See-through Carburettor

A pal sent me a video of experiments with a plastic carb that shows what's happening inside, using a high-speed camera. Rather long at 25 minutes and with too much OTT chat for me, but the high-speed footage is very interesting and well worth a view. The full video is here, but I have extracted the high-speed parts (and one section of chat which will be mentioned further on) lasting just over 3 minutes:

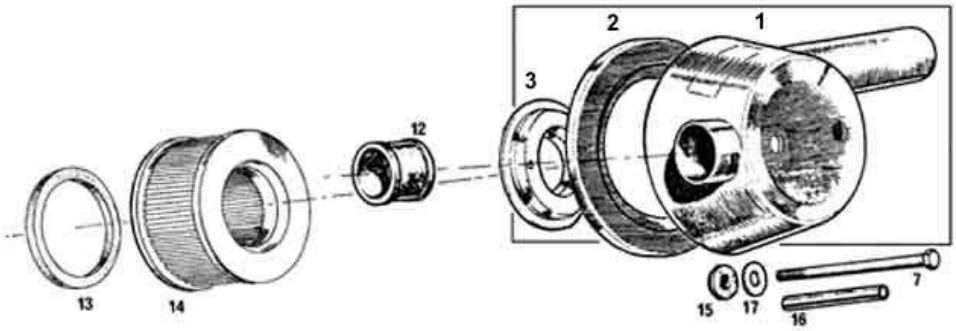
I did try to download the video for editing, which I've done before, but it didn't want to do it this time, probably because systems out there keep changing what they will work with on my computer, and that's probably because it is rather old being Windows XP. So had to resort to filming my monitor.

Interesting bits:

1. Starting with a slow, then a very slow, view of the whole carburettor, and fuel vapour on the engine side of the throttle butterfly at each intake stroke.
2. From 30 secs you can see the end of the intake stroke puffs a bit of vapour out back towards the intake, probably from the way the intake valve doesn't close until after the start of the compression stroke (56 degrees after in the case of the MGB). At 1 min you can see a similar effect from the smaller overlap with the exhaust at the beginning of the intake stroke (16 degrees in the MGB). Particularly interesting is how fuel continues to rise from the jet after the intake stroke has ended, probably from the inertia of the fuel, and just hangs there in the venturi until the next intake stroke, instead of having to pull 'fresh' fuel up from the jet. How much is there, and how long it stays there, will be a function of the rpm of the engine.
3. From 1 min when the stream and droplets rise at the end of the intake vacuum you can see liquid fuel running down the slope of the engine side of the venturi. Clearer still from the different angle at 1 min 20. It seems to me that this effect is what causes HS carbs to bog down when left idling, and a brief rev is needed to 'clear its throat'. My HIFs don't do that, probably because they have a 'sump' immediately after the jet and a passage from there to right by the butterfly, which will clear this excess fuel away.
4. At 1 min 44 Dad says he would make the controls stiffer because the engine sucks the throttle fully open, which I have my doubts about. You can see earlier that the butterfly is unrestrained, and it does not fly open. With as much butterfly surface area above the spindle as below there is as much suction on one half of the butterfly trying to close it as there is on the other side trying to open it. At 2 mins 10 secs you can see the intake stroke sucking **both** halves of the butterfly towards the engine, because heat from the lamp used for filming has softened it.
5. At 2 min 45 the engine is being started with the pull cord (which is in the way a bit) but you can see it takes a couple of intake strokes before any fuel has got up the jet into the venturi.
6. Just after that he stalls the engine and you can see how the intake remains full of fuel vapour when the engine has stopped. And although one of them says he didn't see vapour come out of the intake side of the carb it is there as he removes his hand, and remains between the butterfly and the engine for some time.
7. Finally at 3 min the camera is focused into the intake, with the choke butterfly having been removed, and you can see how the hanging droplet of fuel seems to broaden out before being vaporised, the vapour filling the whole of the (rectangular in this case) throat.

Twin-carb Air Cleaners

The main can (1) with the pressed-steel base (2) and the alloy plate (3), with tube (16), large washer (17), stepped rubber washer (15) and bolt (7). Interconnecting hose (12), filter element (14) and rubber sealing ring (13). Note this last goes between the base and alloy plate: *Moss Europe*



The bolts are UNF BH605401 for HS carbs as they screw into U-shaped brackets on the back of the carb flanges - AHH6731 front incorporating the choke cable support and AHH6732 rear, but are UNC BH505361 for HIFs as they screw into the flanges themselves: (*Moss Europe*)

Note the right-hand bracket for the rear carb is shown reversed, the flat side goes against the back of the carb flanges as for the left-hand bracket.

Early crankcase breathing arrangement showing the rocker cover hose going to the pressed-steel base plate. Note that this is on the outside i.e. the dirty side of the air filter, not the carb side as has been claimed from time to time: *Clausager*

Bee's two cans ...

... no difference that I have been able to find between front and rear:

Showing the filter element sitting on the base, confirming the rocker hose went to the outside of the filter:

Claimed to be a 1971 model, with remote servo, but curved cans which were not apparently fitted until 1972. However note the radiator which has the later centre fill but the earlier right-hand top-hose, and the non-standard brake master, so not an unmolested example:

Straight inlet with servo, but this is claimed to be a 1966 model so well before servos were available from the factory:

The servo is canted up whereas factory installation is horizontal, maybe to clear the inlet tube:

Straight cans changing to curved for the 1972 model year, the curved inlet going almost as far as the straight before it turns. The rear straight points directly at the bulkhead so may account for intake noise in the cabin, especially if grommets are missing:

Split in Bees rear can:

Fuel Tank

Fixings Pickup/strainer Overflow prevention Filler caps

For those worried about ethanol this tank has been on Peter Mitchell's 1978 since he got in 1988, it had done 34k by then so is probably original, and shows no signs of internal corrosion:

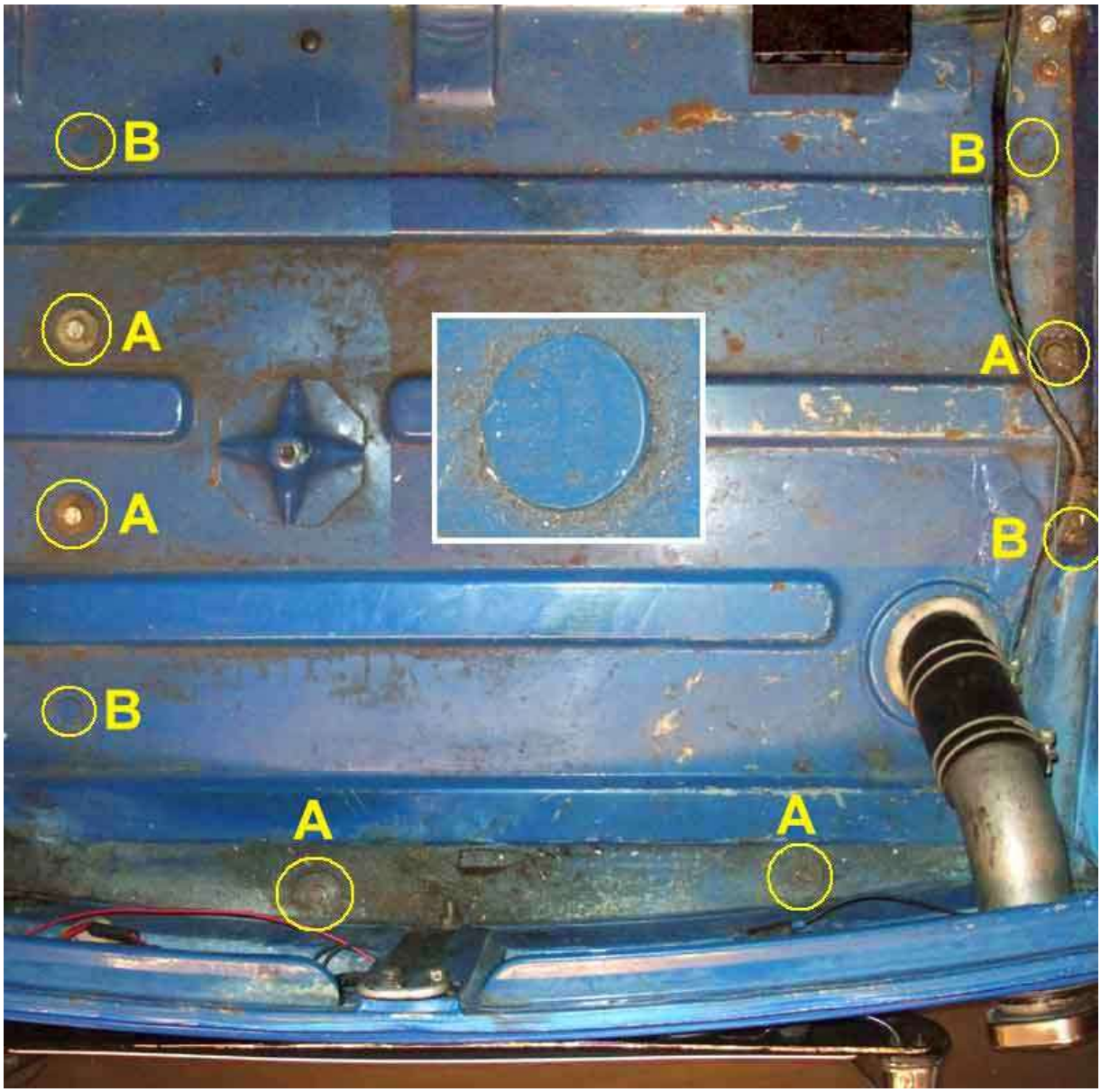
The initial 10 gall strap-hung tank with screwed sender, fuel outlet arrowed:

Later 12.7 gall bolted tank from March 65 with locking-ring sender, fuel outlet prior to August 1976 arrowed, after that it was incorporated with the sender:

Fixings:

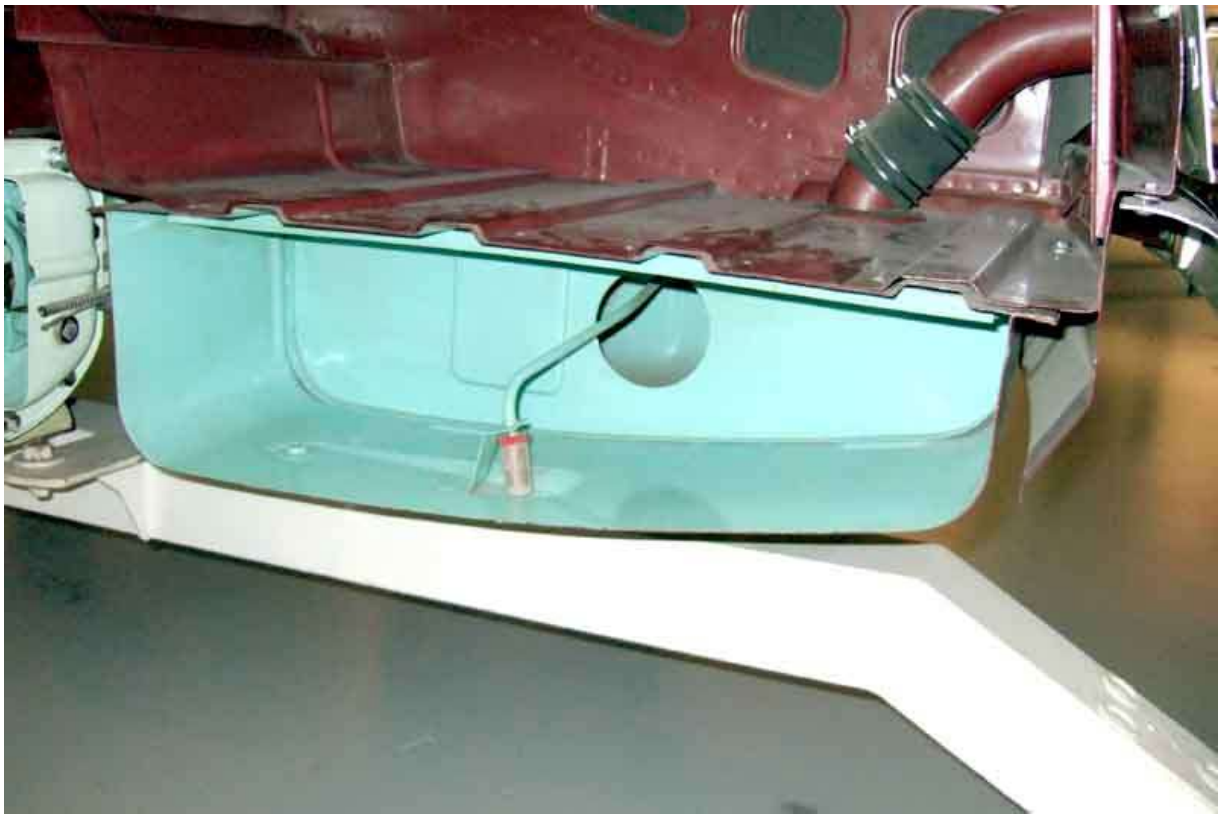
From March 65 the tank was attached using five 5/16" UNF x 3/4" bolts with large metal and fibre washers going through the boot floor into captive nuts clipped onto the tank flange (left arrow, originally 34G523 now 346071A), and four studs welded to the inside of the boot floor with large flat washers, spring washers and 5/16" plain nuts (right arrow). The studs and nuts enable the tank to be positioned and initially attached from below, then the bolts can be fitted from above:

The bolts into the captive nuts are at A, and the welded studs are at B, with a stud enlarged in the inset:



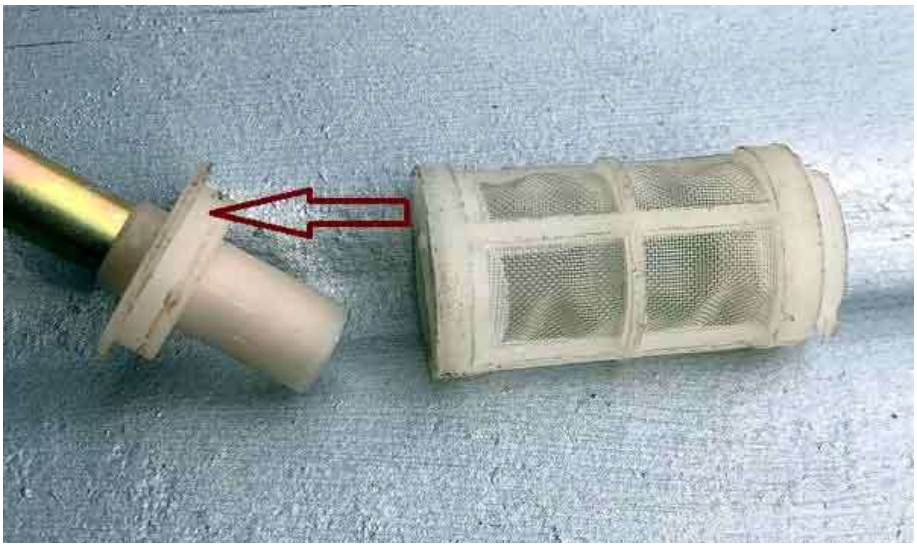
Pickup/strainer:

Bolted tank showing a baffle, also pickup with strainer, right-hand side:



Second baffle, left-hand side:

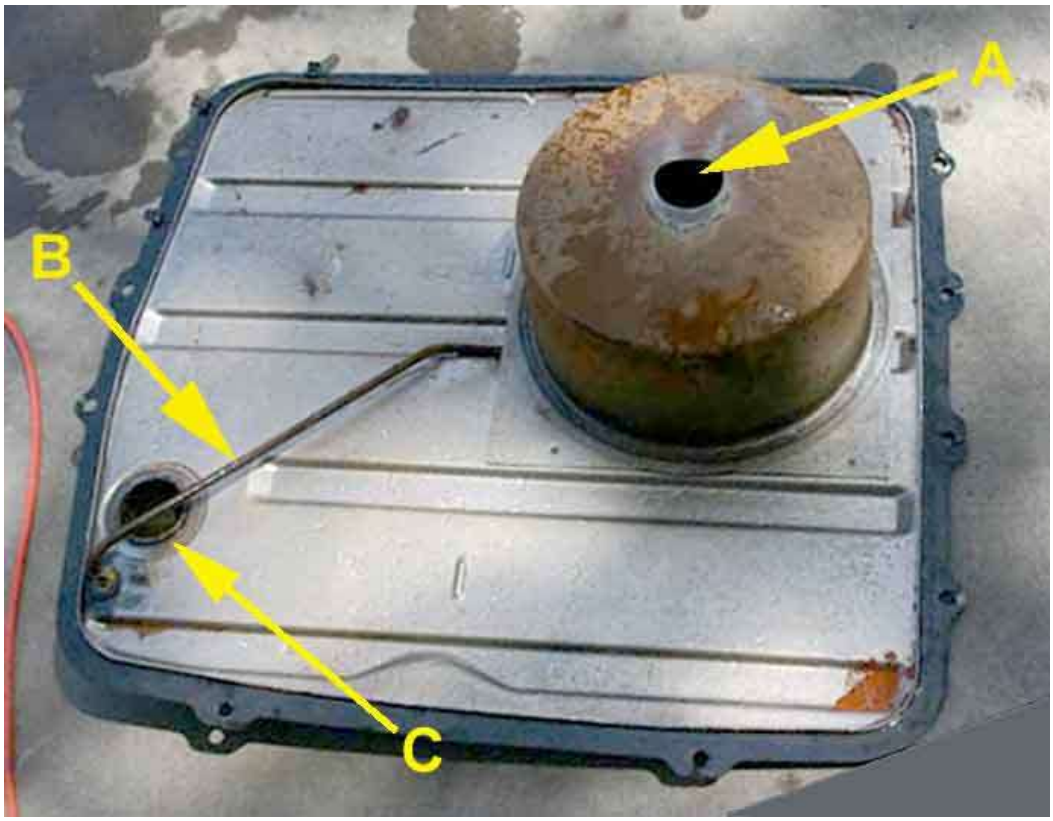
From Albert Ross - detached strainer on a combined sender and pickup, he 'welded' it back together with a soldering iron to melt the plastic, in preference to using an adhesive which would need to be chosen very carefully:



From Richard Massey - a replacement tank from the MGOC with no baffles and the strainer wedged under the bracket, even though there appears to be a hole for the tube to pass through. Interestingly with the strainer lying on the bottom instead of standing up there is probably an extra inch of usable fuel, which considering the size of the base could be a few litres. However lying down like that it is going to be picking up any water lying on the bottom, although that's only likely to be a problem if the car is unused for a long time and something has allowed water to collect. Forget ethanol - that ABSORBS water and it will pass through the engine and the only effect would be an unnoticeable reduction in fuel economy. **Non**-ethanol fuels are more likely to get water separation, and as liquid water it could stop the engine running or cause damage:

Overflow prevention:

American tanks from October 1969 had an internal capacity-reducing chamber instead of the second baffle. This only slowly fills after refuelling has been completed, and reduces the level in the tank as a whole to prevent heat expansion causing an overflow, even if the tank had been brimmed and the car left in hot sun. It reduces the effective capacity by 2 gallons. Hole 'A' allows fuel in and out freely, but fuel can only get in as air escapes slowly via the narrow pipe 'B' which is connected to an external vent port. This vent port and pipe also allows air to enter as fuel is used in running. Note how the filler pipe barely extends below the lid of the tank at 'C': (*Grassroots Motorsports*)



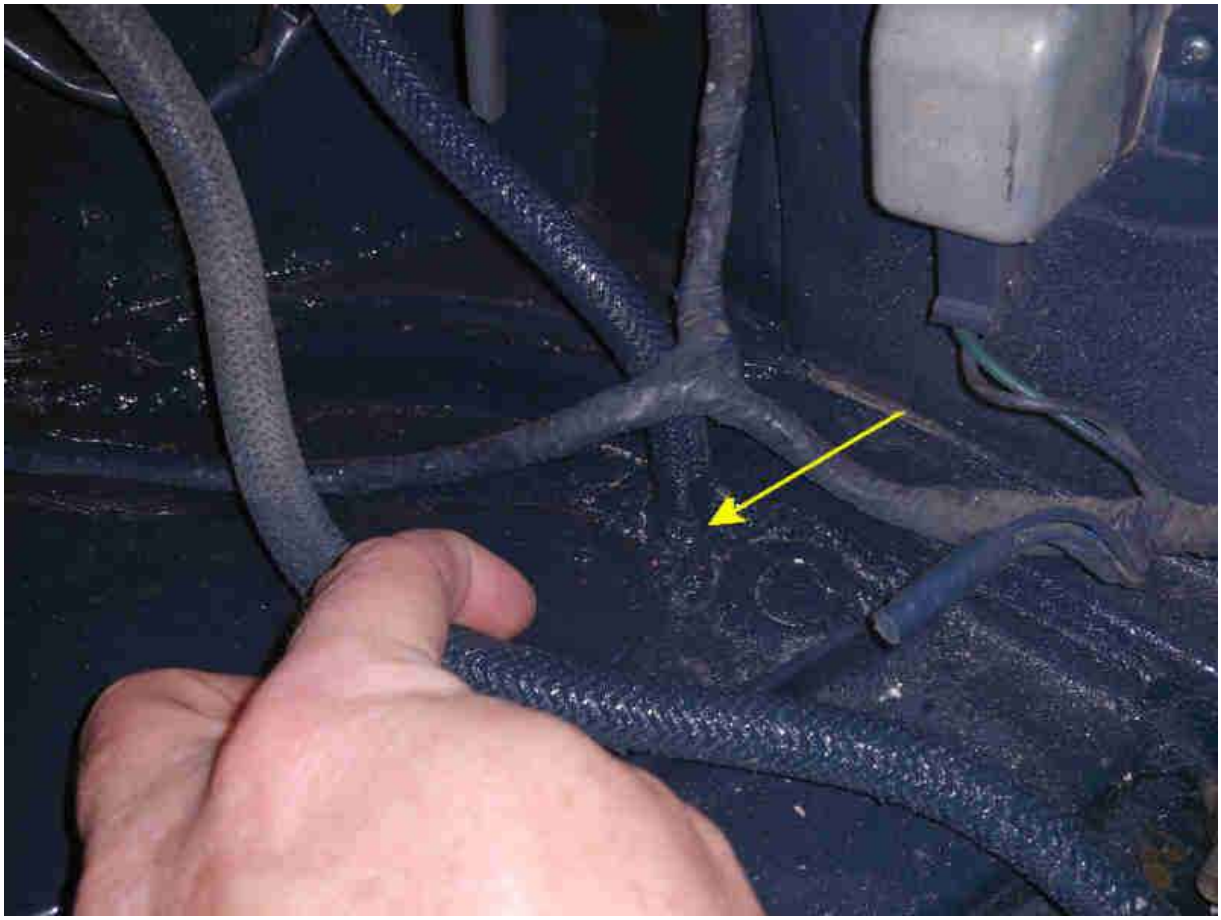
The chamber removed from the lid and lying in the bottom of the tank, also shows the remaining baffle and the pickup:

Breather port (in place of a vented cap) on top by the fuel filler: (*Bill Etter*)

Connection to the tank vent: (*Bill Etter*)

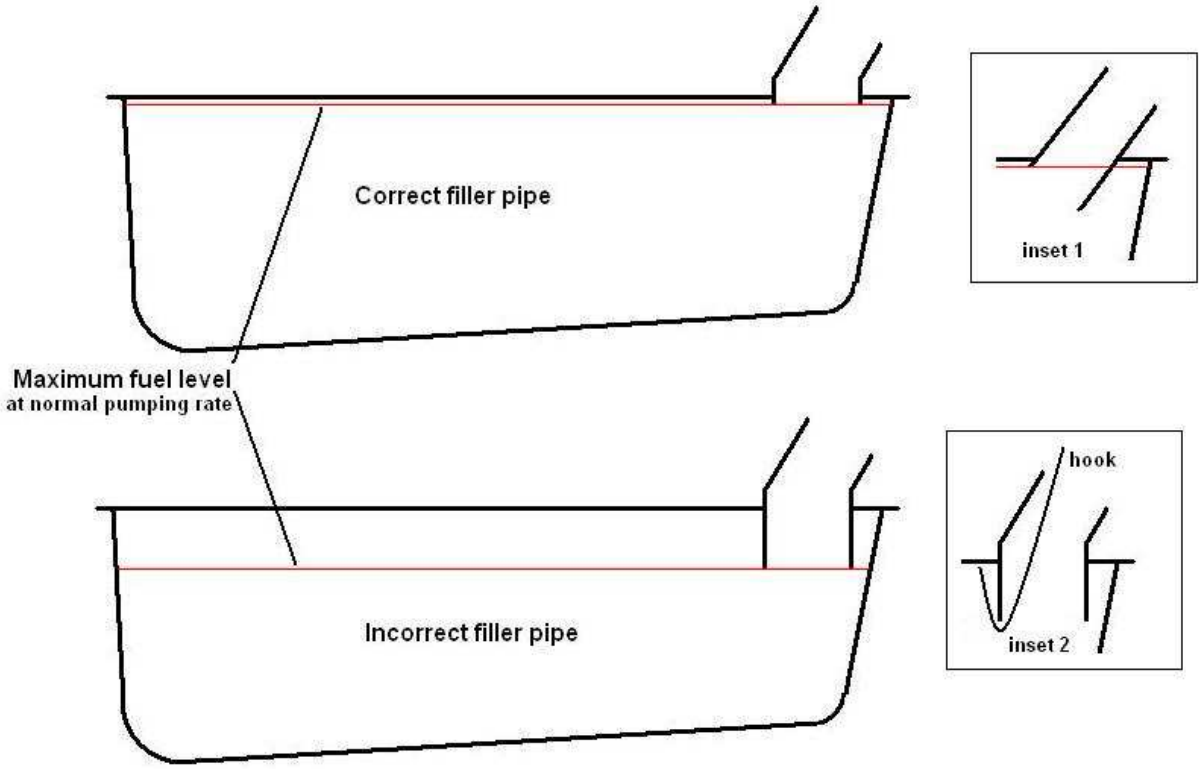
Up to the separation chamber (lower connection so fuel can run back to the tank): (*Bill Etter*)

And from the upper connection through the boot floor to the pipe leading to the charcoal canister: (*Bill Etter*)



Filler pipes, correct at the top (see 'C' here as to how it should be inside), incorrect at the bottom. For each inch the filler extends into the tank you are losing about nine litres or two gallons of capacity! Note that if the filler pipe goes into the top of the tank at an angle it is the highest point of the bottom of the pipe that will determine how much lost capacity there will be, not the lowest point (see inset 1). If the tank is installed with the boot floor and foam seal covering the top of the tank, then with the filler neck

and joining hose removed a length of stiff wire bent into a hook adjusted in length until the loop of the hook is just held below the bottom of the filler by the top of the hook being on the underside of the tank, will give you a good idea, see inset 2:

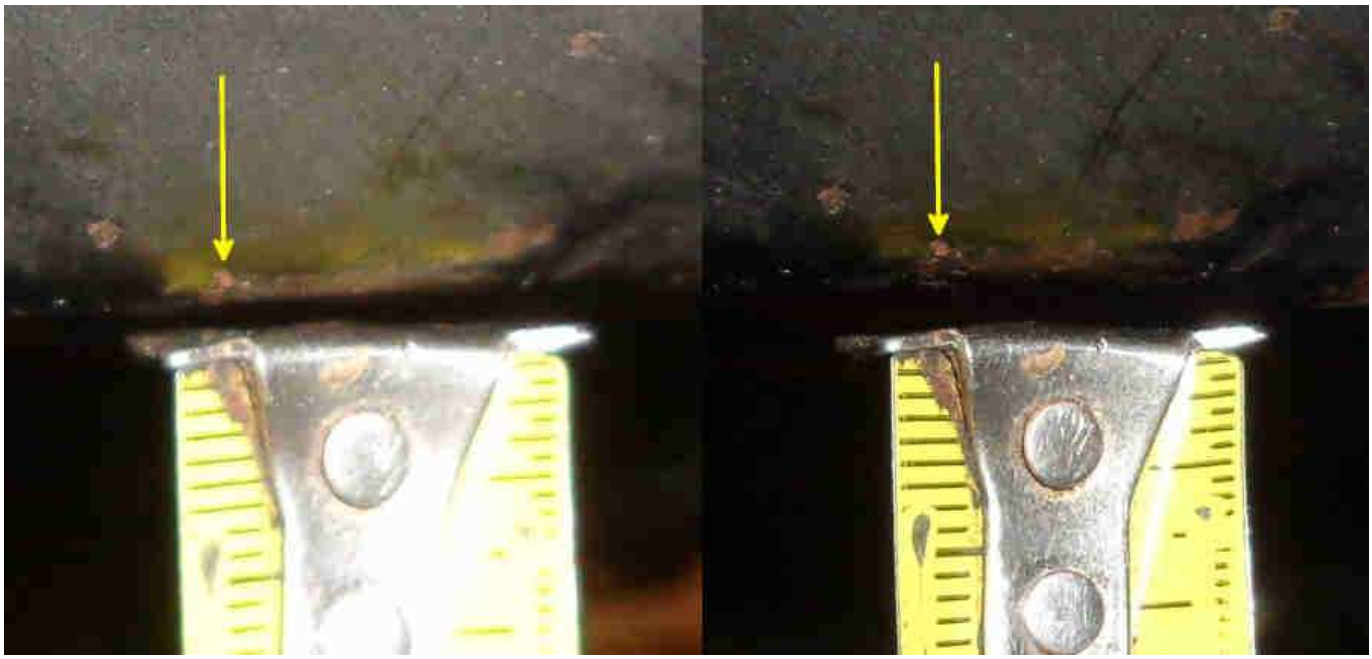


Filler caps:

Bee's vented cap bought from the MGOC probably more than 30 years ago. Almost identical to Peter's more recent cap but his doesn't have the manufacturers name or 'MADE IN FRANCE'. Maybe a copy!

The green part with the - hefty! - spring underneath is attached to the barrel of the lock so the spring is trying to pull the barrel through the cap at one end and pressing down on the grey part at the other. That grey part has lugs (shown here in the fitted position) that latch onto the filler pipe, pulling the seal under the outer part of the cap down onto the neck of the filler pipe. Fitted I can get my finger-tips behind the cap and pull against spring pressure, which is lifting the cap seal away from the filler neck. It may be that with a depression in the tank the reverse happens in that the grey part is pulled back, which takes the pressure off the seal, so letting air in. However it takes quite a lot of force, and the depression will be acting on other parts of the cap and seal as well, the outer part of the cap as well, so I'm still pondering. If not that then there must be another valve and spring inside the cap somewhere (like the radiator cap), and videos do show those with valve and spring much smaller.

Tape measure propped up under the lowest part of the tank, a gallon pumped out, then put in the boot so the weight is as before. Only about 2-3mm difference as indicated by the little rust-spot arrowed:



E10 fuel in the USA

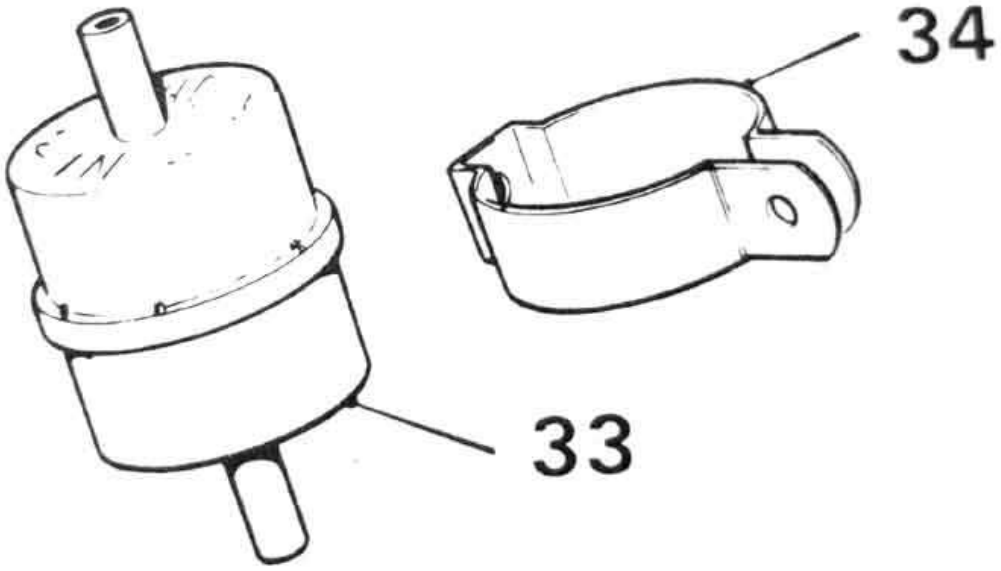
Experiences with E10 Ethanol fuel from people in the USA, which has been available in some states since the mid-70s:

- We've had problems with pretty much all small gas engines, mowers, trippers, chainsaws etc.. Repair shops say it is critical to use stabilizers in the fuel and especially to winterize small engines because the ethanol attracts moisture - Scott Bonacker, MO.
- I haven't had any problems at all. I have five cars that are thirty plus years old. Two American, two British, and one German. I've used the ethanol gas in them for years. The cars are inside and the temperatures are constant during the year. (maybe the reason) I owned a Yamaha motorcycle that was ridden less than fifty miles a year. I got curious and looked into the carburettors. After twenty years they were like new. Last year I put one of my push mowers under the porch. Winter temperatures down to zero. Summer temperatures near ninety. After a year it started on the first pull. - Jim Williams.
- E10 has been available in the US in various locales since at least the mid-1970s. I used to run it in my 65 MGB regularly when I lived in Nebraska in the late 70s. I have also used it when available and priced right the past few decades in my current MGs. The ethanol actually does help clean the fuel system so the first few tanks may cause some debris removal. Ethanol is a lower BTU fuel so there will be a slight decrease in fuel economy. In addition, my 65B had a replacement after market fuel pump mounted near the carbs on the inner fender and this fuel pull was subject to vapor locks under hot driving conditions when using E10. On the other hand, during the winter months I never had to worry about fuel line freezing (in cold climates, auto stores sell gas "anti-freeze" which is just a small bottle of methanol). However, some American cars reportedly had problems with rubber lines and seals using E10 but I never had such problems, at least noticeably, with my MGs. - David Council.
- I have been using E10 exclusively for the past 9 years and have experienced no issues at all. - Kimberley Rae.
- We've also seen zero problems with our aged Troopers which have seen E10 since whenever California made it mandatory. - Paul Resch.

V8 Fuel Filter

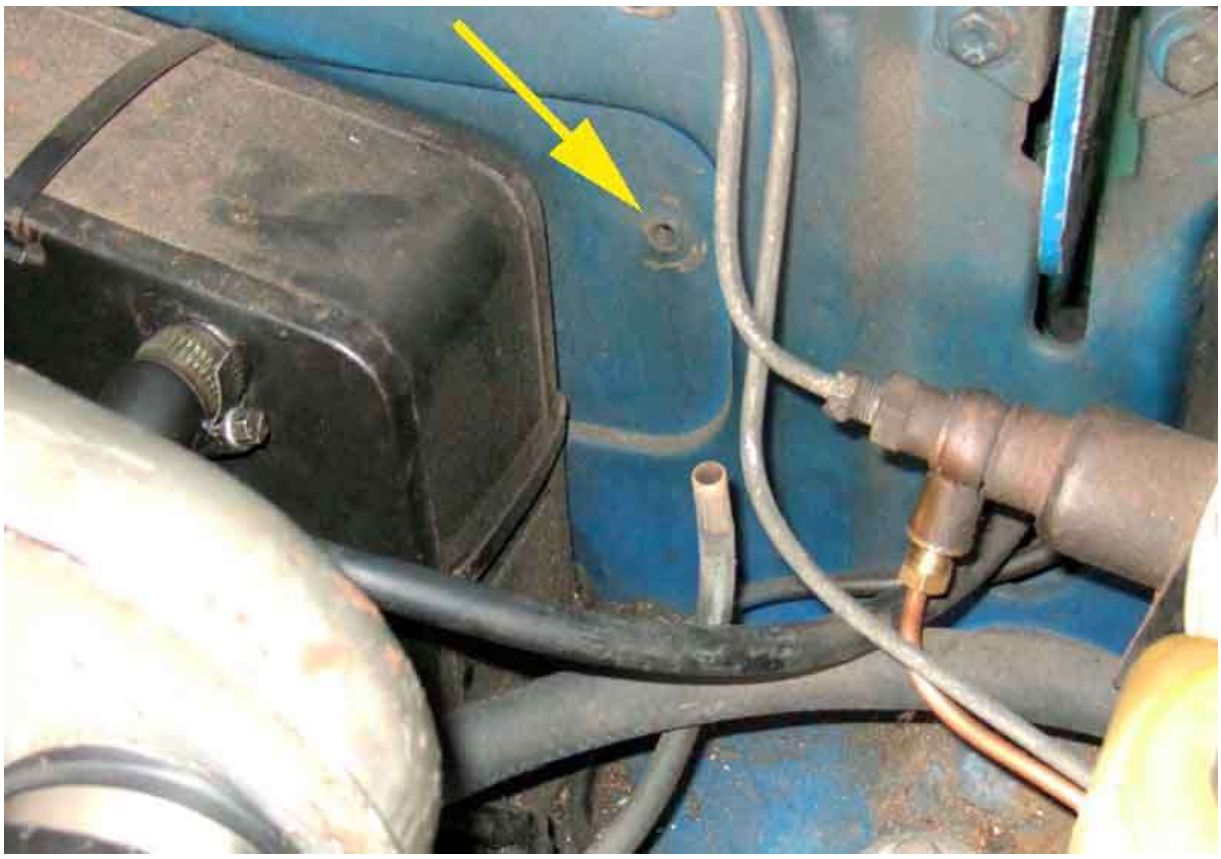
As the car came to me, filter unsupported

The original filter and clip, from the Parts Catalogue



This clip is the only one offered, but is for the crankcase breather filter, not the fuel filter (*Brown & Gammons*)

But given the position of the mounting hole the clip would foul either the heater casing or the brake pipes - short of drilling a new hole and fitting a Rivnut or similar.



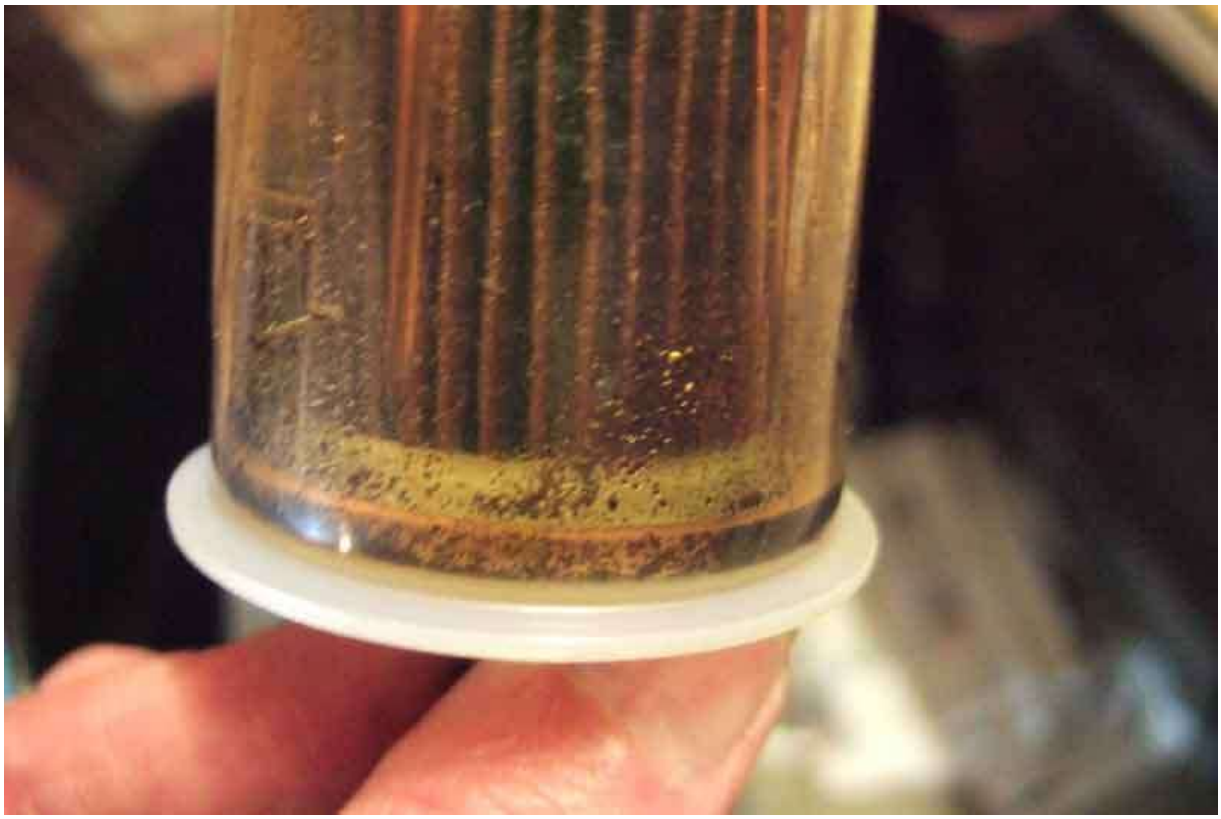
The capacitor clip as received ...

... too small for the filter.

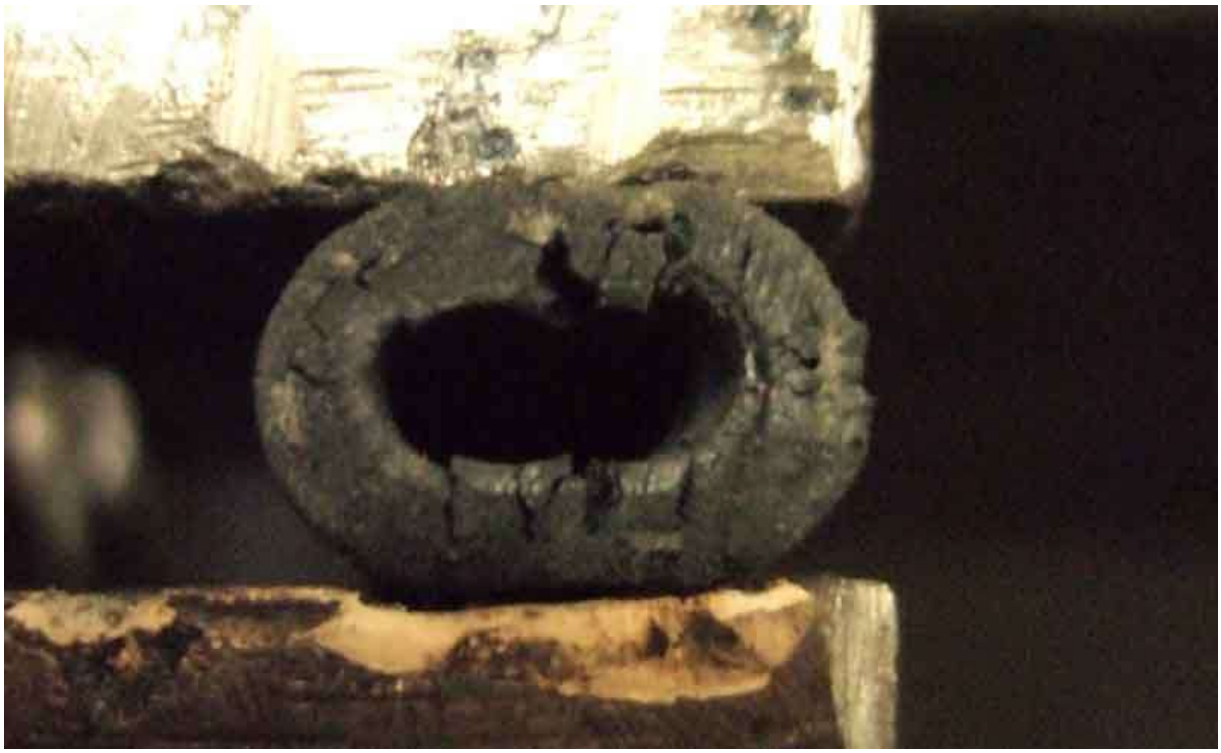
But after tweaking ...

... is perfectly adequate.

Old filter showed no muck when in-situ, and only light sediment once removed. This also shows the 1/4" carb hose on the thinner section of the dual-diameter outlet port (upper-left), whereas the 5/16" supply hose is on the thicker section of the inlet port (lower-right).



Cut ends of hoses showing significant cracking internally:



The original-style filter with the short 5/16" ports at about 4 3/4" long, compared to the later shape with dual ports at 5" long. With the original type having the same diameter port each end there was a 5/16" to 1/4" reducer and short length of hose to go from the supply pipe to the carb port.

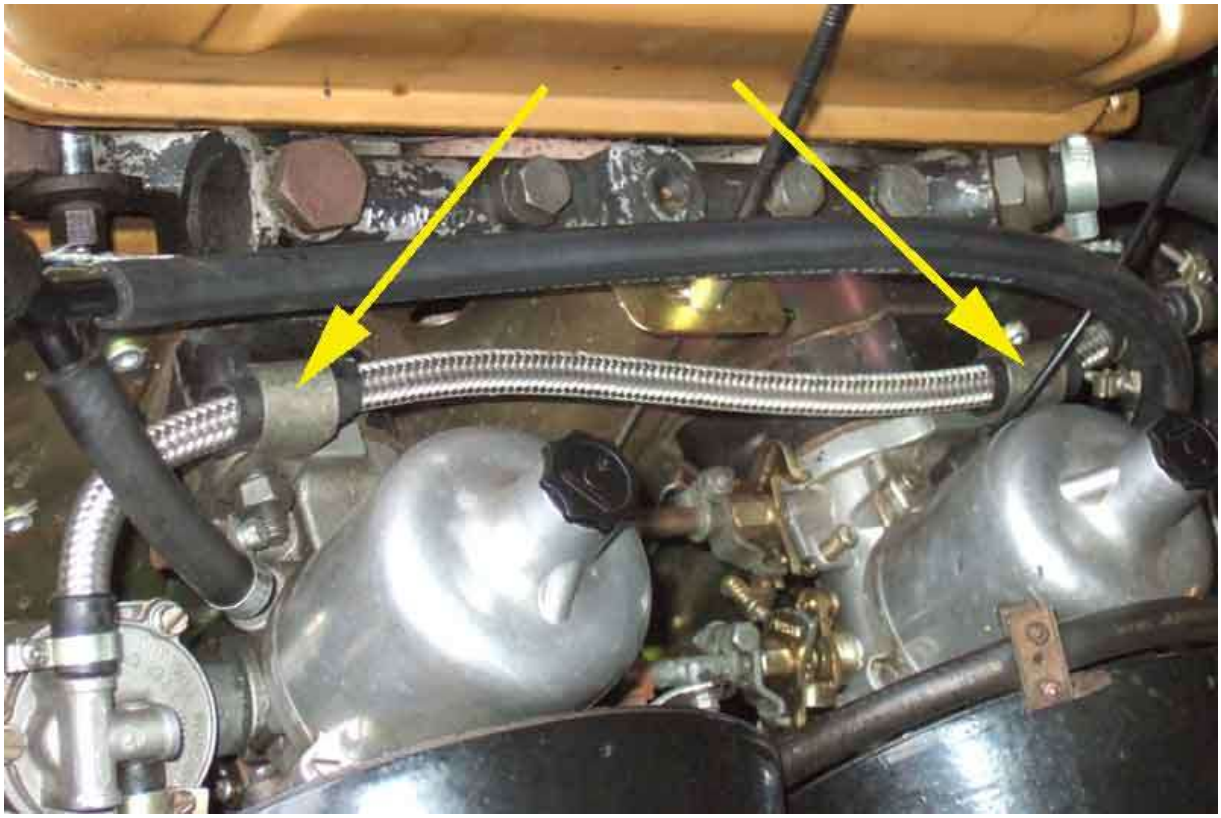
Clip and old (for the moment) filter installed. In the end I had to stay with this type as the supplier I had tried to purchase an original from supplied the later type despite picturing the original.

Showing how an earlier style filter if it had dual-size ports would end up with its central flange under the clip, which would put it in the same position as the later style filter. With the later style having a slightly tapered body I did wonder whether it work its way out of the clip, but it seems to be OK. Don't overtighten the clip to try and be sure, it may split the filter body.


TENTHS
1
2
3
4
5

HS Carb Hose Support

Someone was asking where to get these HS carb hose clips and sleeves, not listed in the Leyland Parts Catalogue or on any of the usual suppliers MGB web pages. I eventually found the clips listed on an eBay ad for hoses and stainless clips complete as 12H1001SS. Several of the usual suppliers list those, but not on their MGB pages i.e. 'in context', only for other models such as Midget and Sprite, or under general hardware. Then I found PCR811 yellow passivated versions which are a lot cheaper, and again shown for other models but not MGB. Oddly the BL Catalogue lists quite a few components with a PCR prefix but not that one:



Support clip PCR811. Incidentally some suppliers show the same clip used for the early heater return pipe, the later pipe has them already attached: (*Motaclan/Leacy*)

Again the sleeves or 'ferrules' only appear against Sprite/Midget and even then only a couple of suppliers (Moss Europe (item 84) and MS&C (item 9)) as HMP215007. My front one tends to slip out as they are a loose fit in the clips. Glue would probably hold it:

Fuel Hose

Rubber shreds in the filter from using undersized metric hose on Imperial fittings, despite the apparent smoothness of the fittings. Note this chrome and glass filter only has one size of spigot.

More bits, this time from the hose after the filter.

This plastic filter has a two-stage spigot at each end so it can take either 1/4" or 5/16" hose, or be used to convert from one size to the other as is required on HIF-equipped cars (*Motaclan/Leacy*).


FDB
Petro
Lucas
5/16"
Lucas
1/4"

Fuel Hoses

The visually very manky pump hoses from the V8 - probably original (40 years and 220k) as they have looked pretty-much like this during my 20 years and 100k. The slight staining at the end of the top hose only occurred during removal.

This type of clip was easy to cut through

Back in with new hoses and Jubilee clips - the latter Waxoyled to hopefully keep them corrosion-free.

A section from the original pump hose - the short blacker section on the right had been over the end of the pipe, the rest exposed to fuel. No reinforcing, and absolutely no cracking on the end or the inside and external surfaces, even slit and opened out like this.

20 year-old carb hose, radial cracks at the end but not extending under the clamps. Some evidence of circumferential damage where the end of the carb port has been, probably from the unsecured filter flapping about all that time (which was how it came to me). Apart from that no other traces of cracking inside or out.

V8 overflow hose replaced in my time but not carrying fuel only fumes, only noticed when that float valve happened to stick:

Bee's carb hose - "Looks like new" until you see under the braiding:

The section from the bulkhead connector to the T-piece but all of them were the same. Probably 30 years old. As all the kits and individual pipes I could see at the usual suspects were braided I cut the bulkhead connector off the old hose and have bought some loose hose SAE J30 R9 as for Vee's pump above:

Plain rubber installed:

Connection to the body pipe by the heater, if replacing braided hoses you will probably need to use smaller 10-12mm clamps. You could reuse the braiding on this first section if bothered about manifold heat:

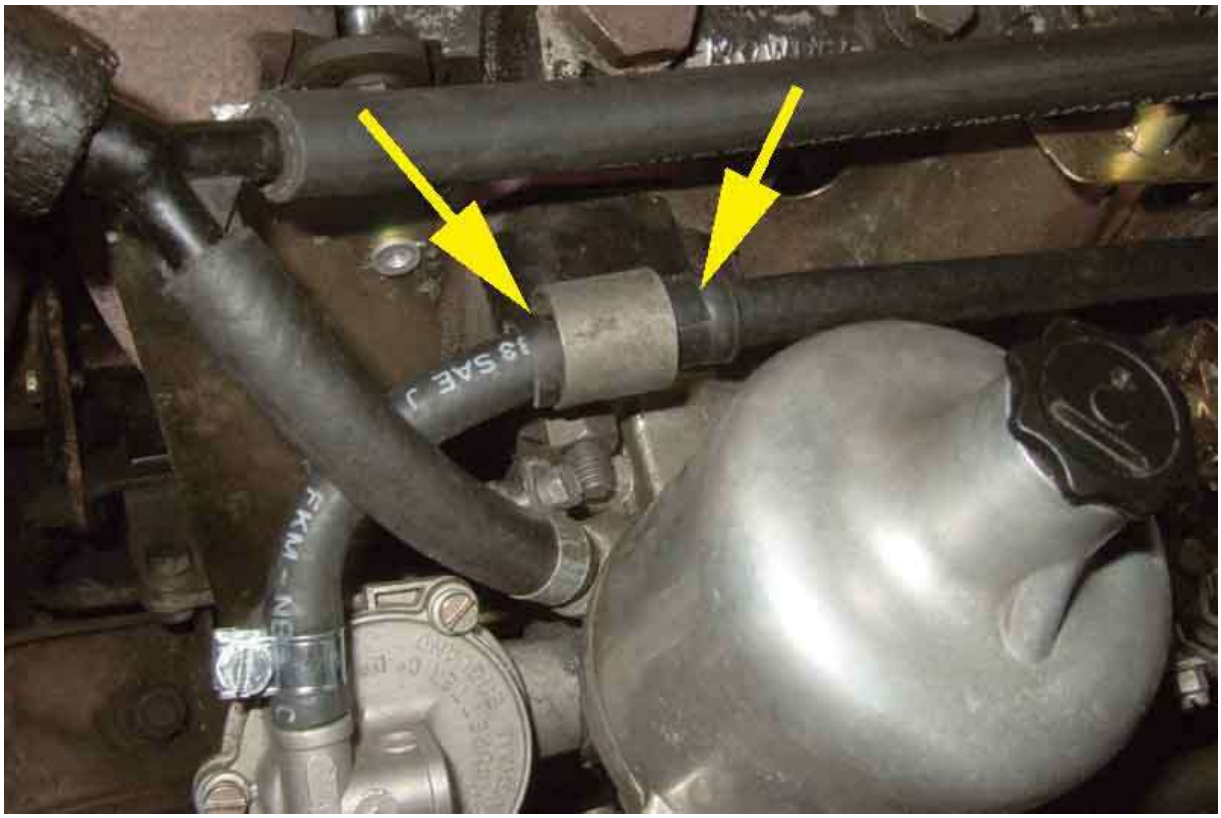
I cut the new hose pieces to the same lengths as the old, but the spur to the rear carb is too long which pushes the Tee towards the heat shield, the inlet hose clamp has to go at angle to avoid rattling against the shield, and that section is closer to the exhaust manifold than I would like:

So I shortened the spur to the rear carb which solved both problems. I thought I might have to make the input section longer but it's fine. The section from the Tee to the front carb could do with being a bit longer, I have enough left over from the 1M so may change that later on:

I thought about putting some of the old braiding over the input hose to protect it from the exhaust manifold heat. You could say that's covering up the problem again, but there is almost as much cracking on the long section to the front carb where it turns to the carb as where the inlet hose turns. Both areas are on the outside of the turns i.e. facing away from the manifold on the input hose, so it's not heat causing it anyway. As soon as either bend shows any signs of cracking I'll know it's time to replace it all:

The top sleeve is original and is supposed to protect the hose from chafing on the carb stud brackets. But the ID was too big for the hose and the OD too small for the brackets so it used to slip out of position. Wasn't a problem with braided hose but I didn't want that happening with the plain rubber which is an even smaller diameter than the braided. The lower sleeves were end caps on the braided hoses to neaten them up, and the clamps were positioned on them:

The braiding sleeves looked like heat-shrink, so I cut the partially closed ends off and slid them onto the new hose where they are a snug fit and shouldn't move. Each one is shorter than the bracket, but there were five on the braided hoses so I've used two inside each bracket and they extend past the edges:



Bee's pump hose with the braiding removed. No sign of any deterioration, but unlike the carb hoses it does have markings - BS3212/1 seems to have a max temp of +60C, OK for pump hoses but a bit marginal for the engine compartment. Dated 1996 and fitted 1998:

I'd bought a new banjo to fit to the hose before I started to save messing about with the old one once removed if fuel started trickling out (it did!). But looking at the old banjo after cutting off the hose I noticed it is flat both sides, not recessed on one side as here. The bolt and fibre washer goes this side, with either another fibre washer or an O-ring (depending on pump type) on the other: *Rimmer Bros*

But I couldn't get this to seal despite using two fibre washers on the recessed side and tightening as hard as I could. Not dripping or running but shiny at the join from a tiny seep, presumably evaporating fast enough, but no smell in the garage. Eventually I reused the original banjo and it was immediately obvious that this was tightening progressively and sealed with only 'normal' pressure on the spanner. The banjo above tightened suddenly, i.e. even with two fibres washers it was too 'thin' for the banjo bolt and was bottoming in the pump thread. More info here.

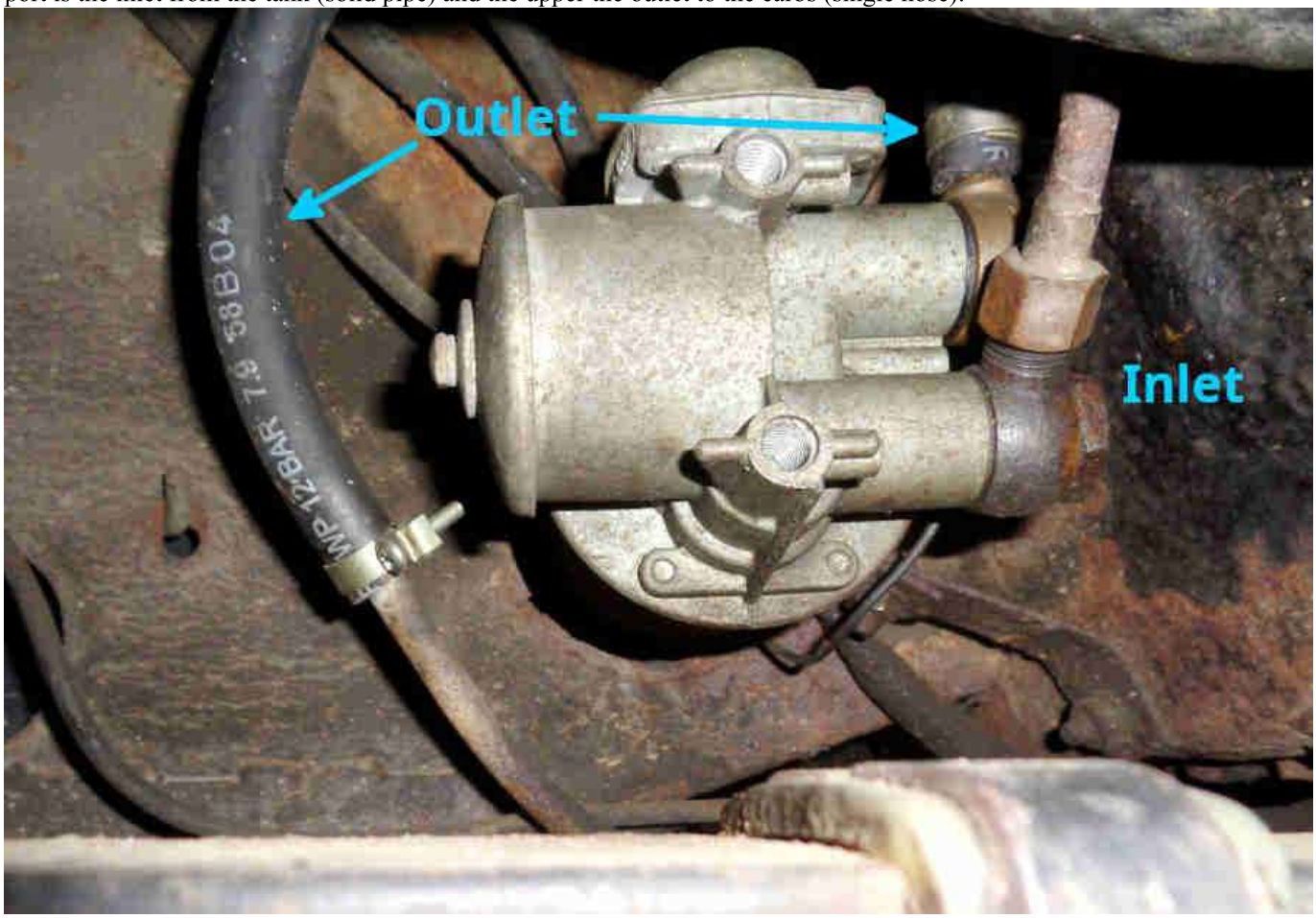
Fuel Pump Mounting

Note that due to the questionable quality of the rubber hose under the braiding of 'correct' replacements all my braided hoses have now been replaced by plain rubber to SAE J30 R6 or R9.

Chrome Bumper Rubber Bumper Vents Cut-off

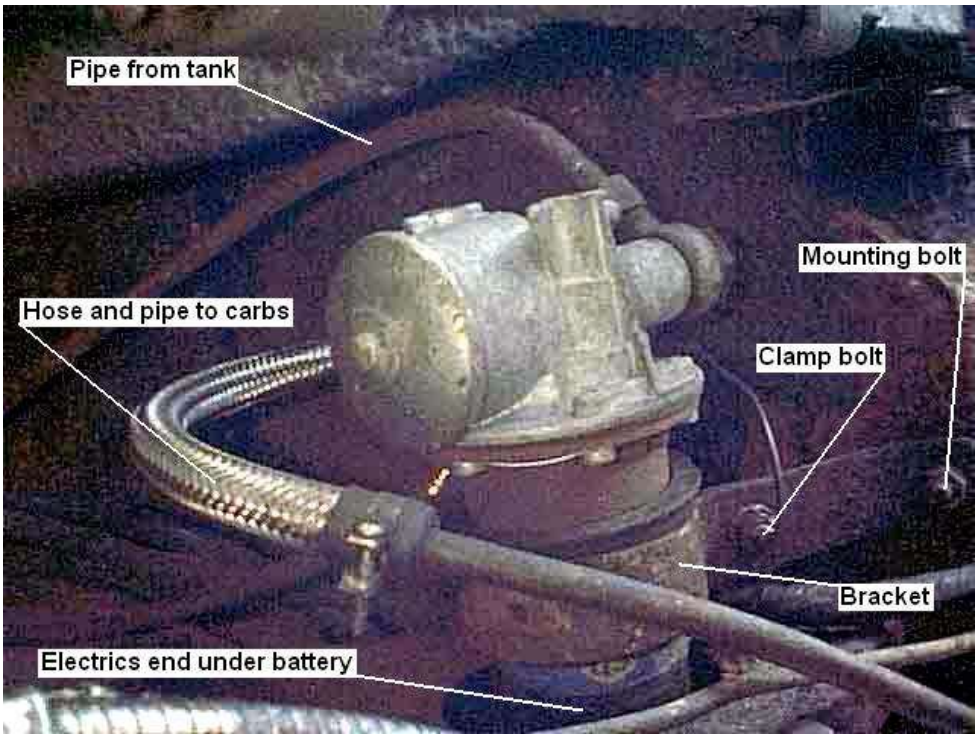
Chrome Bumper:

Not that difficult to see the pump by getting down and squinting in front of the right-rear tyre, ports facing forwards, lower port is the inlet from the tank (solid pipe) and the upper the outlet to the carbs (single hose):



Note the orientation - the two tapped but unused holes facing the viewer are vertical, and the pump ports face forwards. There is a 'TOP' marking on the body of the pump (red arrow) but facing forwards so not visible when mounted. Also indicated is the earth connection to the pump (black arrow):

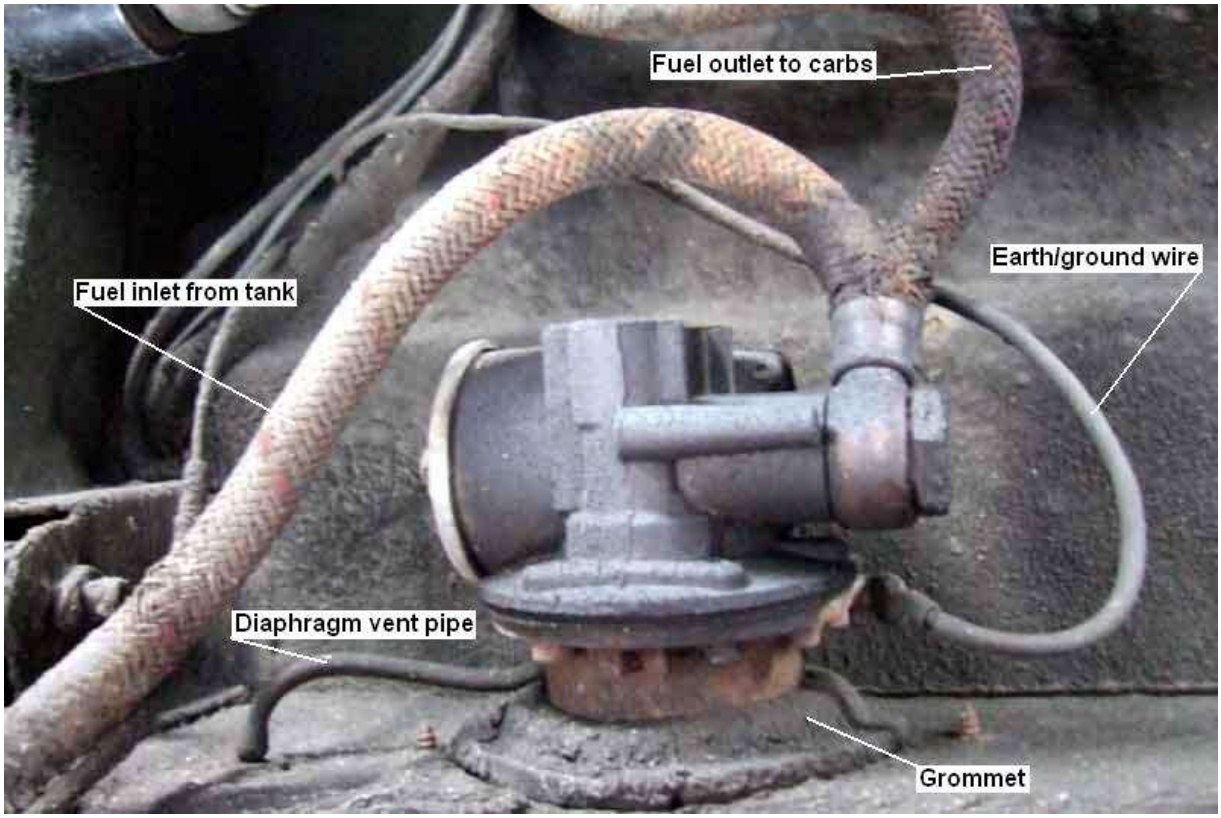
But getting at everything is another matter, the electrics end particularly, which is concealed within the frame-work for the right-hand battery. The bracket mounting stud shown is the lower one, there is another above the pump and slightly rearward of this one. There is a rubber sleeve AHH6708 (available June 2020) round the pump body under the bracket (AHH6709):



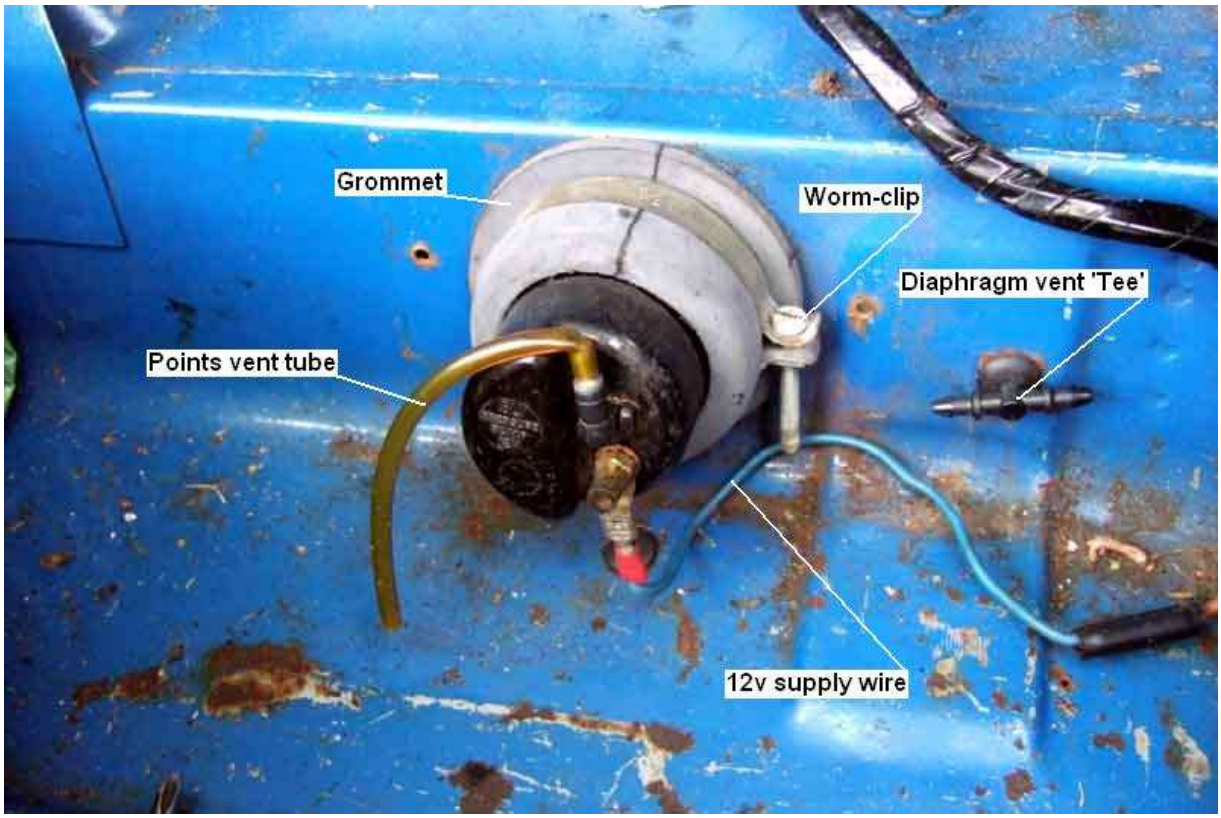
Rubber Bumper:

A large purpose-moulded grommet (BHH1635 available June 2020) is pushed into a large hole in the front wall of the boot and the panel edge located in a groove in the grommet. The pump body is pushed into the grommet from under the car. The pump is orientated so that its ports are pointing towards the middle of the car, but again the lower port is the inlet from the

tank, and the upper the outlet to the carbs, both with hoses. An earth/ground wire comes from the rear harness and attaches to a spade on the pump body near the unions. Also under the car a short length of plastic tubing connects the diaphragm vent nipple on the pump body to the end of a washer 'Tee' sticking through a plain grommet also in the rear wall of the boot:

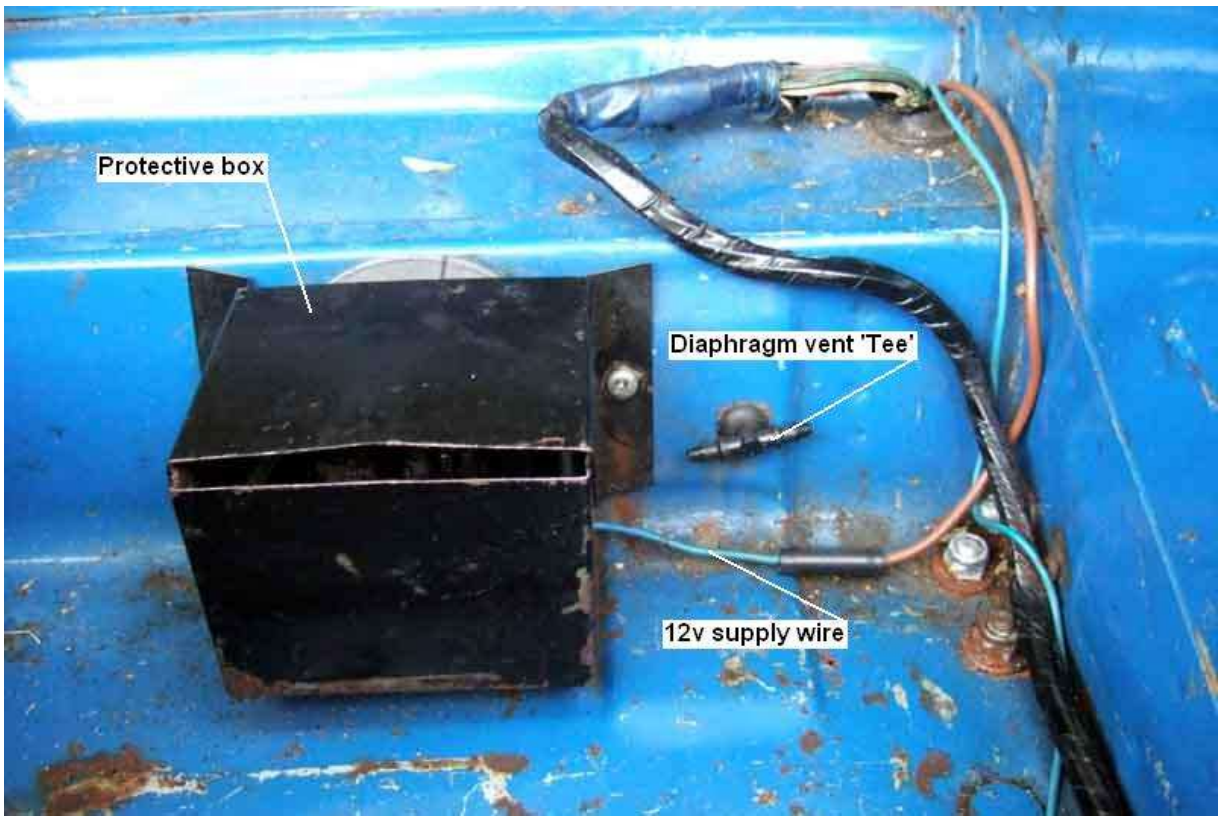


A large worm-clip is fitted around the grommet clamping onto the pump body, which together with the panel edge in the groove of the grommet seals against water entry. The 12v supply wire is connected to the pump terminal. A short length of plastic tubing connects to the vent port on the end-cap and hangs downwards (prevents any debris or water dropping into the upward-pointing port). I can't remember where this came from - Vee came to me with a Moprod pump that doesn't have vents and hence no tubing, this pump is the refurbed one from Bee, and Bee's vent tubes went onto the replacement pump:



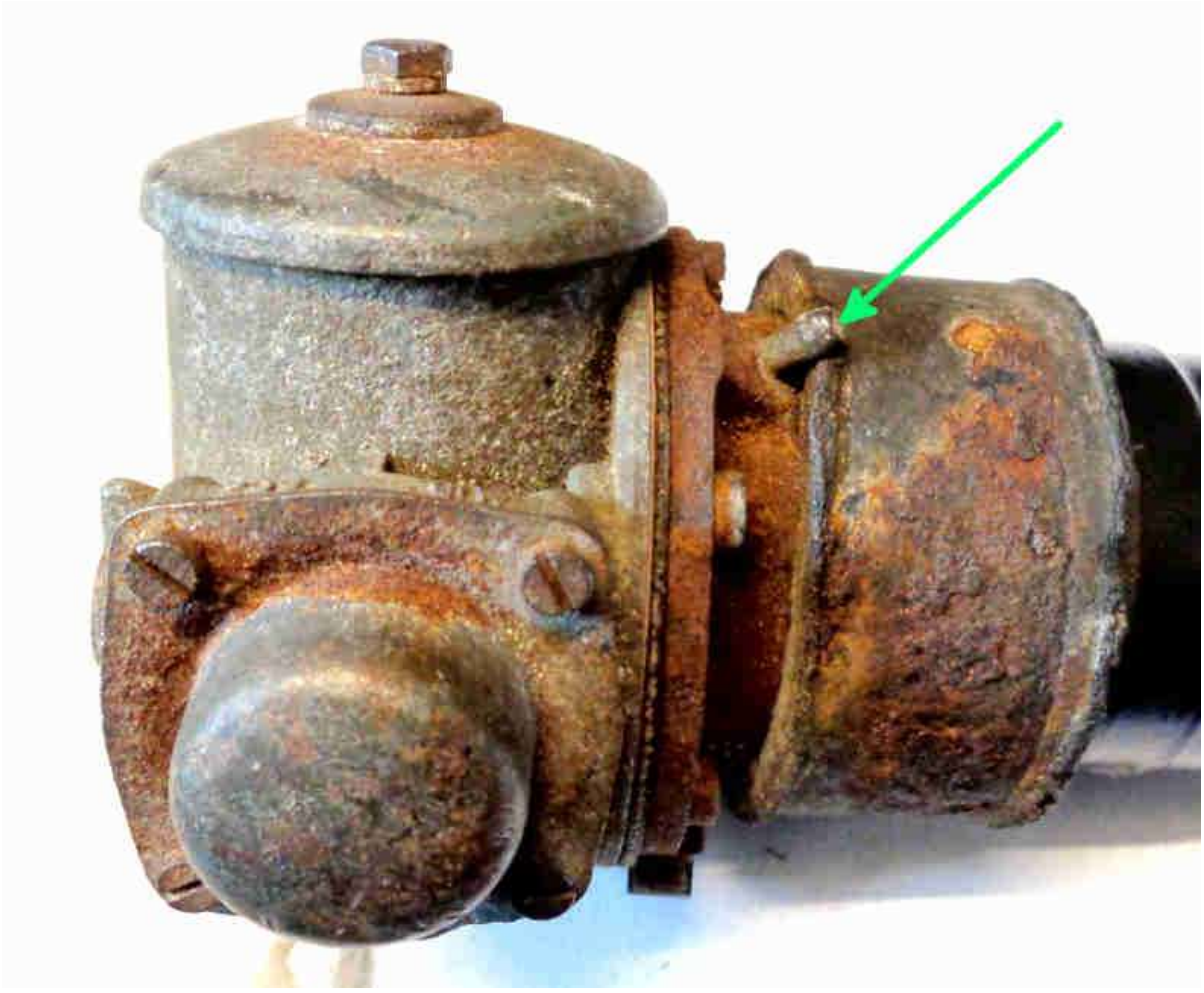
A metal box screws to the boot front wall to protect the pump and wiring from damage from heavy objects in the boot. The arms of the vent 'Tee' are left unconnected and pointing horizontally. Note the new brown wire added by a PO when the pump obviously shorted and burnt out the original white wire in the rear harness, the vestiges can be seen where the

harness enters the boot. Fortunately the rest of the wires in the harness weren't damaged enough to warrant replacement of the complete harness, nor the main harness which also suffered some damage. See 'Pump Fusing' on the main page to protect against the possibility of this on your car:

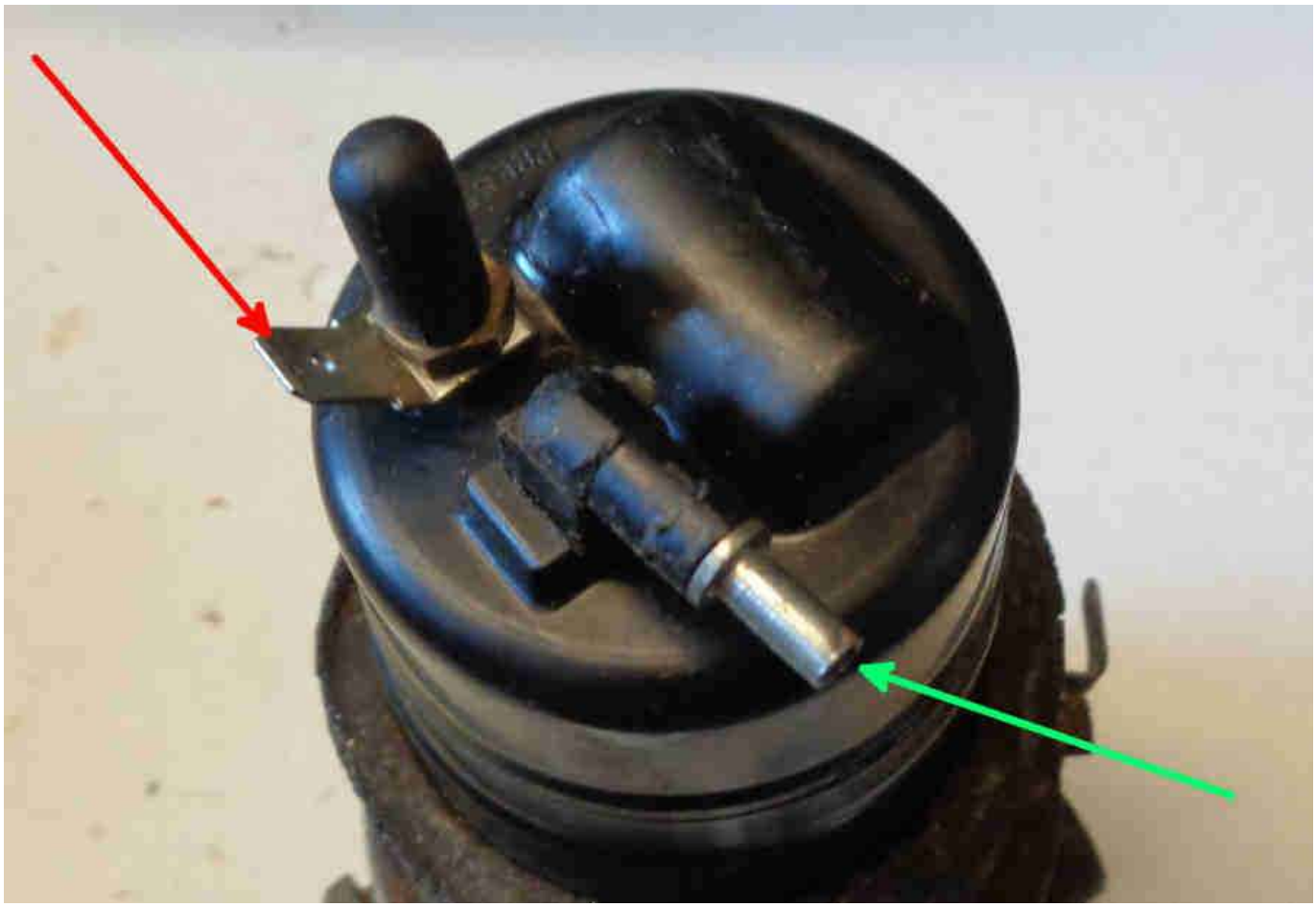


Pump Vents:

The diaphragm-end vent:



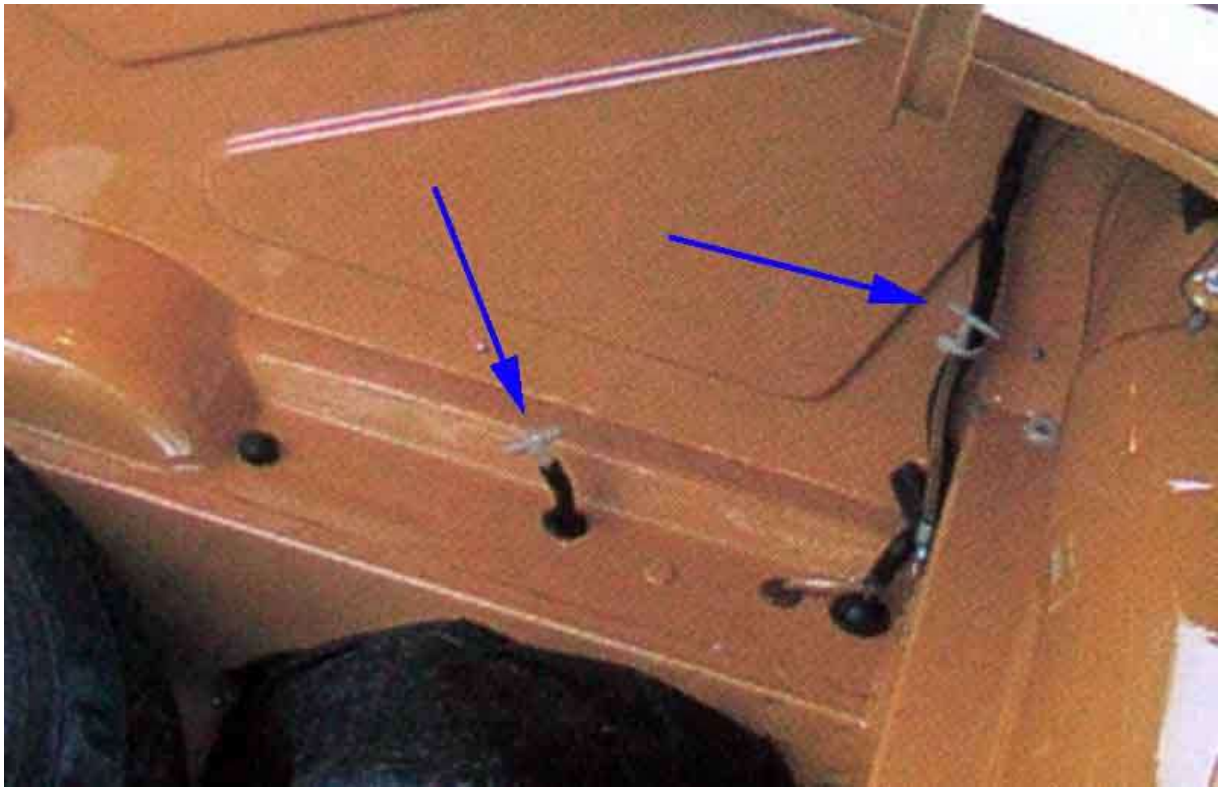
The electrics-end vent (green arrow), also showing the 12v connection (red arrow):



64 roadster - it's not clear whether there is a vent coming into the boot through the same hole as the harness, or terminates elsewhere: (Clausager)

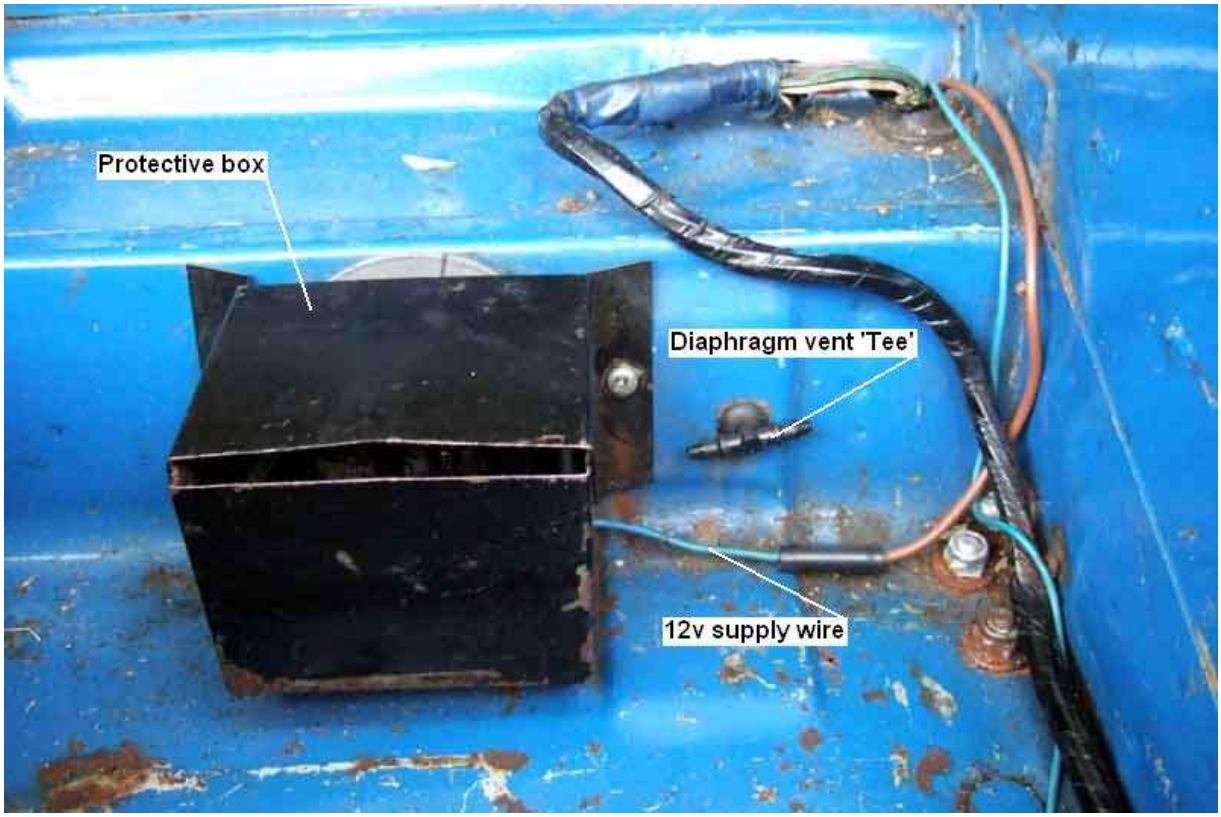
69 roadster - one vent coming up beside the harness and the other further inboard: (Clausager)

71 roadster - one with the harness above the chassis rail and the other one sticking up jauntily from the 'shelf': (Clausager)

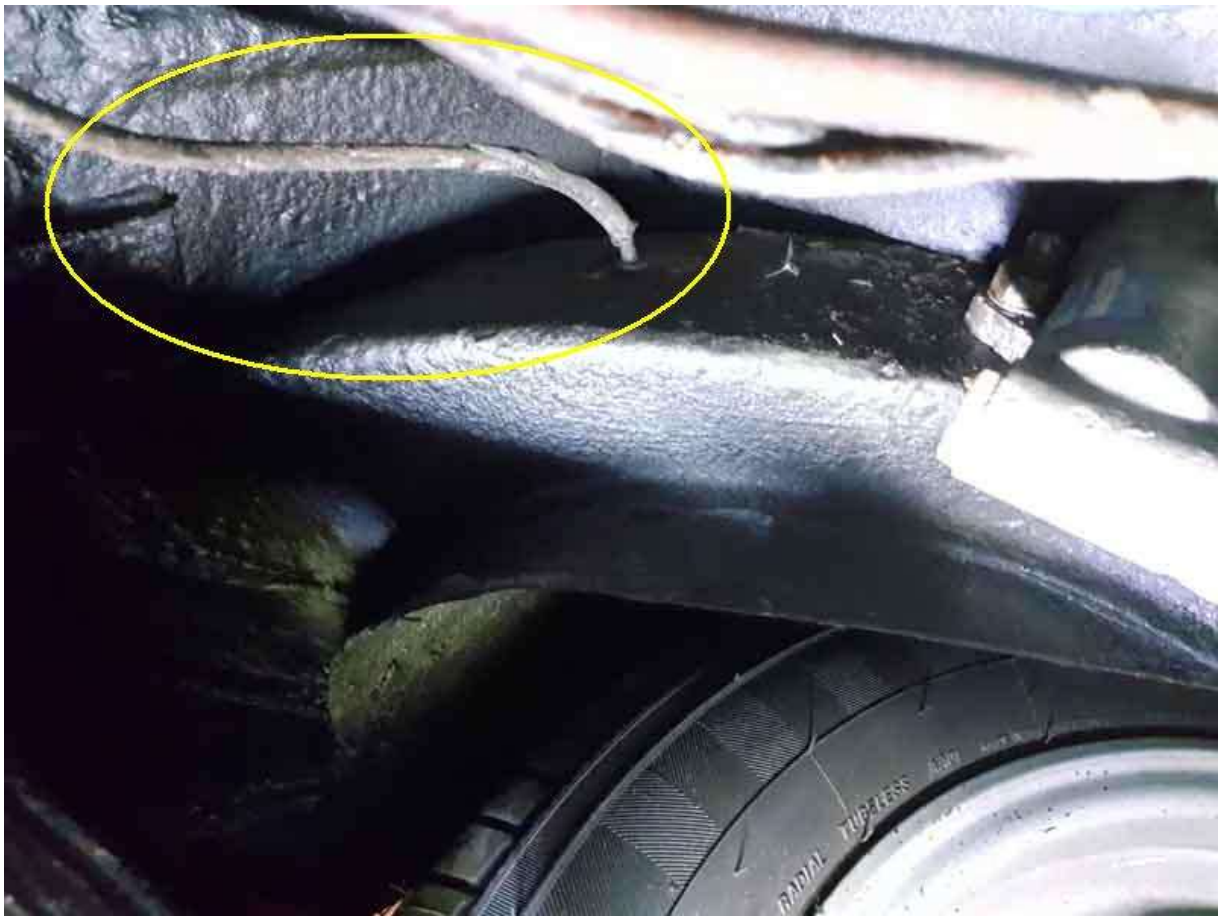


The vent pipes in the boot of my 73 roadster. For some reason one terminates on the shelf and the other is brought up beside the chassis rail. Clausager's 69 and 71 are the same. The pipe and tee on the right are narrower bore than the ones on the left:

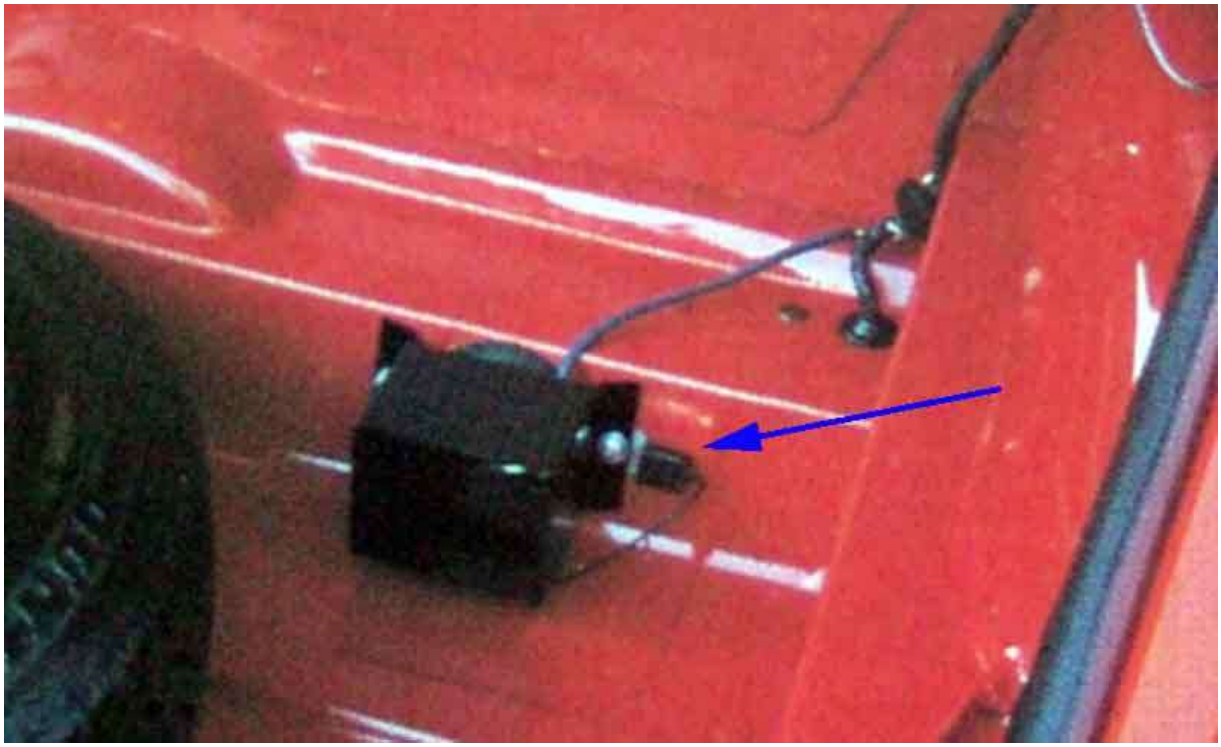
My 75 V8, Clausager appears to show the tube being run up to the harness and clipped there on page 29:



Steve Livesley's 75 roadster has the tube going to a nipple on the side of the chassis rail just in front of the damper:

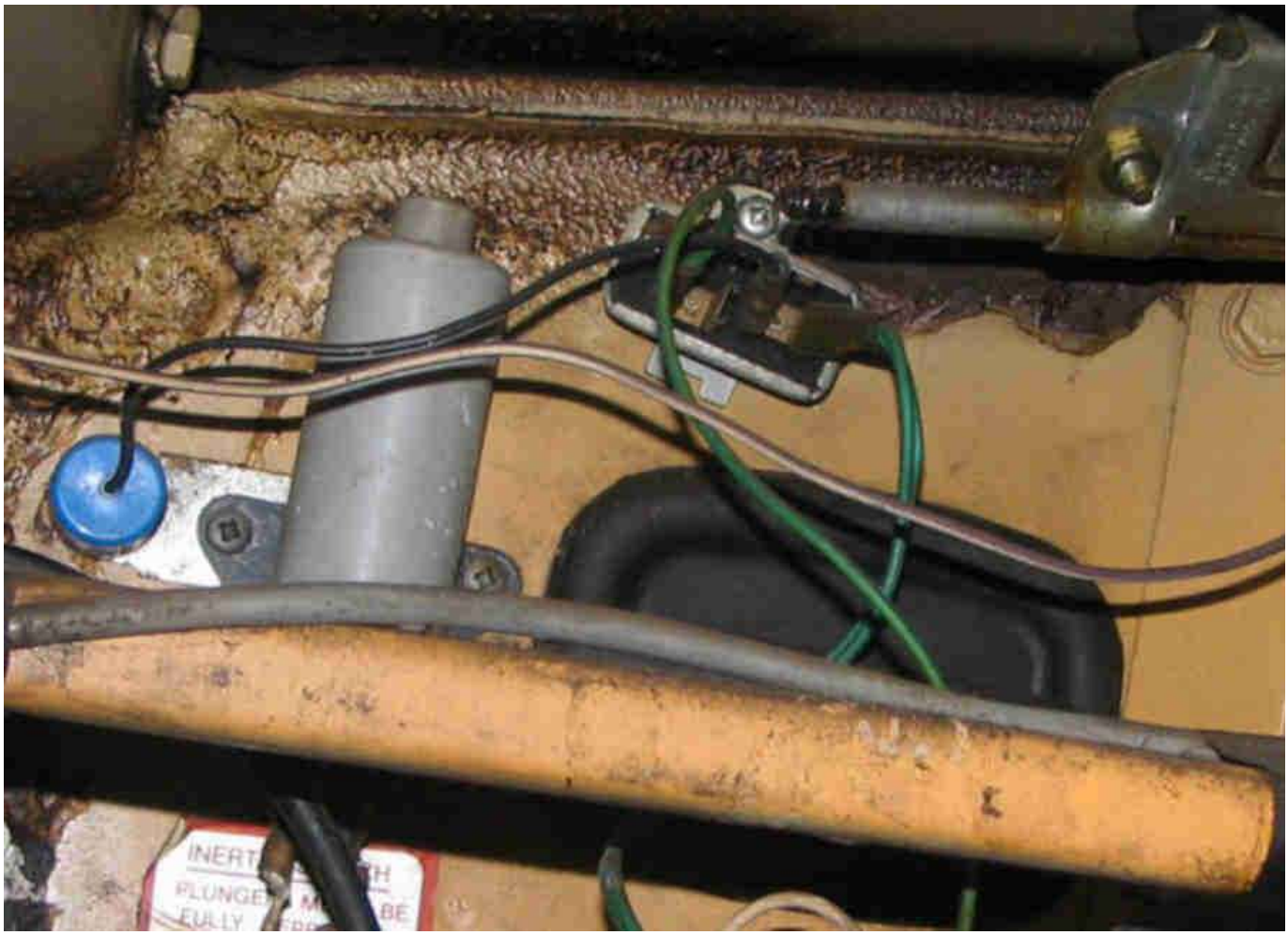


80 roadster - a grommet where one of them used to be. What could be the earth wire or more likely a suppression capacitor: (Clausager)



Cutoff:

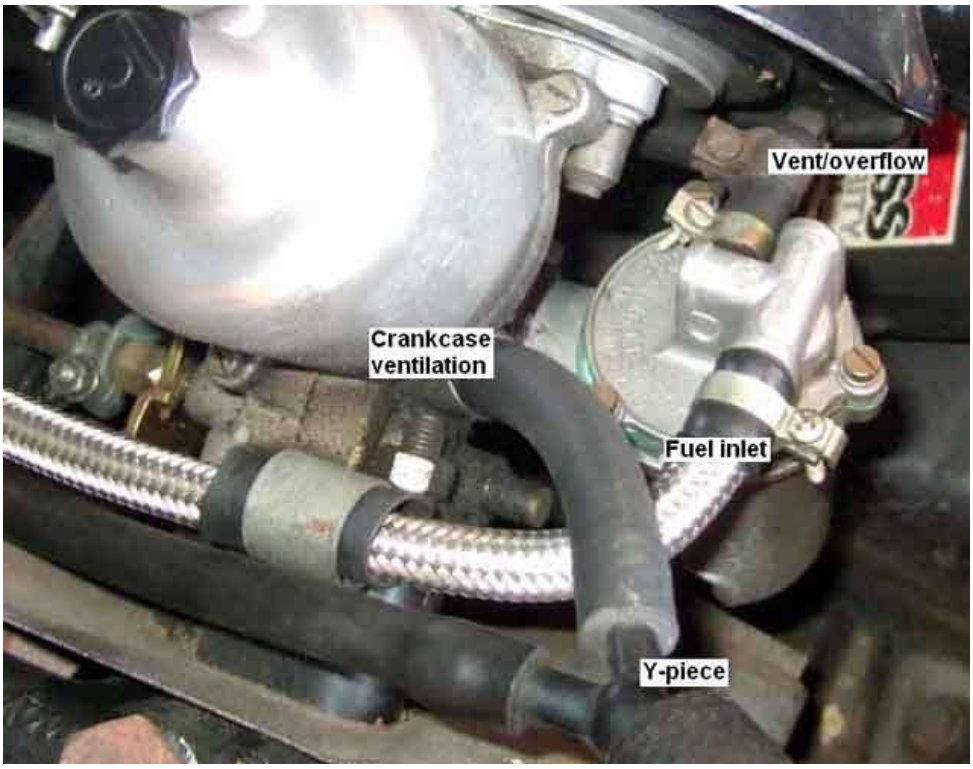
The North American inertia switch cutting power to the pump. Left-hand i.e. driver's side, with the large rubber bung for the master-cylinder connections beside it. Instrument voltage regulator and end of the wiper rack above the bung, with the interference suppressor for the instrument voltage regulator to the left of the inertia switch: (*MG Experience*)



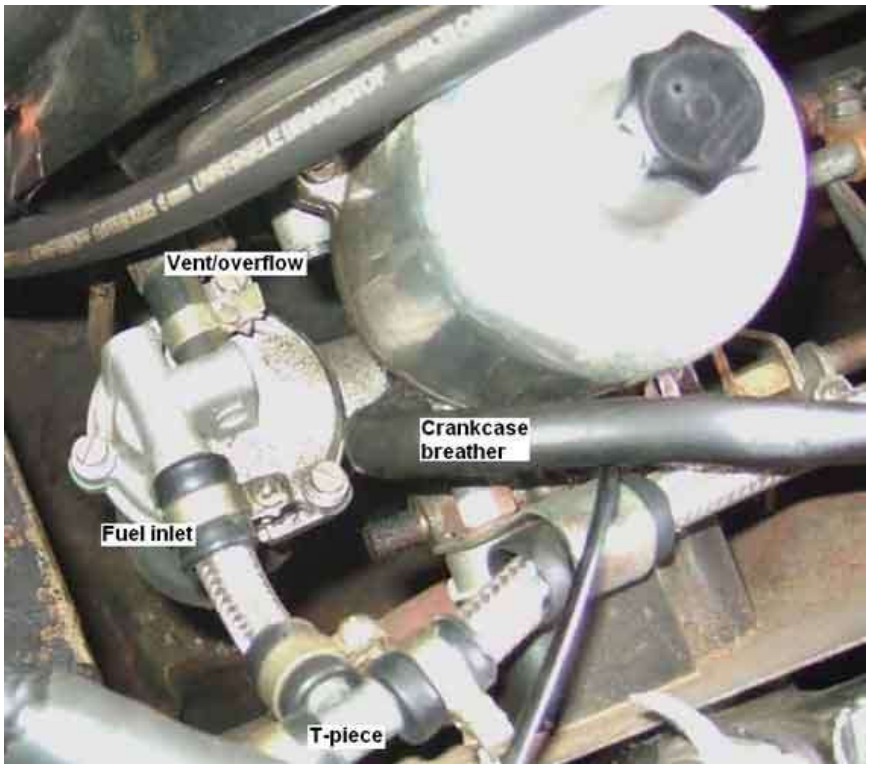
A second fuel shut-off device on North American cars that came into play in the event of a roll-over, this one physically cutting off the fuel flow. However John Twist says they invariably leak and strongly advises bypassing it, as this one has been: (*MG Experience*)

SU Carb Ports

HS carb 4-cylinder front:

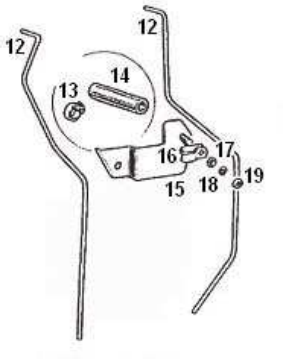


HS carb 4-cylinder rear:



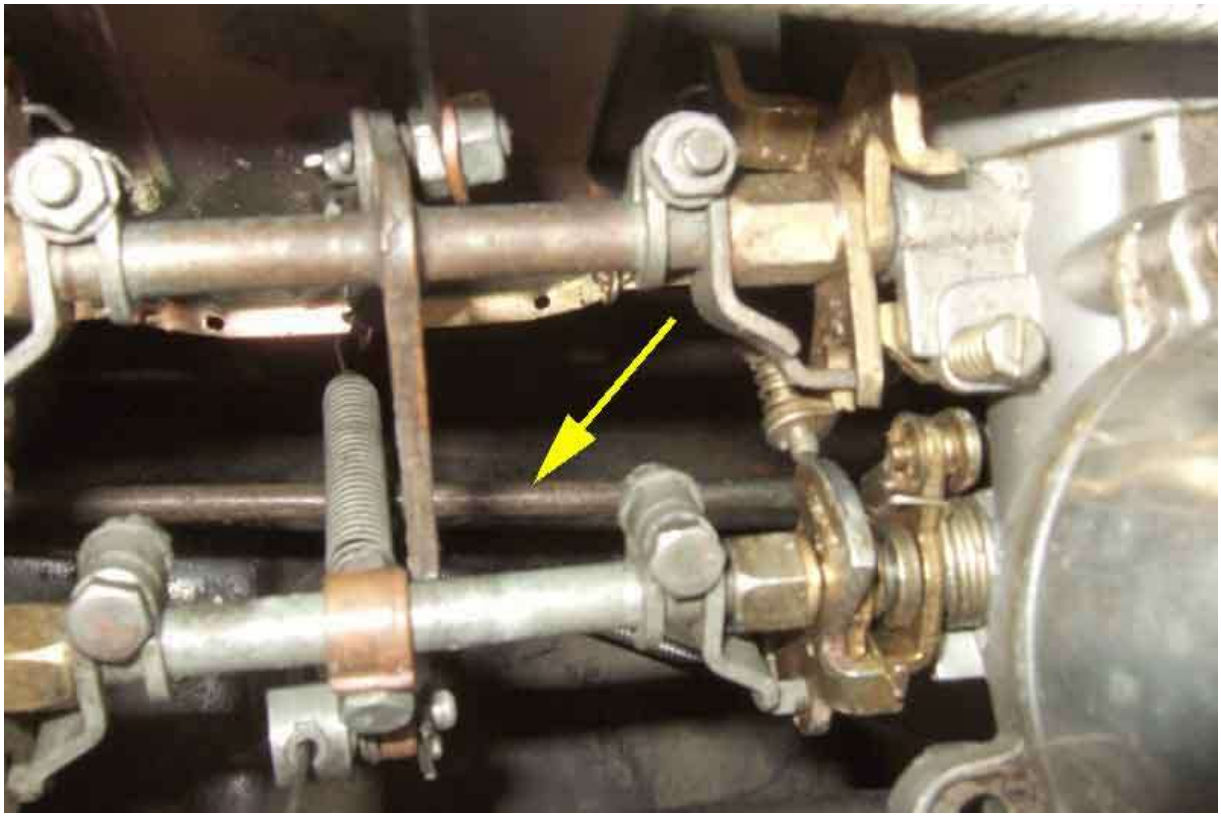
The front float chamber lid on North American emissions-controlled cars may have three ports like this - fuel in, fuel out to rear carb, and overflow: (*SU Burlen*)

The vent/overflow pipes. Short hose and clips 13 and 14 joining pipes 12 to the carb ports. Clip 16 (AHH7355) attaching the pipes to bracket 15 (AHH7382) with washers and nuts 17, 18 and 19. Bracket 15 (AHH7382) looks like it should attach to the left stud hole or blanking plate bolt of the moulding or aperture for the mechanical fuel pump, with the step clearing the right-hand stud and nut of the blanking plate. The Parts Catalogue indicates this arrangement ended at chassis number 258000 on export cars i.e. with the introduction of HIF carbs on those cars: *Image from [MGPartsUK]*

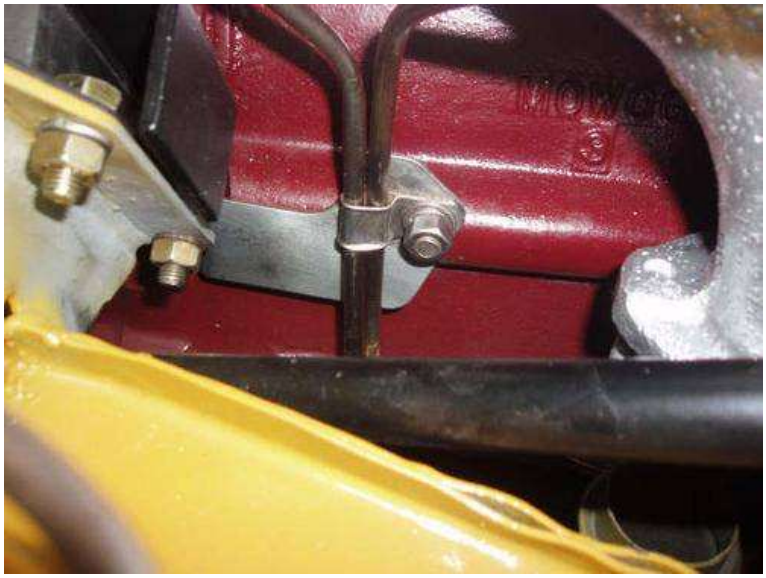


However the above drawing gives no clue whatsoever as to how the pipes are orientated on the car. The front pipe goes straight down and under the edge of the heat shield to meet up with the pipe from the rear carb, then both go through the mounting bracket on the engine mount (as here) or on the block bracket (as below):

The rear pipe goes down from the carb then turns forwards at a right-angle under the carb linkages to meet the rear pipe before going down through the bracket:



AHH7382 remanufactured by Ashley Hinton:



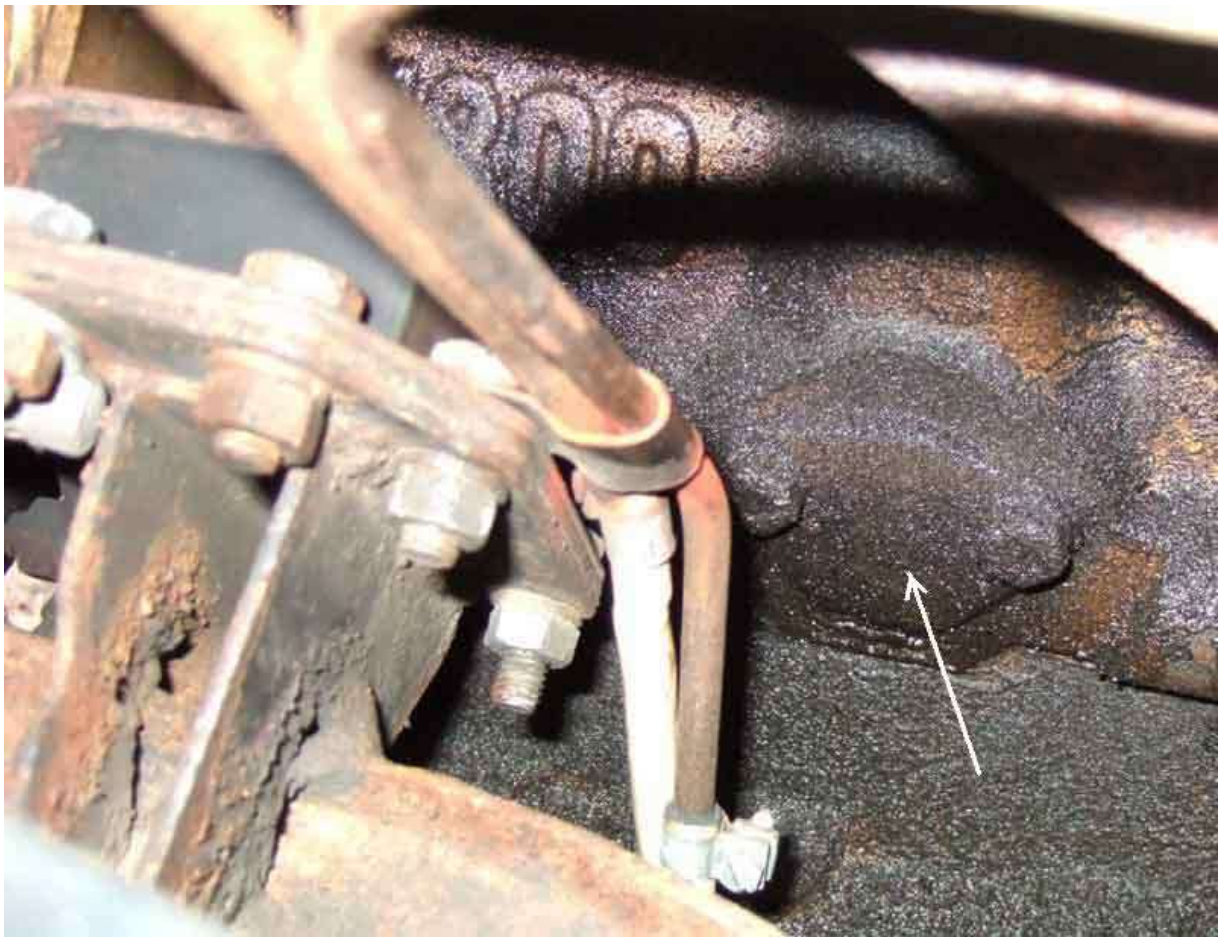
The mounting point for the plate (circled), which seems to be on all engines, largely obscured by the engine mount when in-situ:

Chrome bumper engine restraint bracket AHH7890 that fits round the left-hand engine mount (earlier cars had a mirror image round the right-hand mount as well). The two holes on the left go behind the bracket attached to the engine front plate, on the

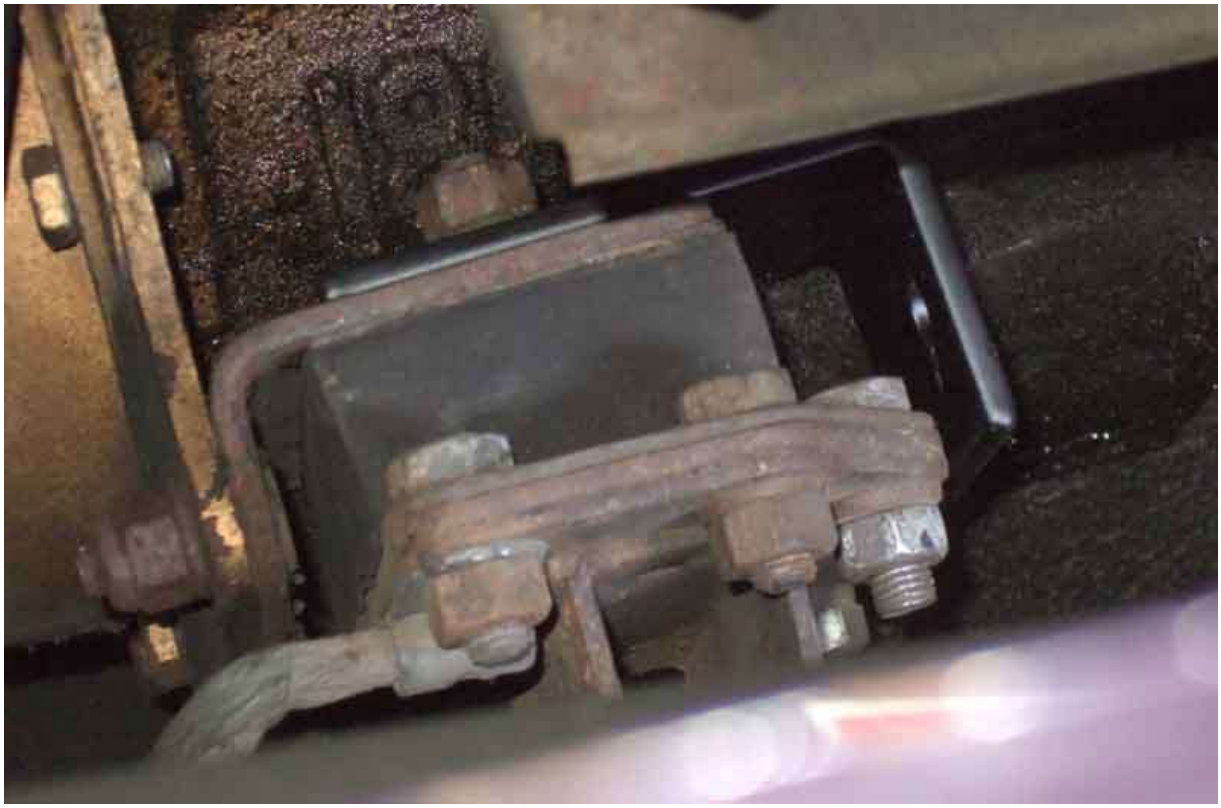
mount studs. The hole in the flange is a bit of a mystery as it is not shown in drawings, but is suitable to mount the carb vent/overflow pipes clip with a P-clip, nut and bolt and avoids getting the special bracket and messing under the engine mount:

Vent/overflow pipes attached to the chassis side of the mount as I'd seen on a concourse winner (also shows the countersunk bolts and stiff-nuts, arrowed) ...

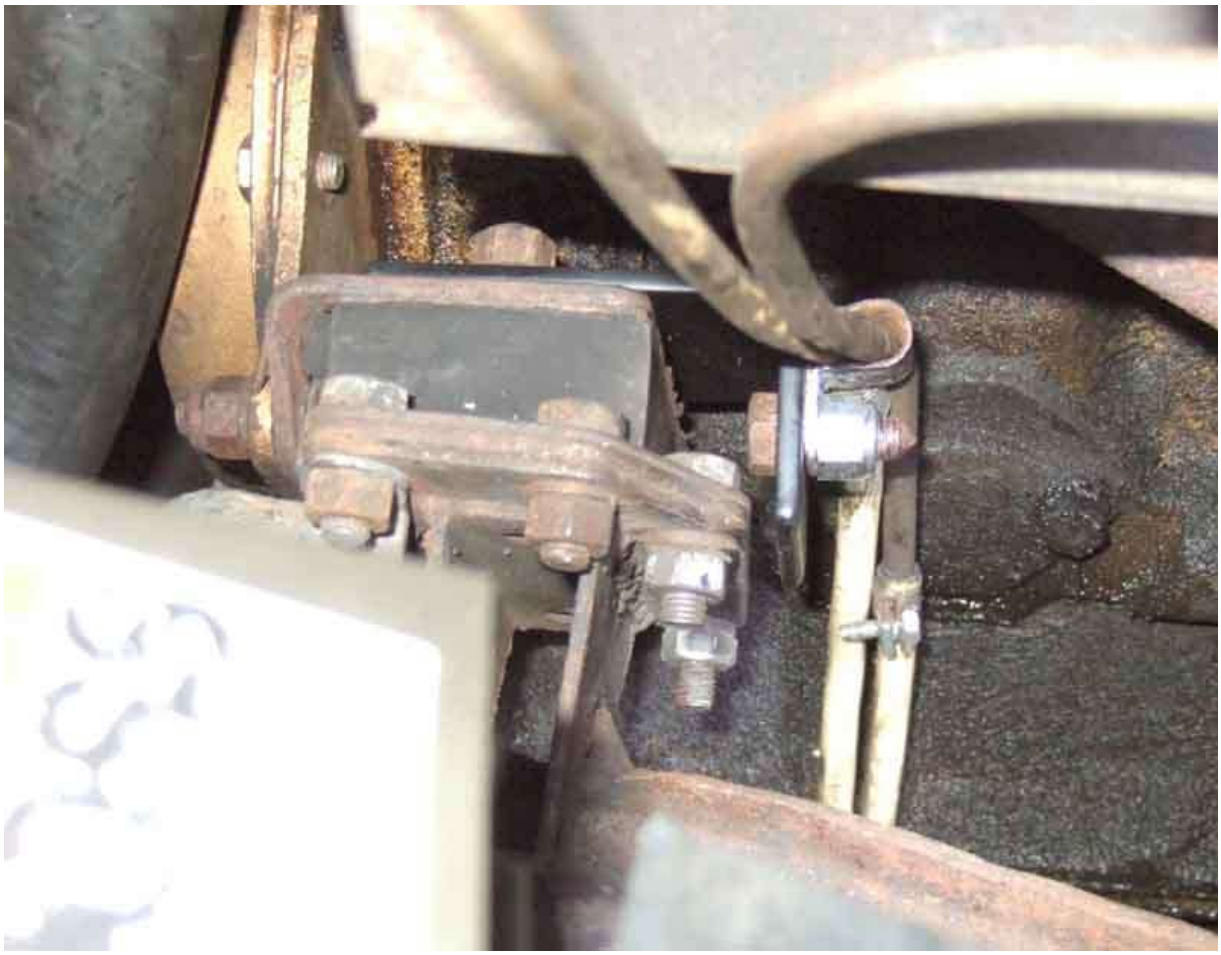
... so moving the pipes on their hoses as the engine rocked. Also shows the mechanical fuel pump blanking plate (arrowed), used for mounting the original crankcase breather draught tube:



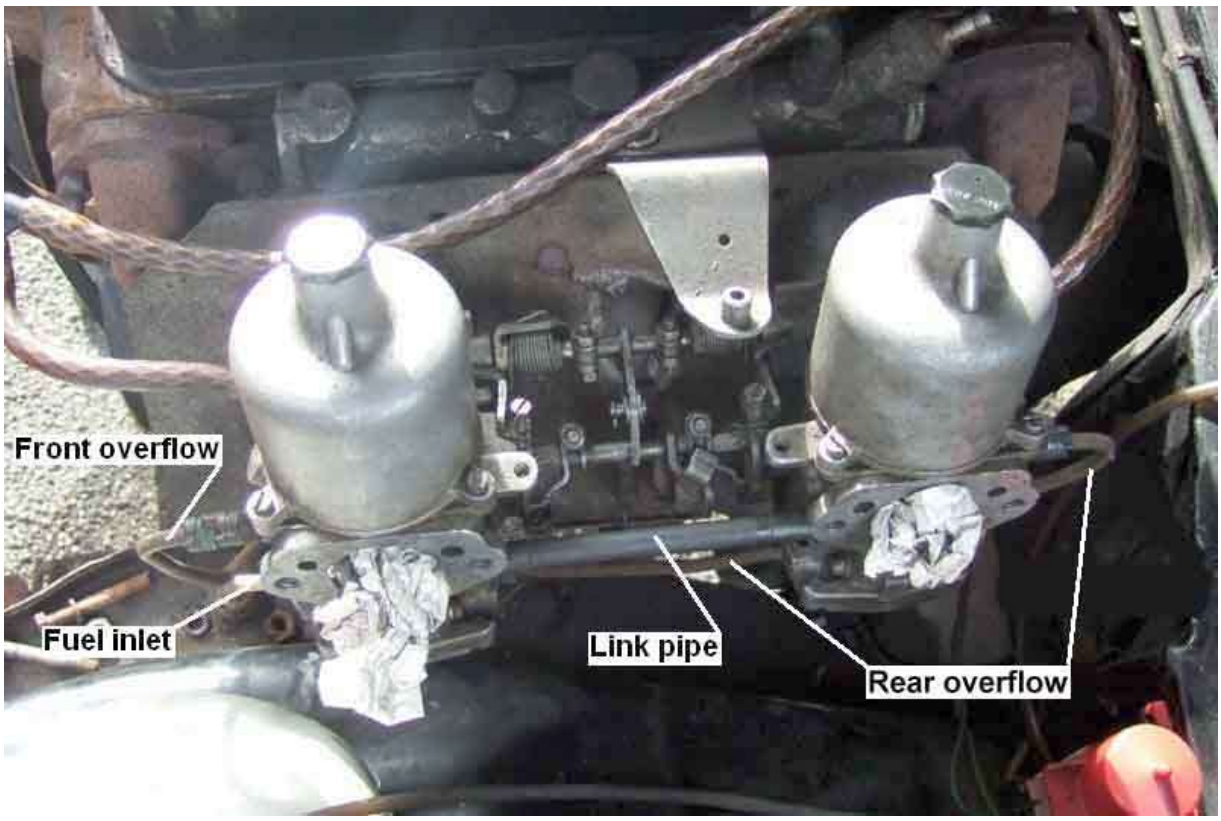
Restraint bracket mounted ...



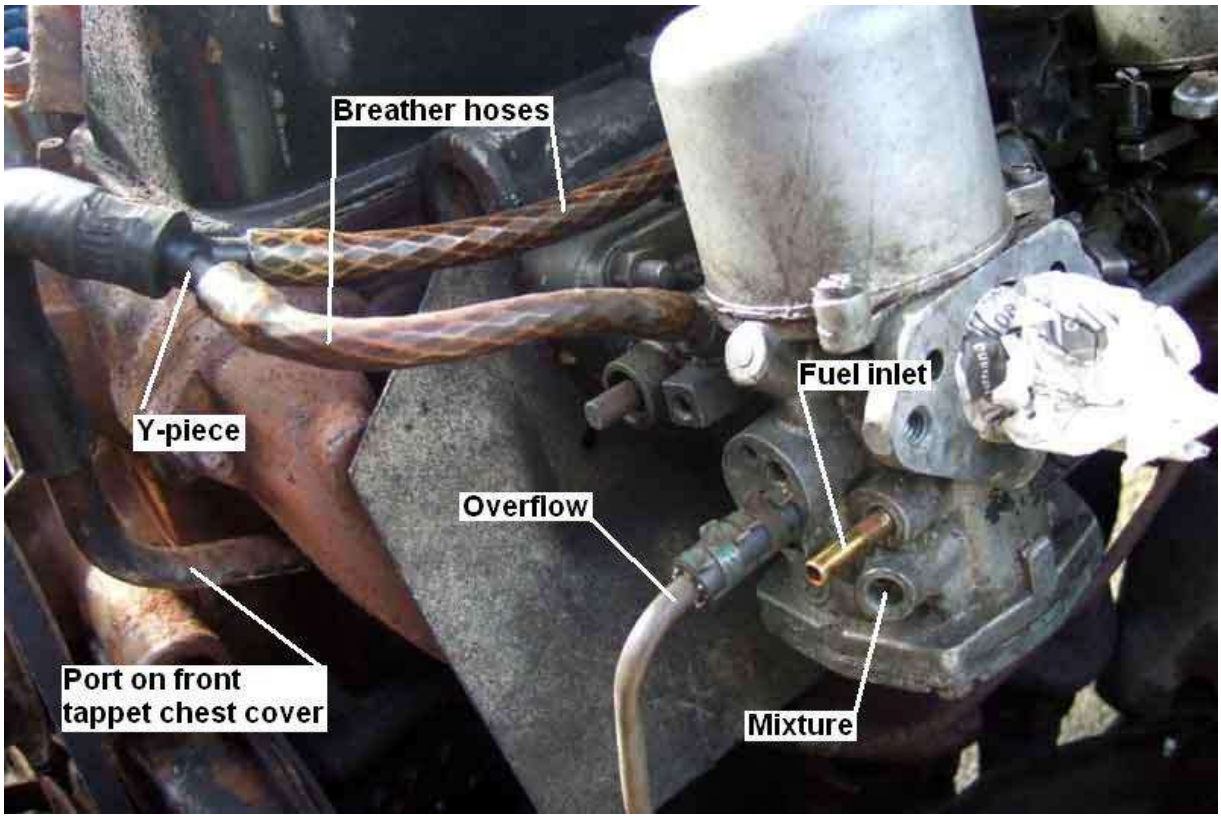
... limiting the forward movement of the engine to about 1/4", with the carb pipes attached to it using the convenient hole so they move with the engine:



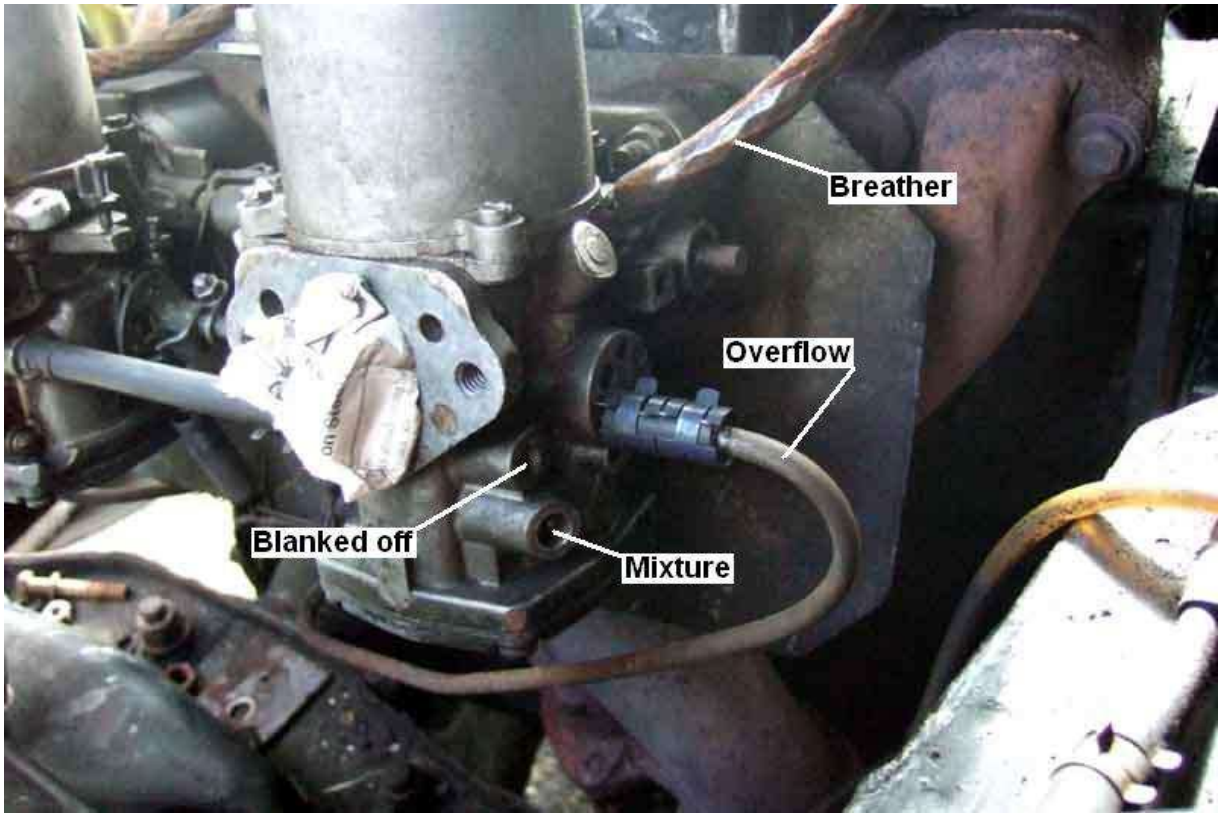
HIF carb 4-cylinder general view (paper bungs in the throats prior to removing the engine for a clutch change). The pipes leave the carbs pointing forwards and backwards, but the remainder of the routing is the same as for HSs:



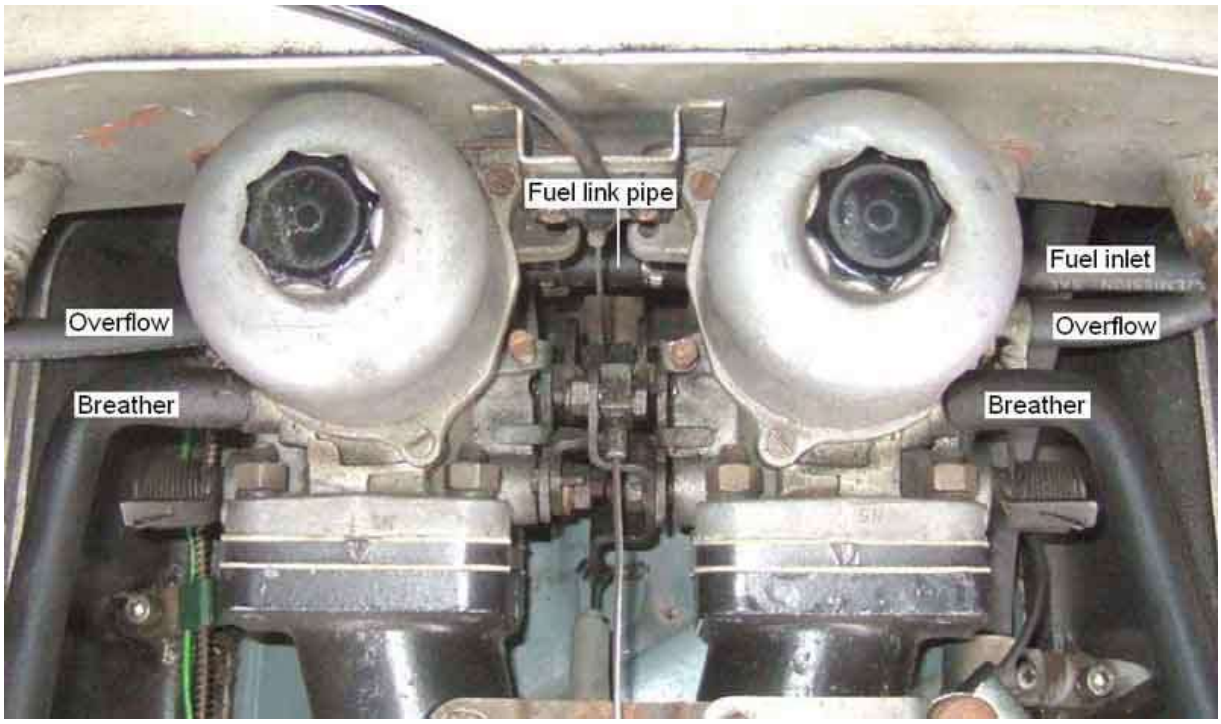
HIF carb 4-cylinder front:



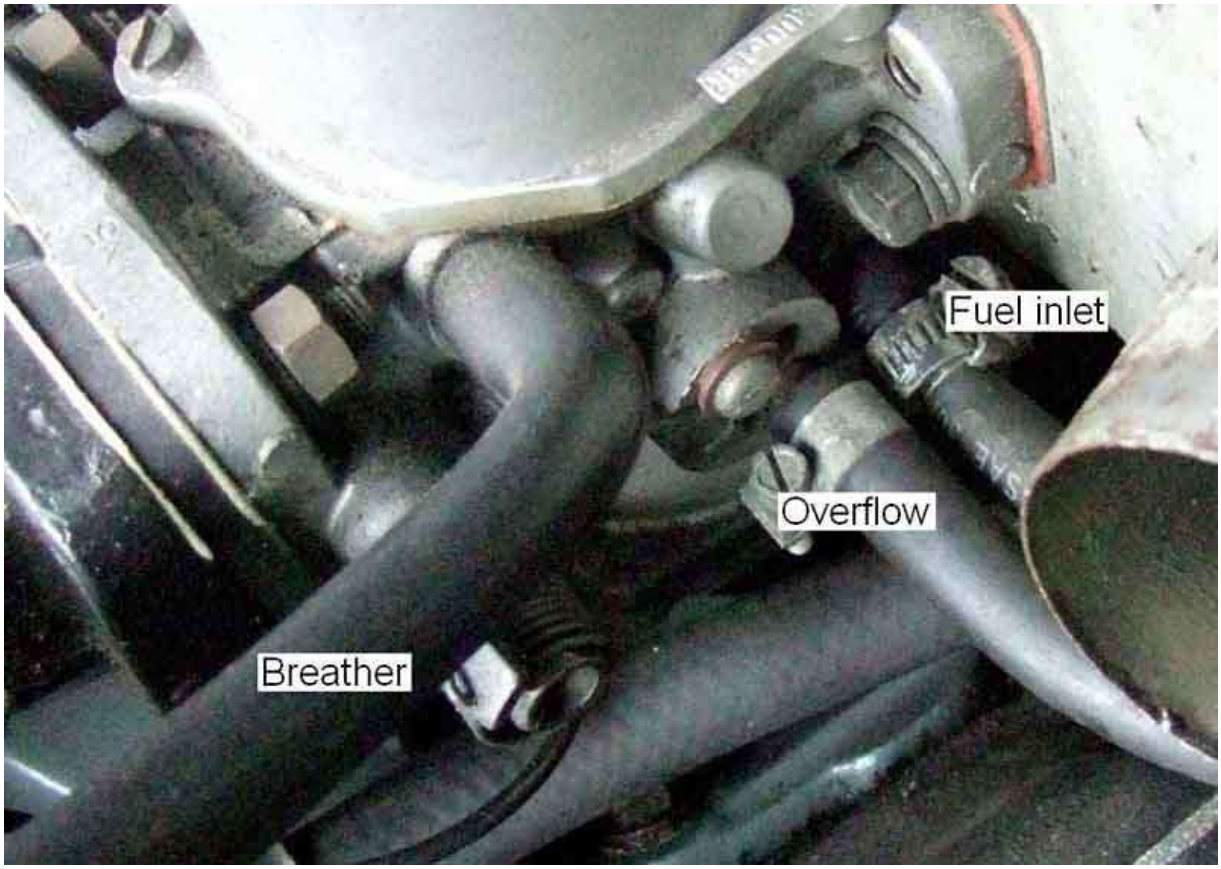
HIF carb 4-cylinder rear:



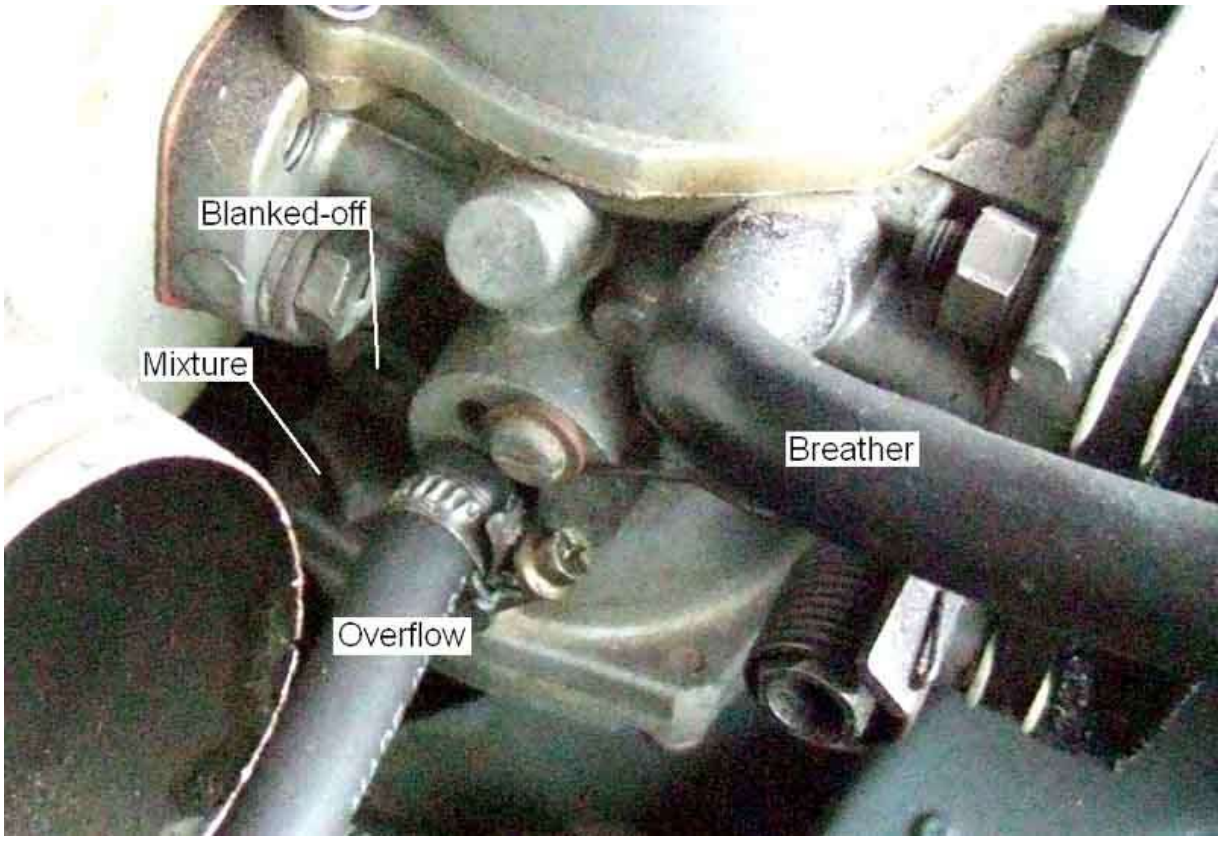
A general view of the V8 plumbing:



Detail of the left-hand V8 carb, mixture screw under the fuel inlet port:

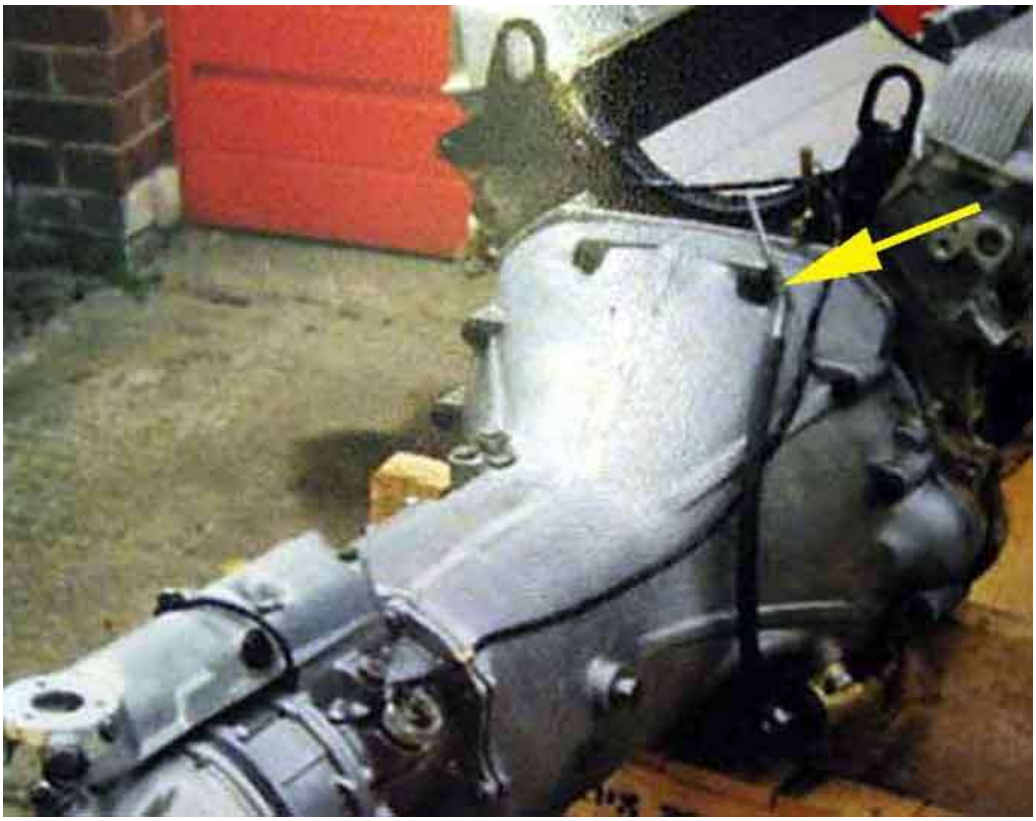


Detail of the V8 right-hand carb:



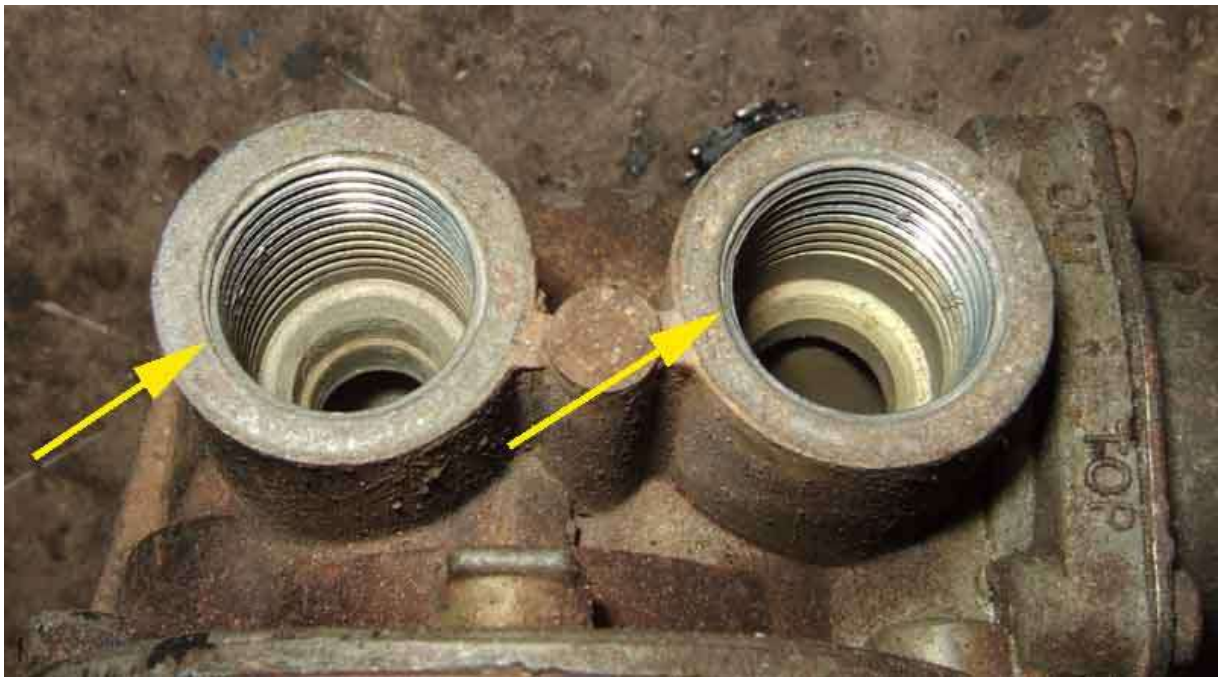
V8 overflow pipe BHH1570 and tee-piece GWW401: (*Brown & Gammons*)

The pipe attaches to the upper right bell-housing bolt, with a short hose to the Tee-piece above, which has two hoses to the carbs, and a long hose leading down past the bell-housing. Because of that it needs to be fitted before the engine and gearbox are installed ... which probably explains why they are often missing, like Vee's. It's attached to the right-hand side of the bell-housing to be clear of the exhaust. Vee came to me without anything on the carb overflow ports which I wasn't happy with, but decided to put the Tee and long hose on that side as it seemed more logical. No supports in my case, but it's never become detached from anything: (*British V8*)

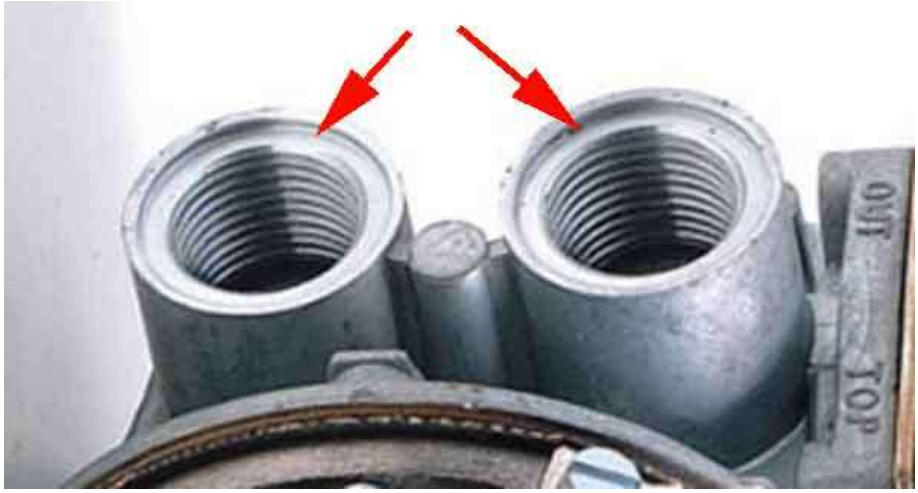


Fuel Pump Banjos

This type need a fibre washer, the threads start (arrowed) right from the face of the port:



This type need an O-ring, there is a recess in the face before the threads start:



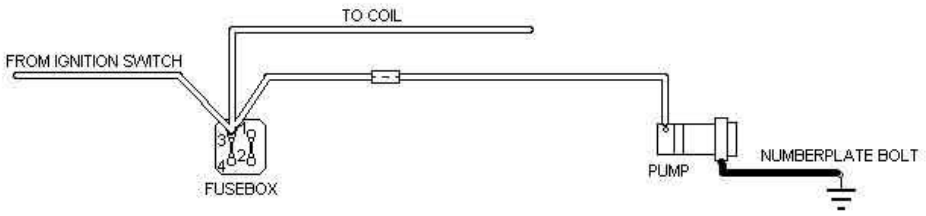
Banjo and bolt with an O-ring on the pump side from Dave Dubois. Both types use a fibre washer on the bolt head side, which may have a recess as shown in this picture. This type may need a second fibre washer (logically the recess side) to prevent the banjo bolt bottoming in the pump and failing to apply sufficient pressure to the seal:

The banjo is recessed internally so fuel can flow round the bolt to get to the exit port, the two holes do not have to be in line: (*MGOC*)

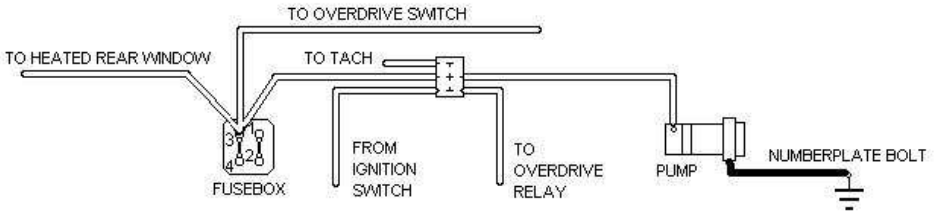
Fuel Pump Schematics

1962-64 1964-67 UK 1967-76, North America 1967-69 North America 1970-74 North America 1975-77 UK 1977-on North America 1978-on

1962-64

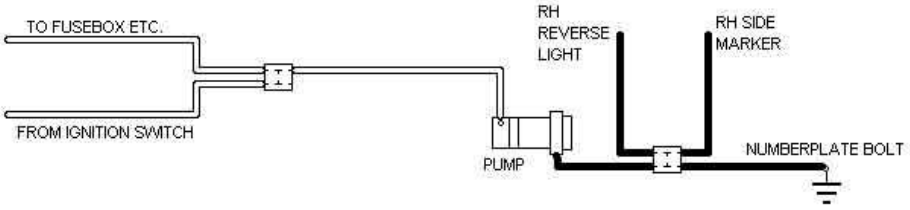


1964-67

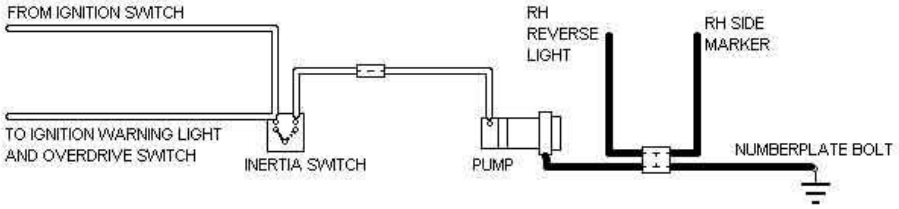


UK 1967-76, North America 1967-69

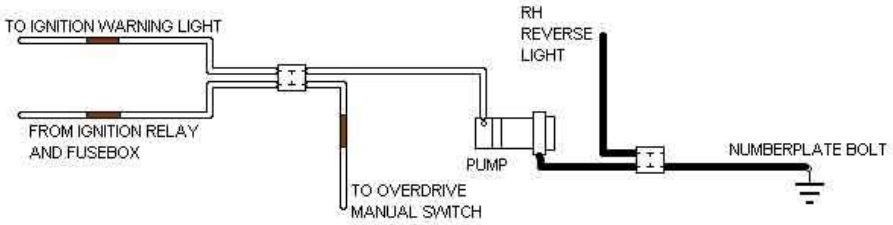
North America 1970-74



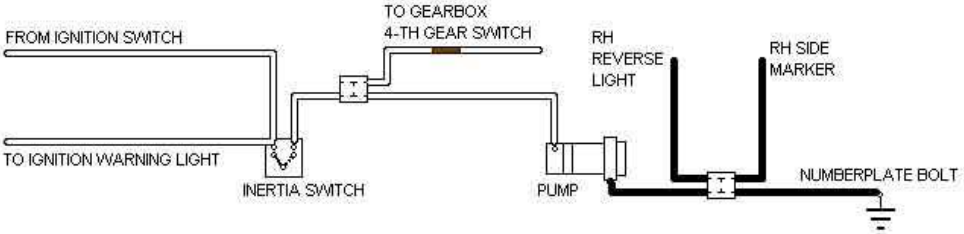
North America 1975-77



UK 1977-on



North America 1978-on



Pump Refurb

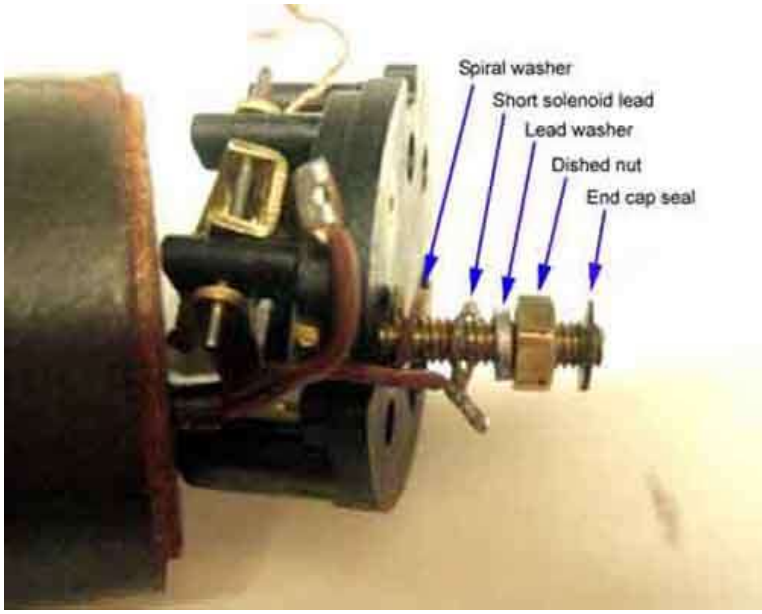
Last updated 22-Dec-2023

Pal Terry is reassembling his third MGB and the fuel pump doesn't work. Not surprising as it is an abandoned restoration. He tried cleaning the points to no avail, so posted it up to me. I immediately found it had some physical damage at the electrical end - broken spade, a punctured end-cap and a broken pedestal where the stud carrying the 12v spade is mounted. He has another spare pump that is also dead, so asked me if I could build up one good one out of his two and posted that up to me as well.

I swapped the good pedestal and spade into the first pump, cleaned the points and tested it, but pumping wasn't very strong. Blocking the output left the pump ticking about once per second instead of once every 30 secs or less, and fuel was draining out of the clear pickup pipe when power was disconnected. So I opened up both pumps and found the first one was pretty oxidised inside, whereas the second was much cleaner. The diaphragm on the first pump was also damaged - it consists of two layers of cloth-reinforced rubber with a thin 'plastic' membrane on the fuel side - but the membrane was split allowing fuel to be in contact with the rubber. So I ended up putting the second spade, pedestal, pump chamber, diaphragm and end-cap on the first pumps solenoid! That gave much better pumping results and was duly posted back to Terry. He had no immediate use for the other pump and said I could keep it, so I said I'd get a repair kit, keep it as a second spare (I already have a Moprod) and he would have first call on it.

I contacted Burlen to ask about pedestals, but they were most unhelpful. Kept trying to sell me a repair kit, which doesn't contain the pedestal! Dave Dubois gave me the part number, and Googling that showed a number of suppliers. They had various combinations of the parts I needed but none had all, and in the end I decided to get the repair kit, pedestal, spade and end cap from Burlen, who do have all the parts on their web site if you are patient enough to search for them by part number.

First thing was to assemble the new points to the new pedestal. In the past on pumps I have worked on the pin has been a loose fit in both so an easy job. But this pin was a tight fit, and had to be pushed in through the outer frame then the pedestal leg while being gripped with pliers. But it's not easy doing that while holding the moving contact inner frame exactly in line with the hole, and it's almost exactly the same width as the gap it has to fit in. But I managed to push the pin through just a fraction, so I could locate the hole in the contact frame over the very end of the pin, then push the pin further through. I could see immediately that the upper and lower fingers on the outer frame were way out of adjustment, and only allowed for a small amount of movement, but decided to leave that until later when the pedestal was on the solenoid body giving me something firm to grip. The contact frame is supposed to be free on the pin, but this was quite stiff to begin with. But flipping it back and fore with the pedestal off the end of the solenoid freed it up.



The brass threaded bolt with the hex head that carries the input spade then has to be pushed through from underneath the top part of the pedestal, a spiral washer fitted, and the shorter of the solenoid wires, before the pedestal can be fitted to the end of the solenoid. The correct order of components is spiral washer, solenoid tag, lead washer, and the dished nut with the dish facing the lead washer. The head of the bolt fits in a recess in the underside of the upper part of the pedestal, and the nut can be loosely tightened.

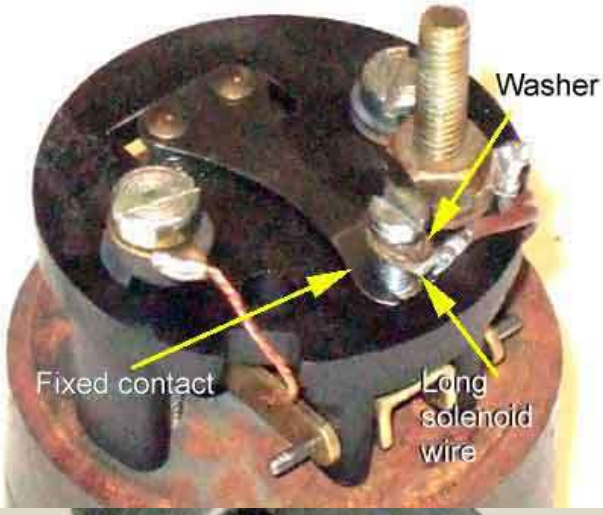
The pedestal is fitted to the solenoid with a spiral washer under the head of the screw by the brass stud. The other screw has the braided wire from the moving contact frame fitted first i.e. against the head, then a spiral washer, before being fitted through the pedestal into the solenoid body.

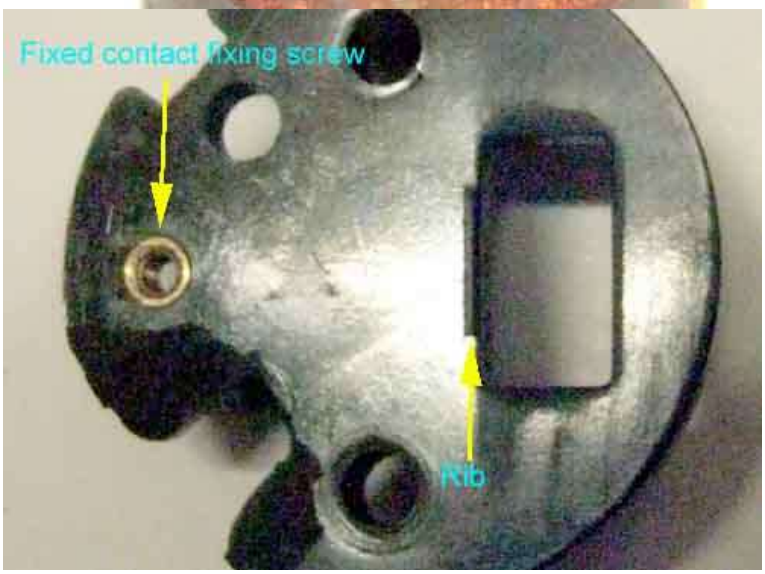
The fixed contact goes against the upper face of the pedestal, with the longer solenoid wire on top of that, then the washer, then the screw. The fixed contact is slotted so can be fitted after the screw with the solenoid wire and washer have been fitted to the pedestal but not tightened, but must go between the solenoid wire and the pedestal. The fixed contact should be adjusted back and fore (utilising the slot), and from side to side, such that it's two contact pips lie directly above the two contacts pips on the moving contact.

Lifting the moving contact by hand check that, as far as possible, both contact pips are touching at the same time to give even wear, and not favour just one of them. The easiest way to do this is look at the fixed contact just as it starts to be lifted off the rib on the pedestal. If one side appears to start moving before the other, then twist the moving contact frame slightly so that both sides start to lift at the same time.

There are three possible quenching devices on MGB pumps (earlier pumps had no quenching at all):

Initially a capacitor that is connected between the screw securing the fixed contact and the screw securing the braided wire from the frame. The capacitor is typically a buff-coloured cylinder with one wire at each end. It's not polarity conscious and can be connected either way round, but if one terminal has a large slotted or holed tag than the other, then the large one goes under the pedestal screw and the smaller one between the solenoid wire and the washer on the fixed contact fixing screw. This means that capacitors are connected across the points.





Capacitors were replaced by diode-resistors by the end of MGB production to give superior quenching, on pumps with an AZX designation. These are polarity conscious and the diode-resistor must be connected the right way round to match the polarity of the car. It won't cause damage to the rest of the car if they are connected incorrectly, it probably won't even reduce the effectiveness of the quenching, but the pump will take an extra 1 amp of current. The diode resistor is a black cylinder with two wires at the same end, one with red insulation and one with black. For early positive earth cars the black wire from the diode should go between the solenoid wire and the lead washer on the threaded brass stud, and the red wire between the solenoid wire and the washer on the fixed contact fixing screw. For later negative earth cars the red wire goes on the brass threaded stud, and the black wire with the fixed contact. This means that diode-resistors are connected across the solenoid coil.

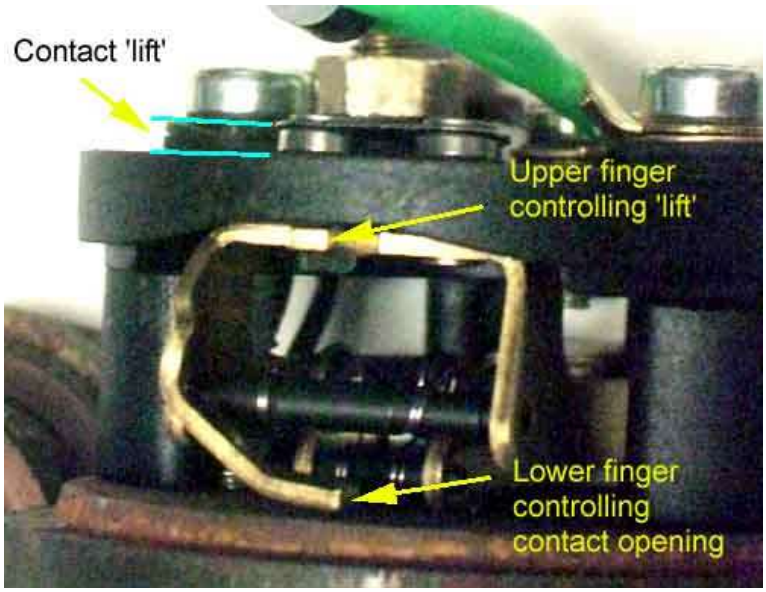
Diode-resistors have now been replaced by a bi-directional transient suppressor, which can be either a flat disc with a wire off each side, one parallel to the other, or a small cylinder with a wire coming away from each end. These are not polarity conscious so can be fitted either way round. However this black one came with a small slotted tag on one end and a larger holed tag on the other. The smaller tag goes between the solenoid wire and the washer on the fixed contact fixing screw, and the larger tag goes with the braided wire tag under the pedestal fixing screw. Note this positioning is only initial fitting, and is not orientated correctly for cap fitting.

When tightening the dished nut it's important to make sure the tag on the shorter of the two solenoid wires doesn't trap or damage the other solenoid wire in the slot by the brass bolt. As you tighten the nut the tag wants to turn as well, and if left to its own devices it can trap the wire. Even if that doesn't happen the longer wire can end up being pressed against the tag by the end-cap. Use an implement to hold the tag away from the longer wire while you tighten the nut (note the tag is nowhere near the right-hand pedestal screw as it appears here). If the insulation is pierced the solenoid is effectively shorted out, which will damage the wiring all the way back through the rear and main harnesses, and the ignition switch, to the starter solenoid. Both my cars came to me with the wiring damaged in this way, plus two that I have worked on, and whilst writing this article I examined the pump a pal has recently been having trouble with to find obvious heat damage from the same cause. It's why I have fused both my pumps and strongly recommend it.

SU Burlen state that these pumps take 1.5 amps at the minimum voltage of 9.5v, which implies a solenoid resistance of 6.3 ohms. However when I measure the resistance between the two pump spades of mine I see about 2 ohms, which implies a current of 6 amps at 12v, and 7 amps at a running voltage of 14v. I then measured the current through the solenoid i.e. bypassing the points and at 12v saw 5.5 amps - so where do Burlen get their 1.5 amps from? If you power a pump on the bench, not pumping fuel i.e. chattering away, using either an analogue meter or a digital meter that will average the current, that's when you will see about 1.5 amps. In other words the current that Burlen quote is the average of the current flowing while the points are opening and closing, and they are open for longer than they are closed. So if you intend to fuse your pump don't be tempted to use the minimum rating of, say, 2 amps, as the fuse will probably eventually fail. I've never seen any reason to use other than the standard 15 amp rated, 35 amp blow fuses, as they are designed to protect the wiring and the pump wiring is no thinner than other fused circuits, and you have (or should have) two spares in the fusebox already. Start fitting blade types, or different ratings, and you have to carry more spares. Ok, that's no great hardship, but it isn't necessary either.

With the trunnion on the moving contact inner frame in the lower of its two stable positions i.e. against the top of the solenoid (shown here before fitting to the solenoid), fit the diaphragm rod up though the middle of the solenoid. Screw the rod into the trunnion, which is easier said than done as the rod wants to push the trunnion away from it, and when it flips up to the back of

the pedestal the rod won't reach. You also have to carefully align the trunnion so the threaded hole is in line with the diaphragm rod. Make sure the plastic washer is fitted to the diaphragm rod before the rod is inserted through the solenoid. This is essential to leave an air gap when the solenoid pulls the diaphragm in, without it the diaphragm may not release when the points open to disconnect power from the solenoid.

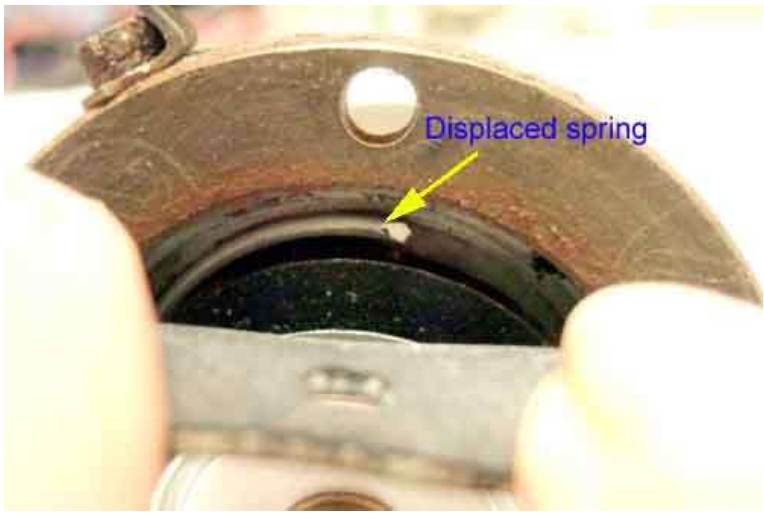


The Burlen instructions mention in step 3 (e) to 'adjust the finger settings', but it's not until step 8 that you are given details of the lift and clearances of the two stop fingers. I have found that you must set the clearance and lift of these before adjusting the diaphragm as described in step 4, as adjusting them afterwards results in a very different diaphragm position. Also it talks about a 'lift' of the fixed contact on top of the pedestal of 35 thou, but shows this value as being between the underside of the spring of the fixed contact, and the pedestal surface. In fact the fixed contact rests against a rib on the pedestal, so is already lifted by a few thou when the moving contact is pulled away from it, making it a clearance rather than a 'lift'.

Whilst I was able to use a pair of long-nosed pliers to adjust the bottom finger that rests on the end of the solenoid, to adjust the upper finger where it rests against the bottom of the pedestal I had to use special spring-adjusting pliers which date back to my GPO days. The two clearances are 90 thou for the lower finger and 35 thou for the upper. Both fingers are adjusted with the diaphragm released, and the moving contact lifting the fixed contact off its rib. The lower finger at 90 thou needs specialised feeler gauges which I don't have, so I used a dial gauge and Mk1 eyeball to gauge the gap. For the upper finger whilst I can make up 35 thou with my standard feeler gauges it is with two or more gauges so you have to make sure they are pressed firmly together, by using an implement to press all of them down onto the top of the pedestal whilst sliding it towards the fixed contact. If you don't press them down like that multiple feeler gauges will tend to splay apart and you will get a larger gap than intended. You can't rely on the fixed contact squeezing them together, like you can when checking valve clearances for example, as the splay on the gauges is as likely to lift the fixed contact as anything else. Recheck that both contact pips are touching at the same time, and if the moving contact frame has to be readjusted to achieve that, then recheck the clearances, and repeat until both are correct.

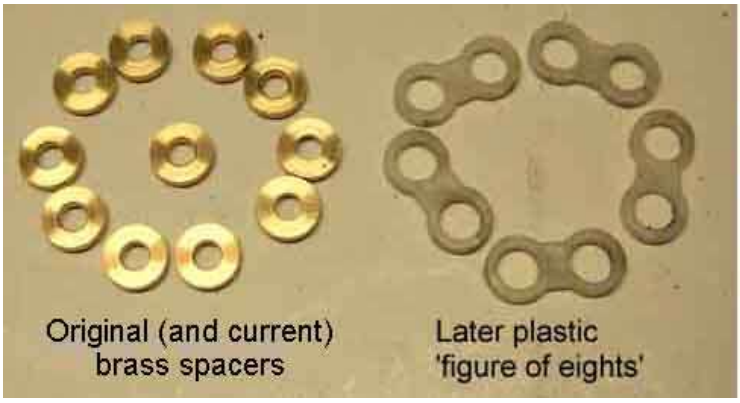
The original diaphragm consisted of a double-layer of cloth reinforced rubber, plus a thin 'plastic' membrane that was in contact with the fuel. The new diaphragm only has a single layer of reinforced rubber, and no plastic membrane. So not only is it less than half the thickness, but the rubber is now in contact with the fuel which is wasn't before. So what that means in terms of longevity of the diaphragm, and its resistance to increasing levels of ethanol in the near future, can only be wondered at. Also with half the thickness of rubber the gasket becomes even more important at taking up any distortion in the two flanges i.e. the solenoid body and the pump chamber body. The former is cast so pretty robust, but the latter is alloy which can be distorted by

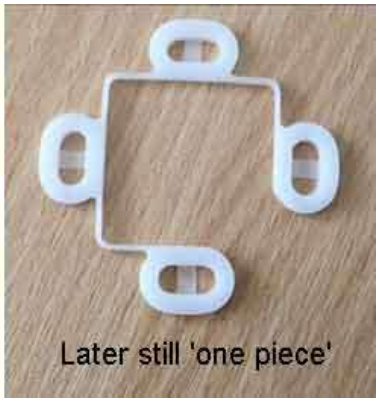
the action of the screws clamping the two together. So I ran a flat carborundum stone around the flange of the pump chamber, to find that the edges were indeed slightly bowed out between the screw holes, and spent some time reducing this as best I could. Another thing to wonder at is how flexible the 'one-piece' diaphragm is compared to the old. I used the edge of the old one to bend down the edge of the new one, and see which bent more. Both bent by the same amount, indicating the stiffness of the new one-piece is much the same as the original.



With the gaps set screw the diaphragm into the trunnion until when pressing the diaphragm towards the base of the solenoid firmly, the contacts just fail to throw over i.e. fail to open. With the new diaphragm and spring I found the spring kept getting displaced to one side and preventing the diaphragm going fully back, which would give a grossly incorrect setting. You have to be sure the spring is centralised, and learn how far the diaphragm goes back when it does so fully. The diaphragm and hence points throw is finally adjusted when the two halves of the pump are ready to be brought together.

There have been at least three methods of correctly locating the back of the diaphragm with the recess at the end of the solenoid. The oldest was eleven brass spacers which are quite fiddly to fit. They were replaced by five 'figure of eight' plastic spacers which are easier to deal with, and that was replaced by a one-piece plastic guide plate (*Dave Dubois*) that effectively joins four figure of eights together which is much easier to fit. Oddly the repair kit came with the individual brass spacers, even though the included instructions show and discuss the one-piece guide plate. As dismantled the pump had the five 'figure of eights', so I reused those.

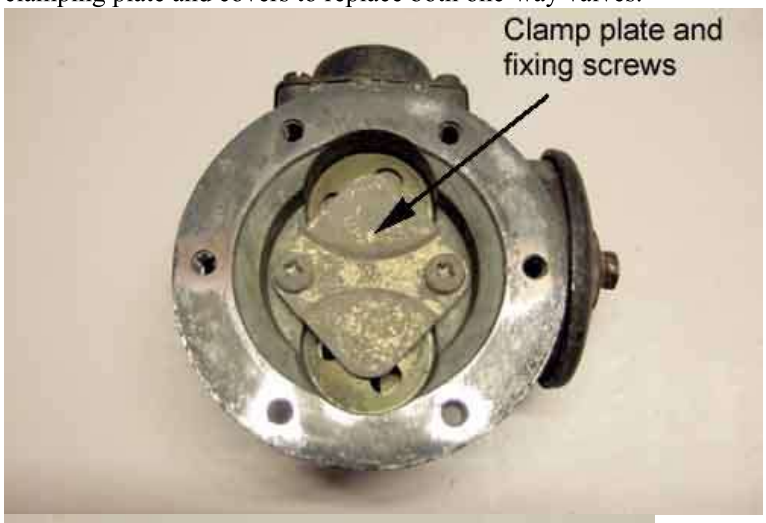


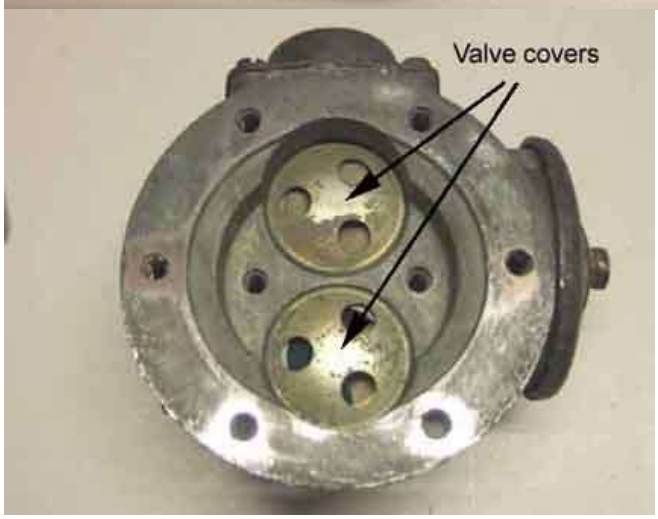


August 2016: Apparently SU Burlen started using the brass spacers again a couple of years ago. Allan Reeling queried this with SU Burlen and they said "The reason we went back to the brass spacers, 11 should be fitted, was that we found that pumps were running cooler with these fitted than the plastic spacers used before". However Dave Dubois who rebuilds pumps says he runs them for an hour and had never noticed any overheating. He does find that the 'figure of eight' type are quite a tight fit and tend to dig into the diaphragm as they have sharp edges. The one-piece type is much looser but because of that can allow the armature to rub against the coil core which makes the pump erratic, and any of those he finds get binned. So the brass spacers are best, but the current ones are just stamped out and have sharp edges which can cut

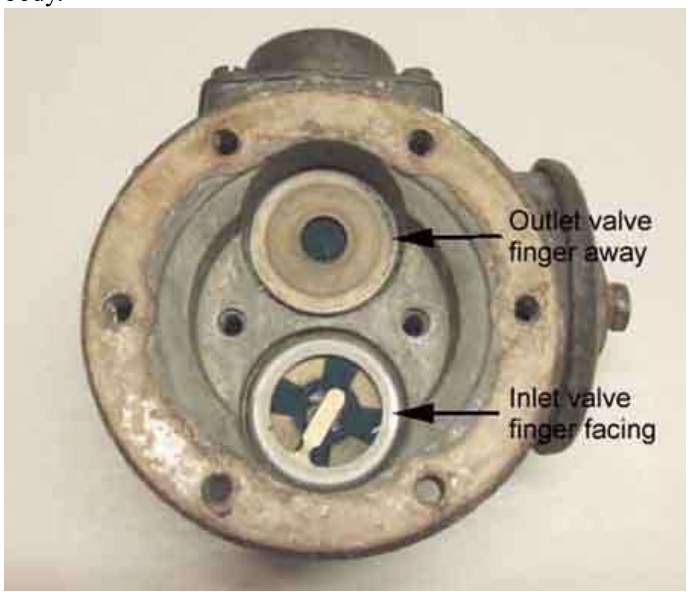
the diaphragm, the originals had at least one face chamfered as in Dave's picture here. Dave keeps and reuses any originals he finds, and 'tumbles' new ones to remove the sharp edges before fitting.

Now you can turn your attention to the pump chamber. As this pump chamber had been leaking back I removed the valve clamping plate and covers to replace both one-way valves.





The inlet consists of the valve that sits on a thin rubber sealing ring, which sits on the mesh filter, which sits on another thin sealing ring, which sits in the pump body. The outlet just consists of a valve and a thin rubber sealing ring sitting in the pump body.



Carefully pick out all the components without damaging the faces in the pump body that the sealing rings sit against. Use a curved implement through the inlet port to push the mesh filter out if required.

Test the new one-way valves before fitting. Use your mouth to make a seal around the edge of each valve and suck and blow. You should be able to blow air through from the 'plain' side to the 'finger' side, but not the other way. The finger retains the moving part of the valve in the fixed part, but make sure there is a clearance of about 1.6mm or 1/16" under the finger to allow the valve to operate.

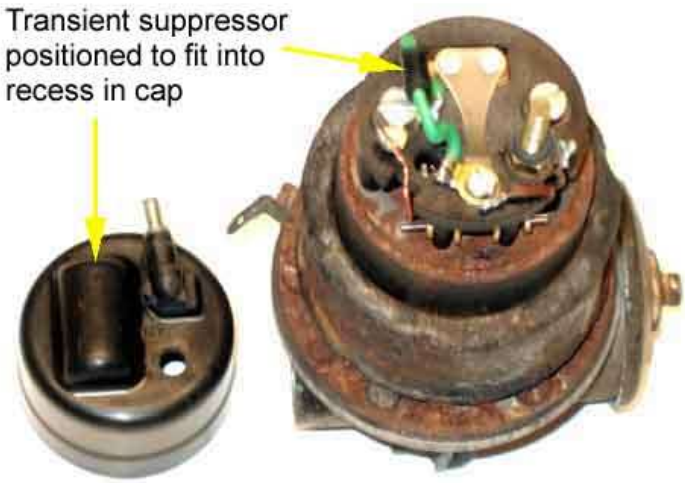
The outlet port is by the small external domed chamber and the words 'TOP' and 'OUTLET' cast into the body. Avoiding any dirt or particles, fit a new sealing ring into the outlet port recess in the pump body, and a new one-way valve, with the finger facing downwards into the pump body. In the inlet fit a new sealing ring, the mesh filter with the dome going into the port, another sealing ring, and the other one-way valve this time with the finger facing upwards. Carefully centralise the valves in the recesses so there is an equal gap all the way round, fit the cover plates, and the clamping plate and screws.

There are no components under the large cover with the central fixing bolt, or the smaller cover with the four fixing screws, so I left those alone apart from checking the screws were tight, even though new gaskets etc. are part of the kit. Subsequently a pal did much the same job on his pump and did replace the gaskets, and had terrible trouble with them leaking afterwards. Eventually he had to replace the pump body, it has become apparent that the bodies were changed slightly but the two types are not differentiated and some replacement parts do not fit old bodies very well.

Preparing to reassemble the solenoid and pump chamber: The Leyland Workshop Manual says that with the solenoid separated from the pump body, screw in the diaphragm until the points don't throw over when the diaphragm is pressed up against the base of the solenoid. Ensure the diaphragm return spring is fully seated, if it is dislodged it prevents the diaphragm moving towards the solenoid body as far as it needs to go. Then unscrew bit by bit, pressing the diaphragm against the solenoid body as you go, until they just throw over. Then unscrew to the next hole, then "unscrew it a further quarter of a turn (four holes)". Now this makes no sense as there are six holes around the edge, four holes would be two thirds of a turn, and a quarter turn is 1 and a half holes! Haynes just says "unscrew a further quarter turn". I've always done them two holes as I couldn't be sure exactly what Leyland meant by 'four holes', and a quarter turn isn't possible, so two is between the two. However a pal just found this SU Burlen page which says "unscrew a further four holes (two-thirds of a complete turn)" which makes more sense. So mine are under-adjusted by 50%, but I've never had a problem with fuel delivery, and I'll leave them be until the next time I have to do one.

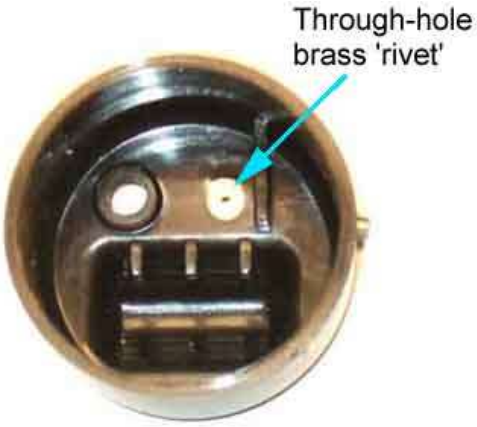
To assemble the solenoid to the pump chamber, look for a square protrusion with a slot on the flange on the solenoid body, and a longer rib facing the flange on the pump chamber. The two halves are fitted together with the rib in line with the slot. Insert the screws and tighten gradually and evenly, again ensuring the diaphragm return spring is fully seated.

End cap:



As I mentioned earlier the points pivot in the new pedestal is a tight fit, so the pump could be operated without the end cap fitted. But if the pin is loose as I have found previously it will work its way out of the points and the pedestal is operated with the cap off, so best to refit the cap. The capacitor/diode-resistor/transient suppressor needs to be carefully orientated to fit into the domed or stepped area of the cap, and its leads must be well clear of both the fixed and moving points, partly so it doesn't physically impede them and partly so that the insulation doesn't wear away and cause shorts.

If fitting a new end-cap be aware that the vent port with the one way valve is not supplied with new caps, so the existing one must be recovered from the old cap or a new one purchased. The remove the existing grasp the external part firmly, and pull, and it should come free releasing a small brass through-hole 'rivet' from the inside of the cap. Fit the vent into the new cap, in the stepped hole, not the plain hole (confirm by test-fitting the cap to the pump and see which hole the threaded stud comes through for the cap to properly seat) then push the brass spigot into the port from inside the cap and press home.



The end cover seal washer - soft rubber or plastic - is fitted over the threaded stud before the end-cap is fitted. Fit the cap. If you have a lock-washer fit that, then the spade terminal, then a plain brass nut. Don't overtighten the nut. But if you have double nuts fit one first but don't overtighten, then fit the spade terminal, and the second nut. The second nut can be tightened down firmly onto the spade and first nut. Finally fit the plastic tubing with the closed end, over the exposed threads of the brass stud.

Testing. Applying power to a pump not plumbed in - observing polarity for diode-resistor quenched pumps - and it should chatter rapidly. Blocking each port in turn with a thumb should slow the chattering slightly, and if you remove the power with outlet port still blocked, then remove your thumb, you should hear/feel a slight release of pressure. Likewise when blocking the inlet port with the power connected, then removing the power, then removing your thumb, you should feel a slight vacuum. If it doesn't slow, or there is no pressure or vacuum left after power is removed, the implication is there is something wrong with the valves or possibly the diaphragm.

If the pressure and vacuum test is OK then unless this pump has been removed from the car because it was faulty, and will be refitted to the car i.e. you are keeping it as a spare, you would want to do a liquid test. The Workshop manual describes a test rig, using paraffin, but if you have spare banjo fittings and some pipe-work/tubing then operating the pump whilst it is a couple of feet above a container of paraffin with both inlet and outlet in the container will more than suffice. You can also do it using a carry-can of petrol, but need to do it in the open air and take as many precautions as are needed to prevent a spark from powering and disconnecting the pump from igniting fumes. To that end the connection and disconnection should be done remotely from the pump, not at the pump terminals, but it's all at your own risk.

Banjo fittings: Originally there were two flat fibre washers that went either side of the banjo fitting. The fittings themselves can either be flat both sides, or flat one side and recessed the other. Where you have a recess it seems more logical for that side to face the bolt head, as that should have a cylindrical part under the hex part which seems designed to press the washer down into the recess in the banjo. Subsequently pumps were designed with a recess in the face of each outlet on the pump chamber, and in this case a rubber O-ring should be used between the banjo and the pump body. However don't confuse the start of the thread inside the port with this recess, the recess is clearly outside the threaded area, reducing the width of the flat area to less than that of the original fibre washer, as shown in this image from SU Burlen. The kit I received contained two fibre washers and two O-rings, whereas the pump I was rebuilding needs four fibre washers, so you may have to obtain an additional two washers AUC 2141. Examine the faces of the bolt head, banjo and pump body for any nicks, ridges of corrosion and flatten them off. This should be achievable except where the banjos and the pump body have the recesses.

With the inlet in your test liquid, powering the pump should cause it to chatter rapidly for not much more than a couple of seconds while it draws the liquid up towards the pump, then slow to a regular ker-chunk-ker-chunk-ker-chunk as it pumps from the outlet. Blocking the outlet should stop the pump, giving an occasional single click at not less than 30 second intervals. Removing power from the pump, and having the end of the outlet above the level of the liquid but the end of the inlet still in the liquid, and clear tubing on the inlet, the liquid should not drain down the clear tube but be retained in it. Pumping from one container to another, and observing the outflow, there should be a steady and continuous series of pulses with negligible bubbling - bubbles indicates the pump is sucking in air as well as fuel. The pump should move a minimum of 7 gallons per hour, or more conveniently one Imperial pint per minute and in practice double that. That's for older AUF 200/AZX 1200 pumps used on Mk1 cars, the later AUF 300/AZX 1300 pumps used on Mk2 cars onwards should move a minimum of 2 Imperial pints per minute, and again in practice double that.

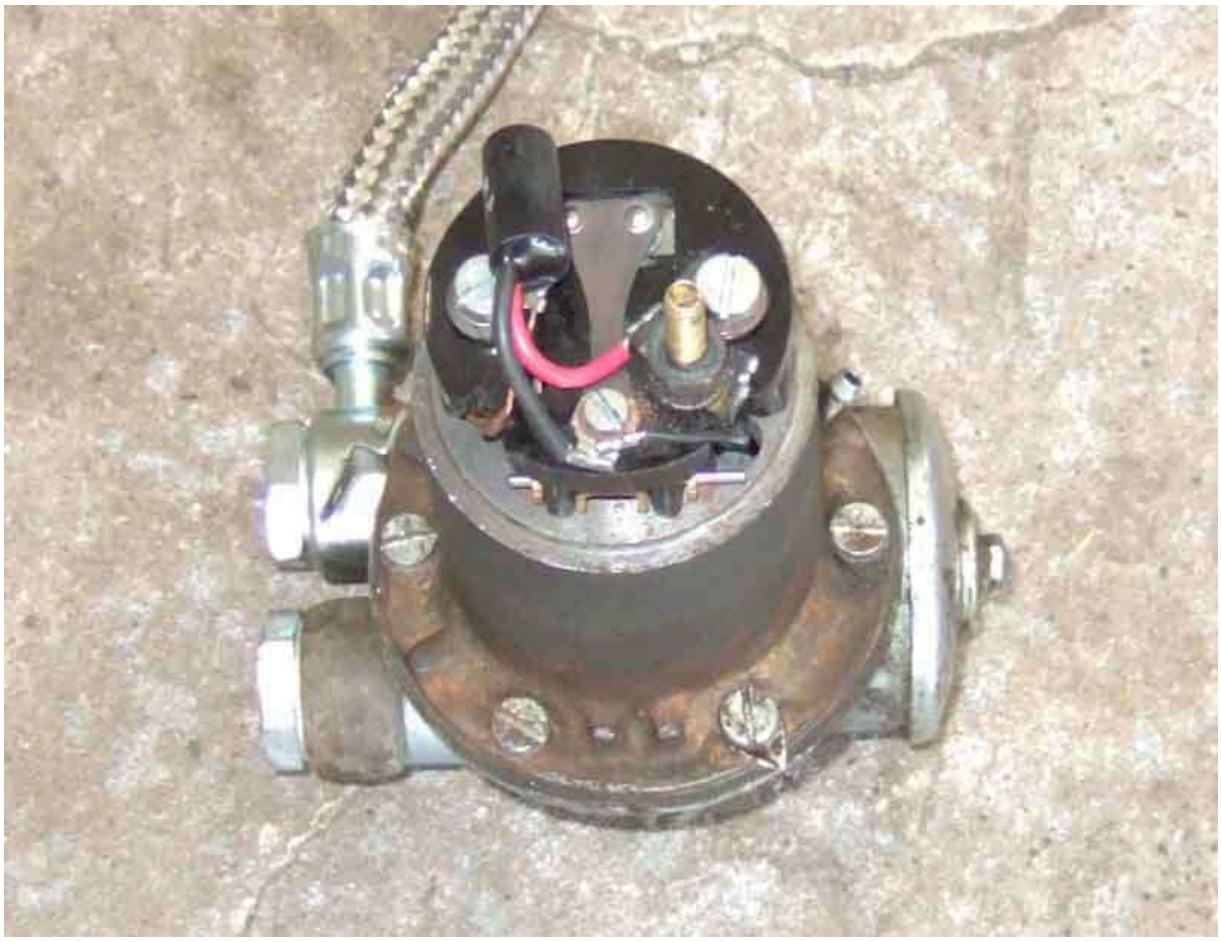
When you are satisfied that the electrical end in particular is functioning correctly, wrap a couple of layers of insulation tape around the join between the end-cap and solenoid. Important on pumps for chrome-bumper cars to keep water out, less so on rubber bumper cars where the electrical end is in the boot/load space.

Pump Types

Capacitor quenched pump (in this case installed to a rubber bumper), showing the beige wire-ended capacitor connected between the points and a earth screw, i.e. effectively connected across the points.

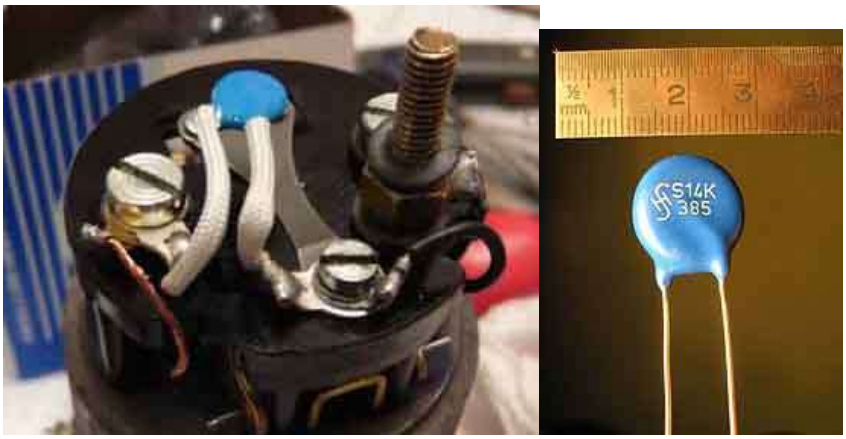
Stepped end-cover of the capacitor quenched pump

Diode-resistor with red and black wires connected between the points and the 12v supply, i.e. effectively across the solenoid winding. This is a negative earth pump, a positive earth pump would have the red and black wires reversed. Diodes do seem to be more effective at quenching, I can still see very slight spitting on the capacitor quenched, but nothing at all on the diode quenched. However having refurbished both types the physical erosion seems to be exactly the same! The diode is in series with a resistor so that if the pump is reverse connected no damage will occur to the pump or the car's wiring. A simple diode would burn out giving no quenching, and possibly damage wiring. The resistor limits the diode current to about 1 amp, which together with the normal pump current of 1.5 amps is well within the capacity of the wiring. The irony is that reverse connection will result in exactly the same quenching effect as correct connection!



Diode-resistor end-cap with a half-cylindrical raised portion instead of the step. Bear in mind the end-caps are interchangeable, and I see no reason why they could not be swapped over between pump types, so you really need to look under the cap to see if there is a diode and which way round it is connected to be sure what you have.

Metal-oxide varistor of the type giving dual polarity quenching in the later version of AZX1331, at least. Note the varistor is connected across the points, the same as the capacitor quench. *Image from Peter Ugle*

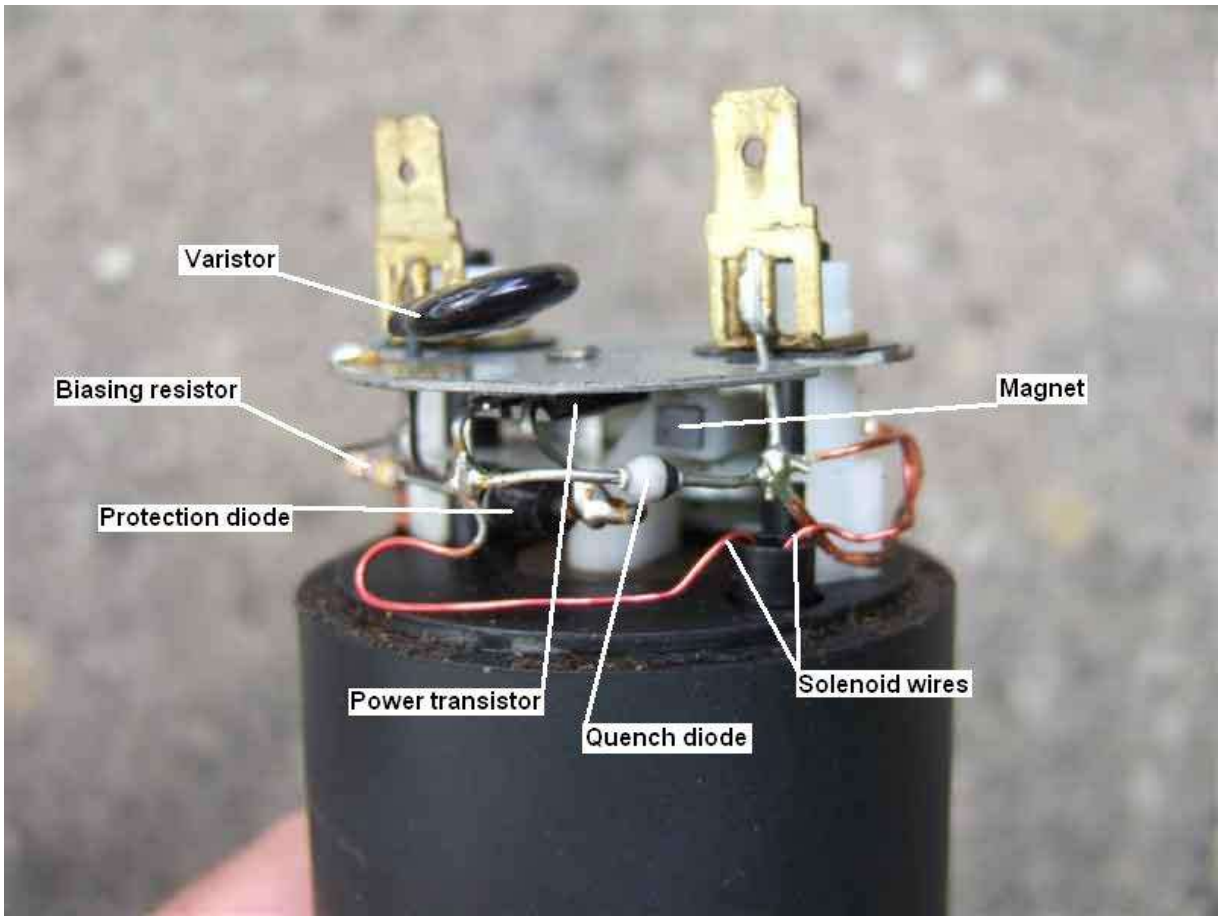


A later type of transient voltage suppressor as supplied by SU Burlen, also bi-directional

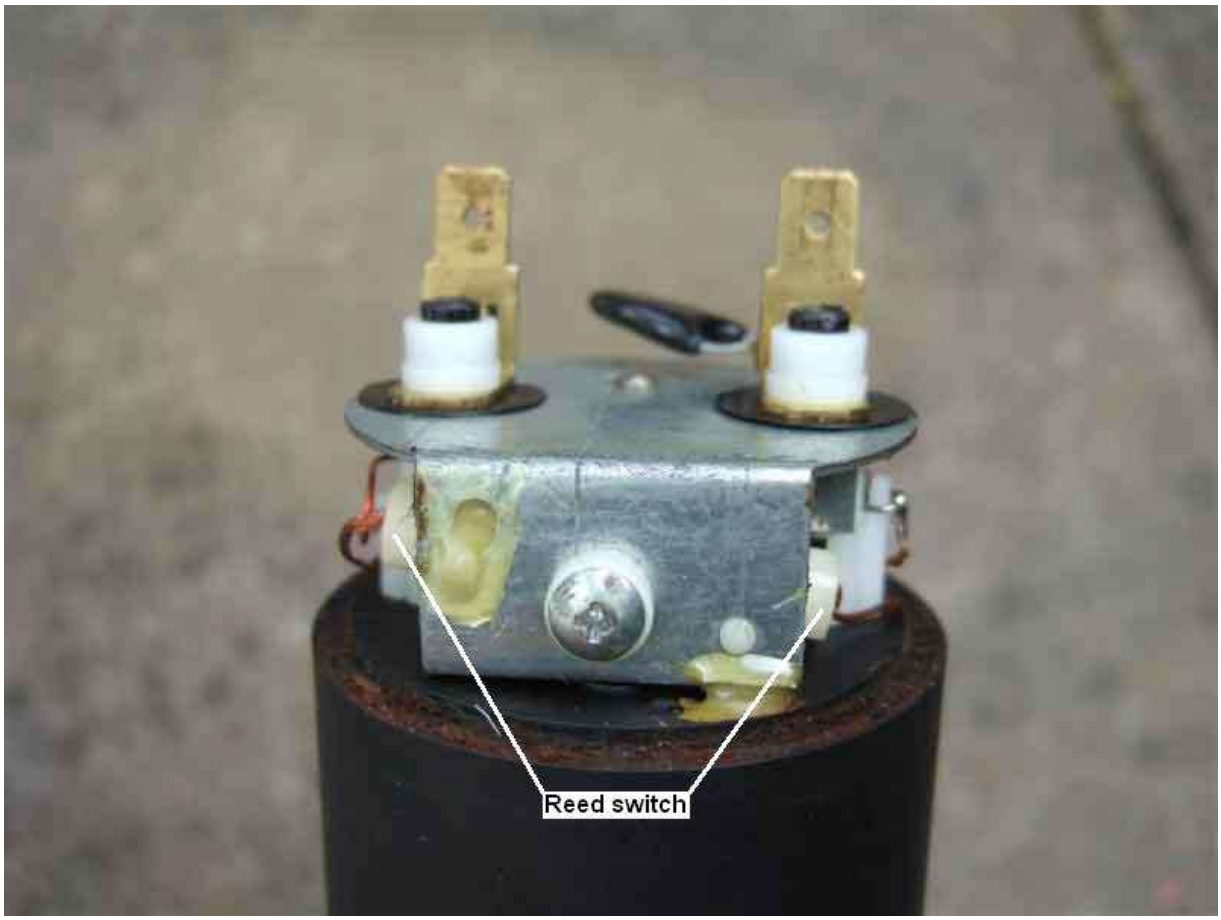
The mounting points of the various devices are shown here, and also given in this Burlen document. However note that the drawing shows the diode-resistor connected as for a **positive earth** pump i.e. the black wire would be on the 12v terminal and the red wire under the fixed point mounting screw.

Plastic-bodied Moprod pump, same pipe fittings mounting arrangements as the SU so an easy swap. Even though these contain electronics there is only one version for both polarities of car as both +ve and -ve electrical connections are in the end cap. Clearly marked, and you need to get them the right way round for the pump to operate, but there is a series diode to protect the electronics against reverse connection, in this case the pump simply won't operate until it is connected correctly. No vent ports, so existing vent tubes should be tied up out of the way ready for refitting a 'proper' pump!

Internals showing the electronic components and the magnet on the end of the diaphragm shaft (this is the 'unused' end, it is the other end that passes across the magnetic reed switch as the diaphragm moves to open and close the switch). The quench diode performs the same function as the quench capacitor and diode in points pumps but to protect the transistor from the back EMF of solenoid winding. The resistor biases the transistor to switch off in the absence of a signal from the closed reed switch. The protection diode isolates the electronic components in the even of the power supply being connected the wrong way round. The varistor connection is curious. A varistor is normally high resistance in both directions, but when the voltage across it in either direction exceeds a certain value (18v in this case) it 'breaks down' to a relatively low resistance. As such it can be used to protect points-type pumps, which means that they will no longer be polarity sensitive as diode-protected pumps are. So far so good, maybe it is just another quench or protection against spikes from the supply, but it is connected between the -ve terminal and the heat-sink for the transistor/mounting plate for the reed switch, with no apparent **electrical** connection to those or anything else.



Showing the reed switch pegged, glued and screwed at a specific angle. What isn't apparent on this pump is the 'hysteresis' that exists in the design of the points in that type of pump. This hysteresis ensures that when the solenoid is energised and moves the points, they don't open until the diaphragm has reached nearly full travel. When they do open the solenoid is de-energised, so the return spring on the diaphragm starts to move it back again (and pump fuel), which moves the points back again, but they don't close again until the diaphragm is nearly fully returned. This prevents the diaphragm 'fluttering' with a very small amount of travel back and fore which is what would happen if the points opened and closed at the same physical position of the diaphragm. As I say I can't see this in the physical design of the Moprod pump, other than the fact that a reed switch requires less magnetism to keep the contacts closed than it did to close them in the first place. The problem I had with mine was that the diaphragm **did** start to flutter, i.e. very short travel back and fore, which caused severe fuel starvation, would start and stop doing that for no reason that I could see, and once started nothing I did would make it start working properly again until it decided to do so for itself. Which is why it now languishes in a cupboard and is only used as a very short-term spare.



Hardi electronic pump: (*Moss Europe*)

An Alternative Mounting Position in Chrome-bumper Cars by Peter Mayo

Aluminium floor riveted into the bottom of the now unused battery cradle

Tank fitting ...

... disconnected to prevent fuel siphoning, allows the tank to be pretty full, fuel level just needs to be below the fitting

Pipes routed through an original hole in the cradle

Pump orientated to give decent access to points ...

... and banjo fittings. Strictly speaking neither vent needs to be piped anywhere 'clean' anymore unless you intend going through very deep water.

Pump orientated as it must be on the car, carb fitting at the top (you can just see 'OUT' moulded into the casting just above and either side of it, tank fitting at the bottom

Sound proofed (to stop it sounding like a monkey bashing a tin drum)

Finished installation

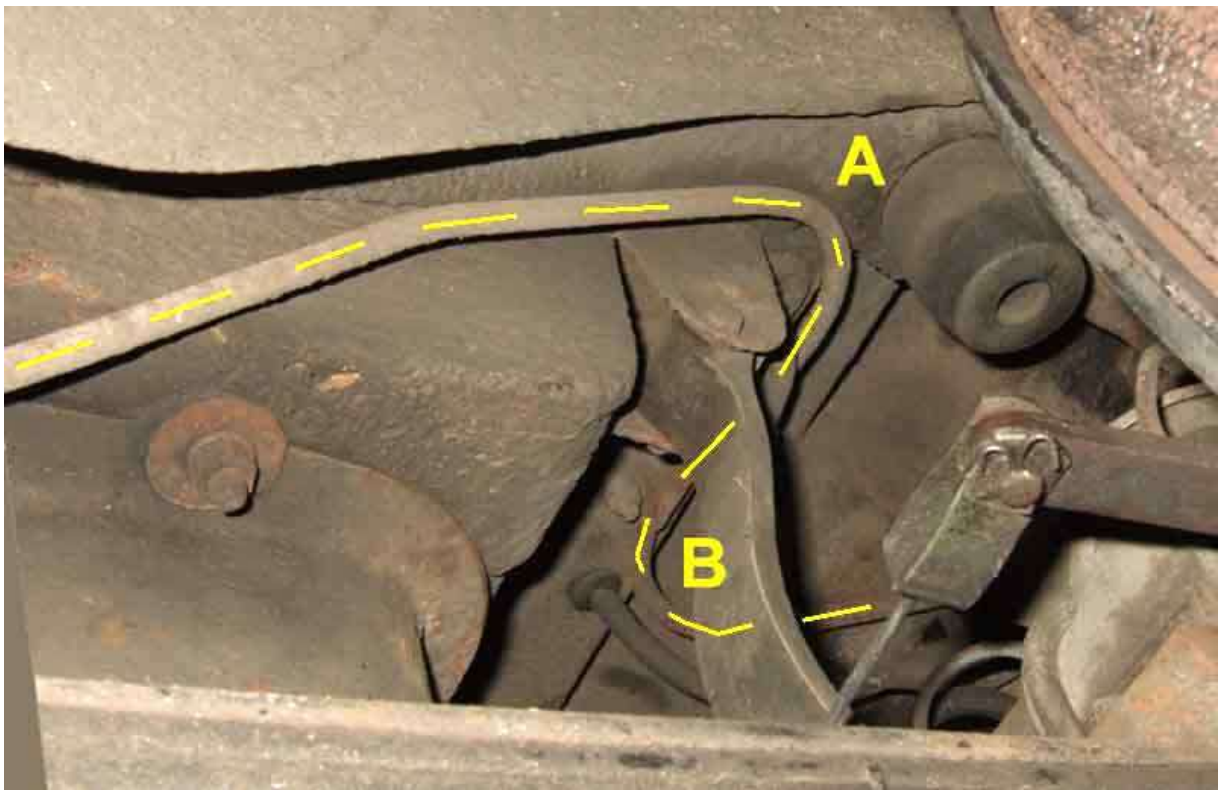
Cable and Pipe - or 'Services' - Routing

Bulkhead holes and grommets

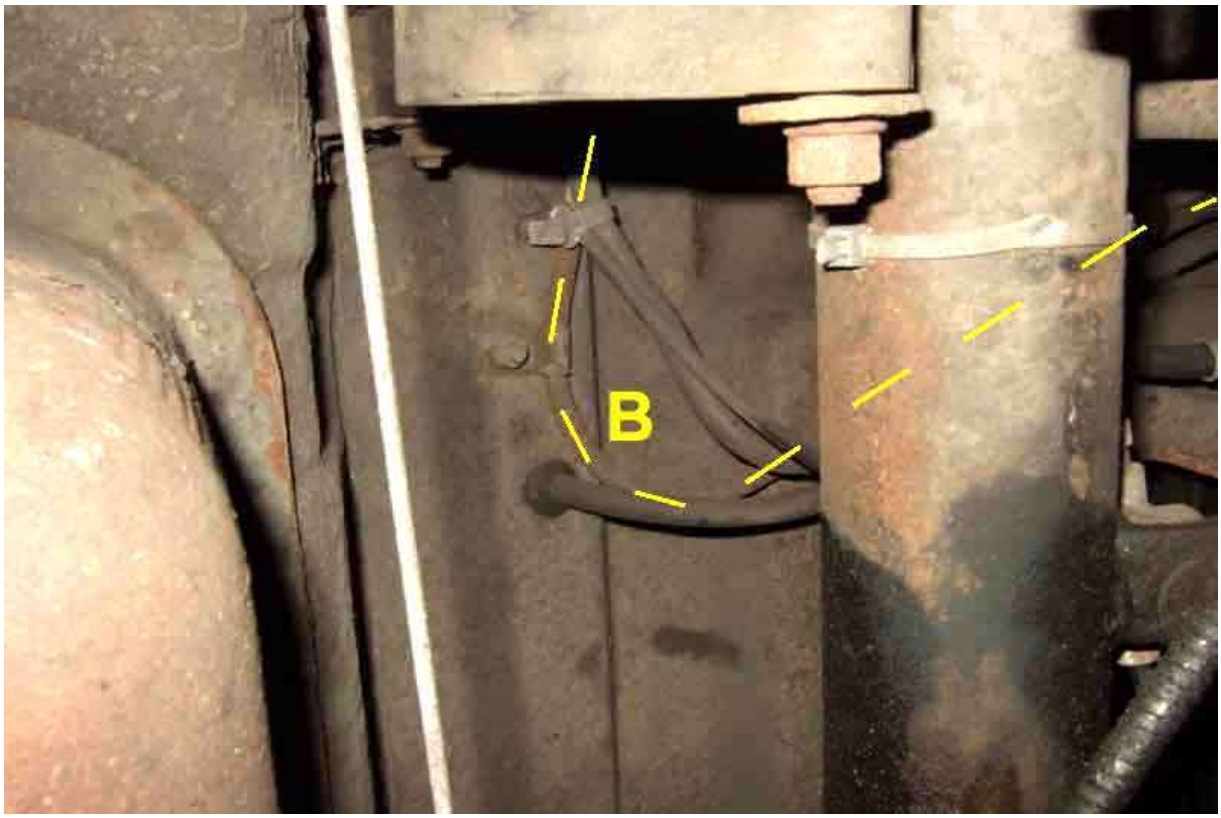
Tank to Pump Pipe - CB and RB, pump to carbs, and body harness, and boot/loadspace:

CB: Alongside the tank, round the axle strap towards the middle of the car:

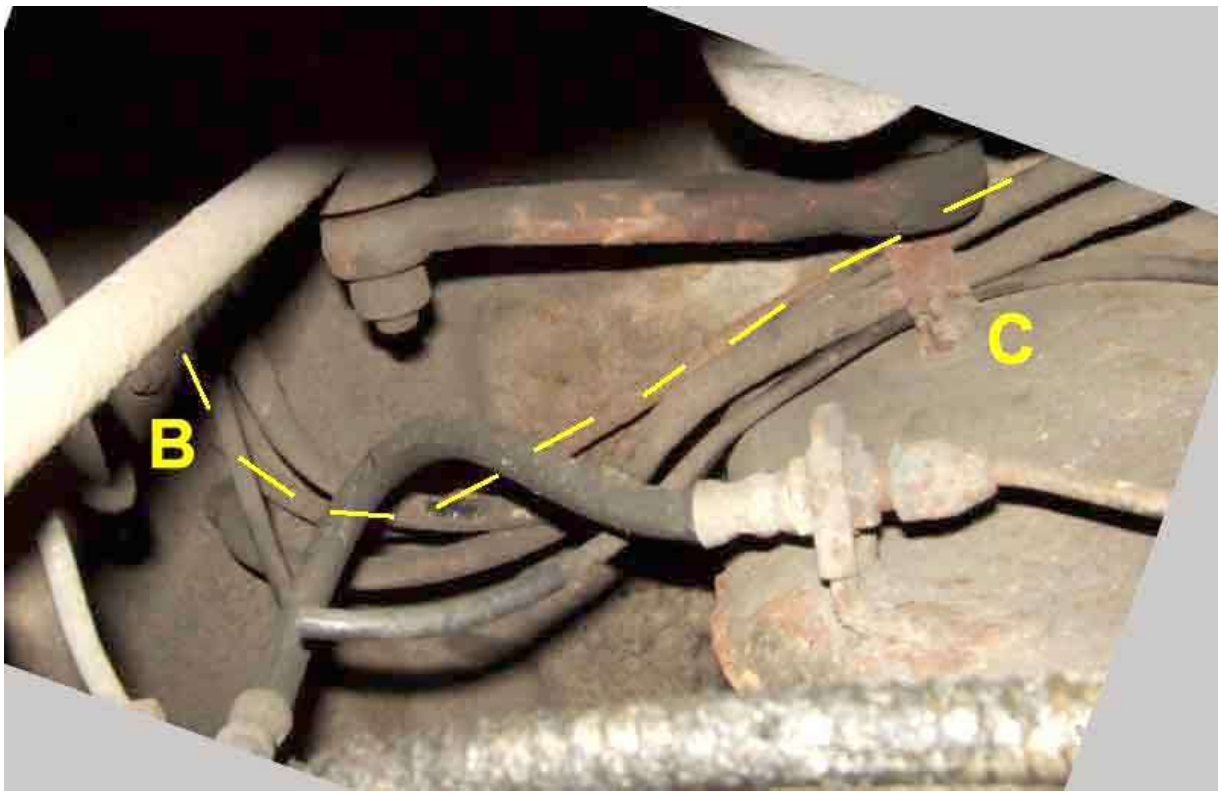
Then turns over the axle:

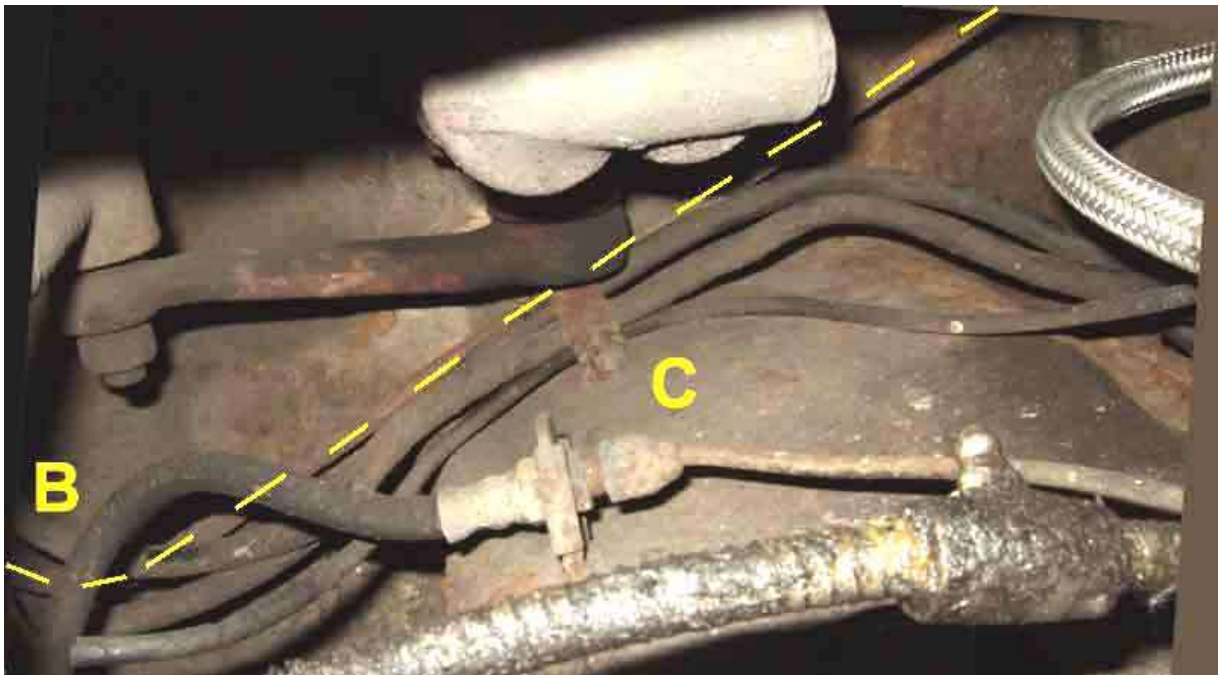


Picking up the harness and a pump breather tubes:



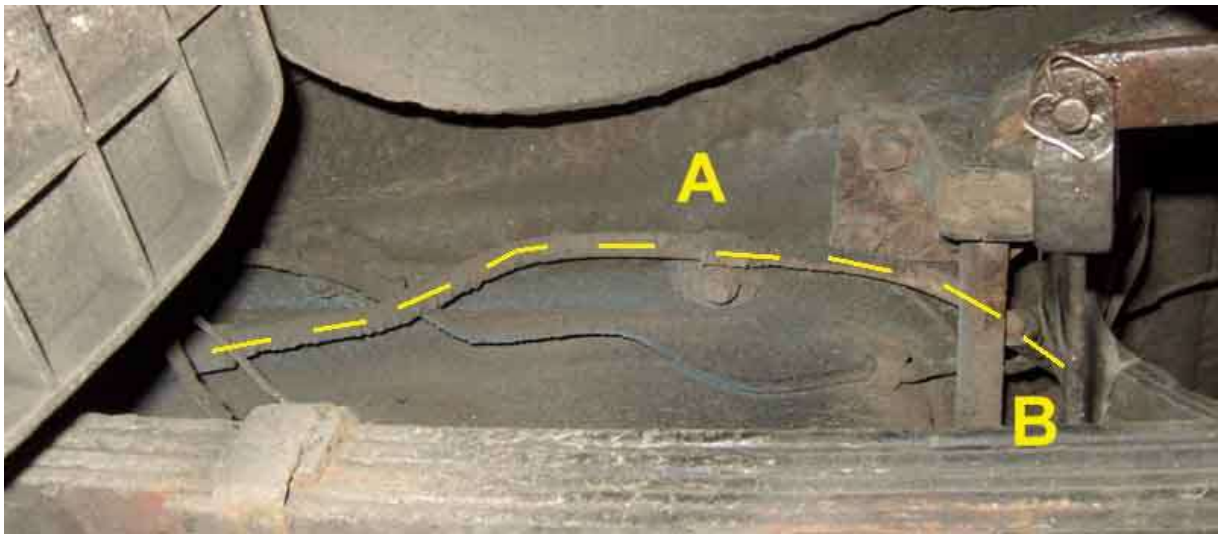
Alongside the battery box:



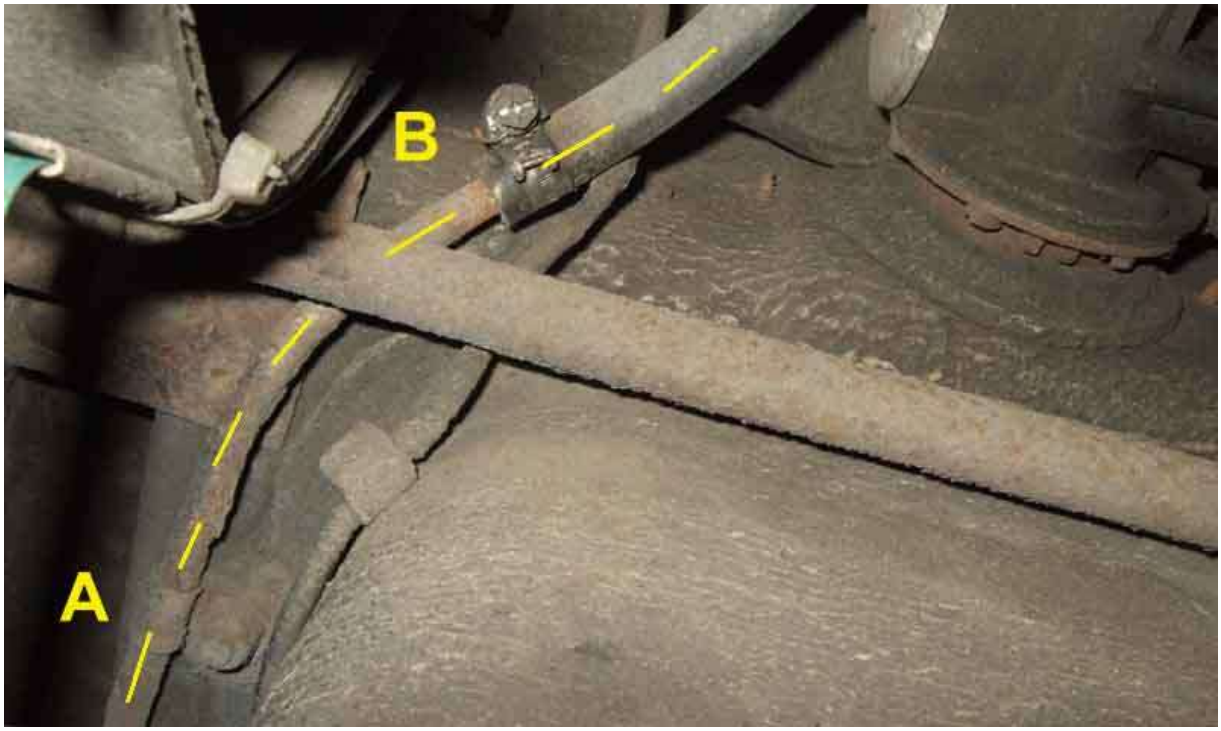


To the pump (note braided hose replaced with plain):

RB is much simpler



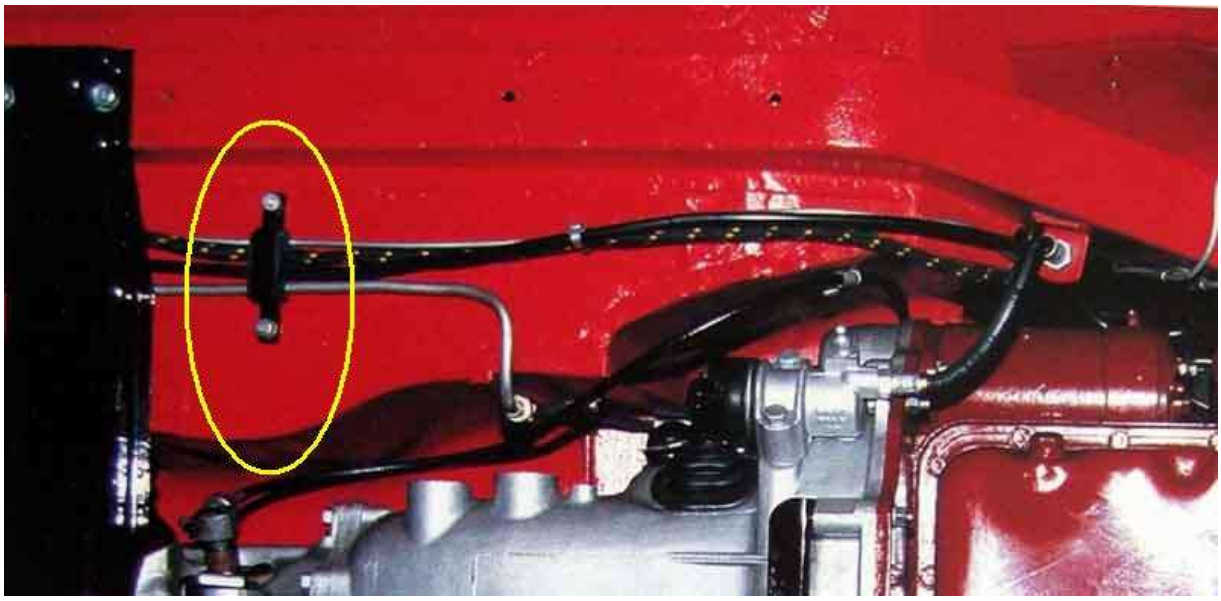
Going back to a hose



To the pump:

Pump to carbs - the rear two small and larger comb:

The small comb in front of the gearbox crossmember on Mk1 cars ...



... and on Mk2 cars with the wider tunnel. The end of the strap fits through a slot in a tab welded to the side of the tunnel. This also shows how the rear harness is routed alongside the other three with P-clips instead of going through the same small combs, this one and the next one back being riveted to the side of the chassis rail:

The rear harness now passes through two grommets in the fixed crossmember instead of a channel and comb with the other services:

And through P-clips attached to the outboard comb retainer in the other two positions aft of the fixed cross-member:

Boot/loadspace:

Earthing points

On roadsters the harness enters the boot on the 'shelf' and goes up the rear bulkhead (two spot-welded tabs with plastic sleeves) and over the arch (two more tabs), then along the join between the outer wing and the boot side floor to under the off-side light cluster (one P-clip on the lower inboard stud). Then along the join between the rear panel and the boot floor (two more tabs) to the near-side light (and another P-clip on the lower inboard stud: (*MGste*)

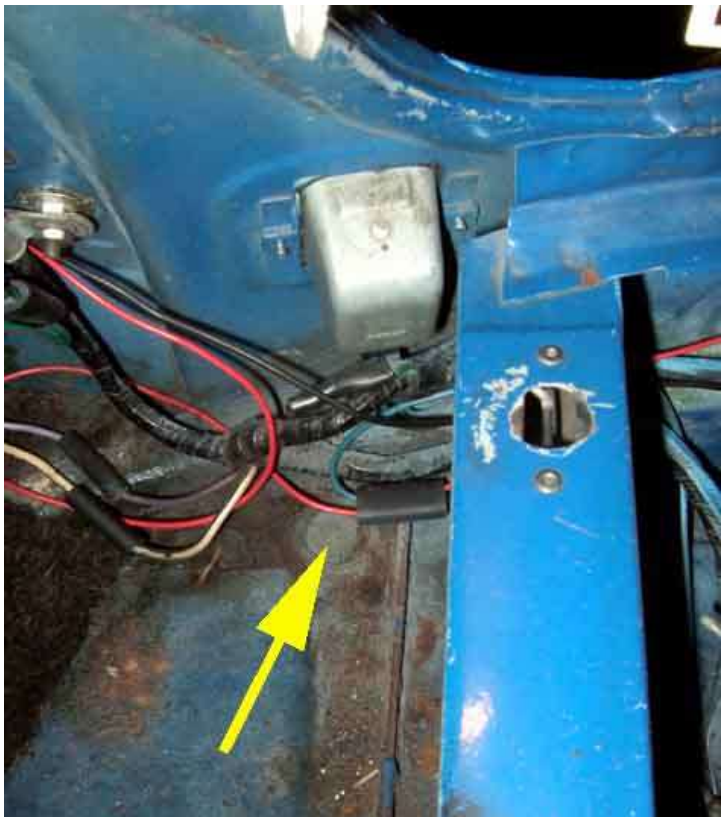
On GTs the harness travels back along the floor (clipped), to the offside light cluster, then as for the roadster: (*Clausager*)

On CB cars the tail to the fuel tank sender stays in the harness until the back of the boot floor, then goes out through a hole by the off-side light cluster:

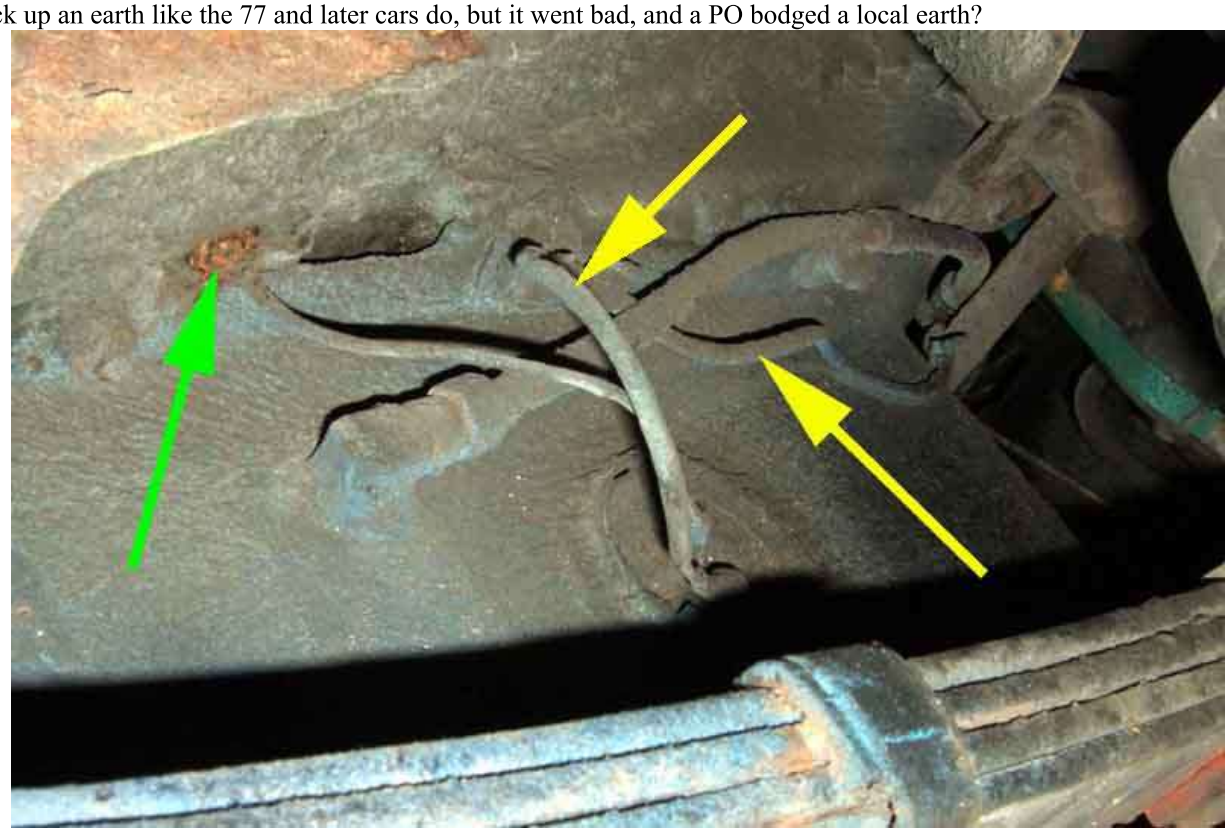
Under the bumper iron and chassis rail:

And forwards to sender, clipped to the edge of the tank:

RB cars still have the hole at the back of the boot but with a plastic plug:



But the tail leaves the rear harness under the floor near the fuel pump and travels back to the sender (yellow arrows). However that's only the gauge wire, the earth wire (green arrow) is separate. The Leyland schematics show the earth wire going back to a number-plate bolt on both CB and RB, but this one (1975) is screwed to the underside of the floor nearby. 77 and later cars did not have an earth wire for the sender, were all RB the same but when the factory found only one wire to put on a sender with two spades they added one i.e. a factory bodge? Or do all RB senders rely on the mechanical fixings to pick up an earth like the 77 and later cars do, but it went bad, and a PO bodged a local earth?

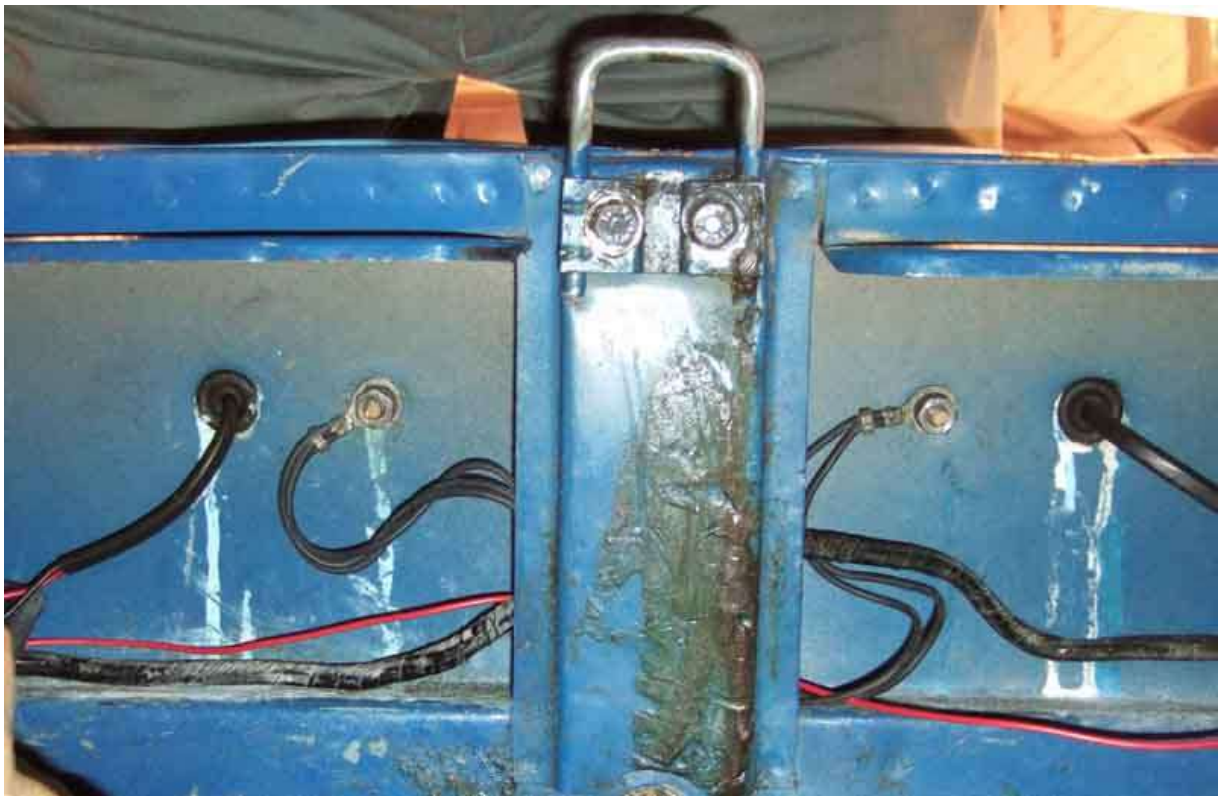


The 1976 (4-cylinder) of a pal in America - the same single wire coming from the harness but with the earth spade on the sender unused, which means mine is probably a PO bodge, maybe from a replacement tank having been treated 'too well': (*Bill Etter*)

Earthing points:

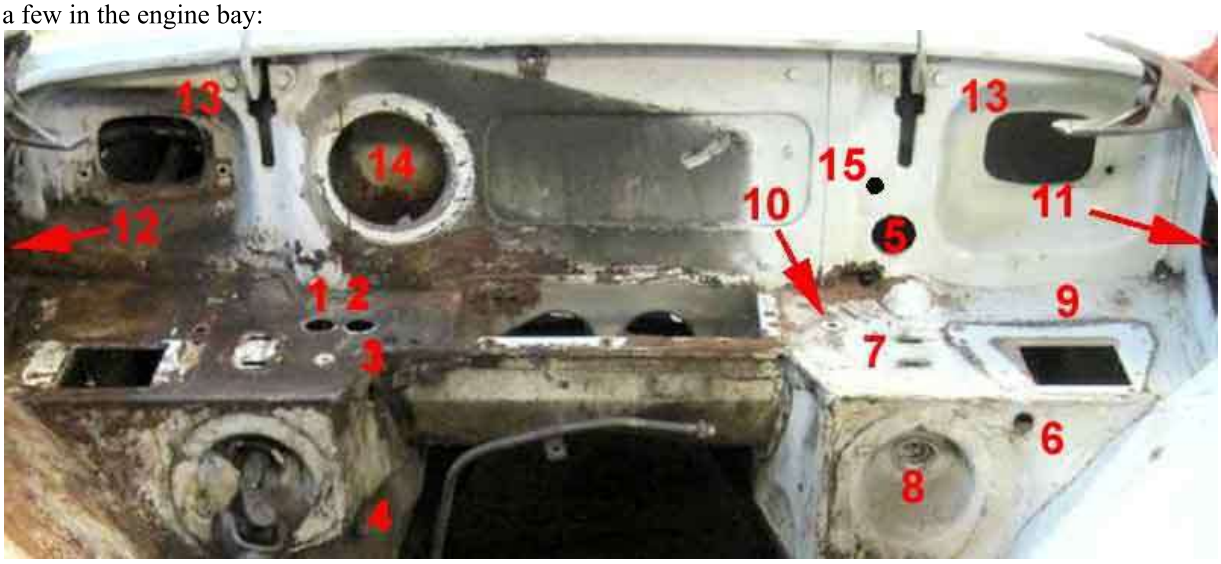
73 roadster, four earth wires - two reversing lights, fuel gauge sender and pump. Two more have been added for the number-plate lights as they did not pick up an earth from their physical mountings after everything had been painted:

75 V8, five earth wires at two points - two reversing lights, two number-plate lights and the pump. Although a sixth is shown for the fuel tank sender on both CB and pre-77 RB diagrams it does not exist here, and there is a local earth provided near the sender:



Bulkhead holes and grommets:

Quite a few in the engine bay:



1, 2 and 3 are for the temperature gauge capillary (where used), 4-cylinder heater valve cable or V8 choke cable with grommets RFR503, and 4-cylinder oil pressure gauge pipe with grommet AAA643 (was ACH805). I'm not aware of a definitive statement of what goes where, there are several arrangements pictured in Clausager. The oil gauge grommet is an odd pointed one, and I have one like that in the side hole on my roadster, with two flat ones in the shelf. One picture does show the oil gauge pipe coming from the side hole with a tortuous path up, back and round to attach to the hose connector, even though there is a logical path up one of the shelf holes and straight into the connector, which another picture does show. The heater valve cable almost certainly does use one of the shelf holes, and the temp gauge capillary could use the other one of those or the side hole. There are pictures showing the temp gauge capillary coming through 1 with a support clip under the oil hose connector and the heater cable coming up 2, which does leave the oil gauge pipe in 3. Temp gauge capillaries should normally be supplied with a grommet already fitted, or you have to cut one through from the edge and slide it on.

4 is the speedo cable (ACB8474, was RFR405) on all RHD, and earlier LHD, although I have a picture of an LHD with the cable entering at 3, and seen one of the cable entering at 4 only to come out at 3 and go across to 15.

5 is for the screen washer tubing, the choke cable on 'top-down' HIF carbs, and V8 heater cable. Not grommeted originally as it is in a double-skin section of the bulkhead, and there is the large open hole for the bonnet hinge immediately above it. Grommets for anything passing through this hole need to be on the cabin side in the footwell for sealing purposes, probably RFN303. However if they rattle about in this hole then a grommet will prevent that.

6 is for the CB choke cable - both HS and early bottom-up HIFs - and needs a grommet as this section is single-skin, RFN303.

7 is two small elongated grommets (AHH6478) to block up the holes for the LHD steering column bolts on RHD cars, on the other side in LHD cars.

Similarly 8 is the plastic blanking plug for the LHD steering column on RHD cars ...

... and 9 is the blanking plate and gasket for the LHD pedal box on RHD cars.

10 is a small plastic plug on RHD cars, grommeted for the accelerator cable on LHD.

11 is the bonnet release cable in the cavity, but secured in the panel with a nut so no grommet is used.

12 is the main wiring harness which should have its own grommet already fitted. The link below lists this as 3H1547, but my two grommets have a much smaller sleeved hole which is a snug fit to the harness, and a flat membrane between that and the grooved section that fits in the body aperture. The V8 oil pressure capillary also goes through here using its own grommeted hole above the harness grommet. In theory it could go across the engine compartment to the holes on the shelf and down one of those, the length would be the same, but there are only two holes there already occupied by the temp gauge capillary and the choke cable, the V8 does not have the third hole on the side.

13 are the large bulkhead grommets behind the master cylinders (14B630, both sides).

14 is the heater inlet seal 17H3714 which is attached to the heater casing.

15 is the speedo cable entry point for later LHD cars, possibly May 72 on.

Also on the heater itself are matrix port seals 7H1993, and strip seals AHH6290 between the heater casing and the bulkhead shelf, not forgetting the dread rubber block BHH389 between the heater and the bulkhead.

The following pages contain information on the plugs and grommets used on the MGB:

Brown & Gammons
Moss Europe
Rimmers
MGOC

Edge-clip info supplied by MGSte (*Images from Brown & Gammons*):

BHA4473 17H9603 BMK385

BHA4473 secures the harness to the edge of the bonnet slam panel.
17H9603 (3/16) secures the brake pipes.
BMK385 (1/4) secures the fuel pipe.

THE NEVER ENDING SAGA OF BB and WW

by Herb Adler

I'm lucky that today is only Thursday 13th. Just imagine what it would have been had it been Friday.

To start with I replaced my rear wheel cylinders, no great trauma. Whilst doing this I noticed oil dripping out of the axle to hub join. Not good, as this oil would drip into the brakes. So drain the diff, then spilt this join, whoa the whole axle comes out! Anyway fit new seals and reassemble. Still waiting for diff to fill.

Then I notice a drop of petrol from the banjo union on the fuel pump, which I had only recently rebuilt and reinstalled. Get a spanner and tighten the bottom union, which was a bit loose. Well if the bottom is loose what about the top? Apply spanner and turn, a geyser of fuel. Bugger!!, what happened? Maybe the union was very loose but somehow managed to seal. Try with fingers and yes it is loose. Finger tighten and then apply spanner. Whoops its loose again. Another bugger. This would indicate stripped threads in the housing. So out with the pump, envisioning helicoils and all. It's the outlet and the threads are bad. The inlet is much better.

Whilst cursing I had a thought, my ration for the month. Why replace the banjo fitting? Why not try standard fittings. I was lucky and had a 3/8" BSP Nipple in my junk box. Tried fitting it and it went in smoothly and tightened up. OK what I need is a 90 deg nipple to hose tail. Whilst driving to the local hose and fittings place I reviewed this idea and decided that a 3/8" to ź" reducer, with a ź" thread, 90deg, 3/8" hose tail would be better, because the reducer would allow me to orient the hose tail, by tightening the thread, without risking cracking the pump case, because the threads are tapered, and get tighter in the bore.

Bought the items. Because of the tapered threads, the reducer did tighten in the damaged threads.

I didn't tighten the pump bracket, until I had fitted the hose, as this allowed me to twist the pump till the orientation of the hose tail allowed me to fit the hose. When the hose was all nice and tight I oriented the hose tail and pump correctly, as shown.

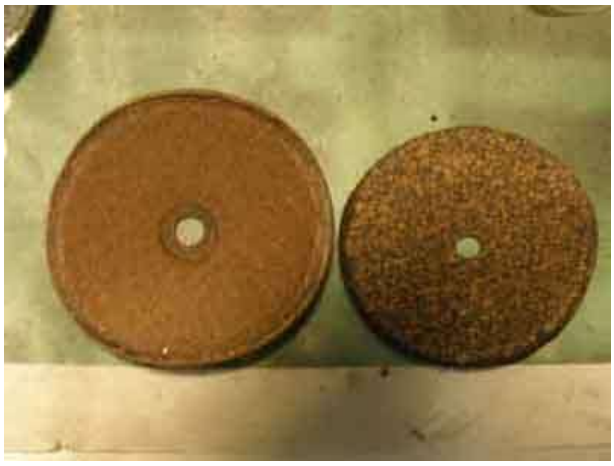
Pump Refurb No.2 - with problems

by Michael Beswick

Last updated 22-Dec-2023

In June 2014 I rebuilt my points type SU pump with the Burlen rebuild kit. In February 2015 I had a significant leak. On investigation the washer below the diaphragm in the fuel smoothing cavity (under the "top hat" cover) was badly distorted as was the cork washer under the inlet smoothing cavity cover (the one with the single bolt through the middle). Replacement parts seemed much the same type/quality but the O ring which fitted below the top hat cover was too "fat" to allow the cover to sit flush. The cover is intended to nip down the O ring but this was not going to be nipped!

Replaced cork washer badly distorted as well as being smaller than the original on the left:



2014 diaphragm washer distorted as if from fuel:

2009 hose showing no sign of deterioration:

After much to-ing and fro-ing the pump was returned and rebuilt by Burlen. It has now been re-fitted. Whilst the whole fuel system was empty I decided to replace the fuel hoses with ethanol resistant hose. Specifically the braided short piece from pump to fuel line (fitted in 2009) and the braided piece along the bulkhead -replaced in 2013. I am very suspicious of braided hoses as I suspect that more attention is paid to the appearance as opposed to the actual hose. The car is chrome bumper so the pump is by the rhs rear wheel.

This Gates 'Barricade' seems to be the Holy Grail but Gates (UK) only sell to their main distributor -Ferrari Piston Services, who in turn sell to motor factors from whom one could purchase. It is 15 or 25 foot rolls.....As soon as the average motor factor realises it is fuel hose they turn off from the specified hose and talk about having plenty of stock..... However Codan make a similar product that appears more widely available. Beware there is a huge amount of mis-information out there. Many suppliers quote lots of different county's specification standards. Different Standards refer to porosity and then abrasion, and so on. Porosity is not necessarily related to the ability to withstand ethanol! I managed to obtain hose to SAE J30 R9 which should be resistant to up to 15% ethanol.

Fitting is relatively simple but be aware that 5/16 (8mm) hose is needed at the fuel pump to fuel line end. I still have the piece at the bulkhead to do. It has a screw fitting at one end and I hope a spigot that I suspect will need 1/4 " hose (to then connect to the fuel filter and subsequently filter to carb(s). I actually bought a new banjo for the pump end (BHH 1940 supersedes AUB846) but subsequently managed to remove the banjo from the discarded braided hose. I hope to do the same with the bulkhead screw fitting.

So did ethanol cause the problem? There has been plenty of chatter about ethanol, but more about what it is capable of as opposed to what it has actually done. I have not heard of a single documented case where it can be shown to be the cause. However the parts in the pump had deteriorated: the washer looked similar to the effect of petrol on a latex glove - wrinkled and distorted. Burlen replaced the cork washer with the new "material and shape" washer, which rather implies something was not quite right. However it could just be a bad batch of replacement parts. There have also been instances where new parts do not fit the older body- such as my O ring in the old body. My rebuilt pump needed a new body as a screw thread had worn, which avoided the problem (conveniently?).

So I examined the hose that I removed (the braided one), which showed no appreciable deterioration of the inner wall.

Ethanol is reputed to attack almost everything, to the extent we may as well dump the cars and buy a bike; but in the meantime it would seem to be worth doing only if you have cause to replace enough hose/pipework to require draining the tank. (Or lowering the level if you are fortunate to have the pump mounted higher in the boot!) I remain suspicious of braided hoses and feel that replacing rubber hoses every five years is probably sensible.

North American Emissions Plumbing - Twin SUs without Anti-Runon Valve

Hover over a number for the key, click on the menu items below to show the vapour/vacuum routings.

Fuel Flow Tank Expansion/Contraction Carb Expansion Crankcase Breathing

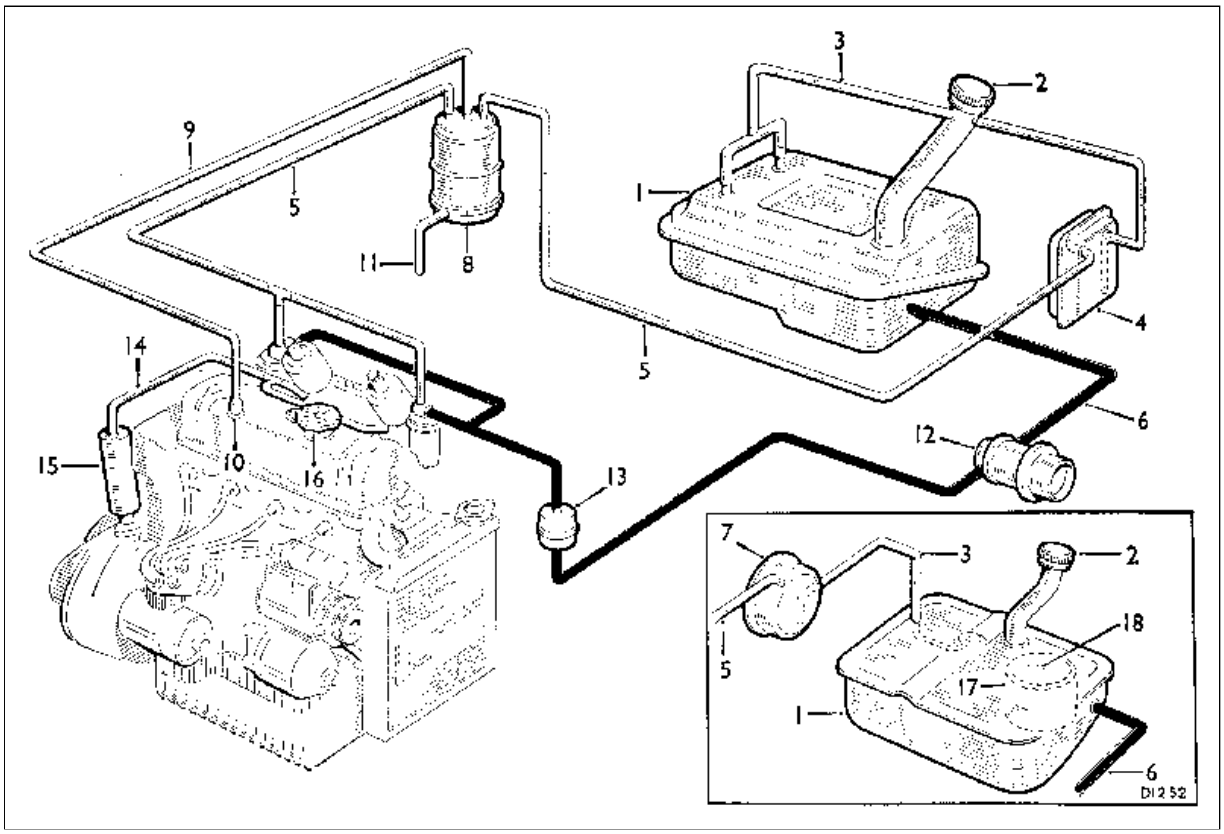
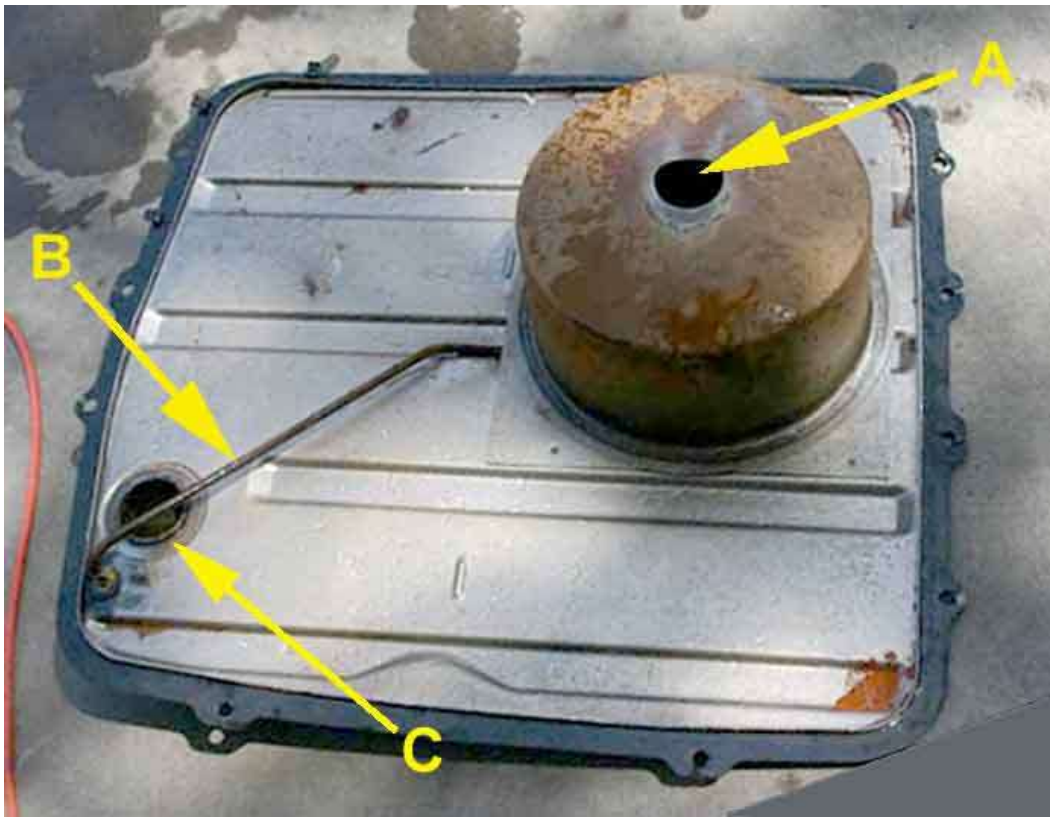


Image from the British Leyland Workshop Manual

Fuel is sucked from the bottom of the tank (1) by the pump (12) and pushed through the fuel filter (13) and into the carb float chambers.

The main drawing is 'generic', it's the inset that is applicable to the MGB with the separation tank (7) and capacity limiting chamber (17). The capacity limiting chamber only fills very slowly, the filling station pump shuts off when fuel reaches the filler neck and the chamber is still largely full of air. That air bleeds out slowly via the separation tank to the charcoal canister (8) and to atmosphere (11). As it does so the fuel level rises in the chamber so lowering the level in the main part of the tank. This prevents fuel expansion while in the tank from overflowing (as it can do from the filler on a hot day just after being filled without this system) via the charcoal canister. Any fuel that does reach the separation chamber e.g. from rapid cornering drains back into the tank from the lower port on the separation chamber when cornering forces subside. A sealed filler cap is used with this system.

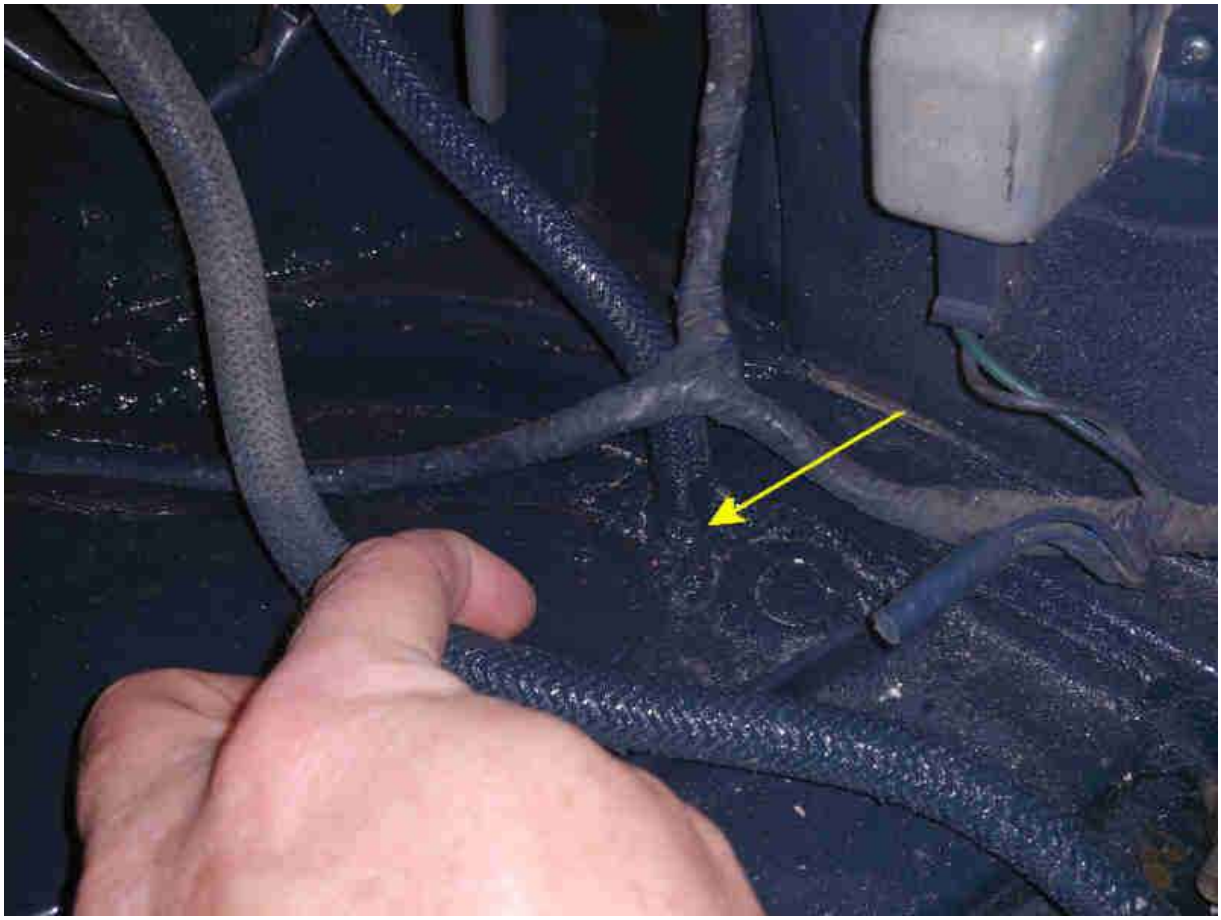
'A' allows fuel in and out of the capacity limiting chamber freely, but fuel can only get in as air escapes slowly via the narrow pipe 'B' which is connected to an external vent port. This vent port and pipe also allows air to enter as fuel is used in running: (*Grassroots Motorsports*)



Tank vent connected via separation chamber to charcoal canister: (*Bill Etter*)

Pictures of the separation chamber on Bill Etter's 1970:

Connection from the top of the separation chamber through the boot floor to the pipe leading to the charcoal canister:



And to the tank vent:

North American Emissions Plumbing - Twin SUs with Anti-Runon Valve

Hover over a number for the key, click on the menu items below to show the vapour/vacuum routings.

Fuel Flow Tank Expansion/Contraction Carb Expansion Crankcase Breathing Anti-runon

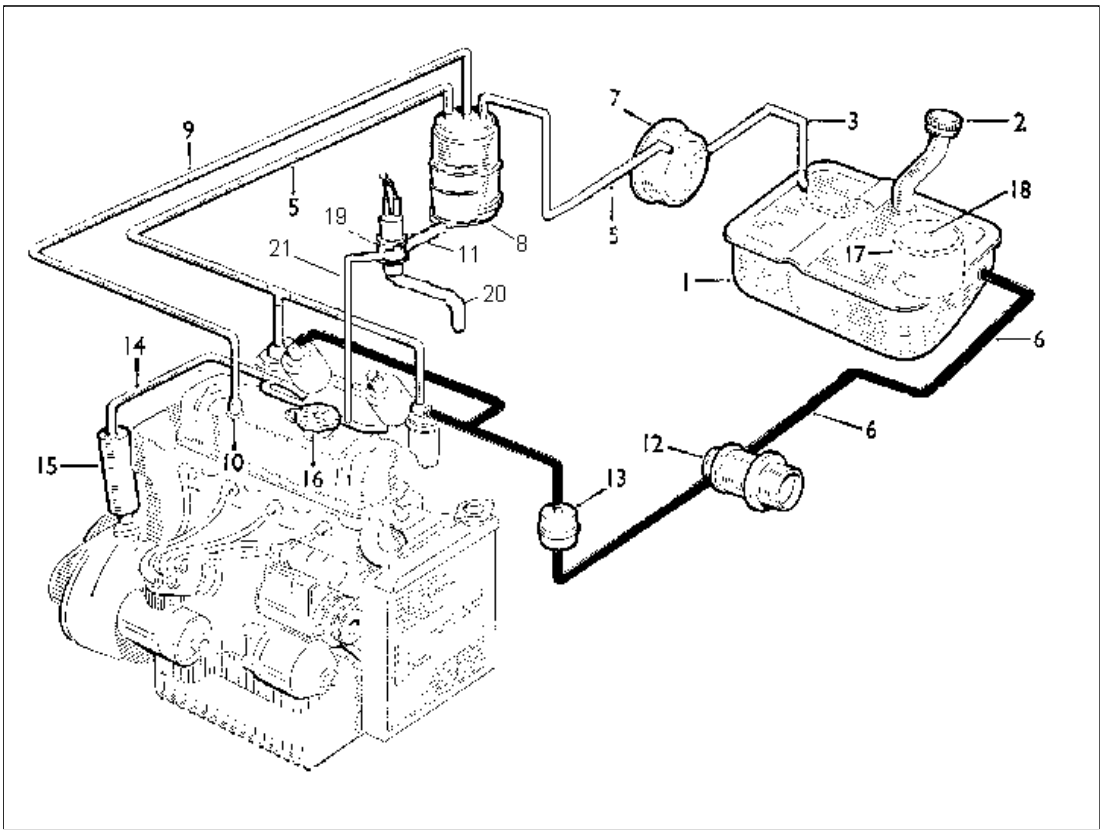


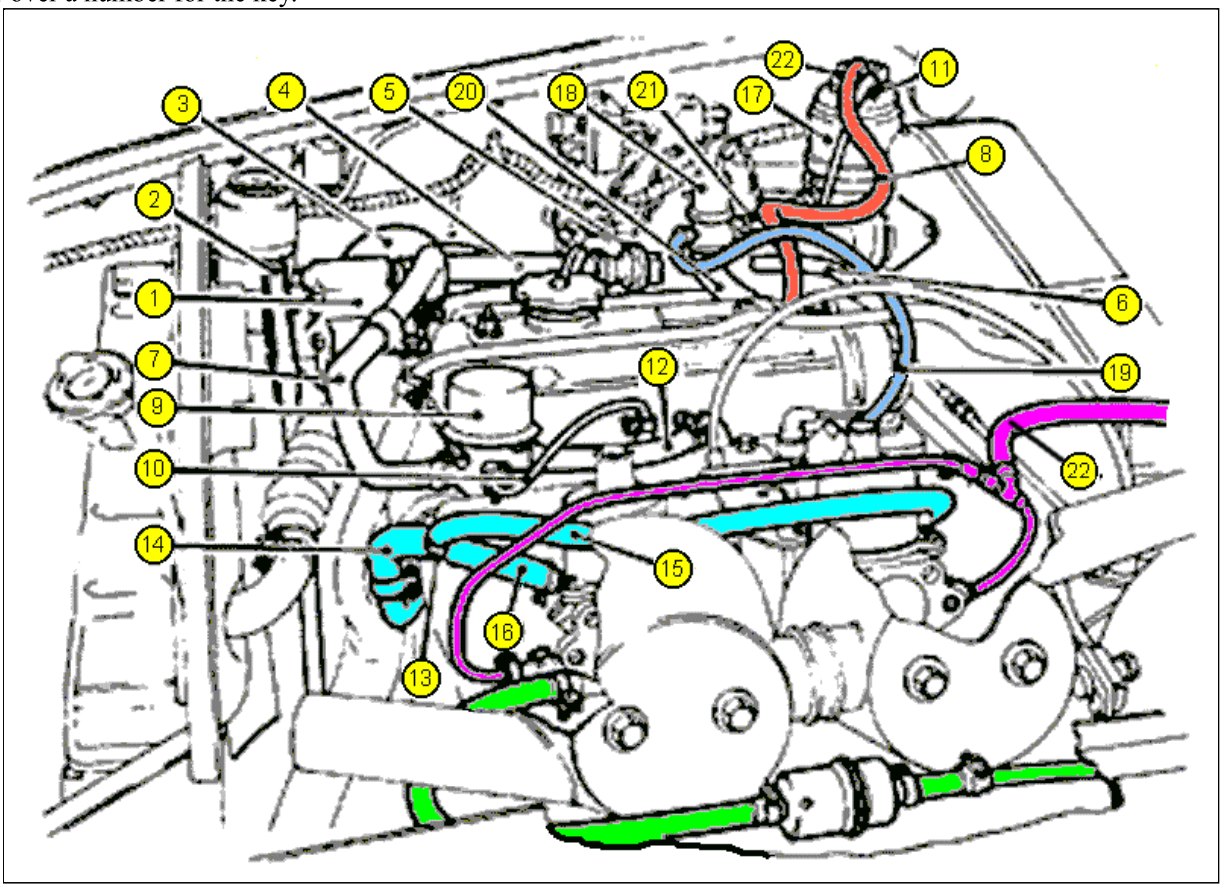
Image based on one from the British Leyland Workshop Manual

Fuel is drawn from the bottom of the tank (13) by the pump (20) and pushed through the fuel filter (12) and into the carb float chambers.

In 1978 a second charcoal canister was added below the anti-runon valve (19), to the air vent pipe (20). As the valve was connected to the inlet manifold fumes there could escape to atmosphere via the valve. The second canister trapped these, and was purged in series with the main canister during normal running.

North American Anti-Runon Valve Plumbing - Engine Compartment Overview, SU Carbs

Hover over a number for the key.



Key:

- 1. Air pump
- 2. Air-pump drive belt
- 3. Air cleaner
- 4. Air-pump to check-valve hose
- 5. Check valve
- 6. Air-injection manifold
- 7. Air-pump to gulp-valve hose
- 8. Purge line
- 9. Gulp valve
- 10. Gulp valve control pipe
- 11. Vapour pipe from carbs
- 12. Gulp-valve to manifold hose
- 13. Y connector
- 14, 15, 16. Crankcase breather
- 17. Charcoal canister
- 18. Anti-runon valve
- 19. Running-on control pipe from inlet manifold to anti-runon valve
- 20. Air-vent pipe to atmosphere
- 21. Hose from canister to anti-runon valve
- 22. Hose from canister to carb vent pipes

Image from Moss Motors on-line catalogue.

North American Emissions Plumbing - Zenith with Anti-Runon Valve

Hover over a number for the key, click on the menu items below to show the vapour/vacuum routings.

Fuel Flow Tank Expansion/Contraction Carb Expansion Crankcase Breathing Anti-runon

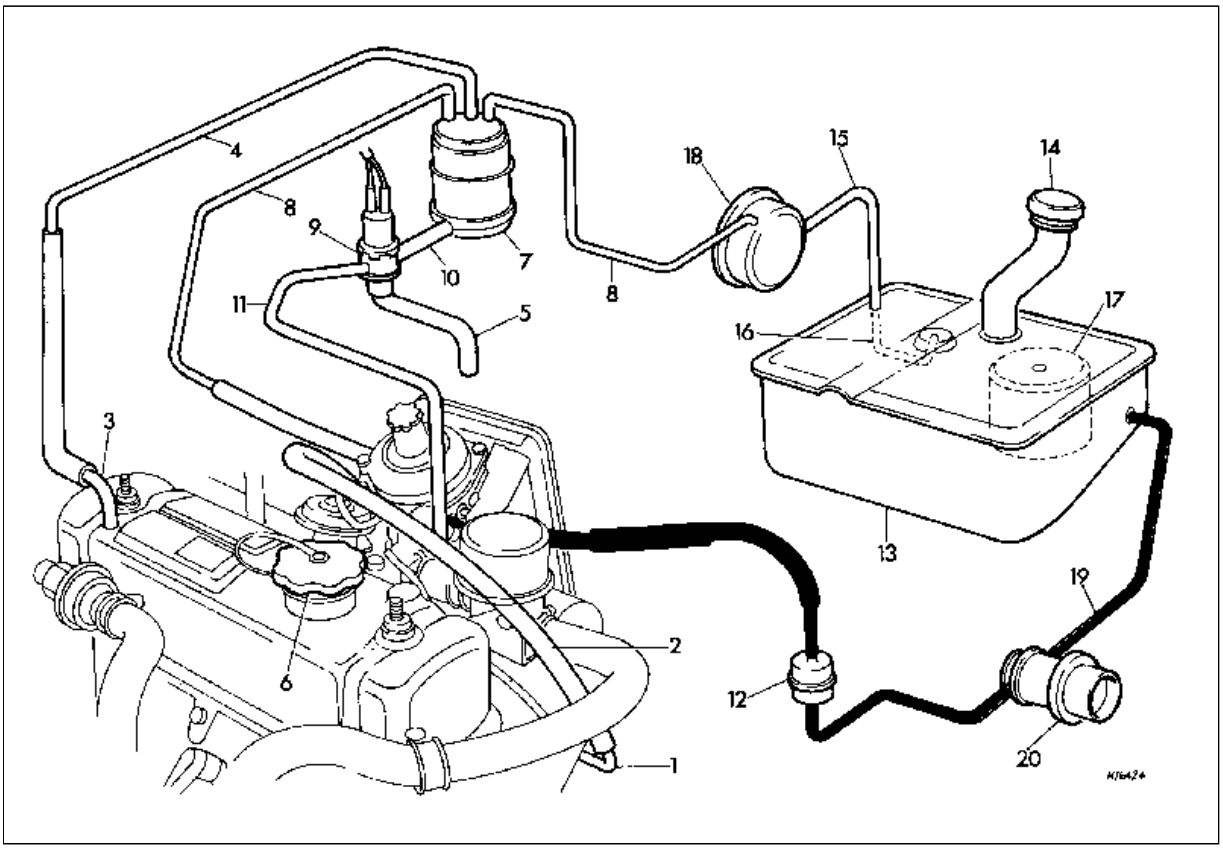


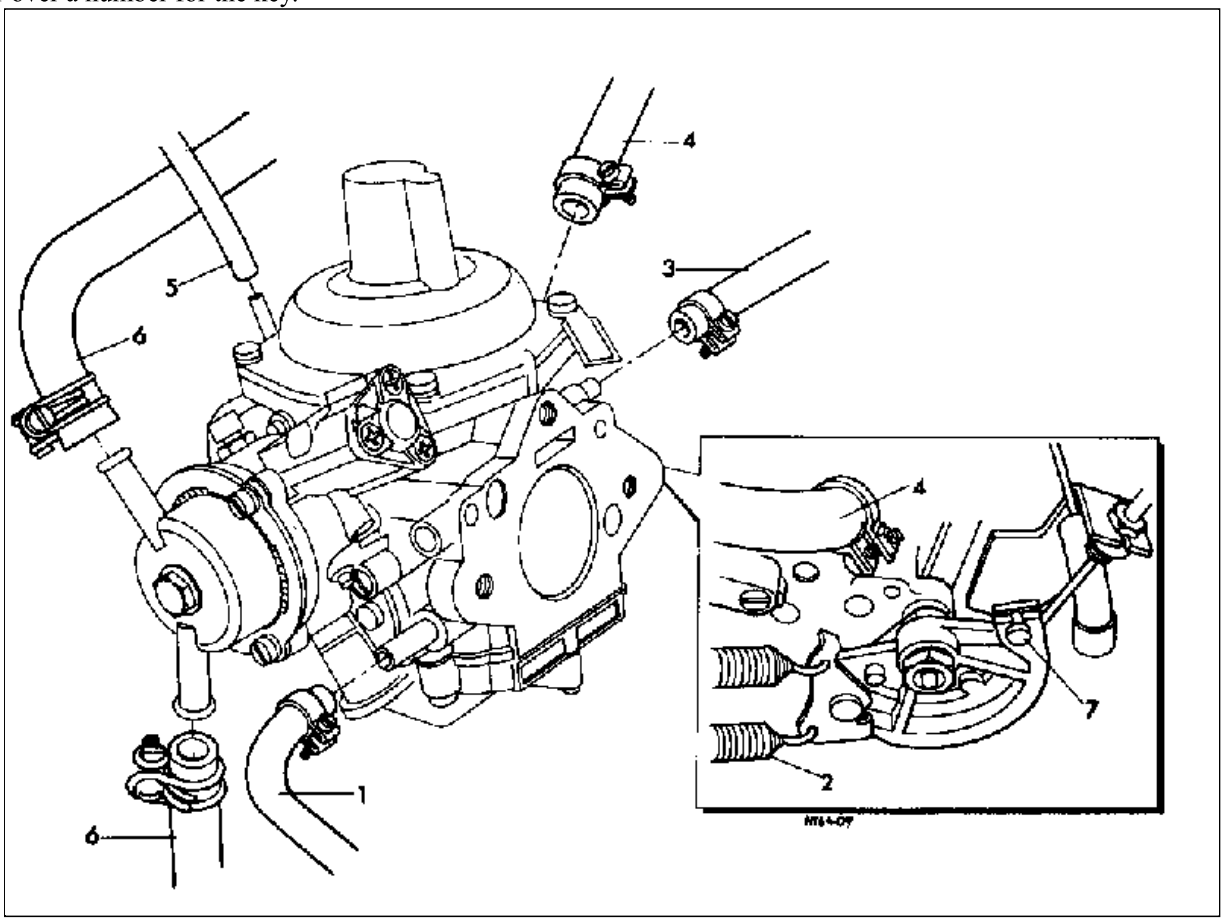
Image from Haynes Workshop Manual

Note: On 1978 models a secondary charcoal canister was connected between the anti-runon valve and the air vent pipe.

Fuel is drawn from the bottom of the tank (13) by the pump (20) and pushed through the fuel filter (12) and into the carb float chamber.

North American Emissions Plumbing - Zenith Detail

Hover over a number for the key.



Key:

1. Fuel feed hose
2. Throttle return spring
3. Adsorption canister pipe
4. Crankcase breather pipe
5. EGR valve pipe
6. Water hose
7. Throttle quadrant

Image from Haynes Workshop Manual

North American Anti-Runon Valve Plumbing - Engine Compartment Overview, Zenith

Hover over a number for the key.

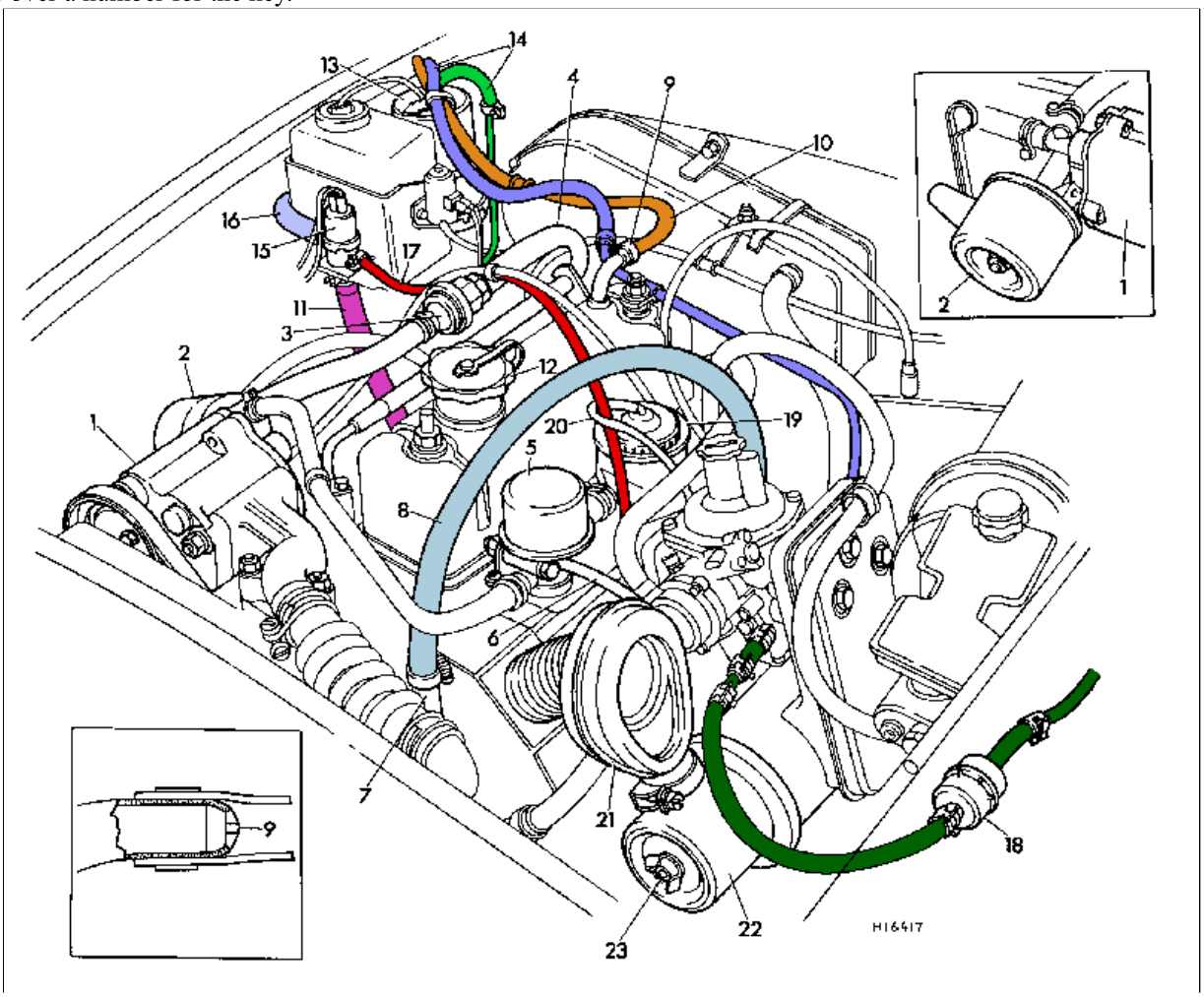


Image from Haynes Workshop Manual

Key:

1. Air pump
2. Air pump air cleaner
3. Check valve
4. Air manifold
5. Gulp valve
6. Sensing pipe
7. Oil separator/flame trap
8. Crankcase breather pipe
9. Restricted connection
10. Purge line
11. Air vent pipe (see Note)
12. Non-vented oil filler cap
13. Charcoal adsorption canister
14. Vapour lines
15. Anti-runon valve
16. Running-on control hose
17. Running-on control pipe
18. Fuel line filter
19. EGR valve
20. EGR valve hose
21. Air temperature control valve
22. Air cleaner case
23. Wing nut retaining Air cleaner cover

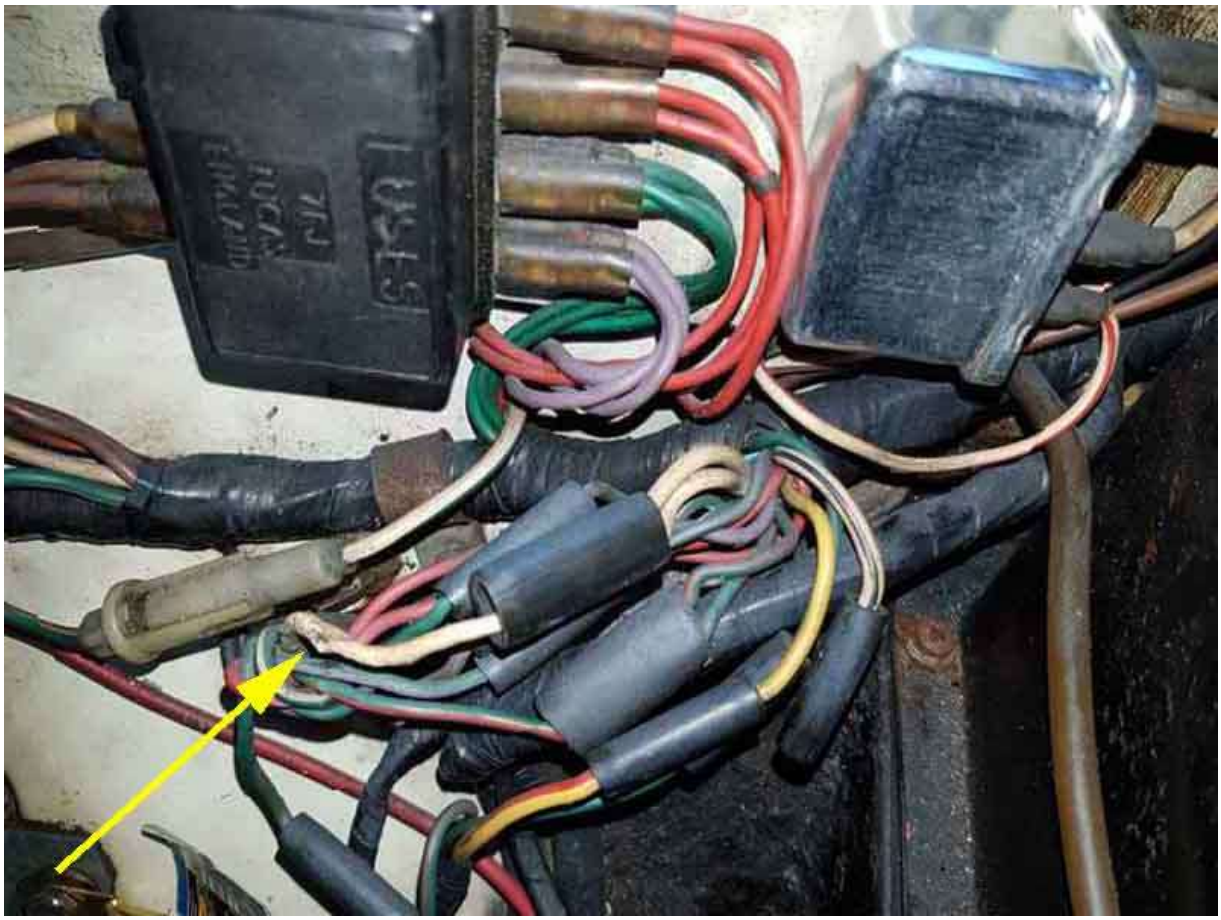
Note: The Leyland Parts Catalogue lists BHH1026 for chassis numbers 294251 (Aug 72) to 386600 (Sep 75) and BHH1851 for 386601 on including for the 77 to 80 cars, Googling shows neither except references back to BL documents. Moss Motors list three different air-vent pipes (hoses) bringing fresh-air in to the valve during running to purge the canister of previously absorbed fumes. The 1970-74 drawing lists 367-280 for 73-74 and the 1979-80 drawing lists 367-290. But the 1975-78 drawing lists three including those two with different dates plus another - 367-280 for 1975-78, 367-285 for 1976-77 (those two date ranges overlap so maybe the first one should read 75-76) up to chassis number 415000, and 367-290 for 1977 from chassis number 415000 to 78. All are NLA so there are no pictures showing how they may differ, but the 1970-74 engine bay and exploded parts lists shows a short pipe (item 64) going downwards, whereas the 1975 -78 and 1979-80 engine bay shows a long hose coming forwards but the exploded parts list shows the same short hose as before. However John Twist in this video indicates the hose on a 1977 going to the front of the car through the radiator diaphragm panel, and a pal with a 76 has this long hose (oil can for scale) which has never been fitted in his ownership: (*Bill Etter*)

Bill has fitted an oil cooler and there is no third hole in the diaphragm panel for the valve hose, so maybe this long hose is supposed to use one of the unused cooler hose holes.

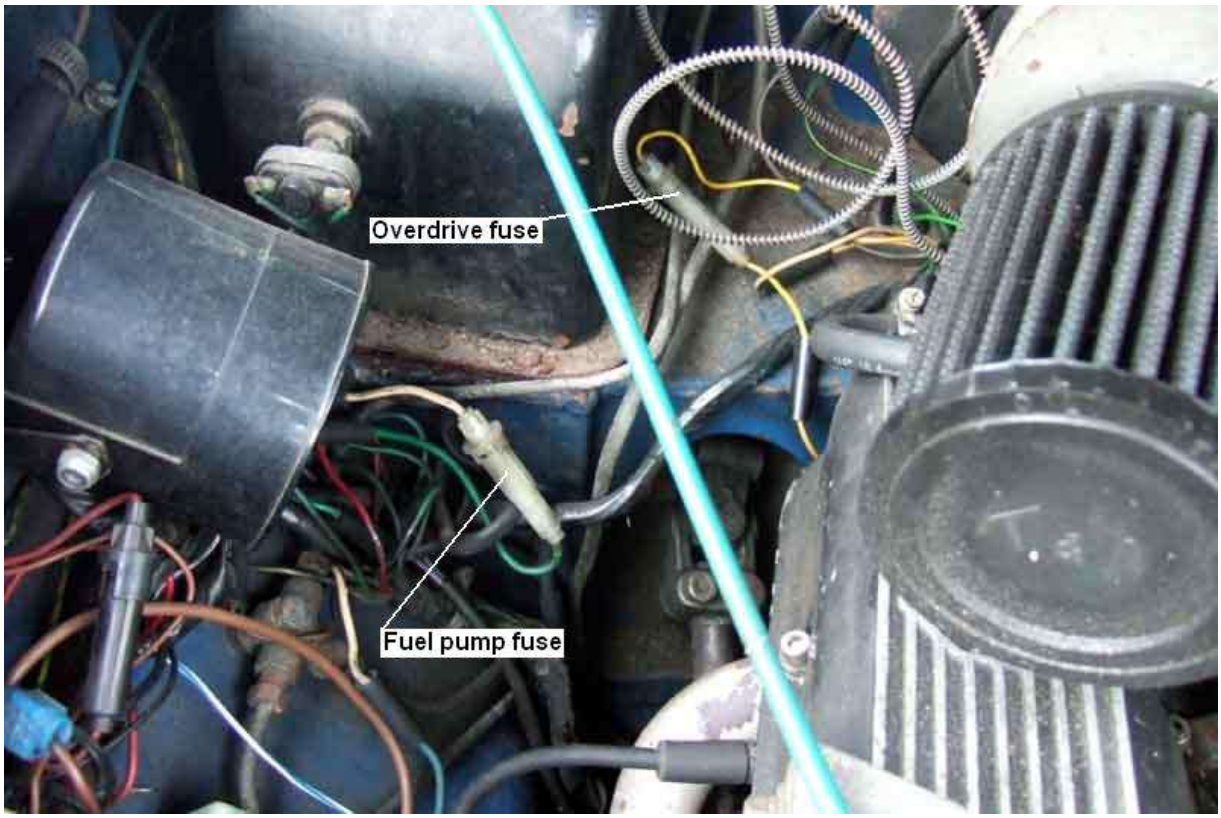
Fuel Pump and Overdrive Fusing

Damage to the V8 rear harness inside the boot. The fact damage is visible here shows the short must have occurred either in the pump or closer to it than this point. Damage runs all the way back through the rear harness and into the main harness, through that back to the ignition switch, and from there on the brown down to the solenoid. This has happened to both my roadster and V8 before my ownership. The roadster is still using the original wire so presumably wasn't damaged too badly, the V8 has had a new wire run in (brown, the blue is a wire I added for the rear fog lights). It also shows why fuses must be as near to the supply as possible. If there had been a fuse near the pump then it would have prevented the damage from this short in the pump, but if the short had happened in the rear harness under the car the fuse wouldn't have blown and the same damage would have occurred in the rest of the wiring.

The bullet connector near the RHD pedal cover where the two white wires from the main harness join the white wire to the rear harness and the pump. Note the heat damage to the pump wire on the left of the connector, insert the pump fuse between this wire and the 4-way connector. On 77 and later the white wires from the main harness are white/brown, also there is a fourth wire - also white/brown - which goes into the gearbox harness for the overdrive circuit. You can take both the output wires into a new 4-way bullet connector and insert a fuse between the two 4-ways, but if one circuit blows the fuse it will stop the other working. Better to use one fuse for each. North American spec cars are wired differently as they have an inertia switch in the pump circuit, and the OD wiring is different, see the main text. (*Image by David Farrar on the MGOC Forum*)



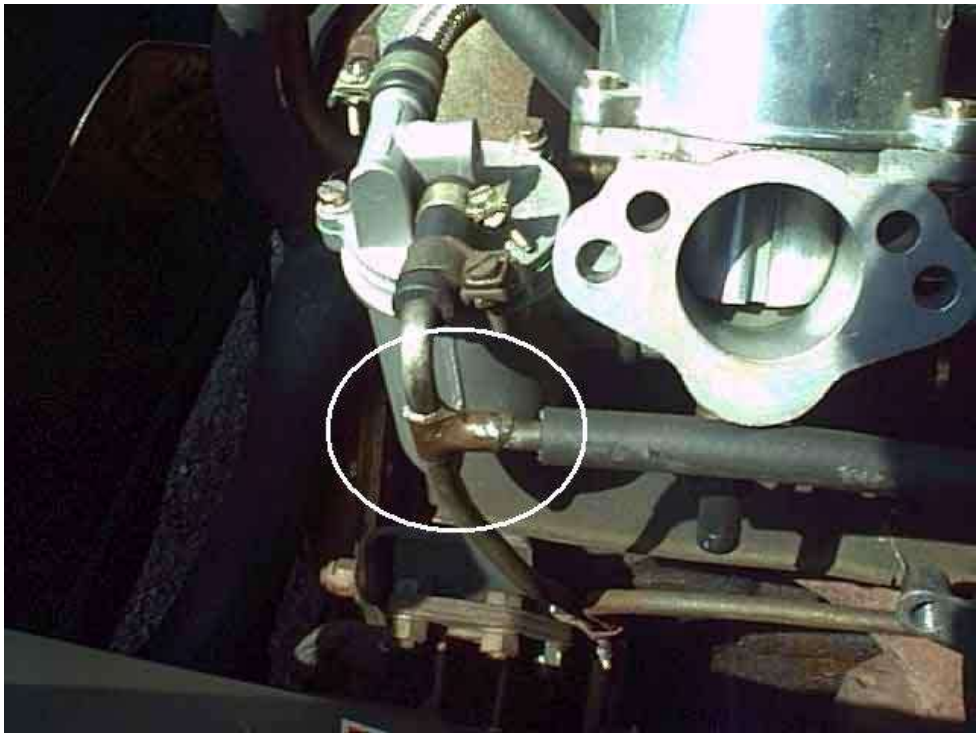
V8 Pump and Overdrive fuses: They should be installed as close as possible to the supply where a unique wire can be accessed. I've inserted them at existing spade and bullet connections which avoids cutting into wiring. It is also reversible - should anyone want to! I had to put the V8 overdrive fuse in the engine compartment as that was the first place I could use existing connectors as it has the manual switch on the column stalk with a multi-way plug connecting to the main harness. On the roadster with the manual switch on the dash I have put the fuse on the back of the switch using spade connectors instead of bullets. When I had a major overflow from one of the V8 carbs the close proximity of the two allowed me to cross-connect them so I could use the overdrive switch to turn the fuel pump on and off!



Controlling Running-on

Solution 1
Solution 2

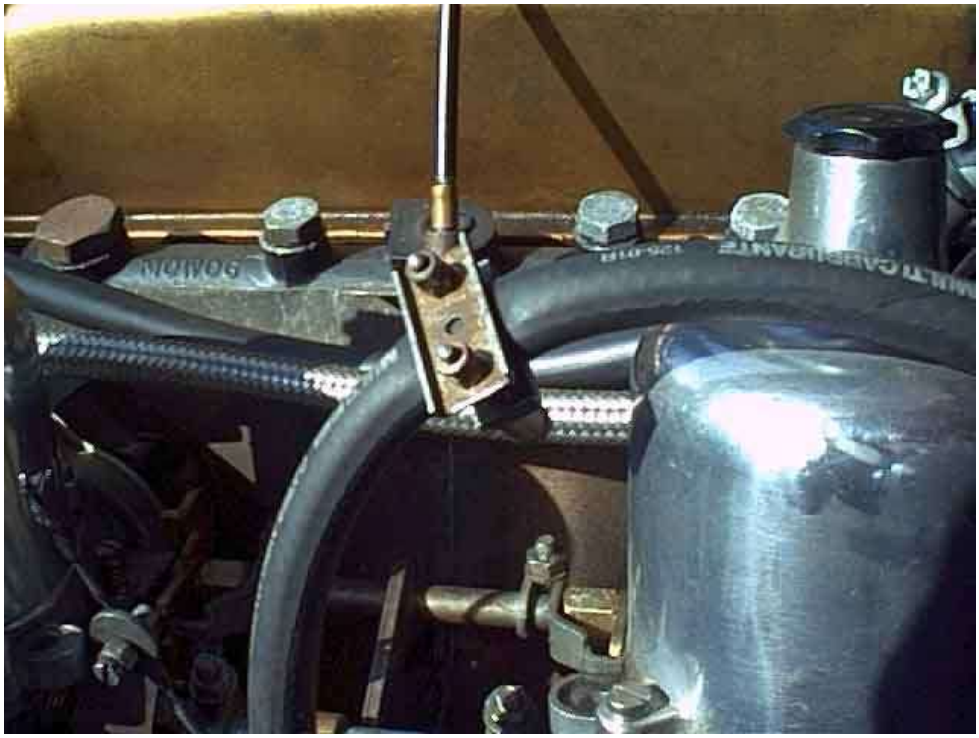
Solution 1: One of the Tees in the overflow/vent pipes (circled) ...



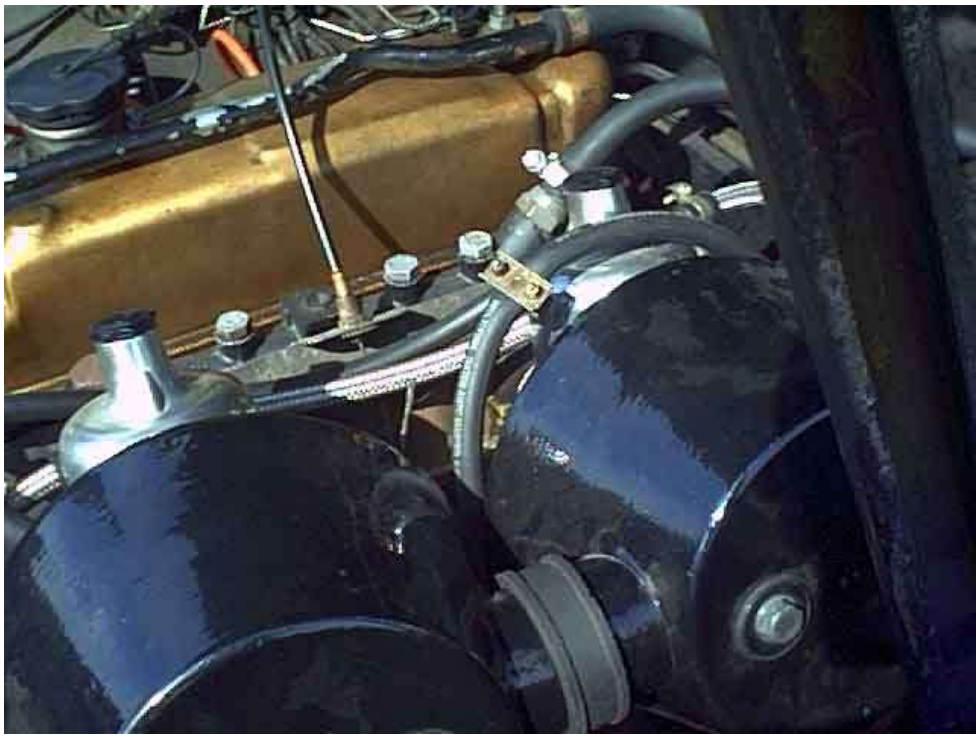
... and the two connected together with the vacuum hose Teed off that

Anti-runon vacuum hose via the after-market anti-runon valve Teed into the servo vacuum hose. A bit of ingenuity required to connect what was the filtered fresh-air inlet of the valve to my vacuum hose going to the vent pipes.

Restrictor in vacuum hose



Easy access to the restrictor after installation, but once set up I have never (eight years at the time of writing) found it necessary to alter it.



Solution 2: Manifold plug

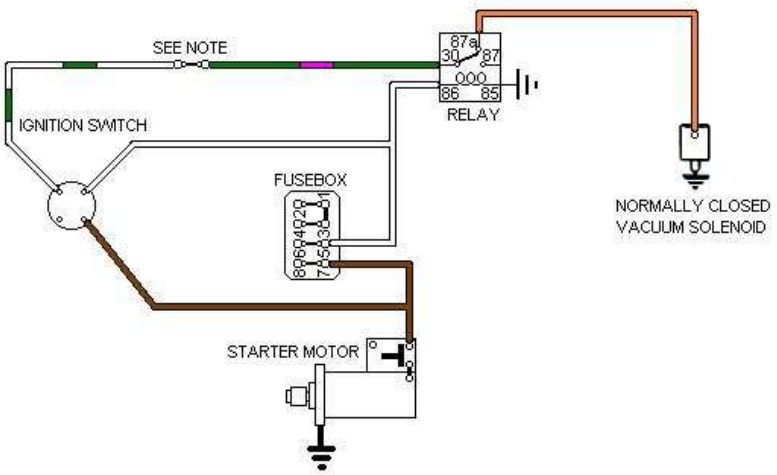
Adapter port 12H1405

Adapter modified by cutting down the thread and fitting copper pipe in place of the original port, and sealing ring.

Installed to engine. I've left the bracket on the body of the valve for the time being, in case it needs to go back in it's original position on the firewall. The hose is an offcut from the length originally supplied with the valve, and is very rigid so there shouldn't be an issue with the valve flapping about. If there is I can rotate the valve in the hose and use an L-shaped bracket to bolt it to the rocker-cover nut under the heater return pipe.

Anti-Runon Valve Retrofit

This uses an original equipment vacuum solenoid from some other make and model (note the MGB anti-runon valve is not suitable unless you are prepared to plumb it in the same as the factory did) which needs to be powered to apply vacuum to the carbs.

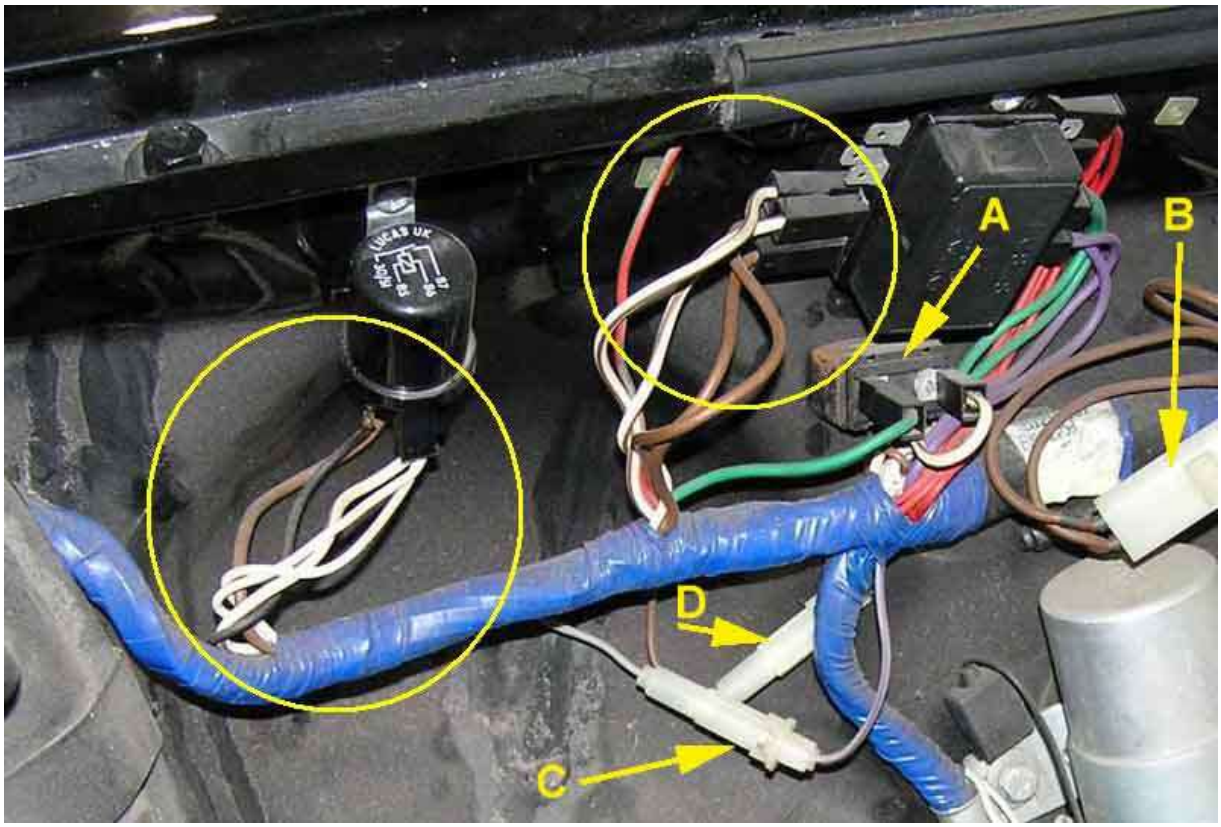


The relay operates and releases with the ignition switch, i.e. is operated all the time the ignition is on. When the ignition switch is turned from the Run position to the Accessories position the relay releases, and power from the Accessories position is connected through the relays normally closed contact to operate the solenoid. When the ignition switch is turned to the Off position the solenoid is released. You do have to remember to pause the ignition switch in the Accessories position until the engine has stopped.

Note: On 71 to 74 models there is an inline fuse connecting the Accessories white/green from the ignition switch to the green/pink for the heater fan, wipers and electric screen washer, use this green/pink for the relay contact. On models before and after this there is no factory fuse so it would be advisable to fit one when connecting to the white/green.

North America 78-on

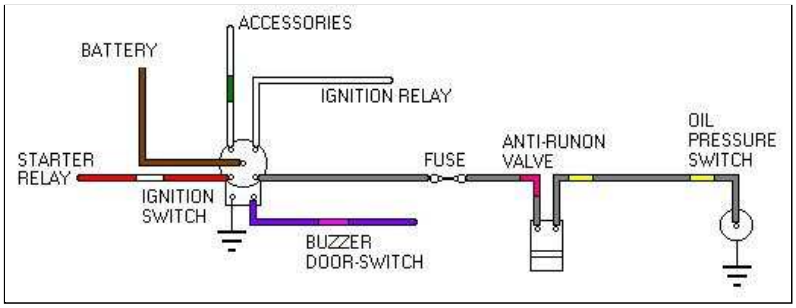
Showing how the coil feed has been moved from the fusebox back to the ignition relay input i.e. the ignition switch circuit to cure the North American-type of running-on, leaving just two white/browns at the fusebox and putting one white plus a white/brown, and another white/brown, at the fusebox: (*Kelvin Dodd*)



This also shows 'A' the thermal cut-out in place of a fuse for the cooling fans; 'B' the 'double brown' coming up from the alternator; 'C' the in-line fuse in the slate to slate/pink for the anti-runon valve; and 'D' another in-line fuse with brown one side.

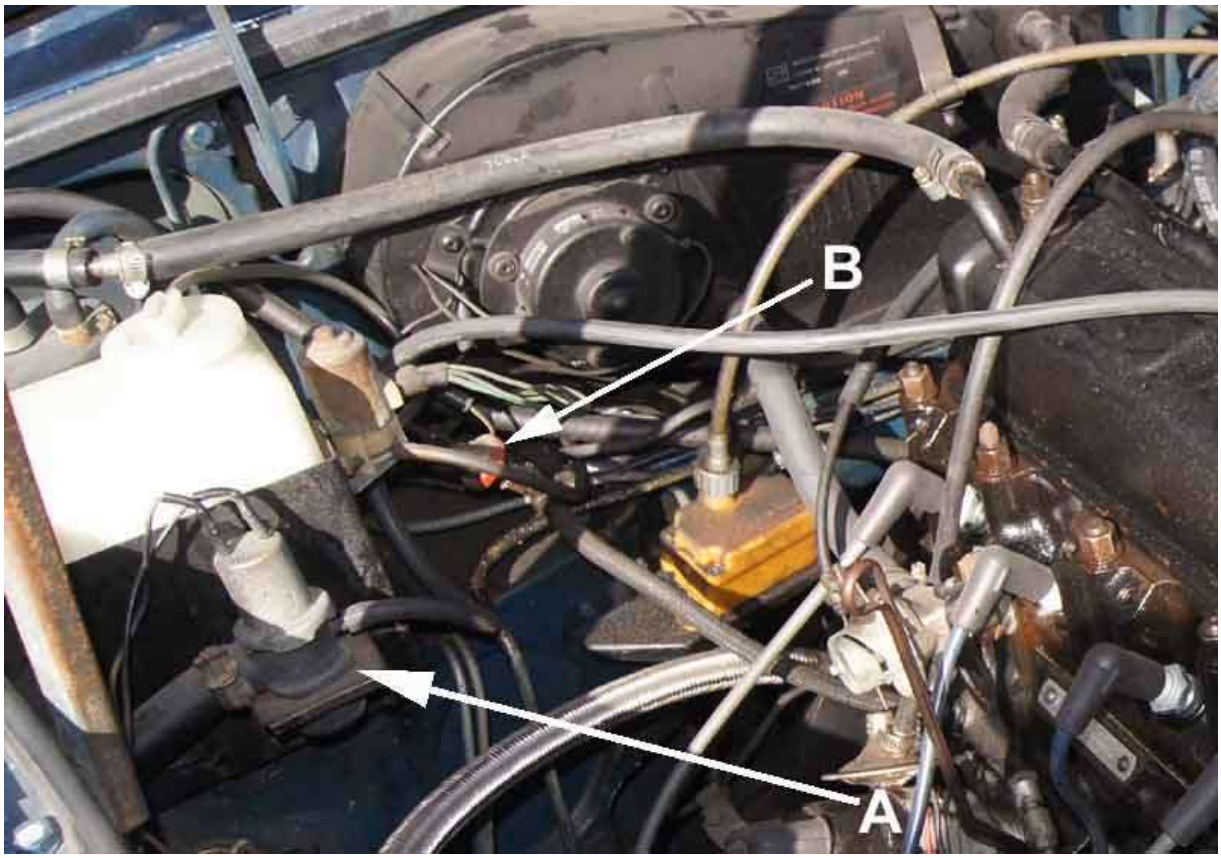
North American Anti-runon Valve - 1973-on

Hover over a wire to confirm the colour



12v is only connected through the fuse to the valve when the ignition is **off**. The oil pressure switch only connects an earth to the other side of the valve when the engine is running and generating oil pressure. So with a running engine the valve only operates when the ignition is switched off. When the engine stops and the oil pressure dies away the valve releases again.

The anti-runon valve (A) and oil pressure switch (B) as fitted to Bill Etter's 76



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