



Training Document

HOWO ZZ4257S3241V

- Clamp the intermediate shaft perpendicularly on the working bench (lead clamping board should be used.). Heat the front tapered roller bearing to 80°C, press it on the shaft and make it contact with the gear shaft tightly without clearance. Choose circlip with proper thickness to fix the position of the bearing without clearance. Put the circlip into the circlip groove on the shaft.





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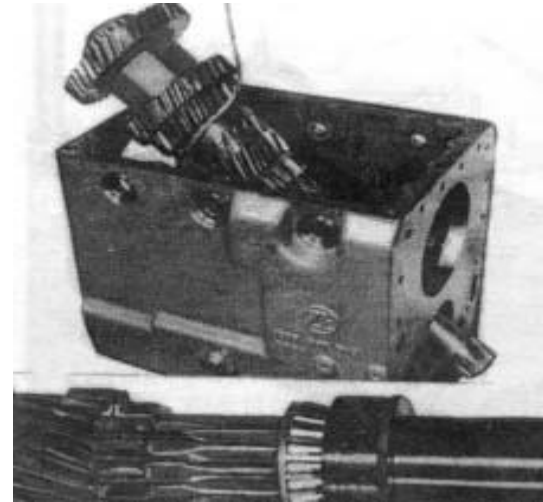
- **Specification of the circlip commonly used**

Factory part number	Washer thickness (mm)
00769144033-1	2.1
00769144033-2	2.2
00769144033-3	2.3
00769144033-4	2.4
00769144033-5	2.5
00769144033-6	2.6
00769144033-7	2.7
00769144033-8	2.8
00769144033-9	2.9
00769144033-10	3.0
00769144033-11	3.1
00769144033-12	3.2





- **(2) Hang up the countershaft with a slinging machine and put it into the box housing**



- slantways with the output end down (The oil sucking pipe has already been attached in the box housing.). Move the countershaft toward the output direction and make the shaft attaching shoulder reach out the box. Heat the tapered roller bearing to about 80°C and press it tightly against the shaft shoulder. Then put the auxiliary shaft in the box housing at a correct setting position and attach the output side bearing outer ring.



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- Attach the oil baffle disc of the bearing at the output end (rear end) of the auxiliary shaft in the relative bearing seat hole in the front housing of the auxiliary box (See to it that the smaller end of the oil baffle disc faces the output side.). Preset auxiliary box front housing together with the gasket on the main box and fix them with part of the bolts temporarily.
- Set the main box together with the front housing of the auxiliary box erect (the auxiliary box is at the bottom.), and make the auxiliary shaft contact tightly against the oil baffle disc of the bearing seat hole in the auxiliary box front housing.





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- (3) Tap the bearing outer ring of the input end into the housing shaft hole. Press the bearing outer ring with two clamping board till the rotating resistance of the intermediate shaft reaches 5~10kg·cm. Measure the distance from the bearing outer ring to the end surface of the housing α . Then measure the thickness of the gasket of the gearbox front end cover b (Measure after the gasket is fully compacted.). In order to guarantee the axial clearance of the intermediate shaft bearing to be within the range of 0.12~0.15mm, the thickness of the outer ring adjusting washer at the input end of the intermediate shaft should be : $(\alpha + b) - (0.12 \sim 0.15) \text{mm}$.





- Specification of the circlip commonly used

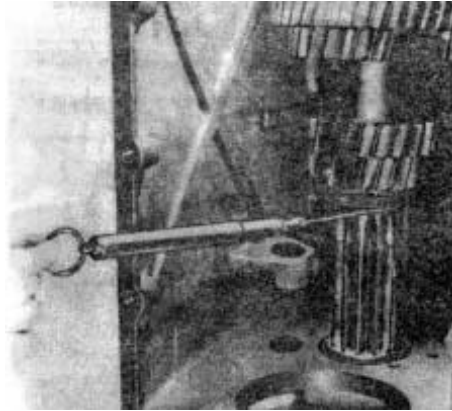
Factory part number	Washer thickness (mm)
1269140004-1	1.85
1269140004-2	1.90
1269140004-3	1.95
1269140004-4	2.00
1269140004-5	2.05
1269140004-6	2.15
1269140004-7	2.20
1269140004-8	2.25
1269140004-9	2.30
1269140004-10	2.35





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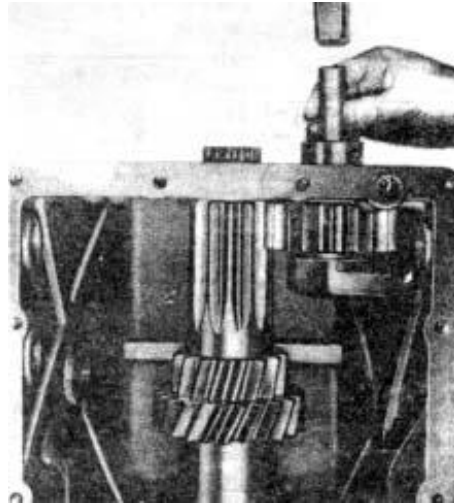
- (4) Moment of torsion resistance of the auxiliary box may be determined with the following method: wind a thin rope on the intermediate shaft at the reverse gear portion for several turns. Tie a spring balance at the tail end of the rope; pull it evenly with hand to make the auxiliary shaft rotate. If the spring balance reads between 1.4~2.8kg, it corresponds to the moment of torsion resistance in the range of 5~10kg·cm.
- Remove the preset auxiliary box front housing, and keep the selected adjusting washer properly, and use it when assemble the gearbox front housing.





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- (5) Set the gearbox housing erectly with the input side down. Put a thrust washer on the reverse shaft seat and insert the bending tongue of the washer into the groove of the seat. Mount the reverse gear on which two needle bearings are attached carefully on the thrust washer and center it with the reverse gear shaft hole.





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- Check the reverse gear for axial clearance with feeler gauge which should be in the range of 0.2~0.6mm. Tap the reverse gear shaft with its small end downward into the shaft hole with a soft hammer, till it is sustained firmly. See to it that the reverse gear shaft should not protrude beyond the junction plane of the housing.

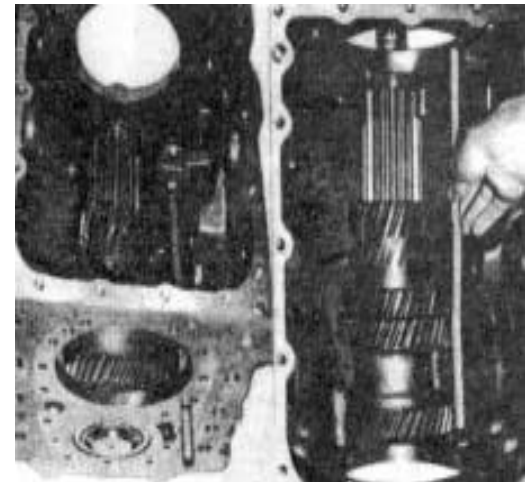


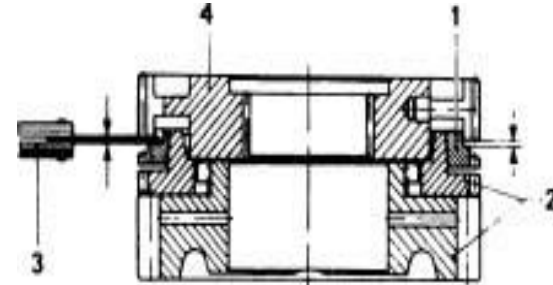
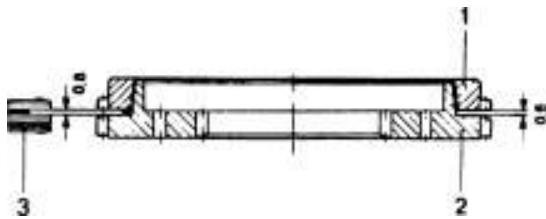


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- (6) Check the oil hole of the jet pipe for blockage. Fix the oil pipe in the housing from the output side. Insert the front end of the pipe in the corresponding oil hole in the front wall. Rotate the oil pipe to make the jet orifice face the gear direction. Then insert the rear end into the hole in the reverse shaft. Tap the front end of the oil pipe gently with a soft hammer to make it enter the hole and keep level with the house junction plane.
- Caution: The jet pipe should not protrude beyond the front end surface of the housing.
- Assemble the output shaft of the main box (the second shaft)
- The operation of the synchronizer should be checked first.





- (7) The maximum wear limit of the synchronizing ring is 0.8mm. Set the synchronizing ring on the synchronizing cone with their centers aligned. Rotate the synchronizing ring to make the conical surface contact evenly. Check the clearance between the end surfaces of the synchronizing ring and the synchronizing cone at the corresponding positions on the circumferences with feeler gauge. The clearance should be greater than 0.8mm. If the clearance is less than 0.8mm, it is permitted to grind off the big conical surface by 0.3mm. If it is too much out of tolerance, the synchronizing ring should be replaced (the figure above).



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- Put the qualified synchronizing ring, conical synchronizing ring and synchronizing toothed seat on the corresponding gear, make the synchronizing toothed seat and the synchronizing cone touch the gear without any clearance. Measure the clearance between the end surfaces of the synchronizing seat and the conical synchronizing ring, which should be 0.6mm.
- The measurement should be performed at multipoint in the circumference direction. Pairing marks should be engraved on the synchronizing cones and the conical synchronizing rings, which are up to the requirement through the inspection.





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- (8) Mount the synch-engaging sliding sleeve . It should be noticed when mounting the synch-engaging sliding sleeve that the engaging sliding sleeves for the 3rd-4th gear and for the reverse gear are symmetric, so they are direction free in mounting. There is an obvious chamfering bevel surface at one side of the synch-engaging sliding sleeve for the 1st-2nd gear. When it is mounted, the chamfered side should face the rabbet of the synchronizing toothed seat.





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- Sheath the synch-engaging sliding sleeve on the synchronizing toothed seat and put the three concaves in the sliding sleeve in line with the three notches on the synchronizer toothed seat. Lift the synchronizing toothed seat a bit, set the driving block with inner and outer compression springs in the notch that corresponds with the concave of the sliding sleeve. Push the three driving blocks into the concaves of the sliding sleeve and press the synchronizer toothed seat into the sliding sleeve with a screw driver.





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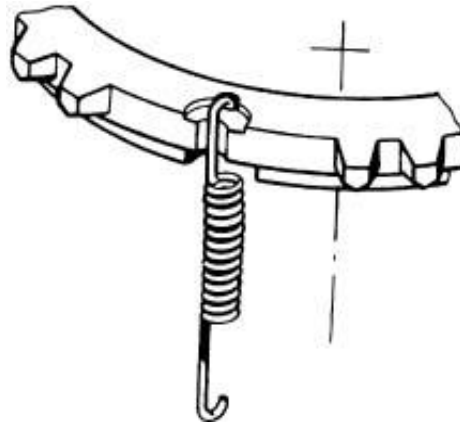
- (9) Put the conical synchronizing rings flanking the synchronizing seat in the synchronizing seat (see to it that the six bosses on the conical synchronizing ring should be set correspondingly in the six notches of the synchronizing toothed seat.).





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- (10) The conical synchronizing rings have tension springs. Pass the three tension springs through the three notches on the synchronizing toothed seat and hook the springs on the flanking conical synchronizing rings.
- When fixing the synchronizer component on the output shaft (the second shaft), pay attention to pairing fitting requirement between the synchronizing cone and the conical synchronizing ring.





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- (11) Check the oil duct and oil holes of the output shaft (the second shaft) for passage through.
- Clamp the output shaft (the second shaft) on the working bench firmly with the input side up (see to it that special fixture should be used and the shaft surface of the second shaft should be kept away from being damaged).
- Set the first gear needle bearing on the journal, mount the first gear on the needle bearing (with the engaging teeth up) and make it touch the shaft shoulder tightly.





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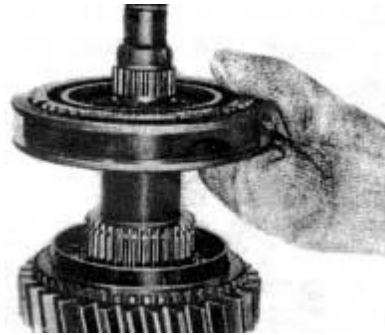
- (12) Sheath the first gear-synchronizing cone on the engaging teeth of the first gear.





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- (13) Heat the 1st-2nd gear synchronizing toothed seat component to about 85°C and sheath it on the toothed seat spline of the output shaft (the second shaft) with the rabbet of the synchronizing toothed seat up. Make it contact with the shaft shoulder firmly and make sure that the toothed seat is free from axial clearance. Check again with feeler gauge whether the clearance of the first gear synchronizer is $\geq 0.6\text{mm}$.
- Check the axial clearance of the first gear with feeler gauge which should be within the range of 0.2~0.45mm, and in no load condition the gear should be able to run freely.





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- (14) Set the circlip in the corresponding circlip groove on the shaft shoulder of the synchronizing toothed seat. The axial clearance between the circlip and its groove should be 0.02~0.05mm.
- They are optional.
- Specification of the circlip commonly used
-

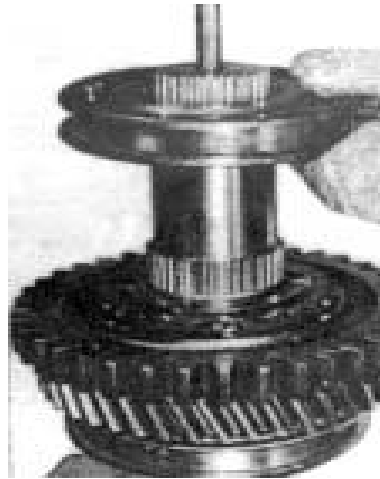
Factory part number	Washer thickness (mm)
115144034-1	23
115144034-2	24
115144034-3	25





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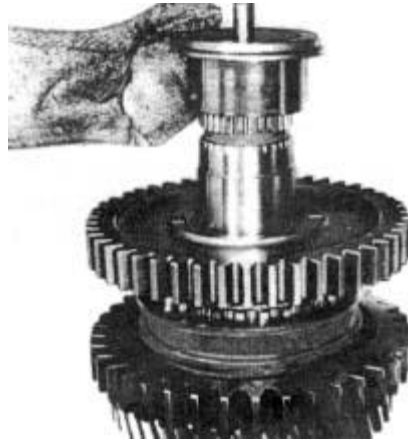
- (15) Reverse the output shaft (the second shaft) and clamp it on the working bench with the output side up. Set the needle bearing on the creep gear shaft journal of the output shaft. Then fix the creep gear on the bearing (with the engaging teeth up) till they contact tightly in the axial direction. Heat the synchronizer toothed seat to 80°C, sheath it together with the sliding sleeve component on the spline shaft of the output shaft (the second shaft) and make it lean against the shaft shoulder tightly. Check the creep gear for axial clearance which should be within the range of 0.2~0.45mm.





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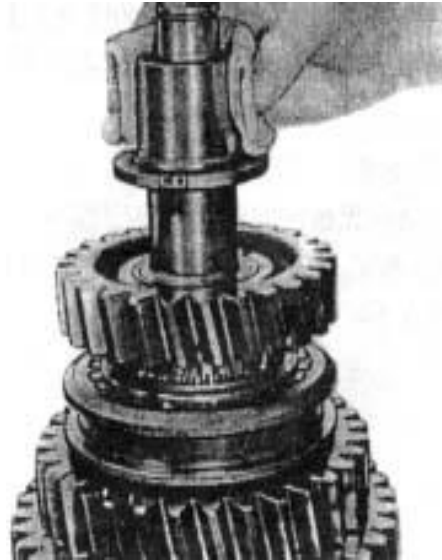
- (16) Smear aluminium bisulfide ointment on the shaft journal of the output shaft (the second shaft) where the bearing race is mounted. Heat the reverse gear and needle bearing to about 100°C, sheath them on the bearing (the engaging teeth of the reverse gear face downward). Then put the bearing lining which has been heated to about 120°C in the needle bearings of the output shaft and reverse gear with the circular bead facing upward, and push the bearing lining forcibly till it touches the synchronizer toothed seat. The fitting process should be performed as quick as possible, otherwise the shaft will be heated which will cause fitting difficulty. Press the bearing lining and the shaft fully and ensure that there is no axial clearance. Check that the reverse gear can rotate freely and the axial clearance is within the range of 0.2~0.4 mm.





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- (17) Reverse the output shaft (the second shaft) and clamp the output side on the fixture with the input side up.





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- Put the second gear-synchronizing cone, with its conical surface facing downward, under the first gear conical synchronizing ring. Set the needle bear at the position of the second gear journal of the output shaft (the second shaft), put the second gear (its engaging teeth facing down) in the needle bearing and make it engage and integrate with the conical synchronizing ring.
- Heat the third gear bearing lining to about 120°C and smear the third gear journal of the output shaft (the second shaft) with aluminium bisulfide ointment. Mount the lining with its circular bead facing down on the journal and make it contact with the shaft shoulder tightly, and ensure that there is no axial clearance. Check that the clearance of the second gear synchronizer is 0.6 mm, the second gear can rotate freely and its axial clearance is within the range of 0.2~0.55 mm.





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- (18) Put the needle bearing of the third gear on the bearing lining and mount the third gear (with its engaging teeth facing up) till it contacts tightly in the axial direction.





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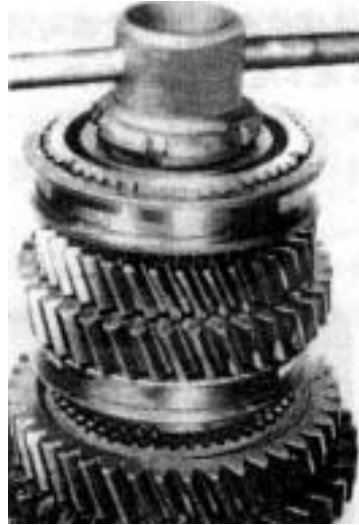
- Place the third gear-synchronizing cone on the joint teeth. Heat the third gear synchronizing toothed seat to about 85°C. Sheath the synchronizing toothed seat and synchronizer sliding sleeve components on the splined shaft of the output shaft (the second shaft) and make them contact tightly in the axial direction (see to it that the synchronizer should be fitted with its internal conical surface facing up), and ensure that there is no axial clearance. Check the clearance of the third gear synchronizer. It should be 0.6 mm. The third gear should run freely and its axial clearance should be in the range of 0.2~0.4mm.





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- (19) Screw the locking nut into the output shaft and tighten the nut on the 3rd-4th gear synchronizing toothed sea with the torsion moment of 250Nm. Lock it by caulking with a special tool (the threads should be coated with thread-locking glue).





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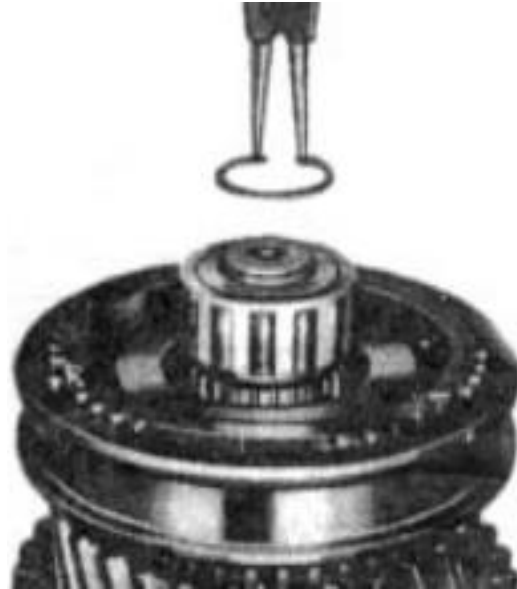
- (20) Heat the cylindrical-roller bearing to about 85°C, sheath it on the head of the output shaft (the second shaft) and press it to the shaft shoulder tightly.





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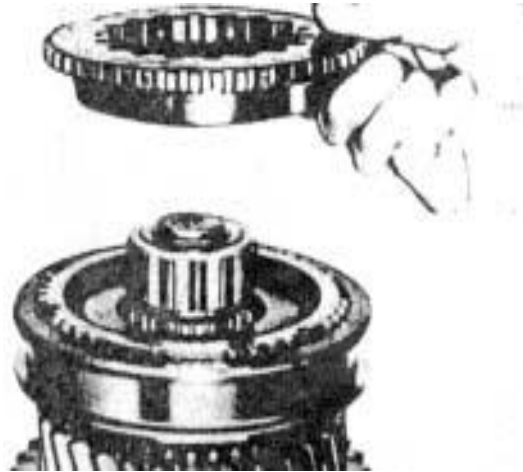
- (21) Set the circlip in the circlip groove in front of the cylindrical-roller bearing with the help of circlip pliers.





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- (22) Set the fourth gear-synchronizing cone on the conical synchronizing ring (Pay attention to check the synchronizing cone for engagement before setting it. It should mesh the engaging tooth of the driving gear on the input shaft easily). Press the oil pipe into the central oil pipe in the output shaft tightly.

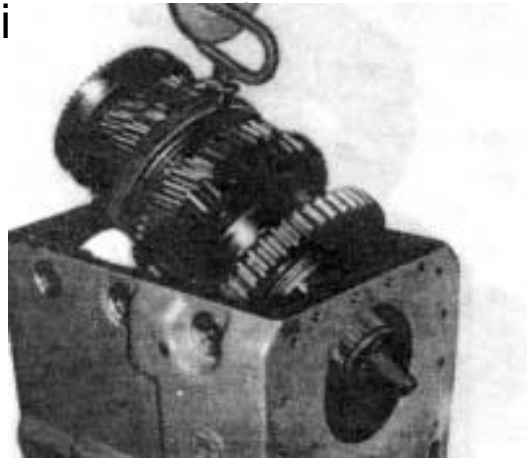




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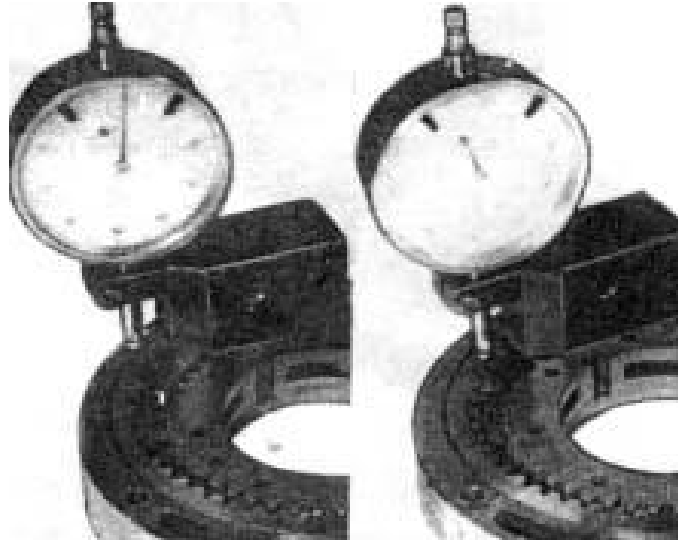
- (23) Connect the special lifting tool on the 1st-2nd gear synch-engaging sliding sleeve, lift the output shaft (the second shaft) and put it into the gearbox. Make its gears and the gears of the auxiliary shaft at corresponding engaging positions. Hammer the output end bearing of the output shaft (the second shaft) into the bearing hole of the output journal in the gearbox, make the bearing inner race lean against the circular bead of the reverse gear bearing lining, and the bearing outer ring locating circlip lean against the junction of the housing tightly.





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- (24) Check whether the axial clearance of the inner and outer rotors of the oil pump within the range of 0.070~0.101 mm with a dial gauge. Replace them if the clearance is too large.
- The oil pump is supplied only in unit assembly.





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- (25) Mount oil seal in the oil seal seat hole in the gearbox front cover with the lip of the oil seal facing the oil pump. Set the oil pump assembly in the front cover, and let the hex screw of the oil pump that protrudes out enter the blind hole on the front cover. Pay attention to its direction when mounting the oil pump and set it level without tilting.





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- (26) Check the oil hole and oil duct of the input shaft (the first shaft) for passage clearness.
- Heat the input shaft bearing to 85°C, make the end bearing outer ring where there is a boss on it face the input shaft (the first shaft) , lean against the driving gear tightly in the axial direction. Ensure that there is no axial clearance with the gear. Press the two tight-fit semicircular locating rings into the ring groove, then put the locking collar around the two semicircular rings, rivet the locking collar tight along the semicircular bevel surface with the caulking tool so as to avoid the movement of the locking collar.





- Specification of the circlip commonly used

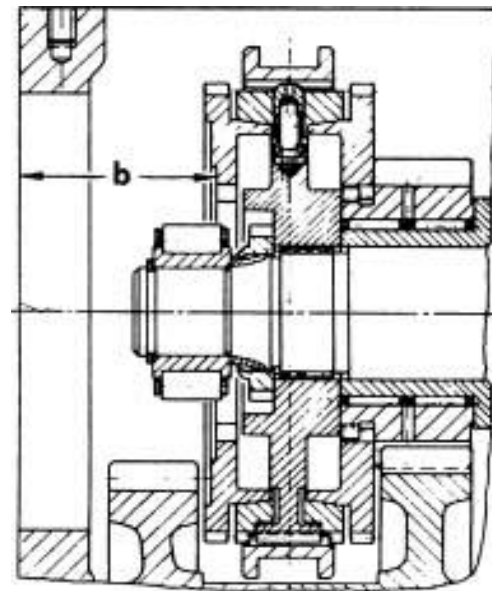
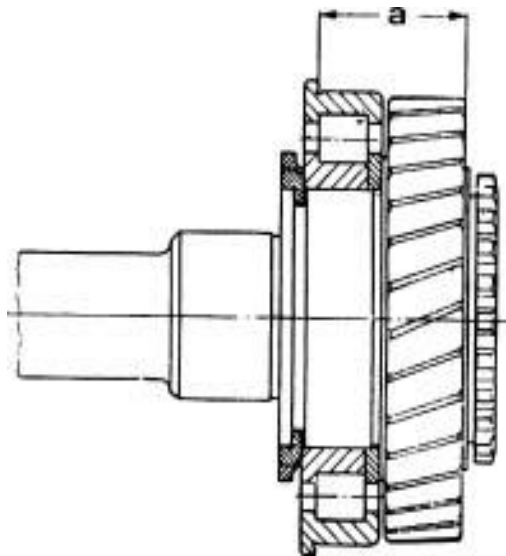
Factory part number	Washer thickness (mm)
0769145010-1	4.10
0769145010-2	4.00
0769145010-3	3.90
0769145010-4	3.80
0769145010-5	3.70

- They are optional.



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- (27) In order to guarantee the axial clearance of the fourth gear synchronizer to be 0.6mm, it is necessary to adjust it with the adjusting washer between the end surface of the input shaft gear and the fourth gear-synchronizing cone. Measure the distance from the end surface of input shaft gear to the surface of bearing circular bead "a", and measure the distance from the front junction plane of the housing to the rabbet of the fourth gear synchronizing cone b. Then the thickness of the adjusting washer is:

$$s=b-a-0.6(\text{mm})$$

- When measuring, it is imperative to make the bearing outer ring at the output end of the output shaft lean against the box housing tightly and make the fourth gear synchronizing cone level and press on the conical synchronizing ring without clearance.





- Specification of the circlip commonly used

Factory part number	Washer thickness (mm)
0769140115-1	2.4
0769140115-2	2.7
0769140115-3	3.0
0769140115-4	3.3
0769140115-5	3.6
0769140115-6	3.9
0769140115-7	4.2
0769140115-8	4.5
0769140115-9	4.8

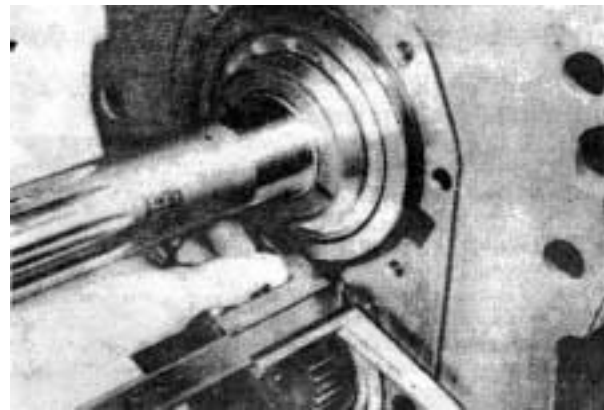
- They are optional.



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- (28) Place the adjusting washer that has been selected on the rabbet plane of the fourth gear synchronizing cone (stick it with grease), put the input shaft (the first shaft) in the gearbox shaft hole, make the bearing circular bead contact with the junction surface of the housing tightly. When fitting, it is imperative to insert the front cylindrical-roller bear of the output shaft (the second shaft) into the shaft hole of the input shaft (the first shaft), meanwhile, insert the central oil pipe of the output shaft into the oil duct of the input shaft (the first shaft). Measure the distance from the circular locating bead of the input shaft bearing to the junction surface of the box housing "b".

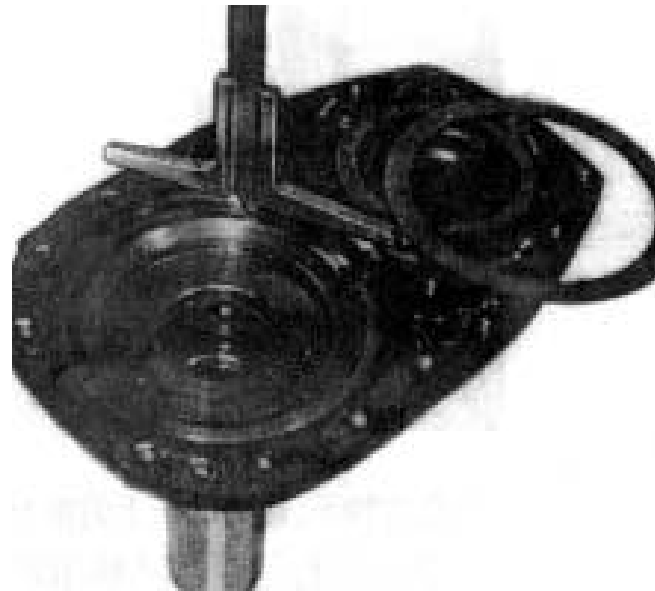




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- (29) Place gasket on the front cover and measure the distance from the gasket to the locating rabbet of the input shaft bearing outer ring "a". To guarantee the axial clearance of the input bearing to be 0~0.05mm, an adjusting washer, the thickness of which is from (a-b) to (a-b-0.05) mm, should be applied between the locating surface of the front cover bearing and the bearing outer ring.





- Specification of the circlip commonly used

Factory part number	Washer thickness (mm)
0769140013-1	0.5
0769140013-2	0.6
0769140013-3	0.7

- They are optional.
- Smear the adjusting washer that has been selected with grease and stick it tightly in the locating rabbet of the front input shaft bearing. Meanwhile, stick the locating adjusting washer of the intermediate shaft bearing on the intermediate shaft bearing outer ring with grease.



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- Coast the journal where the input shaft (the first shaft) mates with oil seal with a layer of molybdenum disulfide ointment. Smear the blind hole with grease, in which the cylindrical roller that drives the oil pump to rotate is mounted, and then set the cylindrical roll in the blind hole.





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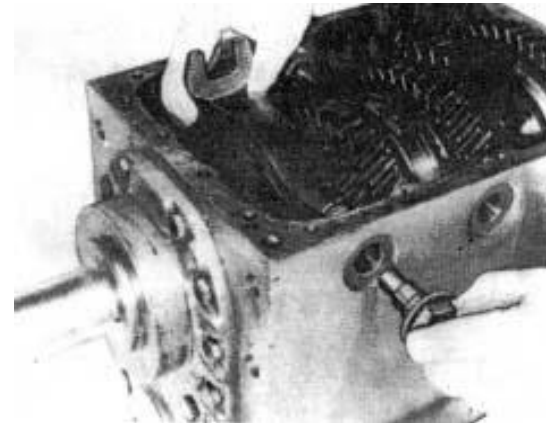
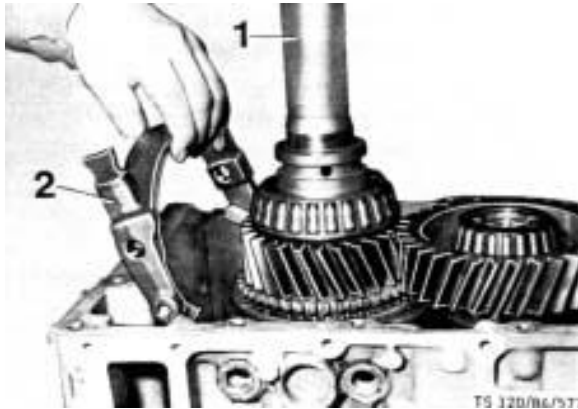
- (30) Rotate the oil pump inner rotor to make the groove on the inner rotor in line with the groove on the pump cover. Rotate the input shaft to make the cylindrical roller (the "O" mark on the shaft end) be up, that is, on a perpendicular line which goes through the input shaft and the auxiliary shaft. At this position, sheath the front cover on the input shaft (the first shaft). It should be noticed that the cylindrical roller on the shaft would now insert into the notch on the oil pump rotor. Attach the front cover on the box body and tighten the fixing bolts evenly with the torsion moment of 49Nm (the thread should be coated with thread locking glue).





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- (31) Fix the 3rd-4th gear shifting yoke component on the 3rd-4th gear synchronizer sliding sleeve, the supporting holes flanking the shifting yoke align with the supporting hole in the box housing. Set the supporting bolt, smeared with locking sealing glue, together with the washer in the supporting shaft hole and tighten it with a torsion moment of 200 Nm.





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- It should be noticed that in fitting, the 3rd-4th gear synchronizer sliding sleeve should be at the neutral gear position. And see to it that the supporting bolt should insert correctly in the needle bearing in the supporting shaft hole of the shifting yoke when the supporting bolt is attached.





- **2. Assembling of gear shifting mechanism in gearbox top head**
- Assembling of gear shifting mechanism in gearbox top head is basically in reverse procedure of disassembling (See the section of removal of the gear shifting mechanism in the gearbox cover for detail). Pay attention to the following points:
- When fix the swing arm on the gear selecting shaft, see to it that the assembling should be performed in light of the relative position mark engraved in disassembling.