

356 - 5 SPEED BUILDING MANUAL

INSTRUCTIONS



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Subject to modifications

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INTRODUCTION

How do you build your 356 5-Speed kit the way we intended....?

OVERVIEW

- Your 356 5-Speed will be built by combining your kit of new parts with donor parts from your Porsche 901, 911 or 914* donor transmission.
- The kit you have purchased includes all the parts necessary to assemble the 356 5-Speed with the exception of those original Porsche parts that will be harvested from the donor transmission. Your donor transmission will yield the input and pinion shafts, crownwheel gear, all 5 gear ratios, the shift rails and shift forks, the reverse gear assembly and all the bearings. Many small hardware parts are also re-used.
- The major components re-used from your existing 356 transmission installation are suspension parts, the axles and the axle tube assemblies. Transmission mounts, throttle bell-crank, clutch cable bracket are all transferred too, along with your clutch release bearing. The 356 transmission removed from your car can be carefully stored in a fully assembled condition once the axles have been removed.
- Your 901, 914, 911 series donor transmission may require regular service repairs, or replacement bearings, synchronizers etc. But for the purposes of explanation, we will assume your donor transmission has been inspected and the donor parts for the 356 5-Speed repaired to fully serviceable condition in any application.
- Due to Copyright and in deference to the superb factory instructions widely available for the 901, 914, 911 series transmissions, we do not reproduce any of these original Porsche instructions or diagrams.

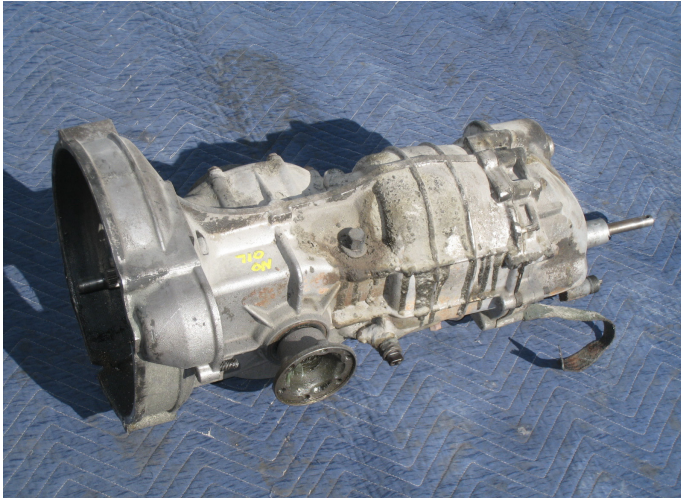
* If your donor transmission is a 914 Side Shift transmission from 1972 – 1976, you will require extra parts.

Which 901 Transmission as my donor....?

- Once your parts kit has been ordered, the next step in your WEVO 356 5-speed conversion is to source your donor Porsche 901 family transmission. Parts harvested from the donor will be used along with your 5-Speed kit parts to build the finished 356 5-Speed transmission.
- Four different Porsche 5-speed transmissions can be used as a donor. They all have subtle variations, so understanding the donor models is a key part of preparations.
- More than 215,000 vehicles equipped with the Porsche 901 family transmissions were manufactured, so there are plenty of core transmissions available. Even if (as Porsche themselves claim...) 75% of all 901-equipped donor Porsches are still driving, discounting those cars still leaves us with more than 50,000 potential donors for the 356 5-Speed kits!

Which 901 Transmission as my donor...?

Porsche 901 Transmission – the original.



The first version of 901, commonly known as the "Chilled Cast" version, is an all-aluminum casting used in the rear engine cars (911 & 912) from 1965 to 1968. It was available in both 4- and 5-speed versions. You will require a 5-speed version to have all the parts needed.

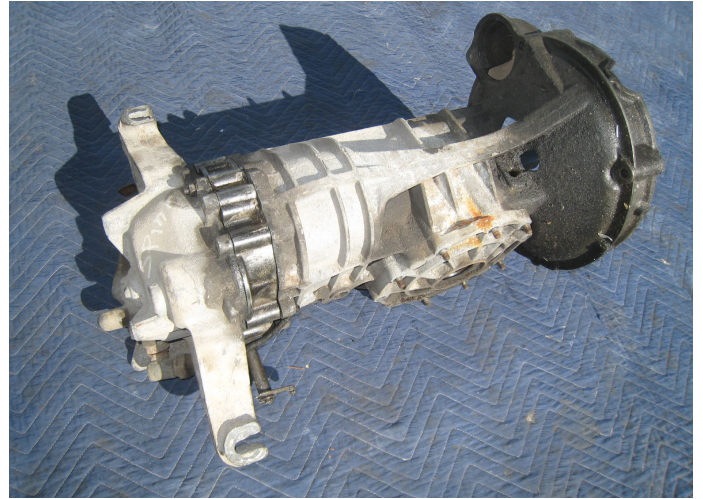
Porsche 911 Transmission – the magnesium version.



The second version of 901, commonly known as the "911 transmission", is an all-magnesium casting that was used in the rear engine cars (911 & 912) from late in 1968 through the end of 1971. The 911 transmission was available in 4- or 5-speed versions. You will require a 5-speed version to have all the parts needed.

Which 901 Transmission as my donor...?

Porsche 914 Tailshift Transmission – the early one.



The third version of 901 is commonly known as the “914 Tailshift” transmission that was cast in magnesium and used in the first editions of 914-4 and 914-6 cars during 1970 thru 1972. The 914 Tailshift transmission was only available in a 5-speed version.



Which 901 Transmission as my donor...?

Porsche 914 Sideshift Transmission – the late version and last of the series.



The fourth version of the 901 is commonly known as the “914 Sideshift” transmission, also cast in magnesium and was used from 1973 to the end of 914 deliveries in 1976. The 914 Sideshift transmission was only available in a 5-speed version.



Which 901 Transmission as my donor...?

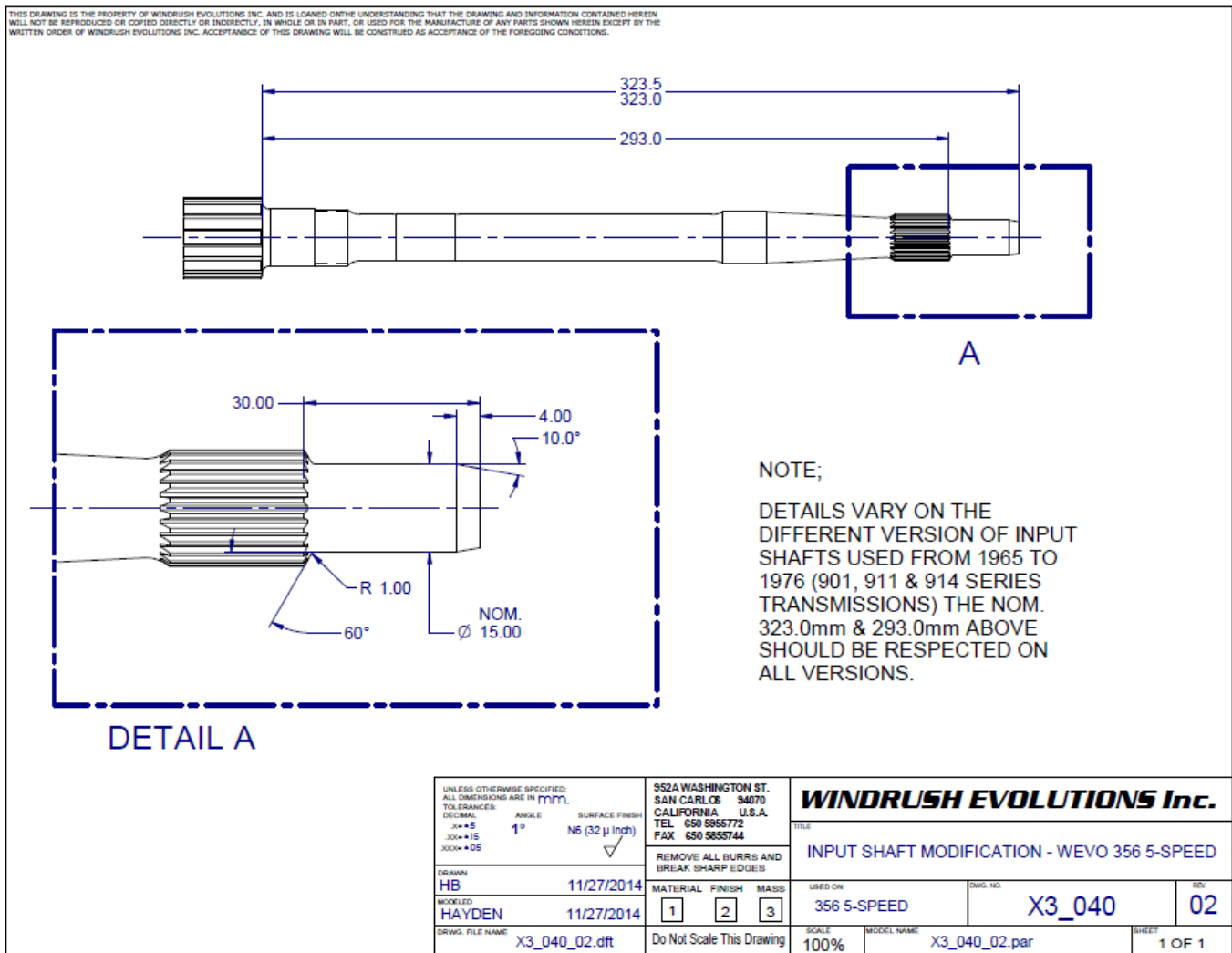
Further donor Transmission Considerations

- Of these four versions, the 901, 911 and 914 Tailshift are the most desirable donor transmissions. These three versions will yield every part required to complete your 356 5-Speed kit.
- The 914 Sideshift transmission will supply all the gears, shafts, sliders, hubs, shift forks, spacers etc, but only one of the three shift rails required and therefore require a few parts from another source. Although the 914 Sideshift transmission is not a 100% donor, they are also the newest of the donor cores and should not be overlooked as a great source of majority of the parts at economical prices.
- The beauty of the 901 family of transmissions is complete modularity of the design and the important fact that parts can be interchanged from all models, even between and the 4 and 5 speed versions to some degree. There is a wide variety of original ratios available from the different model four and six-cylinder engine applications and there is a range of new ratios also available from the after market gear manufacturers.
- Rebuild components for 901 series transmissions like sliders, drive teeth, synchro rings and bearings are all still readily available and, with the exception of a pitted CWP gear set or internal corrosion from poor storage conditions, nearly every donor core can be restored to good functional condition to build a 356 5-Speed.
- There are some subtle technical variations in the assembly dimensions of the different versions and if of consequences, these are covered in the technical notes and guidelines for assembly.
- Once you have your donor core you will need to establish the condition of the core and make provision for any repairs that would affect the operation or reliability of your new 356 5-Speed transmission project.
- There are no special requirements for standard 901 series parts used for the 356 5-Speed transmission. The evaluation of condition would be the same if you were servicing that 901 transmission to be installed in the original vehicle.
- The safest route is to work with an experienced Porsche transmission builder. They can complete an inspection of the components and make the recommendations of any replacement parts required.
- If you are experienced and confident with the servicing of 901 transmissions, the donor parts for the kit should be reviewed for serviceability in the normal manner expressed in the Porsche factory manuals for the 901 series of transmissions.

356 5-Speed Product Specifics.

INPUT SHAFT

- The input shaft (also often called the mainshaft) from your donor 901 / 911 / 914 transmission will require modification. This is a relatively simple task for a technician with the correct equipment - a lathe. Included with the kit is drawing X3-040. Use this drawing to complete the shortening of the input shaft. The shaft must be disassembled from all its gears, bearings etc.



356 5-Speed Product Specifics.

CROWNWHEEL & PINION SET-UP - PART 1

- Two critical set-up procedures of your 356 5-Speed are the Pinion Depth and CWP (Crown Wheel & Pinion) backlash. These are familiar technical terms to a technician who is experienced with the Porsche 901 series transmission.
- These critical procedures are performed in the normal manner developed by Porsche and explained in the Porsche workshop manuals for 901, 914 and 911 transmissions. The variations in set-up dimensions and calculations follow the year of manufacture, so take care to identify the source of the parts and decode the markings on the parts correctly.
- The traditional 901 CWP set-up tools seen in the Porsche manuals can be used to accomplish these tasks when building a 356 5-Speed. The pinion depth is adjusted using the normal shim stack on the pinion shaft, with fine adjustments available with the intermediate plate gasket in conventional Porsche manner. The 356 5-Speed kit includes unique intermediate plate gaskets in 0.10mm and 0.15mm thickness.
- As an efficient alternative, a simple gauge block tool for pinion depth setting has been developed by Windrush. The X3-073 tool fits in position of the right hand side cover and access via the LH side cover opening is used to feeler gauge the pinion depth. For customers in the USA the X3-073 can be rented from WEVO. There are separate specific instructions for using the X3-073.



356 5-Speed Product Specifics.

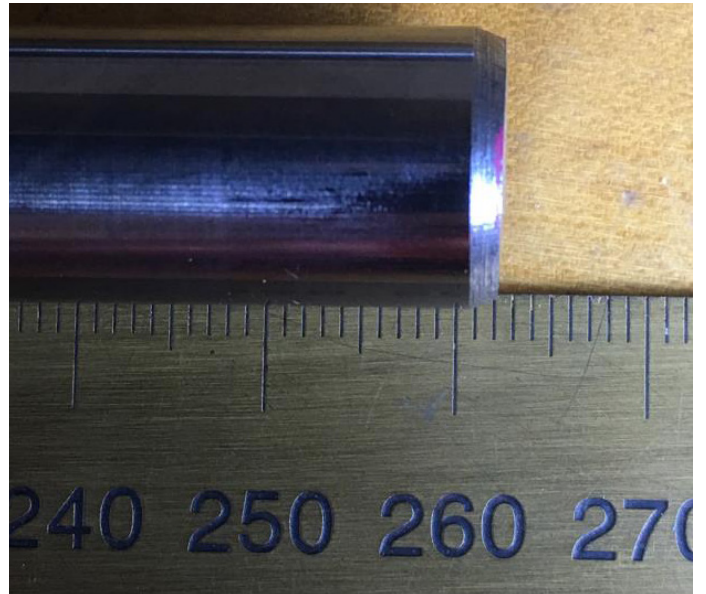
CROWNWHEEL & PINION SET-UP - PART 2

- The Crownwheel backlash is achieved by adjusting shim thicknesses under the differential carrier bearings. This adjustment procedure was introduced by Porsche with the 901 transmission.
Due to the unique carrier bearing dimensions, the shims required are also peculiar to the 356 5-Speed. The X3-042_XX series shims are available in all the incremental sizes necessary. Your kit includes the full selection of shims, of which only a few will be used, the balance will be redundant, but it is never known exactly which shims are required before tackling this procedure – the resultant set-up is matched to your CWP gear set. The nominal design dimension is for 3.0mm shims for both carrier bearings.
- Differential carrier bearing pre-load should be in the region of 0.2 to 0.3mm.

356 5-Speed Product Specifics.

SHIFT RAILS

- The shift rails from the different generations of Porsche 901, 914 and 911 transmissions all vary slightly. There are some early versions in 901 transmissions where the 1st/Reverse shift rail has an extended taper on the end closest to the differential.
- If your parts look like these three 1st/Reverse shift rails in the photo below, it must be shortened in the pink area as shown. This is not a precision operation and can be achieved with a sander or grinder. The overall length of the 1st/Rev shift rail should be reduced to 262 – 263mm.



- The 2nd/3rd Shift Rail and the 4th/5th Shift Rail are used without any modifications. (shown bottom right in these photos)
* Note: Shift rails sourced from the '73-'76 914 Sideshift transmission are not compatible.

356 5-Speed Product Specifics.

SHAFT BEARINGS

- The original bearings in your donor transmission are the correct design and fitment for the 356 5-Speed. Whether or not you elect to re-use them is always a balance of choice in terms of budget, future reliability and potential of bearing noise.

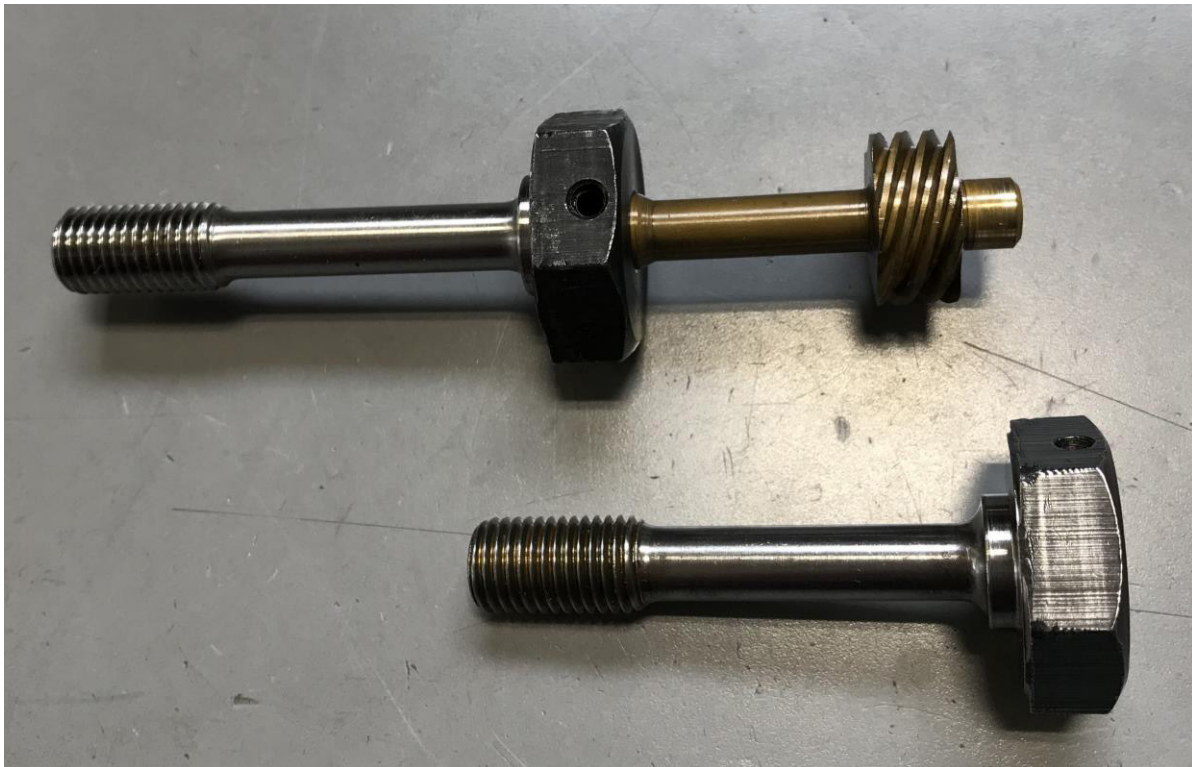
As of early 2018, the replacement cost of the 4 major shaft bearings in a 901 transmission is in the region of ~US\$1200.

- The pinion bulkhead roller bearings are installed with the same combination of snap-rings. The assembly into the 356 5-Speed pinion bulkhead is the same as the removal from the 901 donor, the 4 retaining rings should be salvaged from the donor if you choose to use new bearings.
- The fit of the two thrust bearings in the intermediate plate X3-111 will require heating the plate to around 120°C (~250°F). At this temperature the bearings will be a slip fit, or require a light press to install.
- The Bearing retainer plate X3-068 is fastened by 6x Low Head Cap Screws, with Aircraft locking nuts. The screws are fitted with the head nested into the X3-068 and the nuts are placed directly against the X3-111 with no washer. These nuts should be installed with the Loctite 263 supplied in the kit and tightened to a torque of 35Nm (26ft.lb).
Allow the X3-111 plate to cool fully after heating to install the bearings and before applying Loctite 263 and tightening the 6 screws to final torque value

356 5-Speed Product Specifics.

PINION SHAFT STRETCH BOLT

- The odd looking bolt with a 30mm AF hex head and long plain shank with M12 thread is used to clamp the pinion shaft thrust bearing. When used in the 901 transmissions, it has a brass gear roll pinned to the screw for the speedo drive.
- This brass speedo drive gear must be removed by driving out the roll pin. The tightening torque for the screw is the same as in the 901 transmission. 110 – 120Nm (80-87 ft.lb)



356 5-Speed Product Specifics.

SHIFT FORKS

- All three original shift forks are re-used in exactly the same location and adjustment. The adjustment of the forks should be performed to achieve the gap spacing and neutral alignment described in the factory manuals.
- The hex bolt head that fastens the 1st/Reverse shift fork is very close inside the front cover when all parts are assembled. We have seen witness marks from the hex head touching the inside of the cover as Reverse gear is selected. Be sure to perform a dry test fit of the front cover and exercise the reverse gear selection process to ensure that there is no interference or contact preventing full travel into reverse gear. As this kit is made with sand castings, there can be unique anomalies or surface irregularities on every part.

BREATHER

- The original breather from the 901 donor transmission is used. The breather should be installed with the hole facing forwards and to the right side of the car by 45 -60°.

REVERSE LIGHT SWITCH

- The reverse light switch is a BMW part and offers high quality solution that is simpler than the Porsche arrangement with the free floating pin. The pin is integrated into the BMW switch and therefore this switch unit is installed last – after the shift rails are in position adjacent to the switch port.
- The location of the switch is within reach of the original chassis wiring loom for the reverse switch, requiring no change to the wiring, even though the switch is now on the right, where previously on the 356 reverse switch was located on the left.

356 5-Speed Product Specifics.

MAIN SHIFT ROD

- The main shift rod, which is black in color is installed with the counterbore feature to connect the shift coupler facing downwards. The shift rod is symmetrical, so when the shift finger is transferred from the donor transmission, the orientation must be considered.
- Coincidentally, the arrangement is the opposite of the 901 transmission.

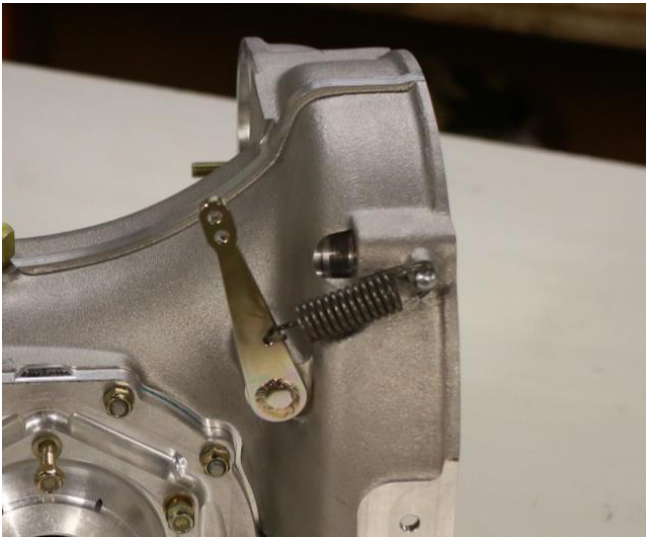
GUIDE TUBE

- The throw out bearing Guide Tube is fastened by two M6 flat head socket screws. These should be secured with some medium strength Loctite.
- The input shaft seal is not a standard Porsche part, but is made of Viton material and can be expected to offer long service life equal to Porsche parts. Be sure to insert the seal in the correct direction when pressing into the guide tube. Your installation view for the seal is from the inside of the transmission therefore the outside of the seal must be away from your view.

356 5-Speed Product Specifics.

CLUTCH RELEASE

- The new parts in the 356 5-Speed kit are assembled in the same way as the original 356 clutch release mechanism.



- The release fork is asymmetric, in the area where the bearing is fitted, the thicker finger on the fork should be arranged closest to the transmission, the thin finger closest to the engine.

356 5-Speed Product Specifics.

GROUND STRAP

- There is one front cover stud on the lower left hand side (of car) that has a full island boss for the nut. This stud is slightly longer to allow for the ground strap and the clamp washer.

PART NUMBER REFERENCES

- Your packing list is the parts list for your kit. You will notice many O.E. parts in the kit, those are always identified by the original Porsche number.
- There are also many bespoke parts manufactured for the kit and these will all be X3-XXX part numbers.
- The balance of numbers will be proprietary numbers from the manufacturer of the part, meaning these are generally available from other sources by that same number.
- For spare parts always identify the part by the numbers used on your packing list.

SEALANTS AND GASKETS

- The 356 5-Speed uses both gaskets and o-ring seals as appropriate and functional.
- The shim gaskets between the main housing and the intermediate plate are not essential. If you complete your pinion depth set-up with no gasket, the bare metal flanges should be sealed with a compound suitable. The o-ring string should always be used between the intermediate plate and the front cover casting – with a suitable sealing compound.
- It is important to use non-setting sealant when installing the differential side covers – both have o-rings – as these faces will be moving during the assembly of the axles tubes and retainer plates, any rigid sealing compound will be compromised during this process.
- In all cases we recommend using your favorite non-setting sealant to dress both gaskets and flanges

356 5-Speed Product Specifics.

FULCRUM FORK

- The main shift rod and shift finger in the 901 is reacted in the “fulcrum fork” that bolts in through the bottom of the transmission. This part is harvested from the 901 donor transmission. The part can only be installed in one direction – due to the bolt spacing, it is installed in the same manner as the 901.

Note: Inquire to WEVO about the “901 GateShift kit” that is also compatible with the 356 5-Speed assembly. This kit replaces the fulcrum plate with a gate unit and can only be installed during assembly of the transmission. Product release is due in Summer 2018.



356 5-Speed Product Specifics.

AXLE INSTALLATION

- If you have purchased a 356 5-Speed kit and assemble it yourself or your technician assembles the transmission, this assembly sequence is important to maintain the correct the correct seating of the differential side covers and the associated crownwheel and pinion set-up.
- The Differential is carried on a pair of tapered roller bearings. Each bearing outer race is mounted in a side cover. The RH side cover is retained by 6 M8 studs, these studs also mount the retaining plate of the RH axle tube.
- The LH side cover is larger and is retained by 10 studs. 8 studs retain the cover alone, 2 studs retain the cover and mount the clutch release cable bracket. The LH axle tube retaining plate is mounted by 6 studs on the LH side cover and this is the only task of those 6 studs.
- The taper roller bearings carrying the differential are installed so that there is **0.2-0.3mm** of pre-load. Therefore when either the LH or RH side cover nuts are slackened, that side cover will be pushed away from its seated position by the preload on the differential carrier bearings.
- This sequence is intended to make sure the RH side cover is fully and correctly seated by the 6 studs before the LH side cover is tightened for the final time.
- Before starting, make sure the spherical surfaces of your axle tubes and retaining plates are free from burrs and abrasion damage that will cause damage to your new side covers or complicate the assessment of free axle tube movement.
- Second point before starting – make sure the 10 nuts on the LH side cover are all at least 1 turn loose and that the LH side cover has a gap between the flange and the main housing – this means the carrier bearing preload will be relaxed.
- Working on the RH axle tube, use the normal method to establish the correct thickness of retaining plate shim gaskets to have free and correct axle tube movement.
- Remove the large snap ring retaining the RH side gear – accessible with the special Knipex oversize snap ring pliers supplied with the kit. Note the orientation of thrust washer – the bevel on the spacer internal diameter faces inwards.

356 5-Speed Product Specifics.

AXLE INSTALLATION

- The thrust washers are specially sized, so if you have decided to disassemble all the parts on the bench, make sure you keep left and right washers allocated to their correct position. It will also be recorded on the packing sheet for your kit.
- The side gear can be removed with your fingers – once again these are matched to the thrust washer.
- Check the fit of your fulcrum plates and axle into the side gear and detail them as necessary to achieve a correct fit.
- Lubricate the side gear, fulcrum plates and axle and assemble them all as a unit. Pass the thrust washer over the axle from the outboard end (note – bevel faces inward), the large snap ring too.
- Slide the whole unit into the differential and install the snap ring – check all parts are correct seated and the axle turns freely.
- Apply your preferred sealant (or not!) to the axle tube retaining plate and shim gaskets. Assemble those parts in the conventional manner, tightening the six M8 nyloc nuts to a final torque of **25Nm**.
- Check the freedom of the axle tube and if the assembly is satisfactory, the RH side assembly is complete.
- Move to the LH side cover and tighten the 10 nuts holding the side cover.
- Now complete the same steps to prepare the axle tube and the axle and assemble per the RH side. This will require installing the clutch cable mounting bracket which uses the standard 356 bracket, part # 644.23.327 at the time of fastening the LH axle tube clamp plate.
- The 356 5-Speed is now ready to accept wheel bearings, hubs, suspension, brakes etc. It is worth noting that all the above steps can be performed with the engine and transmission installed in the chassis, it makes the installation of the transmission much easier, the installation of the engine easier and the installation of the exhaust and other parts that typically conflict.

Technical questions
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