

# Top80 Pull-start replacement by [Mark Kubisch](#) - 15<sup>th</sup> Feb 2008

## ***Introduction***

Regular maintenance of your pull-start system can save you from missing perfect flying opportunities, and your engine from ingesting unwanted parts. The overhaul sequence described here involves replacing the starter cord (which should be done as a matter of course whenever the starter is serviced) and a lubrication service of various related components.

On the Top80 Miniplane, this entails separating the engine from the frame by undoing 4 screws and removing the pull-start spool's 3 screws. There is no riveting work required for this procedure and it should take no longer than 2 hours to complete. The procedure should be similar on other forced air-cooled motors like the Ros125.

It is especially important to maintain the pull-start on a regular basis when flying at the coast due to the large volumes of moist salty air drawn through the starter system by the engine fan to cool the engine's cylinder and head. I would expect that a once a year preventative service should be sufficient with regular weekly use.

## ***Symptoms of potential problems***

**Frayed starter rope** – could break soon

**Rope fails to retract** – spool return spring getting rusty and sticking or some other obstruction

**Hard to pull** – (assuming no other engine problem like seizing), spool spindle or rope pulley needs lubrication, insufficient rope on pulley

**Fails to engage** – Plastic starter pawls seizing on standoff posts. This is especially bad if one or two of the three pawls seize, causing the load to be taken up by the remaining pawl(s) which can cause further damage (see 'strange noises' below)

**Strange noises** – The pawls could have started disintegrating already. Further damage could be caused by ingestion of pawl parts into the engine fan. The remaining pawl standoffs may have been bent by the additional load placed on it causing the pawl to rub on the cover or be broken off. Fan damage/breakup is possible, stop the engine immediately and inspect for damage

## ***Sequence***

Here is a pictorial guide of what to do:



- 1) Raise the Paramotor onto a low table or chest, so that it can be worked on at eye level or slightly below. Tie a rope from exhaust via top of 'A' frame prop guard to carb on the other side to support the engine when the mounts are undone. Tension the rope so that it takes the load of the motor (so that the motor doesn't drop on removing the mounting

bolts). Undo the four mounts by removing the screws on one side only. In the picture above, you can see the 4 rubber mounts still attached to the engine size, the screws having been removed from the frame side. The complete motor unit will now swing away from the frame enough to get at the pull start mechanism.



- 2) Be careful to relieve any tension on the fuel line and throttle cable. They should not need disconnecting though.



- 3) Remove the three screws holding the starter pulley cover onto the engine. The white plastic pawls should now be exposed. Check that they are undamaged and that the posts are straight. The pawls should return easily if tensioned against the springs. These were starting to stick. Lubricate the posts so that the pawls move as freely as possible and wipe off the excess.



- 4) Here is the source of my retracting woes. The rope failed to retract fully as the spring was starting to corrode and stick together. I used WD40 and a flat blade screwdriver slid all along between the leaves of the spring to free it up. Note the abnormal wear on the left side of the '+' guide. I also noted quite a bit of wear on one side of the centre spindle due to lack of lubrication. This caused about 1mm play on reassembling the spool later. Neither of these caused an issue with the spool operation on re-assembly, but left unchecked, who knows...



- 5) Here, we are rewinding the spool with about 1m of special indestructible 3.0mm rope of the 'Titan' variety, dyneema inner and outer for maximum strength. Accept no substitute.



- 6) Re-grease the centre spindle (don't get it on the rope) and rewind as shown. The rope needs to be no thicker than 3mm to allow sufficient length in the spool for a good pull. It will sit staggered in the groove (not on top of each other). This is normal. The spool should be packed out till just level with the edge to obtain maximum leverage on the initial pull without any binding or jumping off the spool on return. Leave another 50cm or so free to sling around the pulley and attach the handle. Don't cut off the excess until re-assembly is complete and tested.



- 7) Time to refit the spool assembly. The pawls need to be held back by some unrestrictive means while refitting. Here I use loops of string, which can be cut and removed later. Only slight tension needs to be maintained on the spool spring, too much and the spring will 'bottom out' before the rope is fully extended, too little and the rope will not remain fully retracted against the weight of the handle and could allow the handle to end up in the prop, ouch!





- 8) Here, I use a clamp as a 'third hand' while fastening the three cover screws. Note, there should not be much force on the rope at this point. The spool also looks a little overloaded here but a little rope will be removed on final adjustment at the handle end. The strings can now be cut releasing the pawls against the spool ratchet. Now reconnect

the motor to the frame and attached the rope via the 'A' frame pulley to the handle, test, adjust and trim the excess once happy. I found the motor much easier to turn over due to the fully packed spindle (more leverage) and lubricated pulley spindle (less drag). The service is worth doing just for that alone even if there is nothing else visibly wrong.

HAPPY STARTING.

Regards,

Markk.