Curing stiff in-mast roller furling

Mark Ryan rebuilds his Seldén furling gearbox after wrestling with stiff roller furling for a year and discovers stress-free and easy reefing

There are three types of sailor: the first has a roller furled main and absolutely loves it, the second type doesn't have a roller furled main and views it with suspicion and distrust after reading stories of jamming and disaster, and the third is the sailor who has a roller furled main and despairs of it.

I'd moved from the second type (with my last boat being a beautiful 30ft Albin Ballad with slab reefing) to being the third type. When I purchased *Mirage,* our 40ft Bavaria, due to the increasing size of our crew – we have four: Thomas, aged 10, Sophie (7), Matthew (4) and Isabelle (1) – one of the big reservations I had was the fact she had a roller furled main.

After much reassurance from other owners who had roller furled mainsails, we took the plunge and I became a somewhat unenthusiastic owner of a beautiful boat with a mainsail furling system I eyed with trepidation. Putting my fears aside, we set off from Poole, where we'd purchased her, bound for the Medway where we would keep her. *Mirage* has the ubiquitous Seldén Mk2 furling system with the winch 'gearbox' on the front of the mast. This gearbox, crudely speaking, contains two cogs that turn a foil inside the mast that the mainsail's bolt rope is mounted into, allowing the sail to be unfurled, then furled.

Mirage at anchor in Stangate

Matthew and the finished roller furling gearbox

The system on the mast

Gearbox modes

The gearbox has two modes, 'Free' that you use for unfurling the sail and then 'Ratchet' which is used for furling it. This mode prevents the sail from either being furled the wrong way or from unfurling again by accident. It is switched between modes by a stainless steel bar mounted on top of the gearbox that is slid to port for Free and starboard for Ratchet. To furl the sails, you can either put a winch handle into the gearbox at the mast, or use the continuous line that runs all the way back to the cockpit, providing a safe and convenient way of unfurling and refurling the mainsail… or at least that's the idea.

Even with little wind, unfurling and furling the sails on *Mirage* was a struggle and required tension to be put on the loose end of the continuous furling line with one hand (otherwise it would simply slip around the drum on the gearbox on the front of the mast), while the furling end of the continuous line was worked on the winch. When there was added friction from lots of wind it became even more of a struggle, leading to anxiety that the sail would jam up entirely and making me put off the dark moment of reefing till often too late.

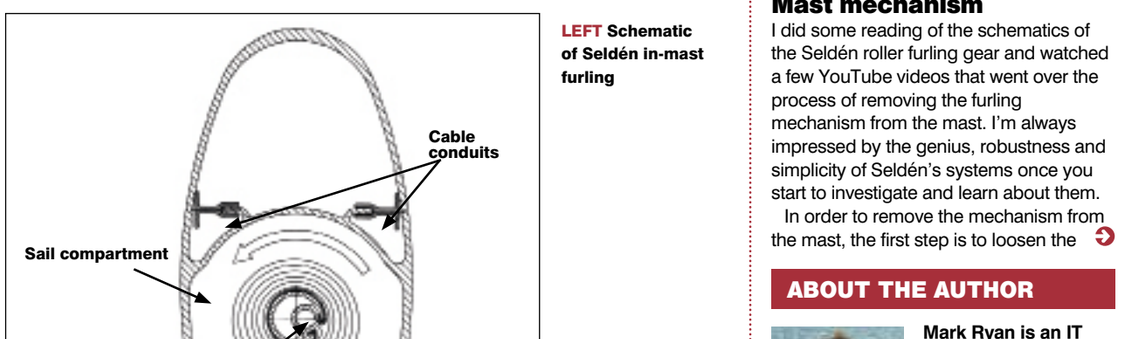
I approached Seldén about this and their technical department helpfully provided useful advice on my furling technique:

- First, put the wind 20° to starboard, with the boom to port – the furling drum furls in a counter-clockwise direction so the boom being to port creates less friction.
- The main should be depowered, but ideally not flogging.
- Make sure the backstay is not tight to limit the bend in the mast (which can add friction as the sail will rub on the inside of the mast).
- Make sure the boom is perpendicular to the mast, or the sail can bunch up.
- Only release a foot of the outhaul at a time when furling, or at least take a few turns on a winch so tension can be kept on the outhaul as the sail is furled.
- When furling, to make sure your furled sail is nice and tight, halfway through the furling process, lock off the outhaul and pull in hard on the furling winch.

So out we went again and made sure all of these conditions were true but no matter what I did, it was still a struggle to get the sail in and out. I concluded this was just how it was with in-mast furling and that I'd have to adjust my expectations.

Over the winter, I took the sails off to get lifted out and with no sails on the mechanism, out of curiosity, I tried to rotate the furling gearbox with the continuous line while standing at the mast. To my surprise, this was still exceedingly stiff to the point the continuous line slipped around the winch. I posted a video of this on the *PBO* forum and enquired if this was normal for Seldén roller furling gear, to which the answer was a resounding "No!".

I approached Seldén once more and sent them the video and they suggested it was the gearbox having difficulty and to send it back to them for a service or replacement. Part of me was relieved that the struggle I was having with my roller furling gear was surmountable, however, the rest of me dreaded the process of overhauling the mechanism. I had visions of needing to drop the rig and dissect the mast to get to the mechanism – but in fact it was much easier than expected.



ABOVE The grub screw and the sleeve RIGHT Use a screwdriver to lock the foil in position to prevent it from turning whilst using the winch handle in the gearbox to unscrew the tension on the foil.

LEFT Schematic of Seldén in-mast furling

Asymmetric luff extrusion giving reduced initial resistance to reefing due to easier bending of the luff

'When I purchased *Mirage*, our 40ft Bavaria, one of the big reservations I had was the fact she had a roller furled main'

Mast mechanism

I did some reading of the schematics of the Seldén roller furling gear and watched a few YouTube videos that went over the process of removing the furling mechanism from the mast. I'm always impressed by the genius, robustness and simplicity of Seldén's systems once you start to investigate and learn about them.

In order to remove the mechanism from the mast, the first step is to loosen the

ABOUT THE AUTHOR

Mark Ryan is an IT director for Keystone Property Finance and has been sailing his whole life. Mark, his wife and his four children sail *Mirage* up and down the east coast of England and have their sights set on heading further afield.

foil. This is untensioned by undoing a grub screw that locks a sleeve around the foil in place to hold the tension of the foil, and once that grub screw is loosened, it will allow the sleeve to be raised. Once the sleeve is raised, a screwdriver can be inserted into the foil that will lock the foil in position and prevent it turning with the gearbox mechanism. The screwdriver will also act as a wedge to keep the sleeve from falling back down again and locking the foil once more. With the screwdriver in place, you can then use a winch handle in the gearbox to undo the tension of the foil.

Once the foil was untensioned, the mechanism was immediately more free (and I made a mental note to not over-tighten it when putting it back together). Undeterred from my quest to rebuild the gearbox, I set about removing the pin that holds the foil to the furling mechanism. This all has to be completed via the small inspection hole through the mast with long-nosed pliers, firstly removing the split pin on one side of the foil and then rotating the foil using the gearbox to pull the pin out through the inspection hole. At no point during this do you want to drop the split pin or the clevis pin, so it becomes a high stakes game akin to the board game 'Operation'. If you do happen to drop either, it's not the end of the world as there is a foam insert in the mast that should catch any stray fastenings that descend from on high.

With this process complete, the foil will be free of the gearbox so the gearbox itself can be removed. This should have been the simplest part of the operation,

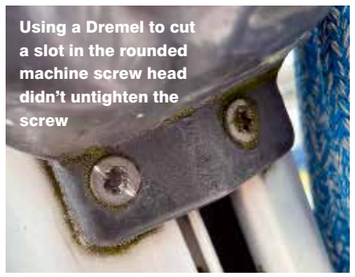
The pin holding the foil will need to be removed with long-nosed pliers

'I half expected all my efforts would be for nothing, however, on unfurling it was clear, as the sail just fell out of the mast, that it was a whole lot better'

with the mechanism only held on with four Torx machine screws onto the mast.

Three of the machine screws came away with a little persuasion, but the fourth had been rounded off by a previous owner in their attempt to remove the gearbox. The machine screws themselves are stainless steel while the body of the gearbox is far softer aluminium. I first tentatively tried cutting a slot into the head of the machine screw using a Dremel, but the screw was still tight and refused to budge. The final option I had with the tools to hand was drill the head out, which filled me with dread as if I slipped I'd drill right through the soft aluminium body and a replacement mechanism would be very expensive.

I set about carefully drilling a small hole in the middle of the machine screw, applying cutting fluid, as much pressure as I dared and a slow speed to the operation. The risk (that I know from bitter experience) is that if heat builds up and you do not make headway, you will work harden the stainless steel and make it even harder to drill out. It's also vital your drilling is exactly centred or you'll start eating away at the aluminium body. As I progressed, I slowly moved up drill sizes until the head came off and finally my gearbox was free of the mast!



Using a Dremel to cut a slot in the rounded machine screw head didn't untighten the screw

The machine screw after the head had been drilled out. With plenty to grip it was now much easier to extract

Gearbox removed from the mast at last

Working from home

Now that the mechanism was off, and much to the delight of the first mate, I took the mechanism home and planted it on the dining room table for an inspection and strip down. I collected together the tools I'd need for disassembly and the very helpful spare parts schematics from Seldén's website.

The whole mechanism is held together

Gearbox on the dining room table!

LEFT Use a tray when deconstructing the gearbox to keep all of the components together

INSET BELOW Needle roller bearings are held in place with grease during reassembly. The pawls will need to be oiled

BELOW A messy, greasy business, but it's all coming back together nicely

by three spring pins (also know as rolled pins, slotted pins or tension pins); two that hold the two cogs onto the shafts and one that holds one of the shafts onto the body of the gearbox.

These need to be driven out using a punch and (so long as they are not mangled, like one of mine was) they can be reused time and time again. Do not attempt to drive these out with anything other than a punch of the correct size as these will (by design) be very snug.

Two of my three spring pins came out as expected, the third just fell out by itself with no knocking required. Reading around the forums, this is a common mode of failure for these gearboxes: if one of these spring pins does exit of its own accord, the mechanism will fail.

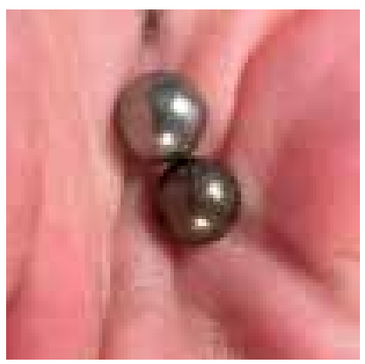
The cog secured with this loose spring pin was seized onto the shaft, meaning it could not have fallen off even if the pin had come out, but the seizure caused its own complications later on.

Once the cogs are free, as you remove the shafts from the aluminium body, all the loose bearings will come rolling out, so it is best to do this in a tray to prevent any bearings from rolling off your work surface.

As you deconstruct the gearbox take photos of where all the bearing cages, bearings, and fittings go together, as it's quite a puzzle when it comes to putting the gearbox back together later on.

Now you have the gearbox in its component parts, it's time to clean all the cogs, shafts, pawls and bearings with a solvent (I only had white spirit to hand, but that did just fine) and inspect them for damage. One of the sets of bearings was visibly worn and clearly needed replacing and was likely the reason my roller furling gear was so sticky.

After unsuccessfully trying to order spares from Seldén (which, while more expensive, I'd have preferred), including replacement machine screws to secure the gearbox back to the mast, new spring pins and bearings, I ordered a job lot of bearings and the parts I needed from a local engineering company at a fraction of the cost.



ABOVE Matthew cleaning the cogs; worn ball bearing to the right of less worn bearing

Gearbox reconstruction

With all cleaning completed and fresh parts in hand, it was time to reconstruct the gearbox. Using the special mega expensive blue Seldén grease to 'glue' the bearings in place for reassembly, and light winch oil to oil the pawls, it all looked very impressive indeed. To apply the grease, I used a syringe to inject a small amount

RIGHT A Sealey puller was needed to remove the seized gearbox cog
BELOW The cog scraping its way off the shaft

onto the cogs and a brush to spread it evenly and thinly.

I hadn't bothered to free the cog that was seized onto the shaft, as I could extract the shaft the cog was attached to from the gearbox body by removing the spring pin from its other end. Now this decision came back to haunt me, as the only way to get all the bearings to stay in place as you gingerly inserted the shafts was to attach the cogs last of all.

A few exploratory knocks, to see how seized the cog was, showed that it was pretty wedged on. It was time to bring out the big guns of my large Sealey puller, and after a surprising amount of force was applied, the cog finally scraped its way off.

After sanding the shaft lightly and then lapping it with the cog itself, the cog would then slide freely onto the shaft meaning that I could reassemble the unit without bearings spraying all over the floor!

Finally, the mechanism was all back together again and could go back to the boat to be refitted to the mast.

Success

Fitting the mechanism back on board, I made sure that I prevented any further galling that had required me to drill out the stainless machine screws by applying TefGel onto the treads of the machine screws. This would stop what was likely galvanic corrosion of the machine screws into aluminium, although that surprised me as usually Seldén fittings have stainless thread inserts to prevent this form of corrosion.

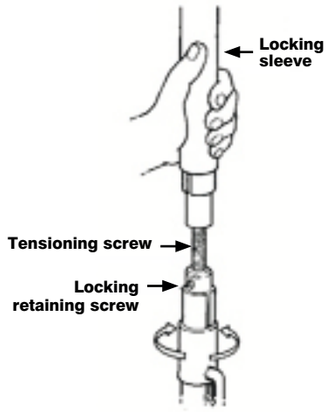
Once I'd fitted the foil back to the top of the gearbox, securing the clevis pin back carefully with the split pin, comes the moment to tension the foil up. If you put too little tension on it, the sail will bang around inside the mast and jam up, if you put too much tension on it the whole mechanism will feel too tight and put too much pressure on the bearings. To get the correct tension is very straightforward. While grasping the locking sleeve firmly with one hand, start turning the winch on the gearbox to wind up the tensioning screw, then once your hand slips, that's it, its tight enough! This advice is in some, but not all, versions of the manual for Seldén's in mast furling, and though simple advice it is very sound indeed.

With the mechanism refitted, I held my breath, bent the sails on and went for a sail. I half expected all my efforts would be for nothing, however, on unfurling it was clear, as the sail just fell out of the mast, that it was a whole lot better. Now my 10-year-old son can furl the mainsail from the cockpit with no winch required and reefing the main away is even freer, simpler and safer than reefing the headsail (I guess that'll be the next project then!).

Mark and son Matthew on the helm

How to tension the foil

Push the locking sleeve up to a level with the upper opening. Put in your left hand and get a firm grip on the locking sleeve.



Now turn the tensioning screw with a winch handle in the drive unit. When the locking sleeve starts to slip in your hand the luff extrusion is tensioned about right. Push the locking sleeve back down and secure with the locking retaining screw.

What to do if it's a struggle to use your in-mast furling

- **Check your furling technique. Follow the advice from Seldén and you can't go far wrong.**
- **Check the tension of your foil. This is surprisingly easy to do and can be done with the sails bent on and the rig up. If it is too tight, it will be very tricky to furl, if too loose, the same will apply.**
- **If furling from the continuous line in the cockpit, check all sheaves for any additional friction where the rope runs.**
- **If all else fails or if in any doubt, service the mechanism. It is surprisingly easy to do, the parts can be cheap and it is rewarding to do – especially when it results in stress free and easy reefing!**

Seldén furling mast mechanism rebuild

Step by step

1 **First unfurl and remove your mainsail. Laying up time is the perfect opportunity to service the in-mast furling mechanism. Start by loosening the foil and undoing the retaining screw.**

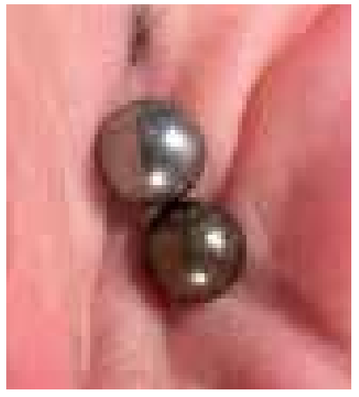
2 **Push up the locking sleeve and insert a screwdriver into the sail groove to stop the sleeve dropping down. With a winch handle in the furling mechanism unwind the tensioning screw until loose.**

3 **Remove the pin holding the foil to the mechanism: Carefully remove the split pin holding the clevis pin in place, and extract clevis pin. If the pin is reluctant, try loosening tension on the foil.**

4 **Remove the four machine screws that hold the aluminium body of the gearbox onto the mast and draw the gearbox out.**

5 **Drive out the spring pins that hold the cogs onto the shafts and deconstruct the gearbox. Take photos to remind you how it fits back together again!**

6 **Use a solvent to clean all parts of the gearbox carefully and completely, removing every trace of old oil and grease.**



7 **Inspect all parts for wear, paying particular attention to bearings. Replace any parts that are damaged or at the end of their useful life.**

8 **Use grease to hold the bearings in place and reconstruct the gearbox. Use light winch oil on pawls. The cogs should be the last item reassembled.**

9 **Refit the gearbox and tighten the foil to the correct tension (being careful to not under- or over-tighten the foil). Enjoy stress free furling!**