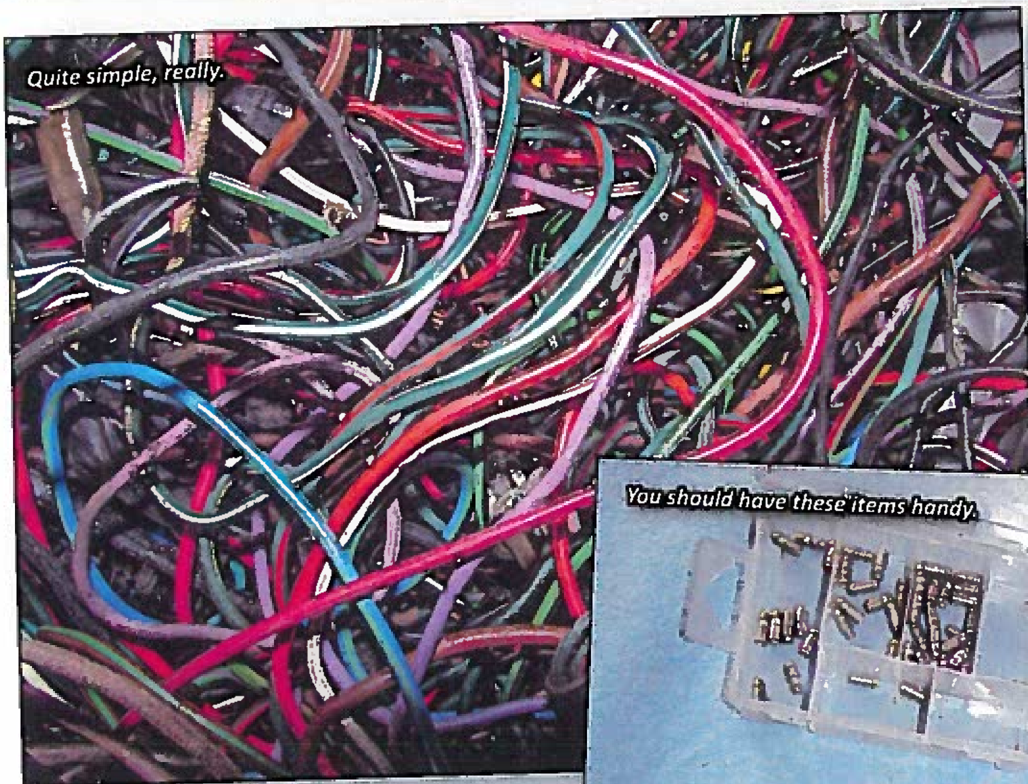
TECHNICAL SERVICE BULLETIN

Getting Wired, Part One

Mike McPhail, Dripping Springs, Texas, Gulf Coast Healey Club



Quite simple, really.

When remembering the outstanding scientists and inventors of yore, several great names immeadiately come to mind: Edison, Bell, Tesla. And then there is Lucas, the "Prince of Darkness." This man is singularly famous for turning electrical science into a black art. When it comes to Lucas electrics, it's really all about preventing the smoke from escaping the wiring harness.

It may be helpful to compare electricity in your LBC to the water in your household plumbing. The water pressure is like the voltage in your battery, and the wires are like the pipes. In the case of Lucas electrics, the electricity is in the form of smoke, which must not be allowed to escape the system!

When examining the Austin-Healey wiring diagram, one might be overwhelmed by the complexity. The trick is not to view things as a whole, but concentrate on the individual circuit. On wiring harnesses with PVC insulation, learning the basic color code will make things easier (cloth-covered wires? Good luck!):

- Black wires are Earth (a.k.a. ground) and connect one side of the battery and electrical components to the car chassis.
- Brown wires are direct from the other battery post and are always hot.
- Purple wires are the same as brown, only with a fuse.
- White wires are hot only when the ignition switch is on.
- Green wires are the same as white, only with a fuse. Note that on very

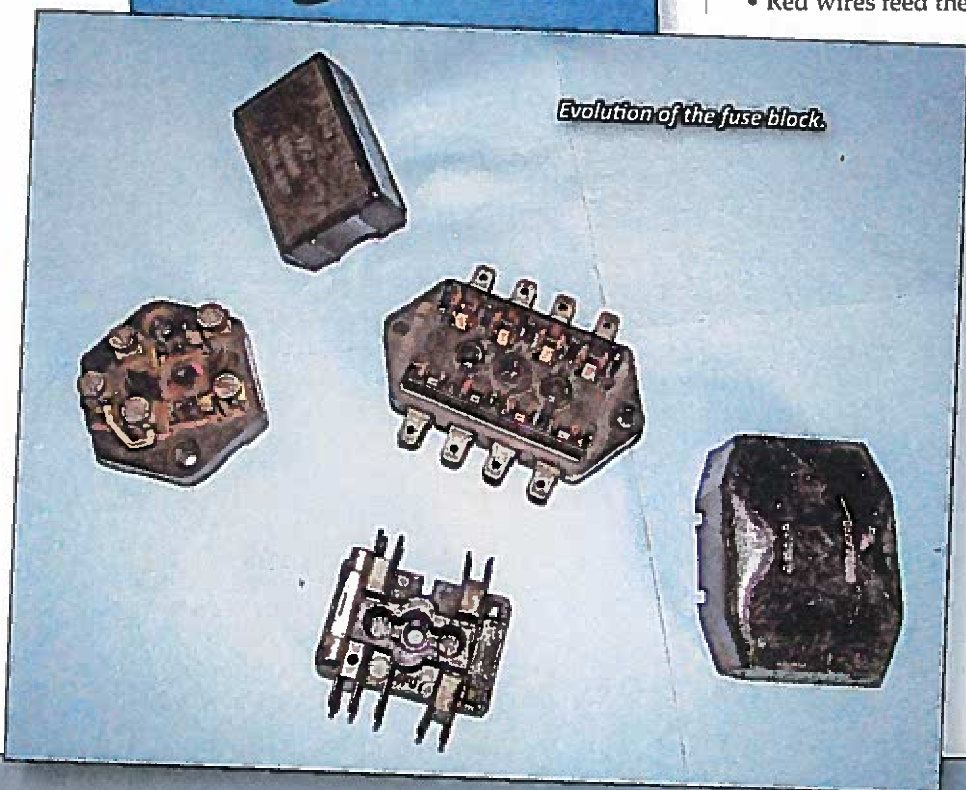
You should have these items handy.

British and American fuses.

early cars, there are just two fuses: one for the horn and one feeding the green wires, which typically power the fuel gauge, wipers, blinkers, heater fan, brake lights and such.

There is more:

- Blue wires feed the dimmer switch and are hot (and typically not fused!) when the headlight switch is on.
- Blue with white stripe, and blue with red stripe, are the high and low beams (still no fuse!) from the dimmer switch to the headlights.
- Red wires feed the runnings lights and are hot (also typically not fused!) when the switch is on.
- Red with white stripe wires are the same as red, only on a switch (no fuse here either!), and feed the dash lights.
- Green with white stripe and green with red stripe are the turn signal wires.



Evolution of the fuse block.

The important thing to remember is that in most cases the main color of any striped wire indicates its origin. For instance, a purple wire with a black stripe going to the horn lets you know that this circuit is fed by a fused wire that is always hot. Similarly, the green-with-stripe wires in the brake light, wiper, or a gauge circuit are fed by the fused ignition switch.

See, it is all very simple, and I hope you took good notes, because Part Two, next month, begins with a quiz. HM

The voltage regulator evolved too.

Negative Ground: English cars were negative ground until World War II. It has been speculated that this was done to confuse the Germans! It tends to follow British logic—electrons are negative particles, so sending them out on wires and collecting them in the positive frame seems logical and practical. The only problem is that if you look at any car, it is always the positive battery terminal that corrodes first. There is no doubt that there is a metallurgical reason for this. The reality is that the ground wires (which are unprotected) tend to corrode on all positive ground cars and almost all electrical problems with Healeys are due to ground failures. Switching to negative ground puts the burden on the protected, insulated hot wires and makes practical sense. All British cars **after** 1967 are negative ground. Switching the ground only requires turning the battery and coil terminals around in pre-1964 Healeys. Starting the car and revving it polarizes the generator. I have had no problems converting over 100 cars in this manner **if they have a Lucas voltage regulator.**

On post-1964 cars, you must switch two wires inside the tach and change the radio over if one is fitted. On **all** cars you must change to a negative ground fuel pump or one that is reversible. I use and recommend AC EP42S fuel pump as it is quiet and has the correct PSI for a Healey (4.5 pounds of fuel pressure).

REGARDING MASTER CUT-OFF SWITCHES

Bob Wilson
Lisle, Illinois
Midwest Austin-Healey Club

After a recent session with the guys at race tech, an interesting situation has unearthed (pardon the pun) itself. It seems that the engine in a race car equipped with a generator and wired negative ground will not shut off with the master shutoff switch while running at any speeds over 1000 rpm. We have known that this is true with cars equipped with alternators, but I am just finding out about generator-equipped cars.

It seems interesting to me that sometime in my 50 years of racing British cars that we would have heard about this or at least have figured it out by now. But no! It took a rejection at tech to bring this to light ... or at least turn our light on, of off as the case may be.

It seems that it works like this: Regardless of the on or off position of the master shut-off, the generator when turning at an engine speed of 1000 RPM or more will make enough electricity to power the ignition system. It will not handle the lights and other accessories, but the ignition system requires so little current to operate that it will just keep on running. The generator is grounded to the engine, beyond the shutoff, and creates its own circuit. Ergo, the engine will continue to run as long as the RPMs stay up.

OK, how do we solve this? Any one of several things will work:

1. Do not run with a generator. Most racecars will do just fine without a generator and should run several hours on a well-charged battery. Besides, a generator in the system robs horsepower. However, it does make a handy fan belt tensioner.

2. Change to an alternator. This requires some simple rewiring including running a wire to the cutoff switch to short the alternator.

3. Simply disconnect the generator leads while racing. This is a better-than-nothing alternative, and it will resolve the problem, at least on a temporary basis; i.e., enough to pass tech and continue on with the racing activities. If you do this, be sure to tape the wire ends secure so that they do not wave around.

4. Replace your old two poles shutoff switch with four-pole switch designed for some alternators. The two large lugs are for the switched ground cables, the spade connectors are for the lead from the ignition to SW side of the coil. Turning the switch to the off position interrupts both the system ground and the ignition power.

Discard the resistor that usually comes with the switch. You can always install the old two-pole disconnect in your street car rather than unhooking the cables to make things safer while working on your car or storing it for extended periods of time.

It seems that I would have discovered this situation before now, but I and at least a dozen of my racer friends were unaware. That probably comes from the fact that we have never shut our cars down using the master cutoff, or that more and more cars are running alternators or no generating system at all. Nonetheless, the situation exists and I am glad to have uncovered it and I am pleased that I can save someone – be they a driver, owner, or tech official – some frustration. HM

STOP LIGHT SWITCHES

Roger Moment

Among lighting issues with Healeys is failure of the brake lights. This can be due to burned out bulbs, easy to fix, or problems with either the brake/stop light switch or the flasher relay box mounted to the left front wheel arch in the engine bay, (on all Healeys from BN1s up to BJ8s with separate turn signal and stop light assemblies).

Design of the switch is rather simple, consisting of a rubber diaphragm that moves, with brake fluid pressure on one side, to close points of a simple contact switch. Over time the diaphragm will become hard and thus can't flex to operate the points. It also can crack allowing hydraulic pressure to pass to the back side, again resulting in the switch not operating. There are no replacement parts to repair these switches, and as the case is crimped over the Bakelite base, opening them requires irreversible machining of the metal housing.

Right – an original stop light switch. The case on the left has had the rolled lip that retains the Bakelite base machined away. The switch nipple is tapered, with 27 threads per inch (American Standard Taper Pipe Thread).

When the hydraulic brake system is pressurized, the diaphragm pushes against a metal disk with a centered steel ball that depresses the copper blade to close the switch points.

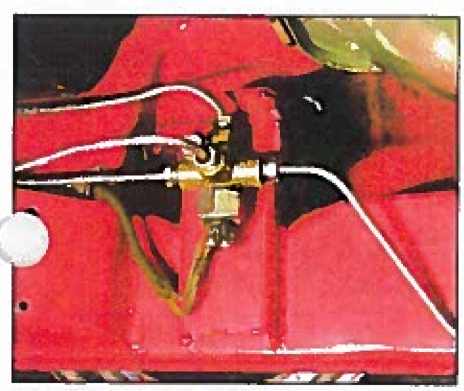
Replacement switches (right) have a slightly smaller hex size than the originals. They come in two "flavors" – a) with screw terminals for earlier cars and b) with blades for push-on connectors (not shown here) found on later cars, starting during 3000 production.

Because failure of these switches in not uncommon, most have been replaced over the years. Still, I highly recommend that you keep a spare on hand, as it is likely that you will eventually need to replace it. And if you own more than one Healey you should have one, with the appropriate style of connectors, for each car.

The stop light switch is attached to the brass brake line junction in one of two locations. For Healeys without a brake servo, which includes all 100, 100-Six, 3000 Mk I, and Mk II models (except for those fitted with the optional brake servo by the factory), this junction is located inside the right front frame on the back side of the front A-arm mounting bracket (see Photo bottom left). On Healeys with brake servos (which includes 3000 Mk IIs fitted with this option and all BJ8s) the junction is located on the right front wheel arch, just behind the riser on which the horns are mounted (see Photo bottom right). In all cases the tapered threads should be made just tight enough to prevent any leakage.

If stop light failure cannot be traced to a burned out bulb or non-functioning switch, then you need to use a volt meter to check other aspects of the electrical circuit. On cars with a flasher relay box (which includes all Healeys up to when separate turn signal lights were introduced on later BJ8s) the problem could be dirty contacts in this box. However, it would be best to first check that all wiring connections at the box, as well as bullet connectors between sections of the wiring harness, are clean. Some fine steel wool will quickly remove any dirt or corrosion from contact surfaces (be very careful not to lose any parts of screw-on connectors at the box).

The relay box cover just pulls off (it may be tight the first time you try to remove it) and you can then dress contact points inside (use 600 grit, or finer, carbide paper). Be very careful to avoid bending any of the metal parts, as doing so will affect whether the points close and open in the proper sequence.



Location of the stop light switch on all big Healeys from BN1 through 3000 Mk II (except for those with the optional brake servo). This is a replacement switch with the smaller hex and screw terminals.minals for earlier cars and b) with blades for push-on connectors found on later cars, starting during 3000 production (not shown here).

Location of the brake light switch on BJ8s. In this photo the horns have been removed from the riser. This is an original switch with the push-on electrical connections.

What Do You Do with a 40-Year Old Relay Box? Repair It, Trash It, or Rebuild It

by Jim Albeck
Agoura, CA

Happiness is having all the wires going to all the right places with no smoke. Gloom is when the turn signal lights do not function.

Such was the case on my BN2 which I hope will be on the road yet this year. With the meter in hand and adequate clip leads, the process of elimination led me to an ominous box on the left front fenderwell called a DB10 relay box.

Getting the box out of the car requires the aid of a nut holder in the wheelwell, unless you have arms like Meadowlark Lemon. Remember to mark the wires one through eight when removing them as it will aid in the reassembly exercise.

With the box out of the car, on the bench, and with the cover removed, the innards reminded me of an antique wall-hung crank telephone or a 1910 high school science project. After removing all the dirt, rust, and caterpillar cocoons, the relays responded to a little electro-shock therapy from a fully-charged battery. The contacts were cleaned and tweaked per Section N.14 of the A-H Manual to finally give continuity; but the contact resistance was 5 to 10 ohms which is very high and would load the flasher so that it would flash only every seven to ten seconds. The question now in my mind was how long will this piece of junk function and was it worth the day's effort that I now have invested?

Well, upon opening Mr. Moss' book to Lucas Electrical Widgets, I found that a replacement was $170. That just went against my Scotch nature—that is, I can buy a lot of Scotch for $170.

Now we have a dilemma. I don't want to use it the way it is, and I don't want to contribute to the Prince of Darkness' fortune, so what do we do?

I decided to rebuild it with modern components, as it would be less pricey than a new one and very reliable. My first choice was to go solid state without electromechanical relays, but laziness and simplicity won out when visiting the electronics store and spotting some small DPDT relays that would fit under the box cover. For $14 including tax, I was committed. Procede as follows:

1. Remove cover by prising (English word) off on the short sides.

2. Drill out the 10 rivets from the bottom side, and remove all parts. Don't throw anything away until the job is complete.

3. There are three insulators, one on the bottom side, and two on the top side. Also there are six insulating washers (small) that are in the metal baseplate between the insulators. (One of my insulators was broken, so I fabricated a new piece—the light colored material in Figure 1.) Save these pieces as they will be reused.

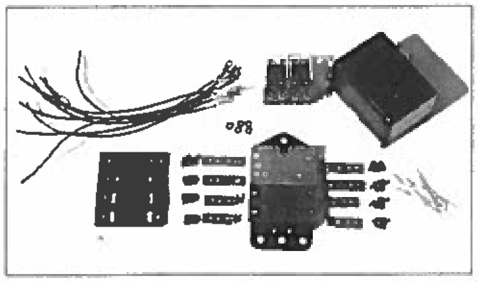


Figure 1: All the parts ready for assembly.

4. The four contact pieces (where the wires from the loom attach) that are designated 1, 2, 5, and 6 are cut off so they are flush with the top insulator when assembled. The insulator acts as a locator for these pieces so they don't short to the baseplate. The four straight contact pieces that go to 3, 4, 7, and 8 have locating pins that interface with the bottom insulator. The pins are inboard on 3 and 7 and outboard on 4 and 8. See the parts ready for assembly in Figure 1.

5. With everything removed, clean up the cover, baseplate, and contact pieces, as they will be dirty and rusty. Paint the cover and baseplate the color of your choice (I used black as it was available).

6. Items you will need from your local electronics supply store or Radio Shack if all else fails:

2-relays, 12VDC, with double pole double throw (DPDT) contacts. Take your baseplate and cover with you as size is important if you want the cover to fit on the finished item.

8-rivets. I used 1/8 diameter pop rivets. Check the length of the rivet as it has to go through the contact piece, insulators, baseplate and the wire terminal.

4 feet of 18 gauge stranded wire. 20 gauge can be used, I had 18 gauge on hand.

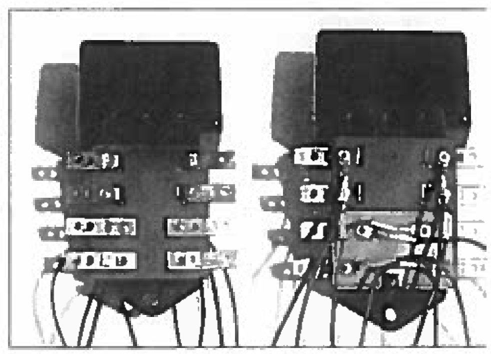
8-1/8 ID wire terminals. Get some extras in case you screw up.

7. I prewired the terminals as shown in Figure 1. I also removed the terminal insulation, as it was difficult to get a clean shot with the rivet, as the insulator wanted to cock the terminal.

8. Replace the insulators (I used contact adhesive to hold them in place), and don't forget to replace the six round washers that go in the larger holes in the baseplate.

9. Locate where the relays will be placed and drill two holes for their mounting studs.

10. Before actually attaching the relays, assemble the wires and contact pieces to the insulated baseplate. I did a trial assembly to see if everything fit before I actually riveted everything in place. I recommend you do the same as you may not have identical relays. See Figure 2, which is the bottom side with the rivets in place and Figure 3 which is the top side *sans* relays.



***Left:** Figure 2: Bottom of baseplate, after assembly of contacts and leads. **Right:** Figure 3: Top of baseplate, after assembly of contacts and leads.*

11. Locate and attach the relays to the baseplate.

12. Check all leads with an ohmmeter to see if you have continuity between the free end of the wire and the contact piece. Resistance should be less than 0.4 ohms. Also check each lead to the baseplate to make sure you do not have a short to ground.

13. Wire the relays per the schematic, Figure 4. See Figure 5 which shows the relays wired.

14. With a volt-ohmmeter we can now check to see if you wired it correctly:

(a) You should have continuity from contact 5 to contacts 3 and 7 (brake light circuit).

(b) With clipleads connect the baseplate to ground and contact 4 to a 12 volt power source. The relay should energize the regulator. The second, a sensing line, runs from the generator to regulator terminal F and is connected to internally to terminal WL, which leads to the ignition warning light. Terminal E grounds the regulator, the overdrive and the windshield wiper motor. Since there is no need for an external regulator, we can connect the output of the alternator is connected directly to the BJ8's battery. The sense line is connected directly to the warning light.

Getting started: First, you'll need to convert the BJ8 to negative ground. You can get an alternator from a variety of sources, and there are adaptors out there that will allow you to hook up Delco alternators using the existing generator mounting bracket. I ordered an alternator and mounting bracket from Denis Welch Motorsport in the UK. The alternator is the standard Lucas ACR found on any number of later English cars.

There are a number of different ways that the alternator can be hooked into the car's electrical system. The method used depends on a number of factors, including how much of the original BJ8 wiring you want to retain, how inconspicuous you want the conversion to appear, what you have available in the way of extra parts, and how much time you want to spend wiring up the car. I found that the most convenient way to integrate the alternator into the existing wiring of the BJ8 was to use a junction box – a decision reinforced by the three-wire configuration of the Lucas alternator I was using, and by a previous owner's decision to paint the engine bay black with the regulator in place (thus leaving a nice original-green patch underneath). The junction box I used was fabricated out of an old BJ8 regulator and interconnects the alternator wiring to the wires coming from the battery and with those feeding the ignition, lights and horn. Use of a "Lucas" junction box also kept the car looking like minimal changes have been made – and it covered up that ugly green patch on the firewall.

To make one of these junction boxes, remove the cover and drill out the three large rivets on the back of the regulator. Then pull out the three coils, wire windings and armatures. You end up with nothing but the mounting plate and spade connectors. Then I sand blasted it clean and interconnected terminals B and D (Battery and Dynamo) internally using a 10-gauge jumper. This gave me a direct connection between the alternator and the battery. The jumper was soldered on one end to a brass nut on a ½-inch screw that passed through the rivet hole above terminal D, and on the other end to the copper tab that connects from the inside to terminal B. The inside of the junction box with the jumper wire soldered in place is shown in Photo 1.

Next, I had to create a new wiring segment between the alternator and the junction box. The Lucas alternator supplied by Welch has two power wires and a sense line, and uses a three-prong plug connector (available from British Wiring). The plug comes with the two required 3/8-inch 90-degree female spade connectors for the power lines and the one ¼-inch 90-degree female spade connector for the sense line. You will also need one straight ³/₈-inch female spade connector and two bullet connectors.

Cut two pieces of 10-gauge wire approximately 48-inches long, strip one end of each and solder on a ³/₈-inch 90-degree spade connector. Cut a similar piece of 14-gauge wire and solder on the ¼-inch 90-degree female spade connector. Run all three wires into a length of ³/₈-inch shrink tubing, leaving about four inches at each end, and apply heat until the tubing firmly encases the three wires. Finally, insert the three ends into the three-prong plug. (In keeping with the Lucas scheme, I used 10-gauge yellow wires and a length of brown with green 14-gauge wire for the sense line. I also painted the alternator Healey engine green.)

Slip a single cover over the opposite ends of the two yellow wires and push it back. Strip the ends and solder both wires onto a single straight ³/₈-inch spade connector. This is kind of tricky and you can easily burn the insulation of one – or both – of the wires. If you do this (like I did), use a piece of shrink tubing to cover the burned area. Finally, pull the cover down over the connector. Solder the bullet connector to the end of the 14-gauge sense wire.

Next, disconnect the battery.

If you use a junction box like I did, disconnect all the wires leading into the regulator and remove it from the firewall. Install the junction box in its place and string the new harness alongside the harness mounted to the right-hand frame rail. Note the four brown wires coming out of the existing harness below the junction box. These four wires terminate in two ³/₈-inch female spade connectors. Reattach these two connectors to dual-terminal B of the junction box (far right facing rearwards). Attach the two wires leading from the alternator and terminating in a single ³/₈-inch spade connector in the new harness to junction box terminal D. Attach the existing black ground wire to terminal E (far left facing rearwards). Cut the spade connector off the brown with yellow wire leading to the warning light and solder on a bullet connector. Connect the 14-gauge sense line from the alternator (brown with green) directly to the brown with yellow warning light wire using a sleeve connector.

Next, you will have to relocate the coil. On the BN1, the coil is very conveniently bolted to the side of the engine block, well out of the way of everything. On the BJ8, though, it is mounted atop a bracket that goes around the generator. Much as I tried to modify the bracket to fit the alternator – drilling, hacking and filing – it was just not worth the effort, so I strongly recommend not bothering with this. I sent a query out to the Healey e-mail list requesting info on where others had mounted their coils, and received a number of helpful replies all suggesting that I mount the coil on the right-hand shroud support, near the horns. Initially I could not figure out how this was done, but after spending a good amount of time staring at the horns trying to figure out how to fit in a coil bracket, I finally came up with a solution: move one of the horns.

Remove the coil from the generator. Unscrew the rear-most horn and remount it facing forward on the shroud support below the horn that normally faces forward. In this setup what was the lower mounting bolt for the rearward-facing horn is now the rear mounting bolt of this horn in its new forward-facing position. Before tightening down the mounting bolt, I slipped the lower part of a coil bracket under the horn bracket. Once the bolt securing the horn and the coil bracket was secure, I drilled two holes – one in the shroud support so I could fasten down the forward end of the lower horn bracket using a sheet metal screw; the second in the shroud support so I could mount down the upper end of the coil bracket using a

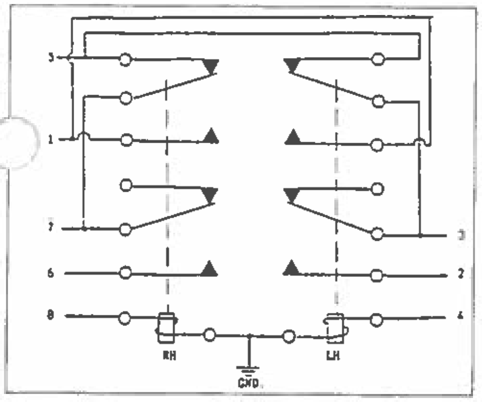


Figure 4: Schematic of how the relays are wired.

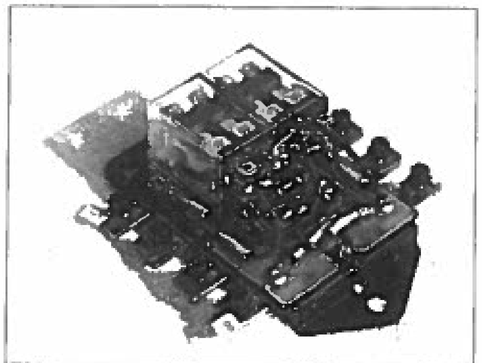


Figure 5: Top view assembly wired. Take your time, it's a tight pack.

and you should have continuity from contact 1 to contacts 2 and 3.

(c) With the same setup as (b) connect the 12 volt source to contact 8. You should

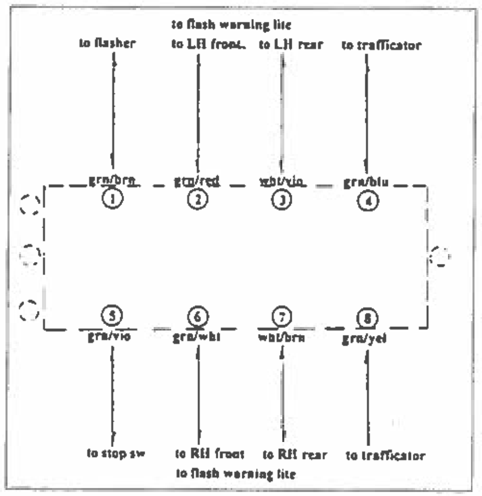


Figure 6: Block diagram of wire colors and where they go.

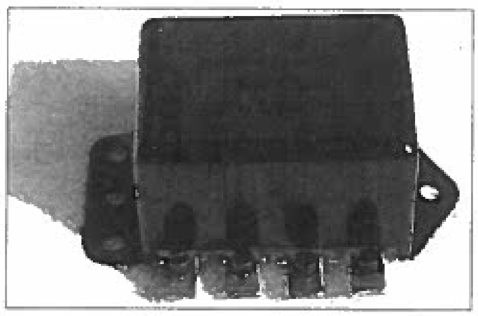


Figure 7: Assembly complete. The concours judge will never now.

now have continuity from contact 1 to contacts 6 and 7.

15. Coat all exposed electrical connections with a silicon material to prevent oxidation, rust, etc. Do not coat the upper side of the contact pieces where the loom attaches.

16. Replace the cover (Figure 7) and install it in your Healey, ensuring that the baseplate is grounded.

17. With all the wires attached, let's check out the system; if it does not function:

(a) Switching the trafficator you should be able to hear the relays energizing. If not, you are not getting power through the trafficator to contacts 4 or 8. (4=left, 8=right).

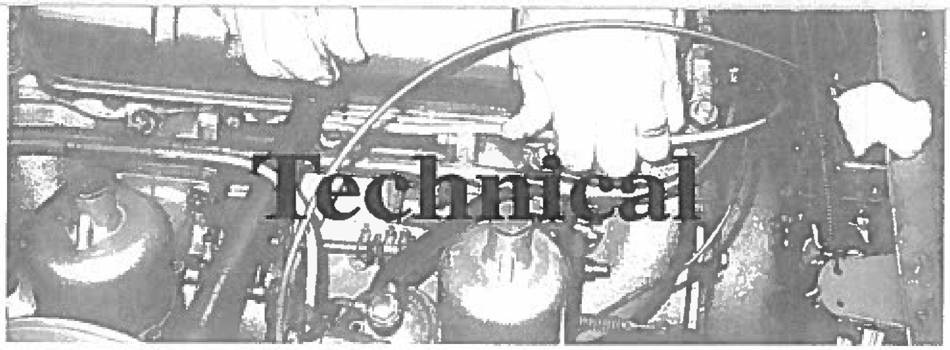
(b) If the relays are operating but the lights do not flash, check to see if you have 12 volts at contact 1. If not, check to see if you have 12 volts at the flasher(terminal B). If you do, short out the flasher terminals B & L and operate the trafficator. The lights should illuminate (not flashing) and this means another trip to the autoparts store for a new flasher.

18. If you have problems with one of the lights not flashing, check out the individual lamps by taking a cliplead from the fuseblock (hot side) to each of the contacts on the relay box:

Contact 2 = left front)
3 = left rear
6 = right front
7 = right rear

If all else fails there're hand signals—straight out is left, up is right, and dangling over the door is a tired arm.

Have fun, and Happy Healeying.



Dealing with un-fused circuits

By John Trifari, Golden Gate AHC

Editor's note: Healey Marque *is running this article again due to the fact that it was accidentally cut short in the February issue. We apologize for the mistake.*

To protect against a short circuit, fuses are used. A fuse is simply a strip of metal that permits current to flow through the circuit. If a short circuit occurs, the resulting surge of heat will melt the metal strip in the fuse, breaking the circuit and protecting the car and the wiring from any further damage. Fuses, however, were an item in short supply in a factory Healey. Why? Don't know. When the cars came out of the factory they had only two fuses, both or which can be easily seen in the engine bay on the left side of the firewall. The first fuse has a brown wire running into the fuse bloc from the regulator. On the fused side there's a brown with green (later purple) wire that runs to the horns. Fuse terminals A1/A2 are hot, even with the key off. Fuse terminal A3 has a white wire from the ignition and is hot only when the key is turned on. A second white wire leads off the un-fused side (A3) to the fuel pump. Twin terminal A4 (the fused side) has the accessories connected via green wires. So let's take a look at what we have on a BN1:

Fused Circuits:	*Unfused Circuits*
1. Horns	Running lights
2. Fuel gauge/windshield wipers/heater	License plate light
3. Directionals/Brake lamps	Headlights (high/low beams)
4. Fuel gauge	Panel lights
5. Flasher	Fuel pump
6. Overdrive	(Overdrive is unfused on other Healeys)

Many feel that some circuits should not be fused. This is true of the headlamps and the overdrive, the theory being that if you are driving at night and you lose a headlamp fuse you lose your headlamps. Others feel that the overdrive could suffer damage if a fuse blew while it was in operation. (Don't know why BN1s have a fused overdrive.) I'll leave that debate for others to sort out. I think fusing the fuel pump is a good idea, as was proven to me on the way to Indi, although admittedly the short I encountered has to be classified as very rare.

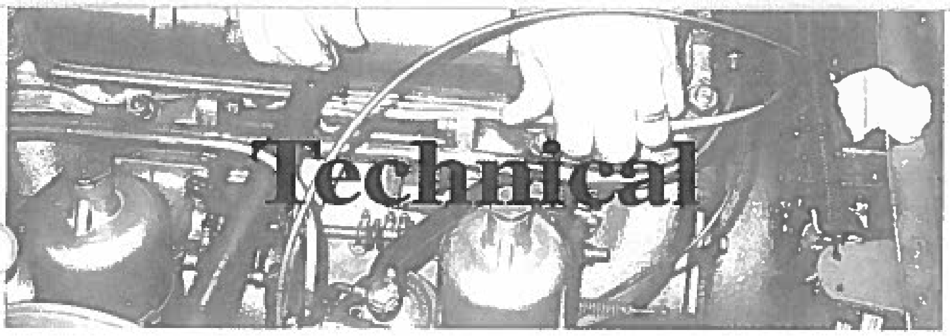
The panel-lamp and running lamp circuits are another matter. Both circuits are un-fused and either one can create major problems if a short occurs. Power to the panel lamp circuit runs from light switch terminal S1 via a red wire to a dual-sleeve connector. From there a red wire runs down to the panel lamp switch. Red wires with white striping then run across to the lamps behind each of the gauges. This circuit is weak: the connections at the gauges are exposed and the lamps sit in poorly designed sockets. If one of these sockets comes loose (easy) the hot exposed end of the connection can come into contact with the dash or anything else metal underneath it, frying the circuit when the lights are turned on. If you look under the dash of many Healeys you will see the result of a panel-lamp short: melted insulation, burned conductors leading up into the harness, panel lights that don't work. Worse.

The running lamp circuit is another problem and is an equally pernicious example of skimping on fuse protection. These lights also run off light switch terminal S1. The circuit powering them uses the same red line that feeds the panel lamps, and goes through the same dual-sleeve connector. Then it branches again in the engine bay and goes to the front and rear running lights. The rear light circuit connects to the vertical segment of the chassis harness and runs under the car. Once in the trunk it connects to the trunk harness which feeds the left and right rear running lights and license plate lamps. This is a very vulnerable circuit. Night-time rear-enders have shorted out the running lights and caused the license plate lamp circuit to short against the rear shroud. Loose tools and metal objects in the trunk have caused shorts by chaffing away the insulation and acting as a bridge between the hot circuit and the trunk floor. Bad/loose connections between the chassis harness and the trunk harness can also leave hot wires in contact with the car body when the headlamps are put on. The list goes on. There have also been reports of shorts occurring because of damage to the chassis harness.

Compare the fuse box of a modern car with the fuse bloc on a Healey and you will quickly see that electrical protection is lacking. So, if you do nothing else, fuse the panel lamp and running lamp circuits in your Healey. It's easy to do and very effective. Here's what you do: ***First turn off the battery.*** Next, drop the light switch (you'll have to pull the console if you're doing this on a BJ8) and disconnect the red wire from terminal S1 of the light switch. Solder a bullet connector onto the exposed end of the red wire. Solder a bullet connector to one end of an in-line fuse holder and strip about ¼-inch of insulation off the other end. Insert the stripped end of the in-line fuse holder into terminal S1, put a 10-amp fuse into the holder and connect the other end to the red wire leading to the panel and running lights using a sleeve connector. Re-install the light switch and mount down the fuse holder where you can get to it easily. Turn on the battery and go for a night ride safe in the knowledge that you are now protected.

For more protection, put an in-line fuse in the license plate lamp line just in back of the point where the wires come into the shroud. If the license plate lamp circuit shorts, then you will protect the trunk and chassis harnesses. I also put an inline fuse at the point where the trunk and chassis harnesses join.

I have an in-line fuse on the auxiliary driving lights on the BN1 and the BJ8 and fuses on the fuel pump lines. I have a fuse on the BJ8 radio and one on the line feeding the air compressor for the Fiat 124 horns on the BN1. I also have an auxiliary fuse bloc on both cars. The bloc draws power from the regulator and feeds other accessories such as map lights and a CB radio on the BN1—all of which if course are fused. Finally, I have a battery cut-out switch on the BN1 mounted just underneath where the spare tire pokes into the cockpit. In case of any real problems I can hit the switch from the driver's seat and kill everything. The BJ8 is bit more problematic since the battery is in the trunk. I'm working on it. Stay tuned. Is all this overkill: maybe. Is it paranoia: perhaps. The BN1 will soon celebrate its 50th birthday, and I want to be sure that both cars are around for a long time to come.



Dealing with Un-fused Circuits

By John Trifari, Golden Gate Austin Healey Club, Sunnyvale Calif.

Short circuits in the panel lamp wiring or in the wiring feeding the running lights and license plate lamps have long been a serious source of Healey electrical accidents waiting to happen. Problems in these two circuits have probably caused more under-the-dash wiring damage, erratic electrical performance, burned-out harnesses and car fires than any other electrical circuit.

This article discusses why this can happen and how best to protect your baby from problems relating to these two electrical circuits. First some long thoughts on shorts. Any electrical circuit in your Healey has four elements. First there's the source – in our case a 12-volt battery. Then there's the load, or resistance. A load can be a headlight, an overdrive solenoid, a windshield wiper motor or a panel lamp. Then there's the ground – the path the circuit uses to return to the battery. Healey grounds use the frame and the body itself, as well as just about any piece of metal attached to them. Finally, there's the wiring – the pathway taken by electricity as goes from the source to the load and from the load to the ground.

Normally, there is a balance between the three electrical elements of a circuit – the voltage, the amperage and the resistance. Voltage is the pressure pushing the amperage (flow rate) through the circuit; resistance is the wiring and the load. When amperage goes into a load such as a windshield wiper motor or a lamp or a fuel pump, it is dissipated as heat (as in a lamp or a soldering iron) or as energy (electric motor) before the circuit returns to ground. Everything is in balance; everything works fine; nothing overheats, nothing catches fire and everybody is happy. This can all be characterized by a thing called Ohm's law: Voltage equals amperage times resistance, from which you can derive the formula that's really-important when it comes to shorts – amperage equals volts divided by resistance.

A short occurs when a power wire (or "hot" wire) line touches the frame or other grounded element in the car before it encounters a resistance. A short could be the result of a loose or broken wire or chaffed insulation that exposes a conductor. When this happens and the conductor touches the frame or body, bang, you've got a short. Shorts can be a real pain to trace. I'm sure everyone has their own favorite horror tale. Here's mine: When I was driving the BN1 to Conclave 2000 in Indianapolis, the fuse I had in the fuel pump circuit suddenly blew when I downshifted off the highway, shutting off the fuel pump. The car came to a stop. When I tried to start the car again I could not hear the pump, so I checked the fuse and discovered it had blown. I replaced it, and to my pleasure the car started right up.

Any electrical circuit in your Healey has four elements:

- **The source**
- **The load**
- **The ground**
- **The wiring**

I wanted to keep moving so I disregarded the fundamental law of fuses: if a fuse blows you don't have a fuse problem, you have a short problem. Anyway, I went on my way – for about two blocks. Then the car stopped again. I replaced the fuse again and let the car idle for about 10 minutes. Everything seemed OK, so I went on my way. After two blocks the car ran out of gas again. I could not figure out what was happening, although I knew I was shorting the fuel pump line. I was running out of replacement fuses and I figured I had a short in the fuel pump line, so I simply jumped the circuit by running a hot line from the battery to the pump. Then I drove off with no further problems. Later, with the car on a rack, I discovered that part of the vertical segment of the chassis harness had come loose from the chassis mount and was coming into contact with the clutch linkage. Over time, the clutch had simply worn away the insulation on the fuel pump line. When I depressed the clutch, the linkage moved and touched the exposed conductor, shorting the circuit and blowing the fuse.

In a short circuit resistance is negligible – say 0.001 ohm – since there's always some resistance in the circuit. So according to the derivative of Ohm's law (amperage = voltage divided by resistance), a short circuit will create very high amperage levels. (Divide 12 volts by 0.001 and see what you get.) The result is a lot of heat. If the short is intermittent, all you'll get is a spark. If the short persists and the hot wire stays in contact with the ground, you'll start smelling burning wire. The lucky ones will find the shorted wire has burned itself up and damage has been limited to only the wire itself and maybe some nearby sticky insulation. It may take a while but you can isolate the bad wire, and install a fix. If you're less lucky, the heat from the short will burn not only the circuit wire but adjacent wires in the harness as well. The result: unpredictable electrical performance of seemingly unrelated electrical components. (Why does the overdrive cut out when I turn off the headlamps? Why can I jump start the car but the starter switch doesn't work?) If you have a serious short you can destroy major portions of the wiring

Installing an Auxiliary Fuse Block

by John Trifari

Sunnyvale, CA, AHC-PC

The Healey electrical system leaves much to be desired, starting with a limited number of fuses. Tapping off these fuses for a clock and a voltmeter stressed the ability of the screw terminals to handle any additional wires, so when I chose to add a few more accessories, I had to re-evaluate my fuse requirements and just how I was going to best protect the car's electrical system.

My first thought was an ambitious one. I actually contemplated pulling the fuse block, replacing it with a block with more fuses and rewiring things. After taking a reality break and contemplating the limited space around the block, I decided that this would not be a smart idea, at least until the Healey's engine comes out for rebuilding, so I settled on an auxiliary fuse block instead.

The 4-circuit fuse block described here is from JC Whitney (part #13VY6040N) and lists for $5.49. It will handle up to 30 amps per circuit and uses conventional fuses. Blocks with more circuits are available. The 4-circuit block is mounted vertically on the small panel below the ID plate on the passenger side of the engine compartment, where it is easily accessible. The panel is used to blank off the hole for the steering column of a right-hand-drive car, and can be easily removed in order to mount the fuse block.

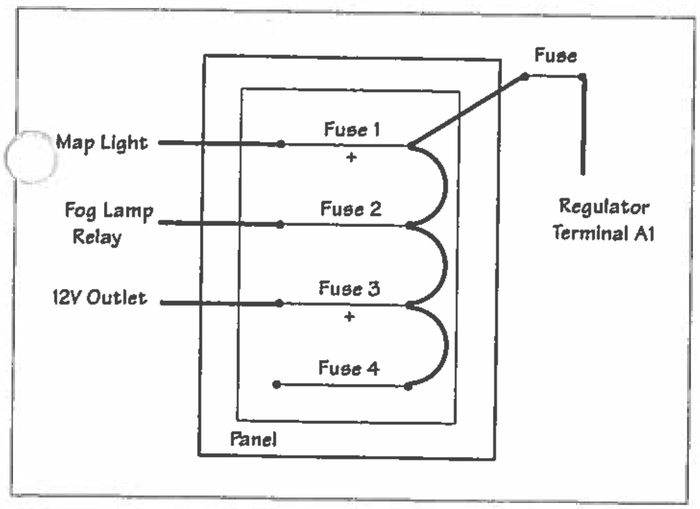


***Figure 1:** Fuse block is screwed onto panel used to blank off right-hand drive steering column. Fuses are interconnected by short loops of wire with ring connectors and to nearby regulator terminal A1. In-line fuse protects regulator. Only three of the four circuits are in use.*

As shown in Figure 1, I interconnected fuses on one side using short loops of wire with ring connectors soldered to each end. Power to the fuse block itself comes from regulator terminal A1 via a short length of wire with an in-line fuse. Connecting the power-in line at this point allows circuit loading to register on my ammeter. At the moment I am using only three of the four fuse terminals: One powers an under-dash map light; the second runs the windings of a relay I use as a switch for the fog lamps I've installed. (Power for the relay contacts comes off the low-beam side of the dip switch so that the fog lamps go off when the high beams go on.) The third fuse powers a standard 12-volt cigarette lighter socket I've mounted on the side wall on the driver's side. I use this for a trouble light and to power my cellular phone. My CB and radio run off the switched side of the ignition, and cannot be inadvertently left on. All accessories running off the supplemental fuse block by-pass the ignition, however, so remember to turn off anything connected through those fuses, and to be careful working around that area—those fuses are hot.

Austin Healey Q&A

Keeping the Smoke In—or—Fuse It So You Won't Lose It

by Fred Vercruysse

Atlanta AHC

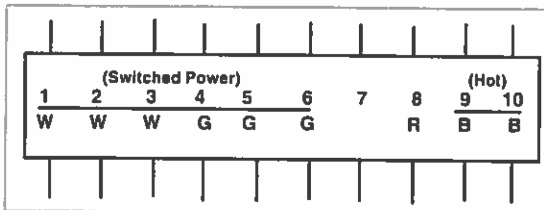
It's a well-known fact that Lucas (and Healey) electrics run on smoke. If the smoke escapes, things cease to function—sometimes in a spectacular fashion. I have been the unfortunate victim of "Loss-of-Smoke" and have had the opportunity to spend some time alongside the road contemplating the cosmic mysteries of life. When it came time to replace the wiring harness (smoke pipes) in my Healey, I decided to install a real fuse-block that was fully functional instead of just being a place to connect a bunch of wires, most of which are not fused at all. So last winter, I not only replaced the wiring harness, but I also removed and rebuilt the main steering box as well. More on this later.

The standard fuse-block has switched, un-fused power with several white wires at A3. This also supplies power to the green wires at A4 through a 35 amp fuse. Terminal A1 is the big brown wire which is un-switched power coming directly from the battery by way of the starter solenoid. It supplies power for just the horns at A2 through the 50 amp fuse. Having this kind of power available means you can arc-weld any time you like! Also, isn't it nice to know that the horns are fused while non-critical things like the fuel pump, overdrive, lights, and ignition are not? However, because the fuses have such a high current rating, the usual result of a short is to burn up the wiring harness.

I wanted to use the KISS method (Keep It Simple Stupid) as much as possible. To this end, all the terminals on the fuse-block use a 10 amp fuse. While 10 amp fuses may be a little more than some of the circuits really require, they are sufficient to protect both the equipment and the wiring harness.

The components used were two fuse-blocks with 1/4" side position (push on) terminals, 10 ATO plug-in (blade type) fuses rated at 10 amps, as well as a large assortment of 1/4" female push-on blade type connectors. In addition, a 20 amp in-line fuse was placed under the dash and supplies power for the lights from the main power line.

The new fuse-block is actually two, five-position fuse-blocks snapped together end-to-end. The entire package is approximately 2" tall by 4" long laid out as shown below. Both the upper and lower terminals accept a 1/4" female push-on connector. The upper portion of terminals 1-6 as well as 9-10 are jumpered together with 18-gauge solid buss wire and soldered at each location. The buss wire was laid flat against the body of the fuse-block so that the main power leads could be plugged in at any convenient location. The two switched power and the hot (unswitched power) leads are plugged in on the

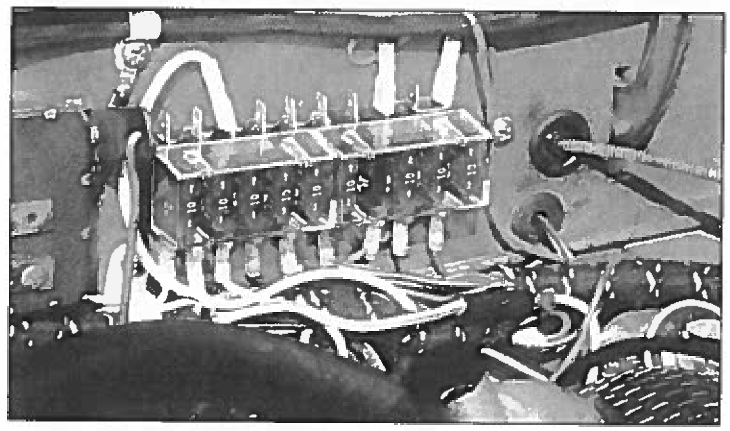


W = White; G = Green; R = Red; B = Brown.
1 : Ignition Coil; 2 : Overdrive; 3 : Fuel Pump;
4 : Fuel Gauge/Heater Motor;
5 : Turn Signal, Flasher Unit and Brake Lights;
6 : Wiper Motor; 7 : not used; 8 : rear lamp power;
9 & 10 : Unswitched power for each horn.

at any convenient position, while the individual circuits plug in using the lower terminals.

I wasn't about to completely re-design the wiring harness layout or splice extra wire length into each circuit. This meant that I would have very little room to maneuver. In order to make room for the new fuse-block, it was necessary to remove the overdrive relay as well as the original fuse-block. (Since I had bypassed the overdrive relay many years ago, removing it was not an issue for me. Bypassing the relay causes the overdrive to turn off as soon as the dash switch is turned off. It also meant that the new overdrive sub-harness wasn't needed anymore.) I finally figured out exactly where to position the fuse-block by attaching a few of the lower feed wires and letting them be my guide. Their length—or lack of it—determined the final position within a very small area. Once this position was determined and the fuse-block mounted, the wiring was eventually completed. *(See photo.)*

Going back to the steering box—while I did not replace the wiring going to the trafficator (horn and turn signal assembly) I did have to remove and re-install it in order to get the steering box and column out of the car. Finally, everything was put back together and tested OK; it was time to hit the road—smoke test it!—if you will. After a short distance the turn signals and brakes lights quit. "Back at the ranch," it turned out that the fuse at position 5 had blown. To make a long story short, the power wire for the turn signals at the trafficator had pulled loose sometime during the in-and-out handling and the vibration of driving caused it to touch and short to ground. It is quite possible that I could have wound up with a burned-up wiring harness if the circuit had not been fused with one of the new 10-amp fuses. Keeping the smoke in let me keep on keepin' on....



Cruise Control Made Easy

by Dennis Juul

Midwest AHC

Rather than mess around with complicated electronic cruise control for my Healey, I used the KISS method.

Using a single choke cable, I rigged up what is essentially a manual throttle control. I welded a bracket to the throttle shaft (spindle) after drilling a hole in the bracket through which the cable would be attached. The bracket is about 1 3/4" long and is attached about 1" in front of the connection between the accelerator linkage and throttle shaft near the fire wall. The bracket should be about 45° from vertical, leaning toward the inside (engine side); see Illustration A *(following page)*.

The choke cable was mounted under the dash on the driver's side (left) with the knob easy to reach, yet out of the way of your leg. The cable was routed through the dash by way of one of the holes at the far left side and attached to an angle bracket screwed to the top of the pedal box. See Illustration B.

The choke cable should [illegible]bricated before final installation; and when twisted (rotated), it should remain in that position. Some adjustment will probably be needed to get the throttle control just right.

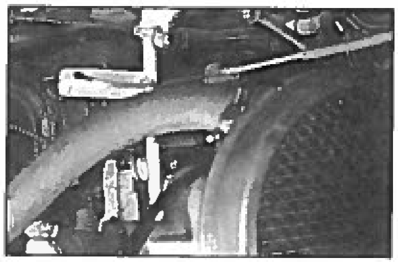
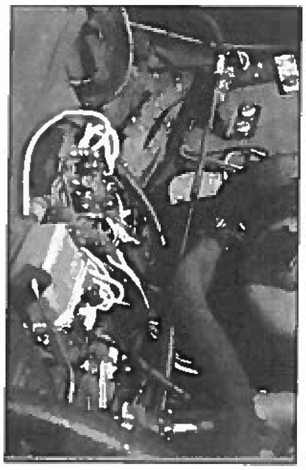


Illustration A shows the bracket welded to throttle shaft just forward of the throttle linkage connection near firewall.



This setup is intended for cruising on major highways and Interstates and certainly only when conditions permit. It allows movement of the driver's right leg, which helps eliminate cramps and improves circulation. Normally, you release the "cruise control" before deceleration and/or braking. If a panic stop is required, dip the clutch and hit the brake at the same time, which should be normal procedure anyway to get the car out of gear should it begin to spin. Used with care, this "cruise control" will make Healey cruising a little more comfortable.

Illustration B shows the mounting of the cable bracket on top of pedal box.

ally are a lot of parts in a Healey when it comes down to it. I have a dirty pile of parts and a clean pile of parts ready to go back on the car when it returns. It is nice to have a sandblaster and so many tools available—these make things easier.

The other fellows at the shop have been very helpful, and I appreciate it very much. Thanks to Brad, Scott, Jerry, Ron, and Chuck. Chuck is 65 years old and runs circles around most of us at work, if he is not flying his airplane.

Ideally, we should work on our own cars; but if you can't, QC is a good place to go for work. I have some pictures of the Healey chassis, and it will be fun to write about putting the car back together. I had planned on restoring a Healey some day; I just got my chance early and got paid for it, too.

It is hard to work on someone else's car because you feel so much responsibility for the job's being done right. It is hard to spend many thousands of someone else's money, but you do the best that you can. I have also had the chance to rebuild a MG TF motor. Today I also repaired a TR3 clutch and got to drive a TR for the first time. A TR6 came into the shop dead, and we found that it had a bad distributor rotor and primary wire lead.

So, I have about three more weeks and then back to school; but what a grand summer this has been. After driving a TF, the TR3 felt like a rocket ship. More later.

Installing a New Wiring Harness

I own a 1959 100-6 BN4 that was in need of a wiring upgrade. I knew that I had a short somewhere in the harness as one of my signal lamps was not working properly (flasher flashing too rapidly) and the entire harness was pretty ratty. However, when I experienced a short in the plate lamp and the short burned off almost 3 feet of insulation I knew it was time to take action. I was somewhat hesitant to undertake the task myself but felt that there is no better way to understand what you have than to jump into a project and see it to completion. Besides, I felt that there are enough members in the AHSTC that I am sure would be more than willing to give me a hand should I need it. So let me take you on a journey that took about 40 hours on and off over a period of 2 weeks.

Shopping Around

My first step was to shop around for a replacement harness. I checked out the catalogues from the usual suspects like Moss, Healey Surgeons, Victoria British and British Wiring (BW). Before contacting anyone I pulled some information off of the internet to understand exactly what needed to be ordered. The Victoria British and British Wiring web sites provided good information on the harnesses but I found the BW site was more detailed in that it was specific to each model Healey. I also spoke to some colleagues and found that British Wiring had a good reputation for a quality product. So I chose BW and I found them to be very cooperative and patient despite all of my phone calls.

Preparation

1. Before the new harness arrived, my first step was to create an enlargement of the wiring schematic that would be used as a reference as I began installing the harness. I redrew the wiring schematic into a 20 by 30 inch diagram insuring that each wire carried the correct color code number assignment.
2. Once I received the harness, I unpacked each component of the harness and laid them out on the floor to get a sense of how it went together; main harness to rear, rear to tail brake lights, main to front, etc.
3. *This next step took a lot of time, but I feel it was the most productive step in the entire process; with wiring diagram in hand and my trusty volt-ohmmeter I proceeded to verify and label the connection points of every wire in the harness. When compete I knew where every wire originated and terminated and where harnesses connected to each other.* (I know some of you will say just follow the color codes and you should be ok). This process picked up a wiring modification for one connection such that I had BW go back to the engineers in England for verification. So my diligence paid off. I also found that the BW harness color coding was right on target.
4. To be complete the harness requires single and double electrical connectors not provided (about 10), new wiring clips and new grommets. To determine how many connectors I needed, I laid the harness out on the floor again and with all wires labeled, I could establish where a connector was required. I also ordered the new grommets and wiring clips.

Where to Begin

I guess you can start anywhere, but I decided to work from the back to the front since the wiring here is pretty basic. Before starting any work, disconnect the battery. By the way, I should state that because of other work being done, the engine in my car was pulled out (this is another story). This made the work up front a lot easier.

As I replaced each wire, I put a red dot at both ends of the wire on the enlarged schematic. So when I was done, I knew everything was connected and accounted for.

1. I started with the rear light harness by clipping the leads to each lamp leaving a pigtail to verify color codes. Replacement required removing the lamps to gain access to the connections. Each wire was removed and the new one soldered to the bullet connector and re-installed. As each lamp was completed, it was reassembled. When complete, I had replaced wires to each brake/tail lamps, battery master switch, fuel pump and fuel gauge sending unit.
2. The brake/tail lamp harness connects to a harness that runs through the left side of the rear fire wall, underneath the car along the left side rail and connects to the main harness in the engine compartment. Reminder: *don't forget to install the new grommets where the harness goes through a firewall before making connections.*
3. Once in the engine compartment I worked the right and left sides of the main harness clipping pigtails and replacing wires and clips. It is somewhat awkward getting to the headlamp harness and pigtails, but just take your time. With the engine out it saved me a lot of work of having to remove the grill assembly to get to the harness and clips that run across the front of the engine compartment.
4. This next step was the point of no return; cutting the main harness going into the dash. Same processes as before; cut and leave pigtails off each gauge and switch and with each wire labeled to where it connects the job went smoothly. All the gauges, switches and lamps were accounted for (no wires left over), in addition to the wiper motor, high beam switch and heater motor.

Save the old harness for spare parts. The picture below shows what you end up with when the job is done.

Checking Your Work

I reinstalled the battery with the intention of finding out how I did. I knew that once I turned the key on, I would start pumping fuel so I had a container ready to catch the fuel. I turned the key on and the fuel pump worked, the fuel gauge worked, I had lights and high beams. That is where I stopped as the container was filling up with fuel and I did not want to waste it. (I have since learned that by plugging the fuel line it will stop pumping once it meets some resistance). Well I continued verifying my work and as it turned out, I had one error. The last thing I wired up was the wiper motor. It was here that I found I had reversed two wires of very similar color; Black with Green and Green with Black. It was getting late and I was at the end of my day. Anyhow, I fixed this error with little trouble right at the firewall. Job completed.

This entry was posted in Electrical on April 14, 2013 [http://www.austin-healey-stc.org/tech-articles/electrical] by admin.

Power Outlet for + Ground Big Healey

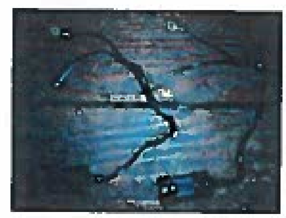
by Shawn Miller

Even want to charge your cell phone or use your GPS in your positive ground Austin Healey? Well you can. Walmart sells a 3M Automotive twin power cord that can be modified to work. Similar cords

can also be found at most automotive parts suppliers. The reason this power cord is so nice for this application is that it NEEDS to remain isolated from any metal (grounding surface) on the rest of the car. This particular power cord is covered in plastic and has a nice rubber end cap. Additionally it has two outlets, so you can make aux outlets for two cars. The other thing to keep in mind is that the cell phone or GPS MUST remain isolated from any grounding sources (metal) on the car. If a metal part of the GPS or cell phone (usually just the charging USB port, or an outlet on some GPS units- most other parts are plastic) touches any metal on the car, you WILL fry it! It would be suggested to charge the cell phone on the passenger seat or on a well covered parcel shelf and use the GPS on a well secured suction windscreen mount.

After cutting the two aux power outlets off the twin power cord identify the marked wire by the raised ribbed markings- this is the wire that goes to the center of the aux power outlet.

Solder a grounding connector to this wire end. On the other wire solder a bullet connector. It is important that the grounding wire is the wire that goes to the center of the outlet- if not you could fry your devise. It would be advisable to test your cell phone charger (as most have a indicator light on them) first to see if it works, it it blows the light, then it isn't wired correctly.



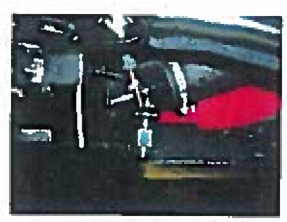
modified outlet

Next find the ignition controlled heater blower fan connection/ power source under the dash and near the heater controls. Remove the Lucas single connector and install a four way Lucas connector.

Power connection

Plug the new aux power outlet bullet connector into the Lucas four way connection. Attach the grounding wire onto the back of the fuel gauge mounting bracket or some other grounding source.

Lastly use a zip tie to attach the aux power outlet wires to the heater control panel cable allowing it to dangle over the parcel shelf.



Secured outlet

Again be very careful that the device does not ground out on any metal part of the car. It may also be advisable to add an inline fuse on the power source wire.

Auxiliary Power Outlet

Even want to charge your cell phone or use your GPS in your positive ground Austin Healey? Well you can. Walmart sells a 3M Automotive twin power cord for around $7.00 that can be modified to work. The reason this power cord is so nice for this application is that it NEEDS to remain isolated from any metal (grounding surface) on the rest of the car. This particular power cord is covered in plastic and has a nice rubber end cap. Additionally it has two outlets, so you can make aux outlets for two cars. The other thing to keep in mind is that the cell phone or GPS MUST remain isolated from any grounding sources (metal) on the car. If a metal part of the GPS or cell phone (usually just the charging USB port, or ant outlet on some GPS units- most other parts are plastic) touches any metal on the car, you WILL fry it! It would be suggested to charge the cell phone on the passenger seat or on a well covered parcel shelf and use the GPS on a well secured suction windscreen mount.

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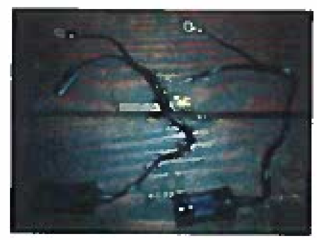
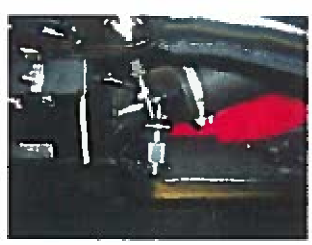


Next find the ignition controlled heater blower fan connection/ power source under the dash and near the heater controls. Remove the Lucas single connector and install a four way Lucas connector. Plug the new aux power outlet bullet connector into the Lucas four way connection. Attach the grounding wire onto the back of the fuel gauge mounting bracket or some other grounding source.

Lastly use a zip tie to attach the aux power outlet wires to the heater control panel cable allowing it to dangle over the parcel shelf.

Again be very careful that the devise does not ground out on any metal part of the car. It may also be advisable to add an inline fuse on the power source wire.



The Millers
"British Car Nuts"

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