

# **NEWAGE TRANSMISSIONS LTD.**

## **SERVICE MANUAL**

### **40M2 GEARBOX**

## GEARBOX 40M2

### Description

The gearbox provides three forward and one reverse gear.

The gearcase is constructed of heavy duty cast iron for rigidity and strength, and the shafts are hardened nickel steel supported by ball and roller bearings.

The gear train is of the constant mesh type and shifting is achieved by substantial involute dogs of gear tooth form activated by a robust selector mechanism.

The design of the geartrain is such that it will accept maximum torque in low gears for long periods.

The weight of the basic 40M2 is approximately 32KG.

### General

When overhauling the gearbox cleanliness is important, remove all dirt, cement etc from the outside of the box before any inner parts are exposed. Take care with the dust within the clutch/bell housing as it may contain minute particles of asbestos fibre which should not be blown out with an airline. Damp the dust down and wipe out using damp cloths. Dispose of the cloths safely after use.

Use a mandrel press, if available, for pressing out bearings, shafts etc. otherwise use hardwood or non-ferrous metal drifts.

Work on a clean surface and wash all parts in clean solvent, lightly oiling before reassembly. If new ball races are to be fitted do not unpack until they are required.

Drain the oil before stripping the gearbox.

### Servicing and Disassembly

Remove the bolt through the clutch operating lever and remove from the cross-shaft. Undo and remove the cotter through the clutch fork, release the cross-shaft circlip and remove the cross-shaft, fork, circlip and washer.

Undo the six self locking UNF nuts inside the clutch/bell housing and pull the housing clear of the studs.

Remove the hexagon headed dipstick, undo the six UNF setscrews securing the top cover and remove the cover complete with gearlever. Remove the gearlever knob and locknut, untab the steel cover and remove the steel and rubber covers from the gearlever.

Pull the gearlever out from underneath the top cover, remove both pads from the top cover. Pull the retaining plate and spring off the end of the gearlever.

Using the special tool spread the spring loaded safety interlock and remove from the interlock plate.

If the special tool is not available insert the jaws of an open end spanner which is slightly wider than the interlock plate between the safety interlock to prevent it snapping shut and lift out, leave the spanner between the interlock until reassembly.

Using a suitable lever move the selector forks so that two gears are engaged, the gear train should now be locked and will not rotate.

Untab the bolt through the output flange and slacken the bolt, remove the bolt, tabwasher, large retaining washer and pull off the flange. The splines of the flange are sealed with silicone sealer which should be cleaned off.

Undo the 5 UNF setscrews and remove the rear cover and gasket. Slide the spacer off the mainshaft.

Undo and remove the small bolt and plate retaining the selector shafts on the back of the gearbox. Drive forward the upper selector shaft, through the selector fork and front of the gearbox. The welch plug sealing the end of the shaft will be removed in the process. Take care as the shaft passes through the fork that the detent ball and spring contained within the fork are not lost. Lift the fork, detent ball and spring out of the gearbox.

Remove the split pins and clevis pins through the two clevis and lift out the interlock plate. Knock out the lower shaft and fork in the manner described above. Do not remove the clevis unless a new case is to be fitted or the clevis are damaged or worn.

Undo and remove the bolts securing the primary shaft oil seal housing and lift the housing and gasket clear.

Remove the primary shaft assembly, it may be necessary to lever between the mainshaft and primary shaft or to tap out the shaft using a soft drift. Take care not to damage the gear teeth in the process.

To withdraw the needle bearing located in the end of the primary shaft use an appropriate bearing puller. In some cases the following procedure may remove the needle bearing but care should be taken.

Remove the circlip and spacer off the primary shaft and press the ball race up the shaft until the ball race covers the oil drain/lubrication drilling in the shaft. Support the shaft in a suitable vice ensuring that it is both rigid and vertical and fill the needle bearing with very heavy oil or grease.

Use a drift which is the same external diameter as the internal diameter of the needle bearing and enter it into the bearing, strike the drift a number of heavy blows, the needle bearing should be forced out by the hydraulic action of the oil or grease.

Remove the ball race.

Align the teeth on the front of the mainshaft so they will pass between the teeth on the 1st speed gear carried by the layshaft and tap the mainshaft out of the box.

The gears and spacers are removed from the back end of the mainshaft, one by one, after it has cleared its supporting ball race in the back of the case. From inside the case tap out the ball race complete with the snap ring.

Remove the circlip from the end of the layshaft.

Carefully lever between the 1st speed gear on the layshaft and the gearbox case moving the layshaft until the ball race is just clear of the case.

If levering fails to move the layshaft use a drift which is just slightly smaller in diameter than the needle bearing supporting the layshaft and drive the layshaft and needle bearing into the box until the ball race at the opposite end is just clear of the case.

Place two plates approximately 3mm thick between the ball race and case and tap the layshaft back into the box thus removing the ball race, take care not to damage the needle bearing. Alternatively use a suitable bearing puller.

Remove the small spacer and reverse layshaft gear via the ball race bore in the case, the layshaft and remaining gears can be withdrawn through the opening in the top of the case. Tap out the needle bearing. The 1st speed gear on the layshaft is a tight fit and is also retained by a circlip. Remove the 1st speed gear, reverse gear and the 2nd speed sliding gear. The layshaft is now dis-assembled.

Undo the split pin and nut on the reverse idler shaft, remove the retaining washer, tap the reverse idler shaft and woodruff key out of the case and remove the gear complete with bush.

### **Re-assembly Details**

Clean all parts including the interior of the gearbox case thoroughly, examine all parts for wear or damage. If the gearbox has been used on continuous heavy duty work it is advisable to replace all ball races, needle bearings and oil seals as a matter of course.

New oil seals should be fitted by pressing them in with a flat steel plate which covers their entire area, otherwise they may buckle and be spoiled.

Output flanges frequently show signs of heavy wear where the oil seal has contacted them. When this condition is observed the flange should be replaced.

Splines on the primary shaft which engage with the clutch friction disc are susceptible to wear and distortion. Check the splines with a new friction disc, if movement within the splines is excessive or the friction disc will not slide freely on the splines the shaft should be replaced.

The shaft and gears are treated with a phosphating process to ensure satisfactory performance. Do not attempt to remove any apparent discolouration by polishing bearing surfaces on shafts or in the bores of gears as seizure may result from the exposure of unprotected steel surfaces.

Coat all threads on setscrews, studs, bolts etc with threadlock on assembly.

## Re-assembly of Main Gearbox

### Reverse Idler

If a new bush has been fitted to the gear the bush will need no further treatment as when fitted it is the correct size. Check that the gear is free running on the shaft. Normally if a new bush has been fitted then it is wise to renew the idler shaft as well.

Fit the idler shaft and woodruff key, gear, retaining washer, nut and split pin.

Recheck the gear is still free running when the idler shaft is tightened up.

### Layshaft

Fit the new needle bearing into the case so that it is flush with the outer face of the case.

The layshaft should now be partly reassembled. Fit the inner 1st speed gear and the 1st speed reduction gear (boss inwards towards the inner 1st speed gear), fit the circlip. The inner 1st speed gear should have at least .007" thou end float. Slip on the 2nd speed sliding gear with the collar towards the 1st speed gears.

Insert this sub-assembly into the case through the top and locate into the needle bearing working the teeth past the reverse idler pinion.

Through the ball race bore on the back of the case insert the reversing pinion and small spacer.

Stand the case on its front face and support the layshaft by placing steel packings approximately 9mm thick between the 1st speed gear and the casing, otherwise the needle bearing will be driven out and it will not be possible to fit the ballrace. With the ball race tapped fully home onto the shaft, remove the packings, fit the circlip and tap the ball race and shaft into the case taking care not to damage the needle bearing at the opposite end as the shaft seats down.

Turn the layshaft and check it spins freely in the bearings.

### Mainshaft

Fit the mainshaft supporting ball race complete with snap ring into the back face of the case.

Pass the mainshaft through the front of the case, feeding on the gears in this order: - 1st speed sliding gear (collar inwards) 2nd speed gear, spacer and the output gear (with the narrow boss outwards). They must all be located on their correct shaft diameters as the mainshaft is entered into the supporting ball race.

Tap the mainshaft through the ball race taking care not to dislodge the ball race in the process.

Place the gearsets in neutral and turn the mainshaft checking all turns freely.

### **Primary Shaft**

Support the shaft in a suitable soft jawed vice and using a suitable drift fit the new needle bearing. Remove from the vice.

Fit the primary shaft supporting ball race over the shaft and tap home. Fit the spacer and circlip. Grease the primary shaft needle bearing and carefully fit the primary shaft into the case over the mainshaft taking care not to damage the needle bearing in the process.

Coat the gasket surfaces of the oil seal housing with a suitable jointing compound and lay the joint in place, fit the cover. Note the oil feed hole in the joint and housing, these must be properly aligned with the oil feed hole in the case. Fit new nylon sealing washers to the four UNF retaining bolts and tighten.

Engage each gear inturn, turning the primary shaft and check all is free.

### **Selector Forks and Shafts**

Refit the 1st/Reverse selector shaft (lower) and the 1st/Reverse selector fork. It is an advantage when fitting the selector forks, to use a short piece of 1/2" diameter rod chamfered at both ends to retain the detent balls and springs in position. The fork with the rod in place, is passed into the box, and the selector shaft is then pushed through the fork from the rear of the case pushing out the piece of 1/2" rod in the process. Secure the shaft using the retaining plate and setscrew and position the fork in the neutral position.

Fit the interlock plate into the clevis using both clevis pins, but do not fit the split pins until it has been ascertained that the slots in the interlock plate and fork are aligned. If the slots are not aligned remove the interlock plate and adjust the clevis by screwing both in or out of the casing until the interlock plate and fork are correctly aligned. Secure the clevis pins with the split pins.

The upper fork and shaft (2nd/3rd) are then fitted in a similar manner to the 1st/Reverse fork and shaft. The retaining plate being removed and refitted so that it secures both shafts. Seal the opposite end of the selector shafts using new welch plugs smearing the plugs with a suitable jointing compound before fitment.

If new clevis were fitted smear the new welch plugs with a suitable jointing compound and drive them home into the case.

Locate the spring loaded safety interlock over the interlock plate and slide off the special tool or spanner jaws.

## Rear Cover

Using a suitable lever move both selector forks so that two gears are engaged, the gear train should now be locked.

Coat the gasket surfaces with a suitable jointing compound, lay the gasket onto the gearcase and slip the spacer over the mainshaft. Assemble the rear cover onto the gearcase lubricating the oil seal with a little grease, fit new nylon sealing washers over the five setscrews and tighten the rear cover in place.

Push the output flange fully onto the mainshaft and run a bead of silicone sealer into the flange sealing the end of the splines. Fit and tighten the retaining washer, lockwasher and bolt. Retab the bolt.

Move the selector forks through each gear turning the output flange, checking all is free.

## Top Cover and Gear Lever

Refit the two pads into the top cover, push the gearlever back up into the top cover.

Refit the rubber and steel protective covers down the gearlever and locate over the top cover. Retab the steel cover. Refit the locknut and gearlever knob. Slip the spring over the end of the gearlever and refit the retaining plate.

Coat the gasket surfaces with a suitable jointing compound and lay the gasket in place on the case. Refit the top cover assembly ensuring the gearlever engages through the safety interlock into the selector forks. Secure the top in place using the six UNF setscrews.

## Clutch/Bell Housing

Press two new bushes into the housing. Locate the housing over the studs and tighten in place using the 3/8 UNF self locking nuts.

With the clutch/bell housing facing you, pass the cross shaft into the clutch /bell housing splines first.

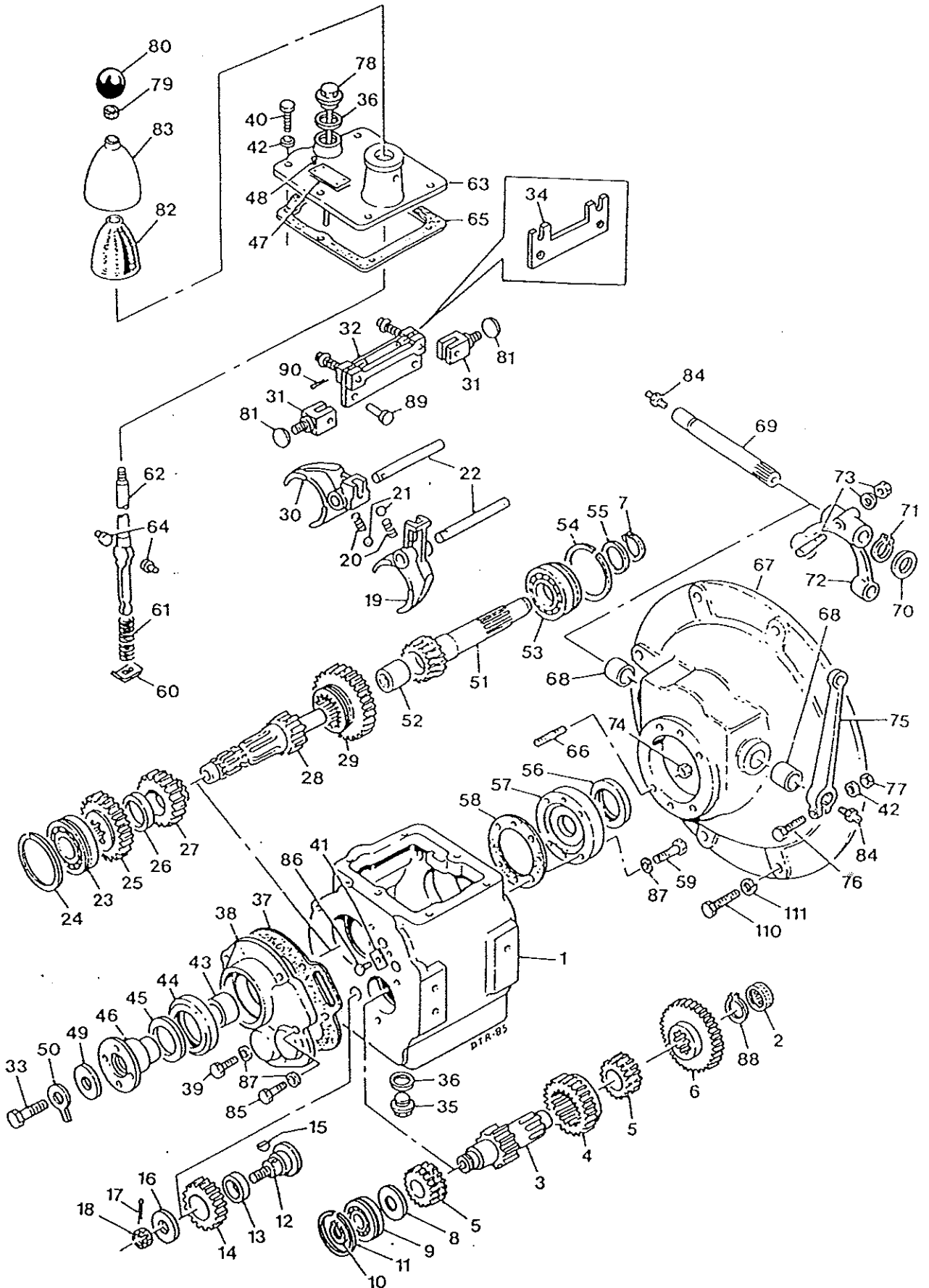
On the 4B2000/4S2000/4S25000 the splines should enter from the R/H side.

On the 2B1000/2B1500/2B2000 they should enter from the L/H side.

Push the cross-shaft through the clutch fork then fit the circlip into the groove cut into the shaft, slip the flat washer onto the shaft upto the circlip. Pass the shaft through the second bush and fit the cotter pin, nut and washer securing the clutch fork to the shaft. Fit the clutch operating lever to the cross-shaft.

Top up the oil and refit the dipstick.

# GEARBOX, 40M



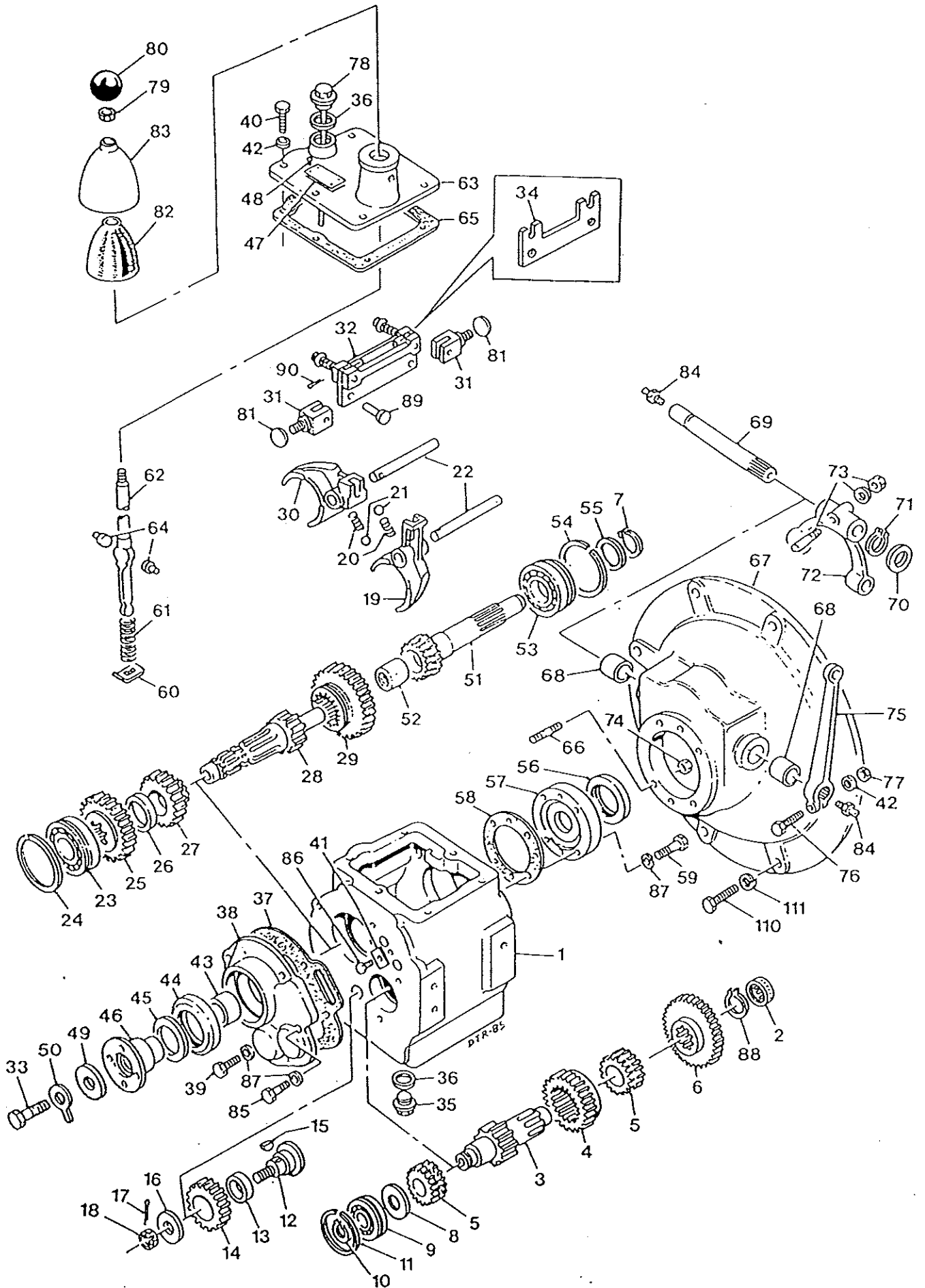


### Tightening Torques

1/4 unf setscrews retaining primary shaft oil seal housing and rear cover.	8-9lbft	10.8-12.2NM
All other 1/4 unf threads	11lbft	14.9NM
3/8 unf selflocking nuts	30lbft	40.5NM
Output flange bolt	40lbft	54NM



# GEARBOX, 40M



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Item	Serial no	Description	Qty
-		GEARBOX, 40M2S , assembly	
1		CASING, gearbox	1
2		BEARING, needle roller	1
3		SHAFT, lay	1
4		GEAR, 2nd. speed	1
5		GEAR, reverse	1
6		GEAR, 1st. speed	1
7		CIRCLIP	1
8		SPACER	1
9		BEARING	1
10		CIRCLIP	1
11		RING, snap	1
12		SHAFT, reverse pinion	1
13		BUSH	1
14		PINION, reverse	1
15		KEY	1
16		WASHER	1
17		PIN, split	1
18		NUT	1
19		SELECTOR	1
20		SPRING, detent	2
21		BALL, detent	2
22		SHAFT, selector	2
23		BEARING	1
24		RING, snap	1
25		GEAR, output	1
26		SPACER	1
27		GEAR, 2nd. speed	1
28		SHAFT, output/main	1
29		GEAR, 1st. speed	1
30		SELECTOR	1
31		CLEVIS, interlock	2
32		INTERLOCK, assembly	1
33		SCREW, set	1
34		PLATE, interlock	1
35		PLUG, drain	1
36		WASHER, sealing	2
37		GASKET	1
38		COVER, rear	1
39		BOLT	3
40		BOLT	6

## GEARBOX, 40M

Item	Serial no	Description	Qty
41		PLATE, locking	1
42		WASHER, shakeproof	7
43		SPACER	1
44		SEAL, oil	1
45		SHIELD, dust ( <i>part of assy. item 46</i> )	1
46		FLANGE, output, assy. ( <i>see item 45</i> )	1
47		PLATE, serial	4
48		SCREW	1
49		WASHER	1
50		WASHER, tab	1
51		SHAFT, input	1
52		BUSH	1
53		BEARING	1
54		RING, snap	1
55		SPACER	1
56		SEAL, oil	1
57		COVER, front	1
58		GASKET	1
59		BOLT	6
60		PLATE, spring retaining	1
61		SPRING	1
62		LEVER, gear select	1
63		COVER, top	1
64		PAD, gear lever	1
65		GASKET	1
66		STUD	6
67		HOUSING, clutch	1
68		BUSH	2
69		SHAFT, clutch	1
70		WASHER	1
71		CIRCLIP	1
72		FORK, clutch operation	1
73		COTTER PIN & WASHER, assembly	1
74		NUT	6
75		LEVER, clutch operation	1
76		BOLT	1
77		NUT	1
78		DIPSTICK	1
79		NUT, locking	1
80		KNOB, gear lever	1
81		PLUG, welch	2
82		COVER, rubber	1
83		CAP	1

## GEARBOX, 40M

Item	Serial no	Description	Qty
84		NIPPLE, grease	2
85		BOLT	2
86		BOLT	1
87		WASHER, nylon	9
88		CIRCLIP	1
89		PIN, clevis	2
90		PIN, split	2
110		SCREW, set	8
111		WASHER, spring	8