

BMW E46 Final Stage Resistor,
also known as the infamous 'Hedgehog'.

Symptoms of defective FSR and Detailed step by step
instructions on how to replace it



The symptoms of a Hedgehog failure (or imminent failure)

Do you have a problem with your aircon blower/fan fluctuating in speed, running at full speed (or any speed) with no control over it? or in the worst scenario possible, the fan running with the ignition off and flattening the battery?

You can immediately suspect the culprit as being the Hedgehog. It is now widely regarded as the main cause of the issues mentioned. BMW have gone through a number of revisions with the Final stage resistor and as a result you may find any replacement part could look considerably different to the new part that you source.

Once a Hedgehog shows signs of failure it only gets worse with symptoms worsening or complete failure with no further warning.

In my case, the fan was running up and down from almost nothing to high and back again in a constant cycle. The fan would run up and down every 2 seconds or so. It only happened occasionally (once a month perhaps) but then started to happen more regularly. More worryingly was the additional development that occasionally after stopping the engine and removing the key the fan unit could still be heard humming slowly to itself for a short time afterwards. All indicative of a Hedgehog in its death throes.

The replacement FSR stopped all the problems I was having immediately after fitment.

Visually there are no clues as to the operational abilities of the hedgehog, Consequently, I would strongly advise you forget any thoughts of buying 2nd hand unless you really are struggling for money. The obvious risk of getting a defective unit isn't worth it the savings for such an annoying job in fitting it. The FSR I just replaced looks fine and was only occasionally showing signs it was on the way out so until it was fitted, any new owner of the part would be none the wiser until it decided to finally fail altogether. My old unit will be hit with a hammer before it goes to scrap to make sure nobody gets caught by it in the future. The job itself is a potential pain in the backside the first time you have to do it. It is far better to start with a guaranteed new component.

Replacement should take an average amateur around 1 to 2 hours.

The quick description of the task is here, followed by far more detailed steps with associated pictures of what you will be see during the job:-

1. Remove panel from under steering wheel.
2. Disconnect buzzer, foot well light and OBD socket (plus any other added ancilliary equipment you may have had fitted beyond the original specifications from the panel).
3. Unclip the stepper motor from its housing in front of the final stage resistor.
4. Disconnect/remove stepper motor housing.
5. Disconnect wiring plug from Final Stage Resistor.
6. Unclip Final Stage Resistor then remove and replace with new unit.
7. Refit everything you disconnected or removed and complete the job.

For such a potentially irritating job it looks so simple written like that. The fact of the matter is that it really should be that simple. Such a shame that BMW choose to hide the Hedgehog in such an awkward place to get to and made it all the more difficult.

Here is the longer and much more detailed version of the job :-

These were the tools needed for the task. The picture was taken when I had finished, so the Hedgehog shown is actually the old FSR.



If the Torx bit on the handle been any further out from the main driver shaft, the width of the rotating motion needed to undo the screw would have prevented its use. It would have fouled on the surrounding metalwork.

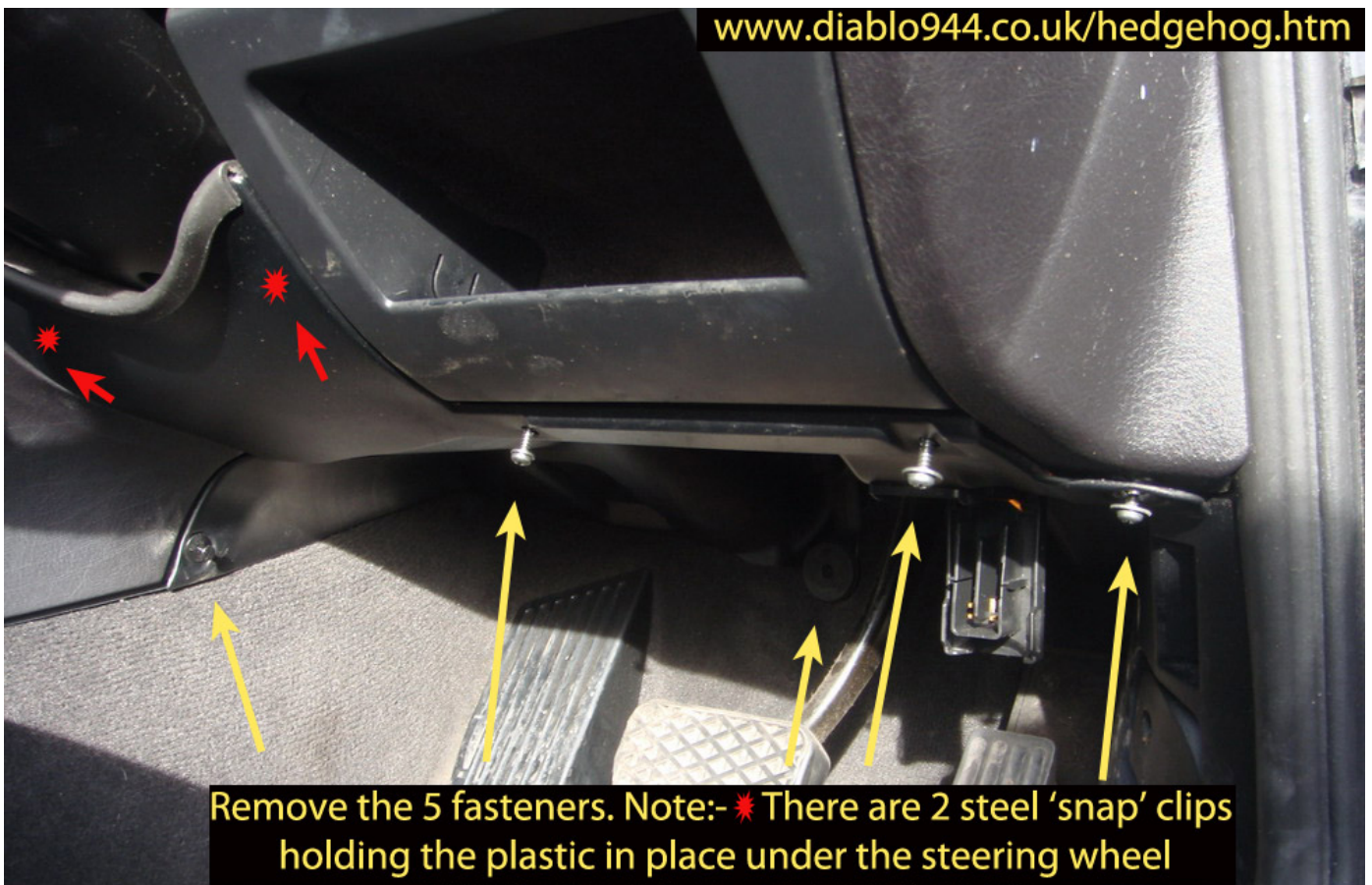
First task is removing the panel.

All the fasteners that hold the panel in place are indicated here

www.diablo944.co.uk/hedgehog.htm



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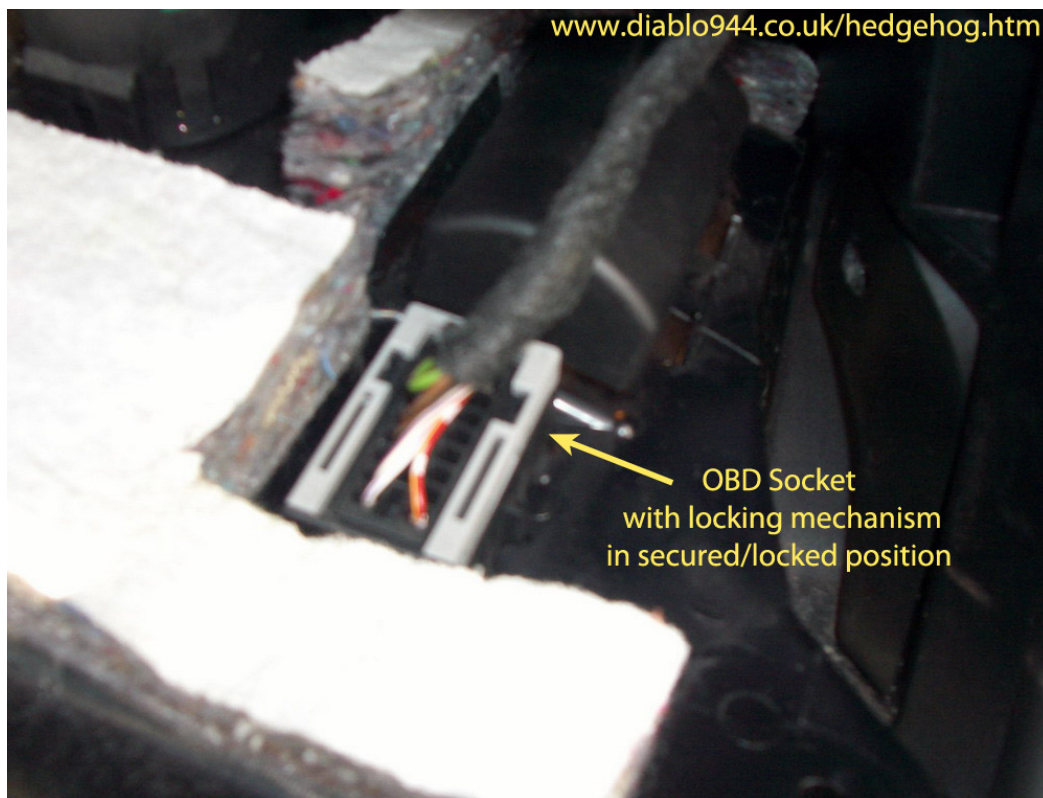


Extra care needs to be taken once the 5 fasteners have been removed as the 2 steel clips securing the panel under the steering column can hold tightly enough to break the tabs.



Once the panel is detached, you need to remove any electrical connectors that are attached to components on the panel.

Remove the OBD socket first as it is the most important of the 3 components. The OBD housing is fitted with a grey locking mechanism that holds the socket firmly into the housing.



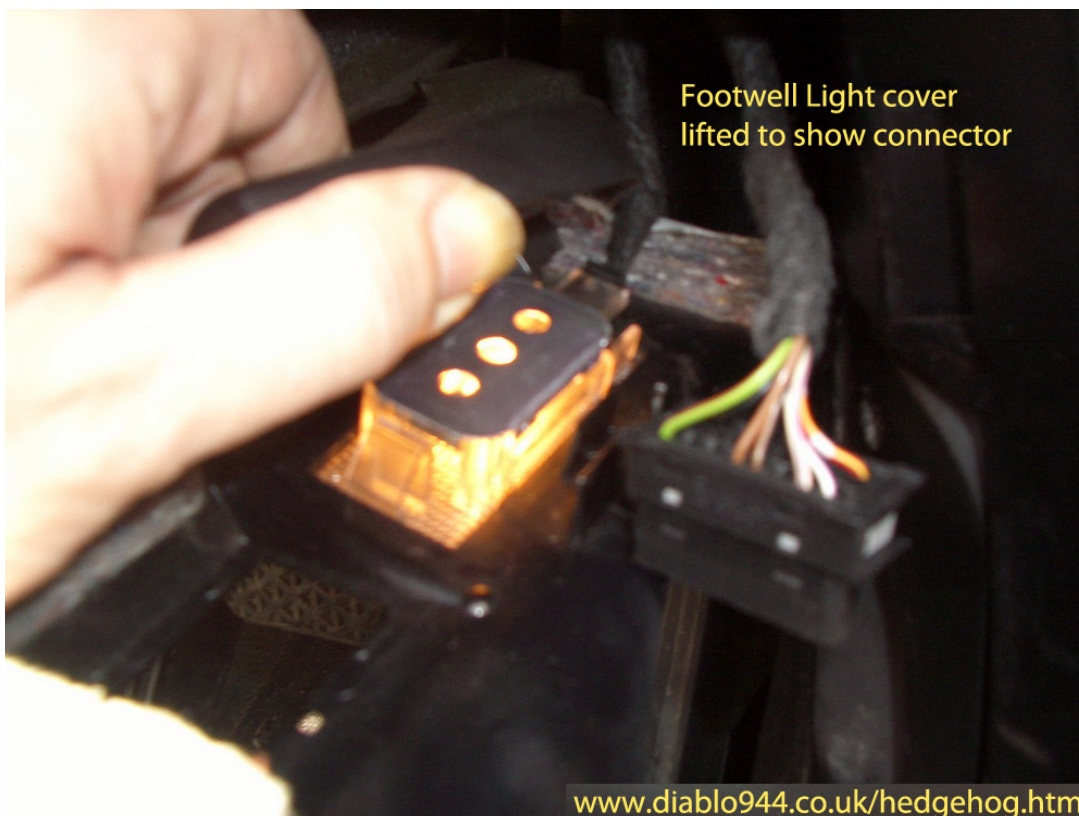
Slide the grey lock open. Although the socket is now in the release position, it is still clipped into place. Don't be tempted to try and pull it free with the wiring! Open the OBD cover on the underside of the panel and push the socket through the housing



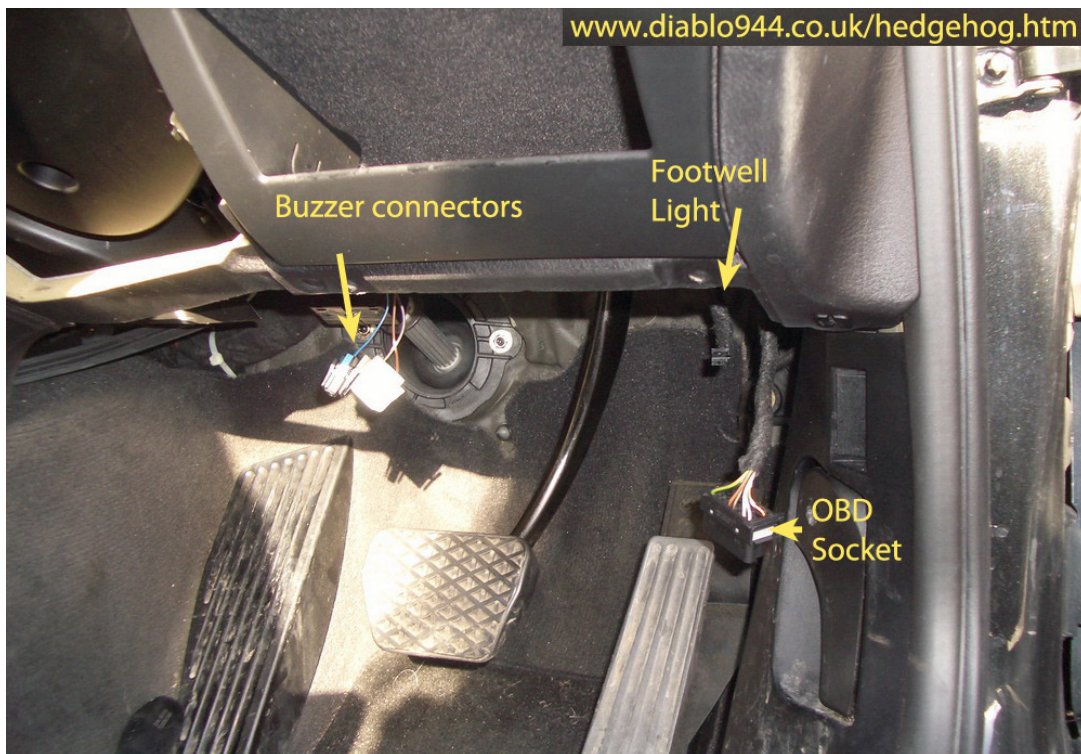
Next disconnect the buzzer wiring. Take note of where the plugs are fitted as there are a lot of alternative sockets in the top of the buzzer. For each of the plugs, push the tabs together and gently pull them free of the unit.



Now for the foot well light. It is behind a plastic protection cover. Lift the cover open to reveal the connection and pull the plug free of the light unit.



You can now remove the panel altogether. Tuck the buzzer connectors up out of the way. I looped them over the steering shaft to keep things clear for the job in hand. You may spend a bit of time squeezed into this area later so it is worth tucking the OBD somewhere safe as well rather than risk potential damage if you get it caught in clothing



You are finally in a position to see the area you will be working in. Space is tight under here so prepare for a few potential aches, pains and scrapes. There are edges under here that you don't realise exist until you see all the scratches on your hands later. I looked like I had been savaged by an angry cat after my time working under the dash



The image below clearly shows what you will be confronted with when you get your head under there to find the area where the FSR is hidden.

The large gold tube is the steering column.

The vent to the left is the foot well vent (the edges are fairly sharp on this bit of plastic).

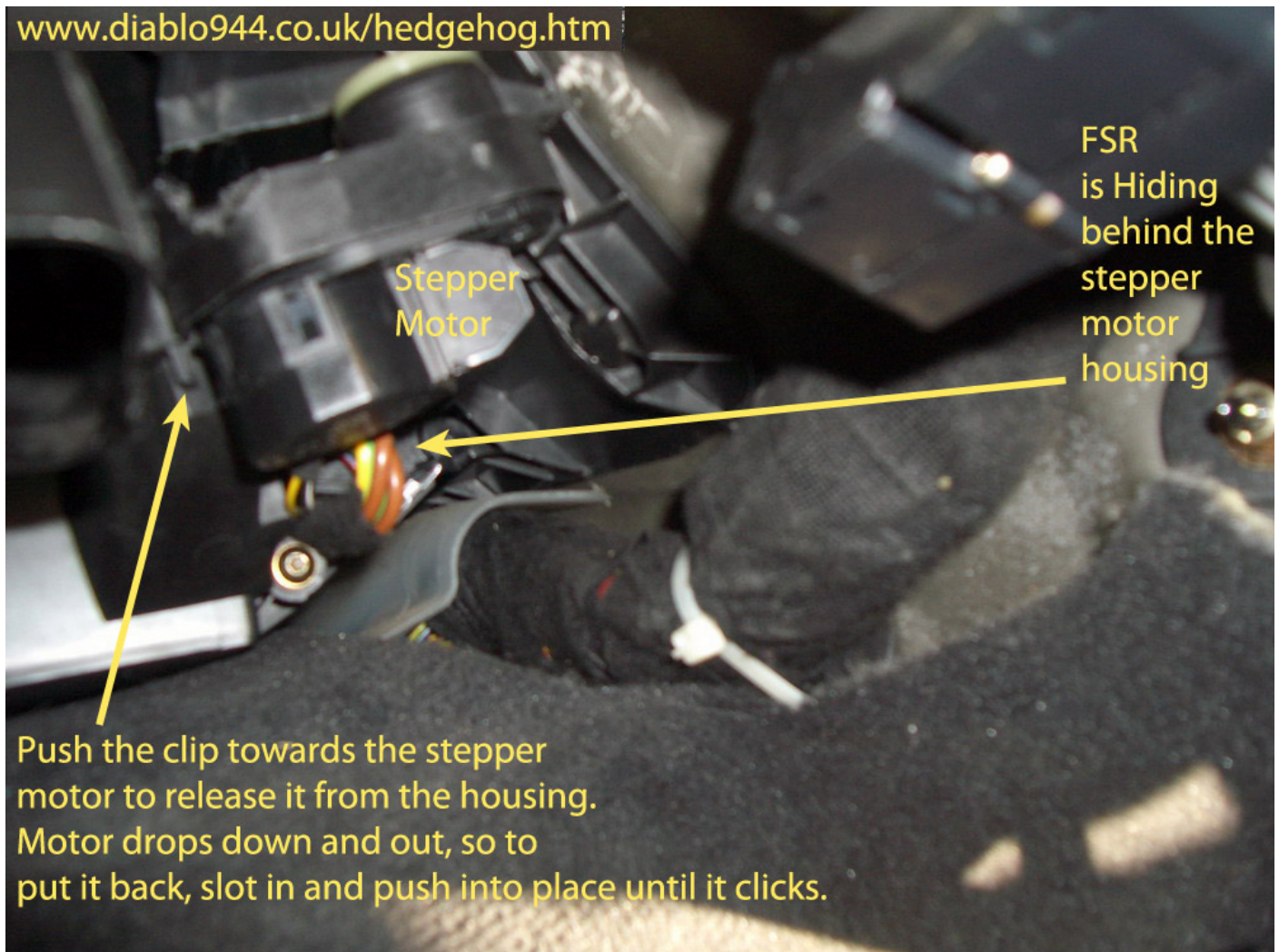
The thing looping over the vent (that looks like a windscreen wiper) is a cable with a rubber protector.

The wiring marked by the arrow is actually plugged into the Final Stage Resistor, but the stepper motor and its housing is directly between you and the hedgehog.

There is no way to remove the Hedgehog without first removing the Stepper motor housing, something which becomes instantly obvious when you are finally confronted with the area it is located.

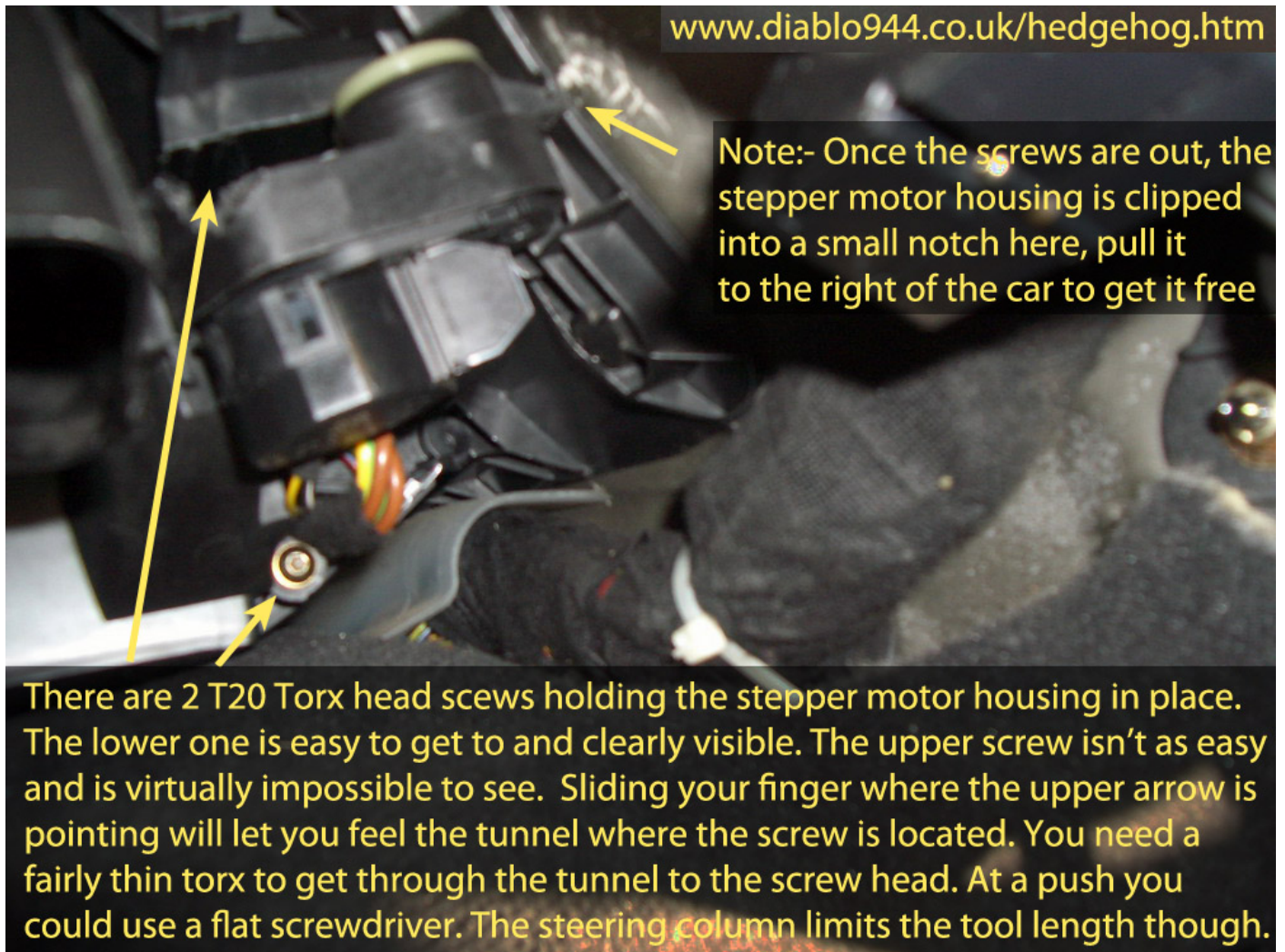


Whether you leave the motor in the housing or not is largely irrelevant for the time being. Personally I would say remove it as you will be removing it later anyway, but it does no harm there at the moment. To remove it from the housing, push the single clip at the large end of the motor in towards the motor and it will click free, it then drops down and slots out from the opposite end of the mounting. Inserting it back is as simple as sliding it into the notch and pushing it back up. Note:- I had to remove a small portion of plastic from the corner of my cars stepper motor housing due to an added complication. It is only a nick out of the corner, but it is obviously visible on this picture and needed to be mentioned. Ordinarily the corner is unmarked and has no notch in it.



There are two T20 Torx screws holding the stepper motor housing in place. The first (the lower screw) is plainly visible and easy to get at. The second is anything but visible and is either a quick and easy job or a nightmare to get at. You will find space limited under here. It is hard enough to get yourself in a position that is comfortable, much less a position to work blind and by feel, but that is exactly what you need to do. If you slide your finger over the housing you will be able to feel the tunnel moulded into the plastic that provides access to the upper screw. The channel is too narrow for a Torx socket type tool, nor will many of the flexible driver adapters fit down it. So you need a T20 driver that can reach down there.

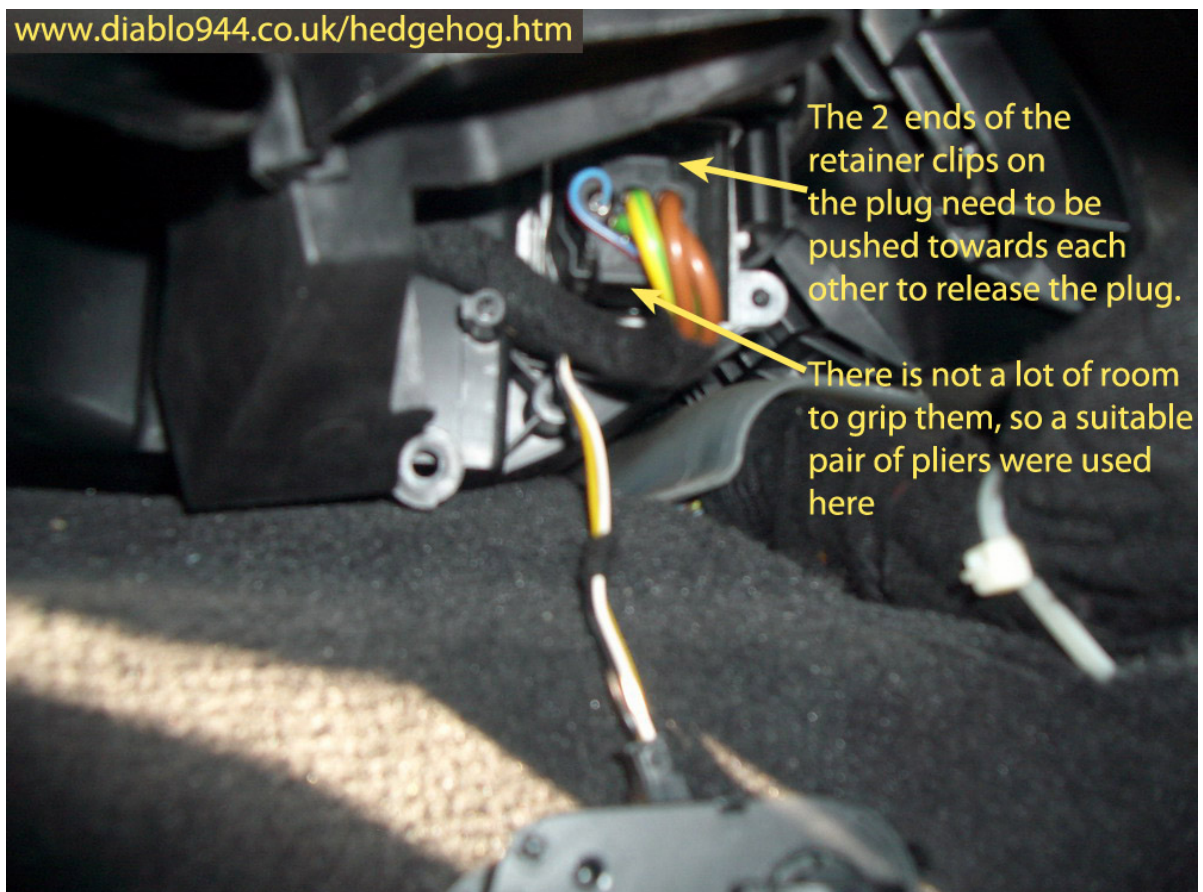
Unfortunately there is a steering column to consider as well, so the length of the driver is important. The upper screw thread points almost perfectly at the steering column, so long handles won't get in there as they foul on the steering gear, further to that, the tool you use has to be run down the tunnel to even get to the screw, so working from an angle isn't an option. Finally there is the issue of getting a grip on the tool you manage to actually get in there. There isn't room to hold a screwdriver properly. This one screw is the most talked about (and hated part) of any thread related to the hedgehog replacement.



With the screws out you finally have access to the FSR. If you didn't remove the stepper motor earlier, then do it now and let it dangle free as it will only get in the way if you leave it in the housing. The housing will likely not drop free when the bolts are out as it is clipped into a notch in the panel at one corner (where the cable attaches), a gentle pull towards the right side of the car will see it come loose. You can disconnect the cable but it isn't a necessity. The only reason I could see for removing the cable would be if you couldn't wedge the housing out of the way. But as there are sufficient areas for it to go without disconnecting the cable it is silly to give yourself even more work. Gently push the housing up out of the way to somewhere it can be wedged leaving clear access to the FSR and making sure it leaves the FSR free to come out when we are ready to pull it.

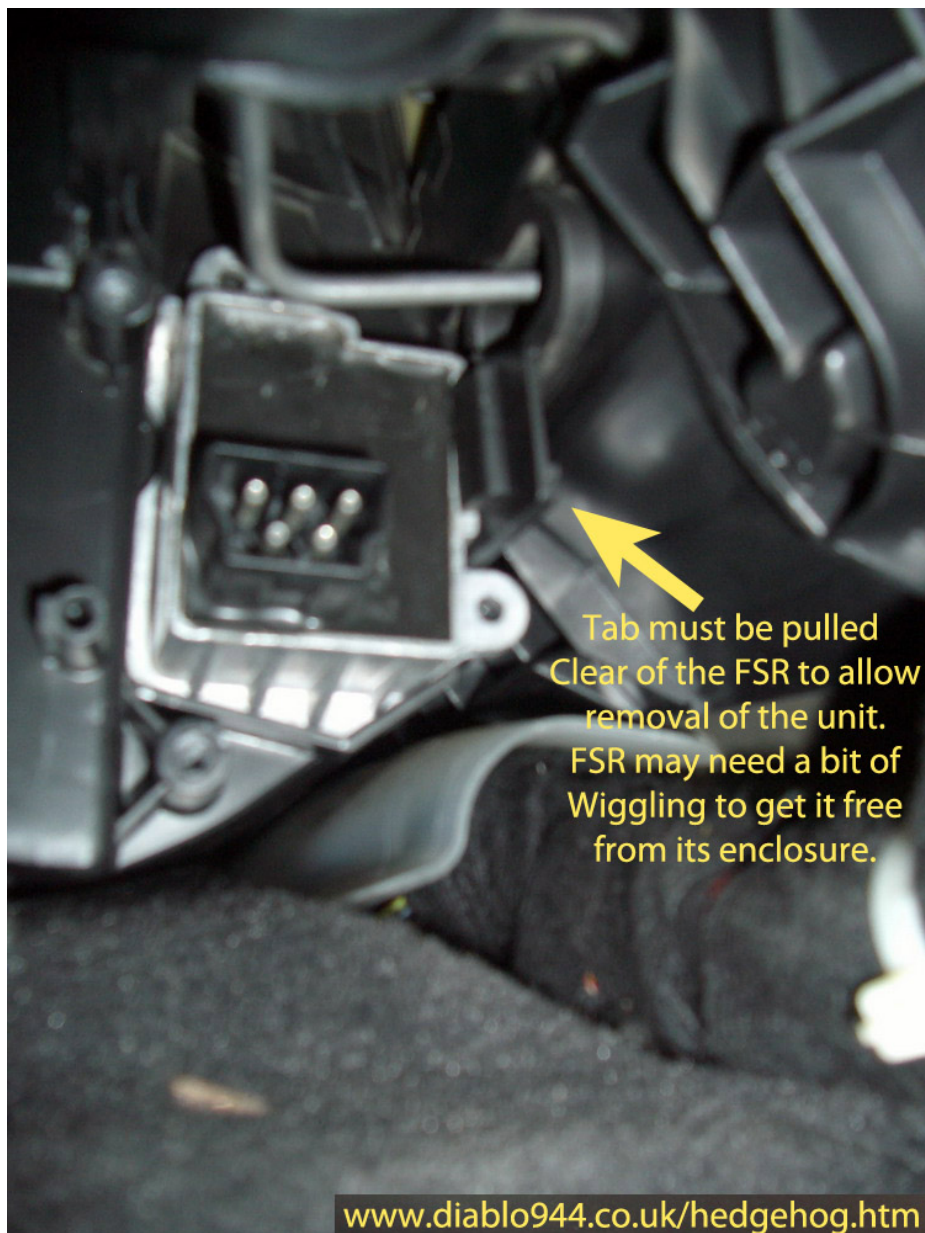
You can now clearly see the FSR wiring loom plug connected to the base of the FSR unit. The base is all you can see while the part is fitted as the majority of the unit is hidden in its enclosure. The two clips of the connector plug (top and bottom) need to be pushed together to remove the plug from the FSR. This isn't necessarily an easy thing to do with the limited space available. I had to resort to a pair of grips and a more aggressive (albeit delicate action) approach as it really didn't want to let go.

Despite the clips of the connector being top and bottom, the actual connection of the plug to the unit is more horizontal. obvious when once you have the connector off but potentially misleading for when you come to reconnect later as you will remember the top/bottom clips, so being confronted by a horizontal layout when you fit the new part may initially trigger ill founded concerns. Seems like a strange way to do a plug arrangement, but as long as you are aware of the quirky design, it saves confusion later.



With the power plug off you can finally see the back of the FSR unit clearly. The cable coming through the grommet can be pushed out of the way to a minor degree. The black plastic tab needs pushing back clear of the FSR to allow the unit to be pulled free. be careful not to break it. Note that the clip is in very close proximity to the grommet, so care and a bit of swearing may come into play as even at this late stage the car can fight you if the clip fouls the grommet.

Take note of the alignment of the FSR power plug. It will make life easier if you remember the way it is fitted. The FSR only fits in there in one orientation, but it is better to do things in one go than having to work it out while you are under there. You may find it will just slide straight out, but for many there is a bit of wiggling involved. The only thing that holds it in place is the clip, so as long as you know the clip is free then it is just a matter of brute force and ignorance to get it out.



With the unit finally out of its hole you can now slot in the new replacement. The two images below show the old unit and its replacement side by side. As mentioned earlier they are vastly different in appearance but are an interchangeable part. The old FSRs long & thick heat sink pins are replaced by the newer models shorter and thinner pins, though there are a lot more of them. Regardless of their appearance and the fact the pins appear to spread out further on one than the other, both will perfectly fit the aperture and when working correctly they both operate identically. It is only the shape of the base itself that is important as it is an exact fit at that point.



Putting the new FSR in and refitting everything is obviously the reverse of what you already did to get to the FSR in the first place, so the next bit is a text description for the completing the job as any images you need are already in place further up the page.

Slide the new FSR into the socket until it clicks home firmly (you did remember the orientation didn't you?).

Connect the power plug. It is advisable at this point to test the heating to see if it is doing its job (Even new parts can fail). If you are happy with how your fan is working then we can put things back together.

If you didn't disconnect the cable from the stepper motor housing earlier, then clip the stepper motor housing back into its notched slot, make sure the FSR wiring is in the channel of the housing bracket, fit and tighten the lower Torx screw, refit the stepper motor into the housing and once again try the heater/aircon unit to make sure the fan is doing what it should be doing.

Personally, I would take the car for a drive at this point (the OBD cannot see any of the stuff you disconnected from the panel so there is no reason not to).

Once you are fully happy then you can refit the second Torx screw into the Stepper motor housing bracket, How much do you want to bet that one hell of a lot of cars are running around without that second screw and with no ill effects? The lower screw and the clip in design certainly feels solid enough without the awkward one fitted.

Retrieve the buzzer and OBC plug wiring from wherever you pushed them earlier ready for refitting the panel. Slide the panel roughly into place. Reconnect the foot well light (the door is open so it should illuminate), the buzzer connection plugs and the OBD socket, remembering to snap the locking mechanism shut on the OBD socket.

Slide the panel back onto the clips under the wheel, make sure the foot well vent is fitting the aperture in the panel and that everything is straight and aligned before finally securing the 5 fasteners.

That's it. Job done.

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