



# AJS/Matchless Lightweight Gearbox Overhaul

How to overhaul the gearbox from a 250cc AJS Model 14 / Matchless G2 or a 350cc AJS Model 8 / Matchless G5 motorcycle.

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## INTRODUCTION

This guide will show you how to remove, dismantle and overhaul the gearbox from a 250cc AJS Model 14 / Matchless G2 or a 350cc AJS Model 8 / Matchless G5 motorcycle (all years).

You will need a decent set of tools and plenty of patience. Note that parts for Lightweight gearboxes can be very tricky to find. Although they were made in large numbers, there are lots of subtle variations that can make finding the correct part quite difficult. If you get stuck, remember that the Norton Lightweight shares some of the gearbox internals and these can be a useful source of parts.

### TOOLS:

- Set of Whitworth spanners (1)
- Set of Whitworth sockets (1)
- Flathead Screwdriver (1)
- AMC clutch extractor tool (1)

*Optional*

- C-spanner (1)
- 38mm deep socket (1)
- Impact Driver (1)

### PARTS:

- 044075 Sleeve gear with bushes (1)
- 041266 Main gear bearing (1)
- 041267 Main gear bearing oil seal (1)
- 012545 Mainshaft bearing (1)
- 041289 Layshaft bush (1)
- 042158 Gasket (1)
- 042159 Gasket (1)
- 042154 Gasket (1)
- 040006x O-ring gearchange (2)
- 040079 O-ring kickstart (2)

## Step 1 — Remove the primary drive cover

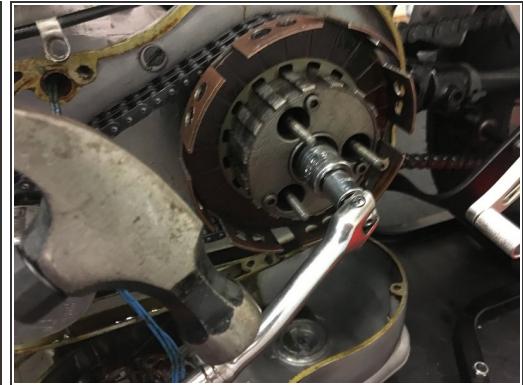
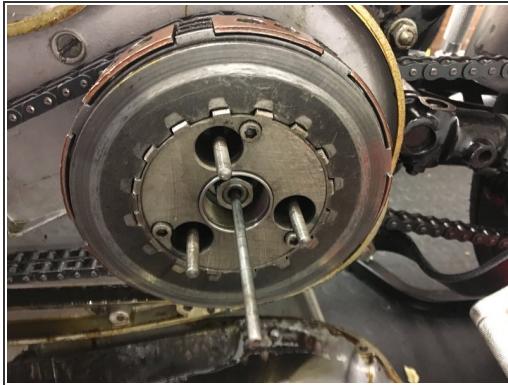


- Remove the six screws holding the primary drive cover on.

**⚠** You can either drain the oil first, or just put a dish underneath to catch the oil spillage.

- Lift the cover away. Note that the cables to the alternator will still be attached, so make sure the cover is supported and not pulling on the cables.

## Step 2 — Undo the clutch



- Unscrew the clutch springs with a piece of flat metal.
- Lift off the clutch cover and withdraw the clutch operating rod and clutch plates.
- Engage a gear and undo the clutch retaining nut. This is likely to be tight; it will undo more easily if you "shock" it loose with light hammer taps onto a socket driver.

*(i)* If you are lucky, the clutch will be loose on the shaft. If it is stuck fast, you may need to use the special puller.

## Step 3 — Remove ancillaries



- Remove the kickstart.
- Remove the gear position indicator (if fitted) and the gear lever.
- Remove the exhaust.

*(i)* You may need to remove other ancillaries such as footrests and chain cover (not shown in these pictures)

- Remove the link from the rear chain and move it clear of the gearbox sprocket.
- Drain the oil from the gearbox.

## Step 4 — Right side cover



- Undo the four screws holding the right side cover on and remove it.
- ⚠ Some trapped oil may run out if there are any leaks on this side of the engine.
- Undo the two screws holding the inspection cover on and remove it.

## Step 5 — Release the clutch cable



- Slacken off the clutch cable completely at the handlebar end and release it from the clutch lever.
- Push the cable through to release it at the gearbox end.
- Look in through the gearbox inspection hole and release the cable from the operating fork.
- Withdraw the clutch cable from the gearbox and put it to one side.

## Step 6 — Remove gearbox tensioner



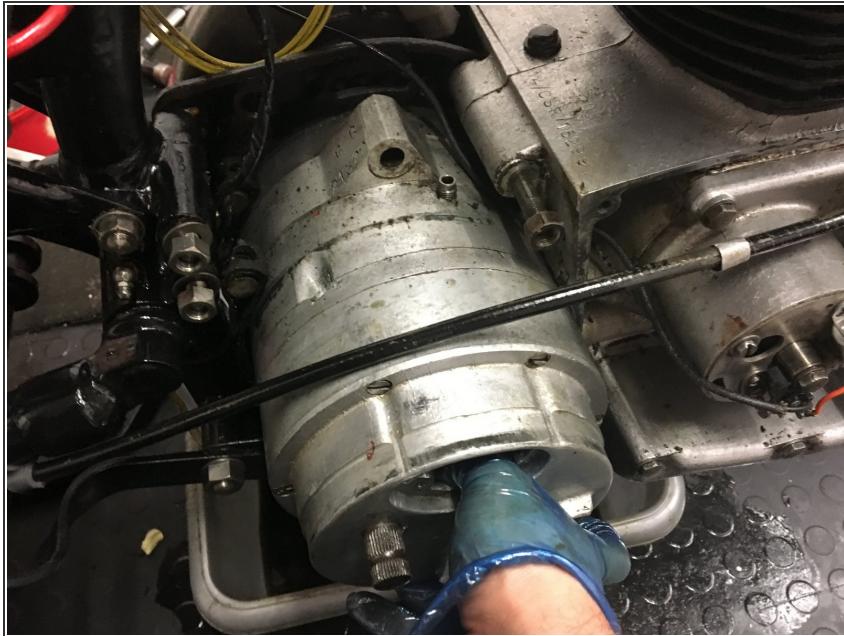
- Remove the two barrel bolts from the gearbox retaining bands.
- Remove the two nuts holding the tensioner in place.
- Withdraw the tensioner and the two spacers either side of the gearbox mounting tab.

## Step 7 — Remove gearbox mounting plate



- Remove the two nuts at the rear of the mounting plate.
- Lift the mounting plate away.

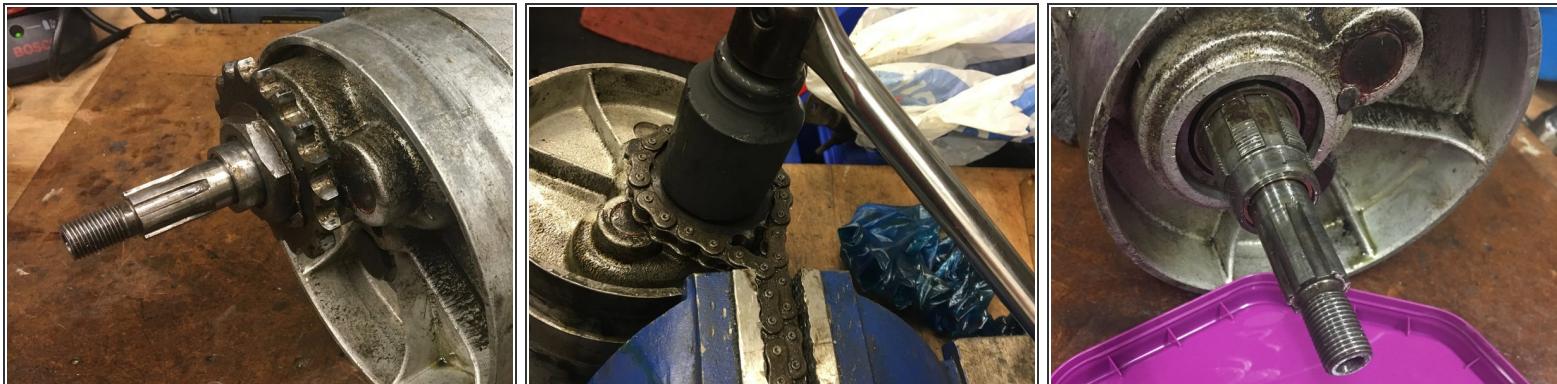
## Step 8 — Remove the gearbox



- You can now lift the gearbox away from the bike.

 Don't forget to hold on to the clutch basket on the other side of the bike. It will fall away as you remove the gearbox.

## Step 9 — Remove the output sprocket



- Bend down the tab washer securing the large sprocket nut.
- Undo the nut with a deep 38mm socket and a power bar.

 The nut is **left hand thread** and may be very tight. Use an old chain to secure the gearbox sprocket in a vice.

- Remove the sprocket from the output shaft.

## Step 10 — Separate the gearbox halves



- Undo the six screws holding the gearbox together.
- An impact screwdriver will make this task much easier. With a normal screwdriver, the screw heads are likely to strip, meaning you will need to drill them out.
- Lift off the gearbox end cover.
- Lift out the gearbox centre web complete with the gear cluster.
- Retrieve the two selector forks from the gear cluster (otherwise they'll fall off).
- Retrieve the detent plunger and spring from the main casing (otherwise it will fall out later).

## Step 11 — Inspect the main casing



- ① There are many ways in which the Lightweight gearbox can wear. Don't worry if the components aren't perfect; these gearboxes are simply designed and will usually continue to function well, even when worn.
- ① In the picture, a breather union (visible in the top-right corner) has been fitted to the gearbox casing. This is a modification for racing use, so it can be ignored here.
- ① The layshaft bush is almost always worn oval. It may be so loose that it just falls out; assume you will need to replace this bush.
- Check the large output bearing for signs of corrosion or roughness. If in doubt, it is a good idea to replace it. Note that it is a special part and is *very* expensive.
- Check the output seal for signs of oil leakage.
- Check the selector pivot shaft is secure. It can work loose and cause oil to leak from the end of the casing.
- Check the two steel plugs are secure and oil tight. Drift them out if in any doubt.
- ① Later gearboxes may have a hole for a pin to secure the layshaft bush. Check the pin for security or signs of oil leakage. Remove it if in doubt.

## Step 12 — Strip down the main casing



- Gently tap out the main oil seal together with the metal spacer using a suitably-sized socket or drift.
- If you plan to replace the main output bearing, you can also tap this out with a socket or drift; it should come out easily.
- Drift out the steel plug covering the layshaft bush and drift the bearing out (if it hasn't fallen out already).
- Unscrew the gear selector pivot shaft
- Unscrew the detent plunger housing bolt.

⚠ Note this bolt may be incredibly tight. If it's stuck, apply a bit of gentle heat to the casing and use a power bar and a good-quality wall-drive 21mm socket to remove it.

- There's no need to remove the gear selector bush, as it's unlikely to be worn.
- Wash the casing out with paraffin or degreaser.

## Step 13 — Rebuild the casing



- Remove all traces of old gasket or sealant form the casing face.
- Pop the casing in an oven at approx 150°C. Put the main bearing and layshaft bush in the freezer.
- Once at the correct temperature, the bearing and bush should both drop into the casing (or go in with a light tap).

*(i)* Use Loctite 603 to fix the layshaft bush in place.

*(i)* If you have the later type of casing with a locating hole for the layshaft bush, make sure the machined recess in the bush lines up with the hole as shown here.

**!** Check that the face of the layshaft bush is proud of the casing. Some replacement layshaft bushes are too thin and will cause the layshaft gear to touch the casing.

- Put some thread lock onto the thread of the selector pivot shaft and screw it in firmly.
- Don't put the plunger bolt in yet; that comes later.

## Step 14 — Ream the layshaft bush to size



- If you fitted a new layshaft bush, check the size. It should be reamed to 0.6255-0.6260".
- (i) The layshaft measures up at 0.6235", so by my reckoning that's a running clearance of at least 2 thou.
- (i) An adjustable H6 hand reamer (19/32" - 21/32") will do the job.
- (i) Don't worry too much about getting the size *precisely* right; just open up the bushing until the layshaft turns freely. Slightly loose is better than too tight.

## Step 15 — Fit the blanking plug and oil seal



- Tap the blanking plug home with a little Loctite 603 to hold it in place.
- If your casing has a hole next to the layshaft bush, an M3x19mm screw appears to fit perfectly. Use some Loctite 603 to hold it in place.

**⚠** Ensure the other end of the retaining screw is recessed at least 1mm from the layshaft bush surface.

- Fit the metal spacer (larger diameter inwards) into the oil seal (metal side outwards) and tap the seal into the casing. When fully home, it should sit ~4mm in from the outer surface i.e. do not leave it flush, otherwise it will bind on the sprocket.
- At this point, it is a good idea to test fit the sleeve gear and outer sprocket to check that everything turns smoothly.

**⚠** If the sprocket binds against the seal, make sure the seal is fully home.

## Step 16 — The output shaft bearing



- ⓘ The output shaft bearing is unusual, as it has no inner race.
- ⓘ When assembled, the bearing is self-aligning. Don't be overly concerned if the sleeve gear seems wobbly when fitted to the bearing. This movement will go away when the mainshaft is fitted.
- ⓘ Finding a replacement can be tricky, as the cheaper variant has an ID of 31.5mm - which **doesn't fit**. You need SKF RNU205 Single Row Cylindrical Roller Bearing 32x52x15mm

## Step 17 — Remove the clutch actuator and mainshaft



- The clutch actuator is held in place with a threaded ring. Ideally, you would use a C-spanner to remove it, but access is so restricted that you will probably need to use a drift and hammer...

! Watch out for the 3/8" ball under the clutch actuator.

- Now you can undo the nut on the end of the mainshaft.

! The nut on the end of the mainshaft may be extremely tight. Clamp the mainshaft firmly in a soft-jawed vice and use a power bar to undo it.

- There should be a pin or screw to align the clutch actuator. You will need to remove it before you can get the mainshaft bearing out. If a screw has been used instead of a pin, an impact screwdriver might help to get it out.
- Now you can drive out the mainshaft bearing. It is worth replacing this bearing as a matter of course as it is relatively cheap.

## Step 18 — Remove the kick start spring and pawl



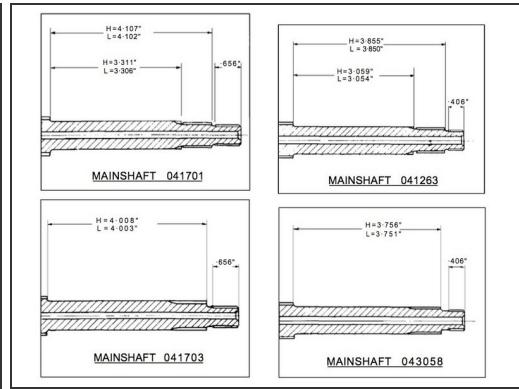
- Use a pair of long-nosed pliers to remove the kickstart spring.
- When the tension is released, the pawl will pop off the end of the shaft.
- Note the washer and circlip arrangement under the spring (if fitted). This is a modification on later gearboxes to prevent premature wear of the layshaft bearing.

## Step 19 — Reassemble the kickstart mechanism



- Remove all traces of gasket or sealant from the centre web.
- Check the kickstart mechanism and bushes for wear and damage, replacing as required.
- Fit the kickstart return spring using a pair of long-nosed pliers, noting the washer underneath the spring (if fitted). Use a pair of pliers to make sure the spring is fully engaged in the hole in the shaft.
- Don't forget to fit the coil spring on the gearbox side.
- Temporarily fit the kickstart and rotate the shaft by hand more than 90 degrees to tension the return spring.
- Fit the kickstart pawl, then release the kickstart so that the return spring is left tensioned by approx. 90°. It takes a few goes to get it right.

## Step 20 — Inspect the gears (1)



- The gearbox cluster is pretty straightforward and almost impossible to assemble incorrectly.
- Later first gears have a brass bush; earlier ones are plain.
- Later fourth gears have undercut dogs; earlier ones have holes.
- There are four different types of mainshaft. Make sure you have the correct one for your bike, otherwise the clutch won't fit.
  - Mainshaft 041701 was fitted to 350cc boxes number from 0 to 3757. 041703 was an improved main shaft fitted from box number 3758 onwards. The parts list shows this shaft was also fitted to the 250cc CSR. You need this shaft if your bike has a duplex primary chain.
  - Mainshaft 041263 was fitted to 250cc boxes number 0 to 9974 and 10064 to 10128 as a temporary measure. 043058 was fitted to box numbers 9975 to 10063 inclusive and all boxes after 10128 according to the manual (but there is no mention of this part in the spares list). You need this shaft if your bike has a simplex primary chain.
  - Early mainshafts 041701 and 041263 need clutch centre 043186. Later mainshafts 043058 and 041703 need clutch centre 043509.
  - Gears ratios are the same for all models (2.92, 1.85, 1.31, 1:1) except the CS, which has a higher ratio first gear (2.42:1) and the close-ratio box fitted to 1965-on CSRs (2.76, 1.75, 1.24, 1:1)

## Step 21 — Inspect the gears (2)



- The output 4th gear ("sleeve gear") can suffer from wear. Check the exposed bearing track carefully and the inner bushes. If the inner bushes are worn, they can be replaced, but if the bearing track is worn or pitted, then the gear is scrap.
- The other gears should be in usable condition (unless the gearbox has been run with wet oil). Check the case hardening for pitting and the bushes for wear.
- There are three different types of 3rd mainshaft/2nd layshaft gear. They are generally interchangeable, but if you have the later output gear then you should use 044076 on the mainshaft.
- There are two types of mainshaft 3rd/4th gear: the earlier dog/recess type (041276/041273) and the later undercut dog type (044076/044075). The earlier type is prone to jumping out of 4th gear. The later type solves this problem, but is often mixed up with the earlier 3rd gear. Try to pair the correct gears if possible.
- The scrambler CS models have a higher ratio first gear - overall gearing on these models is much lower due to the large rear sprocket.
- The 1965/66 CSRs have a close ratio gearbox. This is apparently achieved by means of a 19 tooth 4th layshaft gear (043666) which replaces the 18 tooth one used on the other models. If you have a photo of one of these rare beasts, please send it to me!

## Step 22 — Check the selector shaft and bush



- ⓘ If the selector shaft and camplate turns OK and isn't too loose then you can leave it assembled.
- Check for endplay - there should be thrust washers on either side of the centre web as shown in the photos.
- There may also be a washer under the circlip that hold the selector cam on. This isn't shown in the gearbox diagram, but might be necessary to control the end float.
- ⓘ The thin thrust washer (041389) goes on the inside. The thicker thrust washer (041390) goes on the outside (under the selector pawl). There's also a thin washer (041323) under the securing nut.

## Step 23 — Refit mainshaft and clutch actuator



- Fit a new mainshaft bearing.
- Fit first and second gear to the mainshaft, fit the mainshaft into the bearing and do up the the nut **very** tight.

*(i)* Use thread lock to make sure the mainshaft nut cannot come undone.

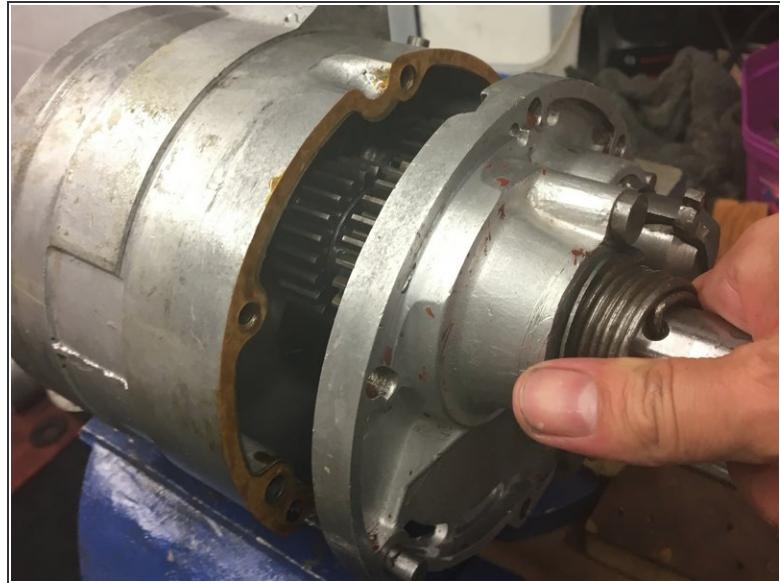
- Fit the clutch actuator locating pin (or screw).
- Check the pivot pin through the clutch actuating lever is secure.
- Fit the clutch actuator, aligning it with the locating pin in the housing and not forgetting the 3/8" ball underneath. Add a dab of grease to the ball, as the actuator sits above the gearbox oil level.
- Do up the clutch actuator retaining ring. It is difficult to get it tight using a C-spanner.

## Step 24 — Fit the gear cluster



- Assemble the gear cluster as shown.
- Fit the gear selector forks as shown and make sure they are engaged with the selector.
- ① Put a long screwdriver through the hole where the selector pivot shaft goes. You can then check that the gears select properly. Leave the screwdriver in place then withdraw it as you fit the gear cluster into the case in the next step...

## Step 25 — Reassemble the two gearbox halves



- Paint a thin layer of Wellseal or similar non-setting sealant onto the mating surfaces. You can also fit a paper gasket, though it's not absolutely necessary.
- Fit the sleeve gear into the main bearing.
- Fit the two halves together. This will require a bit of jiggling to align the various shafts; whatever you do, don't use force.
- At this point, it's a good idea to check that the shafts rotate freely and the gear selector works .

## Step 26 — Replace gearchange seal and springs



- Check the kickstart and gear change bushings, replace as necessary.
- Fit a new gear change o-ring seal into the outer case.
- Check the main gearchange spring is in good order. The earlier type is prone to cracking and failure. The later "cross over" type of spring shown in the picture fixes these issues.
- Now fit the cup washer and pawl spring as shown. This can be tricky to get right!

## Step 27 — Refit the outer cover



- Fit new o-rings to the kickstart and gear indicator shafts.
- The design of the kickstart seal assumes that there will be no endfloat on the kickstart shaft. This is rarely the case and means that oil weeps from the kickstart shaft. You might be able to limit the weep by fitting a second o-ring, or you can fit a rubber grommet between the casing and the kickstart lever (a 20mm cable grommet fits perfectly).
- Clear all traces of gasket or sealant from the gasket surfaces.
- Paint a thin layer of Wellseal or similar non-setting sealant onto the gasket surfaces. You can also fit a paper gasket, though it's not absolutely necessary.
- Refit the gearbox cover, taking care to make sure that the gear change pawl spring stays in place.
- The cover should fit easily (with a bit of jiggling). Do not use force. If the cover won't go on, it may be fouling on the kickstart spring or the gear change pawl.
- Tighten the six retaining screws evenly.
- The gear change should operate freely. If it binds, take the cover off again and check that the gear change pawl spring is correctly placed.

## Step 28 — Refit the detent spring and drain plug



- Inspect the detent spring components. The spring should be straight and the detent plunger should have a pointed (not rounded) top.
- Assemble the spring and plunger into the retaining bolt and screw the assembly into the end of the gearbox.
- Refit the oil drain plug.

## Step 29 — Refit the output sprocket



- Fit the output sprocket, tab washer and nut.

⚠ The nut is **left hand thread**.

- Use an old chain to secure the sprocket in a vice.
- Tighten the nut **very tight** with a deep 38mm socket.

⚠ Check the sprocket rotates freely. If it binds, you may need to move the output gear seal slightly.

- Bend up the tab washer.

Congratulations. Your gearbox overhaul is complete!

Refitting is the reverse of removal, not forgetting to refill the gearbox with 3 pints of SAE 50 oil.