into the main case, along with the selector forks and the selector rod.

NOTE: The selector rod is timed in the main case to align the oil jets. Ensure the slot in the end of the selector rod lines up with the pin in the main case.

Measure and record the central position of each selector fork between the fully engaged positions (*measure to the hole in the selector fork*).

Calculate the average of these values.

STEP 2



Fit the Cam with the Collar (*SF-018*), Shim (*SF-019*), Needle roller bearing (*106-424713*), and Stop Plate (*SF-020*). Fit the four M6 screws.

Measure and record the central position of each cam track in the Neutral position.

Calculate the average position.

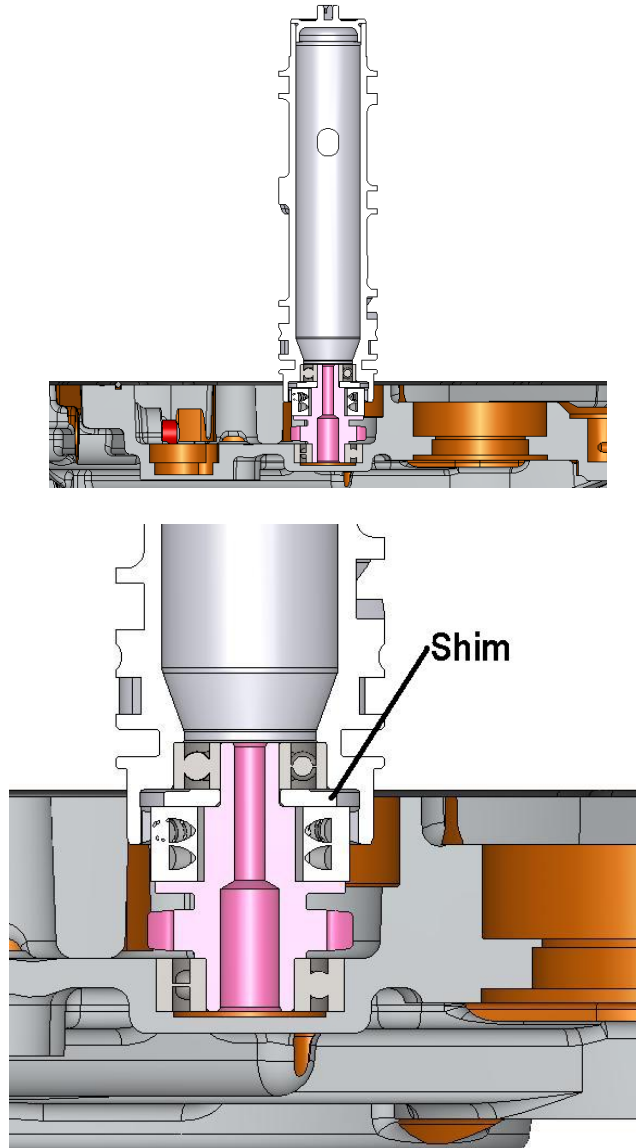
STEP 3

Compare the average from Step 1 and Step 2, and adjust the cam shim so that the cam track matches the gear train.

The shim *SF-019* is available ground to the required thickness from Holinger Engineering.

STEP 4

If the Cam shim *SF-019* is adjusted, then the Pawl carrier shim *GTR-SEQ-023* must be adjusted also.



Fit the Pawl Carrier (*SF-022*), the Shim (*GTR-SEQ-023*), the Bearing 103-102608 (6000) and the Cam (*MF-017*).

Repeat Step 2, and calculate an average value for the cam tracks.

Calculate a Shim (*GTR-SEQ-023*) thickness to position the cam 0.004"-0.008" (0.1-0.2mm) **below** the value in Step 1.

When the camshaft is finally assembled with all parts in place, the Collar (*SF-018*) will hold the cam in position, and the Pawl Carrier (*SF-022*) should have end float.

GEARBOX ASSEMBLY.

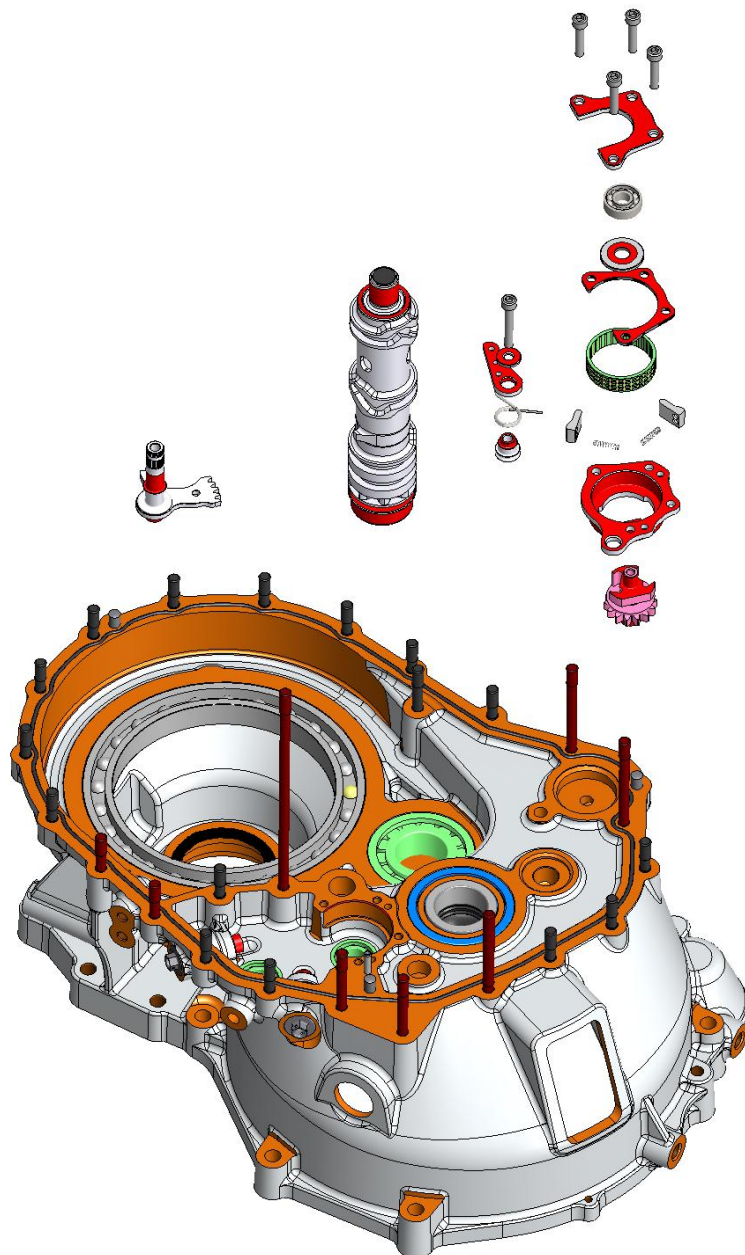
Check that the sub-assemblies are complete - refer to the SUB ASSEMBLY section.

Check that the shims are set - refer to the SETUP section.

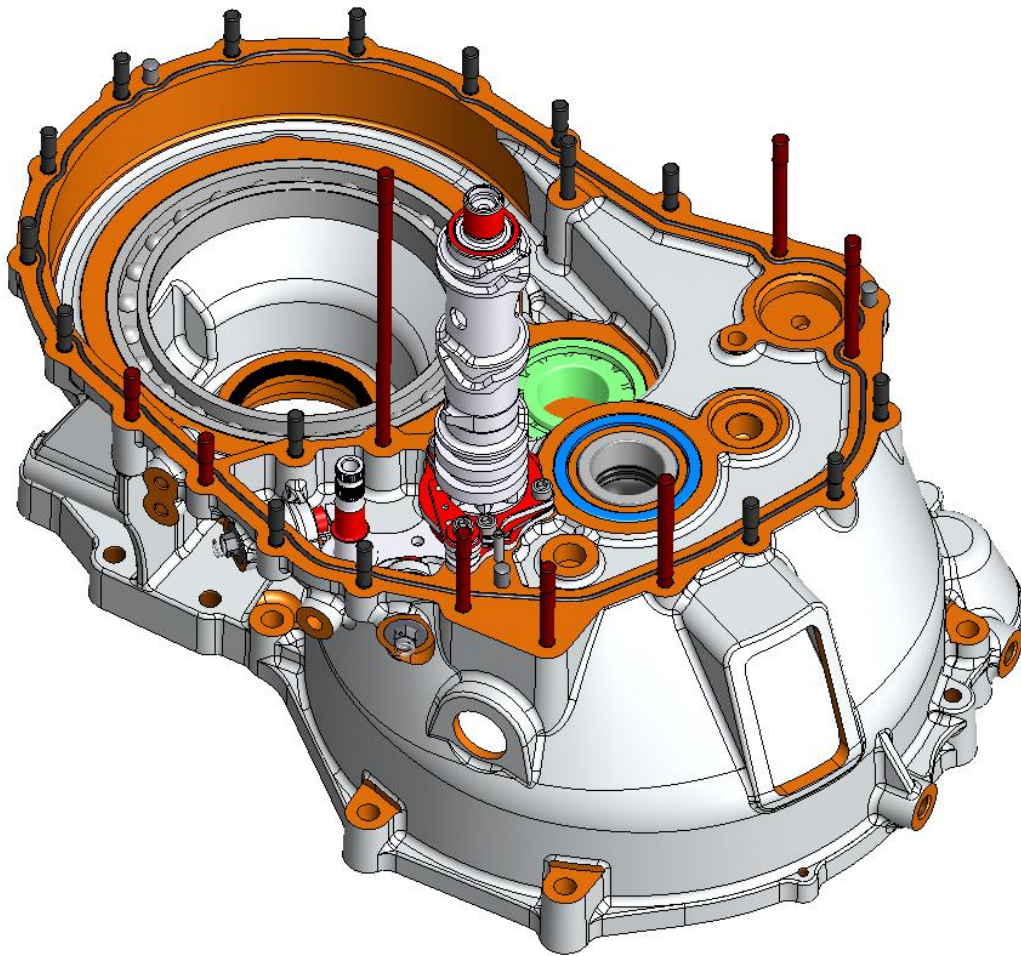
Check that the reverse *Idler* Gear Ratio matches the 1st Gear Ratio.

STEP 1

Assemble the camshaft mechanism according to the diagrams below:



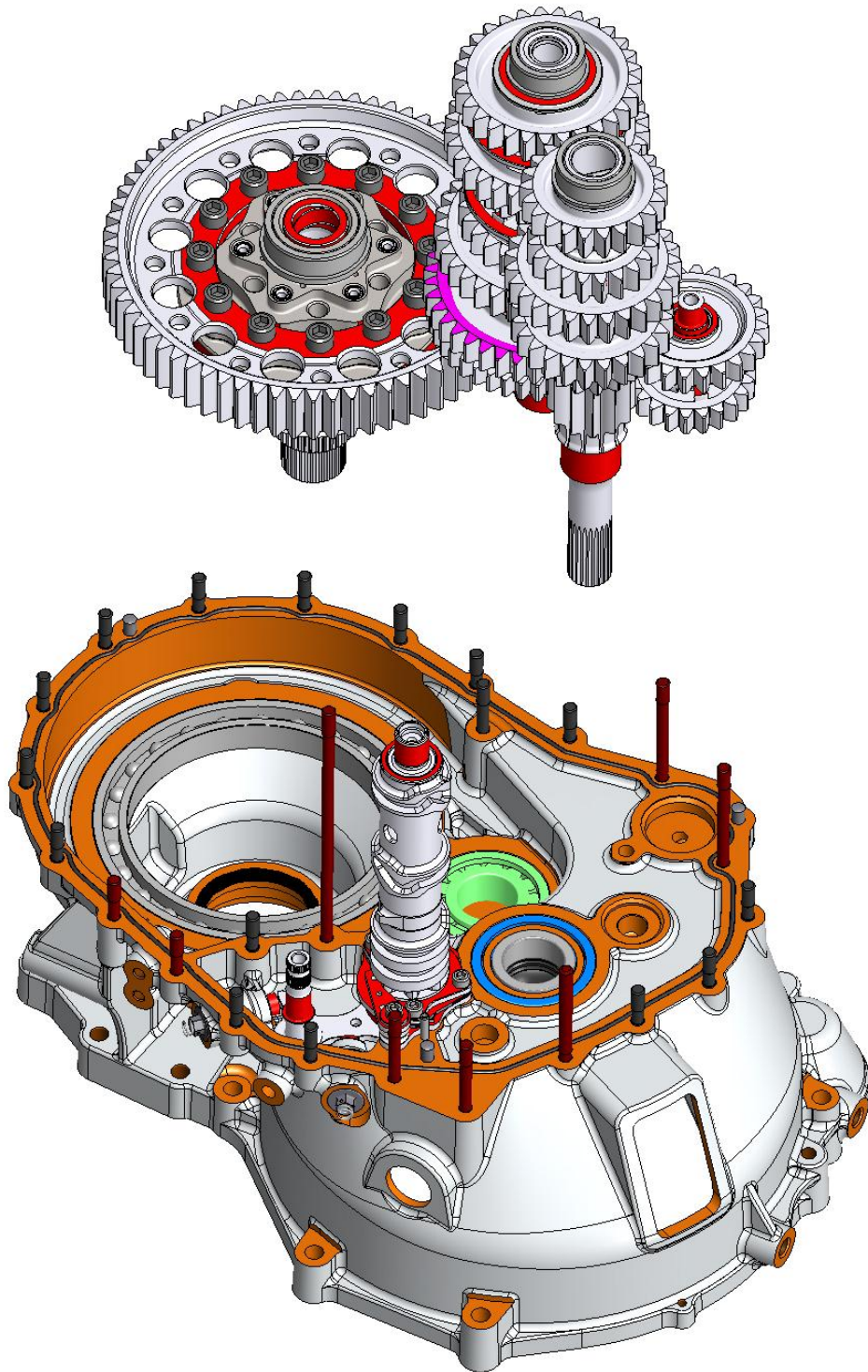
Fasten the five M6 screws using Loctite 243. Tighten to 16Nm.



STEP 2

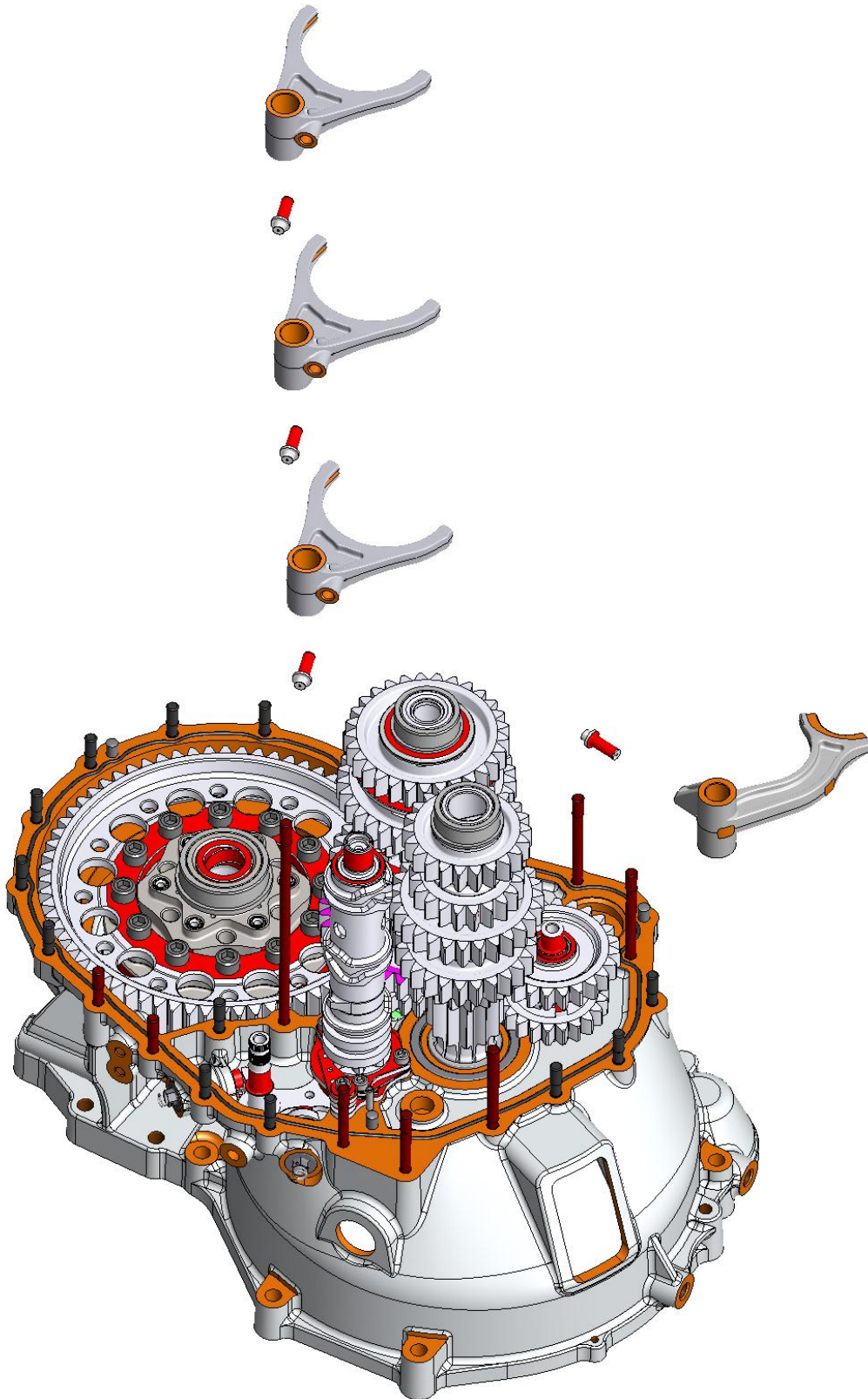
Fit the Gear train as a group.

NOTE: The reverse spindle (*MF-013*) must be aligned with the pin in the bore.



STEP 3

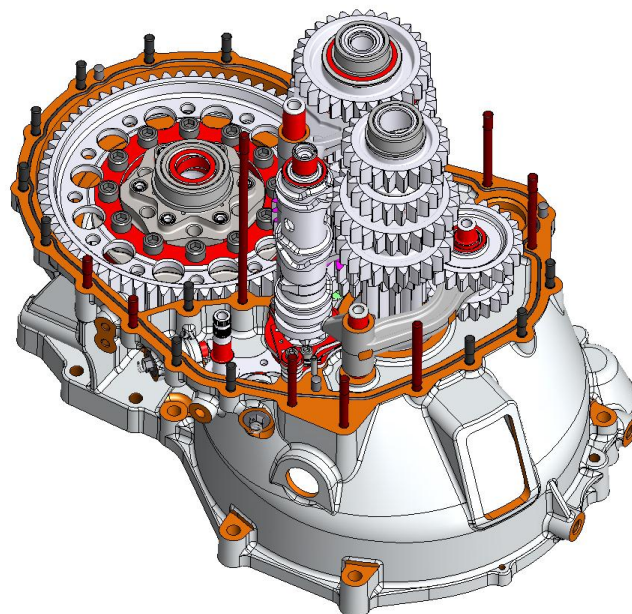
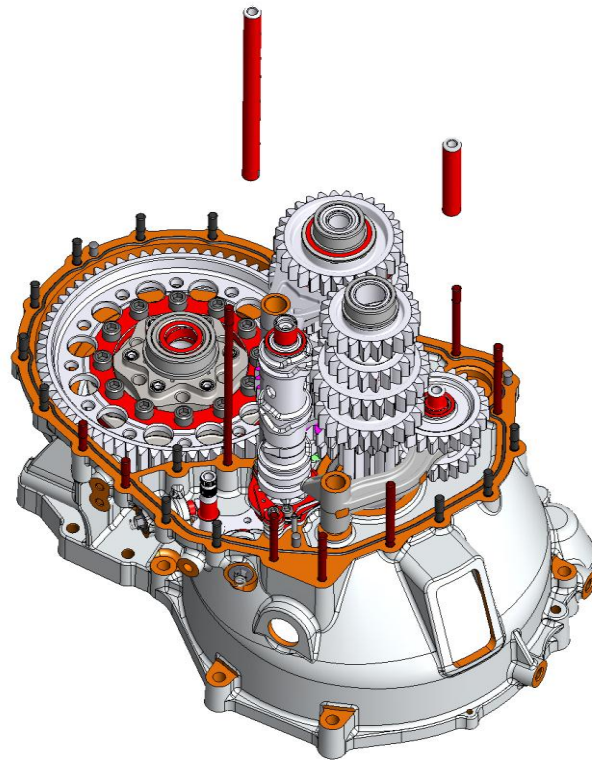
Fit the Forks and Follower Pins.



STEP 4

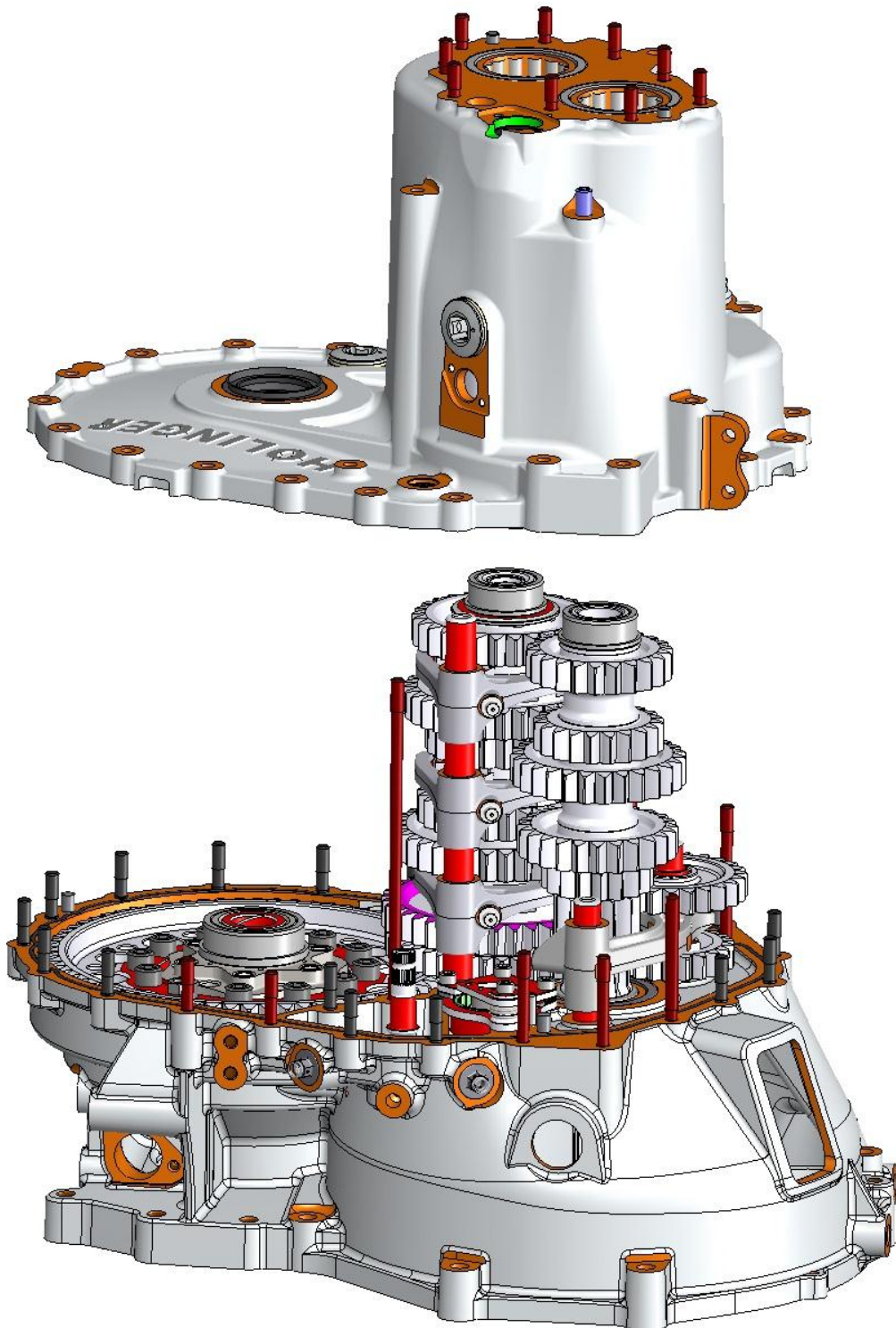
Fit the Selector Rods.

NOTE: The forward ratio Selector Rod (*MF-026*) has an alignment slot. Its purpose is to align the Oil Jets. Ensure it is fully inserted and the oil jets line up with the holes in the fork - *when a gear is engaged*.



STEP 5

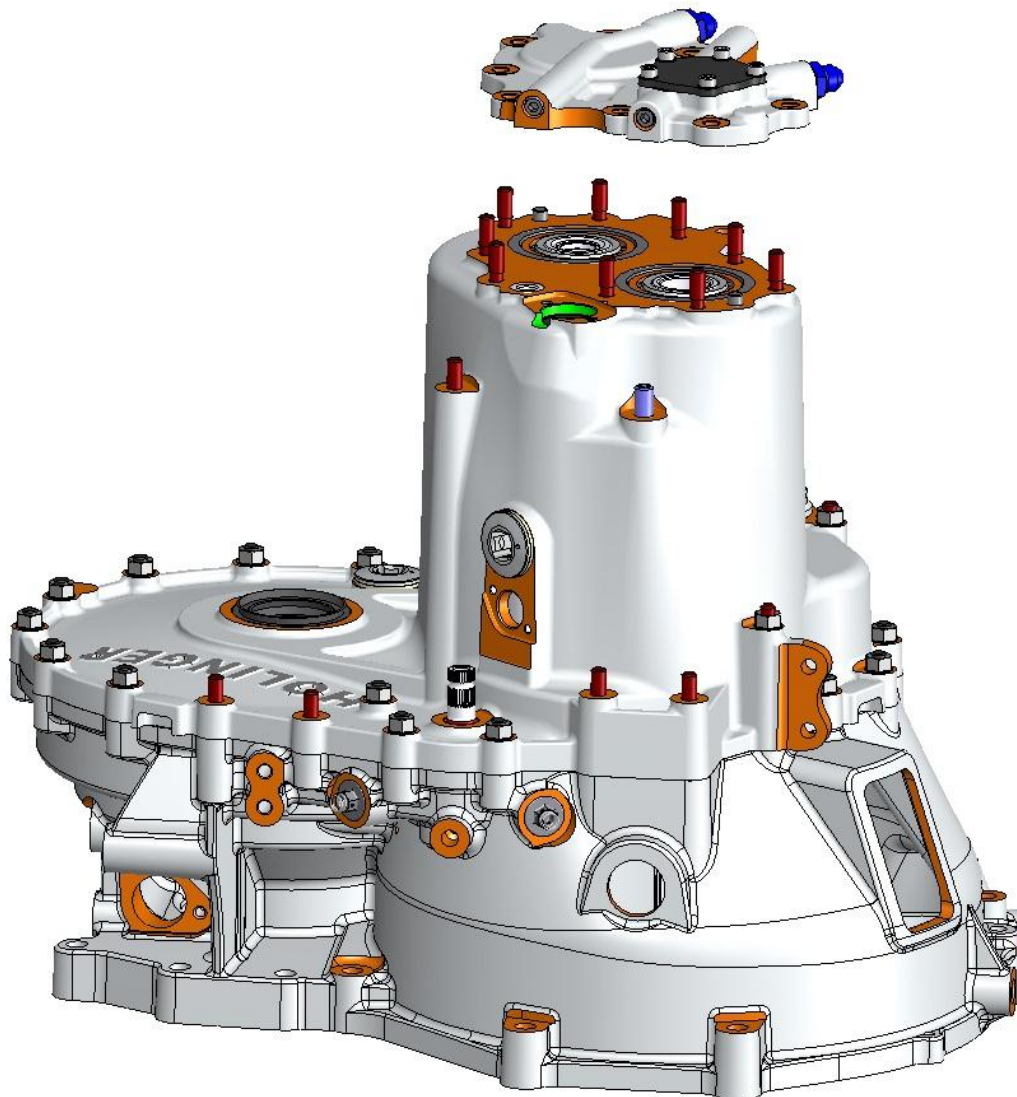
Fit the Gearbox Housing (MF-002).



STEP 6

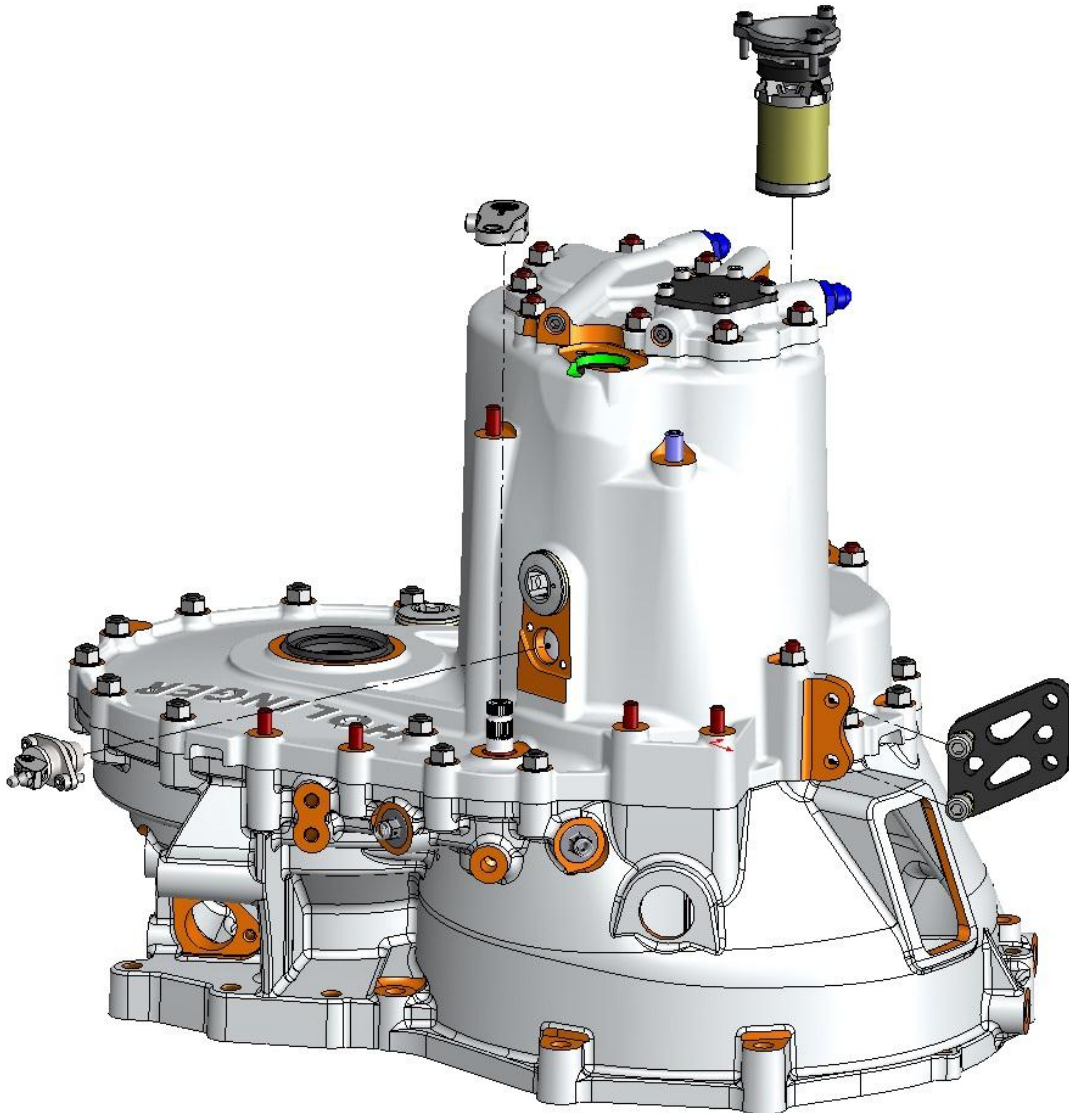
Fit the preassembled Oil Pump.

NOTE: Ensure the drive slot in the pump is aligned with the drive pin in the shaft.



STEP 7

Fit the remaining components; the gear-change lever (*SF-033*), oil filter/magnet, the neutral release mechanism and the clutch slave cylinder mount (*MF-029*).



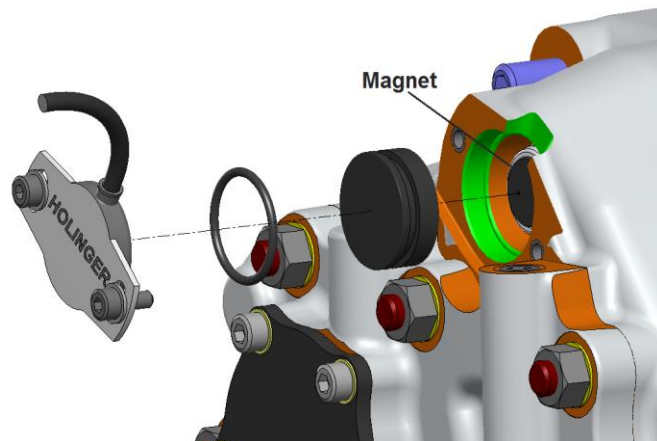
Shift back and forward between all the gears (to go from 1st to neutral, pull on the neutral release lever and shift down a gear), including reverse.

Check that the gear-change lever centralises properly and the gears engage in the correct sequence.

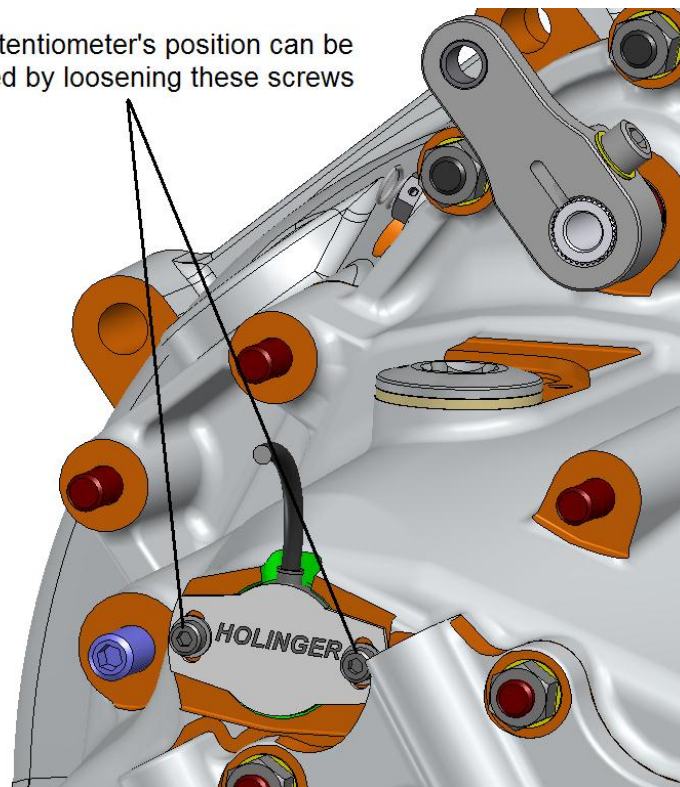
Gear Position Potentiometer Installation/Setup

Install the 181-01 gear position potentiometer into the side of the gearbox behind the camshaft.

NOTE: Be sure to insert the sealing plug and o-ring (MF-027C/222-0), also ensure that the magnet is installed in the end of the camshaft.

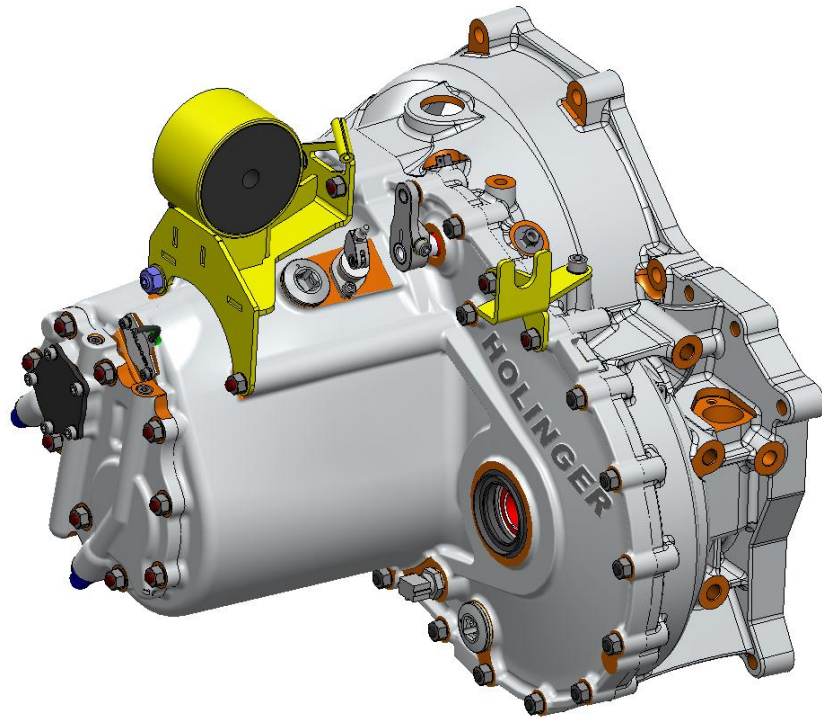


The potentiometer's position can be adjusted by loosening these screws

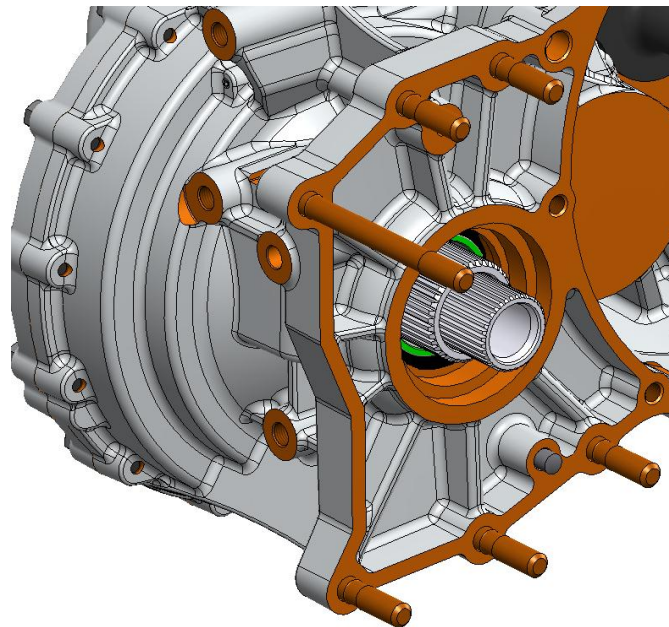


Plug in the dash mounted gear indicator, supply 12 Volts and shift through all the gears. If the display reads incorrectly, it will require adjustment by rotating the potentiometer body on the gearbox.

Finish the assembly of the gearbox by installing the mounts:



Then the transfer case mounting studs, securing with Loctite 263:

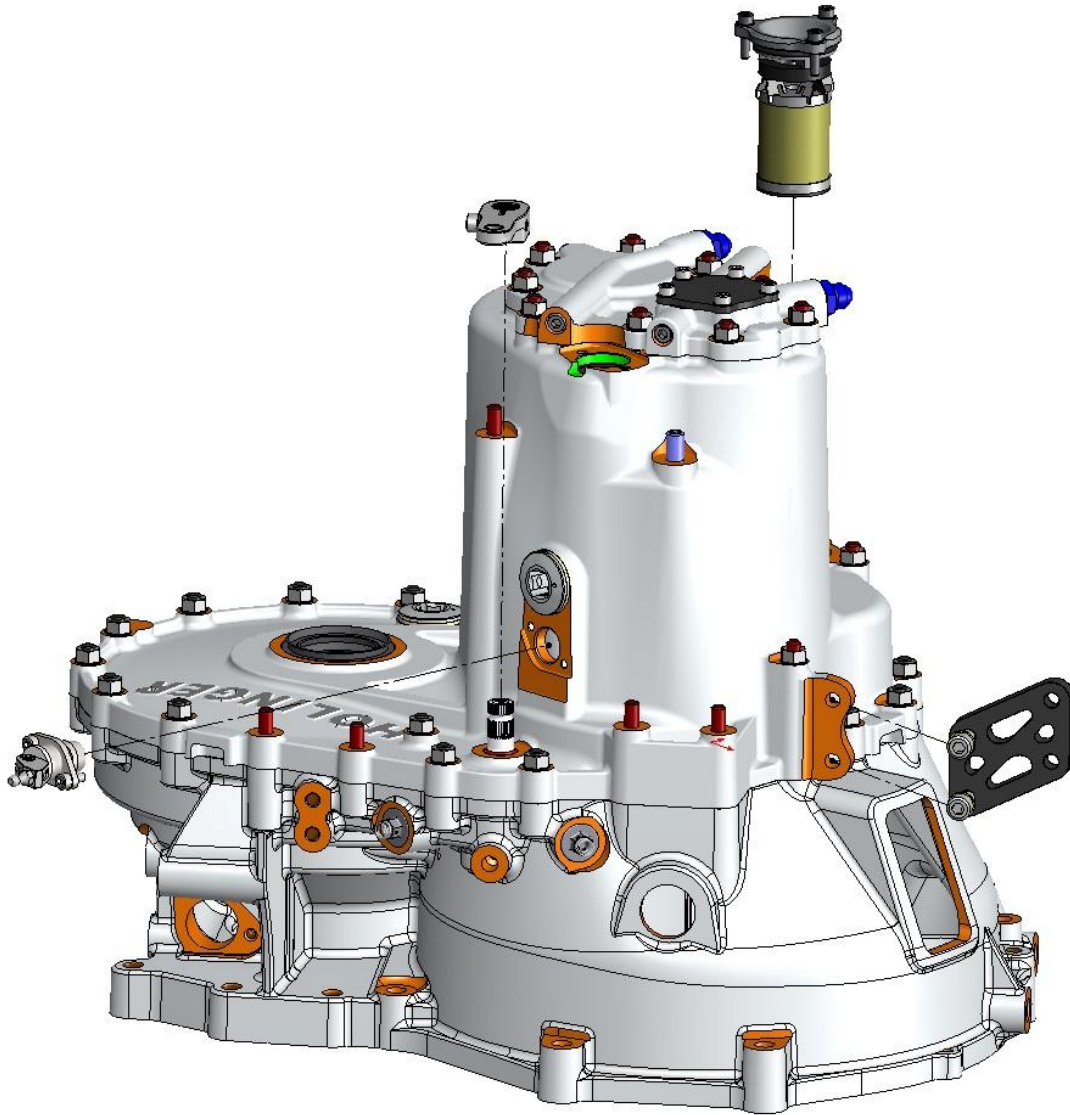


- 5 x M12x65mm studs with approximately 37mm protruding.
- 1 x M12x140mm stud with approximately 113mm protruding.

Also lubricate and install a 10x35mm dowel pin, .

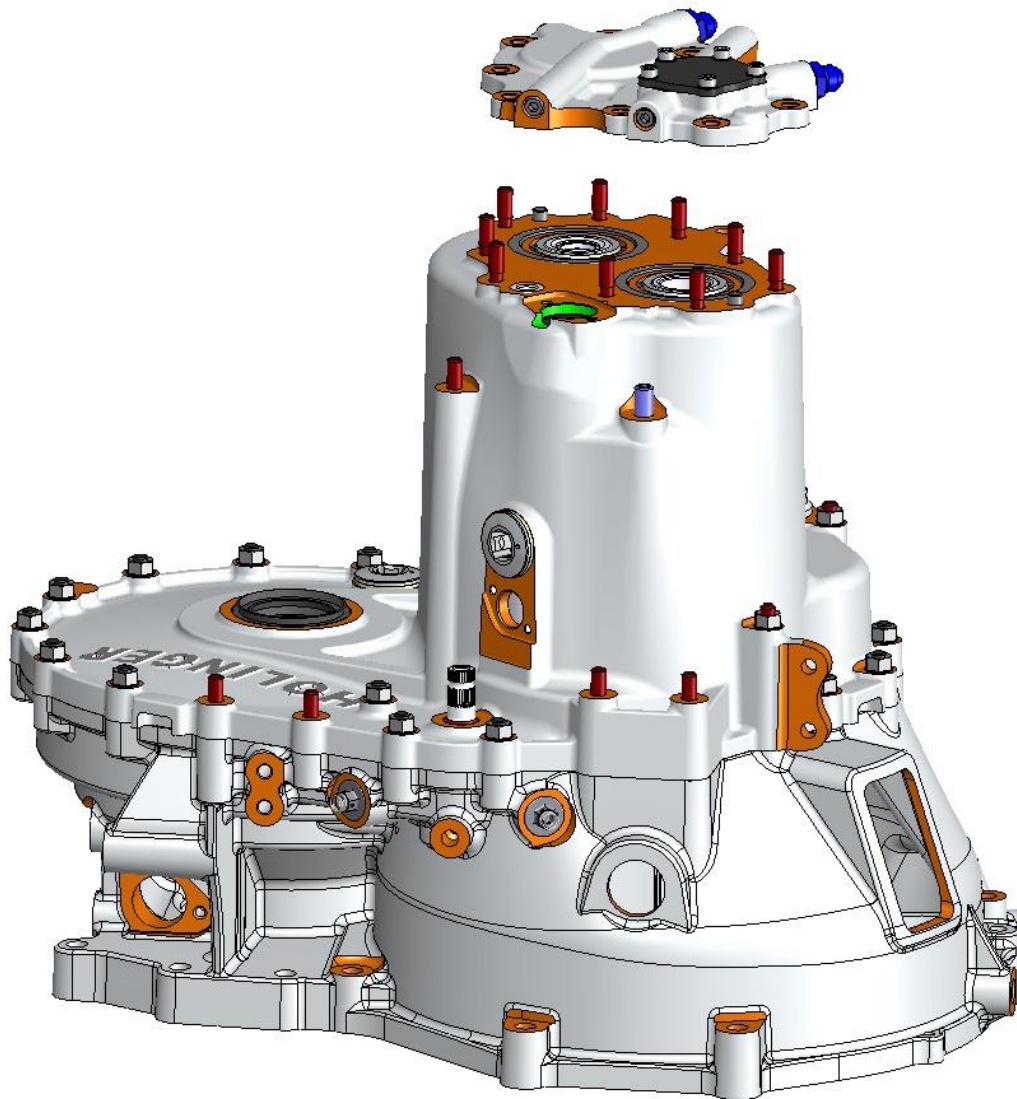
DISASSEMBLY

STEP 1



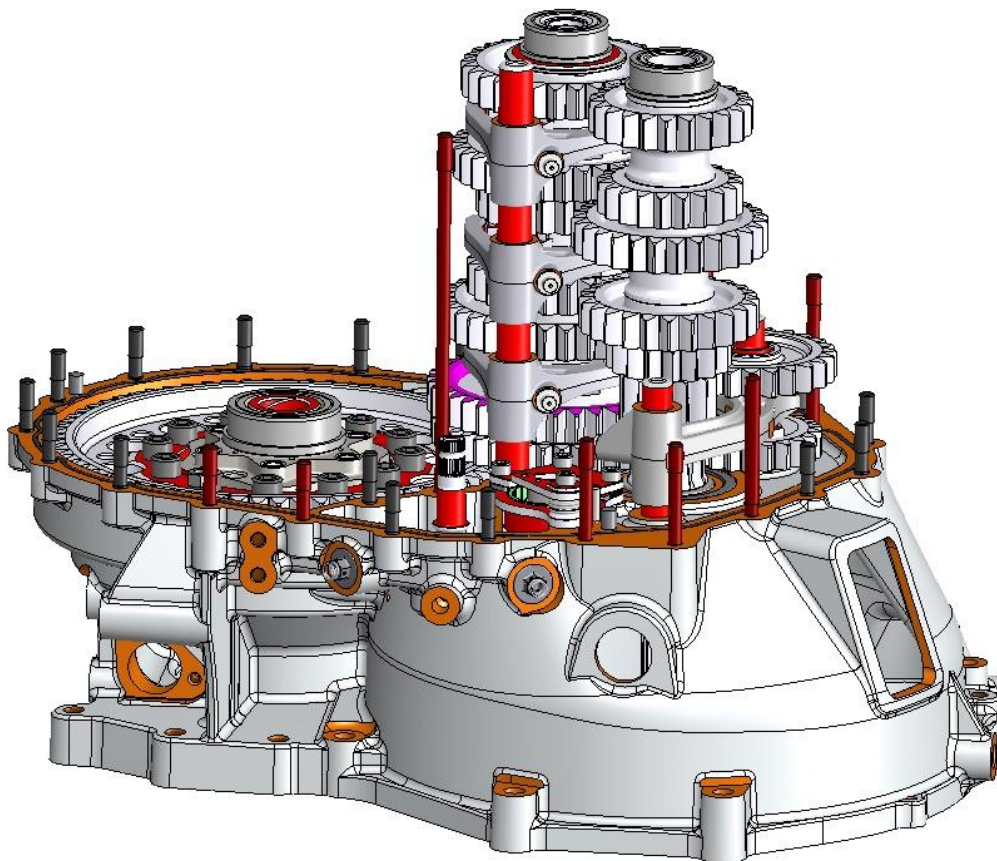
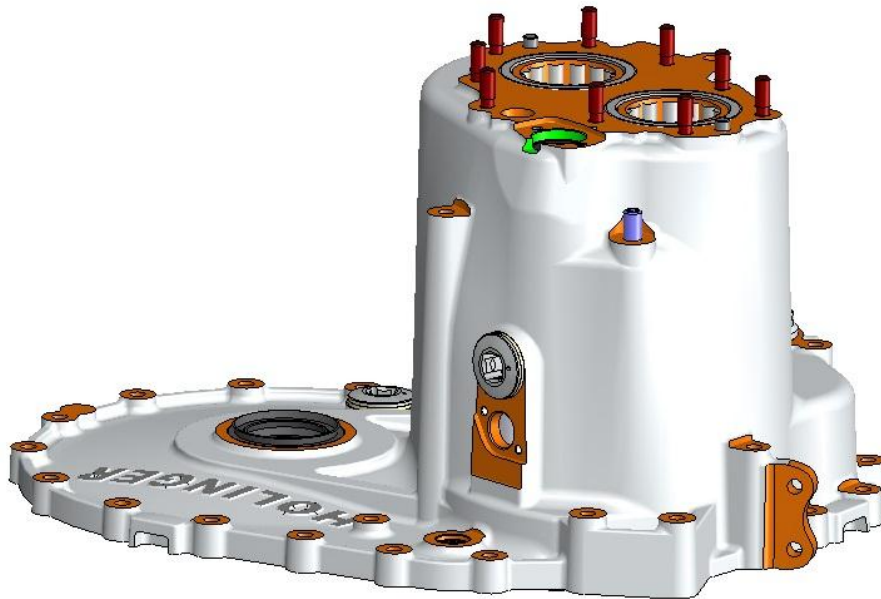
Remove the gear-change lever, oil filter, clutch slave cylinder mount and neutral release mechanism.

STEP 2



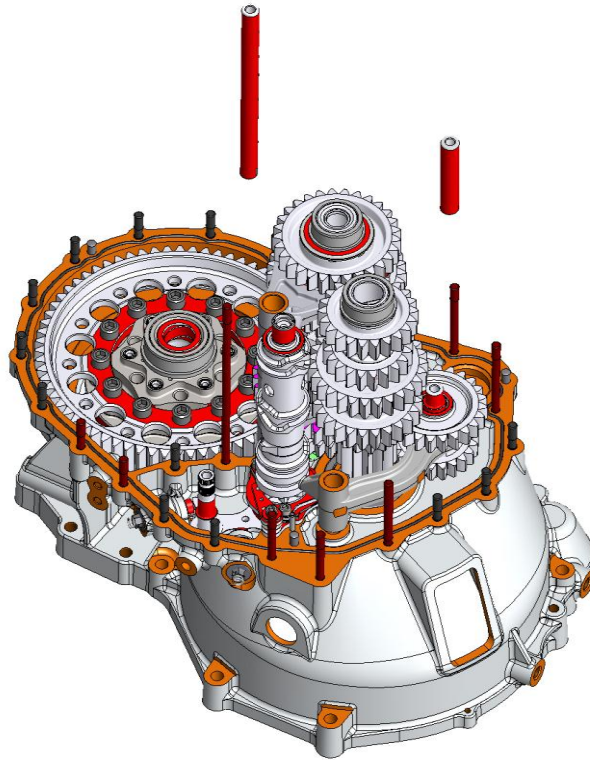
Remove the Oil Pump.

STEP 3



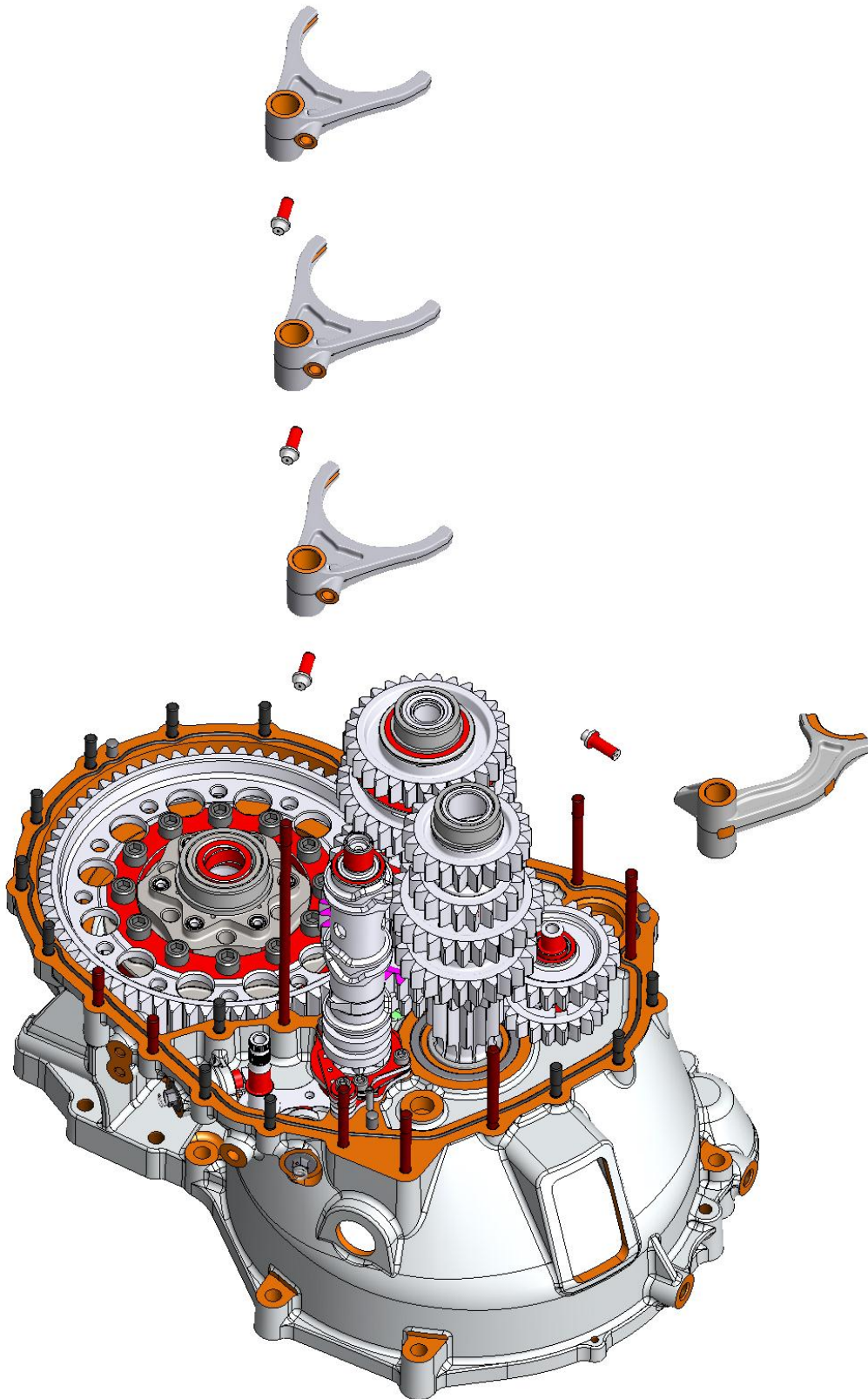
Remove the M8 nuts and the Gearbox Housing.

STEP 4



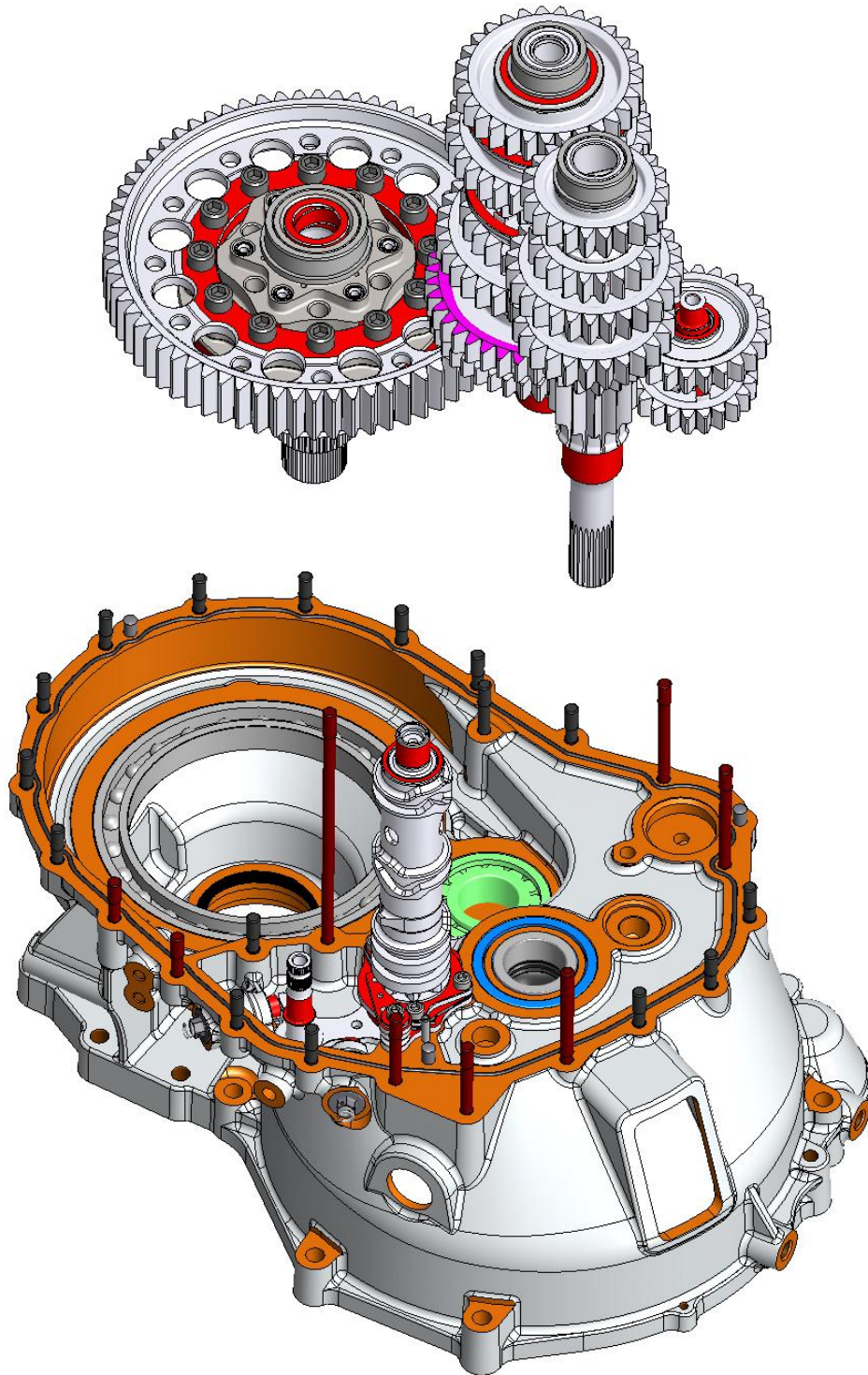
Remove the two Selector Rods.

STEP 5



Remove the Forks with the Follower Pins.

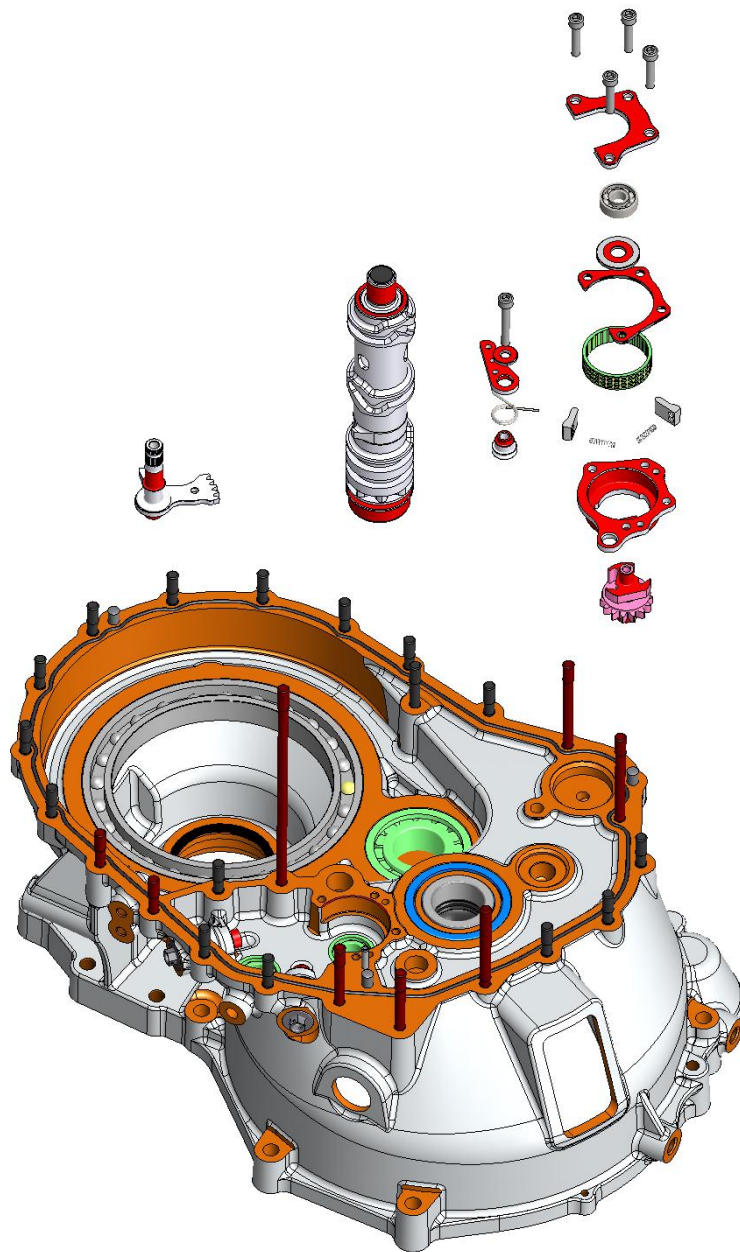
STEP 6



Remove the gear train as a group.

STEP 7

Remove remaining components as required.



Thoroughly clean and inspect all parts for cracks and wear.

BEARING END-FLOAT SETTINGS

Input Shaft / Pinion Shaft / Differential	0.003"-0.005" (0.08mm-0.12mm)
Pawl Carrier	0.004"-0.008" (0.1mm-0.2mm)

TORQUE SETTINGS

Drain and filler plugs	60 lbs-ft (80 N-m)
Differential Bolts (M10)	57 lbs-ft (77 N-m)
M8 Nuts	20 lbs-ft (27 N-m)
M6 Nuts	10 lbs-ft (14 N-m)
M6 Capscrews	12 lbs-ft (16 N-m)
M5 Capscrews	7 lbs-ft (9.5 N-m)

LUBRICATION

The extreme pressure additives in Limited Slip Differential oil have proven to aid gear life.

We recommend fully synthetic LSD oil, with an API GL 5 or higher rating and heavier viscosity range, typically 85w-140. 75w-90 is also acceptable.

Note: Some "Shockproof" oils are not suitable for use in this gearbox. It can clog the oil pump, paper element filter, galleries, and spray bar.

The Holinger MF requires approximately 2.5 litres of gear oil. The gear oil and filter should be checked regularly to quickly evaluate the gearbox condition. If oil condition looks overly metallic in appearance, further inspection of gearbox and differential should be conducted.