IceShark Battery Upgrade Kit

Installation by Andre Ruest (aka 951Porschiste)

This write-up is based on installation of the kit in a 1986 Porsche 944 Turbo. The usual disclaimers apply as to individual cars that may vary. Please follow all safety precautions regarding working on the engine, the engine compartment, and working underneath the vehicle.

A number of preparatory steps are necessary to install the kit. To gain proper access to the engine ground point and the alternator it will be necessary to remove the intake manifold. To gain proper access to the alternator, it will be necessary to remove some coolant lines. Therefore, you must also drain the coolant system.

- Removing the intake manifold
  - It will be necessary to remove the fuel rail before removing the intake manifold
    - Depressurize the fuel system. There are 3 possible ways of doing this
      - Let the car sit for a few days until the fuel system depressurizes.
      - Start the engine and remove the fuel pump fuse at #34 on the fuse and relay board (see Image 1). The engine will stop from lack of fuel in a few seconds.
      - Remove the fuel pump fuse at #34 on the fuse and relay board (see Image 1) and then attempt to start the engine. The engine may or may not start.
    - Disconnect the negative lead from the battery. Then disconnect the positive lead and remove the battery.
    - The fuel rail can be removed from the intake manifold with the fuel lines still attached. However, I found it easier to disconnect the fuel lines from the rail before removing the rail itself.

Image 1 - Removing the fuel pump fuse at #34

- First, stuff some rags under the fuel pressure regulator and the fuel damper to catch any remaining fuel in the lines. Then, unscrew the hose clamp at the fuel pressure regulator (#1 in Image 2) which holds the fuel return line and pull off the fuel return line. Next, unscrew the fuel line from the fuel pump using a 24 mm wrench on the fuel damper body and a 19 mm wrench on the fuel line nut. (#2 in Image 2). Be prepared to use some force as this nut is very tight to prevent fuel leakage. If your car is equipped with cruise control, you must also remove the cruise control line from the intake manifold (#3 in Image 2) and the control unit (#4 in Image 2). Pull the vacuum lines from both the damper and pressure regulator (#5 and #6 in Image 2).

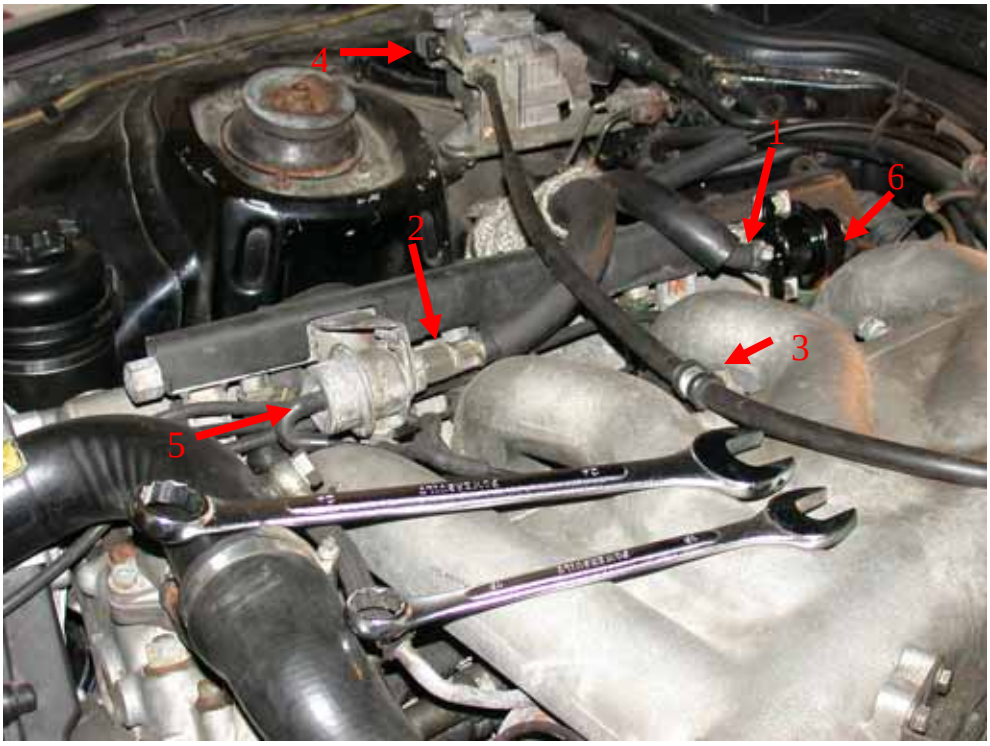


Image 2 - Fuel rail and fuel lines. 1. Fuel return line. 2. Fuel line nut. 3. Cruise control line hold-down bolt. 4. Cruise control servo unit. 5. Vacuum line to fuel damper. 6. Vacuum line to fuel pressure regulator.

- Then attach the fuel lines out of the way (See Image 3) and remove the fuel rail plastic covering. It is held in place with three plastic connectors (#1 in Image 3).

Image 3 - Fuel lines removed and attached out of the way and fuel rail cover

- Using a small flat tip screwdriver, disengage the wire clips on the fuel injector electrical connectors plugs and disconnect the plugs. Move the fuel injector wiring harness out of the way (Image 4).

Image 4 - Unclipped connector for fuel injector. Notice the metal retaining wire around the connector (#1 in Image).

- The fuel rail is held by four (4) 10 mm bolts. Two are bolted to the cam cover (the forward bolt can be seen in #2 of Image 4), and two are bolted to the intake manifold itself. Using a 10 mm socket and an extension unbolt the 4 bolts (see Image 5). Unclip the spark plug wires from the rail and pull them from the spark plugs. You can then pull out the fuel rail. Be careful not to break the fuel injector plastic tips as you are pulling. Have rags ready to collect escaping fuel from the rail. Drain as much fuel as possible from the rail and store away from heat and sparks.

Image 5 - Unbolting the forward fuel rail to intake manifold bolt.

- The next step is to remove the vacuum tubes to the intake manifold (See Image 6, bottom portion). One is between cylinders 1 and 2. The other is between cylinders 2 and 3. Next remove the banjo bolt holding the KLR line and another vacuum line between cylinders 3 and 4. Disconnect the vacuum hose under the throttle body. Disconnect the electrical plug to the TPS (Throttle Position Switch). At the back of the intake manifold, remove the speed and reference sensor electrical plugs from the retaining brace or alternatively unbolt the retaining brace from the intake manifold. Unbolt the throttle cable retaining brace and finally, disconnect the throttle cable from the throttle body. Remove intercooler pipes.

- The next step is to unbolt the intake manifold itself. It is held in place by 8 Allen head bolts (6 mm socket) to the engine head; two Allen head bolts (5 mm socket, Image 6 top portion) to the air-oil separator near the oil filler tube; one 13 mm bolt to the left of the throttle body on the intake manifold brace; one 10 mm bolt to the oil dipstick tube (Image 7).

- Remove the intake manifold. If the gaskets are stuck you may need to tap the manifold with a rubber mallet to “unstick” the assembly. Once removed cover the intake holes with duct tape to prevent accidents (see Image 8).

Image 6 - Intake manifold mounting bolts and vacuum hoses

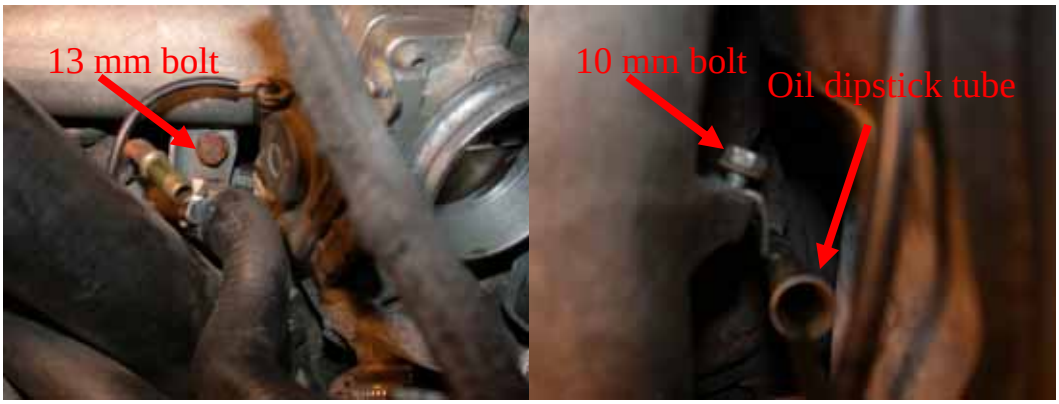


Image 7 – Intake manifold bolts


Image 8 - Cover the intake holes to prevent contamination of intake chamber

- The negative ground connects to the engine at the bellhousing. To properly access that area the block to heater valve hose will need to be disconnected. The positive starter to alternator cable connects to the back of the alternator underneath the rear alternator shroud. The alternator lies underneath a mess of coolant lines. Before proceeding with those cable installations you must therefore drain the coolant system.

- Draining the coolant system
    - First loosen the lug nuts on the front wheels and open the heat knob on the instrument board to full heat.
    - Raise the vehicle securely on four jackstands (follow all necessary precautions)
    - Once the vehicle is raised and leveled, verify that you have enough clearance underneath to gain access to the starter area at the bottom rear of the bellhousing.
    - Remove the front wheels, any engine undertray and the front “batwing” underneath the nose.
    - There is close to 8.5 liters of coolant in the car. Place a catch tray or catch can close to the coolant draining nut (blue plastic nut with brass washer) at the bottom left (driver’s side, LHD cars) of the radiator. Slowly unscrew the nut and drain the coolant. Avoid spillage and conserve the liquid unless you were planning on replacing it. Once the system is drained, screw the blue nut back on unless it appears damaged.
- You can then go to the back of the engine and remove the block to heater valve hose (Image 9 and 10).

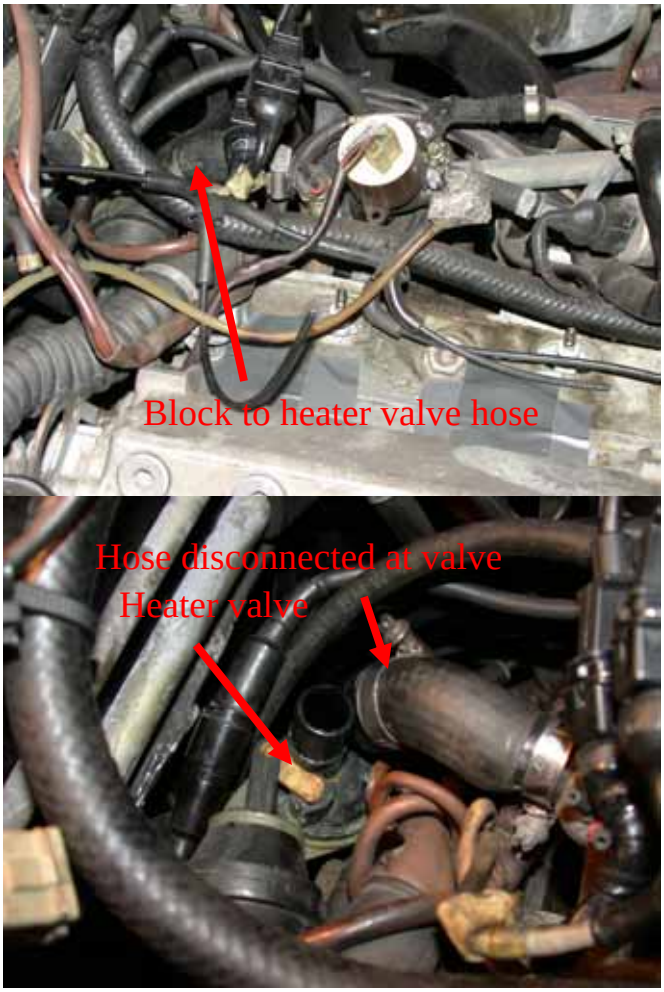


Image 9 - Block to heater valve hose

Negative cable installation

- Once the hose is removed you will see the ground connection on the bellhousing. This connection receives the ground wire from the battery and a second smaller brown ground wire from the DME wire harness (see Image 10). Notice the bellhousing inspection hole. Stuff a rag or cover with duct tape to prevent dropping a nut down in there. Using a 10 mm socket and an extension, unscrew the connecting bolt

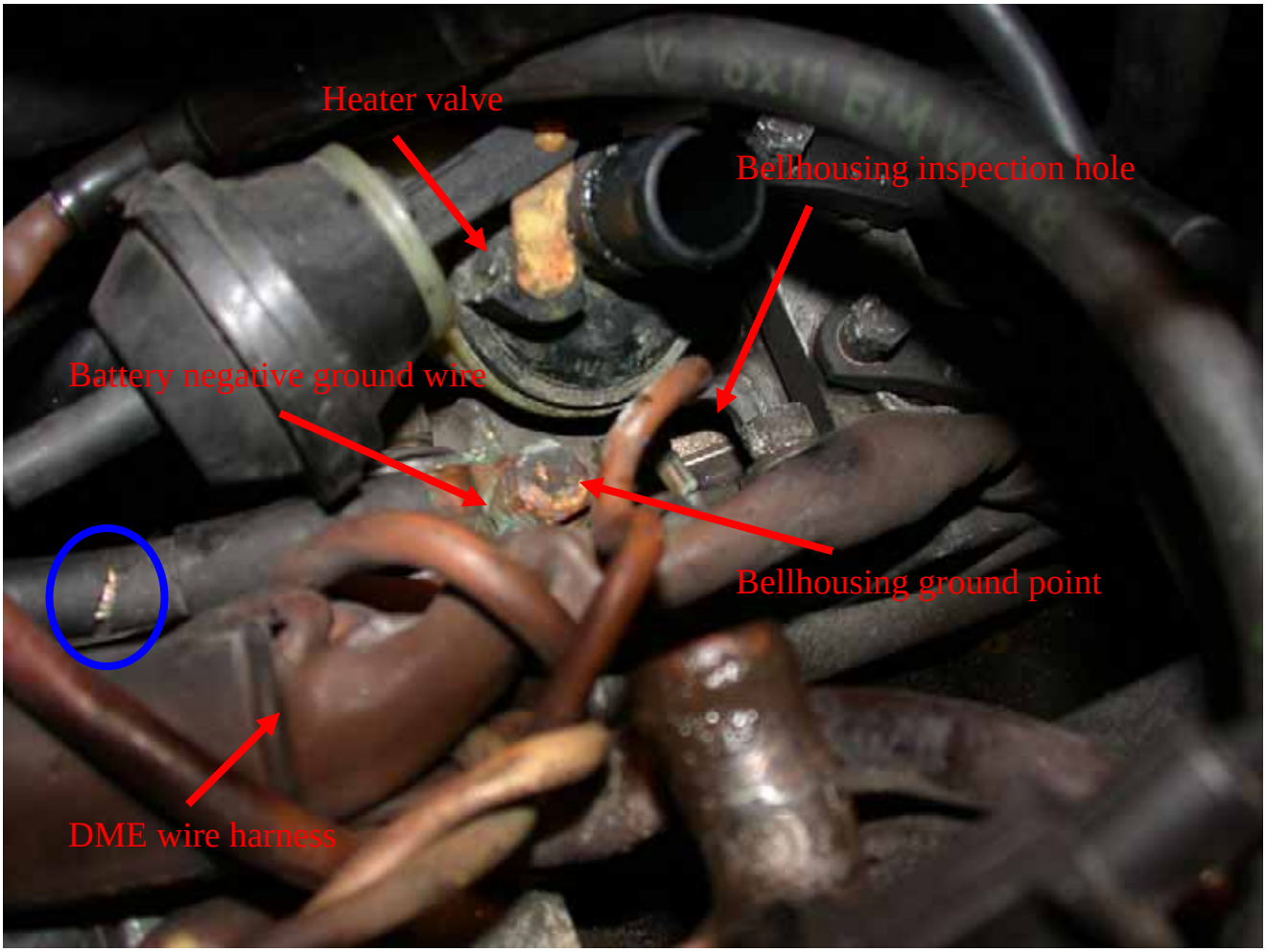


Image 10 - Bellhousing ground point. Notice the tear in the insulation of the old ground wire (circled in blue).

- In the battery tray area you will notice a second ground connection on the inner firewall sheet metal (see Image 11). Unbolt that connection.
- Now that both negative grounds have been released pull the old engine block cable out through the firewall grommet after having lubricated with dish washing soap or Vaseline (see Image 11).

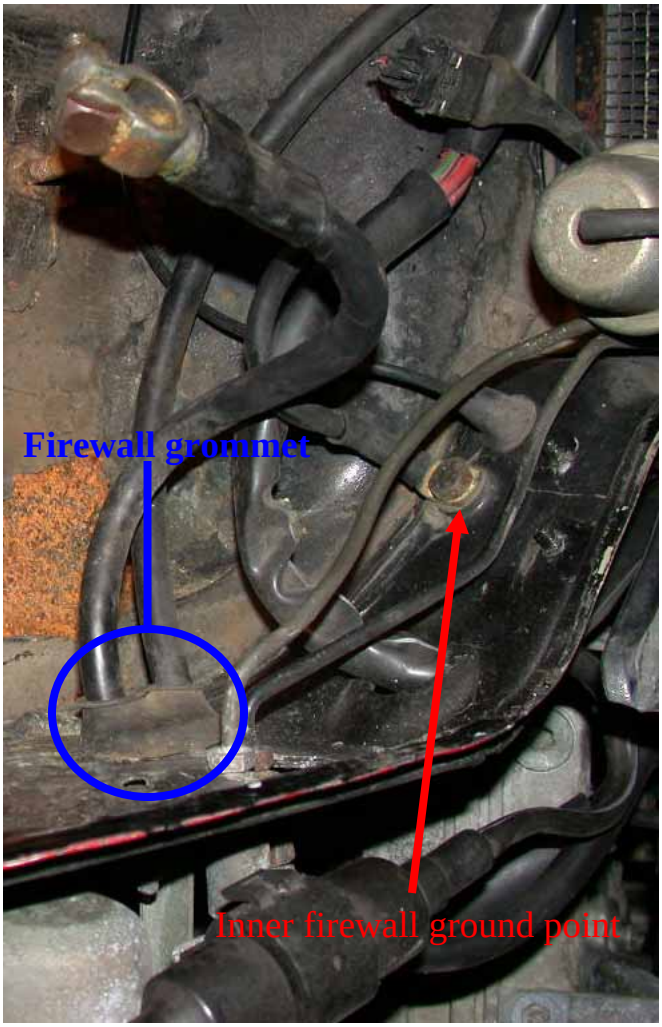


Image 11 - Inner firewall ground point and grommet

- Note the orientation of the cables on the battery clamp as the short ground to inner firewall ground point flows better if it is connected to the "rear" of the new military/marine battery clamp as it sits in the car (see Image 12).

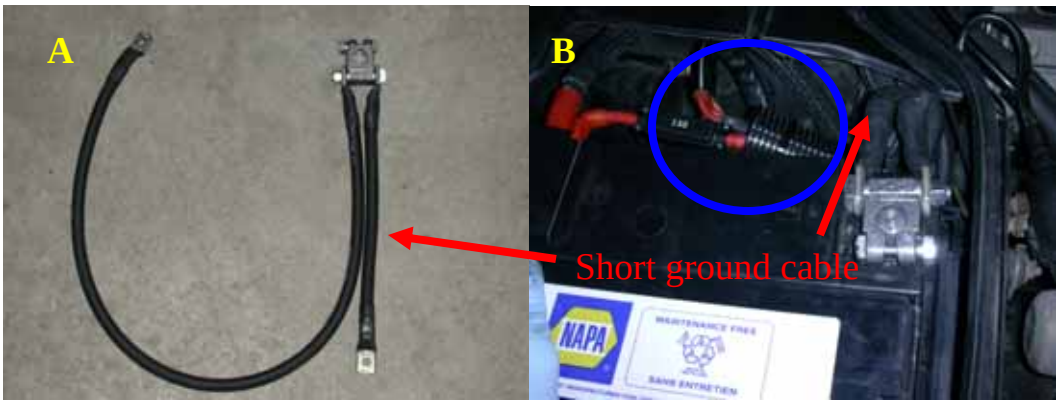


Image 12 - Battery negative cable and clamp orientation. In B the blue circle highlights the plastic loom covering the accessory positives connecting to the supplemental positive passed the 150 amp fuse.

- Insert the new engine block cable with dish washing soap or Vaseline to ease the entry through the firewall grommet. A small sanding sponge has been included to clean off the contact points on the bellhousing and inner firewall sheet metal boss. Apply some of the included dielectric grease to the mating surfaces and attach the eye terminals.
- The ground to the inner firewall sheet metal is much heavier than stock. Because it is more difficult to bend, a few extra inches in length have been added over stock length. Make a nice smooth "S" curve over to the ground boss the cable attaches to.

Positive cable installation

- To change the starter to alternator positive wire you will need to gain access to the back of the alternator. To remove the alternator you must first remove any coolant hoses that lie on top of the alternator.
- Next you will need to loosen the alternator-a/c ribbed belt. First, unscrew the a/c turnbuckle bolt at the a/c compressor (see Image 13). This will loosen the a/c compressor such that it will move towards the engine block thereby releasing the belt. When you reinstall, make sure that the belt is correctly inserted in its grooves. Then, using a crowbar against the engine block, press the compressor to the side while reinserting the turnbuckle bolt. You will need to use a considerable amount of force. However, this technique ensures that you will not have to retighten the belt.

Image 13 - A/C compressor turnbuckle bolt

- Next unscrew and pull out the two alternator retaining bolts. One is at the bottom of the alternator just above the a/c compressor and connects the alternator to the block to a/c compressor brace (see Image 14A, circled in blue). The other one is at the top and connects the alternator to the block at the upper balance shaft (see Image 14B, circled in blue).
- Next unscrew the three shield retaining nuts (see Image 14 A&B, circled in yellow). Pull the rubber grommet at the top of the shield to loosen the two positive wires.

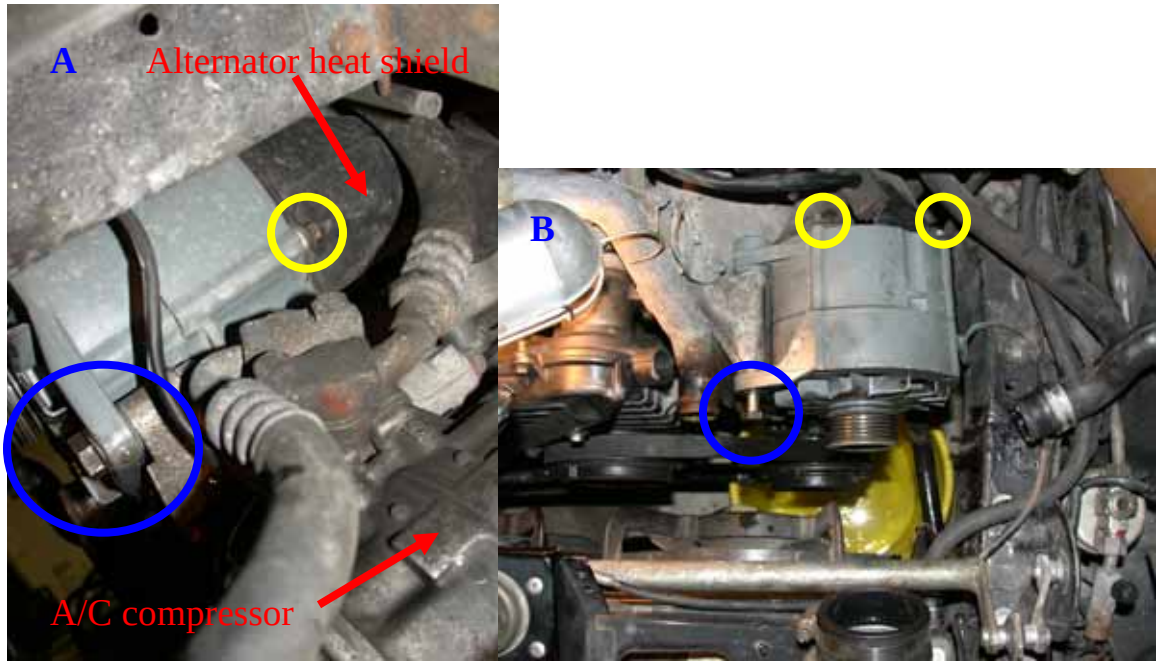


Image 14 - A. Alternator bottom view (bottom bolt circled in blue). B. Alternator top view (top bolt circled in blue)

- Next push the shield back and down. Pull the alternator out to expose the back connections. Unscrew both wire connections (see Image 15).

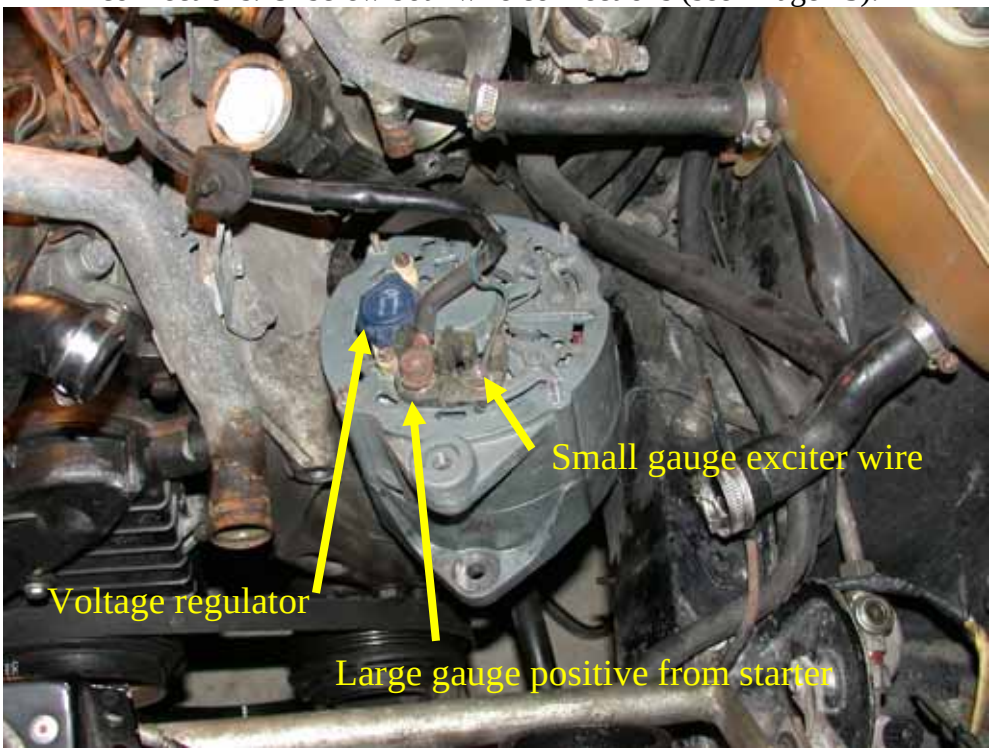
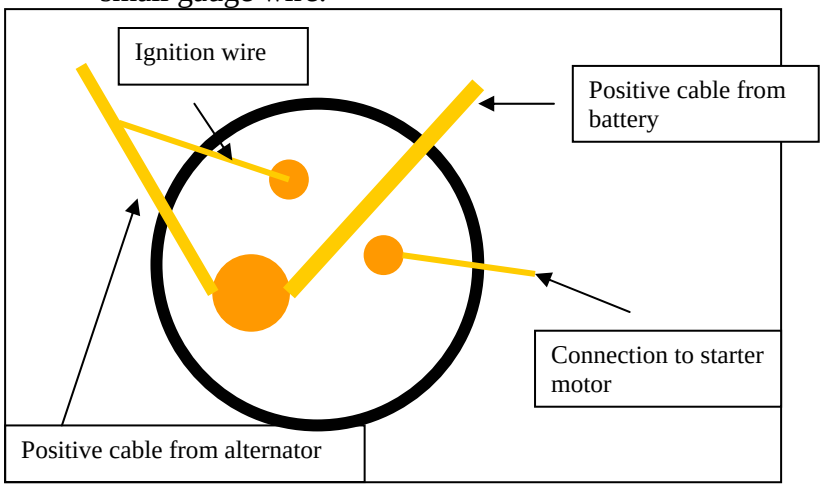


Image 15 - Alternator out to expose the back area connections

- Next, get under the car to the starter area. If your starter is equipped with a heat shield, remove the shield by loosening the two heat shield retaining bolts on the clutch housing using a 17 mm wrench. The bolts do not have to be completely removed. You will see two large gauge wires connected to a large diameter post on the starter solenoid and a smaller gauge wire connected to a secondary smaller post. You may need to unbolt the starter before disconnecting the wires. I, however, was able to do it with the starter in place. Once you have managed a proper access to the starter solenoid, unbolt both the large gauge wires and the small gauge wire.



- Next, remove the two rubber covered metal clamps on the bellhousing that hold the alternator to starter cable and the battery to starter cable. Pull the battery to starter cable out through the firewall grommet (see Image 11, circled in blue). There are a number of additional positive cables that are tied to the positive battery clamp. Unbolt those additional wires and push out of the way until you are ready to install the new positive battery cable.
- Cut the plastic clamps holding the alternator to starter cable under the intake manifold. The pull up from the starter area. You will notice that this cable has two smaller wires which must be removed from the harness. These two wires are connected to a white plastic connector lying across the brake booster (see Image 16, circled in blue). Disconnect the wires.

Image 16 - Wire connection

- The smaller of the two wires goes to the alternator and the slightly larger wire goes to the starter. The fiberglass harness sleeve of the new alternator to starter cable has a hole cut in it into which to feed these wires (see Image 17). As well, there are 2 installed bare wires which are to be used to fish/pull the two wires through the harness sleeve towards their respective ends. At one end of the cable you will find an inline 175 amp fuse and an eye terminal. This end attaches to the large starter positive lug. The harness sleeve at the alternator end stops several inches short of the eye terminal for clearance purposes.

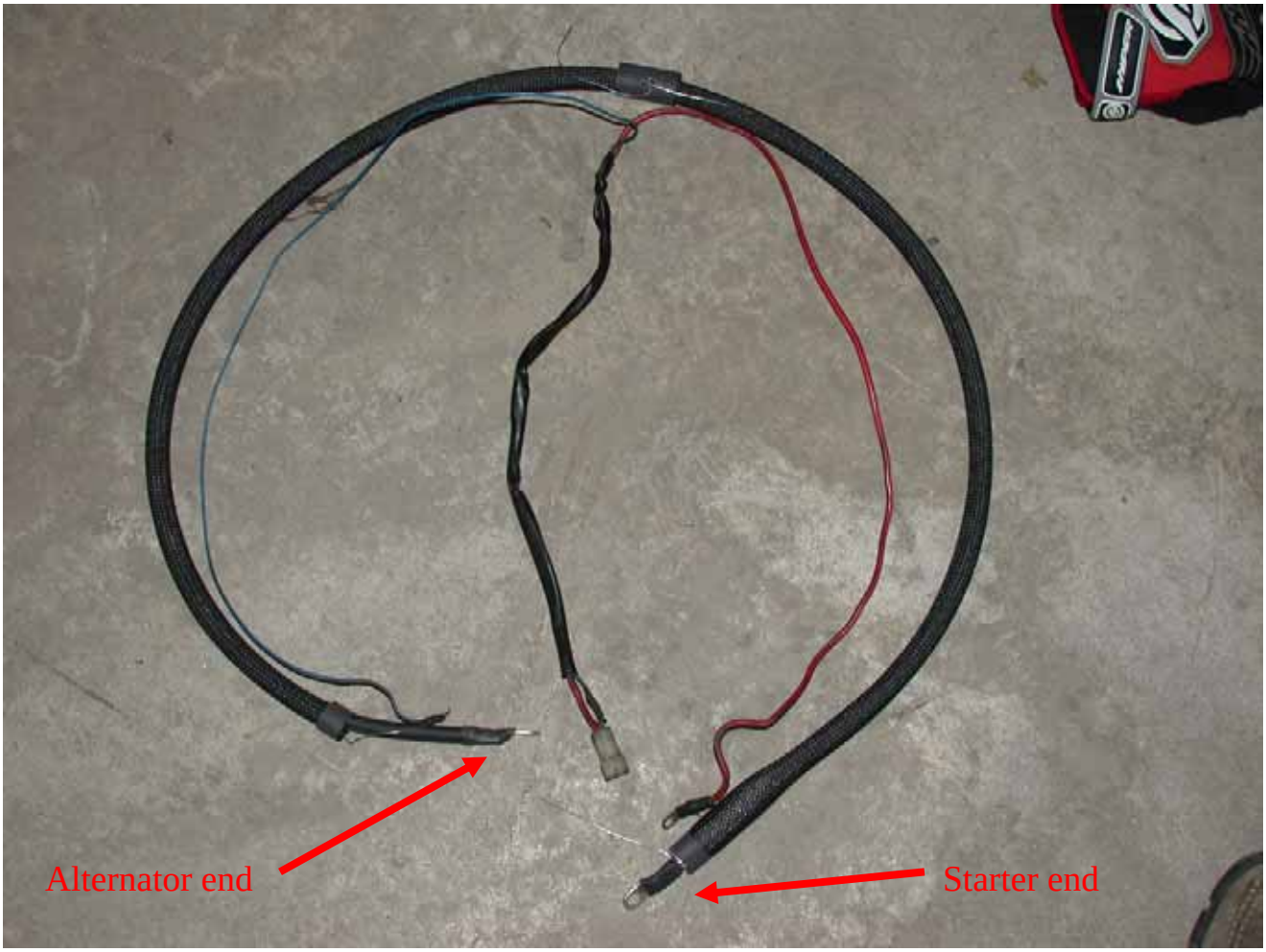


Image 17 - Starter to alternator wire with accessory wires ready to be fed into the harness. Notice the fish/pull bare wires, the heat shrink, and the bulge at the starter end where the 175 amp inline fuse lies.

- After you have fished the wires through the new harness, you should heat shrink the ends and the middle hole portion to seize the fiberglass threads and secure the wires in place.
- Feed the new cable under the intake manifold to the alternator and the fuse end down to the starter.

- The new alternator cable is larger than original so enlarge the rubber sealing grommet on the alternator to allow for insertion (see Image 18). If you are installing the IceShark Headlight kit at the same time, now is a good time to install the alternator positive feed for the relays.

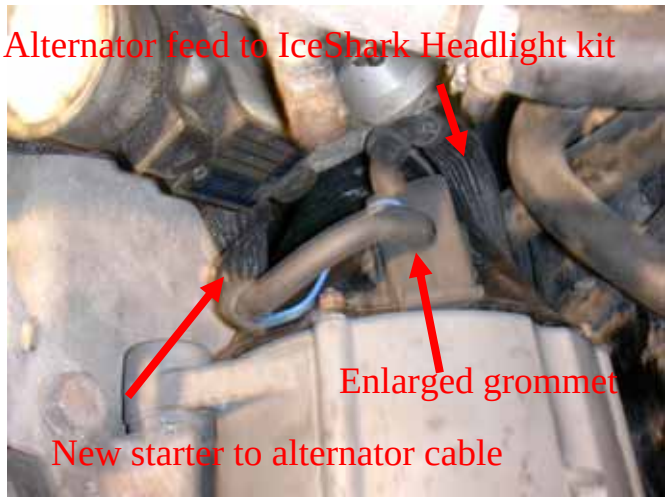


Image 18 - Routing for starter to alternator cable

- The next step is to feed (using dishwasher soap or Vaseline) the larger #1 gauge cable from the battery (see Image 19A) through the firewall grommet(see Image 19B) and then run it along just below the top portion of the firewall and down to the starter area.

Image 19 - A. Positive battery cable. B. Negative and positive battery cables going through the firewall grommet.

- There are two replacement rubber covered metal cable clamps in the parts bag which can be used to replace the original you have removed. Install the cable clamps over the two cables and loosely attach to the hold down studs. Both cables should extend approximately 10 inches beyond the rear bellhousing clamp. Route the cables smoothly in an “S” curve to the starter solenoid keeping the cables away from sharp edges.

- After test-fitting the routing, bolt the three wires in place. Both large gauge eye terminals should be bolted to the large positive lug on the starter solenoid, while the smaller gauge wire (ignition) eye terminal should be bolted to the smaller lug on the starter solenoid. Make sure that both cables do not come in contact with the exhaust pipes in the area. If you had to remove the starter, bolt it back up. Fasten the rubber covered metal cable clamps, route the harnesses smoothly and cable tie down with the enclosed normal cable ties as well as the special replacement firewall ties.

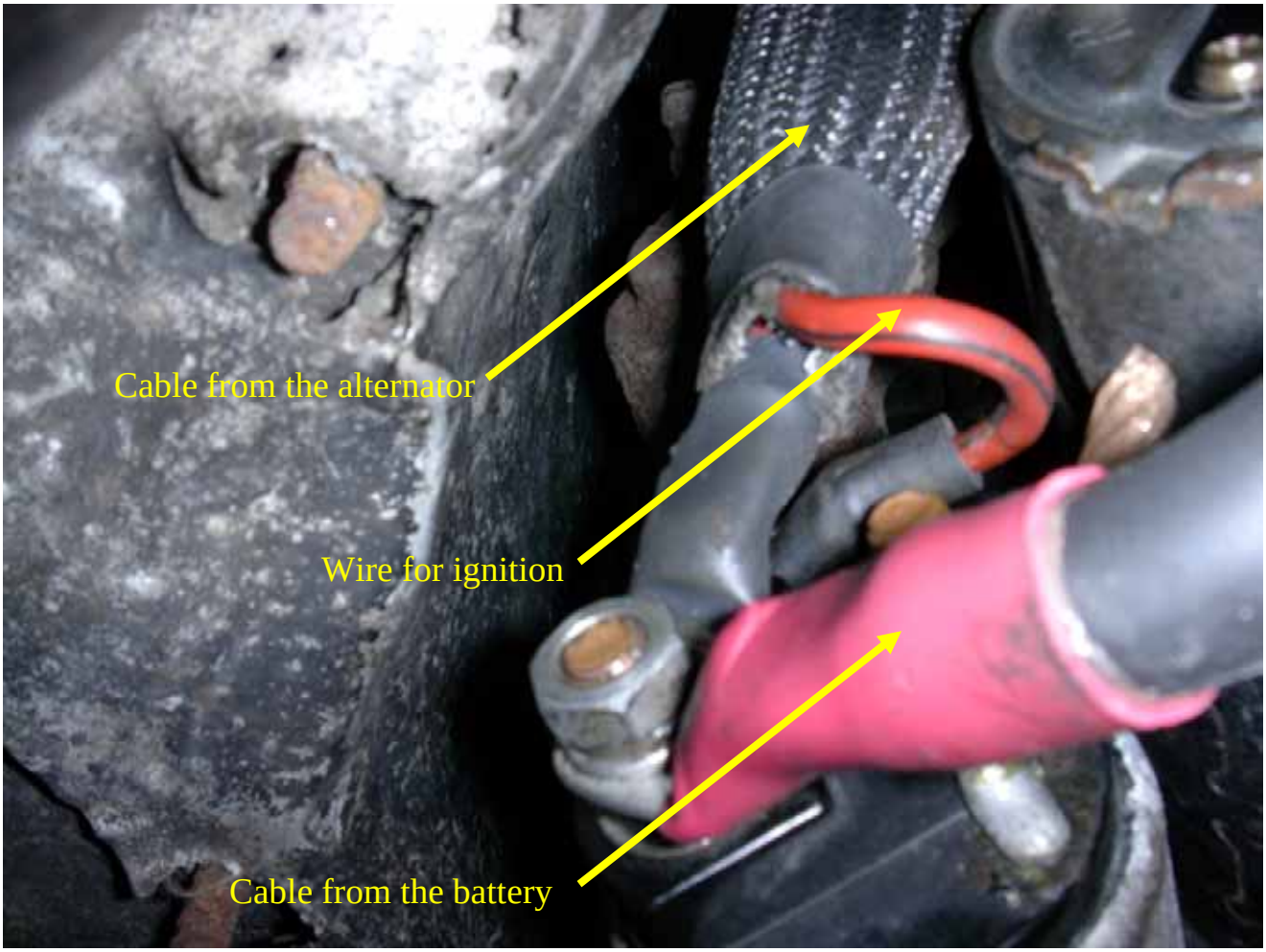


Image 20 - Starter solenoid connections. The smaller lug for the ignition wire is hidden by the alternator cable in the picture.

- Button the car back up. If you have not ordered the supplemental positive cable, the positive battery clamp will have a special coupling nut and ¼" hex head bolt attached. The car's remaining positive battery wires can now be attached via the ¼" bolt and then covered with the enclosed plastic loom and cable tied down in place to prevent accidental shorting with a tool.

Supplemental positive cable installation

- The supplemental positive cable is a fused (150 amps) cable running from the battery positive lug to the fuse/relay board positive feed. If you have a plastic debris cover over the heater/air conditioning blower motor, pull up the front of that and the weather stripping that seals against the hood (see Image 21). Run the supplemental cable over to the fuse/relay box in the gap next to the back of the firewall (see yellow line in Image 21) and cable tie down after you have made the connections.

Image 21 - Plastic debris cover lifted up to expose the blower motor area.

- When you get to the fuse box you should see a large cable grommet going through the sheet metal "floor" at the forward right hand side of the fuse/relay box. Using a normal hole saw, drill a 1" hole through this floor a bit back from the existing grommet, approximately 4 ½" back from the forward vertical firewall and 1 ½" to the right of the fuse box side. In my car that area is where the paint code sticker was situated (see Image 22). You won't hit anything on the other side as long as you don't shove the hole saw down too far. This sheet metal is less than 1/16" so it is fairly easy to cut through so don't go overboard with pressure.

Image 22 - Supplemental positive entry besides fuse/relay box

- Once you have drilled through, clean up the burrs at the edge of the hole so they will not cut into wires and cause a short. Insert the cable and fix the grommet in the hole. Open the fuse/relay box, unscrew the two pull-up screws and pull up on the board. Insert some wooden sticks under it to keep it raised. From the footwell, fish the supplemental positive over to the fuse box opening and feed up (see Image 23A). Cable tie off on the sheet metal supports and keep it clear of the clutch pedal mechanism and the steering rod. The plastic protective flange to the left of the clutch mechanism will help in preventing the cable from getting tangled with the mechanism.
- Look at the fuse board. On the forward right edge you will note two 6 mm red wires that bolt up on the forward right edge. Apply dielectric grease and bolt the supplemental to the outer positive screw point with the existing red wire (see Image 23B). Cable tie.

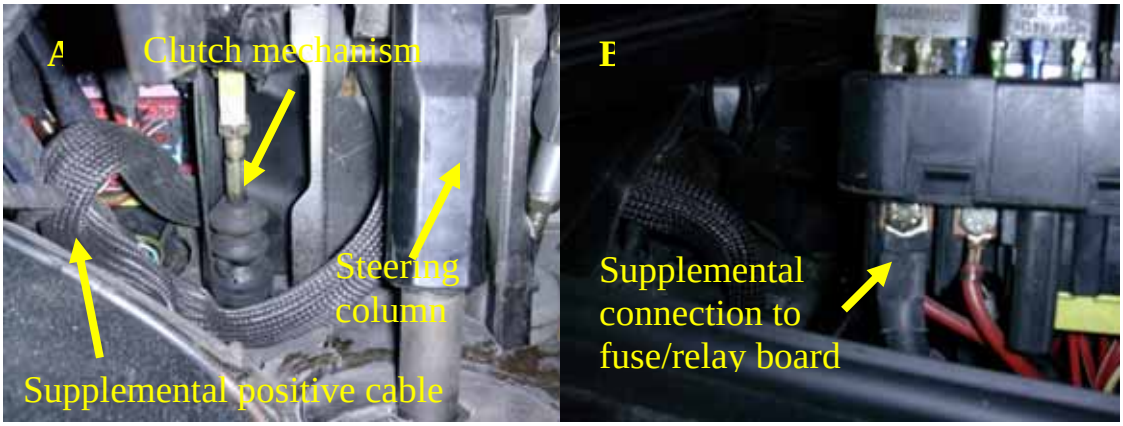


Image 23 - Feeding the supplemental positive in the footwell and bolting to the board

- The existing positive feeds which you unbolted from the main positive cable to the starter can now be bolted back to the ¼" eye terminal attached to the 150 amp fuse (see Image 12B). If a large aftermarket stereo amplifier has been installed, the power draw must be calculated to determine if it may blow the 150 amp fuse with other car loads such as fans. It may be advisable to attach a large amplifier directly to the battery clamp and fuse separately. Cover the bare terminals at the end of the fuse with the enclosed slit plastic loom to prevent accidental shorting and cable tie in place.

- You will find a hex head machine screw and nut in the package that is 2 ½" X ¼". Store that in the glove box. If you blow the 150 amp battery fuse, this will get you back on the road but you better make sure the fuse didn't blow because of a short before you utilize this backup!

- I bolted both positive cables to the clamp as shown in Image 24. If they had been bolted at the yellow circle, water (blue arrow) from the windshield runoff would have flowed directly on the cables. Depending on the size of your battery this may not be necessary.

Image 24 - Bolting the positive cables to the battery post

- For extra moisture protection, I dabbed on some dielectric grease to the post contacts and covered the post clamps with red and black rubber boots available at any auto parts store.

Image 25 - Red and black rubber boots for the battery clamps