

## WINDOW REGULATOR REPAIR KIT

International Patent Applied For  
PCT/GB2009/000139.

### “HOW TO” GUIDE

#### You should have:

- 1 x length of stainless steel wire
- 6 x stop ends
- 1 x Permabond 2 part epoxy adhesive
- 1 x mixing palette & spatula
- 2 x IPA (alcohol) wipes & abrasive sheet
- 2 x non-reversible temperature indicators
- 1 x stop end adhesive guide (via e-mail link)



### GENERAL

This guide explains the principles involved in replacing the wire on the three-section wire regulators these kits are made for and gives a step-by-step example of a regulator repair to illustrate these principles.

The mechanism consists of three sections of wire, two of which are anchored in and then wound around a motor driven reel. These two wire sections leave the reel in opposite directions and are fed through outer sheaths onto two metal tracks where they are anchored in sliders (see figures 1 & 2 below). The third wire section connects the two sliders using similar anchor points. When assembled inside the car door, the window glass is attached to the sliders which are moved up or down the metal track by the operation of the motor. When the window glass reaches the end of its travel in either direction the motor continues to operate momentarily until the additional current it draws under strain is detected by a separate electronic controller which cuts the power to the motor.

The failure of the regulator is normally caused by corrosion of the wire sections. When they corrode, the wires expand and lose their flexibility and strength. The wires can then jam or break completely. The stainless steel wire in the kit will resist this process and retain its flexibility for much longer. All three wire sections should be replaced when carrying out the repair. Once repaired your regulator will be superior to when it was originally fitted and will give you years of trouble free service.

The most important aspect of the repair is getting the finished mechanism correctly tensioned. This is achieved by accurately re-creating the length of each wire section.

Figures 1 & 2 below show the wire section routing on typical regulator designs. The three reference points are: A – wire reel housing; B – plastic slider on the metal track with motor attached and; C – plastic slider on the metal track without the motor.

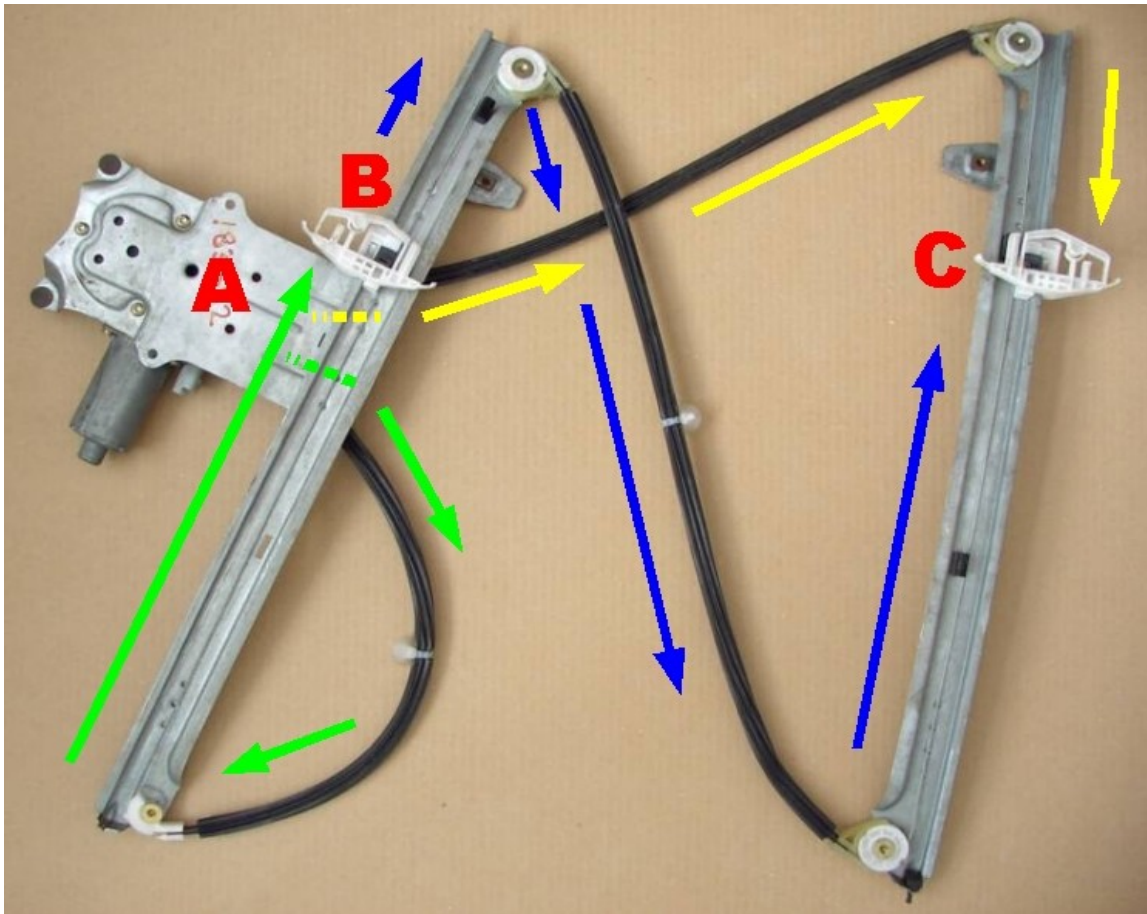
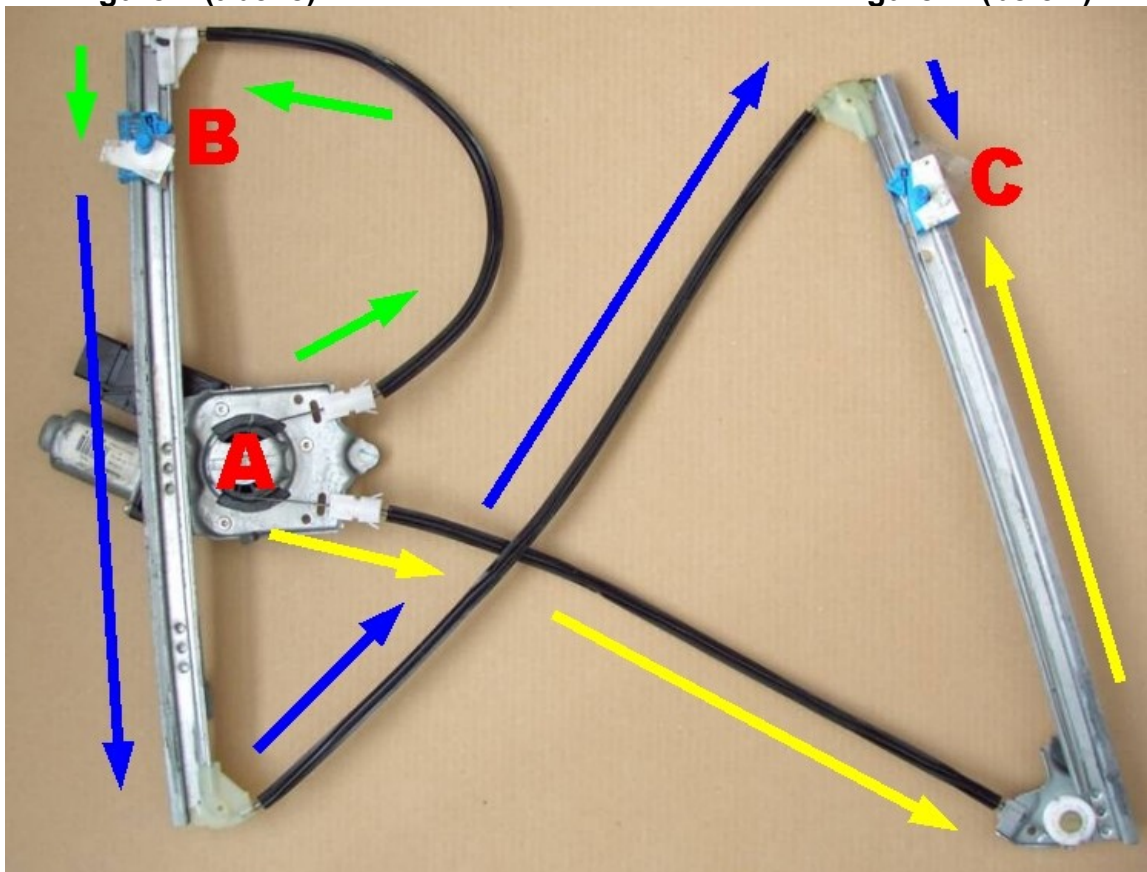


Figure 1 (above)

Figure 2 (below)



## **PRINCIPLES OF THE REPAIR**

To repair the regulator you will need to accurately re-create the length of the three wire sections. This is much easier than you might think.

If all three original wire sections are unbroken this is easily achieved by removing them, straightening out any kinks in the wire with pliers and pulling them tight before measuring them accurately and making new wire sections from the kit.

If one original wire section is broken, the two unbroken wire sections are duplicated in the same way and refitted to the regulator. The length of the third (broken) wire section can then be established by fitting the components and tensioning the mechanism. To do this the third wire section is partly made up using the uncut remainder of the new wire from the kit but without fitting one of the stop ends to the wire (one that locates in a slider) and the wire is then anchored at one end only. The complete wire sections are then tensioned from the motor end and the sliders locked in place on the metal track. The incomplete wire section is then tensioned correctly and the unfinished end of the new wire can be accurately measured against its final anchor point in the slider. Once cut to length and with the last stop end fitted to the wire, the mechanism can be reassembled and will be correctly tensioned. (How to do this is shown later in straight-forward steps.)

In carrying out the repair you're going to save some hard earned cash, in some cases quite a lot of it. In the process you'll extend the life of the window regulator (often beyond the life of the car), reduce the demand for replacement units to be manufactured and transported and prevent your own one from having to be recycled or worse still from ending up in a landfill site. Perhaps these are the most important principles of all.

### **Step-by-Step Example**

As a result of the sheer number of design variations manufactured, the examples given here may not exactly match the regulator you're about to repair but the same methods apply to them all. The design of regulator fitted often varies from door to door, even on the same car. The methods and suggestions in this guide are based on what someone with access to some basic inexpensive tools, who's doing the repair at home, can follow or readily adapt to suit their own circumstances. Please read through this guide and the stop end adhesive guide before you start.

**Don't cut the single length of new wire supplied until you reach step 4. Avoid threading the stop ends onto the new wire until you've removed all traces of the oily coating on the new wire using the IPA wipe.**

**Step 1:** Set the regulator on the bench and study how it operates and what's caused it to fail (no need to power it up). If one of the wires has broken completely check you've got all the parts of the outer sheath assembly from the bottom of the car door and set them out in the correct order. You'll find it useful to mark or label the outer sheaths and show where each end locates as they're not interchangeable but do look remarkably similar once removed from the mechanism. Inspect the plastic parts to make sure these aren't broken. The most important aspect of the repair is to get

the correct tension on the wires, so make sure you're familiar with the spring tension pieces (and any separate tension adjusters if fitted).

You'll also need access to the wire reel, so check where the fixings are and how to remove them.

**Step 2:** Now you need to remove the wire from the wire reel. Don't cut any of the existing wires. Dismantle the unit to give you access to the wire reel (normally very obvious screws). Mark the position of the reel in relation to its housing (and so you know which side of the reel faces up). Carefully lift the reel off the centre shaft and remove the wires from the reel and from the metal track so you're left with just the wire sections (with the outer sheath and other parts if the wire is intact). Take care not to damage any of the wire grooves on the side of the wire reel when removing it from the shaft. Clean up the grooves in the reel and straighten or trim any damaged edges. Check how the stop ends get fully anchored in the wire reel and sliders.

**Step 3:** Carefully straighten any kinks out of the intact original wires using pliers to enable you to measure their length (between the inside edges of the stop ends). To do this accurately you can easily pull the wire tight (using some combination of vice, pliers & vice grips to hold the existing stop ends firmly). Note: the wires will not all be the same length – they need to be measured accurately each time.

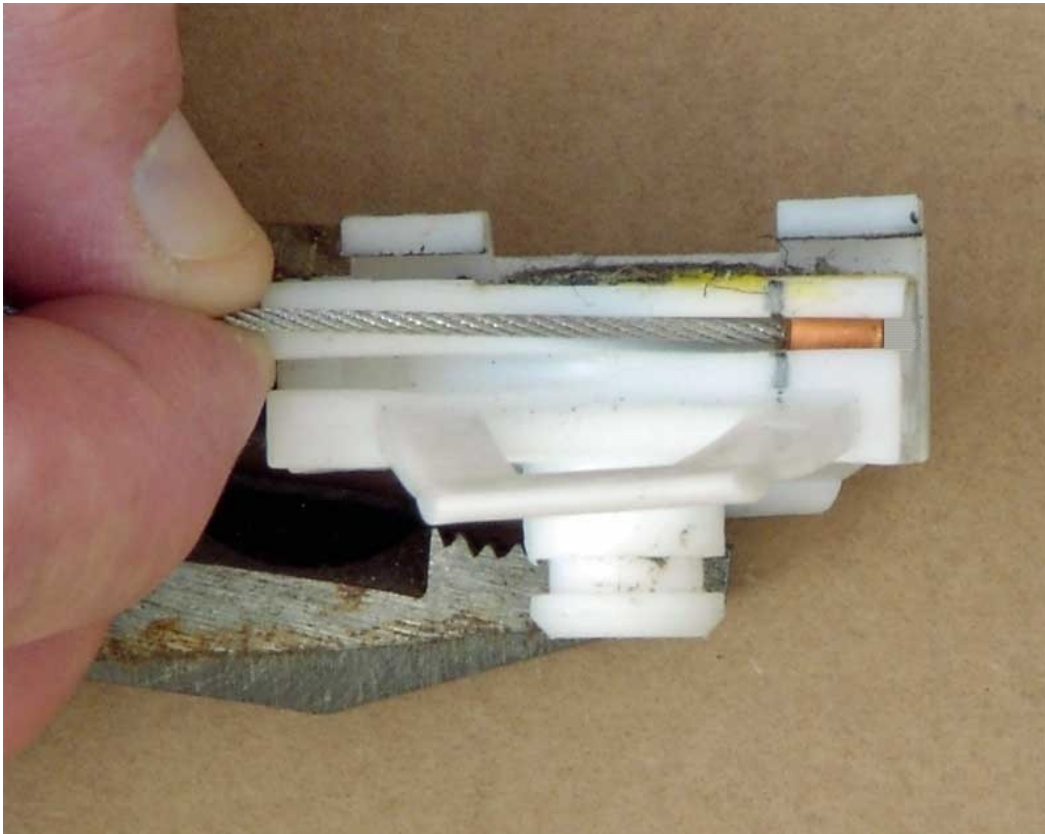
**Step 4:** When you're confident you have accurate measurements, cut the old wires, remove the outer sheaths and any other parts from the wire sections and set these out in order (and correct orientation). Take care not to lose the springs and other small parts from the ends. Use a clean length of the old wire to clear any rust or obstructions from inside the outer sheath. If you don't have access to wire cutters, use sections of the old wire to test how cleanly you're able to cut the wire. If you don't get a cut that can be twisted tight to pass through the new stop ends, ensure in the following stages that you assemble the new wire section and components from a clean cut end of the new wire. (Clean the old wire before test threading any new stop ends onto it.) Clean any rust off the spring tensioners and make sure they operate freely. Clean any rust off the ends of the outer sheath. Now re-assemble using the carefully measured lengths of the new wire and stop ends. (See the “stop end adhesive guide” document.) Ensure you make allowance for both stop ends at each end before cutting the wire to the finished length. **Double check that you've fitted all the parts in the correct order and orientation before fixing the second stop end to each new wire section.** When both stop ends are fixed apply a little 3-in-1, WD40, Plus-Gas or similar to any rusted areas, on to the spring tensioners and run a few drops down the wire into the outer sheath. Repeat steps 3 & 4 for all remaining intact wire sections. If all 3 were intact, go to step 8.

**Step 5:** If you had one broken original wire you should now fix a stop end to one end (the wire reel end where applicable) of the remaining section of new wire. **Don't cut the wire at this stage.**

**Step 6:** You will now need to mark the outside edge of one of the sliders to make it easy to see where the stop end is positioned inside it. This mark will be used to determine the exact length of the incomplete wire section by tensioning it along side the slider on the track. To create the mark, remove the slider from the open end of



the metal track (if one end is open). Locate the stop end anchoring point that the incomplete new wire will fit into. Temporarily fit the stop end into this anchor point and check that it's seated correctly. Apply enough tension on the wire to hold the stop end firmly in place and make a mark on the outside edge of the slider in line with the inside edge of the stop end. (See figure 3 below.) Remove the stop end and refit the slider to the metal track.



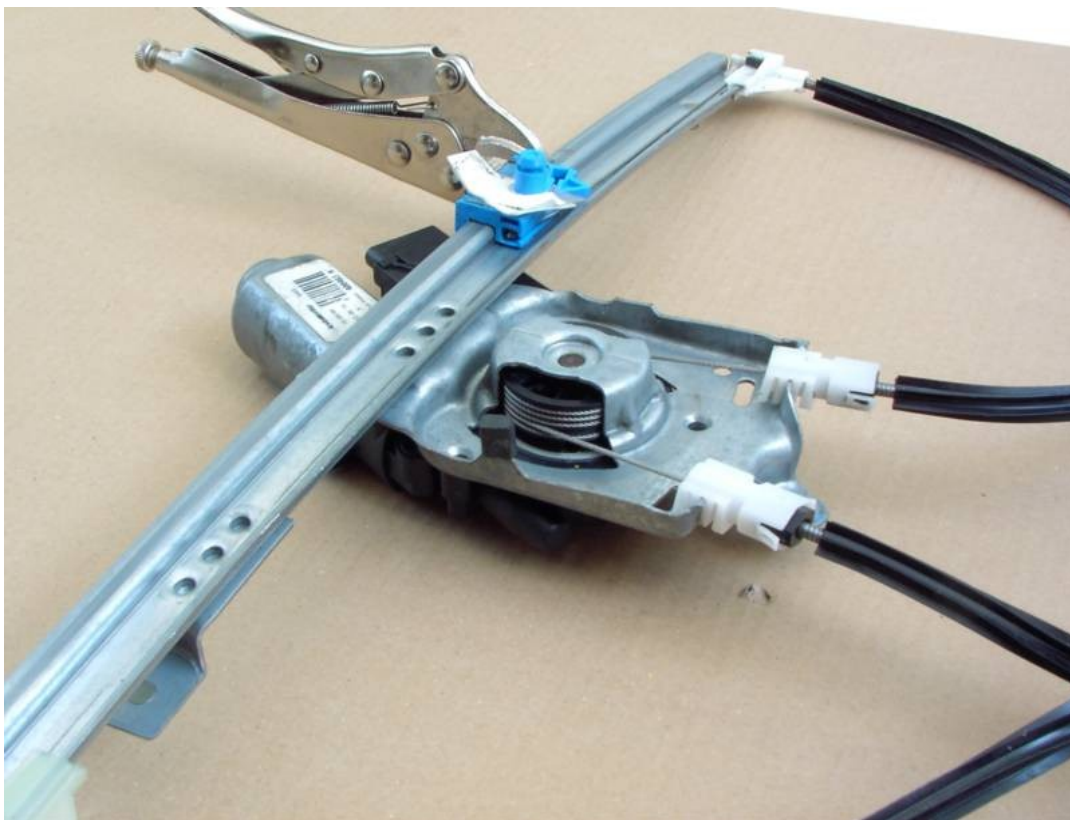
**Figure 3**

**Step 7:** Repeat the relevant parts in step 4 and assemble the remaining wire section with the fixed stop end (fitted in step 5). If one end of this wire section locates in the wire reel, fit the stop end at the wire reel end in step 8. **Don't fix the second stop end or cut the wire at this stage.**

**Step 8:** Clean up the wire reel and housing, lightly grease the housing and apply a few drops of oil to the centre post. Insert the correct wire into the base of the wire reel and ensure the stop end is properly seated. (On some models you'll first need to ensure you've threaded the wire through the wire reel housing.) Check how the reel is going to locate into the housing (with reference to your markings) and wind the correct wire up around the reel to the half way point. Locate the reel firmly in position keeping tension on the wire. Repeat with the second wire, working down from the top. This will result in both sliders being positioned towards the centre of the metal tracks. (You may need to make slight adjustments to ensure the sliders are positioned at a point where they can easily be clamped to the track without obstruction.) Keep good tension on both wires and fit the wire reel cover (where applicable) taking care to route the wires correctly.

**This is a critical part of the repair since any loss of tension on the wires will result in them slipping off their tracks on the reel. This can happen without you noticing so proceed carefully.**

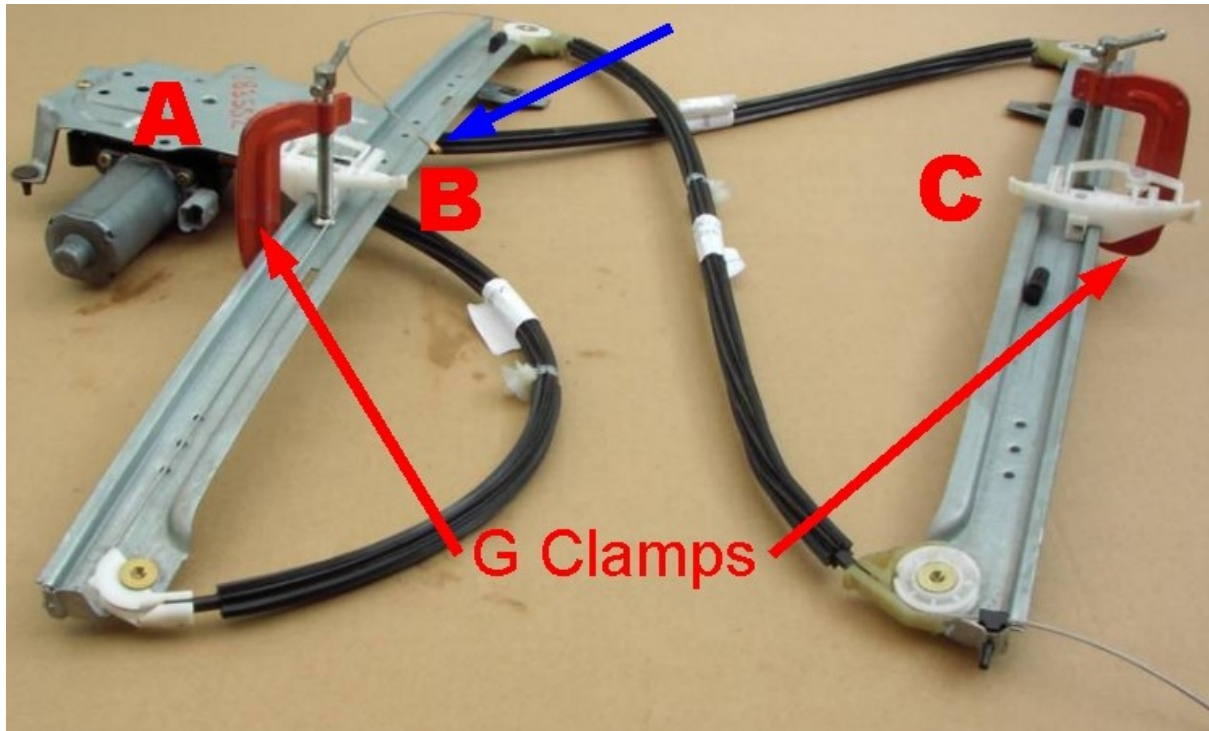
Continue to keep both wires under good tension and refit the wire reel and motor assembly to the metal track. On the fully assembled wire, make sure the spring tensioner and other parts on the outer sheath are correctly seated and seat the outer wire assembly firmly in its final position at the reel housing end. Continue to keep both wires under tension and seat the other end of the outer wire assembly firmly in its final position at the end of the metal track, route the wire correctly and locate the stop end in the slider on the track, ensuring it's properly seated in the anchor point. Now move the slider to take up and retain the tension on the wire section and lock the slider in place with a clamp or vice grips applied to the metal track to prevent the slider moving back. (Don't try to clamp the slider itself.)



**Figure 4 – First wire section tensioned and slider locked against metal track.**

The wire should be tight and it's useful at this stage to position the end of the metal track against something solid so you have something to push firmly against before locking the plastic slider in place. Take care to ensure you don't damage the slider. Repeat this process to fit the second complete wire section.

**Step 9:** If you already have all three wire sections completed – repeat this process for the third one. Note however that final assembly is achieved by placing the centre wire section over the wheel at the end of the metal track. (See step 12.)

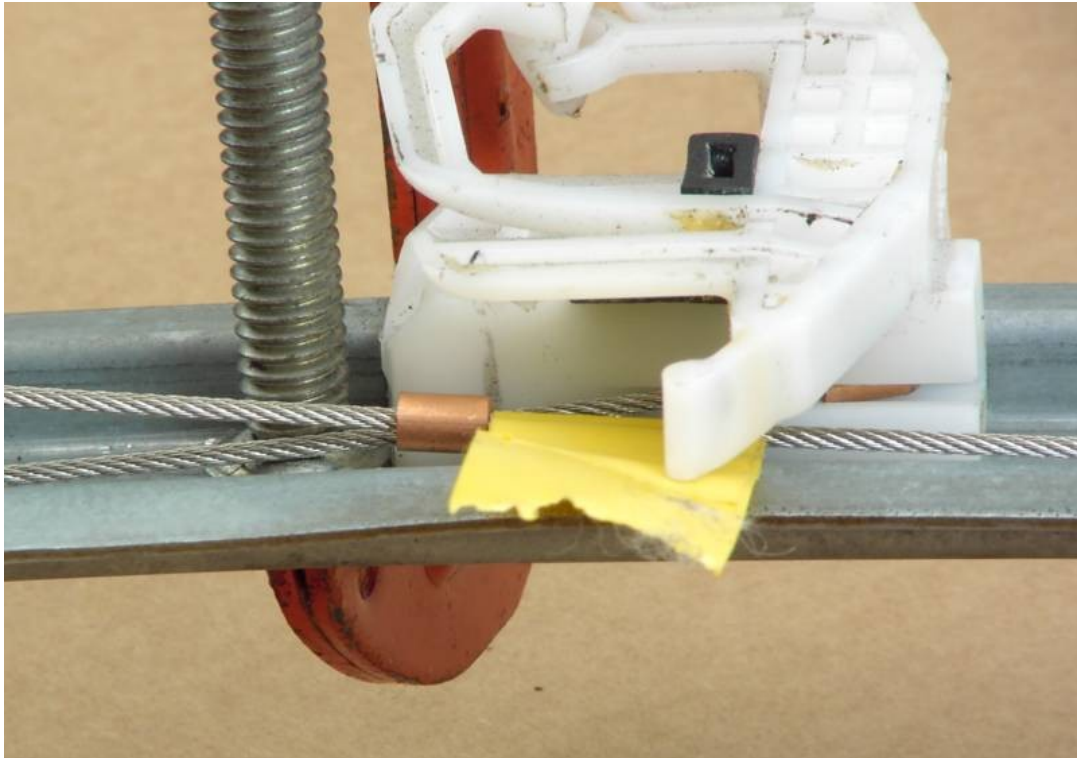


**Figure 5 – Two wire sections tensioned and sliders locked against metal track. Blue arrow pointing to stop end fitted to the incomplete wire, now about to be located in plastic slider “B”. The unfinished wire end will then be tensioned and measured against the mark on slider “C”**

**Step 10:** If you still have one incomplete new wire keep it under tension if one end is already located in the wire reel, otherwise fit the stop end to the unmarked slider. Now carefully locate both ends of the outer sheath in position and route the unfinished end of the wire so that it's still exactly aligned with it's final correct routing along the side of the marked slider. Keep the wire under tension. Clean any oil coating from the free end of the wire and fix a marker to the wire to enable you to determine the exact length needed. Insulating tape can be used as a marker. Getting the length of this final wire correct will ensure the whole mechanism is tensioned correctly. **This is now the most important part of the repair.**

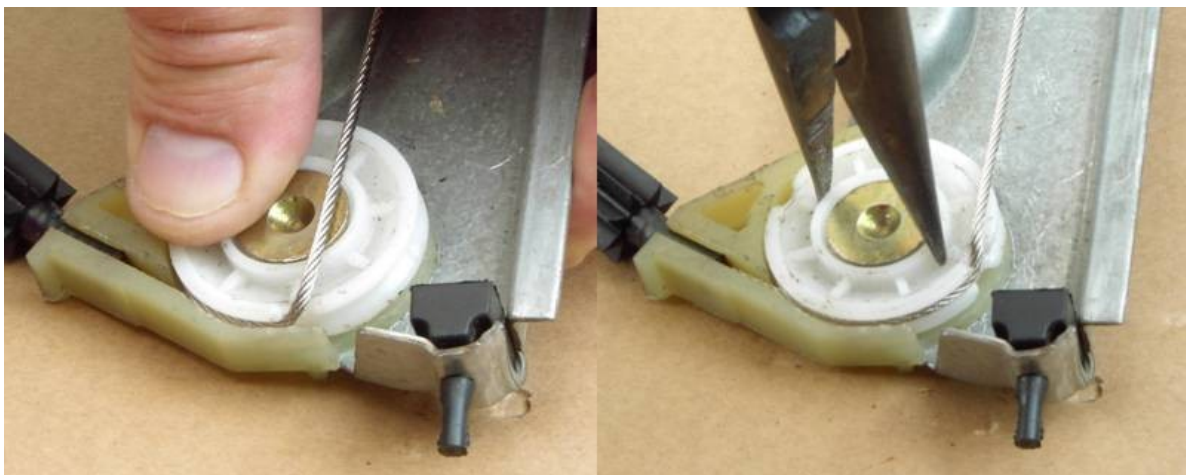
**Step 11:** Before marking the final length of the wire you need to remove all the free play on the wires and ensure the spring tensioners are fully compressed. If necessary, make any adjustments to the tension of the two complete wire sections by altering the position of the clamps on the metal track and lock in place when done. Now grip the unfinished end of the third wire and pull tight to remove all the free play (and fully compress the spring tensioner(s) if applicable). Make sure the wire passes along the marked edge of the slider and is routed correctly, then align the marker on the wire with the mark you made on the side of the slider in step 8 (see figure 6 below).





**Figure 6 – Aligning the marker on the wire to the mark on the slider.**

Make sure the marker is pressed firmly on the wire in the correct position and lock the wire against the end of the metal track to retain the tension. (A section of outer insulation from electrical cable, or similar, should be used to protect the wire when locking it against the metal track. Ensure you do not over tighten or the wire will be deformed or damaged.) Carefully remove the free end of the wire from the edge of the slider and clear of the metal track. The marker now indicates the inside edge of the final stop end so make allowance for this and cut the wire. Fix the final stop end. When the final stop end has set to handling strength (5 minutes) you can remove it from the mechanism and reel to heat cure it if you wish. If you use the “tin can” method described in the stop end adhesive guide you should be able to heat cure the joint with the wire left in position. Once set to full strength (and cooled completely) you can follow the relevant parts from step 8 to re-assemble the mechanism to this point quite quickly and continue to step 12.



**Figure 7**



**Step 12:** To complete the assembly the final stop end should be fitted to the slider with the wire slipped off the guide wheel at one end of the metal track (this should be the metal track that does not have the motor attached to it). When you slip the wire off the guide wheel you should take care to retain tension on the wire. Once the final stop end is fully seated in its anchor point on the slider, the wire should be refitted to the guide wheel (working from the motor end) by locating it in one of the notches on the wheel or by using the cam on the top of the wheel. Press down over the notch (or cam) to keep the wire in place and turn the guide wheel carefully using pliers until the wire is fully in position. (See figure 7 above).

Long nose pliers are ideal for this as they can be pushed down on the wheel and pressed against the spokes to turn it. If using standard pliers grip the outside edge of the wheel with just enough pressure to allow it to turn. Take care not to damage the guide wheel.

**Step 13:** Apply a reasonable coat of grease beneath the wire routing on the metal tracks and a light coat to the surfaces the sliders comes into contact with. This will ensure the mechanism runs freely and will continue to coat the wire over time.

The regulator is now ready to be fitted back in the vehicle. If you want to check it's operation beforehand, or need to adjust the position of the sliders to refit it – you can plug the unit back into the cars wiring loom and operate it using the window switches. **DON'T operate it with “one-touch” switch buttons and DON'T allow the slider to travel close to the open end of the metal track until it's fully fitted back in the vehicle or you will damage the unit.**

## **OTHER THINGS YOU MAY ENCOUNTER**

### **Damaged wire reel:**

When the reel is damaged because the wires have become entangled inside the reel housing, it's almost always possible to clean it up to a satisfactory standard using a sharp knife and small file. The damage is rarely so bad that it can't be re-used.



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