

GEARBOX FOR CAR 330/GT 65





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INSPECTION
ASSEMBLY AND OVERHAUL
INSTRUCTIONS

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DISASSEMBLING THE GEAR BOX

- 1 - Drain the oil completely and remove the clutch cover and lever.
- 2 - Place the gear box on the special rotating stand and secure it with the cover studs.
- 3 - Remove the gear control support (1) and the cover (2) on the main box.
- 4 - Remove the box (3) nuts and. slide the box off with its components.
- 5 - Place the three rods in neutral, remove the 1st, 2nd and 5th speed control forks, release the clamps on the 1st, 2nd, 3rd and 4th speed forks and slide off the two corresponding rods.
- 6 - Engage any two gears so that you may release, using the special hook spanners, the two locking rings (4) and (5), both with left hand thread, after removing them from the locking plate. Please note that the locking ring (4) should not turn whilst (5) is being released because they cannot be removed at the same time. Release also locking gear (6) on the secondary shaft.
- 7 - Remove the three fixing nuts on box (7) between the intermediate body and the back box (3), the reverse light switch and the cap. Slide off the box and. remove the small rollers from the rods.
- 8 - Release the clamp on the 5th speed fork.
- 9 - Remove the 5th speed stationary gear (8) on the secondary shaft and the reverse stationary pinion (9), pushing forward, if necessary, the secondary shaft.
- 10- Turn the 5th speed rod and reverse to disengage the fork from the rocker lever controlling the reverse gears.
- 11- Slide off the 5th speed idle pinion (10) complete with synchronizer. The sleeve and fork remain in the box.
- 12- Remove the internal and external holding nuts off the intermediate body (11) and remove body from main box.
- 13- Slide the secondary shaft off the front section, using a suitable pipe in order not to damage the spindle (12) driving the oil pump and the thread of the shaft.

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- 14- Having removed the secondary shaft, push the stationary gear of the transmission (13) out of the bearing seat and let it fall at the bottom of the box.
- 15- Remove the flange with sleeve (14) and release the locking ring (15).
- 16- Having fitted the special extractor in place of the locking ring (15), pull on the transmission shaft until the sliding body (16) skims the wall of the box. Take care not to force it against the wall not to remove it off its seat on the gear. Note: Only if an extractor is not available tighten the locking gear (15) by a few threads and with the assistance of two special levers push the mandrel forward.
- 17- Using a special hook spanner unscrew the locking ring (17) after first releasing it from the locking plate.
- 18- Unscrew the nuts fixing the flange (18) to the centre bearing (19).
- 19- Using another special extractor (with left hand thread) tightened on the primary shaft, remove the shaft completely from the box. Note: To carry out this operation we recommend that the gear box should be placed vertically so as to prevent any shims becoming wedged in the oil grooves in the shaft.
- 20- Remove all parts left in the box and remove the extractor from the transmission shaft.
- 21- Slide the shoulder ring (21) off the bearing (20) and. push the assembly into the box for removal.
- 22- Remove shaft (24) from the inside of box (3) and the front bearing after releasing the nut (22) and removing the Seeger ring (23). The sleeve with helicoidal screw for the speedometer drive, the front bearing, oil ring and the transmission shaft flange are removed from the back.
Note: Before taking the sleeves off their guide cores check the location marks.

CHECKING THE GEAR BOX.

- 1 - Wash in paraffin all the components, including the oil filter, and dry them out with compressed air. Make sure that all lubrication holes are free.

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- 2 - Check the box and cover for cracks and the bearing seats for wear or scoring.

LONGITUDINAL SECTION OF GEAR BOX. (See separate sheet)

- 3 - Make sure that the ball and roller bearings are fully efficient. If they are harsh or noisy in operation, or if the cages, races, balls or rollers are worn, they must be replaced.
- 4 - Check that the profile of the teeth show no signs of seizure, wear or scoring. The working surface must be smooth and the marks should show that the contact is uniform and covers the full length of the tooth.
- 5 - Check that the working surface of the pink metal bushes in the idle pinions of the primary shaft do not show signs of abnormal wear, seizure or overheating and the play does not exceed the maximum given in the table on page 4.
- 6 - Check the sleeve cavities and the speed control forks for wear.
- 7 - Check that the idle pinion shims do not show signs of wear or seizure and that their end thrust does not exceed the maximum figure given in the table.
- 8 - Check the external conical surfaces of the synchronizer ring; they must not show excessive wear nor considerable seizure or overheated zones. Please note that these rings are of different sizes and consequently they must all be fitted in their respective place if they are still sound. All leakage can be checked by measuring the outside diameter in the three positions shown in fig. (2), table (11) and on page 5.
The thickness is measured where the eccentricity is highest. If the dimensions are within the tolerance limits it is advisable, when refitting the gear box, to turn the rings by 180°.
- 9 - Check the guide rings for cracks.
- 10- Check the oil seal ring on the primary shaft flange. Replace it when overhauling the gear box.
- 11- Check the oil pump components and body for wear, the gears for clearance and the gear spindles and bushes for play.
- 12- Before mounting the secondary shaft check with the dial gauge fitted halfway on its length, that there has been no deformation on assembling the various parts. The maximum deformation

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permissible is $.03 \pm .05$ mm.

Set the assembly on ball bearings for checking.

- 13- When replacing any components of the gear box check that the primary and secondary shafts are still quite free.

ASSEMBLING THE GEAR BOX.

For the correct re-assembly of the gear box we give again, in their proper order, all the various operations necessary as well as some suggestions for a simpler and quicker assembly.

Preliminary Operations.

- 1 - Having checked all the components and replaced those which are no longer in perfect condition, fit the synchronizer on the idle pinion of each single speed as shown in 1, table 6.
- 2 - Assemble the washer (25) bearing (19), distance sleeve (26) reverse gear (27) 5th speed guide core, shim washer (29), idle pinion (10) with sleeve and distance washer (28) and the roller bearing inner ring on the primary shaft held in a vice and without lubrication.
- 3 - Lock the assembly on the shaft with ring (4) and check the end play of the gear with a feeler. If this play is different from $.07 - .08$ mm. alter the thickness of the shim washer (29) by the amount required.
- 4 - At the other end of the primary shaft fit the 1st speed pinion (with bush directed so that the oil holes correspond to the keyway in the shaft), the shim washer (30), the 1st and 2nd speed guide core having the inside hole chamfer to the 1st gear, washer (31) also with chamfer towards the core and the 2nd speed pinion with sleeve correctly placed.
Also fit the shim washer (33), the 3rd speed pinion and bush (correctly placed) and lastly the shim washer (34) and the 3rd and 4th speed core. Tighten firmly the assembly with locking ring (17) but do not overstrain it.

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FITTING CLEARANCES OF GEARBOX COMPONENTS.		
Gearbox components	Fitting Clearance mm.	Wear allowance mm.
Bush to bore in idle gears of primary and secondary shafts.	.050 - .076	.12
Idle gears to shims (end play) 1st, 2nd, 3rd 5th	= .07 = .08	.15
Sleeves to speed control forks	.320 - .445	.8
Between sides of teeth in each pair of teeth (cold)	.01 - .04	.08
Spindle sleeve (reverse)	.040 - .055	.1
Pinion hole to o.d. of bush	.010 - .035 interference fit	-
O.d. of gunmetal bushes to bore of pump body.	.012 - .040 interference fit	-
Bush bore to pump pinion spindle.	.015 - .029	.06
Speed engaging rods to bore.	.016 - .064	.10
Eccentricity of primary and secondary shafts, with fitted assemblies and locked nuts.	.03 - .05	-

SIZE OF SYNCHRONIZER RINGS.		
	O.d. mm.	Thickness mm.
1st speed.	93.7 x .044 -.043	4.6 x .05
2nd speed.	94.1 x .044 -.043	4.9 x .05
3rd speed.	93.7 x .044 -.043	4.8 x .05
4th speed.	93.7 x .044 -.043	4.6 x .05
5th speed.	93.7 x .044 -.043	4.6 x .05

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SPECIFICATION of rod holding spring.	
Length of free spring.	19.25 mm
Length of spring with 5 Kg. load.	17 mm
Length of spring with 9.4 Kg. load.	15 mm
o.d.	7.8 mm
Wire dia.	1.4 mm
Working coils	7
Total coils	8½

SYNCHRONIZING ASSEMBLY

- a) Fork.
- b) Synchronizing ring.
- c) Idle Gear Bush.
- d) Sliding body.
- e) Synchronizing ring.
- f) Guide ring.
- g) Guide Core.
- h) Stopping ring.
- l) Sliding sleeve.
- j) Second speed.

(See page 12)

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- 5 - Take a reading of the end play of the pinions and vary the thickness of the shims until they all are .6 - .7 mm.
- 6 - Loosen locking ring (17) and remove all parts together with bushes and shims, but without any alterations.
Only the 1st gear pinion bush is to be left on the shaft.
Note: The shims (29), (30), (31), (33), and (34), must be fitted with their front slots facing the gears.

ASSEMBLING.

- 7 - Fit the synchronizer and bearing (20) without the shoulder ring (21), stopping plate and locking ring (15) on the transmission gear.
Tighten the locking ring hard and bend the stopping plate.
- 8 - Insert the assembly from the inside of the box and push it forward until the sliding body (14) skims the wall of the box.
- 9 - Place box vertically, with the spindle upwards to prevent it from falling.
- 10- Slide the bearing (32) by about one half of its depth into its seat and keep it in that position with a bar held by two nuts against the flange stud bolts (18).
- 11- Slide into the box the 1st, 2nd, 3rd and 4th speed stationary pinions letting them press against the bearing (32).
- 12- Fit the bush and rollers, properly greased in the primary shaft housing.
- 13- Insert the 1st gear assembly without bush, in the box after removal from the primary shaft for inspection, the guide core with sliding sleeve in the position shown by the location marks and, subsequently, the 2nd speed assembly in the same way.
- 14- Set the locking gear (17) and the stopping plate on a metal strip and insert them in the transmission slot keeping them hanging whilst the complete 3rd gear assembly is being fitted.
- 15- Fit the primary shaft with bearing, washer and 1st speed bush from the bottom upwards.
- 16- Tighten the locking ring (17) with the hook spanner, keeping the primary shaft fast, and bend the stopping plate.

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- 17- Undo the locking gear (4) again and remove the 5th speed set, the core and gear with bush and washers, and finally, the reverse gear (27).
- 18- Fix flange (18) for clamping the bearing (19) to the side.
- 19- Fit the shoulder ring on the transmission bearing and push the assembly into its seat.
- 20- Fit the sleeve with flange (14) without packing and remove any burrs from the spindle slots so as not to damage the seal ring.
- 21- Turn the gear box with the primary shaft at the bottom and insert the secondary shaft from the front, whilst the ball bearing is clamped.
- 22- Fit the reverse idle pinion on the spindle fixed to the intermediate box. Insert the fork in the cavity, arrange the rocker lever horizontally so that it can be hooked on to the fork and bring it back to the normal position for fitting the fulcrum to the box. Check that the pinion can move in both directions. Fit the reverse pinion (9) on the secondary shaft.
- 23- Fix the intermediate body (11) to the main box using inside and outside bolts and interposing a thin paper packing.
- 24- Fit the distance sleeves and the reverse pinion (27) on the primary shaft.
- 25- Fit the fork controlling the rocker lever on the reverse and 5th speed rod and lock it with the stopping plate, also the 5th speed fork without closing the clamp and insert the sleeve. Slide provisionally the speed control lever fork at the other end and lock it with its bolt.
- 26- Insert the rod in its seat end turn it, suitably hooking the internal fork on to the rocker lever.
- 27- Slide the 5th speed and reverse speed core on the primary shaft in exact accordance with the location marks on the sleeve, also the shim washer (29), the 5th speed pinion (10) with bush, the shim washer (28) and finally the roller bearing inner ring.
- 28- Fit the reverse stationary gear (5) the 5th speed fixed pinion (8) and the roller bearing inner ring on the secondary shaft.

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- 29- Dismantle again the 5th and reverse gear outside fork rod, slide the two long rollers for side rods (1st, 2nd, 5th and reverse) into their seats in box (7) and fix it to the intermediate body (11) together with a special gasket.
- 30- Engage two gears with the screwdriver to tighten the locking ring (4) normally.
Add the stopping plate and also lock locking gear (5).
Bend the plate of both rings. (The two locking rings must be firmly, but not too much, closed).
- 31- Tighten the locking ring (6) hard on the secondary shaft and bend the stopping plate.
- 32- Insert the 1st, 2nd, 3rd and 4th speed forks in the sleeves and fit the corresponding rods into their seats. Place the short roller in its own hole in the case of the 3rd and 4th speeds.
- 33- Insert the balls and springs for the rods into the corresponding seats and keep them pressed with a steel rod in place of the cover.
- 34- Fixing the forks. Engage 4th speed and set the fork halfway on the sleeve cavity (see fig.1. table 12).
Check that the gear lever slot at the end of the rod is in the vertical position and close the fork clip.
Engage 3rd gear, when the fork should still be halfway in the slot and forcing lightly with a screwdriver the pinion in both directions the fork must still be free at the sides and in the bore of the slot.
The same operation must also be repeated for the 1st, 2nd, 5th and reverse speed forks remembering that, before the fork clips are closed, the holes in the rods for fixing the speed control forks must be vertical.
- 35- Fitting the forks controlling 1st, 2nd, 5th and reverse speeds.
When locking the two forks on the rods see that the slots are properly aligned with the stationary slot of the central rod and shift them around by using the clearance between the fixing bolt and the hole in the fork.

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- 36- The fixing bolts for the 1st, 2nd 3rd and. 4th speed forks are locked by an annealed steel wire whilst the bolt of the 5th and reverse speed fork are locked by a spring washer.
- 37- Assembling the Box (3).
Fit the components as described in paragraph (22) of the disassembling instructions.
Insert a special paper gasket between the two boxes.
- 38- When refitting the components of box (3) make sure that the shim (35) is free and has a clearance of $0.15 \div 0.18$ mm.
- 39- Fit the turret with gear lever (1) and the top cover (2), both with their “Guarnital” packing.
- 40- Fix the cap and reverse light switch on the box (7).
- 41- Fit the clutch cover with gasket and. rubber ring on the flange sleeve (14).
- 42- Fill with $4\frac{1}{2}$ Kg. of SHELL Spirax EP 90 oil.

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