

Electric Power steering conversion for MkII & S-Type Jaguar

Our electric power steering conversion has been developed over the past year to enhance our already successful engine driven pump system. The advantages of using an electric powered pump unit are quicker and simpler installation and a much better feel to the steering, giving a more positive feedback. This is due to the combined electronic and hydraulic sensing circuits built into the system, which supply just the right amount of hydraulic pressure needed by the steering rack to manoeuvre the vehicle under all conditions.

There are some other alterations required in order to fit this unit, in that the Dynamo and Voltage Regulator have to be removed and replaced by a high output Alternator. In order to do this the vehicle polarity has to be changed from Positive to Negative Earth. This will entail having to disconnect the electric clock as this is for Positive earth use only, and a check on the fuel pump to ascertain whether it has a later Positive Earth only unit fitted. Most vehicle owners have already done this to allow the fitting of modern radio / cassette / cd players or the installation of electronic ignition systems or alarm systems. It is also suggested that the existing Ammeter could be replaced with a Battery Condition meter (Voltmeter) although this is not essential. If the Ammeter is to be retained then the connections on this unit will have to be reversed, this is done by simply swapping wires from side to side. After installing the Alternator and wiring the Ammeter will only have a small amount of movement.

These instructions are broken down into 7 main categories.

1. Removal of old steering components
2. Modifications to chassis
3. Fitting steering rack and brackets
4. Modifications to steering column
5. Fitting of Electric / Hydraulic pump
6. Fitting of Alternator
7. Wiring

1. Removal of old steering components

With the front of the car raised and on stands, or use a ramp if available, remove outer ball joints (track rod ends) from the steering link arms. The use of a press-type ball joint splitter will allow the ball joints to be reused.

In most cases, it will be necessary to partially remove the upper steering column to facilitate the removal of the lower steering column. If your vehicle has a lower steering column made up of a rubber doughnut type coupling at its upper end and a universal joint at the lower end this is an early type, on the other hand if at the top of the column it has a sliding constant velocity joint, signified by a convoluted rubber boot, this is a later type. **Early type** lower columns can be removed by releasing and removing the pinch bolts from both ends of the lower column, then pull on the steering wheel so that it moves out by an inch (25mm) or so, this will release the lower column from the upper column. **Later type** lower columns can be removed by releasing the upper column mounting bolts located under the dash and the clamp at the base of the upper column, located close to the floor on the inside of the vehicle. Release and remove the pinch bolts at both ends of the lower column and pull on the steering wheel so that the upper column moves out about an inch (25mm), this will release the lower column. Once the lower steering column has been removed, the steering box and the idler assembly can now be removed.

2. Modification to chassis

Once the old steering components have been removed, it is now possible to modify the right-hand front chassis leg. By placing of the supplied template onto the chassis, mark the arc section, which is to be removed. Using a power hacksaw or angle grinder remove the welded seam. Using a G clamp and a piece of heavy flat bar to support the outside of the chassis leg, wind on the pressure so that clamp pulls in the inner section of chassis leg. Now cut or grind off the excess from the top panel of the chassis to the line drawn by the template. It is now necessary to weld this new seam, taking care to ensure that the top and inside areas of the chassis come together to form a close welded joint. Repaint the welded area to protect the chassis from rusting. This is the only modification necessary to the vehicle chassis.

3. Fitting new steering rack and brackets

Fit steering rack brackets using supplied 3/8" UNF x 1" setscrews, shake proof washers and plain washers to existing captive nuts in front cross-member, where the old steering box and idler were fitted.

Fig 1.



View looking up and forwards from underneath the car

Fig 2.



Lower steering column pictured from below

It is necessary to remove 3/8" (10 mm) from each end of the steering rack tie-bars before fitting track rod ends and locknuts. Fit feed and return steel pipes to steering rack pinion (forming the pipes to follow the steering rack across to left-hand side on RHD vehicles). Fit steering rack to brackets using the supplied 5/16" UNF x 2 1/2" bolt's, washers and self-locking nuts. We have found through experience that when fitting the new track rod ends, wind on the locknuts and the track rod ends fully, then undo by 2 turns. Turn up the locknuts hand tight to the track rod ends and connect to the steering arms, fit self-locking nut and tighten.

4. Modifications to steering column

Fit a modified/shortened lower steering column before replacing upper steering column. **Early type** lower columns maybe shortened by grinding off the weld at the lower end of the tube adjacent to the casting for the universal joint. Mark the upper and lower joints with some paint so that they can be realigned later. Using an angle grinder carefully removing material until the tube is released from the casting. Now cut off 3 1/4 inches (82mm) of the tube and fit back into the casting. Line up the paint marks made earlier and weld the new joint of the tube and casting. **Later type** lower column is made from solid cast steel, mark the upper and lower joints using paint so that they can be realigned later. Cut through the column about 1 1/2 inch up from the radius at the lower end using a hacksaw. Now remove 3 1/4 inches (82mm) of the column from the centre of the shaft. Use the tube provided to sleeve over the cut and weld both ends, ensuring the two parts are aligned by means of the paint marks made earlier. Depending on the thickness of the shaft it may be necessary to reduce the

diameter of the sleeve tube to fit the shaft. This is done by cutting out a section of the sleeve tube along its length, usually about $\frac{3}{8}$ inch (10mm), using a vice squeeze the tube to reform it smaller and welding along the joint after it is fitted.

If you feel that this work is beyond your skills or you are in any doubt as to whether you are capable of completing this part, we can carry out this work for you at an extra cost. It would also be prudent at this point, to check the condition of the joints on the lower column as these are often neglected at usual service intervals and examination reveals worn, seized or corroded joints or a split rubber gaiter. If you suspect any wear or malfunction of these joints, now is the time to effect repair. We can offer to shorten your own column or shorten and refurbish it.

IMPORTANT NOTE

If your vehicle was originally fitted with power steering the lower column will already be shorter than the standard column. After removal of the lower column it is essential that you fully compress the sliding constant velocity joint and measure the length of the column. Do **NOT** remove $3\frac{1}{4}$ inches (80mm). When cutting to shorten the column remove the amount of material to ensure that when completed the column measures $12\frac{1}{2}$ inches (317mm) when fully compressed, this usually amounts to approximately $1\frac{1}{2}$ inches (38mm) i.e. original length - $12\frac{1}{2}$ inches = amount to be removed.

When refitting the lower column, the process is a reversal of removal, ensuring that the recess in the steering rack pinion spline and that the extended recess in the upper column is aligned with the pinch-bolt holes in the lower column. Replace pinch-bolts and tighten, fitting new "nyloc" nuts.

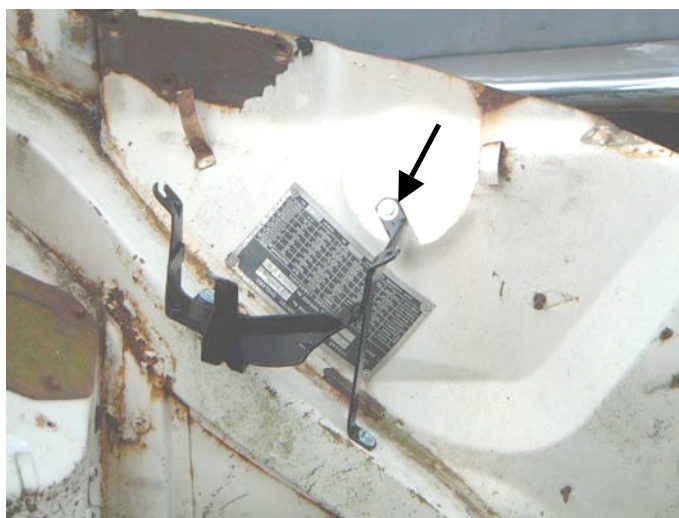
5. Fitting of Electric/hydraulic pump

Fit the pump mounting bracket to nearside inner wing between the heater box and fuse panel as in photographs below, using supplied self tapping bolts (drill size $\frac{3}{16}$ " or 4.5mm). Use the round protrusion on the inner wing panel as a guide (as arrowed).

Fig 3.



Fig 4



Mount the pump into the bracket (Fig 5.) and secure with supplied nuts and washers. Connect hydraulic pipes from pump to steering rack. It may be necessary to carefully bend the steel pipes to suit your application or better still form the around a pipe bender. Secure to rubber pipes to the diagonal chassis section with "P" clips as necessary (Fig 6.). Fill pump reservoir with T. Q. F. (automatic transmission fluid) to the required level. This will require topping up once the pump has been run.

Fig 5.



Fig 6.



6. Fitting of alternator and bracket

Disconnect battery. Remove wiring from dynamo and remove dynamo. Use existing dynamo bracket and use the tube supplied as a spacer. This will mount the supplied alternator in the correct position. Fit alternator and visually check to ensure alignment of all 3 pulleys, fit alternator drive belt and tighten to correct tension. **DO NOT OVERTIGHTEN**, as this will cause damage to alternator and / or water pump bearings.

7. Wiring

A DIY enthusiast can carry out this part, but if at all doubtful you should contact a local auto electrician.

Disconnect the Battery,

If your vehicle has already been converted to **NEGATIVE EARTH** you can go to the next paragraph. Remove the battery clamp bolts and clamp. Carefully lift the battery from the tray and turn around so that the battery terminals are reversed so that the negative terminal is towards the outside of the car. Refit clamp and bolts. On vehicles fitted with bolt on battery post clamps undo the retaining screws and change over the clamps on the cables, otherwise it may be necessary to replace the battery cables. **DO NOT RECONNECT BATTERY AT THIS TIME.**

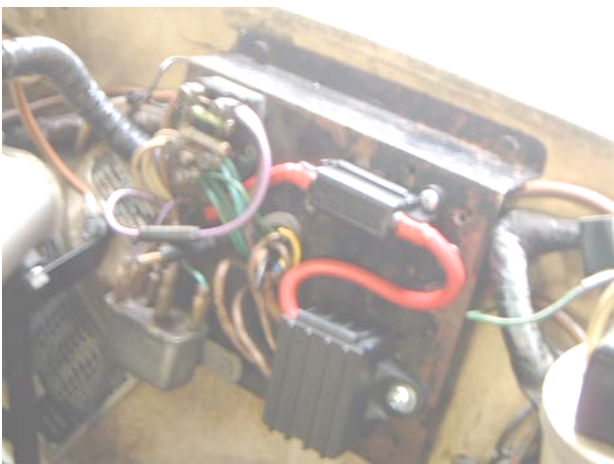


Fig 7.

Your vehicle will be fitted with either an RB310 (early cars) or an RB340 Voltage Regulator mounted on the fuse board, secured to the left hand inner wing. Identify which type of Regulator your vehicle has and refer to the appropriate section. If the wiring to the Regulator is of the cotton braided type it may be difficult to identify the colours of the braid, if so, use a small piece of masking tape around each wire in turn and mark it with the terminal letter of the Regulator. Remove wiring from regulator and remove the regulator. Place the supplied connector block in place of the regulator, mark and drill holes for mounting, mount connector block. Place the supplied fuse block alongside the connector block, mark and drill holes for mounting screws, mount fuse block. (Fig7.)

RB310 Regulator

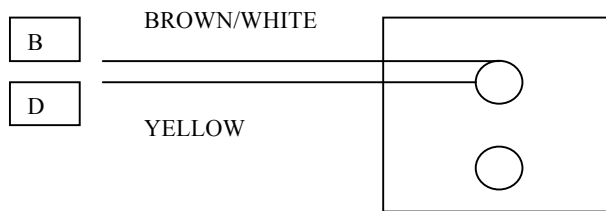
Cut wires.

Join the thin Yellow Cable (D on enclosed wiring diagram) to thin yellow/green cable (F on enclosed wiring diagram).



Join both cables to the blue/slate cable of the power steering pump.

Fasten heavy Yellow (D on enclosed wiring diagram) and Heavy Brown/White (B on enclosed wiring diagram) into one side of connector block



RB340 Regulator

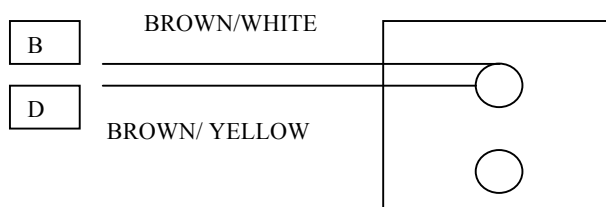
Cut wires.

Dispense with earth wire E. Join light Brown/Yellow (WL on enclosed wiring diagram) wire to light Brown/Green (F on enclosed wiring diagram)



Join both cables to the blue/slate cable of the power steering pump.

Fasten heavy Brown/Yellow (D on enclosed wiring diagram) and Heavy Brown/White (B on enclosed wiring diagram) into one side of connector block



For all vehicles

Fasten the long heavy brown wire to the battery side of the solenoid. Connect the other end of this wire to the alternator main terminal.

Connect the short heavy brown cable to the alternator main terminal. Fasten the other end of this to the connector block.

Connect the heavy red cable to the connector block and fasten the other end to the 80 amp fuse.

Connect the heavy red wire from the power steering pump into the other side of the 80amp fuse.

Fasten the heavy brown cable of the power steering pump to a good chassis earth.

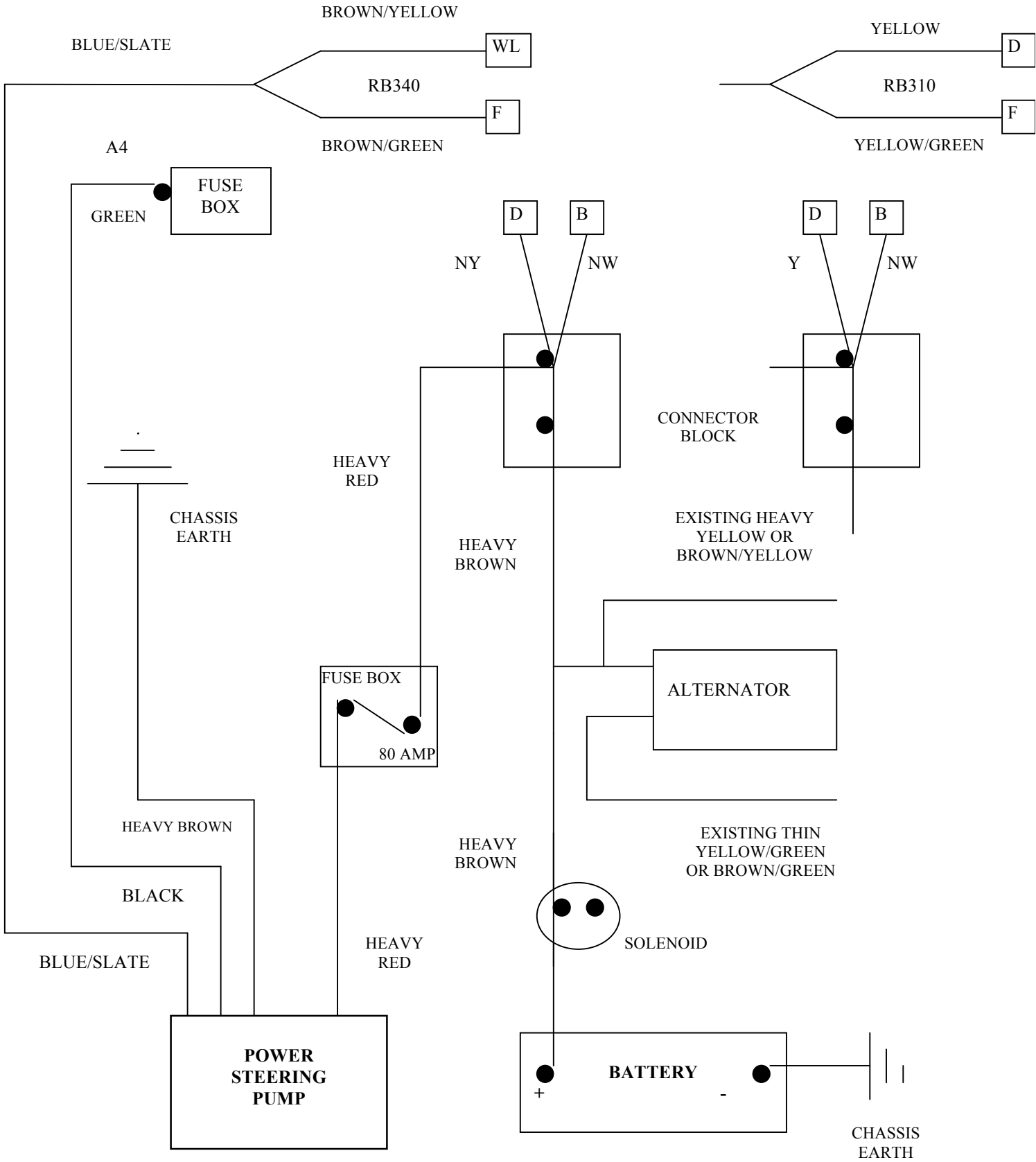
Connect the thin Black wire from the power steering pump to the Green A4 terminal of the fuse box.

Once all wiring connections have been made, ensure that fluid reservoir is filled to required level. Reconnect Battery. Start engine and allow engine to run at a fast tick over around 1000 RPM for around 10 seconds. The Generator lamp should extinguish, the Alternator should be charging and the electric pump should be running. Switch off engine and top up fluid in Pump reservoir. Restart engine and turn steering from lock to lock to clear air from the system. It may be necessary to top-up fluid reservoir again after all air has been cleared from the system. If the fluid in the reservoir becomes foamed leave to settle for a short while so that a positive fluid level can be ascertained.

It should be noted that if the pump fluid runs low, the pump will stop running and no power assistance will be available for the steering system, this is a safety feature of the pump to prevent damage to the pump.

The electric pump will only operate once it senses an output from the Alternator and therefore will not run until the engine is running. However, should the engine stall once it has been running, the pump will continue to run gradually reducing in speed and hence hydraulic power, for around 20 seconds, proving the ignition is still left on. This feature has been found particularly useful when manoeuvring the vehicle when the engine is cold and has stalled; you still have power for the steering for this short period.

POWER ASSISTED STEERING WIRING DIAGRAM



TEMPLATE FOR CHASSIS LEG

