

## **R.G.M MOTORS A.T. 10 SYNCHROFLEX BELT DRIVE KIT**

Thank you for choosing our AT10 Aluminium hard anodised belt drive system, tried and tested for over 35 years, genuine Continental polyurethane drive belts, billet aircraft alloy for the clutch drum and engine pulley, utilizing off the shelf readily available clutch internals with all the options and alternatives that allows. Fitted carefully, a long and trouble free life can be expected.

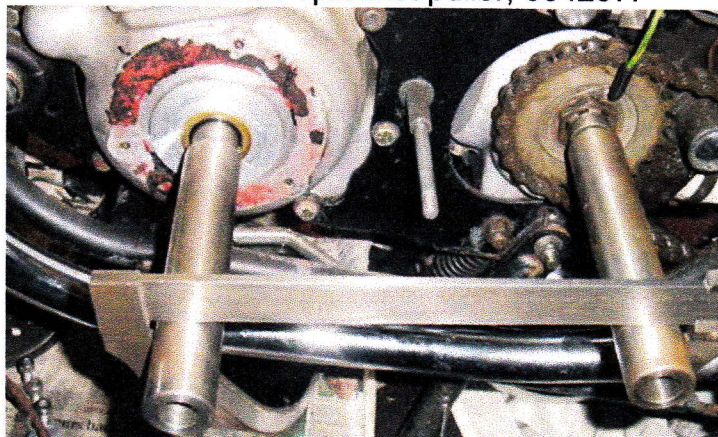
Here follows a list of the salient features.

1. 54 Tooth Clutch drum (smallest possible size, reduces weight and potential clearance Problems on some applications) aircraft grade alloy, lightweight, improves acceleration and reduces stress on the gearbox mainshaft. The latest (and unique) design allows for a freely removable wear plate with no screws to come loose and allows adjustment of plate stack overall height (and therefore spring rate)
2. Engine pulley again Aircraft grade alloy and on the later designs (Currently all Commando, some pre Commando twins and shortly non alternator singles) features an integral rear keeper plate again eliminating the need for any screws. With both the pulley and the clutch drum machined from solid aircraft grade alloy we have here two very sturdy tried and tested components.
3. Hard anodising of all alloy parts ensures a very long life expectancy (tooth wear is virtually nil) failure to hard anodise can render components useless within months.
4. Use of a sealed clutch bearing enables the system to run completely dry, this will totally eliminate the irritating clutch slip problem often encountered on Commando's caused by oil contamination. (The clutch bearing only actually operates when the machine is in gear and the clutch lever engaged).
5. Primary ratio increased 9.5% from 2.192-1 (Standard Commando) to 2-1. The faster clutch rotation reduces stress on gears and gearbox components.
6. Super strong A.T. 10 polyurethane belt is steel backed and is unaffected by oil. Should the more commonly used (and much cheaper) fibre backed HTD belt become oil contaminated the teeth can swell and soften. Comparing equal widths of belts the A.T. 10 belt also has a much greater tensile strength, but perhaps more important it will operate successfully at the higher temperatures sometimes encountered when primary chain cases are fitted.
6. Use of a diaphragm spring gives a feather light operation and ensures easy assembly and clean disengagement.
7. Sturdy chamfered steel outer keeper plate of maximum O.D. firmly locates the drive belt, the integrated inner keeper plate provides additional security.

### **Contents: 750 COMMANDO AND 850 COMMANDO PRE MK3.**

1. Clutch drum with bearing and bearing circlip fitted, 54 teeth.
2. Engine pulley, one piece, 27 teeth, complete with integral rear keeper plate.  
(FOR NON STANDARD FITMENTS WE CAN OFFER A RANGE OF PULLEY'S 26 TO 32 TEETH).
3. 890 x 30 mm A.T. 10 drive belt.
4. Chamfered steel ventilated outer keeper plate, sliding fit on the crankshaft sandwiched between the pulley and rotor. Please note, on commandoes the outer keeper plate is not fitted to the pulley, it is sandwiched between the rotor and pulley. This allows for easy belt fitting and pulley removal, additionally all our pulleys are drilled and tapped for the standard Commando sprocket puller, 064297.
5. Rotor lock washer.
6. Clutch lock washer.
7. Clutch lock washer support washer.
8. Contents list and instructions.

Using a pair of ground centres to check shaft alignment. This accurate method of measurement reveals that the majority of shafts run far from Parallel. As an alternative simply looking at the Belt as it runs under load can be just as good. It should run free without excessive tension and not be trying to run over the front keeper plate.





## **Contents: 850 MK3 COMMANDO. (Not retaining the starter motor)**

### **AS previous page PLUS**

Spacer to suit MK3 crankshaft.

Different keeper plate machined to suit the larger diameter crankshaft and Special stainless steel gearbox top bolt and nut incorporating our own design of face cam adjuster enabling gearbox tensioning on a MK3 without slotting the cradle simply by rotating the bolt via its fitted lever. The gearbox is automatically adjusted squarely.

The MK3 Commando has as we know got fixed centres, unfortunately there is quite a variation between the shaft centre distance from bike to bike which can make the production of a one fits all kit rather difficult, we currently use a 27 tooth front pulley with a 54 tooth clutch drum and an 890 mm (89 tooth) belt. This set up has a tendency to be slack but even with the face cam adjuster an 880 mm (88 tooth) belt is too tight on most bikes. What we have found is that with the top bolt rotated such as to make the gearbox as far back as possible and then with the gearbox pulled further back with the rear wheel tensioners the correct amount of free play can be achieved. This also has the advantage of tending to move the gearbox back slightly more on the drive side thus assisting shaft alignment when under load. Interestingly once positioned and the top/bottom fixings fully tightened the gearbox stays put, the engine load being countered by the rear wheel load.

### **Contents Pre Commando Twins. As Pre MK3 Commando plus**

1. 980 27 mm belt in place of 890.
2. Three stator spacers and combined studs.
3. Three 5/16" UNF reduced hex nuts.
4. Three 5/16" lock washers.
5. Narrow pulley to fit behind stator.
6. Extended sleeve type rotor nut.
7. Specially Modified Commando clutch centre which locates on the end of the main-shaft splines as do all the Norton three spring clutches rather than the circlip used on the Commando.
8. Diaphragm spring clutch compressor.
9. Full set of clutch internals. All clutch plates, diaphragm spring, diaphragm spring circlip, adjuster and nut, etc.

We can also supply kits to suit Norton singles alternator and pre alternator, pulley blanks to allow the fitting to anything (if you have the skill and equipment) Pulleys broached for Triumphs etc.

### **Why fit a belt drive?**

Drive belt technology has progressed enormously over the last thirty years it is certainly a fact that any designer working today whose chief aims were performance and noise reduction would specify a belt drive rather than a chain. Whilst the many different designs of primary transmissions used on British motorcycles, and the many different types of belt drive kits on the market make direct comparisons difficult, typically you should find that a belt drive kit offers greater efficiency (upto 98%). A very noticeable reduction in noise and vibration. Reduced weight. Complete elimination of clutch slip and of course complete absence of oil leaks (due to the elimination of oil). Improved gear tooth life (due to the elimination of high frequency shock loads which a traditional drive chain transmits, and the increased rotation speed of the gearbox effectively dividing the loads through a greater number of teeth). And if using a belt drive with a diaphragm spring a much lighter lever action, (coil springs get progressively heavier when compressed diaphragm springs do the opposite)

Our belt drives have been fitted to machines as diverse as Vincent twins, Puma racing outfits, vintage racing sunbeams, Pre 65 trials bikes and in the states there is one fitted to a small racing car powered by a massive Mercury two stroke outboard. And of course Nortons in all shapes and sizes. From plodding trials bikes to supercharged drag machines, all using essentially the same basic components.

On many occasions special builders have returned again and again and specified our kits.



## INSTRUCTIONS (GENERAL) (required reading here on in)

### 1. BELT TENSION

Belt tension is not as critical as people sometimes think. If you aim for **free play** of 1/2 inch up and down movement in **total** when **hot**. (This is actual **FREE PLAY**, not total up and down movement which will be greater). When static there should be no pull on the bearings. Total up and down movement will depend on gearbox wear, how hard you pull, etc., but expect at least an inch. When cold. Remember **check when hot** and if possible examine belt when under load to make sure it is not trying to climb over the outer keeper plate. (A rolling road is ideal.) Alternatively check belt tension by rotating belt firmly between finger thumb, 70 to 80 degrees of rotation each way being there or thereabouts correct. Essentially the aim is to have the belt when the bike has reached operating temperature still maintaining some free play on the bearings, if the belt starts to run tight without free play it will not stretch and as it gets tighter the mainshaft will be flexed forwards causing the belt to try to climb over the keeper plate quickly damaging its edge and possibly the keeper plate. Poor gear change can be an early indication that the belt is too tight. In certain conditions, very hot climates or excessive stop-starting (Slipping the clutch) a small additional amount of free play may be necessary to allow for expansion. SO.. **Always**, after fitting check for free play when **hot**, **if you do some work that may get it hotter than normal you must stop check the tension and if necessary allow it to cold down. Tension should be set at the maximum temperature the bike will ever reach.** It may take a little time to get all set well with the shafts parallel etc but once correct they are virtually maintenance free and run indefinitely.

### 2. BEARING FITMENT AND REMOVAL

If you purchase a complete belt drive kit from us then the clutch bearing will be fitted, if you should ever have the need to change the bearing. First you must remove the clutch centre, this should be carefully pressed out having first removed its retaining circlip, great care must be taken if the centre is tight, leave it to soak in releasing fluid and ease out gently. Then the bearing should be removed by placing the drum in an oven at about 200 degrees, leave until the bearing drops out otherwise unaided. If obstinate its acceptable to tap the drum down on two pieces of wood. A new bearing should drop in unaided at again 200 degrees and the drum left to cool.

### 3. SHAFT ALIGNMENT.

Perhaps the most important aspect of fitting a belt drive is shaft alignment, whereas on a chain driven motorcycle any small discrepancies in shaft alignment will merely result in a small reduction in transmission efficiency, with a corresponding increase in heat generation and wear. If a belt drive is fitted onto shafts that do not run parallel then the belt is thrust firmly towards the lesser dimension. In practise this always equates to the belt trying to move outwards away from the engine hence the stronger outer keeper plate. As obviously the crankshaft is fixed we turn our attention to the gearbox mainshaft alignment, when tensioning this in the conventional manner the box is tensioned from the right hand side, the tendency here is to allow the box to pull back more on this side. This undesirable effect can be countered in one of two ways, either when tensioning the box use rear wheel adjusters to pull the box back squarely, (pressing the chain down with your foot also works) or use our double sided primary chain tensioner part no: PTC, (its very good and nicely made but difficult to access for adjusting on a standard Commando, personally I make do with careful measuring of the shaft orientation and with the box nipped up just enough to stop it moving back and forward, (bouncing about) I pull/push with the standard tensioner, tap right side with a hammer and a piece of wood, pull the left hand side with the rear chain. Test, measure, repeat.) Back to the double tensioner it requires drilling a 3/8" hole, it can be in front or behind depending on best access and application and will allow the gearbox to be tensioned from both sides. If using the double tensioner this is best done with the inner chaincase removed, once correct it will not need adjustment for many thousands of miles. The aim is to actually have the gearbox shaft pointing away from the crankshaft slightly so that under power the mainshaft flexure and the small amounts of play in the relevant bearing/bushes combine to achieve optimum position. As a guide the belt should feel slightly tighter on the outside edge, and when fired up and ticking over the belt should ideally not be running against the outer keeper plate but rather moving slightly inwards or just aimlessly rotating without any specific bias.



### **Some further notes on fitting....Commando**

1. Dismantle the primary transmission as per the workshop manual do not remove the inner primary chaincase (Pre MK3) (unless fitting the double tensioner). If the Bike is a MK3 remove the inner chaincase and replace the gearbox top bolt with the stainless item supplied. The nut should be on the right hand side with the slots initially facing forwards to assist belt fitting. With the current set up, 27/54 Teeth, 890 belt the slots face to the rear and any excessive slack taken up by pulling the gearbox back with the rear wheel tensioners, (or standing on the drive chain). The top bolt slots help to accommodate the variation found on the shaft centres of the MK3 Commando. Now replace the primary chaincase (MK3) without the hydraulic primary chain tensioner its studs or starter equipment.
2. Lightly grease and gently press the clutch centre into the drum, fit plates, thick steel wear plate first then friction steel etc, all as standard Commando except you can mix and match with the various different plates we stock to maximize the plate stack height and thus minimize the clutch lever pull.
3. Debur any rags from the top edge of the woodruff key then fit the key to the crankshaft.
4. Place pulley over crankshaft engage woodruff key and tap home with a soft tubular drift.
5. Check that the spacer is over the clutch location circlip on the gearbox mainshaft, place the drive belt around the clutch and assemble the clutch onto the mainshaft engaging the belt with the engine pulley at the same time.
6. The clearance between the inner primary chaincase and the rear of the clutch drum should be checked. Some localised points are close. The necessary clearance can be achieved by localised re working of the chaincase or if the clutch is located by a circlip as on commandoes then the addition of an appropriate shim.
7. Now fit the keeper plate over crankshaft. Note that the keeper plate is fitted with the chamfered edge inboard, ie against the belt. Next fit the alloy spacer rotor, lock washer etc. Assemble alternator as std (remember to check the rotor to stator air gap).
8. When the crankshaft nut is fully tightened, check the clearance between the back of the pulley and the crankcase. Crankcase shape and thickness varies quite a lot and the clearance is reduced as the motor warms up. Minimum cold clearance is 1 mm.
9. Clutch can now be assembled, steel wear plate, friction then steel etc ending with the thick alloy end plate, we recommend if run dry use our special plates to get stack height as high as poss to lighten the clutch lever.
10. Check tension on all disturbed nuts and bolts check that the rotor nut is torqued up to 80 ft lb. Turn clutch adjuster in until it just begins to lift the operating arm, back off 3/4 of a turn and then take up the slack with the cable adjuster.

### **Additional notes for Pre Commando machines.**

Atlas and Dominator owners wishing to retain the alternator and standard chaincases will have to space the stator out with the three special studs provided, as this will disengage the stator from the housing these incorporate an increased diameter to locate the stator. Remember to check rotor to stator clearance with an .008" feeler gauge, if there is a tight spot slacken the three stator holding nuts, insert a feeler blade in the tight spot, as thick as possible, and re-tighten the nuts, now check clearance again. Should an alternator not be required then the standard Commando kit with the appropriate length belt can be fitted. Other fitting details are as per Commando/general notes above.

Your belt drive should now be ready to run, we recommend for maximum advantage the unit should be run dry. However if you expect to be using your motorcycle in particularly hot climates, or you are using it in competition events and you retain the enclosed primary chaincase it would be worthwhile arranging the passage of some cool air through the chaincase, the specific details of which can safely be left to the preferences of the individual owner.

Now is the time to see if all your effort has been worthwhile, testing the unit you should experience absolutely no clutch slip under any conditions, finger light clutch operation, smoother running, quieter running, and the super light weight design should produce a small increase in acceleration and or top speed depending on final gearing used.

Should you encounter any technical difficulties contact:

**RJM Norton Ltd**



## Addendum. Belt drive clutch plate pack.

We have been asked what clutch plate stack should be used with our belt drive kits but the answer would be "That depends" which is not particularly helpful so I will try to explain. We have a large range of plates that allow almost infinite adjustment of the clutch plate stack height (The total thickness of all the plates beneath the spring) The thicker the stack the harder it is to fit the circlip but the lighter the spring pressure and thus the lighter the lever action. This may be the customers main priority or perhaps delivering ultimate power is top priority. Consider that a too powerful clutch can give too much bite when setting off causing stalling on lower powered machines or low RPM. Basically the clutch can be tailored to suit any machine. The owner must consider the weight and power of the motorcycle involved. After considering the above points at one end of the spectrum the five friction plate system would be best at the other perhaps dropping to three would be best. Some earlier bikes (Pre AMC gearbox) can (depending on lever fulcrum distance, cable routing, adjustment, wear on the lift worm etc) suffer from a lack of lift and so clutch drag, this would suggest using the lowest number of friction plates possible would be best (Total lift divided by the number of faces giving clearance between each plate). Given that the pre AMC gearbox bikes generally have less horsepower than the later bikes and being older are perhaps not worked so hard a three friction plate system may be the best choice.

Background. The Commando on its introduction had a revolutionary clutch featuring a diaphragm spring developed for Norton by Laycocks. Actually a forerunner was used on the AJS Stormer motocrossers but on the Commando it made its introduction to the world at large. The drums remained the same dimensions from beginning to end and at first had four Ferodo style plates, (postage stamp friction material bonded to a steel plate) on part number 060749 with three steel plates 060746 and a thick steel end plate. These plates were 3.6mm 2mm and 6mm (at teeth) thick respectively. The clutch centre on early bikes was not hardened and the steel core of these friction plates caused notching which could prevent the plates from separating. The Ferodo plate was replaced with a solid fibre plate 061339, same thickness and easier on the centre. Eventually Nortons introduced induction hardening to the centres teeth and that sorted the problem out. Either of these plates can be used with the same effect but the moulded fibre plates tend to stick on the center and their teeth require a wipe with a knife to free up so I tend to use the Ferodo version. Our clutch centres are properly induction hardened so can be used with any plate.

As a youth I hurtled around on a 750 Combat using all its performance and the clutch worked fine with four solid fibre plates except every three months or so I had to dismantle the clutch to thoroughly degrease the friction plates, remove All oil contamination then dry out overnight on a radiator then rough the plates up a little.

Wind the clock on twenty years and my highly tuned 950 Commando with belt drive and five plate clutch that could be Operated with two fingers never had any clutch slip issues.

In about 1973 Nortons introduced the bronze clutch plates primarily to counter oil contamination problems. This clutch had five friction plates 063741 at 3.2mm, four steel at 2mm and a thinner end plate at 2.8mm on the teeth. The design was flawed, by using a harder material with the same surface area the surface was not renewed but instead tended to glaze (our bronze plate corrects this oversight). Consider that a dry plate in a belt drive will transmit more power than a wet plate and experimentation can now commence. Aim to stop just short of the end of the clutch drum teeth as a starting point. Its fine to mix and match friction plate types and thickness.

The first plate at the bottom of our belt drive drum would normally be 4mm thick, 3mm is OK but do not use 2mm as the first plate. An Average build for a Commando might be 1 X 4mm 4 X 2mm 4 X 3.6 1 X 050014N at 5mm on teeth Equals 31.4 at drum.

Having just assembled one for a customer that selection ends about .5mm short of the end of the teeth. To make the lever lighter substituting a 3.2 for a 3.6 friction and a 3mm steel for a 2mm would =32mm

Now I have one to build for an old Norton single and I am going to go for a three friction plate clutch using the Thicker aluminium end plate 050014 so the stack is 4mm-3.6-4-3.2-3-3.6-3-7 =31.4 This should not be too savage and Give a slightly bigger gap between the plates compensating for any lack of lift on the early box. If the clutch worked well with no slip (Maybe the riders 20 stone and he canes the living daylight out of it, who knows) the 3.2 could be Changed to 3.6mm. On it goes, lots of options to tailor the clutch to your specific requirements.

### Clutch plate thickness. All dimensions are nominal.

#### Steel plate thickness/type

HS0746 2mm Narrow hardened  
060746 2mm Standard  
0607463 3mm Standard+1mm  
0607464 4mm Standard+2mm

#### Pressure plates

063768 6mm overall 2.8mm teeth standard 850 steel  
060745 9mm overall 5.8mm teeth standard 750 steel

#### Friction plate thickness/type

060749 3.6mm Ferodo  
061399 3.6mm Solid Fibre  
122M11 3.2mm Ferodo  
063741 3.2mm Hi torque bronze  
0636413.6 3.6mm Hi torque bronze

050014N 8mm overall 5mm teeth aluminium  
050014 10mm overall 7mm teeth aluminium

For longevity aluminium pressure plates should have one of the 746 steel plates beneath them.