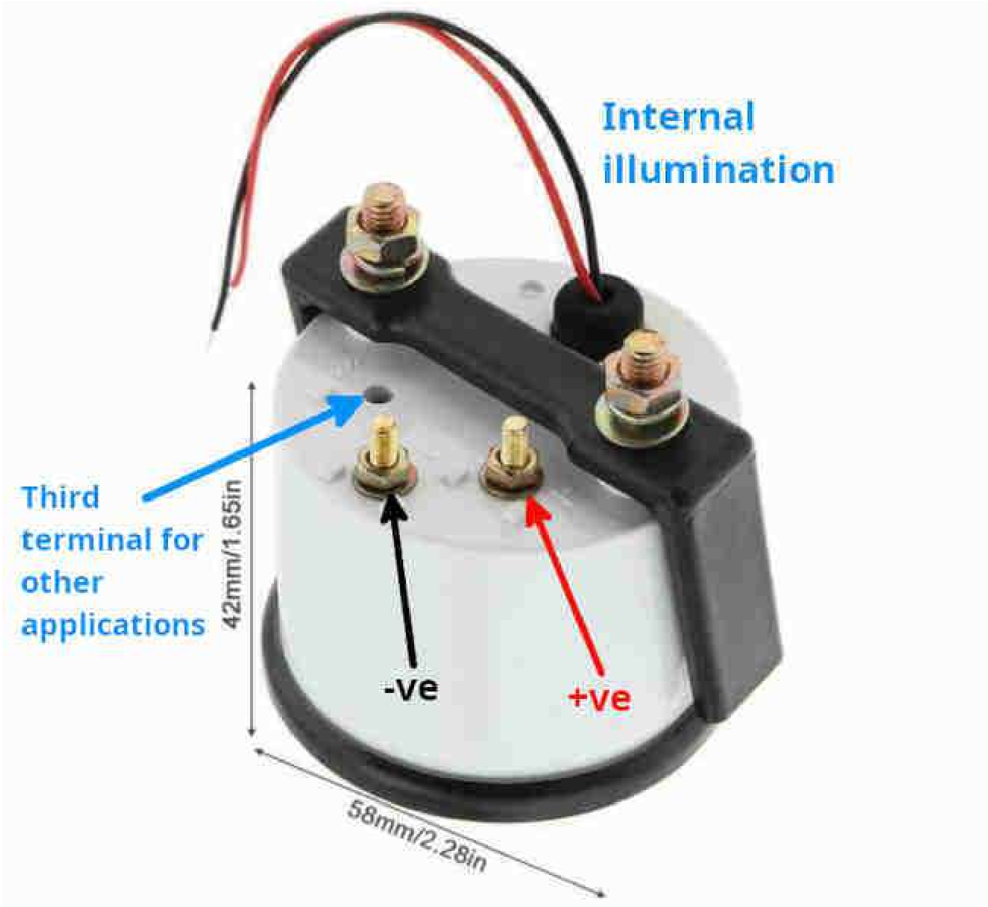
Voltmeters

This classic voltmeter has a coloured scale which is useful for showing at a glance if the voltage is in or out of limits. Up to 15.2v is shown as 'green' and dynamo-equipped cars can show this although an alternator should not get that high. At the lower end above 11.5v is also shows as green, but for me anything below 12v may be discharging the battery - subject to voltage differences between where you have picked up the 12v supply and the battery cable on the solenoid.

There are a few Smiths 'hanging pointer' (as above i.e. like the fuel gauge on pre-77 cars) volt meters around but they are very expensive being in the order of £50 plus. More common are 'upward pointer' types as here, they can be even more expensive from specialist shops but there are others in the £10-£15 range. This one has a less than ideal 10-14v 'good' range and a slightly compressed scale but can be lived with as I know what is good and what is bad! Interestingly these are described in some places as stepper-motor types that go up to the voltage quickly rather than slow-acting thermal like the fuel gauge on Mk2 cars. A sign of the times I suppose when components and assembly for that are cheaper than a bit of wire wrapped round a bi-metal strip! As well as 'pointing the wrong way' they only seem to be available with a black bezel, apart from some from India with a high P&P and a long lead-time. I was puzzled by a reference on one from Gorgeri to "When the white pointer stops running, remove the LED bulb from the rear and turn the white pointer a few times with a thin iron wire, then check." Analogue dials on up-market cars seem to wind round to max then back when you first turn on the ignition which I thought was just a gimmick. But it seems in some cases this is part of the calibration procedure as stepper motors can get out of ... well ... step and not show zero when off or the correct reading when on. I'm assuming these meters don't have that self-calibration feature so if they do get out of step one has to do it manually. We shall see, as I've ordered one!

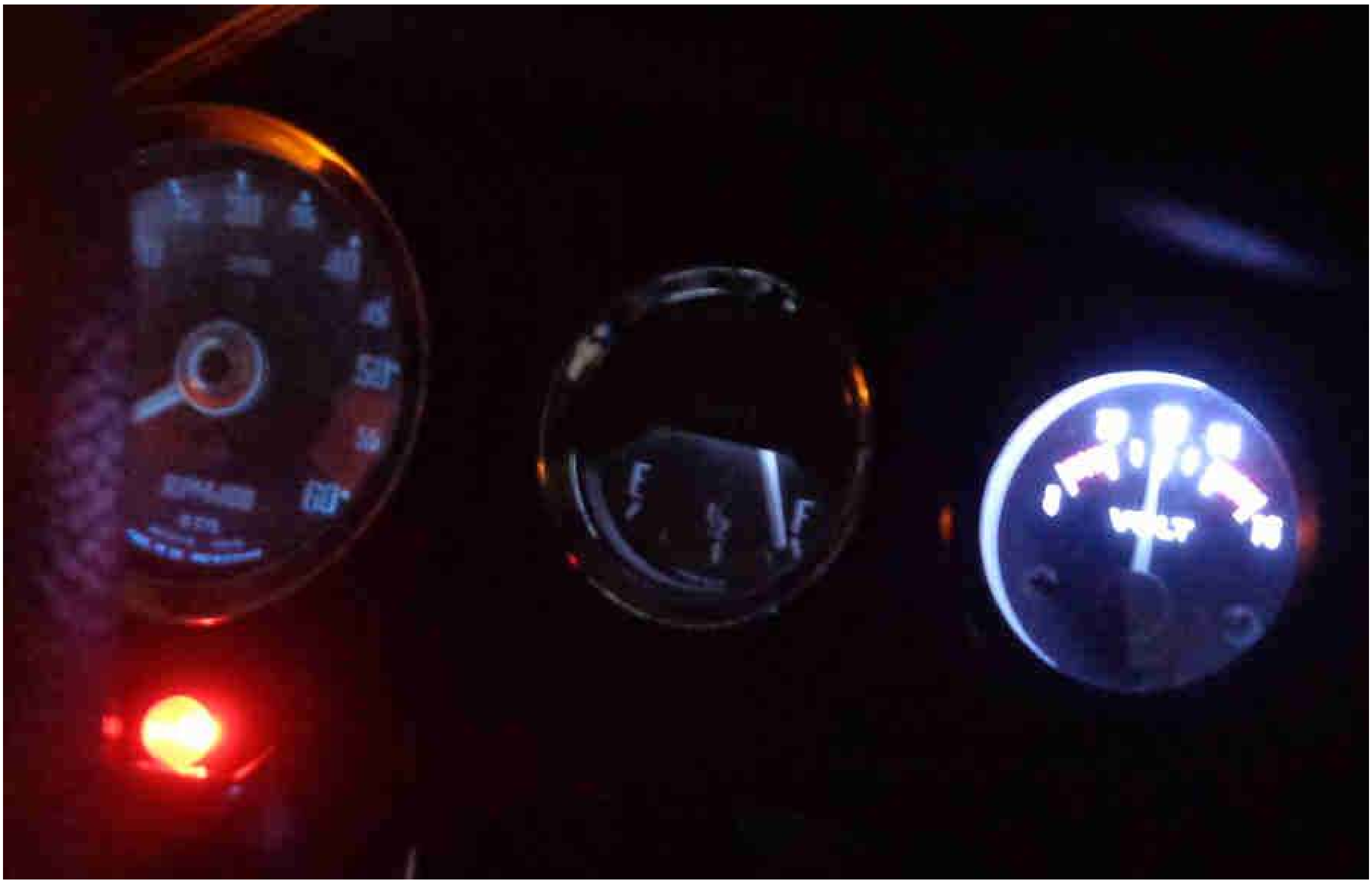
On arrival I did take the LED out but there was nothing to see except the back of the dial face, sticking an 'iron wire' in there could scratch the markings on the dial. There is a smaller hole lower down and initially I did think that would be for calibration but the other three applications (temp, oil pressure and fuel) have a third terminal there. Nothing about resetting on the instructions so that remains a bit of a mystery. It comes with additional plain and lockwashers and nuts for the terminals, you don't undo the ones shown here:



I tested the LED and the meter itself, the pointer rises quite rapidly on power application and falls similarly when power is removed. If it IS a stepper motor then the electronics must include a capacitor to hold enough charge to wind the needle back again when power is removed, and maybe that's why sometimes it can fail to completely wind back. The LED wires are very flimsy, I teed the earth connection with the earth supply for the meter into a through-hole connector on the case terminal to pick the earth up from the fuel gauge mounting bracket which is next to it. 12v is picked up from the fused ignition supply to the Smartscreen intermittent wiper control which is nearby, using a piggy-back spade connector.

Fortunately not too difficult to access where I will have mine on the V8 in a hole in the dash to the right of the fuel gauge (where the overdrive switch was on earlier cars) that a PO had cut for some ancillary gauge which I filled in although I was never happy with the result. Fitting was more of a fiddle than expected - I hope I don't have to remove it to reset the pointer! It uses a plastic U-bracket to secure it in the dash so I'm assuming that is why there are two studs on the case and holes in the bracket instead of just one. But that, together with the wires and in the restricted space behind the dash in that far corner, made it tricky to get the bracket onto both studs, and the plain washers, lock washers and nuts.

The instructions that came with the gauge show the LED connected to 12v and earth for all four applications (volts, fuel, temp and oil pressure) instead of the 12v coming from a dash illumination feed which means it will always be on with the ignition on. I've not connected that yet, it's very bright and I would need to add a resistor to tone it down to the level of the fuel gauge, and I rarely drive Vee at night:



Testing it comes up to 12v with the ignition on, drops a volt or two when cranking, then goes up to 14v when charging. Ignition on and charging is as expected, but dropping when cranking is useful as it will show up a weak battery or weak connections from it to the starter solenoid, so in this case does indicate the 'strength' of the battery:

Stepper-motor car voltmeter

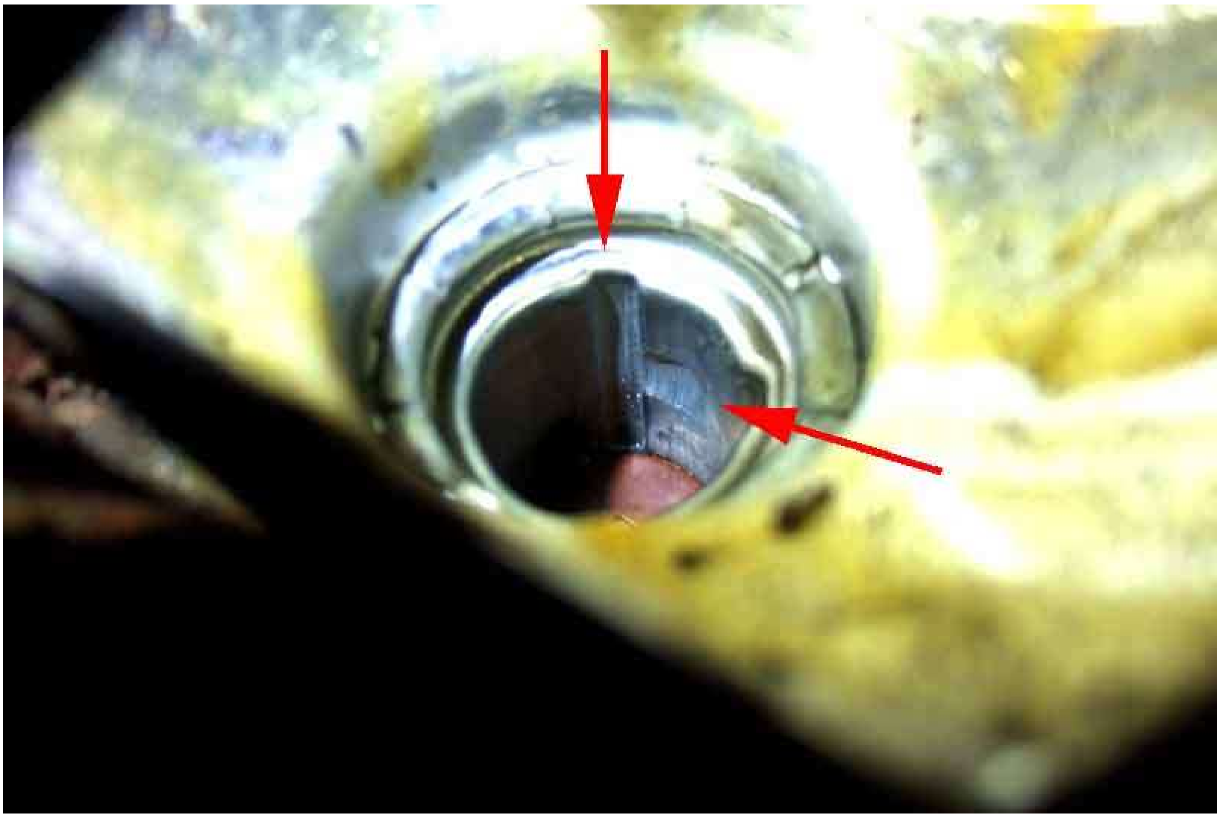
Not to be outdone (although the availability of this meter started it all off) Bee gets a digital:

Rear Light Cluster

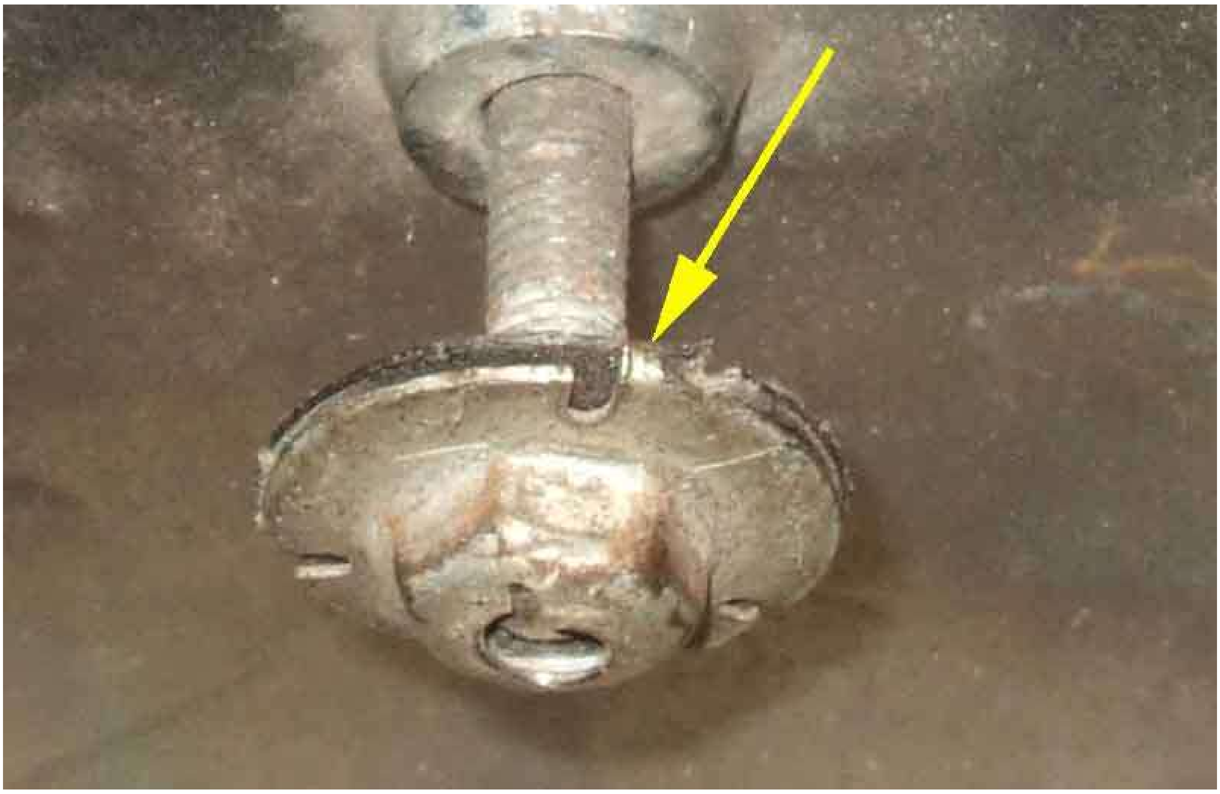
Rear light clusters can suffer from bad earth connections in three places. If only the dual filament circuits are affected then the problem is most likely between the bulb and the holder. Arrowed is the blob of solder at the top of the bulb base which can be used as a test point. If you see anything more than 0v here with the bulbs powered then there is a bad earth:

If, with the bulbs powered but not working as they should, you have an earth at point 'A' (test against a known good 12v source) then a bad connection between bulb and holder is the likely cause. However if point A shows any voltage, then the problem is more likely to be where the light unit is attached to the wing, but that should be affecting both bulbs i.e. all three filaments. This would show up as a voltage anywhere on the base of the light-unit 'B' and the ends of the fixing screws. I have heard of voltage being seen at A, but not at B, only the dual filament bulb was affected, and this was caused by a bad connection between the bulb holder and the base of the light unit. About the only thing you can do about that is solder a wire to A and terminate it under a nut on one of the fixing studs, on top of the standard 'nut':

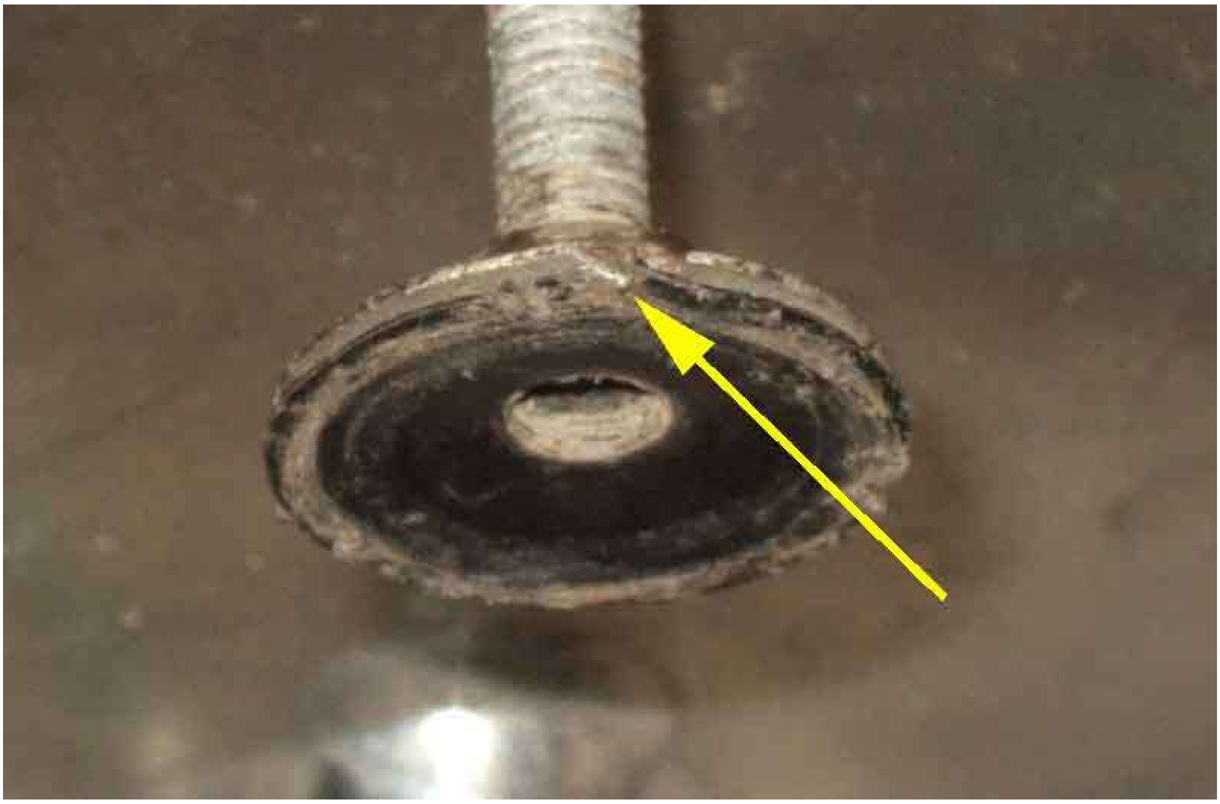
The dual-filament stop-tail bulb holder. The channel is deeper on one side than the other to accommodate the off-set pins that should exist on these bulbs to ensure they are installed the right way round:



The special pressed DOTLOC 'nut' BHA4242 that has spikes (arrowed, three on each) to make electrical connection to the wing:



Oddly, despite the spikes to cut though the paint (arrowed), there is a plastic washer on the back of the nut:



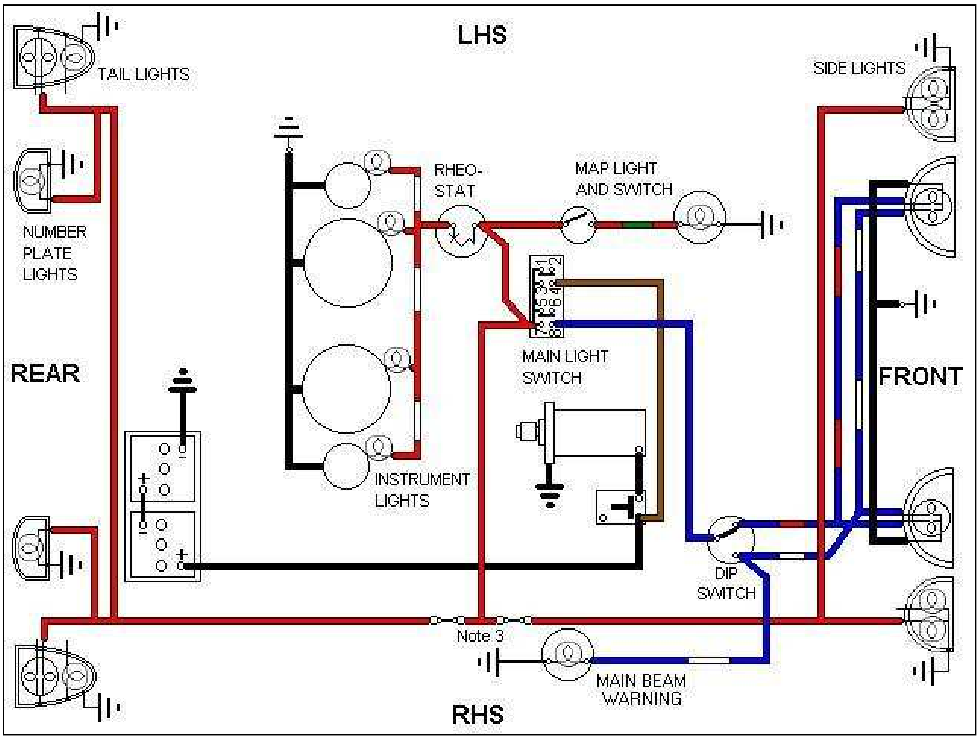
NLA from the usual suspects (but seeming available here) replaced typically by conventional nut NH911011 plus star washer WE702101. Take care not to overtighten the nut or you may pull the stud out of the light unit!

Main lights

[Head lights and parking lights Mk1 and Mk2 68 and 69](#) [Parking lights 1970-on](#) [Instruments](#) [Switch Connections](#)

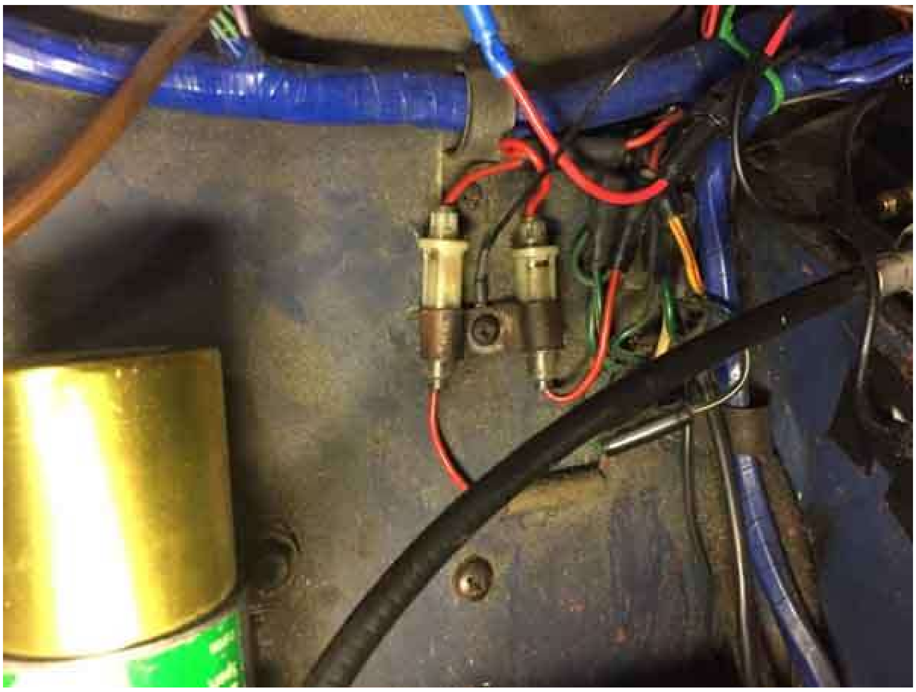
Head lights and parking lights Mk1 and Mk2 68 and 69

Hover over a wire to confirm the colour



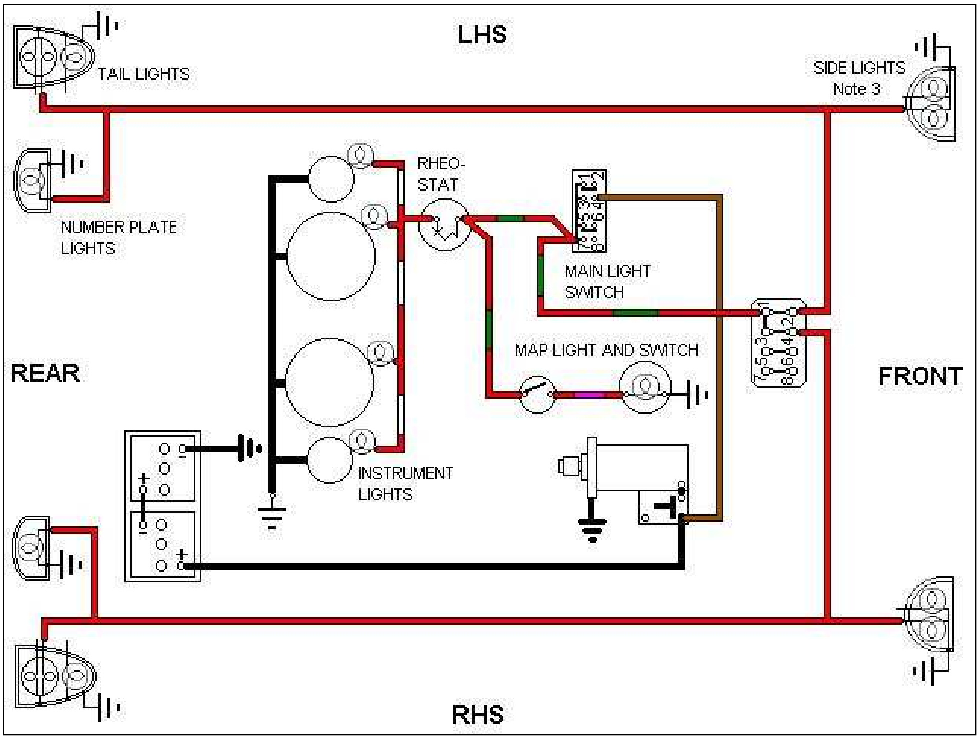
Notes:
1: Blue/white is main beam, blue/red is dipped beam.
2: Parking lights were unfused on Mk I cars.
3: Mk II cars for 68 and 69 had in-line 10A fuses for the parking lights (one for the front and one for the rear), fitted at the bullet connectors where the main and rear harnesses joined together.
4: Dip-switch moved from floor to column stalk for North America in 1968.
5: Mk1 cars had a map light available when the parking lights were on. Mk2 cars for 68 and 69 may have had a courtesy light operated from door switches as well as the map light.
6: Mk2 LHD cars up to 1971 have a panel light switch on the steering column in place of a rheostat on the dash.

The separate front and rear fuses for the parking lights in 68 and 69:



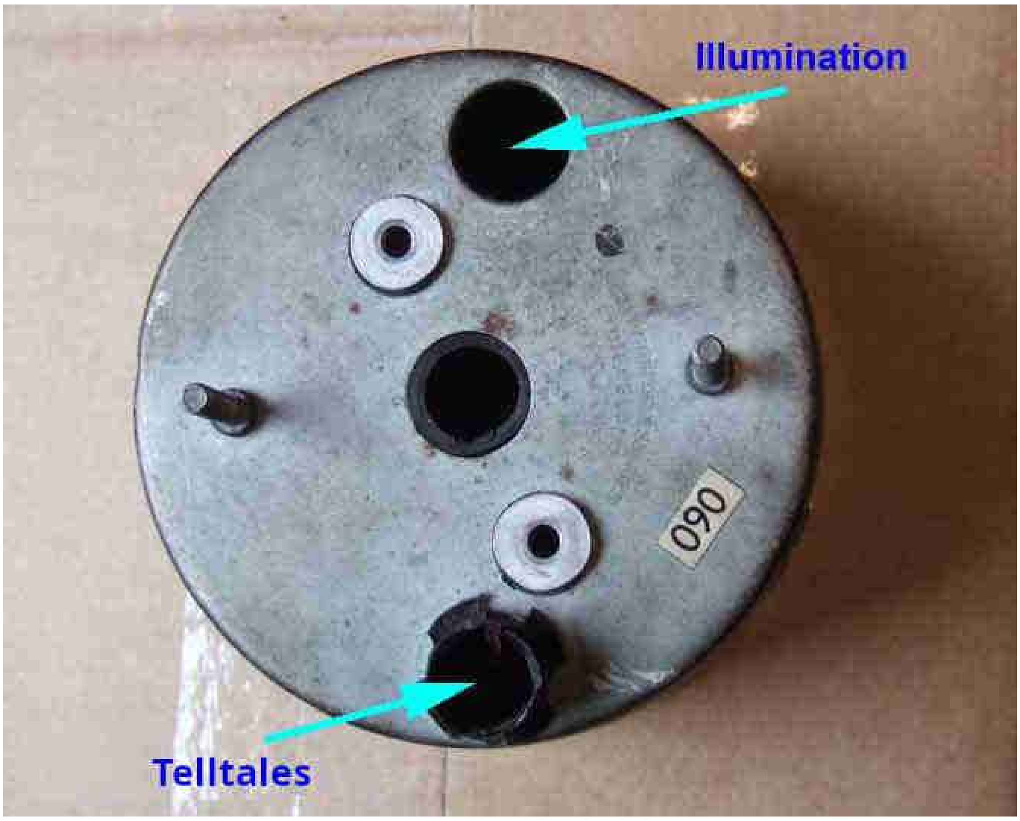
Parking lights 1970-on

Hover over a wire to confirm the colour



1. Headlamp and instrument light wiring is much the same as for earlier cars, except that the dip-switch has now moved to the column stalk for all markets.
2. From 1970 the parking lights were fused from the main fuse box, one fuse for each side. At least that was the intention, but with four separate connections to the fusebox they can be cross-connected so that one fuse feeds right front and left rear, and the other fuse left front and right rear.
3. Also from 1970 North America used a dual-filament 21w/6w bulb for the indicators and the parking lights behind an all-amber lens, and this continued with rubber bumpers.
4. 1970 (all) and 1971 (UK only) models may have had a courtesy light operated from the door switches as well as the map light and switch, now available all the time. After that all models had the courtesy light controlled from door switches only i.e. no map light.
5. 1971 models on had boot (roadster) and load-space (GT) courtesy lights.
6. 1970 LHD cars have a panel light switch on the steering column, reverting to a rheostat on the dash for 1971.
7. Rubber bumper models (and North American 1974 models with the split rear bumper) have the number plate lights mounted on the number plate backing plate and wired earths back to the bullets for the reversing lights.
8. RHD rubber bumper cars had the front parking lights inside the headlights and used the same wired earth, the indicators are mounted in the bumper and also have a wired earth. North American had dual filament bulbs behind an all-orange lens for both parking lights and indicators.
9. North American cars with side-marker lights therefore had three lamp units needing an earth on each side, and with the main harness having two earth wires by the right-hand headlight (one from the earthing point the other to the left-hand headlight) means there are five earth wires to be connected together by the right-hand headlight, and used a 6-way bullet connector. The left-hand side used a 4-way.
10. 1977 and later models have the main lighting switch on the steering column cowl.
11. 1977 and later models had dash switches (not the main lighting switch) and heater controls illuminated at night, together with the gauges, clock etc.

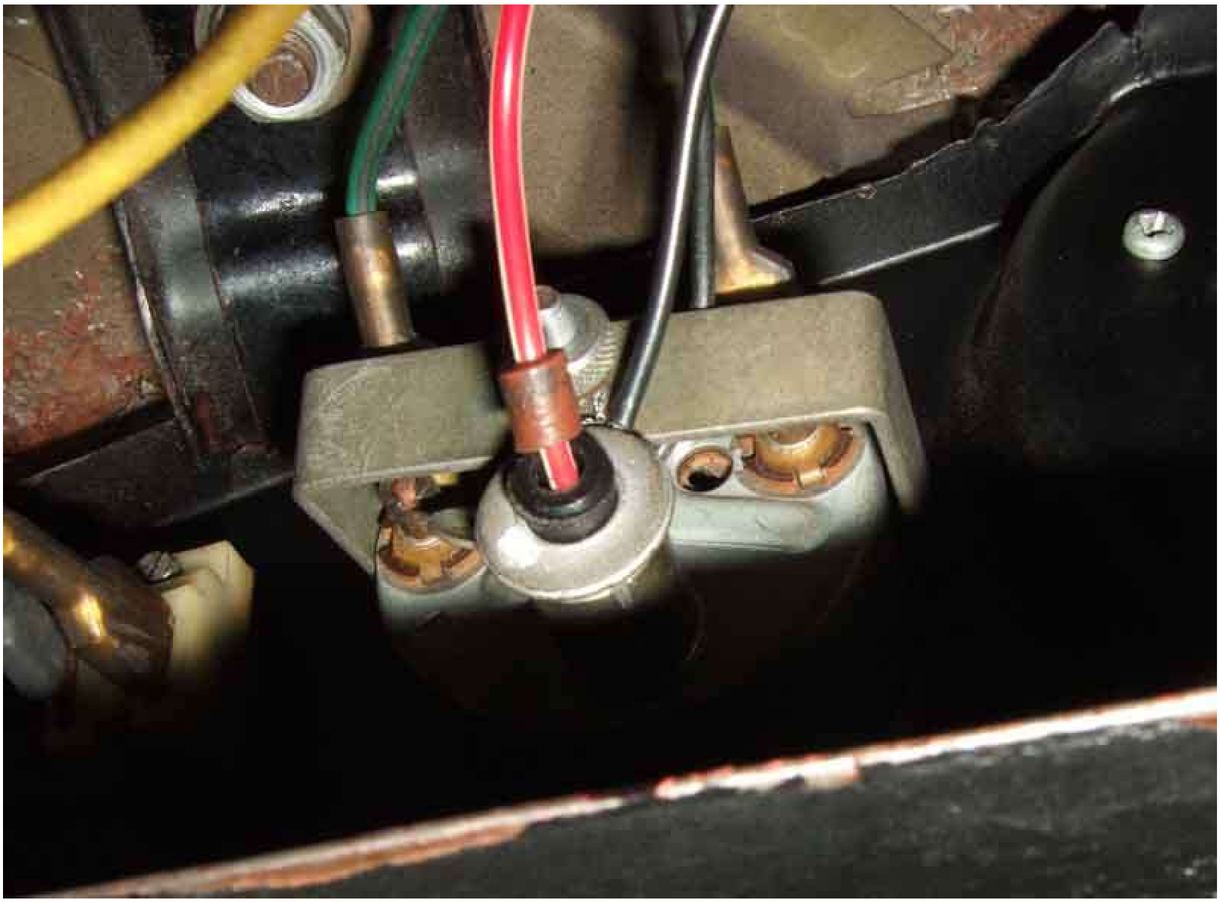
Instruments (in most cases) have a single red/white wire going to the bulb holder. The earth is picked up from the instrument case, there should be earth wires under the clamp screw or going to a spot-welded spade on the back of the case (later tachs). However a replacement harness came with two-wire plastic holders that took push-in wedge bulbs. UK CB tach and speedo have the illumination bulb at the top and the main-beam and ignition tell-tales at the bottom:



The illumination bulb holder is the claw type that can be difficult to remove and refit, the tell-tales have a cylindrical bulb-holder that pushes into a plastic sleeve, the front of which has the red and blue 'jewel' in the dial face.

UK RB speedo and tach only have illumination bulbs, speedo (as here) still at the top but tach now at the bottom. North American Mk2 are similar, details here:

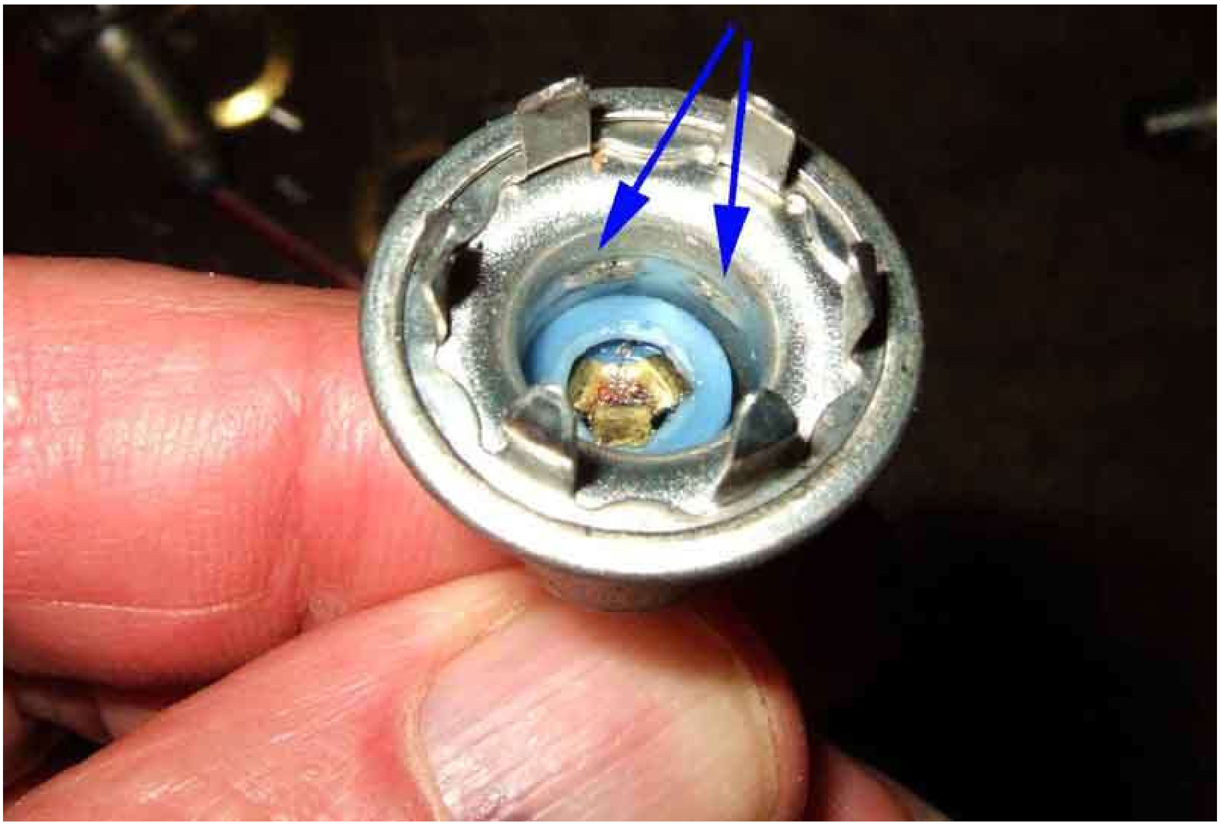
Fuel gauge and dual gauge are similar:



However a replacement harness for a 1980 came with holders for capless bulbs, which is probably what is shown here. These are plastic so have an earth wire as well as they cannot pick up an earth from the instrument case, which is now superfluous on all instruments except the tachometer: (*Mark Garrett*)

MES E10 (screw bulb) claw-type holder for 4" speedo and tach illumination:

Although these take a screw bulb the holder is not fully threaded but just has these two bumps on each side:

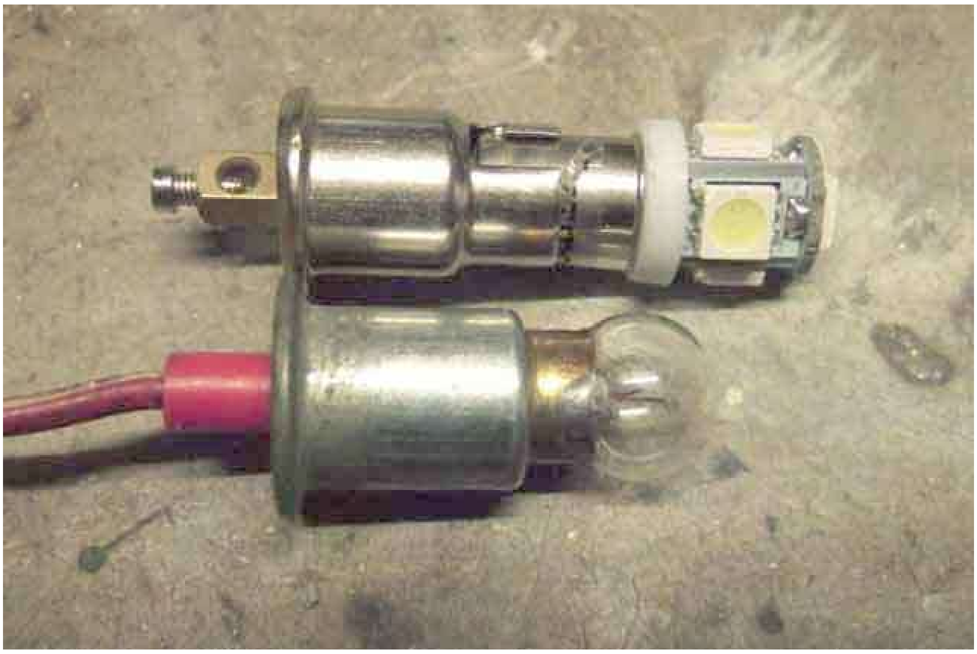


Visible as indentations on the outside. The claws make it a bit of a fiddle to screw the bulb in as you are pushing the centre contact of the holder back against spring-pressure as you screw the bulb in - this one is only partially fitted. If you hold the holder in one hand with the wire pulled back and gripped between the second, third and forth fingers and palm while pushing the holder forwards with thumb and fore-finger to retract the contact pad, the bulb screws in more easily:

MES E10 (screw bulb) tube-fitting for 80mm speedo and tach as well as fuel and dual gauges, easier to screw in than claw holders:

V8 and RB have slimmer warning light bulbs and holders, the fitting is a type of bayonet but the bulb can be fitted and removed by pushing and turning 90 degrees in either direction:

Alternative BA9 (bayonet) fitting (top) to replace tube-type when I was experimenting with LED illumination:

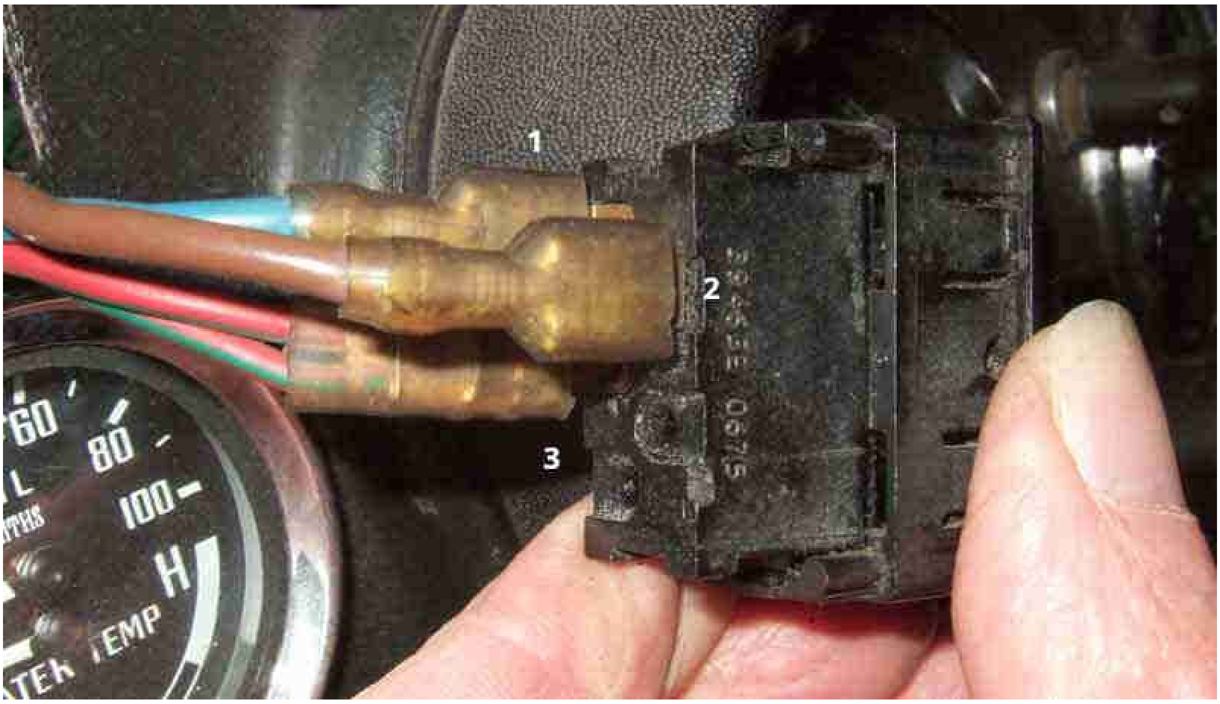


T10 (capless/wedge) holder as received on a replacement harness for a 1980:

Switch Connections:

Push-pull and toggle switches - Brown to 4, Red to 7, Blue to 8: (*Car Builder Solutions*)

Rocker switch - Blue to 1, Brown to 2, Red/Green to 3:



Cowl-mounted toggle switch 77 and later - connections as above: ([Moss Europe]())

Clocks - after-market

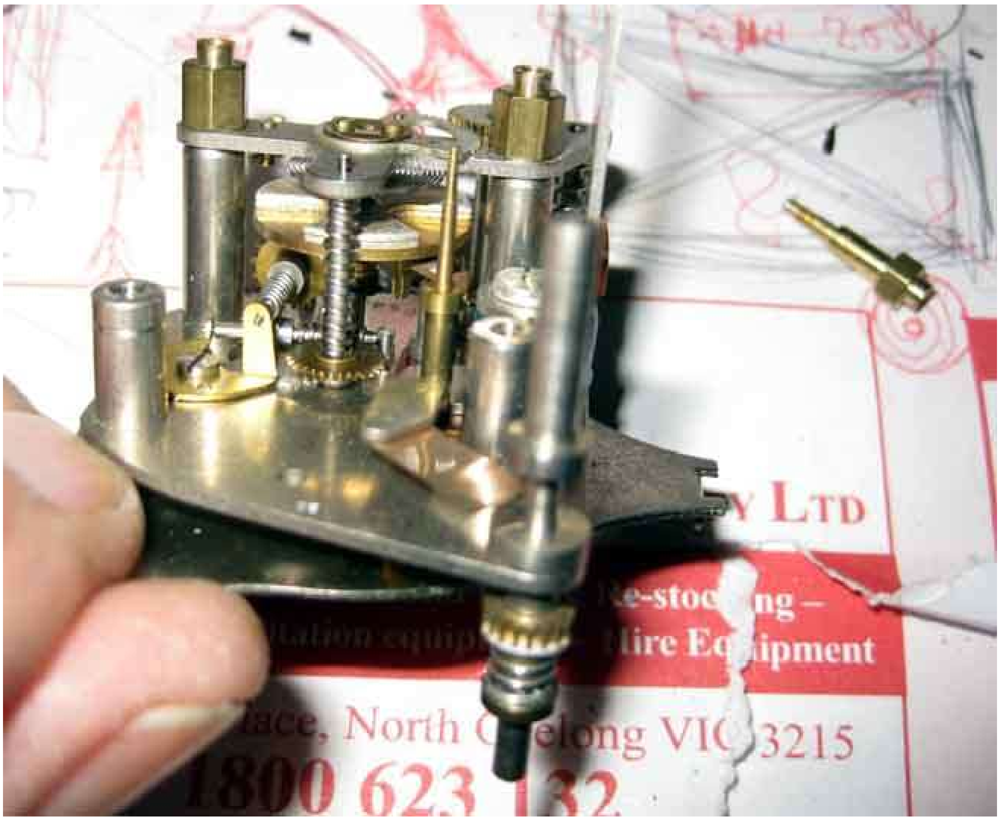
Vee's clock, added by a PO

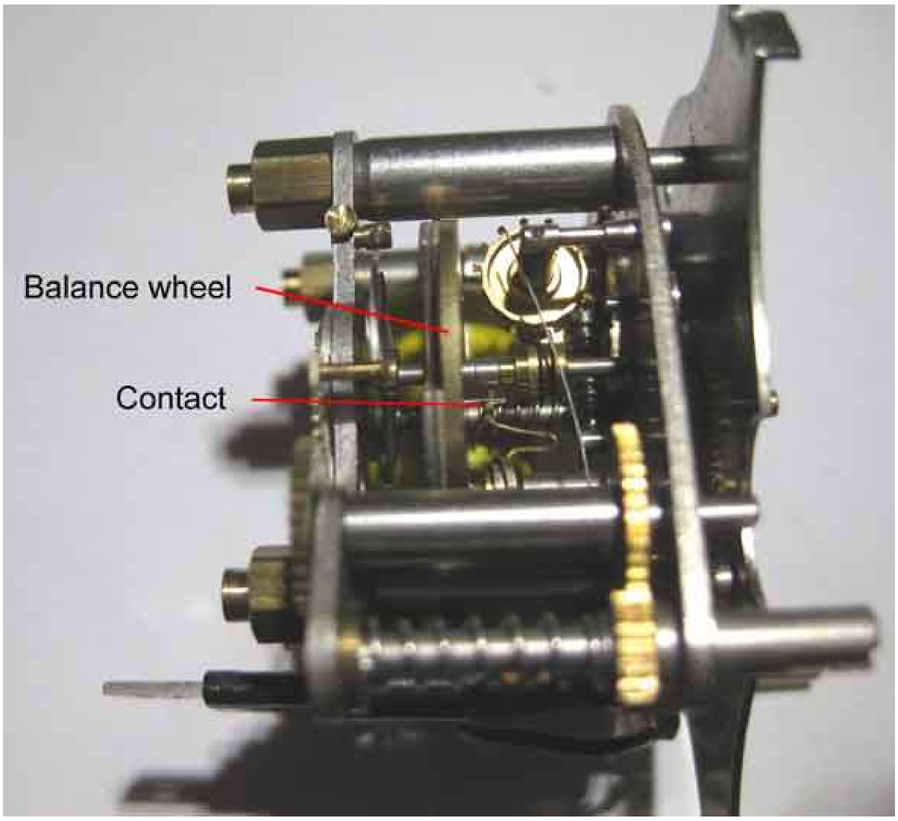
For Bee a watch insert and holder ...

... slots into the her lighter socket. The hands are reflective and being low down often one or another hand was reflecting something dark which meant I couldn't see the hands. So I hit on the idea of a thin coat of Snopake on each hand, which meant I could see them clearly. However the flaw in that argument was that having done the second hand I couldn't tell that from the minute hand until it moved at one second intervals! So cleaned the Snopake off the second hand and it's unambiguous now.

For interest - a classic clock used by Rootes Group and possibly Rover, sent to me by Herb Adler in Oz:


MEDICAL SUPPLIES


LTD



A commentary on this clock by the late Graham Robinson, Hillman Owners Club of Australia, a can be found here.

ZS180 bits

Last updated 22-Dec-2023

27th July 2020: A sad day, I sell the ZS.

It was a real wrench to hear someone else start it up and drive it away, but still a glorious sound from the engine and exhaust. Unfortunately it did have to go as it was needing more time and effort to find and fit parts now it is fifteen years old and a classic in its own right. I need at least one car that needs minimal attention year on year, and for that reason it has been replaced by a Golf. I don't have the space to keep the ZS as well as it has lived outside the twelve years I have had it, getting either of the MGBs out of the garage was a bit of a 'missing square puzzle', and with four cars both the ZS and the Golf would be used even less than the ZS has been. The ad only appeared on Car and Classic late Saturday or early Sunday and on Sunday night when my phone was in 'quiet hours' and doesn't ring the same chap rang eight times. Ed also sent me an email, and phoned again on Monday morning. Drove up from Gloucester with a transporter mid-day, and bought it without driving it. He said he wanted one to restore and obviously knew what he was talking about so I was happy to accept his offer to go to 'a good home'. It was a brilliant car to drive, I shall miss it.

Postscript: I've never been a fan of Elvis and only came across 'Always on my mind' from the Pet Shop Boys, but the lyrics are applicable even though it's 'only' a car. It suddenly struck me that although I enjoyed driving the ZS I did really only drive it when we couldn't use either of the MGBs for any reason. In my mind the ZS was a 'long term' car just like the MGBs, and 'We have all the time in the world'. But of course we didn't, and I wish now I had driven it more, particularly on wet Sunday mornings to get the paper when instead of just going to the shop and back I could have made more of a trip of it, like I do with the MGBs. 'Use it or lose it'.

Get a birth certificate for your MG Rover ZR/ZS/ZT. There seem to be at least two options - one from the MGOC which has limited information, and another from MG-Rover.org which is more comprehensive. For my car the latter tells me:

- This vehicle was the 23,358th ZS to run off the production line, out of 27,514
- This vehicle was the 6,267th ZS 180 to be made out of 6,876
- This vehicle was the 239th ZS in Mica Blue (Ignition) (code: JGY) to be made out of 999 Mica Blue (Ignition) ZSs
- It came off the assembly line on Thursday, 19th August 2004 @ 00:17:46 and was sold on 1st September 2004.

This cropped up on the MGOC forum recently and another owner chimed in to say his ZS180 was only 20 cars away from mine, so practically siblings.

There is also the 'How many left' web site which gets its data from the DVLA database, but that has to be treated with caution. Searching on 'MG ZS' gets a list of many variants including 'V6', which shows only 61 left on the road as of Q1 2019 plus 44 on SORN. However it shows the peak as 154 cars in Q4 2006, and none before 2004 which is obviously wrong, given that the MG-Rover site says there were 6,876 ZS 180s made from 2001 to 2005, so the vast majority of those must be registered under a different description. Adding up the peak numbers for all those ZS variants (excluding the Chinese cars from 2016 on) I get to 20,496, whereas MG-Rover above says there were 27,514. So 7,000 short, most of which seem to be the ZS 180 which is 6,722 short. However Roger Parker tells me that 5563 ZS were exported, many of which were 180s so wouldn't appear on the DVLA record, but that still leaves over 1000 cars 'missing'.

Nevertheless, the DVLA figure of 61 probably does represent how many face-lift ZS 180s are left on the road.

The_Car Aerial Air-con Battery Body Bonnet_and_Boot_Badges Brakes Bumper_Damage Cambelt_Change Central_Locking Cooling_System Crankcase_Ventilation Dipstick_Tube Electric_Windows Exhaust Headlights Heated_Rear_Window Horns Idle_Control Key_Fob MP3_Player Mud_Flaps Oil_Level Servicing Starter_Motor Sun_Strip Suspension Variable_Intake_System Wheels_and_Tyres

The Car

Bought just after it's first MOT i.e. at three years old in autumn 2007. Four-door version, which was my preference over the hatch-back five-door. Despite my age I really did have to suppress a big grin when taking it out for the first time. Ironically it was to pick up a re-spoked chrome wire wheel for the roadster. A bit annoyed to get there (60 mile round trip) as agreed with the repairer to find no sign of him, despite hanging around for half-an-hour. Ordinarily a trip in an MG is a worthy event it its own right, and all it means is that I'll have to go again. But I was really annoyed to pick a massive 'star' chip right in the middle of the screen while on the motorway (from a car alongside, there was no one in front of me), although hopefully it can be invisibly repaired by one of the specialists (I didn't bother, and now it has gone milky as well, so may need the whole screen replacing before the MOT). PS it didn't, whilst the damage **is** probably just over the maximum size allowed of 10mm in Zone A in front of the driver, this is well outside that zone and the maximum size allowed is 40mm.

2.5 litre V6 engine. 175 bhp, 177 ft lb, 0-60 7.3s, 139 mph, MPG: Urban 20.0; Extra Urban 41.1; Combined 29.7. CO2 227 gm/km. This engine is actually more economical and cleaner than the 2.0 litre straight four, as well as being more powerful of course.

One year on: Unfortunately our illustrious chancellor in the 2008 budget has seen fit to raise the car tax from £210 to £415 in the interests of ecology. The annoying thing is that I could have a Bentley, Ferrari, Aston, or even a Hummer and only pay £25 more! And what price the resale value now, let alone the insurance valuation?

The 04/05 face-lift version has the more purposeful front styling.

'Shark-gills' reminiscent of the SV, and 17 inch alloys with 205/45 R17 88 W tyres, good lookers but oh so easy to kerb. These Mk2 11-spoke wheels have 7.5" rims, the Mk1 cars used 7" (from Ralph Gadsby). Someone had commented that this combination looks 'under-tyred', and indeed mine do look as if the tyre wall is having to lean out to reach the wheel rim, a straight-edge laid across the wheel is resting on the rim, even though there is a rib of a few mm on the tyre wall. No wonder they are easy to kerb. However the advice is (Ralph again) that 215s are the widest that should be used if they

aren't to roll off the rims under heavy cornering, and they should be 40 profile to maintain the rolling circumference and speedo accuracy.
One year on: I suddenly noticed the right front tyre looked a bit flat, and found it well down at about 15psi! After that I kept an eye on it and found it was losing a few psi per week. Took the wheel off and rolled it down the drive looking very closely for a nail or anything but found nothing, and at that rate of loss dunking it in a bath of water wasn't going to be easy to find it either. Then at the MOT the tester noted 'nail in right front tyre' so I though he must have good eyesight. Took the wheel off again, and immediately noticed a huge silver screw in the middle of the tread sticking out like a, well, huge silver screw in the middle of the tread! Pulled it out and it was only in 1/2" but had obviously been there some time. Dribbled some water into the hole and waited ... and waited ... and eventually after several minutes a tiny bubble of air popped out, and continued to do so once every several minutes. So that **is** leaking, the question is whether it is the only leak and somehow I missed that screw when I looked last time, or whether it is another more recent leak and the original remains, I don't know. Had it repaired (£17) and whilst the tyre was off the repairer showed me the paint bubbling up on the inner rim which he had to scrape off and repaint to get a good seal. He said MG Rover wheels are the worst for corrosion as they only paid for a minimal coat of paint. He said his scraping and repainting would give a good seal for a very long time now, but when left they eventually start leaking, so that could have been my original non-screw leak. Time will tell.
February 2009: That front tyre repair has been fine, but now I find the left rear is going down. Not consistently like the other, it can lose nothing over two weeks, then suddenly go almost completely flat on a journey of just a couple of miles. Seems unlikely to be a puncture, I suspect inner rim corrosion as mentioned by the tyre chap when repairing the front. But a friend suggested checking the valve first, screwed in very tight so I settled for depressing it as far as I could and letting a good blast of air out, then pumping back up. Since when it seems to have been OK ... Two 'punctures' on the ZS in a few months when I have only had one each on the other MGs over the previous 20 years is most odd though. Subsequently, probably is rim corrosion as I found it completely flat after a bit of exuberant driving, which may well have affected the seal of the bead to a corroded rim.

Improved styling of the dash on the face-lift model, which was the only thing I actively disliked on the original model, it being virtually unchanged from the 'Honda' Rover 45 style.
One year on: However I don't like the pull-pull dip-switch arrangement, when you want to flash the headlights unless you are very careful you also change the beam, so you have to flash them again to switch the beam back again. Why they fiddle with these things I just do not know, what could be simpler than the MGB arrangement? Still, it doesn't have the same arrangement for the indicators, thank goodness, I've driven a BMW with those and they are awful.

One year on: One drawback I soon found is with the horn buttons. These are small, so a finger or thumb has to be precisely placed to operate it, and on the wheel but nearer the rim than the centre, and also quite low down. Holding the wheel in the correct '10 to 2' position one's fingers and thumbs are several inches away from the buttons, and as the buttons move position as the wheel is turned one has to look to see where they are before you can sound the horn! Hardly ideal in an emergency when you need an 'audible warning of approach', not much better as a 'rebuke'.

Rather heavy rear treatment, this was the only thing I was doubtful about on the face-lift model, but I got used to it very quickly. The boot lid has a small lip spoiler, just visible in this picture, in preference to the much larger standard and outrageous optional 'bed tray' versions on the original model. The problem with this bootlid is that you can't see it from the drivers seat, even in the rear view mirror, so have to guess how long the car is, I may invest in an audible reversing aid, possibly just a fresnel lens to stick in the rear window.

Aerial

March 2017: The radio never had good reception - Radio WM for example fading out half-way between Birmingham and Coventry about a dozen miles. I'd wondered about the aerial as it was fairly floppy, bending near the base. It looked like the 'whip' part should unscrew from the mounting on the roof, but a fairly firm attempt at unscrewing it didn't shift it, so I left it as we listen to MP3 more than radio. Then I noticed it had become much floppier, what looked like a black plastic sheath around the 'whip' having split near the base so that it was only hanging on by a thread. Research confirmed it did screw in, and they were available from Rimmers at £15 (possibly cheaper elsewhere but longer, and maybe generic options) so I ordered one. When it arrived it was obviously much stiffer than mine ever was, and seemed to be a fibre-glass rod with the black plastic sheath, so must have a wire up the middle. I suspect my fibre-glass rod had broken (before my time, perhaps in a car wash) which had then broken the wire, and it was only the sheath holding things together. I'll have to shift it now, sprayed a bit of Shock and Unlock on the join, I was surprised how easily it came undone with grips, and it was moments work to screw the new one in. Tremendous improvement in reception - said WM now lasts all the way to the end of the M6 - well over 35 miles.

Electric Windows *January 2020*

Been using the ZS more lately, and in and out of car parks with barrier ticket machines, and one day I noticed the driver's window didn't go down with the 'one-touch' switch as far as it usually did, but did struggle down a bit further when I operated the switch a bit more. Then I noticed that the inner rubber seal had been doubled over near the front. Up and down again but this time holding the seal out of the way and the window went down normally.

Started looking for something to stop the seal sticking to the glass. Of course silicone spray came up, although for the channels, not the seal. Then I came across a recommendation for a German product called Sonax Gummi Pflege which is primarily intended to dress door and seals to stop them sticking in icy conditions, with a couple of mentions of weather stripping. Bought some, and the tube and the stuff inside is just like Pritt Stick ... and then I started wondering if 'Gummi' was German for adhesive! But it spreads over the seals, and can be rubbed in without a trace of stickiness. I subsequently see that the literal translation of 'gummi pflege' is 'rubber maintenance', so I'll see how it goes. Rubbed some on the boot seal as well as the lid usually sticks down when opened with the cabin lever or remote, and see how that goes as well.

Exhaust

The PO fitted a 'dustbin' rear silencer and tail pipe which is a bit too 'blue neon washer jet' for my taste (in the flesh it is more 'in yer face' than it appears in this picture), but the original came with the car so I shall retro-fit it and maybe be able to sell the other one (I tried removing it but I need more room under the car to swing my breaker bar to undo the bolts so I've left it for the time being).

June 2020: The middle section needs replacing again having crumbled at the flange for the rear box, when I was trying to remove that to replace the ARB bushes that side! Initially I was a bit peeved as it didn't seem long since it was done, but I see it was 2014 so six years isn't bad I suppose, and I dare say it wouldn't have failed had I used the air-gun on it instead of a socket. Gave up on the middle to back cat connection as I didn't want to do the same thing, so entrusted it to Cranmore Garage to see if they could shift it without collateral damage. In which case I'd get the exhaust done, get it back to do the calipers, then back to Cranmore for another MOT, otherwise scrap it there and then. They did get it off quite easily as it turned out, so ordered all the stuff. Exhaust was a pain with it taking longer than advertised, then forgetting to send the gaskets, then when told about that they sent them and another exhaust!

Cranmore fitted it but said the hangers on the new section were about an inch out, which has pulled the rear section to one side and the tail pipe is very close to the cut-out in the rear bumper.

June 2019: Fails the MOT on the back box leaking: 'Major - repair immediately", together with a list of advisories. I knew it would fail (although not on this as usually you can hear a blowing exhaust) as for some reason I was reluctant to make the appointment at the beginning of the '30 days in advance'. Then a few days later I got a phone call to say their MOT hoist had been condemned and they couldn't do it for two weeks! By this time I'd paid, but I did ponder getting it moved to another branch but dismissed that, and my sense that it was going to fail was reinforced. Back to the fail, and Halfords proceeded to give me my options including scrapping it (!) or taking it somewhere else to get it fixed, but stated that a fail immediately cancelled the existing MOT (which still had a week to run), and if I drove it I could be picked up by ANPR cameras and fined, and my insurance would be invalid, which started the second saga.

I did opt to leave it, but primarily because of the difficulty of getting parts for these cars now (only 66 still taxed as of the end of 2018), which was what I did when I had the central section replaced a while ago, also that if another part was a problem I didn't want to replace just the back box, then bring it back for a retest only for it to fail again. They said they would let me know - this was at 10:30. Nothing by 4pm so I called them, so be told they had taken the back box off and got a replacement! In addition to starting the work without advising me or getting my agreement, they had received the wrong item (too short, so it was one for the hatch and not the saloon which is longer). They expected to get the correct replacement next morning by 11:30 and would let me know. I played my face about not being kept informed and he said they would do the job at cost - £135, which was OK as far as the job went, but still left the 'you can't drive it' statement outstanding. Next day 12:30 comes and goes with no phone call, so I call them to be told it is done and they were just doing the paperwork - another failure to keep me informed. Collect the car, and ask again about his statement regarding the existing MOT, and he is adamant. But subsequent research shows he is telling porkies. So another complaint to head office about what could be construed as lies to get work, and they reduce the charge by a further 50%. I accept that, but it leaves a nasty taste considering I've been using them for multiple cars for 30 years or more, and I decide to take the V8 to another place nearby. I'll see how I feel for the next round of MOTs.

Looking at the new back box it was immediately obvious that it didn't come back quite so far as the old one - barely reaching the trim round the aperture in the bumper. I did wonder whether they had fitted the shorter one with a spacer at the flange, but no. Then when I looked inside the tail-pipe I could see there was a 'chisel' end inside, with an extension piece bolted on, like a tail-pipe trim! Now whether the exhaust came like that, or whether Halfords couldn't get the longer one and decided to add the trim (they don't stock this design online) remains to be seen.

April 2018:

While working on the right rear caliper I noticed the exhaust waggled more than I expected, looked underneath and found the rear hanger rubber broken. Called in at Halfords and got another one of theirs for 91 and later Escort - and it's significantly bigger than the one that has come off! So much so that once on the box bar it doesn't want to point upwards to go on the body bar. The previous one was OK with the after-market box, so it looks like when I had the original box refitted in 2014 Halfords replaced it with the correct item, in which case it's not lasted very well. Do a bit of research and although Rimmers don't list one for the ZS 180, several other places say it is DBP7104 which is the same as for the other MG Rover models on the Rimmer site, and also for many other marques and models, so I order one from a Land Rover site which are showing several pounds cheaper than MG sites. Along the way I spotted this hanger for Fiat and Alpha - with a reinforcing band round the outside, so I'm thinking of doing the same with a cable-tie. Fit the rubber to the long bar on the box, jack up the box so the upper hole is in line with the body bar, and it goes on quite easily despite the corrosion on the box bar. Still jacked up to take a bit of stretch out of the rubber, I fit a cable tie round the rubber which takes some of the load. A cable tie on its own (as it came to me) resulted in a surprising amount of noise and harshness, I'll soon see if this adds any (it doesn't).

February 2014: No further problems with exhaust mountings, but other work needed. The original insurance company had no qualms about the modified exhaust, but renewing online elsewhere for a £100 saving there were no questions on the form but perusing the documentation subsequently I noticed a statement about modifications that was pre-filled with 'None'. Rang the company and told them, and they wanted to know how much BHP it added. I said I didn't know, and they suggested I ring the previous owner! I told them I'd had the car six years, and they asked what previous insurance companies had done about it. I told them they had been fine with it, but they insisted on knowing the BHP. I couldn't find out what make it was, and vendors of other after-market systems wouldn't say, saying it depended on all sorts of factors including fuel grade, and even the weather! I made some enquiries about putting it on a rolling road, at about £80, but had no guarantee the insurance company would accept that. It's going to be easier just to replace the back box with the original. Get under the car to start that, and find the nuts between middle and back sections heavily corroded so will need cutting off. Also whereas the original back box has welded studs facing forwards, the middle section appears to have studs facing backwards! And going by the nuts the studs would be equally as bad, so I'd have to cut them off and drill them out, and use nuts and bolts. So maybe it had been a 'cat back' enhancement i.e. both middle and back sections. Another factor is that been aware of a slight blow near the middle of the car for a while, and I found a very small hole in the centre box. No point in swapping the back box without replacing the centre section. But as the weather has been lousy lately, and it would need the ZS up on the ramp i.e. the two MGBs outside, I decided to have someone else do it.

Halfords quoted me £120, I could have got it cheaper at Sh*tFit but wouldn't trust them not to wreck the very expensive cat section, so had it done at Halfords, including swapping the rear boxes. I had the after-market rear box back, with a view to eBay-ing it, but the flange was so heavily corroded even though the rest of the system was pretty-well pristine stainless, I just junked it.

March 2009: The exhaust knocked in slow-speed manoeuvres over dropped kerbs and sleeping policemen right from the start. I did get underneath soon after purchase to see if there was anything I could do, and found a cable tie on the rear support for the back box, even though the proper rubber one was fitted to the body pin. So I removed the cable tie and fitted the rubber, but if anything the knocking was slightly worse, and was probably why the cable tie was there! However whereas before there had been noticeable NVH (Noise, Vibration and Harshness) it had now gone so that was a benefit. I've lived with the knocking for some time now, but with the onset of spring and warmer weather I decided I had to do something about it. If I waggled the tail pipe it knocked up and down as well as side to side, but with a different noise. Getting underneath I discovered the pipe leading into the back box was knocking on the anti-roll bar in side to side movement, but in up and down it was the tail pipe knocking on the bumper trim. I also noticed the refitted rubber support had split one side, so that would need replacing anyway. Down to Halfords to see what they had on the shelf, and they only had one of that style, for a 91 and later Ford Escort. Same distance between mounting holes, same profile, but about 50% thicker. Less than £2 so worth a go. Wondered if the extra thickness would make fitting much harder, but it hardly did at all. I don't know whether the Rover mounts are softer, or mine had gone soft even when I refitted it, but with the new mount the rear box is held much firmer, not hitting either anti-roll bar or bumper. As ever, time will tell.

Air-con

One year on: I was quite excited to get climate control, but it has been a pain. Not only does the system seem to take a long time to warm up - longer than either of the Bs - but once it does so it pumps out masses of hot air until the cabin sensor wakes up to turn it back down again, so you have to turn the heat down manually or you boil. And once it thinks the temperature is right, it switches the air from the footwell vents and screen to just the face-level vents, so your feet get cold. So you manually select footwell, which makes things better for a bit, but then they get cold again so you turn the heat back up again, then the upper part of the cabin gets very warm but your feet are still cold! In spring and autumn it can get very stuffy, I'm finding it difficult to get the face-level vents adjusted to get some air without a draught, and when the blower cuts in with the vents only partly open it is very noisy. When you do get it right, next time you use the car everything is set wrong and you get cold air blown onto your feet when you start off, so you have to switch everything back to auto again. I don't know about automatic - there are 11 buttons to fiddle with and four vents. I'd rather have the sunroof and conventional heater with just two rotary controls and one switch like in the V8. The chiller in summer is nice, but when the weather changes between hot and cool I have to keep opening and closing the face-level vents as they are too draughty when fully open in cool weather but don't cool the car properly unless fully open in hot weather. Eventually the trick seems to be to open the vents fully (which makes them quieter) but angle the outer ones to the windows and the centre ones to the roof so you aren't sitting in a blast. That may also control the temperature better, but the weather is warmer at the moment needing a bit of chilling from time to time and fully automatic with the vents adjusted as described seems to be OK. I'll wait to see what happens in the autumn when we start needing a bit of heat again.

February 2009: Leaving all the dash vents open but angled away from the occupants seems to have done the trick - mostly. Warms up quicker now, and copes with varying outside temperatures from below freezing to needing the chiller better. But the cabin still gets over-warm to begin with, and on a long run in cold weather it seems to get too cool so one has to up the temperature a degree or two. But overall much better than before, I rarely have to touch anything but the demister button. One spectacularly illogical feature concerns the outside temperature, displayed by pushing a button. The display can show both internal and external temperatures in degrees C or F, and to switch between them you hold a 'temperature' button down for a second. Wouldn't you think this would be the button to switch between internal and external temperatures as well? Oh no - you have to use the demister button!

2018: After eleven years I think I may have cracked it! As well as setting the air flow manually to body, feet, body & face or screen, and the fan speed above or below what the computer thinks is appropriate, there is an 'Auto' button that sets everything back to 'normal', and for direction this is body & face and computer controlled speed. But I've discovered that if I set the direction manually to feet, the temperature sensor 'warms up' much quicker to turn the heat down after starting off, and one's feet don't get cold after running for some time. Only discovered in late Spring, so I'll see what happens over winter.

June 2014: Had the car 7 years now, and the air-con has gradually become less effective over that time. In good weather we are usually using the MGBs, so are well used to being very warm, so for both those reasons it wasn't something I really noticed. However it occurred to me that it probably wasn't a very good idea to let it run out of fluid, if that wasn't good for the system.

I investigated various options - companies large and small, as well as DIY kits, also scanned forum posts. Now the summer is upon us (in season if not weather) companies that were charging £25 or so in winter are charging £49 or more. DIY kits just add more fluid, but by the time you have bought a bottle plus the gauge and connector you are talking about the same money. The other problem with those is that they don't check for leaks, don't add leak detection fluid, and they don't add fluid by weight which is what you are supposed to do, and adding fluid to a pressure reading you can end up with too much or nowhere near enough. So I opted for a local mobile specialist - Roadchill at £20 for a system check and £20 for a recharge if all was good.

First thing was to check the pressure which with A/C off was near normal, although way down with A/C on. Next was to extract the remaining fluid - 140 gm left, so no major leaks. Next evacuate the system as another leak check, then add leak detector for any future problems as well as lubricant. Finally add new fluid by weight - 560 gm. Before the work face-vent temp was 23C, after 6C. Very happy with the job, I can recommend Roadchill.

June/July 2018: Not used the ZS for several weeks while the weather has been so good, until one day for just a very short trip when it wasn't really worth getting the V8 out. Ambient 24C, output didn't seem much cooler than that at max. Later on I put the thermometer in one of the vents - 39C just after switch-on, dropping to 35C ... er, I think it's bust. Back to Roadchill, who said there was still some pressure left so he didn't think it was a major fault, and that four years wasn't bad (despite being 10 years and only a gradual reduction last time). Recharged - temp 3.1C. In those inevitable words - "We shall see ...".

Summer 2019: Barely chilling, not spending any more money on it.

Summer 2020: Not chilling at all, and ditto.

Battery *Added May 2009*

Battery Clamp Problems
Cut-off Switch
Battery or Starter Problems?

The ZS tends to stand for a week quite often, longer in the summer when we use the V8 for pottering around. I'd been aware that the battery had been getting a bit soft for a while, but it didn't fail to start the car until this week. As that was just under a week after I had driven the car for an hour or more, and the starter was really whizzing the engine over the day after that, it's time for a replacement. As it was an MG/Rover battery, presumably the original, 4 1/2 years or so isn't bad I suppose. As luck would have it I had a sheet of discount vouchers for National Tyres and Autocare including £10 off batteries. Did some research and Halfords have a 5-year HCB075 with 60Ah at the 20-hour rate and 540 'starting' amps at £85, whereas the original states 63Ah and 570CCA. They also have a 4-year HB075 at £75. National Tyres have a 5-year GTE 075 with 600 'Voltage charge' (presumably CCA!) at £82 and a 4-year version with 540 at £72 so slightly cheaper than Halfords. You also get an 8% discount for ordering on-line from National (specifying the fitting station you want to use, then they tell you when it is in stock), although with my voucher I was able to do even better than that. Straight-forward dropping the new battery in, at the cost of losing the radio tuning and clock time.

Update February 2014: Although I added the cut-off switch in 2009 I generally only use it in the summer when the car could go for several weeks without being used in the better weather. Normally in the winter it got regular runs of 80 miles or so. However this winter for various reasons it's only doing a few miles per week, and I've noticed the cranking speed gradually getting slower, much as it did in 2009. I didn't want to pay-out for a new battery after just five years, when the two MGBs are lasting double that, so I thought I'd try a boost charge. It's always been the case that vehicle charging systems won't put back the full charge if the battery has been significantly discharged, as they are limited to 14.5v or less. These batteries are designed to give a high current for a short period of cranking, not to be noticeably discharged then recharged, unlike 'leisure' batteries for caravans and motor homes. However boost charging - within limits - will restore a battery capacity. So I took the battery off (not without some trauma) and recharged it on the bench with my high power charger. Initially it took just under 6 amps and registered only 13v, but after about five hours it had dropped to 4 amps and registered about 15.5v (on charge, dropped rapidly to just over 13v off-charge). Refitted it, check the car started, then left it overnight with the cut-off switch not turned off. Next morning cranking was significantly faster than previously, and that was after a night of alarm and ECU discharge. Ditto after two more days of not being turned off, and journeys of just a few miles, so the capacity restoration ploy seems to have worked. I shall have to use the cut-off switch as a matter of course from now on.

April 2018: Still using the battery bought in May 2009, and no more boost charges needed, so using the cut-off switch after every trip unless I know I'll be using it the next day seems to work. As a comparison Vee's battery was fitted in January 2004 and still going, that cut-off switch (and Bee) goes off every time I put her away in the garage regardless. This is because to turn off and on just means reaching behind the seat, whereas for the ZS I have to lift the bonnet.

Autumn 2019: Failed to start but as in June I had bought a lithium battery pack following another sudden battery failure in Bee it was only a moment work to get going. After a few short runs here and there it was holding up, but cranking was getting a bit slow after a couple of weeks of non-use, so I gave it another boost charge with the same results as before i.e. left overnight without the cut-off switch being off it cranks over just fine, so battery still OK - 10 years now.

Battery Clamp Problems: Incidentally the trauma in removing the battery was that initially the clamp bolt was quite stiff, then came free with a 'ping'. However nothing so convenient as shearing the clamp bolt, the welded nut under the battery box had broken free, trapping the battery. And of course the battery box fixing bolts are under the battery. However with a strip of metal to protect the battery case I was able to use a large screwdriver to lever the clamping flange on the other side back just enough to get the battery out, which enabled me to remove the battery box and re-weld the nut. This time along all four sides of the (square) nut, rather than tack-welds at each corner. All refitted with copper-grease, and another example of checking you can undo things before you have to, instead of waiting until you need to, find you can't, and are stranded.

Cut-off Switch:

Given the experience with the V8 some years ago when I stopped using that every day, and having to replace the battery every 18 months or so, I didn't want the same thing to happen with the ZS so I have been disconnecting the earth strap unless I know I'm going to be using it next day. Ironically my son has just bought (another) classic BMW (M3 E30 limited edition) with the same problem and a new battery so he is doing the same thing. The ZS is fairly convenient in that the clamps have a top nut instead of a side nut and I happened to find a socket on a tommy-bar that is a perfect fit for the nut, courtesy of some self-assembly furniture we bought years ago ("If you haven't found a use for something yet, you haven't kept it long enough"), so it is relatively easy to remove and refit. The BMW needs a spanner, but the tool-tray is right beside the battery so again no big deal. I had eventually fitted a battery cut-off switch (with a bypass fuse direct to the clock to avoid having to continually reset it) to the V8 which has solved it's battery problems, so have been looking at ways of making things easier on both the ZS and the BMW. I'll have the same problem with the clock (and the radio) in the ZS. Fortunately F8 in the engine compartment fusebox feeds both them both, so if I remove that and connect a separately fused supply direct from the live-side of the cut-off switch to the load side of that fuse holder, they will stay powered when the cut-off switch disconnects everything else. One minor inconvenience is that I'll have to lock the three passengers doors with their buttons, and the drivers door with the key. The cable doesn't run past a convenient panel in the passenger compartment like it does with the V8, so I will have to suspend the switch in the cable and lift the bonnet each time, unless I can find a convenient place to mount the switch in the firewall under the dash somewhere, which would mean running longer cables to battery and fusebox. That in itself should be no big deal, as there are two cables coming off the battery post - one going direct to the solenoid for cranking which I shall leave as is, and the other connecting to the alternator and remainder of the cars electrics, which carries much less current than the cranking cable. Standard starter cable (likewise the switch) will have no problem carrying these non-cranking loads and cause negligible volt-drop even on longer cables, which would still be shorter than the cranking cables in the MGB or BMW. If I didn't want to keep the radio and clock alive in theory there would be a very slight benefit in putting the switch in the earth cable, but as there are three cables coming off the clamp it would have to cut off all three, which would mean attaching all those three to the switch then a single cable from the switch to the battery. The switch and battery cable would then be carrying **all** the load, i.e. including cranking, so cable length would start to become relevant. In order to be able to provide a bypass circuit for the clock and radio, I **must** switch the 12v supply and not the earth, or I'd have to get to the back of the dashboard, find and remove all existing earth paths, then provide new wiring to the clock and radio, no mean task.

Update July 2009: Not long after writing this section I came across this Battery Brain which automatically disconnects the battery if it drops below 12.1v. There are a number of models - all can be manually reset using a button on the unit, the Type II can be reset using a remote, and the Type III can be disconnected **and** reset using a remote, making it the most convenient, at the expense of another fob hanging around. The Type IV offers a manual switch which can be fitted inside the cabin for disconnection and reconnection instead of a plipper. This does away with the extra key fob (and a saving of £10) at the slight expense of having to manually open the door to reconnect the power if, as seems sensible, you have the switch inside the cabin. However a significant inconvenience is having to manually lock all the doors after turning the unit off, as none of them lock with a door open i.e. before I flip the cabin switch to disconnect the power. £60 for the Type III version with full remote is a bit pricey, even £45 for the basic version is expensive and still results in the same drain until it comes into play, so I think I'll opt for a mechanical under-bonnet switch as the doors **will** lock with the bonnet up, albeit at the expense of a polite warning beep from the horn. Subsequently realised the following points:

- On modern cars like the ZS with sophisticated alarm and immobilisation cutting the power when the alarm has been armed causes it to go into full 'son et lumiere' mode when power is reconnected, which is not ideal.
- The Type III with plipper reset must still be taking current from the battery when power has been cut to the rest of the cars electrics, but presumably less than normal.
- Unless you provide a bypass feed to things like clock and radio these will have to be reset each time power has been cut and reconnected, and some radios may need to have the code entered before they can be used again.
- If power is cut ECU's may well lose engine management settings and have to 'relearn' them, which could cause the engine to run poorly for a while. In practice the engine seems to run OK once started, but the first start after turning the power back on quite often fires up then cuts out, but starts and runs normally on the second crank.

There is a completely separate cable from the battery to the starter which only carries current when the starter is operating, so I only need to interrupt the cable from the battery to the main fusebox, for which the smallest battery cut-off switch will be more than adequate. I looked at a DisCarNect which mounts on the battery post, but the two +ve cables on the ZS are crimped into a special battery connector and I don't want to have to cut that off and solder new lugs onto each cable. So I'm going for the same type of switch as I've used on the MGBs, which inserts into the a cable run. I **could** cut the existing cable and solder two new lugs but again I don't want to do that so a bit of lateral thinking is called for. The battery cable attaches to the fusebox with a conventional lug, so if I unbolt that and connect that to one side of my switch, then get another ready-made cable for between the other side of the switch and the fusebox I am sorted, and it can be restored to normal very easily. That leaves the clock and radio memory to be reset each time we use the car, but again that is solvable the same way as on the V8. Cut-off switches often come with bypass fuses, but all they do is prevent someone cranking the car when the switch is off, it doesn't stop the drain as all the electrics are still powered as normal. The answer is to remove the existing fuse (F8) and take a new in-line fuse (15A) from the live side of the cut-off switch into the fusebox, terminated with a male spade connector, and insert that into the load side of F8! Remember before doing **any** work on the electrics to disconnect the **earth** cable, not the 12v cable, and reconnect it last.

Just connected to two lengths of cable the switch would flap about quite a bit, so a mounting bracket is called for. The switch needs to be easily accessible, not block access to anything else as far as possible, and be clear of the bonnet. There is a nice triangular space between the fusebox and an air-con pipe that fits the bill, so next I need a couple of mounting points. There is a what is probably a suspension mounting stud with several threads clear of the nut, which should be suitable with a second nut, and I can use one of the fusebox mounting points. I cut, shape and trim a card template to suit, then use that as a pattern for cutting a bracket out of a sound section off an old MGB wing, with additional flanges for strength. Cut, drill, bend and weld the bracket into shape, then paint. My previous two switches I have bought at the annual Stoneleigh spare show in February but I don't want to wait that long. Halfords have the identical item at about £12, but that is more than double what I paid, so I look around on the web. Several ads on eBay for silly money (like 99p!) which I just don't trust, plus some others at various prices all plus postage of course. Then I think of Min-Its only a couple of miles from me, a classic Mini specialist from which I've bought 20W/50 oil and some headlight parts recently. They have the same switch, and at less than £6 and no postage that gets my vote. The switch is actually intended to mount on the front of a panel, but that requires a large and irregular hole which would take most of the strength out of the panel, so I opt to mount the switch from the back which only needs a much smaller round hole. I don't want to leave the lugs and nuts on the bottom of the switch bare and risk shorting, so a couple of rubber covers at the princely sum of 44p each fits the bill. Min-Its didn't have these, nor a couple of local auto electricians, so they did have to come from the web and its postage charges, but very quickly (less than 24 hours) from Auto Electric Supplies Ltd. Halfords have a selection of ready-made battery cables in both red and black (£4 for 18"), and I have a spare inline blade fuseholder. I also have some split ribbed tubing to protect the switched cable and bypass wire, and some large diameter heat-shrink to seal that to the cables at the fusebox end as per the original, which gives an element of moisture sealing. I did find I had to open out the end of the original cable being moved from the fusebox to the switch to fit the switch studs, and also the switch end of the additional cable. I also had to trim a male spade slightly to fit in place of the original clock and radio memory fuse, as the spades on those are slightly thinner and narrower. There is still the drain of the clock and radio of course, but that is only about 9mA, and a significant chunk of that is the flashing LED in the radio (visible with the face-plate off and ignition off to act as a deterrent) which is off half the time reducing the current still further. Not long enough for me to see on my analogue meter, but it is less than 5mA. Original drain is about 27mA to 30mA (pulsing between them) so a useful saving.

The first time I reconnected the power using the switch the alarm went off, something it hadn't done when I had been removing the earth connection. I think the problem is that I had used the key fob to lock the doors for convenience while I still had the bonnet up, which sets the alarm, but when I reconnected power the doors were unlocked and one of them open as well as the bonnet. I recalled that the alarm 'remembers' its state even after a battery disconnection for security, so I'm not going to be able to lock the doors with the key fob before switching off the power, but will have to go back to locking the doors manually i.e. alarm not set before I switch off. I **may** be able to use the central locking from the key in the drivers door which doesn't set the alarm instead, before switching off and closing the bonnet, but will have to wait to test that for something other than a Sunday morning! And in that event locking the door with the key with the power on means it has to be unlocked with the plipper or the alarm goes off.

Body *February 2020*

The body has always been very good, just minor chips here and there, pretty good for 15 years albeit only 54k, kept outside and used more in winter weather than anything else. But gave it a once in a blue moon wash as it's got very mucky with unusually frequent use over the last few weeks. Giving a final rinse down with a garden hose nozzle on low pressure (NOT a Karcher!) and I spot something that looks like it's sticking to the vertical part of the boot lid, and as I'm spraying it chunks of colour coat start flaking off to leave beige primer! I leave it to dry in the sun and wind, and on my return there are more chunks flapping in the breeze. Pick those off to leave several square inches stripped. When I got the car 12 years ago they gave me a plastic pot of paint for touching up, which stayed liquid for many years. Gone to a creamy consistency now, I've used it to disguise it a bit, although the colour match is poor.

It's a bit of a mystery, although the back of the car faces south-east it's the vertical surface not the horizontal which one might expect to suffer more from sun damage. Also why now, in winter, when the summer before last was more notable for hot sun than last year? I've sent off for some spray paint, it's not worth spending any money on a full strip and repaint at a body-shop. Next day after more wind and rain more lifting edges are showing, so how extensive the problem will be is anyone's guess.

Bonnet Badge *Added November 2012*

Where the ZS was parked at the previous house the bonnet faced due south and the badge had faded almost completely to silver. I remembered Roger Parker describing in the MGOC magazine that this happened, and having prised up the old badge carefully from the front as it is stuck on with double-sided sticky tape and the back is inaccessible. The problem is that the badge sits in a recess and there is very little space to get a blade under without damaging the painted grille. Subsequently a saw a reference to using fishing line to cut through the double-sided stick-tape, which seemed to make more sense. In any case there was little point in doing anything about it while the car was still parked in the same place.

Then we moved house and now the front of the car is only in sun for a short time each morning, so when I eventually get round to getting some new covers for Vee's tailgate props from Brown and Gammons I get a new badge as well. I'm not a fisherman, but scrounged some line off a pal of a pal. However that didn't seem to make any impression on the tape before breaking, maybe the cold weather is making the tape harder. I've got an old bicycle brake cable inner, so I peel a strand of that off, and being steel should be much stronger. Pull it back and fore over the shaft of a screwdriver to straighten out the spiral, and tie a loop in each end so I can use two screwdrivers as handles - and realise I have made myself a garrotte!

It slides under the badge easy enough, and with relatively little pressure cuts through the bottom half of the tap and partly up the sides. There are two pegs on the back of the badge which stop it coming up all the way. But with that much done it's easy to get a fingernail under the bottom of the badge, and the top half comes away. The tape on the top half has peeled off the grille completely, but the bottom half where the garrotte cut through is shredded with some stuck to the back of the badge and some to the grille, but again peels off easily with a fingernail, and I clean up the recess ready for the new badge. The garrotte had put a couple of fine scratches on the edge of the recess, so silver or grey was showing through. With the badge offered up you would have to look very closely to see them against the silver badge surround, but the dealership mixed some paint for touching-up when I bought the car, and that was still liquid even though it was in a plastic mixing cup with a lid, and it was five years later! A fine brush soon covered the scratches.

I play a heat-gun onto the recess and the back of a badge to warm them up (holding the badge on my palm so I can be sure I'm not going to damage it or the grille), peel off the backing, and stick it in place. **Don't** go by the writing on the back of the badge, that is upside down compared to the logo on the front! Apply some pressure around the badge and job done, about half an hour.

However since moving house the bulk of the sun is now on the offside rear quarter and the boot, and fading the badges there!

Summer 2020:

Washing it (just a hose and brush) and I saw some marks on the boot lid just to the right of the MG badge that I thought were streaks of dirt. Squirted the hose at it and chunks of paint started coming off! 'Just' the colour coat, leaving the primer behind. There were further wrinkles and they peeled off as well over the next few days. I could blame the sun (the MG badge has faded) but the boot only starts getting any in the afternoon, and then at an oblique angle. I had some paint from first getting the car that had gone pretty thick, which smeared over it to disguise it to some extent while I pondered what to do. I got a couple of aerosols of colour and clear coats, not enough to do a proper job on the whole of the lid under the spoiler, so I'll just have to go for a patch repair, of a better quality than so far. It looks like quite a good colour match, but more has peeled off since. So whether it's worth doing a better job only to have more come off is another matter. I could get the whole of the panel under the spoiler done professionally, but it's getting more advisories these days, and can't be far from a significant failure, so I'm wondering if it will shortly be time to move it on. Which will be shame as I really like it.

Brakes

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Brake Pads *Added June 2011*

After an advisory on brake pads at the MOT a couple of years ago I bought a set (pukka MG Rover) but found there was plenty of meat still on them. Pleased to see springs, piston shims, and even four new bolts as part of the kit. Same last year, so thought I would have a look at them this year. Book specifies 3mm minimum friction material, mine have 4mm plus, and there are wear indicators so I decide to leave them in, no point in changing them too soon given the mileage I do. However Haynes is not correct in its instructions for pad changing. It says to remove the lower caliper bolt and pivot the caliper upwards, but the caliper only moves a few degrees before it runs out of brake hose! This is because the caliper hose comes off the strut and not the body, so only needs to be just long enough as the two ends have a fixed relationship to one another. So both bolts have to come out and the caliper tied up out of the way. *June 2016:* At least ... they did until I realised that if you detach the clip securing the hose to the strut (arrowed here), it **does** give you enough hose to pivot the caliper upwards and fully off the pads.

Updated June 2012: MOT looming so decided to change the pads anyway. Still plenty of meat, I reckon at least as much again from the wear indicator touching the disc, but I might as well. All pretty straight-forward, I just had to clean a bit of corrosion off the carriers before I could get the new springs in, but that's all. One initial concern on pushing the pedal afterwards to push the pistons back out before driving off (I don't want a repeat of the V8 where I forgot once and had no brakes when rolling off my sloping drive!), engine running, was that the pedal went a long way down even after having reset the pistons, and under heavy pressure seemed to be sinking. However it stopped before reaching the floor, and driving even when pressing the pedal quite heavily to bed the pads in it didn't seem to go down anywhere near as far, and in normal driving it felt the same as before. The thing is I've never sat with the engine running and pressed the pedal very hard before, so I don't know what it was like before, could just be hose expansion. However the following year it failed on front brake balance, the discs had always been ropey, so had to change them ... and consequently the pads again.

Brake Discs

Fronts
Rears

Fronts: *June 2013* Annoyingly failed the MOT on front brake balance - 34% and 19%. Absolutely no pull on the steering, which tends to confirm my theory that modern suspension alignment is such that the king-pin and tyre contact patch relationship prevents it, otherwise ABS would fling you one side or the other unless tyre grip was equal both sides, certainly not something to be depended upon. One thing I had noticed was a faint pulsing at the pedal, although only since I changed the pads, from the calipers as it slows with road speed i.e. not the ABS, which I've only ever activated on snow and ice and then only rarely. I had also been aware that the outer surface of the right-hand disc wasn't polished right across and had been like that since the pad change at least, but it was only when looking at the left-hand disc and finding that polished right across that I could see the reason for the imbalance. The calipers were fine when I changed the pads, i.e. piston movement and carrier movement, so whilst I shall have to spring for new discs and another set of new pads I'm hoping the caliper is OK. I'm very light on brakes, keeping my distance on motorways so I can usually control my speed just with the throttle, and on minor roads using anticipation to lose speed through deceleration except for the final stop. Sudden hard braking is rare. A pal says I need to be more of a hooligan and use them more, the Navigator would not agree!

New discs and pads ordered, I'm expecting problems freeing the discs from the hubs. They have counter-sunk screws like MGB rear drums, and just as unnecessary in use as the wheels clamp the discs to the hubs. However I see from a photo when I changed the pads that the screws and the area of the discs where they are (one side at least) was clean and shiny then, so may come undone OK, but the centre hole may be a different matter as that is a snug fit to centralise the disc on the hub and is showing rust. Before ordering the parts I need to check the calipers are free both in terms of the piston and the sliding carrier on each, which they are and is a relief. And while I'm doing that I might as well see how much of a problem I'm going to have getting the discs off. Right side screws come off just with a screwdriver, the disc needs a couple of taps with a wooden mallet so easy enough. The left side screws were tighter so before I damaged the slots I used my impact driver on them and they came undone ... and that disc just fell off. Ordering the parts it was a toss-up between MG Rover stuff from Rimmer at about £170 plus P&P, or Mintex from eBay at £115 inc P&P and I opt for the latter - noting that discs and pads for the MGB would be less than that. With these discs having to be replaced in 9 years and 40k miles, whereas the V8 discs are originals at nearly 40 years and over 200k miles, I don't think the extra cost is warranted. Maybe change my mind if these discs have to be replaced in 4 years!

Parts ordered Friday pm and arrive Monday am, good service from Motor Spares Dewsbury. Discs (Mintex) have some sharp edges, so watch your fingers, I wiped the surfaces off with brake/carb cleaner and a clean cloth to remove surface oil from manufacturing. The pads (also Mintex) have huge chamfers on the leading and trailing edges maybe removing as much as a third of the initial contact patch, which will increase as the pads wear down, probably not reaching the full contact surface until they are one third worn. One thing to note is that these are bare pads, if yours have been on a long time then I'd recommend getting MG Rover pads as these come with anti-squeal shims for both the pads and the pistons, anti-chatter springs for the carriers, and even new caliper bolts. Changing mine last year the caliper bolt heads had rusted quite a bit, one needing an under-sized socket hammered on before it could be undone.

Removal was easy as everything came undone easily this time, it took more time fiddling the pads into the anti-chatter springs on the right-hand caliper than anything else. Copper grease on centre hole of the discs, and the locating screws, as well as the caliper bolts. If I thought the outside of the right-hand disc was bad, the inside surfaces of both were dire. As well as being different amounts of clean metal on each, giving the unbalanced braking, I can also see that the amount of clean metal varies around one of the discs, which will give the pulsed braking I have increasingly been able to feel. Back together a static test showed much less sinking of the pedal than with just the pad change. A short drive and several moderate braking checks from about 50mph has good feel and retardation, and back home both discs show even initial marking from the pads so hopefully not much bedding-in required. Next day the MOT retest is successful, even though I can see slight imbalance between the sides on the braking machine when both are checked together, possibly just needs fully bedding-in.

Rears: *September 2013* Last MOT there was an advisory that the right rear was grabbing slightly. Nothing this year but a couple of weeks ago I noticed some brown staining on that wheel, then a couple of days after that it was squeaking when going backwards. Thought it might be the wear indicator so had a squint at the outer pad and it seems to be worn down to the backing, whereas the left outer has bags of meat left on it - I wonder if the right caliper is sticking ... Order a pair of discs and pads from the same place I got the fronts and they arrive in a couple of days.

Get the right rear wheel off, and the first thing I do is check that the disc screws will undo. A bit tighter than the fronts were, but still came undone with my impact screwdriver and a mallet. Next was to push the piston back in, as you can never get pads off the edge of old discs as they are thicker there as well as being rusty. Piston doesn't want to move, maybe the caliper **is** seized. Oh well, see if I can get them off anyway.

Next was to remove the carrier complete with caliper and pads from the hub, and compared to the fronts that is a bit of a fiddle. My socket only just goes on the lower bolt - really it needs a slim-line socket as it is very close to the suspension arm, and I have to try various extensions before I can undo both. Try and remove the assembly from the disc, but it jams before it has got half-way, that piston simply isn't moving. If it is the caliper then the other one might be as bad, so refit that side and have the same battle with the other side, with the same result. Hmmm, both calipers seized? I refit it and get the navigator to pull the handbrake on and off, and press and release the foot brake while I turn each wheel, and both wheels are braked and released as they should be, so what's going on?

Off to the internet to have a browse, and I discover that because the handbrake acts on the pads via the caliper piston, there is a ratchet mechanism behind the piston that acts as a self adjuster for the handbrake as the pads wear, and you have to wind the pistons back in with a special tool, you can't just press them back in! So that's what going on. Haynes doesn't say anything about that in disc replacement, but it does in pad replacement. It also says to remove the caliper, carrier and pads complete when changing the disc, but as I've discovered that is unlikely to be possible with old discs. It looks like I'll have to disconnect the caliper from the carrier and lift that out of the way, and then remove the carrier with pads, before I can get the disc off. But as one has to press the piston in while turning it, I may have to remove the caliper, remove the pads, remove the carrier, remove the disc, refit the carrier, and refit the caliper so as to hold it firmly while I press and turn the piston! Then remove the caliper again, remove the carrier, fit the new disc, refit the carrier, fit the new pads, and refit the caliper - quite a palaver. One of the internet sources I browsed has a link to a source for the rewinder. They are just a couple of miles from me, but as they do free postage and I have run out of time anyway I opt to order online and it arrives in a couple of days.

This time I remove the caliper from the carrier. Top bolt is fine but the bottom bolt is shrouded by the hydraulic pipe, that would have to be disconnected with the inevitable need for bleeding in order to get a socket on it. I do have a 12mm ring spanner, but it is a ratchet ring and I don't like using those for the initial undoing of a nut, but I don't have any solid metric rings. Nevertheless I give it a go, and a few taps with a mallet shift that one on both sides. Caliper comes off quite easily, and can be suspended from the rear box bracket on the drivers side, and a hole in the inner wing (for the fuel pipe cover that was fitted to early cars) for the passenger side. I remove the pads from the carrier while that is still attached to the suspension arm as they are quite tight and need to be drifted out. If had removed that first I would have had to clamp it in a vice. Drivers outer pad completely worn out, inner pad nearly so. Passenger pads well down. Next the carrier comes off - for some reason it was much easier to get a socket and short extension on the two bolts this time, and finally the disc.

I had wondered if I would need to reattach the carrier to the suspension arm, and the caliper to the carrier, to hold it firmly enough to be able to screw the piston back into the caliper with the rewinder, but it turned quite easily. The rubber dust-seal did start to snag a bit as the piston was nearly fully in as the edge of the piston was quite rusty, so I wound it out again and used a small file around the edge to clean it up which allowed the piston to bottom without twisting the seal.

Clean up the new disc with brake cleaner and fit that. Refit the carrier to the suspension arm, with a smear of copper-grease on the faces of the retainer spring that butt up against the edge of the pads. Fit the pads, the outer goes in fine, but the inner goes so far then stops. Peering round the back I realise it is the wear indicator spring, the free end has to be lifted up with a screwdriver so it fits over the edge of the carrier. The biggest potential problem is that these Mintex pads are bare pads i.e. no springs, shims, and sliding pin bolts that the pukka MG Rover front pads came with. I discovered that when I changed the front discs and pads, but there the 'missing' items had only been fitted a couple of years previously so bare pads were fine. I had forgotten that for the rears, I should have got just the discs and got pukka pads elsewhere even at the higher price. Fortunately the springs are fine, the shims for the backs for the pads are pretty corroded but are just about OK to reuse. Copper grease on both sides of the shims, and the caliper slides over them - I had wondered if there would be enough clearance with the corrosion on the shims. Then it's just a matter of refitting the sliding pin bolts, tightening them and the carrier bolts, and refitting the wheel. The handbrake comes up a helluva long way to begin with after doing the second side (didn't seem much different after the first), but after a couple of pumps on the foot-pedal and raising and dropping the handbrake a couple of times it settled back down to a more normal position. Quick test-drive round the block, footbrake is fine, but the handbrake is (still) pretty poor, but then again the pads need to bed-in. About 2 hours for both sides, including setting up i.e. jacking under the boot floor before putting axle stands under the sill supports just in front of the wheels, then packing everything away. All-in-all easier than I was expecting.

Dust Shields: *January 2020*

Had something rubbing at the left front for a while going round tight right-hand turns when manouvering. At first I thought it was the tyre on the engine compartment splash shield as it seems very close, clipped it further out of the way but no different. The problem is that it only happens when the weight is on the wheel, it is rotating, and at or near full right-hand lock, pretty difficult to reproduce while being in a position to see just what is rubbing. Eventually I decided to start removing layers in that corner to see if I could find anything. Wheel off, caliper off complete together with the hose support to the strut (all easy) and caliper tied up, and disc off (also easy). Then signs of rubbing against corrosion on lower part of the dust shield. Corrosion causes the metal to expand, which takes up some of the clearance, and with the weight of the car on that corner in a tight right-hand turn, and the wheel angling very slightly due to the clearance in the bearings with the top leaning out and the bottom in was enough to rub slightly. Dressed it back although there isn't that much room to the hub and strut components. With the disc and caliper back on it was easy to see the clearance, and even easier to use a screwdriver to lever it back a bit more. Wheel back on, some tight turns, and silence. Really it needs a new shield as although not perforated it's pretty flimsy, but that needs to hub to come off. Word is that the part is SEC000100, Rimmers say 'not MG', the various fora say it **is** right for MG including ZS180, and an alternative is Honda 45255-st3-e01. That's over £50, with Rimmers being £35, so another reason to wait! Note that unlike those for other models (or the rear shields for the ZS) this front shield fits either side.

February 2020: Roger Parker advises that SEC100120 was superseded to SEC000100 way back, SEC000100 fits MG and Rover. Circa £25 each from All Car Parts Fast and MG Rover Genuine

Brake Calipers *June 2016*

Front
Rear

June 2020: MOT failure on O/S front and N/S rear dragging, and advisory on N/S front, which surprises me as I checked them two days before and although the off-side rubbed a bit (probably the dust shield as per the near-side previously) both seemed to turn OK. I did notice the N/S rear which will need a replacement and disc and pads as done to the off-side in 2018, but didn't do it before the MOT as I wanted to know what else it was going to fail on! Exhaust centre section also damaged during replacement of the rear ARB bushes, so I'm debating whether to do all of it to give me some breathing space to get a replacement, or effectively scrap it and get something else. NS rear and OS front (the failures) came off surprisingly easy, cleaned up the pads in the carriers so they were moving OK, but the pistons in both seized.

Couldn't undo the centre to back cat joint so gave it to Cranmore Garage to try, if they damaged the back cat then I'd scrap it there and then, but it came off OK with their specialist kit so ordered the exhaust (nightmare!) and both calipers. B&G have the front but not the rear saying they aren't getting them back in exchange for new ones, and Rimmers have the rear but not the front, albeit at the huge price of £124 plus £66 surcharge against return of the old unit. B&G surcharge is only £12 (for the front, £36 for the rears) - probably why they don't get them back, and as the cheapest carrier to send one back is £5 they won't be getting mine back either! I find another source - Spareto - at half the price of Rimmer and no surcharge so go for that, to discover they are in Estonia and it is shipped via Poland! B&G item arrives next day, Spareto takes a week but with all the faffing with the exhaust it's not an issue.

Once the exhaust has been done I get the car back and next day start on the calipers - rear first, then the front. Rear a bit of a fiddle, front very straightforward, both done less-bleeding in not much more than an hour. Left hose clamps in place on both. I left the bleeding until after I had changed both as the Navigator has to do the pedalling, not having an EeziBleed cap to fit the master, and she was shopping. Not ideal as if they still don't feel right you won't know which one has the problem. Rears seemed to take a few strokes to get what seemed like the tiniest bubbles out, front only took a couple of strokes, but pedal left spongy and long. So did them again, rear first this time with the handbrake released (an info sheet that came with the caliper indicated that the handbrake shouldn't even be connected until after bleeding). Did several strokes starting with a few quick jabs to 'pump them up' then the long hard stroke for maximum pressure, before opening and shutting the bleed nipple, and seemed to get more tiny bubbles out. Ditto the front but that seemed completely clear. Still seems a bit long under hard pressure - much harder than I need to press when driving, but didn't pump up, and a test drive felt completely normal. So MOT booked, and I'll see what comes from that.

Front: *June 2020:* Replacement very straightforward having shifted all the bolts previously. Had to reuse the copper washers for the hose banjo as although this caliper came with a carrier, sliding pin bolts and the three stainless pad shims those washers weren't included.

June 2018: Another advisory about the OSF wheel binding, verbal this time otherwise it would have been a fail under the new rules! The caliper came off the pads surprisingly easily, whereas I had to drift the pads out of the carrier! So this time it looks like the pads binding in the carrier, much as the OSR were, although in that case the piston was failing to retract after the handbrake had been used as well. With the caliper off and the pad out I took the carrier off and over to the bench, and scraped/filed the corrosion off from under the stainless shim that 'ears' of the pads press down on. Lightly copper-greased all metal to metal contact points and the pads slide back in easily. Refitted the caliper, applied the brakes, released, and could press piston back by levering between the disc and the carrier on the outer pad side, so all looks well. After a drive and normal braking, on a barely perceptible incline, within about a second from stopping and releasing the brakes the car started creeping, so that looks fine.

Some years earlier: Advisory at the MOT said the 'o/s/f brake was dragging slightly'. Took both front wheels off and levered the outer pad back from the disc, and whilst the near-side moved OK the off-side was reluctant, so that will need looking at, although both wheels were turning equally freely. Then a couple of weeks later coming home from a trip away I became aware of quite a loud wittering noise intermittently, that was definitely me and the off-side, that went as soon as I touched the brake pedal. I then started to notice it pulling to the left very slightly on braking, so definitely needs looking at sooner rather than later.

At the first opportunity I had the wheel off again, which was spinning really freely, but I couldn't move the outer pad away from the disc at all. So the caliper will have to come off, which has caused me a problem in the past as Haynes just says to remove the bottom screw and pivot the caliper up and away from the pads. But the caliper has a short hose which is clipped to the strut, which means the caliper can only move an inch or so, and I have had to remove both screws and tie the caliper up out of the way. But this time I suddenly realised I could detach the hose from the strut by undoing two small screws, and 'hey-presto!', the caliper pivoted right up! Now I have unfettered access to the piston and pads, as well as the caliper still being supported quite firmly.

When changing pads in the past I'd checked the sliding pins of the caliper and copper-greased them, so I knew the caliper was sliding OK, so I need to try and 'exercise' the piston by moving it in and out of the bore. I have a small, cheap (pound shop many years ago!) metal sash-cramp which I used with a square of metal plate over he cupped part of the piston to try and push the piston in, but it doesn't seem to be moving, and the sash-cramp is warping. With that removed I try the brake pedal, but it doesn't seem to be coming out either, and I don't want to press down too hard in case it suddenly blows right out. So I fit the sash-cramp again but just nipped up, which will restrain the piston, and start pedalling again. I can now move it out, so slacken the sash-cramp, pedal again, and so on to gradually push the piston further out. I then notice that when I press down on the pedal, the piston is coming out enough to warp the sash-cramp, but when I release the pedal the sash-cramp un-warps itself i.e. is pushing the piston back in again. So more of that until the piston appears to be moving freely in a variety of positions relative to the bore. Drop it back over the pads, press the pedal to push the pads onto the disc, and I can then lever the outer pad off the disc i.e. push the piston into the caliper.

So refit the caliper, refit the hose to the strut (copper-greased the screws even though they came out easily), refit the wheel, and on a test drive no tendency to pull or drag. Saved replacing the caliper - this time at any rate - although a pal said I don't drive it enough. It's true, each of my three cars only gets about 3k per year, but the ZS seems to suffer more from things 'seizing up' than the MGs. Before I started I looked at replacement calipers. Several suppliers on eBay, where I got the pads and discs, but checking Euro Car Parts as well I realised that there are two types of caliper for the 45/ZS - one at £45 and one at £80 ... and of course the ZS180 has larger discs and needs the more expensive caliper. Clearly stated on the Euro site, but not the eBay sites, so caveat emptor.

Rear: *June 2020* MOT failure on near-side dragging, which I was aware of. I'd left it to see what else might need doing and take a view whether to repair and sell, or basically just scrap it. O/S front failed on dragging as well, with N/S an advisory, which surprised me as I checked them two days previously. Having undone all the bolts previously I knew none of them would be a problem - getting them off at least! This caliper came without the carrier, or sliding pin bolts, but did have new sliding pin rubbers and copper washers for the banjo union. The old rubbers showed no signs of tearing so I left them on the (original) carrier. With new disc and pads I just could not get the caliper over them, even with the piston wound back as far as it would go, and aligned so the slot in the piston went over the pip on the back of the pad. As I'd already fitted the discs and pads with the old caliper, it has to be the caliper itself. The old pads are only slightly worn so they go back on. No issues with the wear indicator this side, unlike the other last time, which is odd. Neither was there any issue getting the handbrake cable bracket bolts into the caliper - initially! I'd checked that the bolts would start in the thread, but they started getting tight before clamping the bracket down, then very tight. Didn't want to take it all off again to check why, but the bracket is tight. The two copper washers are the same, unlike before, I suppose one of the reused ones then must have extruded somewhat. Bleeding needed quite a few strokes to get rid of tiny air bubbles, and after doing the front as well the pedal is a bit spongy and long, and needed doing again.

April 2018: Had to change the rear discs and pads in 2013 as the outer pad one side had worn right down and scored the disc. But only five years later recently it's felt like the offside rear was sticking on occasionally as that side seemed to dip down as I pulled away. At other times I could roll to a halt on a level surface with no sign of dragging. At the service I jacked up and that side would barely move whereas the other was fine, and the pads had obviously been cooked. Disc showed some scoring with part clean and part rusty. Got the caliper off (needs a 12mm ring spanner as the hydraulic fitting is in the way of a socket) and with some levering - not as much as I was expecting - it came free. Sliding pins were free. Getting the pads out was much harder, it seems the caliper body had corroded under the stainless shim, expanded, and was pressing up (and down) hard on the lugs on the ends of the pads. That on the inner pad would tend to clamp the pads onto the disc. Filed down the ends until they fitted, and refitted with copper-grease. Wound the piston back which took some effort, but did move. With the handbrake cable disconnected the lever on the caliper was moving freely. Reassembled and the wheel was spinning freely. Pumped the footbrake a few times to reposition the piston and the wheel still rotated easily, so it doesn't seem like the piston itself is sticking. But with the handbrake pulled up and released it was jammed again. Levering between the caliper and the carrier rocked the former relative to the latter, which seemed to push the piston back and the wheel rotated again, only to jam again when the handbrake was used again. The balance bar behind the rear ash tray was horizontal i.e. not angled forwards on one side and back on the other with the lever both pulled up tight and released, which again indicates that the cable and the caliper levers are moving as they should be. So how can the handbrake mechanism be holding the piston hard out? Or is it just a very stiff piston? I don't fancy going in blind and possibly having the car incapacitated for a while, so opt to replace the caliper, as well as the disc and pads that side but as they only come in pairs I suppose I'll have to replace the other side as well, keeping the good ones as spares.

Came the day, and everything came undone fairly easily. Concerned about the brake hose banjo bolt I had laid in a spare hose, but it came undone quite easily. Before removing that I put a hose clamp close to the banjo to limit fluid loss. Handbrake bracket bolts needed a lot of effort to remove almost all the way and they have long threads, ditto the carrier to hub bolts. The disc screws were easy, I degreased and fitted the new disc. The inner pad has to slide relative to the carrier as the piston goes in and out. The tabs on the pads sit on stainless shims so shouldn't be a problem, but the carrier under these had corroded, the products of corrosion take up more space than the original metal, they press against the stainless shims and jam the pad in position. I filed those faces on the carrier, copper-greased them and the ends of the tabs of the pads, as well as the pad back-plates and their anti-squeal shims. Fitted the new stainless shims and spring that came with the pads to the carrier and caliper. I also removed the sliding pins, cleaned and greased them as one was a bit sticky. Fit the pads, the wear indicator makes the inner one slightly fiddly compared to the outer. Line up the slots in the piston so one of them slides over the pip on the back of the inner pad, and fit the caliper to the carrier using the new bolts that came with the pads. Then the hardest job of the day - refit the handbrake bracket to the caliper! This was a right pain as the handbrake cable is very inflexible, and holds the bracket at an angle to the caliper as well as slightly past the holes. In the end I removed the top caliper bolt which allows the top of the caliper to tilt backwards, which corrected both problems, and finally the bolts started, but it would have been easier to start the bolts before fitting the caliper to the carrier. Copper-grease on all the threads allows them to go back in easier than they came out. Next was to fit the brake hose banjo. Two copper washers, one may have the slightly larger ID to fit over the shoulder on the bolt head, as even using the new washers only one of them would fit that end. Finally bleeding - I don't have a cap for my Eezi-Bleed so call for my beautiful assistant to do the pedalling. Quite a lot of air comes out, several strokes needed, but after two with no more that'll do. Less than an egg-cup full in the jar, but more needed to top up the master as the new caliper was empty of course. Pumping and releasing the pedal, and the handbrake, feels good at that end, and the hub spins freely when they are released, so fit the road wheel and job done ... all bar fitting the new rubber hanger for the back of the rear box. Subsequently the ABS light wouldn't go off occasionally. Checked all round where I had been working but shouldn't have been anywhere the reluctor ring or pickup, cable undamaged, and connector well inboard. No error codes with my cheap reader, and Halfords couldn't find any either. Eventually they said this system only stores the codes while the problem is evident, and auto-resets. Can't make up my mind whether that is a rubbish system ... or Halford's porkies! Eventually it stopped happening anyway. And of course, the day after I wrote that which was eighteen months later, it happened again, this time with the red brake warning light on as well as the amber ABS light! Switched off and back on again and restarted, and they both went off, so I'll just have to see how it goes. December 2019 the ABS warning light comes on and stays on, and the speedo is flickering at about 70mph.

What lies inside:

No less than 19 components between the handbrake lever on the caliper and the piston! As well as direct fluid pressure from the footbrake pushing the piston out, the handbrake cable operates a cam which pushes on a bolt screwed into the back of the piston which pushes the piston out to apply the brakes when parked. As the pads wear the piston moves further and further out, which would ordinarily mean that the lever would have to rotate the cam more and more, and the cabin lever would come up more and more, to hold the car while parked. But some aspect of the mechanism causes the bolt and what it is screwed into to unscrew with pad wear, and the cabin lever range of movement remains the same. When it's time to replace the pads the piston has to go back into the caliper in order to fit the new, thicker pads over the disc. But it can't simply be pushed back as with front calipers as the bolt prevents that, the piston has to be turned in a clockwise direction to 'screw' it back in, using a 'piston retractor'.

There are quite a few reports of cars with rear calipers rolling away after being parked. This seems to affect those that use the pads for both footbrake and handbrake as the ZS does, other makes have a separate drum brake inside the rear brake assembly. I have read a dissertation that went into a huge amount of detail to show how it happened - cooling of the disc and other brake parts makes them smaller which removes force from the pads (whereas if anything drum brakes tighten as they cool). In tests whilst pulling on just one click beyond what is needed on hold the car with hot brakes allowed the car to roll away as they cooled, three clicks was enough to hold it on even a 25% incline. So the problem is almost certainly people being used to power-assisted everything, simply not pulling it up hard enough for the conditions.

ABS, and Speedo *December 2019*

I noticed the speedo flicking around at about 70 mph one day, and on the same journey the amber ABS came on, which has stayed on with subsequent starts. Last year the amber came briefly immediately after the caliper change, but not since then. Last month the red warning light came on briefly, and a couple of times I thought I could feel the brake pedal vibrating with light braking. On these the ABS system drives the speedo and not a gearbox sensor, so almost certainly all associated. Tried my cheapo reader again but still no DTCs despite the amber light being on, don't know whether it's worth taking it somewhere and paying for a check while it's still on as they couldn't find anything after it had gone off again last time. I can visually check the reluctor rings as it's quite common for rust on the hubs to swell and crack them, maybe measure sender resistance and output, but until I get the V8 back on the road after its gearbox work I can't do much more.

January 2020: Subsequently inspected all the reluctor rings - the rear ones are a bit of a pain as the caliper and disc has to come off (maybe not the disc but didn't think about that till after, and it's only two screws). Ironically the near side which has never been off came off easier then the offside that I replaced last year, even though I refitted everything with copper-grease. The rears were a waste of time as they are well shrouded and were clean with minimal rusting. The fronts can be seen with just the wheels off (and maybe not even that) and being exposed were more corroded. Couldn't see any cracks, they didn't move when I tried levering in various places, and tapping didn't reveal any 'dead' sounding areas. Subsequently I realised that as the light came on but went off again shortly after changing the rear caliper, and someone else on the MGOC forum has the same thing, the warning light is self-resetting. That being that case, and the light coming on with the ignition and staying on all the time instead of going off again after a couple of seconds, the implication is that the problem is a 'static' one rather than a 'dynamic' one, i.e. the system is detecting a problem with the sensors rather than the reluctor rings which would only happen when the car is moving. Oh well.

I did a bit more work at the diagnostic plug looking at actual voltages, first with a meter then with an oscilloscope in case they were pulsing. Two connections from the ABS to the connector, on pins 7 and 15. Two vertical rows of connections on the socket - pins 1 to 8 counting from top to bottom on the side nearest the front of the car, 9 to 16 from top to bottom on the side nearest the occupants. You can confirm that by checking for 12v on pin 16, with respect to earth which is pin 4. Getting about 5.5v on pin 7 and 9.5 on pin 15 with the ignition on but engine stopped, a couple of volts higher with the engine running as all voltages go up with the alternator charging of course (same voltages seen when the problem was fixed and the light back out). Steady voltages shown on the oscilloscope in all cases.

From various sources sensor information is as follows:

- Right front sensor connects to the ABS unit on pins 4 and 5, left front to 6 and 7. These should have a resistance of 1300 to 1800 ohms.
- Right rear connects to 1 and 2 and left rear to 8 and 9, and have a resistance of 1000 to 1300 ohms.
- They should generate 0.5v AC with a wheel rotating.

Along the way I found this web page which contains more information about testing the system than I have found anywhere else so far. However it describes the sensor as a Hall-effect device but shows it as a coil of wire. It could be a coil of wire with magnetic pulses from the teeth on the reluctor ring inducing a current and hence a voltage as the wheel rotates - a passive sensor. Hall-effect devices are semi-conductors where exposure to a magnetic field affects the flow of electrons through the device, so they are sensitive to standing magnetic fields as well as rotational and give a much more precise indication of wheel speed as well as direction - an active sensor. They consist of a permanent magnet behind the Hall-effect device which generates a base signal in the device, and the teeth of the reluctor ring cause fluctuations in that to vary the current. As such they are not affected by external magnetic fields. The measured resistance will be from additional components in the sensor, which can include integrated circuits to amplify the signal.

Both active and passive can be 2-wire (as on the ZS) or 3-wire. As to active or passive on the ZS, they are only used for speed and ABS, and not tyre inflation or automatic handbrake which require the more sensitive type, so they are more likely to be passive. I've seen a couple of sources saying you can't measure the resistance of sensors without destroying the Hall-effect semi-conductor, but loads more saying that is the standard way for an initial static test. They don't say whether they are talking about active or passive, which leaves us in a bit of a quandary. If you are concerned about that go straight to the AC test, turning the wheel about one revolution every 2 seconds.

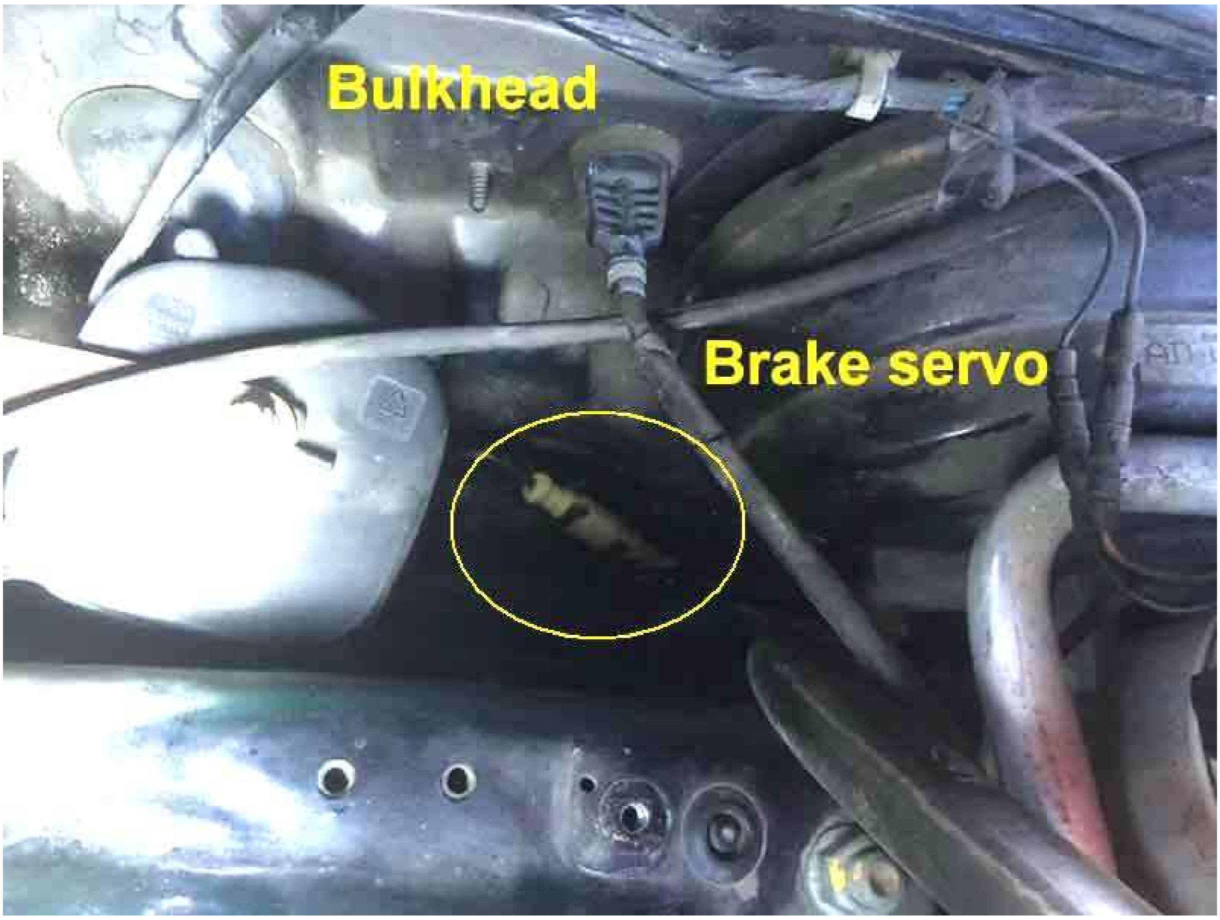
Next day tried to remove the ABS modulator connector to enable me to test all the wiring out to the sensors and the sensors themselves. That needs the engine compartment fusebox to be unbolted (which needed my cutoff switch to be unbolted, which took more time working out how I had fitted it in the first place than unbolting the fusebox...). It's a big connector with a rubber boot covering everything except what looks like push-button pointing towards the bulkhead. Being such a big connector with lots of mechanical resistance from many pins I can imagine that it does have some kind of release and reconnect mechanism to make it easier. This button does move a bit, and has a curved channel that looks like it would ease that end of the connector out when pushed. But purely with hand-pressure in quite a small space it didn't budge, and I was reluctant to lever it with anything without having more idea how it worked. So that was the end of that. So next step is to disconnect the sensors from the harness and test for resistance one way (the sensor) and voltage the other (ABS unit). More grovelling underneath for the rears but at least they are near the centre of the car and not in the arches, and Haynes says the fronts are in the engine compartment by the ABS unit so I'll start with them.

Haynes indicates that both front connectors are by the ABS unit, but I could only see one:

Surely more logical to have the other one on the other side, so I peer under the coolant reservoir ... and spot this:

Now I did [change the coolant reservoir]() in early November, but this problem didn't appear until mid December. I can't imagine pulling it apart when I was working on the reservoir as there is loads of slack in the hoses and level switch harness. Maybe the ABS connector was draped over the main hose and lifting that up was enough to part the connector. Maybe it wasn't fully pushed together in the first place. And whilst the other three connectors have a clip over each half, keeping them together as well as stopping them flapping around, I can't see or find by feeling around any clips for this connector. Anyway, pushed back together, ignition turned on, and the ABS light comes on and goes off again as it should. Ten minutes work for the find and fix after spending several hours messing around with the reluctors and ABS connector!

Jim Farrell via the MGOC forum posted this picture that shows the connector in its clip (CLP8934A, available from several of the usual suspects), which sits on a small shelf on the bulkhead several inches below the accelerator cable. I have what looks like a hole there, but no clip, so for the princely sum of £1.20 I shall get one with my next order from [B&G]():



I did, but found it very difficult to push the peg on the clip into the hole (which was clear) while the connector was in the clip. It didn't take much to dislodge it, but I left it pushed in as best I could. Maybe it's better pushed in first, or maybe for some reason this hole doesn't want to accept the clip, which was why it was missing. As the same time I parted and reconnected the connector, as it didn't seem to be pushed fully together, which needed a very firm push.

As the connector was obviously parted, and reconnecting extinguished the warning light, I didn't bother going any further i.e. checking resistance or output, just checked the diagnostic plug pins for the ABS with the ignition on and light out and they were the same as before.

Bumper Damage

November 2015 - the background: I've got to run a 6" duct across the garage from the kitchen to the outside wall for an extracting cooker hood, which involves drilling a hole through the cavity wall into the kitchen and another through the (single-brick) garage wall to the outside. I could go down to 4" with a reducer, but going to all this trouble and expense I might as well go the whole hog. Hired a drill and core bit for two days as I had no idea how long it would take. Boy is it heavy, and working right up against the garage ceiling I have to push at head height, which is really hard work. I drill the cavity wall from the garage to keep the mess in the kitchen to a minimum, so push the V8 outside, and roll the roadster forwards and cover it, so it is well out of the way. Makes a horrendous mess with brick dust everywhere, so I decide to drill the garage wall from the outside ... and of course it pees down. Waterproofs and hat on I persevere, and by mid-afternoon both are done but I'm knackered. The V8 is soaked but it has stopped raining now and decided to leave it outside to dry off a bit. Stick the drill stuff in the back of the ZS to take it back to the hire shop to reduce the hire to one day ... and manage to back into the side of the V8! A combination of being knackered, never having driven the ZS when either of the other two cars are out before, and not being able to see the front of the V8 in the rear-view mirror (OK it was visible in the passenger mirror, but I'm used to seeing a neighbours car in that but further away), all conspire against me.

Stove the V8 wing in, which is bad enough, but what is worse is there is now a 6" crack in the corner of the ZS bumper! A home visit bumper repairer and a body shop declined the repair as due to stresses in the way the bumper is fitted the crack was opened up, so if they forced it closed while they plastic welded they said it would probably open up again. The home visit had previously estimated £150, the body shop declined to quote. So I decided to take the bumper off to remove the stress on the crack, get it repaired somehow, then reinforce it with glass-fibre mat and resin on the back. Googling I found a hot staple repair method which looks ideal as they embed metal wires across the crack, which has got to be better than plastic welding. But the nearest place is Reading about 90 miles away. Then find a plastic welder in Solihull, take it round, and he says £25 if we remove the bumper. That's just the structural repair which is all I'm looking for at this stage, I can deal with the finishing and painting later.

There are just seven plastic fittings and three screws holding it on so it only takes a few minutes to remove. But off-car it is huge, needing an estate car as a minimum or ideally a van to transport to the repairer. We can drive it there then remove it, but there is no way we can drive back home with no back bumper, so go in two cars so we can leave mine there. A few hours later it's done so we reverse the process only putting the minimum fastenings back, then once home it comes off again ready for the fibre-glass reinforcing next day. Fortunately with a bit of juggling there is just enough room to get it in the garage flat on the ground beside the V8. There are supposed to be two plastic fittings pushed into holes in the wings which support the upper sides of the bumper with spring clips. But although there are the four fittings there are only two clips - one each side so it isn't as if I've lost two of them. Check Rimmers who don't have the originals, only an alternative. Get those, but they are a few mm longer than the originals so when fitted they push the sides out a bit which is annoying. But by cutting about 2mm off each of the flat ends they now fit the same as the originals. There has also been evidence of a small water leak into the boot for a long time which might have come from those fittings, I had reduced it by siliconing from the inside, but it still happened slightly. So I removed all four fittings, so find that only the rear two - that had the original spring-clips - had mastic round, the front two didn't have anything! Clean off the original mastic and put silicone round the peg of all four fittings, and round the holes in the wing.

There is also a bracket supporting the bottom of the wing at the wheel arch on the driver's side, but not the passengers. There is a hole in the body for the plastic nut, but no hole in the arch for the screw, so again it isn't as if it has been lost. It's probably to give more support to the driver's side which has the cut-out for the tail-pipe, but I make one for the passengers side to give that some more support, as that is the side with the crack - more bits for the order from Rimmers.

Next day is reinforcing. Originally I was going to use a layer of expanded aluminium mesh first, but realise that can only be used with resin paste, not the resin liquid that is used with glass-fibre mat. Lay strip after strip of the mat over the crack in various directions, building up about eight layers. The other corner has a very slight crack as well, so we had that plastic-welded at the same time, and I put a few small pieces of mat at the back of that as well. Harden it off using the heat from a work lamp, and a couple of hours later it is ready for fitting. The plastic welding had been left proud on the outside of the bumper, which will need to be taken back before finishing. I masking tape then duct tape down the sides of the crack so as not to spread the damage any further than necessary prior to sanding it down, but 80 grit on a block is really slow work, so I put some on a rubber backing disc and very gently using just the edge reduces it nicely.

Refitting goes OK, but son-in-law had noticed the brake light on the damaged side wasn't working when we brought the car back, and after puzzling out how to remove the back of the light fitting to expose all the bulbs, find it is blackened with the filament rolling round inside - possible damaged in the bump. I have a spare so that's easy. The number plate lights are in the bumper, so before refitting we check those - to find one not working, again the damaged side. Pull the wiring out of the holder expecting to find a bulb - no bulb. Look underneath and see the plastic lens can be removed, and see the bulb at what looks like a jaunty angle as if it became dislodged when removing the wiring. But check the other side and that is the same, it is a wedge bulb going in at that angle. Move the bulb from the faulty side to the good side and that works. So put the bulb from the good side in the faulty, and with a bit of wiggling that works as well. One of the lenses is a bit green inside, as if there has been water ingress, so probably that side, and probably not a very good connection, I shall have to keep an eye on it. We decide to leave the fitted bumper with the welding line unpainted for a while, in case it opens up again, in which case it will mean a new bumper from somewhere, so no point in repainting this one.

After several weeks there is no change, so several coats of spray primer/undercoat wet-and-drying in between, only masking-off the light cluster and the wing so I don't get a hard edge, and I ponder what to do about top-coat. Repairer still wants a lot of money, and people are very critical of Halfords 'mix while you wait' paints. I still have a tub of paint that son-in-law had mixed for me when I got the car from BMW eight years ago, and it is still liquid! That is a very good match, so several coats with a very fine brush, then careful wet-and dry, gets a reasonable finish. After leaving that to harden for a couple of weeks I try to polish-out the spray drift to the sides of the main paint, but no matter what I use can't get rid of it. But it stands anything but close examination, and even I barely notice it now. Some months later: At the time I spent some time searching for a possible replacement bumper - including second-hand - which I could get painted, but came up with nothing. Then while looking for something else noticed that Rimmers had what seems to be exactly the right one for this model in stock at £250!

Cambelt Change

October 2015: I really couldn't face doing it myself again, being six years older and it was really hard work last time, so decided to farm it out. However finding a place I was happy with took some time which is why it ended up being six years since the previous change, albeit only 14k. I'd been aware of SAS Autos locally for some years and emailed them for a quote and it came back as £1200 with MG Rover parts as 'the engine needs to come out', but didn't say whether that included VAT or not! Hmmm. Then I heard about Hogan Brothers a bit further away, emailed them and they came back with £620 including VAT, but didn't include the auxiliary belt and water pump I had asked about nor specified the parts they would use. Nevertheless I visited, they looked OK, and I asked for another quote for MG Rover parts including aux belt and pump. Phone line problems meant they couldn't give me one there and then so promised to call back, but they never did. Hmmm again. Making further enquiries through contacts Tanworth Garage were recommended, phoned for a quote, and they came back later that day with a detailed quote itemising the parts (MG Rover, a bit dearer than the Gates they would otherwise have used) and the labour and including VAT of £836. Interestingly they said nothing about needing to drain the oil which Haynes says is required as the oil level is up inside the dipstick tube, and that has to be removed.

Visited, they looked fine, so they got the job. I was happy to leave it with them for a couple of days having other cars. On return I could immediately see the aux belt had been changed, but nevertheless removed the rear front belt cover and could see a new MG Rover belt so that's fine. Removed the dip-stick to check the oil level and there looked like there was a load of crud on the upper part where the top of the oil was - not good! Wiped it, not crud, but the upper half of the plastic indicator looks like it has been melted or burnt somehow. Fortunately the Min mark is OK, and about half-way up from there to the Max would be, but even so. Rimmer have them at £10 inc VAT, I Googled their part number and got loads of hits, but half of them describe that part as 'dipstick tube'! I don't think any of them have pictures (except one used eBay item showing tube and dipstick at £33) except Rimmer, which does looks right. Queried it with the garage and apparently the mechanic had ordered a replacement at the time but the boss wasn't aware of the problem when I picked up the car so couldn't let me know, and they subsequently phoned to tell me it had arrived. So overall a positive experience, and I would use Tanworth Garage again ... or would I?

December 2015: The car was parked in a different place to normally and one day I noticed rainbows on the wet ground under the front. Knelt down and there was a drop of oil hanging off right under where the dipstick tube is fitted! Put a board under that area and a puddle forms maybe 2" in diameter overnight. Wiped off and put back with the car not being used shows it is a continual small drip - the oil level is normally above where the tube fits in to the engine - maybe the heat that damaged the dipstick also damaged the tube seal, and that started another saga.

September 2009 **DIY belt change:** MG Rover recommends 90k or 5 years change intervals, the 90k being very high in my opinion. Haynes agrees advising 60k or 3 years, and also says if the usage is predominantly short journeys then one should opt for sooner rather than later. My car has only done 30k, but it **does** do mainly short journeys, so I opted to change them now it is five years old i.e. splitting the difference time-wise. I studied the process in Haynes, which is quite difficult to follow as it flips about between sections for various parts of the job. I also Googled 'KV6 cambelt change' and got a lot of references to various fora discussing this job, however the vast majority of posts were from several years ago, and from the comments I don't think many people had followed the Haynes method. One really useful reference is this factory film describing the change. It's a different version of the engine to mine, and uses the factory tools (of which more later) but is still handy as you get to see what's under the covers and the basic steps in the process. Because of the flipping about in Haynes I decided to produce my own sequential list of steps, which as well as making things easier during the process also familiarised me with the steps, and allowed me to extract the various torque figures to add to the rebuild steps to avoid even more flipping about. It also kept the manual clean!

I then spent some time peering around the engine working out just where I had to get to, immediately realising the very restricted space at the front of the engine where the auxiliary belt is, with the primary belt behind that, is going to be pretty tricky to access.

I've got quite a comprehensive tool kit with 1/2", 3/8" and 1/4" drive metric sockets, ratchet spanners, torque wrench, 30" breaker bar. You also need T30 and T55 Torx drivers, and an 8mm Allen key. There are a number of specialist tools required, most of which are to ensure the correct alignment of the four camshafts and crankshaft, which is absolutely vital. These are available in a kit, but the kit contains the tools for several different versions of the engine and is pretty expensive unless you intend to this job on a regular basis! However Haynes details a method without using these special tools, but which does require fabricating some oneself. The most important two of these are the flywheel locking pin to hold the crankshaft in a known position, and a forked tool to hold the various sprockets steady while loosening and tightening their fixing bolts. Again it is very important not to transmit these forces along the camshafts or through the belts. It was only after making these tools that I purchased the various parts required for the change:

- Primary belt LHN100410
- Two secondary belts LHN100420
- Two secondary belt inlet sprocket bolts LYP101080 (these are stretched on tightening and must be replaced once removed)
- Three inlet manifold seals LWF100090 and three O-rings MYX100180
- Auxiliary drive belt PQS101272 (not mentioned as part of the job, but given the work needed to replace this it would be foolish to reuse the existing one)

You need to drain the oil so fresh oil and a filter (LWP100160) will be required. At the previous (first) oil change I had noted the sump drain bolt washer was a curious one with a rubber insert, whereas it is supposed to be an aluminium washer. I have never in my life replaced a copper washer, or re-annealed one as some insist, and never had a leak from one. However I wasn't keen on reusing this washer for a third time so replaced it (ALU1403 or Halfords HFX222). I dare say I could have got all the parts via Halfords, but they would be pattern parts and I didn't want to risk those as any breakage will destroy the engine, so I bought the pukka MG Rover items which are quite a bit more expensive. They hadn't got the aux drive belt so I did get that through Halfords, at least if that goes it is "only" an inconvenience and not destructive. Together with a set of brake pads which will be needed soon, the parts alone came to over £300. Then I needed about three days for concentrated effort and hopefully dry weather, and September 8th-10th fitted the bill. In the event we had a hot and sunny week and as I was working in full sun the whole time it was pretty exhausting for that alone. I'm not going to detail the steps as that is in Haynes and you should have that anyway, I'll just cover where things differed from the manual for various reasons.

I did remove the under tray but didn't remove the right-hand wheel arch liner, it didn't seem necessary on my 2004 model.

I have a battery cut-off switch so didn't disconnect the battery. I found I didn't have to remove it, or the battery tray or move the ECU as stated (these steps are probably necessary for **removing** the engine, and is one of the drawbacks of the format of these manuals). Neither did I remove the spark plugs, that looked a lot of work and very awkward at the back of the engine, and it is easy enough to turn the engine over against the compression anyway.

I disconnected all the plumbing and wiring around the engine as recommended in the early stages, but **didn't** remove the inlet manifold itself until after I had changed the primary belt. This was because getting at the primary belt was obviously going to be the most difficult part, and I didn't want to do any more work on the 'easy' side than I had to in case I had to abandon the job. I had to disconnect the fuel feed pipe to get the manifold off, something which isn't mentioned in the manual. Most are pretty easy - depressing locking collars to remove the pipes, although the small bore vacuum pipe is a tight-fitting push-on rubber connector which needs to be levered off from below. Most of the electrical connectors are also straightforward with various locking tabs and springs, although one on the purge valve you have to depress two white bits into a recess which is a bit of a fiddle. 'Unclip the rear ignition coil wiring harness from the manifold' is a typical Haynes understatement. All I could see was what looked like two cable ties, so just cut them through. It was only after the manifold was off that I could see they were specials with pegs that pushed through the manifold bracket and expanded behind it, impossible to see that in-situ let alone squeeze the pegs to 'unclip' them! It wasn't a problem though, I pulled the cut-off end out of the slot in the fastener, cut the attached end off, then could feed a plain cable tie though the slot and fasten it as normal. But that is a long way away yet.

Inserting the flywheel locking pin is an early step, and took me ages to sort out as the instructions are wrong. There are two holes, and Haynes says the outer is for the flywheel and the inner for the locking plate if an automatic gearbox is fitted. I just couldn't get my locking pin inserted, although I could feel the hole and it limited the movement of the crank if I inserted a small screwdriver or undersized bolt. I thought maybe my pin was too big, so progressively reduced the diameter, but to no avail. I was tempted to use the smaller bolt, but was concerned about it falling out half-way through. Eventually I managed to peer inside the holes with a torch and mirror to find that it was the **inner** hole I should be using! That must have taken almost an hour of faffing about, and I'm not even sure why it is mentioned so early as you have to take it out again to undo the crank pulley nut, and it is only really required after that.

My 2004 model differs slightly around the right-hand engine mount to Haynes, but it is easy to see what has to be done. From this point the sump is supported on a block of wood on a jack, and one is continually moving this up and down to get at various bolts. I initially left the power steering reservoir and upper steady bar rear bolt in place, lifting the steady bar itself up and back, but did have to remove them altogether later on. Not mentioned in Haynes are two small bolts connecting an air-con and an oil (?) pipe to the bottom of the engine lower mounting bracket, and these were really fiddly to get out let alone put back! Some of the bolts in this area only have an inch or so clearance to the side of the engine bay, so you need sockets to be as low a profile as possible, maybe even grinding some down so the head only just fits in, or you won't get them in the space available.

You use the T30 torx driver to slacken the three screws on the power steering pump pulley while the belt is still on and under tension to hold the pulley still, removing them once the tension has been released and you have lifted the belt off. The T55 Torx driver is used on the idler pulley, which doesn't need the idler pulley to be held still. Removing the primary belt rear upper cover is a fiddle. It's easy to drop small bolts and sockets, which I did two or three times. The first time the socket appeared right out by the wheel hub on top of the lower wishbone after a short search, the second time I couldn't see it anywhere and it only fell out while I was moving the engine about later on. One of the cover bolts remained hidden until I had the car running again, when it fell out further down the drive.

This is where you MUST remove the flywheel locking pin if it was inserted earlier. Failure to do so will probably shear it off inside the flywheel or do other damage. Needless to say the crank pulley bolt is really tight, 118 ft lb! No chance of undoing it from below without a pit or hoist, but at least I can get a breaker bar in from above. Fifth gear selected, with the Navigator standing on the brakes, but the force required is such that the movement of the crank in the engine, engine in the bay, and the bending of the bar takes up all the swing space without cracking it. However by removing the power steering reservoir and upper steady bar and rear bolt I gain an extra couple of inches, and end up with just 1/2" to spare before the bolt moves. When the bolt is slackened, but the pulley still held on its keyway, re-align the notch (it's tiny, mark it with white paint) in the pulley with the SAFE mark on the front cover, and re-insert the flywheel locking pin. It is essential to keep this pin in place from now on. At the other end of the engine with the air cleaner and intake hose out of the way you should be able to remove the front secondary belt cover. Check the notch in the lower (exhaust) sprocket is facing the upper (inlet sprocket). If not the flywheel locking pin should be removed and the crank pulley turned 360 degrees so the SAFE mark is aligned again, and reinsert the locking pin. The notch in the secondary belt exhaust sprocket should now be in line with and adjacent to the groove on the inlet sprocket. The notch is on the back of the exhaust sprocket and the groove on the front face of the inlet sprocket, so check the alignment with a straightedge. Put paint marks on the backplate and sprockets now, even though you aren't going to be touching the secondary belts for a while yet.

There is no locking collar on my dipstick tube, its metal end just pushes into a hole in the casing. Slightly concerning as the oil level is normally above this (which is why you have to drain the oil before this point), although it doesn't seem to be leaking ... yet! There is a bracket and small bolt further up the tube, behind the idler pulley, not mentioned in Haynes. You need to remove the dipstick tube to allow more room for the oil cooler hoses to move with the oil cooler, but even then there isn't enough movement on the oil cooler to get a straight run at any of the three air-con pump bolts. These are very tight at 63 ft lb even they only have 10mm heads. I only discovered a damaged 10mm 3/8" drive socket at this point, and broke a 1/4" drive socket and adapter undoing them. I could only undo the upper bolt using the breaker bar pushed in under the wheel arch and between various pipes and hoses, fortunately I had just enough swing using a 16-point socket. The lower bolt just above the oil cooler needs a very low profile socket and driver. These three bolts were one of the hardest parts of the job.

More low-profile sockets are needed to undo the two lower rear bolts from the engine front plate, and more manoeuvring of the engine to get the top rear boss-bolt out. Getting the cover itself off is another very tricky operation, as it has to be lifted, tilted and twisted by varying amounts at different times. The very restricted space compounded by an air-con hose in the worst possible place conspires to make this very awkward. Even worse getting it back on as you have to prevent the edges of the cover damaging the edge of the new belt. Recover the rubber tensioner cover, which could be lying in place or dropped somewhere by now.

At this stage I removed the inlet manifold (plugging the intake holes to prevent anything dropping down them) and secondary belt covers, and marked the rear exhaust and inlet sprockets and covers as per the front ones.

Next the primary belt tensioner and an error in Haynes. There is a tensioner wheel and a separately mounted tensioner that bears on the wheel carrier. Haynes says to loosen the two tensioner body bolts, then release belt tension by turning the tensioner clockwise with an (8mm) Allen key in the tensioner wheel. However turning the Allen key clockwise adds **more** tension to the belt, but this is the correct thing to do. If you attempt to release the tension on the belt by turning the tensioner wheel Allen key anti-clockwise as seems more logical, you will undo the Allen bolt which will destroy the setting of the tensioner wheel. By adding tension to the belt you lift the wheel away from the tensioner, which allows you to remove the tensioner bolts without them being under tension and pinging off somewhere, and lift the tensioner away. Then you can release the tensioner wheel, the belt will slacken and the rear cam sprocket rotate under valve spring tension. The front sprocket should remain where it was as it is held by the belt going round the locked camshaft. Be careful not to disturb the belt in the sprockets until you have painted alignment marks on the two covers and sprockets. It might seem odd only painting marks after releasing tension, but it is easier to get the new belt on and the sprockets in their correct positions this way. If you paint the marks before releasing the tension then you will have to keep applying full tension and releasing it again if you need to move either sprocket.

As you take the belt off the front sprocket will move, and the rear sprocket will move more. This is normal, but don't turn the sprockets any more than that. When fitting the new belt you will need the soft wedge under the crank sprocket, as that is your reference point. Lay the belt over the idler wheel, turn the front sprocket clockwise (you can use a spanner for this as it is effectively tightening the bolt, not loosening it, which you must not do) and lay the belt over this sprocket so that its marks are aligned again when the belt between it and the crank is under tension from the sprocket. Lay the belt under the water pump wheel and loosely over the rear sprocket, turning the sprocket anti-clockwise **with the forked tool** (not the bolt), such that its marks are also aligned when the belt is finally laid over the tensioner wheel. I found the new belt was more prone to jumping out of the sprockets, so had to have two or three goes to get the alignment correct. When you think it is, double-check the alignment marks on the secondary belts as well. When all are correct you can refit the tensioner.

I had imagined this was a simple spring and would be relatively easy to compress but no. I did have to put it in a large vice, and it took a lot of pressure to start closing up, less after that, whereas one would expect a spring to get harder the more you compressed it. A suitable-sized pop-rivet served as a locking pin. With the tensioner bolted into place I also imagined I would have difficulty pulling this pin out as it is ostensibly holding back quite a bit of tension. But with the tensioner wheel resting on it came out quite easily. All things considered I reckon it must consist of some very slow-acting compressible material rather than a simple spring. With the belt now under tension you remove the flywheel locking pin and soft wedge under the crank sprocket and turn the crank through **two** complete revolutions then reinsert the pin, which should put the secondary sprockets back in their aligned positions, double-check this to be sure before proceeding with refitting the front plate and starting on the secondary belts. With the front plate back on refit the tensioner rubber cover. It took a bit of working out just which way round it went!

For the secondary belts to undo the inlet sprocket bolts you must use the forked tool, don't undo them against resistance from the camshafts or belts. It's safest to align the tool and a breaker bar on the socket so they are a few degrees apart, you can get your hands round both, and squeezing them together will loosen the bolt. This ensures that there is no torque on the camshaft if the forked tool should slip. With the bolt removed the sprocket has to be levered of the keyway, when it comes loose it will simply fall off so be ready for it. Again the exhaust camshaft and sprocket will move, but the inlet won't as it is held by the primary belt. On my engine the exhaust sprocket moved three teeth, so when I fitted the new belt to the exhaust sprocket and inlet sprocket to the belt I put the inlet sprocket three teeth out in the same direction. Haynes recommends a tapered pin now to get the new bolt inserted, but it simply isn't necessary, on mine both screwed straight in, although the sprocket and cam keyways weren't aligned of course. Haynes now says to use the 'flat bar tool' to turn the inlet sprocket into alignment. However I found the slots in the sprocket were so shallow that it needed two hands to hold the bar square while turning the sprocket against valve spring pressure, which left me no hands to tighten the bolt, using one hand on each it kept slipping out. Eventually I screwed the bolt in just short of taking up all the slack, and simply used the forked tool to turn the inlet sprocket, which via the belt turned the exhaust sprocket, and when the exhaust sprocket notch was aligned with its paintmark I checked the inlet sprocket paint marks were also aligned, then simply screwed the bolt in a bit more which pulled the inlet sprocket onto its keyway. Could have been a fluke, but both belts were as easy as that, so I'll leave it for you to judge.

Tightening the bolt must be done using the forked tool again, again a few degrees apart from the torque wrench squeezing the two together. After tightening to the correct torque it must be tightened another 90 degrees. I jibbed at spending £15 on a degree wheel so downloaded a jpeg from the web, printed it out and stuck it on a piece of card, varnished it, and cut a 1/2" drive hole in the middle - just the ticket.

After that it is a matter of refitting the removed components. I simply worked backwards though my list, although the dip-stick tube needs to be fitted between replacing the primary belt front upper cover and the aux belt idler wheel. When fitting the aux belt to the grooved pulleys it is important to check it is sitting in the grooves as recommended in Haynes. I thought I had it on the alternator pulley OK, but when I checked the clearances between the sides of the belt and the edges of the pulley I noticed a difference one side to the other, whereas all the other pulleys had an equal clearance both sides. Releasing the tensioner and pushing the belt slightly I felt it drop into the grooves, and the clearances were now equal. Note that the clearances vary from pulley to pulley, but each pulley should have the same clearance both sides. More struggling with getting all the parts back on the front of the engine. I couldn't get the torque wrench on all of them, so had to settle for testing the ones I could do then repeating the same amount of effort on the others.

The three seals in inlet manifold VIS unit came out easily, there is a handy bit sticking out from a slot you can lift up with a fingernail. Getting the new ones back in is equally easy, tilt the seal so the outer edge by each of the ribs in turn is in the slot, then press with the back of a fingernail on the inner edge and it will go in the slot. Likewise the O-rings on the alloy were levered off with a small screwdriver, and new ones pressed over the lips. When offering up the VIS unit to the engine you need to lay out all the connectors and pipework that remained on the engine in their correct positions ready for reconnection. There are only two tubes that come up between the throttle body and the VIS unit - the thin flexible vacuum pipe and the much stiffer servo vacuum pipe, and these should be fed through as you lower the VIS unit down. The thinner pipe is easy to do afterwards, the other one less so. Possible, but it could crack the pipe on a cold day. The fuel pipe also needs to be lifted up out of the way then laid back over the VIS unit and throttle body. Due to different connectors and sizes of pipe etc. it is easy to get everything back in its right place, don't forget the breather on the rear cylinder head which is partly concealed under the VIS motors. Change the oil filter if you haven't already done so, refill with oil, select neutral, reconnect the battery, and with heart in mouth switch on, and if everything looks and sounds normal go for a start. After a few moments checking for oil leaks and anything else untoward I switched off and refitted the road wheel, but left the under-tray until after a road test.

So, the first three objectives met - get everything back with no bits left over; get the engine running; go for a test drive. The fourth objective is not to have anything fail over the next several thousand miles! Would I do another? Well, I was on the verge of giving up a couple of times as things around the front of the engine and particularly the air-con compressor were so difficult to access, so I would have to think very carefully. Would I do this one again? The old belts were perfect so probably didn't need changing there and then, but then again how long after any visible deterioration appears will they last before breaking? The exhortations about using the time interval for cars doing short start-stop journeys rather than mileage probably relates to those cars regularly doing those sorts of journeys five or more days a week, whereas this car is rarely used more than once per week, and can go several weeks without being used at all in fine weather. Whilst there will be some hardening of the belts occurring over time when it isn't being used, I could probably afford to go several years longer next time, maybe splitting the difference between the mileage limit and the time limit. At 3k per year it will take me 20 years to do the Haynes limit of 60k, so half way between that and the 3 year limit means 10 years in round numbers. By that time I'll be over 70, so I probably won't be capable of doing it anyway!

Central Locking

Key Fob

Had to laugh watching 'The Hatton Garden Job' when one of the baddies a passenger in a ZS180 said "I hate this ******* car" when he couldn't open the door when being dropped-off. A few months later the same thing happened to me and a pal and I had to push the button for him. Then back at his house being wise now he pushed the button himself, but by that time I'd turned off the ignition so he succeeded in locking himself in! Laughed even louder.

Firstly, never unlock just the boot, open it then slam it shut leaving your keys inside! I've got into the habit of unlocking the car even if I then use the boot button to open the boot, as with your arms full of shopping it's all too easy to put the keys down inside.

It has something of a mind of it's own in circumstances other than unlocking, opening the door, getting in, starting up and driving off in one fluid operation. Firstly if one unlocks but doesn't open a door then it re-locks itself in a few seconds which is fair enough. But even if you do that, messing about putting stuff in the car before starting is where the problems start. After a few moments the dash light comes on, and when trying to start the car one of several things will happen:

The car will start as normal. Or
The engine will crank but not start. Or
Turning on the ignition will start the internal alarm warbling and it won't crank.

Then sometimes turning off and back on will extinguish the light and it will start. Or
It will extinguish then crank but still not start. Or
It will warble at you again and not crank.

Under those circumstances you have to press the unlock button, then it should crank and start as normal. The annoying thing is that if it did the same thing every time you would get used to dealing with it. But because quite often if fires up as it should, then on other occasions do so after a quick switch-off and back on, the times that it doesn't and needs a button press are really annoying, and orientating the fob to the right position when the key is in the lock is a fiddle.

Key Fob:
Case replacement

I've only ever used one of the two key fobs that came with the car, but imminently need to have the second available for the parking monkeys at Stansted airport so they can lose that one instead of my every-day one with my fancy MG key-ring. Tried it and dead as a dodo.

Did a quick Google and found a YouTube but it was for the older one, then found a description that was a bit cryptic. Also slightly concerned to read that it needs resynching afterwards, although that is apparently achieved by standing close to the car and pressing one of the buttons four times.

First step is to unlock the car! However you also need to open the door, as otherwise it will simply lock itself again after a few seconds.

Worked out how to slide the bottom cap off for fob, then split the two halves to extract the battery. Tried cleaning the contacts first but no go. Fitted a new battery, reassembled the two halves but not the end-cap, and went outside to try it. Tried the 'lock' button - no go. Tried it three or four more times - still no go. Starting to get a bit nervous then realised it had locked itself after being unlocked because I hadn't opened a door. Tried the unlock button and fortunately that worked.

I've had the car seven years and I've always needed to be close to the car to unlock it, which I've never really seen as an issue as I'm usually quite close to the car when getting in and out! The plippers that work over hundreds of yards are also a bit of a security liability as they make it so easy for someone finding the keys to discover which car they fit. And I don't usually need to be reminded where I've parked the car. With the new battery I move further and further away and it still responds, not yet discovered just how far it will work. I did momentarily ponder changing the battery in my every-day fob as well, but as both would have been from the same Pound Shop packet I don't want them both failing in days through faulty manufacture! So I opt to just open that up and clean the battery and fob contacts, and now that works over a longer range as well.

A couple of sources said once the battery has been removed press any of the keys 'to discharge the capacitor'. I didn't do that with the second fob and the first key press of that functioned as it should. I suspect **not** pressing a key to discharge the capacitor kept enough energy in the electronics to mean resynching the rolling codes wasn't required.

Low battery warning: Another source showed a section from the driver's handbook for the earlier rectangular fob stating that when the battery gets weak the indicator light on the dashboard flashes rapidly for 45 secs. However both of my oval fobs do that, including the one with the new battery, and reading the handbook with my car it says "... the alarm indicator light flashes (0.5 seconds on, 0.5 seconds off) for up to a maximum of 15 seconds or until the starter switch is turned on." But I've never noticed that even when I had to get close to the car before my 'every-day' fob would work. It also says another indication of a weak battery is "The alarm control unit only accepts every other operation of the handset lock and unlock buttons". Not specifically noticed that either, except perhaps when I've been on the limit distance-wise ... but then the effect of low battery or being too far away are probably the same!

Case replacement *August 2017*

I noticed the buttons starting to crack recently, and quite soon it went into holes, and soon after that I was having to press the tiny button through the hole with a finger-nail. Googled 'MG ZS key fob case' or similar and got loads of hits. Some as cheap as a couple of pounds, but from China, and in the past stuff from there has taken weeks. So opted to buy from a UK seller at just under a fiver and it arrived in a couple of days. No central logo (on any that I could see advertised) as it is a generic Rover/MG item, but then the one I have been using for 10 years has never had one either so no loss there.

The procedure is almost exactly the same as for changing the battery above, the circuit board just drops out of its half of the case, the only extra step is to carefully pick the battery contact gizmo out of its half, and slot it into the new case.

February 2020: I'm having to press the unlock button harder and harder, the last time digging a nail in before it would unlock. Lock button going the same way but not as bad. I had a second fob when I bought the car 12 years ago, tried that and it unlocks much easier, I can feel if not hear the button underneath clicking. Either the switches are going - would they get harder to press? Or more likely the plastic in the replacement cover is going hard. I could swap the cases over, but it hardly seems worth it, so I've swapped the fobs on the key-rings. This one has the 'MG' logo present in the middle unlike the replacement.

Cooling System

[Cooling Fans](#)
[Coolant Reservoir](#)

Cooling Fans:

Looking at how best to attach the front number plate, which is only held on by double-sided sponge tape which is coming free at one end, I happened to notice a plastic grille lying on top of the steel armature behind the painted bumper and under the bonnet safety catch. It was completely free to move around, and with a bit of wiggling came out. I'd had the bumper off to look at the horns a year ago, certainly didn't notice it then, and would have had no cause to touch it as it was above the armature and I was working below.

With it out of the way it was immediately noticeable how easy it would be for small persons to stick their fingers in the fan while daddy (or grandad) had the bonnet up. Two holes in the grille but couldn't immediately see where it would attach. Roger Parker at the MGOC opined it was either a security grille (in which case it almost certainly would have been metal) or a safety grille, and forwarded a page from the Parts Catalogue showing it more or less where I found it, with two blind fixings to secure it to the armature.

Fiddled it back in, but need to see if I can get some fastenings as it is just rattling around, although it does protect the fans a bit better. It was apparently a face-lift change, maybe after reports of injuries. If the guards on the fans themselves had been a bit deeper it wouldn't have been necessary.

Coolant Reservoir: *November 2019*

After getting a 'low coolant' light not long after getting the car and topping up, nothing more for the next ten or more years till it pops up again. Fair enough, I have to top up Bee and Vee more often than that so topped up a similar amount as last time, although I did notice some crazing on the side of the reservoir above the coolant level.

Probably only three or four weeks later it happens again - not good. Check the level and it's no lower than it has been previously, so ignore it (have to be somewhere local urgently) and sure enough as the temp gauge starts to rise it goes out. But on our return I lift the bonnet, to see bubbles coming from the crazing. Do a Google search on 'MG ZS coolant reservoir but get images of lots of different types, so select a Rimmers link as they are usually pretty good at identifying parts and part numbers, but the only section for the 180 heating and cooling I can see is for a single heater hose and clips. Try several other Google links but no go. Then on an MG/Rover forum site someone mentions the coolant level sensor for the 180, and someone else mentions the tank is PCF000180 which is linked to Rimmers. Click on that and it says it has been superseded by PCF000181, and clicking on that says "This is the expansion tank that was fitted as standard to facelift models (from VIN 5D637209) which had a coolant level sensor fitted. Pre-facelift models did not have a sensor fitted but this tank is now used for all applications.", so that is the one I want! Then I discover that the section I wanted is under 'Radiator', but that was off my screen to the right, which is why I couldn't see it in the first place! However they were out of stock and not expected until the end of November a whole month away.

Googling PCF000181 got me quite a few hits including Brown & Gammons and an XPart site showing three places in the UK, one of them Rimmers plus two MG dealerships. B&G came up with a different part but a comment saying "Please note this is the tank up to vin 5D637208 and you cannot fit a sensor into this tank, if you want a tank that you can fit a sensor into please use tank PCF000181", and searching for that on the site came up with nothing. Emailed them and they came back saying to use PCF000180, which Rimmers show as the one without provision for the level sensor. Emailed for clarification but got no response ... options being whittled down.

Emailed the other two on the XPart page to be told by one that they had 'sent it back to the factory' and hadn't updated the listing. Now down to one - [A E Wilcox](#), who emailed back saying they had it in stock albeit the most expensive, but as yet more Googling didn't come up with anything else I phoned and ordered that one. Phew! You do have to be dogged and persistent with these cars.

Arrives a couple of days later ... and a bit of a surprise. As well as B&G saying I should use PCF000181 but they only have PCF000180, they show it with sensor PCJ000050. Now I was hoping to reuse my old sensor of course so only

ordered the tank, but when it arrives it comes with a sensor already installed. B&G state £68 for the tank and £19 for the sensor, so what I thought was 'expensive' for the tank at £68 is in fact a bargain. But more confusion as moulded into the bottom of the tank is 'PCF000170', and Googling that brings up loads of references to a Rover 45 tank, but once I got it off the original tank is the same. As far as the sensor goes, B&G show it has a rod going up into the tank. I thought that being immersed in coolant from underneath was unlikely because of the risk of leaks, so wondered if it was some type of capacitive sensing through the wall of the tank. However I find there is in fact a float inside the tank, rising and falling with coolant level on a hollow tube closed at the top which forms part of the tank body, and the sensor rod fits up inside the tube. So it will be magnetic, with the magnet in the float, and a reed switch in the sensor, and testing with a continuity meter (before I started removing the old one!) shows a simple on (low coolant) off (satisfactory coolant) operation as the tank is inverted back and fore. As such it the same principle I have used for brake fluid level sensing in the MGBs, the only difference being the MGB system has to go down through the filler cap, so both float and sensor tube are in the fluid. As the ZS system only closes the switch when the coolant level is low it's not 'fail safe' in that if the wiring should become disconnected it will disable the warning (as discovered by Jim Farrell when he discovered his probe detached from the tank). I opted for the reverse logic with my brake fluid level (the float is reversible to obtain the required logic) so that low fluid level **or** wiring disconnection raises the alarm.

Fitting only took about half an hour, the longest part being siphoning the coolant out of the tank rather than lose a litre or so on the ground. The book says to put a container underneath when disconnecting the outlet hose, but that really isn't feasible given the lack of space in that corner - maybe a funnel in a tube going down to a container on the ground. Slacken the hose clamp on the return hose on the top port first while the tank is still firmly supported and remove that, then remove the two fixing screws in front. Then tilting the front upwards and moving it forwards the location peg comes out of the socket behind, and angling the left front corner forwards and upwards further the peg comes out from under the engine compartment flange. The outlet hose is a long one going down then across the back of the engine compartment, and there is also loads of slack on the cable to the sensor, so the tank can be lifted up plenty high enough to slacken the outlet hose clamp, and lever it off the port. That done turn the tank over and push the spring clip on the sensor connector down firmly, wiggle the connector off, and it's free. If transferring the sensor over lever it gently close to where the probe is, and out from a plastic 'claw' on the bottom of the tank. Then, in the immortal words, "Replacement is the reverse of removal".

After reconnecting everything I only replaced about half the coolant to check the warning light worked. Then delayed final fitting until I had run the engine up to temperature, checking for leaks from the two hoses. That was fine, but what surprised me was that even though the coolant was significantly below the MAX mark, with the coolant expansion from running the engine the warning light had gone out. After cooling down the level had dropped enough to light the warning lamp again, and topped up to MAX it was out, so I'm pretty sure it's OK. So the new one is far less sensitive than the old, with that the level didn't even have to drop visibly below the centre seam - the top of which is the MAX point, for the light to come on. If I thought that would be the end of the saga I was wrong. Just out of interest I put the continuity meter on the old sensor in the old tank ... and got nothing no matter how I tipped the tank, and I could see and hear the float moving. But with a magnet by the sensor it switched on, so something is very marginal.

Then moving the tank around I could hear the float moving, plus something else as well, so find the magnet lying in the bottom. Probably fell out when the float dried out, and explains why the float no longer operated the switch.

January 2020: In mid December I noticed the speedo was a bit erratic at 70, and then that the ABS light was on all the time the ignition was on. Way too much time spent messing around checking reluctor rings later, I decide the problem is more likely to be with a sensor. The fronts are easier to get at than the rears, so I start with those with a view to testing the resistance from the sensors and voltages from the ABS unit. Looking to see where both are first I find this under the reservoir:

I can't find any clips that support this connector, unlike the others which have two each that hold the connector together as well as stop it flapping around. So if removing your reservoir, make sure that connector is fully pushed together before you refit it.

Crankcase Ventilation

Some months ago I read on one of the Rover BBs a long and tortuous tale of dismantling the VIS unit because the butterflies that change the length of the intake tracts had seized or otherwise failed and burnt the motors out. Changing the motors isn't too bad, but unless the butterflies are freed up they will go the same way, and not operate properly even with new motors. The intake unit is plastic in two halves welded together so isn't intended to be dismantled. But as a new intake unit is said to be around £500 the poster felt they had nothing to lose, but it took pretty extreme violence to part the two halves. As part of the job the poster mentioned they had fitted an oil catch tank, but either I missed it or they didn't explain why. This months (February 2009) MGOC mag has an article on a ZS180, and the owner said he had fitted one as well, but this time mentioned it prevents the motors failing, so time for some research.

Apparently the crankcase breather system can deposit oil into the throttle body, which gets into the intake unit, and gums up the butterfly pivots which is what burns out the motors. The visible symptom before the motors fail is said to be oil coming from the air filter housing drain and dropping on the ground. Once the motors fail you no longer get the benefits of the variable intake system which hits both performance and economy. Another symptom of a failing or failed unit is said to rattling from the butterfly valves. I've been able to feel the effects of first two changes in intake length so at least mine were working, and no oil drips. I removed the air filter and there was just a line of sticky oil on the lowest part of the plastic frame for the filter material, and signs of oil having run down from the throttle body into the filter housing. In the grand scheme of things this is classed as very 'minor' oil contamination.

So I take off the concertina hose between the throttle body and filter body, to find more liquid oil lying in the folds of the hose - not so good.

Then look up into the throttle body to find liquid oil all around the bottom of the butterfly, that forms a column as the butterfly starts to open - even worse!

So I'm pretty sure I should fit a catch tank, but then wonder to myself that if I stop fresh oil going into the intake unit, will that cause the oil that is there to go sticky and so cause the problem? It's being so cheerful as keeps me going, as they say. So now for this catch tank. One person recommends one from a well-known MG parts supplier, which costs £73! Large alloy box with an external glass tube so you can monitor oil level, but the problem I and others see is that the inlet and outlet pipes are so close together that while droplets of oil may fall down from the inlet any oil mist will go straight through unless there is an oil-trap filter mesh between the two! Do a search on Google and find an eBay supplier that shows a photo that looks externally identical to the £73 item, but this is only £14! I write and ask about any mesh between inlet and outlet, and there isn't any so I'm not happy about even the lower price. On one of the many MG-Rover.org posts on the subject someone mentioned they had used a petrol filter, which seemed like a neat and cheap alternative to me, and being translucent you can see any oil building up in it, and they are throw-away service items of course.

There is also quite a lot of discussion as to just where in the breather system it should be connected to. There are two halves to the system, each half having a pipe that comes off different places on the throttle body, to a tee, and then to each cam cover on opposite sides of the engine. A larger diameter hose comes off the forward part of the throttle body, between the butterfly and the air filter, this hose is at atmospheric pressure and supplies filtered air into the crankcase. The smaller diameter hose comes off the throttle body on the engine side of the butterfly, so is at a significantly high vacuum whenever the engine is running at anything less than full throttle. This is the suction side that draws fumes and vapours from the crankcase to be burnt in the engine. It is this pipe that picks up oil mist and deposits it into the throttle body, to be sucked backwards into the intake unit, and to run forwards past the butterfly into the air filter. Some say the catch tank should be fitted into the large pipe (**wrong!**) and some into the small (**correct!**). It can be seen that because the airflow is from the air filter, through the large pipe, through the crankcase, through the small pipe and into the throttle body it **must** be in the small pipe to do anything at all. Some say you need two catch tanks, which you could fit but the one in the large pipe would probably do nothing useful but it wouldn't cause any harm. Some say you can run both pipes via a single catch tank, but this is the worst option of all and definitely should not be done. By connecting both pipes to one tank the first thing that will happen is that the small pipe going to the throttle body will take the vast majority of its air direct from the large pipe coming from the air filter, and virtually none will go through the crankcase. This may well stop any oil getting into the engine, but it won't be removing fumes and condensation from the engine either i.e. it kills the breather system. But by far the biggest effect will be to introduce a massive vacuum leak into the inlet manifold which will have a huge effect on running. In the breather system there is a restriction that controls just how much air can be pulled through the engine and fed into the inlet manifold, and it is a very small amount. On the MGB the restriction is on the fresh air inlet side, which is either inside the oil filler cap on cars without a charcoal canister, or in the port on the back of the rocker cover on cars with a canister. This keeps a small negative pressure inside the crankcase at all times. On the ZS I don't know whether the restriction is on the inlet or the outlet, but it is there. Subsequently removing the oil filler cap didn't change the engine note, and even laying a sheet of paper over the hole revealed no vacuum. But disconnecting the small pipe between the engine and the upper throttle body caused the engine to race, so the restriction must be in the small pipe **before** the engine. Probably deliberately, otherwise removing the oil filler cap would cause the engine to race, rather than there just being a slight change in engine note as on the MGB. The difference is because the ZS uses full manifold vacuum as a source, rather than the very low vacuum from the carbs and earlier PCV valve of the MGB.

I have an MGB fuel filter with inlet and outlet ports pointing straight up and down. The problem with this is that it needs to be upright with the inlet at the bottom and the outlet at the top, so oil doesn't soak through the filter and run to the outlet anyway, which it might if the filter lies on its side. Ideally it should be mounted above where the pipe connects to the engine so any oil that gathers will run back down, but because the pipes are at the top of the engine there isn't enough clearance to the bonnet. Someone also mentioned a right-angle filter, which seems a good idea as that would lead less vertical space and would help to keep the filter vertical. A trip to Halfords revealed a right-angle filter at just under £3.50 (HFF202, cheaper than the in-line port type the MGB uses!) and a metre length of 8mm or 5/16" hose with clips for £4.30 (HFH402). This size of hose is a good compromise to fit the breather hose and the ports on the filter.

Now the point of no return - to cut the existing breather pipe. I did this about mid-way between where it joins to the throttle body and the tee, at a right-angle bend. I cut on the throttle body side of the bend then swivelled that half of the pipe round to face more or less the battery, which was the area I had decided to position the filter. I was going to cut the angle off the other half of the breather pipe, but instead used a paint gun to soften it and a drill shank inside the pipe to straighten it. A 3" length of pipe needed a firm push to get it onto the breather pipe so won't need a clip, but is a looser fit to top horizontal port on the filter so clips will be needed on both filter ports. A longer length of hose will be needed to connect the port on the bottom of the filter to the engine half of the breather pipe. This needs to be long enough to go vertically downwards from the filter then round, up and across, and fed round and past various pipes and cables in a series of smooth curves, to join to the breather pipe to allow the filter to be secured in an upright position, I probably used not much more than a foot of the metre length I had bought. Again a tight push onto the breather pipe and a clip onto the filter. Finally a cable tie secures it to the main cable from the battery to the fusebox. Started the engine to check all was well, and was a bit startled to hear a slight rattling coming from the intake unit! Now I can't say I have ever noticed this before, but I can't say either the last time I ran the engine with the bonnet up, and I may only have noticed it because of recently reading up on the problem. Nothing I can do about it now, I've got a couple of hundred mile journey coming up tomorrow, so I'll see what effect the filter has on trapping any oil. I had already decided I'm going to have to remove the throttle body and intake unit to flush them out as best I can, but that will have to wait for warmer frost-fee weather so I can use the V8 as a daily driver while I'm doing it. There are also going to be things to check on the VIS motors and limit switches, which can also gum up and cause other problems.

After reading lots of experiences and opinions and thinking on them I have come up with a number of what I think are salient points:

- The oil in the breather is a red herring. If anything it will keep the VIS linkages lubricated, and not make them stiff as is claimed. However if your engine does pass a lot of oil through the breather it is worth fitting a catch tank to prevent the air filter getting contaminated.
- **Fitting a catch-tank could potentially make the VIS problem worse** as it will stop new oil getting in there and the old oil will get very sticky, binding up the linkages.
- The problem with the valves themselves is that their linkages to the operating levers break. This is when you hear the loud rattling from the VIS unit, which is the valves rapidly opening and closing under the effect of the

pulses of suction from each induction stroke of each cylinder. Even when you can't hear any rattling the induction pulses are still trying to open and close the valves with each revolution of the engine, wearing the linkages.
- The problem of the motors burning out is again another issue, this time of the limit switches breaking away from the circuit board. If the limit switch moves so it can't be operated by the motor actuation lever, or the electrical connections are broken so it can't signal the ECU to disconnect power from the motor, then the motor will still be powered when the valve moves as far as it can, which will distort the gear wheel (another effect seen) as well as burning out the motor. It also puts even more stress on the valve linkages.
- Most of the posts on the problem are 2 to 7 years old now, and some posts part way through that range say a modified VIS unit was fitted by the factory, sometimes changed under warranty on early cars, so hopefully later cars like mine won't suffer from the problem. I still intend to remove and open up the motors to check both the motors and the limit switches, as well as check the linkages of the valves.

Update:

After 200+ miles, where the performance seemed normal complete with the additional acceleration felt as the various stages of intake modification came into play, the filter does have some oil in the very bottom, so it's trapping some oil at least, but until I have removed and cleaned the throttle body, concertina hose and VIS unit I shan't know if it is trapping all of it. Because of the routing of the hose to the bottom of the filter this will fill up with oil first and not drain away, so the breather will have to bubble air through it, as well as deal with any gunging up of the filter material itself. Unlike the MGB engines removing the oil filler cap has no effect on engine note, so I suspect that the restriction in the breather must be on the suction side and not the intake side as it is on the MGB. Unfortunately this means I can't easily check that the breather is still breathing and isn't blocked without disconnecting the join between the filter and the engine, however that is just push-fitted so is only a moments work. If I find it getting blocked between service intervals then I think I'll have to go for a proper catch-tank, but with the inlet and outlet separated, and perhaps a V8 oil-trap/filter on the inlet to be sure any mist is condensed into drops and falls into the bottom of the tank.
Further update:
I have tracked down what looks to be an ideal filter, with both inlet and outlet ports on the top but pointing sideways, and at an ideal angle to each other to plumb into the small pipe at its right-angle bend, which means there won't be any oil lying in hoses to cause problems. The manufacturer has advised me that the flow on these filters is from the inlet down to the bottom past the filter material, then up through the middle and the filter material to the outlet. This is ideal as oil and debris are trapped in the bottom of the filter below the filter material (to begin with, at any rate). You have to get the inlet and outlet ports on the correct sides of course, so the inlet is connected to the crankcase and the outlet to the throttle body. There are four filters of this style available, two having the inlet and outlet on the required sides, presumably the other two having them the other way round. They are cheap at less than £3 each excluding VAT, unfortunately the supplier only sends them via carrier and won't post them which costs another £7.50. Also unfortunately they have neither in stock, nor does the manufacturers UK site, so the one I have ordered has to come from the US which is going to take seven or eight weeks!

Update April 2009:

Well, it took eight weeks, and I don't know whether it came from the US or not (I assumed it would as it seems to be a US manufacturer) but the filter itself has a label 'Made in Russia'! Fits a little more neatly, and despite the image on the suppliers website it has a clear plastic body making it easier to see what is going on. But whether those are worth the time and extra cost is debatable of the ones available off the shelf from Halfords, if not doubtful. In fact almost certainly not, as the spigots are slightly smaller diameter than the Halfords ones, which meant I had to put a couple of layers of heat-shrink tubing on first or the clips wouldn't tighten the hose onto them. The 'old' unit had done about 1000 miles, but doesn't seem to have any more in it than after 200 miles. There was none in the loop of hose under the filter, so almost certainly it is just a mist that condenses inside the filter, and can't run back out again, even with the inlet on the bottom. And whilst the inlet spigot was a little oily the outlet was perfectly clean, so it almost certainly has been trapping any oil coming from the crankcase.

Update May 2010: After building up a little oil in the bottom it didn't seem to get any more. Looking at the filter it is marked 'inlet' and 'outlet', and that is the direction of breather flow. However despite what Baldwins told me above it seems more logical that the **outlet** will go down the bottom, to ensure it gets fuel even if there is air trapped at the top, the inlet pouring in at the open top. That's certainly how the V8 filter works, which can be almost completely full of air and yet the engine still runs fine. Pouring a little petrol into the filter and blowing into each port in turn certainly seemed to confirm that, which means it has been sucking oil out once there was enough to cover the bottom! I've enough slack on the hoses to cross them over, so I'll see what happens from now on.

Update February 2019: A few months ago there was still no more oil in the filter, despite swapping the connections round, so I took it off and fitted a bit of hose between the cut ends of the pipe. Since then I've tried putting water in it and blowing in each port in turn (unwilling to suck!) and both blow water out of the other until it is empty, which makes it look as if both go to the bottom. As it didn't seem to reduce the oil in the intake or filter I've left it off.

References:

[VIS power and balance valve operating strategy](#)
[Intake unit pictures](#)
[Intake unit repair](#)
[VIS actuation](#)
[VIS motors and limit switches](#)
[Catch-tank installations](#)

Dipstick Tube *March 2016*

Very confusing situation, all the references to the dipstick tube I have seen use a plastic quick-release connector pushed into the sump, and the tube pushes into that. However mine seems to push into a seal that is below the surface of the sump, so my tube must be longer than the one for the connector as there seems to be only one dipstick. Fora and parts suppliers lists only show the connector and matching tube, my arrangement seems unique!

After the discovery of the leak from where the dipstick tube fits into the sump following the most recent cambelt change, the tube has a bracket near the top which is pretty well concealed until you start dismantling. Could they have forgotten that and hence applied heat to the bottom? Looking from above there is very limited access to where the tube goes into the engine, but from the wheel arch a screw from a splash guard screw can be removed, the guard drops down and gives pretty good access. Two oil pipes and the crankcase front cover are right by where the dipstick tube plugs into the engine, so in theory the leak could be from any of them. No quick-release connector on mine, so if the mechanic did apply heat he could have damaged concealed parts in that area. Cleaned everything off, and it did seem to me that oil was beginning to form in the crevice between the dipstick tube and the sump hole, so hopefully that is it. I wedge cloths under each of the crankcase cover flange, the oil pipes and round the dipstick tube, in the hope that in a few days time only one of them will show oil, and hope that will be the dipstick tube. Then I'll be armed with enough info to tackle the garage about it. *January 2016:* After a few weeks the cloth around the tube is showing signs of oil albeit not dripping, so get the wheel off and lower the splash guard and whilst that cloth is oily the others under the oil pipes and the front cover are not so it is definitely the tube. Wedged more cloths in to hopefully keep the oil from dripping until I can perform an early oil and filter change when the weather gets a bit warmer, but after much less time than previously the cloth is soaked and it is dripping. Maybe disturbed the tube when replacing the cloths, I wonder if slackening the upper screw on the tube bracket and tapping the tube down into the block might help. (It did - while parked, but dripped for a while after running, so it will have to be removed and sealed and/or the bracket adjusted to press it down more firmly into the sump).

I can't find any reference anywhere to a seal in that location. The only suggestion from Rimmer is that I change to [connector LYC100510](#) and tube LQN000050 ... but that tube is no longer available! Land Rover sources indicate that tube LQN101121L is used on their KV6, but it's £180! [Rimmer do list that](#) ... but would it fit my engine? Even more importantly, if I lever the old seal arrangement out of the sump, will the plastic connector fit correctly in the resulting hole!? So I decide to try and seal the existing tube.

Slathering sealant around the join was unlikely to be effective having already leaked so oil in the crevices, so the tube had to come out for it and the socket to be cleaned first. There is a bracket about half-way up the tube (not easy to see and not even mentioned in Haynes) with a screw to the front head (even less easy to see). The screw (8mm head) is exactly in line with the flange on the idler pulley. Had it been half an inch lower it would have been easy to deal with, but I do have a miniature 1/4" ratchet handle that will just go on. However as you unscrew, it gets closer to the idler pulley, which makes it a beggar to get off again! But once slackened a 1/4" nut driver handle can be angled upwards to fit on the screw for complete removal. Refitting can only be guessed at, at this point!

With the screw removed the tube pulled up out of the sump quite easily, but because of its serpentine shape, the auxiliary belt and idler pulley, there is no way it will come out altogether. I had thought about adjusting the bracket slightly to press the tube harder down against the sump, but that can't be done without further dismantling. Nevertheless it comes up far enough to be swung forwards to clear the hole, and with the right-front wheel removed, one screw supporting the plastic undertray can be removed and that side of the undertray drops down to give reasonable access to the bottom of the tube and the hole in the sump.

Thoroughly cleaned the bottom of the tube, and the sides of the hole, which seems to consist of an alloy ring pressed into the top of the sump to be flush with it, with a cavity underneath. In this cavity there is something that moves slightly if I poke it with a probe, I assume that is the actual seal, quite probably an O-ring of some kind. As to the cause of the leak after the belt change, together with the burnt indicator at the bottom of the dipstick itself, I suspect the mechanic applied heat to the bottom of the tube when trying to remove it - perhaps he didn't know about the hidden bracket! If he did, then that makes it quite likely that he damaged this seal as well. I put a smear of seal around the inside edge of the ring, and the bottom of the tube, and refitted the tube, that way I should get sealant where the two overlap, and not just across the join at the top. As I push the tube down it goes through the ring, then I can feel a little extra resistance as it goes through what I've assumed is an O-ring, to be fully seated.

Next, to refit the bracket screw! I can position the tube to put the hole in the bracket over the hole in the block, but can only get two fingers from one hand and one from the other round the tube and idler pulley to get three finger-tips on the screw head. But this completely obscures the holes from view, so I have to feel where the hole in the bracket is with the nail of one of the fingers holding the screw, then try to position and align the screw with the hole. However due to the restricted space even my slim hands are pushing the tube backwards, so the holes are no longer aligned. I tie the top of the tube to a pipe in front of it to try and hold it in position, but although I can then feel the screw go through the bracket and into the block, trying to turn it with three finger-tips while keeping it aligned I just can't get it started. Using the nut driver handle is a non-starter as the threads would be at completely the wrong angle, and the miniature ratchet won't fit behind the pulley.

I'd considered this as a distinct possibility before I started, which may mean having to remove the idler pulley, which would mean taking the pressure off from the tensioner. Fortunately the square hole in the tensioner arm, which is used to lift it off the belt, is visible through the engine mount components. I had modified the short end of an Allen key to fit this when doing the belts the first time, and whilst I can't get enough leverage on that to lift the tensioner, with a suitable socket on the nut driver and that on the long arm of the Allen key I can indeed lift it. Having done it before I also have the correct Torx bit to fit the idler pulley screw, slacken that then with the tensioner lifted off the belt remove it and then the pulley. I don't want to release the tensioner and find it drops too far to get my tool back in, or damage the belt by tensioning it against something it shouldn't be, so keep the tensioner lifted off with one hand, while I insert the dipstick tube bracket screw by hand as there is now plenty (relatively!) of room. In as far as it will go with my fingers, then refit the idler pulley and its screw, only releasing the tensioner (after checking the belt is correctly fitted to the upper and lower pulleys) to finally tighten the pulley screw. Then using the nut driver to get the dipstick tube bracket screw nipped up, before using the miniature ratchet for final tightening.

Final job was to daub more sealant on top of the ring and round the dipstick tube, using a small flat-blade screwdriver bent at a suitable angle to get to the back part of the tube. Next day we had a 200 mile trip visiting family, and on the return from that no sign of oil. So fingers crossed, time will tell. As to what happens the next time the belts need changing, I'll cross that bridge when I come to it.

2018: Noticed it leaking again. Fortunately only slightly so opted to wrap several thicknesses of blue hand-wipe paper round the bottom of the tube secured with a cable tie to act as a 'nappy'. Relatively quick and easy to do, so could be repeated as long as it's not too frequently, then hope to do something more permanent at the next cam belt change.

Headlights *April 2014*

I've had the ZS for nearly seven years now, and for most of that it has spent large amounts of time facing due south in hot sun as I use the MGBs more in the summer. I can't recall seeing it when I bought the car but a while ago I became aware of what seemed to be a coating on the headlight 'glasses'. This was an irregular area covering about 50% of the surface, with a slightly opaque appearance. I don't know whether this has been caused by long exposure to hot sun, but the bonnet badge had faded to nothing over the same period. On moving house a couple of years ago I replaced the badge, and wondered if I could do anything about the headlights short of replacement. At the time advice was to try a product called 'Plexus'. That is really intended for things like motorcycle visors, and while it did seem to bring up the uncoated areas well it made no impression on the coated areas, even when a cotton mop wheel was used in a drill. It's now getting noticeably worse, using the car one night I was struck by how bright a beam of light coming out at an oblique angle from the side was compared to the forward light, and I can see (pun not intended) the day when it fails the MOT due to an indistinct beam pattern. I had to change the V8 headlights many years ago because of that.

Quite by chance almost to the day the MGOC mag arrived containing an article by Roger Parker on just this problem. He recounted how a local valeter had solved the problem for him with his magic potions, so I've contacted the same chap to see what he can do for me. He wanted £60, so I contacted a couple of other valeters in my area to see what they said. No more quotes, but one was kind enough to send me a link to an Amazon page of DIY products. 3M had the most comments, almost all positive, and that was £20 but didn't include a UV protector to put on after the cleaning process. Turtle was much cheaper but mainly negative comments. Another product priced between those two had mainly positive comments, although only six in total. But by perusing the products it seems that most of them contain various grades of wet and dry abrasive paper from 1000 to 3000 grit, then a polishing compound, and some include a UV protector spray. I've got some 1200 grit, and some Solvol Autosol, so decide to have a go on an unobtrusive corner. As expected the wet and dry - used wet - immediately leaves a matt grey surface, but by alternately rubbing and drying (You can't see the coating until the surface is completely dry, so a warm dry day is best) I can see that the coating is being removed. Then polishing that area vigorously with a Mk1 digit in a cloth with a bit of Solvol Autosol on it, brings it back to clear again - so worth a go.

Scour the internet for suitable abrasive paper, and purchase 2 sheets of 2000 grit and 2 of 3000 grit from The Polishing Shop. This company allows you to buy exactly what you want in terms of numbers of sheets, and have 18 grades available, and were also good value. Most other vendors only have packs available. In the end I only used one quarter of a sheet of each grade for both headlamps, so could have saved even more money!

I had decided to take the headlights out as I reckoned that would be easier than masking round the wing and bumper - but that's easier said than done. Four plastic fittings on top of the bumper, four bolts underneath, and two more at the sides up into the wings. There is also a plastic clip just a couple of inches forward of these last two, very brittle, and both mine snapped when taking the bumper off a few years ago two fit a decent pair of horns. It doesn't seem to suffer without them, Rimmers and Lakeland Minis have them (DYC101340) although the latter want £5 to post two clips costing £2! Ease the bumper forward to unplug the fog lights, try to part the grey connector for the temperature sensor but no go. However while struggling with that the clip securing the pair of connectors to the bumper came free, and it was a moments work to unclip the sensor itself.

Next you have to remove the plastic structure that goes across the front of the car, which is the real 'bumper' as opposed to the external panel. Four bolts easily accessed - but two of mine were well seized. Fortunately I could get WD40 on the backs and by working them back and fore finally got them out and the structure off.

The headlights have two bolts on top, one at the indicator end into the wing, and another one underneath by some kind of electrical device with heat-dissipating fins. However with the first three removed on the left-hand light, it was free, the bracket for the lower one had fractured. Two wiring plugs to remove - the black one was easy, and again the grey one was difficult, but finally came free. Took the headlight to the bench for wet sanding. The problem is that the shape underneath and at the back doesn't make it easy to support firmly and safely, paying special care to the bulb holders. I supported it on a block of wood to protect those, and as I was hand sanding could hold the unit steady with one hand. Starting with 1200 grit I concentrated on the areas that had remaining factory coating, periodically wiping off and drying to check progress. It's only when completely dry that you can see if the coating has been completely removed or not, tilting it at angle looking for edges, so a dry and sunny day is best. I was surprised how little time it took, probably only about 10 minutes When the coating is fully removed move up to 2000 grit, which visibly reduces the fine scratches left by the 1200, and then the 3000 grit. It's ironic that when wet the lens looks completely clear after this stage, going 'smoky' again when it dries.

For polishing I decided to put the headlamp back loosely, as I would need both hands for the drill and polishing mop. But while out I masked the remaining few inches of body-work that was round the headlight - the wing - using duct tape for strength but ordinary masking tape underneath that in case the duct tape adhesive was a beggar to remove. Smeared Solvol Autosol over an area of the lens with a finger-tip, then used the electronically variable drill on its slowest speed, and light pressure on the mop. It very quickly brought back full clarity to the lens - very pleasing. Bear in mind that too much speed and/or pressure could create excessive heat and score the plastic. Wiping off the residue with a clean duster created quite a bit of static, but an application of Plexus removed that and left it crystal-clear.

The second headlight I decided to wet-sand in-situ, partly because of the risk of damage as I mentioned earlier, but mainly because I simply could not get the grey connector out. Undid all the bolts as before so I could move it out of the way to mask the wing, then loosely refitted it. Much easier working with it firmly held. This one took probably two or three times more effort and time to shift all the original coating, but eventually did, then polished up as easy as before.

Refitted the headlights and reconnected the wiring, then checked all the bulbs worked before refitting the armature or bumper! All good, so refitted the armature, with copper grease on the bolts. Discovered there is a dinky bracket remaining on the body, that you can hang the armature on while fitting the bolts, so you don't need one hand to hold it while you struggle with the other to line up the holes and get a bolt in. Hung the bumper in place with its top four screws, then refitted the fog light wiring and the temperature sensor. Again, checked the fog lights worked at this point. A bit of a struggle getting the bumper to go fully back, until I realised there are two pegs on it that fit into slots on the armature, again to hang the bumper while you are fitting the screws! Used copper grease on the four bolts underneath and the two at the sides as they were also variously stiff and rusty on removal.

Ordered some UV spray - there seem to be two types, one looks like a plastic coating where I would have to be very careful not to get overspray anywhere else, so passed on that one. Settled for [Glass Sealant, UV Inhibitor and Coating] which at £12 delivered is by far the most expensive part of the job. No instructions, but it's a cream so I squeezed it out on to a clean cloth and rubbed in, then polished off with a clean soft cloth. Lens maybe very slightly brighter after that, many droplets formed in rain later that day, so it's done something. However I used hardly any even though I did two applications, anyone want to buy 49mL of UV protector?

June 2017:

Failed the MOT on 'not able to distinguish beam pattern'. I had noticed they were getting cloudy again, and although the near-side was noticeably better than the off-side they still failed both. I did wonder if this time the cover would have clouded all through, but a test patch just using Solvol Autosol on a cloth and the Mk1 digit came clear, so about 20 mins saw both bright and clear again. Much time saved by not bothering to remove the bumper and headlights, just mask around the opening first with masking tape (to peel off easily) with duct tape over that for strength. I put the UV protector on again, but will try and remember to use it regularly this time, and see if that makes a difference. But a few months later I can see it clouding again, so will have to be an annual job before the MOT.

May 2019: Don't think I bothered doing them last year, but looking a bit cloudy at the annual service. Just masked off with masking tape this time as I'm not using an power tools, and a few minutes with Solvol Autosol and Mk1 digit again brings them up just fine.

Heated Rear Window

Only available with the engine running and actually charging, if you drag the idle speed down enough to stop the alternator charging it will switch itself off.

January 2020: Three dead tracks now ...

In 2016 I noticed one of the tracks had failed, despite rarely cleaning the inside of the rear window, and the last time being way before the failure, so I investigated repair paints. One such paint is from Bare Conductive, but from their data sheet you can see a 70mm strip 3mm wide has a resistance of 473 ohms. Now this is much longer than one would hopefully need to repair a track, but even if it were only 1mm long it would have a resistance of nearly 7 ohms. And if one kept to the track width of about 0.75mm it goes up to 28 ohms, although increasing the thickness will reduce it. As my screen measures about 1 ohm, which represents 9 elements of 9 ohms each, you can see that even one 'repair' is going to leave the track virtually useless for screen clearing. There is also this HRW kit from Holdens, which consists of lengths of self-adhesive foil that can be cut into narrow strips and stuck to the glass. Expensive at £60, it's intended for providing full HRW rather than a repair, and I don't think I could reasonably cut anything as narrow as my strips, and there is the problem of connecting the ends to the existing connectors. They say it is suitable for front screens as well, but getting it thin enough not to cause annoying if not dangerous obstructions would be difficult to say the least.

August 2016: The above paint is not aimed at HRWs, but another specifically for HRWs is Granville Electro Connector. They couldn't tell me the resistance of a typical bead of product, saying a typical repair is a 'thin bead to a preferred short length of 3-5mm although it is possible to mend longer breaks'. At the time of writing the typical price from Amazon and eBay is in the order of £15, but amazingly Halfords have it for £11.49! Mostly negative reviews, but one gave a detailed description of how he made a successful repair, so I thought it was worth a punt.

I tested with a voltmeter by powering the HRW, connecting one side of the meter to the lock latch on the rear door frame, and carefully placing the other probe at various points along the track. On a good track you should see 12v on the very end of the offside, slowly reducing as you move across the screen until it reaches zero at the end of the nearside. On a faulty track you will see 12v as you work across the screen, suddenly dropping to zero volts as you pass the fault. Stick a bit of masking tape beside the track and mark the point where the voltage drops. To see if you have more than one break you should also work from the near-side to the offside, with one side of the meter connected to 12v picked up from somewhere convenient. Starting from the end at the near-side use the other probe of the meter on the track again carefully, you should see 12v, then as you work across towards the off-side it will again suddenly drop to zero. If this is at your previously marked point then you do only have one break. But if it occurs before that then you have a second break - make another mark on another bit of masking tape. Bear in mind you may have one or more breaks between those two points, but there is not much you can do about that until at least one of the found ones have been fixed.

I do only have one break and as there is no visible break hopefully it is hairline and stands a chance of repair by bridging it with conductive paint. It took three goes ordering online before Halfords managed to find it in the store, by which time they had reduced the price to about a tenner for my trouble! A single-coat test section about 1mm long and the same wide exhibits a resistance of about 1 ohm, which is significantly less than the other product. I had to wait until the weather was warmer and dryer before I could apply it, then wait for damp weather before I could test it! To try and keep the repair neat I stuck two bits of masking tape **each side** of the track to leave just a 'channel' the same width of the track, peeling them off as soon as I had put the paint on so it didn't pull dried paint and maybe a chunk of track with it! It didn't work, and despite re-testing and finding a(nother?) break right at the end of the repair, and applying a longer repair, it still didn't work. Annoying, as I hate seeing that dead track in my rear-view mirror. Even more annoying is a second dead track a year later.

Horns

Didn't take long to notice how puny the single horn was, but looking in Haynes I noticed that some cars had two, probably the original ones and the reduction was a penny-pinching exercise, something of a tradition at MG. You have to remove the front bumper to get a good look at how they are fitted and wired, which I didn't want to do until I was ready to do something about it. So at Stoneleigh in February I bought a pair of horns intended for a classic MG (£4.50 to £8 depending on which stall you went to, about £10 or £12 normally). Removing the bumper was easier than expected except for two plastic clips on the top edge near the wheel arch, both of which broke. Haynes says to 'release' them but didn't say how. I was trying to lever them open gently rather than just yank on the bumper, but they both snapped without any apparent flexing beforehand. These are one-offs not used anywhere else on the car (except perhaps the rear) so are probably going to be difficult to get hold of. Fortunately the front ones are only about 3 or 4 inches from the end bolts and alignment doesn't seem to have suffered. The hardest job in removing the bumper was removing the connectors from the fog-lights and temperature sensor. I could only get one off by removing the bulb from the lamp unit (fortunately just a 60 degree or so turn of the bulb holder allows it to be withdrawn) to give me more access to disconnect the wiring connector from the holder. I could have left the bulb dangling on the wiring but didn't want to damage it. The other two did come off more easily, but only because they had obviously been removed in the past and the clips broken in the process!

The new horns are slightly bigger than the original, so I did a test fit to make sure there was enough room and there is enough clearance. I wondered if I was going to find the unused wiring tail on the drivers side, but no, they deleted that as well. No matter, the horns I had bought had standard spade connectors of course whereas the original(s) have special connectors for two very fine pins on the horns, so I made up a tail to go across the car from one to the other. The existing bracket was angled affair with a locating peg to ensure the horn was mounted at a given orientation, but the mounting 'bracket' (just a strip of metal with two holes) for fitting to an MGB was just the right size to put a bend at the end and mount the extra horn in the same orientation. Fortunately they **hadn't** deleted the mounting hole, which is used to mount something else as well, so came complete with bolt. Broke the habit of a lifetime and cut the original connector off for the existing horn, as I couldn't see how I was going to connect the new horns to it otherwise, those ScotchLok connectors being a bit iffy anyway, especially exposed to all the elements, and doubly so given the very small gauge of the horn wires. I soldered bullet connectors to the wires and assembled them with Vaseline, to aid assembly as well as give some protection against moisture.

Tested the horns before refitting the bumper and they have much more presence! By the way, test the horns before you start, you wouldn't want to go to all that effort and find that one didn't work! Loosely attached the bumper with just its top fixings, refitted the fog-light and temperature sensor connectors and tested the fog lights, then refitted the bumper. Final test of the horns and lights, and all done. I did wonder if the missing clips would result in any squeaks or rattles, but in fact one rattle which appeared to be coming from the front right corner seems to have vanished, in two drives of just a few miles anyway.

Idle Control *June 2012*

Ever since I had the car it very occasionally stuck at a high idle, which is a bit disconcerting when lifting-off for a hazard and one continues at the same pace! More recently it has had a tendency to stall, just as disconcerting if I'm turning into a side road and have depressed the clutch and lifted off and then lost power steering! When it has happened in slow-moving traffic I've sometimes not noticed it until I let the clutch out again and effectively bump-started the car, which causes a rapid deceleration, and the Navigator has not been a happy bunny at all. Also I've always found it difficult to get a very small increase in revs for low-speed manoeuvring, it's always either over-revving (for me at least) or on the verge of stalling, and trying to find a happy medium sometimes causes it to cut-out. I did think of looking at it when I had the inlet manifold off for the cam belts change, but was so knackered at the end of that I couldn't face it. Since then it has been getting slightly worse, so I've got to do something about it.

I suspected a sticking idle control valve, which lets air in past the fully closed (when the throttle is released) butterfly valve, to electronically control the idle speed. I knew it was fairly accessible, but it is very accessible - right on top of the inlet tract and near the front with very little round it. Depress the collar on a vacuum pipe and remove the tube, remove the electrical connector to the stepper motor, then two hex socket screws are all that holds it onto the inlet tract, and you can carefully lift the valve from the main tract being careful not to rip the gasket.

Two passages on the bottom of the valve, with a plunger controlled by the stepper motor between them. Quite a bit of soot around the plunger whereas I was more expecting thick oil from the crankcase ventilation system. Two Torx screws hold the stepper motor to the valve, and the plunger comes out with the motor. Gave the valve body and the plunger a good spray with carb and fuel injector cleaner, which is highly pressurised so blasts muck off as well as the solvent dissolving it, and a wipe got things completely clean. Refitted the motor and plunger to the body, put a smear of Hermetite Red on the bottom of the valve (the gasket had remained on the main tract), and refitted the valve to the tract. Replaced the vacuum pipe and electrical connector, and started up. I made tiny movements to the throttle to close and open the valve, also put it in 5th and slowly let the clutch out with no throttle to make the valve open more than normal, and everything was exactly as expected. I've done a few miles in it since but it will need a few weeks without any reoccurrence of the sticking or stalling before I can say if it has fixed things or not.

A bit later on the stalling reoccurred, so took the idle control valve off again. This time it was clean, but I put a drop of oil on the moving parts, and the problem hasn't reoccurred by February 2018.

However the high idle has continued to be a problem, but I could never get it to occur stationary with the bonnet up. And even when it occurred when driving and I tried to come to a halt to get the bonnet up, it would always drop back down before I did so. However one morning in February 2018 it became very much worse, and finally on one occasion with my head under the bonnet operating the quadrant manually the high idle occurred, and I could see what was happening. Although the throttle quadrant carrying the cable returned to normal, the throttle lever it acts upon wasn't. The quadrant has a slot that a pin in the throttle lever sits in, such that when the throttle is opened the quadrant lifts the throttle lever.

March 2018: No different, but in the meantime I spotted a comment on a ZS forum saying they sprayed their throttle body internally with carb cleaner every year. I did that, and then WD40, which improved the sticking throttle thing straight away, and after a few trips seems to have gone away altogether. However as the rubber connector between filter box and throttle body has to be wrestled off and back on I'm wary of splitting it by doing it annually, so will wait until I notice it again. Subsequently another benefit noticed is that creeping in traffic is now no problem at all - an hour on the M5 on Good Friday proved that!

February 2019: Stalling and sticking again, so another spray which seems to have cured the stalling but still get slight and occasional sticking on lift-off. I ran the engine immediately after the spraying hoping to draw off the dissolved products while they were still liquid, but perhaps I should have left it to 'soak'. Or maybe follow up with WD40 as I did before. And it does look like it'll need doing every year at least.

January 2020: At least - as it's stalling again, with the revs surging and dying probably because the control valve is momentarily sticking open as well as closed. Carb cleaner in the throttle body washed quite a bit of oil out, and some sprayed in the bypass port as well with the engine running so it was sucked through. However almost immediately doing it again, so WD40 sprayed just in the bypass port.

MP3 Player

The car came with an 6-CD autochanger, but it only plays CD format and not MP3 on CD like a computer which means you can't get many tracks on a CD, and I need loads of CDs flapping in my door pockets to get my collection on. My son-in-law gave me an MP3 player (NHJ Digital Jukebox with 5GB hard disc) which is more than enough, but how to connect it to the radio? There **is** an adapter available that plugs in place of the autochanger, but it is specifically for the iPod.

I found some FM transmitters, including by chance one at Halfords (Sendai) which is very simple just having a socket for the player to plug into, two buttons to change the transmit frequency, and a display to show the frequency. Plugs straight into the cigar lighter socket (OK, 'auxiliary power supply socket'), and much cheaper than any of the others. I wondered how much range/signal strength it would have, internal radio aerials are notoriously poor as compared to external. Plugged it in, started the player playing, selected a frequency, and set the radio seeking for it. It found it OK, but there is quite a bit of interference with the player down by the cubby under ashtray and the wire coiled up, which is the most logical place to keep it. Then I found that if I moved the player further away from the transmitter i.e. straightened the wire out it was much better. So far so good. But it was all downhill after that as it started cutting out after a few minutes. Back to Halfords who suggested cleaning the power socket, which did seem to improve things - once - but then started playing up again. After a lot of faffing about where sometimes it would work OK for a while and sometimes not, in both the ZS and Vee, it was back to Halfords again but they didn't have any more in stock, and I thought it was worth trying another one so I hung on.

August 2008: After more bouts of it running OK for some time then cutting out again after a few minutes I went back to Halfords again, this time they did have another one on the shelf, and exchanged it without question. First drive of nearly half an hour and no cutting out but it is early days yet. However it also has much better signal quality and that is with the player and cable coiled up in the cubby, so I'm cautiously optimistic that the first one was faulty and this one will be OK. After a longer test next day and still fine I thought we were there. But the next day it kept cutting out after just a few seconds, so back to Halfords yet again, a refund, and good riddance. Next option was to get an MP3 radio, the cheapest of which I could find locally from the usual suspects was £60. I'd fitted one for my pal with the 'barn find' 78 GT which he sourced very cheaply so asked him where he got it. The good news was that it was under £40, the bad news was it was from Aldi who tend to get these bargains periodically but when they are gone that's it. However he said they had got them in again, so it was down to Aldi. Yes they had, in silver which probably matches the ZS fascia better than the black, but the only take cash or debit cards and I only had my credit card with me! So back home for the right card, back to Aldi for the radio, and back home again. Checked the connections at the back and it was a standard plug with the connections the same as the old radio, but the plug on the end of the aerial cable was the ISO very low profile right-angle, whereas the radio needed a long straight standard plug. So back to Halfords yet again to get an adapter. After that it was a matter of swapping the cages over (the new one not sliding in as far as the old but far enough) then removing a couple of the switches close by so I could hold the big in-line multi-way connector up into a recess above the radio with a screwdriver (the main slot isn't deep enough to accommodate the radio plus this large connector behind it) and push home. Everything works OK, and I'm sure it sounds better than the old one (Kenwood) which took a lot of fiddling with equaliser and bass, treble and middle controls to get sounding anything like decent. MP3 player plugs into the aux socket on the front, but you have to use the MP3 player controls. There are also sockets for SD card (1GB max, I need over 2GB) and USB flash drive (no limit given), the implication being that you can use the CD controls on MP3 files on a flash drive, so that is the next thing to investigate. *September 2008:* And a 4GB proves just the ticket. It can plug directly into the front, and one that swivelled through 90 degrees would reduce the chance of it getting knocked and causing damage, but mine doesn't swivel. No matter, there was a USB extension cable with the radio, which doesn't stick out much, and allows the flash drive to be tucked into the cubby under the ashtray. Not only can you navigate both folders and files, but it displays the names while it is playing.

Mud-Flaps

There was a bit of peppering from stone chips along the lower sides of the car where parts of the body kit faced forwards, obviously from little stones flipped up from the wheels. Although all the body-kit is plastic I still didn't like the look of it, so touched them up and investigated mud-flaps. I didn't want the full-size things which are way too big and agricultural, just small pieces sticking out from the lower side and bottom of the front arches, some cars seem to have something like this as standard. Spent some time searching with Google, but could only find the big ones. Ditto in Halfords, and nothing in the local car spares shop. However the Halfords ones were only £7, quite thin and without any deep moulding on either side which meant they would butt up against the arch quite nicely. The ZS also has three screws securing the body kit and arch moulding in that area, in an ideal position for the mud-flap.

I made a template out of card drawing down the lower edge of the arch and across underneath, then back to encompass all three screws. Cut that out, then put a blob of paint on the head of each screw, carefully lined up the template with the arch, then pressed the template onto the head of each screw, which left a perfect imprint of where to make the holes. Then I could position the template over each arch (turning the template one way for one arch and over for the other) to get the amount of overlap I wanted, and scribed round the template for what needed to be cut off. The material is quite rigid plastic rather than rubber, and so was easy to cut with a jig-saw.

Removed each road wheel in turn, the three screws with washers, then fitted the flaps. Being thin there is still plenty of thread left to hold them and secure the body-kit and arch liners. Replacing the road-wheel I put a little copper-grease round the centre hole, as this is a snug fit to a boss on the hub, and you can get corrosion here which makes the wheel difficult to remove.

Servicing

[Checking the oil level]

One year on it's due for an oil and filter change. Rather confused by the Mobil 1 sticker in the window but the specification is 10W/40 ACEA A2/A3 whereas the Mobil 1 viscosity is 0W/40. Turns out they were only paid to put the sticker in the window, not the oil in the engine! Wandering round Homebase while Bee was having her MOT I found some Castrol GTX 10W/40 they were selling off at half-price, so that was a result. Subsequently I did use Mobil 1, and even more subsequently it's gone back up to 5L and on offer so comparable to lesser products. Next problem was the filter. Halfords don't have the ZS (or ZT) listed in their customer quick reference cards only the ZR for some reason, and it isn't even listed on their computer, however it is listed online as HOF319. Following an enquiry on the BBS I found the MG Rover/XPart number was LPW100160, and an MG/Rover specialist only a few miles (S.A.S Autos) away had them at £7.50 and no

VAT, so another result (*Update May 2011:* Part No. updated to LPW100161, **not** 100181 which is the smaller filter for the 1.4, and only £7 this time).

Much less of an issue than with Bee as the ZS uses a hanging filter rather than inverted. This is significant as hanging filters don't drain when parked, unlike inverted like Bee's which can take a long time to get oil pressure on restart. Inverted filters need an anti-drainback valve to try and prevent draining, but not all do, and some are more effective than others. It just so happens that the Halfords **does** contain an anti-drainback valve, whereas the MG Rover doesn't, but as I say that's not an issue. But another difference is in the length of the filter element - 87mm on the Halfords against 77 for the MG Rover. I found references to Crosslands 2C2277 and Filtron OP580/6 equivalents but don't quote me. Another car spares place nearby had a Fram equivalent at half the price of the MG Rover, but since I found the pressure rise time with a Fram on my roadster was very poor compared to Volvo/Mann (and even Halfords and Champion), and some don't have a bypass valve so the filtration medium can burst on cold starts, I won't use them again. *March 2019:* I get my Mann filters for the two MGBs from Halfords so look to see what they have for the ZS as I have a discount voucher to use. Showing a Crossland L10289PS but at only £4.66 which seems worryingly cheap. Also a Mann W719/33 which although it is £12.35 gets my vote. Another time I'll probably go back to the MG Rover item which a couple of eBay places have for £6, or £9 for two from the same vendor (£10.76 if you buy two in the first link!), post free, and come with new aluminium sump bolt washers.

Oil Filter and many other part numbers at MG-Rover.org together with other spec and 'how to' info.

It will be due for a cambelt change next year and out of interest I asked the filter supplier how much - £700 ouch! But a neighbour knows people at Gaydon who worked on these engines and has offered to help, so I think I'll be taking him up on that (did it myself in the end, see here).

The Haynes manual shows where the filter, drain plug and gearbox level plugs are but as close-ups so it isn't easy to see where on the car they are. These pictures give a more general view and have the items arrowed. The filter and drain plug (15mm) are on the right-hand side near the back of the engine, the gearbox level plug on the left-hand side immediately behind the driveshaft. Mine is an R65 gearbox, the plug is slightly closer to the driveshaft on PG1 gearboxes it seems. Haynes says to remove the undershield, but it isn't necessary on my ZS180 at least, either side. The sump drain plug was very tight, I had to use my breaker bar. If you undo the final threads with your hand coming in from the side and above the bolt you can avoid the dreaded 'hot oil up the sleeve' syndrome. But the old oil squirts out quite fiercely in an arc to begin with landing a good 12" or so from a position vertically beneath the drain plug, I also got a small amount dropping vertically as well, so you need a large enough receptacle to collect both. Whilst newspapers will collect drips they won't be good enough to collect even the smaller vertical flow. Bear in mind the sump and filter holds 5.2 litres so make sure your receptacle is big enough. As the level lowers the arc lessens, eventually dropping vertically for the last trickle, so you need to be watching it to keep the receptacle under the flow(s), as well as watch out for any breezes blowing the smaller trickles around (newspaper is fine for catching these). Haynes says to renew the sump plug sealing washer, but they always say that, I never have with previous cars and I've never had a problem, so didn't lay one in. However on all my other cars they have been copper washers, this one looked like steel with a rubber insert sealing to the threads, so I think it advisable **to** replace and I will do so in future. However subsequent research showed this to be a mystery part that no one had ever seen on a ZS 180, although Halfords have something very similar for a Ford (I think). It should be an aluminium washer (ALU1403) but Halfords have the correct size, so I bought one for the second service. The filter came off easily enough with my chain wrench, which only just fitted between the filter and the part of the sump that is adjacent to it. Because the filter is angled oil leaks down the side while you are unscrewing it, which with latex gloves makes the filter very slippy and impossible to get a grip on. But the oil is hot so you do need gloves! Eventually I have the idea of wrapping a couple of turns of masking tape round the filter before I start, and that makes things much easier. It isn't really feasible to change the filter while the oil is still draining from the sump unlike my MGBs, so you have to wait until it is finished, refit and tighten the sump plug before doing so. A lot more oil comes out of the filter and filter head, so again the receptacle needs to be underneath. Mine was pretty full from the sump, so I emptied that into an old 5L oil can before removing the filter. With the old filter off and it and the oil out of the way get the new filter, lubricate the rubber ring with fresh oil (the books say, personally I use the oil just drained. Just use a smear, if you put too much on it might run down the side of the angled filter when fitted making you think the seal is leaking), screw it on to the filter head bearing in mind the ZS180 is at an angle and not vertical i.e. don't cross-thread it. When the rubber seal just touches the filter head use hand pressure to turn another 270 degrees or 3/4 turn. Double-check the sump plug is tight. Refill with 10W/40 ACEA A2 or A3 (ignore the Mobil 1 stickers everywhere). Fill to the Min mark, another litre should bring it up to the Max mark. Start the engine, **immediately** check underneath for any major leaks, check the oil light goes out (it will take longer than normal this first time) then spend longer underneath making sure there are no drips or leaks. Switch off, and after a few moments recheck the level, you will probably have to add a bit more to take account of what is now sitting in the filter.

Update May 2010: Time for the oil and filter change again. After discovering last year that my drain bucket only holds 5 litres and overflowed, this time I bought a 6 litre drain can, which made more mess than the overflowing bucket last time! The trouble is that the flow shoots out with such force, even with the oil filler cap still on (which makes no difference with this type of crankcase breather system as the restriction is between the crankcase and the inlet manifold, not between the crankcase and outside air as in the MGB), that it shot over the shallow sides of the drain pan. Even standing on large sheets of newspaper in a cardboard tray it escaped, fortunately the corner of the tray was just over the edge of the groundsheet I was lying on so stayed off the drive. The can must be lying completely flat and level or again it will overflow the sides, and the side you drain into bulges up so you have to press the middle down to get it to pour in through the bung hole, and there is always some left behind. I'll have to think of something else for next time, maybe building up the sides, or holding a 1-litre container with the bottom cut off in the flow, with its flexy nozzle sticking in the bung hole. The hanging oil filter is also a pain, being at an angle oil starts running down the side as soon as the seal comes off the seat, latex gloves won't grip it any more, so you have to wait for that to finish draining before you can get some newspaper round it to get a grip and unscrew it the rest of the way, more oil running down, and up your sleeves if you aren't careful, and even after that when you finally remove the filter another cupful of oil spurts out of one of the ports in the filter head. Ended up dropping old filter and paper into the bucket, more mess to clear up. You can quite see why people bang a nail in the bottom first to fully drain it, but I wouldn't dare do that until I had started it undoing. I changed the rubber-cored sump-plug sealing washer for a plain alloy one last year, so that just went straight back on. After running the engine to check for leaks I noticed a little runnel of oil comes down the side of the new filter to form a small droplet on this and previous occasions, just the one, so probably just surplus oil round the top and not a leak.

August 2014 **Checking the oil level:** I say 'fill to the Min mark ...' and 'recheck the level' above, but it nowhere as simple as that compared to any other car I have had. For some time the erratic readings confused me - sometimes above the Max mark (strongly advised against in the handbook) and sometimes below, with no correlation to usage or topping-up, even when I followed the handbook advice of withdraw, wipe, reinsert, withdraw again, and check. Then I realised that because of the wavy tube and the wire dipstick, as I'm withdrawing it the indicator is depositing oil further up the tube. Then when I reinsert and withdraw again, the oil that has been deposited in the tube is being picked up by the top of the indicator and hence appearing above the Max mark.

So I can only check the oil after it has been standing some time, ideally overnight, and then only withdraw it once checking the level immediately. If it needs oil I would have the same problem, so going by the indicator I have to judge how much I need to add (nothing if it is more than half-way from Min to Max, 1/2 litre if it is between Min and half-way to Max, or 1 litre if it is below Max), add that amount to a 1 litre container that has graduations down the side, then empty all that into the engine. However. Having found the level about 1/4 the way from Min to Max, I added 0.6ml. Next day the level is off the top of the indicator! I hadn't run the engine after topping-up, but surely oil can't lodge at different levels in the engine until it is run, can it? But I run the engine for about a minute, switch off, leave it for about five hours, and now it is only about 1/8" above Max. A couple of people have suggested leaving the stick out overnight, then pushing it down, pulling it up and reading it then. But for that to make a difference the indicator would have to be trapping the oil above it, and seeing as how the indicator is less than half the diameter of the tube I can't see how that would happen. Nevertheless I pull it up a few inches (not quite the same thing I know) i.e. more than the length of the indicator and wedge it under a suitable bolt (or the bonnet will push it back down again) and will see what it is like in the morning.

For similar reasons I can't check it shortly after running the engine either. For oil changes I have to add the bulk then a litre at a time until it appears on the indicator, then use that level to judge how much extra I need to raise it to Max, and add that amount with my graduated 1 litre container. This is all before running the engine for the first time, checking the oil light goes out, and for leaks. Then I have the problem of not knowing how much extra I need to replace what has gone into the new filter, and anywhere else it might have drained out of, until it has been left several hours or overnight again. A pain.

May 2015: Oil and filter time again, and this time I decide to measure how much comes out. The book says 5.2L for an oil and filter change, so I put 4L of the old oil in one empty oil container (4L was the highest mark even though it is a 5L container) and got another 2L in another oil container - i.e. 6L! So I emptied a fresh container (5L) of Mobil 2000 in first, then added another Litre from a part used container. Dip-stick initially showed up to the Max mark, but I'll have to wait for it all to drain down before I can get a better idea.

Jan 2016: Still struggling to get repeatable indications on the dip-stick - sometimes nothing, sometimes way overfilled. Then I read that you have to pull it up a bit, leave it 30 secs, then push it down and pull it out to read, and that should give an accurate reading. Thinking about it I realised what is happening to make it so erratic. Because the oil level is above the bottom of the tube, and the top is sealed, you effectively have an inverted closed cylinder in the oil. And if you ever played with beakers in the bath, you should have discovered that if you fill one with water, invert it under water, then lift it up, it will remain full of water until the bottom breaks the surface. Likewise if you press an inverted beaker down into the water, it remains full of air. So almost certainly what is happening is that under normal driving conditions the level of oil in the tube could be anywhere from level with the bottom, so some way above the level in the sump. That added to the fact that when in oil, the indicator drags some up the tube, so that when you push it back in and pull it back out again the indicator picks up oil from the sides of the tube even though the main level in the tube may now be correct, makes it almost impossible. However by lifting the dip-stick up just enough for the O-ring to clear the top of the tube you have opened the top of the cylinder, so the oil level inside the tube will now equalise with that in the sump (probably best done hot to flow quicker). The bit I read said to leave it pulled up for 30 secs, then push it fully back and pull it right out to read. However once the O-ring reaches the top of the tube it closes off the cylinder, and pushing the stick in further will push the oil level down the tube a bit, so I don't think there will be much of a difference in the reading between doing that, and pulling it straight out from the O-ring being just above the top of the tube. And having tried it several times it does appear to work! You still can't do the normal trick of pull it out, wipe it, push it back in, then pull it out to read it because of the oil being dragged up the tube, but the oil level will equalise on the dip-stick indicator as well as inside the tube, so although not 'dry' above the sump level it is still reasonably easy to see where the actual level is. *March 2016:* At the service I emptied a new 5 litre can in, then carefully added another 0.2 litres as best I could judge from the markings on another 5 litre can, and after leaving it to settle for a good few minutes (because it was cold) with the stick pulled up slightly found it exactly on the Max mark! Rechecking using this method over the next two or three days (checking hot it settles much quicker) showed the level as consistently correct, so at last I can put that one to bed.

Haynes says the gearbox could be either an R65 or a PG1 - mine is an R65. With the gearbox level plug (17mm, drain plug is 3/8" square drive!) undone use a mirror and torch to check the level. Mine is down a bit, I didn't get any in to begin with, so I shall have to get some then get down and under again to top-up. Use 70W/80 gear oil in the R65 gearbox, should be easy enough to get hold of. The PG1 takes MTF 94 - Haynes gives this a viscosity of 10W/40 which makes it sound like engine oil but I don't think it is so don't use it instead, other suppliers indicate it is 75W/80. There is a lot of discussion on various boards (search Google with 'MTF94 oil') and it seems a bit specialist - people reckon it is vegetable oil and not mineral (which is why you wouldn't use engine oil even of the same viscosity); other sources say it is fully synthetic; yet more say ATF either isn't up to the job or makes for stiff changes when cold, and so on. The R65 has a routine replacement schedule of 60k or 4 years and takes 2L dry fill or 1.8L drain/refill. The PG1 is 'filled for life' except for topping-up, but if found necessary takes 2.2L dry fill or 2L drain/refill.

Starter Motor *January 2017*

A couple of times during 2016 I'd turned the key to crank, got a slight click and slight dimming of lights but no starter. The next turn of the key started as normal, so I was pretty sure it wasn't the battery itself. After the third instance I decided I had better do something about it. As it was so intermittent, and the next try was always OK, testing at the time was obviously not going to be any use. So I positioned my trusty little analogue multi-meter I've had since the 60s on the centre console by the little cubby-hole, and ran a 2-wire cable from there behind the glove-box, out through the door-seal, then under the top rear corner of the wing into the engine compartment (invisible with the door shut), straight to the battery connectors (with an in-line fuse on the 12v connection in case my cable should get damaged and short). That should confirm the battery as well as checking the post connectors - as long as I remember to watch the meter each time I cranked. Needless to say it was many weeks before it happened again, but on one occasion in December it did it again and I was watching - and the battery dipped from 12v to between 10 and 11v. That should be more than enough to turn the starter, so not a battery or battery connection problem. As another check I did a test crank with the car in 4th gear to check the voltage with a stalled starter, and that dropped right down to about 7v, so I reckoned the dip I did see was purely from the solenoid, which on the MGB at least takes 50 amps to pull in then 10 amps to hold while cranking. So the problem would appear to be further towards the starter, but the solenoid itself was almost certainly being energised.

The next thing was to monitor the voltage on the solenoid stud, then on the link between the solenoid and the motor - which conveniently also has a stud. There does seem to be some corrosion around the battery cable stud, which may be the cause of the problem. If I remove the nut and put the meter wire under it and retighten, if corrosion there is the cause that interference may be enough to make the fault go away for a time at least. In which case if I remove it, clean it up and refit with copper-grease that would solve it for good, but I would never be sure it was the problem. As there is a reasonable amount of thread left exposed on the battery cable stud I lightly attached the meter wire to that with another nut, and when it happened again I could see 11v or so, so it isn't the battery cable.

The output stud on the solenoid doesn't have enough free threads, so I remove the existing nut and put my meter wire under it, and retighten. It doesn't take long for it to happen again, and now I can only see 2v, whereas when it cranks there is 10v, so it is the solenoid contacts that are the problem. Researching replacement starters there are a couple of specialists that have them at £60 inc VAT plus £10 P&P and £85 inc VAT and P&P, plus Rimmers who have the original at £188 (plus £120 exchange surcharge and the cost of sending the old one back), or an outright purchase after-market at £92 (all plus P&P). Incidentally the Rimmers drawing shows a geared starter with three mounting bolts, which is **NOT** correct for the 2500cc 6-cylinder ZS 180, which only has two mounting bolts. There are several different motors for the 45/ZS range, including a different one for the 2 litre 6-cylinder engine, so make sure you get one that is equivalent to NAD101340. As I stand a chance of opening up the solenoid and investigating the contacts as I did with the V8 I decide not to order a replacement starter just yet. But as we are in a cold spell at the moment with temps at or just below freezing I'm not minded to start fiddling immediately. So far it has always cranked at the second turn, but the incidence is now getting more frequent, so I can't leave it too long. Incidentally, when it just clicks it always shows 2v, and not zero volts as you might expect if the contacts were failing to close at all, or different voltages which you might expect from a bad connection. See here for the probable reason.

A few days later it is a few degrees warmer. Disconnected the battery earth connector. The charcoal canister is in the way and Haynes says to remove it. The quick-release connector from the tank pipe comes apart very easily, the one on the inlet tract a bit more awkward having to press both sides in together, but comes off. The easiest way to deal with the canister is to remove it complete with the bracket, which will have to be removed anyway. The bracket slots into a tapered slot on the inner wing, and is jammed tight, but with a bit of gentle levering and wiggling it comes free. You may need to slacken the clamp bolt and remove the canister, then remove the bracket.

The solenoid operate wire is a large spade connector, so just wiggles off. The battery cable stud takes a 13mm socket and is a moments work.

The two (on this engine) bolts are 15mm and are very tight, it needs my breaker bar on a medium extension to get the bar in with enough swing-space. But once cracked a 3/8" socket driver and extension undo them further until they can be removed with fingers. Tip! Fully remove the **top** bolt first, as it is much easier to do that with the bottom bolt holding the motor mounting flange up against the block. It is much easier to support the solenoid while removing the bottom bolt, the top bolt is more awkward to get at if you are having to support the motor as well. Note the top bolt is longer than the bottom bolt! Also note that under the head of the top bolt is a bracket supporting an electrical connector and its cables. With the two bolts out the motor lifts off easily after just 20 mins at most.

The solenoid looks like it is held to the motor with three Torx screws - No. 25. However the recess is very shallow, and even with an air-gun I can only undo one of them, the other two get chewed up. So at that point I decide to replace the motor, and refit this one while I'm waiting for a new one. Which is the reverse etc. Remember to get the bolts the right way round (long one in the top), and the connector support bracket under the bolt head and not behind the starter flange - it has to be lifted out of the way to get the motor in. There is another cable in that area (probably from the reversing light switch) and that has to be lifted up as well or it gets trapped between the flange of the starter and the crankcase. Tighten bolts with breaker bar (without going mad), refit battery cable and operate wire, refit charcoal canister with it's bracket remembering the tank connector, and the battery connector. Test and it fires up. Just an hour to remove and refit.

Try to purchase the £60 replacement above, but it says 'your bank has declined the payment' which is a bit concerning. Rather than try again immediately, as the car is working, I'll leave it a couple of days to check the credit card and make sure no payment has gone through. No payment went through, so I tried again, but because of my previous concerns this time paying by PayPal. That worked, and the motor duly arrived. However a couple of days after that I was contacted by my credit card company about two suspicious transactions totalling almost £1000, which I had not made! Coincidence? Hmmmm. Because of that I've deleted the link to the supplier.

Anyway, back to the motor. I opted for Click and Collect and on the way back from that the old starter needed three goes before it would crank the engine, so definitely time to change it. But first, test the new motor. You don't strictly need jump leads, almost any wiring will do, as the current when not cranking an engine is very much lower. In the past I've used little more than bell-flex. Applying 12v to the body and just the solenoid operate terminal (not the battery cable stud at this stage) elicits a big clonk from the solenoid, the pinion moves out, and turns slowly, note in which direction. Disconnect, now connect 12v to the battery cable terminal, earth to the starter body as before, and then connect 12v to the solenoid operate spade. The same big clonk and pinion movement, now turning much faster.

Remove the old motor as before - battery earth connector first, and do the first test again on the old motor (unless it is completely dead) and make sure the pinion turns in the same direction. Then simply refit the new motor, holding it in position with one hand while you fully insert the bottom bolt, which makes it much easier to get the top bolt in. Again make sure the bolt goes through the cable connector bracket first, and doesn't trap the other cable behind the flange. Tighten, refit battery cable, solenoid operate wire, charcoal canister, and finally the battery earth connector. Check over everything, then test.

It's immediately apparent that this motor is much quieter and cranks noticeably faster than the old one. There is also less volt-drop - what was about 10v when cranking is now 11v after sitting overnight at zero temperatures. When I first had the car I felt that cranking it sounded much like my MGBs, i.e. significantly noisier than other 'modern' cars heard round and about. This is almost as quiet as a geared starter, but not quite. Incidentally this motor design looks identical to the 'Hi Torque' non-geared replacement for the MGB from the likes of Moss, and about half the price of an MGB OE (and about a quarter the price of a geared) as well as significantly lighter and smaller, so I'd have no problems about using this type on my MGBs.

Subsequently I dismantle the solenoid to see if I can see what is wrong. Whilst the solenoid can be removed from the motor by undoing three screws, removing the motor cable from the output stud of the solenoid, and unhooking the plunger from the lever that moves the pinion into engagement, the solenoid itself is sealed by having the casing peened over the end of the insulated end-plate that carries the three terminals. This makes any investigation of the solenoid internals destructive.

Sun Strip

With the much deeper screen on modern cars compared to the MGBs, and even the old Celica, we were getting dazzled with the sun much higher in the sky than we were used to. The ZS has sun visors of course, but there are gaps around where the mirror is which was irritating, and we found we were needing them even for a bright cloudy sky and not just sun dazzle. Even with its shallow screen the V8 has a shade band across the top edge, so I spent some time searching the web with various terms looking for a plastic strip I could stick on, which I felt sure existed. Found loads of references to tinted film to stick over the whole of the glass, but not this top strip. Eventually I gave up. Then months later I saw a reference to 'sun strip' in the Sunday Times motoring section, searched on that, and bingo! What's more, Halfords have them, in various colours. I decided on black as the pale blue they had, despite possibly matching the colour of the car, looked like it might have been a bit obvious.

Followed the instructions to the letter cleaning the glass with meths, then wetting it, before attaching the film. This helps it slide into position as well as stick well afterwards. The only tricky bit was cutting out round the mirror, which isn't perfect, but doesn't really notice. The film consists of clear plastic film covered in dots, which start off at the top being more do than space, then the dots get smaller towards the bottom edge, to give a graduated effect. Makes a noticeable difference, but if anything a deeper or double strip probably wouldn't be too much, it still dazzles more than the V8.

Suspension

Not much to report. A bit harder than I would like, and harder than the launch model as I recall, which had good compliance over poor surfaces as well as good handling in corners. The front springs have always tended to 'bong' occasionally going over our many traffic calming measures, whether the springs tend to twist in the upper or lower seats under lock I don't know.

June 2020: Last year I had an advisory for the second time about the rear ARB bushes splitting, which are the ones attaching the bar to the body brackets, and in a fit of madness decided to replace them. Standard bushes not available but aftermarket poly from B&G were - at the not inconsiderable cost of £36. Access looked easy on the passenger side, but the bolts securing the U-clamp and bush to the brackets on the drivers side are facing the other way and about an inch from the end of the silencer! Won't get a socket in there (mine is 1/4" drive so would need the 3/8" to 1/4" adapter) and didn't want to risk my 10mm ratchet-ring, so bought a 3/8" 10mm socket and a plain spanner. Then did nothing about it until just before this MOT.

Passenger side came off OK, the new bush wasn't split like the original so had to be cut, which when fitted round the bar seemed miles too small. Neither would it fit in the U-clamp, meaning the clamp was about an inch away from the body bracket with the bolts having only about 16mm of thread. Of course the bar had been rusting under a plasticky coating so had swelled up, and the clamp had rusted which similarly reduced the space for the bush. But scraping and chipping the chunks out of both got the bush to fit OK, and smeared with Waxoyl as a lubricant tightened up just fine.

Then the drivers side! Even with the new spanner the flats just rounded off the bolt heads. They'll have to be drilled out, but not enough space to drill back into the threads, so the rear box will have to be removed which will give plenty of space to drill into the heads. Only fitted last year and the nuts and bolts through the flanges look OK, but when leaning on the socket to undo the first one there is a crunching sound and the pipe of the middle section is breaking away from its flange! Buggah, wasn't replaced that long ago, until I checked and found it was six years. Annoying as I can get my air gun in there to undo them, and if I'd done that in the first place I'd probably have got away with it. Nuts and bolts came apart easily as they are stainless - at least Halfords got that part right. Box pulled off the three hangers relatively easily, and then I could get at the bush clamp bolts. Tried again with the air gun put it just spun on the flats, and couldn't force a 9mm socket on (didn't think to try an Imperial). A 3mm cobalt drill bit (Halfords again) made short work of going through the bolt, unfortunately coming out off to one side in the threaded part. Got a selection of larger bits to increase the size bit by bit (ho ho) but my standard 'gold'-coloured bits made little impression. Broke a 6.5mm cobalt which was annoying, but eventually drilled large enough to get the U-clamp and old bush off, and that and trying to retap at 8mm loosened the stubs in the welded nuts of the brackets. Got those out, but the drilling had caught the sides of the threads, so I may have to use longer bolts and additional nuts. Of course as soon as I knew I could drill them I'd ordered replacements (Kayfast - very good supplier) ... but at the correct 16mm when I could have gone for 20mm. Oh well. A bit of chiselling and scraping gets the new bush (only finding the supplied lubricant now) and U-clamp to be a decent fit ... but what to use for bolts in the meantime? Browse round the engine bay and spot two flanged 10mm (head, 8mm thread) bolts holding the belt cover on, and they turn out to be 16mm i.e. the identical bolts. Why use them? Because I already booked the MOT for two days hence before I decided to change the bushes! When the new ones come they can go in the belt cover, although I could probably do with something to hold that in place for the MOT! The filched bolts tighten up reasonably well in the ARB bracket, although I don't lean on them as tight as I might. I may well get the 20mm ones and some nuts from Kayfast to be sure. For the belt cover I find a couple of M8 20mm bolts in my tub of nuts and bolts, so could have used those for the bush clamp as I almost certainly have a couple of nuts as well. 'Oh well' again, however as these have a larger hex head (the originals are flanged which gives the same clamping friction with the smaller head) a larger socket may not fit the head properly with the U-clamp being beside it.

Variable Intake System *Added February 2009*

The variable intake system uses two motors to control a single balance valve and six power valves that change the length of the intake tracts in three stages according to throttle opening and revs to get the best balance between economy and performance. Initially all valves are open, and remain so at throttle openings less than 31.4% regardless of revs. At throttle openings above that the power and balance valves are closed below 2980 rpm. Above 2980rpm between 31% and 37% throttle the balance valve opens. Above 3750 rpm for throttle openings between 37% and 43%, or above 4350rpm for throttle openings above 43%, the power valves open as well. See also this YouTube. The effect is quite marked and under brisk acceleration each transition can easily be felt. However that hasn't stopped several people wiring up dash lights to show the valves operating. Except that they don't show the valves operating, only when the ECU is supplying power to the motors. If the motors have failed, or there is a mechanical fault with the valves, you will get the lights, but no VIS!

Wheels and Tyres *Added January 2011*

Wheels
Wheel Nuts
Tyres
Spare Wheel

Wheels: As mentioned above the wheels are horribly easy to kerb, being wider than the tyres. Four years down the road (so to speak) and not having kerbed them for a couple of years or more, I was just thinking I might get them refurbished when blow me if I didn't clout one of them again, so that idea goes on the back-burner. Another problem has been staining of the painted surface particularly at the front from brake dust, but also the rear, being impossible to shift the stains which look like deep scratches with normal hose brush, sponge, cloth, or leather. I did tentatively try a wet green fibrous pan scourer (which is excellent for getting staining of UPVC window frames, fascias etc.) but even tentative rubbing immediately showed some surface scratching so that was out. Then in Halfords I noticed a brake dust remover 'brush' which used wet removes the staining completely, even in the angles between the spokes and the rim, very easily and without any damage. It is perfect for the ZS spokes, and although it started to look a little ratty quite quickly at £4 you can afford to get one every year, and in fact it hasn't deteriorated any further and is still working well 2 or 3 years later. There is a 'premium' version at £5, and no less than 11 wheel brushes altogether from £3.50 to £13, but this one looks the best for getting in between the ZS spokes in the narrow space at the hub. *January 2017:* The original is no longer stocked, another did as good a job, but two years later that was NLA as well.

Wheel Nuts: *April 2017* It wasn't until James Cave wrote saying his had been damaged by previous owners/garages and the wheel spanner had to be hammered on that I remembered my own experiences.

The original nuts have a steel core with a stainless cover over the hex part, that the spanner or socket fits over. Also note that the part that engages with the alloy wheel is radiused, and not a straight taper like MGB wheel nuts for example. So if replacing the wheel with a different type, you may have to replace the nuts as well. The wheel-changing kit had never been unpacked when I got the car, and I've not needed to change a wheel by the roadside. I always use my own jack at home, using a breaker-bar and 19mm socket which I keep in the boot. However early on I mistakenly used a slightly larger Imperial socket, and after that found the 19mm would not go on, much like James has found. I could see that the stainless sleeve had been distorted, but by repeatedly clamping each pair of opposite sides in a vice (smooth faces, or with protection) it restored the situation to some extent, so that now the correct socket only needs a bit of wiggling.

Rimmers show the wheel nuts I have at £12 as well as another type which don't seem to have the cover, and may be chrome at £8. Both seem to have the same radiused seat. The index page shows the original type as being 'from 1980', and the alternative as 'to 1980'. Odd, as the vehicles they are for are the Rover 200/25/400/45/MG ZR/ZS series, and the oldest of those is the Rover 213 which dates from 1984. eBay also throws up some different types, including some with a straight taper. I would avoid chrome as they get damaged by tyre places, if solid stainless are available (as for the MGB) maybe they are a better option than the originals.

Tyres: The ZS has always been noisier than I would have expected (good job I'm used to MGBs) in the shape of tyre/road noise more than wind noise, and almost to the point that I wondered if it was a wheel bearing growling. But first I replaced the front tyres in mid-2010 (normal wear) then I had to replace the rears (moved to the fronts when the fronts were replaced) when there was still some life left in them. The problem is the ZS rims don't always give a good seal, and enthusiastic cornering can deflate them. They are so low profile that I've not noticed any change in handling even when completely flat, unlike the MGB which is immediately obvious even when it is a rear. The trouble is that driving them flat knackers them, putting splits in the side-wall, and when I had them removed to seal the rims one of them was full of rubber crumb which had been eroded from the inside of the sidewall. Nothing else but to replace the pair, which was annoying as even though the same place would have done the fitting I could have got a better deal ordering online than just turning up. However I immediately noticed with four new tyres (Avon on the rear, Coopers said to be made by Avon on the front) it seems noticeably quieter, and the noise I thought could be a wheel bearing has gone. The old tyres were Federal all round and I was wondering whether there was a connection with MG Rover (even though the car has done 35k!) so Googled 'MG Rover Federal' and blow me if I didn't land on an MG-Rover.org posting about Federals warping when they get hot and it sounds like a wheel bearing going! The other thing is that in the extended period of ice and snow in December the ZS performed very well, virtually no wheel spinning or ABS despite travelling from Solihull to Cambridge just hours after several inches of snow at each end. By contrast I saw some FWD cars struggling on barely any incline, and RWD cars stood no chance, being stuck in my road with a slight incline either end for the duration!

September 2017: Yet another puncture, this time in a tyre barely a month old, from a massive hand-tightening clamp like something off a bike carrier or roof rack! Halfords manager said it trumped anything he'd seen before.

Fortunately outside Halfords (but on the public highway ...), they got the wheel off and once the offending item was unscrewed they declared it repairable - good news. However once done it was still bubbling very slightly - bad news, but they didn't charge me. First thought was it would be scrap, but second thought was yet another can of TyreWeld - it really should be able to repair this tiny leak. OK, if I get another puncture the tyre will be scrap, but if I don't then it's only cost me a tenner instead of about £60.

July 2017: For a long time the near-side rear (which used to be on the front) had a very slow puncture which I assume was still from a poor bead seal. Eventually I wondered if Holts Tyreweld would be any good, so purchased a can and 'installed' it. It says to empty the can then remove it, then drive at least six miles not exceeding 50mph, and only then inflate to the correct pressure. As I was at home I decided to correct the pressure straight away, I seem to recall having two tyres on the same axle at more than 10% difference is illegal, and I found it at about 20psi. A couple of weeks later it doesn't seem to have lost any pressure, so fingers crossed.

But then I discovered the front offside completely flat, after having found it 10psi down and reinflated a few days ago - the first time I'd checked that wheel for ages. Jacked up that corner - trolley jack only **just** fitted under the sill with it right down, and turned the wheel to find a screw in the tread.

Will need replacing soon, but still some life in them, so I decide on another can of Tyreweld - never used it before in over 40 years, and now twice in a couple of weeks - as to fit the space-saver spare it has to go on the rear, and a good rear wheel moved to the front. Reinflated, only going down very slowly, slowly enough to allow a quick trip to Halfords. Removed the screw and turned the wheel so the hole is at the bottom as instructed, and connected the can. It's immediately obvious the gunge is coming out of the hole - hmmm. Nevertheless I persevere, and when complete reinflated from about 20psi as before to 33. Drive six miles, and get home to find the gunge has been sprayed around the wheel-arch!

Double-hmmm. Still hissing very slightly, but pressure OK, so I leave it for a couple of hours. Come back to find the gunge has dried, and the pressure at 40psi! Deflate back to 33 and leave it another couple of hours, and no change. Next day it is down to 20 again, so I reinflate, and that afternoon it is back down to 20 again. I know it is only a temporary 'repair' and should have a proper repair as soon as possible, but I'm not impressed that it can't cope with a screw this size. It's all some cars have from new - maybe I should have left the screw in! I did wonder afterwards whether I should have left it just with can pressure and only inflated it to the correct pressure after the six miles, but too late now.

Next working day a quick trip to JustTyres for repair, but a) the inside edge has worn smooth (not easy to see on the car) and b) they won't repair tyres where a product such as this has been used anyway! So on balance definitely not a good idea unless you were really desperate like had already used the spare ... and who is going to carry a can just for that eventuality? So two new tyres, fortunately they were near the wear bars anyway and would need replacement soon. Top - outer edge, bottom - inner edge.

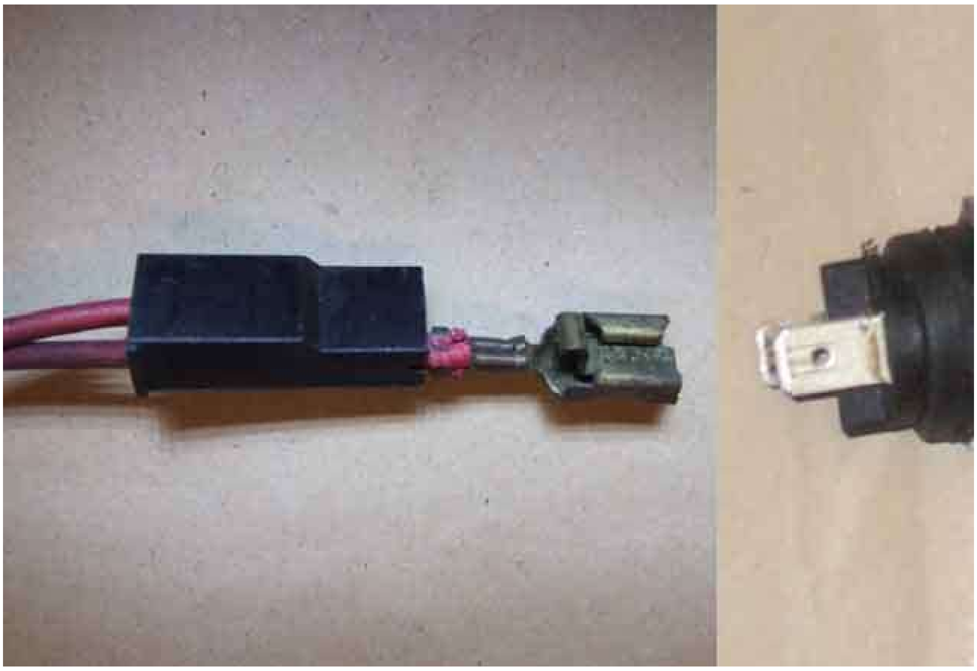
A couple of days later I went back for a tracking check. Only slightly out, +1 on the OS and -1 on the NS when they should both be zero. I expressed surprise they (the other was the same) had worn like that and they said low-profile when they are near to replacement do that. However I always put new tyres on the back and move those to the front so they don't get too old, and have changed them a couple of times before without seeing it before. As with so many things - 'time will tell', and as usual I swapped front to back.

Spare Wheel *Added November 2012* After having owned the car five years I thought I'd better check the spare tyre pressure. Certainly the jack has never been used (still in its cellophane wrapping) and I very much doubt the spare has been out either. In the end it took me over an hour! I could just about move the clamp back and fore, but even with releasing fluid it got so far then I couldn't undo it any more. Good job I was at home and not at the roadside with a puncture, as I had to use various tools to grip the clamp hard enough to be able to unwind it the rest of the way, and it had to be forced all of that way. Just rust on the threads, even though there was no sign of water in the well (so to speak!). Once out I had to clean up both threads with a tap and die before it would move freely, then put copper grease on it for good measure.

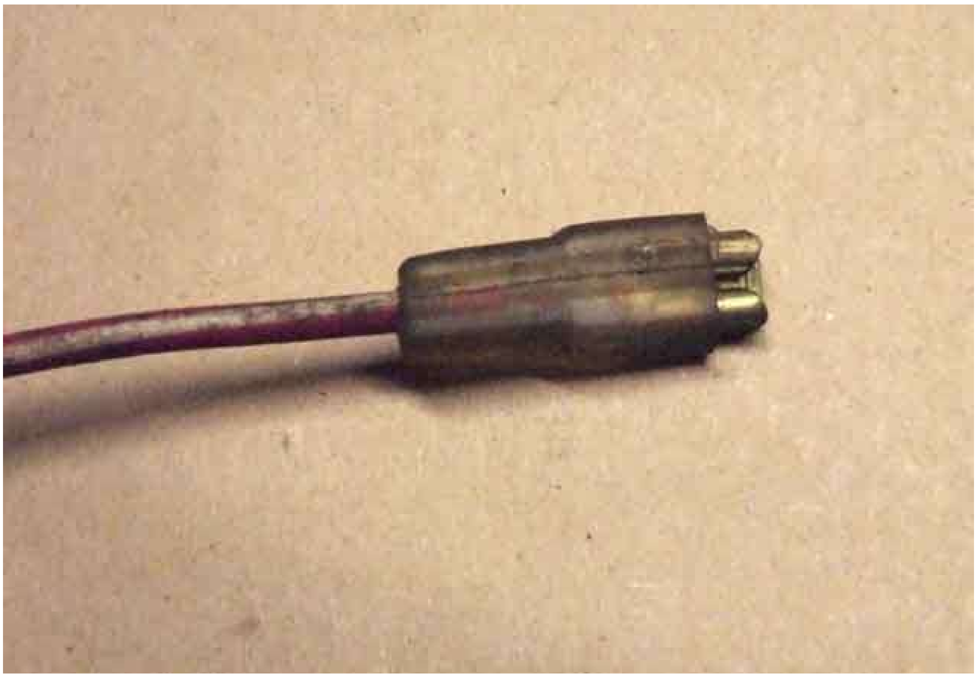
Connectors and Terminals

With this type of spade connector the cover cannot be pulled back but you can test the voltage on the wire but putting the meter or test-lamp probe in alongside the wire, as well as reach the spade.

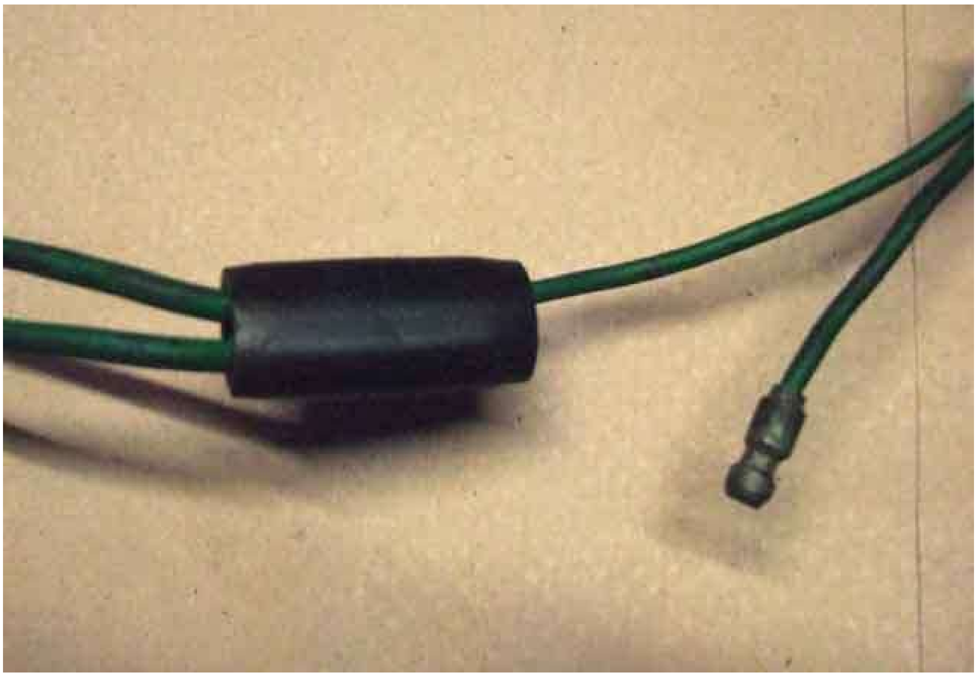
You can't pull the connector off the spade by pulling on the wire as a sprung pin on the connector engages with a hole in the spade. Slide the cover back to depress the spring and move the pip out of the hole to release the connector from the spade. Remember electrical tests need to be done with the connector on the spade, not removed from it.



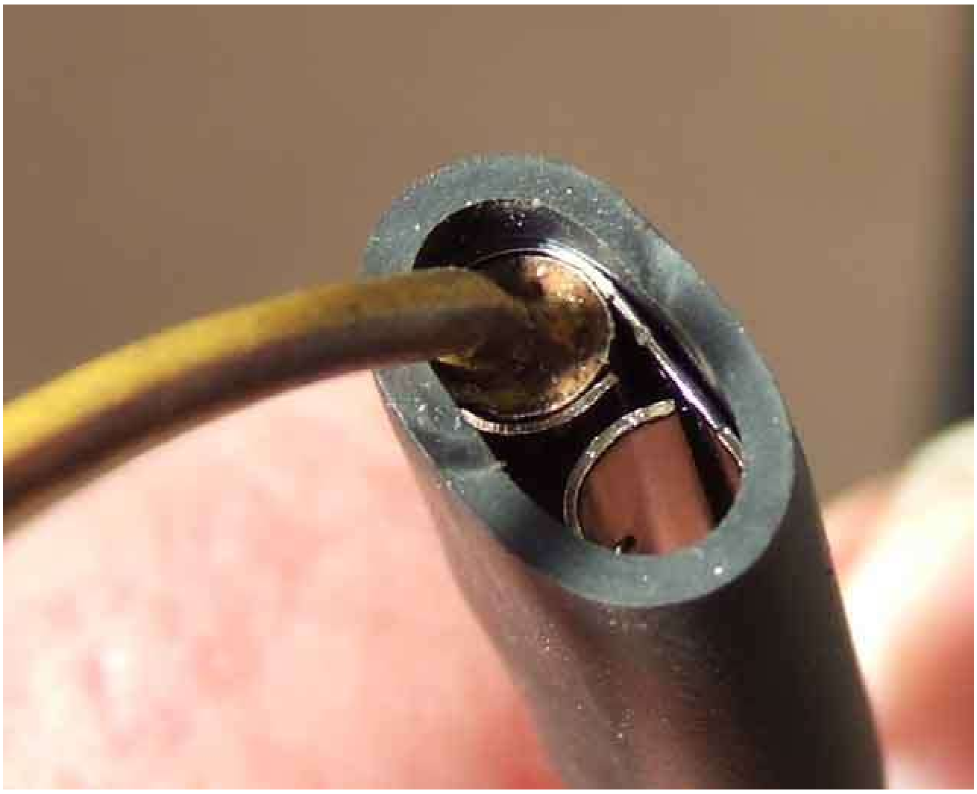
This type has a translucent insulating cover than can usually be slid back to expose both connector and spade for testing. A small pip on the connector engages with the hole in the spade to prevent the two from vibrating apart, but doesn't need to be depressed for removal, just give the connector - not the wire! - a tug.



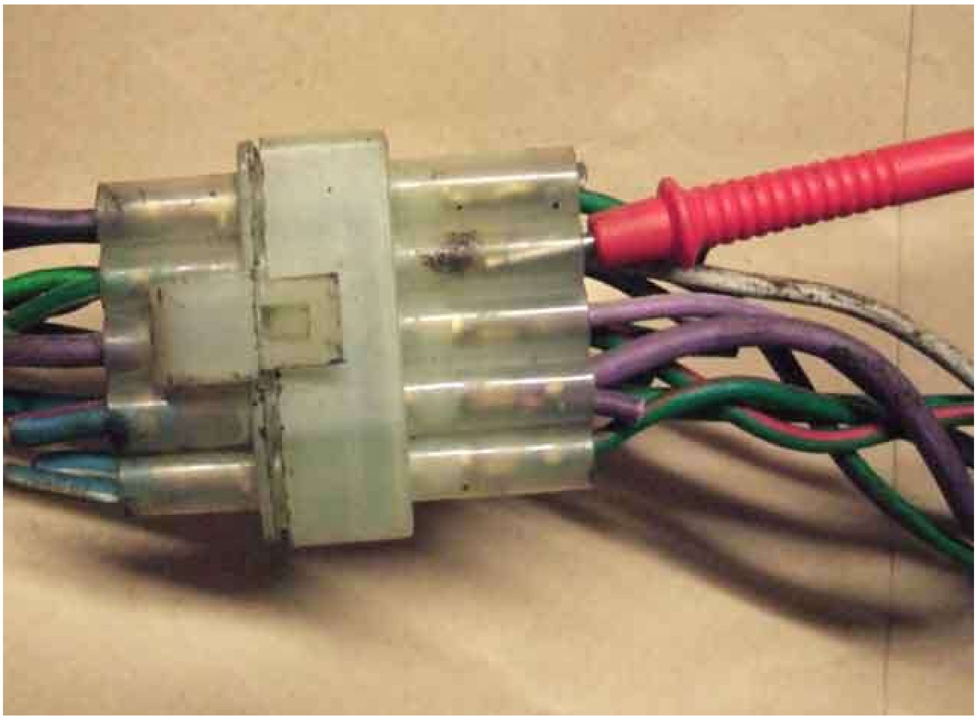
Typical bullet connection ...



... with bullets both sides and sleeves accessible with a test probe.



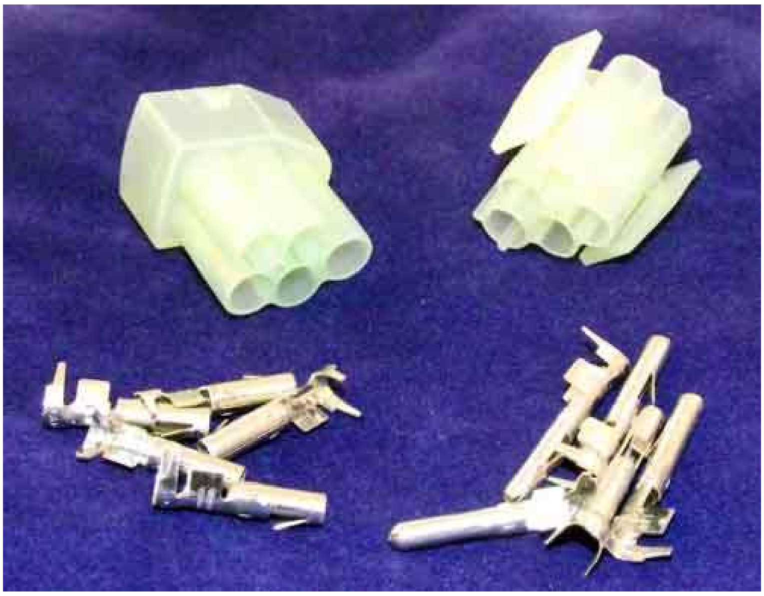
Translucent multi-plug where a probe can be inserted alongside the wire to reach the pins, both sides.



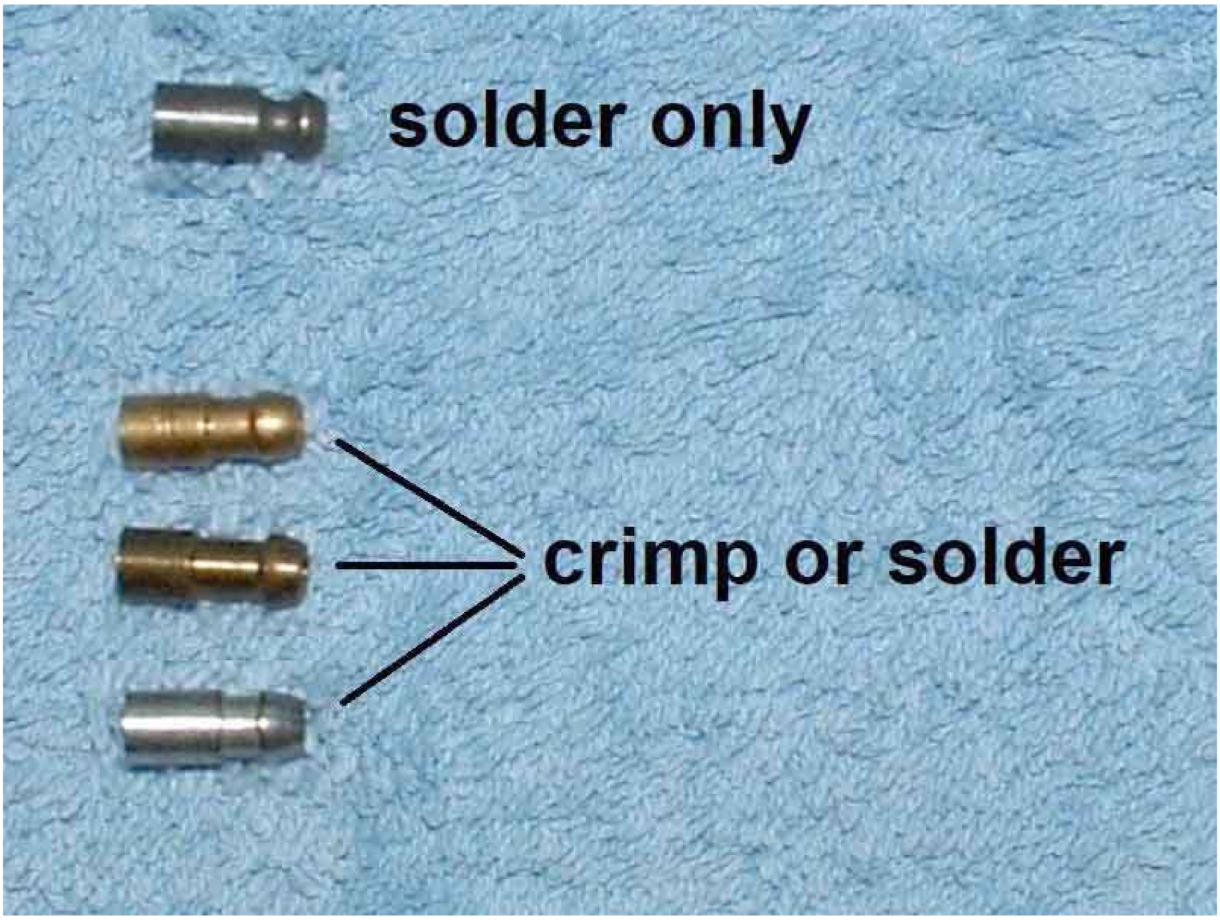
However black and grey multi-plugs are usually moulded onto the wires with no access from the back. In this case all you can do is slightly part the connector just enough to expose the pins, and even then only the pin-side.

Connector pins can be teased out of the non-moulded type by sliding a bit of tubing over the open end, to depress the two little tabs that can be seen here:

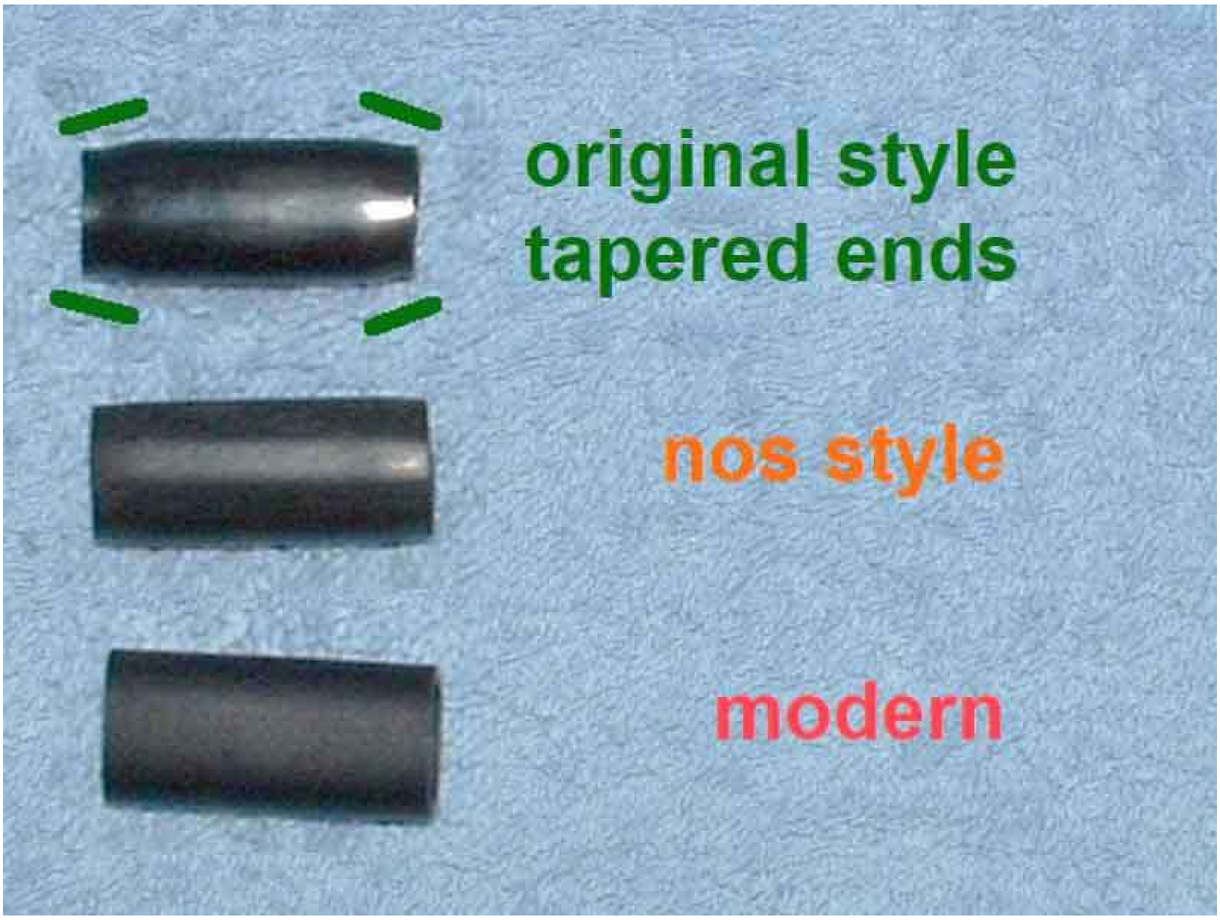
For projects and modifications Autosparks sell multi-way kits in 1, 3, 4, 5, 7 and 9 pin configurations - at a price!



Bullets for use with MGB bullet connectors. Crimp-type need a special tool that acts on the neck of the bullet. Don't use the insulated crimp-type bullets as the red ones are too small and the blue ones too large for the standard connectors: (*Nigel Atkins*)



Typical original (top) and current stock (bottom) bullet connectors. The original have rubber sleeves slightly smaller than the metal part so is a tight fit. Modern stuff uses plastic sleeves of these same size so the metal part can easily slide out of the insulator and short out on surrounding components: (*Nigel Atkins*)



Original connectors have a pronounced dimple that the head of the bullet must be pushed past to snap into position, which also retains it very firmly. Modern connectors have a much less pronounced projection so the bullet can be pulled out more easily: (*Nigel Atkins*)

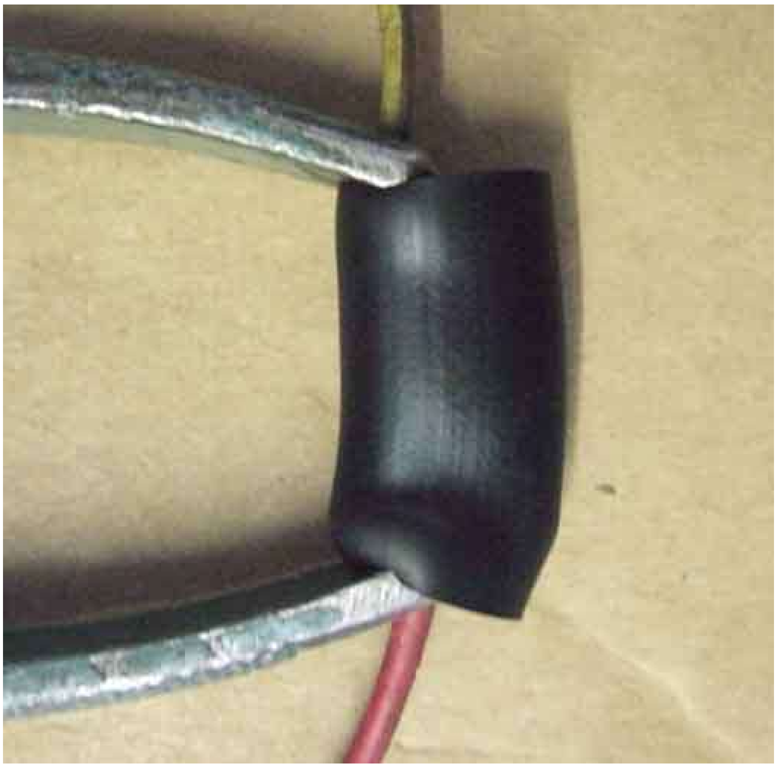
Original connectors have another projection in the middle of the metal part (arrowed) which helps prevent one bullet being pushed too far in, so preventing its opposite number being pushed in far enough. Modern connectors don't have this: (*Nigel Atkins*)

For easy of assembling cut a notch in the handles of a pair of pliers just large enough to slip over the wire but press on the back of the bullet.

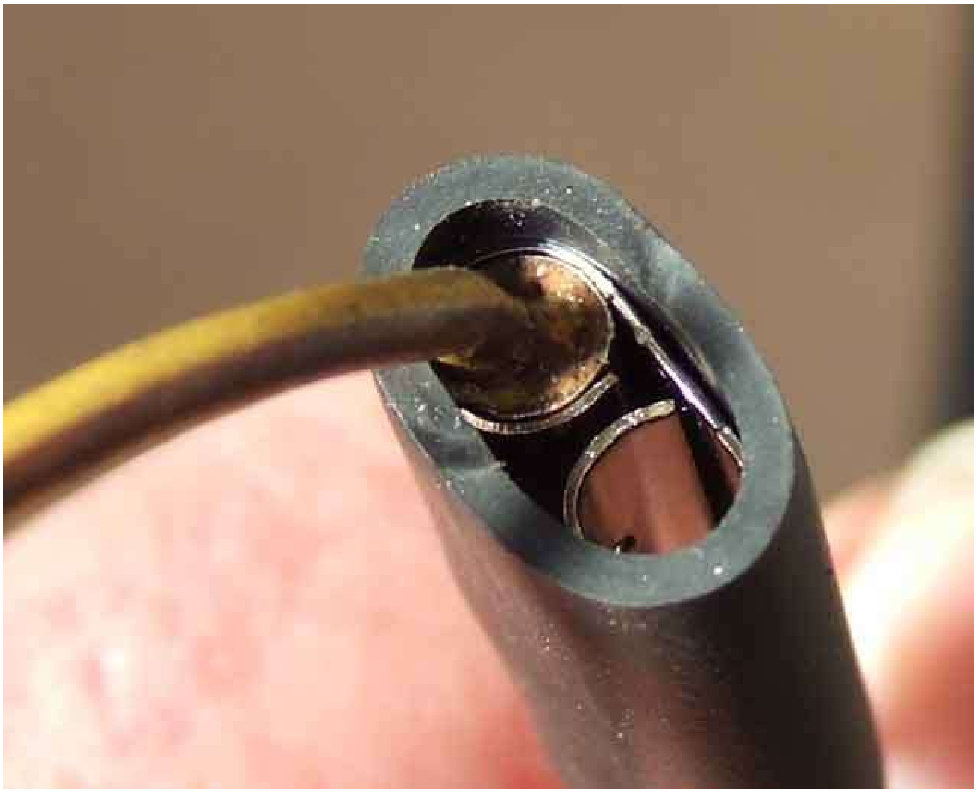
Make sure the closed distance between the handles is less than the length of the metal part of the connector or the bullets won't be pushed in far enough.

Preparing to push the bullets in ...

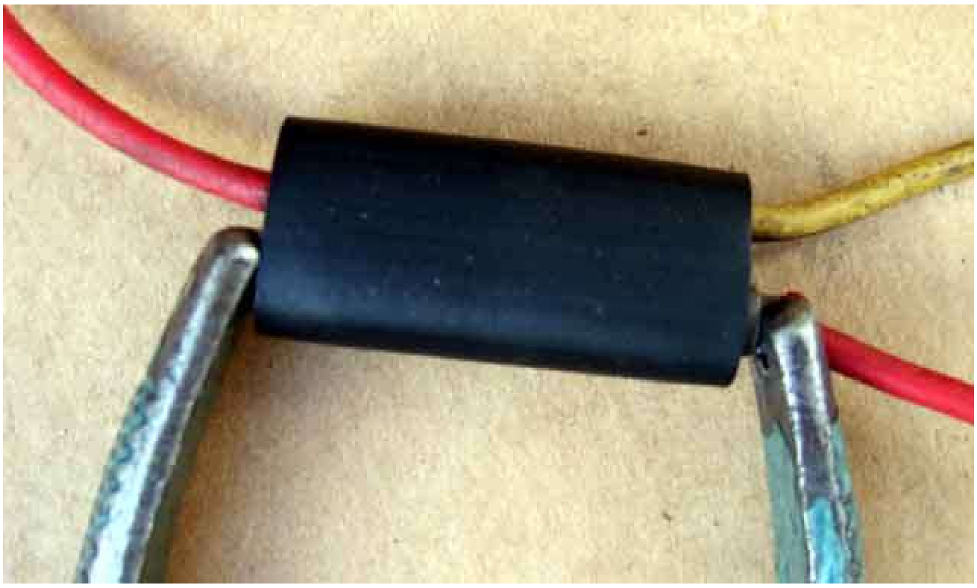
... squeeze until the outer covering is compressed ...



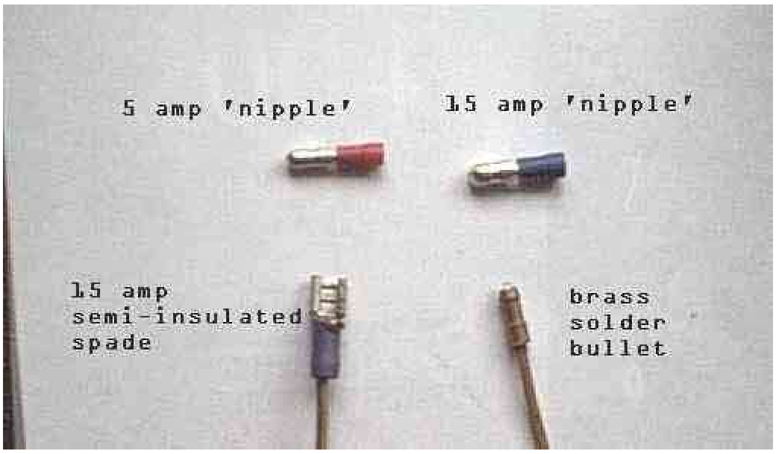
... and the back of the bullet is flush with the end of the metal part.



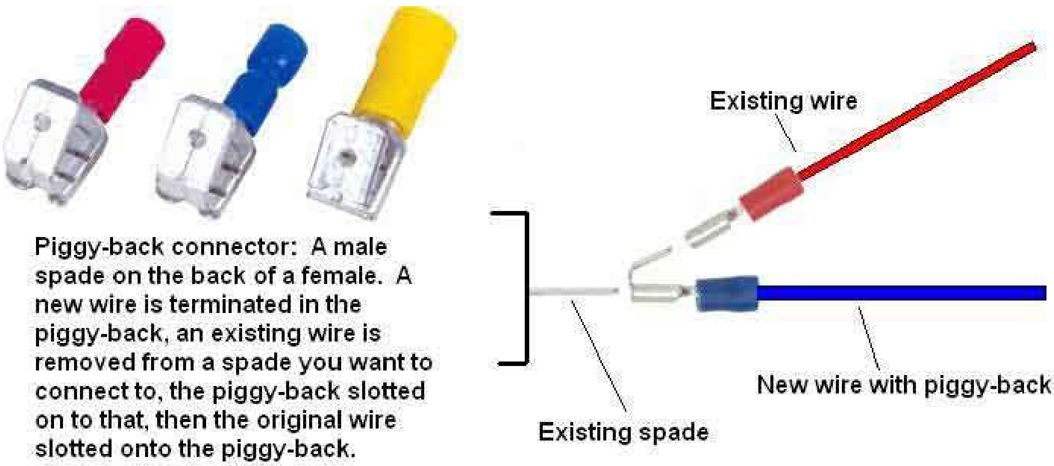
'Odd' bullets i.e. only 3 wires are dealt with in the same way. Finally make sure the metal part is centralised in the outer covering



Various after-market crimp bullets (which don't fit the original bullet connectors) and spades, and an after-market solder bullet which does fit the original connectors.

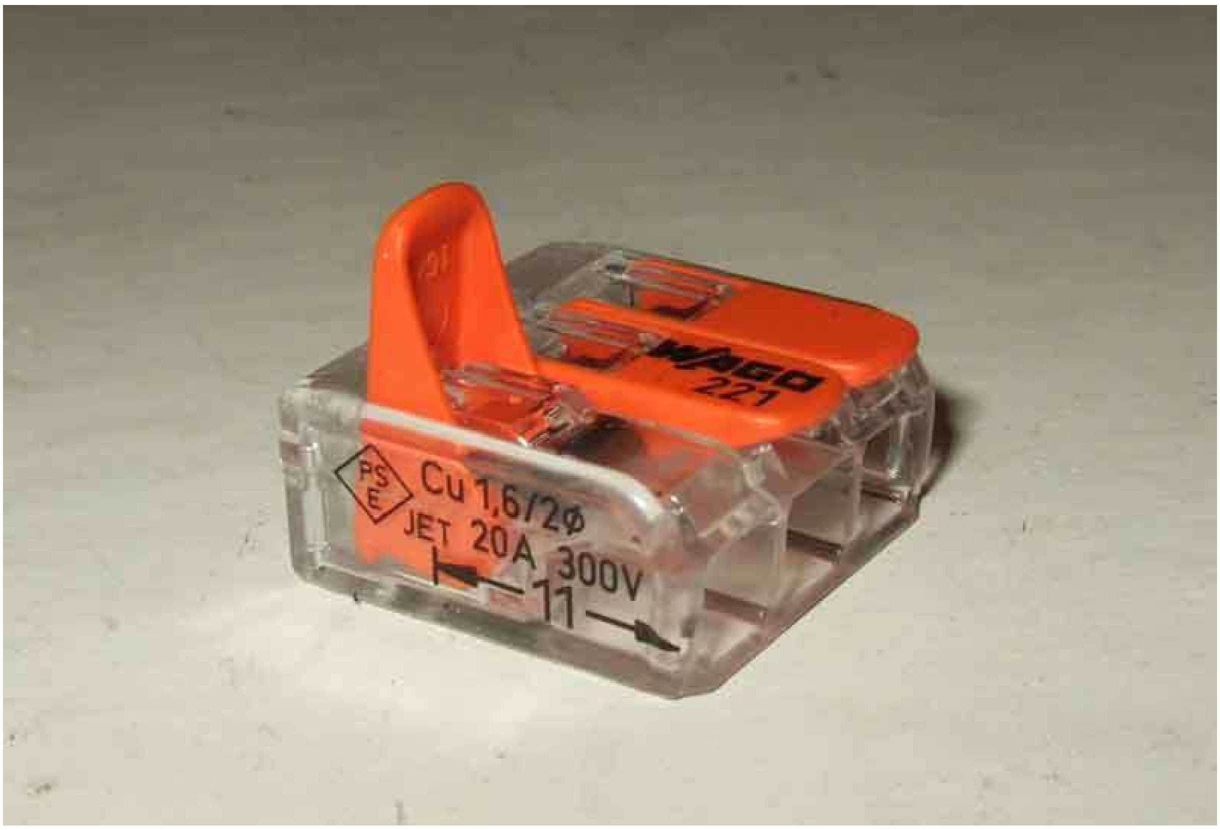


Piggy-back connectors, very useful for daisy-chaining additional circuits off existing spade connections.



Another very useful gadget - a 'Y' adapter when you need to connect two existing females to one male. Saves changing one of the females for a piggy-back. Available from UK, two in America, in side-by-side or back-to-back configuration, another here in side-by-side configuration, and one in Australia.

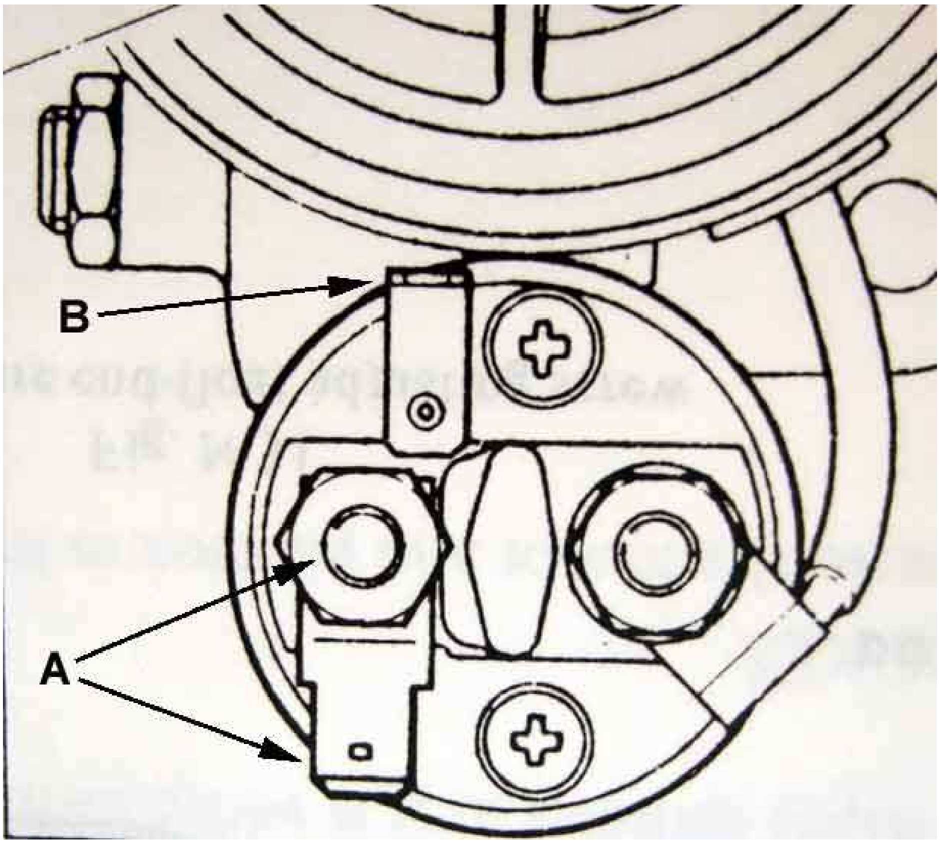
If you need to power several additional circuits from the same power supply whilst you could piggy-back off piggy-backs it's not the best. For those situations you can use one piggy-back to pick up the supply from a convenient location, and take that to one of these WAGO221 connector blocks which allow you tee-off anything up to four other wires. You could cut a factory wire but that would take up two positions and personally I don't like cutting in to factory wires if it can be avoided. Rated at 450v and 32A (although when mine came they are marked 300v and 20A) with slots for a test-meter probe you flip up the orange lever to insert the wire - 24AWG to 12AWG, then press back down to clamp it firmly. If you need more than four circuits they can be daisy-chained. There are cheaper push-fit versions but they are no good for stranded conductors. Available from various sources, [RS Components](#) may be slightly dearer than some but at the time of writing they have no minimum order and free P&P for standard postage.



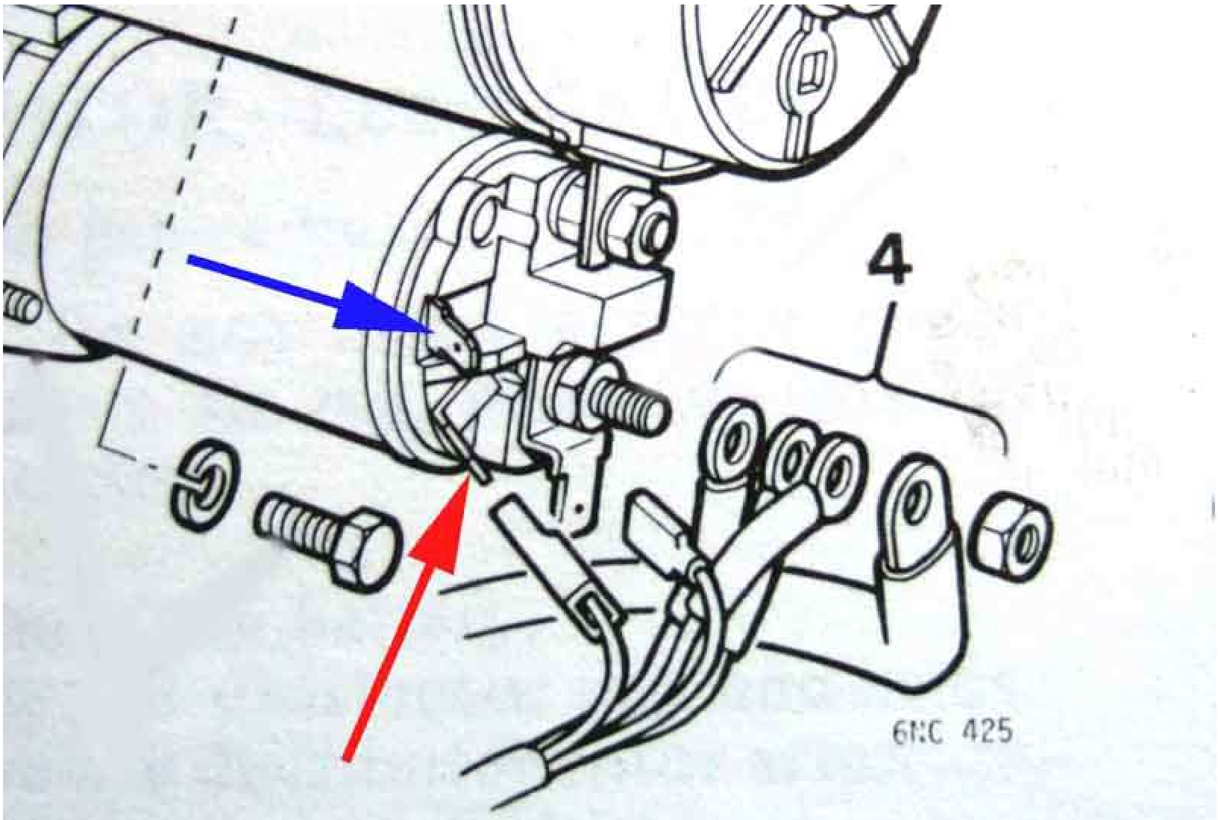
Solenoid Contacts

4-Cylinder pre-engaged:

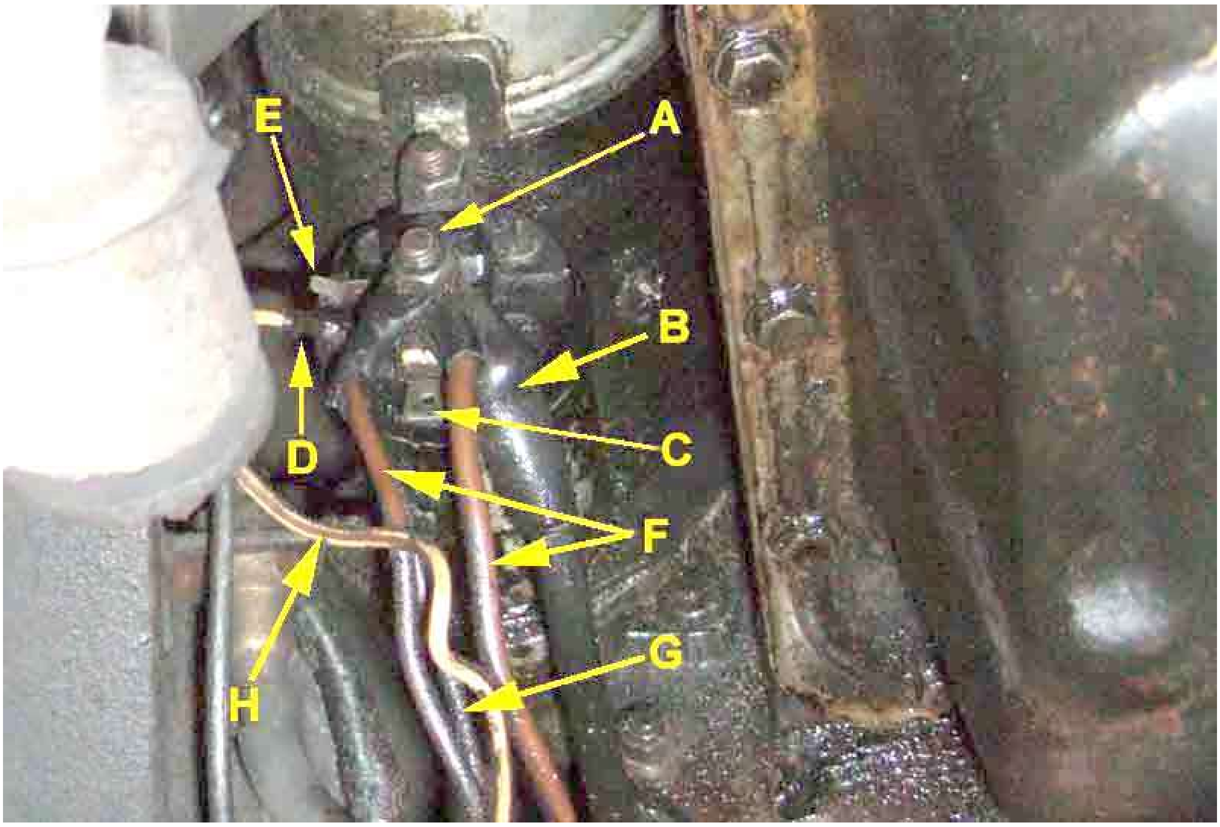
Earlier 2M100 pre-engaged starter on 18Gx engines: A - battery cable stud and large 12v spade. B - standard-sized solenoid operate spade. No 'boost' contact:



Later 2M100 pre-engaged starter on 18V engines, V8 starter is similar: Everything bracketed as '4' goes on the stud - battery cable and two or three brown wires. There should always be two thick brown wires (from the alternator and to the rest of the cars electrics) and an optional standard-gauge brown wire which goes to the alternator for voltage sensing. The large spade (9.5mm) on the stud is for compatibility with earlier models. The standard-sized spade (6.3mm) lower left (red arrow) is for the solenoid operate wire which is a thick white/brown or white/red (or possibly a brown/white, diagrams vary). The small spade above that (4.8mm) is for the coil boost wire (rubber bumper 4-cylinder and all V8s) which is a standard gauge white/light-green (white/light-blue on V8). (*Leyland Workshop Manuals*)



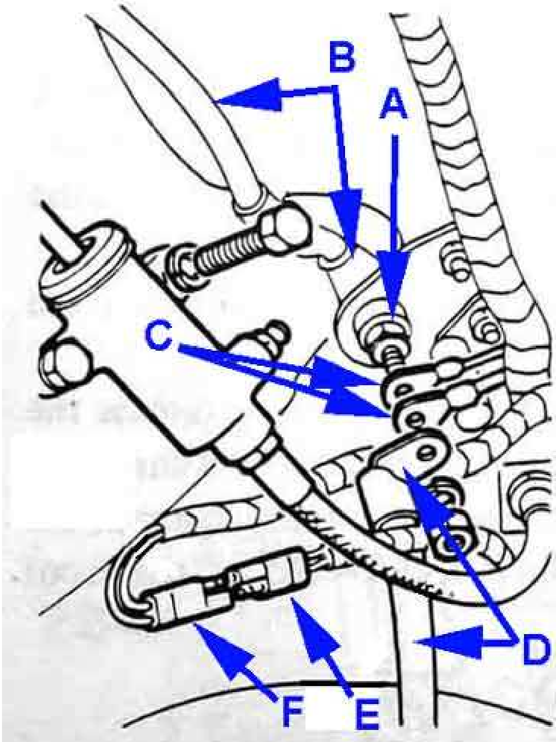
In practice: 'A' is the battery cable stud, 'B' the battery cable, 'C' the large spade for brown wires as used originally. 'F' are the brown wires to the cars electrics and the output from the alternator, 'G' is the additional smaller gauge wire to the alternator on cars that used battery sensing. 'D' is the solenoid operate terminal and 'H' the solenoid operate wire, 'E' is the coil boost terminal only used on rubber bumper cars and V8s:



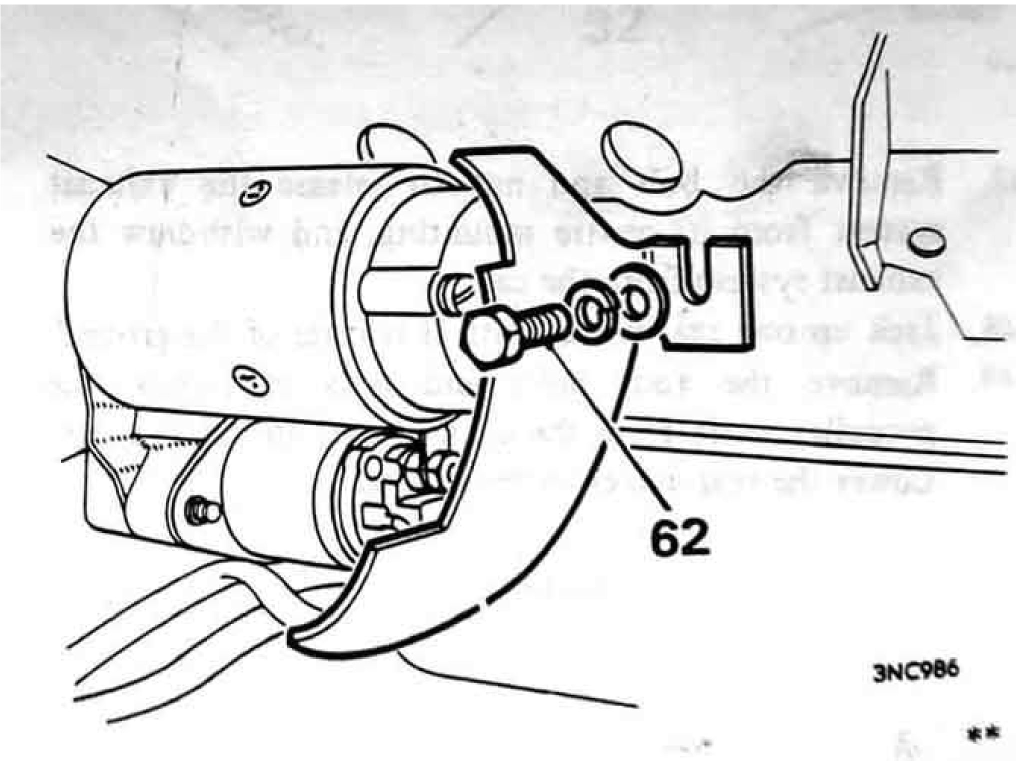
Rubber boot over the starter connections from May 72: (*Ahmed EL Abasiry, Canada*)

V8:

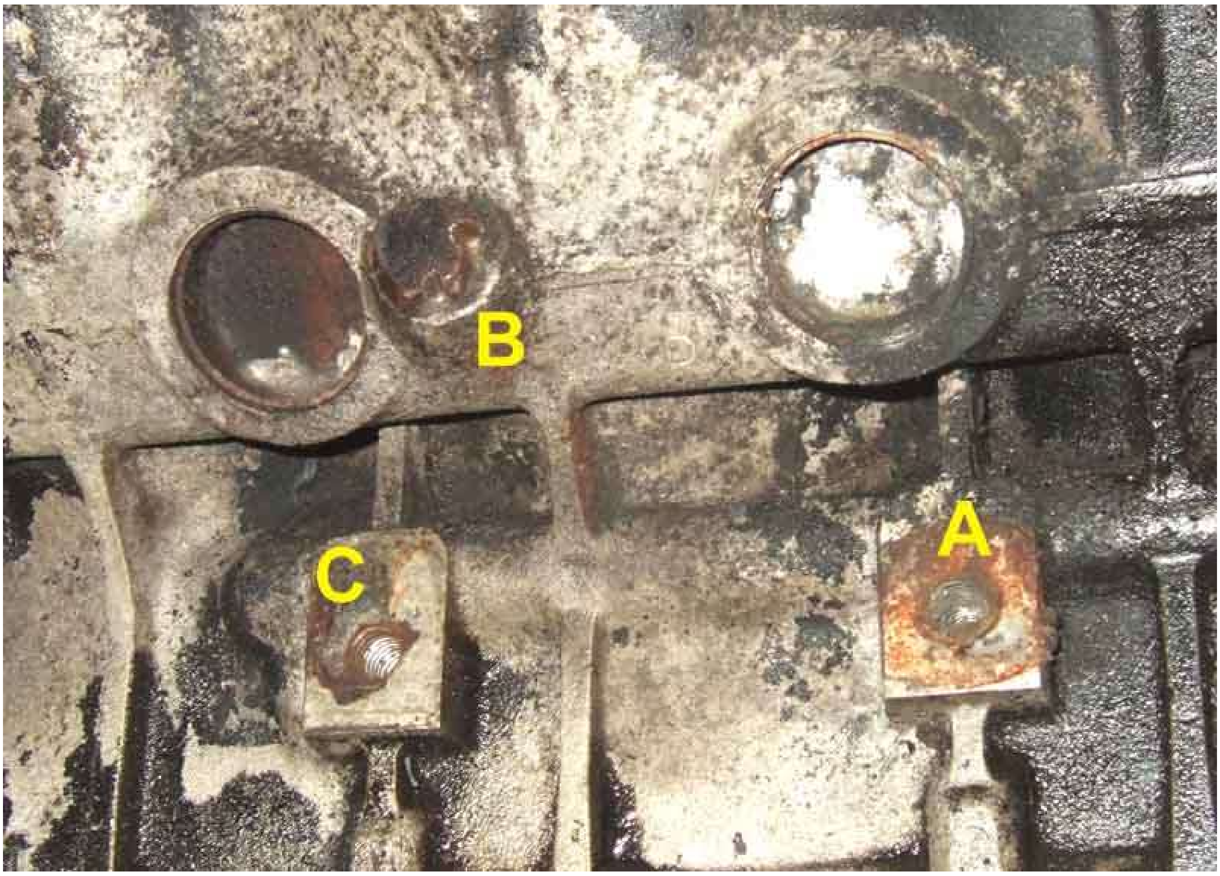
The intermediate connection in the V8 battery cable: 'A' is the insulated stud on its mounting plate bolted to the toeboard; 'B' is the cable from the battery mounted to the top part of the stud; 'C' are the two brown wires from the harness; 'D' is the short length of battery cable to the starter solenoid stud; 'E' is the 2-pin connector on the short sub-harness going to the solenoid spades; 'F' is the other half of the 2-pin connector on the main harness tail. This connector can only be assembled one way (and is the same as the cooling fan connectors): (*Leyland V8 Workshop Manual Supplement*)



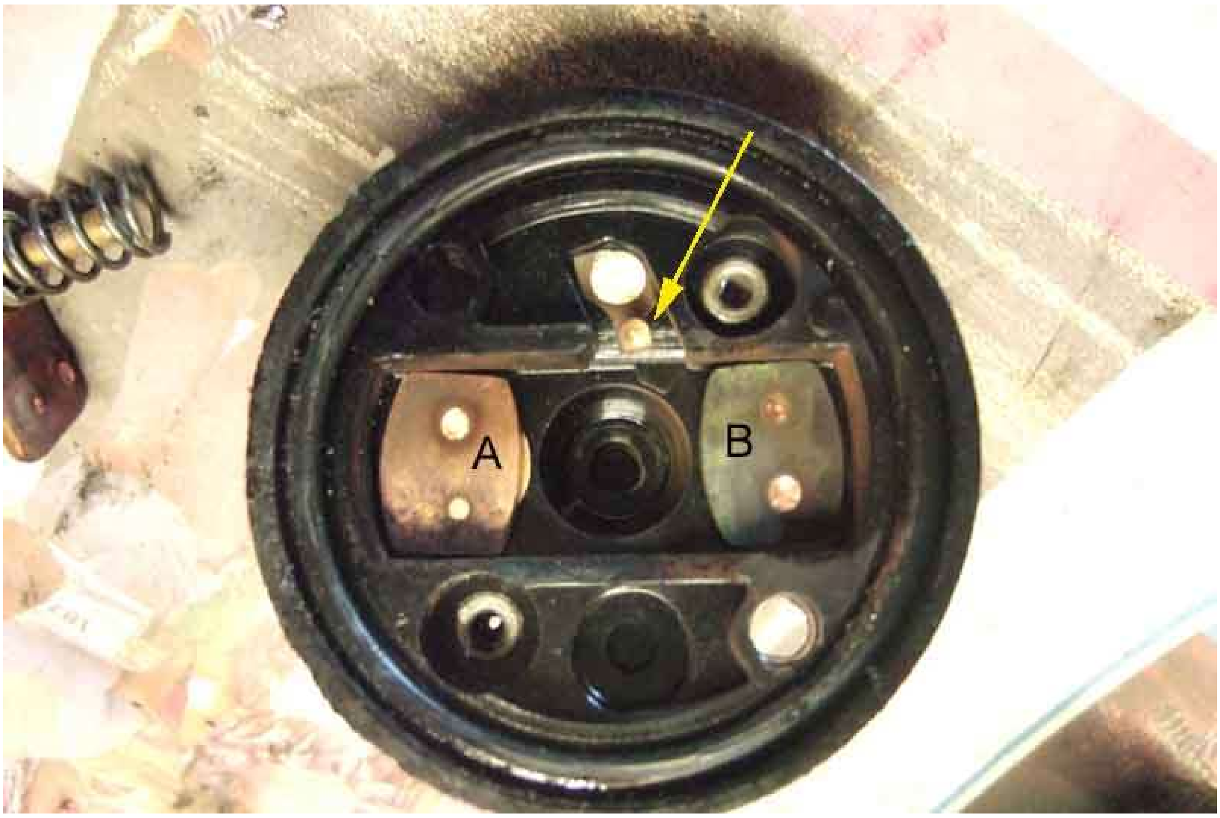
V8 starter heat-shield, the correct item is moulded heat-resistant material with a metal bracket riveted on. Not shown but the off-side exhaust down-pipe is immediately to the right of this, but it also passes underneath so although the end of the solenoid and starter are shielded the lower body of the solenoid isn't. The heat eventually weakens the ability of the solenoid to hold in once it has connected power to the motor and battery voltage has dropped, and it chatters as if the battery is flat. When Vee came to me it was just a tin sheet which wouldn't have helped much with keeping heat off the solenoid, with one of the bracket rivets broken away so with relatively light pressure it could by pushed against the battery cable stud shorting it out! (*Leyland V8 Workshop Manual Supplement*)



At least one person has said his block doesn't have a tapped hole for the fixing bolt, but both my original and an engine from elsewhere both have it. 'A' is the lower mounting point for the engine mounting plate, 'B' is the block drain plug, and 'C' is the hole for the heat shield:



Vee's replacement starter: A copper bar bridges the two stud contacts A and B when the solenoid operates and is supposed to connect power to the small coil boost contact as well. But that contact (arrowed) is bent back ...

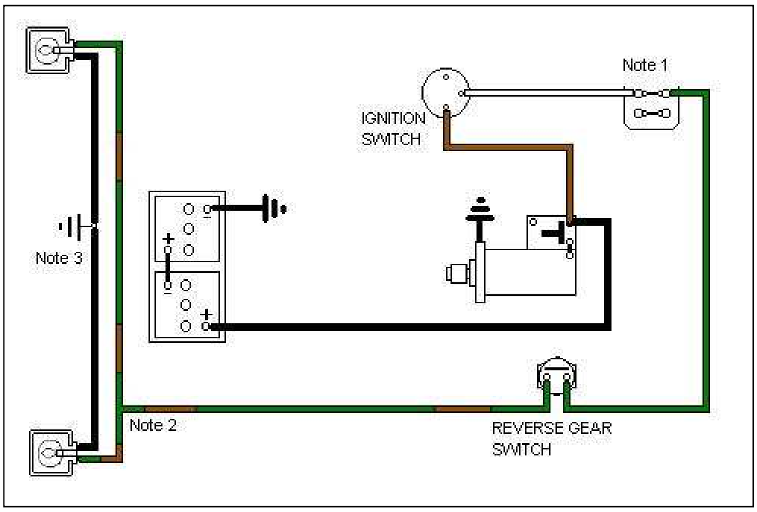


... so that the copper bar misses it altogether, and has obviously never worked on this starter that I fitted in December 1999 as a newly rebuilt item:

The coil boost contact is straightened and positioned so that the copper bar touches it and pushes it down just before it reaches the two studs:

Reversing Lights

Hover over a wire to confirm the colour



Note 1: Late UK cars seem to have a subdivision of the green circuit with its own in-line 35 amp fuse supplied by the white/brown (ignition relay) circuit feeding things like heated rear window, indicators, heater fan and tach, which leaves the original green circuit fuse (2nd one up in the four-way fuse block) feeding things like reverse lights, stop lights, washers, wipers, and circuits associated with the seat belt warning lamp and time delay buzzer.
Note 2: The junction in the green/brown for the two reversing lights is done with a sealed connection (arrowed below) under the off-side light, and not with bullet connectors. This is because the connection to the light units is with a plug and socket instead of with tails as is the case with all the other lights. A bullet connection between three wires all from the same harness would be pointless.
Note 3: Originally the two earth wires go to a number-plate mounting bolt. Possibly all RB cars but definitely 1977 and later (and 1974 North American with chrome split rear bumper) those earth wires go via bullets shared with the earth wires for the number-plate lamps.

The reverse light switch seen through the gearbox tunnel, right-hand side:

The 2-'pin' (actually two female spades in a three-position holder) arrowed:

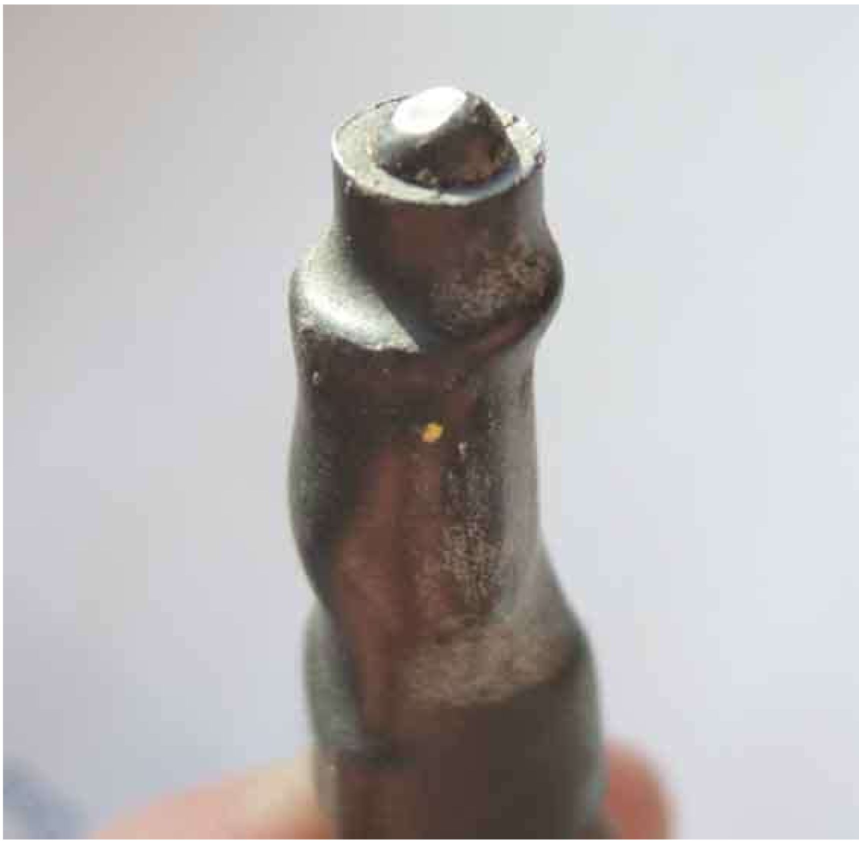
The spades are smaller than the 6.3mm standard at 4.8mm:

Sealed Wiring Junctions

Typical sealed junction, in this case in the red/white instrument illumination circuit

Brass 'staple' crimped round the wires and soldered ...

... with a heat-shrink end-cap plus a length of standard heat-shrink tubing over the junction



Fuel Gauge Sender

Screwed type
Locking ring type
76-on
'Plastic' senders

Relative positions of the screwed sender on the original strapped tank and the locking-ring sender on the later bolted tank, fuel outlet positions indicated (prior to 1977): (*Moss Europe*)

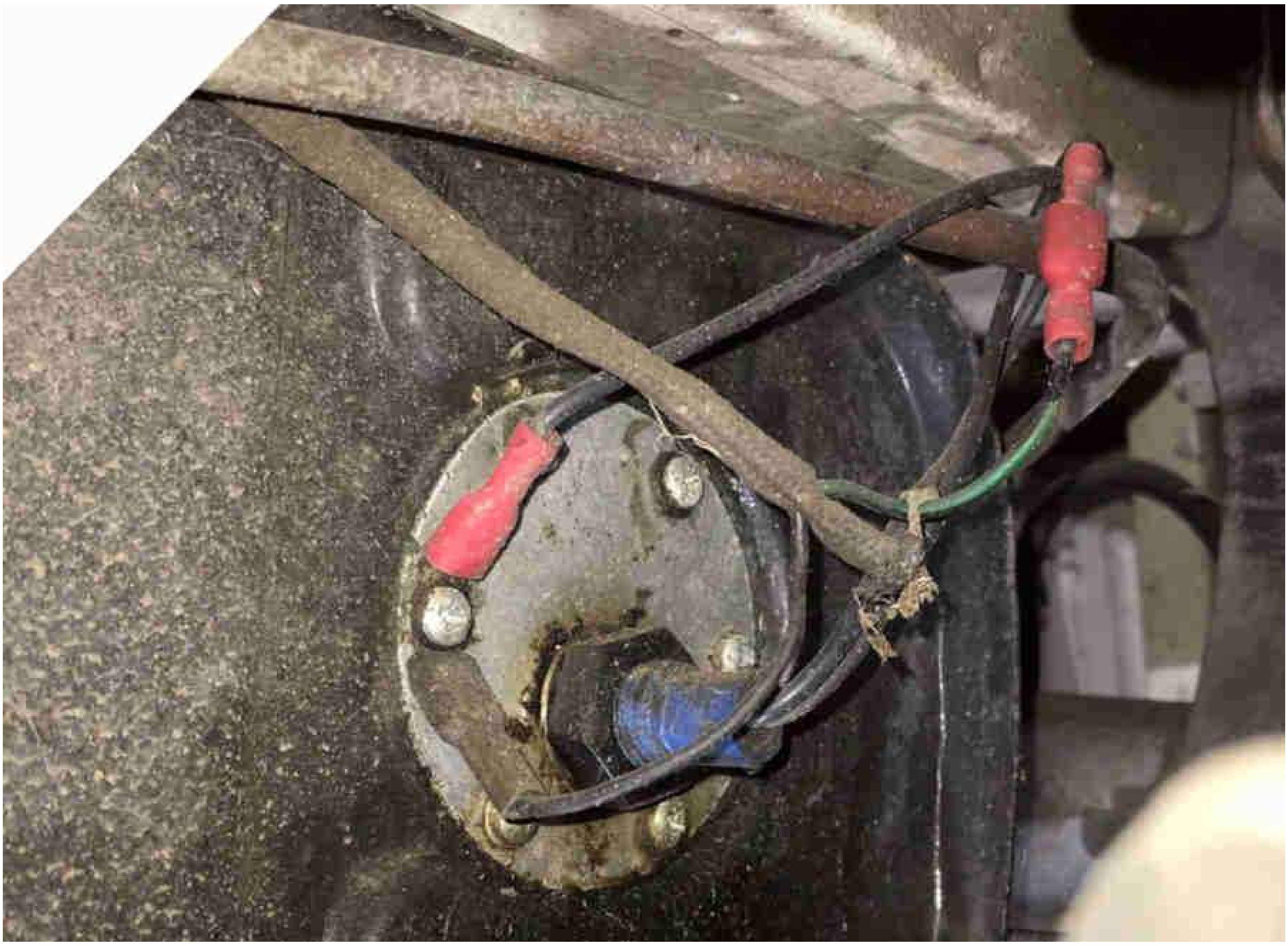
Screwed sender:

Early screw-fitted sender for the Jaeger undamped gauge, with a housing on the outside with a cover and four screws: *Moss UK*

Original cork gasket on the left, more recent Viton alternative 'for all fuels' (at five-times the price) plus a gasket for the cover: (*Moss Europe*)

Screw-fitted sender for the early Smiths thermal gauge used from October 1964 for the remainder of Mk1 production, this seems to have the 'flat' outer face like the later senders. Long NLA a re-manufactured item from two sources - jmccspares in the UK and Bastuck in Germany. Note this version of sender was used from October 1964 to March 1965, not from 1962 as indicated on the suppliers web sites, however if you have to replace the original Jaeger gauge with 17H 299 new stock of which are bi-metal and not magnetic you will need this sender as well as a voltage stabiliser:

December 2022: Geoff on the MGOC forum posted this picture of the sender on a 1964 car. As a 64 it could have had either system from the factory, but his chassis number predates the change by several months. This sender could well be the same Smiths one as above, but what looks like a 2-wire connector going into the sender and the wiring mods means it could be from something else altogether. His car has had the fuel gauge replaced by a voltmeter and he was enquiring about putting one back. He bought a Smiths gauge (an original Jaeger gauge on eBay was over Â£200) and stabiliser but it didn't show anything with about half a tank and testing indicates the sender is faulty:



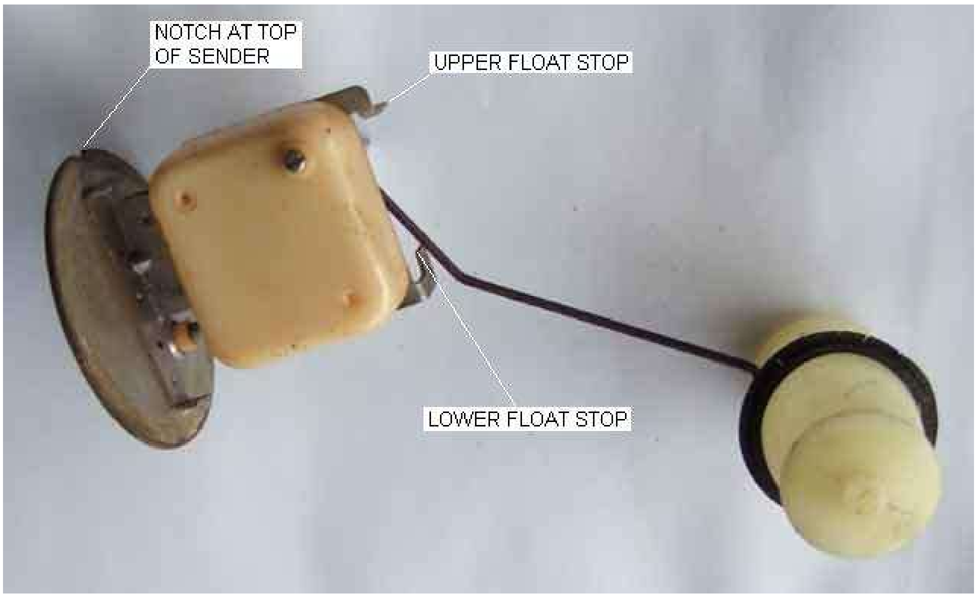
It may well be that the PO fitted the 'wrong' sender and when the fuel gauge didn't work, that didn't work either so they gave up on it. This complicates things as you need to know what type of sender it is, as well as whether it works or not, to know which gauge is needed. There is also the stabiliser to consider - if the Smiths system and that is missing as well then the polarity of the car needs to be taken into account as replacements are electronic and polarity sensitive.

Geoff replaced it with the remanufactured interim type above and as well as the existing sender being completely different externally it is even more different internally! It looks like it could be a magnetic proximity system. There are float switches similar to this but they open and close a contact which isn't much use for fuel gauge, so would have to be part of a tuned oscillator circuit, needing a whole mess of electronics at the gauge end. I can't make up my mind whether it is a home-brew experiment or from a very different marque and model, although perhaps a bit too much of a lash-up for the latter:

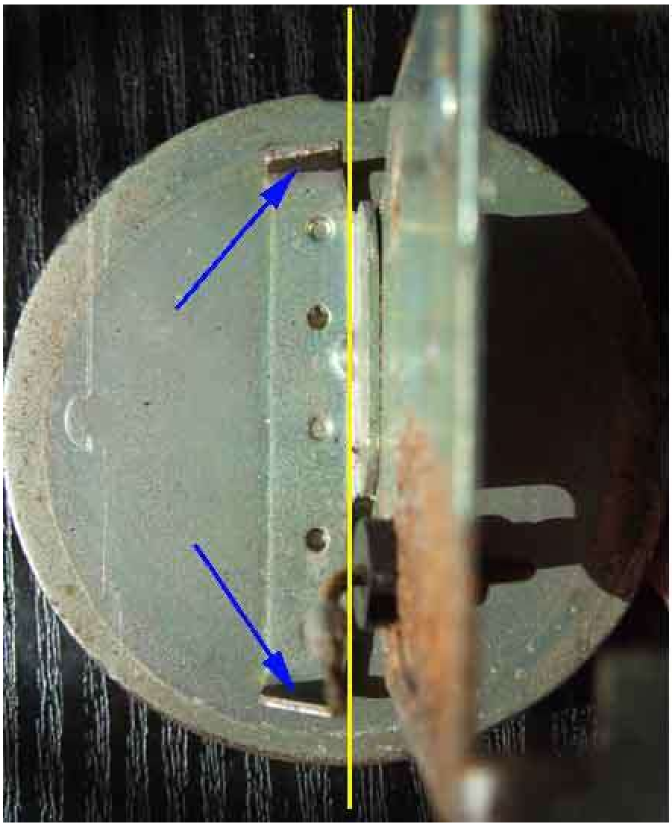
Locking-ring type:

This is the sender used from March 1965 to the end of the 1976 model year that is attached to the tank with a locking-ring, although all the senders work on the same basic principle of a float arm moving a wiper contact across a winding as the fuel level rises and falls to vary the resistance. This change in resistance is used to alter the gauge reading.

Float shown in the 'empty' position showing the upper and lower 'stops' for float arm movement. The screwdriver slot isn't for calibration as one may hope but is just cut into the end of the float arm where it comes through the plastic box which is one half of what locates the arm. The tabs of the upper and lower 'stops' do give some adjustment of the upper and lower extremities of movement of the float but they are designed to set the relative positions of the wiper to the ends of the resistance winding at the upper and lower extremities. You may be able to get a bit more travel of the float by adjusting these but go too far and you will allow the wiper to come off the end of the resistance winding which will cause the gauge to drop back past E. You can also bend the float arm up and down which will alter the relationship between fuel level and wiper position and hence gauge reading but unless you get it right first time is much more of a fiddle to calibrate the gauge than adjusting the gauge itself. As new senders seem to stop short of both E and F bending the float arm will result in being even more short of F if you adjust for E or vice-versa. Note also the notch at the top of the sender mounting plate, however this is not the main part that ensures correct orientation in the tank:



That is done by two offset tabs on the inside face of the mounting plate - seen here to the left of the yellow centre line, that engage in cut-outs in the tank:

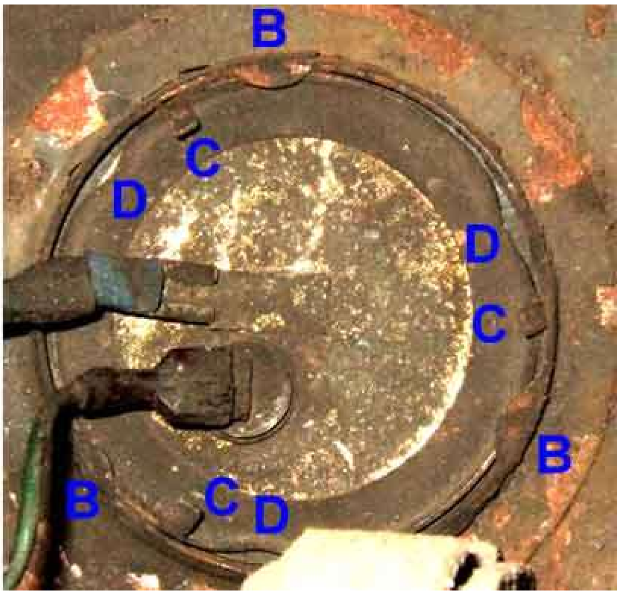



Similar offset tabs on the later plastic senders: (*Mark Morris*)

Matching offset cut-outs in the tank:

Locking ring and rubber gasket for the later system. **Note that the gasket goes between tank and sender not between sender and locking ring**: (*Moss Europe*)

Three tapered sections (A) on the ring slot under turned-over lugs (B) on the tank. Originally [Service Tool 18G1001](#) would have been used, but in the absence of that I've always done it by going round the three tabs (C) on the ring in turn bit by bit tapping carefully, turning the ring anti-clockwise to remove and clockwise to replace. If there is petrol in the vicinity you should be careful not to make a spark, perhaps by using non-ferrous tools, but you shouldn't be striking it that hard anyway. When removing turn the ring anti-clockwise far enough to align the three recesses in the ring (D) with lugs 'B' so the ring can be completely removed, reverse for refitting. When tightening tabs 'C' should stop short of lugs 'B'. All three tapered sections should be locked under their respective lugs or the sender will not seal:

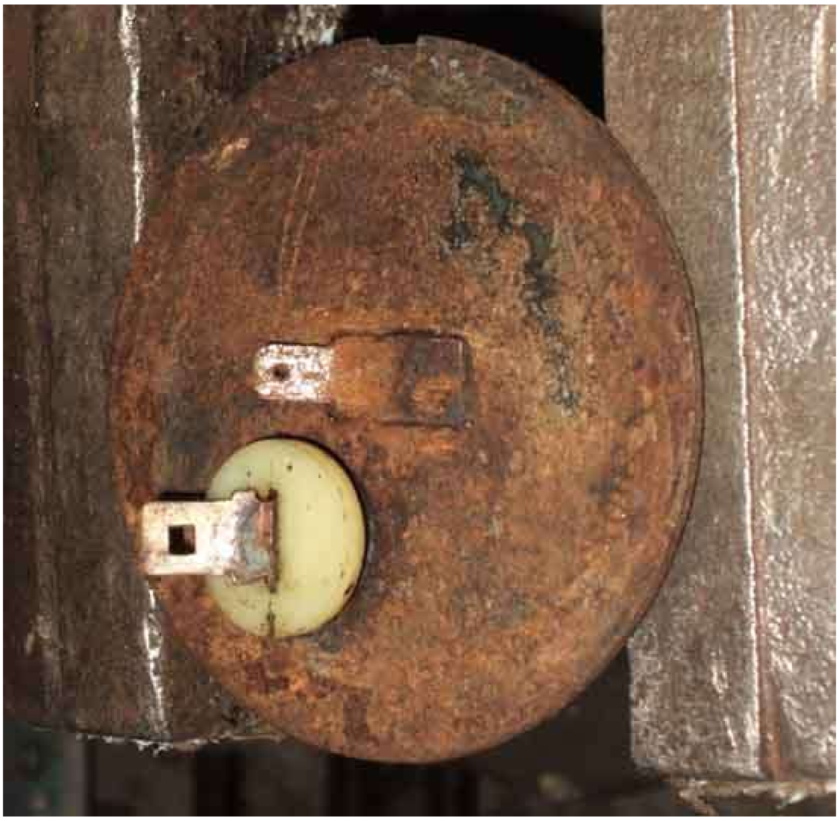


If the three tabs 'C' have been sheared off (as happened to Mark Morris) you will have to try something else. One possibility is to carefully drill through the locking ring in at least two of the recesses 'D' and use self-tappers with the points ground down once the thread has been started. If you leave the points on they could dig into the tank part of the fitting and you will be no better off.

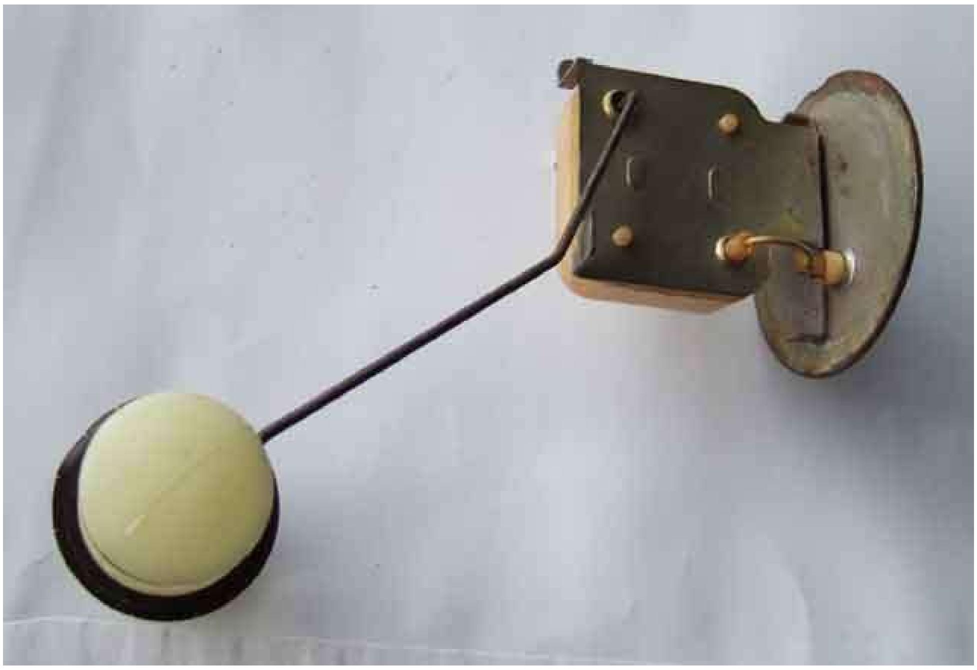
Locking ring removal tool 18G1001. On the basis of that not difficult to fabricate one. I'm not sure why it needs a cut-out, much less an L-shaped one, surely one would disconnect the wires before undoing the locking ring?

A couple of hours - first looking for something about the right size (plastic cap of aerosol contact adhesive) to act as a pattern, then for a suitable bit of metal (an off-cut from an exhaust trim that's been in a box of metal bits for years). Longitudinal cut so I can open it out to the right size (about 6cm), then three slots at 120 degree spacing (about 5mm square), and Bob's my uncle. Haven't used it anger as I don't want to break the seal until I need to. May need a couple of holes drilled through the outer end for a tommy-bar. I don't think that end will need welding up like the above as it's pretty hard metal and needed quite a bit of effort with two pairs of pliers to open up:

Showing the standard spade in an insulator for the green/black gauge wire, and the under-sized earth wire spade riveted directly to the base:

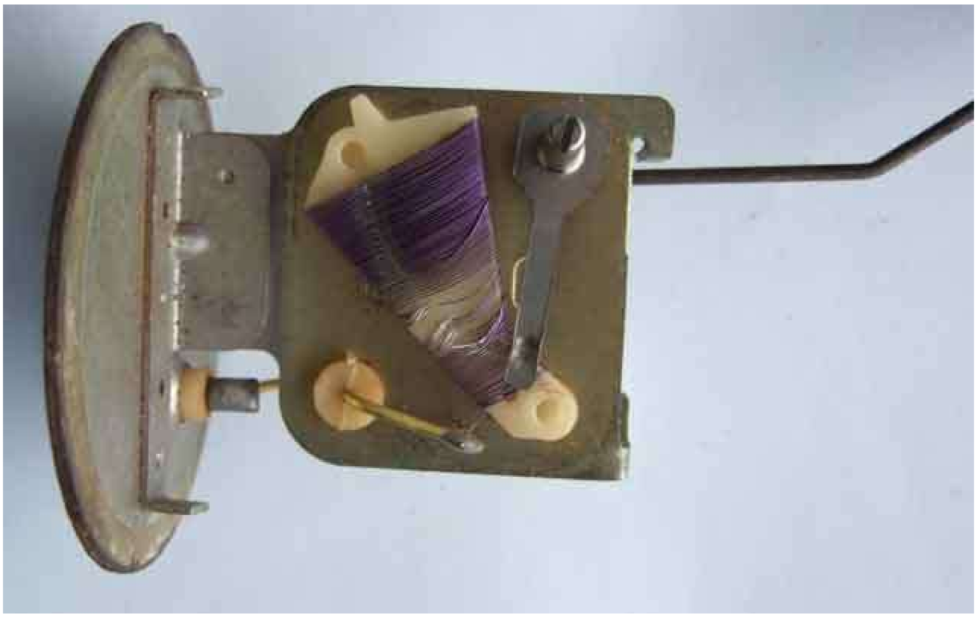


The other side again with the float shown in the 'empty' position showing the float arm going through the metal back-plate and the end of the resistance winding coming out through an insulated plug and going to the back of the insulated spade terminal. Note the rubber ring on the float which in theory is to prevent the float rattling on the bottom of the tank with low fuel levels. However in practice the lower float arm stop further downward movement of the float quite some time before it reaches the bottom of the tank. On my cars this happens with somewhere between a half gallon and a gallon before they actually 'run out' i.e. the fuel level drops below the level of the pickup:

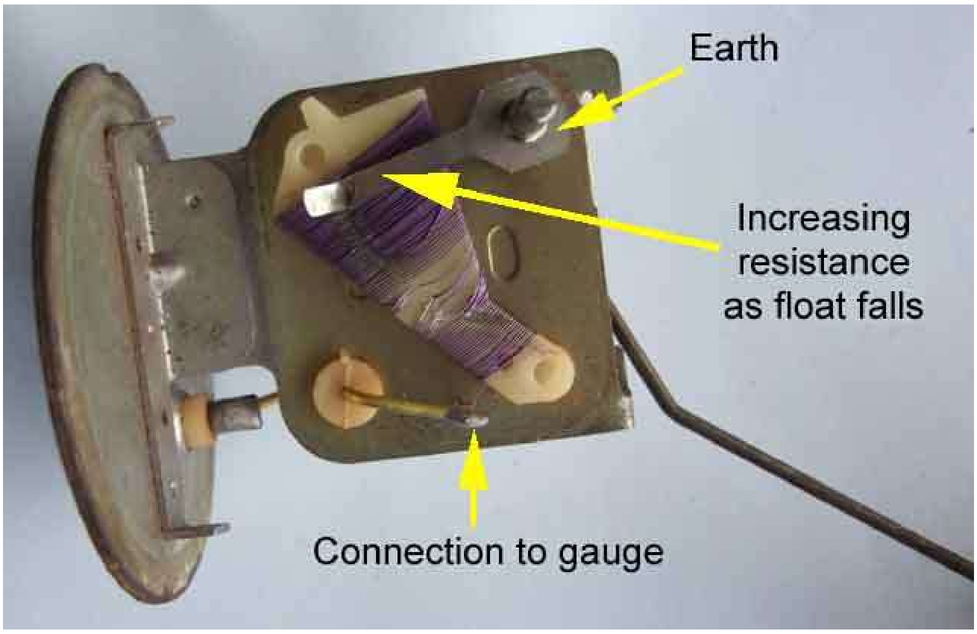


With the float relatively close to the side of the tank you get the gauge rising on a left-hand bend and falling on a right-hand, which then takes several seconds to stabilise after straightening up. Some have said they prefer the earlier 'undamped' system as the gauge goes back to the actual reading quicker.

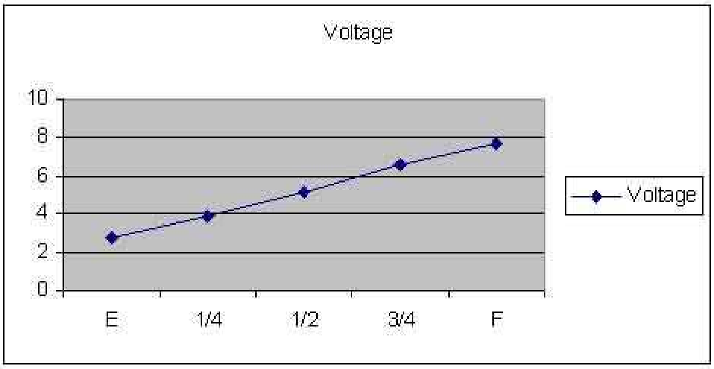
Inside the plastic box, float in the upper or 'full' position. You can see the wiper attached to the float arm and the resistance wire wrapped around the former. Where the float arm comes through the metal back-plate it picks up an earth connection which it then applies to the resistance winding by the moving wiper. The resistance winding has a connection from its lower ('full' or low resistance) end to a stiff wire which goes through an insulator in the back-plate to the insulated spade connection on the sender. This means that when the tank is full there is very little resistance in circuit, a relatively high current flows, and the fuel gauge reads full. As the level in the tank falls, the resistance increases, the current falls, and the gauge reading reduces. Clearly visible is the damage to the windings probably caused by a poorly manufactured or adjusted wiper. This is the 'original' (or at least very old) unit off the roadster, but the 'original' and the first replacements to both roadster and V8 all failed in exactly the same way. The second replacements to both cars have (so far!) lasted much longer:

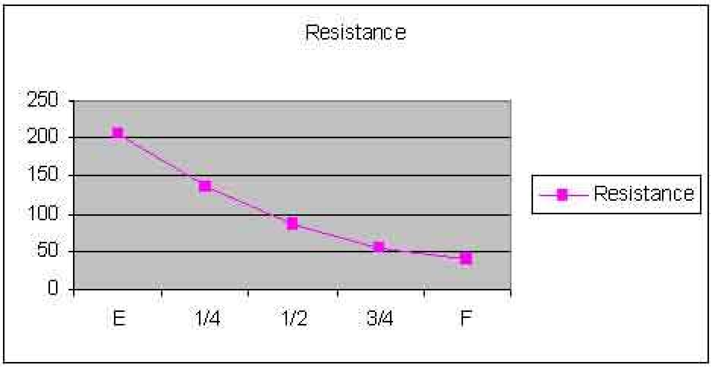


Float shown in the 'empty' position. All of the resistance is now in circuit from the earth on the wiper to the terminal leading to the gauge, so minimal current, and minimal gauge reading. In both pictures you can clearly see the change in shape of the winding former about 1/3rd the way from F to E. The narrower width at the F end means the turns are shorter, so there is a relatively small change in resistance as the float starts to fall from F. When the former starts widening, the turns are getting longer, so the rate of change of resistance gets higher as the float falls further. Then there is a change from wide-spaced turns to close-spaced turns about half-way up this widening section, about 2/3rds the way from F to E. This increased number of turns also causes the resistance to increase rapidly as the float moves down, doubly so with the increasing length of the turns. The reason for these two changes in the rate at which the resistance increases as the fuel level drops, is partly because of the natural non-linearity of the thermal gauge and partly because the float moves in an arc, and is an attempt to compensate for those. However it's only partially successful. It's quite normal to see a slow fall from F to 1/2, then shortly after that it seems to drop like a stone towards 1/4, then thankfully slow again after that. Whether the modern 'solid state' senders are any different isn't known. Potentially (ho ho) they could be as the wiper passes over a series of contacts with resistances wired between them. Even to maintain the existing 'linearity' the resistance between each contact would have to vary in the same way that the winding resistance varies, so in theory they could have varied them in such a way as to give a linear movement at the gauge, but whether they did or not is another matter:



Voltages and resistances needed to drive the gauge: I had to use 12v as the supply voltage as I have the original thermal stabiliser which switches 12v on and off to average 10v and not an aftermarket electronic that outputs a steady 10v, I used various values of fixed resistance to position the gauge pointer on the level marks. Note the voltage is linear but the resistance isn't, almost certainly due to the positive temperature coefficient of the resistance wire inside the gauge, combined with the changing force needed to bend the bi-metal strip at different points along its movement. Also note that my voltage to show E is higher than normal as I've chosen to have about a gallon left at that point. But whilst the gauge clearly has factory (Smiths, not MG) calibration marks at E, half and F, at the end of the day it's what your sender characteristics are that determines what your gauge will show, and I have found three replacement senders out of four needed the gauge to be recalibrated, the first replacement for Vee showing significantly above E when I ran out:





For comparison I have measured both my gauges at 61.5 ohms +- a tenth or so, and with just under half a tank I measure 90mA. That's with the original thermal stabiliser that switches 12v on and off about once per second, with an electronic stabiliser outputting 10v I'd expect to see about 70mA: Current-stock version of the locking-ring type, with a plastic base and three terminals. The centre terminal is earthed with the black wire, and the green/black wire goes on the top terminal. The bottom terminal should be covered with a plastic sleeve and is unused as that is for a 'low fuel level' warning that the MGB does not have. Note that all three spades on this type of sender seem to be the same size, so the connector on the harness will need to be replaced, or an adapter made up: *Moss UK*

August 76-on:

Combined sender and pick-up, original metal version. I thought these had all been replaced by the plastic type but several suppliers are currently (November 2023) showing this, some alongside the plastic type. The electrical part that varies the resistance is several inches into the tank, with the float further in still. This may be to position the float near the middle of the tank to deal with the problem of the gauge reading going up on left-hand bends and down on right-hand, which can then take several moments to correct. Being that much longer the tanks almost certainly don't have baffles: (*MGOC*)

The plastic version, float nearer the side of the tank as pre-76 so the gauge reading is still affected by cornering. The centre terminal must be earthed to a point nearby with the provided wire as there is no earth wire in the harness of these cars. The original sender had a metal base and relied on earthing via the tank mounting, not possible with this plastic base. The harness wire goes on the top terminal, and as above the bottom terminal should be covered with a plastic sleeve: Moss UK

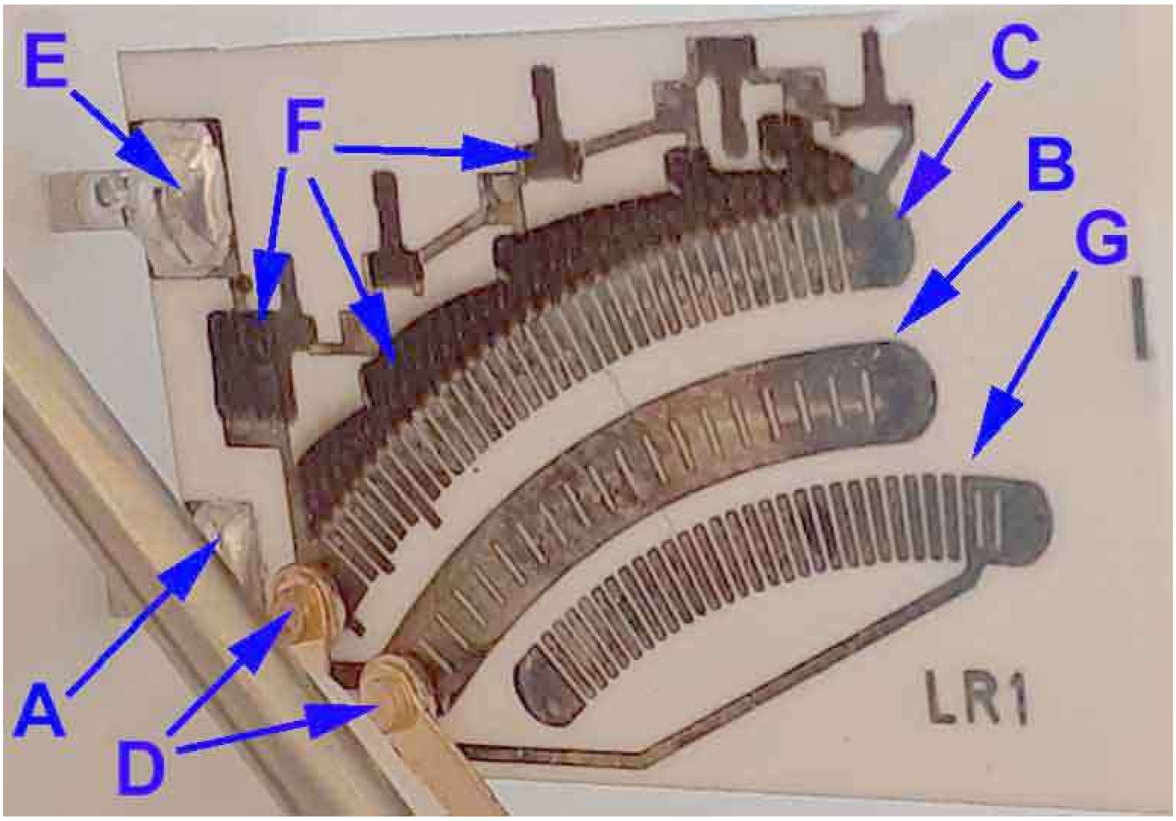
September 2022: Incidentally the black plastic right-angle hose connector on this sender seems to be a push-fit to the sender body. Mark Morris had a couple of problems - pump chattering when it shouldn't, then a leak from that connection - certainly the latter and probably the former from a split O-ring seal on that connector. The usual suspects only supply the complete sender, but he got a suitable replacement seal from a local motor factor. The original metal 77 and later senders had a metal pipe almost certainly brazed to the metal base-plate: (*MGEXP*)

Note that for some reason the installer of this used the later sender on an earlier tank, which has the original port with a short length of hose and a bolt plugging the end. It's possible this was done because the original pick-up pipe inside the tank had rotted through meaning the full contents of the tank were not available:

'Plastic' senders:

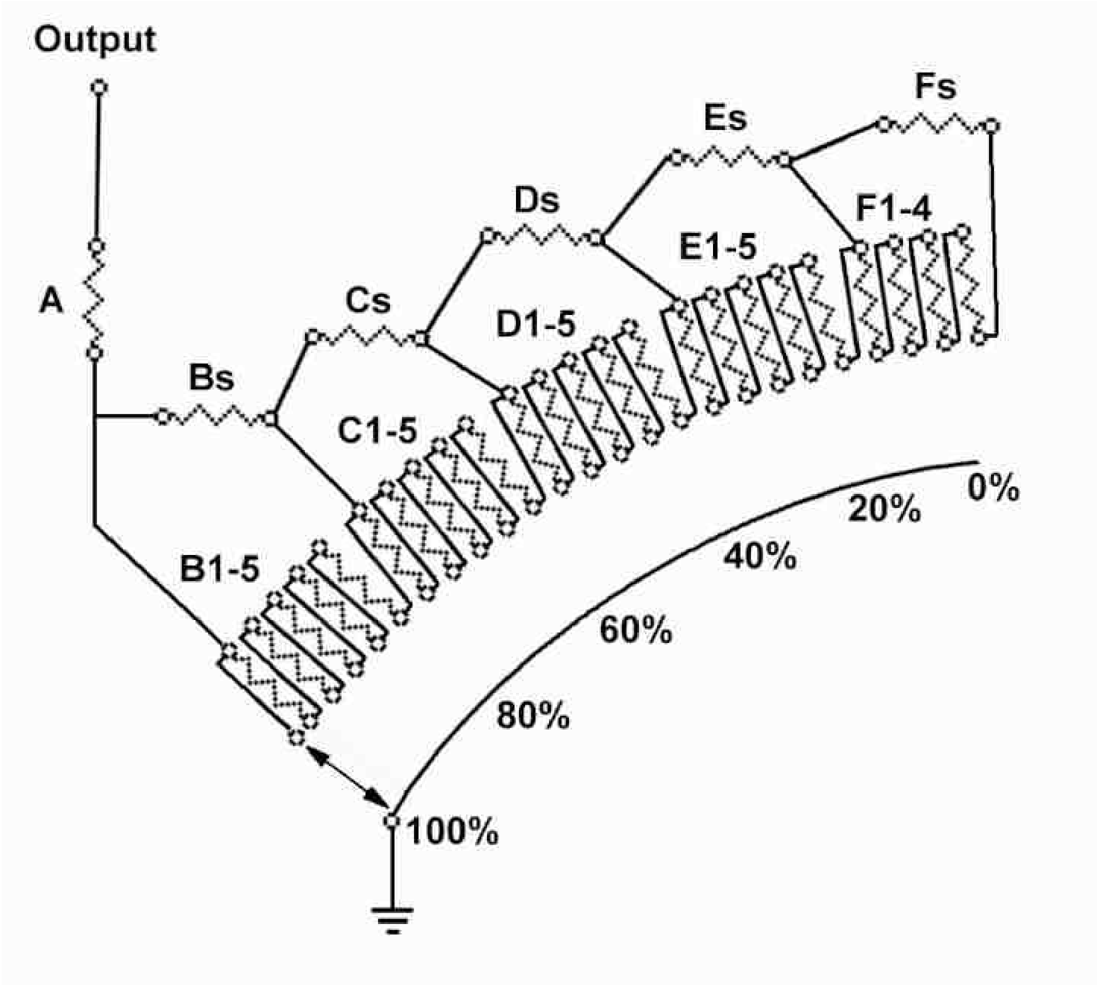
The business side: (*Mark Morris*)

'A' - the earth connection to the earth track 'B'; 'C' - the output track; 'D' - the linked wipers that connect the earth track to the output track as the fuel level changes. The float is in the 'full tank' position so the wipers are connecting the earth to the output with just the minimum value resistance (left arrow from 'F') in series; 'E' - the output terminal; 'F' - the network of resistances that cause the sender resistance to vary with the fuel level; 'G' - not used on the MGB, the 'low fuel' track which outputs an earth on the third terminal when that wiper (not fitted for the MGB) reaches the point indicated:



The resistance track comprises a network of series and parallel resistances that increases resistance in a non-linear fashion to match the non-linear characteristics of the thermal gauge. The 'sawtooth' section indicated by the middle arrow of 'F' consists of a line of individual resistances in series with each junction connected to a short piece of the track 'C'. The first 'tooth' with 6 segments, then 10, another 10, then 4, and finally 4. Within each 'tooth' the segments get progressively shorter as the fuel level drops, so even though the resistance is increasing from segments being added, it is increases less and less with each segment. Near the beginning of each 'tooth' a parallel path is added back to the output via another resistance, so each 'tooth' consists of a number of different resistances in series, with another resistance in parallel with those series resistances, and there are five sets of those in series with each other. This creates a much more nuanced change in resistance as the wiper moves along the track than is possible with the original wire-wound sender, which only has one basic change in former shape (and hence the length of each turn) and one change in the spacing of the turns across the whole of its range of movement. Despite that and the non-linear markings on the gauge which are another attempt to match the tank contents to the gauge indication, my gauges at least move a lot more rapidly from 1/2 to 1/4 then they do anywhere else, a 'feature' which has startled me more than once. Whether this new sender has been designed to replicate the original, or whether they have taken the opportunity to better match tank contents to gauge indication, I don't know.

Schematically the circuit is somewhat as shown here, the double-headed arrow is the slider that moves around the arc as the contents vary, currently showing as a full tank:



With a full tank the earth goes through the slider, bypasses resistors B to F, and through resistor A to the output, which gives the minimum resistance of about 20 ohms. When the fuel level starts to drop the slider moves to contact B1. All the C, D, E and F resistances are bypassed but a small portion of the current can flow through B2 to B5 and back towards the output via Bs, which are all in series with each other as well as being in parallel with B1. With two resistors in parallel the effect is to lower the overall resistance, for example if a 100 ohm resistor is connected in parallel with a 10 ohm resistor the overall resistance will become 9.09 ohms (you can try your own values here), so B2 to B5 and Bs will only reduce the effect of B1 by a small amount. As the slider moves through B2 to B5 the series value increases each time as each segment is added to the previous one. The parallel value is reducing as this happens, but the overall effect is a non-linear increase in resistance which takes account of the non-linear action of the fuel gauge.

When the slider moves to the bottom of C1, that resistor is now in series with Bs and A, with B1 to B5 being in parallel with Bs. Additionally a small proportion of the current is now passing through C2 to C5 and Cs all in series, which are all in parallel with C1, as when the slider was on B1, and again the series resistance increases as the slider moves through C2 to C5, with the parallel resistance reducing, but the overall effect increasing with reducing tank contents, of course. The same happens through D, E and F.

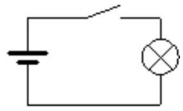
As well as this network of resistances causing the overall resistance to increase in a non-linear fashion to match the characteristics of the gauge, the 'sawtooth' appearance of each section implies the individual resistances change one to another adding to the non-linearity, which may well give a more accurate indication of contents than you can get with the original wire-wound type. At the time of writing I have no personal experience of this type of sender to see if that is the case.

Article for MG-drivers and enthusiasts

How to make Your dull number plate lamps brighter by Felix Weschitz from Austria

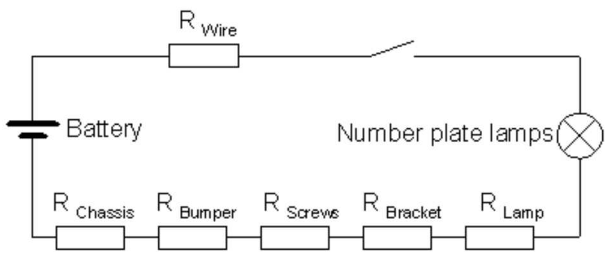
If You have a MG of 1972 onwards where the number plate is lighted from the overriders of the bumper, I am sure You are having, or You had a lot of troubles with those tiny bulbs. It is a known problem, that the number plate lighting lamps are always a little dull, if they are working at last on the MG. In Austria this can be a MOT failure. Just for imagination my little story: After rechroming the bumpers and the overriders, I also replaced the rubbers between the bumpers and the overriders. I also protected the inner side of the bumpers with plenty of (similar to) waxoil. (the brown stuff you see on these pictures is waxoil) To protect the threads of the mounting bolts I used some fluid for bolt securing. After polishing the new rechromed bumpers, we then proudly took part at the club championship. After the prize giving we made our way home. In the garage I just recognised, that both of the numberplate lamps are not working. This hit me like a thunderlightning. Next day I started thinking ......

Before all a little theory:
In the ideal world, You have a battery, the light switch and the numberplate lamp and some wires - with no resistance - and then back to the battery also with no resistance - as shown here



As we all know, the reality is not ideal, so we have a lot of parasitic resistances.

- first we have wires of copper and this wires have a electrical resistance (RWire)
- then we have the chassis, where the current tries to go back to the battery (Rchassis)
- there is also a resistance from the overrider to the bumper. Because the overrider sits on a rubber band on the bumper this is an electrical isolation (RBumper)
- as the bumper is mounted with screws on the chassis, we have a resistance called RScrews
- if You look close, the lamp is just hold by pressure on the fixing bracket on the overrider. So, there is another resistance. (RBracket)
- if You look even closer, the lamp is fixed with the standard bayonet. (RLamp) Additionally to all this, we have corrosion, oxidation which all increases the named electrical resistances.



Just have a look and see how many unwanted resistances there are. What this means is that instead of all the battery voltage being available for the lamp - which in itself is a resistance, some of the voltage gets 'lost' in the unwanted resistances leaving less for the lamp, making it less bright than it should be.

If one of those resistances goes to endless the lamps will not light. (This is the same as the lamps on the Christmas tree. If one lamp gives (resistance goes to endless) all other lamps does not work.)

To let our numberplate lamp work in an efficient way it is our main task, to avoid all those parasitic resistances or get them as low (small) as possible. The easiest thing is, to shortcut as much as possible of those resistances.

Here the way I did it:
I put a wire from the bracket of each the two lamps to a solid (not rusty) chassis mounting bolt. The best and nearest mounting bolt I found is the lock bracket of the boot. There I fixed two wires in a ring terminal and crimped both wires. (see picture)

Then I put the wire into the hose where the red wire goes to the lamp. This is a little bit a fiddle, but it looks nice. For 'water'-protection I used some heatshrink hose on the end, so dampness has no chance. On the lamp-side I also used a ring terminal to fix the wire on the mounting screw where the lamp is mounted on the overrider. (see picture) This action shortcuts the two resistances RScrews and RBumper. The resistance RChassis is a little bit lower. The next thing is to minimise the two other resistances.

RBracket can only be minimised (as I think), when smearing some petroleum jelly on the surface where the lamp holder fits in the bracket. This is true on the long term, because I think the petroleum jelly avoids the oxidation of the lamp holder and the resistance will still be low in the future (hopefully).

The RLamp can also be minimised a little when smearing some Petroleum jelly around the lamp. (I mean the metal part not the glass part of the lamp ;-)) This also keeps the oxidation on the lamp holder and lamp socket low on the long term. Instead of petroleum jelly I used the same grease which I used to use on the battery contacts to avoid oxidation.

As You can see, my numberplate lamps are brighter then new.

Nearby: All of the electrical consumers are working the same way. To get brighter lamps, just think of the return flow of the current to the battery. Often there are a lot of such parasitic resistances which can be avoided. Sometimes rusted or heavily corroded ground / earthing points do make troubles. Also corroded lamp sockets are a point of failure. The few pennies invested in new lamp sockets are worth the money.

So, hopefully Your numberplate lamps are now as bright as new; and keep Your MGs on the road.

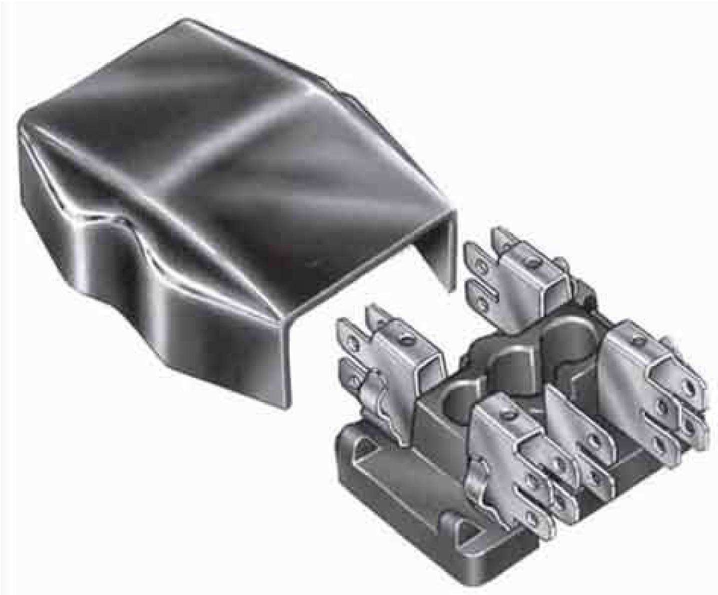
Felix Weschitz
MGOC Member: A6421-3
Date: 14. September 2009

Fusing

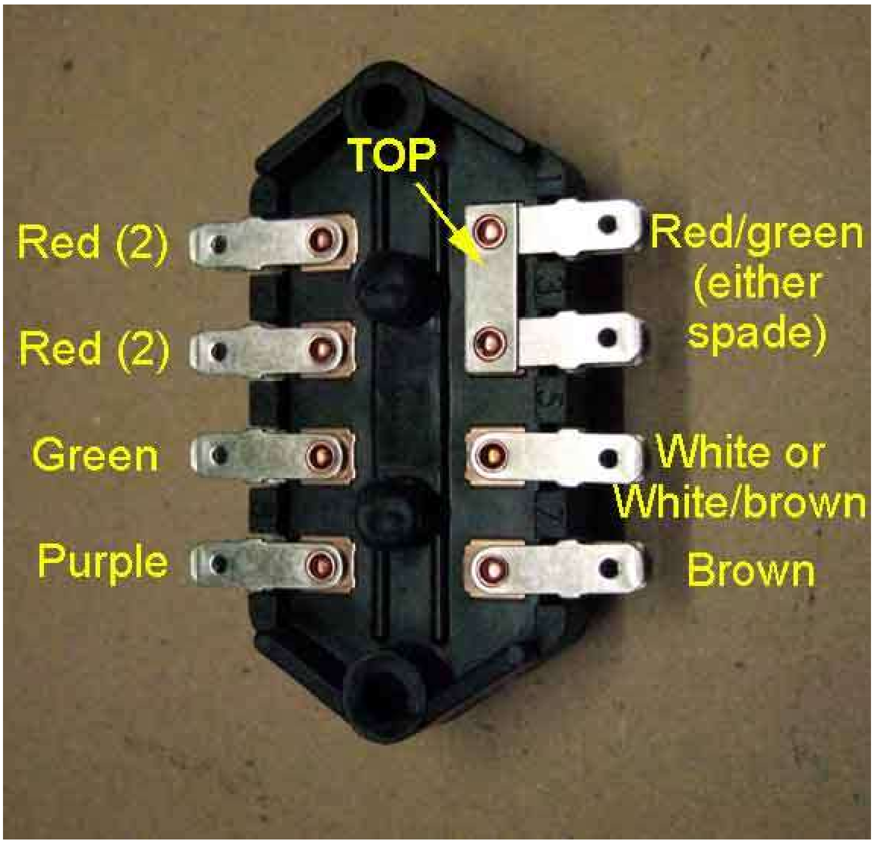
Fuseboxes In-line Fuseholders Fuses

Fuseboxes

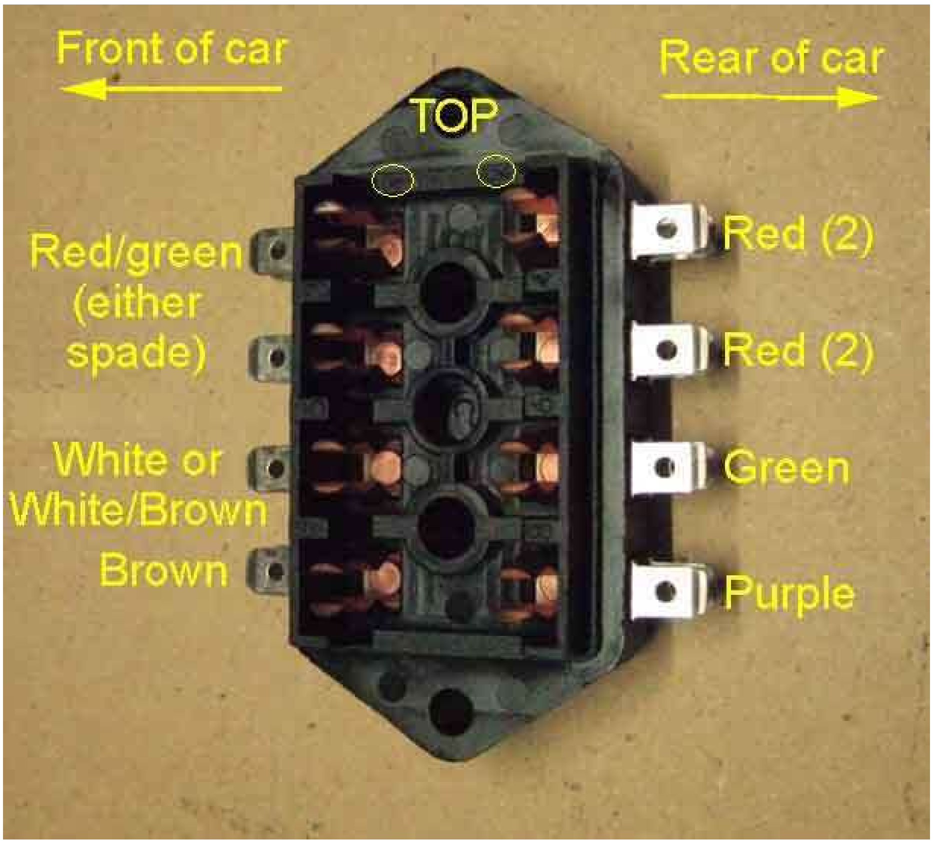
The 2-fuse fusebox, with the six spades for the green wires shown bottom left. These six spades should point backwards, which should put that fuse in the lower of the two positions. The white wires go on the front of that fuse, the purple on the back of the upper fuse, and the brown on the front of the upper fuse.



The 4-fuse fusebox showing the orientation and wire colours from the rear. Make sure the link between terminals 1 and 3 goes at the top front. The 'correct' position for the red/green is shown, but electrically it doesn't matter which of the top two front spades it goes on. Strictly speaking the red wires for the left-hand side of the car go on the top fuse, but electrically it doesn't matter if the left and right sides are reversed. Some white wires changed to white/brown with the introduction of the ignition relay for the 77 model year.



Showing the orientation and wire colours from the front. Terminal numbers are visible when fitted, 1 and 2 (circled) should be at the top.

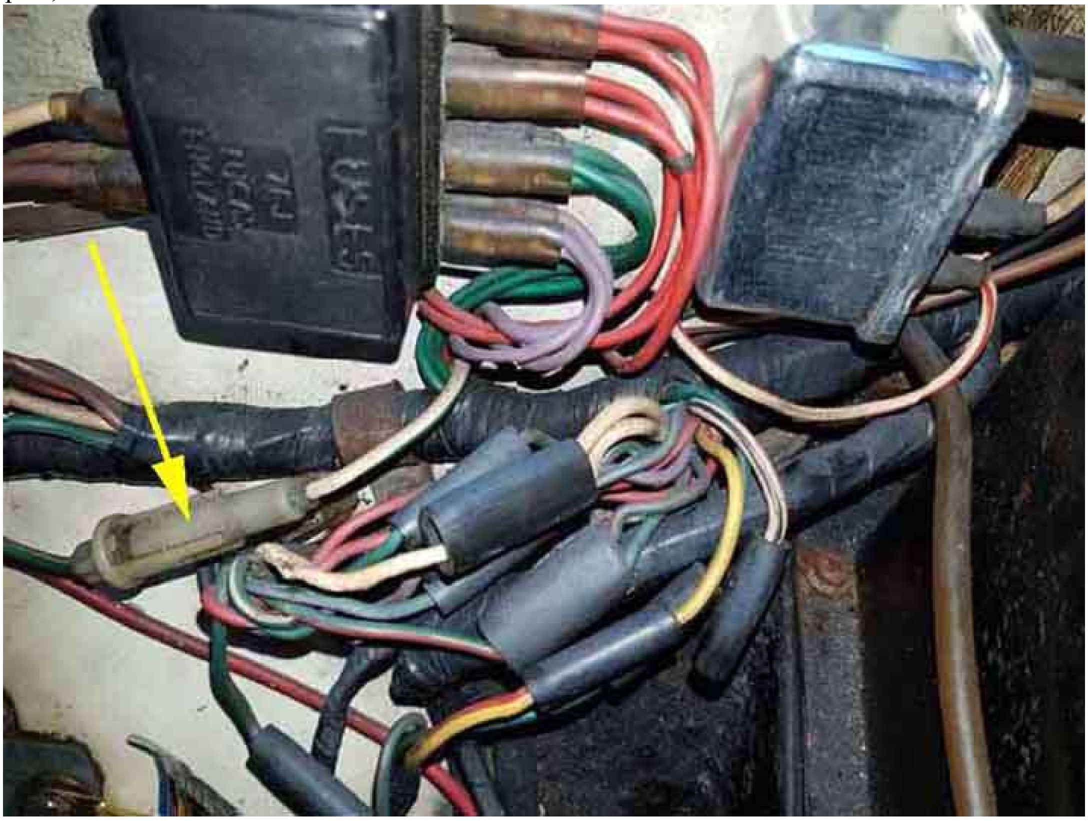


Typical fuse-holder corrosion.

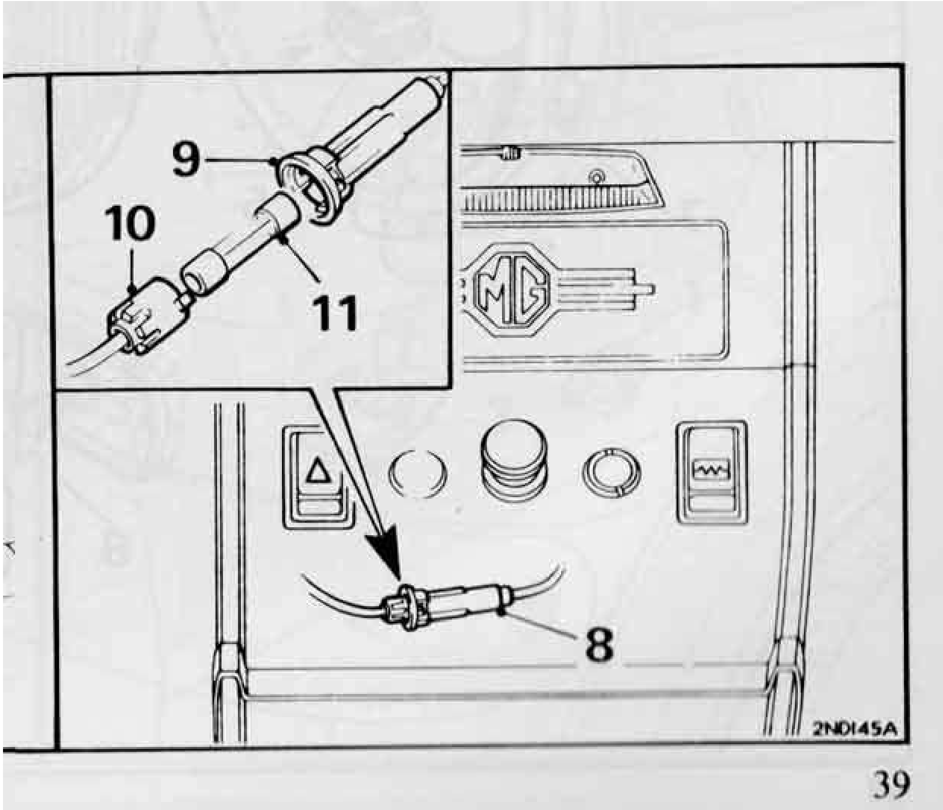
Fusebox cover with spare fuses.

In-line Fuseholders:

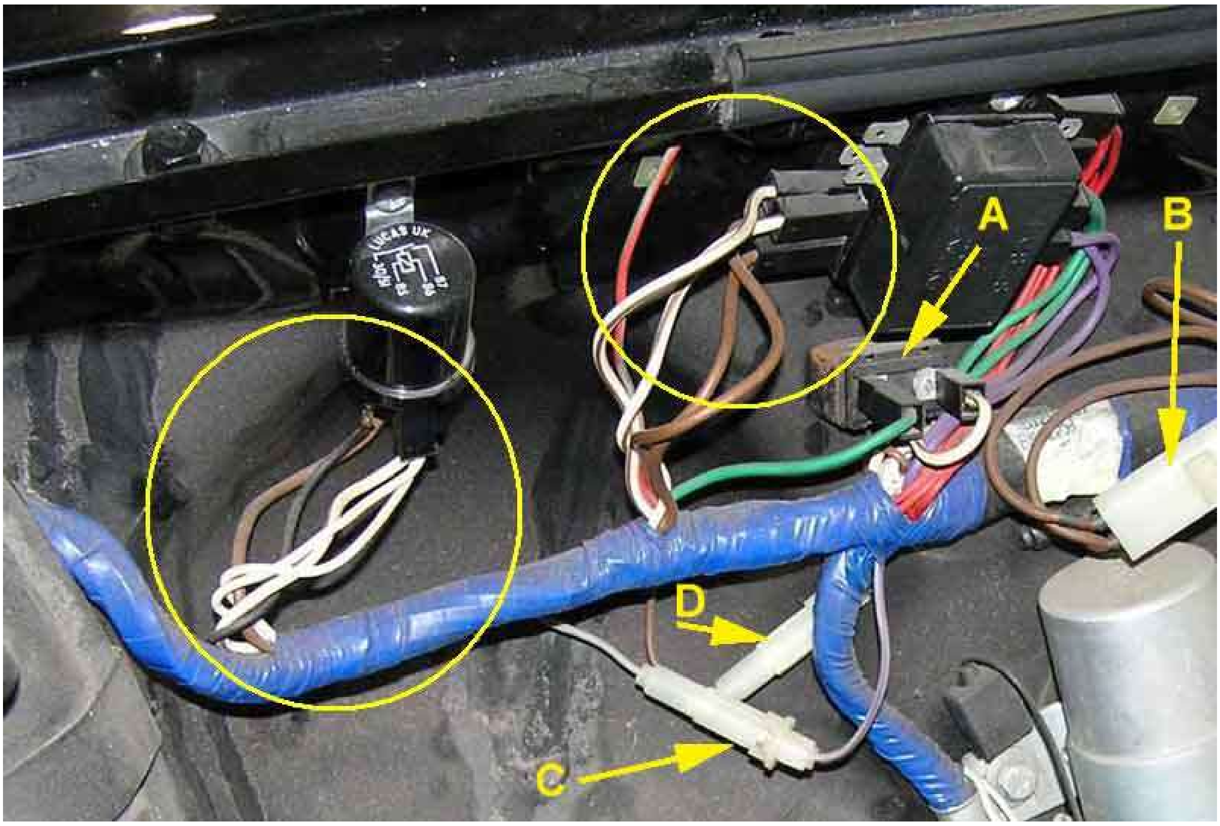
The first was the 'accessories' fuse for wipers, heater fan and North American electric washers from 1971 until the end of chrome bumpers, under the fusebox:



Mk2 North American, all V8s, and rubber bumper cars gained hazard flashers and the fuse for that in RHD cars at least was initially behind the centre console:



Later hazard fuses ('D' here), and first one (all markets) then two (RHD) additional green circuit fuses, and the North American anti-runon valve fuse ('C') also appeared under the fusebox, and the accessories fuse was deleted.



Fuses:

Glass screen-printing showing '35A' and '17 hold'.

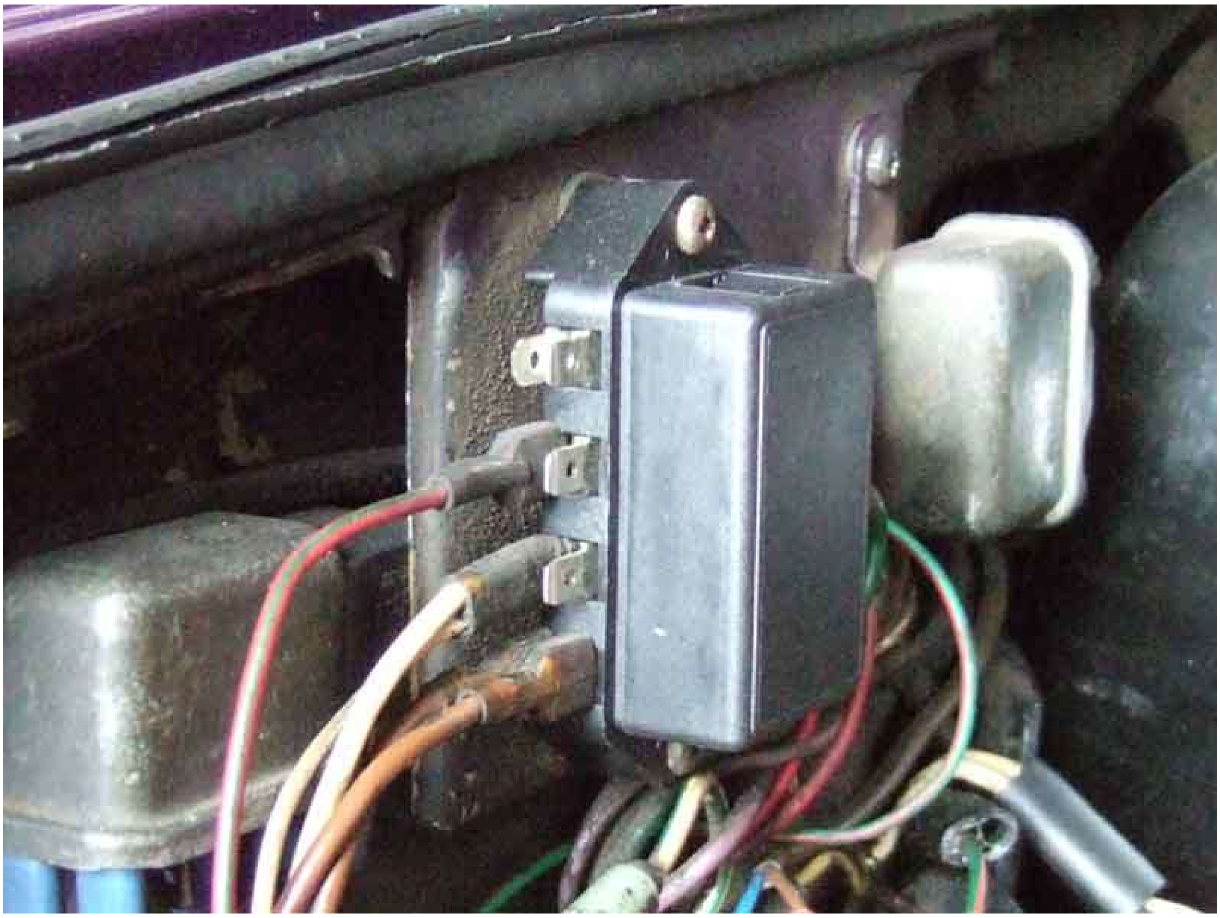
Slip of paper showing '17A continuous' and '35 AMP blow', both unambiguous.

'35A' on an end-cap ...

... and the only number on a slip of paper less so.

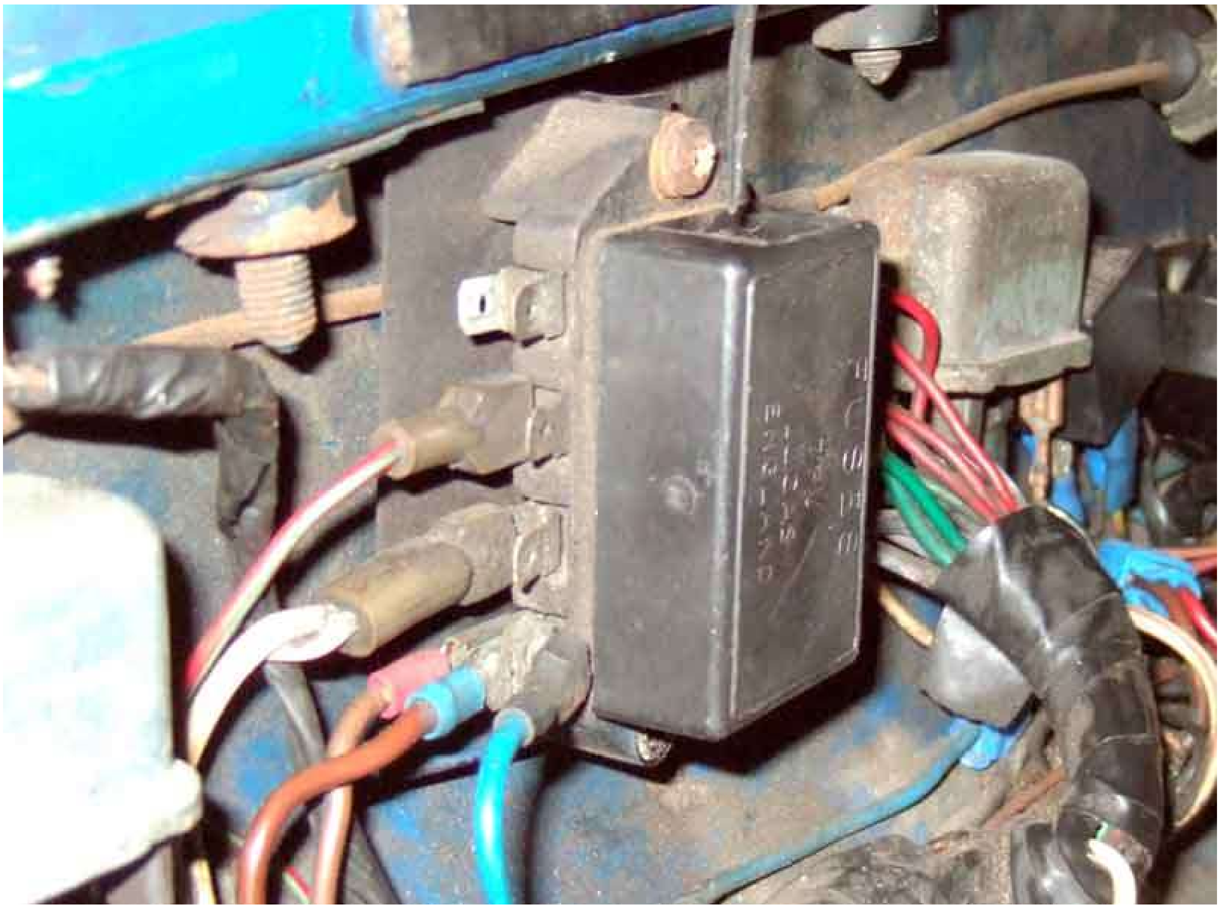
Fusebox mounting

73 roadster mounted on a plinth ...

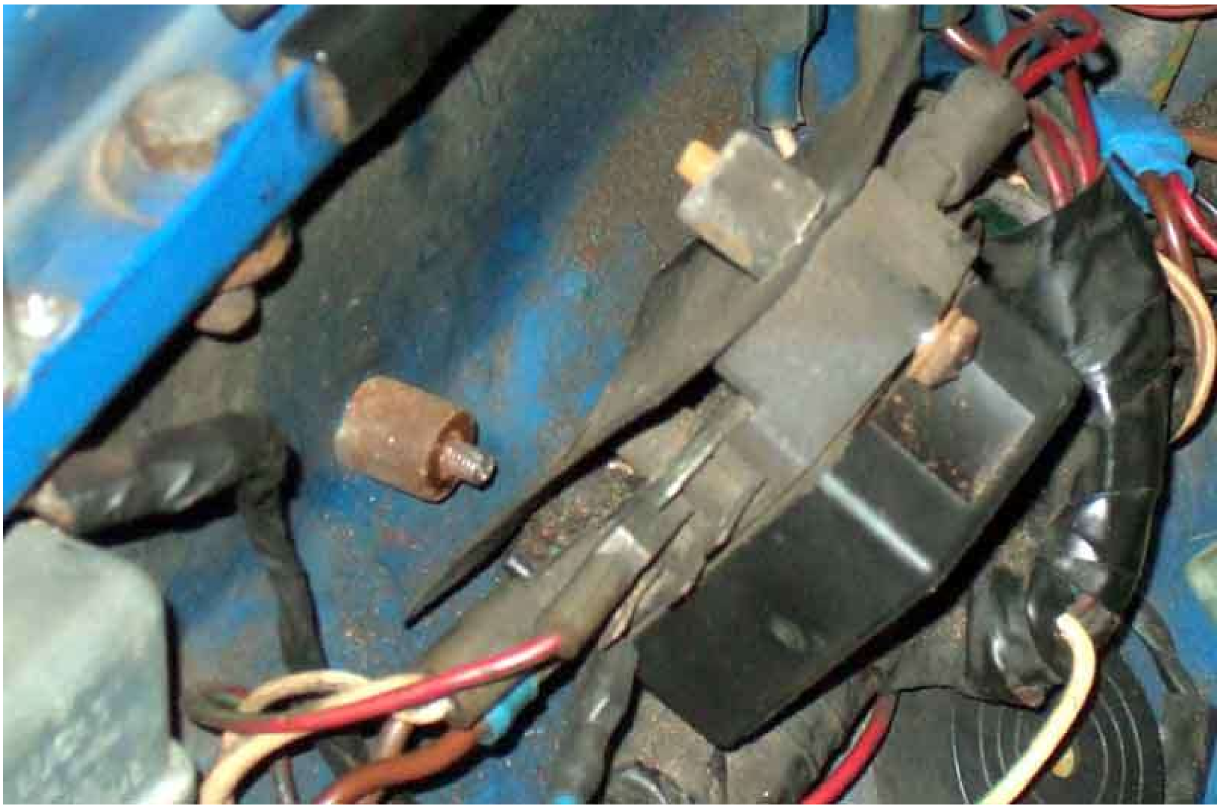


... with 1 1/4" self-tapper screws into nylon sockets. No insulating sheet or spacers.

V8 no plinth - what looks like a plinth ...



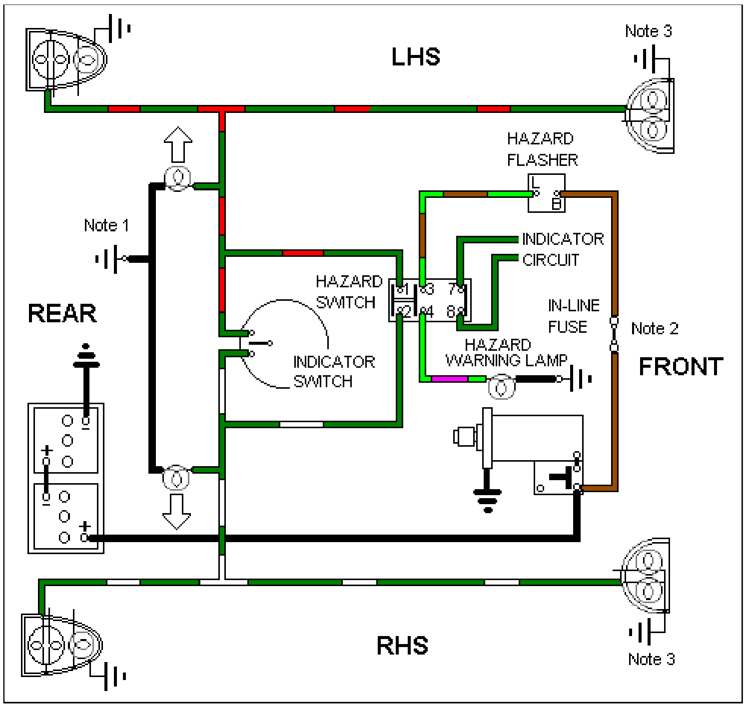
... is an insulating sheet between the fusebox and the spacers. 3/16" UNF screws (note the lower one is sheared) into welded nuts on the back of the inner wing.



V8 screw is 1 1/2" long, the rusty part is all contained within the nut, it does not protrude beyond it.

Hazard Warning Schematics

[Adding hazards to earlier cars](#)
Hover over a wire to confirm the colour



Flasher unit GFU2204 or SFB130, these can either be cylindrical or rectangular, as can the mounting clips.

With the hazard switch off the light-green/brown, green/white, green/red and light-green/purple (where provided) are all isolated from one another, and the two greens (one from the fusebox and the other to the indicator flasher) are connected together.

When the hazard switch is on the two greens are isolated from each other, and the other four are all connected together. The load of the four indicator bulbs starts the hazard flasher flashing on and off after a short delay.

Note 1: Tin-dash cars seem to have a local earth from the physical mounting of the bulb-holder in the bracket. American padded-dash, all V8s and rubber bumper cars have a wired earth to the bulb holder as they are mounted in plastic panels.

Note 2: Originally the fuse - like the flasher unit, was behind the console and hence inaccessible. At some point it moved to under the fusebox - possibly with rubber bumpers although the V8 remained behind the console, possibly with 1977 models. At the same time the flasher unit moved to behind the dash by the indicator flasher.

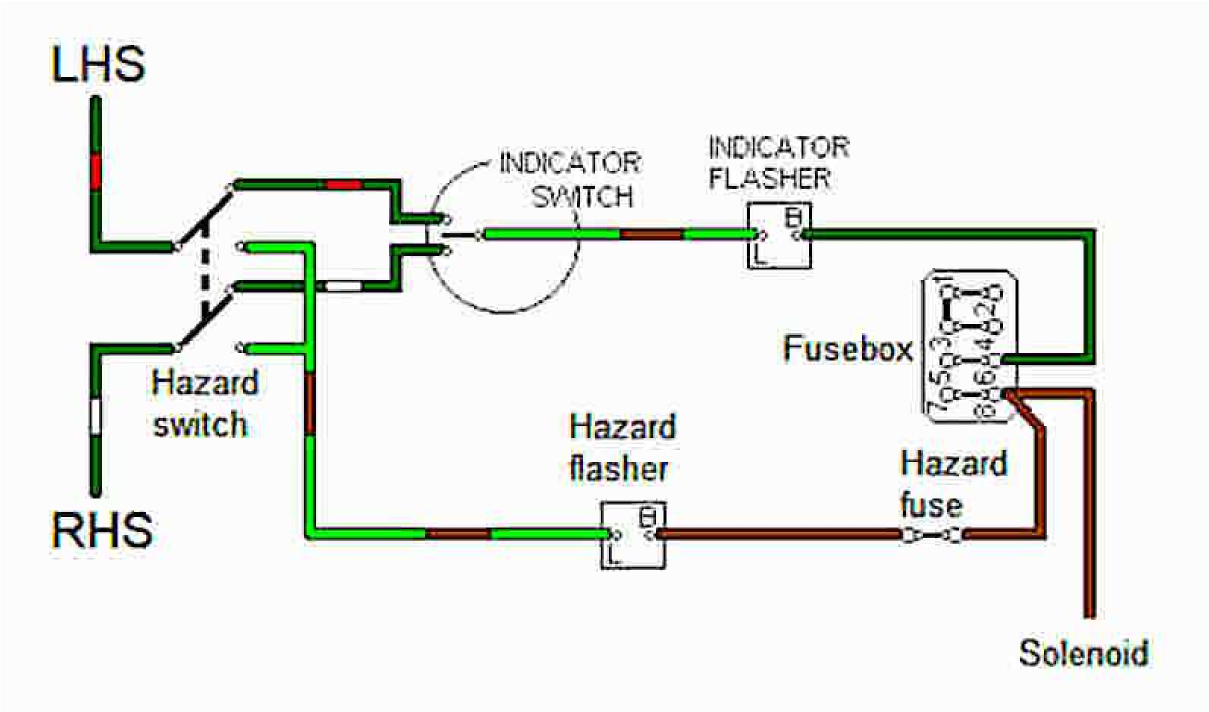
Note 3: Rubber bumper cars have a single orange lensed light unit in the bumper with a wired earth to the main harness with the headlamp earth. RHD cars have a single filament bulb which is for the indicators/hazards only, North American spec have a dual filament bulb for the parking lights as well as the indicators/hazards.

Hazard warning repeater (light-green/purple) on North American spec only.

For the 1977 model year on the switch was illuminated when the hazards were on.

Options for adding hazard flashers to earlier cars:

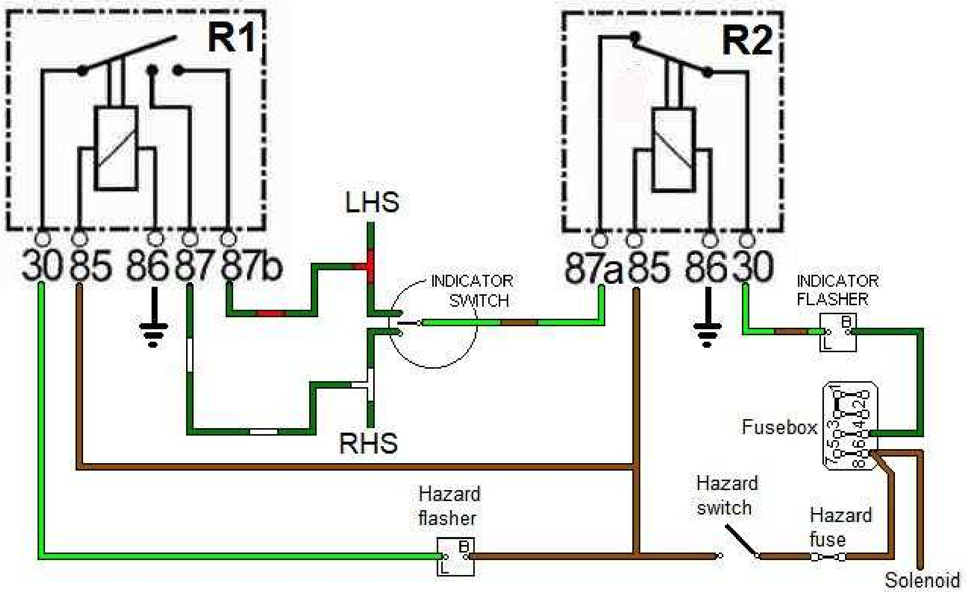
Using a double-pole, double-throw switch:



Requires breaking into the white/red and white/green wires, which can be done at the bullet connectors between the main and rear harnesses in the engine bay if you don't want to cut wires.

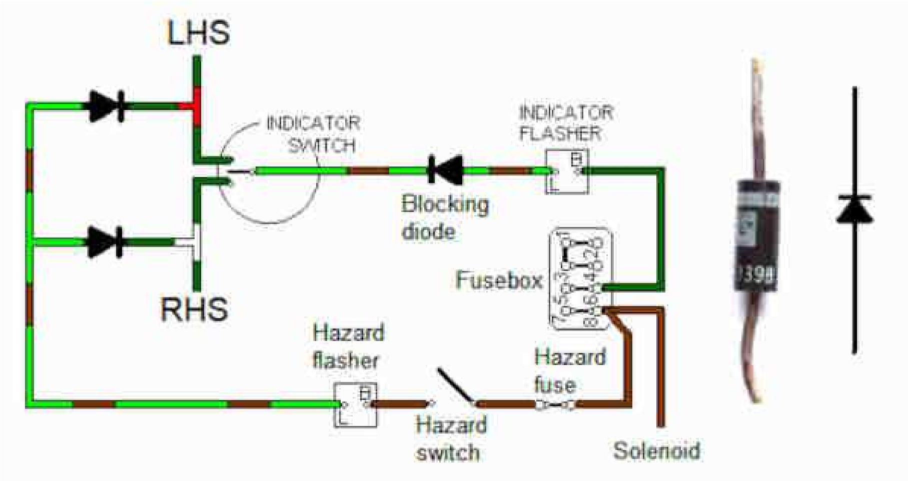
Using a dedicated hazard fuse from the brown circuit (always live unfused) is preferable to using the purple circuit which is already fused in the fusebox. This is because the purple wire goes across the front of the car and could have been damaged in a frontal impact so blowing that fuse.

Two cube-style relays can be used with a generic on/off switch:



These relays are different to the starter and ignition relays usually found on an MGB. Both relays operate when the hazard switch is turned on. R1 is a 'dual make' (aka double make, twin make) relay which connects the input 30 to two separate output contacts 87 and 87b when the relay is operated, connecting the hazard flasher unit to the lamp wires. When the relay is released the two outputs are isolated from one another, not to be confused with high power relays with one or two 87 terminals but no 87b terminal. R2 is a 'normally closed' relay with an 87a terminal, disconnected from terminal 30 when the relay operates, isolating the indicator flasher unit if the indicator switch has been left operated.

Using a standard 'on/off' switch with three diodes:



Avoids cutting into wires but three diodes have to be used, suggested 5 amp, 60v minimum such as SR506. The blocking diode can be connected at the indicator flasher spade terminal. The white band on the diode represents the point of the arrow in the symbol, orientation shown above is for negative earth cars, they would need to be reversed for positive earth. On the right is shown how a typical physical diode relates to the circuit diagram symbol. Using diodes is not ideal as they always exhibit a forward volt-drop which reduces the voltage at the load, in this case lamps which will reduce their brightness slightly. Proponents of electronic ignition should note that the same effect reduces current through the ignition coil compared to a decent set of points!

Cooling-fan Fusing

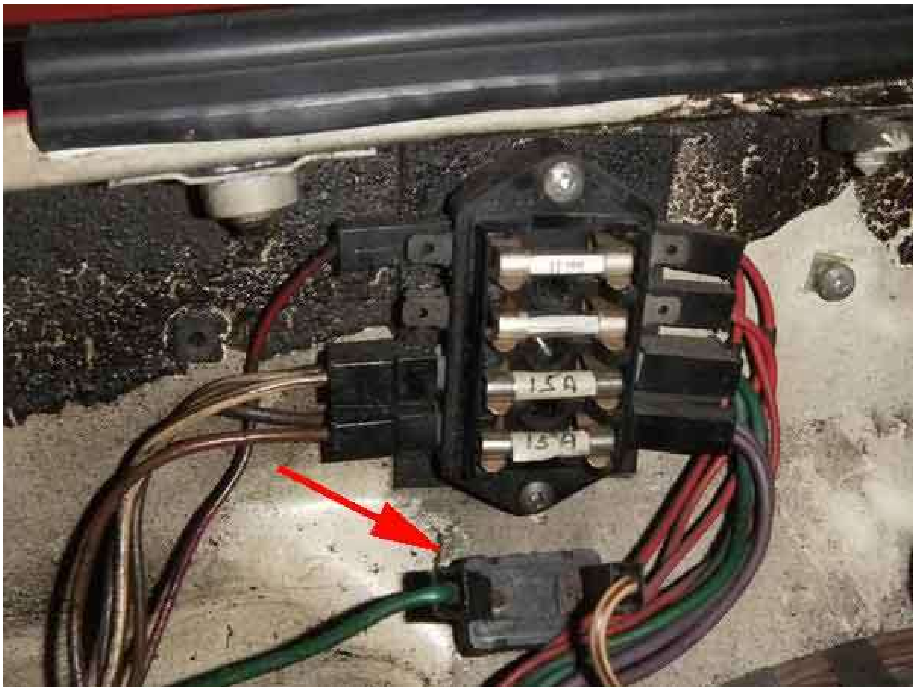
4-cylinder **V8**

4-cylinder:

Probably only applicable to the North American spec 4-cylinder from 77 on with two cooling fans is this thermal cut-out in place of the conventional in-line fuse fitted to UK cars with the single fan:

However that differs from this on-car example with spade terminals ...

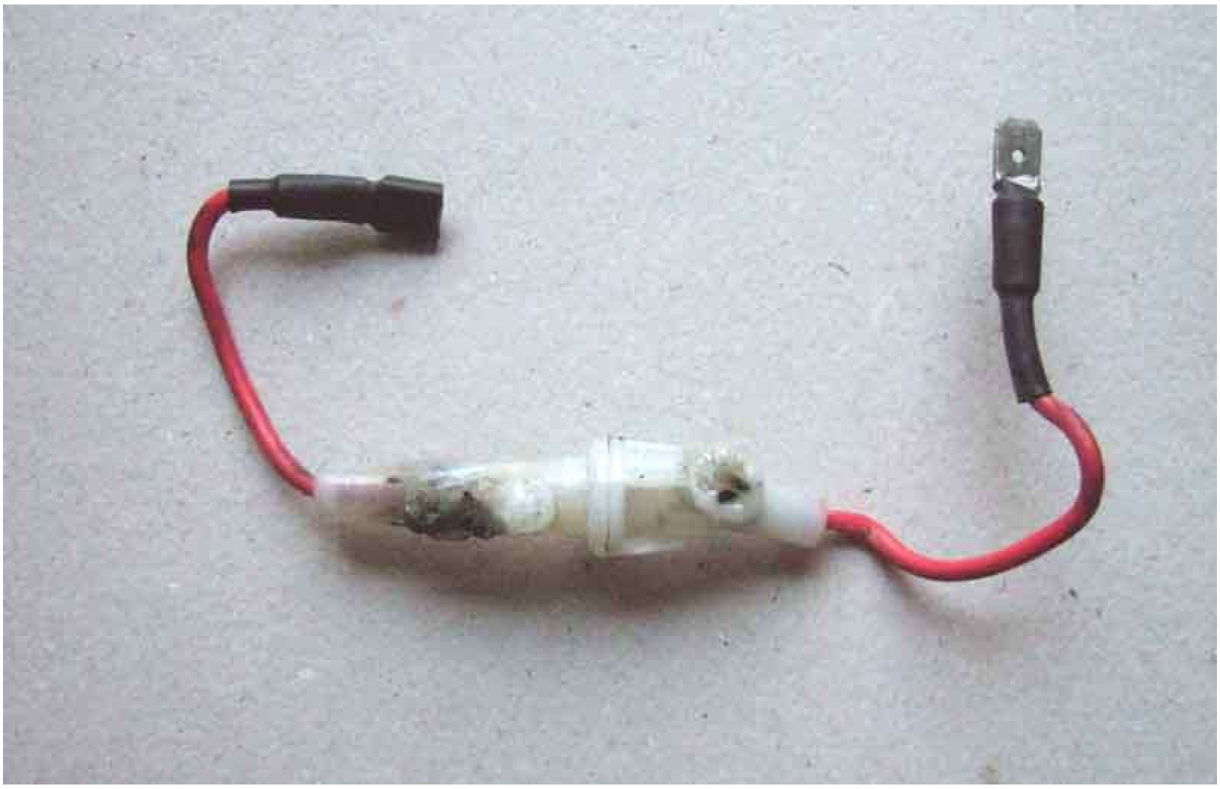
... as does this:



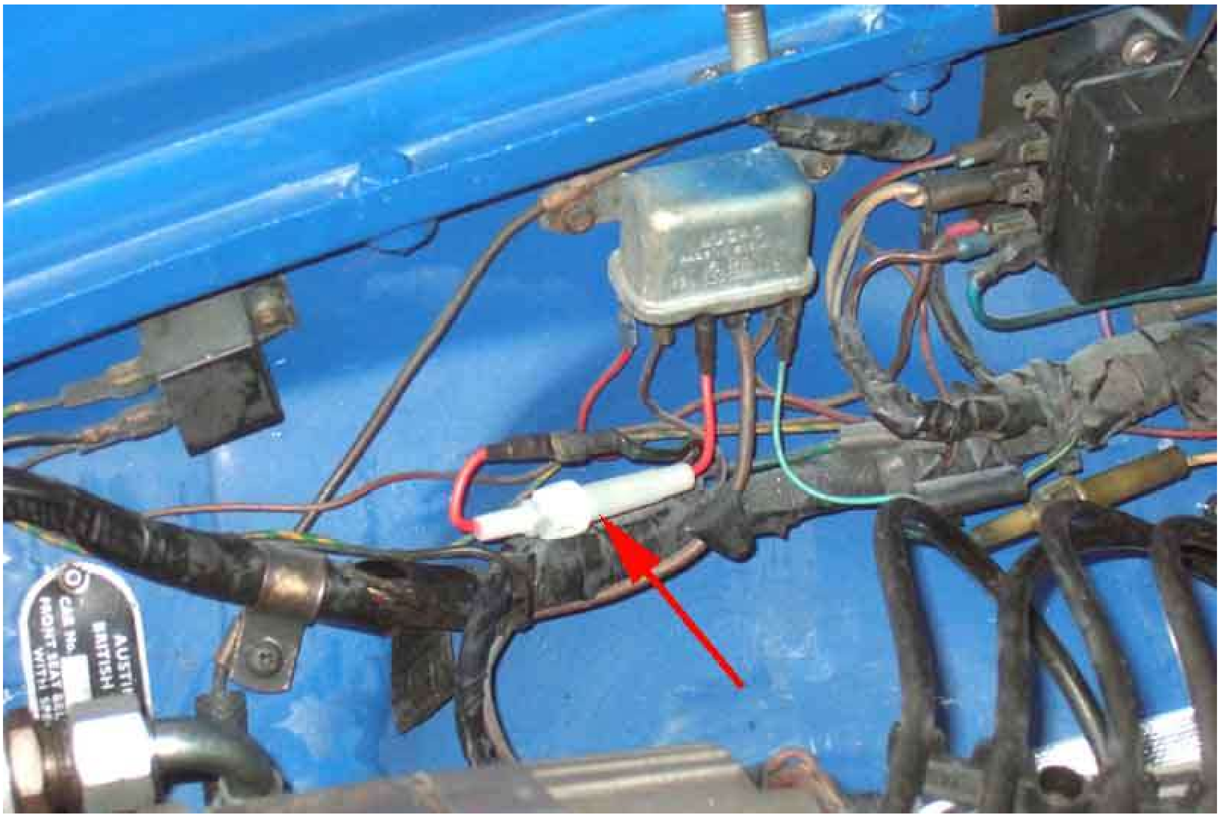
V8:

The first fuse I fitted to Vee - melted in normal use but still functioned:

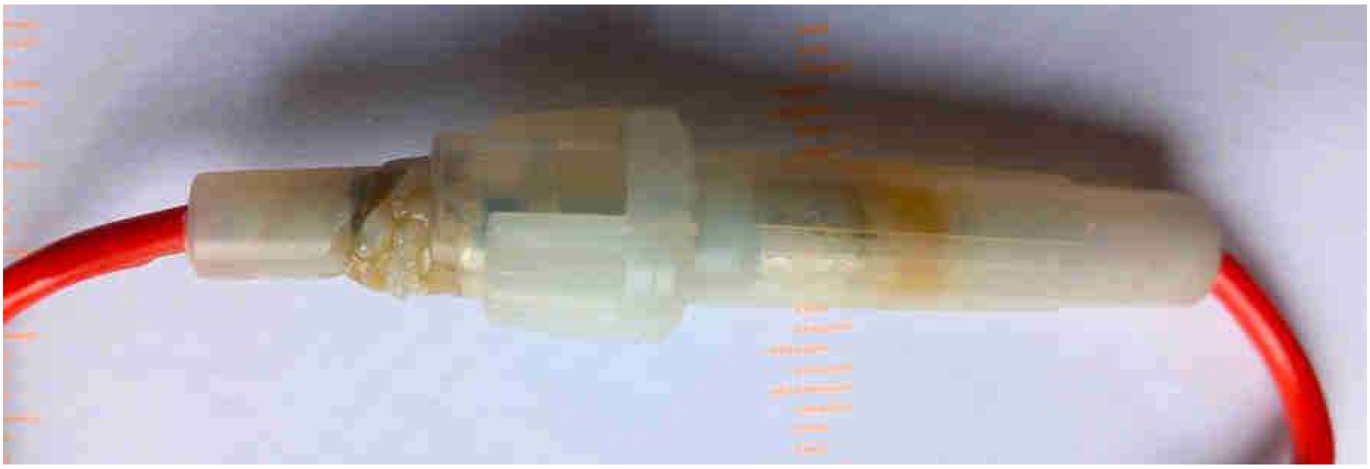
The second type - fine in normal use but melted when one of the fans was unable to spin:



Replaced with the same type and rating:

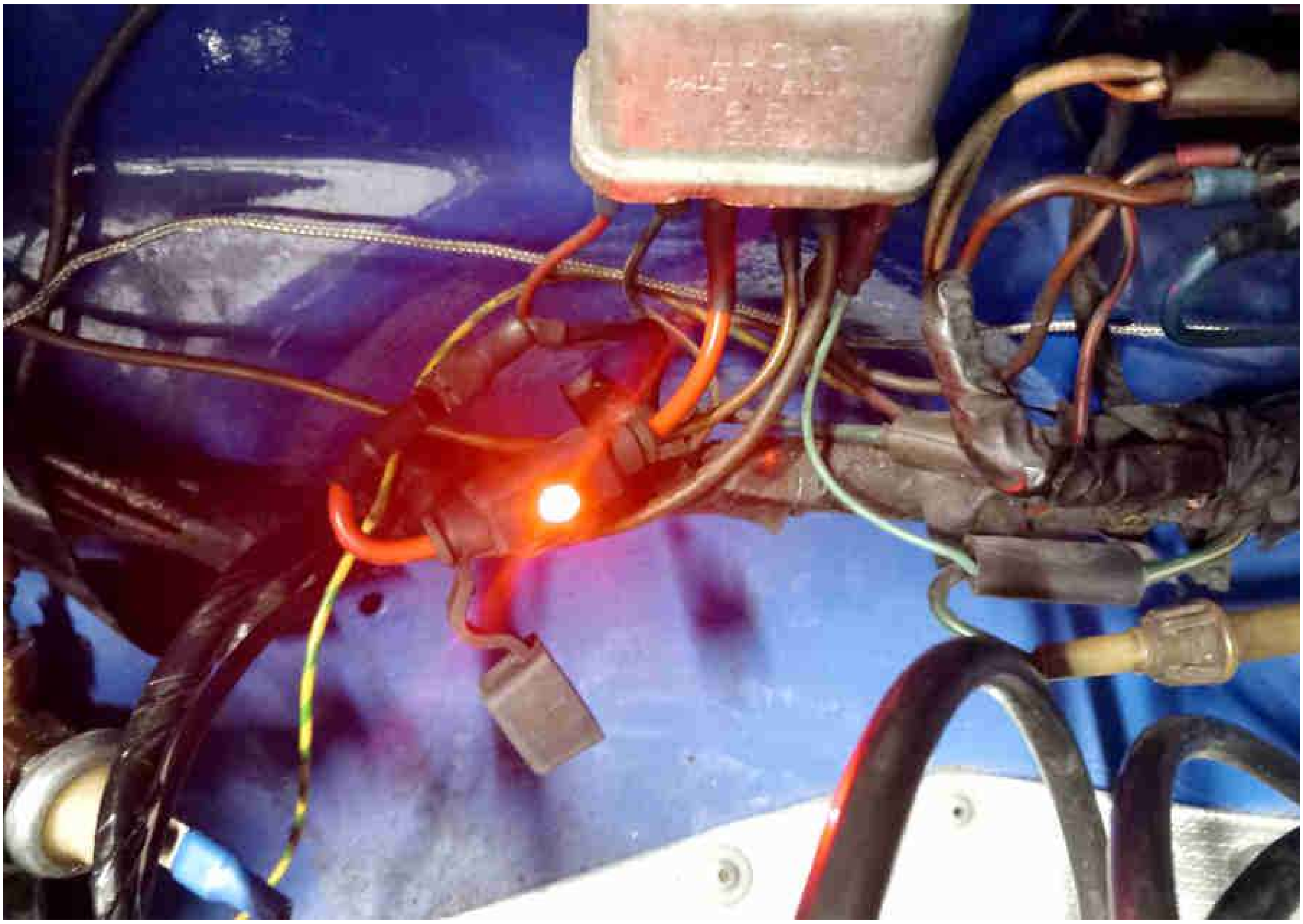


Yet another heat-damaged fuse holder and open-circuit, with the damage again occurring where the ends of the fuse contacts the holder terminals, which led to a more in-depth investigation:



So this time go for a 30A blade-type fuse (with an LED to show when the fuse has blown ...), but a new one and hope it makes better contact then the previous one:

Testing with fans powered but fuse removed:



I hadn't realised they were this small. The 'standard' size might have been better, the fuse is a bit of a struggle to pull out as it is gripped so tightly - which is hopefully a good thing!

Comparing glass-tube in-line holders the fuses included with the eBay items (lower) are noticeably longer (as well as slightly fatter not visible here) than separately bought (top) fuses. Both types are fine in the main fusebox:

However the longer/fatter fuse jams down in the eBay holder (top), whereas the shorter/slimmer is pushed back out by the spring with no hint of jamming (bottom):

But it was a shorter/slimmer fuse in the second failed holder so jamming wasn't the problem, maybe not pushed tightly enough into contact with the terminals:

No hint of jamming in the 12v Planet 20A holder (green wires, available with and without spade terminals) which also has a longer free-length of the spring (top image) and is stronger (lower image) so avoiding both issues:

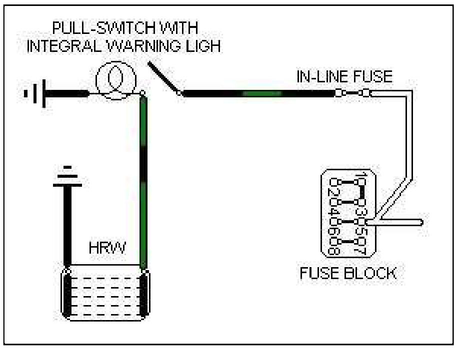
Not all 12v 20A in-line fuse-holders are equal!

I used the eBay fuses for the overdrive and fuel pump on the basis that at 1 amp continuous for the former and 7 amps but with very intermittent pulses (usually) for the latter they would be fine. However pumping a gallon out of the tank I was surprised to find the pump fuse warm to the touch when I went to disconnect it to stop the pump. SU Burlen state that the pump takes 1.5 amps at 9.5v, which will be on test continually pumping, which equates to 2 amps at 12v. Warm to the touch indicates resistance within the fuseholder, i.e. volt-drop, i.e. less voltage reaching the pump. Obviously not enough to cause problems as these eBay fuses have been in circuit for years, but it is an indication that they are only fit for low-current applications.

Heated Rear Window

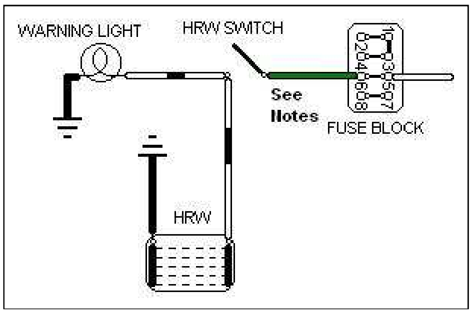
Hover over a wire to confirm the colour

Chrome Bumper to 1970



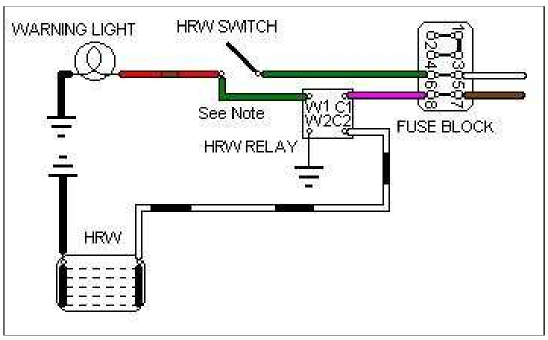
Note 1: North America used a separate switch and warning light, and white/black wires from fuse to switch and switch to screen, from 1968.
Note 2: There was a separate wire from the front to the back of the car for the HRW, and on at least one example this feeds the left-hand side of the screen instead of the right-hand side on later cars. Also being optional the earth wire route and connection could be anywhere.

Chrome bumper 1971 on and all V8s



Note 1: Pull-switch with integral warning light used from 1973 in North America.
Note 2: In some diagrams the wire to the external warning light is shown as red with a brown stripe off the same terminal as the white/black to the screen.
Note 3: The 12v circuit from the switch has bullet connections where the main harness joins the rear harness in the engine compartment, [by the right rear light cluster] where white/black for the HRW goes up the C-pillar (together with purple for the load space light); and where the white/black connects to the wire coming out of the screen rubber by the right-hand hinge.
Note 4: The earth circuit uses a single black wire down from the bullet connector by the left-hand hinge, to the [top mounting point for the left rear light cluster].

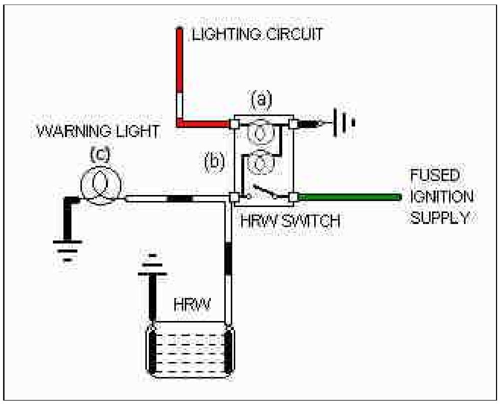
Rubber bumper to 1976 (not V8)



Note 1: Green from the output of the switch to the relay is logically incorrect. This colour is normally used for fused ignition i.e. is live all the time with the ignition on which would operate the relay all the time. It also means that two different colours are on the same terminal which normally never happens - the other being red/brown to the warning light.

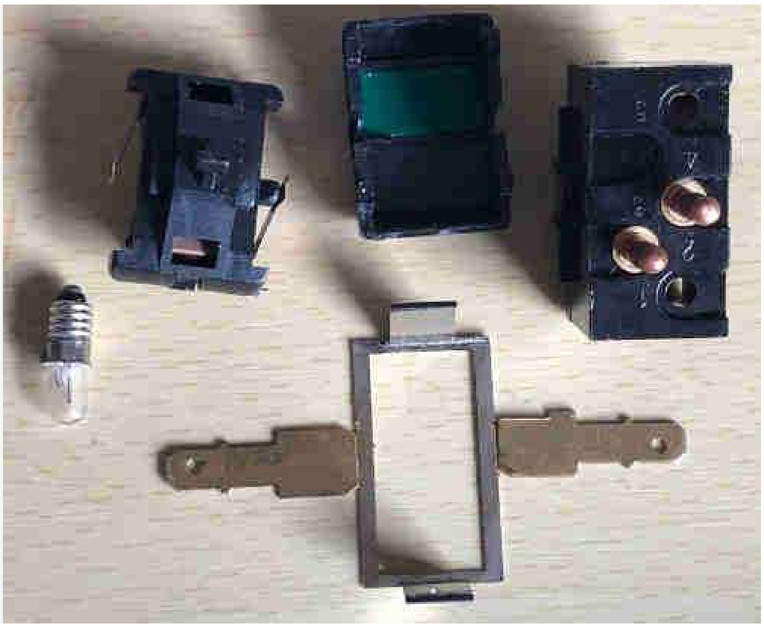
Strictly speaking red/brown should have been used as the colour feeding the relay as well as the warning light.
Note 2: The 12v and earth connections are the same as for the 1971 and later, see Notes 3 and 4 here.

Rubber bumper 1977-on

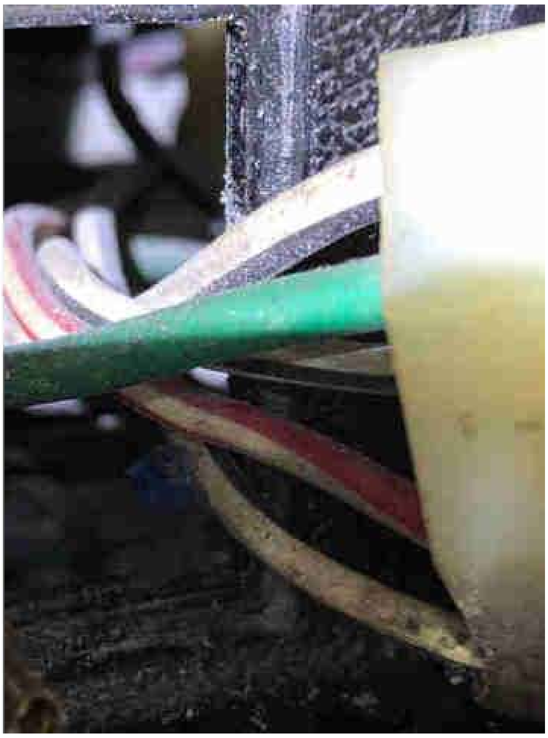


- The switch was illuminated - (a) above - with the parking lights on and hence has additional red/white and earth wires.
- From some time in 1978 the HRW (GTs in RHD only by this time) was powered from a subdivision of the green circuit fed by a separate in-line fuse under the fusebox. One of two connecting a white/brown to a green, it is the one with the thinner wires, the other one with thicker wires is for the cooling fan. See ignition schematics for more info.
- Clausager says that 1977 models up to December 77 had the heated rear window switch with built-in warning lamp - (b) above - even though there was space beside the switch for the warning lamp. From December 77 to the start of the 1980 model year there was a separate warning lamp (c), however 77 to 79 (I do not have a 1980) diagrams only show the separate warning lamp. When the fog-guard switch was added in 1980 the space for the HRW warning lamp was lost and a switch with internal tell-tale of unknown part number was provided again. But this drawing of the switch is a bit of a guess as it's not clear from users whether the 1980 switch does have both night-time and tell-tale illumination, as one person says his has the latter but not the former.
- As well as the 12v and earth connections listed in Notes 2 and 3 above, 1977 and later cars have the white/black output wire going via a bullet connection (left unused on roadsters) and multi-plug behind the dash where the main harness joins the dash harness.

Albert Ross show this wiring on the connector to his 1980 HRW switch, which is rather confusing. There seems to be a green (12v, correct), three white/blacks (there would only be one to the HRW, plus one to an external tell-tale which he doesn't have), and a red/white for night-time illumination which would normally go to one of the spades on the side of the switch, plus a black (earth for night-time illumination to a spade on the other side of the switch) which isn't shown:

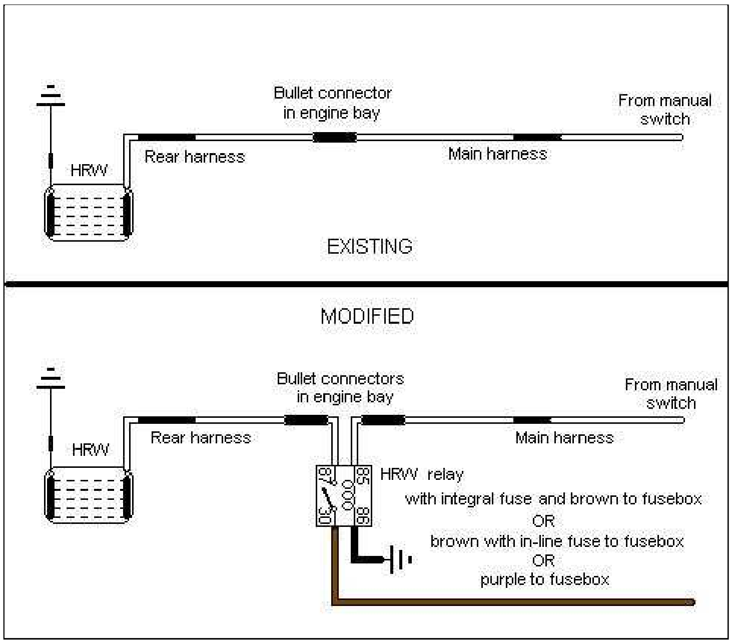
His switch, showing multiple pins instead of just two pins which is how replacement switches for the MGB are shown:



As the original switch part number is unknown this 1977 and later Mini switch YUF101680 might be suitable, although it has a yellow lens on the rocker instead of probably a green, and the edges of the rocker look more rounded. It still has the two spades on the side for the red/white and black wires, but has only two pins on the back for green and white/black wires (which is all it needs ...): (*Moss Europe*)

But information from owners is confusing in that cars earlier than 1980 only have the night-time illumination, but a 1980 has the tell-tale but not night-time illumination! Whether that is because of a failed bulb, or a faulty connection somewhere, wasn't established. More info on internal bulbs here.

Adding a relay

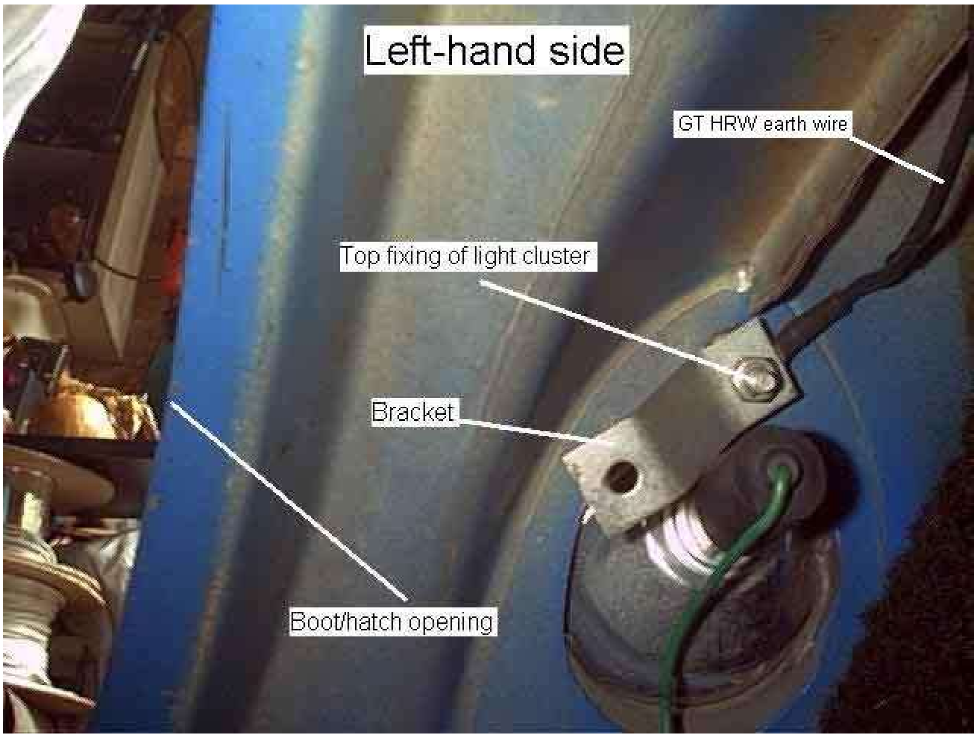


Physical wiring

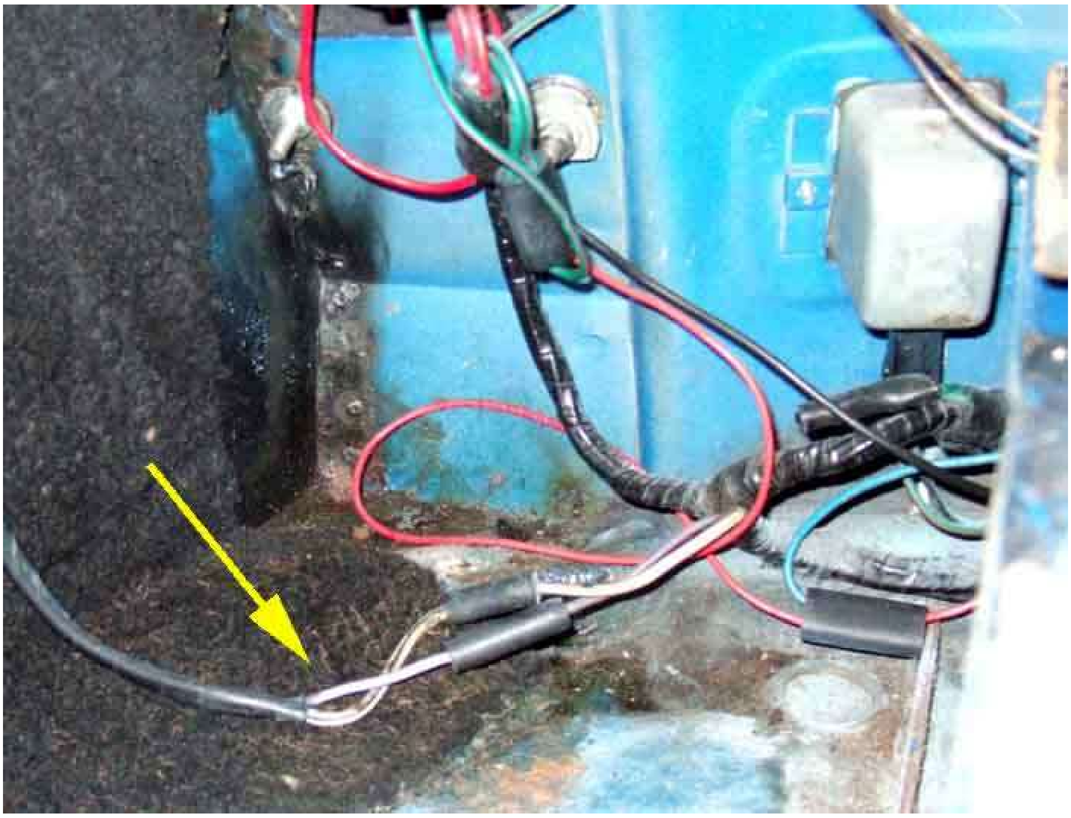
Hatch open, wire exiting from the window seal rubber and going to a bullet connector above the rear header rail of the headlining.

Hatch closed, just a small loop of wire visible

This is the earth wire which runs down the C-pillar to the top mounting stud of the rear light cluster. A similar wire runs down the other side to join with the rear harness by the light cluster. (The bracket is for the carpet piece that covers the back of the light cluster.)



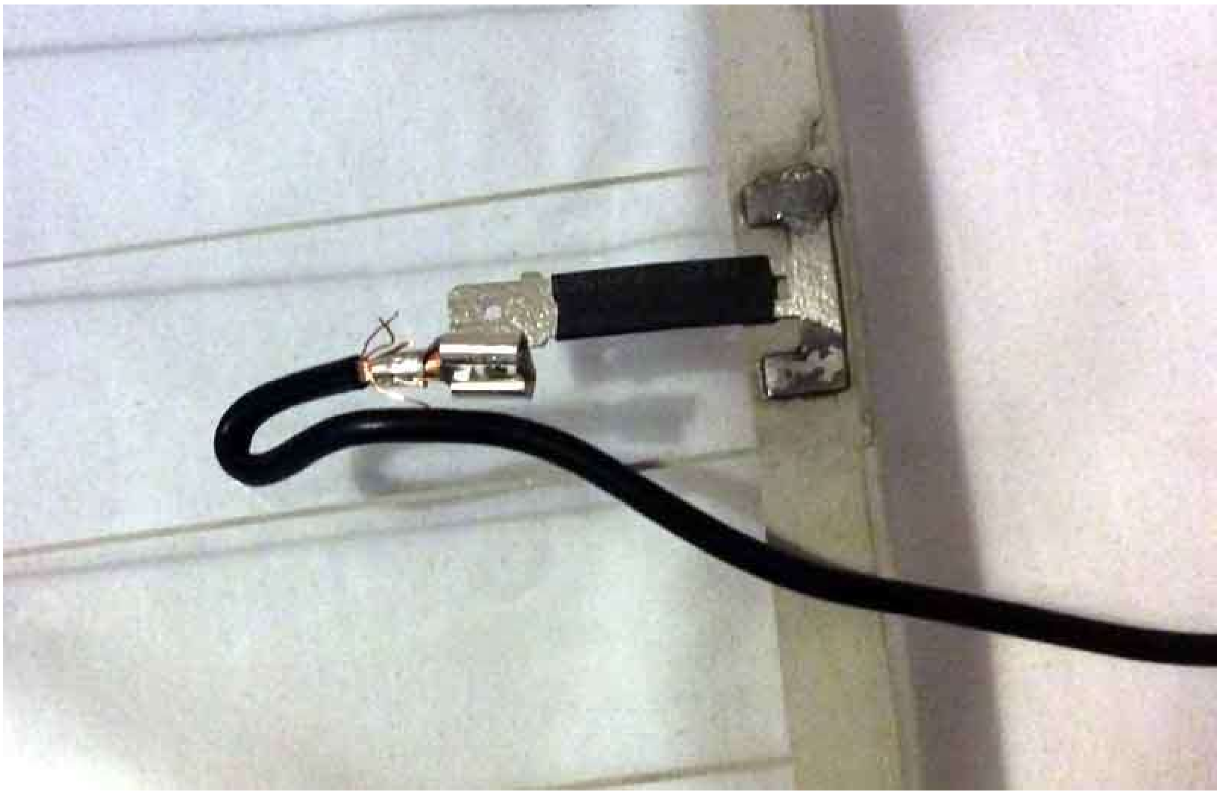
The two 12v feeds going up the right-hand C-post for the HRW (white/black) and the load-space light (purple).



The soldered connection point on the surface-printed element, about mid-way down the side of the glass, with the connections and wiring covered by the rubber seal, but exposing a test-point.

Robert Kerr's car, glass removed, showing the two spades on the inner edge of the glass. I'd say extreme care needs to be taken if you need to disconnect/reconnect the wire attached to this connector, say when replacing the glass, to avoid the risk of detaching the connector from the screen.

Roy Marshall's replacement glass, showing the very inconvenient connection arrangements.

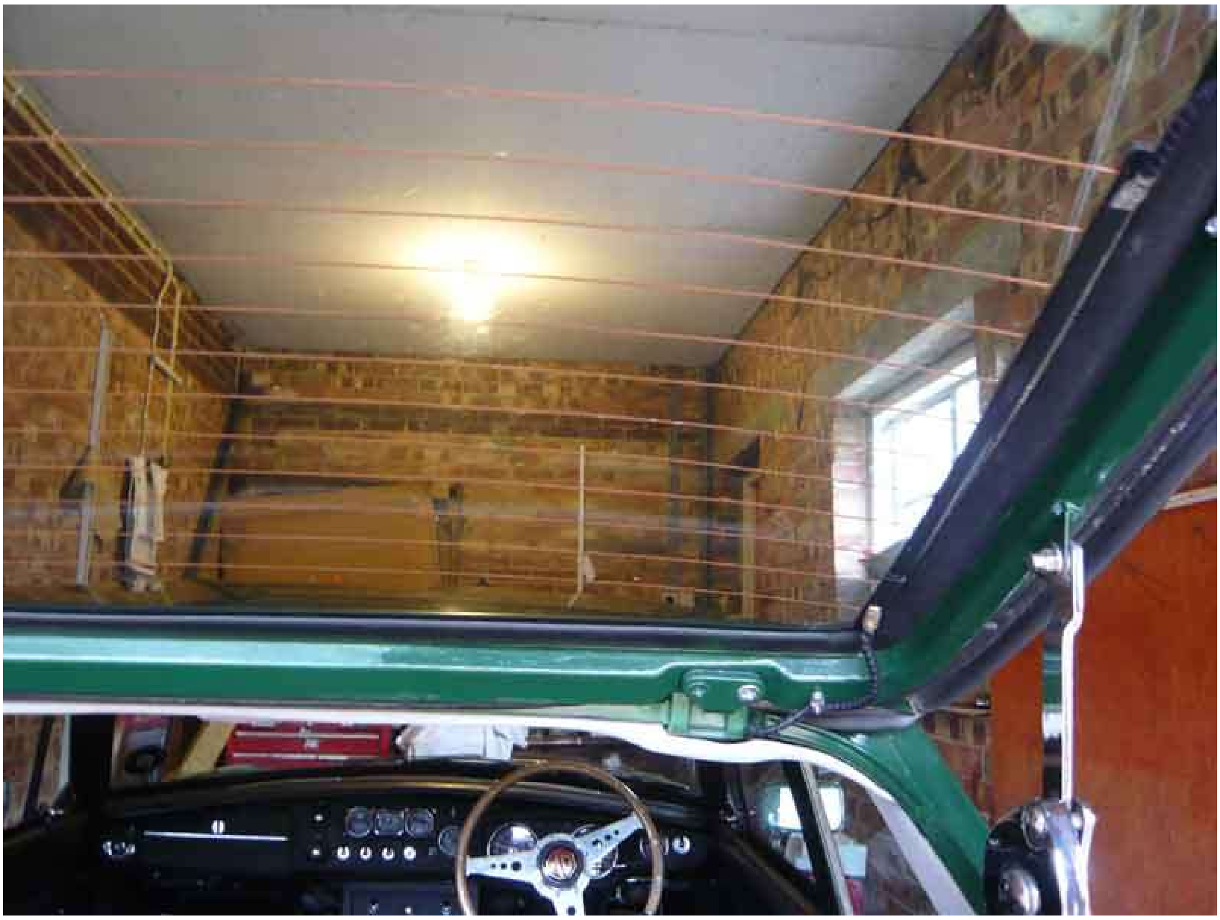


I suggest a right-angle wiring connector is the best way to get a half-way neat installation, however check the size of the spade on your glass first.

Heated Rear Window Repair

An extremely neat kit from DS Demist,and an equally neat installation job by Peter Ugle. Whilst it isn't essential to remove the glass or hatch to fit the kit it obviously makes it much easier to get a neat finish working from above on a horizontal surface as opposed to trying to fit it lying on your back, even if the hatch is propped in the horizontal position.

Unlike the original both electrical connections are made from the same side.



This should be the off- i.e. right-hand side to pick up the 12v supply ...

... as the earth can be taken to a screw in the hatch frame.

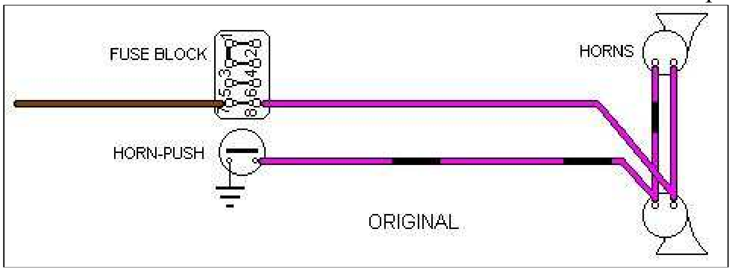
The other side of the kit just has the stick-on end-strip.

Horns

Hover over a wire to confirm the colour

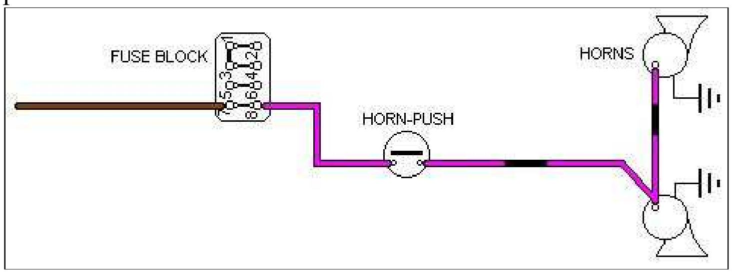
2-wire Horns (pre-79)

The horn push switched an earth to the horns which are backed by 12v from purple wires from the fusebox. Prior to 1977, with the exception of 1970, the horn button was on the steering wheel and picked up its earth from the body via the crossmember, rack, steering column U/J and column. That earth path is very convoluted with many mechanical connections which can give poor electrical connectivity. For that reason in the event of weak horns installing a relay may be much simpler than trying to improve the mechanical connections. In 1970, 1977 and 1978 the horn push was on the indicator column stalk and had a wired earth from the harness which did not suffer from that problem.



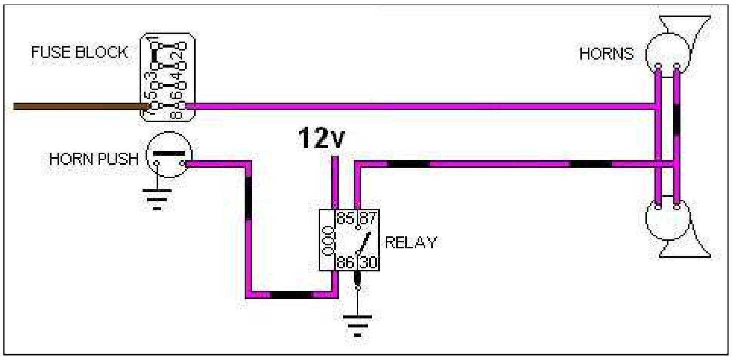
1-wire Horns

For the 1979 year on the horn push supplies a switched 12v supply to the horns, which pick up their earth return from their physical mountings. Relay option not shown for this as any bad connections should be relatively easy to solve, unlike the convoluted earth path of the pre-77 2-wire horns.



However there is conflicting information as to when this arrangement came into use. The Parts Catalogue shows the same horns i.e. with two terminals being used for the whole of rubber bumper production including 1977-80. The Workshop Manual diagram for 1977 models shows a similar arrangement to before albeit with the switched earth now via the horn push on the indicator stalk, and a 12v return path as before. The diagram for 1979 shows 12v being switched by the horn push on the indicator stalk, and a local earth return at the horns, i.e. only one horn terminal. Suppliers variously list the use of the later single-terminal horn from 1975, chassis number 410001 (June 76 and the start of the 77 model year) or chassis number 417001 (Sept/Oct 76). Clausager states that from the start of the 1979 model year in May/June 78 at chassis number 471001 (roadster) and 471036 (GT) "horns with earth return instead of an insulated return" i.e. single terminal horns picking up an earth from their physical mounting.

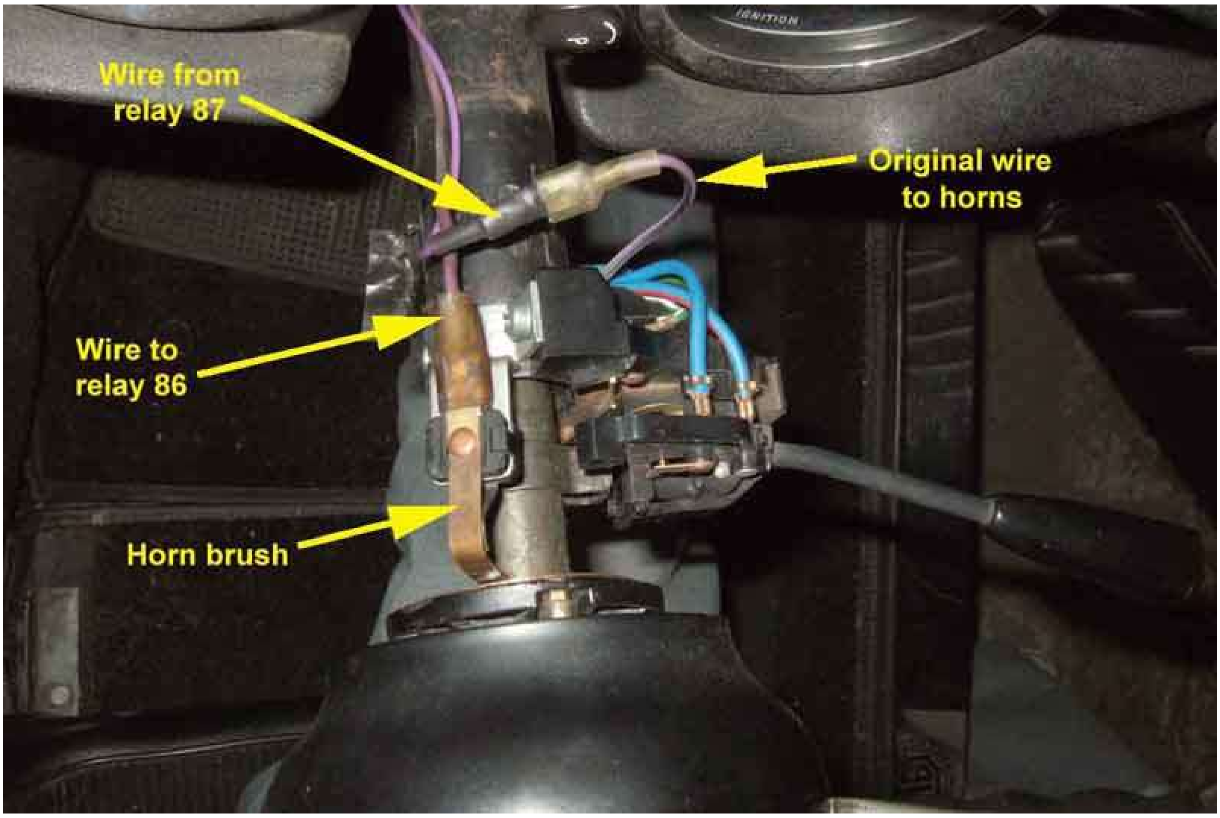
2-wire Horn Relay



Some Bosch-type relays have an internal diode between terminals 85 and 86 see 'S2' and 'S6' here but it's strongly advised not to use these as the terminals need to be connected the right way round to match your car's polarity. Get them wrong and you will blow the fuse, and maybe the relay.

Fitting the relay behind the dash avoids the effects of weather by the horns themselves. Behind the radiator is also usually safe enough, but to fit it without cutting wires you need to remove the purple/black wires from the off-side horn and run a wire from there back to the relay coil, then run another wire from the relay contact forwards to the off-side horn, and daisy-chain it from there to the nearside horn, removing the existing purple/black. You also need to pick up a purple for the other relay contact although that is easy enough from the fusebox, and an earth for the other side of the relay coil, possibly from its mounting point. Quite a lot of wiring and connectors.

If behind the dash you only need to interrupt the purple black between the horn push and the first horn, and pickup a purple and earth as before. A convenient place to do that without cutting wires is at the brush contact under the cowl on 1970 to 76 inclusive. Take a new wire from the horn brush to a relay coil terminal e.g. 86, and extend the original purple/black wire to one of the relay contact terminals e.g. 86. Connect an earth e.g. from the relay mounting point to the other contact terminal (30), and provide a 12v supply from a convenient purple (fused, always live) circuit to the other relay coil terminal (75):

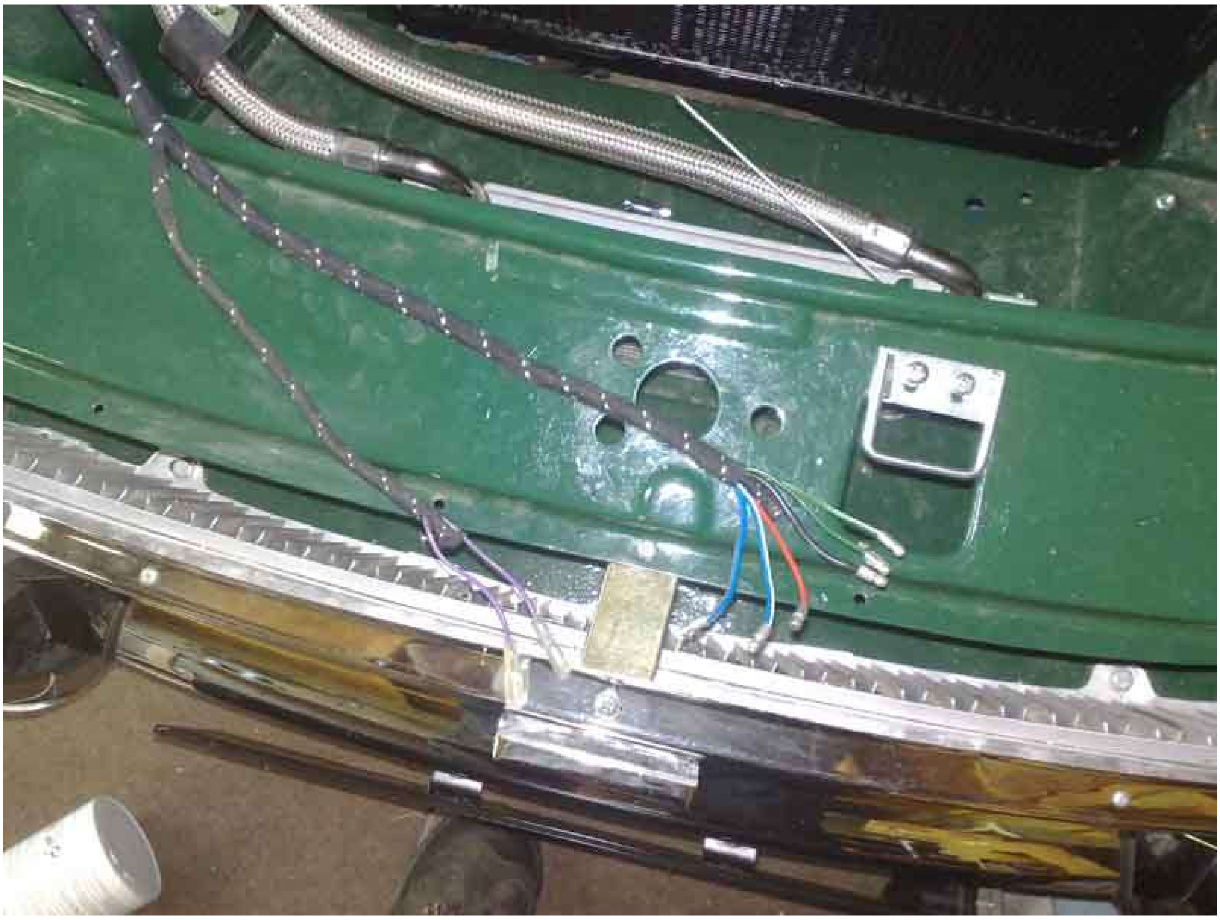


However the cowl is pretty snug around the harness and column, and unless you relieve the inside of the cowl carefully to make space the two halves of the cowl may not come together cleanly, and even if they do they will probably be pressing the wires against the column which could eventually chafe through. Not dangerous - it would just sound the horn! For that reason I decided to leave mine as I did it originally i.e. cutting the purple/black behind the dash and using a 2-way terminal block to cross-connect the wires with the relay wires.

Horn Mounting

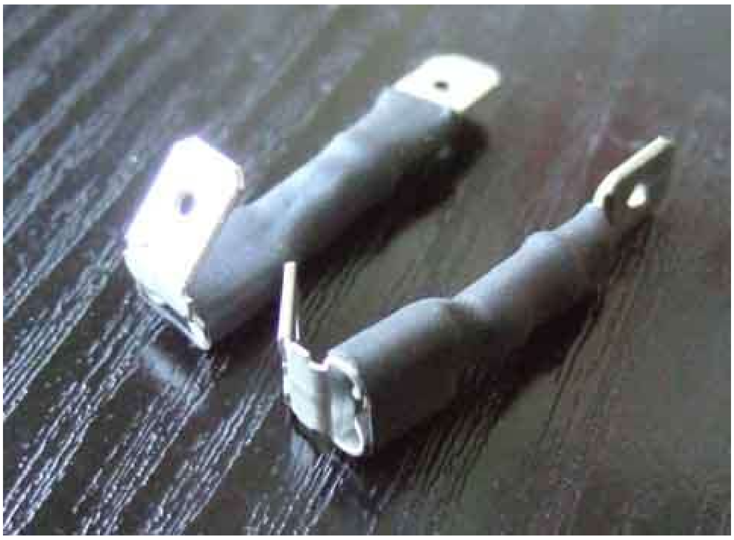
Originally a flat bracket 57H5309 mounting the horn (optionally 2) on the slam panel: (*Motaclan/Leacy*)

The early main harness only had wires for the single horn on the off-side:



For the optional second horn a sub-harness was needed, and the original horns had double-spades like these BHA4514 and BHA4515 horns from Motaclan/Leacy:

But if you have the later single-spade per terminal horns you can avoid mangling the harnesses by using a male-male-female spade adapter. Loads in America apparently, but I've not been able to find any in the UK, or even China (which is surely where they come from). I'm not paying the ludicrous postal charges that seem to be the norm from America, so looked at making some up. It occurred to me that I could use a piggy-back (one male and one female) and a male spade, back to back. Conveniently my piggy-backs have an second tube around the main crimp tube, and extending back from it, so with the insulation stripped off both the back of the male slots neatly into that. A copper nail that extends through both components, crimped, soldered and the whole thing heat-shrunk makes a neat job:



Subsequently I came across these via Google. 6.3mm from several sources - UK, two in America, in side-by-side or back-to-back configuration, another here in side-by-side configuration, and one in Australia. However the 'side-by-side' type look as if the spades are too close to each other to fit two insulated females:

In January the bracket changed to angled GCE110 mounting the horn(s) in the inner wing(s). Two horns became standard in October 69 at the start of the 1970 model year: (*Motaclan/Leacy*)

Mixo horns at least are mirror-images:

Mounted vertically with the trumpet facing forwards and the spades uppermost ...

... the curve of the trumpet is downwards (as indicated by the arrow), so anything that gets inside will lodge there:

This is what came out of just one of mine (not the tape measure, that's just to indicate the scale ...):

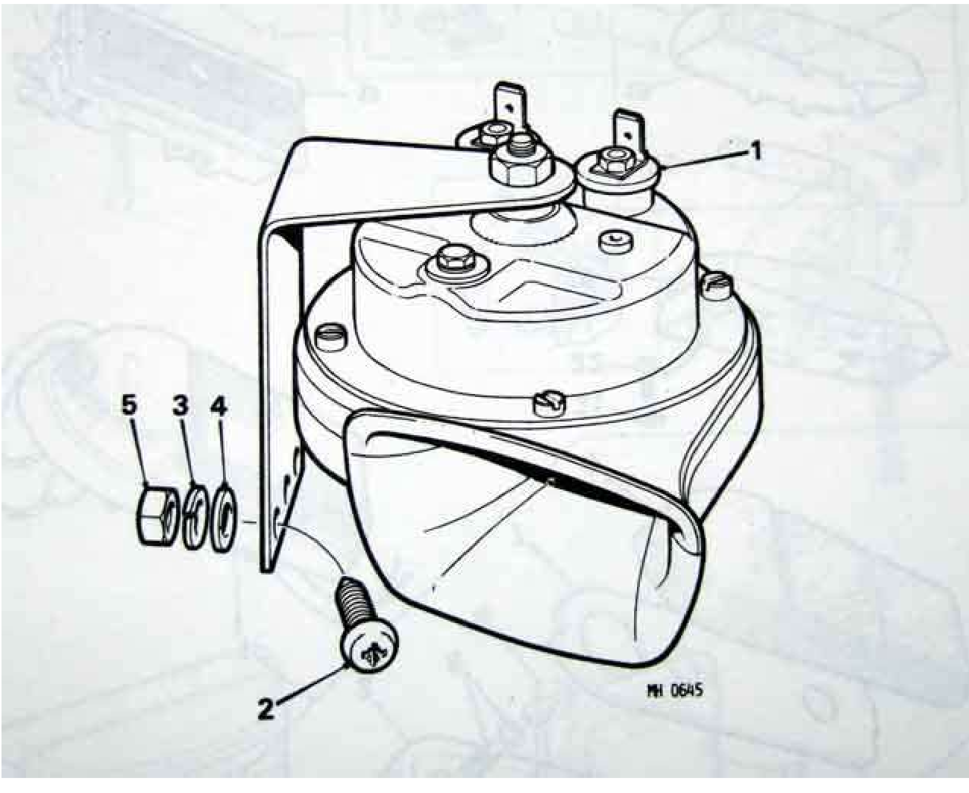
They would need to be mounted such that the curve of the trumpet is upwards (see arrows), which will resist water and debris getting stuck inside, even though this puts the spade connections at the bottom. This can be partly alleviated by angling the open end of the trumpet downwards to some extent, which will further help avoid muck getting inside:

Bee came to me with them mounted direct to the inner wing and not on brackets, I've left then that way, but orientated to resist dirt and water going into the trumpet. Connections now underneath, but still accessible by touch:

At some point - possibly with rubber bumpers - each off-side connection gained a rubber boot with two separate holes for the wires, possibly to protect the connections from the worst of the weather:

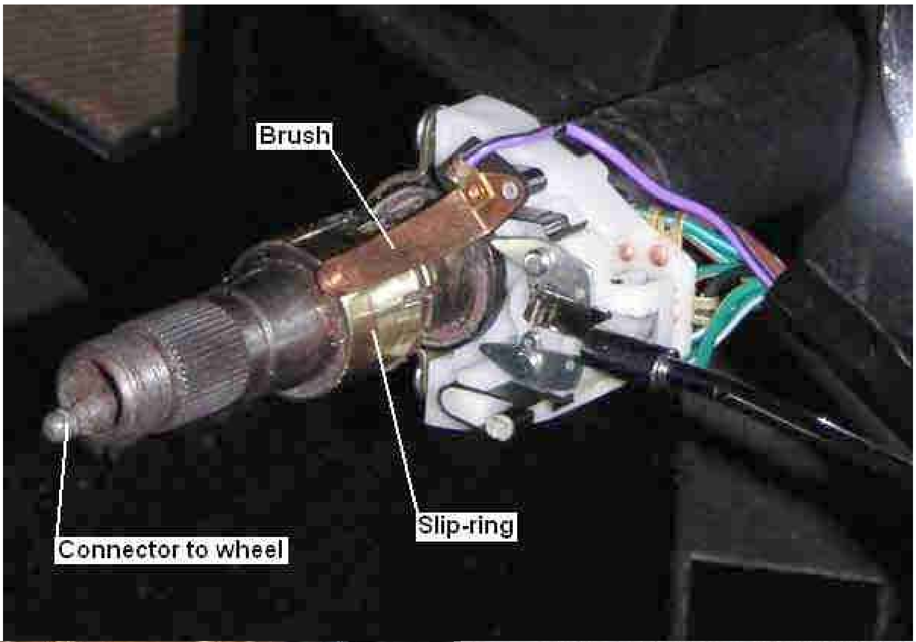
However going by Vee at least the near-side didn't. Both the Mixo horns on the roadster and the different make on Vee have the spades to one side which means they can be mounted so the trumpets face across the car and avoid the worst of the weather driving into the trumpet. Clausager shows a 72 model (p65) like this, but bear in mind the horns in his pictures may not be original, as mine aren't:

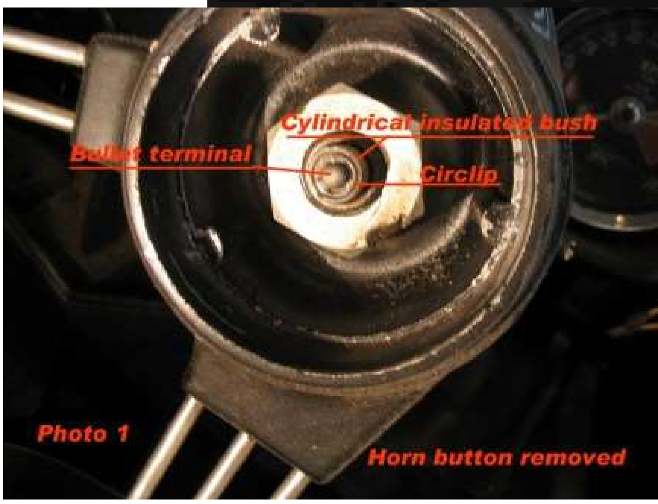
This drawing from the 77 model year and later Leyland Parts Catalogue shows the spades on the opposite side to the trumpet, which means the trumpet has to be facing forwards (or backwards) or the spades foul the bracket. Clausager shows a 69 model (p63) with them pointing forwards like this:

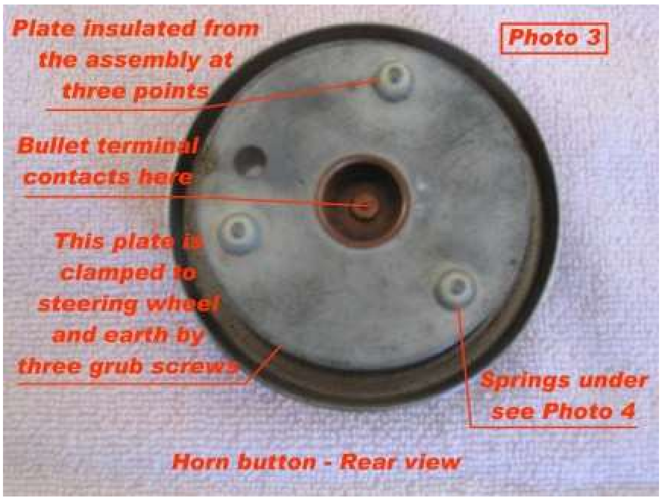


Horn Push

North American Mk1, and up to and including 1969 (other markets): The brush rubs on a brass cylinder (slip-ring) attached to the column, but insulated from it. A wire comes from the slip-ring up through the centre of the column to a ball-shaped end ('bullet' below). This presses on a brass contact attached to the middle of the horn push. Operating the horn push connects the brass contact to a metal plate which secures the horn push to the wheel. The wheel and this metal plate are at earth potential, so when the brass contact touches it the horns sound. This series of photos are from John Minchin:

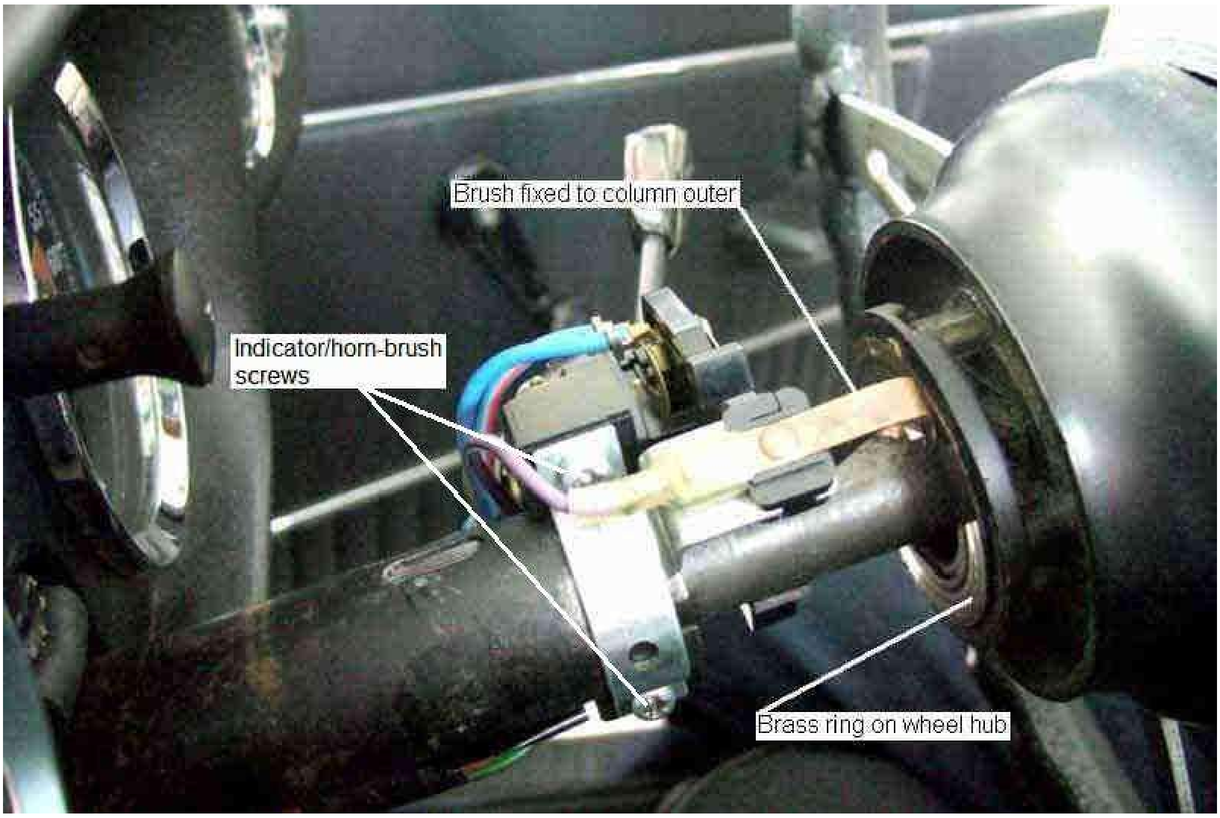






This ebay item shows the column gubbins more clearly. The box describes it as a slip-ring, although the slip-ring itself isn't shown, just the split plastic sleeve it slides over, and the wire that connects it up to the 'bullet' at the end of the column, part number 27H3387. The cylindrical brass slip-ring that fits round the plastic part is 27H5401, both Not Currently Available:

71-on: This is the brush (UK single stalk) 37H8051 on CB cars, fixed to the column outer, and rubbing on the brass slip-ring on the back of the wheel as it is turned:



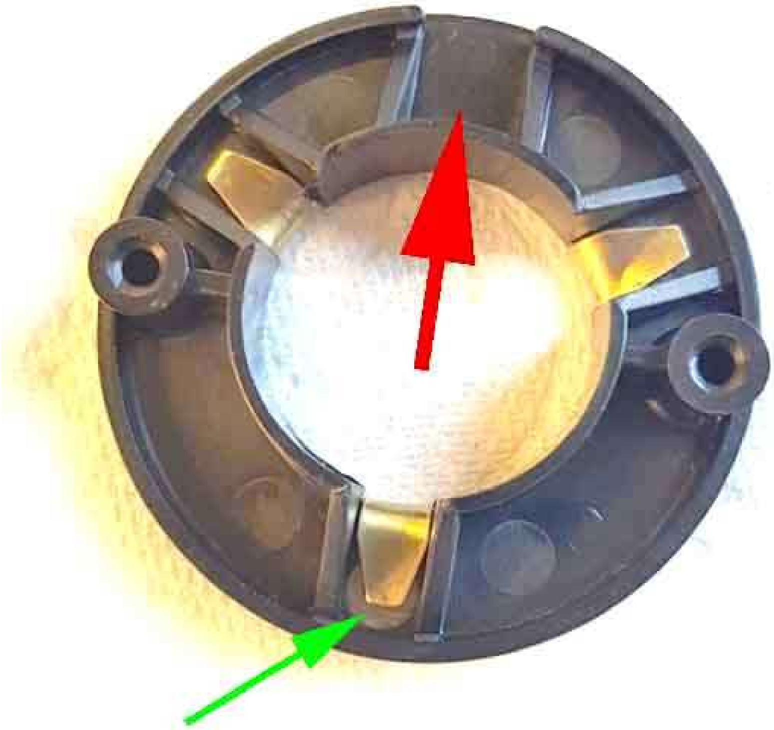
71-on CB 37H8051 on the left, RB until 1977 37H8102 (for twin stalks) on the right: (*Moss Europe*)

August 2020: As you can see these have copper pips on the end which rub on the brass slip-ring on the wheel, hopefully silently. However these can fall out and the copper spring then makes a loud scraping noise against the slip-ring. I eventually lost Bee's so put a dome-head screw and nut in its place, which worked fine for very many years until it started squeaking again. Put a spot of grease on which worked but squeaked again after a year or so, so really I ought to bite the bullet and replace it. But when someone asked about this very problem on the MG Enthusiasts forum just a few days ago Chris @ Octarine Services said he just put a blob of solder on the end of the spring, so worth a go. Initially it just flowed round the hole, but dabbing more on eventually filled the hole and made a dome-shape, so we shall see. But along the way the steering was clonking, which looks like the off-side track-rod moving laterally as well as in and out with the steering, so that will need investigating. New racks are c£200 and reconditioned £100, but the quality of the latter in two recent cases has been appalling, and there have been cases of new grease-filled racks from Argentina not even being assembled correctly.

August 2021: A while ago it started squeaking again, solder gone flat, so put a bit of grease on. Then at the pre-MOT check the horn wasn't working which turned out to be a build-up of grease between the slip-ring and the contact insulating the two. I had used copper-grease, and I note elsewhere that I had used it on heater dash controls and it got very sticky and made them stiff, so best kept for bolt threads. I'll have to get a new contact next time I buy anything ... unless I can find a little copper button in my tin of nut, screws, washers and bolts. What I actually found was a contact button on the end of a little copper strip, which I soldered to the original copper brush arm over the hole for the missing button.

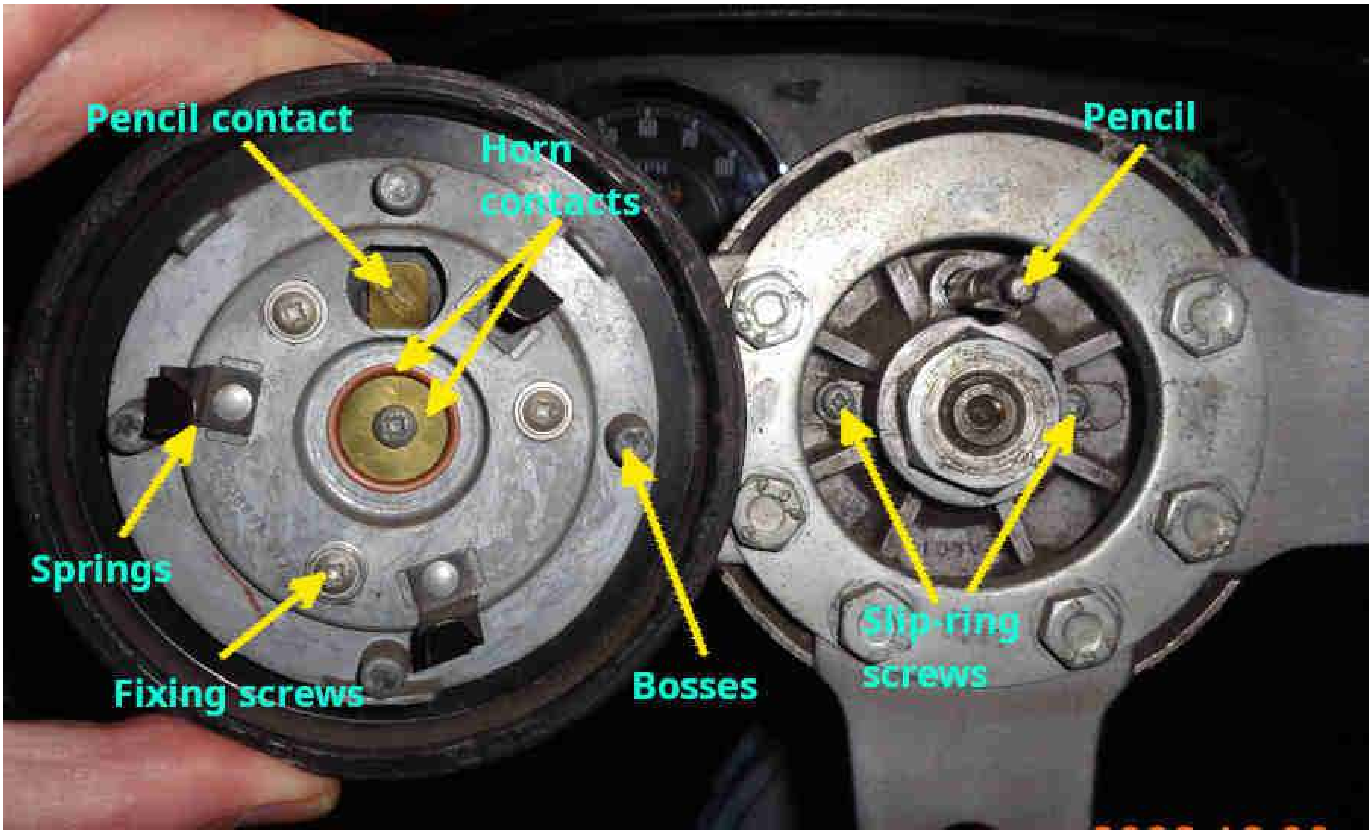
Slip-ring BHA5042. I've not found the screws for this listed anywhere, and checking one from both Bee and Vee against taps they have a very coarse thread for their diameter. D A Jenkins in Australia wrote on the MG Enthusiasts forum that a new slip-ring came without a tapped thread in the (plastic) holes, so I suspect they are self-tappers of some kind, but without a point or other specially-shaped tip. He tapped them for a 6-32 UNC screw by 3/4" long. Incidentally arrowed is the hole for the sprung 'pencil' (it's not a brush) that connects the back of the slip-ring to the horn push: (*Moss Europe*)

May 2021: Andy Robinson gets one from the MGOC and it has no hole for the sprung 'pencil' (should be where the red arrow is) that connects the back of the slip-ring to the horn-push. Their eBay site clearly shows the hole, but it wouldn't be the first time that images are not fully (or even partially) representative of current stock:



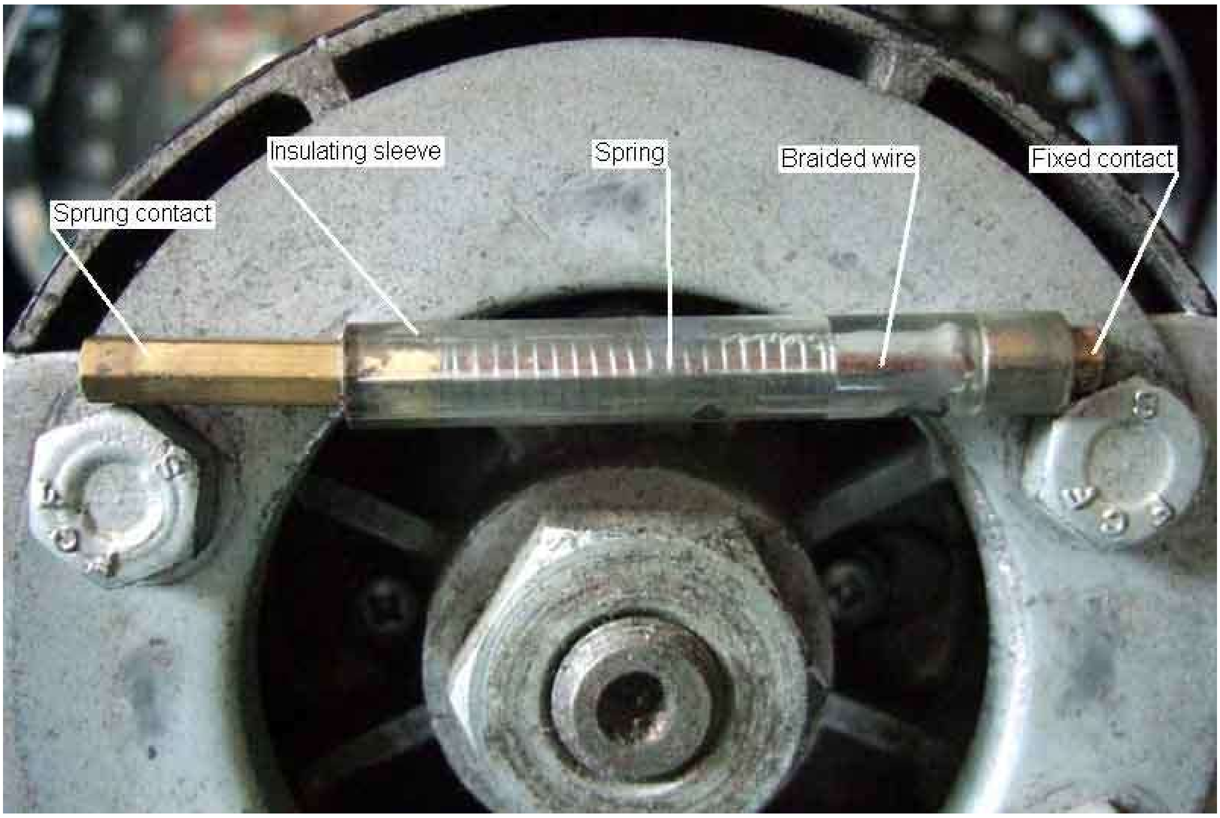
He sent that back and bought another from a different supplier and surprise surprise it was the same. Then he noticed it **did** have a hole, but on the other side of the plastic moulding. Partially concealed by the bottom slip-ring tab (green arrow) and it was only looking again I saw it on Andy's original photo above. Originally I suggested he could drill one where it should be, but cutting the tab back might also be enough. The recess is narrower there than the correct place, but as the longer springy end of the pencil should be facing the slip-ring that probably wouldn't matter.

Wheel and horn push showing the various components:



... it should be fitted with the fixed contact facing outwards so the insulating sleeve can prevent the contact touching the horn push body as it is fitted or if it is twisted once fitted. *Update March 2010:* Tim Schorn queried this saying he fitted a new one this way round and it very quickly broke, adamant I had it wrong. This has to be a faulty part, once fitted it only ever operates in compression. Not only is this logically the correct way round but Moss (Europe and US) and the Leyland Parts Catalogue all show it this way round. Also John Twist says "The longer piece should go in there first" and shows it compressing before refitting it at 0.55 here. Tim says he paid $43(US) for this part, in which case he was robbed as they are only £8/$12 at Moss, even less elsewhere:

The component parts of the pencil (BHA 5041):



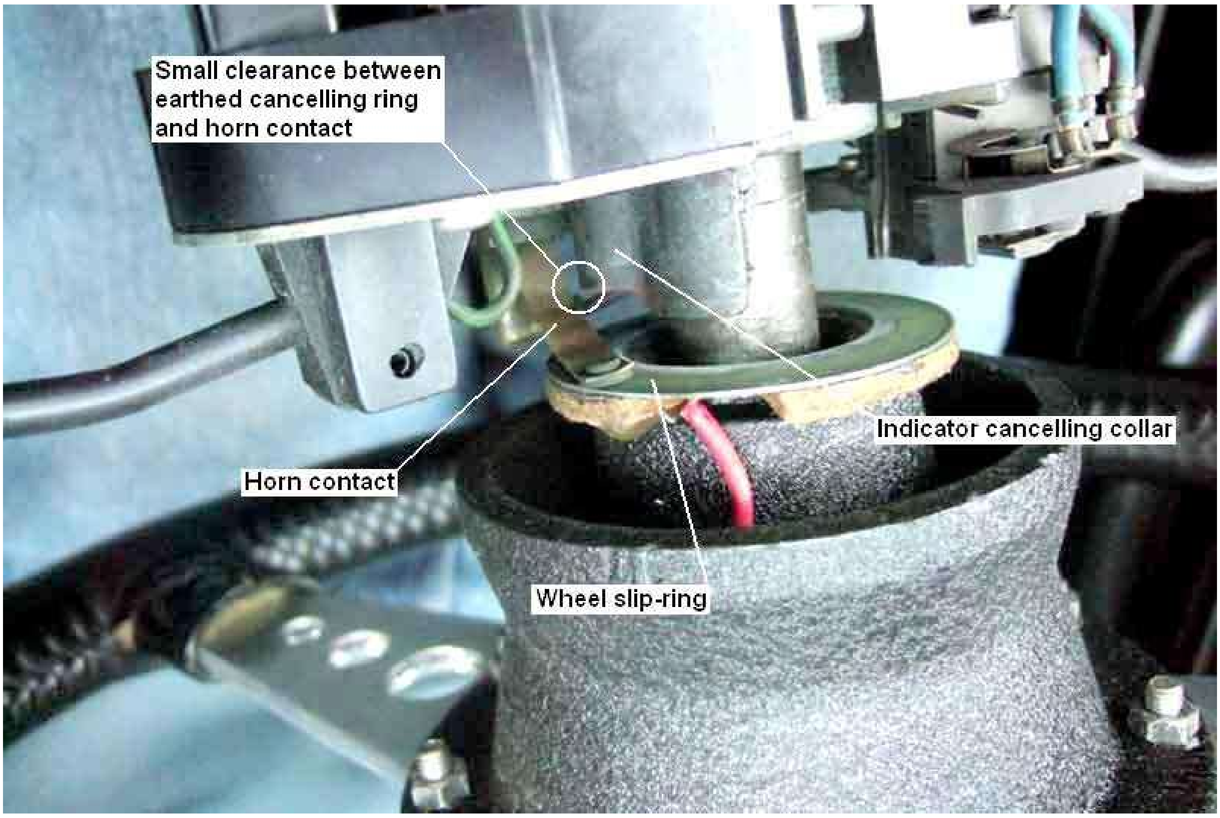
April 2019: Discovered the horn was only sounding when depressed at a particular point, so an opportunity to dismantle this type. Three screws through the grey part and springs into bosses in the rubber cover:

Brass contact on the rubber part and copper on the grey part pretty manky after 45 years:

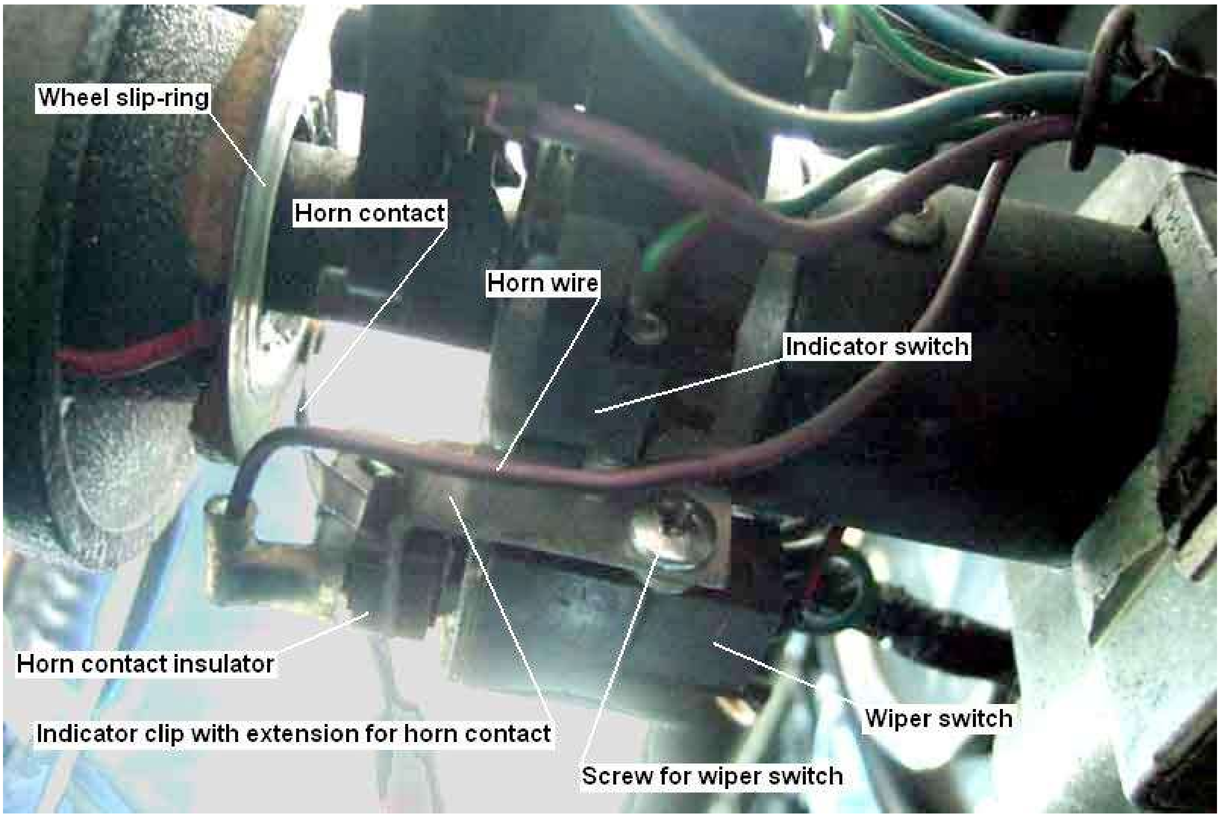
The brass contact can also be unscrewed, note the location ribs in the rubber:

Cleaned up with fine wire wool and reassembled, horn sounds all the way round now:

Twin-stalk models to the end of the 76 model year: There is a very small clearance between the indicator cancelling collar and the horn contact, Paul Bulley reports that his has broken in the past and been soldered back on, which has probably shortened it, and the horn sounds as the wheel is turned! Note this is with a Moto-Lita wheel so the contact has been 'adjusted' somewhat to suit:

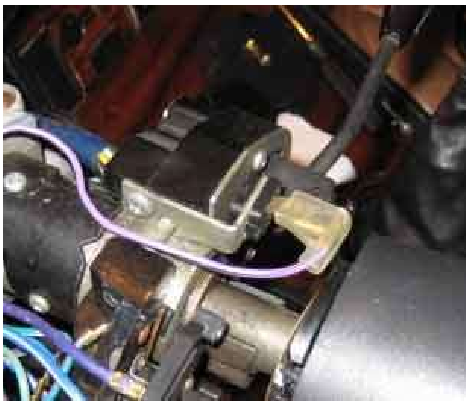


The horn contact is riveted to an extension of the stalk switch clamp plate (via an insulator). Both stalks use the same clamp plate, the indicator switch (on the right) being clamped to the column first, the wiper switch then being screwed to the clamp plate:



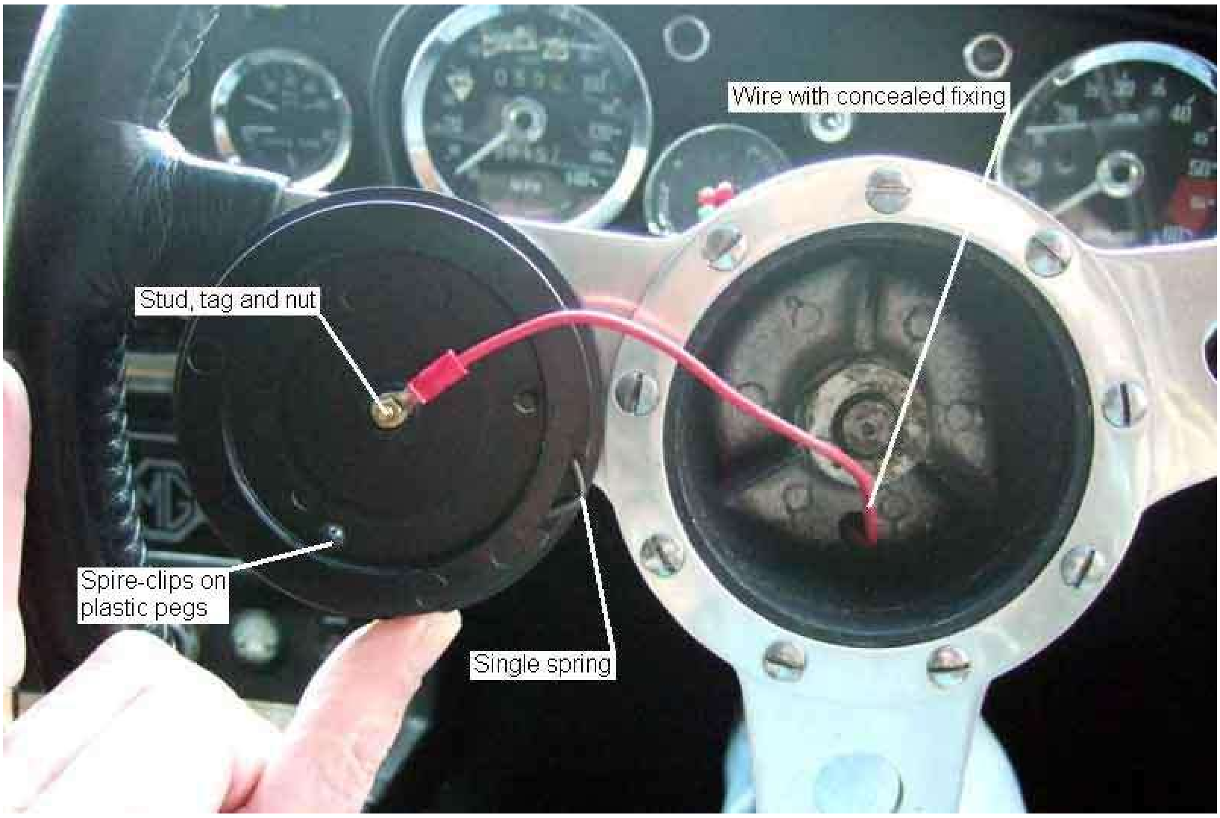
The horn contact/brush for twin-stalk RB cars prior to the 77 model year is 37H8102 (right) and is different to the single-stalk CB version (left):

This is Michael Calandrino's 1974 (I think) US spec with a Mountney wheel. It shows a bracket with the offset holes, but horn contact is on the other side and also at a different angle to my (twin stalk) V8. It took me a while to realise that this is because LHD cars have the indicator switch on the left and the wiper/OD switch on the right!

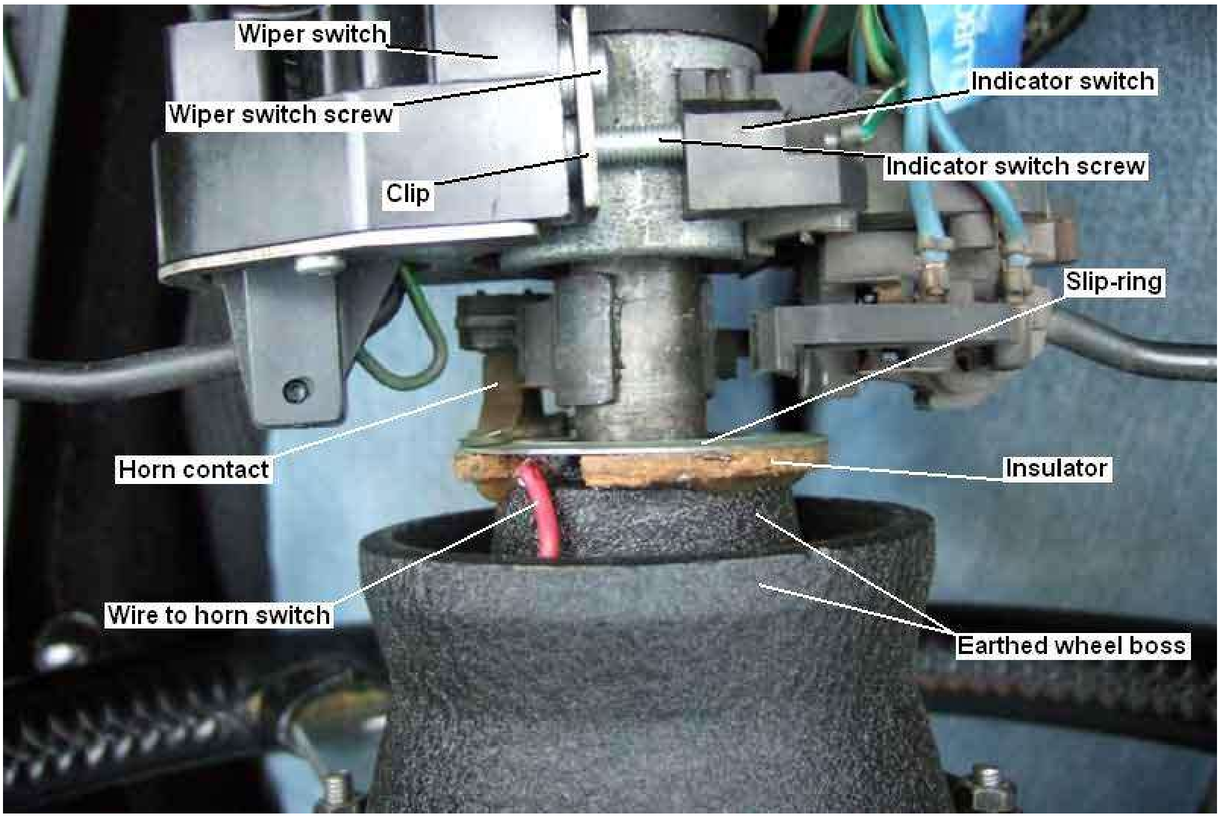


The Moto-Lita wheel on my 75 V8:

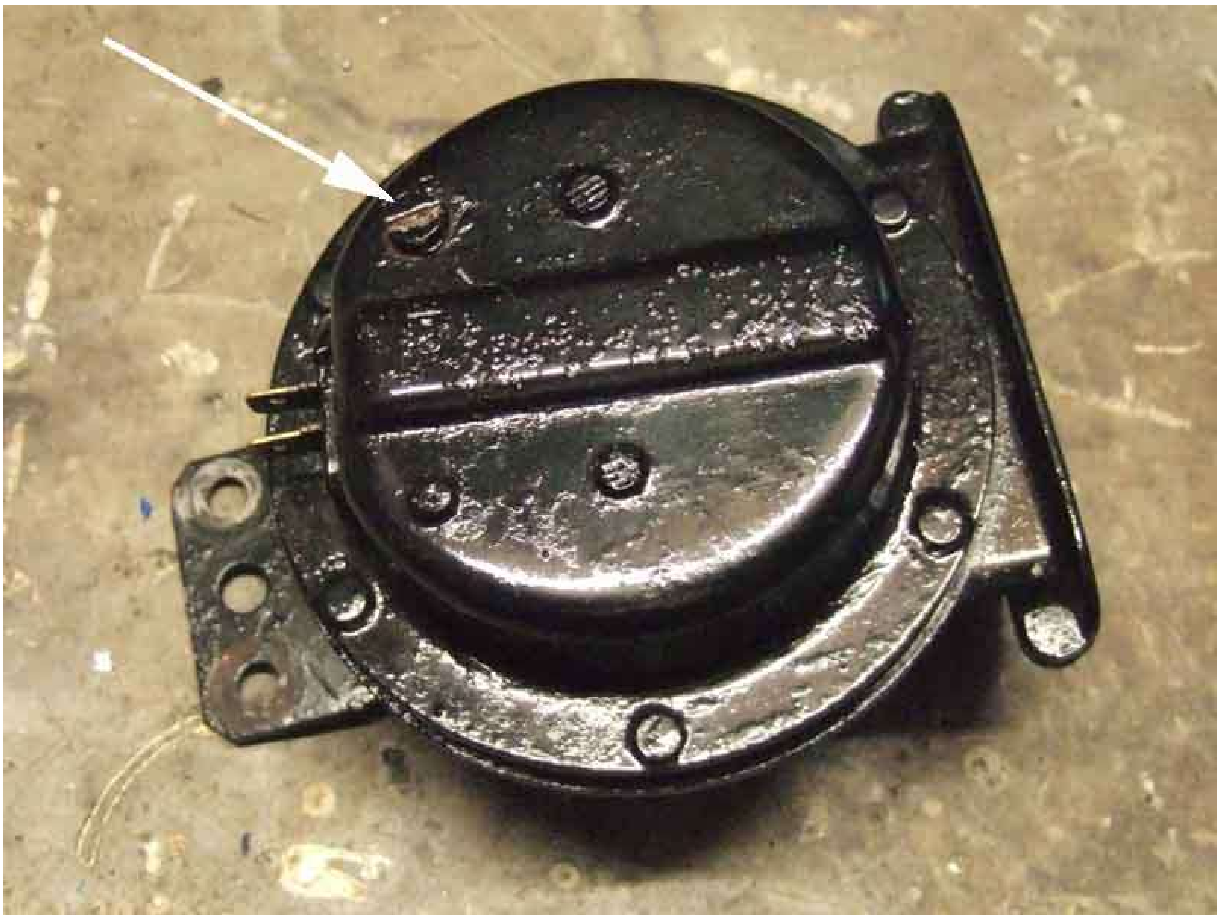
And its connection arrangement. The wire coming out of the hub is 'permanently' attached to the back of the brass ring, but can be removed from the horn-push itself by undoing the nut securing the wire tag (to allow fitting of horn-pushes with different logos). This horn-push only has a single earthing/grounding spring, which means if you look carefully it sits very slightly offset in the hole in the hub. There is no arrangement to make the logo sit square in the wheel, it has to be twisted manually to suit. The actual switch contacts are concealed, and unlike the factory wheel (which has screws) this wheel can only be opened up by prising the spire-clips off the plastic pegs - something which must be done with great care if the pegs are not to break. All a bit cheap:



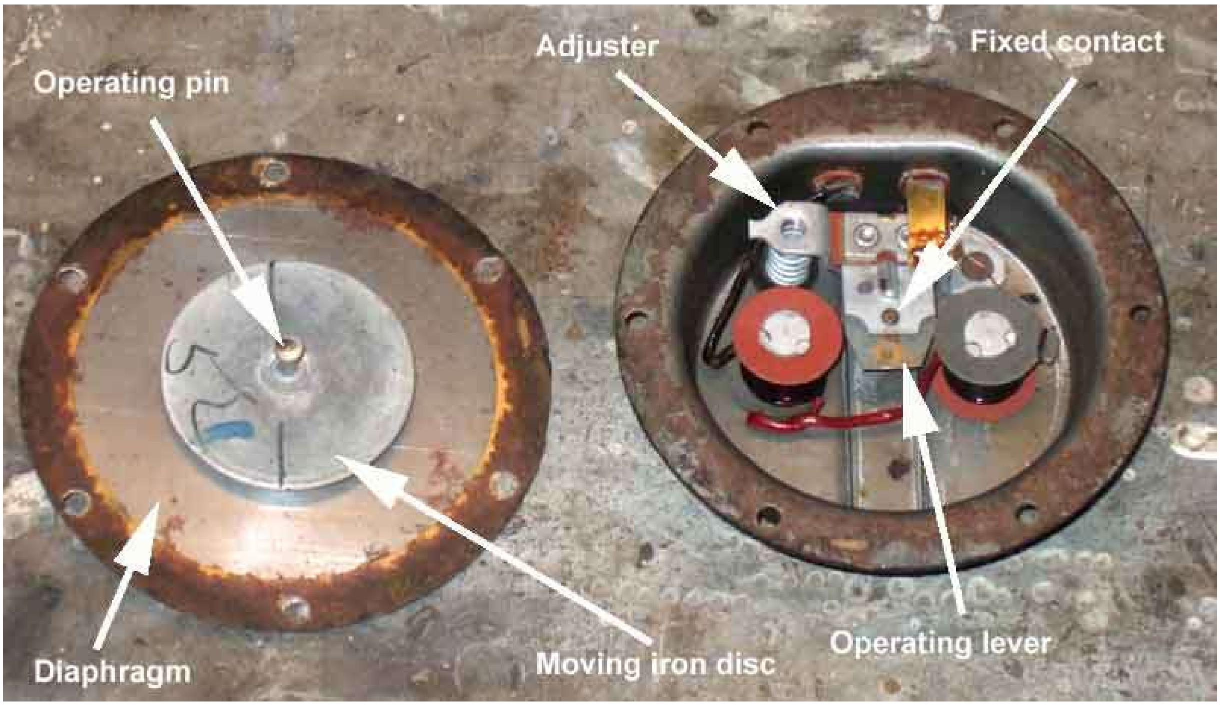
The pretty manky arrangement behind the Moto-Lita wheel. The slip-ring seems to be simply glued to the insulator which is glued to the back of the boss. This also clearly shows the single double-width clip which clamps to the column with the indicator switch, then the wiper switch is screwed to the clip:



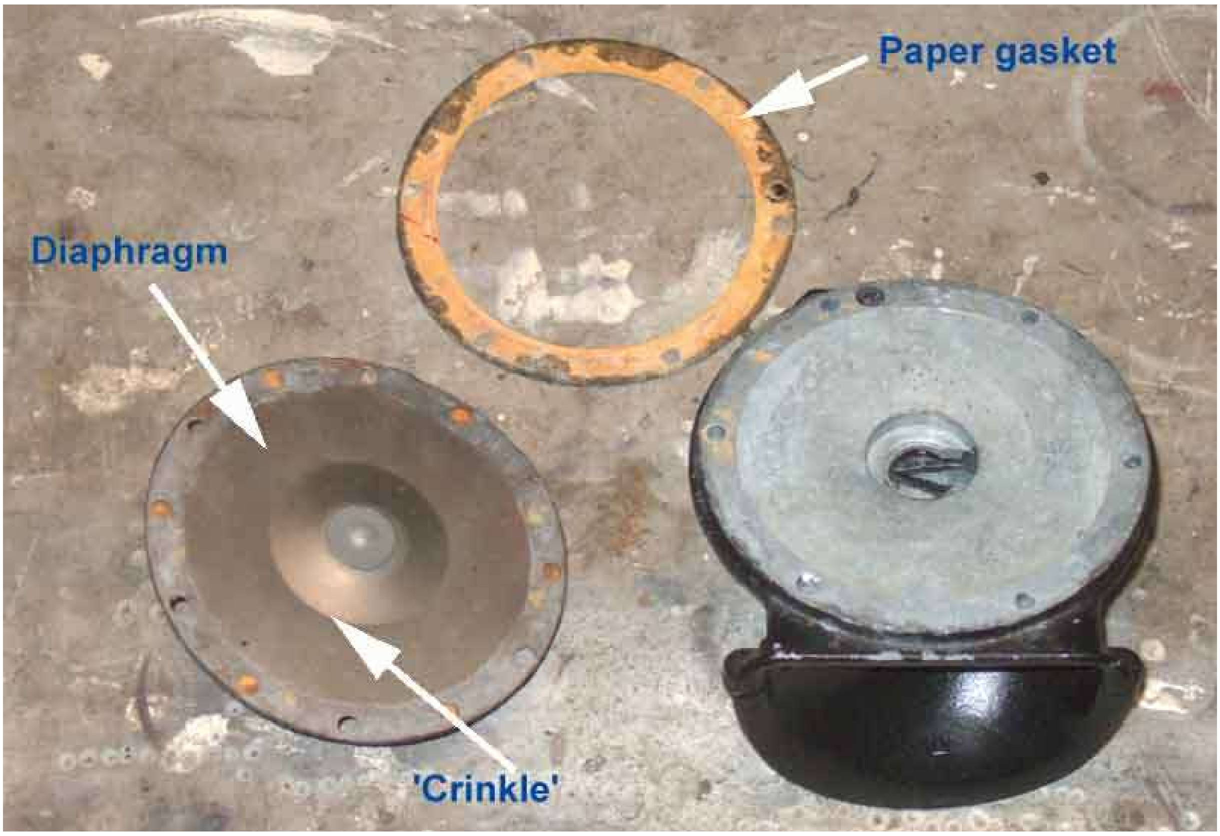
Top of the horn, adjuster screw arrowed



Internals of the upper part. When the coils are energised they attract the iron disc to move the diaphragm. The operating pin is bearing on the operating lever, which has the moving contact attached to it. There is a piece of insulating material on top of the lever in this horn to fully isolate the electrical circuit from the casing. The pin pushes the operating lever, with its moving contact, away from the fixed contact to break the circuit and release the diaphragm. That allows the contacts to close again, repeating the cycle. This half of the casing is steel to form an efficient magnetic circuit with the coil armatures and diaphragm.

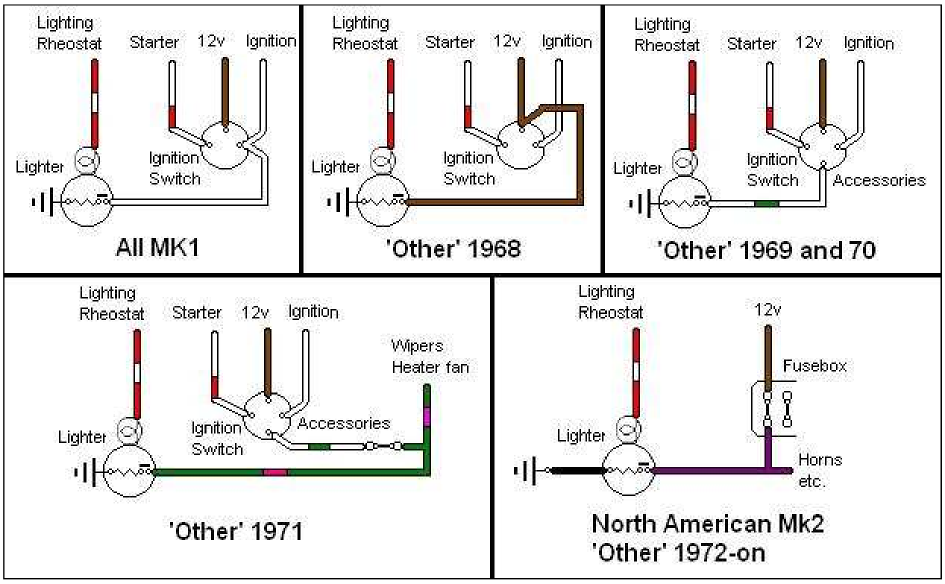


The 'crinkle' in the diaphragm has the effect of making it 'snap' between the operated and released positions (like a ['pop-o-matic dice shaker']), which greatly amplifies the sound the horn makes. This half of the casing is alloy.



Lighter Socket

Hover over a wire to confirm the colour



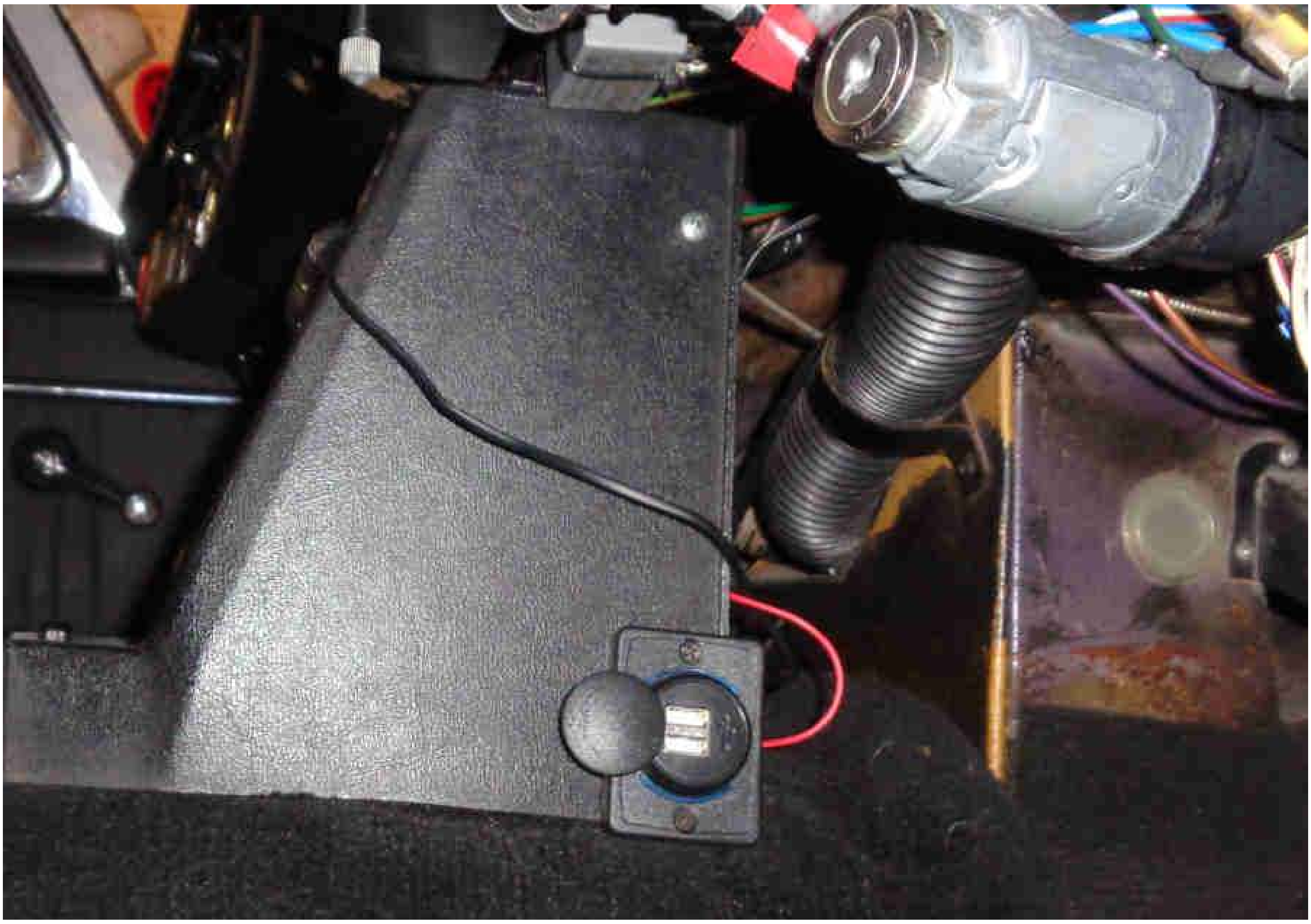
Note 1: 'Lighting Rheostat' is a simple on/off switch for North American spec Mk2 until 1970, when it changes back to a rheostat.

Note 2: A wired earth is needed where the lighter socket is in the plastic centre console on North American Mk2 and 1972 models for other markets. It may not be needed when dealer fitted to a bracket screwed to the metal dash, for example.

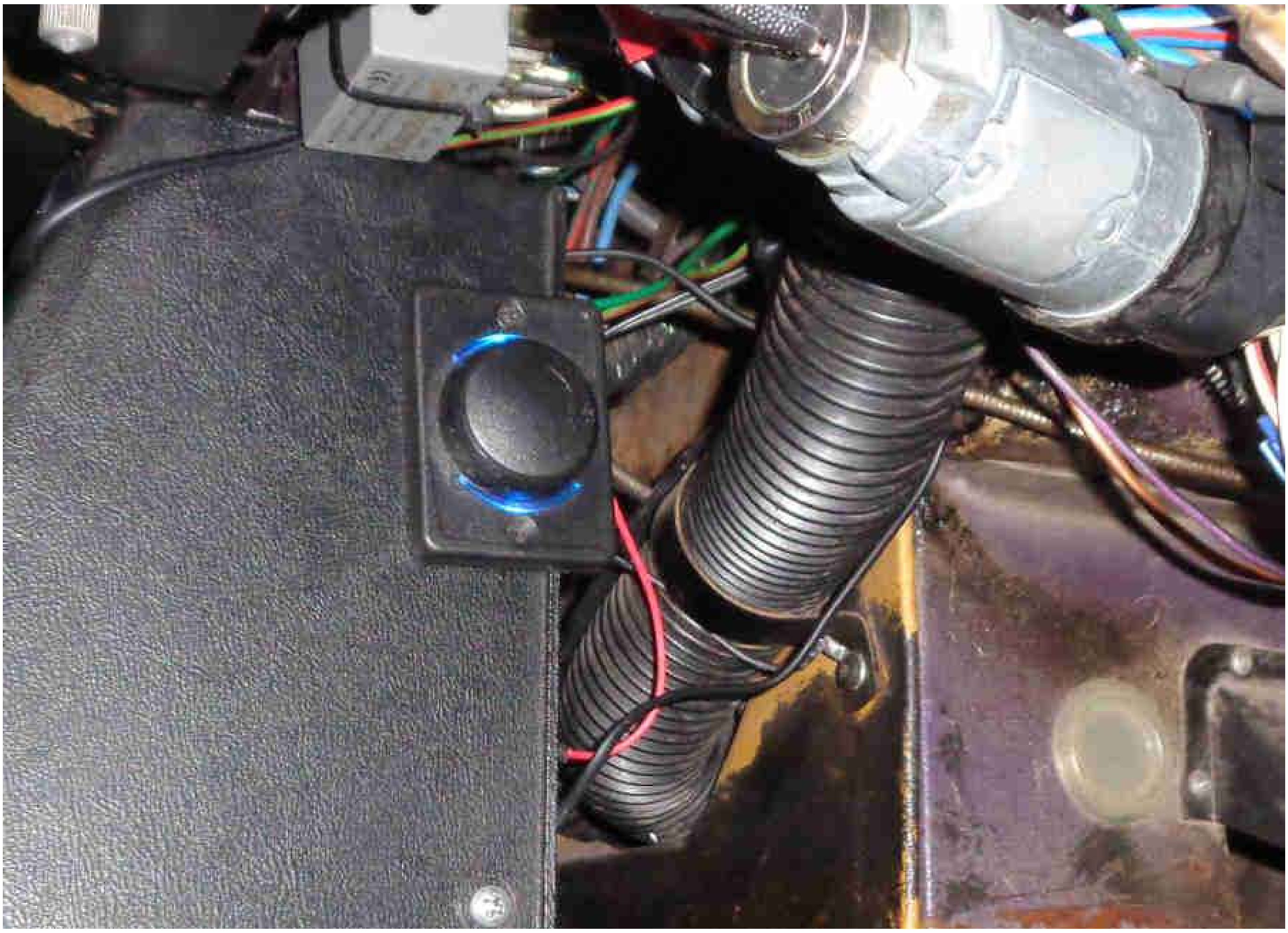
USB Sockets

Cover swivels round to reveal the sockets. Glows blue round the edge when powered and white from the sockets aiding location. All you have to do is get the USB plug the right way up ... or round ...:

Bee's mounted vertically but still intrudes into the space needed to access the rubber plug in the tunnel for the gearbox dip-stick. Just one screw though so no big deal - the rubber plug will take longer to remove and refit! There was a reason I didn't use the upper screw, it's a bit more awkward to get at and I think it was immediately before a weekend away so I wanted to fit it as quickly as possible. Access easy from the driving seat:



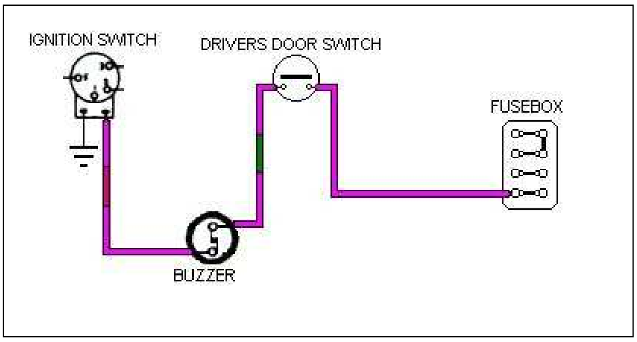
Subsequently I moved Bee's to the top screw to give more room for accessing the tunnel plug for the gearbox dipstick. I had no problems making an earth connection initially but found it not working after a 320-miler, so as well as moving the socket I moved the earth to the screw for the screen vent hose clip. Still visible and easily accessed from the driving seat:



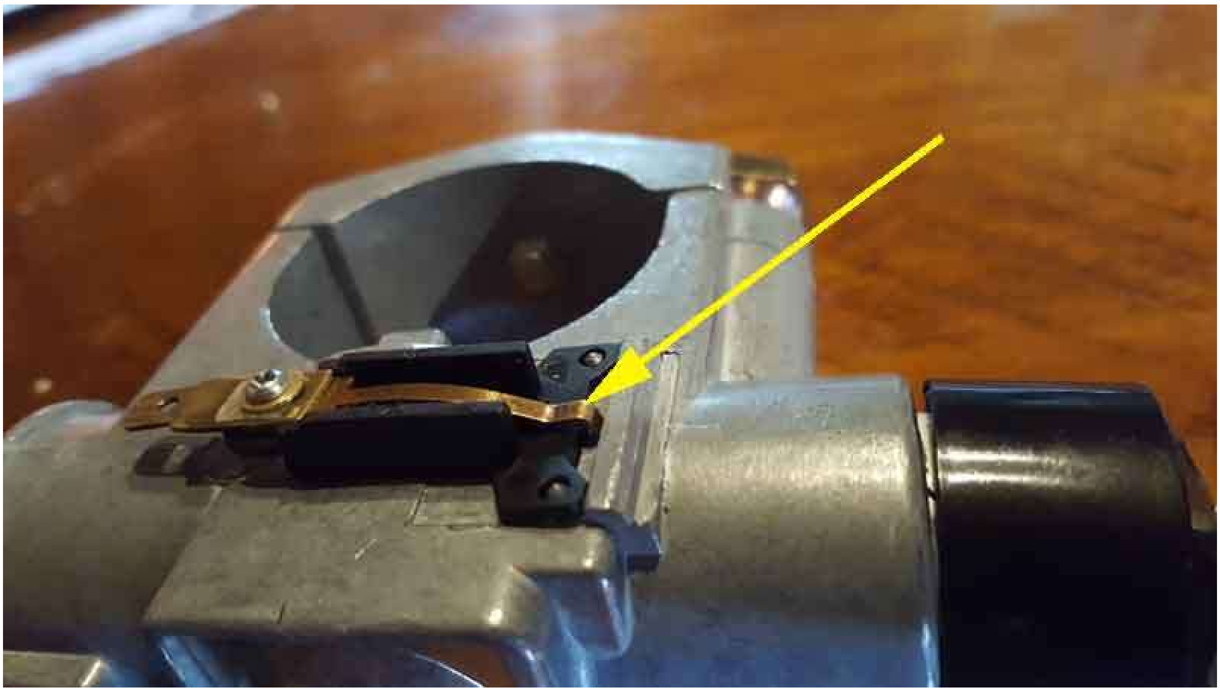
Initially I mounted Vee's on the lower screw but it had to be horizontal because of the alarm controller. After moving Bee's to the top screw I moved Vee's as well and put it vertically as that gives more support when pushing the USB plug in. Used the same screen vent clip screw for the earth.

"Key In" Warning

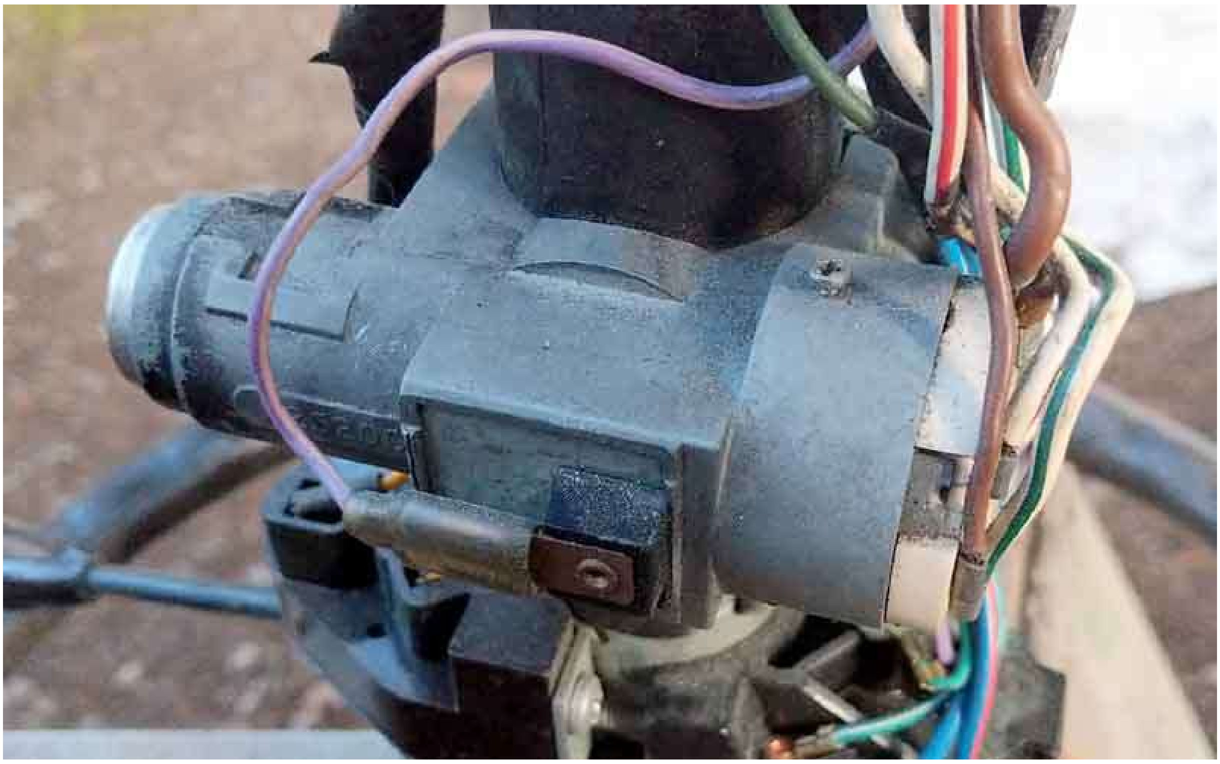
North America 1970-on



Showing the additional contact for the purple/pink wire: When the key is inserted a pin pushes the spring (arrowed) against the body of the lock to connect an earth to the wire, which if the driver's door is opened sounds the warning buzzer. Testing has shown that this only happens when the switch is in the 'OFF' position, however one would expect that it should also be operated in the accessories position. On the face of it, it doesn't need to be operated if the engine is running (should be obvious ...), but that still leaves the situation of no warning buzzer if the engine has stalled and the ignition is still switched on. (*Arthur Johnson, restoring a 1972 ex-California GT in Australia*)



One of two North American 1973 cars where the warning buzzer sounds if the steering is not yet locked, even though the key has been removed. Different to the one above, this one has the connection inline with the locking pin, instead of at the side of the lock. The wiring is otherwise the same: (*Arthur Taylor*)

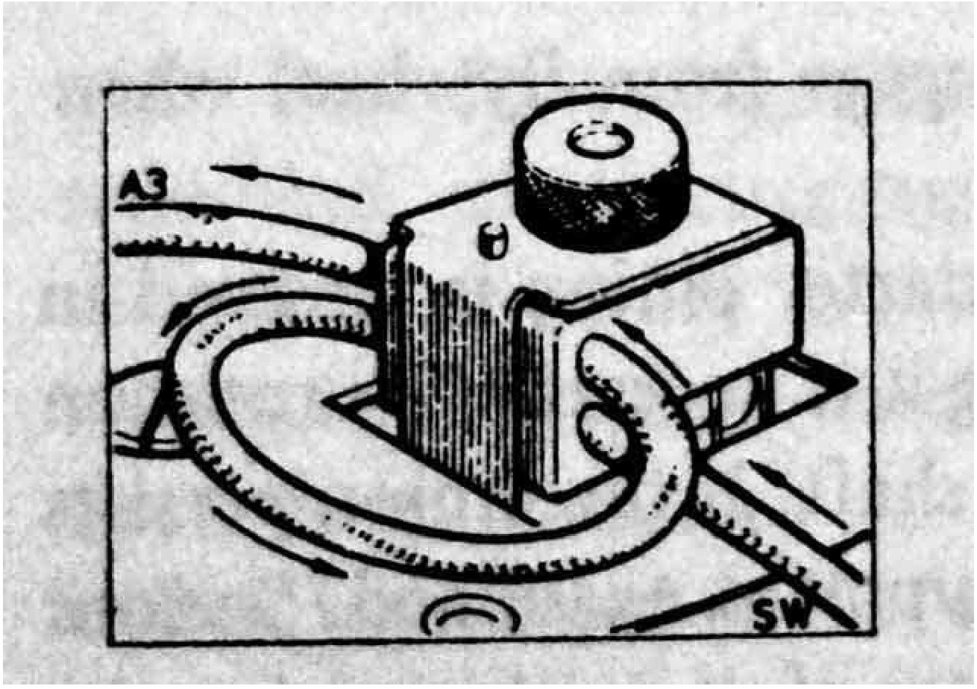


Tachometers

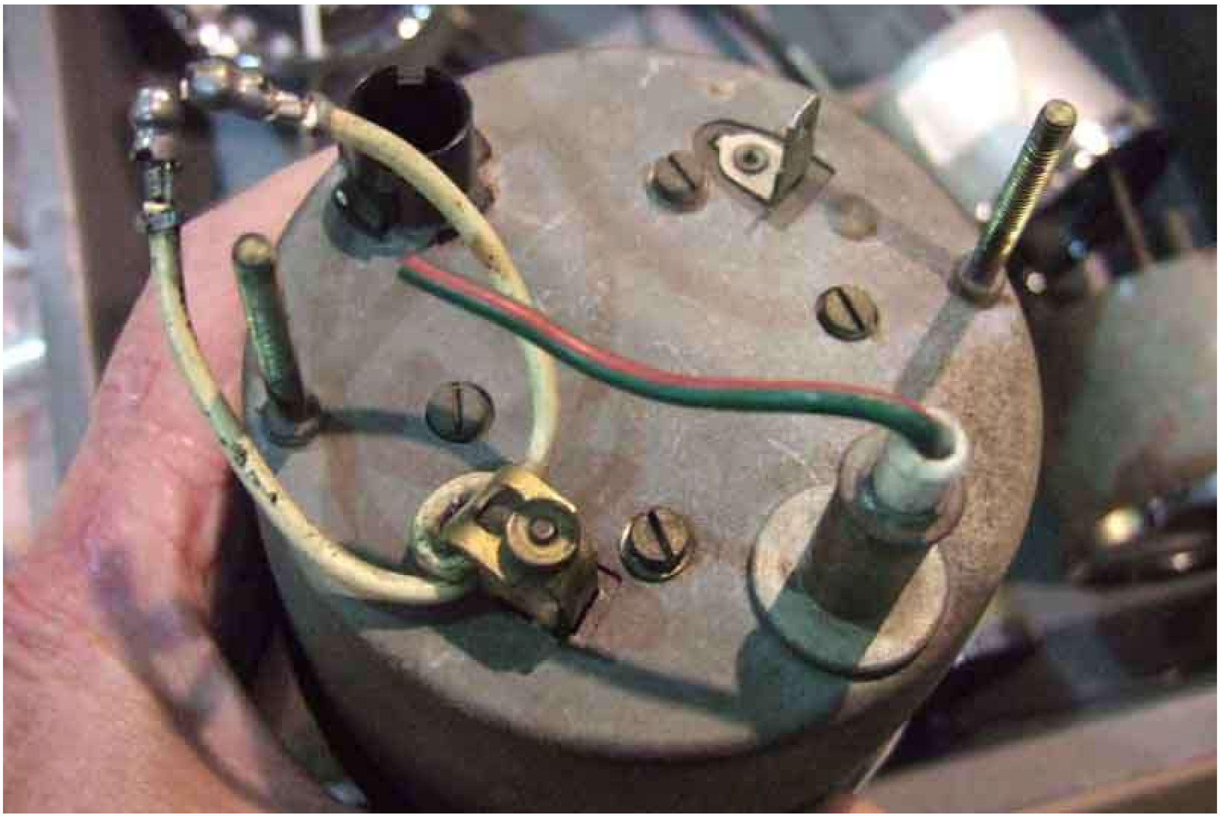
Electrical Connections Fixings Dials

Electrical connections:

Showing the external pickup on the 64 to 67 RVI tach and the routing of the wire from the coil (SW, +ve earth) towards the ignition switch (A3, -ve 12v) for positive earth cars. For negative earth conversions the wire must be routed in the other direction undoing the knurled nut should allow the pickup to be dismantled and the wire reversed otherwise keeping the layout identical. In other words the white from the ignition switch comes in from the 'SW' direction and goes to the coil +ve in the 'A3' direction. However with a continuous loop from the harness you don't know which end is which without cutting it, so if you didn't mark one of the ends originally you will have to go by trial and error:

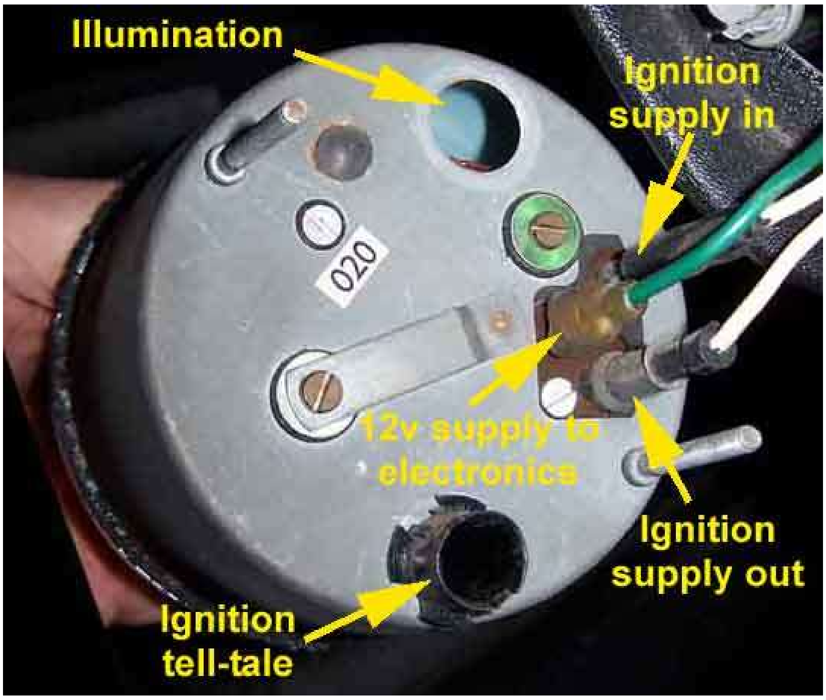


However some variants have a short length of white in the pickup terminated with two bullets as shown here, labelled as being for a +ve earth MGB. Easy to reverse, but easy to get wrong as well as they don't seem to be marked, although having these connections reversed or the earlier continuous loop going through the pickup the wrong way won't harm the tach. Don't reverse the 12v and earth connections though, which may destroy the electronics. 12v supply spade is at top-right on the case back, the earth would be under one of the thumb-nuts securing the tach in the dash same as the other gauges. The gauge illumination bulb holder is shown bottom-right, and the insulated socket for the ignition warning lamp at top-left.

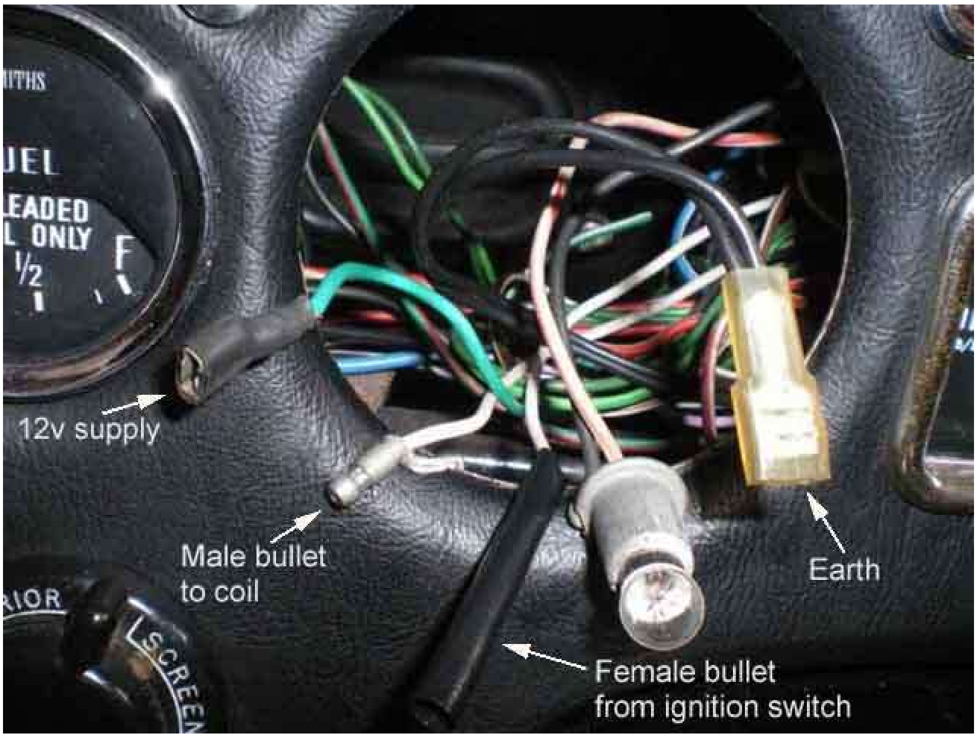


One of the metal parts of the pickup, and the nylon part that acts as a former for the wire, are detachable and may get lost. The Parts catalogue indicates these are 27H8215 for the 'Core', and 13H784 for the 'Loop-sleeve (nylon)'. Googling the first of those has a couple of suppliers describing it as a 'tachometer retaining strap', which doesn't seem to be the right thing, and they also give applicable dates from 64 to 76 and say it is also for the V8, both of which are clearly incorrect. But A-Head 4 Healeys converts that part number to 1S4150, which appears to be the complete assembly of metal and nylon parts, plus wire, washer and nut, at £22. Rimmer only has the first part, Moss both at £19 but without the washer and nut. (*Image: A-Head 4 Healeys*)

The 68 to 72 RVI 4" tach, with internal pickup, and male and female bullet connectors for the coil and ignition switch wires and the 12v spade in a cluster on the right. These seem to be smaller than the standard wiring bullets and connectors at 4.5mm as opposed to 5mm (Malc Gilliver). The pick-up 'in' wire from the ignition switch goes on the male bullet above, and the 'out' wire to the coil goes on the insulated female below. As before the earth wire goes under one of the knurled nuts securing the tach in the dash. The position for the gauge illumination lamp is at the top, and the insulated holder for the ignition warning lamp is at the bottom: *Photos: Peter Mayo*

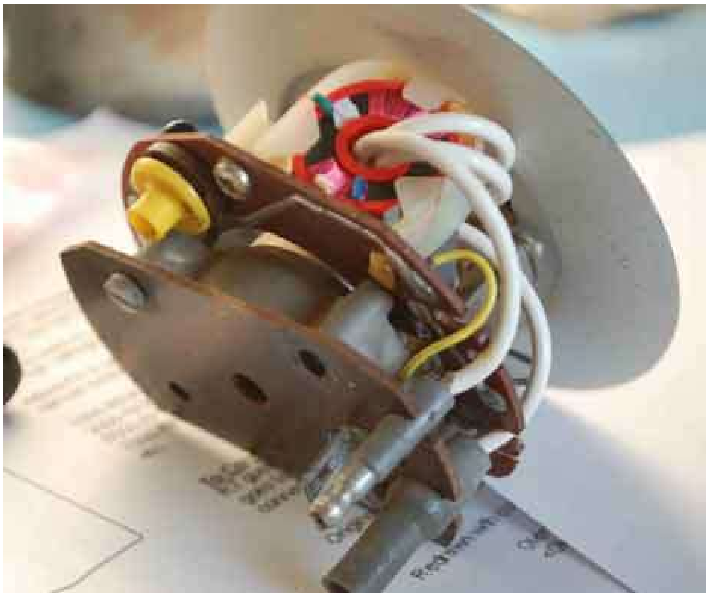


Another version this time an 80mm from a 1968 North American padded dash (the 'unleaded fuel only' fuel gauge seems to be from a 1975 or later car) ...



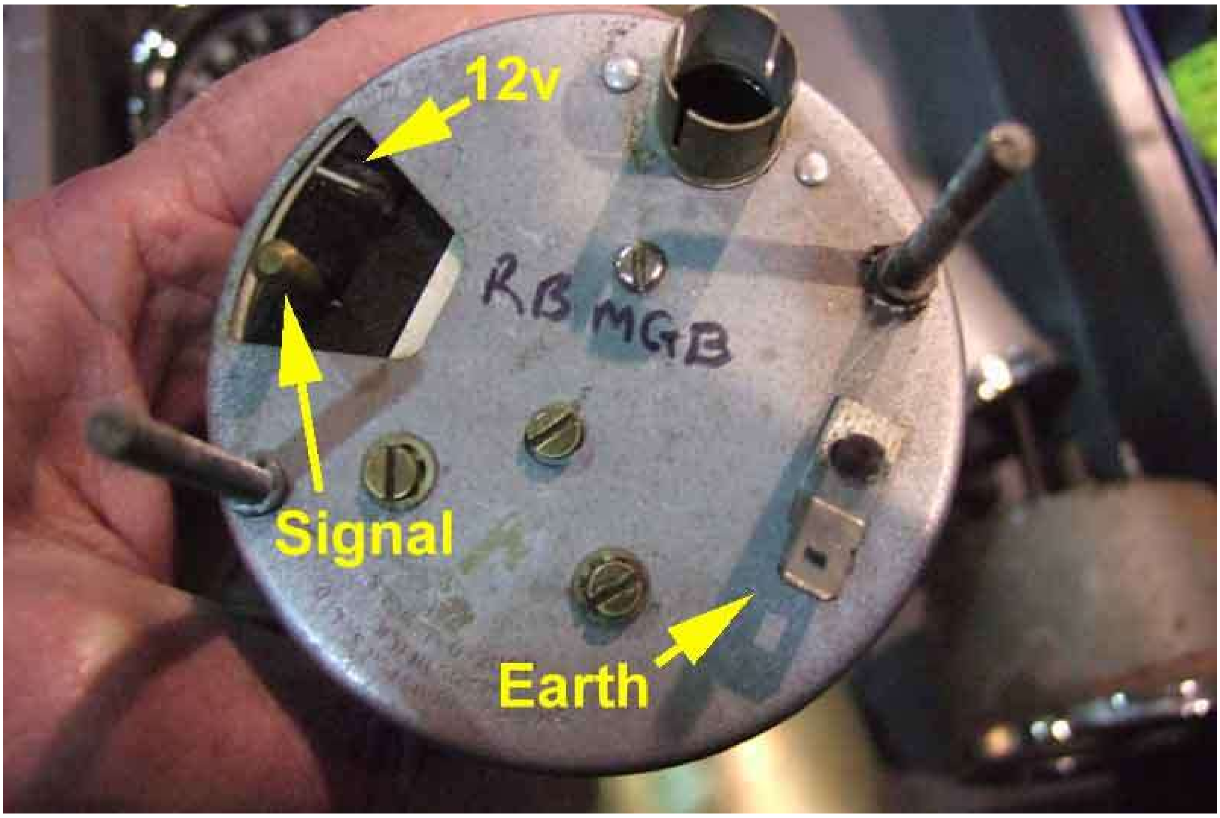
... this time with earth wires going to a spade spot-welded to the tach case instead of under one of the knurled screws. This type only has the night-time illumination in the gauge. *Photos: Bill Mason*

Internals of this type as posted on the MG BBS by Steve Church.



Chrome-bumper voltage-triggered 4" RVC tach i.e. 73 and 74, with male bullet for white/black signal wire and 12v spade (green wire) close by. The earth will be a tag under one of the knurled nuts that fix it to the dash. Plain hole for the night-time bulb at the top, insulated hole for the ignition warning light at the bottom. The signal bullet on this tach (and the rubber bumper version) seem to be the standard bullet size:

Rubber bumper voltage-triggered 4" RVC tach with male bullet for trigger wire and 12v spade close by as above, but this now has an earth spade on the back of the case. This type only has the position for the gauge illumination bulb holder, the ignition warning light is now in the binnacle.

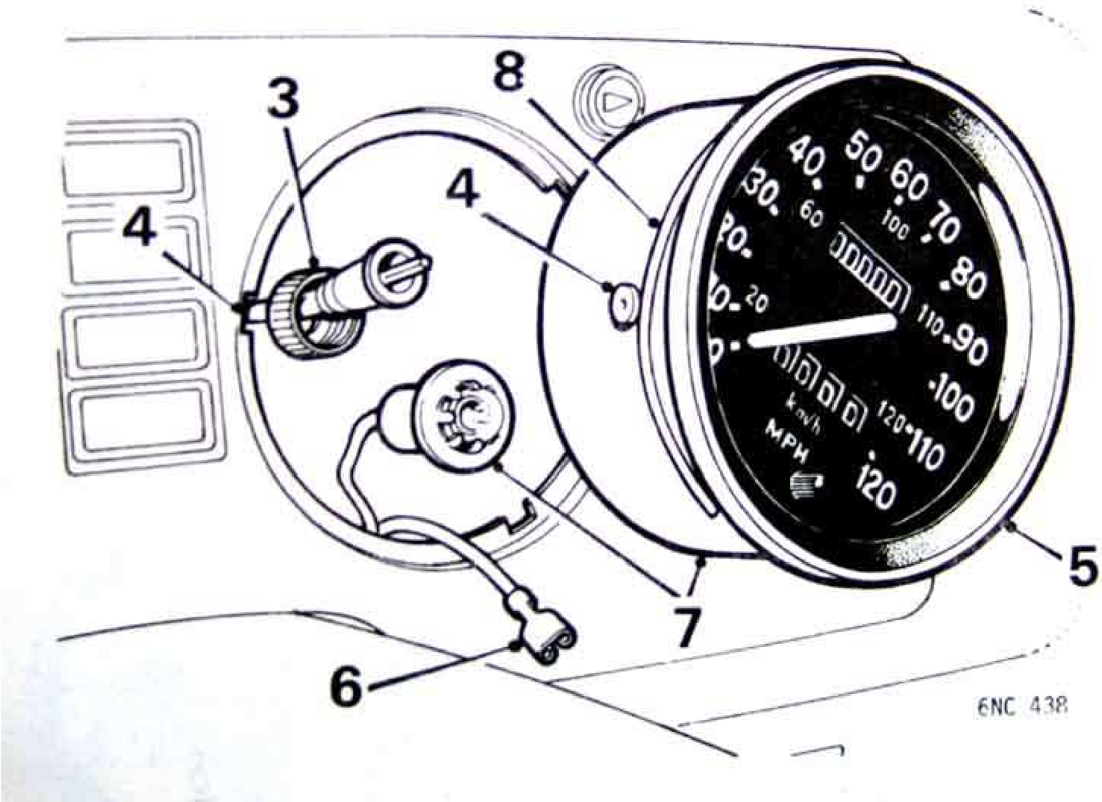


Fixings:

AJH5176 for 62 to 64 speedo and tach with thumb nut 17H 1304 and spring washer: (*Moss Europe*)

17H3744 for 65 and on CB speedo and tach, subtly different 17H1339 for RB, using the same thumb nut as above with a shake-proof washer: (*Moss Europe*)

LHD 1977 and later have three studs (4) in the speedo and tach cases, and rotating the instrument 30 degrees until these studs align with cut-outs in the dash will allow it to be withdrawn: (*Leyland Workshop Manual 1977*)



Dials:

RVI/RVC designation and reference number is positioned by the 'SMITHS' (arrow). The **original** polarity is also indicated (circled), probably on all chrome-bezel tachs, but not the 77 and later plastic tachs. This is an RVI 2401/00B positive earth for 1964 to 1967 as used in all markets. Note that a PO may have changed the internal wiring to convert it to negative earth and not changed the legend on the face.

This is an RVI 2430/00 negative earth for 68 to 72 as used in markets other than North America, but also used in Canada for 1968.

An RVC 2415/00AF (and hence negative earth) as used in markets other than North America, Sweden and Germany from 1973 to the end of chrome bumper production.

An RVC RVC/1810/00/AF used on V8s, still carrying the polarity indication.


0
5
10
15
20
25
30
35
40
45
50
55
60
SMITHS
RPMx100
8 CYL
NEGATIVE EARTH
MADE IN U.K.

Radio installation

Installed ...

... removed (the surround is cut from an old Metro blanking plate to cover up a mass of holes a PO had drilled around the edge of the opening):

And the modified blanking plate ...

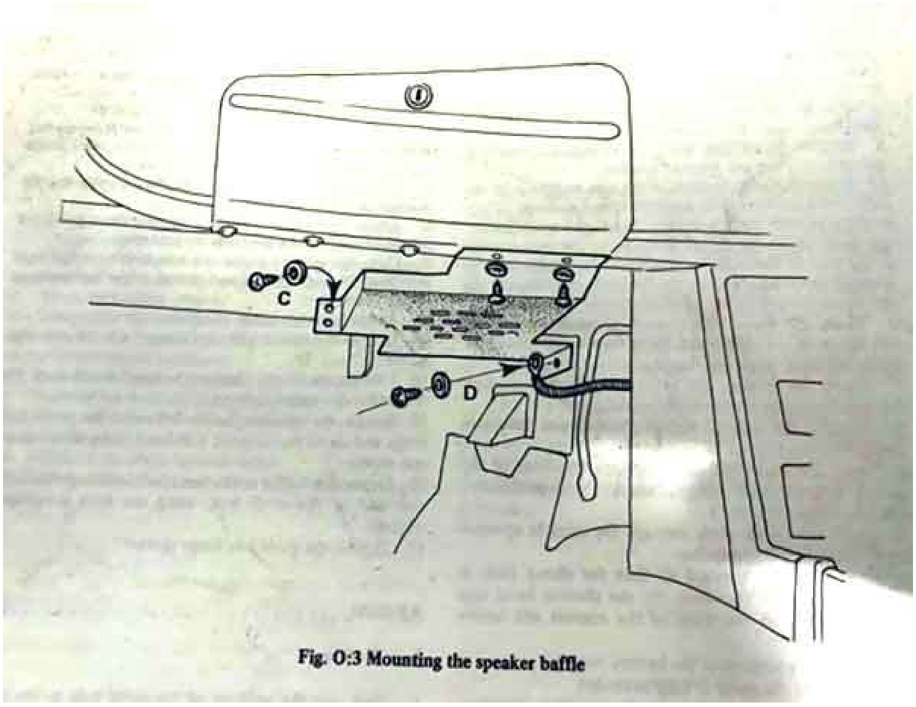
... installed:

CD player with cassette adapter:

MP3 'jukebox':

Factory mono speaker baffle:

Maybe some artistic licence in this drawing as it doesn't seem to match up with the above picture. Appears to use two of the five glovebox lid screws as mounting points:



Different mounting points to the above drawing in this installed picture from Mark Denny:

This in a pal's 77/78 (no wiring to the doors): (*Geoff Turner*)

Looks like it uses the one(s) for the LHD steering column:

'Dual voice-coil speaker' (Google it), ideal for stereo output using a single speaker, particularly in the early centre console. There are many types, this is just one example: (*Classic Car Stereo*)

77-on (America) and 78/79 (UK) factory speakers: (*Mark Denny*)

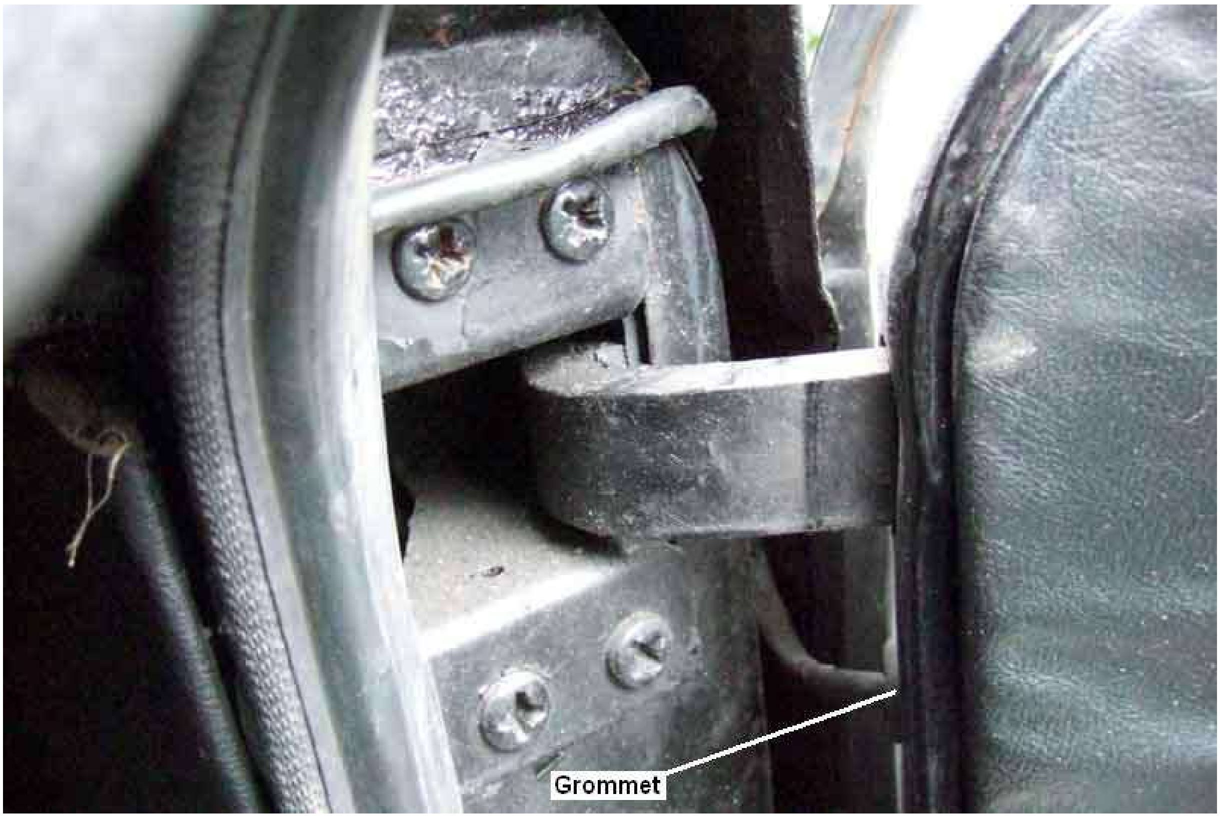
Shrouded to protect the cone and voice-coil from water getting past the drop-glass seals:

Shroud removed:

The shroud:

Factory cable routing, showing the grommet in the panel between door space and cabin ...

... and in the end of the door casing. I've used similar routing for the central locking in my 75 V8. This had the holes in the door casing already, with a sealing grommet, but I fed the cable through the hinge as I didn't want to drill a visible hole, not knowing this routing at the time:


Grommet

Relay Types

A general view of a typical 6RA 4 terminal, 4 spade type:

Four terminals but five spades. The double spade on terminal C1 offers a convenient branching point for a 12v supply wire to another circuit:

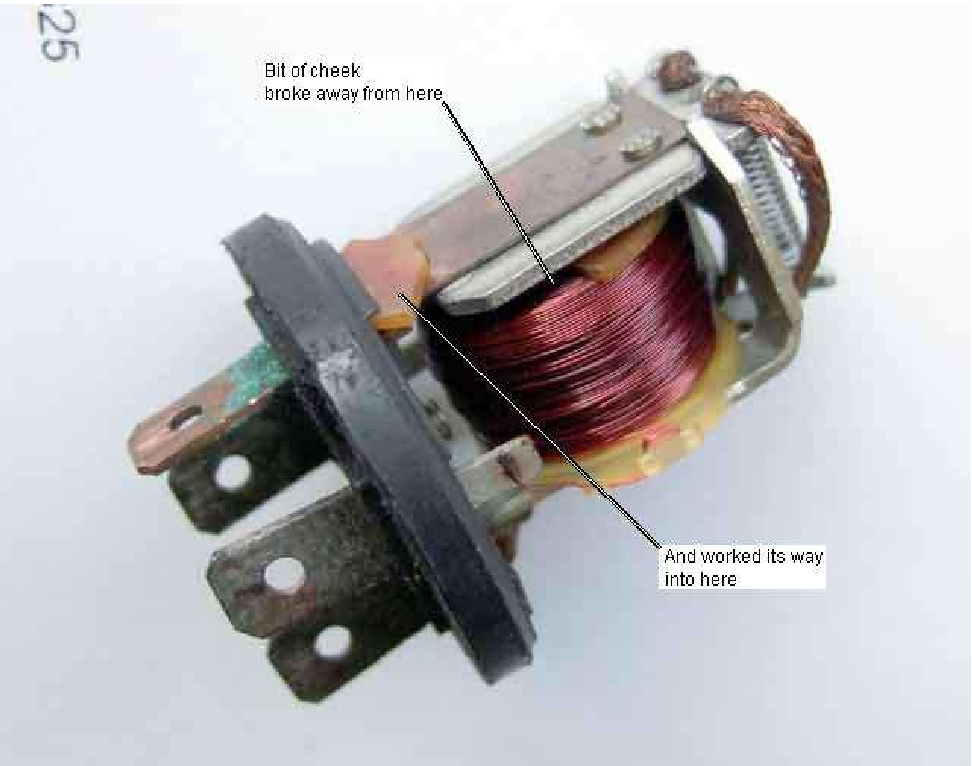
An alternative 4 terminal, 4 spade but with W2 in a different position and a C3 instead of a C1. This is a relay where the contact is 'normally closed':

Five terminals and five spades, this has a 'changeover' contact i.e. when the relay opens it switches a common contact (C2) from a 'normally closed' contact (C3) to a 'normally open' contact (C1):

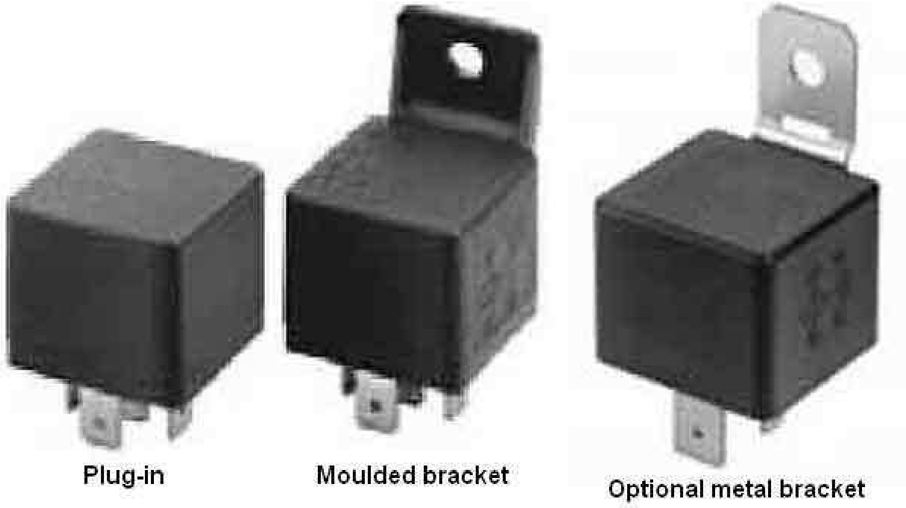
The three terminal, four spade relay 33188/SRB102 originally used for the cooling fans in V8s. The system may have been dealer-modified with a 4-terminal, 5-spade relay to take the load of the fans off the green circuit fuse. Seemingly obsolete, they were also used on Standard/Triumph, BSA motorcycles, Cobra, Jaguar/Daimler and Ferrari, for the horns and other circuits. Contrary to several opinions the missing fourth terminal (W2) is not replaced with an internal earth i.e. via the can, but instead is internally connected to the C2 terminal. The 12v supply is connected to this terminal, an earth from the switch is connected to W1 to operate the relay to the C2 12v supply, which is then extended out through the C1 terminal to operate the fans or horn: (*[TR Register]*)

Cylindrical Lucas relays used on later MGBs, designated 26RA, SRB402. These can have either the same mounting points as the 6RA (left), or a single mounting point creating space for an additional relay if needed:

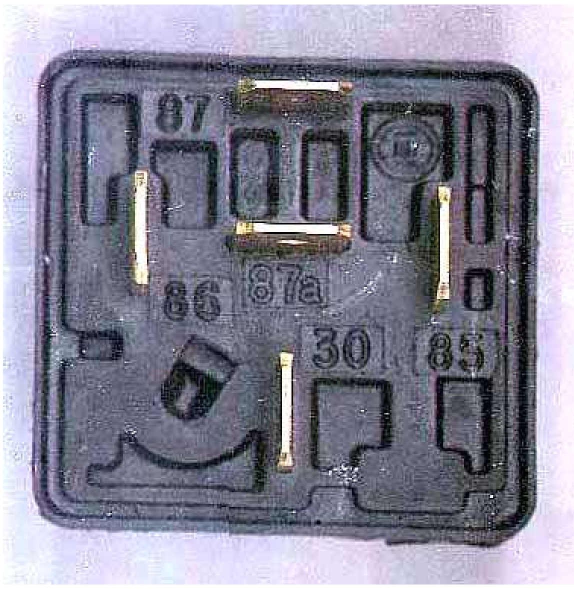
Took this off a friends car as although it was clicking as the ignition was turned off it's output was permanently energised, which had flattened the battery. Opened up (never could resist) to find one of the coil cheeks partly broken away, which had worked itself round to the back of the armature, holding the contacts closed all the time. For a start it must have been sculling around in there for ages before getting into that position, and I'm amazed the gap was big enough for it to slide in, yet small enough to keep the contacts closed! You couldn't engineer it to do that!

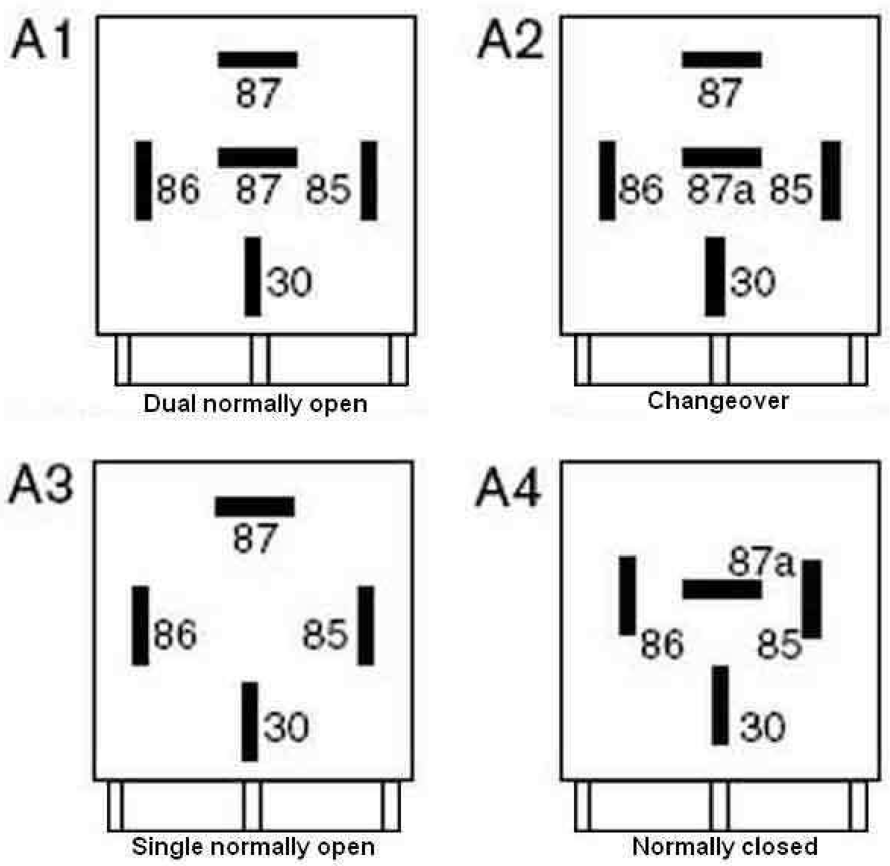


Cube-type Lucas 28RA SRB520 relays also can be found on late MGBs, identical to current (pun not intended) after-market relays

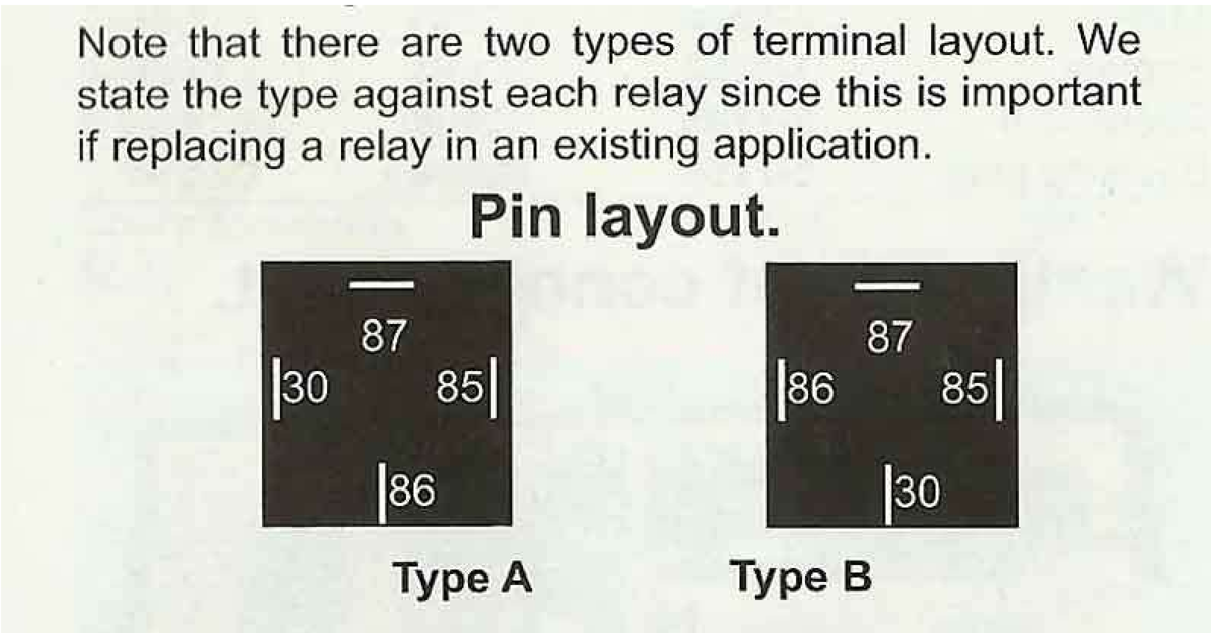


Terminal arrangement, pin 30 is usually adjacent to the mounting bracket



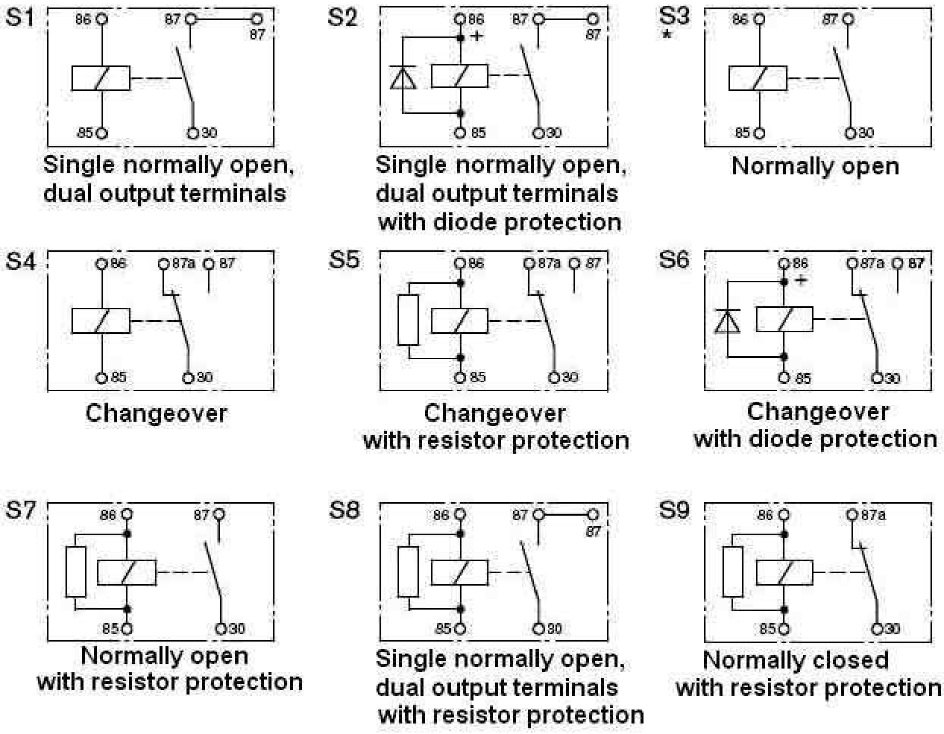


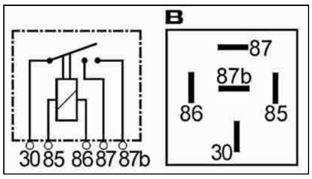
However! Note that these relays can have two different terminal layouts, 30 and 86 swapping places, as below:



I've only found one reference to this - by Vehicle Wiring Products, although it is only detailed in its printed catalogue as Type A or Type B with terminal layouts as above. However although their web site allows you to order Type A or Type B only Type B shows the terminal layout. The option is only available for the basic four-terminal 12v relay, not 6v, fused, dioded or five-terminal types. The most recent relays I've purchased have been Type B, but it could vary from supplier to supplier.

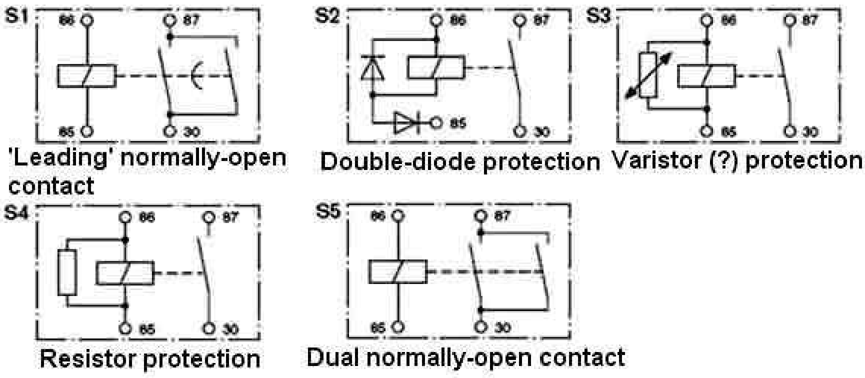
Internal circuitry of standard relays. Note that with S2 and S6 single diode protection the power supply to the winding must be connected the right way round or it will blow the diode, +ve must be connected to 86 and -ve to 85. Resistor protection isn't polarity sensitive, but doesn't give as much protection to the operating circuitry as diode protection:





One not shown above is this dual make (aka double make, twin make) relay which connects the input to two separate output contacts (87 and 87b), when the relay is released the two outputs are isolated from one another. This relay can be used to reinstate the coil boost function when replacing the starter motor on RB cars with an after-market alternative. Not to be confused with high power relays with one or two 87 terminals but no 87b terminal.

Internal circuitry of power relays. S1 has a tungsten contact that closes first and opens last, and a lower resistance contact which closes last and opens first. The tungsten contact protects the lower resistance contact against the back emf and high current from large inductive loads. S2 has double diode protection, the series diode protecting the parallel diode from damage through reverse connection, if reverse connected the relay simply won't operate. As before +ve is connected to 86 and -ve to 85:



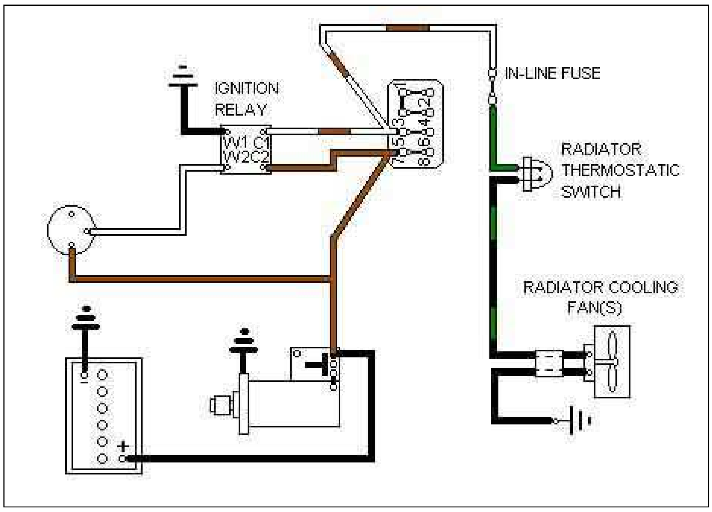
Electric Cooling Fans Schematics

4-cylinder cars 4-cylinder cars with added relay Factory V8 Factory V8 modified

Hover over a wire to confirm the colour

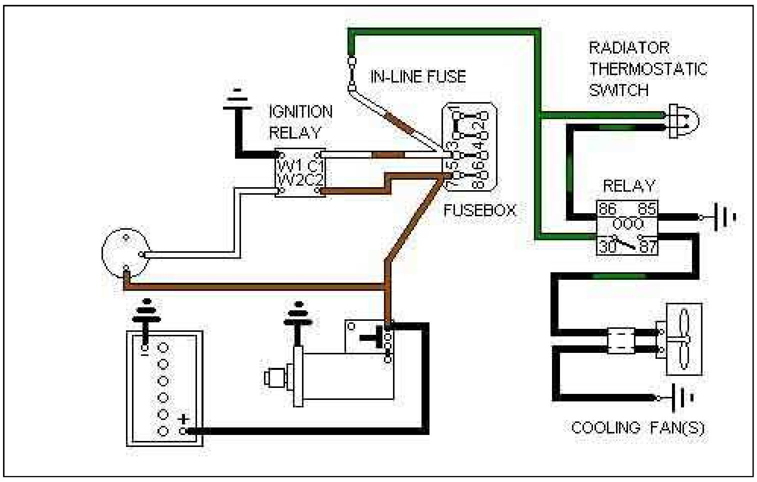
All cars fans share an earth with the headlights, so a slightly poor earth connection here may cause the headlights to dim more than usual when the fans switch on. Likewise when the headlights are on it will affect fan speed and hence cooling more than normal.

4-cylinder cars



Notes:
1: North American cars had two fans connected in parallel, other markets only have a single fan.
2: All 4-cylinder cars have an in-line fuse under the fusebox in the fan circuit. This fuse is fed from the white/brown (ignition relay, but see below) circuit, then feeds the thermostatic switch with a green wire. Later models from some time in 1978 had a second in-line fuse between a white/brown and a green feeding the indicators, heater fan and GT HRW. Be aware that these green wires are electrically separate from the main green circuit that is fused from the 2nd fuse up in the 4-way fuse block.
3: It's possible that early cars with electric fans may have had a fan relay before they got an ignition relay, and when they got the ignition relay the fan relay was deleted, but I've not seen any diagrams that show this. The Parts Catalogue shows a 3-terminal relay the same as for the V8s, but in order to use this the sensor switch would have to be wired differently, probably he same as for the V8s.
4: Some owners have moved the white/brown wire for the fans from its usual position on the 4-way fuse block to a spare brown spade. This results in the fans continuing to run when the ignition has been turned off, or indeed, starting to run after you have left the car. Nothing earth-shattering in doing so - except that a fault could cause the fans to flatten the battery, or in the worst case start a harness fire.

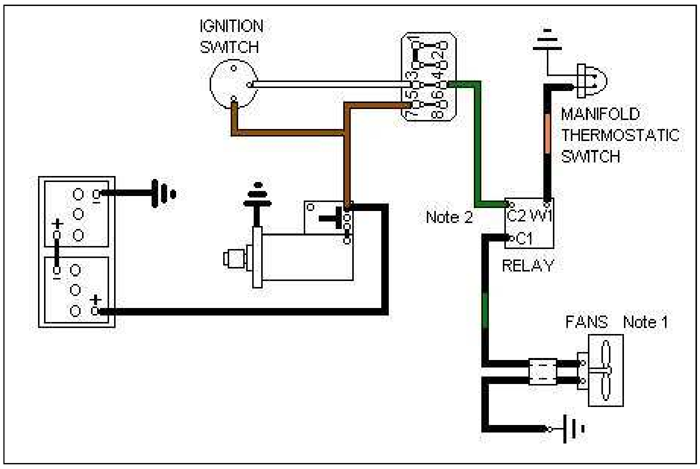
4-cylinder cars with added relay



Notes:
1. In this circuit the fan wire is moved from the thermo switch contact to a relay contact. When the thermo switch closes it extends 12v from the green through to the relay which operates to earth. The green on the thermo switch contact is

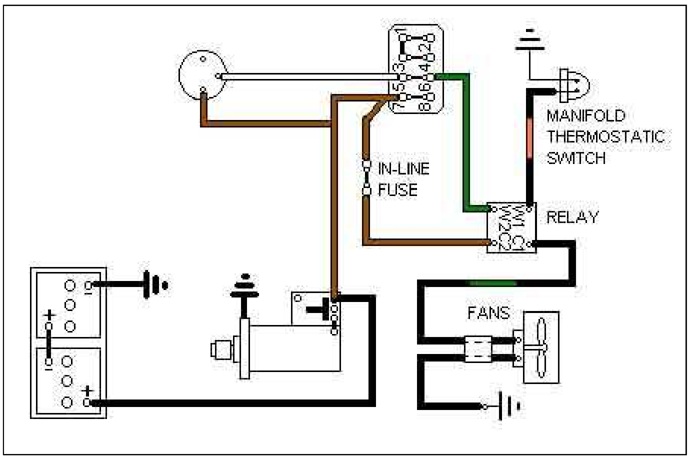
extended to the other relay contact which when it closes powers the fans. Thus the same green feed is used to power both the relay and the fans, but the thermo switch only carries the light current of the relay, the relay carries the heavy current of the fans.
2. You should not need to add a relay to 4-cylinder cars with standard fans, even two, as the standard switch seems more than man enough for the job. However if replacement radiator switches fail quickly they may, like replacement brake light switches, be of poorer quality than the originals in which case a relay may be beneficial.
3. The relay contact number given are for current after-market relays. If using a standard Lucas relay use W1 for 85, W2 for 86, C1 for 30 and C2 for 87.

Factory V8



Notes:
1. Factory V8s have two fans wired in parallel.
2. The Workshop Manual Supplement shows the relay been fed by a green wire as shown here i.e. fused. The relay is an unusual 3-terminal design in which the power supply from the fusebox is used to operate the relay in series with the sensor switch to earth, as well as being extended through the contact to power the fans. This puts a heavy load - about 10 amps in my case - on the fusebox and ignition switch, and the heated rear window, also a high current item, does the same thing. Not a good idea with 30 year-old electrics and a significant contributor to slow or non-flashing indicators.
3. Mine came to me with a 4-terminal relay with the power for the fans fed from the brown at the fusebox and unfused, while the relay itself is still powered from the green circuit. I thought that might have been a PO mod but I've since heard of others, so possibly a dealer mod to reduce the load on the main green circuit in the fusebox. The glovebox handbook shows the power coming from the brown circuit and not the green, albeit using the same 3-terminal relay. So whether the colour is an error in one of the drawings, or whether the change to the relay was missed off the handbook drawing, we will never know.

Factory V8 modified

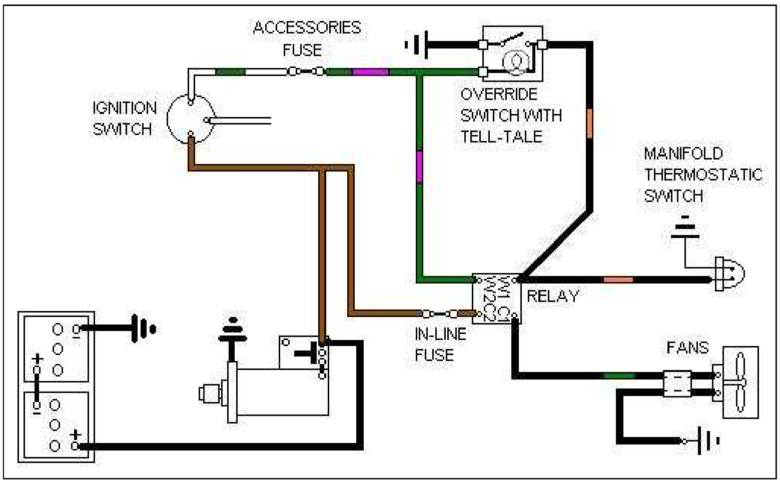


Originally I though the factory V8 diagram was a misprint as mine has a four terminal relay with a connection from the brown circuit at the fusebox to the relay contact to power the fans, meaning that only the load of the relay winding is on the green circuit. A useful modification, but it meant the fans were not fused, easy enough to add an in-line in the brown wire between the fusebox and the relay.

However even with this brown feed instead of the green there is still significant volt-drop in the fan earths, which share a relatively small-gauge wire with each other and the headlights right back to a earthing point by the fusebox. I provided an additional heavy gauge earth connection to a lug under one of the mounting bolts to the bonnet slam-panel for each motor. As my alternator has a spare large output spade, and a spare input spade on the relay, I provided a heavy gauge brown wire between them to increase current still further. These changes supplied an extra 25% or so voltage to the motors, which gives a very noticeable increase in fan speed and hence cooling. Because this meant there were now two brown feeds to the relay (with my additional brown wire effectively creating a 'ring main' circuit) I opted to fit the in-line fuse on the relay output to the fans wire.

Thanks to Graham Cornford for pointing out the error in the relay terminal naming, and if using a modern relay the terminal numbering would be W1 = 85 or 86, W2 = 86 or 85, C1 = 87, C2 = 30.

Factory V8 modified further



I opted to make a further modification so that the fans can only operate when the accessories circuit is powered, which means that they are disconnected during cranking which takes a significant load off the battery. Yes, they will continue to run when turning the ignition key from 'run' to 'accessories', but still will stop when the ignition is turned fully off and the key removed. The green fused ignition feed to the relay is removed and a green/pink fused accessories feed connected instead. Note that if you have an override switch, and if that has a tell-tale, then you need to make the same change at the switch. The easiest way of doing both of these is to take a piggy-back feed off the heater switch (which is powered from the accessories circuit) to the override switch for the tell-tale, then extend that wire into the engine compartment to the relay.

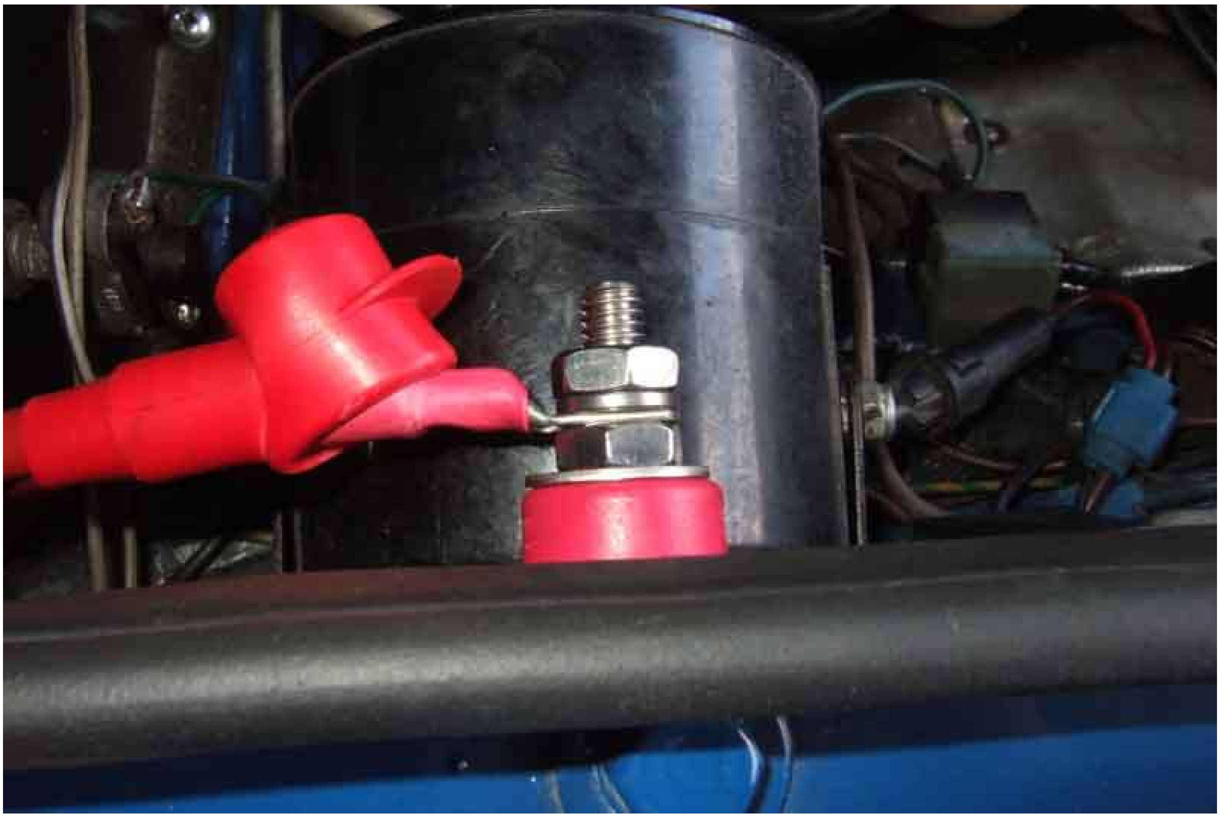
Battery Post in Engine Compartment

Installed to Bee:

And Vee:

The cap is a good fit over the cable and the nuts on the post but there are two problems - one is that it leaves a washer exposed which is live:

And the other is that the stud is too long for my specific needs which makes it difficult to get the cap over it:

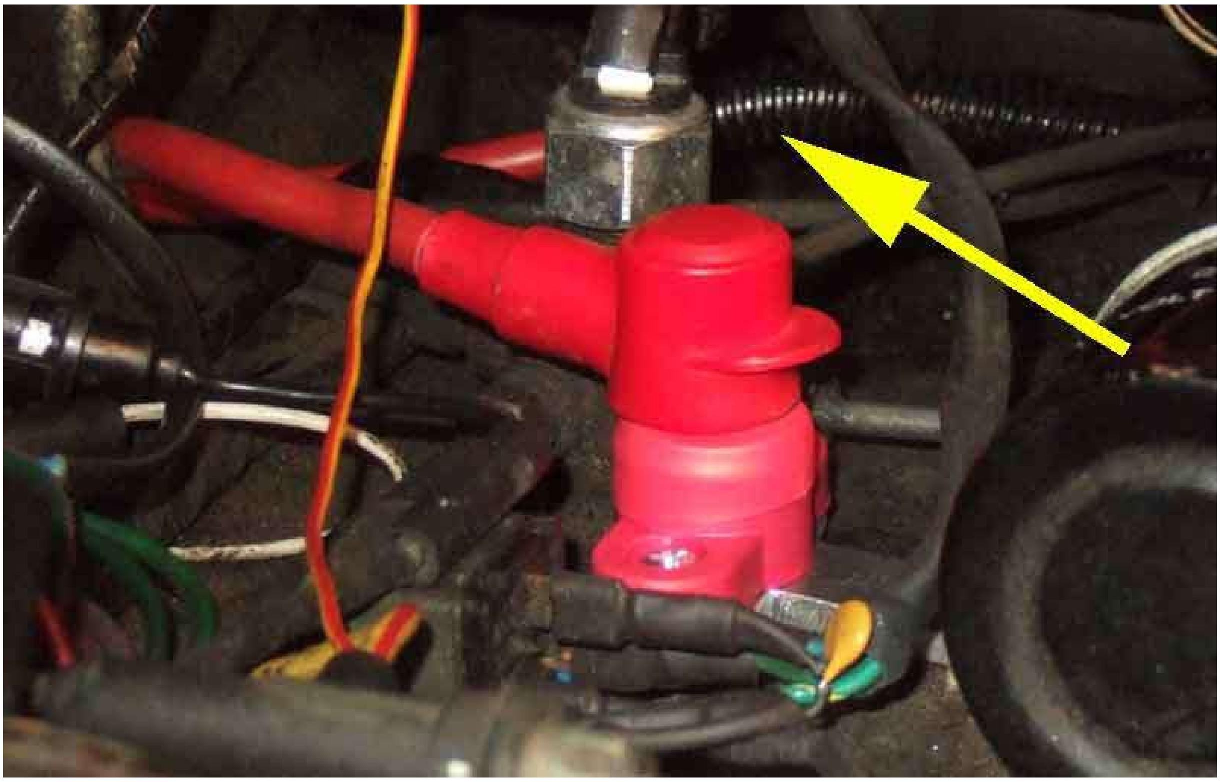


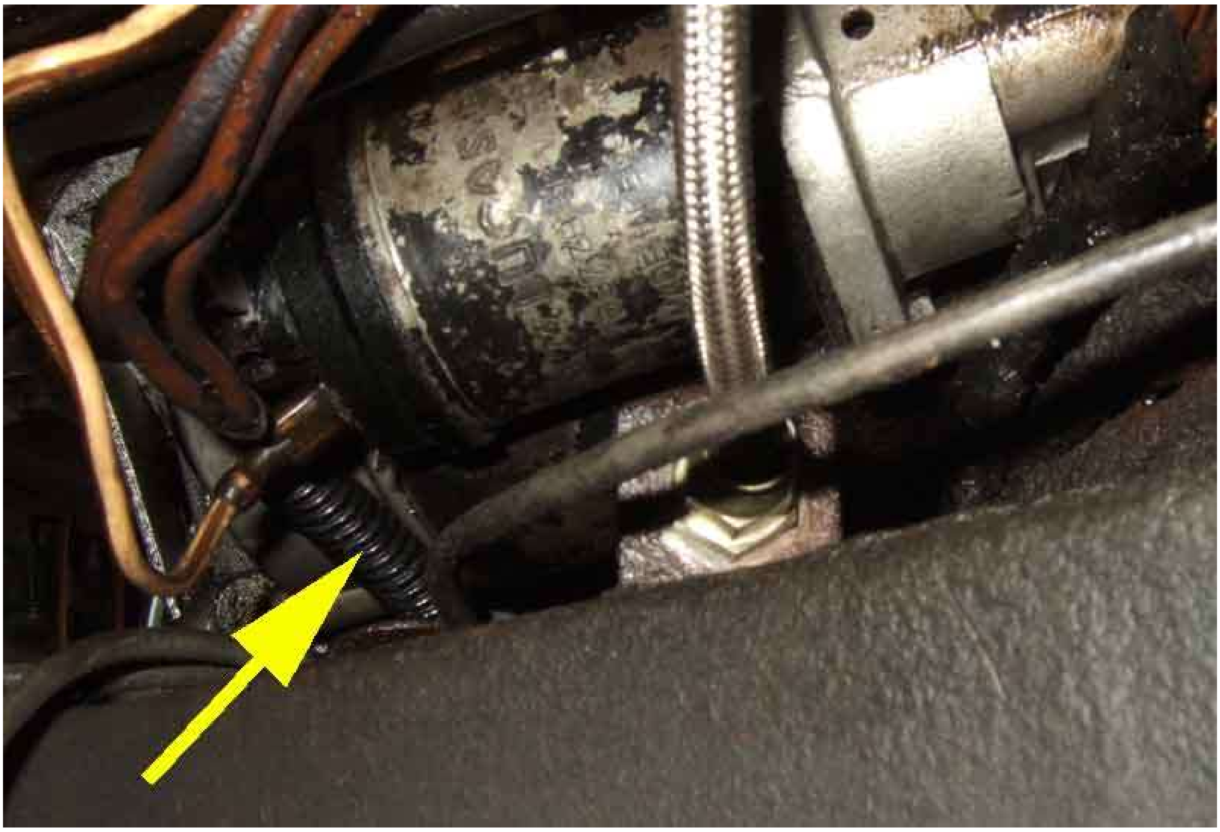
With the stud shortened the cap is much easier to fit:

I did wonder if that would then allow the cap to be pushed over the washer onto the base of the stud, but it's not quite big enough. So I have ordered some 1" red heat-shrink to fit over that part of the base (which is 0.96" dia), the washer, and the lower nut.

As I could only get a 1M length, the remaining 95cm is awaiting further opportunities ...

I also put split corrugated sheathing round the lower part of the cable where it passes between the engine and the chassis rail:

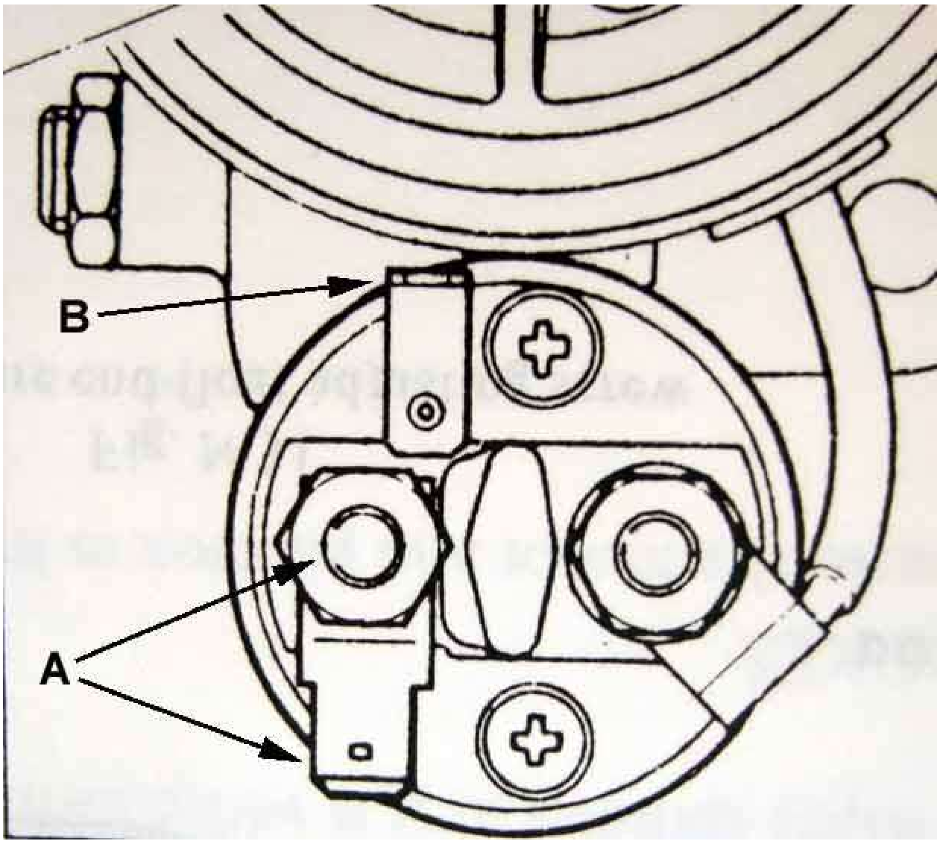




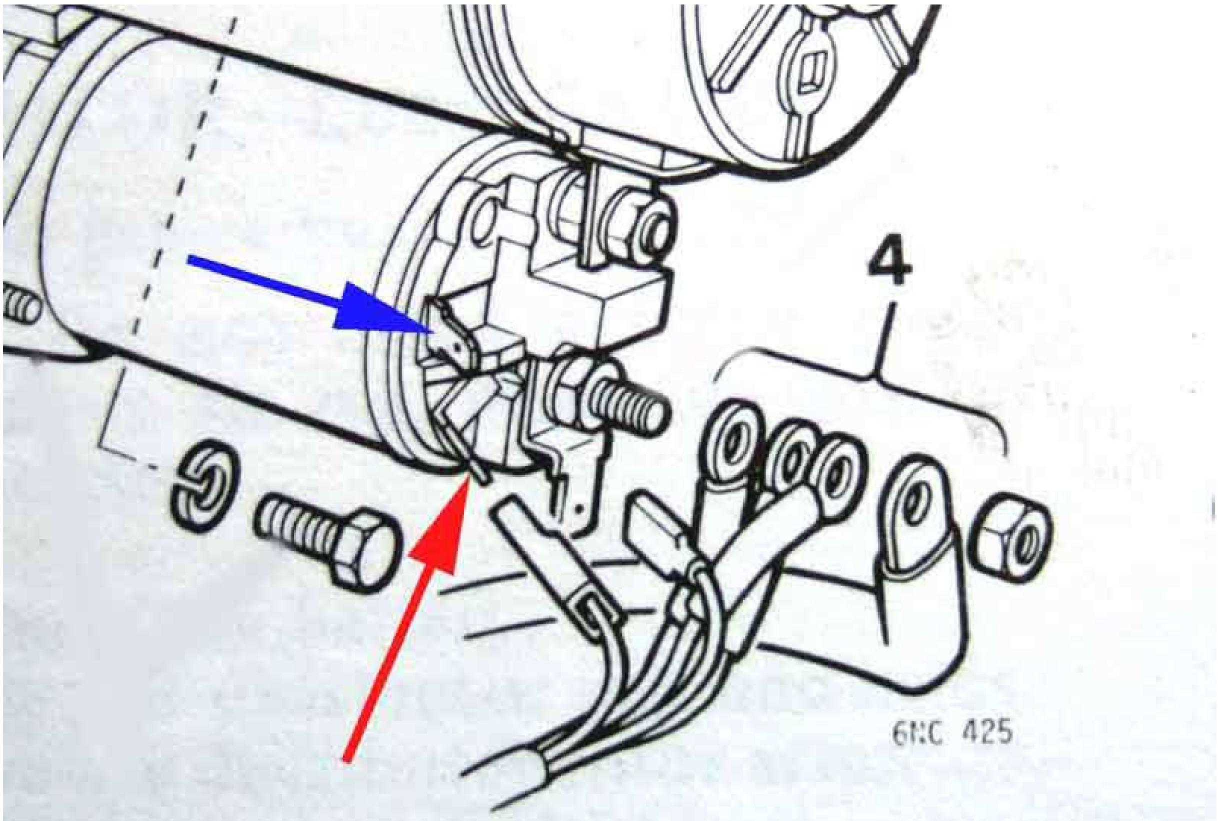
Solenoid Contacts

4-Cylinder pre-engaged:

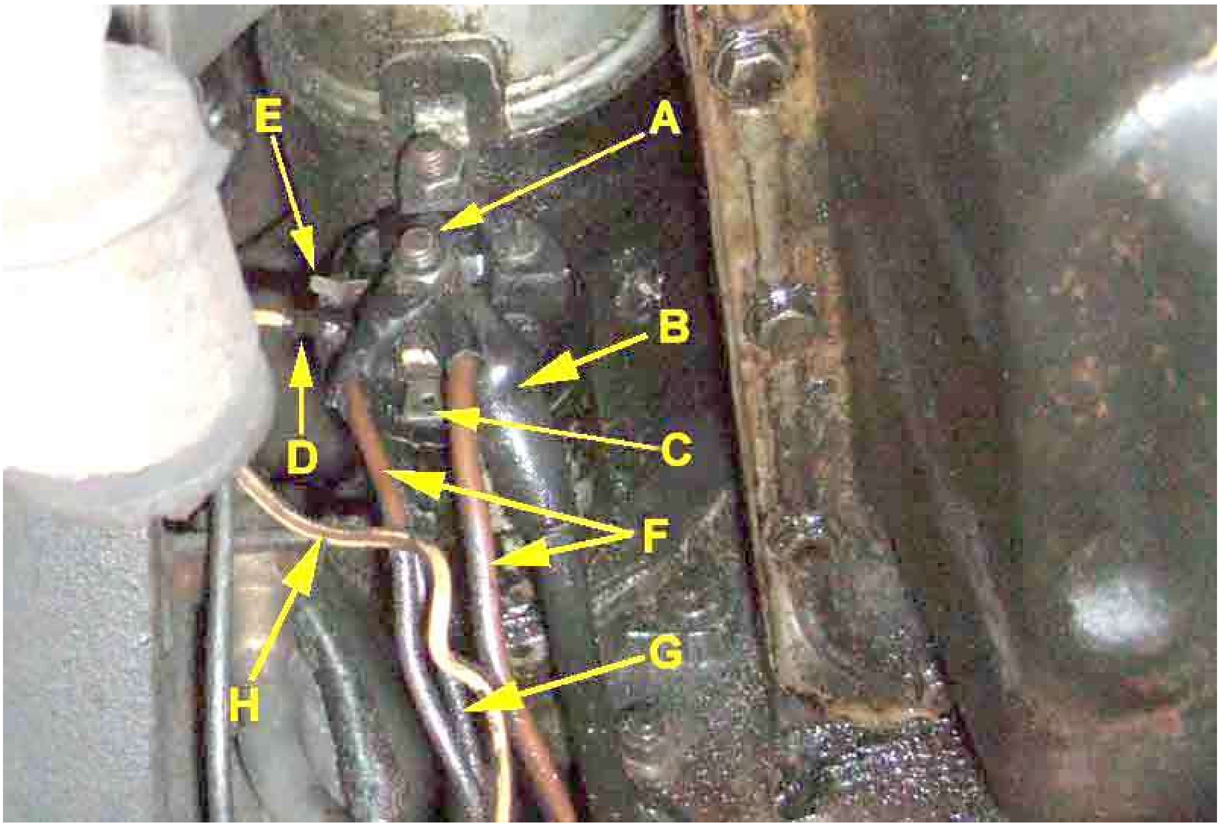
Earlier 2M100 pre-engaged starter on 18Gx engines: A - battery cable stud and large 12v spade. B - standard-sized solenoid operate spade. No 'boost' contact:



Later 2M100 pre-engaged starter on 18V engines, V8 starter is similar: Everything bracketed as '4' goes on the stud - battery cable and two or three brown wires. There should always be two thick brown wires (from the alternator and to the rest of the cars electrics) and an optional standard-gauge brown wire which goes to the alternator for voltage sensing. The large spade (9.5mm) on the stud is for compatibility with earlier models. The standard-sized spade (6.3mm) lower left (red arrow) is for the solenoid operate wire which is a thick white/brown or white/red (or possibly a brown/white, diagrams vary). The small spade above that (4.8mm) is for the coil boost wire (rubber bumper 4-cylinder and all V8s) which is a standard gauge white/light-green (white/light-blue on V8). (*Leyland Workshop Manuals*)



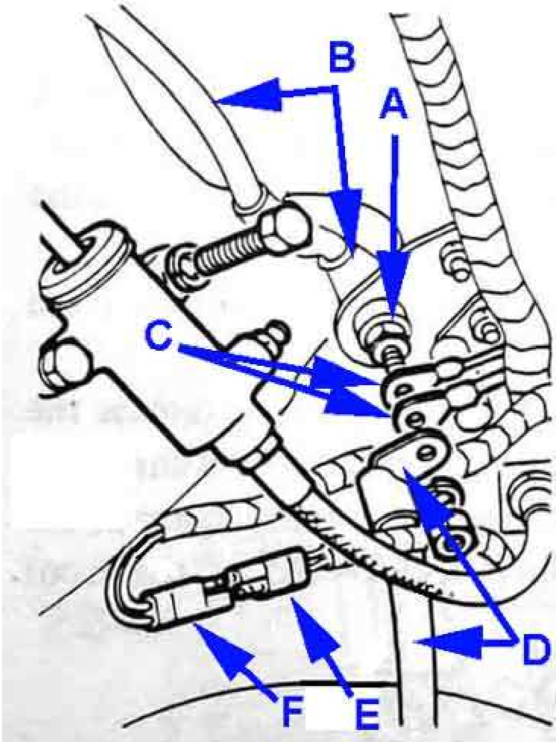
In practice: 'A' is the battery cable stud, 'B' the battery cable, 'C' the large spade for brown wires as used originally. 'F' are the brown wires to the cars electrics and the output from the alternator, 'G' is the additional smaller gauge wire to the alternator on cars that used battery sensing. 'D' is the solenoid operate terminal and 'H' the solenoid operate wire, 'E' is the coil boost terminal only used on rubber bumper cars and V8s:



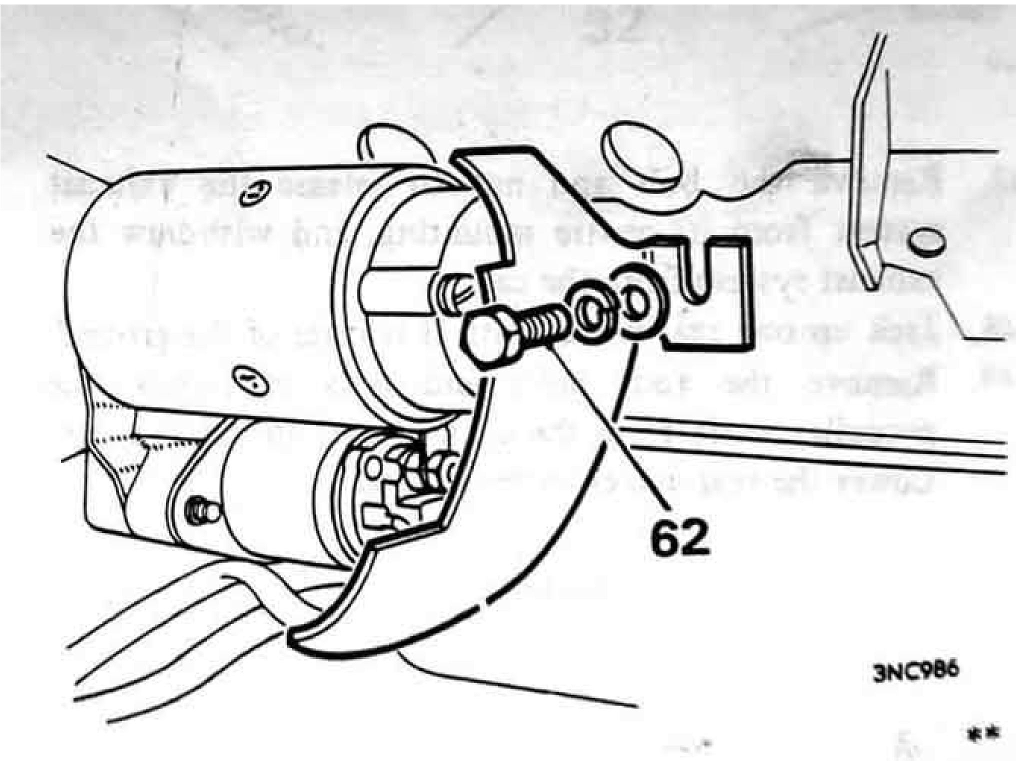
Rubber boot over the starter connections from May 72: (*Ahmed EL Abasiry, Canada*)

V8:

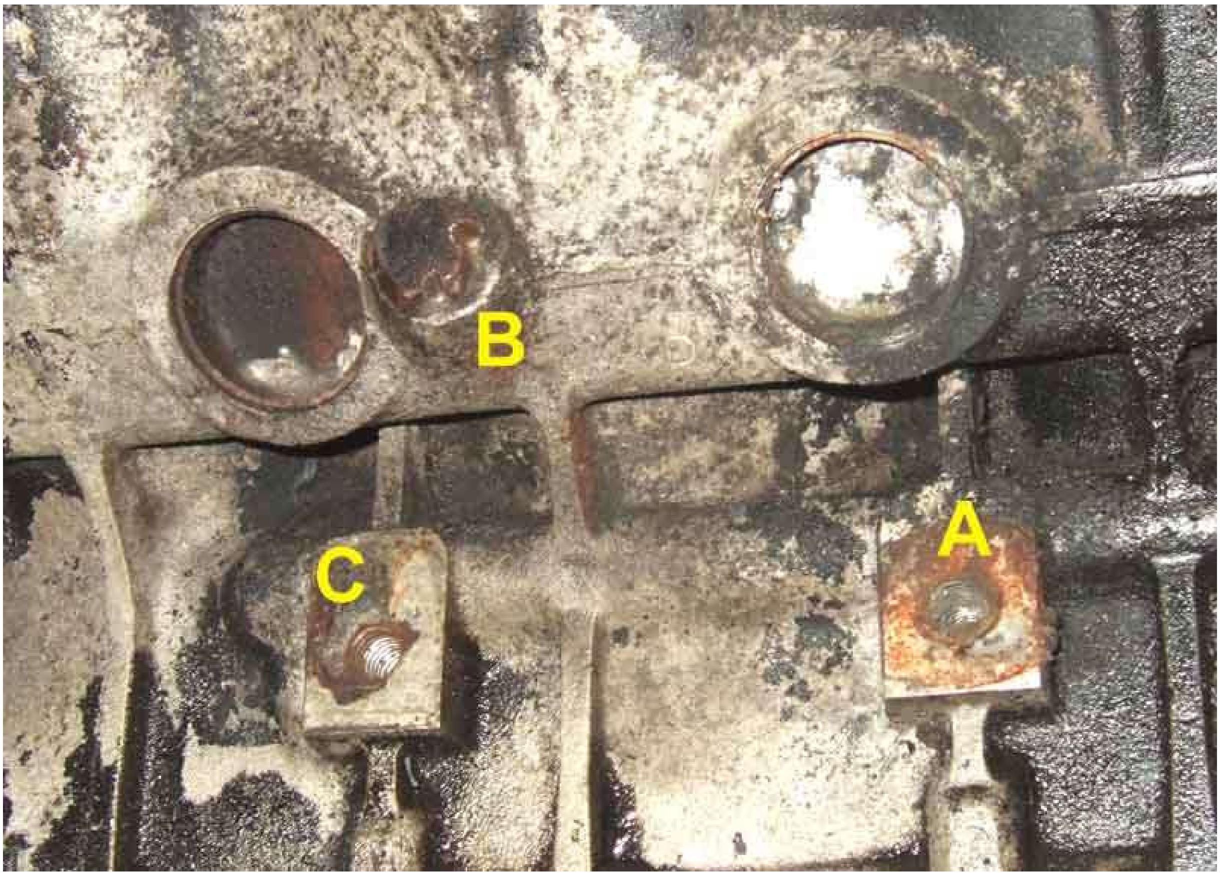
The intermediate connection in the V8 battery cable: 'A' is the insulated stud on its mounting plate bolted to the toeboard; 'B' is the cable from the battery mounted to the top part of the stud; 'C' are the two brown wires from the harness; 'D' is the short length of battery cable to the starter solenoid stud; 'E' is the 2-pin connector on the short sub-harness going to the solenoid spades; 'F' is the other half of the 2-pin connector on the main harness tail. This connector can only be assembled one way (and is the same as the cooling fan connectors): (*Leyland V8 Workshop Manual Supplement*)



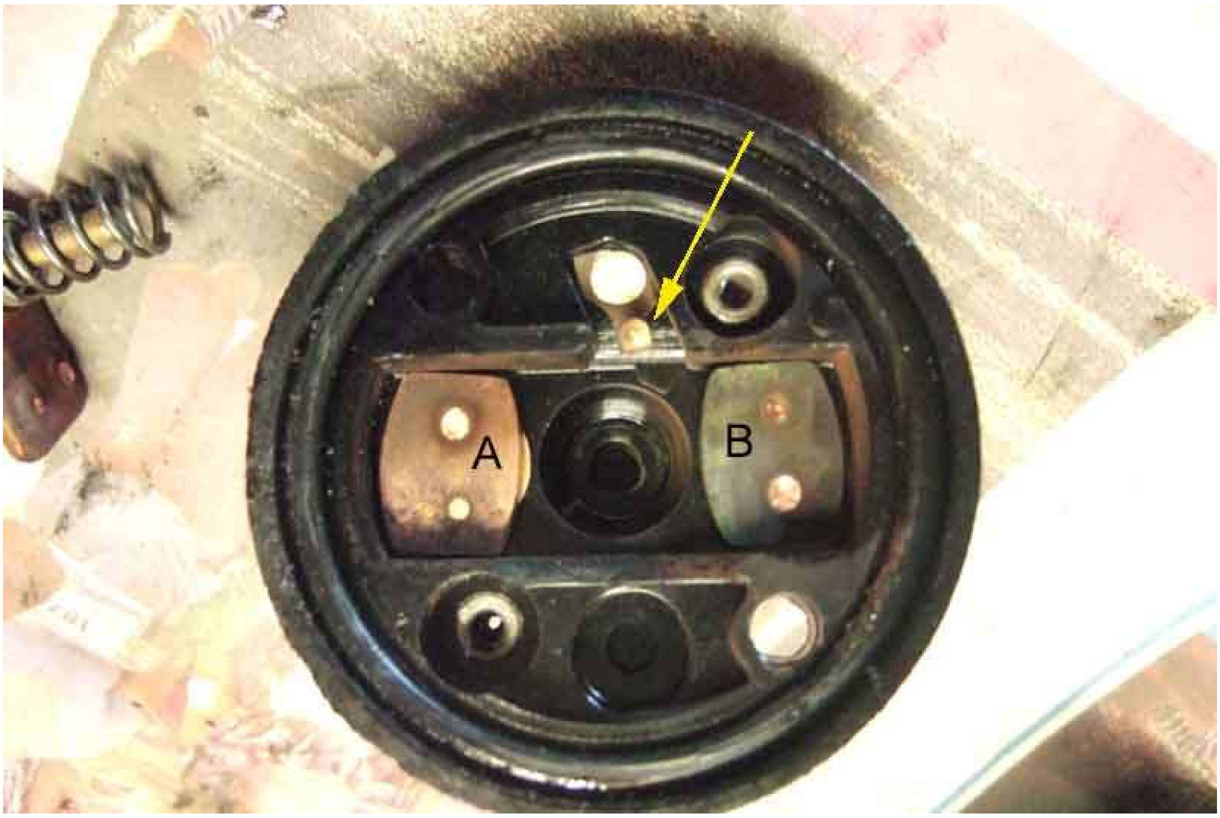
V8 starter heat-shield, the correct item is moulded heat-resistant material with a metal bracket riveted on. Not shown but the off-side exhaust down-pipe is immediately to the right of this, but it also passes underneath so although the end of the solenoid and starter are shielded the lower body of the solenoid isn't. The heat eventually weakens the ability of the solenoid to hold in once it has connected power to the motor and battery voltage has dropped, and it chatters as if the battery is flat. When Vee came to me it was just a tin sheet which wouldn't have helped much with keeping heat off the solenoid, with one of the bracket rivets broken away so with relatively light pressure it could by pushed against the battery cable stud shorting it out! (*Leyland V8 Workshop Manual Supplement*)



At least one person has said his block doesn't have a tapped hole for the fixing bolt, but both my original and an engine from elsewhere both have it. 'A' is the lower mounting point for the engine mounting plate, 'B' is the block drain plug, and 'C' is the hole for the heat shield:



Vee's replacement starter: A copper bar bridges the two stud contacts A and B when the solenoid operates and is supposed to connect power to the small coil boost contact as well. But that contact (arrowed) is bent back ...

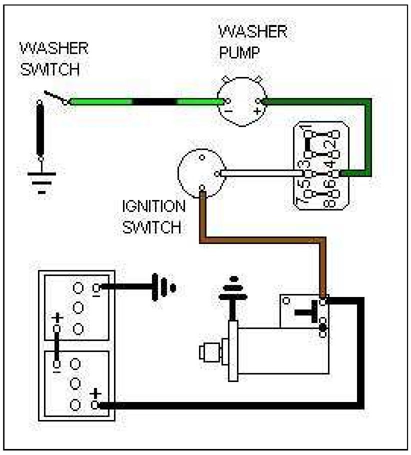


... so that the copper bar misses it altogether, and has obviously never worked on this starter that I fitted in December 1999 as a newly rebuilt item:

The coil boost contact is straightened and positioned so that the copper bar touches it and pushes it down just before it reaches the two studs:

Electric Screen Washer

Hover over a wire to confirm the colour



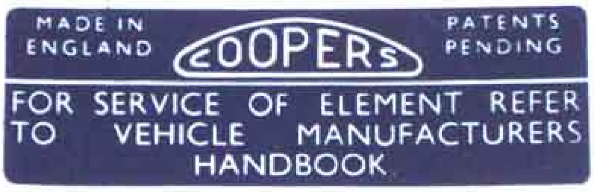
Note: From 1971 for the remainder of chrome bumper production and all V8s the electric washers (and wipers and heater fan) were powered from the accessories position of the ignition switch via a white/green to an in-line fuse under the fusebox, and then via a green/pink.

Decals

Images from Motaclan/Leacy except where stated.

Roadster hood header rail

Speedo - could be black, red or green. However on my 73 and 75 the knob points downwards behind the dash so 'clockwise' is a matter of interpretation, and doesn't need to be pushed, just turned. It seems that some North American (at least) types do have to be pushed up then turned to have the desired effect. It seems that their late-model speedos (79-80?) had a push-button reset on the face.



Air filter cans up to 1969

Air filter cans 1970 to 1976

Air filter cans 1977-on (*Miniphernalia*)

Heater case, facing forwards, between ports

Heater motor, top

Rocker cover - carb side, black screen-printed plate to 65, sticker as here 66 to 72

Rocker cover - plug side, plate up to 66, sticker 67 to 72 (*Moss Europe*)

Rocker cover - 18V engines to 1979

Container for replaceable oil filter element

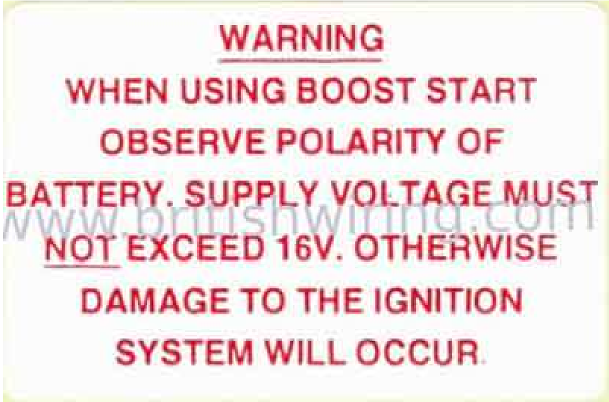
Round washer bottle

SU fuel pump

Bonnet slam-panel, Mk2 on chrome bumper?

1970 on chrome bumper?

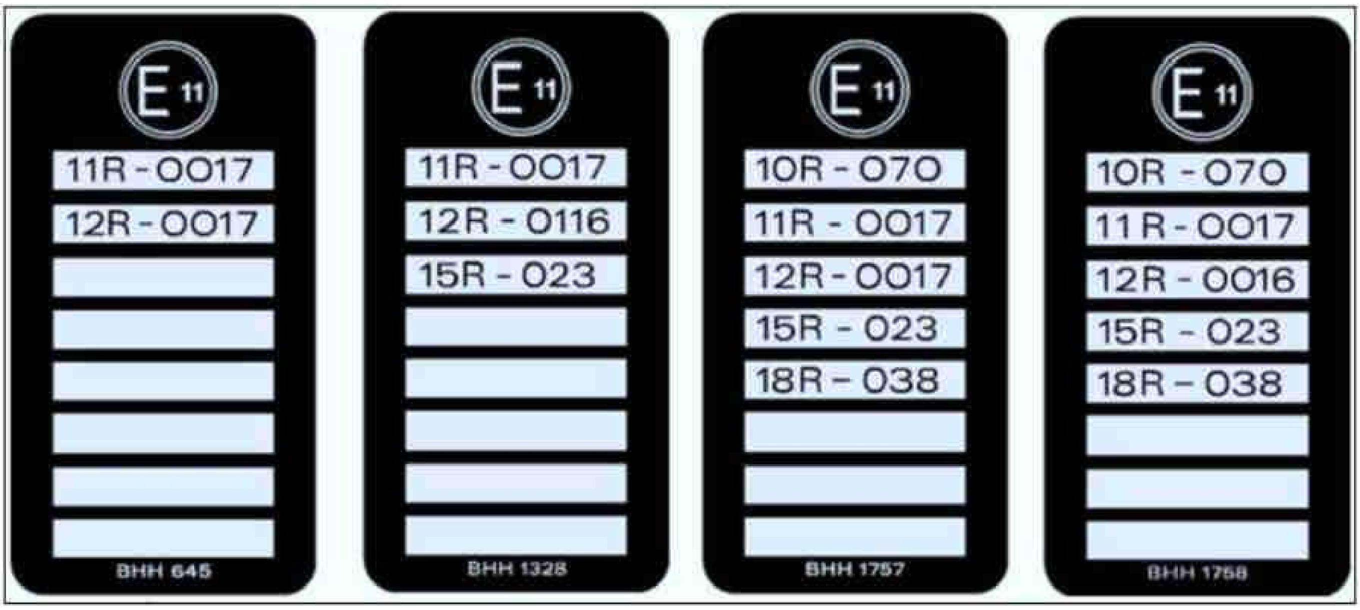
Rubber bumper replacing the previous two?



Clausager shows this label on the battery cover of a 1980 roadster. Apparently a UK car, I could expect it on a North American model with factory electronic ignition, less so an RHD model with points. (*British Wiring*)

V8 radiator

November 2023: Four examples of EU conformity stickers used from when the UK joined the EU in 1973: (*V8 Register*)



Not exhaustive, found as a result of a query on the MGOC forum from someone who had one showing a part number of BHH2008 and a different set of code numbers and was asking what it meant. Not listed in the Parts Catalogue, and only paper so most were 'lost' years ago.

There are very many more for North American spec, mainly concerned with their emissions and car ID requirements.

Screen Washer

Manual pump   Nozzles   Valves/filters   Convert manual screen wash to electric   Schematic

Manual pump

As simple as can be, and a testament to the quality of original rubber that they last as long as they have:

Nozzles

Two single nozzles on roadsters to 1977: *(Moss Europe)*

One dual nozzle on GTs to 1977: *(Moss Europe)*

Two black plastic nozzles on all cars from 1978: *(Moss Europe)*

Valves/filters

A one-way valve at the bottle is essential with the manual pump as otherwise the water runs back to the bottle as fast as you pump. Less so with the electric as pumping is continuous:

On Bee's bottle valve the valve flaps are visible so if there **is** a filter it must be behind those which would makes no sense:

Moss Europe indicates they only included a filter from June 73 with the change from the bottle to the bag:

In-line valve. Parts Catalogue says "13H6501 (was BHA4610)" but does not indicate where it was used, Moss Europe says "GWW504 GT" and others indicate GT only, Brown & Gammons does not list it at all:

However roadsters prior to 1977 have dual nozzles with a tee linking them whereas GT have a single dual-port nozzle. So the roadsters need a tee, and that tee includes a valve. Form 1977 both roadsters and GTs had that arrangement. The Parts Catalogues don't indicate by either the drawing or the description that this is the case, and the 77 and later catalogue seems to have a complete mis-match in item numbers between drawing and list, but one of the plain tees in the both catalogues depicted as 13H6472 includes the filter. GWW408 is a later number but few places seem to have either of them, some showing a separate tee and in-line valve with a short length of tubing to connect them:

Note that 13H6472 on the face of it needs larger bore tubing for the inlet port (and one supplier states that), whereas GWW408 ports seem to be the same (not known) size. The larger 13H6472 port is the same size as both pump ports, but one run of tubing connects the 4.7mm port on my bottle to the 5.7mm port on the manual pump.

Convert manual to electric

Dave Birkby Ditto Bee

Dave Birkby: I tried to open the old pump to see if I could salvage it but I inevitably damaged the end doing so. Shame maybe because the problem was corrosion in the pump main bore that was simply jamming the plunger in the 'in' position. But as my plan was to fit an electric pump, I ordered a kit online which consisted of pipe, joiners, nozzle jets and a small momentary push switch, smaller diameter than the hole in the dash:

I found a washer in my tool box that had a 12mm inner hole (to take the switch) and 28mm diameter which fitted in the bore of the old pump:

With the bore cleaned up I put the original plunger back in and dropped the new switch in behind it:

I didn't want any 'noticeable' feeling of a gap between the two switches so I put a small light spring to keep the plunger out but not operate the new switch:

I cut the body down to within about 5mm of the steel washer and then cut tabs out of the body to hold the switch in. I bent the tabs over which worked well and I have since finished it off with a foam washer:

It feels decent to operate and touches the new one within about 5-6 mm of movement and returns nicely. And it looks like it did before.

November 2021: **Ditto for Bee:** I fancied doing the same thing myself before the pump gave me any problems but didn't rush into it. In the 'once a year operation prior to the MOT' I had a real struggle to get any water out which turned out to be the valve in the washer bottle foot partially dislodged. A moments work to fix, but time to think seriously about converting. I didn't want to mangle Bee's so got a used one from Andy Jennings, and a cheap pump off eBay. The tubing and nozzles can stay.

My pump looks shorter and fatter than Dave's, and with careful levering round the turned over edge of the alloy housing I released the plastic end-cap, and the rubber bulb and plunger fell out (incidentally unscrewing the slotted nut that holds it in the dash will also release the plunger on this type):

Pondering the switch to go inside, it suddenly occurred to me that a micro-switch might just fit in my large housing, and with a bit of tweaking to the NO and NC terminals on the side it does indeed go in and the contacts help it to stay there. The 'normally open' contact is on the end of the switch and touching the housing, which is probably at earth potential on the dash, so I connect an earth wire to that and have 12v at the pump, which happens to be how they are wired from the factory. I'll have to cut off the 'normally closed' contact so it doesn't touch the housing or it will operate the pump with the plunger released! The pump plunger is much narrower than Dave's and doesn't line up with the switch button, so I cut a circular disc to go between them.

With very little movement of the switch plunger the pump plunger would rattle about unless I positioned the switch very carefully, but a second plastic disc with a strip of draught-proofing foam between them results in a 'soft' feel and no rattle. Somewhere I have a packet of assorted springs bought decades ago, which may include a compression spring that would fit down inside the plunger to take up all play but would still need one disc, but needless to say I can't find them.

Thinking about mounting the switch I find there is just enough room inside the housing to push the switch all the way in, with another plastic disc on top to be held in place with the edges of the alloy housing turned back over again.

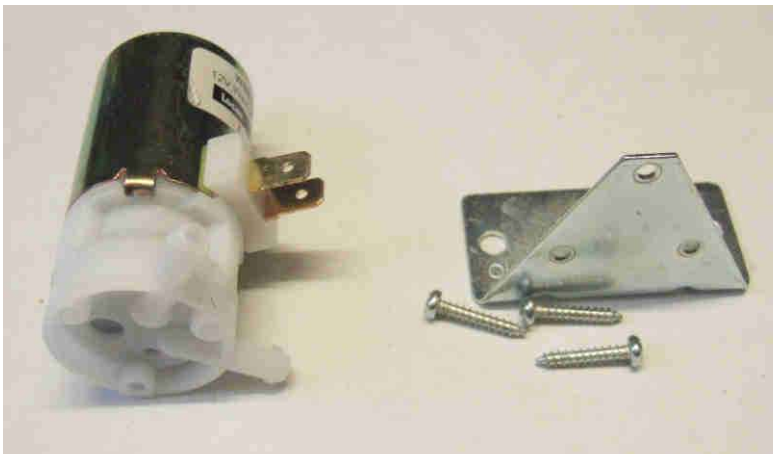
The pump plunger only moves about 3mm before the switch operates, which is less that I would like, but it does work and is really neat even though it won't be visible once installed!

I'll have to pull the tubing off the existing pump, and being tight see if I can use a short section of hose or tubing to join the two ends together behind the dash.

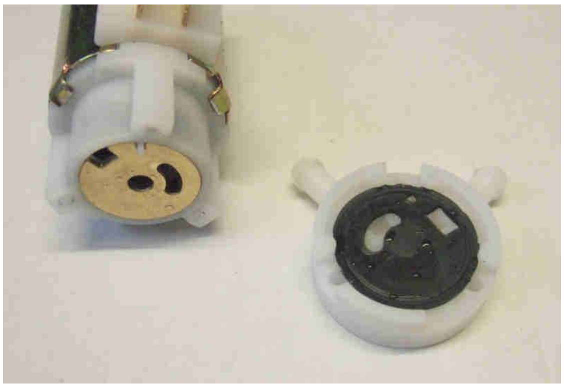
I Googled electric pumps and got a Peugeot item (left below) for under £4 which has a very large port which I assumed was the inlet that pushes into the bottom of the screenwash container, the other port being standard for tubing. The large port was going to be a bit of a fiddle to connect to tubing so I used it for another job (don't ask ...) and Googled again and this time found an Austin/Morris item with more conventional ports for less than £3! Testing that dry it's really noisy compared to the Peugeot item so I use the AM pump for the other job, and since I had come up with a way of reducing the large port to accept tubing for that job can use the same on the car.

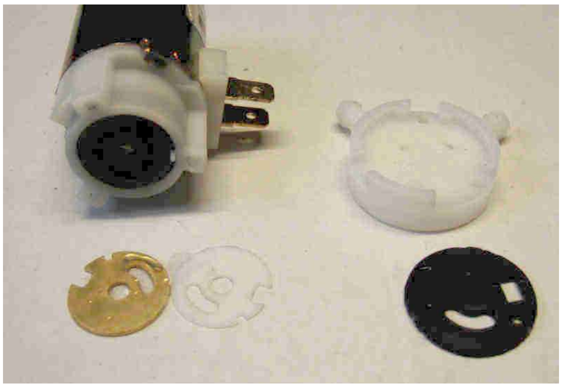
However neither pump sucks water up when fitted with tubing on both ports and tested in a bucket! I can sort of understand it for the Peugeot pump as that is designed to connect to the bottom of the bottle and so is kept full of screenwash. Less so the AM item as although the port at one end is slightly bigger than the side port and I'm assuming that is the intake, unless it pushes into a receptacle sticking out of the bottom of the bottle it's not going to be kept full of water. That one blew air out of either port (connected to tubing with the end in water) if the polarity was in the appropriate direction, so why it doesn't suck up with the polarity the other way round (it didn't blow then) I don't know. MGB pumps are mounted to one side of the bottle but the intake tubing goes up to the cap and down inside. So that must be able to suck water up without priming as Vees which was removed from the car and dry for many months during the engine rebuild and repaint worked straight away on re-installation. So, I'll just have to get one of those for a tenner (GWW125, WSB100), and suck that up.

That arrived ... and didn't work! Some very weird and varying noises, a lot of sparking when testing on my battery charger, got hot very quickly as if it were partially seized, and no pumping. Message to eBay vendor and an immediate apology saying he would send another one out - good service. While waiting for that, and not returning the old unit I decided to have a look.

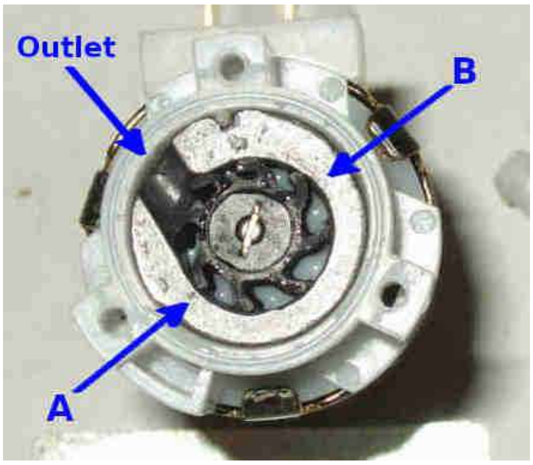


Three screws attach the mounting plate to the base of the pump so they come off, and I realise the bottom half of the plastic pump can now move.

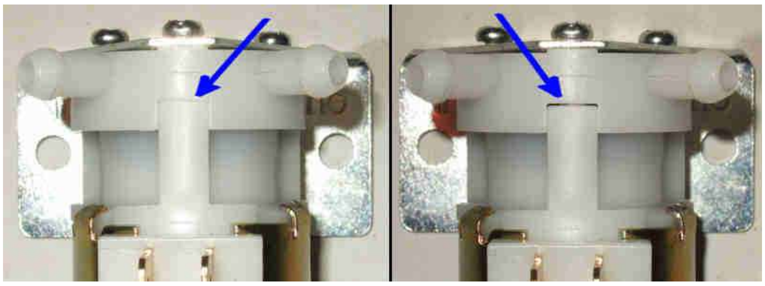




Careful not to have miscellaneous bits flying around and not know where they came from, I removed it, and a rubber gasket comes with it. There is a brass disc left in the pump, and under that is a plastic disc, and then I can see the vanes of the pump.



I couldn't immediately see how they draw water in and pressurise it to get it all the way to the fine nozzles and give a good spray, but I also noticed some of the vanes were bent over. At first I thought it was damaged and that was the cause of the problem. But then I realised that the vanes turn clockwise with water trapped between them. At 'A' they are getting bent over so the space between them gets smaller, and the water is forced into the outlet port. At 'B' which is under the inlet port they are opening up again which sucks water in. Very clever.

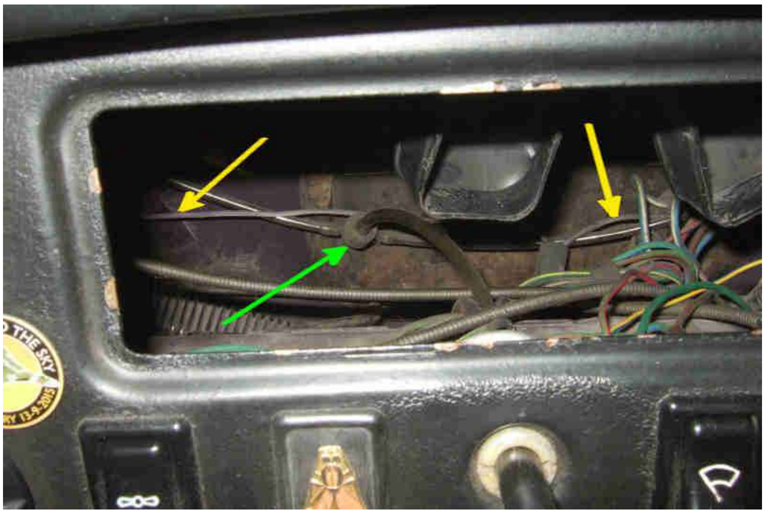


Powered up like that the motor is obviously spinning faster and quieter and doesn't get hot, so that part seems OK. Putting it all back together as I'm tightening the three screws for the mounting bracket I realise they are clamping the two halves of the pump together - maybe too tightly. So I back the screws off a fraction until a tiny gap is visible. Testing now is a little noisier but not much, and it pumps water from the outlet with great gusto! So a dimensional issue. If the screws are left too loose screen wash will probably leak from the join, so that will be subject to some experimentation.

On to mounting. Amazingly there are three Posidrive screws in a row under the gutter just aft of my forward-mounted washer bottle, no clues in Clausager's pictures as to what they might be for, and two adjacent ones are close to the spacing of the holes in the pump bracket. It means mounting the pump upside down to fit directly as otherwise motor wouldn't allow the bonnet to shut, which might affect pumping, but to extend the bracket and put it the right way up puts the ports on the wrong sides. Solvable with longer tubing but initially at least I'll go for upside down. One of the screws comes out easily and the other after a bit of encouragement with penetrating spray and grips, then offering the bracket up shows its holes are just half a hole too widely spaced for the holes in the inner wing. But removing the bracket for the pump to avoid damaging the pump it's just a couple of minutes work with a needle file and I can fit it to the inner wing.

The screws only just reach the ends of the nuts in the wheel-arch but amongst the many nuts, screws washers and bolts I accumulated during Vee's reassembly I have two 1" stainless which do the job. If the pump being inverted causes a problem I have some alloy strip exactly the same width as the pump bracket to use as an extender.

Tubing is the next consideration. The existing tubing will just reach the pump with it inverted, but I'll need a short piece to get from the pump to the bottle, but what size? Measuring the various ports I get 4.7mm for the bottle, 5.7 for the manual pump I have modified (not necessarily the same size as mine as I haven't taken that out yet), and 6.1mm for the new pump! I don't see how I can go any bigger than 5mm ID tubing or it will be sucking air in at the bottle, and 4mm would be a bit of a stretch for the pump. As it is I'll probably have to warm them with a heat-gun to stop them splitting, especially the original tubing on the new pump outlet. However looking at eBay sources the minimum length is 0.5M at nearly Ł3, whereas 10M is less than Ł6! 10M will allow me to replace the whole length, avoid the join where the manual pump now is and should have less chance of splitting on the new pump than the original tubing, so that's what I go for.



With the pump in position, the tubing on order (but annoyingly and rarely for eBay sellers no info as to despatch after two days) and the switch ready to install, it's time to get the old manual pump out and investigate what's behind that. Two separate jets so I'm expecting a tee, but when I first looked into the subject it was confusing (subsequently resolved) as to whether there is a one-way valve there or not as there doesn't seem to be one for roadsters unlike GTs. First get the dash vents out and moving the corrugated tubing from the air-box out of the way I can see the tubing and tee (green arrow), and also the separate purple/white wires going out to the courtesy light door switches (yellow arrows) from a 4-way bullet connector feeding the courtesy light as they are not in the harness on this era.

By now it's apparent that (as well as looking like it's been in a wheel arch for over 30 years instead of behind the dash!) the tee includes the valve (13H6472).

Then by twisting the pump body back and fore and holding the 'nut' for the 'back' and releasing for the 'fore' it unscrews without having to use pointy pliers in the slots of the nut. Same type as the one from Andy Jennings i.e. the plunger and nut come out the front of the dash and the pump from the back. Untangle it from the heater cable and some wires and I can lift it out of the vent slot to get the tubing off the ports, and a bit more wiggling gets the short piece from pump to tee/valve off as well. Three days passed before I got any update from the eBay vendor which is annoying, and looking at their feedback there have been more than 50 complaints about non-delivery and incorrect items in the last six months! Shoulda paid a few coppers more. I've had such good service from eBay people for so long now that I must admit I stopped checking the feedback, I'll have to start doing it again. It also occurred to me that with the long pipe removed from the pump less is needed to reach the tee/valve, so I could pull a bit back to give me more in the engine bay should I need to mount the pump the other way up.

For the electrics I run a short length of green from a piggy-back connector on the green side of the fusebox to the +ve spade of the pump, and from the switch 'live' wire via a 2-way bullet connector a much longer length of green/black (don't have any green/blue to hand which is what the factory used on later cars) from the middle of the dash and through the main harness bulkhead grommet to the pump -ve. With the vents out there is clear access to a knurled nut on the back of the dual gauge for the earth wire from the switch. An unexpected benefit is that Bee's original manual pump nut looks like chromed plastic with some of the plastic having worn off to show white underneath, whereas the replacement is shiny bright! Only noticed from the pictures that the plunger is quite scratched though compared to Bee's, but it only took a couple of minutes to swap them over.

Even though in theory the piece I removed from between the manual pump and the tee/valve should be a bigger bore than the rest it's actually the same as the main length with the ends expanded to fit on the larger tee/valve and pump ports, and warming the two ends that go on the even larger electric pump ports with a heat gun gets those on easily, to retain the 'patina' of the old tubing ...

All done it's time for a test, and dry first with the foot valve out of the bottle, then in and water soon squirts out. Passenger side nozzle is a bit low, something not easy to notice when you are only getting short squirts with the manual pump, but the nozzle jet turns easily to be as high as the driver's side. Not that I expect to be using them until the next MOT!

1962 - 1964, All Markets

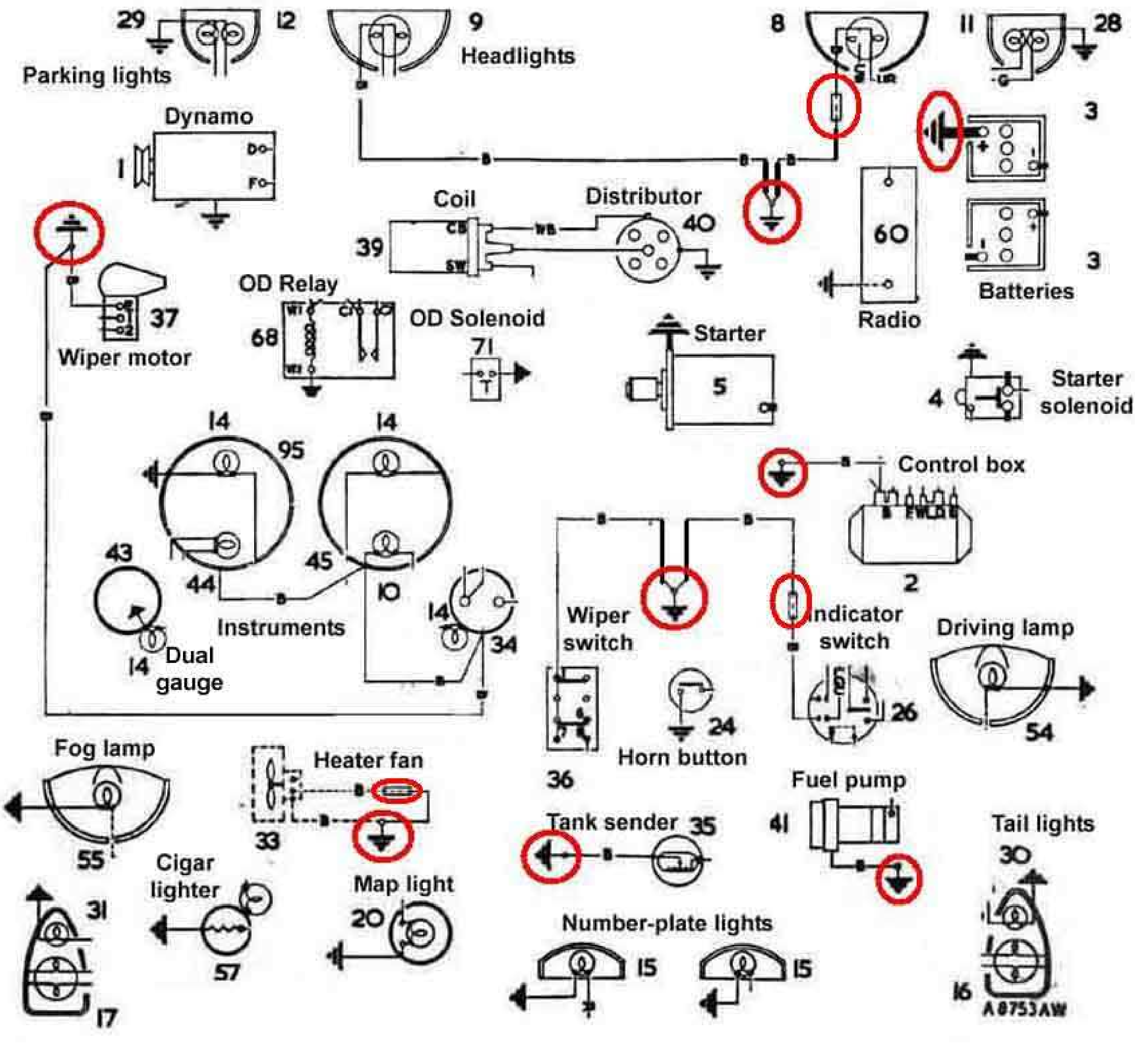
Earth wiring

Colour	Fuse	Components
black	none	earth
black/green	green	wiper switch wiper motor 'normal' speed
blue	none	main lighting switch dipswitch
blue/red	none	dipswitch headlamp dipped beams
blue/white	none	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown	none	solenoid ignition switch fusebox main lighting switch headlamp flasher switch cigar lighter dynamo control box
brown/green	none	dynamo control box
brown/yellow	none	dynamo control box ignition warning light
green	green	fusebox brake light switch indicator flasher heater fan switch wiper motor fuel gauge
green/black	green	fuel gauge fuel tank sender
green/brown	green	heater fan switch heater fan
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers
green/white	green	indicator-signal switch right-side flashers
light-green/blue	green	indicator-signal switch right-side flasher repeater
light-green/brown	green	indicator flasher indicator switch
light-green/purple	green	indicator flasher indicator repeater lamps
light-green/yellow	green	indicator switch left indicator repeater lamp
purple	purple	fusebox horns
purple/black	purple	horn switch horns
red	none	main lighting switch rear/parking lights panel lights dimmer map light switch
red/green	none	map light switch map light

red/white	none	panel lights dimmer panel lights
white	none	ignition switch ignition warning light fusebox coil SW fuel pump overdrive relay overdrive manual switch
white/black	none	coil CB distributor
white/red	none	ignition switch starter solenoid
yellow	none	overdrive manual switch overdrive relay overdrive vacuum switch
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive vacuum switch overdrive relay overdrive gearbox switch

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:



1964 - 1967, All Markets

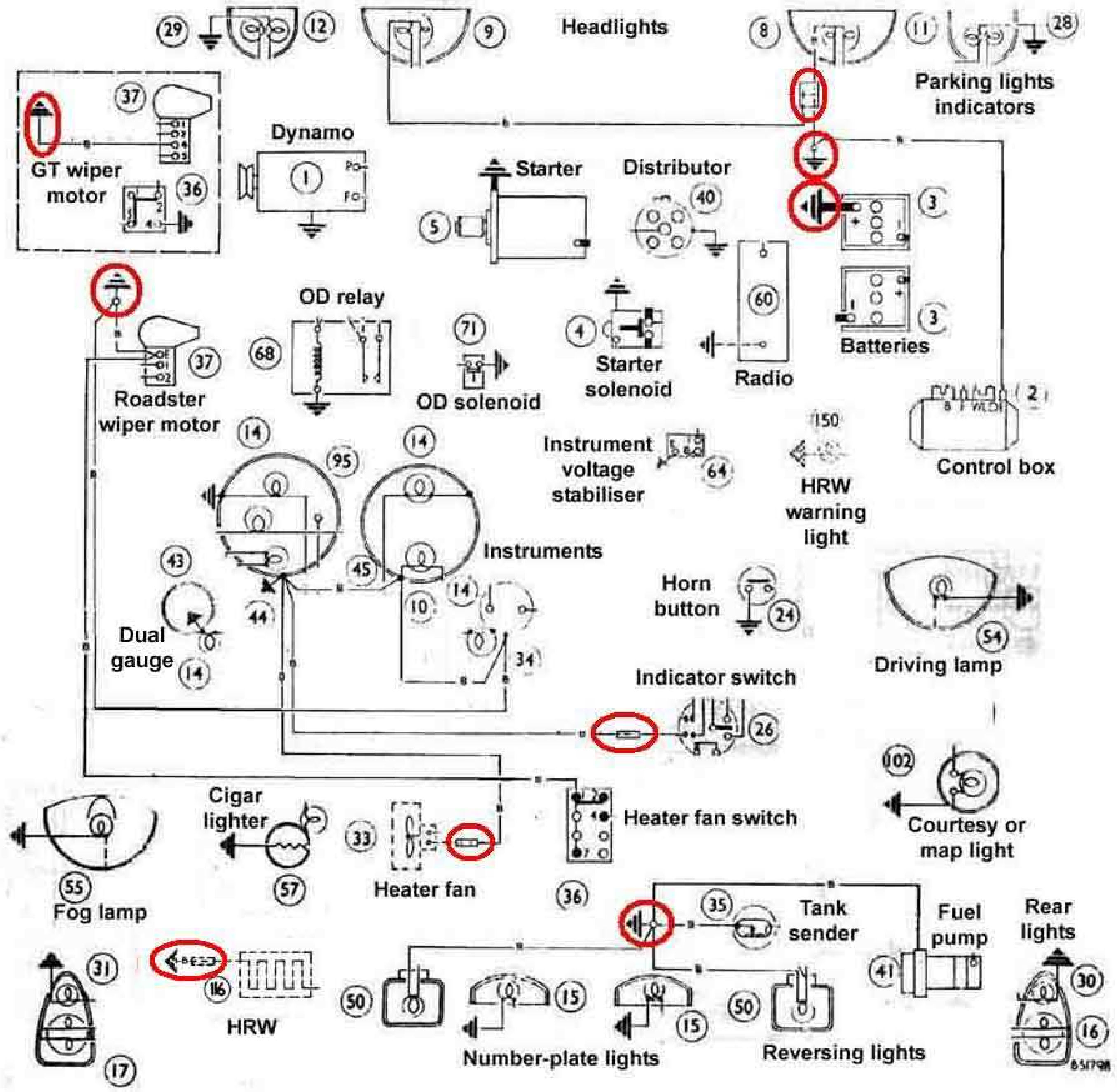
Earth wiring

Colour	Fuse	Components
black	none	earth
black/green	green	wiper switch wiper motor 'normal' speed
blue	none	main lighting switch dipswitch
blue/red	none	dipswitch headlamp dipped beams
blue/white	none	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown	none	solenoid ignition switch fusebox main lighting switch headlamp flasher switch cigar lighter dynamo control box
brown/green	none	dynamo control box
brown/yellow	none	dynamo control box ignition warning light
green	green	fusebox brake light switch indicator flasher heater fan switch wiper motor voltage stabiliser reverse light switch
green/black	green	fuel gauge fuel tank sender
green/brown 1	green	heater fan switch heater fan
green/brown 2	green	reverse lights switch reverse lights
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers
green/white	green	indicator-signal switch right-side flashers
light-green	green	wiper switch wiper motor 'fast' speed
light-green/blue	green	indicator-signal switch right-side flasher repeater
light-green/brown	green	indicator flasher indicator switch
light-green/green	green	voltage stabiliser fuel gauge
light-green/purple	green	indicator flasher indicator repeater lamps
light-green/yellow	green	indicator switch left indicator repeater lamp
purple	purple	fusebox horns
purple/black	purple	horn switch horns

red	none	main lighting switch rear/parking lights panel lights dimmer map light switch
red/green	none	map light switch map light
red/white	none	panel lights dimmer panel lights
white	none	ignition switch ignition warning light fusebox tachometer (12v) via tachometer pick-up to coil SW fuel pump overdrive relay overdrive manual switch heated rear window fuse
white/black	none	coil CB distributor
white/red	none	ignition switch starter solenoid
yellow	none	overdrive manual switch overdrive relay overdrive vacuum switch
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive vacuum switch overdrive relay overdrive gearbox switch

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:


Headlights
Parking lights indicators
GT wiper motor
Dynamo
Starter
Distributor
Batteries
OD relay
OD solenoid
Starter solenoid
Radio
Roadster wiper motor
Control box
Instrument voltage stabiliser
HRW warning light
Instruments
Horn button
Dual gauge
Driving lamp
Indicator switch
Heater fan switch
Courtesy or map light
Cigar lighter
Heater fan
Fog lamp
Tank sender
Fuel pump
Rear lights
HRW
Number-plate lights
Reversing lights

1968 model year, UK

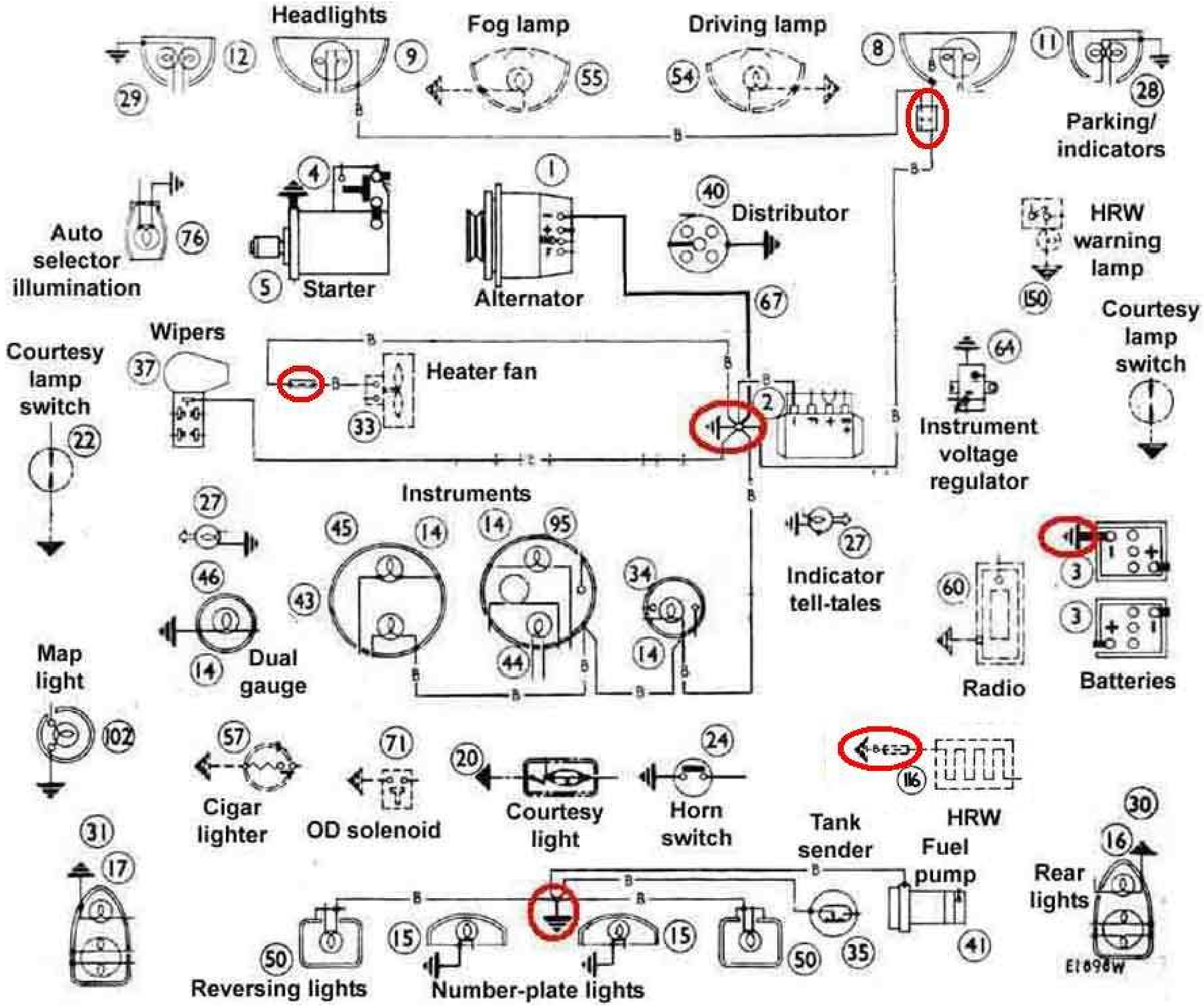
Earth wiring

Colour	Fuse	Components
black	none	earth
black/green	HRW in-line	HRW in-line fuse HRW switch
blue	none	main lighting switch dipswitch
blue/red	none	dipswitch headlamp dipped beams
blue/white	none	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown	none	solenoid ignition switch fusebox main lighting switch headlamp flasher switch alternator external regulator cigar lighter
brown/black	none	alternator external regulator ignition warning light
brown/green	none	alternator external regulator
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator external regulator
green	green	fusebox brake light switch indicator flasher heater fan switch tachometer (12v) wiper switch wiper motor voltage stabiliser reverse light switch
green/black 1	green	fuel gauge fuel tank sender
green/black 2	HRW in-line	HRW switch HRW HRW warning light
green/brown 1	green	heater fan switch heater fan
green/brown 2	green	reverse lights switch reverse lights
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers left-side flasher repeater
green/white	green	indicator-signal switch right-side flashers right-side flasher repeater
light-green	green	wiper switch wiper motor 'fast' speed
light-green/brown	green	indicator flasher indicator switch
light-green/green	green	voltage stabiliser fuel gauge

purple	purple	fusebox horns courtesy light
purple/black	purple	horn switch horns
purple/white	purple	door switches courtesy light
red 1	none	main lighting switch rear/parking lights in-line fuses (one for front, one for rear) panel lights dimmer map light switch
red 2	red 1	rear/parking lights in-line fuses (one for front, one for rear) rear/parking lights
red/green	none	map light switch map light
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch HRW in-line fuse
white 2	none	tachometer (signal 2) coil +ve
white/black	none	coil -ve distributor
white/red	none	ignition switch starter solenoid (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch (part way) overdrive gearbox switch

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:


Headlights
Fog lamp
Driving lamp
Parking/ indicators
Auto selector illumination
Starter
Alternator
Distributor
HRW warning lamp
Courtesy lamp switch
Wipers
Heater fan
Instrument voltage regulator
Courtesy lamp switch
Instruments
Indicator tell-tales
Dual gauge
Radio
Batteries
Map light
Cigar lighter
OD solenoid
Courtesy light
Horn switch
Tank sender
HRW
Fuel pump
Rear lights
Reversing lights
Number-plate lights
E1898W

1968 model year, North America

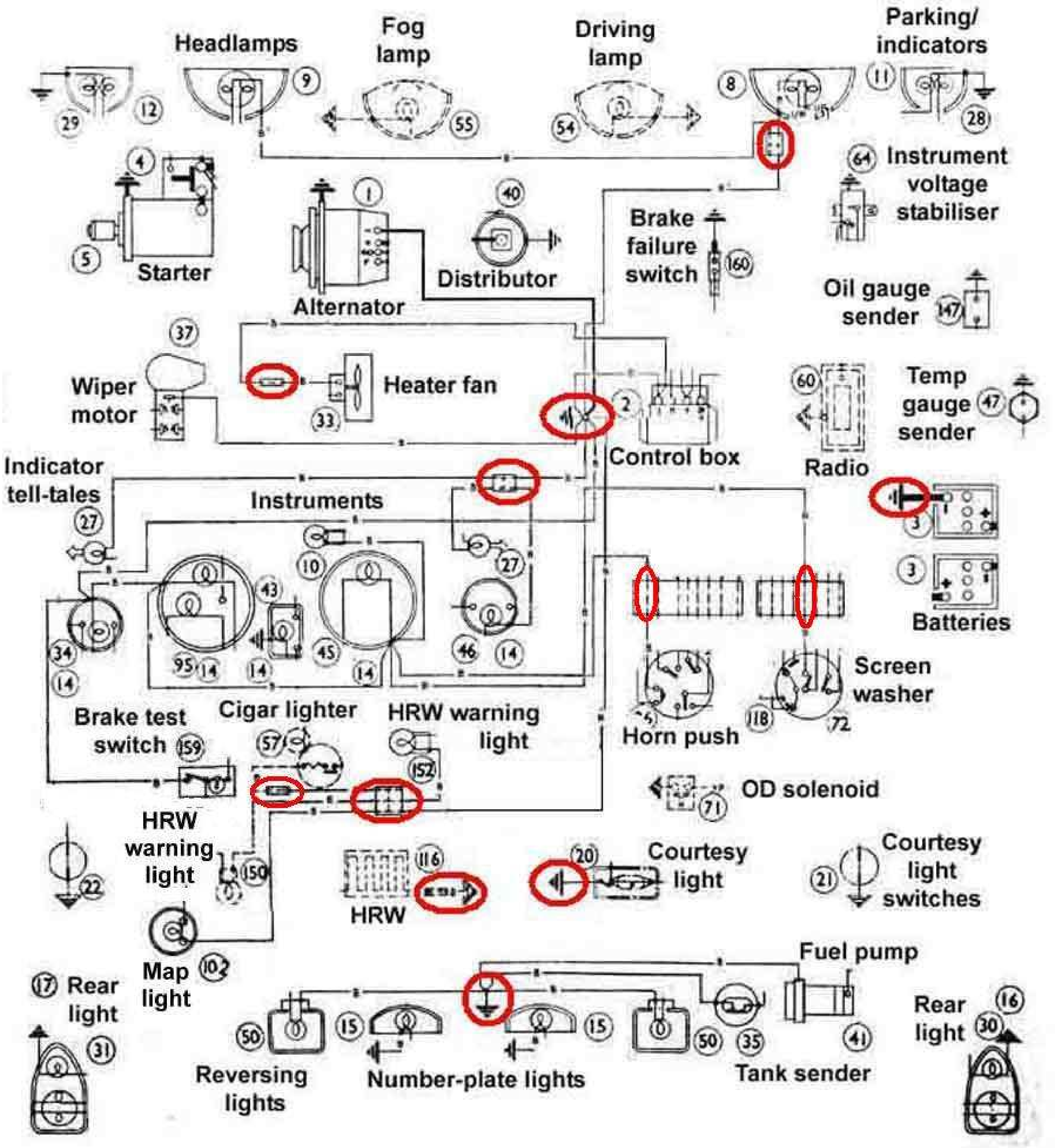
Earth wiring

Colour	Fuse	Components
black	none	earth
black/white	purple	brake pressure test switch and failure lamp brake pressure failure switch
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid ignition switch fusebox main lighting switch headlamp flasher switch cigar lighter dynamo control box
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/black	none	alternator external regulator ignition warning light
brown/green	none	alternator external regulator
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator external regulator
green 1	green	fusebox brake light switch heater fan switch wiper motor wiper switch voltage stabiliser tachometer (12v) reverse light switch hazard flasher switch screen washer motor brake light switch
green 2	green	hazard switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	indicator-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	indicator-signal switch hazard switch right-side flashers right-side flasher repeater

green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	indicator flasher indicator switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge oil pressure gauge
purple	purple	fusebox horns courtesy light cigar lighter brake pressure fail lamp headlamp flasher
purple/black	purple	horn switch horns
purple/white	purple	door switches courtesy light
red 1	none	main lighting switch rear/parking lights in-line fuses (one for front, one for rear) panel lights switch map light switch
red 2	red 1	rear/parking lights in-line fuses (one for front, one for rear) rear/parking lights
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	map light switch map light
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights switch panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch HRW in-line fuse
white 2	none	tachometer (signal 2) coil +ve
white/black 1	none	coil -ve distributor
white/black 2	HRW in-line	HRW in-line fuse HRW switch
white/black 3	HRW in-line	HRW switch HRW
white/brown	green	oil pressure transmitter oil pressure gauge
white/green	purple	purple connector cigar lighter
white/red	none	ignition switch starter solenoid (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. The remainder are picked up from the physical mounting of the component:



1969 model year, UK

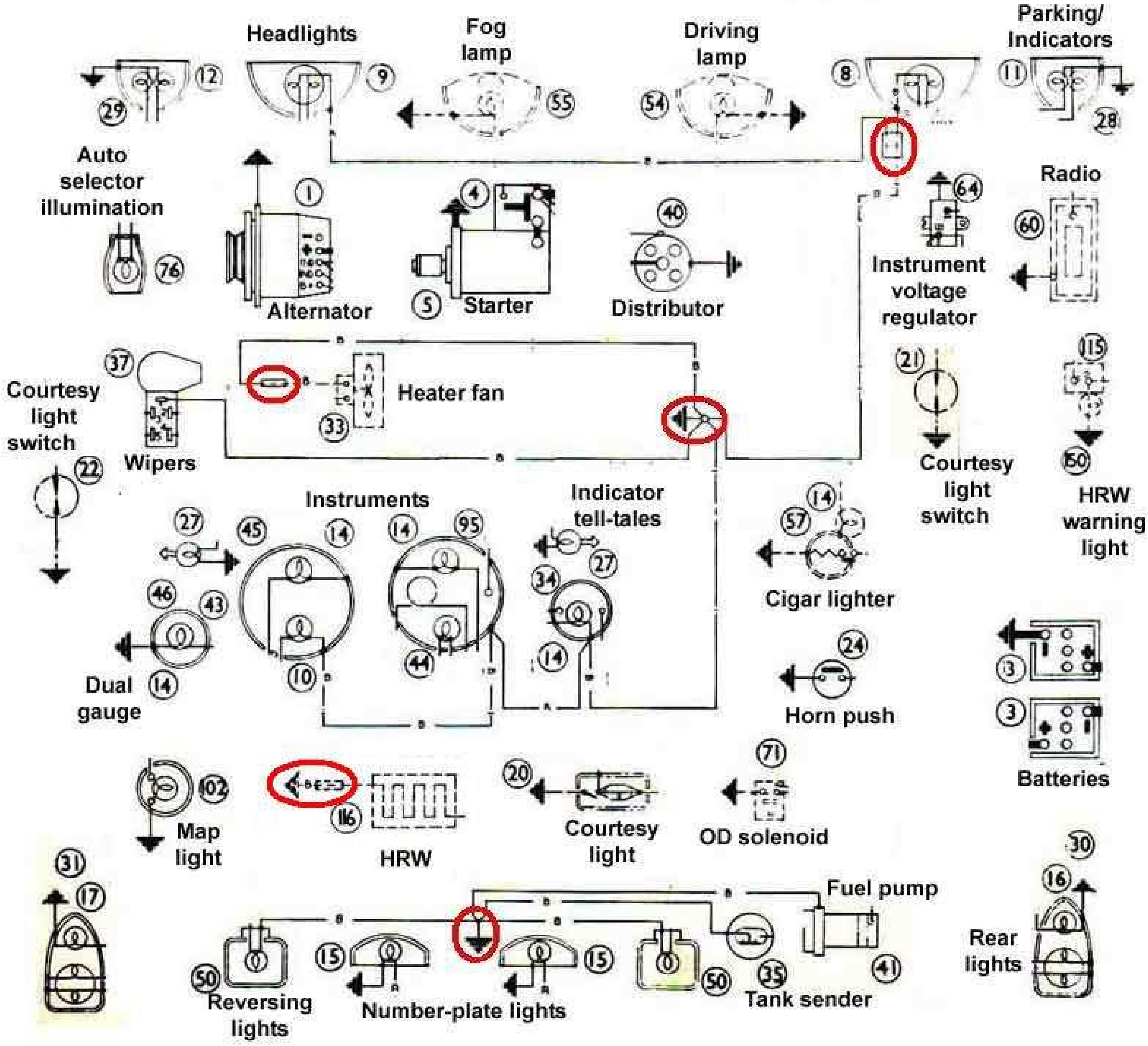
Earth wiring

Colour	Fuse	Components
black	none	earth
black/green	HRW in-line	HRW in-line fuse HRW switch
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown	none	solenoid ignition switch fusebox main lighting switch headlamp flasher switch alternator (2)
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green	green	fusebox brake light switch indicator flasher heater fan switch tachometer (12v) wiper motor wiper switch voltage stabiliser reverse light switch
green/black 1	green	fuel gauge fuel tank sender
green/black 2	HRW in-line	HRW switch HRW HRW warning light
green/brown 1	green	heater fan switch heater fan
green/brown 2	green	reverse lights switch reverse lights
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers left-side flasher repeater
green/white	green	indicator-signal switch right-side flashers right-side flasher repeater
light-green/brown	green	indicator flasher indicator switch
light-green/green	green	voltage stabiliser fuel gauge
purple	purple	fusebox horns courtesy light
purple/black	purple	horn switch horns

purple/white 1	purple	door switches courtesy light
red 1	none	main lighting switch rear/parking lights in-line fuses (one for front, one for rear) panel lights dimmer map light switch
red 2	red 1	rear/parking lights in-line fuses (one for front, one for rear) rear/parking lights
red/green	none	map light switch map light
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch HRW in-line fuse
white 2	none	tachometer (signal 2) coil +ve
white/black	none	coil -ve distributor
white/red	none	ignition switch starter solenoid (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:


Headlights
Fog lamp
Driving lamp
Parking/ Indicators
Auto selector illumination
Alternator
Starter
Distributor
Instrument voltage regulator
Radio
Courtesy light switch
Heater fan
Wipers
Courtesy light switch
HRW warning light
Instruments
Indicator tell-tales
Cigar lighter
Dual gauge
Horn push
Batteries
Map light
HRW
Courtesy light
OD solenoid
Fuel pump
Rear lights
Reversing lights
Number-plate lights
Tank sender

1969 model year, North America

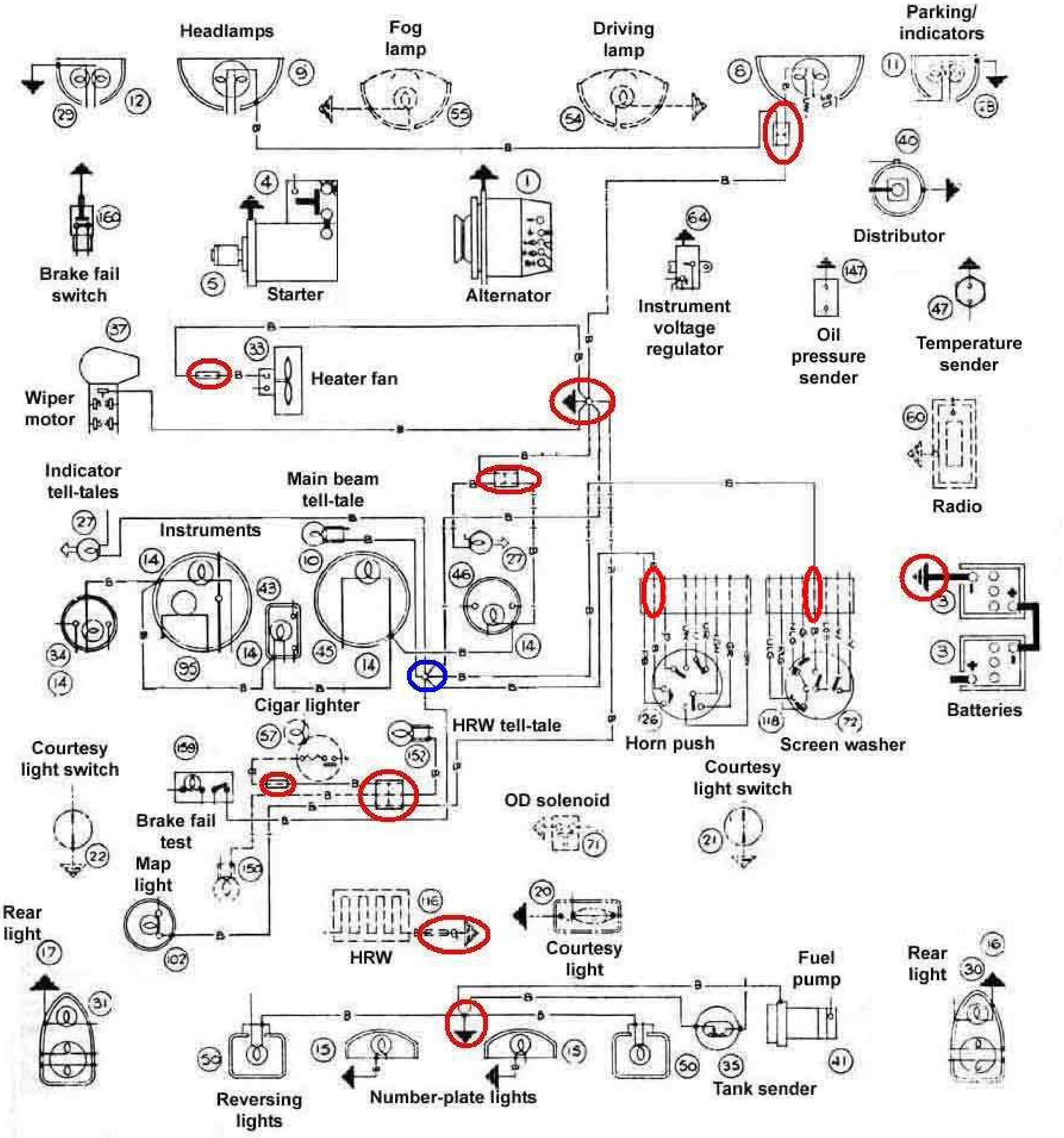
Earth wiring

Colour	Fuse	Components
black	none	earth
black/white 1	purple	brake pressure test switch brake pressure failure switch
black/white 2	purple	brake pressure failure switch brake pressure failure lamp
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid ignition switch fusebox main lighting switch alternator (2) hazards in-line fuse
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox brake light switch heater fan switch wiper motor wiper switch voltage stabiliser tachometer (12v) oil pressure gauge reverse light switch hazard flasher switch screen washer motor
green 2	green	hazard switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	indicator-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	indicator-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan

light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	indicator flasher indicator switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
light-green/purple	hazards in-line	hazard switch hazards warning light
purple	purple	fusebox horns courtesy light cigar lighter brake pressure fail lamp headlamp flasher
purple/black	purple	horn switch horns
purple/white 1	purple	door switches courtesy light
red 1	none	main lighting switch rear/parking lights in-line fuses (one for front, one for rear) panel lights switch map light switch
red 2	red 1	rear/parking lights in-line fuses (one for front, one for rear) rear/parking lights
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	map light switch map light
red/white	none	panel lights dimmer switch panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch HRW in-line fuse
white 2	none	tachometer (signal 2) coil +ve
white/black 1	none	coil -ve distributor
white/black 2	HRW in-line	HRW in-line fuse HRW switch
white/black 3	HRW in-line	HRW switch HRW
white/brown	green	oil pressure transmitter oil pressure gauge
white/green 1	purple	purple connector cigar lighter
white/red	none	ignition switch starter solenoid (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple 1	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. The remainder are picked up from the physical mounting of the component:


Headlamps
Fog lamp
Driving lamp
Parking/ indicators
Distributor
Brake fail switch
Starter
Alternator
Instrument voltage regulator
Oil pressure sender
Temperature sender
Wiper motor
Heater fan
Radio
Indicator tell-tales
Main beam tell-tale
Instruments
Batteries
Cigar lighter
HRW tell-tale
Horn push
Screen washer
Courtesy light switch
Brake fail test
OD solenoid
Courtesy light switch
Map light
Rear light
HRW
Courtesy light
Fuel pump
Rear light
Reversing lights
Number-plate lights
Tank sender

1970 model year, UK

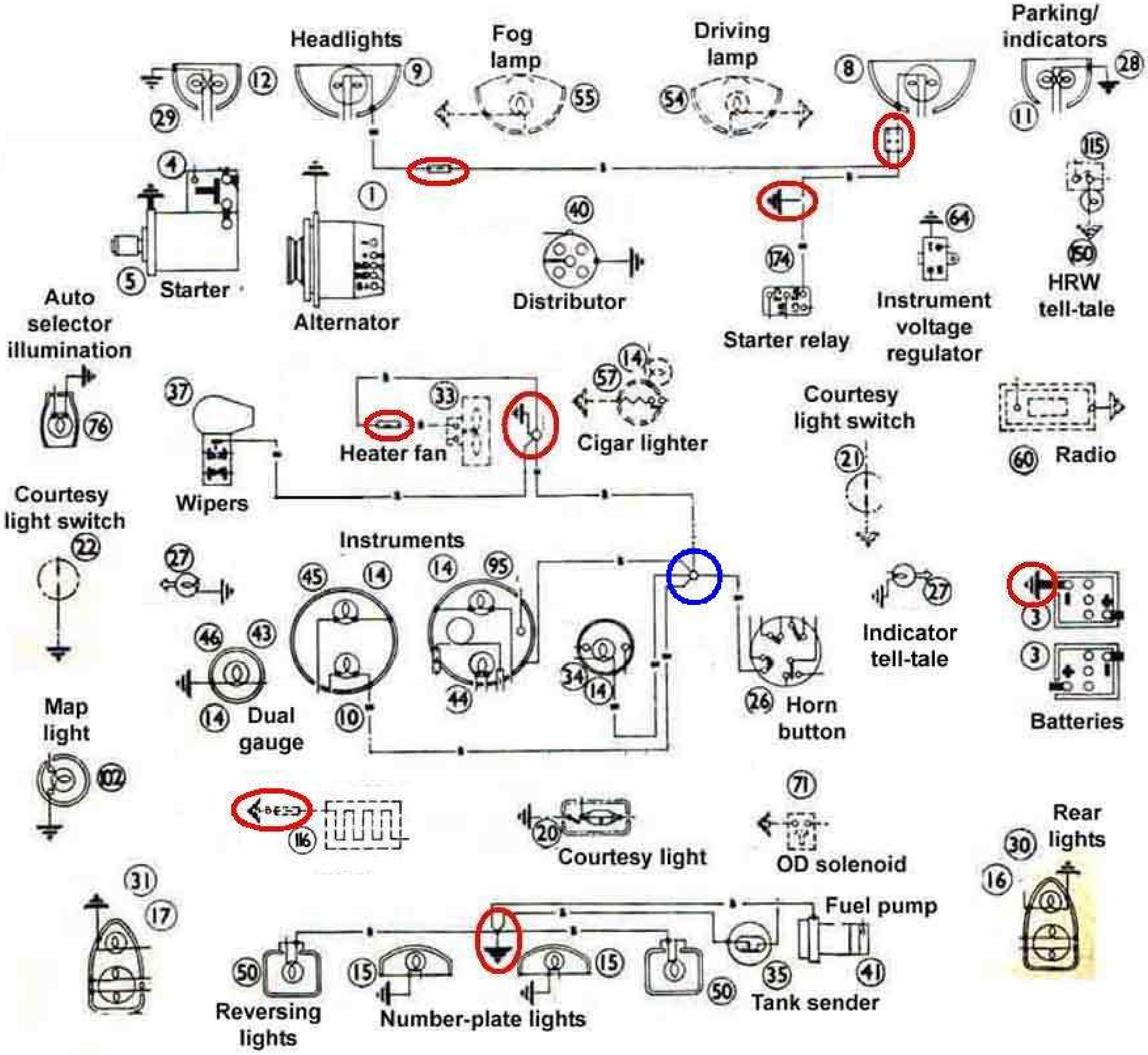
Earth wiring

Colour	Fuse	Components
black	none	earth
black/green	HRW in-line	HRW in-line fuse HRW switch
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown	none	solenoid ignition switch fusebox starter relay main lighting switch alternator (2)
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green	green	fusebox brake light switch indicator flasher heater fan switch wiper motor wiper switch voltage stabiliser tachometer (12v) indicator flasher reverse light switch
green/black 1	green	fuel gauge fuel tank sender
green/black 2	HRW in-line	HRW switch HRW HRW warning light
green/brown	green	reverse lights switch reverse lights
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers left-side flasher repeater
green/white	green	indicator-signal switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/brown	green	indicator flasher indicator switch
light-green/green	green	voltage stabiliser fuel gauge
purple	purple	fusebox horns headlamp flasher switch courtesy light

purple/black	purple	horn switch horns
purple/white	purple	door switches courtesy light
red	red	fusebox rear/parking lights (one fuse per side)
red/green	none	main lighting switch fusebox panel lights dimmer map light switch
red/light-green	green	wiper switch wiper motor 'normal' speed
red/purple	none	map light switch map light
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch heated rear window fuse
white 2	none	tachometer (signal 2) coil +ve
white/black	none	coil -ve distributor
white/brown	none	starter relay starter solenoid
white/red	none	ignition switch starter relay (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:


Headlights
Fog lamp
Driving lamp
Parking/ indicators
Starter
Alternator
Distributor
Starter relay
Instrument voltage regulator
HRW tell-tale
Auto selector illumination
Heater fan
Cigar lighter
Courtesy light switch
Radio
Wipers
Courtesy light switch
Instruments
Indicator tell-tale
Dual gauge
Horn button
Batteries
Map light
Courtesy light
OD solenoid
Rear lights
Fuel pump
Reversing lights
Number-plate lights
Tank sender

1970 model year, North America

Earth wiring

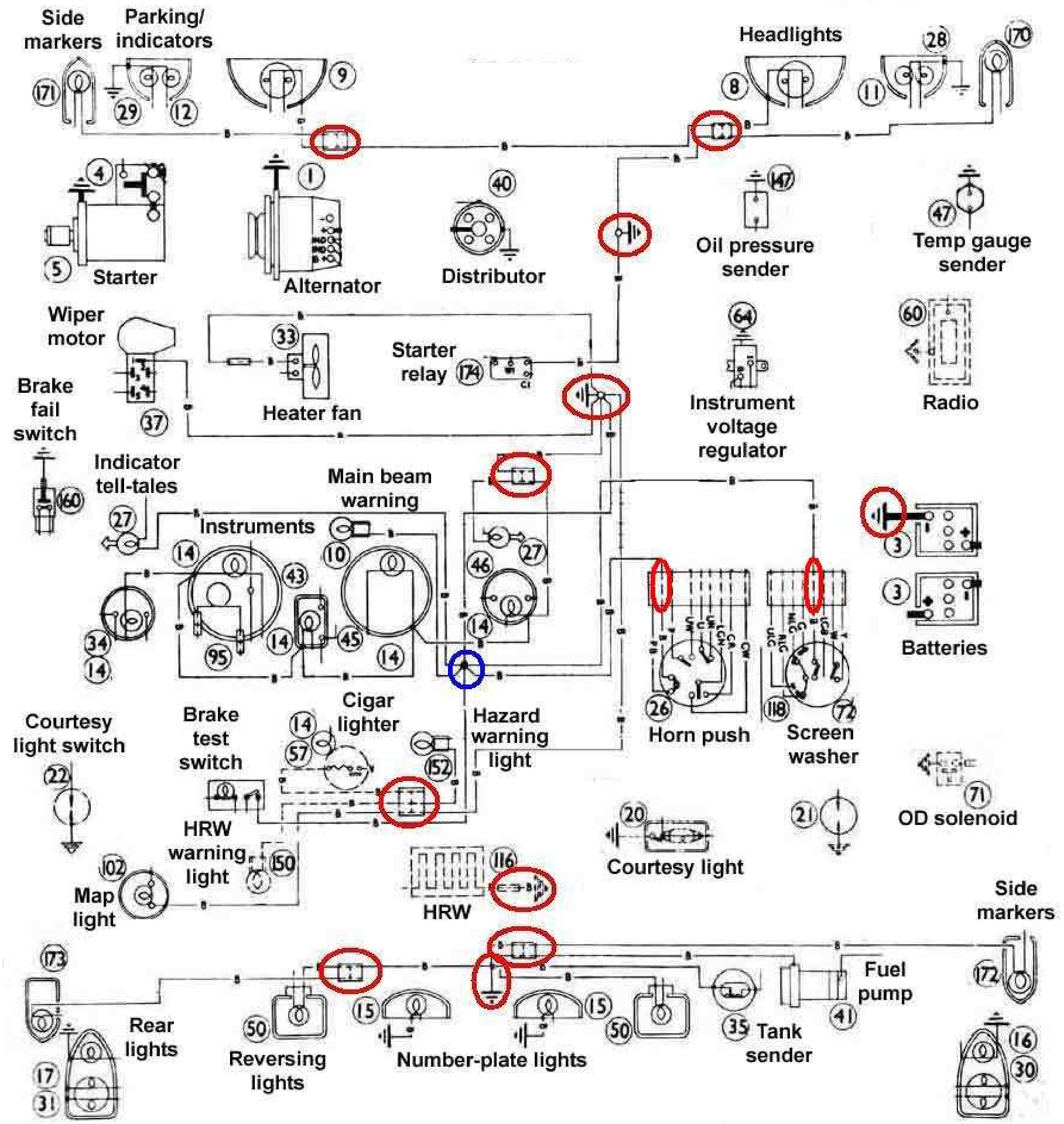
Colour	Fuse	Components
black	none	earth
black/white 1	purple	brake pressure test switch brake pressure failure switch
black/white 2	purple	brake pressure failure switch brake pressure failure lamp
blue	none	main lighting switch dipswitch side-marker lights
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator (2) hazards in-line fuse fusebox main lighting switch ignition switch starter relay
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox brake light switch heater fan switch wiper motor wiper switch oil pressure gauge tachometer (12v) voltage stabiliser reverse light switch hazard flasher switch screen washer motor
green 2	green	hazard switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	indicator-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	indicator-signal switch hazard switch right-side flashers right-side flasher repeater

green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	indicator flasher indicator switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
light-green/purple	hazards in-line	hazard switch hazards warning light
purple	purple	fusebox horns courtesy light cigar lighter connector brake pressure fail lamp headlamp flasher ignition key warning door switch
purple/black	purple	horn switch horns
purple/green	purple	ignition key buzzer door switch ignition key buzzer
purple/pink	purple	ignition switch ignition key buzzer
purple/white 1	purple	door switches courtesy light
red	red	fusebox rear/parking lights
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights switch map light switch
red/light-green	green	wiper switch wiper motor 'normal' speed
red/purple	none	map light switch map light
red/white	none	panel lights switch panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch heated rear window fuse
white 2	none	tachometer (signal 2) coil +ve
white/black 1	none	coil -ve distributor
white/black 2	HRW in-line	HRW in-line fuse HRW switch
white/black 3	HRW in-line	HRW switch HRW
white/brown 1	green	oil pressure transmitter oil pressure gauge
white/brown 2	none	starter relay starter solenoid
white/green 1	purple	purple connector cigar lighter
white/green 2	none	ignition switch accessories in-line fuse or connector
white/red	none	ignition switch starter relay (via park/neutral switch

		automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component:



1971 model year, UK

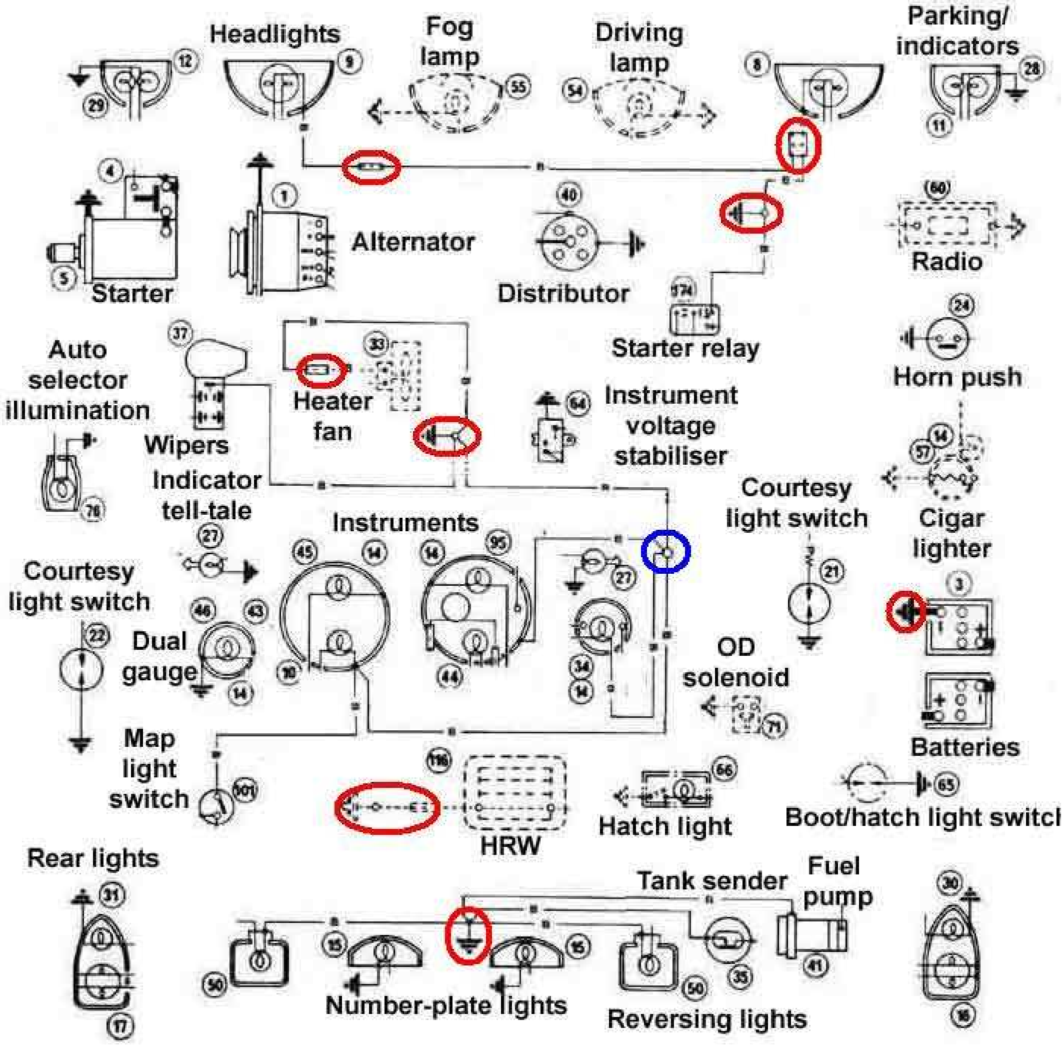
Earth wiring

Colour	Fuse	Components
black	none	earth
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown	none	solenoid ignition switch fusebox main lighting switch alternator (2) starter relay
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox brake light switch indicator flasher voltage stabiliser tachometer (12v) reverse light switch HRW switch
green/black 1	green	fuel gauge fuel tank sender
green/black 2	HRW in-line	HRW switch HRW HRW warning light
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line fuse	accessories in-line fuse wiper switch wiper motor heater fan switch cigar lighter
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers left-side flasher repeater
green/white	green	indicator-signal switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/brown	green	indicator flasher indicator switch
light-green/green	green	voltage stabiliser fuel gauge
purple	purple	fusebox horns map light courtesy light or map light

		headlamp flasher boot/loadspace light
purple/black	purple	horn switch horns
purple/white 1	purple	door switches courtesy light or map light
purple/white 2	purple	boot/loadspace switch boot/loadspace light
red 2	red 2	fusebox rear/parking lights (one fuse per side)
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch
white 2	none	tachometer (signal 2) coil +ve
white/black 1	none	coil -ve distributor
white/black 2	green	HRW switch HRW warning light HRW
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories in-line fuse or connector
white/red	none	ignition switch starter relay (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:


Headlights
Fog lamp
Driving lamp
Parking/ indicators
Alternator
Distributor
Radio
Starter
Starter relay
Auto selector illumination
Heater fan
Horn push
Instrument voltage stabiliser
Wipers
Indicator tell-tale
Courtesy light switch
Cigar lighter
Instruments
Courtesy light switch
Dual gauge
OD solenoid
Batteries
Map light switch
Hatch light
Boot/hatch light switcl
HRW
Rear lights
Tank sender
Fuel pump
Number-plate lights
Reversing lights

1971 model year, North America

Earth wiring

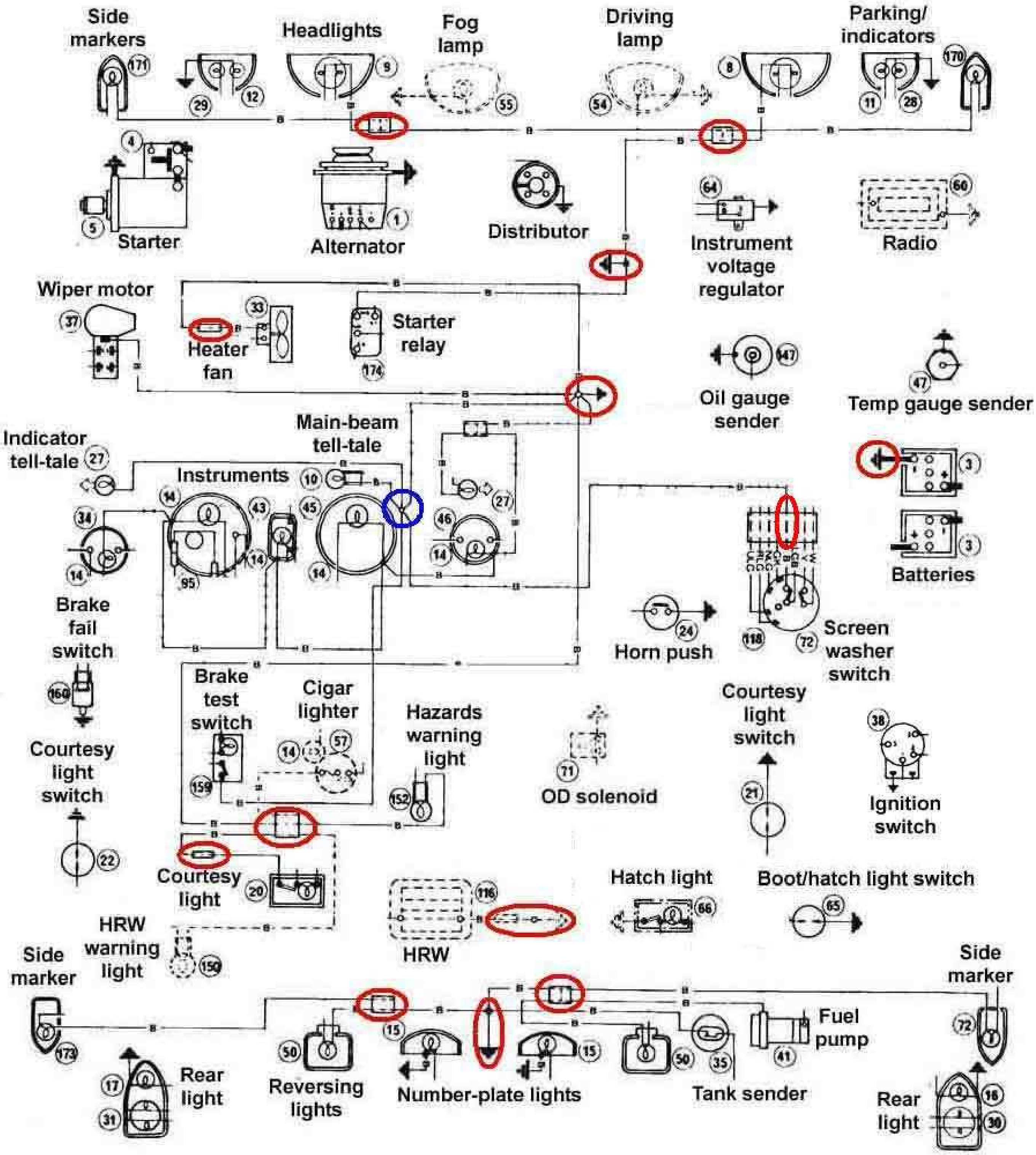
Colour	Fuse	Components
black	none	earth
black/white 1	purple	brake pressure test switch brake pressure failure switch
black/white 2	purple	brake pressure failure switch brake pressure failure lamp
blue	none	main lighting switch dipswitch side markers
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator (2) hazards in-line fuse fusebox ignition relay main lighting switch ignition switch starter relay
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox brake light switch heater fan wiper motor voltage stabiliser reverse light switch hazard flasher switch screen washer motor HRW switch oil pressure gauge tachometer (12v)
green 2	green	hazard switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line	accessories in-line fuse screen washer motor wiper motor heater fan switch wiper switch
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	indicator-signal switch hazard switch

		left-side flashers left-side flasher repeater
green/white	green or hazards in-line	indicator-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	indicator flasher indicator switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
light-green/purple	hazards in-line	hazards switch hazards warning light
purple	purple	fusebox horns courtesy light cigar lighter connector brake pressure fail lamp headlamp flasher boot/loadspace light ignition key warning door switch
purple/black	purple	horn switch horns
purple/green	purple	ignition key buzzer ignition key buzzer door switch
purple/pink	purple	ignition switch ignition key buzzer
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/loadspace switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch
white 2	none	tachometer (signal 2) coil +ve
white/black 1	none	coil -ve distributor
white/black 2	HRW in-line	HRW switch HRW
white/brown 1	green	oil pressure transmitter oil pressure gauge
white/brown 2	none	starter relay starter solenoid
white/green 1	purple	purple connector cigar lighter
white/green 2	none	ignition switch

		accessories in-line fuse
white/red 1	none	ignition switch starter relay (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component:



1972 model year, UK

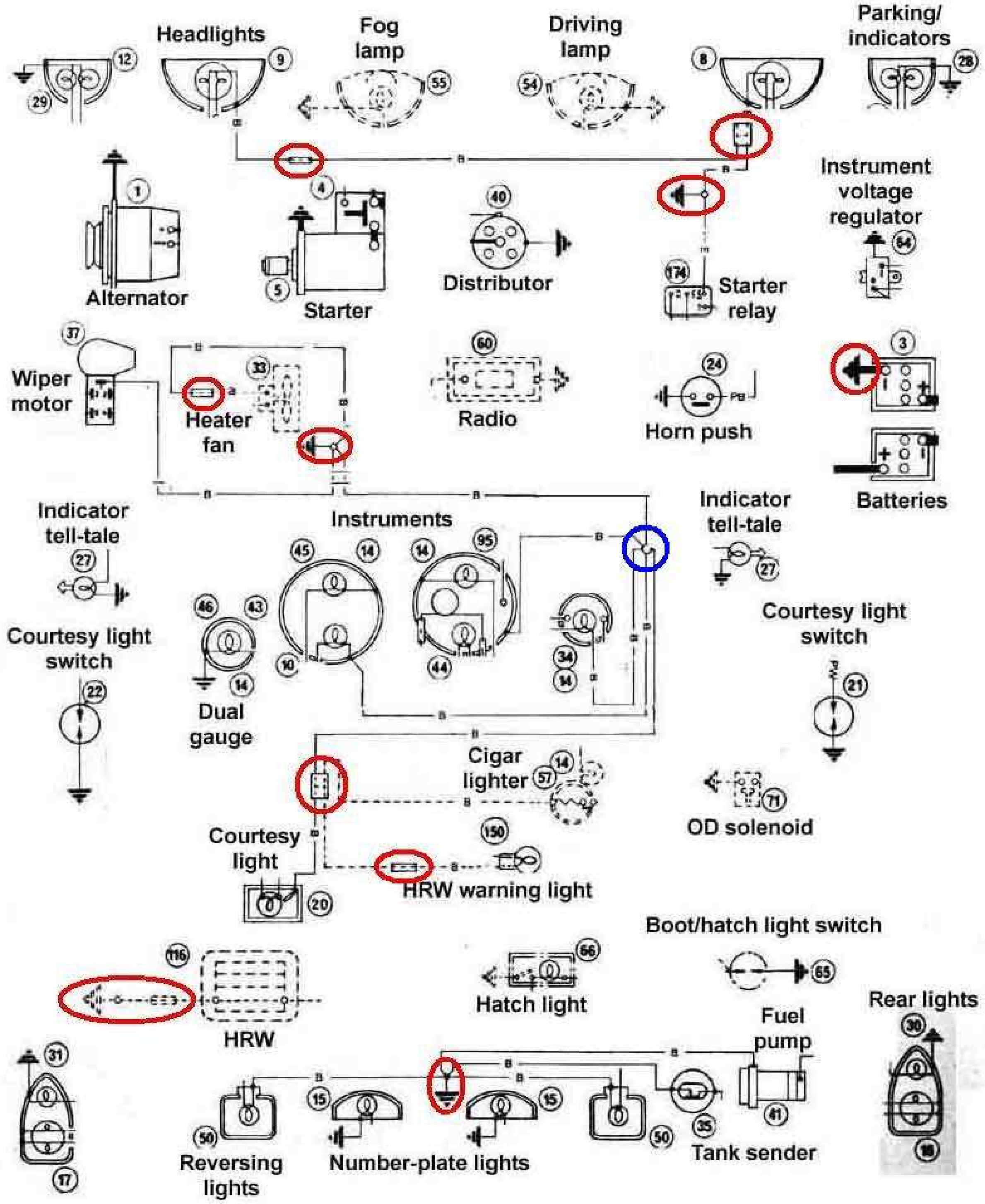
Earth wiring

Colour	Fuse	Components
black	none	earth
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown	none	solenoid ignition switch fusebox main lighting switch alternator starter relay
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green	green	fusebox voltage stabiliser tachometer 12v brake light switch reverse light switch indicator flasher HRW switch
green/black	green	fuel gauge fuel tank sender
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line fuse	accessories in-line fuse wiper switch wiper motor heater fan switch
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers left-side flasher repeater
green/white	green	indicator-signal switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/brown	green	indicator flasher indicator switch
light-green/green	green	voltage stabiliser fuel gauge
purple	purple	fusebox horns boot/loadspace light headlamp flasher courtesy light cigar lighter
purple/black	purple	horn switch horns

purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/loadspace switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch
white 2	none	tachometer (signal 2) coil +ve
white/black 1	none	coil -ve distributor
white/black 2	green	HRW switch HRW warning lamp HRW
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories in-line fuse or connector
white/red	none	ignition switch starter relay (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:


Headlights
Fog lamp
Driving lamp
Parking/ indicators
Alternator
Starter
Distributor
Instrument voltage regulator
Starter relay
Wiper motor
Heater fan
Radio
Horn push
Batteries
Indicator tell-tale
Instruments
Courtesy light switch
Dual gauge
Cigar lighter
OD solenoid
Courtesy light
HRW warning light
Boot/hatch light switch
HRW
Hatch light
Rear lights
Fuel pump
Reversing lights
Number-plate lights
Tank sender

1972 model year, North America, without seat-belt warning

Earth wiring

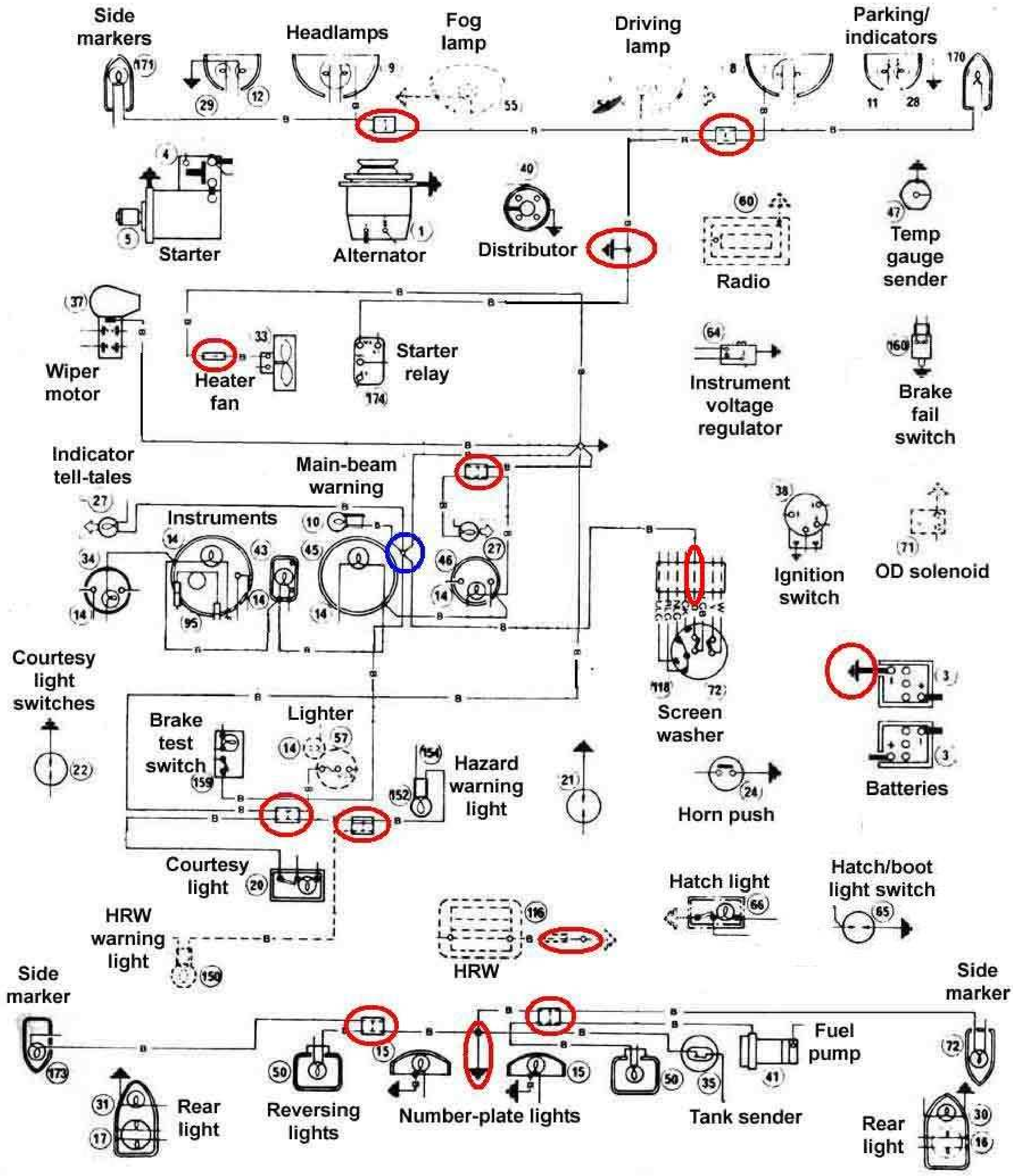
Colour	Fuse	Components
black	none	earth
black/white 1	purple	brake pressure test switch brake pressure failure switch
black/white 2	purple	brake pressure failure switch brake pressure failure lamp
blue	none	main lighting switch dipswitch side markers
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator hazards in-line fuse fusebox main lighting switch ignition switch starter relay
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox tachometer 12v voltage stabiliser brake light switch reverse light switch hazard flasher switch screen washer motor HRW switch
green 2	green	hazard switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line fuse	accessories in-line fuse wiper switch wiper motor screen washer pump heater fan switch
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	indicator-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	indicator-signal switch hazard switch

		right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	indicator flasher indicator switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
light-green/purple	hazards in-line	hazards switch hazards warning light
purple	purple	fusebox horns courtesy light cigar lighter brake pressure fail lamp headlamp flasher boot/loadspace light ignition key warning door switch
purple/black	purple	horn switch horns
purple/green	purple	ignition key buzzer ignition key buzzer door switch
purple/pink	purple	ignition switch ignition key buzzer
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/loadspace switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch
white 2	none	tachometer (signal 2) coil +ve
white/black 1	none	coil -ve distributor
white/black 2	green	HRW switch HRW
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories in-line fuse
white/red	none	ignition switch starter relay (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid

yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component:



1972 model year, North America, with seat-belt warning

Earth wiring

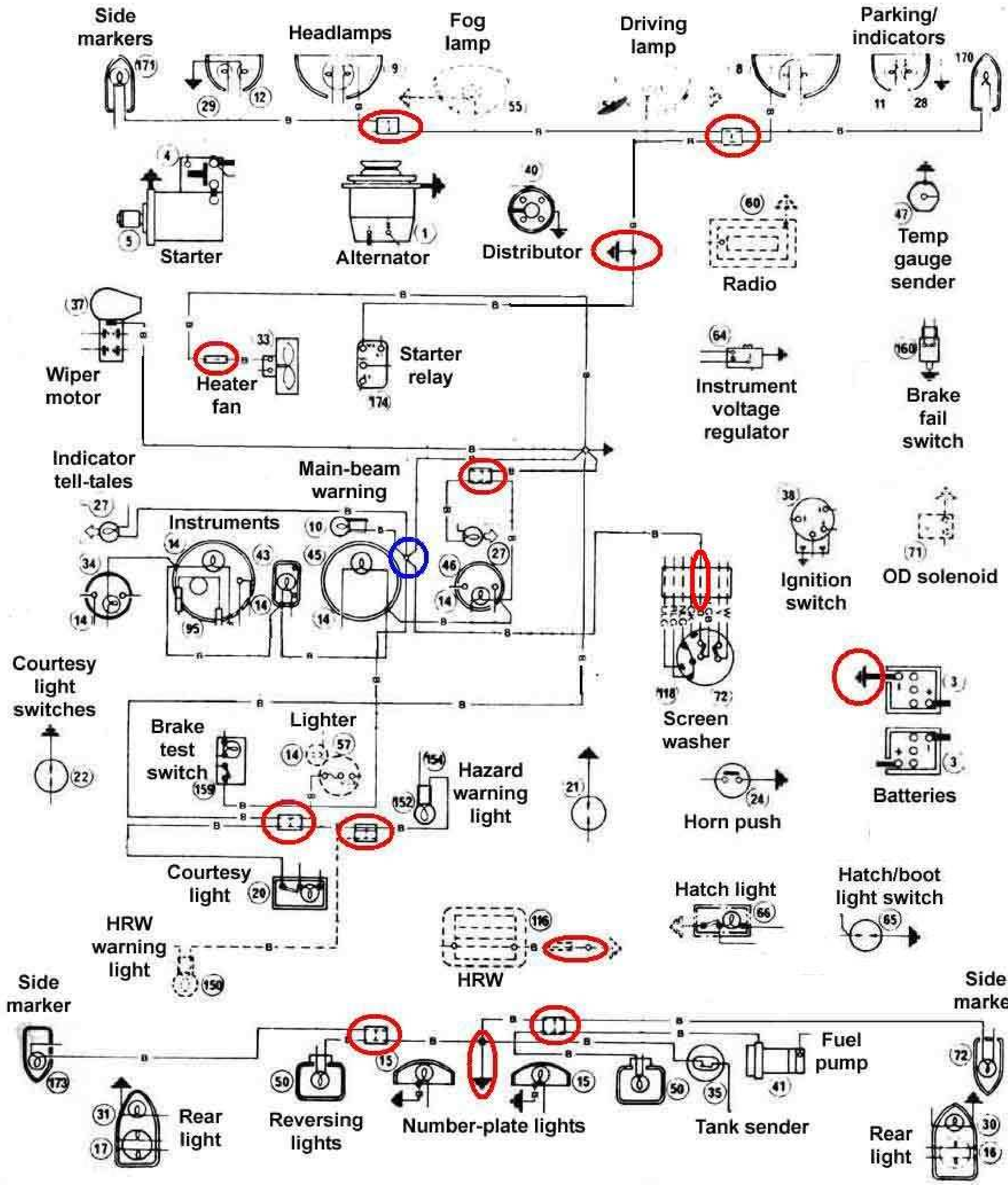
Colour	Fuse	Components
black	none	earth
black/white 1	purple	brake pressure test switch brake pressure failure switch
black/white 2	purple	brake pressure failure switch brake pressure failure lamp
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator hazards in-line fuse fusebox ignition relay main lighting switch ignition switch starter relay
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/red	green	passenger seat switch driver seat-belt buckle switch seat-belt diode seat-belt warning light
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox voltage stabiliser tachometer 12v brake light switch reverse light switch hazard flasher switch seat-belt gearbox switch HRW switch
green 2	green	hazard switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line fuse	accessories in-line fuse wiper switch wiper motor screen washer pump heater fan switch
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	indicator-signal switch hazard switch

		left-side flashers left-side flasher repeater
green/white	green or hazards in-line	indicator-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light- green/brown 1	green	indicator flasher indicator switch
light- green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
light- green/orange	green	passenger seat-belt buckle switch passenger seat switch
light-green/white	green	gearbox seat-belt warning switch seat-belt buckle switches
light- green/purple	hazards in-line	hazards switch hazards warning light
purple	purple	fusebox horns courtesy light cigar lighter brake pressure fail lamp headlamp flasher boot/loadspace light ignition key warning door switch
purple/black	purple	horn switch horns
purple/green	purple	ignition key buzzer ignition key buzzer door switch
purple/green	purple	ignition key buzzer ignition key buzzer door switch seat-belt diode
purple/pink	purple	ignition switch ignition key buzzer
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking/side marker lights (one fuse per side)
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition warning light fusebox tachometer (signal 1) fuel pump overdrive manual switch
white 2	none	tachometer (signal 2) coil +ve
white/black 1	none	coil -ve distributor
white/black	green	HRW switch HRW

white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories in-line fuse
white/red	none	ignition switch starter relay (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch
yellow/purple	none	overdrive gearbox switch overdrive solenoid

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component:


Side markers
Headlamps
Fog lamp
Driving lamp
Parking/ indicators
Starter
Alternator
Distributor
Radio
Temp gauge sender
Wiper motor
Heater fan
Starter relay
Instrument voltage regulator
Brake fail switch
Indicator tell-tales
Main-beam warning
Instruments
Ignition switch
OD solenoid
Courtesy light switches
Screen washer
Batteries
Brake test switch
Lighter
Hazard warning light
Horn push
Courtesy light
Hatch light
Hatch/boot light switch
HRW warning light
HRW
Side marker
Side marker
Fuel pump
Rear light
Reversing lights
Number-plate lights
Tank sender
Rear light

1973 model year, UK

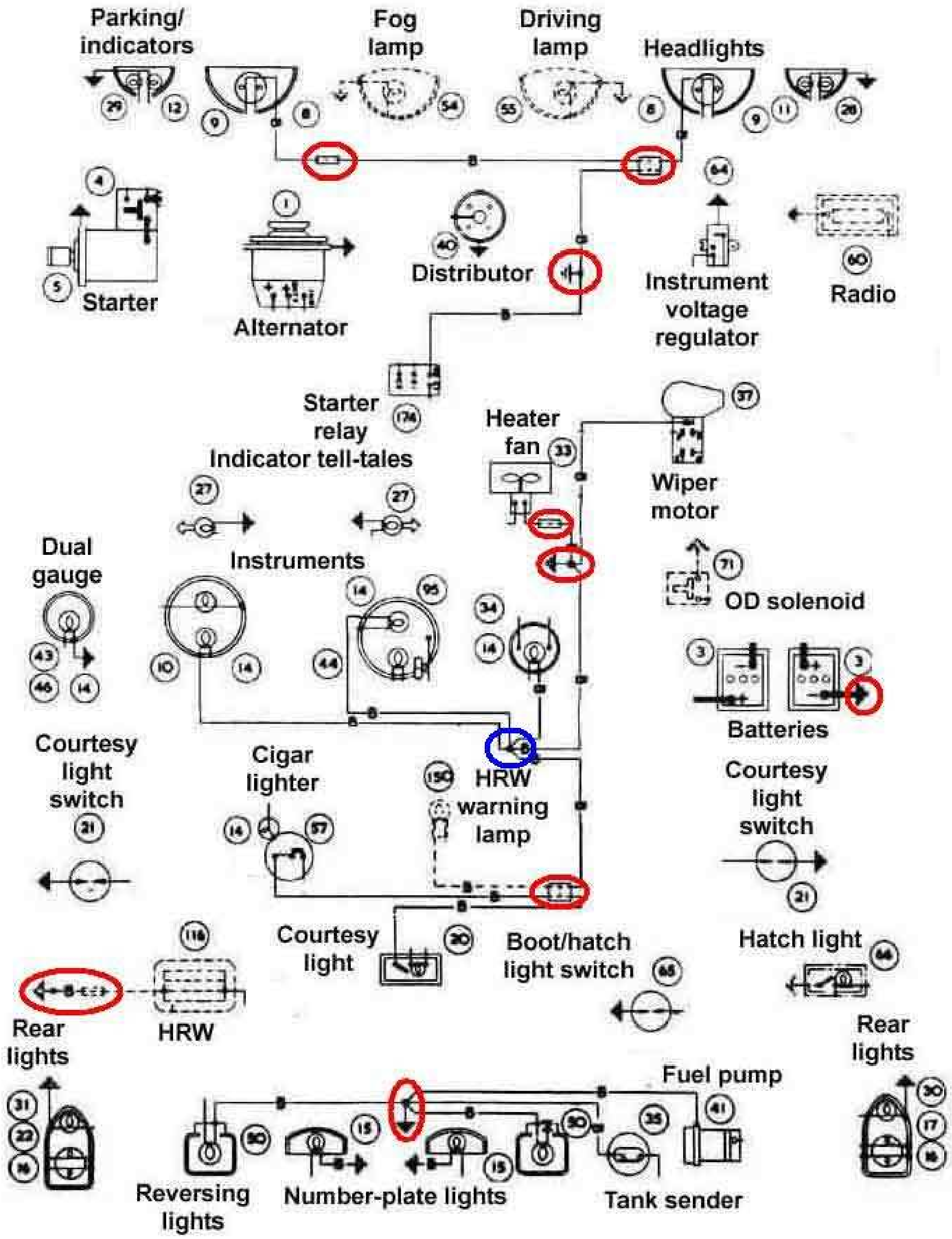
Earth wiring

Colour	Fuse	Components
black	none	earth
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown	none	solenoid (V8 toe-board stud) ignition switch fusebox main lighting switch alternator (2) starter relay
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green	green	fusebox voltage stabiliser tachometer 12v brake light switch reverse light switch indicator flasher HRW switch
green/black	green	fuel gauge fuel tank sender
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line fuse	accessories in-line fuse wiper switch wiper motor heater fan switch
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers left-side flasher repeater
green/white	green	indicator-signal switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/brown 1	green	indicator flasher indicator switch
light-green/green	green	voltage stabiliser fuel gauge
purple	purple	fusebox horns boot/loadspace light headlamp flasher courtesy light cigar lighter
purple/black	purple	horn switch horns

purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white	none	ignition switch ignition warning light fusebox coil +ve fuel pump overdrive manual switch
white/black 1	none	coil -ve distributor tachometer (signal)
white/black 2	green	HRW switch HRW
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories in-line fuse
white/red	none	ignition switch starter relay (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:


Parking/ indicators
Fog lamp
Driving lamp
Headlights
Starter
Alternator
Distributor
Instrument voltage regulator
Radio
Starter relay
Heater fan
Wiper motor
Indicator tell-tales
Dual gauge
Instruments
OD solenoid
Batteries
Courtesy light switch
Cigar lighter
HRW warning lamp
Courtesy light switch
Courtesy light
Boot/hatch light switch
Hatch light
Rear lights
HRW
Rear lights
Fuel pump
Reversing lights
Number-plate lights
Tank sender

1973 model year, North America

Earth wiring

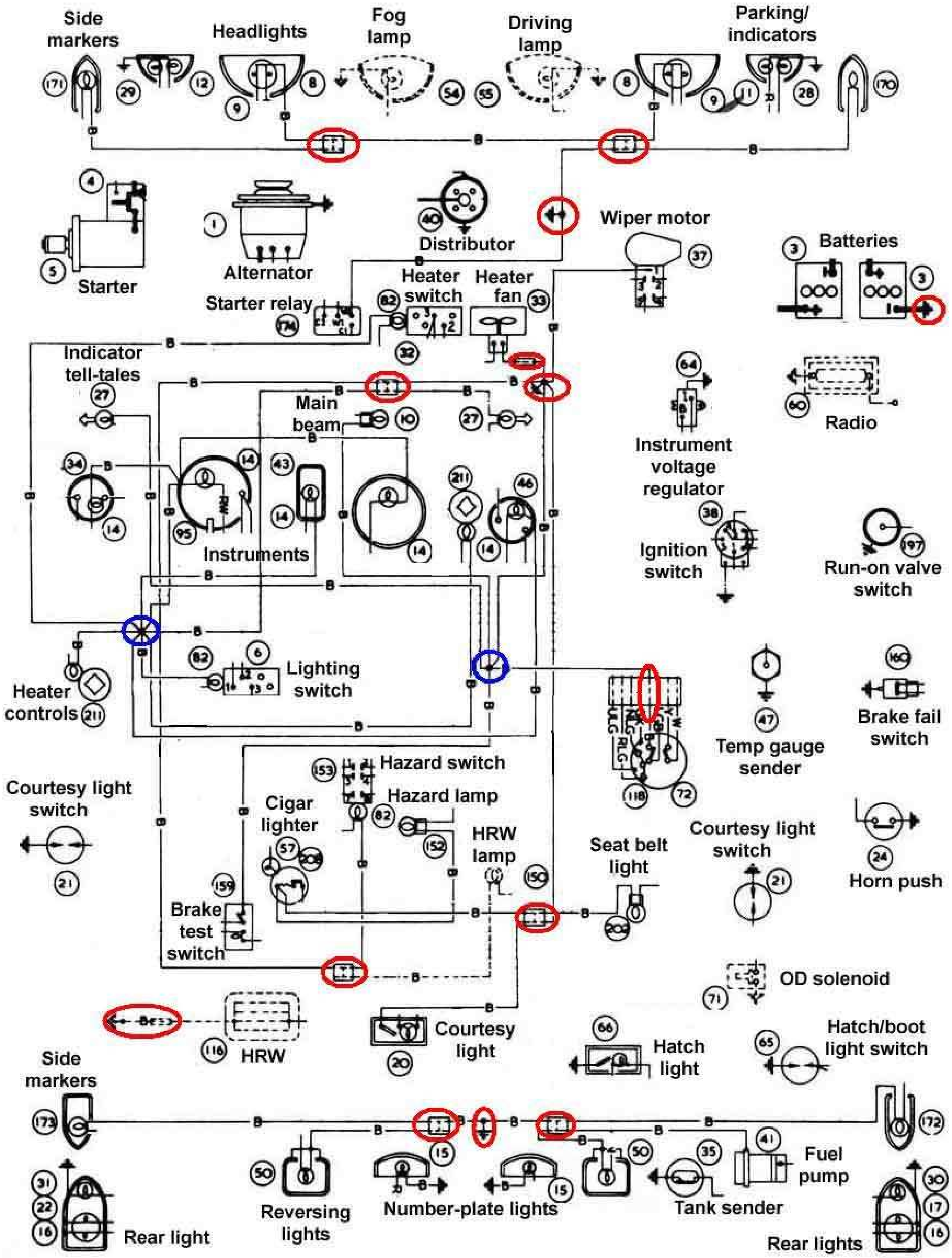
Colour	Fuse	Components
black	none	earth
black/white 1	purple	brake pressure test switch brake pressure failure switch
black/white 2	purple	brake pressure failure switch brake pressure failure lamp
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator (2) hazards in-line fuse fusebox ignition relay main lighting switch ignition switch (2) starter relay
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/red	green	passenger seat switch driver seat-belt buckle switch seat-belt diode seat-belt warning light
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox tachometer 12v voltage stabiliser brake light switch reverse light switch hazard flasher switch gearbox seat-belt switch HRW switch
green 2	green	hazard switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line fuse	accessories in-line fuse wiper switch wiper motor screen washer pump heater fan switch
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	indicator-signal switch hazard switch

		left-side flashers left-side flasher repeater
green/white	green or hazards in-line	indicator-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	indicator flasher indicator switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
light-green/orange	green	passenger seat-belt buckle switch passenger seat switch
light-green/purple	hazards in-line	hazards switch hazards warning light
light-green/white	green	gearbox seat-belt warning switch seat-belt buckle switches
purple	purple	fusebox horns courtesy light cigar lighter brake pressure fail lamp headlamp flasher boot/loadspace light ignition key warning door switch
purple/black	purple	horn switch horns
purple/green	purple	ignition key buzzer ignition key buzzer door switch seat-belt diode
purple/pink	purple	ignition switch ignition key buzzer
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking/side marker lights (one fuse per side)
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
slate	none	ignition switch anti-runon valve in-line fuse
slate/purple	anti-runon valve in-line fuse	anti-runon valve in-line fuse anti-runon valve
slate/yellow	anti-runon valve in-line fuse	anti-runon valve oil pressure switch
white	none	ignition switch ignition warning light fusebox coil +ve fuel pump overdrive manual switch
white/black 1	none	coil -ve distributor

		tachometer (signal)
white/black 2	green	HRW switch HRW
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories in-line fuse
white/red	none	ignition switch starter relay (via park/neutral switch automatics only)
yellow	none	overdrive manual switch overdrive gearbox switch
yellow/purple	none	overdrive gearbox switch overdrive solenoid

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There are also two sealed junctions circled in blue, these rarely give problems. The remainder are picked up from the physical mounting of the component:


Side markers
Headlights
Fog lamp
Driving lamp
Parking/ indicators
Starter
Alternator
Distributor
Wiper motor
Batteries
Starter relay
Heater switch
Heater fan
Indicator tell-tales
Main beam
Instruments
Instrument voltage regulator
Radio
Ignition switch
Run-on valve switch
Heater controls
Lighting switch
Temp gauge sender
Brake fail switch
Hazard switch
Hazard lamp
Courtesy light switch
Cigar lighter
HRW lamp
Seat belt light
Courtesy light switch
Horn push
Brake test switch
OD solenoid
HRW
Courtesy light
Hatch light
Hatch/boot light switch
Side markers
Fuel pump
Reversing lights
Number-plate lights
Tank sender
Rear light
Rear lights

1974 model year (chrome bumper), UK

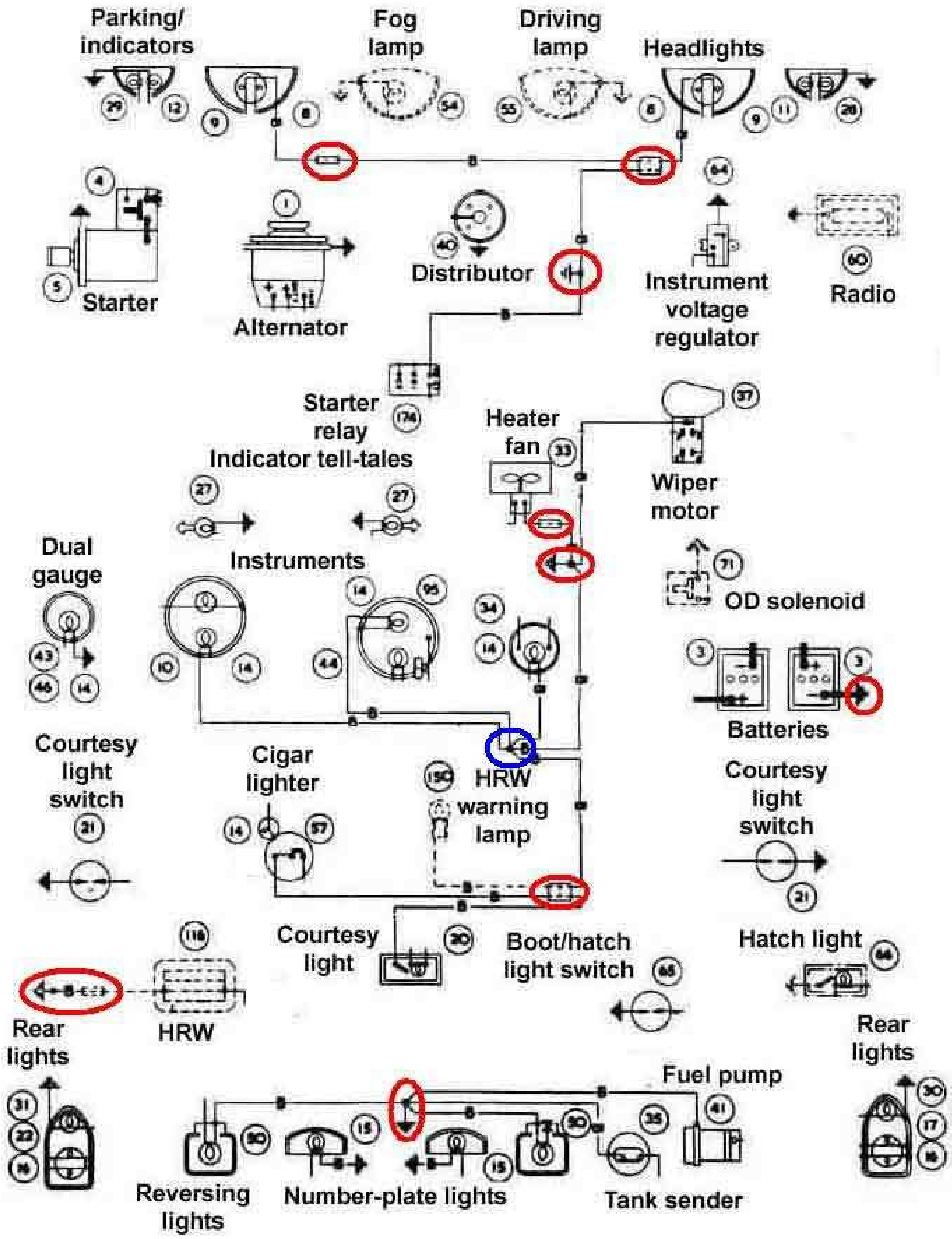
Earth wiring

Colour	Fuse	Components
black	none	earth
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid ignition switch fusebox main lighting switch alternator (2) starter relay hazards in-line fuse
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox voltage stabiliser tachometer 12v brake light switch reverse light switch
green 2	green	hazards switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line fuse	accessories in-line fuse wiper switch wiper motor heater fan switch
green/purple	green	brake light switch brake lights
green/red	green	indicator-signal switch left-side flashers left-side flasher repeater
green/white	green	indicator-signal switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/brown 1	green	indicator flasher indicator switch
light-green/brown 1	green	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge
purple	purple	fusebox horns boot/loadspace light headlamp flasher

		courtesy light cigar lighter
purple/black	purple	horn switch horns
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white	none	ignition switch ignition warning light fusebox coil +ve fuel pump overdrive manual switch
white/black 1	none	coil -ve distributor tachometer (signal)
white/black 2	green	HRW switch HRW
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories in-line fuse
white/red	none	ignition switch starter relay
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component. Note the dual gauge is shown with a local earth instead of a wired earth as for the other instruments, this is probably an error:



Parking/ indicators
Fog lamp
Driving lamp
Headlights
Starter
Alternator
Distributor
Instrument voltage regulator
Radio
Starter relay
Heater fan
Wiper motor
Indicator tell-tales
Dual gauge
Instruments
OD solenoid
Batteries
Courtesy light switch
Cigar lighter
HRW warning lamp
Courtesy light switch
Courtesy light
Boot/hatch light switch
Hatch light
HRW
Rear lights
Rear lights
Fuel pump
Reversing lights
Number-plate lights
Tank sender

1974 model year (chrome bumper), North America

Earth wiring

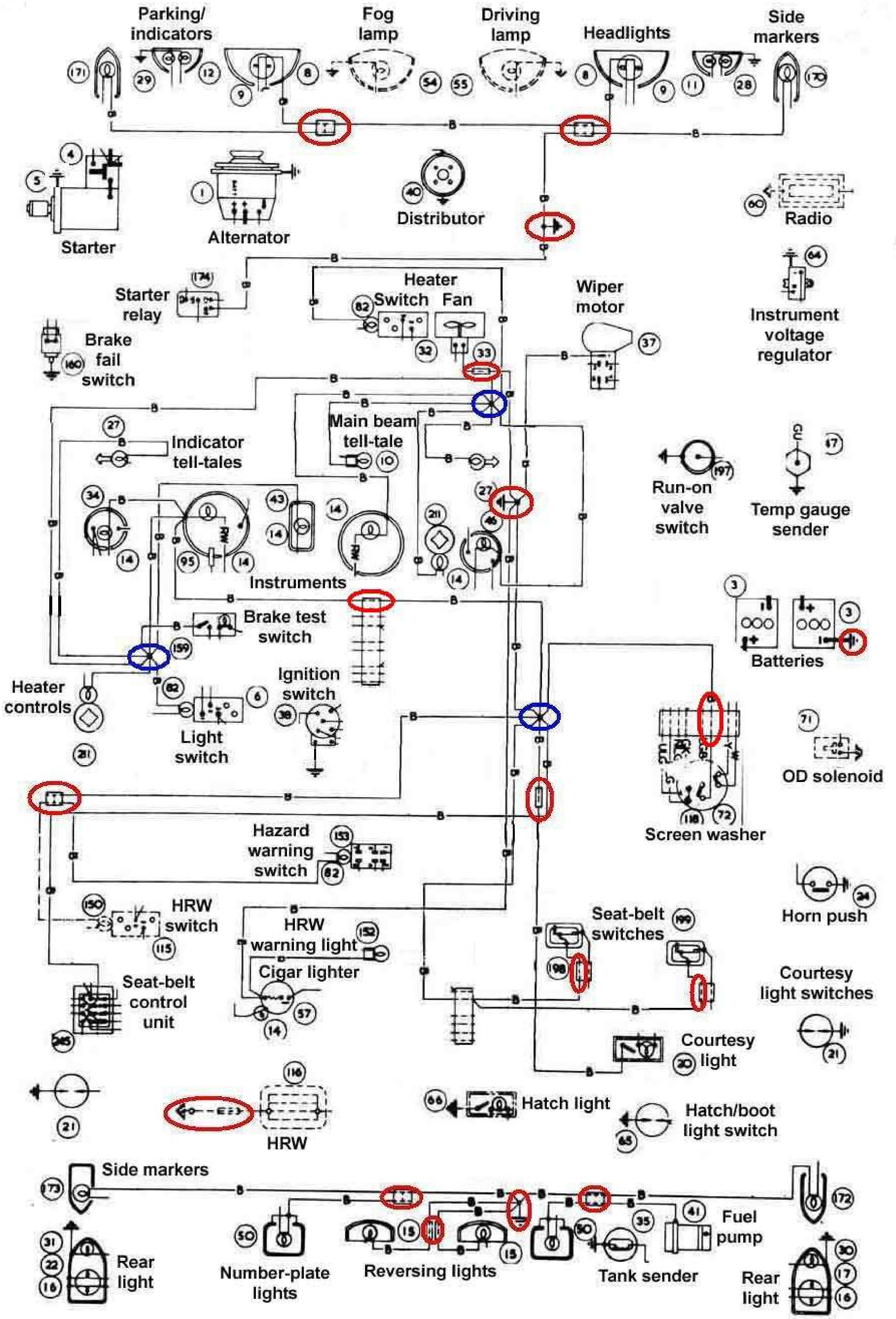
Colour	Fuse	Components
black	none	earth
black/white 1	purple	brake pressure test switch brake pressure failure switch
black/white 2	purple	brake pressure failure switch brake pressure failure lamp
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator (2) hazards in-line fuse fusebox main lighting switch ignition switch starter relay sequential seat-belt system in-line fuse
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/purple	sequential seat-belt system in-line fuse	ignition key buzzer seat switches sequential seat-belt unit seat-belt warning light
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox voltage stabiliser tachometer 12v brake light switch reverse light switch hazard flasher switch sequential seat-belt unit screen washer motor HRW switch gearbox seat-belt switch
green 2	green	hazard switch indicator flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line fuse	accessories in-line fuse wiper switch wiper motor screen washer pump heater fan switch
green/purple	green	brake light switch brake lights

green/red	green or hazards in-line	indicator-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	indicator-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	indicator flasher indicator switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
light-green/purple	hazards in-line	hazards switch hazards warning light
purple	purple	fusebox horns courtesy light cigar lighter brake pressure fail lamp headlamp flasher boot/loadspace light
purple/black	purple	horn switch horns
purple/green	purple	ignition key buzzer door switch ignition key buzzer sequential seat-belt unit
purple/pink	purple	ignition switch ignition key buzzer door switch
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking/side marker lights (one fuse per side)
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
slate	none	ignition switch anti-runon valve in-line fuse
slate/purple	anti-runon valve in-line fuse	anti-runon valve in-line fuse anti-runon valve
slate/yellow	anti-runon valve in-line fuse	anti-runon valve oil pressure switch
white 1	none	ignition switch ignition warning light fusebox coil +ve fuel pump overdrive manual switch
white/black 1	none	coil -ve distributor tachometer (signal)
white/black 2	green	HRW switch HRW warning lamp HRW

white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories in-line fuse
white/red	none	ignition switch sequential seat-belt unit
yellow	none	overdrive manual switch overdrive gearbox switch
yellow/blue	green	sequential seat-belt unit drivers seat switch
yellow/brown	green	sequential seat-belt unit drivers seat-belt buckle switch
yellow/green	green	sequential seat-belt unit passenger seat switch
yellow/orange	green	sequential seat-belt unit gearbox seat-belt warning switch
yellow/pink	green	sequential seat-belt unit starter relay
yellow/purple	green	sequential seat-belt unit seat-belt warning light
yellow/white	green	sequential seat-belt unit passenger seat-belt buckle switch

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There are also three sealed junctions circled in blue, these rarely give problems. The remainder are picked up from the physical mounting of the component:


Parking/ indicators
Fog lamp
Driving lamp
Headlights
Side markers
Starter
Alternator
Distributor
Radio
Starter relay
Heater Switch Fan
Wiper motor
Instrument voltage regulator
Brake fail switch
Main beam tell-tale
Indicator tell-tales
Run-on valve switch
Temp gauge sender
Instruments
Brake test switch
Batteries
Heater controls
Ignition switch
Light switch
OD solenoid
Screen washer
Hazard warning switch
Horn push
HRW switch
HRW warning light
Seat-belt switches
Cigar lighter
Seat-belt control unit
Courtesy light switches
Courtesy light
HRW
Hatch light
Hatch/boot light switch
Side markers
Rear light
Number-plate lights
Reversing lights
Tank sender
Fuel pump
Rear light

1974 1/2 (rubber bumper) - 1976 model years, UK

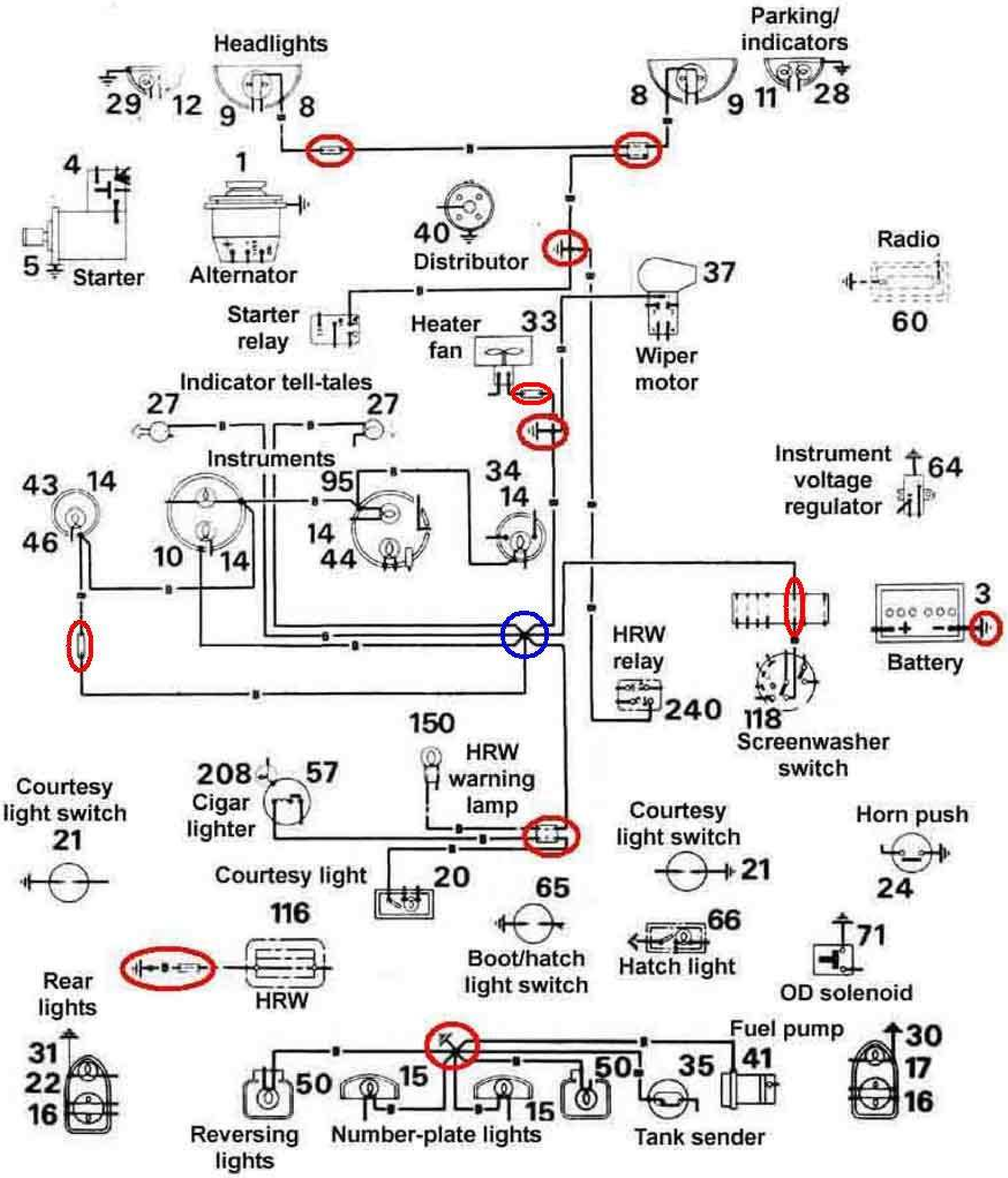
Earth wiring

Colour	Fuse	Components
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid ignition switch fusebox main lighting switch alternator (2) starter relay hazards in-line fuse
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox wiper switch wiper motor HRW switch hazards switch voltage stabiliser tachometer 12v heater fan switch screen washer pump brake lights switch reverse lights switch
green 2	green	hazards switch turn flasher
green 3	green	HRW switch HRW relay
green/black	green	fuel gauge fuel tank sender
green/brown	green	reverse lights switch reverse lights
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	turn-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	turn-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	turn flasher turn switch

light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge
purple	purple	fusebox HRW relay horns boot/loadspace light headlamp flasher courtesy light cigar lighter
purple/black	purple	horn switch horns
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white	none	ignition switch ignition warning light fusebox coil ballast resistor fuel pump overdrive manual switch
white/black 1	none	coil -ve distributor tachometer (signal)
white/black 2	purple	HRW relay HRW
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories connector
white/light-green	none	coil ballast resistor coil +ve starter solenoid
white/red 1	none	ignition switch starter relay
yellow	none	overdrive manual switch overdrive gearbox switch (part-way)
yellow/purple	none	overdrive gearbox switch overdrive solenoid
yellow/red	none	overdrive manual switch overdrive gearbox switch (part-way)

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the engine earth not shown. There is also a sealed junction circled in blue, this rarely gives problems. The remainder are picked up from the physical mounting of the component:



Notes:

1. Rubber bumper cars have the parking lights inside the headlamp unit and share that wired earth.
2. The indicators are in the rubber bumper and have a wired earth going to the headlamp bullet connectors.
3. The tank sender does not have a wired earth, it relies on its physical mounting to the tank and the tank to the body, so exuberant painting may prevent that working.

1974 1/2 (rubber bumper) - 1976 model years, North America

Earth wiring

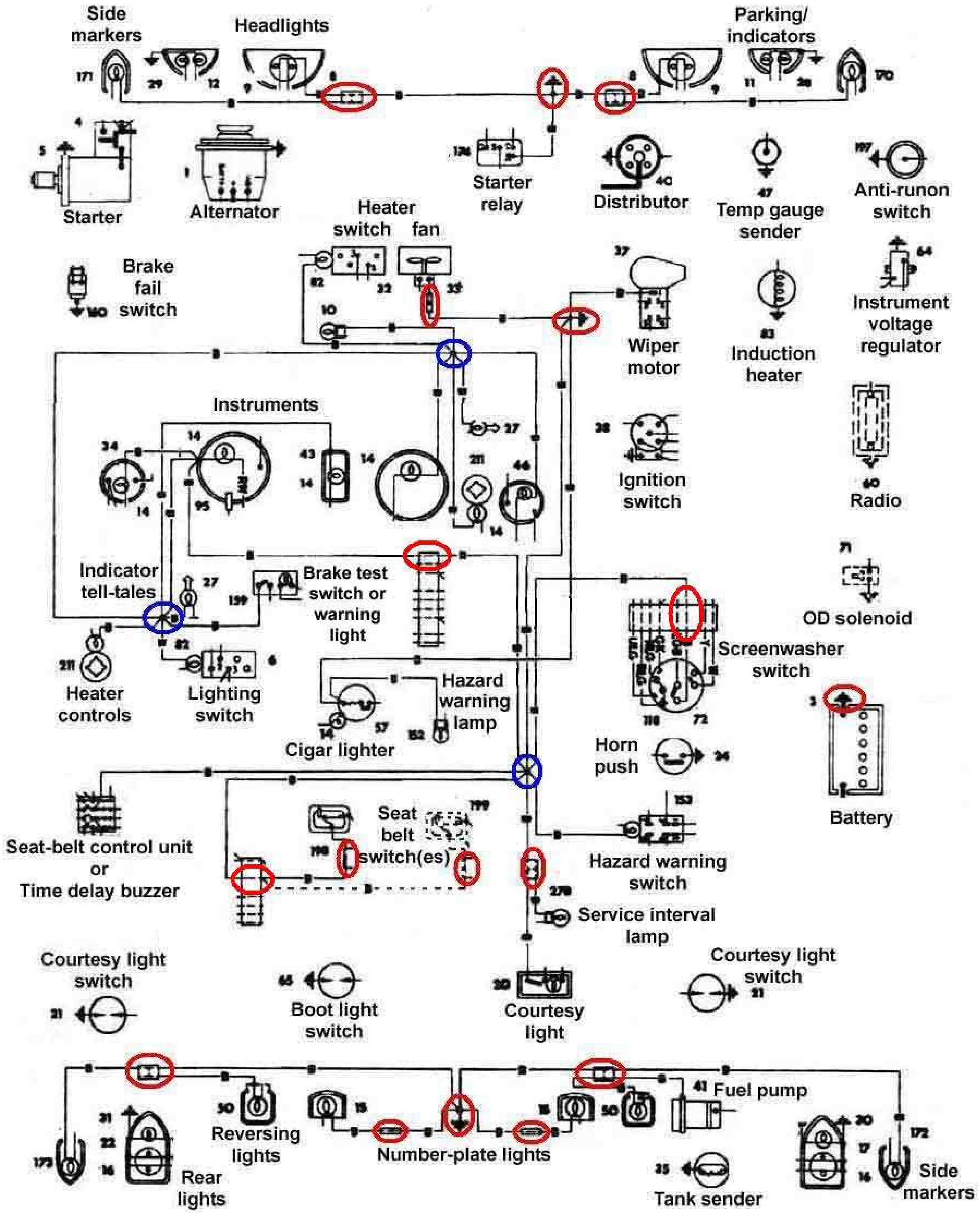
Colour	Fuse	Components
black 2	none	45DM4 distributor 45DM4 distributor amplifier
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator (2) hazards in-line fuse fusebox main lighting switch ignition switch starter relay
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox reverse lamp switch screen washer pump stop lamp switch brake pressure failure switch induction manifold heater wiper motor service interval counter wiper motor switch voltage stabiliser hazards switch tachometer 12v heater fan switch handbrake switch seat-belt warning lamp HRW switch
green 2	green	hazard switch turn flasher
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown	green	reverse lights switch reverse lights
green/orange	green	brake pressure failure switch brake diode handbrake switch handbrake warning light
green/pink	none or green	service interval diode service interval counter service interval warning lamp
green/purple	green	brake light switch brake lights

green/red	green or hazards in-line	turn-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	turn-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan motor
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	turn flasher turn switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
purple	purple	fusebox horns boot/loadspace light cigar lighter headlamp flasher time-delay unit courtesy light
purple/black	purple	horn switch horns
purple/green	purple	ignition key buzzer door switch time-delay unit
purple/pink	purple	ignition switch ignition key buzzer door switch
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/loadspace switch boot light
red	red	fusebox rear/parking/side marker lights (one fuse per side)
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
slate	none	ignition switch anti-runon valve in-line fuse
slate/purple	anti-runon valve in-line fuse	anti-runon valve in-line fuse anti-runon valve
slate/yellow	anti-runon valve in-line fuse	anti-runon valve oil pressure switch
white 1	none	ignition switch ignition warning light fusebox 45DE4 distributor resistor 45DE4 distributor coil ballast resistor inertia cut-off switch overdrive manual switch
white 2	none	inertia cut-off switch fuel pump overdrive manual switch
white/black 1	none	coil -ve distributor tachometer (signal)
white/black 2	green	HRW switch HRW warning lamp

		HRW
white/blue	none	45DE4 distributor resistor 45DE4 distributor
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories connector
white/light-green	none	coil ballast resistor coil +ve starter solenoid
white/red	none	ignition switch starter relay brake diode service interval diode time delay unit
yellow	none	overdrive manual switch overdrive gearbox switch
yellow/brown	purple	drivers seat-belt buckle switch time delay unit
yellow/purple 1	none	overdrive gearbox switch overdrive solenoid
yellow/purple 2	purple	time delay unit seat-belt warning light
yellow/red	none	45DM4 distributor 45DM4 distributor amplifier

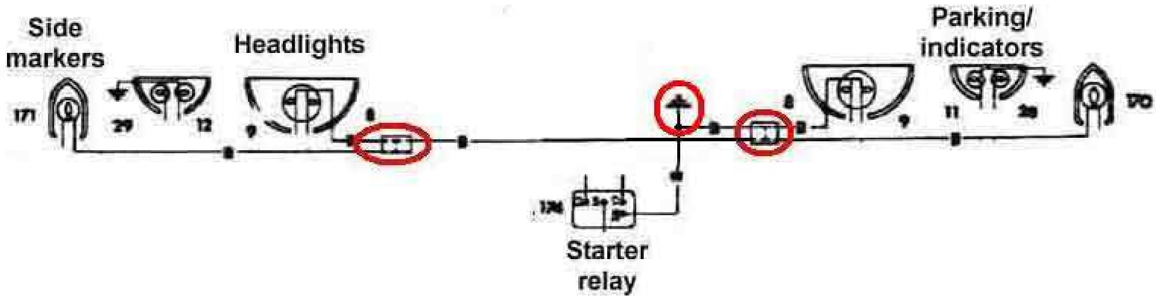
Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the gearbox earth not shown. There are also three sealed junctions circled in blue, these rarely give problems. The remainder are picked up from the physical mounting of the component:



Notes:

1. Front parking/indicator light units in rubber bumpers have a wired earth going back to the headlamp bullet connector and are not as shown in the diagrams.
2. From February 1975 the complex sequential seat-belt system was replaced by a simple time-delay buzzer system with the only detector being on the driver's seat-belt.
3. In 1976 the combined brake fail warning and test switch was replaced by a simple 'BRAKE' warning light, with a switch on the handbrake and a circuit from the starter relay acting as a test facility.
4. The front lamp earth wiring was changed:


Side
markers
Headlights
Parking/
indicators
Starter
relay
171
29
12
9
8
11
170

1977 model year, UK

Earth wiring

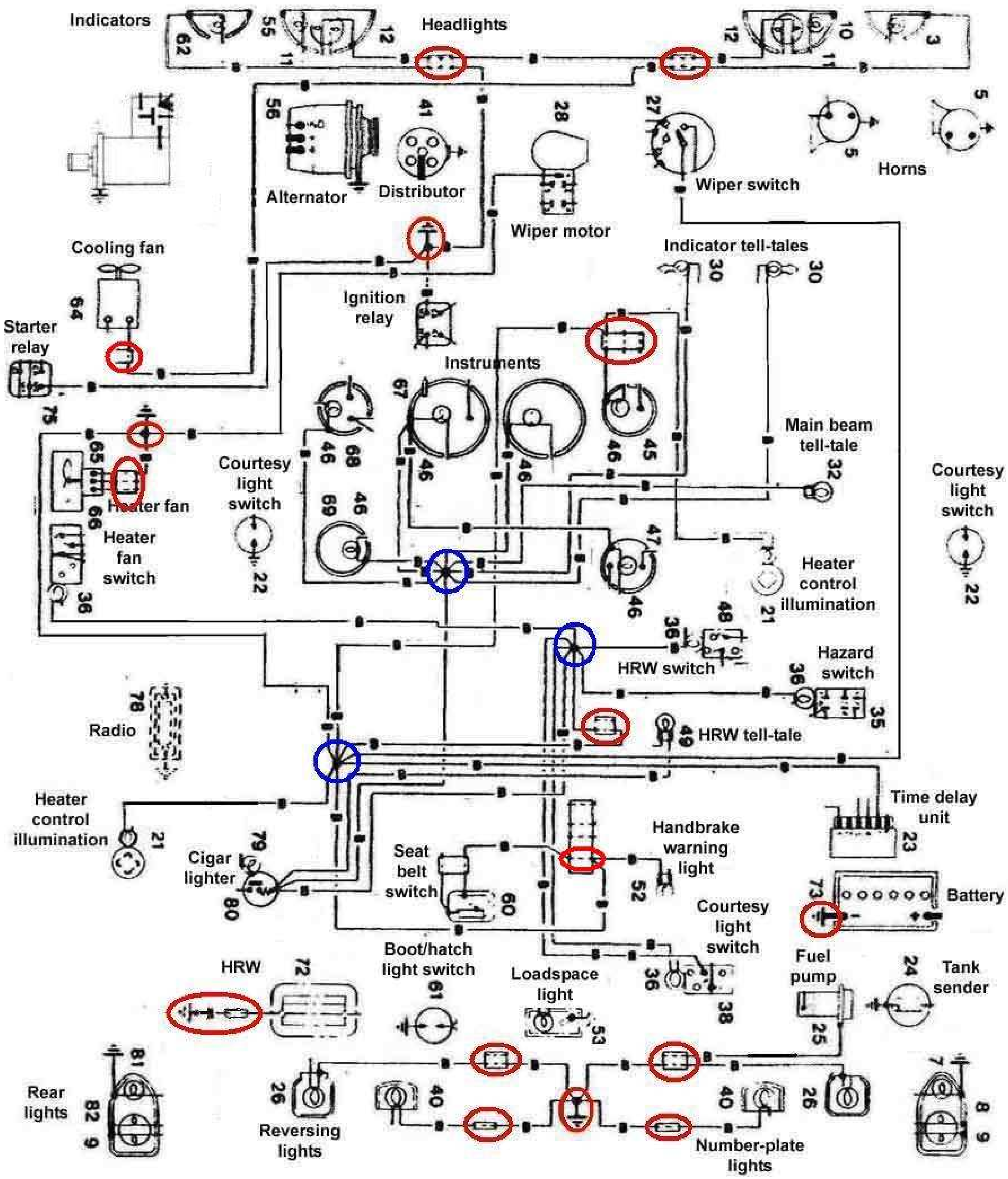
Colour	Fuse	Components
black/green	cooling fan in-line	cooling fan switch cooling fan
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator (2) fusebox ignition relay main lighting switch ignition switch starter relay hazards in-line fuse
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox handbrake switch seat-belt warning light voltage stabiliser wiper motor wiper switch hazards switch heater fan switch tachometer 12v HRW switch screen washer motor
green 2	green	hazard switch turn flasher
green 3	cooling fan in-line	cooling fan in-line fuse cooling fan switch
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp gauge sender temp gauge
green/brown 1	green	reverse lights switch reverse lights
green/brown 2	green	heater fan switch heater fan fast speed
green/orange	green	handbrake switch handbrake warning light handbrake diode
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	turn-signal switch hazard switch left-side flashers left-side flasher repeater

green/white	green or hazards in-line	turn-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan slow speed
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	turn flasher turn switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
purple	purple	fusebox horns boot/loadspace light headlamp flasher courtesy light cigar lighter clock time delay unit
purple/black	purple	horn switch horns
purple/white 1	purple	door switches courtesy light manual switch courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition relay
white 2	none	ignition relay (part way) fuel pump
white 3	none	ignition relay (part way) ignition warning lamp
white/black 1	none	coil -ve distributor tachometer (signal)
white/black 2	green	HRW switch HRW warning lamp HRW
white/brown 1	none	starter relay starter solenoid
white/brown 2	none	ignition relay fusebox cooling fan in-line fuse coil ballast resistor fuel pump (part way) overdrive manual switch ignition warning light (part way)
white/green	none	ignition switch accessories connector
white/light-green	none	coil ballast resistor coil +ve starter solenoid
white/red	none	ignition switch starter relay

		time delay unit handbrake diode
yellow	none	overdrive manual switch overdrive gearbox switch
yellow/brown	green	drivers seat-belt buckle switch time delay unit
yellow/purple 1	none	overdrive gearbox switch overdrive solenoid
yellow/purple 2	green	time delay unit seat-belt warning light

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the gearbox earth not shown. There are also three sealed junctions circled in blue, these rarely give problems. The remainder are picked up from the physical mounting of the component:


Indicators
Headlights
Alternator
Distributor
Wiper motor
Wiper switch
Horns
Cooling fan
Starter relay
Ignition relay
Indicator tell-tales
Instruments
Main beam tell-tale
Courtesy light switch
Heater fan
Heater fan switch
Courtesy light switch
Heater control illumination
HRW switch
Hazard switch
HRW tell-tale
Radio
Time delay unit
Heater control illumination
Cigar lighter
Seat belt switch
Handbrake warning light
Battery
Courtesy light switch
Boot/hatch light switch
Loadspace light
Fuel pump
Tank sender
HRW
Rear lights
Reversing lights
Number-plate lights

1977 model year on, North America

Earth wiring

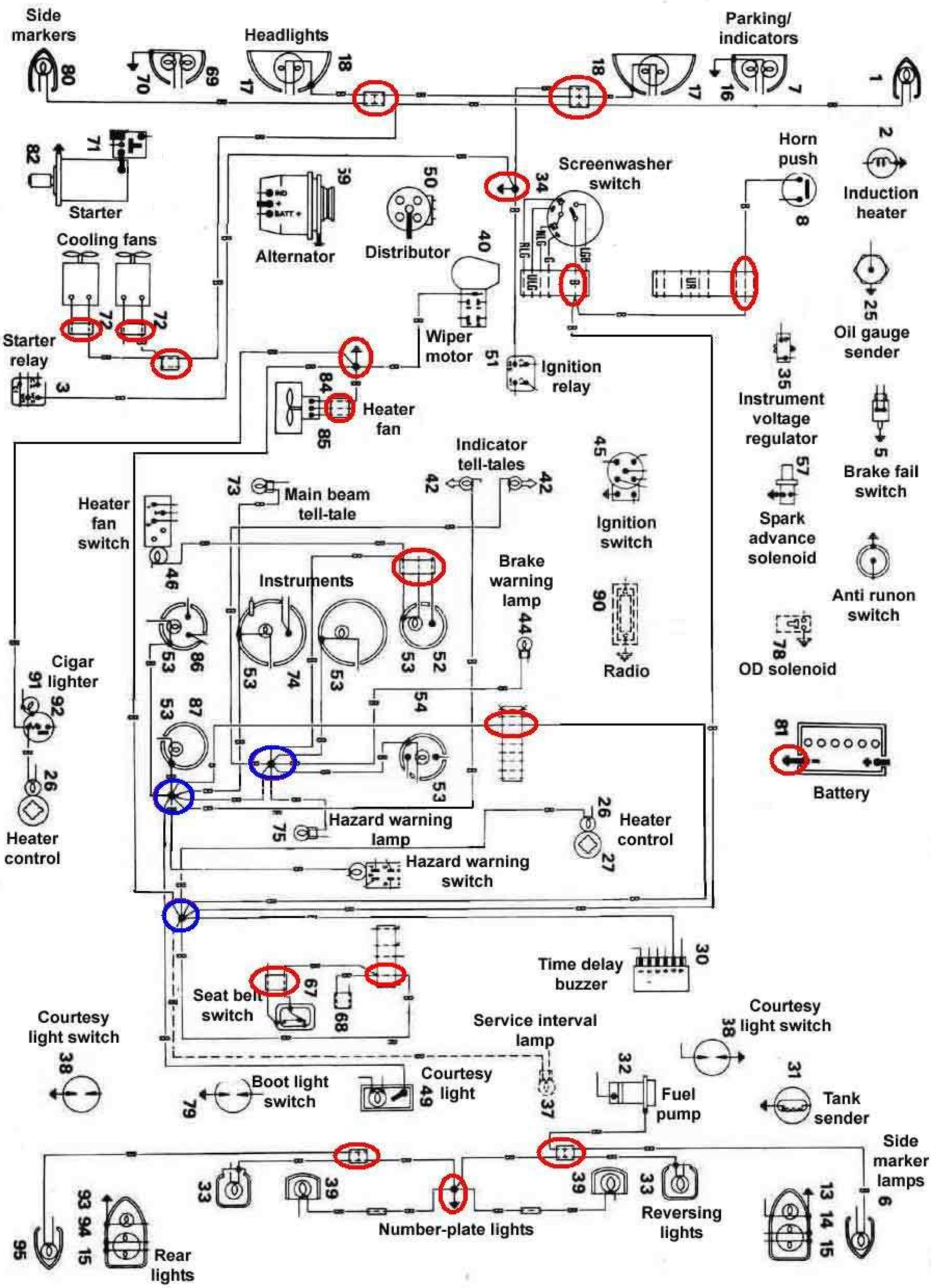
Colour	Fuse	Components
black 2	none	45DM4 distributor 45DM4 distributor amplifier
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator (2) hazards in-line fuse fusebox ignition relay main lighting switch ignition switch starter relay
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/white	none	starter relay starter solenoid
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox reverse lamp switch screen washer pump stop lamp switch brake pressure failure switch induction manifold heater wiper motor service interval counter wiper motor switch voltage stabiliser hazards switch tachometer heater fan switch handbrake switch seat-belt warning lamp
green 2	green	hazard switch turn flasher
green 3	cooling fan in-line	cooling fan in-line fuse cooling fan switch
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp transmitter temp gauge
green/brown 1	green	reverse lights switch reverse lights
green/brown 2	green	heater fan switch heater fan fast speed
green/orange	green	brake pressure failure switch brake diode handbrake switch handbrake warning light

green/pink	none or green	service interval diode service interval counter service interval warning lamp
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	turn-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	turn-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan slow speed
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	turn flasher turn switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
purple	purple	fusebox horn switch boot light cigar lighter headlamp flasher time-delay unit clock courtesy light
purple/black	purple	horn switch horns
purple/green	purple	ignition key buzzer door switch time-delay unit
purple/pink	purple	ignition switch ignition key buzzer door switch
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot switch boot light
red	red	fusebox rear/parking/side marker lights (one fuse per side)
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
slate	none	ignition switch anti-runon valve in-line fuse
slate/purple	anti-runon valve in-line fuse	anti-runon valve in-line fuse anti-runon valve
slate/yellow	anti-runon valve in-line fuse	anti-runon valve oil pressure switch
white 1	none	ignition switch inertia cut-off switch ignition warning light ignition relay
white 2	none	inertia cut-off switch fuel pump overdrive gearbox switch (part way)
white 3	none	ignition relay (part way) coil ballast resistor

		45DE4 distributor 45DE4 distributor resistor
white/black	none	coil -ve distributor tachometer (signal)
white/blue	none	45DE4 distributor resistor 45DE4 distributor
white/brown 1	none	ignition relay fusebox 45DE4 distributor resistor (part way) 45DE4 distributor (part way) coil ballast resistor cooling fans in-line fuse
white/brown 2	none	inertia cut-off switch (part way) overdrive gearbox switch
white/green	none	ignition switch accessories connector
white/light-green	none	coil ballast resistor coil +ve starter solenoid
white/red	none	ignition switch starter relay brake diode service interval diode time delay unit
yellow	none	overdrive gearbox switch overdrive manual switch TCSA vacuum solenoid (part way)
yellow/black	none	TCSA gearbox switch (part way) TCSA vacuum solenoid
yellow/brown	purple	drivers seat-belt buckle switch time delay unit
yellow/purple 1	none	overdrive manual switch overdrive solenoid
yellow/purple 2	purple	time delay unit seat-belt warning light
yellow/red	none	45DM4 distributor 45DM4 distributor amplifier

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the gearbox earth not shown. There are also three sealed junctions circled in blue, these rarely give problems. The remainder are picked up from the physical mounting of the component. Note that front parking/indicator light units in rubber bumpers have a wired earth going back to the headlamp bullet connector and are not as shown in the diagrams:


Side markers
80
70
69
Headlights
18
17
18
17
16
7
Parking/ indicators
1
82
71
Starter
39
Alternator
50
Distributor
34
Screenwasher switch
Horn push
8
2
Induction heater
Cooling fans
72
72
Starter relay
3
40
Wiper motor
51
Ignition relay
25
Oil gauge sender
84
Heater fan
85
35
Instrument voltage regulator
5
Brake fail switch
Indicator tell-tales
42
42
45
Ignition switch
57
Spark advance solenoid
Heater fan switch
46
73
Main beam tell-tale
Instruments
Brake warning lamp
44
90
Radio
Anti runon switch
78
OD solenoid
53
86
53
74
53
53
52
54
Cigar lighter
91
92
53
87
53
81
Battery
26
Heater control
75
Hazard warning lamp
26
Heater control
27
Hazard warning switch
Time delay buzzer
30
Seat belt switch
67
68
Service interval lamp
Courtesy light switch
38
Courtesy light switch
38
Boot light switch
79
Courtesy light
49
37
32
Fuel pump
31
Tank sender
Side marker lamps
95
93
94
15
Rear lights
33
39
Number-plate lights
39
33
Reversing lights
13
14
15
6

1978 model year on, UK

Earth wiring

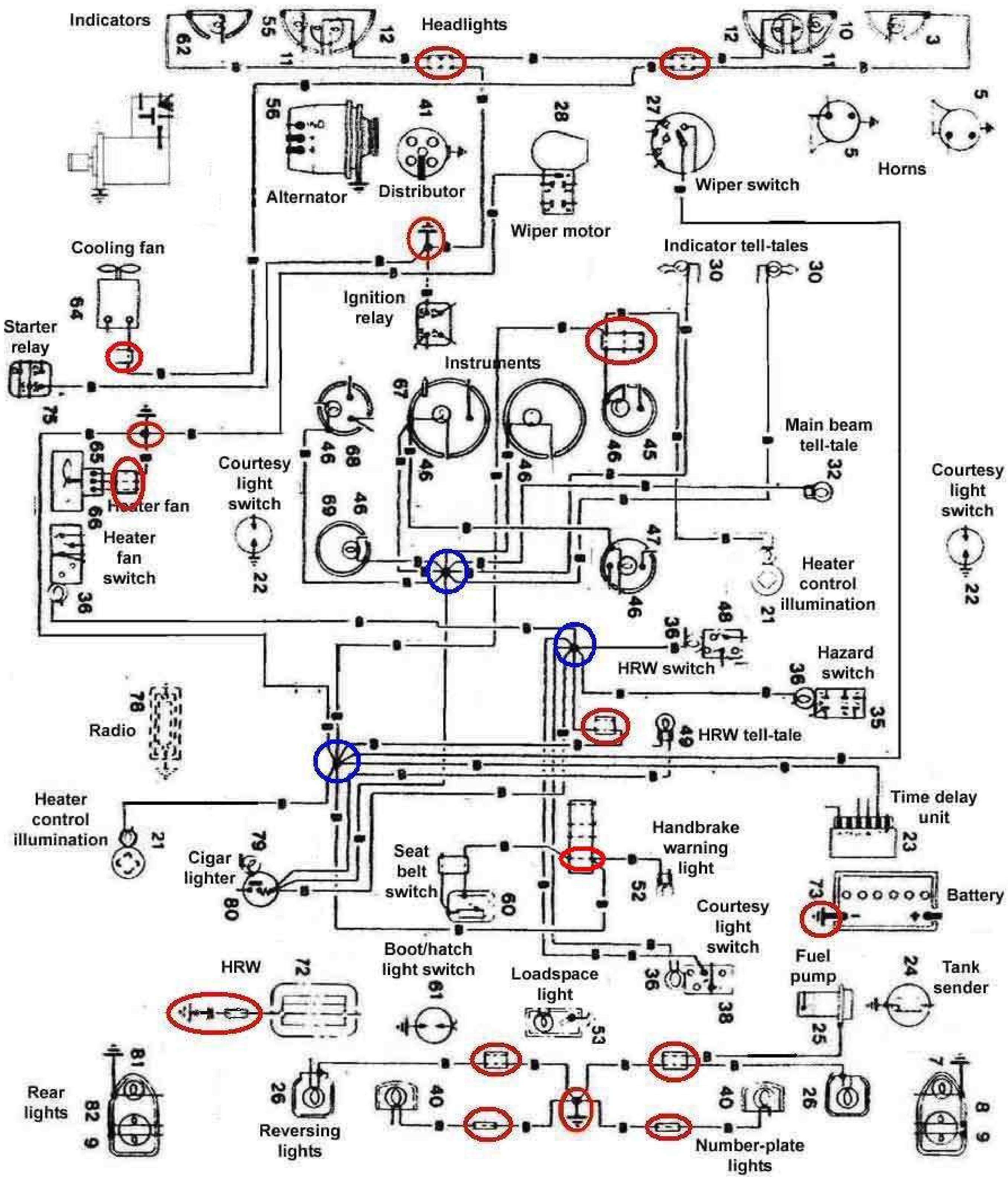
Colour	Fuse	Components
black/green	cooling fan in-line	cooling fan switch cooling fan
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	solenoid alternator (2) fusebox ignition relay main lighting switch ignition switch starter relay hazards in-line fuse
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox handbrake switch seat-belt warning light voltage stabiliser wiper motor wiper switch brake light switch reverse light switch screen washer motor
green 2	green 1	hazard switch turn flasher
green 3	cooling fan in-line	cooling fan in-line fuse cooling fan switch
green 4	green 4	green 4 in-line fuse hazards switch heater fan switch tachometer 12v HRW switch
green/black	green	fuel gauge fuel tank sender
green/blue	green	temp gauge sender temp gauge
green/brown 1	green	reverse lights switch reverse lights
green/brown 2	green	heater fan switch heater fan fast speed
green/orange	green	handbrake diode handbrake switch handbrake warning light
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	turn-signal switch hazard switch

		left-side flashers left-side flasher repeater
green/white	green or hazards in-line	turn-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan slow speed
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	turn flasher turn switch
light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge temp gauge
purple	purple	fusebox horn switch boot/loadspace light headlamp flasher courtesy light cigar lighter clock time delay unit
purple/black	purple	horn switch horns
purple/white 1	purple	door switches courtesy light manual switch courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white 1	none	ignition switch ignition relay coil ballast resistor (part way)
white 2	none	ignition relay (part way) fuel pump
white 3	none	ignition relay (part way) ignition warning lamp
white/black 1	none	coil -ve distributor tachometer (signal)
white/black 2	green	HRW switch HRW warning lamp HRW
white/brown 1	none	ignition relay fusebox fuel pump (part way) overdrive manual switch cooling fan in-line fuse ignition warning light (part way)
white/brown 2	none	ignition switch (part way) coil ballast resistor green 4 in-line fuse
white/green	none	ignition switch accessories connector
white/light-green	none	coil ballast resistor coil +ve starter solenoid

white/red 1	none	ignition switch starter relay winding time delay unit handbrake diode
white/red 2	none	starter relay contact starter solenoid
yellow	none	overdrive manual switch overdrive gearbox switch
yellow/brown	green	drivers seat-belt buckle switch time delay unit
yellow/purple 1	none	overdrive gearbox switch overdrive solenoid
yellow/purple 2	green	time delay unit seat-belt warning light

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the gearbox earth not shown. There are also three sealed junctions circled in blue, these rarely give problems. The remainder are picked up from the physical mounting of the component:


Indicators
Headlights
Alternator
Distributor
Wiper motor
Wiper switch
Horns
Cooling fan
Starter relay
Ignition relay
Indicator tell-tales
Instruments
Courtesy light switch
Heater fan
Heater fan switch
Main beam tell-tale
Courtesy light switch
Heater control illumination
HRW switch
Hazard switch
HRW tell-tale
Radio
Time delay unit
Heater control illumination
Cigar lighter
Seat belt switch
Handbrake warning light
Battery
Courtesy light switch
Boot/hatch light switch
Loadspace light
Fuel pump
Tank sender
HRW
Rear lights
Reversing lights
Number-plate lights

1973 - 1976 V8

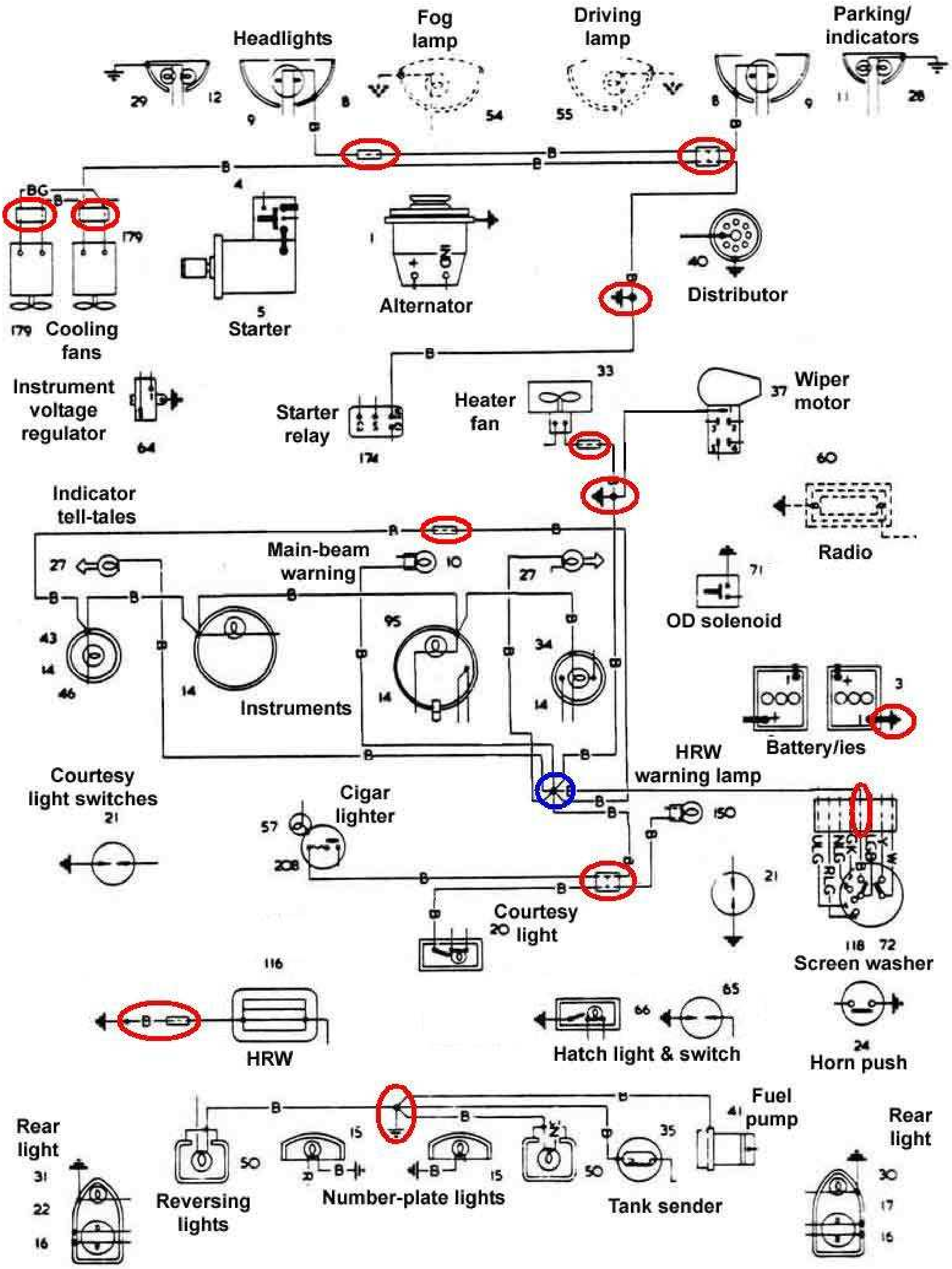
Earth wiring

Colour	Fuse	Components
black	none	ground
black/green	none	cooling fan relay cooling fans
black/orange	green	cooling fan switch cooling fan relay
blue	none	main lighting switch dipswitch
blue/light-green	green	wiper switch wiper motor 'fast' speed
blue/red	none	dipswitch headlamp dipped beams
blue/white	none or purple (flasher)	dipswitch headlamp flasher switch 'main beam' warning light headlamp main beams
brown 1	none	toe-board stud ignition switch fusebox main lighting switch alternator starter relay cooling fan relay hazards in-line fuse
brown 2	hazards in-line	hazards in-line fuse hazard flasher
brown/light-green	green	wiper manual switch wiper motor park switch
brown/yellow	none	alternator ignition warning light
green 1	green	fusebox cooling fan relay HRW switch hazards switch voltage stabiliser tachometer 12v brake lights switch reverse lights switch
green 2	green	hazards switch turn flasher
green/black	green	fuel gauge fuel tank sender
green/brown	green	reverse lights switch reverse lights
green/pink	accessories in-line	accessories in-line fuse heater fan switch screen washer pump wiper motor wiper switch
green/purple	green	brake light switch brake lights
green/red	green or hazards in-line	turn-signal switch hazard switch left-side flashers left-side flasher repeater
green/white	green or hazards in-line	turn-signal switch hazard switch right-side flashers right-side flasher repeater
green/yellow	green	heater fan switch heater fan
light-green/black	green	screen washer switch screen washer pump
light-green/brown 1	green	turn flasher turn switch

light-green/brown 2	hazards in-line	hazards flasher hazards switch
light-green/green	green	voltage stabiliser fuel gauge
purple	purple	fusebox horns boot/loadspace light headlamp flasher courtesy light cigar lighter
purple/black	purple	horn switch horns
purple/white 1	purple	door switches courtesy light
purple/white 2	purple	boot/hatch switch boot/loadspace light
red	red	fusebox rear/parking lights (one fuse per side)
red/brown	HRW in-line	HRW switch HRW warning lamp
red/green	none	main lighting switch fusebox panel lights dimmer
red/light-green	green	wiper switch wiper motor 'normal' speed
red/white	none	panel lights dimmer panel lights
white	none	ignition switch ignition warning light fusebox coil ballast resistor fuel pump overdrive manual switch
white/black 1	none	coil -ve distributor tachometer (signal)
white/black 2	purple	HRW switch HRW
white/blue	none	starter solenoid coil +ve
white/brown	none	starter relay starter solenoid
white/green	none	ignition switch accessories connector
white/light-green	none	coil ballast resistor coil +ve
white/red	none	ignition switch starter relay
yellow	none	overdrive manual switch overdrive gearbox switch
yellow/purple	none	overdrive gearbox switch overdrive solenoid

Earth wiring:

All earths wired to a body bolt or via bullet connectors are circled in red, plus the gearbox earth not shown. There is also one sealed junction circled in blue, these rarely give problems. The remainder are picked up from the physical mounting of the component:


Headlights
Fog lamp
Driving lamp
Parking/ indicators
Cooling fans
Starter
Alternator
Distributor
Instrument voltage regulator
Starter relay
Heater fan
Wiper motor
Radio
Indicator tell-tales
Main-beam warning
Instruments
OD solenoid
Battery/ies
HRW warning lamp
Courtesy light switches
Cigar lighter
Courtesy light
Screen washer
HRW
Hatch light & switch
Horn push
Rear light
Reversing lights
Number-plate lights
Fuel pump
Tank sender
Rear light

Wiring and Fusing - BS-AU7 Colour Codes

In the United Kingdom the British Standard BS-AU7 determines colour coding of automobile wiring. Lucas use a 7 colour set in which plain colours - purple, green, blue, red, white, brown and green are supplemented by a further group using a base colour with a thin line trace of a different colour. Note that these are BS-AU7 colours, the MGB has some departures from this, indicated thus [ ].

Brown	main battery feed, unfused
Purple	auxiliary devices not fed via the ignition switch, e.g. horn, interior light, fused
White	base colour for ignition circuits, unfused
Green	feeds to auxiliary devices controlled by the ignition switch, e.g. wipers, flashers, etc., fused
Red	sidelights (parking lights), rear lights, instrument lights [and later American side-marker lights. Cars with the 4-fuse fusebox have red/green as the unfused colour to the instrument light rheostat or switch and the side/parking light fuses, fused red wires to the light units
Blue	with white trace main beam headlamp, with red trace - dipped beam headlamp [plain blue is used from the main lighting switch to the dip-switch and to early American side-marker lights]
Black	earth (ground) connections

Handbooks are usually printed in black and white only, so the cable colours are identified by a lettering code, such as:

N	Brown	P	Purple	W	White	G	Green	R	Red	U	Blue	B	Black

Other colours are used, according to equipment specifications:

S	Slate	LG	Light-Green	O	Orange	Y	Yellow	K	Pink

When a wire has a base colour and a second trace colour the code is two letters, for example: WG = White with green tracer, RLG = Red with a Light Green tracer:

Main	Tracer	Destination
Black		All earth connections
Black	Blue	Tachometer generator to tachometer
Black	Brown	Tachometer generator to tachometer
Black	Green	Screenwiper switch to screenwiper (single speed) relay to radiator fan motor
Black	L. Green	Vacuum brake switch to warning light and/or buzzer
Black	Orange	Radiator fan motor to thermal switch
Black	Pink	
Black	Purple	
Black	Red	Electric speedometer
Black	Slate	
Black	White	Brake fluid level warning light to switch and handbrake switch
Black	Yellow	Electric speedometer
Blue		Lighting switch (head) to dipper switch
Blue	Black	
Blue	Brown	
Blue	Green	
Blue	L. Green	Screenwiper motor to switch
Blue	Orange	

Blue	Pink	Headlamp dip beam fuse to left hand headlamp when independently fused)
Blue	Purple	
Blue	Red	Dipper switch to headlamp dip beam. Headlamp dip beam fuse to right-hand headlamp (when independently fused)
Blue	Slate	Headlamp main beam fuse to left hand headlamp or inboard headlamps (when independently used)
Blue	White	Dipper switch to main beam (subsidiary circuit headlamp flasher relay to headlamp). Headlamp main beam fuse to right-hand headlamp (when independently fused). Headlamp main beam fuse to outboard headlamps (when outboard headlamps independently fused). Dipper switch to main beam warning light
Blue	Yellow	Long range driving switch to lamp.
Brown		Main battery feed
Brown	Black	Alternator warning light, negative side
Brown	Blue	Control box (compensated voltage control only) to ignition and ignition switch, e.g. wipers, flashers, etc lighting switch (feed)
Brown	Green	Dynamo 'F' to control box 'F', Alternator field 'F' to control box 'F'
Brown	L. Green	Screenwiper motor to switch
Brown	Orange	
Brown	Pink	
Brown	Purple	Alternator regulator feed
Brown	Red	Compression ignition starting aid to switch. Main battery feed to double pole ignition switch (ac alt. system)
Brown	Slate	
Brown	White	Ammeter to control box. Ammeter to main alternator terminal
Brown	Yellow	Dynamo 'D' to control box 'D' and ignition warning light. Alternator neutral point
Green		Accessories fused via ignition switch (subsidiary circuit fuse A4 to hazard switch (terminal 6))
Green	Black	Fuel gauge to fuel tank unit or changeover switch
Green	Blue	Water temperature gauge to temperature unit
Green	Brown	Reverse lamp to switch
Green	L. Green	Hazard flasher unit to hazard pilot lamp
Green	Orange	Low fuel level warning light
Green	Pink	Choke solenoid to choke switch (when fused)
Green	Purple	Stop lamps to stop lamp switch
Green	Red	Left-hand flasher lamps
Green	Slate	Heater motor to switch (or to fast)(on 2-speed motor)
Green	White	Right-hand flasher lamps
Green	Yellow	Heater motor to switch, single speed (or to 'slow' on two-speed motor)
L. Green		Instrument voltage stabilizer to instruments
L. Green	Black	Screen jet switch to screen jet motor
L. Green	Blue	Flasher switch to left-hand flasher warning light
L. Green	Brown	Flasher switch to flasher unit 'L'
L. Green	Green	
L. Green	Orange	
L. Green	Pink	Flasher unit 'L' to emergency switch (simultaneous flashing)
L. Green	Purple	Flasher unit 'F' to flasher warning light
L. Green	Red	Fuel tank changeover switch to right-hand tank unit
L. Green	Slate	Fuel tank changeover switch to left-hand tank unit
L. Green	White	
L. Green	Yellow	Flasher switch to right-hand flasher warning light

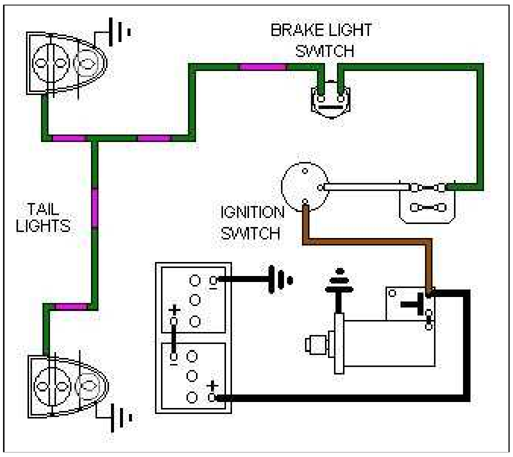
Purple		Accessories fused direct from battery
Purple	Black	Horn or horn relay to horn push
Purple	Blue	
Purple	Brown	Horn fuse to horn relay (when horn is fused separately)
Purple	Green	
Purple	L. Green	
Purple	Orange	Aerial lift motor switch DOWN
Purple	Pink	
Purple	Red	Boot light switch to boot light
Purple	Slate	Aerial lift motor to switch UP
Purple	White	Interior light to switch (subsidiary circuit door safety lights to switch)
Purple	Yellow	Horn to horn relay
Red		Side and tail lamp feed
Red	Black	Parking switch to left-hand side lamp
Red	Blue	
Red	Brown	Variable intensity panel lights (when used in addition to normal panel lights)
Red	Green	Lighting switch to side and tail lamp fuse (when fused)
Red	L. Green	Screenwiper motor to switch
Red	Orange	Parking light switch to right-hand sidelamp
Red	Pink	
Red	Purple	Map light switch to map light
Red	Slate	
Red	White	Panel light switch to panel lights
Red	Yellow	Fog lamp switch to fog lamp
Slate		Window lift
Slate	Black	Window lift
Slate	Blue	Window lift
Slate	Brown	Window lift
Slate	Green	Window lift
Slate	L. Green	Window lift
Slate	Orange	Window lift
Slate	Pink	Window lift
Slate	Purple	Window lift
Slate	Red	Window lift
Slate	White	Window lift
Slate	Yellow	Window lift
White		Ignition control circuit (unfused) (ignition switch to ballast resistor)
White	Black	Ignition coil CB to distributor contact breaker. Rear heated window to switch or fuse TAC ignition
White	Blue	Choke switch to choke solenoid (unfused). Rear heater fuse unit to switch. Electronic ignition TAC ignition unit to resistance.
White	Brown	Oil pressure switch to warning light or gauge
White	Green	Fuel pump No. 2 or left-hand to change-over switch
White	L. Green	Screenwiper motor to switch
White	Orange	Hazard warning feed (to switch)
White	Pink	Radio from ignition switch
White	Purple	Fuel pump No. 1 or right-hand to change-over switch
White	Red	Solenoid starter switch to starter push or inhibitor switch
White	Slate	Tachometer to ignition coil

White	Yellow	Starter inhibitor switch to starter push. Ballast resistor to coil. Starter solenoid to coil
Yellow		Overdrive
Yellow	Black	
Yellow	Blue	Overdrive
Yellow	Brown	Overdrive
Yellow	Green	Overdrive
Yellow	L. Green	Screenwiper motor to switch
Yellow	Orange	
Yellow	Pink	
Yellow	Purple	Overdrive
Yellow	Red	Overdrive
Yellow	Slate	
Yellow	White	

Brake Lights

Hydraulic switches Relay Mechanical conversion

Hover over a wire to confirm the colour



Note that late UK cars seem to have a subdivision of the green circuit with its own in-line 35 amp fuse supplied by the white/brown (ignition relay) circuit feeding things like heated rear window, indicators, heater fan and tach, which leaves the original green circuit fuse (2nd one up in the four-way fuse block) feeding things like reverse lights, stop lights, washers, wipers, and circuits associated with the seat belt warning lamp and time delay buzzer.

Hydraulic Switches:

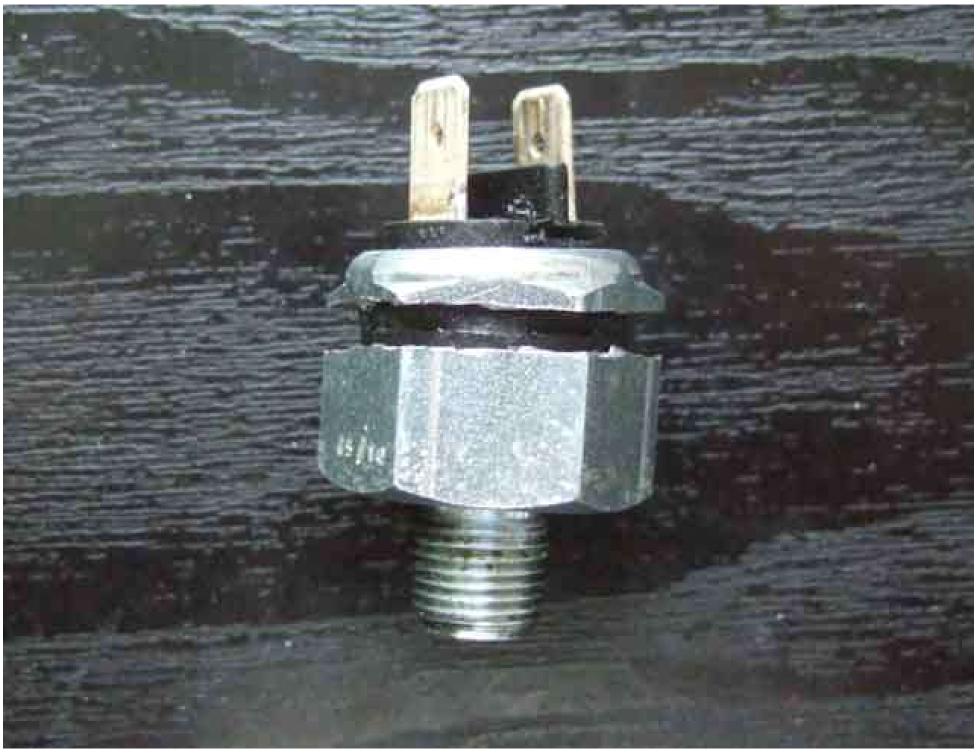
The old switch diced and sliced. I had cut off the ring at the top of the 'nut' which is what looked like was holding the plastic bit in, but it still wouldn't come out. Only later could I see that I would have had to cut a ring around the nut level with the point where each flat joins to get below the 'peened over' part.

Surprising number of bits - rubber diaphragm in the bottom, then a metal disc with a pip on each side but a tin cover on the diaphragm side, then the plastic bit with the two contacts, a light spring holding the moving contact away from the fixed. Pressure on the diaphragm pushes the metal disc up against the moving contact, compressing the spring, and bringing the moving contact to the fixed, so completing the circuit. The design of this is such that as the moving contact is pressed against the fixed by the pip on the disc, it will flex, which imparts a rubbing action between the two contact surfaces, helping to keep them clean. Compare this with the simple 'bridge' connection on modern switches below.

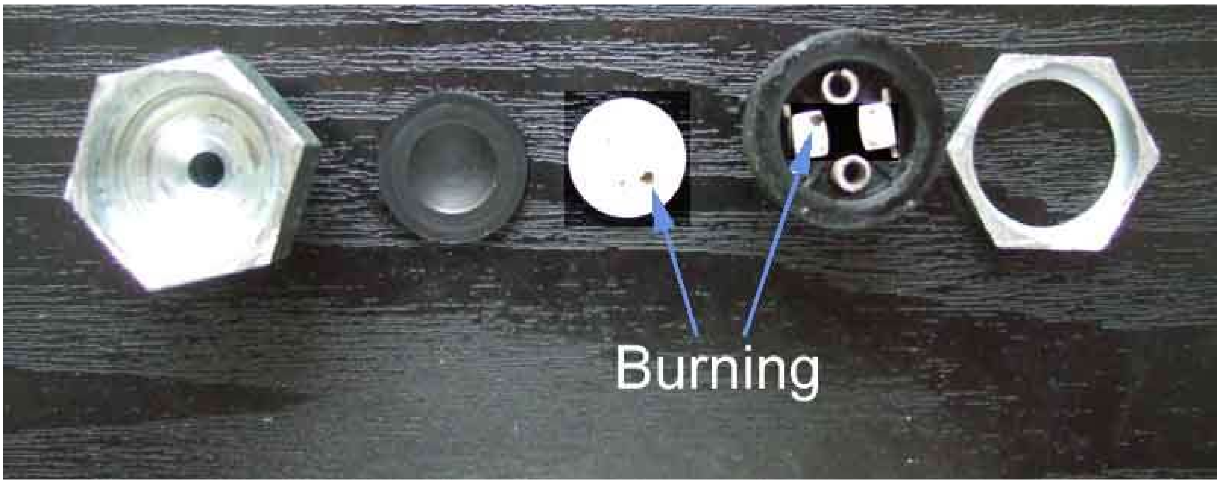
Burnt and pitted contacts, hardly surprising it had failed, surprising it lasted so long!

As far as fluid contamination goes although the rubber diaphragm is probably squeezed pretty tightly between the body of the switch and the plastic part forming a seal, maybe silicone can squeeze through that, and maybe modern switches don't compress the diaphragm as tightly anyway, and maybe the contact material is just poorer. But these (a very old switch much before my time 21 years ago, and quite possibly original) look pretty flimsy anyway.

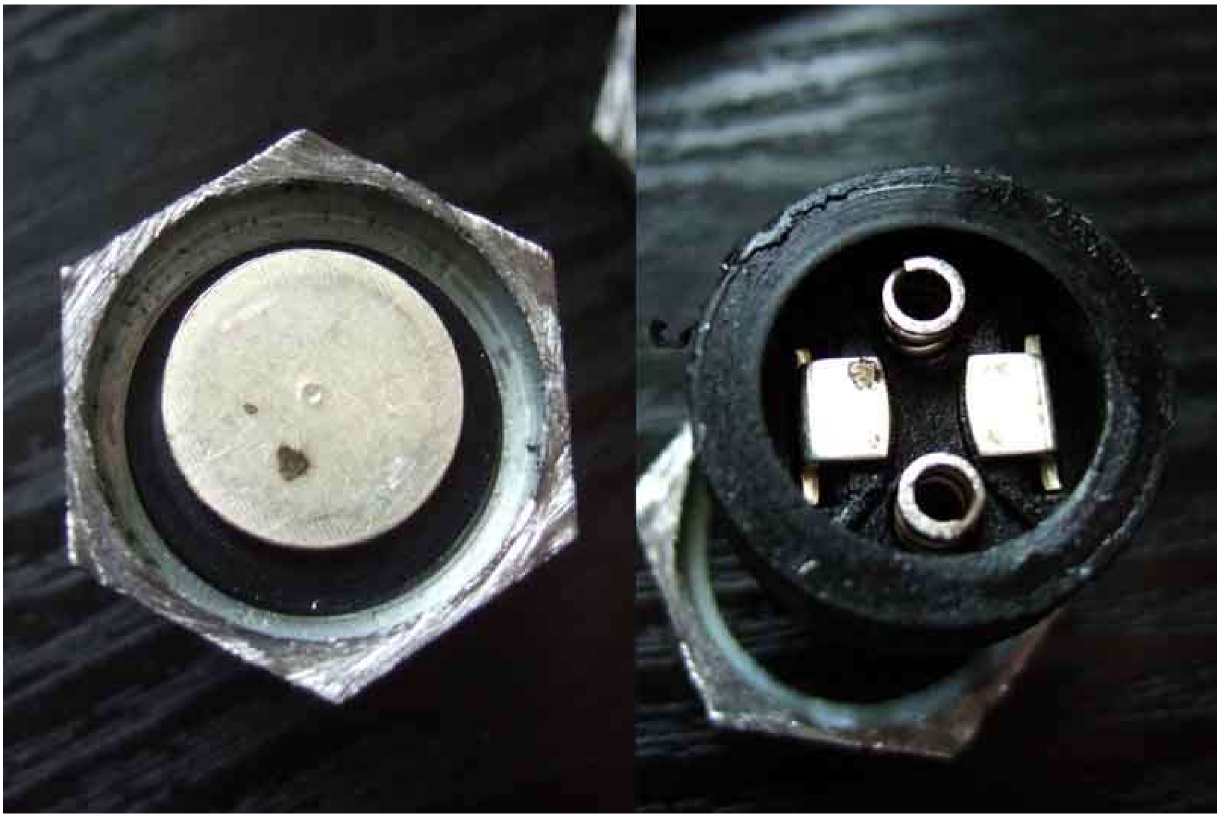
The 'new' switch, showing the position of the cut to open it up:



A different internal construction, from left to right: The metal body, the rubber diaphragm, the contact disc (no tin cup), the plastic body containing the two contacts and two springs this time, and the cut-off part of the metal body. The contacts are visibly different, being simply the ends of the pushed-through spades bent over, as compared to the domed-head rivets used to attach the original spades and contacts. Whereas the original design was able to select a different, and more suitable material for the contact surfaces to the spades, the present design does not.



Only slight burning of the disc and contact on this switch compared to the severe burning of the original, but obviously enough to significantly affect operation, almost certainly because there is no rubbing action between the contacts as on the originals.



The LMS switch: *(September 2017)*

The same basic construction i.e. a disc pressed against the internal part of the spades, but with two possibly significant differences:

- Instead of the ends of the spades being bent over, these are left straight. This could well mean that sharp edges are better able to cut through any burning.
- The material of the spades and discs appears to be different. Instead of possibly soft alloy, these are more brass-like, so could be harder, which may well resist burning better in the first place.

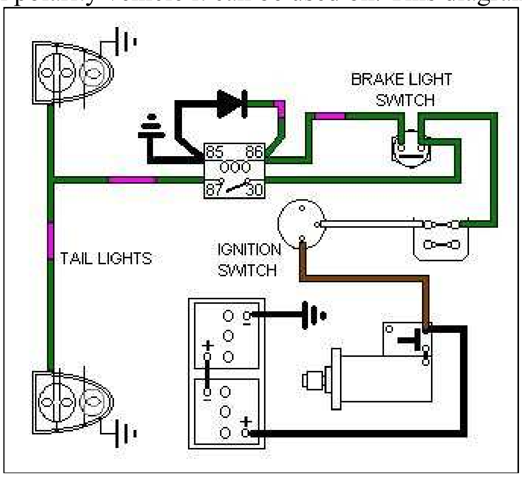
Note also the single central spring as in the original, rather than the two springs in the failed switch.

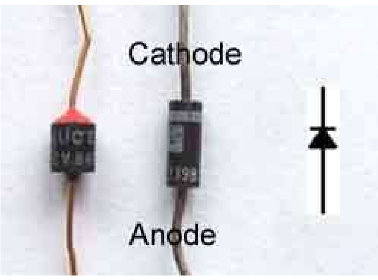
October 2018: LMS now have their switches for sale at about Ł4 i.e. the same as the usual suspects, so I rather think they are the same poor quality inside.

In an effort to compare hardness I was intending to see how the spades in the two sectioned switches resisted bending. However I couldn't find the one I did four years ago, so decided to use the replacement I got from MGOC which has been in Bee ever since - with a relay ... only to find it has riveted spades!

Brake Light Relay

Note this shows the use of a quenching diode across the relay coil, but a Metal Oxide Varistor (MOV) as used on the latest SU pumps is preferable as they are bidirectional so you don't have to worry about polarity, of either the component when connecting it, or which polarity vehicle it can be used on. This diagram is for negative earth:





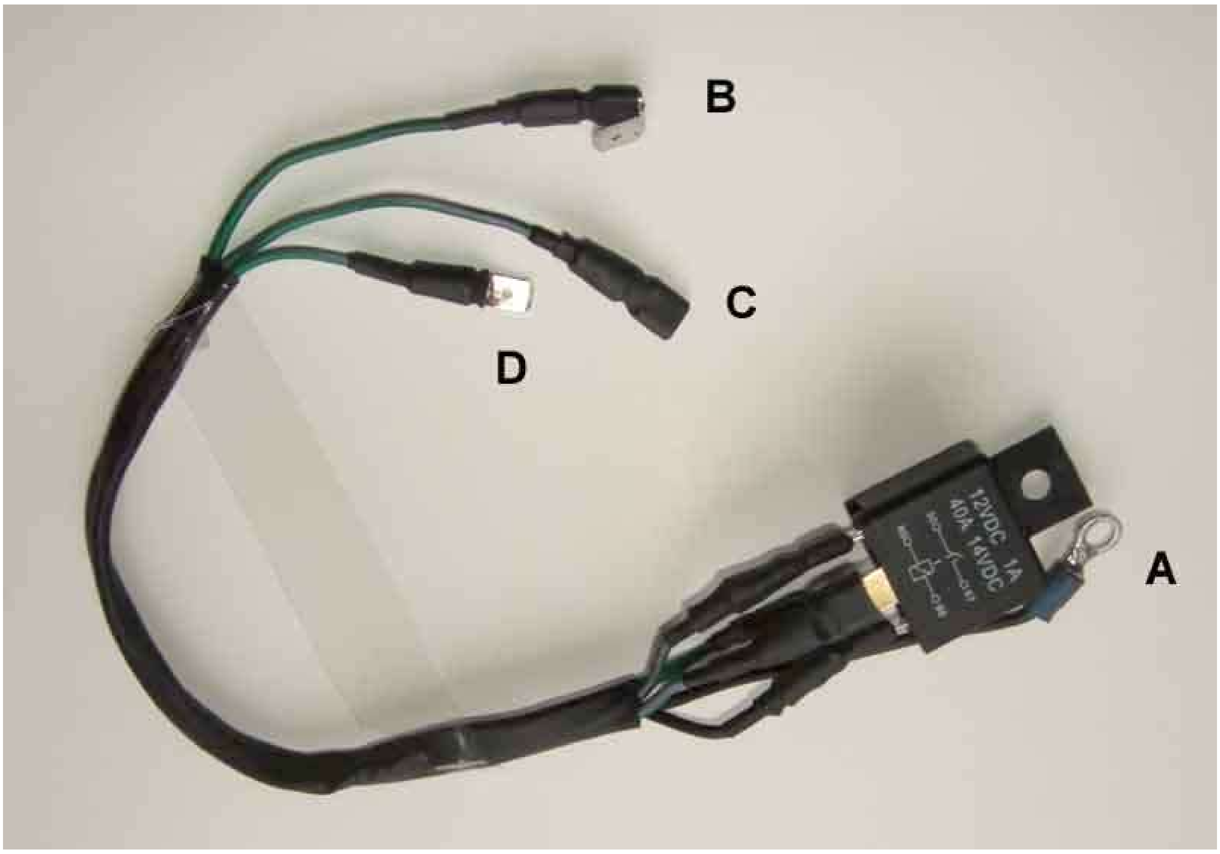
To make one yourself any automotive accessories relay should be suitable. You may be able to get one that includes the diode but this is not usual and you will have to add one. In both cases it is essential to get the diode connected the correct way round or you will blow the green circuit fuse, possibly the diode, and almost certainly your new brake light switch. As shown it is correct for negative earth systems, the older positive earth systems will need to have it wired the other way round. The diode must oppose normal current flow in the circuit as the only time it conducts is in the presence of back EMF from the relay just as the brake light switch contacts open, and that current is in the reverse direction from normal. The diode 'shorts out' the back emf and prevents the brake light switch contacts from sparking and welding just as they open.

Relays with diode protection are available off the shelf, see the 30 Amp Relay With Diode 72714 on [this UK site](), or the 50 Amp Sealed Automotive Relay With Diode R-50ASD on [this North American site](). These both have a single diode across the winding which protects against reverse voltage spikes, but there are other types around with a second diode in series with a winding terminal which protects against incorrect connection as well. The types linked above will protect whatever operates the relay, **but you must be sure to connect the relay winding the correct way round or you will blow a fuse and/or the diode and/or the switch that is operating it**. The series diode in the second type protects against reverse connection as well, if connected the wrong way round the relay simply won't operate. When installing the first type bridge the terminals on the brake light switch or the spade connections on the wiring **before** pressing the brake pedal (ignition on of course). If the lights operate without blowing the fuse then reconnecting the wiring to the switch and operating the pedal should be fine. If the fuse blows, the relay is wired the wrong way round, and you may have blown the internal diode. You can protect against **that** by wiring a 12v bulb in series with the relay winding when testing. If the bulb glows at full brightness the wiring is reversed, but won't blow the fuse or damage the relay. If the relay clicks and the brake lights come on, it is connected correctly.

Brake light relays made to order for the MGB as well as other makes and models. They come with a varistor/MOV to protect your switch contacts on both negative and positive earth cars, positive earth cars can subsequently be converted to negative earth without changing the circuit. It uses existing connection points i.e. no cutting of wires, and can be restored to original in moments if required. Just specify your postal address, length of wiring from relay mounting point to switch position, and switch terminal type if they are other than conventional spades. £10 each plus £4.69 (Second Class Signed-for 3 days or less) or £5.39 (First Class Signed-for) to the UK, other countries P&P on request. Payment by PayPal is preferred (selecting Friends and Family would be appreciated), to paulbhunt73@gmail.com, or if you don't have a PayPal account yourself you can click this button and pay with your debit or credit card. Please make sure your postal address is included somewhere as Paypal can vary:

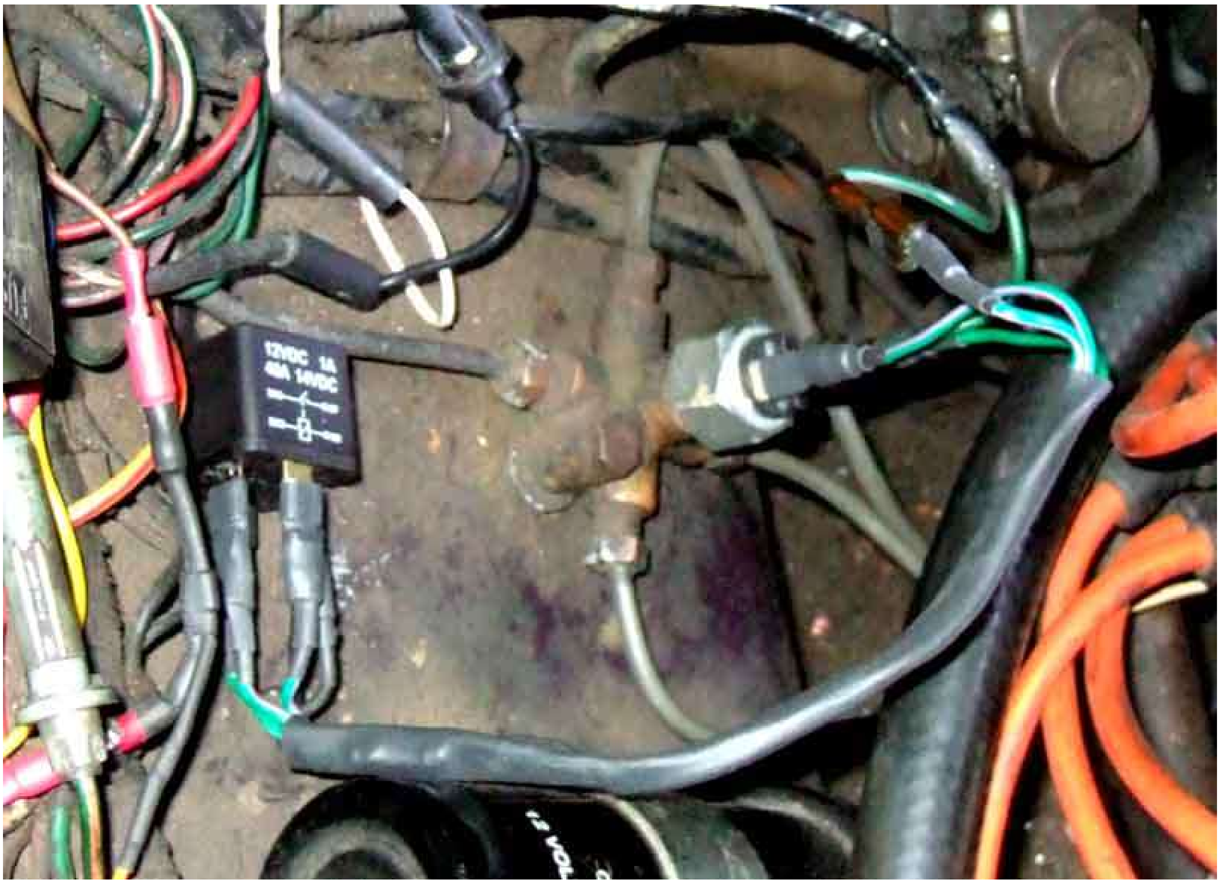
Donate With PayPal

Usually despatched within 24 hours of receipt of payment, installation instructions will be included but can also be found here.



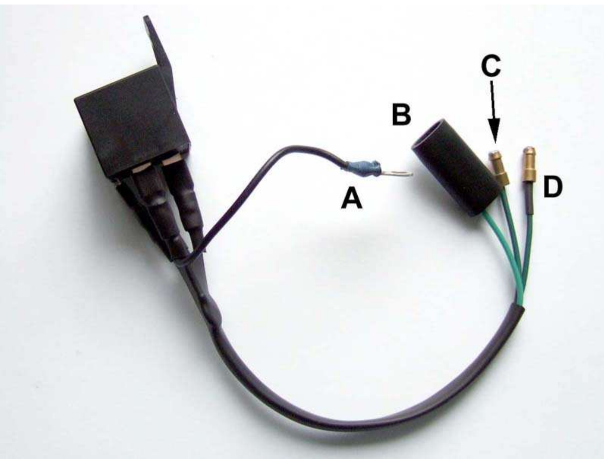
March 2021: If you find your brake pedal needs more and more pressure to light the brake lights then you will need to replace the hydraulic switch at the same time as you fit the relay. If you just fit a relay then the situation **may** improve, and the switch won't get any worse, but it is already damaged so must be replaced. Mike Robertson has just purchased one saying he replaced his switch about a year ago and it's got progressively worse so the switches obviously haven't got any better! He has another new one to fit with the relay.

If you mount the relay close to the switch you pick up the earth (A above) from its mounting, and if you use a piggy-back connector (B) to pick up the green circuit everything can easily be restored to normal very easily if required. But if you connect terminal 30 to the purple circuit at the fusebox instead of the green or via an in-line fuse to the brown, your brake lights will probably be slightly brighter and you will suffer less from the indicators slowing down when the brakes are applied.



Relay installed, using a handy and unused earthing point nearby. The green/purple is removed from the switch and extended to one of the relay contacts (87, D above), that switch contact being connected to one side of the relay winding (85, C), and the other (86, A) taken to earth. There is a quenching varistor connected between these two points to protect the brake light switch contacts. I piggy-backed the green on the hydraulic switch to extend 12v for the relay contact (30, B) to light the lamps, rather than a purple or fused brown which would probably give slightly brighter lamps. They will be brighter now than they were before ... or at least they were until the switch deteriorated further just a couple of days later - new switch now installed.

January 2020:

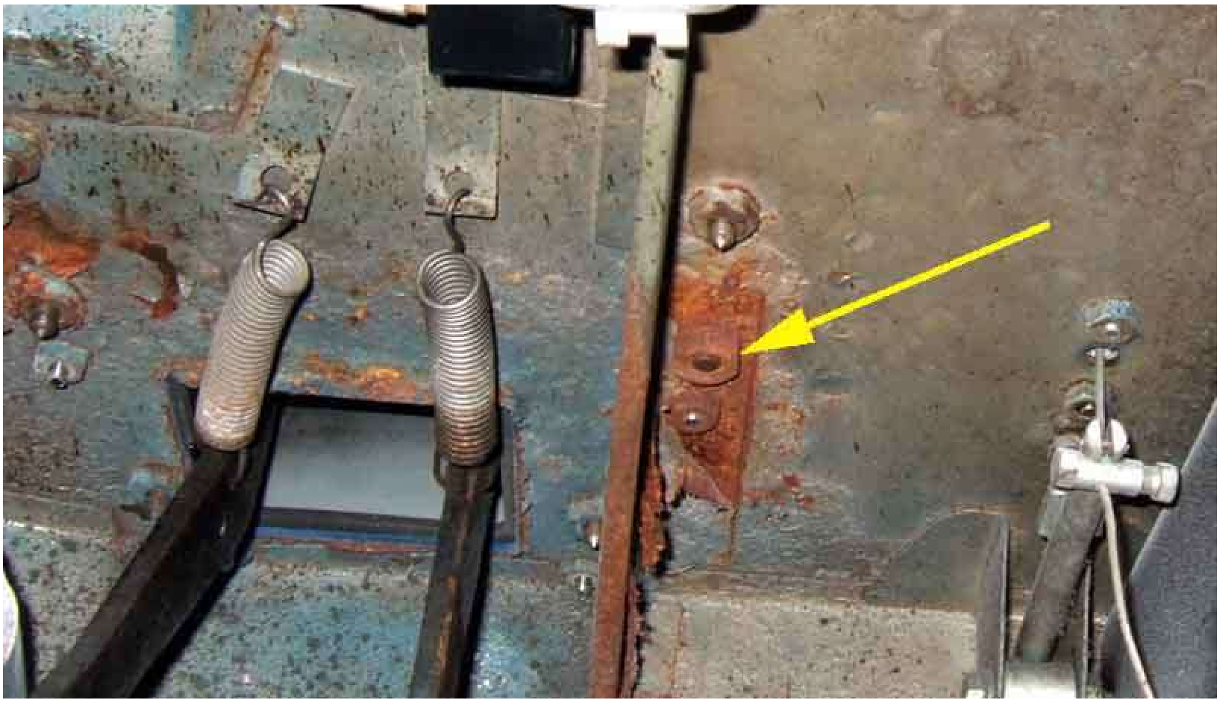


Hank Stallings in North Carolina asked me to make one to work with his mechanical switch, much the same just a bit more care needed in connections as the three wires have identical bullets in place of three different types of spade connector which are self-explanatory.

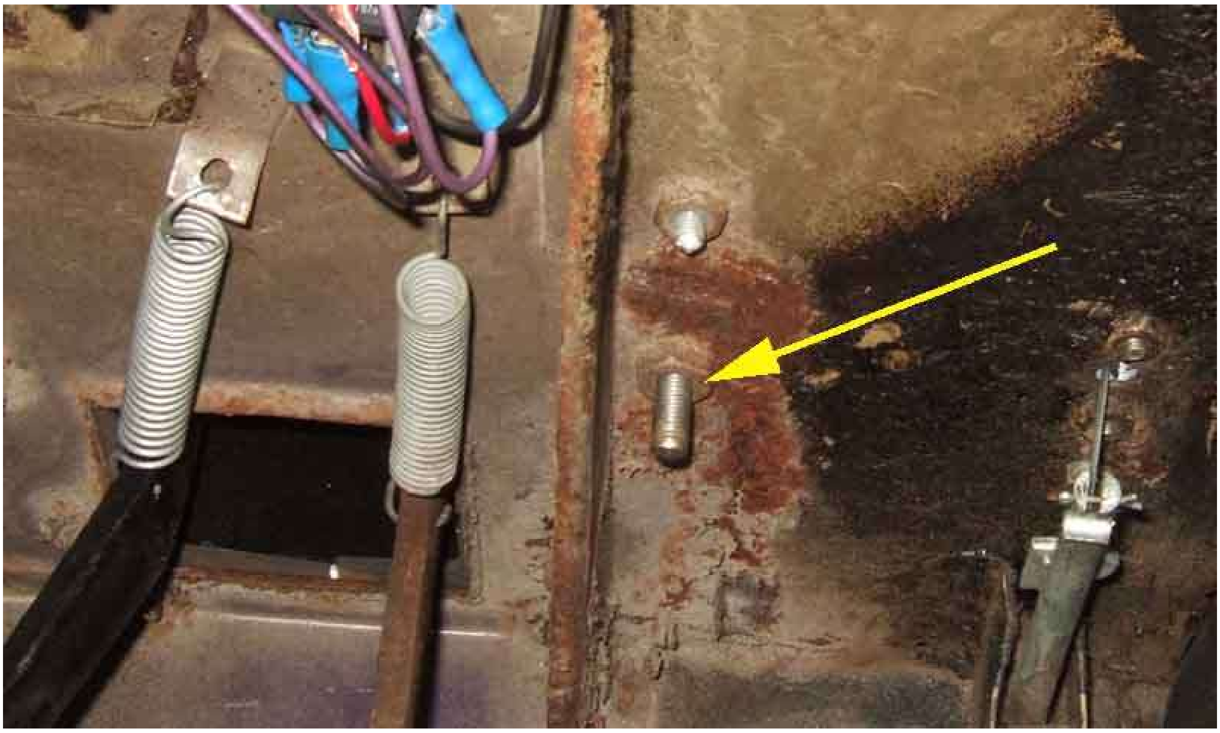
Mechanical Conversion

This is probably the best alternative as not only does it do away with the problem of the suspect switches altogether, but also allows the lights come on as soon as the pedal is moved just like the rubber bumper cars, instead of waiting until you have developed a certain amount of hydraulic pressure and hence slowing of the car. It does require a certain amount of ingenuity and 'engineering', you have to locate a suitable switch and manufacture a suitable bracket, as well as connect the wiring. On the face of it the RB switch could be used, but it requires a thread to be screwed into for adjustment in a bracket, that bracket needs mounting somewhere, and its orientation will mean that the bigger the distance between the switch and the bracket mounting point the stronger the bracket has to be to avoid bending away from the pedal when the pedal is released. If it bends away, then as the pedal is operated it will bend forwards, delaying the point at which the switch closes to light the lamps, tending to defeat the object of the exercise. You could use the RB pedal cover but they are NLA, although you could get one from a breaker. You could also drill and weld a suitable nut to the existing cover, but positioning needs to be pretty precise in both vertical and horizontal planes.

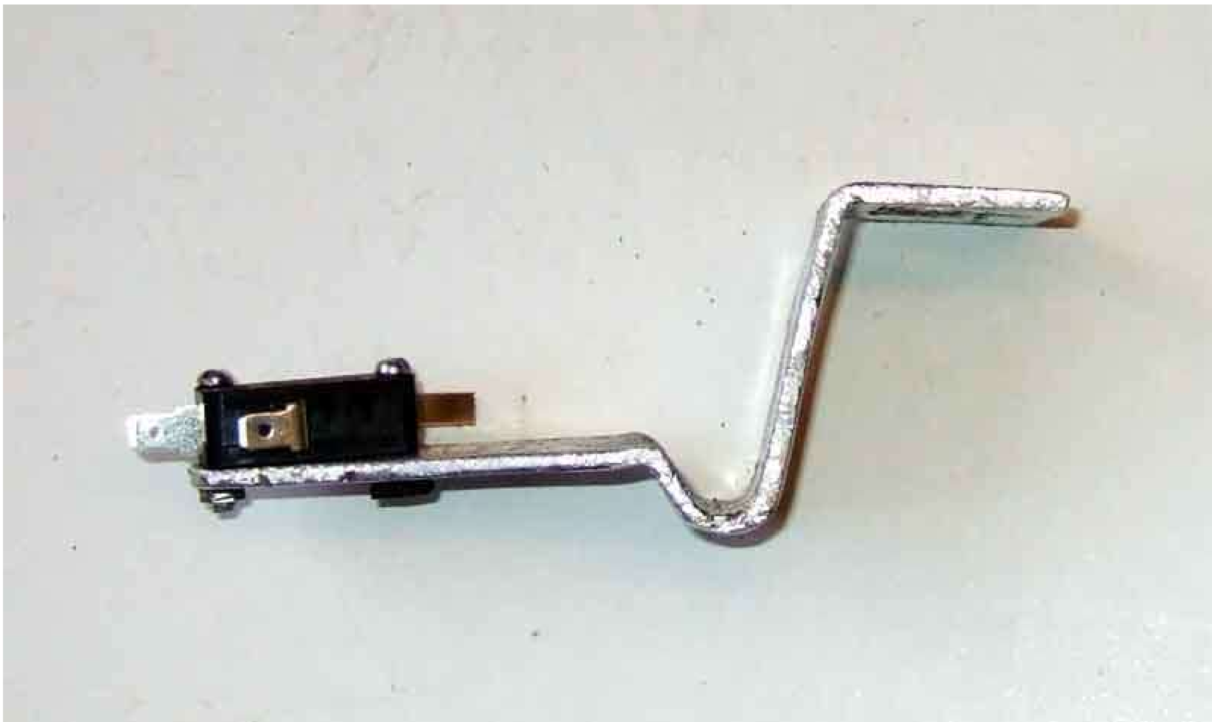
There is a handy stiffener bracket beside the brake pedal giving potential for mounting the switch, but I don't like drilling holes in my cars, and access would be tricky. I can visualise a bracket wrapping round that stiffener, clamping onto it somehow, but that seems a bit fiddly. Looking past that I espy the welded nuts for the bolts that attach the pedal-box to the heater shelf, and one is pretty-well in exactly the right place:



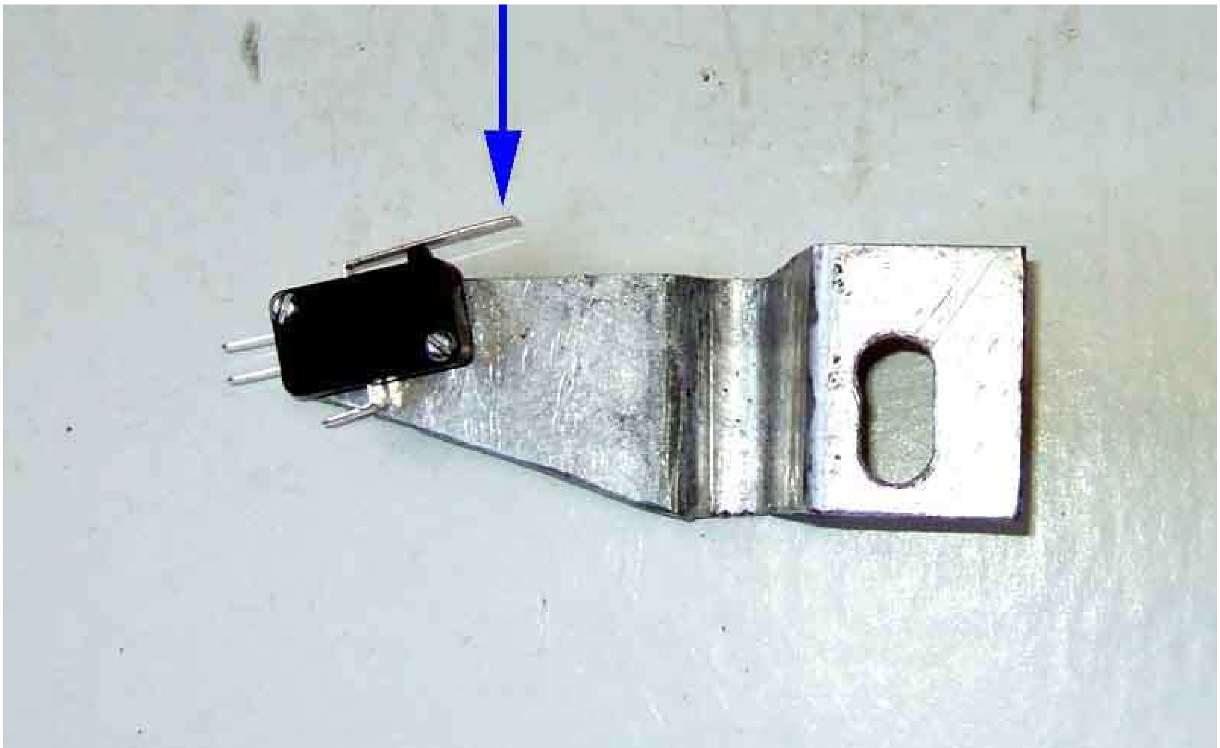
Fitting a longer screw would allow me to attach a bracket using a nut and washers, but while looking at it I realise that the one I'm intending to use is bigger than the other five! Wondering if it is an oddity on the roadster I check the V8 and that is the same. The odd one is 5/16" UNF with a 1/2" head, the others are 1/4" with 7/16" heads. More info on that here:



I have some thin strips of steel which are easy to bend into shape and produce a pattern, then use that on some thicker alloy, although quite difficult to get the U-shaped section right. Switch mounted above the bracket out of the way of feet. This type of micro-switch has snap-action contact closure and opening which will resist contact burning far better than the slow opening and closing of the hydraulic switch:

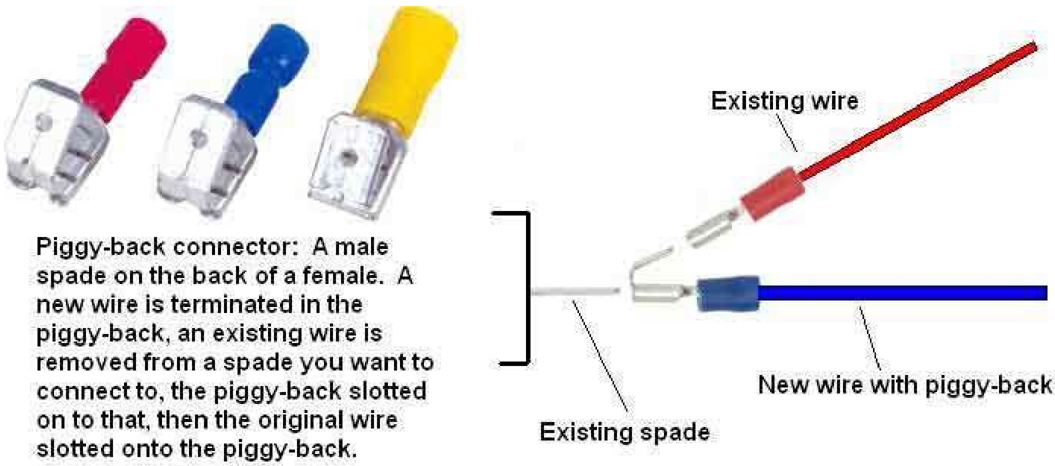


I position the operative corner of the switch off the edge of the bracket, and also past the pedal arm so it is the end of the springy finger that contacts the pedal (arrowed) and not the switch itself, or the bracket. When the brake pedal is released it pushes on the springy finger in the direction of the arrow, which pushes the actuator on the side of the switch in to open the normally-closed contact and turn off the lights. When the brake pedal is operated it moves away from the springy finger, which allows the actuator to pop back out and close the normally closed contact to light the lights. Slot for adjustment purposes:

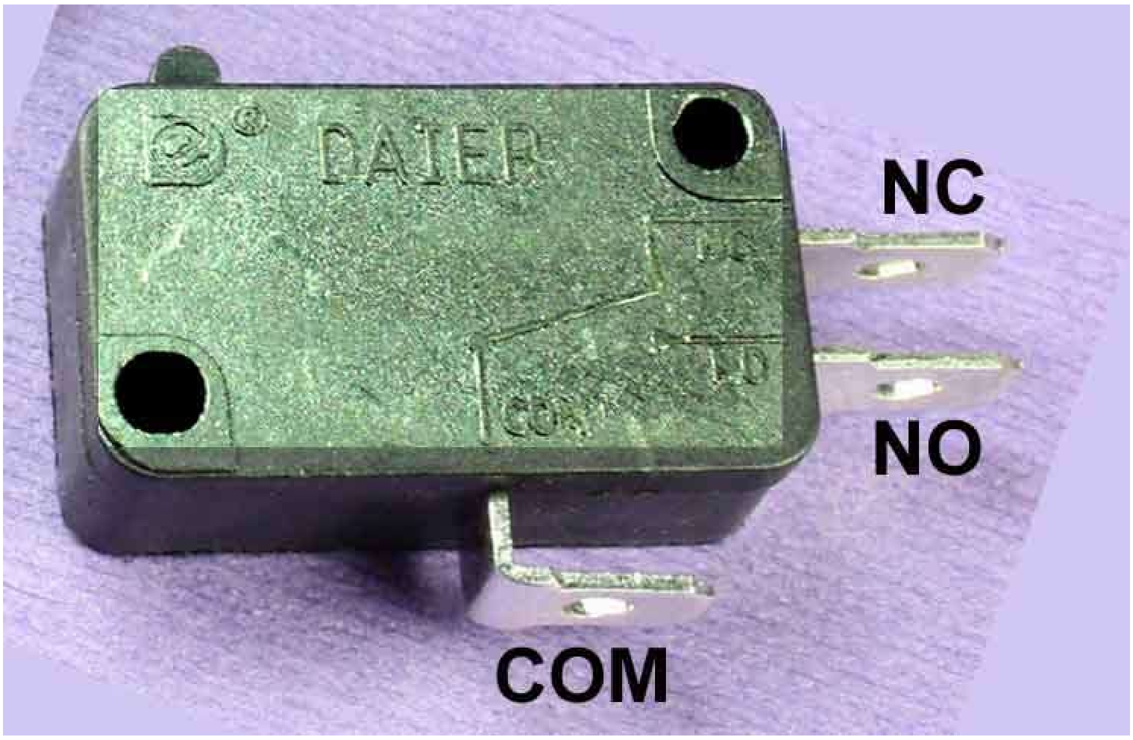


Installed. Initially my thinking was that with the bracket being curled round the flange on the stiffener, it would resist any tendency to pivot away from the pedal which could result in the lights remaining on. Subsequently I realised that a simple 90-degree bend under the stiffener would still be well out of the way of feet in normal use, and by making the bend for the horizontal section that goes on the pedal-box screw a little less than 90 degrees, when tightening the nut the vertical part of the bracket would be pressed hard up against the side of the stiffener (arrowed), having the same effect:

The easiest way to make a connection to the existing wiring is with piggy-back connectors on the ends of the new wires. These push onto the hydraulic switch in place of the existing harness female spades, then those go on the male part of the piggy-backs. This has two benefits - one is that the connections between the new and existing wiring is supported by the hydraulic switch - if you used simple male spades on the ends of the new wires the connection to the existing females would be flapping about and could come loose. The second benefit is that unless your hydraulic switch has already completely failed, it will be acting as a 'second string' to light the brake lights if the mechanical switch should fail. In normal use the mechanical switch will be carrying all the current, there will be no further deterioration of the hydraulic switch electrical contacts, and it will be ready to take over if needed. Periodic checking of the brake lights - as we all should be doing anyway - will soon reveal if the mechanical switch has stopped working as the pedal will need to be pushed further for them to come on:



A typical switch (although this one doesn't have the springy finger, there are very many types) showing the connections. You will be using the COM (Common) and NC (Normally Closed) terminals, leaving the NO (Normally Open) unused. It doesn't matter which way round the wires connect to the switch as it is simply joining them together, but if you are interested in convention then the 12v supply would go to COM and the one for the brake lights would go to NC. *Update:* However Herb Adler has pointed out that wired that way round leaves 12v on the exposed and unused Normally Open terminal when the pedal is not depressed. If you reverse the wires and put 12v on the Normally Closed and the lights on COMmon then that is avoided, a view with which I can concur:


NC
NO
COM

Main Wiring Harness

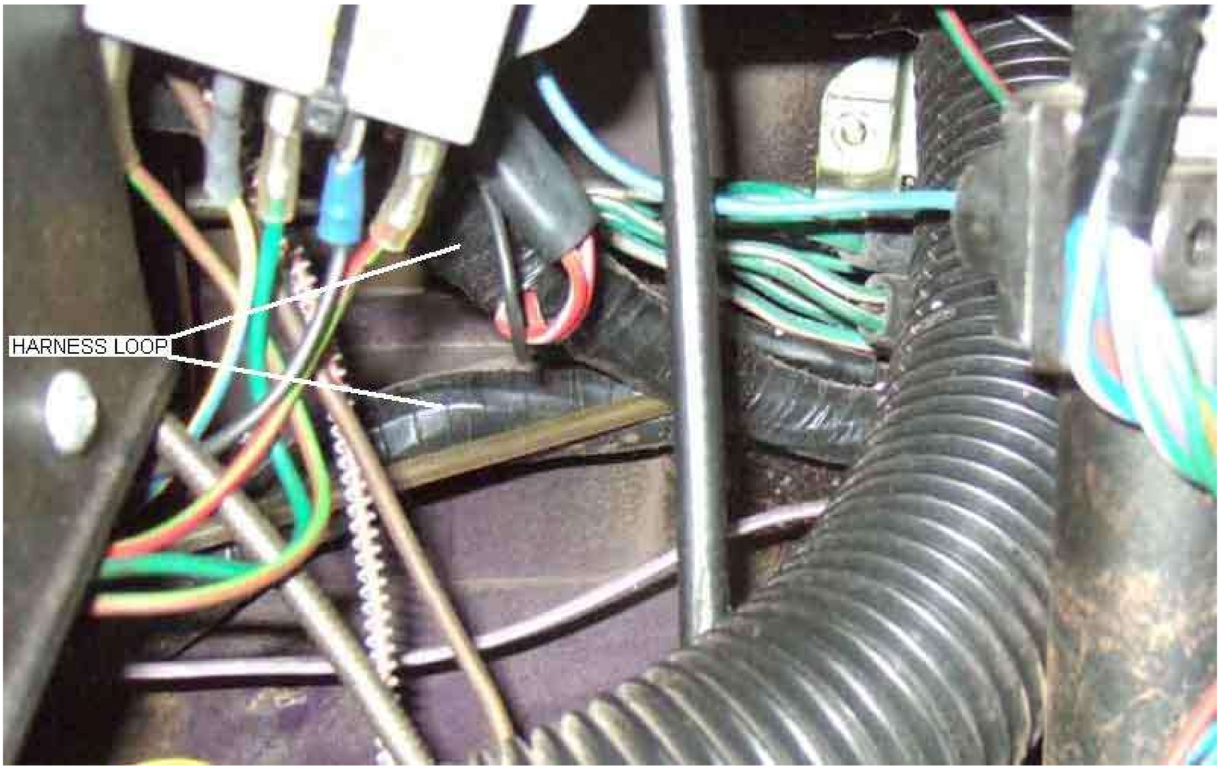
Main, rear and gearbox harness interconnections

Showing the main harness coming across the firewall behind the wiper motor, before looping back down and through a clip mounted below the motor for RHD. Basically the same harness was used for LHD but going across the firewall to the other side: (*Richard Coombs*)

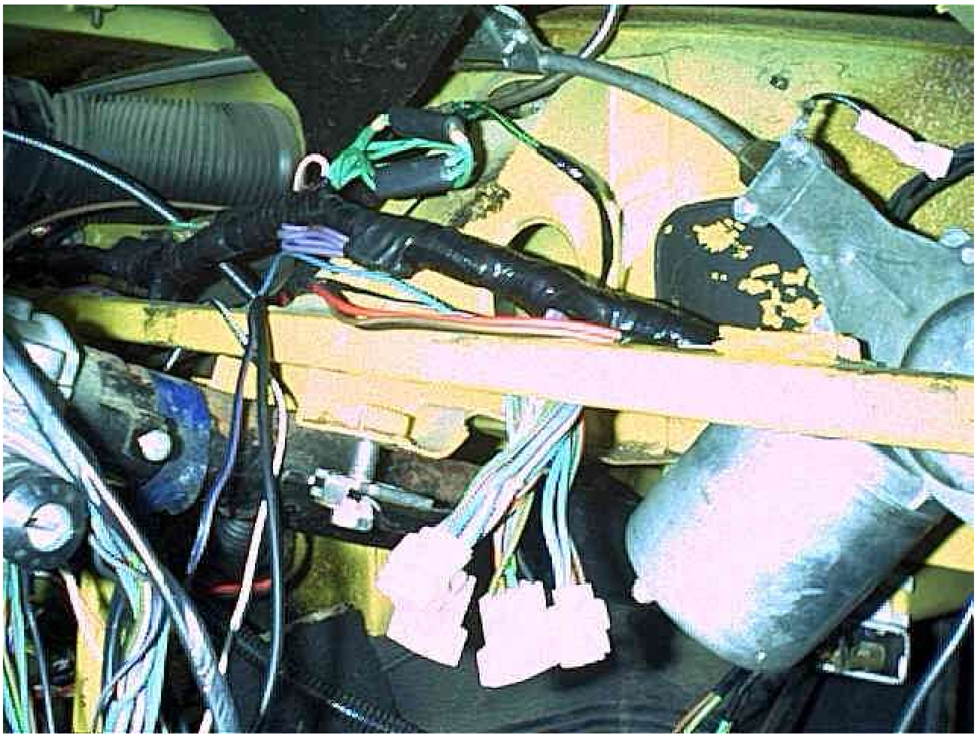
Note that the wiper rack goes through the wheelboxes under the spindles, not above.

However mine seems to pass through the clip twice - once on its way towards the left, then again after it is looped round and comes back to the right:

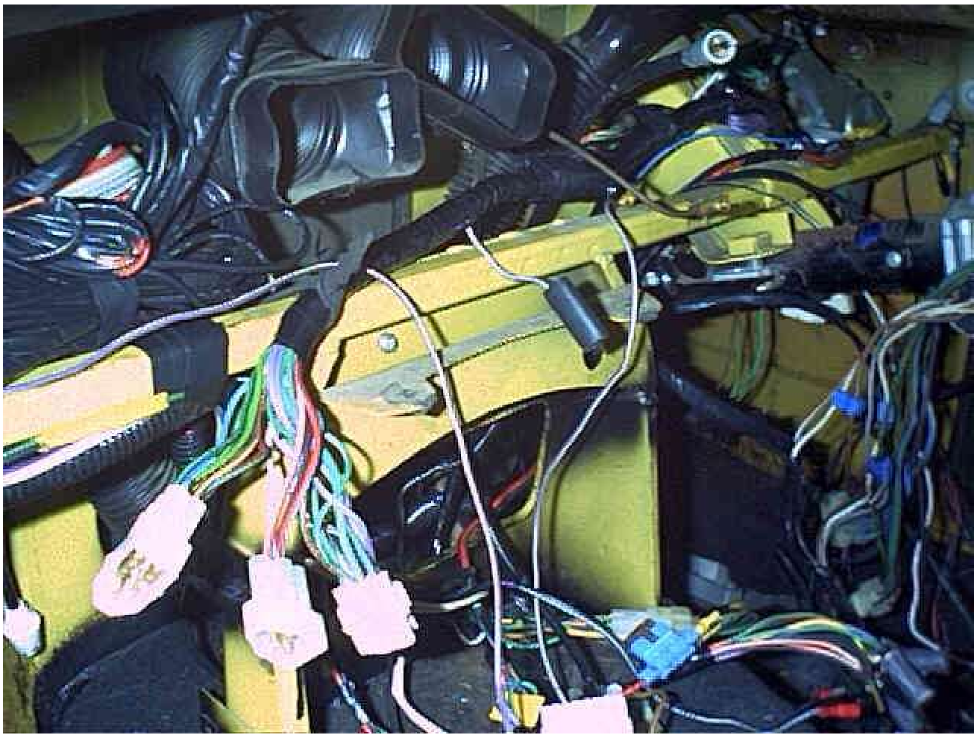
Whilst I had the dash off when I repainted the car I'm pretty sure I didn't disturb the routing of the main harness:



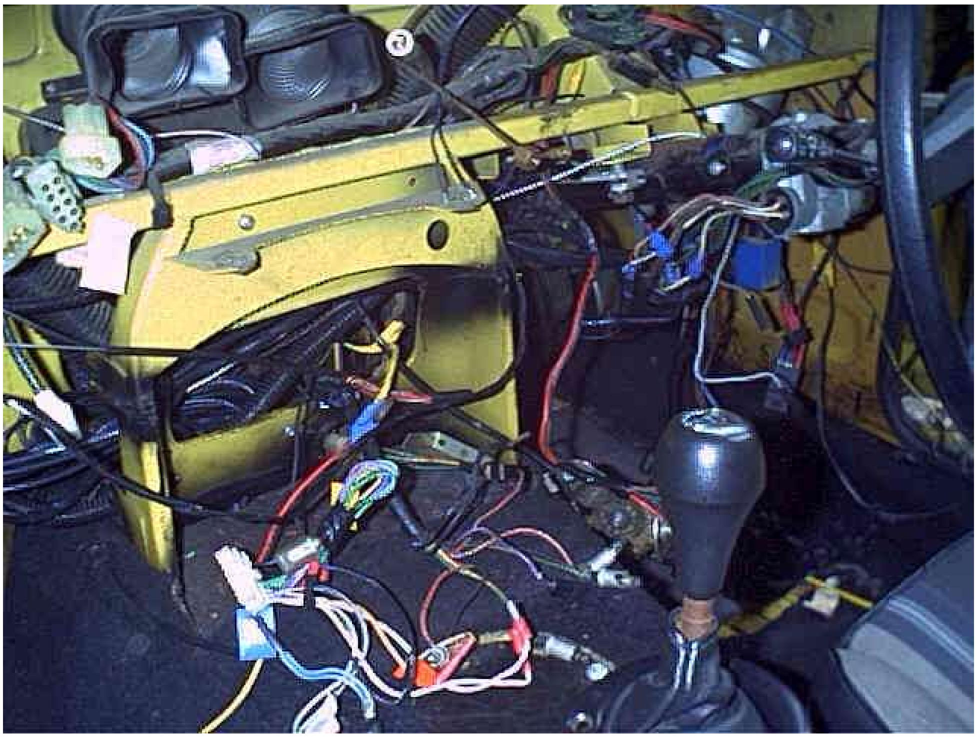
There is just too much additional wiring behind the dash of the V8 to get anything remotely useful, this 1980 I rewired is a bit clearer with the dash out, and by this time RHD and LHD were so different they had unique harnesses so no loop with the RHD. The connectors for the column controls are by the wiper motor, and the main harness goes across over the steering column bracket not through the hole:



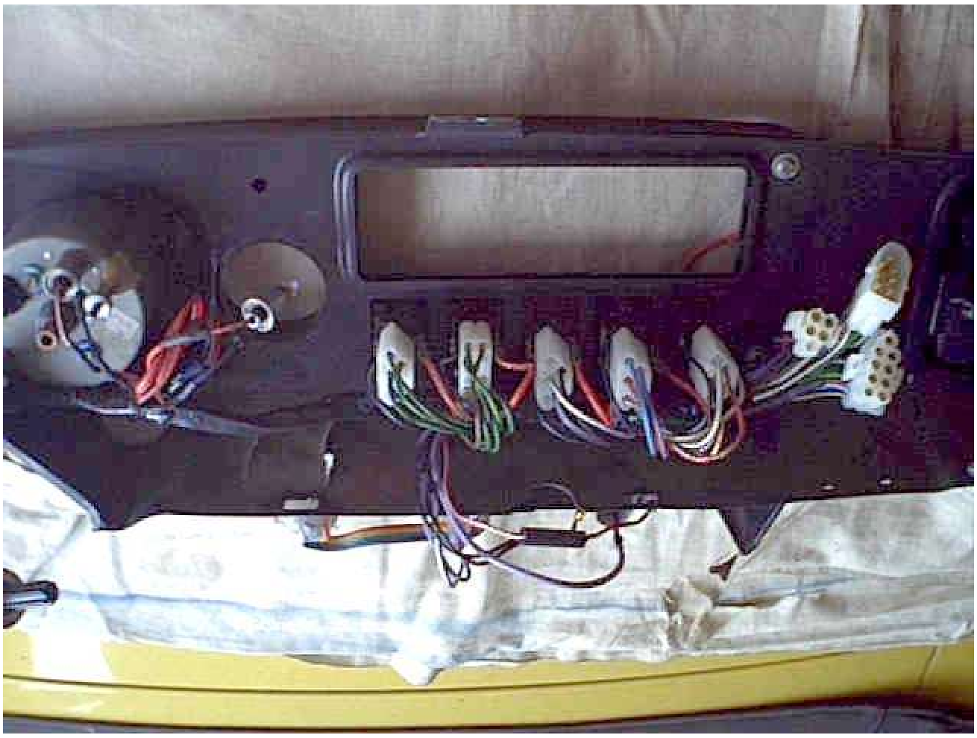
Ending just past the centre console with the dash sub-harness connectors. The loose door switch wires run along the square-section bracing bar to a 4-way bullet connector, they are not part of the harness:



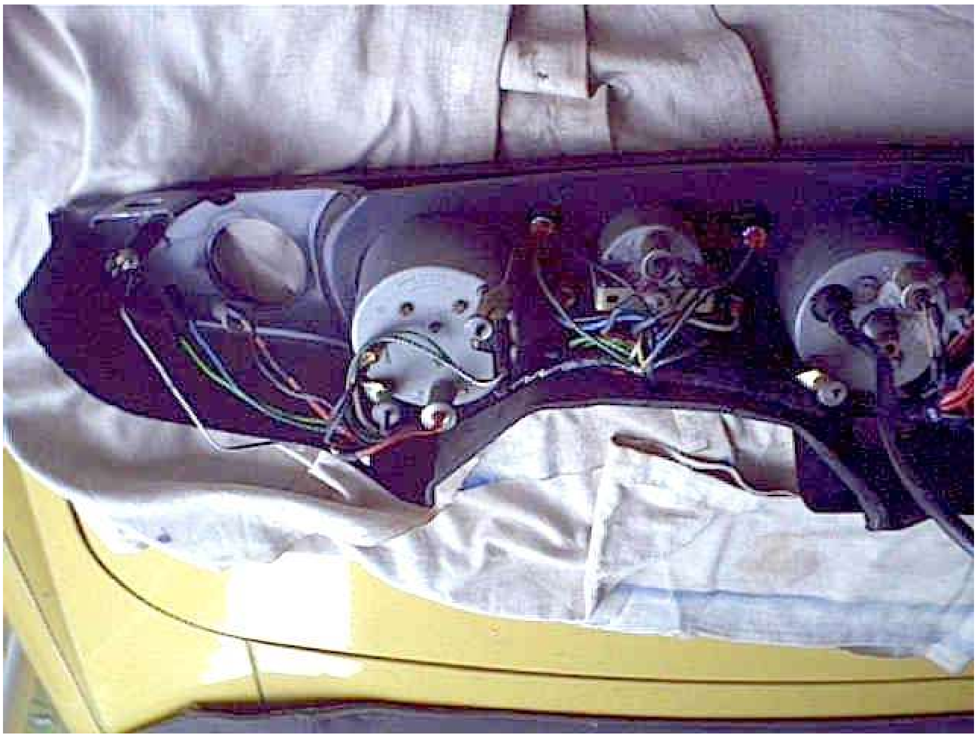
A spur comes down off the main harness behind the console for the console controls:



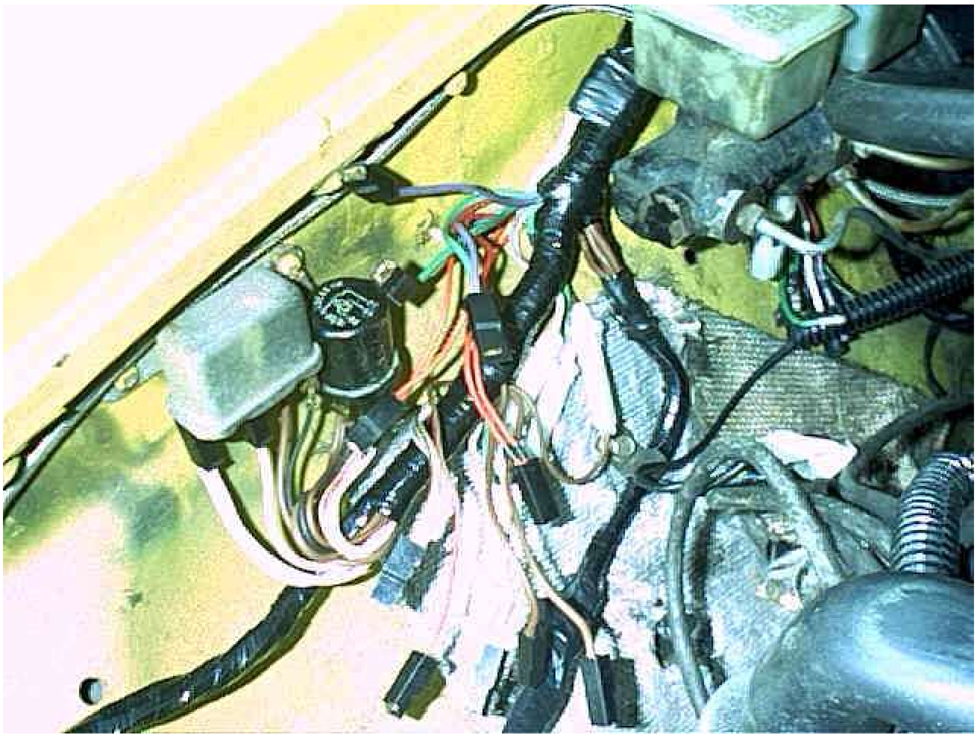
Dashboard sub-harness to the switches:



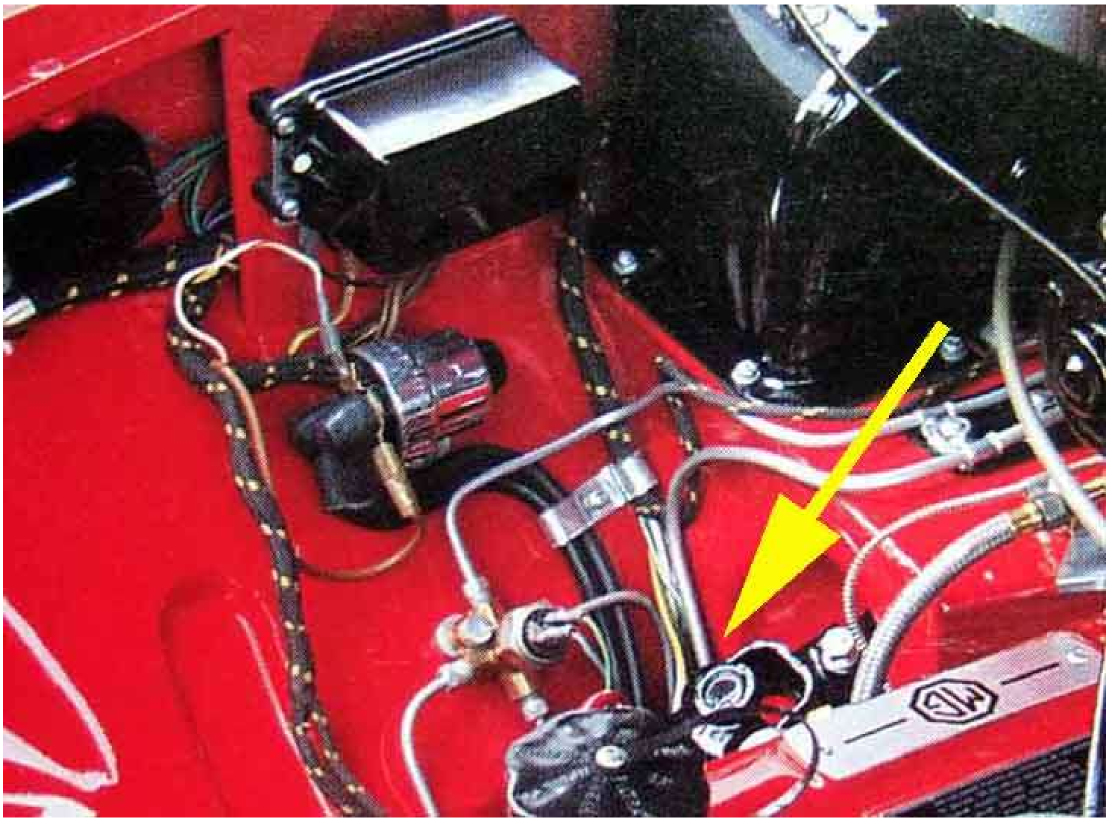
And to the instruments:



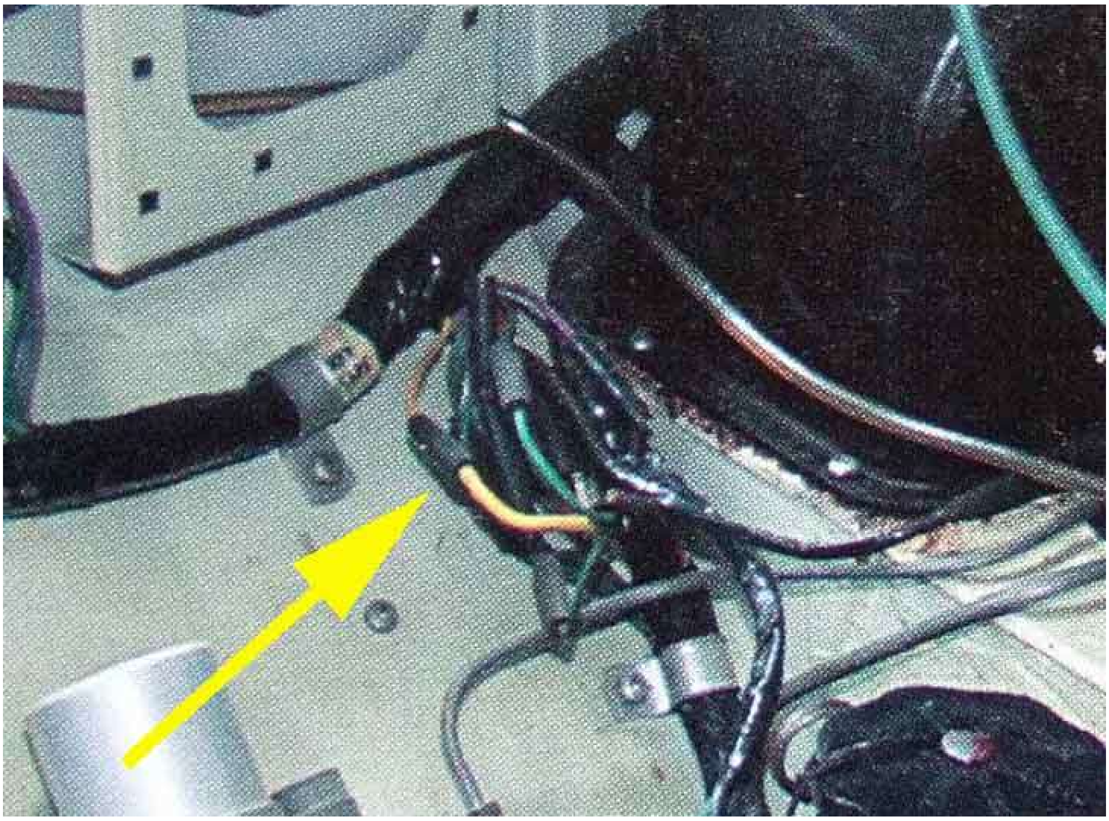
Engine compartment, relays in-situ, fusebox goes between them and the brake master:



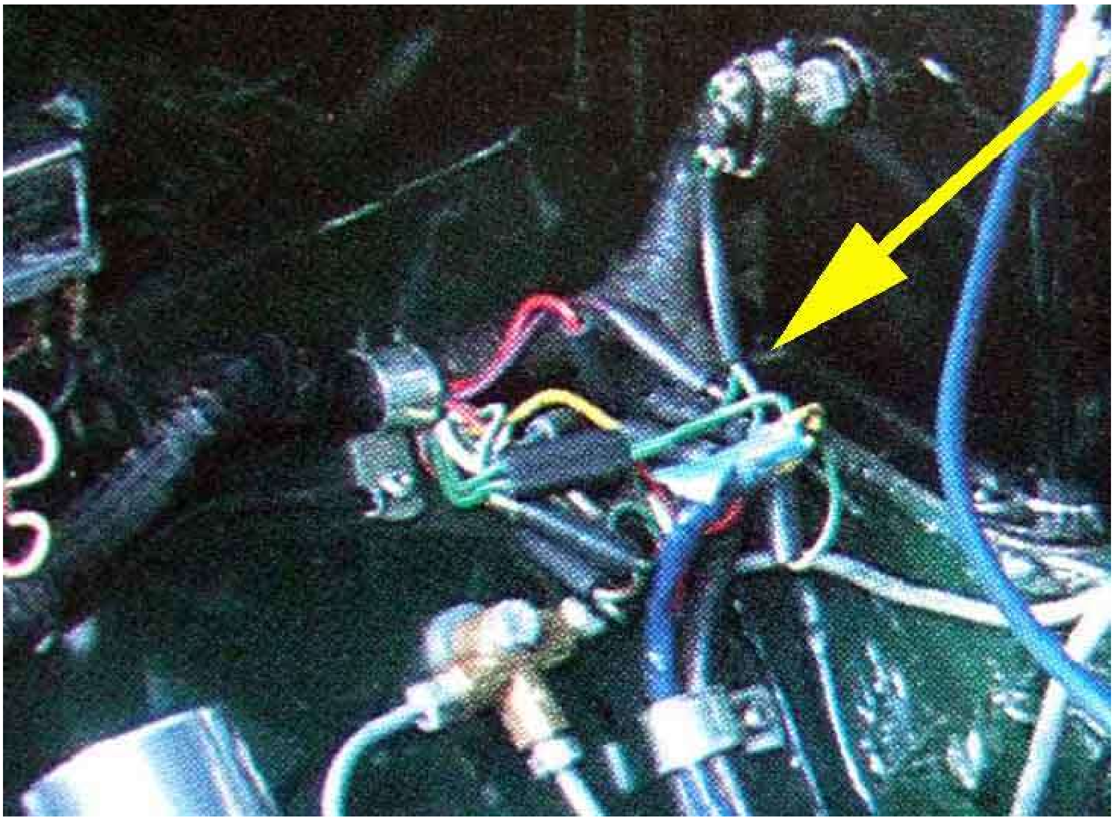
Main, rear and gearbox harness interconnection: In these images from Clausager this 1965 looks like it has a long tail on the main harness with connections close to the steering column UJ:



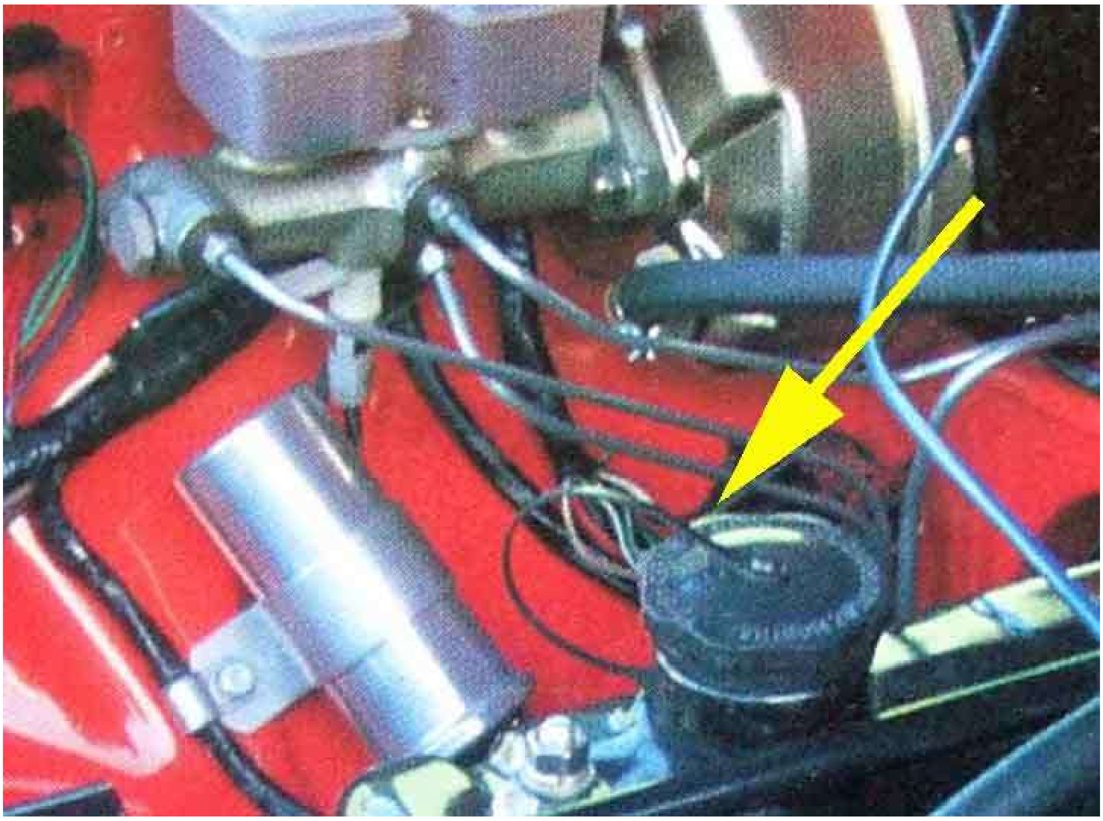
But in this 1969 the connections are only just below the main harness:



Where they stayed through 1973 and this 1975:



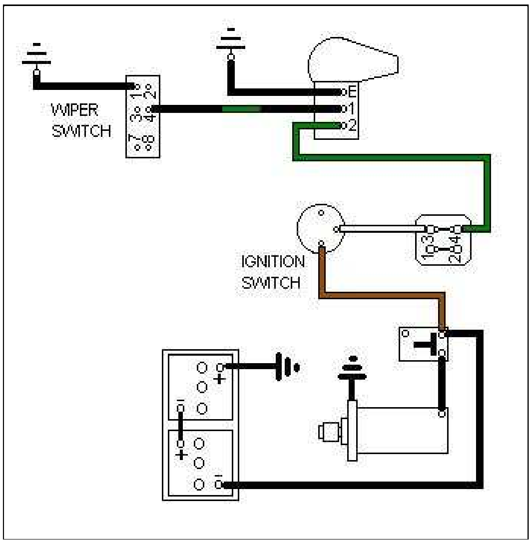
Until for 1977 with the longer brake master and servo assembly again there is a long tail with connections close to the steering column UJ:



The V8 also had them my the main harness:

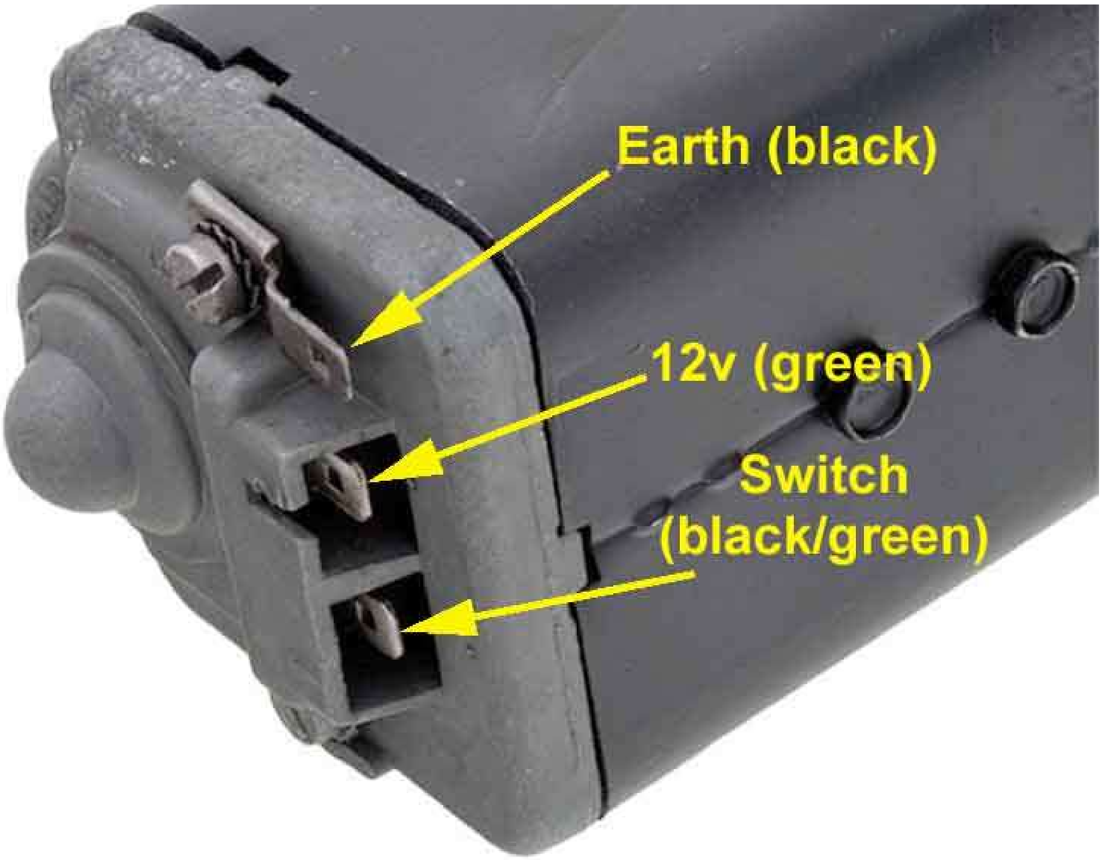
Wipers - MkI Roadster, single-speed, square bodied motor

Hover over a wire to confirm the colour



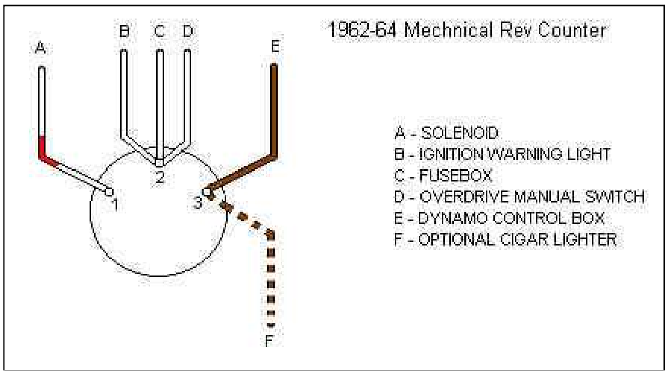
Notes:
1. The green at the motor is needed for running and parking, the earth at the motor for parking only.
2. One source indicates that this system is also used for their MkI GT single-speed round-bodied motor

Showing the connections. It looks like the spade connector on the green wire should have a 'fin' so it only fits one of the two shrouded spades (the one with the slot in the housing), but replacement harnesses may not. If you get the two coloured wires the wrong way round on those spades the fuse will blow. Get the black and the black/green the wrong way round and the motor will run all the time the ignition is on: (Moss Europe)



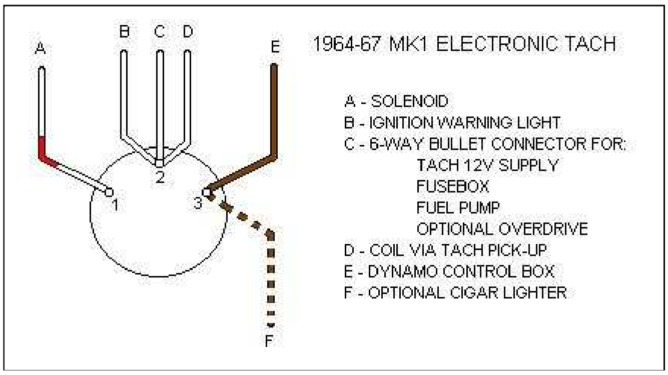
1962/64_Mechanical_Rev_Counter 1964/67_Mk1_Electronic_Tach Mk2_1967/68 Mk2_1967/68_North_America 1969 1969_North_America 1970 1970_North_America 1971/72 1971_North_America 1972_North_America 1973 1973_North_America 1974 1974_North_America 1974_1/2_to_76 1974_1/2_to_75_North_America 1976/77_North_America 1977 1978_on 1978-on_North_America V8

1962/64 Mechanical Rev Counter



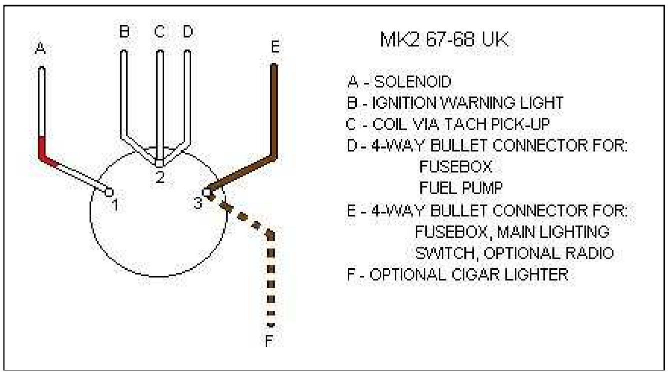
With the key inserted and turned to the first position (ignition) terminals 3 (brown) and 2 (white) are connected together. When turned to the 2nd position (start) all three terminals are connected together.
With the key turned fully left or out of the lock all of the terminals are isolated.

1964/67 Mk1 Electronic Tach



With the key inserted and turned to the first position (ignition) terminals 3 (brown) and 2 (white) are connected together. When turned to the 2nd position (start) all three terminals are connected together.
With the key turned fully left or out of the lock all of the terminals are isolated.

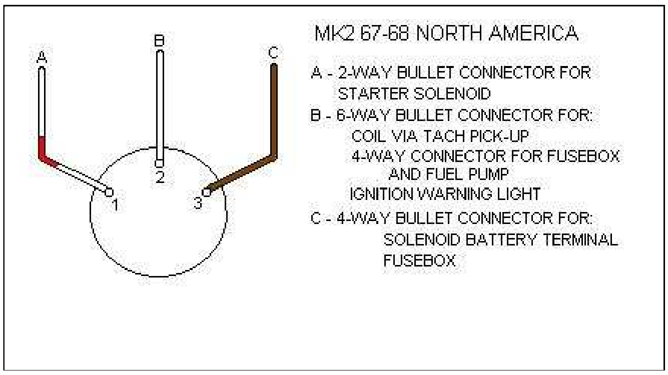
Mk2 1967/68



With the key inserted and turned to the first position (ignition) terminals 3 (brown) and 2 (white) are connected together. When turned to the 2nd position (start) all three terminals are connected together.
With the key turned fully left or out of the lock all of the terminals are isolated.

Note: The Parts Catalogue indicates that MkII cars had the later 13H926 ignition switch with the 4th 'AUX' terminal, but the schematics don't show this being used until the 1969 model year.

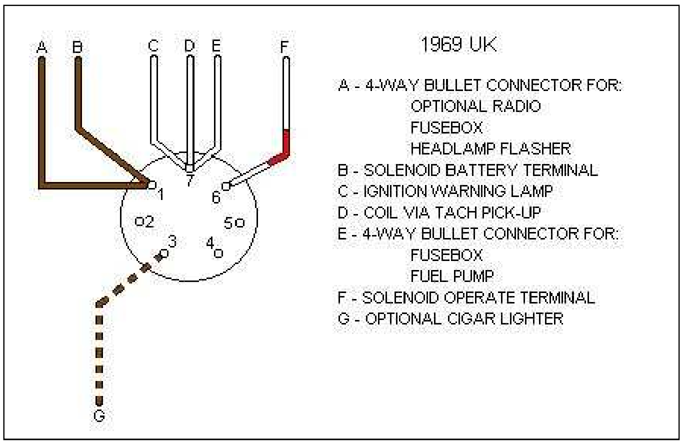
Mk2 1967/68 North America



With the key inserted and turned to the first position (ignition) terminals 3 (brown) and 2 (white) are connected together. When turned to the 2nd position (start) all three terminals are connected together.
With the key turned fully left or out of the lock all of the terminals are isolated.

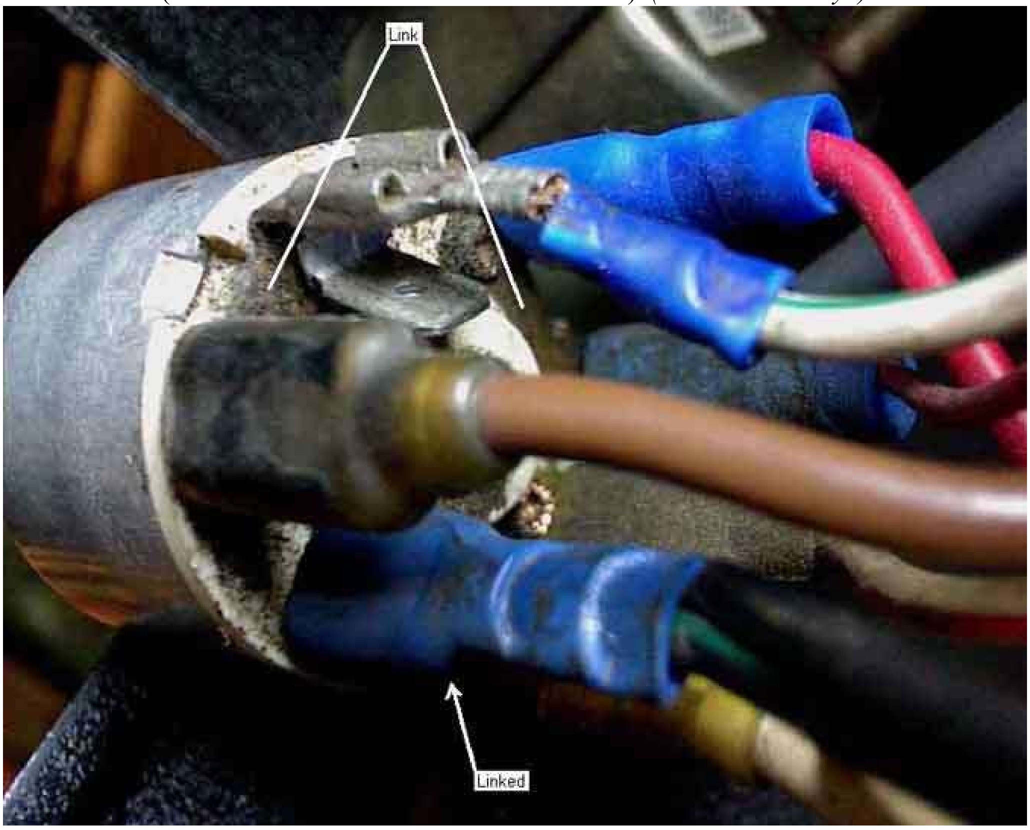
Note: The Parts Catalogue indicates that MkII cars had the later 13H926 ignition switch with the 4th 'AUX' terminal, but the schematics don't show this being used until the 1970 model year.

1969

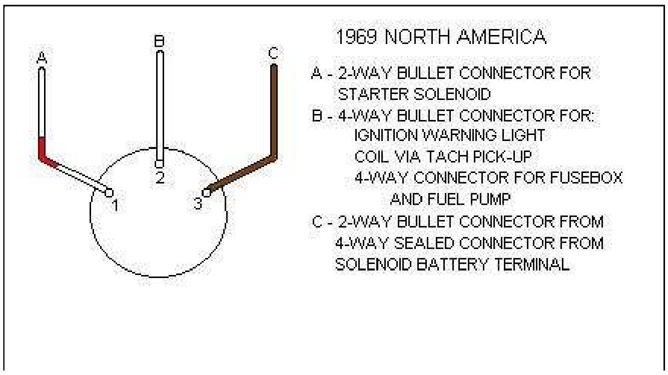


With the key inserted and turned to the first position (accessories) terminals 1 (brown) and 3 (dealer wired colour can vary) are connected together.
When turned to the 2nd position (ignition) terminals 1 3 and 7 (white) are connected together.
When turned to the 3rd position (start) terminals 1, 7 and 6 (white/red) are connected together and terminal 3 is isolated.
With the key turned fully left or out of the lock all of the terminals are isolated.

However whilst the diagram indicates there are seven electrical connections to the switch, a look at a switch will show that several of these are paired giving just the four electrical connections that one would expect. The picture below shows the brown and the next spade (non-factory wiring) being paired, then the next two terminals are paired (again non-standard accessory wiring), then the white/brown for the starter is on its own, then the last two are paired for white ignition wires (non-standard wires on the second of these). *(Photo Peter Mayo)*



1969 North America

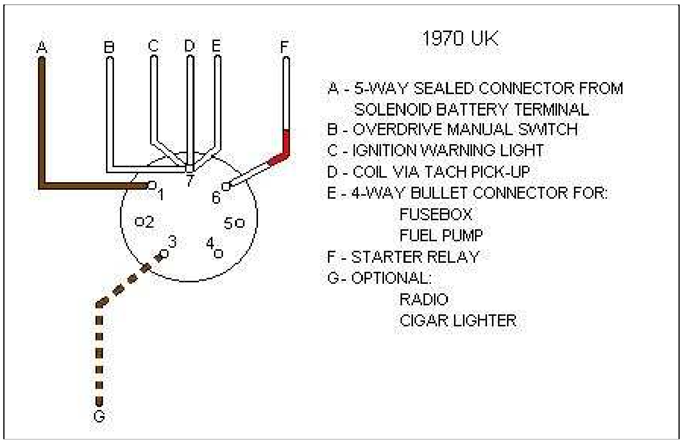


With the key inserted and turned to the first position (ignition) terminals 3 (brown) and 2 (white) are connected together.
When turned to the 2nd position (start) all three terminals are connected together.
With the key turned fully left or out of the lock all of the terminals are isolated.

Note: The Parts Catalogue indicates that MkII cars had the later 13H926 ignition switch with the 4th 'AUX' terminal, but the schematics don't show this being used until the 1970 model year.

1970

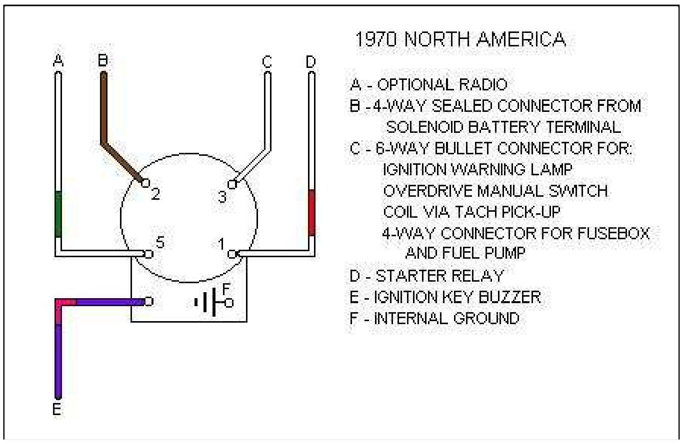
With the key inserted and turned to the first position (accessories) terminals 1 (brown) and 3 (dealer wired colour can vary) are connected together.
When turned to the 2nd position (ignition) terminals 1, 3 and 7 (white) are connected together.



When turned to the 3rd position (start) terminals 1, 7 and 6 (white/red) are connected together and terminal 3 is isolated.
With the key turned fully left or out of the lock all of the terminals are isolated.

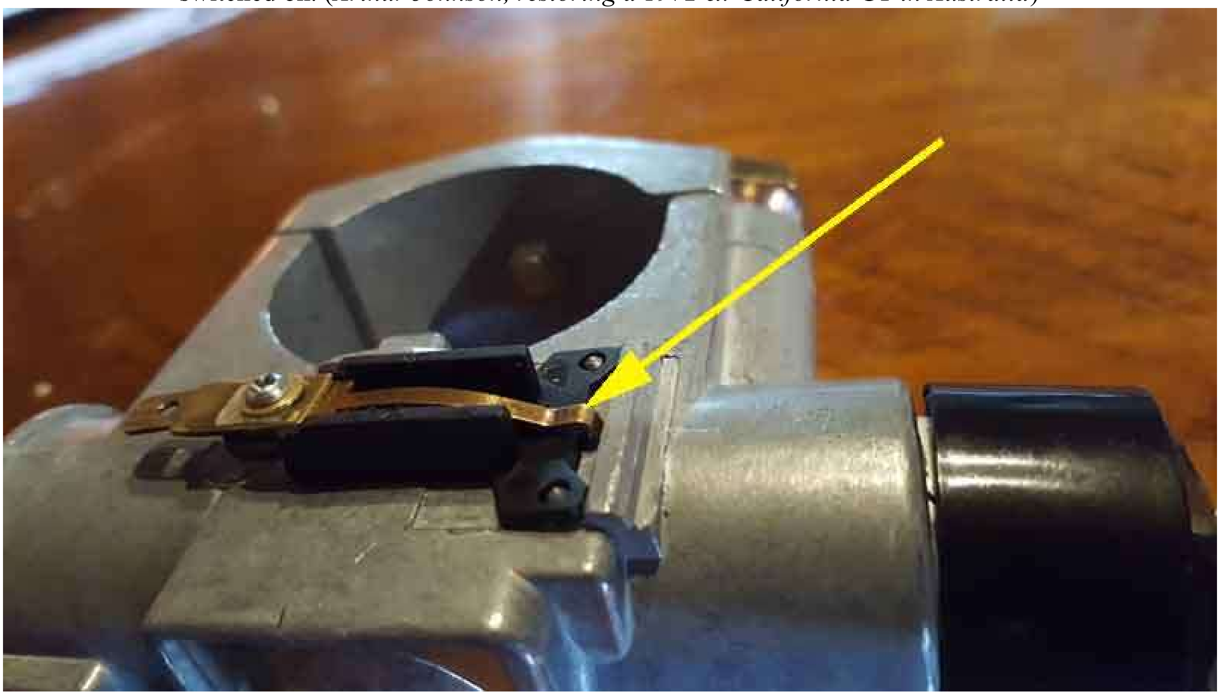
Again refer to the photo above for the physical arrangement.

1970 North America



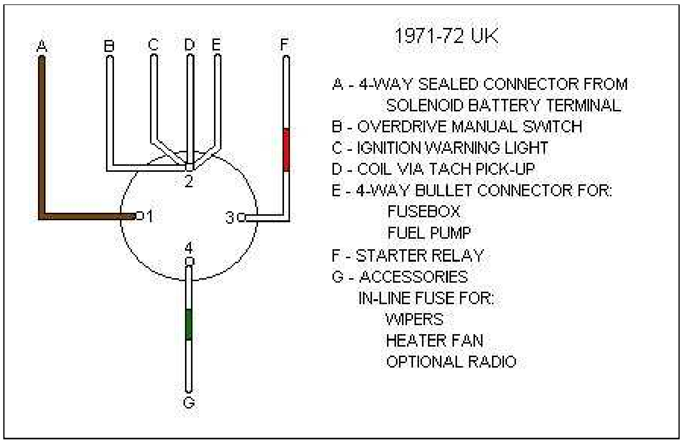
With the key turned to the first position (accessories) terminals 2 (brown) and 5 (white/green) are connected together.
When turned to the 2nd position (ignition) terminals 2, 5 and 3 (white) are connected together.
When turned to the 3rd position (start) terminals 2, 3 and 1 (white/red) are connected together and terminal 5 is isolated.
With the key turned fully left or out of the lock terminals 1, 2, 3 and 5 are isolated.

Showing the additional contact for the purple/pink wire - E. When the key is inserted a pin pushes the spring (arrowed) against the body of the lock to connect an earth to the wire, which if the driver's door is opened sounds the warning buzzer. Testing has shown that this only happens when the switch is in the 'OFF' position, however one would expect that it should also be operated in the accessories position. On the face of it, it doesn't need to be operated if the engine is running (should be obvious ...), but that still leaves the situation of no warning buzzer if the engine has stalled and the ignition is still switched on. (*Arthur Johnson, restoring a 1972 ex-California GT in Australia*)



1971/72

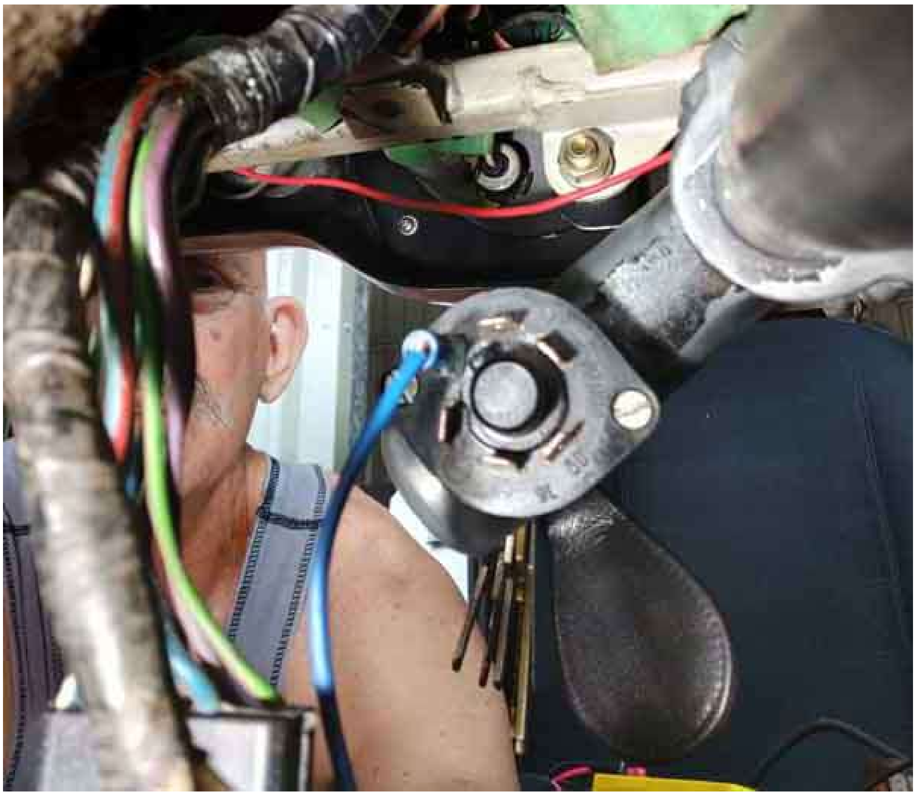
With the key inserted and turned to the first position (accessories) terminals 1 (brown) and 4 (white/green) are connected together.
When turned to the 2nd position (ignition) terminals 1, 4 and 2 (white) are connected together.



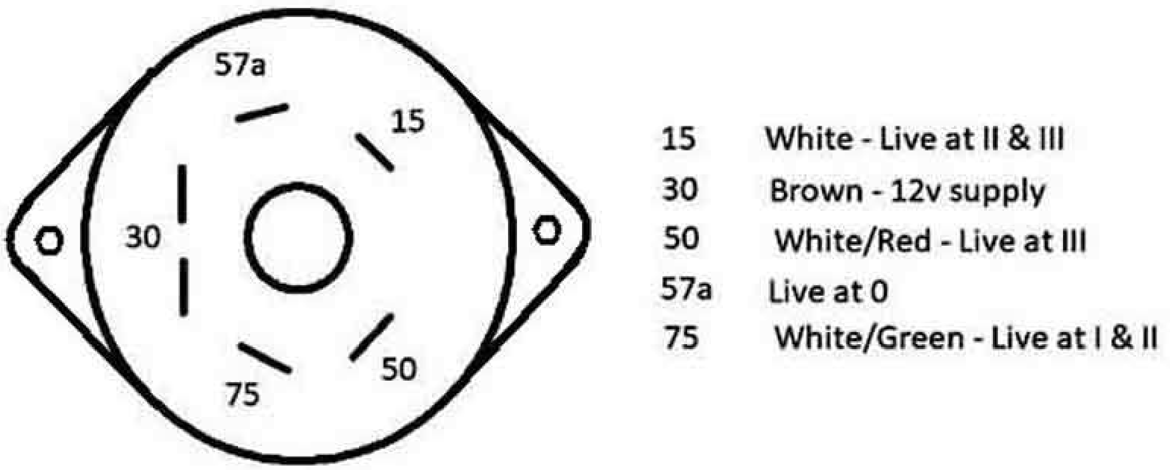
When turned to the 3rd position (start) terminals 1, 2 and 3 (white/red) are connected together and terminal 4 is isolated. With the key turned fully left or out of the lock all of the terminals are isolated.

May 2015: Note that this numbering may not be correct. The white wires are shown going to terminal 2 - four wires on two spade connectors. But one example of a switch from a 72 has terminals 1, 2, 3 and 4 with linked spades (which will be for the two connectors on the four white wires) on terminal 3. 73 and later schematics show the white wires on terminal 3, which would be correct for this switch, but the white/green for 73 and later is on terminal 5 and there is no terminal 4.

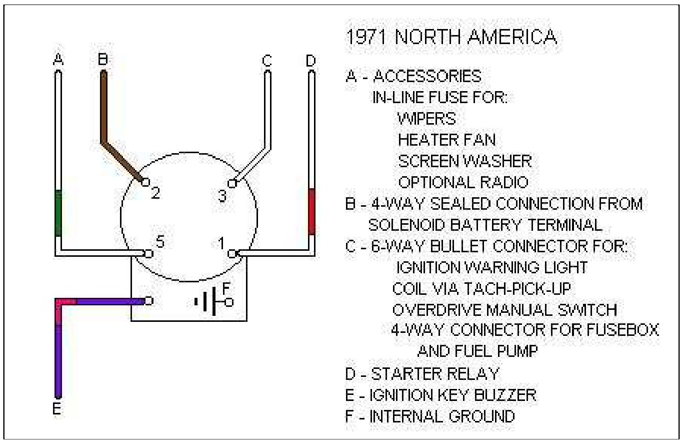
Info from the Parts Catalogue and Clausager indicates that a different type of lock and 'eared' switch was fitted from February 72 to the end of CB production, as in this case on John Hall's 1973 MGB in Queensland Australia:



The connections, in the fitted orientation as above, by Dave O'Neil:

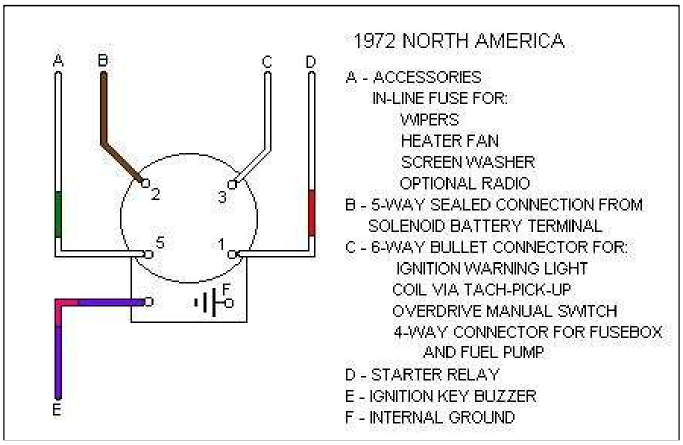


1971 North America



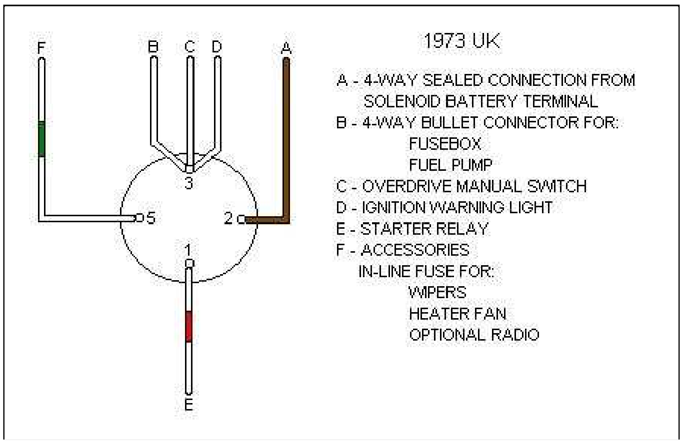
With the key turned to the first position (accessories) terminals 2 (brown) and 5 (white/green) are connected together.
When turned to the 2nd position (ignition) terminals 2, 5 and 3 (white) are connected together.
When turned to the 3rd position (start) terminals 2, 3 and 1 (white/red) are connected together and terminal 5 is isolated.
With the key turned fully left or out of the lock terminals 1, 2, 3 and 5 are isolated.
For the purple/pink see 1970 North America above.

1972 North America



With the key turned to the first position (accessories) terminals 2 (brown) and 5 (white/green) are connected together.
When turned to the 2nd position (ignition) terminals 2, 5 and 3 (white) are connected together.
When turned to the 3rd position (start) terminals 2, 3 and 1 (white/red) are connected together and terminal 5 is isolated.
With the key turned fully left or out of the lock terminals 1, 2, 3 and 5 are isolated.
For the purple/pink see 1970 North America above.

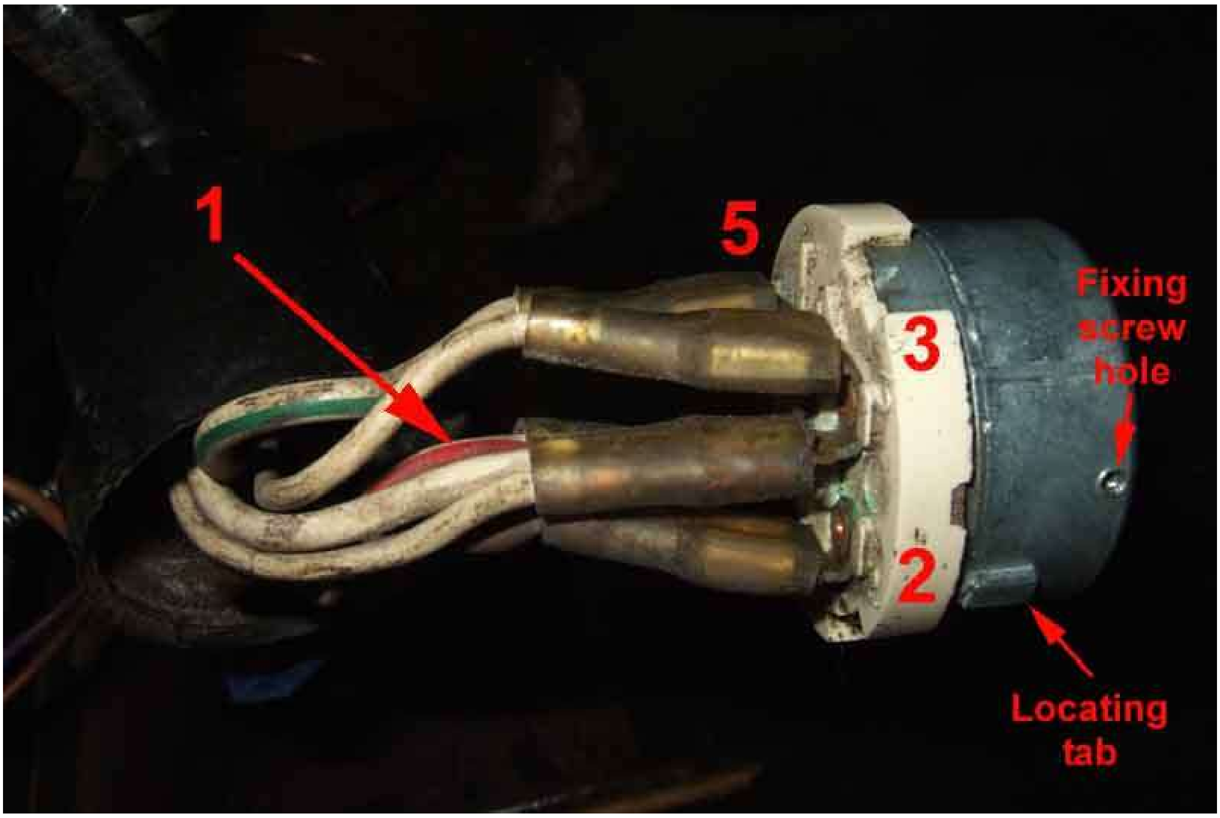
1973

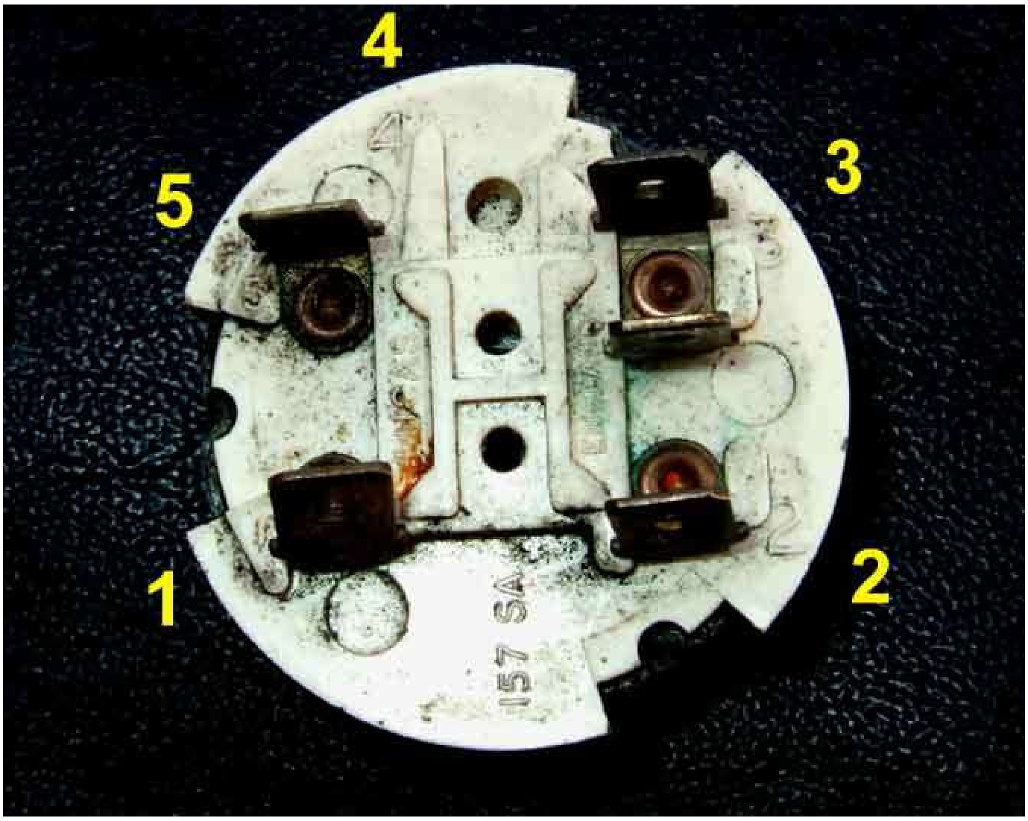


With the key inserted and turned to the first position (accessories) terminals 2 (brown) and 5 (white/green) are connected together.
When turned to the 2nd position (ignition) terminals 2, 5 and 3 (white) are connected together.
When turned to the 3rd position (start) terminals 2, 3 and 1 (white/red) are connected together and terminal 5 is isolated.
With the key turned fully left or out of the lock all of the terminals are isolated.

Note there is a number '4' moulded into the switch but this is for an unused space between 3 and 5.

Ceramic-base type:



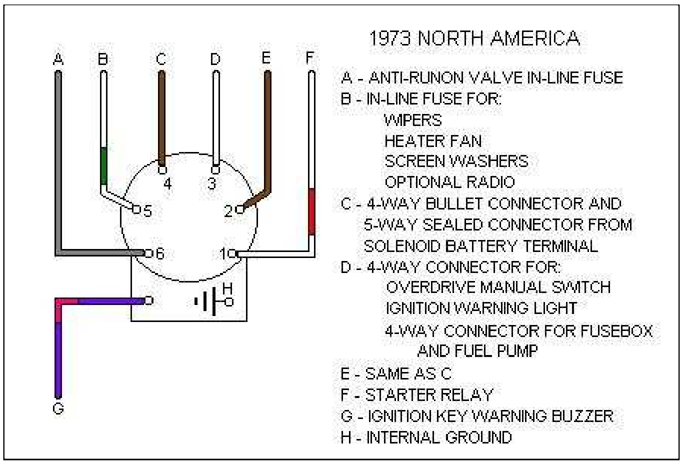


There are also 'paxolin'-based types with the same terminals and numbering, and others with double spades on two or more of the terminals.

On this model at least more than one spade is used for the white wires, and I found one of those swapped over with the green/white accessories wire. Fortunately it was only the wire feeding the OD, had it been one of the others either the ignition warning light would have been on when switched to accessories, or even worse the ignition, fuel pump and all the green circuits would have been powered. Even so it meant the OD solenoid would have been powered had I left it in 3rd or 4th with the manual switch on, which is not a good thing. As I'd had the car nearly 30 years by then, it had probably been like it since new.

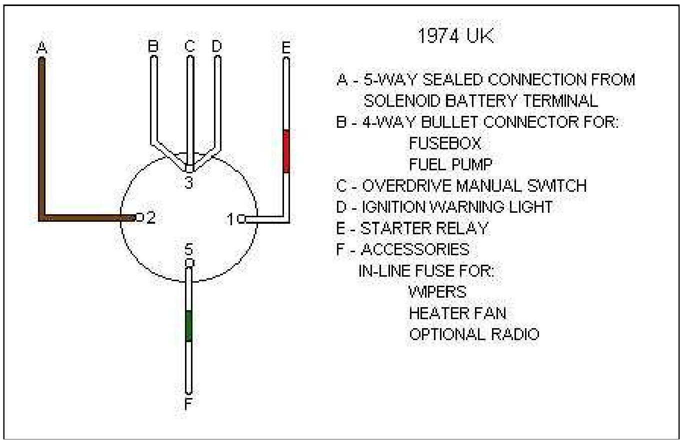
See also this alternative

1973 North America



With the key turned to the first position (accessories) terminals 4 or 2 and 5 (white/green) are connected together, and terminals 4 or 2 and 6 (slate or grey) are connected together.
When turned to the 2nd position (ignition) terminals 4 or 2, 5 and 3 (white) are connected together, and terminal 6 is isolated.
When turned to the 3rd position (start) terminals 4 or 2, 3 and 1 (white/red) are connected together and terminals 5 and 6 are isolated.
With the key turned fully left or out of the lock terminals 1, 3 and 5 are isolated, and terminals 4 or 2 and 6 are connected together.
For the purple/pink see 1970 North America above.

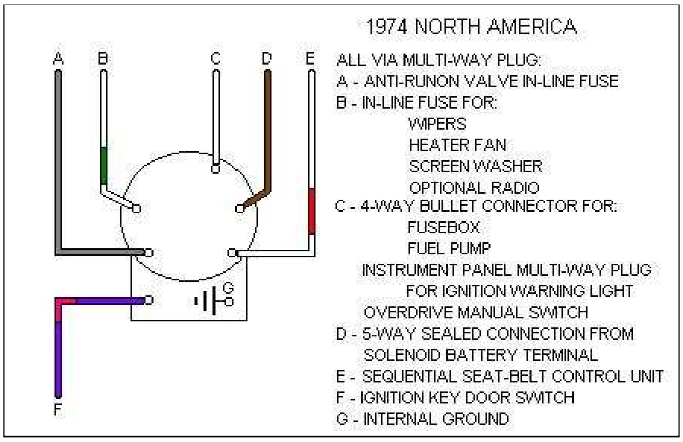
1974



With the key inserted and turned to the first position (accessories) terminals 2 (brown) and 5 (white/green) are connected together.
When turned to the 2nd position (ignition) terminals 2, 5 and 3 (white) are connected together.
When turned to the 3rd position (start) terminals 2, 3 and 1 (white/red) are connected together and terminal 5 is isolated.
With the key turned fully left or out of the lock all of the terminals are isolated.

See also this alternative

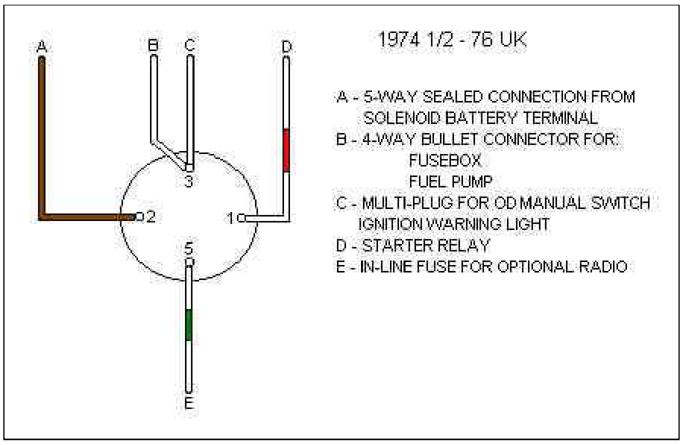
1974 North America



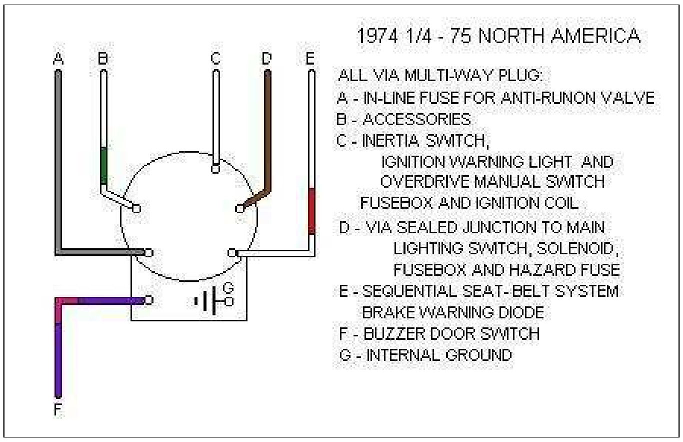
My wiring diagrams do not show terminal numbers for this lock.
With the key turned to the first position (accessories) the brown (12v), white/green (accessories) and slate or grey (anti-runon valve) wires should be connected together.
When turned to the 2nd position (ignition) the brown, white/green and white (ignition) wires should be connected together and the slate or grey wire should be isolated.
When turned to the 3rd position (start) the brown, white and white/red (starter) wires should be connected together and the white/green and slate or grey wires should be isolated.
With the key turned fully left or out of the lock the white, white/green and white/red wires should be isolated and the brown and slate or grey wires should be connected together.
For the purple/pink see 1970 North America above.

1974 1/2 to 76

With the key inserted and turned to the first position (accessories) terminals 2 (brown) and 5 (white/green) are connected together.
When turned to the 2nd position (ignition) terminals 2, 5 and 3 (white) are connected together.
When turned to the 3rd position (start) terminals 2, 3 and 1 (white/red) are connected together and terminal 5 is isolated.
With the key turned fully left or out of the lock all of the terminals are isolated.
Note that UK cars seem to have an extra grey wire on the ignition switch that does not have a matching wire in the main harness.
Note also that replacement switches for UK cars have an extra purple/pink as well as the extra grey wire. These are the same switches as used for North America from 1973 on. They *should* be plug compatible with UK harnesses, but check the four main wires - brown, white/green, white and white/red match up correctly in both halves of the connector.



1974 1/2 to 75 North America



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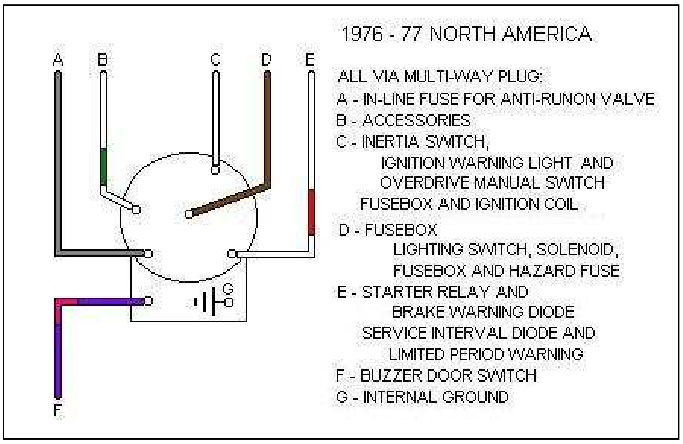
When turned to the 2nd position (ignition) the brown, white/green and white (ignition) wires should be connected together and the slate or grey wire should be isolated.
When turned to the 3rd position (start) the brown, white and white/red (starter) wires should be connected together and the white/green and slate or grey wires should be isolated.
With the key turned fully left or out of the lock the white, white/green and white/red wires should be isolated and the brown and slate or grey wires should be connected together.
For the purple/pink see 1970 North America above.

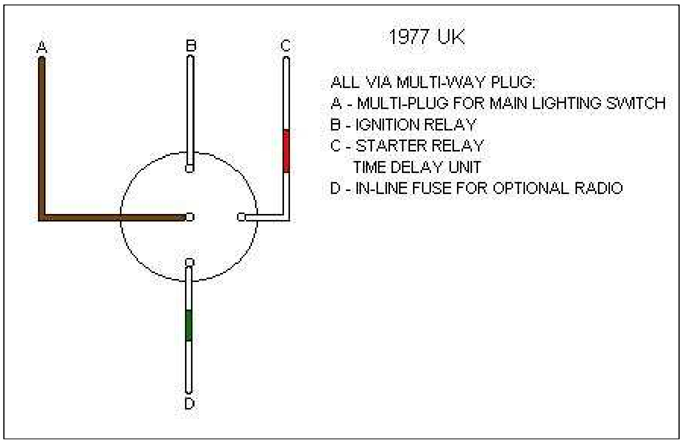
1976 to 77 North America



My wiring diagrams do not show terminal numbers for this lock.
With the key turned to the first position (accessories) the brown (12v), white/green (accessories) and slate or grey (anti-runon valve) wires should be connected together.
When turned to the 2nd position (ignition) the brown, white/green and white (ignition) wires should be connected together and the slate or grey wire should be isolated.
When turned to the 3rd position (start) the brown, white and white/red (starter) wires should be connected together and the white/green and slate or grey wires should be isolated.
With the key turned fully left or out of the lock the white, white/green and white/red wires should be isolated and the brown and slate or grey wires should be connected together.
For the purple/pink see 1970 North America above.

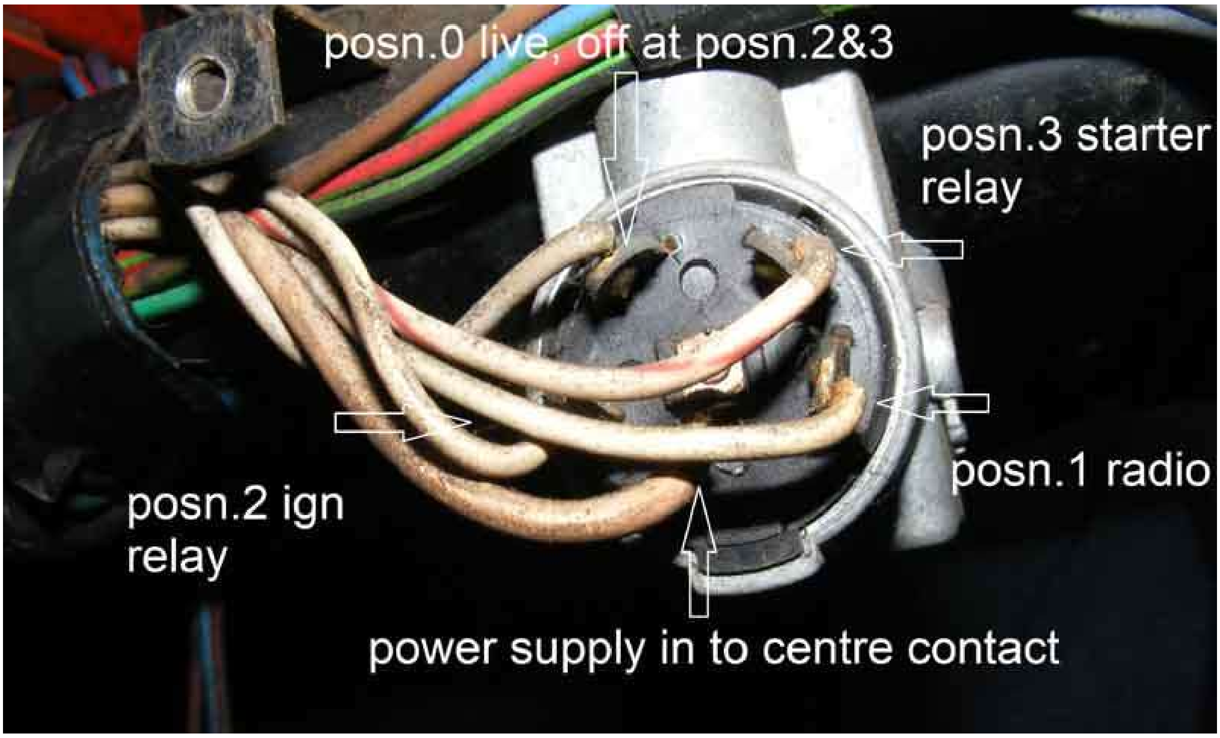
1977

My wiring diagrams do not show terminal numbers for this lock.
With the key inserted and turned to the first position (accessories) the brown (12v) and white/green (accessories) wires should be connected together.
When turned to the 2nd position (ignition) the brown, white/green and white (ignition) wires should be connected together.
When turned to the 3rd position (start) the brown, white and white/red (starter) wires should be connected together and the white/green wire should be isolated.
With the key turned fully left or out of the lock all of the terminals are isolated.
Note that UK cars seem to have an extra grey wire on the ignition switch that does not have a matching wire in the main harness.
Note also that replacement switches for UK cars have an extra purple/pink as well as the extra grey wire. These are the

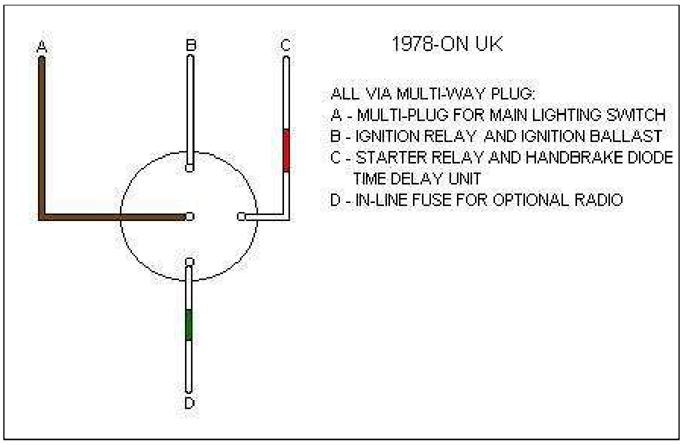


same switches as used for North America from 1973 on. They *should* be plug compatible with UK harnesses, but check the four main wires - brown, white/green, white and white/red match up correctly in both halves of the connector.

Image from Crispin Allen showing the North American slate/grey anti-runon valve wire at 'posn.0' on a UK 1977:



1978-on



My wiring diagrams do not show terminal numbers for this lock.
With the key inserted and turned to the first position (accessories) the brown (12v) and white/green (accessories) wires should be connected together.
When turned to the 2nd position (ignition) the brown, white/green and white (ignition) wires should be connected together.
When turned to the 3rd position (start) the brown, white and white/red (starter) wires should be connected together and the white/green wire should be isolated.
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Note that UK cars seem to have an extra grey wire on the ignition switch that does not have a matching wire in the main harness.
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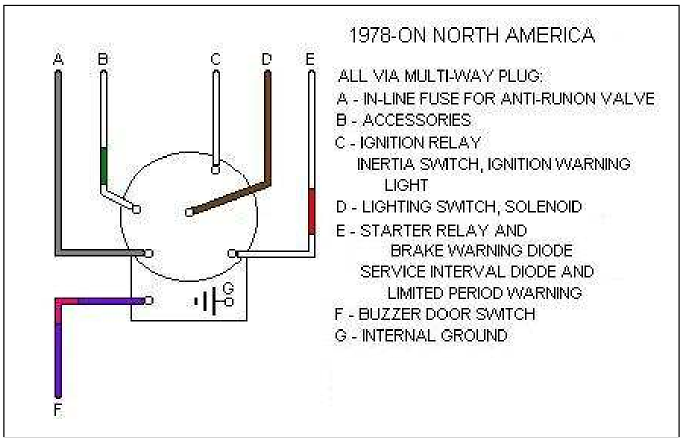
1978-on North America



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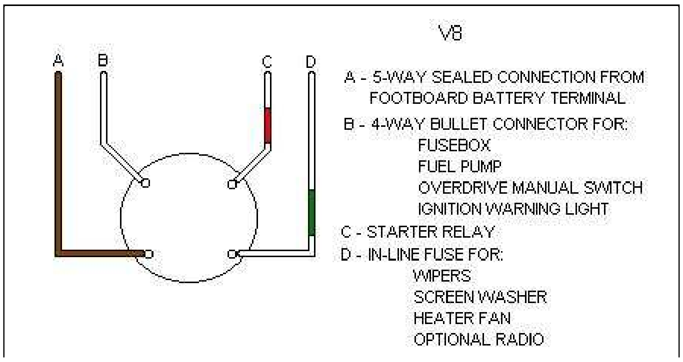
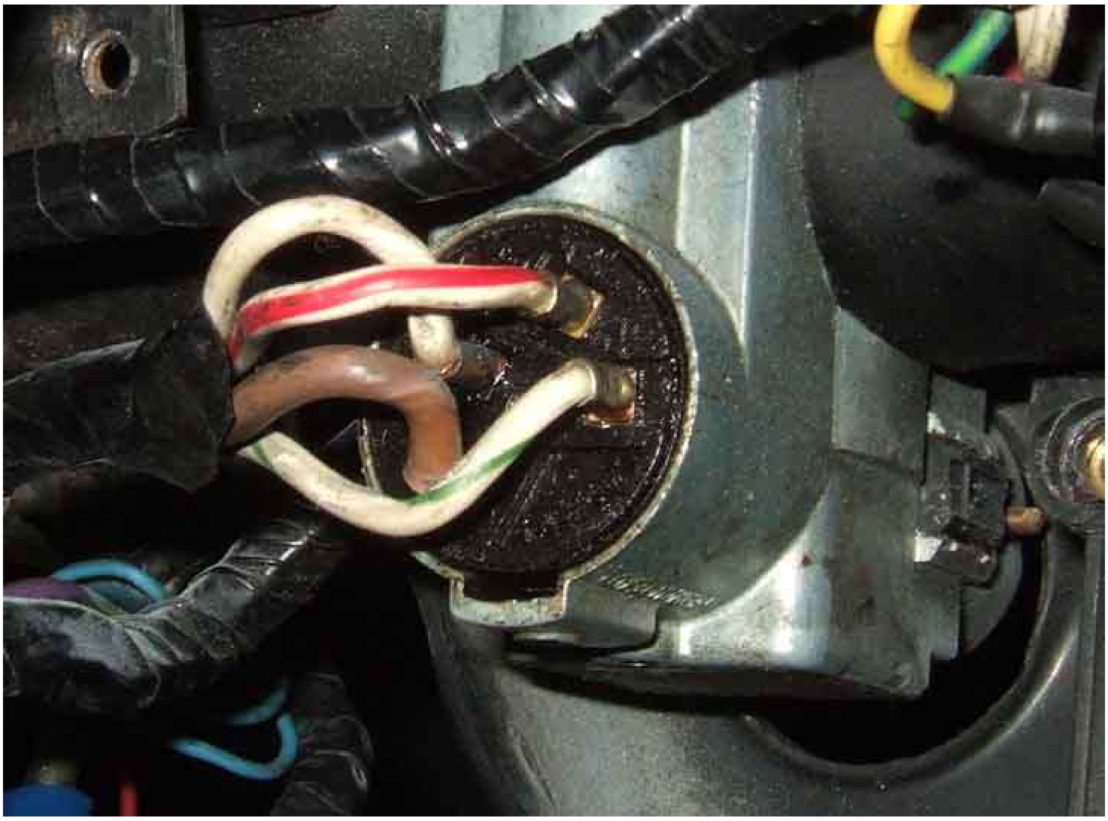
With the key turned to the first position (accessories) the brown (12v), white/green (accessories) and slate or grey (anti-runon valve) wires should be connected together.
When turned to the 2nd position (ignition) the brown, white/green and white (ignition) wires should be connected together and the slate or grey wire should be isolated.
When turned to the 3rd position (start) the brown, white and white/red (starter) wires should be connected together and the white/green and slate or grey wires should be isolated.
With the key turned fully left or out of the lock the white, white/green and white/red wires should be isolated and the brown and slate or grey wires should be connected together.
For the purple/pink see 1970 North America above.

V8



My wiring diagrams do not show terminal numbers for this lock.
With the key inserted and turned to the first position (accessories) the brown (12v) and white/green (accessories) wires should be connected together.
When turned to the 2nd position (ignition) the brown, white/green and white (ignition) wires should be connected together.
When turned to the 3rd position (start) the brown, white and white/red (starter) wires should be connected together and the white/green wire should be isolated.
With the key turned fully left or out of the lock all of the terminals are isolated.

As you can see this switch comes with a short sub-harness and bullet connections to connect to the main harness:



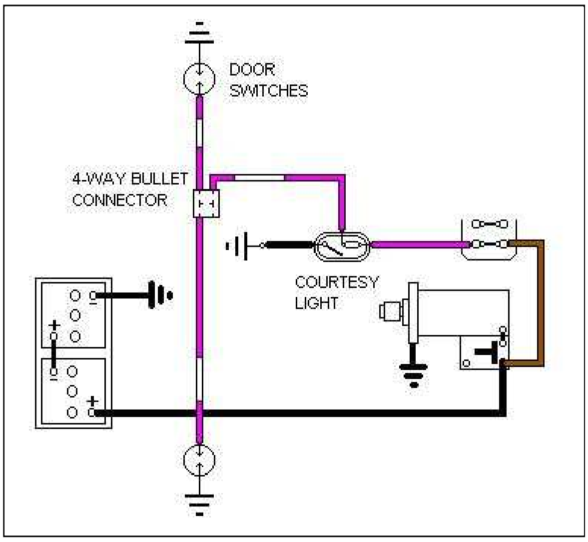
Interior Lights, and 'lights on' warning

'Lights on' warning **LED Upgrades** **Roadster boot light** **GT Loadspace light**

Hover over a wire to confirm the colour

Prior to 1971 the Workshop Manual shows North American cars having an optional courtesy light controlled by door switches and an integral manual switch, as well as a map light. But according to Clausager all North American Mk2 cars prior to 1971 had a map light on the centre console controlled by a rocker switch below the radio, not getting the courtesy light until the 1971 model year. The WSM also indicates the earth to the manual switch in that courtesy light as coming from its mechanical fixings, but being mounted on a plastic console it would have to be a wired earth.

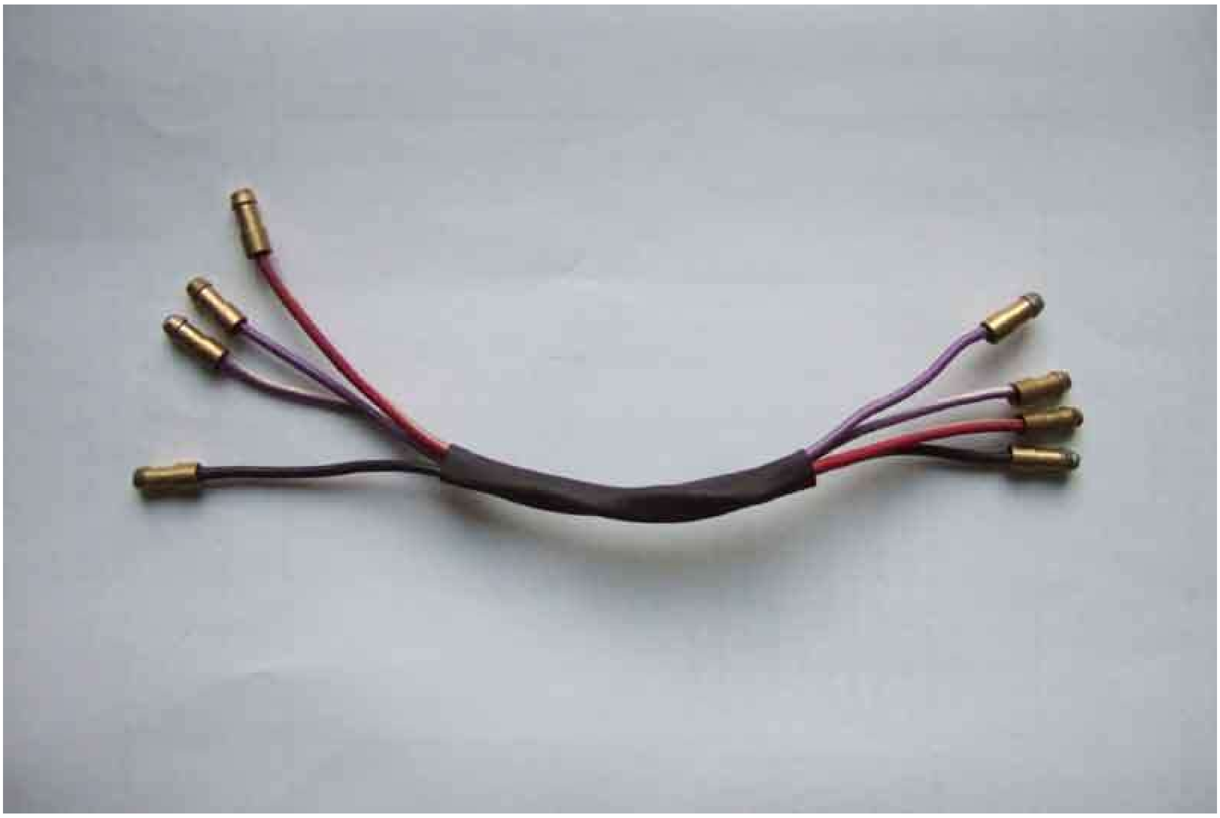
The standard circuit as used from 1971 (North America) or 1972 (elsewhere):



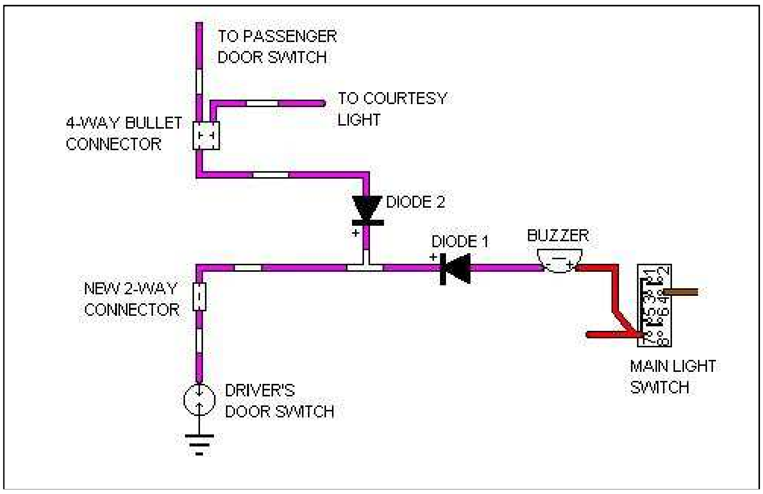
Note: Haynes issue dated 2010 with coloured schematics has an error in the drawing of the courtesy light for 1973 cars, and later - they have reversed the 12v (purple) and earth (black) connections, putting 12v to the switch and earth to the bulb. Wired that way it wouldn't work at all from either the door switches or the manual switch, but if both are operated at the same it will blow the purple circuit fuse. Earlier versions e.g. my 1989 copy are drawn correctly.

Centre console light BHA5138: (*Moss Europe*)

An extender harness for the purple (fused 12v), black (earth), purple/white (courtesy switch earth) and red/white (illumination) wires behind the centre console. That still has to be fitted to the main harness as a one-off exercise, but once that's done things like the courtesy light, lighter socket etc. will be easier to deal with in future:



With 'lights on' warning buzzer:



This has been redrawn and rewritten as the previous version still allowed for a drain. Only discovered when helping a pal look for a drain - found to be through the buzzer diode. I then looked at the circuit to compare his with how I thought it should be wired, and immediately realised the circuit was wrong, and had been for over 15 years! Hopefully right now ... unless anyone knows different.

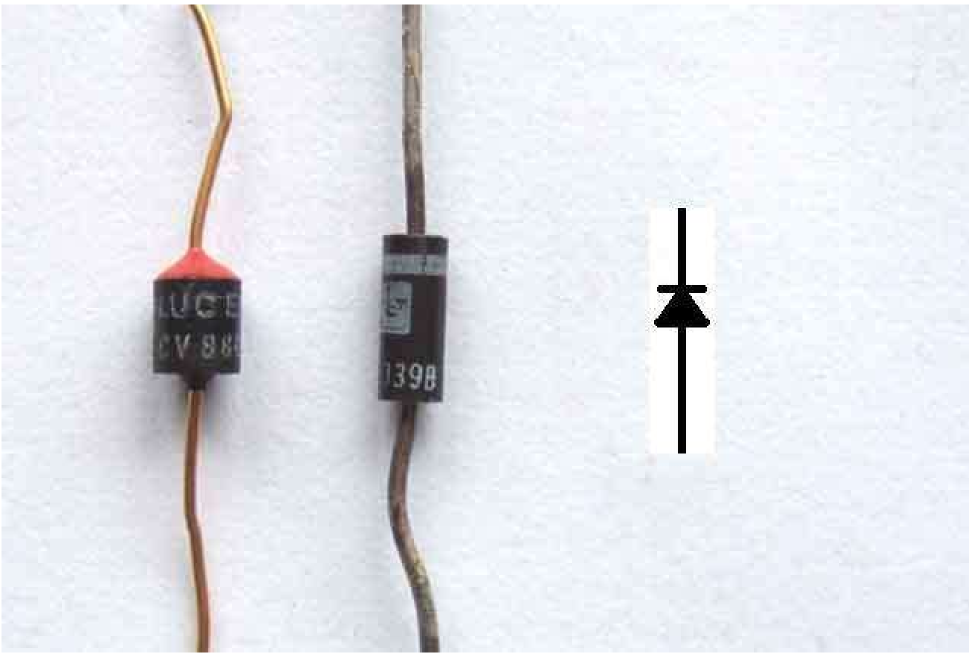
Diode 1 is essential to prevent a continual small drain from the courtesy light circuit, through the buzzer and to earth via the parking lights while the car is parked with the lights off. This option is provided by connecting the positive end of diode 1 into the spare hole of the 4-way bullet connector that is behind the centre of the dash.

Diode 2 can be added to prevent the passenger door and the manual switch on the courtesy light also sounding the buzzer. To avoid cutting wires this version can be provided by taking the drivers door switch wire out of the 4-way bullet connector behind the centre of the dash, and making up a 3-way tee with diode 1 and the buzzer to the parking light circuit; diode 2 to the 4-way bullet connector; and a wire via a new 2-way bullet connector to the drivers door switch wire.

Diode polarity is shown for negative earth cars, reverse for positive earth..

Diodes showing how the markings relate to the schematic symbol, i.e. the marked end (red blob, thick silver band) denotes the pointed end of the 'arrow' symbol, and the direction of the arrow indicates the direction of conventional current flow i.e. from

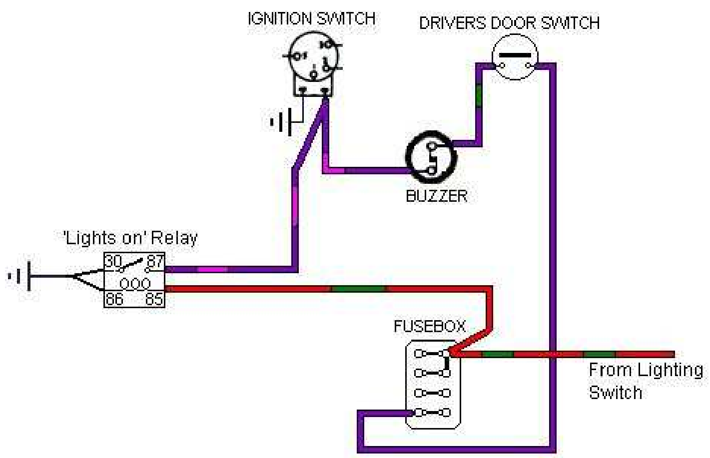
+ve to -ve. Note the one on the left is a Lucas (yes, that Lucas) diode, the other is the type you are more likely to find these days:



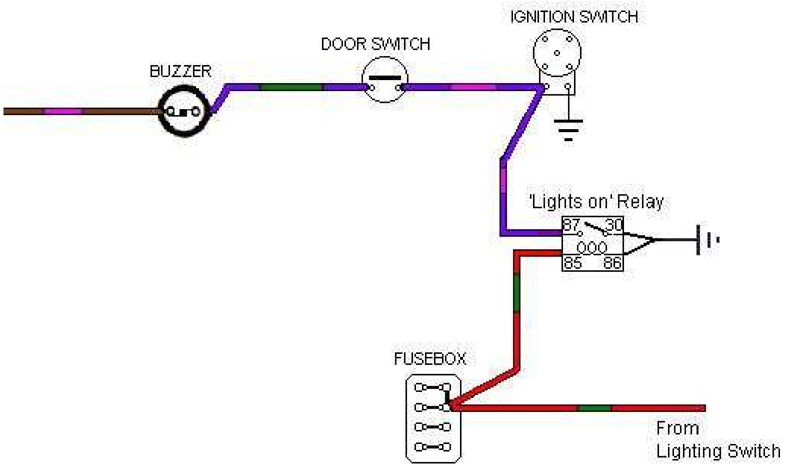
North American spec cars with Seat-belt Buzzer:

In all cases add the relay with connections to the purple/pink and red/green circuits as shown. The relay simulates the key being left in when you open the door, i.e. sounds the buzzer, but from the lights being left on instead. The key-in function is unaffected, if either the lights are on **or** the key is in when the drivers door is opened, the buzzer will sound.

1971-73 driver and passenger seat-belt warning system



1973-75 driver and passenger seat-belt warning system with starter interlock, and 75-80 driver only systems.



LED upgrade

From top to bottom an original 6w type; commonly available '5050'-type; less commonly available Cree type. There are several different lengths of festoon available (reverse light festoons are 44mm for example), whilst the holders can be 'adjusted' for a range of sizes opt for the standard 39mm for courtesy lights.

In the reversing lights for comparison - both sides taken in the same picture then edited together for convenience. Standard 18w festoons on both sides, despite the one on the left appearing brighter, possibly a newer bulb with less blackening inside the glass.


Standard 18w festoon on the left, noticeably brighter than the 6w on the right

5050-type on the left, 6w festoon on the right - not obviously brighter, just whiter

Cree-type on the left - very much brighter than the standard 18w festoon on the right

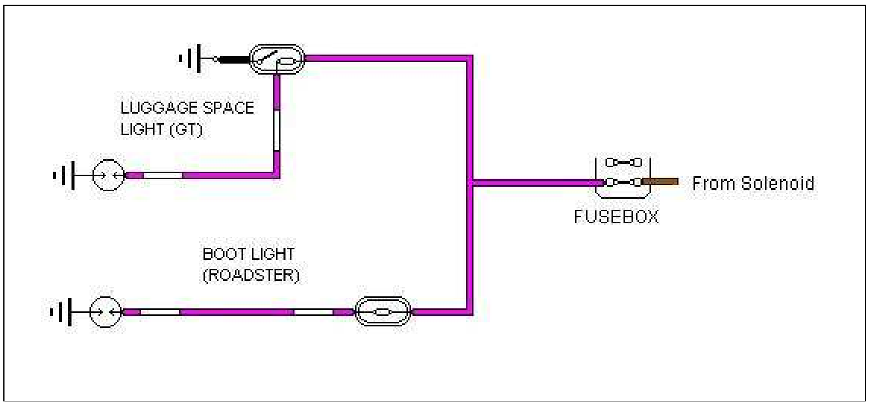
Finally Cree-type on the left - again much brighter than the 5050-type on the right

More difficult to compare the three in the interior light fitting as I can only take one at a time - standard 6w festoon.

5050-type - almost identical exposure as shown by the foot brace and floor mat patterning in the passenger footwell, hence equivalent brightness, albeit whiter of course.

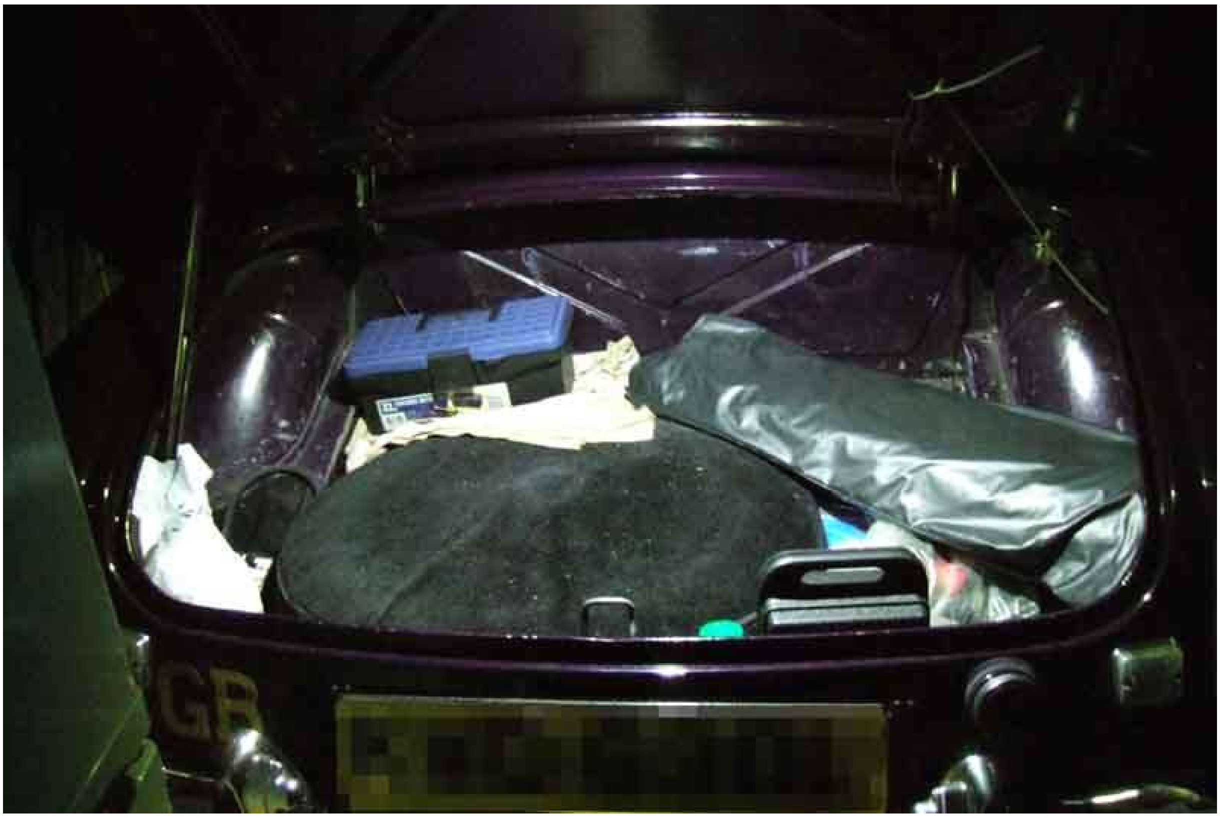
Cree-type: Much less exposure, sharper contrast, much less detail in the passenger footwell, showing it is much brighter.

Roadster boot light



Standard light

'Eagle Eye' light

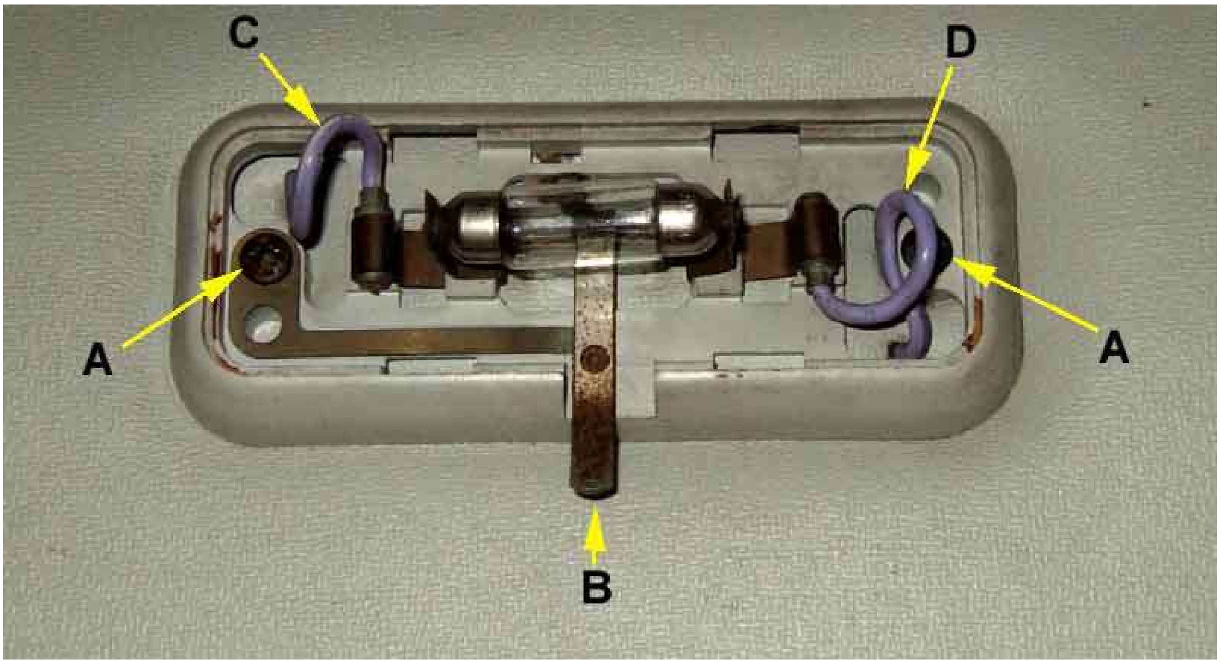


The LED positioned in the cut-out for the latch release, on the right-hand side so as not to interfere with the release mechanism in either the locked or unlocked positions. Attached using a strip of plastic (from an offcut of square black guttering downpipe - very useful stuff) under one of the latch fixing screws. It could be attached using a screw or double-sided sticky pad to the underside of the latch, but I have my emergency boot release mechanism already there.

The cable is run down inside the reinforcing frame towards the right-hand hinge, then up into the cavity in the boot surround, to the switch and boot harness bullet connector for the switched earth and 12v supply respectively. A cable tie round the frame near the hinge keeps it in position. I've removed the existing boot light and its sub-harness making connection of the new light easier - just two bullets on the end of the cable - as it no longer serves a useful purpose, and the cover was always falling off anyway.

GT loadspace light The original incandescent festoons can damage the cover (and that on the interior lights) through heat - the bright patch just above the switch is a hole in the cover (24G3389). Annoyingly although I have replaced the roadster boot light with an LED the undamaged cover from that will not fit the GT as even though the bases of both light units are flat, and the edges of the GT cover are also flat, the edges of the roadster cover are curved!

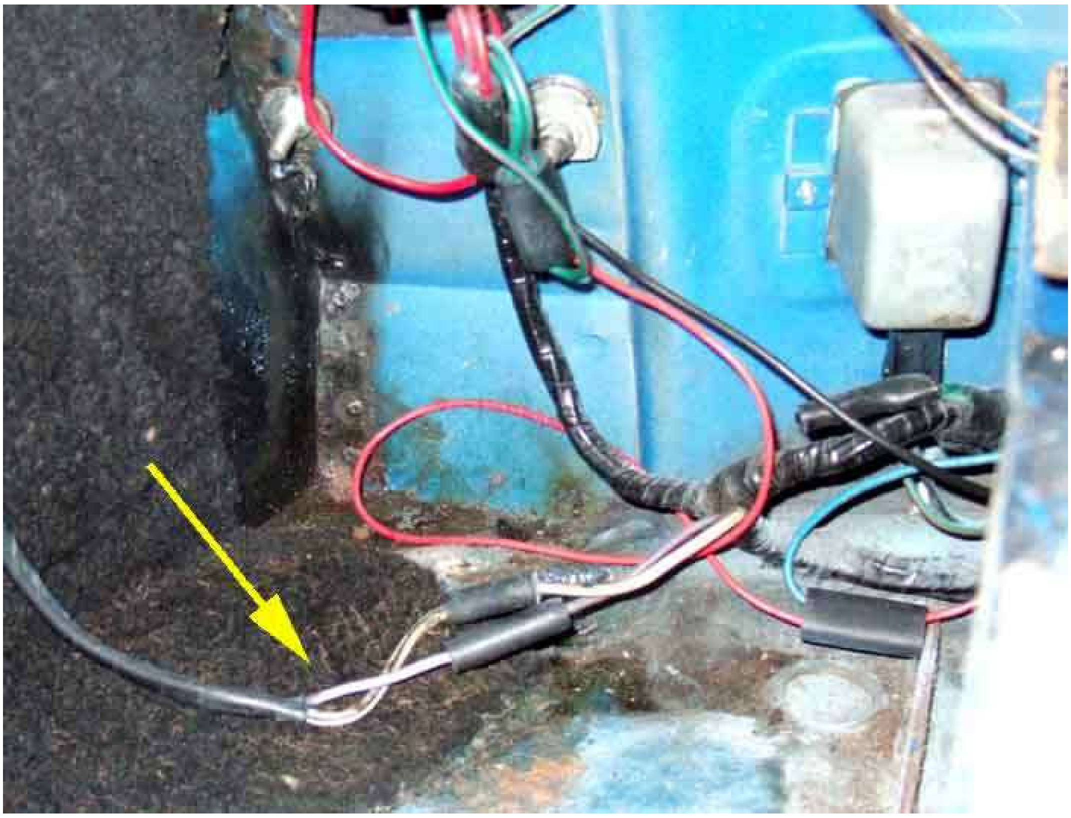
'A' are the fixing screws, the left-hand one (in this image, right-hand on the car) picks up the earth for the manual switch from the car body.
'B' is the manual switch.
'C' is the purple/white wire from the hatch switch.
'D' is the purple 12v supply wire.



Manual switch operated, simply touches the left-hand (in this image, right-hand on the car) bulb contact. The purple/white wire from the hatch switch must go to this end of the courtesy light and the purple 12v supply to the other end. Getting them the wrong way round will blow the fuse:

The manual switch (arrowed), depressed by the tab on the hatch to turn the light off.

The 12v feeds to the load-space light (purple) and HRW (white/black) come off bullet connections by the right-hand light cluster and go up the C-post.



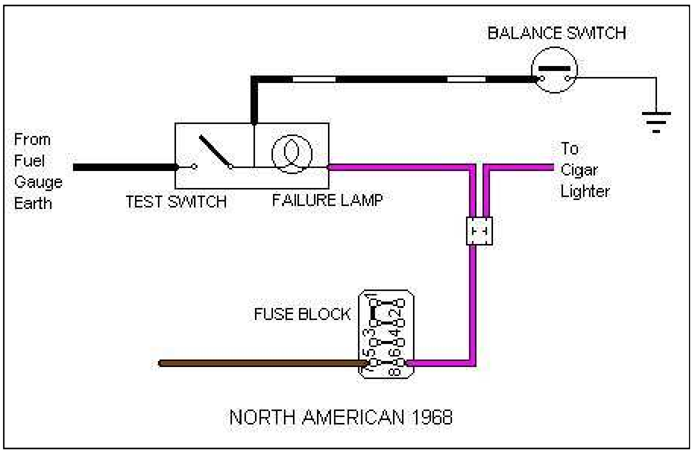
Why a manual switch? Perhaps ... (from an original sales brochure). It should be noted that the only way someone of typical adult stature can sit in the back is if their head is craned forwards ... hence the magazine.

With new cover and an LED, it's the big increase in brightness that has reduced the exposure.

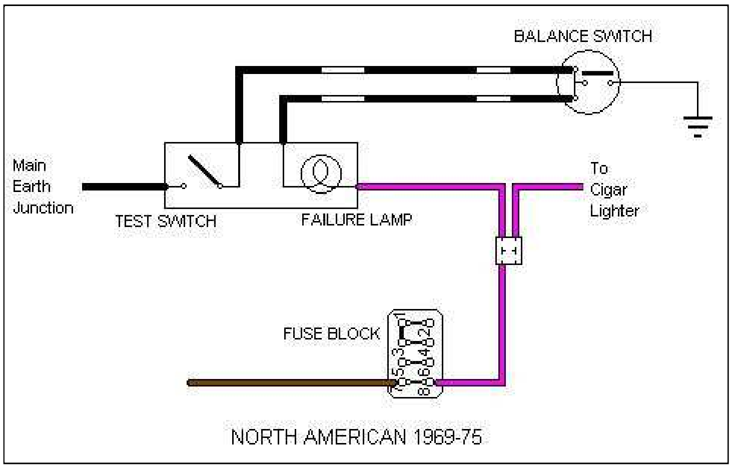
Brake Balance and Handbrake Warning

North America 1968   North America 1969-75   North America 1976-on   UK 1977-on

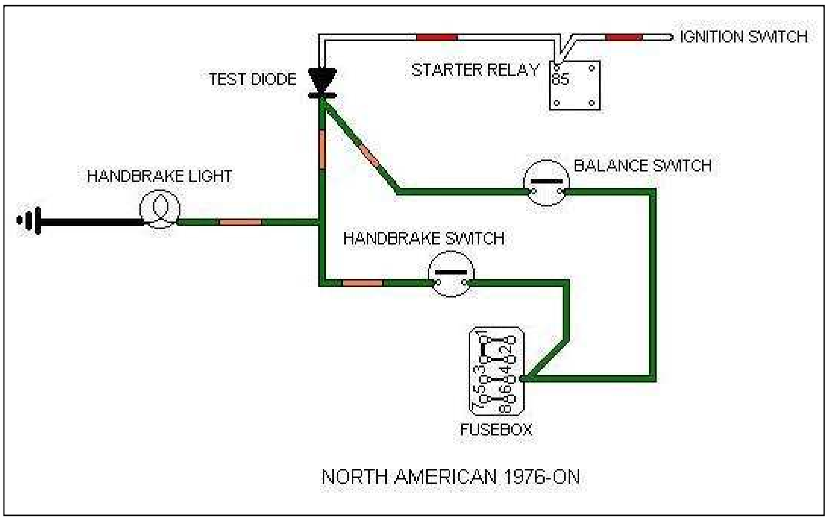
North America 1968 A simple circuit where the manual test switch merely tests the bulb and the 12v supply to it:



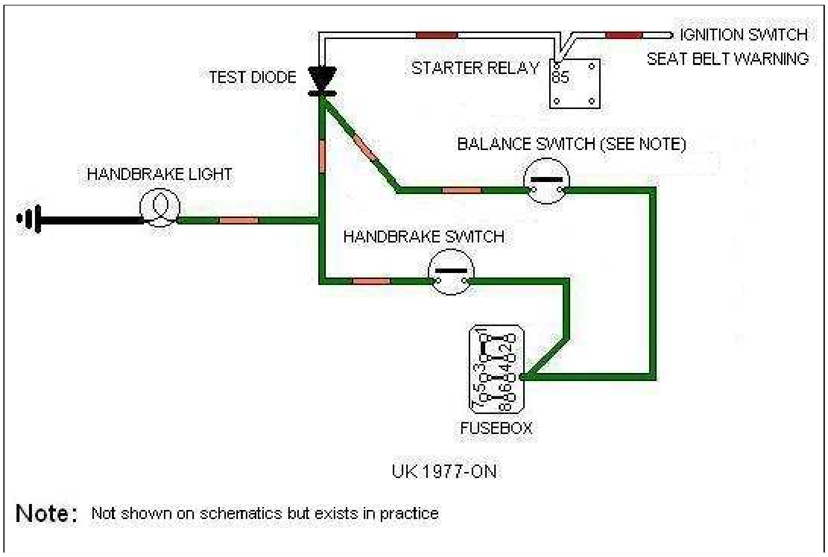
North America 1969-75 A more comprehensive circuit that tests all the wiring to and from the balance switch and bulb, only the switch itself is untested:



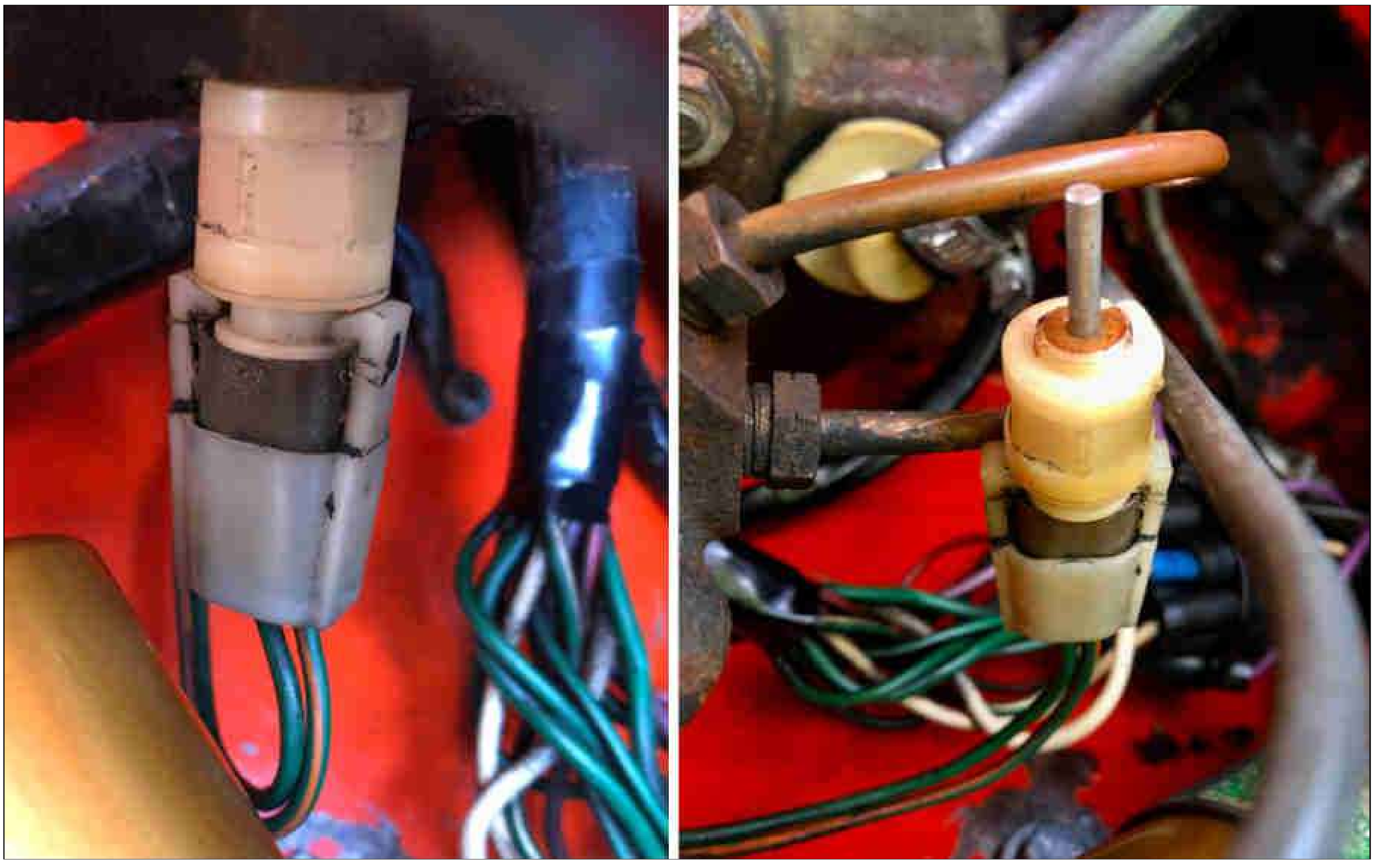
North America 1976-on A completely different approach. No manual test switch, the balance switch now only lights the handbrake warning lamp, and only when the ignition is on. The handbrake switch lights the same lamp, and for some reason the (USA) powers that be decided that the lamp should also be illuminated while cranking, even though the handbrake will almost certainly be on anyway! Not unreasonable for automatics perhaps, when one has used Park rather than the handbrake, but not relevant to MGBs by that time. The wiring to and from the balance switch isn't tested at all, one wonders why they bothered, especially when if the diode fails short-circuit it causes the starter to crank continuously! (In which case drop the handbrake ...):



UK 1977-on According to the schematics all this system does is light the handbrake warning lamp when the handbrake is on or when cranking with it off (even though the handbrake is likely to be on and illuminating it anyway while cranking). No brake imbalance switch is shown, so completely pointless, especially as it has the same problem when the diode fails short-circuit and causes the starter to crank continuously as above. However the lack of brake balance switch seems to be an omission in the schematics as all the cars checked do have the switch and wiring, making it the same as for North America, so the switch has been included here:



Switch AAU2454 mounted under the master cylinder, but the threaded portion can break leaving the switch dangling: (*Graeme Stoten*)

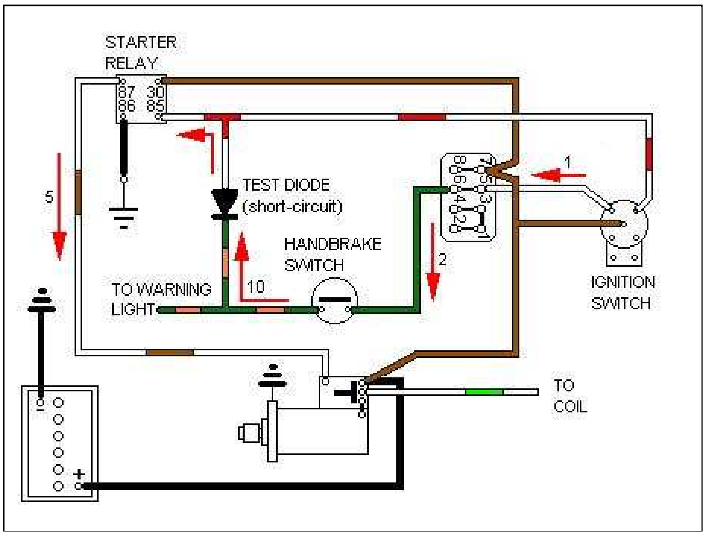


AAU2454: (*Moss Europe*)

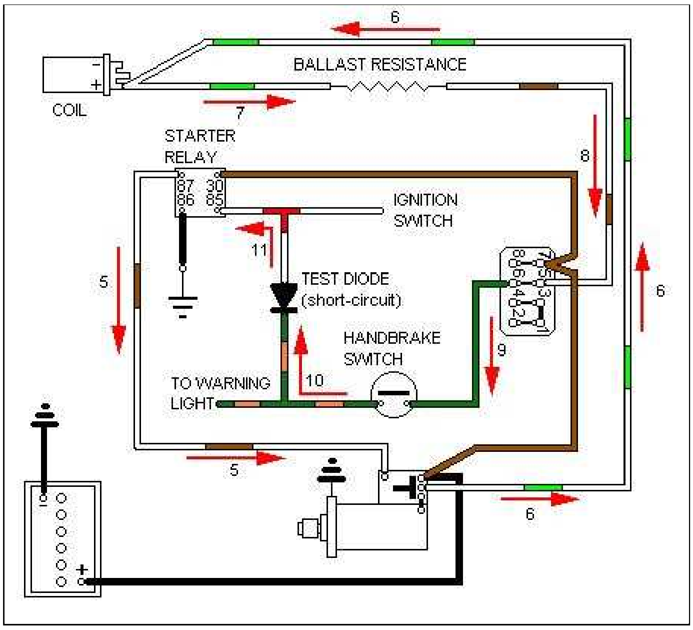
The UK seat-belt and handbrake switch wiring:

The handbrake switch used is AAU2492: (*Brown & Gammons*)

What happens when the test diode goes short-circuit? As soon as you turn on the ignition, power goes from the white circuit (1) through the fusebox to the green circuit (2). With the handbrake on it passes through the handbrake switch onto the green/orange circuit (3), and with a short-circuit diode onto the white/red circuit (4) to operate the starter relay, which connects 12v to the white/brown solenoid circuit (5) to start cranking immediately:



The real problem comes when turning off the ignition - the starter keep cranking! Once the ignition switch has operated the starter relay 12v is sent to the solenoid (5). With this operated 12v is sent on the white/green circuit to the coil +ve (6), and backwards through the ballast resistor to the fusebox (7, 8), even though the ignition switch is off by this time. 12v on the white/brown at the fusebox passes through the fuse onto the green circuit to the handbrake switch (9), which is normally closed when cranking i.e. handbrake pulled up, and on the green/orange to the diode (10). With the diode short-circuit 12v flows backwards through it onto the white/red and thence to the starter relay (11), which keeps it operated and keeps the starter cranking. Hence dropping the handbrake is the only way of stopping it cranking short of pulling the wires off the starter relay or disconnecting the battery:



Warning light test diode showing the male connector for the white/red wire ...

... and the recessed female connector for the green/orange wires: