

CONVERSION OF EARLY 80'S MERCEDES BENZ (MODEL 123) DIESEL TO RUN ON RECYCLED VEGETABLE OIL



In the spring of 2006 my son and I converted an '85 Mercedes Benz 300D to run on waste vegetable oil (WVO). The conversion is a 2 tank system using the stock tank for WVO and added an 11 gal tank for the diesel. The tank is a marine tank added on the passenger side in the trunk. This was our second conversion and the goal was to get the longest range and the lowest cost. Since the diesel tank was small we wanted the ability to use the stock tank for diesel also.

Contained are plumbing and wiring diagrams, bill of material and photos of the conversions. Just guessing I had 60 hrs of time involved. Sometimes with the help of my son, so approximately 80 man hours.

Below is the plumbing/wiring diagram. I suggest printing several copies and use colored highlighters and trace through the system in the different modes to fully understand how it works.

What skills are necessary to perform this conversion? Average mechanical skills and basic tools are required to complete the conversion. The only special tool I had to purchase was a hole saw. I did use a drill with right angle head quite a bit in tight quarters. The passenger rear fender was cut and a formed piece was added to allow the marine tank to be moved forward and to improve the placement. This was not absolutely necessary, but worthwhile. This would be the only task not easily performed in a basement garage and required cutoff wheel, welder and a fabbed sheet metal part.

The goal is to refine and make this as available to as many as possible. If there are comments and improvements please email to kcipilotpat@yahoo.com. The bill of material needs refinement to further determine the exact cost and minimize the trips to the hardware store. Many of the costs are estimates for the small parts

It is strongly recommended a compression test be run prior to the conversion to have a benchmark to measure against if there are any problems. Keep the compression test information to compare to later.

FEATURES

Fill Alarm- a float switch is installed in the tank to warn when it's nearly full. My filter/transfer system does not have an automatic shutoff system and the flow is relatively low. We found it easy to get distracted and overflow making a mess. The fill alarm is activated with a reed switch when the fuel door is open and chirps when nearly full.

Veg Alarm- a buzzer will indicate the system was shut down with the vegoil left on.

Tank Drain- To drain collected water or crud from the tank the existing tank outlet is used as a tank drain. The suction screen was cut off the top of the fitting. A valve was mounted to the inner fender to allow a quick drain point.

Control Panel-The ashtray was removed and a control panel constructed from aluminum to mount the switches and the diesel fuel gauge. A 5 pin connector was used to allow removal of the panel or the shift console with a minimum of wires having to be disconnected. The wood panel from the ashtray was used to make it attractive.

Hose Routing- It is difficult to rout the hoses around the drive train and exhaust to the trunk. With some research on a parts car, it was discovered there is a path in the side channels that can exit under the backseat and through a plastic plug for access to the shock mount and into the trunk. The hoses enter the car under the driver's seat. The hoses pass through tubes attached with U-bolts and sealed to the floor pan. Heat shrink tubing seals the hoses to the tubes.

Hose in Hose (HIH). A counter flow heat exchanger is constructed by routing a 3/8 aluminum tube inside the heater hose going from the engine to the trunk. It was very difficult to make the tight bend under the seat with the aluminum tube. I would recommend using Nylon tubing purchased from a hydraulics supply company. Others use a 5/8" heater hose with the tube inside. It is difficult to pass the fuel tube through the hose barb fitting. This conversion used 3/4" heater hose for the supply and 5/8" for the return.

Coolant Pump- The stock benz auxiliary coolant pump runs whenever the system is turned on. Switchover doesn't occur until the coolant exiting the tank reaches 150 deg f. I've tried it with the boost pump removed and am not sure it makes much difference.

Automatic Switchover- The vegoil system can be activated as soon as the engine is started. A thermostatic switch is attached to the coolant line exiting the fuel tank. The switch to vegoil won't take place until the temp on the coolant line exiting the vegoil tank reaches 150 deg f.

Electric Heat- A glow plug heater is added inline before the filter to add extra heat at startup. A Thermostatic switch limits the temp to 180 deg f and resets at 150 deg. At switchover, the heater cycles for the first 5 or 10 minutes. After it's warmed up a bit I don't think it comes on very often. Also are installed Fattywagons injector line heaters. They run all the time vegoil is being supplied to the engine.

Vegoil out/disable- a separate toggle switch will allow the stock tank to be filled with diesel (if you can afford it). Flipping the switch shuts off the coolant flow to heat the fuel heating system using a standard benz monovalve and disables all the electric heat. The vegoil switch changes which fuel pump is activated thus which tank supplies the fuel. I flip it to disable when the vegoil is out or I don't intend to use it. Heating the tank, particularly when empty causes condensation inside the tank. When making the panel I was working on the back side and accidentally put the led on the wrong side. I had to do something with the hole and added an led that lights when the disable is activated. It's really not necessary.

Operation

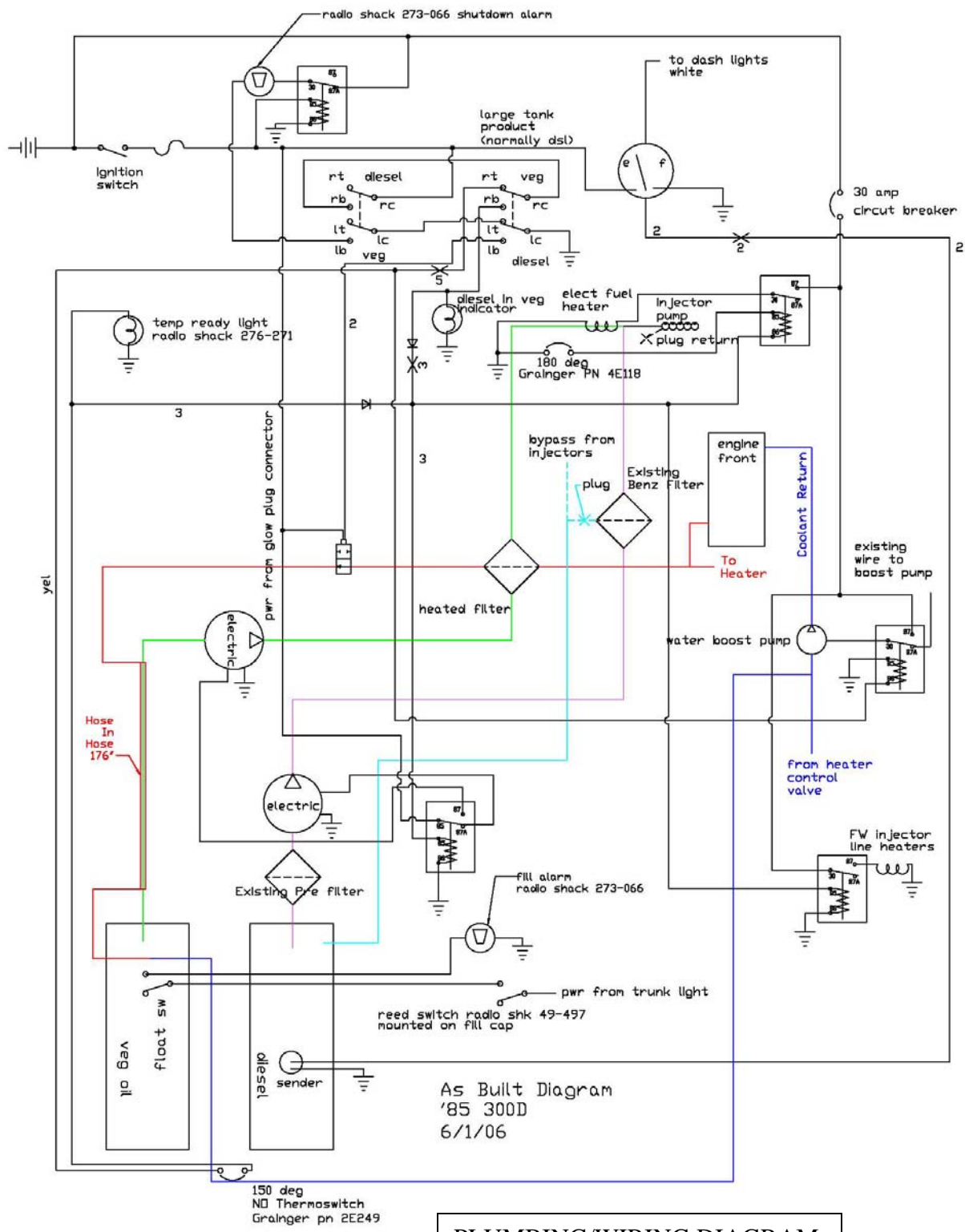
VegOil- On a trip of 15 min or more, activate the vegoil as soon as the engine is started. When it gets to operating temp, it will turn off the electric diesel pump and start the vegoil elect fuel pump. The light will glow above the switch. About 5 min before reaching destination, switch back to "diesel" to purge the vegoil out of the engine. For stops of 10 or 15 minutes it is not necessary to purge the system. If it is shut down with the vegoil left on an alarm will sound. Restart the engine and allow to idle for 5 min or so. I suggest you don't leave the car running and assume you will remember to come back and turn it off. I have found it does quit by itself when it runs out of diesel!

Don't run it out of fuel on either tank. The system has to be purged and it is not easy. I have found it will run 60 mi comfortably after the low fuel light comes on for the veg tank.

An 11.5 gallon tank for diesel is in the trunk.

Diesel Only- if the vegoil tank is out of oil. Switch the right toggle to "vegoil out/disable". This kills the system and the both tanks can be filled with diesel. The left switch selects which tank is used. Up is the main tank (normally vegoil) and down is the trunk tank.

Filters- there should be spare filters in the trunk. Diesels are very sensitive to plugged filters. If there is a reduction in power, particularly noticeable when accelerating or going uphill, the filters are likely plugging. When changing the filters the air must be purged out of the system before starting the engine. A diesel can't tolerate any air in the system. The systems are independent and if there is a problem with either system, the other is still useable.



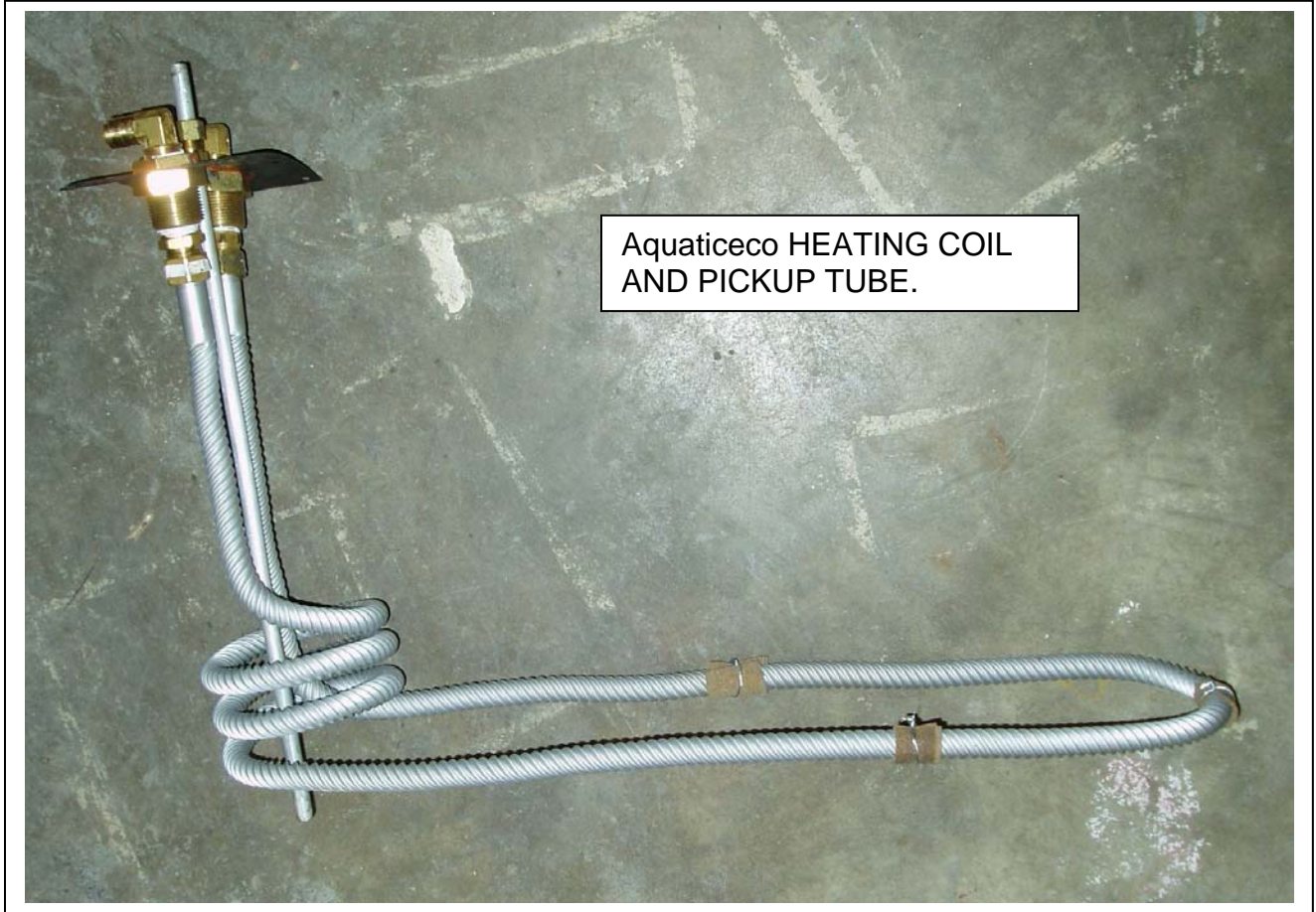
PLUMBING/WIRING DIAGRAM

bill of material

item	source	PN	qty	cost *	shipping	total	web address
fuel pumps	Napa	p74017	2	60.31		120.62	
diesel aux tank, 11.5 gal	west marine	406405	1	130	17.65	147.65	www.westmarine.com
coolant coil 5/8"	aquatic eco systems, inc.	EX11	1	10	5	15	http://www.aquaticeco.com/index.cfm/fuseaction/product.detail/iid/9248/cid/2224
fitting 1/2 mnpt x 5/8 compression	hwd store		2	4		8	
fitting 90 deg el, 1/2 mnpt x 5/8" barb	hwd store		2	4		8	
bulkhead 1/2 fnpt	hydraulic supply		2	4		8	
fitting, 3/8 npt x 3/8 comp	hwd store		3	3		9	drill out 25/64 to allow alum tubing to pass for HIH
bushing 3/4 x 3/8 npt	hwd store		2	2.49		4.98	for hih in 3/4" tee.
fitting 1/8 npt x 5/16 barb	hwd store		2	1.49		2.98	
elbow 3/8 comp x 1/4npt	hwd store		3	2.49		7.47	
plastic compression sleeves	hwd store		6	0.15		0.9	
3/8" npt x 3/8" barb	hwd store		3	1.79		5.37	
heater hose 3/4"	auto store		25	0.75		18.75	
heater hose 1/2"	auto store		25	0.5		12.5	
fuel gauge	west marine	280080	1	34		34	
coolant temp thermostat	kidde fenwal	08-023384-435-02	1	24		24	no close 150
electric heater thermostat	kidde fenwal	08-023384-594	1	24		24	NC open 180 close 160
1/2" hose barb tee	mcmaster carr (pkg of 2)	91355k	1	13.15		13.15	
3/4" brass tee	mcmaster carr	5078k76	2	9.06		18.12	
screw clamp 11/16 to 1 1/4	mcmaster carr (pkg of 10)	5388k33	2	5.49		10.98	
screw clamp 15/16 to 1 1/2	mcmaster carr (pkg of 10)	5388k14	2	5.36		10.72	
5 pin electrical plug female	mcmaster carr	1864k37	1	10.32		10.32	
5 pin electrical plug male	mcmaster carr	1864k35	1	10.04		10.04	
5 cond 18 ga wire	mcmaster carr	7673k23	30	1		30	probably can find less expensive
aluminum tubing (HIH)	mcmaster carr	5177k15	1	34.32		34.32	50' coil. 25' sufficient
3/4" elbow	mcmaster carr	50785k46	1	8.13		8.13	
fuel fill cap non vented	hydac	306040	1	26.25		26.25	hydraulic supply will have vented and can change to automotive cap
hook up wire 4 colors	auto store		1	16.09		16.09	
tank holddown eye bolts 1/4 x 1 7/8	hwd store		2	0.29		0.58	
elbow 3/8"npt x 1/4" barb	hwd store		1	3.49		3.49	
elbow 3/8"npt x 3/8" barb	hwd store		1	3.49		3.49	
reducer 3/8 barb x 1/4 barb (nylon)	hwd store		1	1.5		1.5	

item	source	PN	qty	cost *	shipping	total	web address
terminal eyes, #8 x red	hwd store		25			0	
butt connectors red	hwd store		25			0	
butt connectors blue	hwd store		25			0	
eye connector 1/4" x yel	hwd store		1			0	
eye connector #10 x blue	hwd store		10			0	
1/4" spade x blue	hwd store		25			0	
1/4" spade x red	hwd store		25			0	
switch dpdt	auto store		2	6		12	
led w/holder	radios shack		2	1.5		3	
30 amp circuit breaker	auto store	bp/cbc-30hb	1	4		4	
relays	advance auto parts	MR78	4	10		40	
elect fuel heater (glowplug design)	vegoil conversion kit		1	30			http://vegoilconversions.netfirms.com/
injector line heaters	fattywagon		1	20	5		http://www.fattywagon.com/index.htm
heated Fuel Filter							
filter	wix	33616	1	13		13	
seal	vw	6034b	1	6.27		6.27	
Oil cooler oring	bus depot	021-117-070-A	1	2.7		2.7	www.busdepot.com
Filter Base	Summit Racing	trans dapt #1028	1	12		12	
vw oil cooler	ebay		1	40		40	
fill alarm							
reed switch	radio shack	49-497	1	4		4	
buzzer	radio shack	273-066	1	4		4	
float switch	grainger	2A554	1	13		13	
nipple 1/8" x 3 brass	hwd store		1	1.59		1.59	
coupling 1/8" brass	hwd store		1	1.19		1.19	slide in as low as it will go to start
strain relief/seal fit over 1/8" nipple	hwd store		1	4		4	
		totals			27.65	809.15	
		misc ?				25	
		Grand Total				861.8	

* items without decimels are estimates



Aquaticceco HEATING COIL AND PICKUP TUBE.



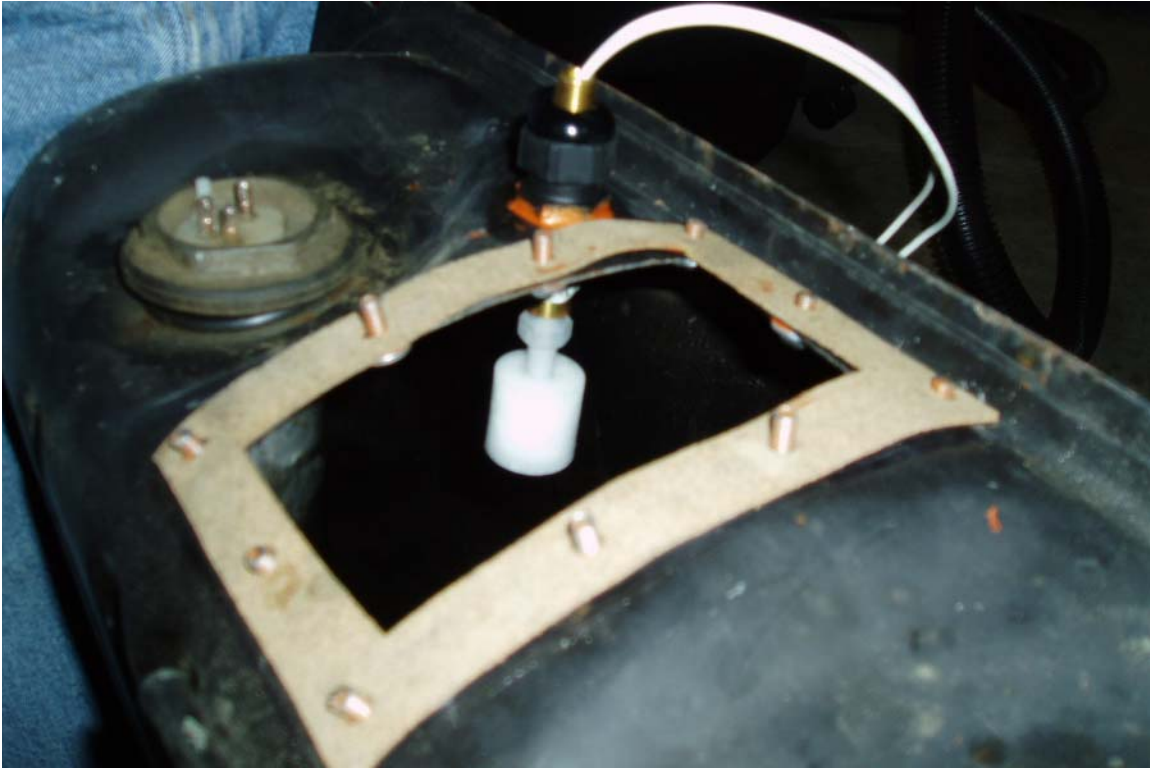
BULKHEAD PLATE AND PICKUP TUBE



PRESSURE TESTING WITH HOT WATER



HOLE CUT IN TOP OF TANK. HOLES WERE THREADED AND MACHINE SCREWS INSERTED FROM INSIDE THE TANK. USE PAPER OR CORK GASKET. VEGOIL WILL ATTACK RUBBER



FLOAT SWITCH FOR FILL ALARM

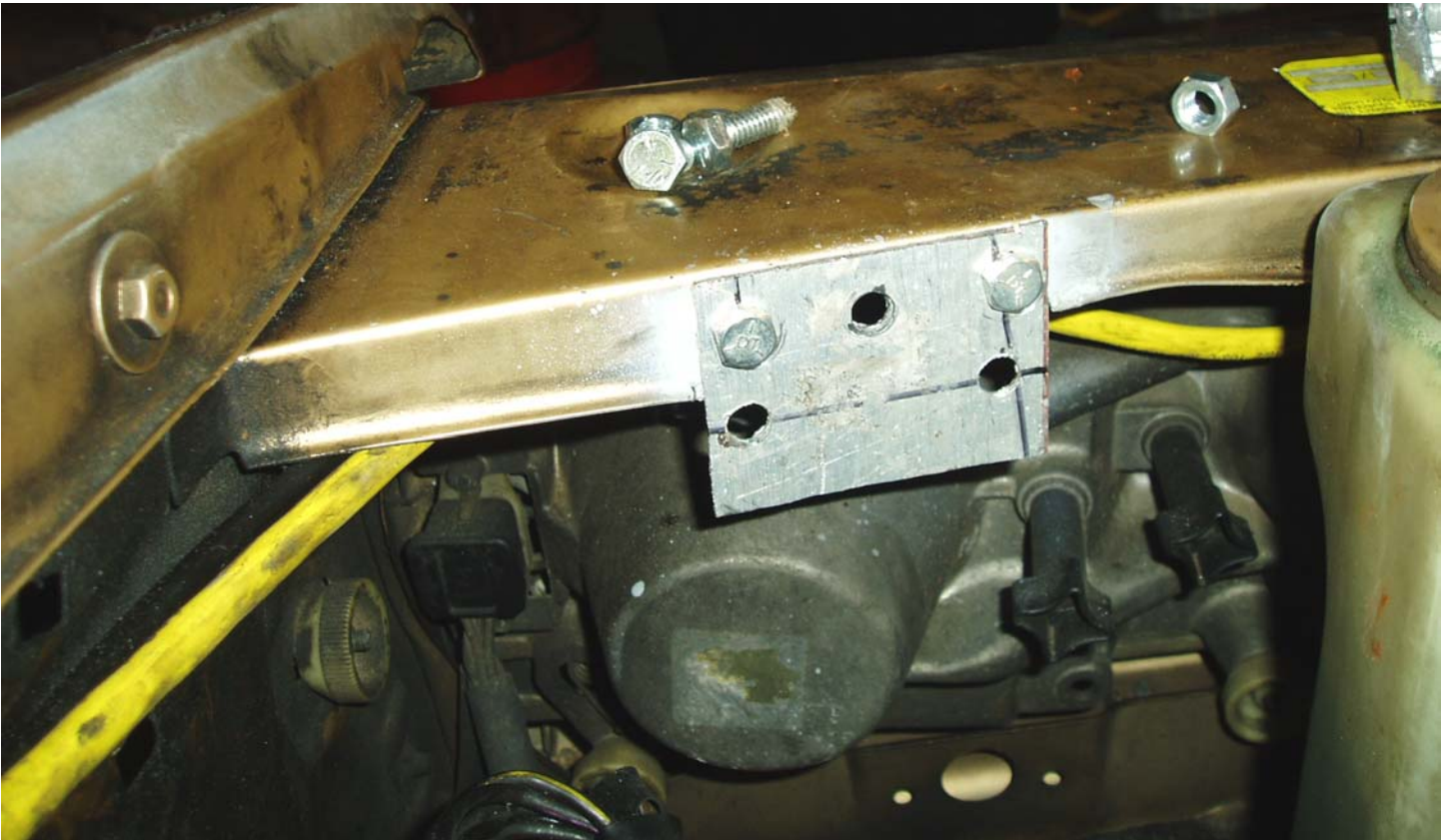


VW OIL COOLER FOR HEATED FILTER

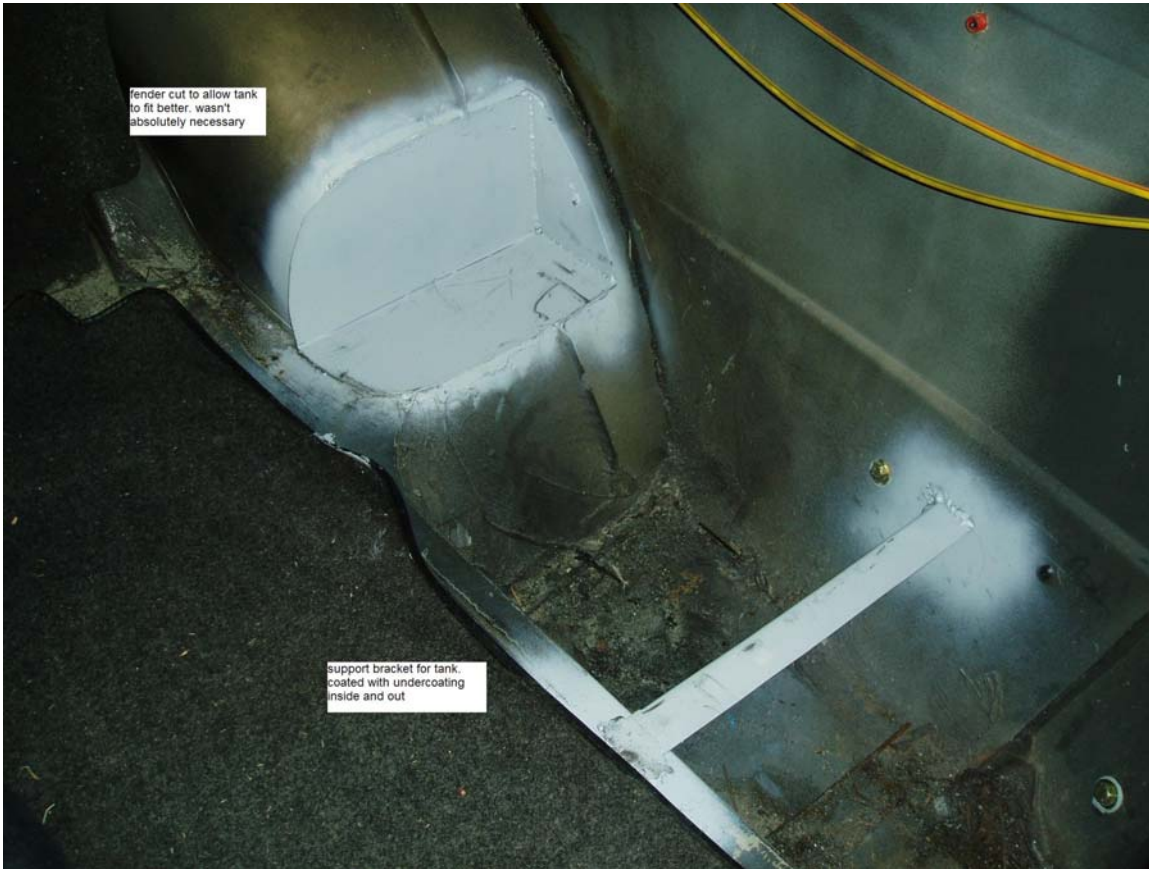




ASSEMBLED FILTER



FILTER BRACKET. IT'S PRETTY FLIMSY. REALLY NEEDS A SUPPORT TO THE BOTTOM



CUT IN FENDER AND TANK SUPPORT BRACKET



TANK INSTALLED IN THE TRUNK. NYLON WEBBING WAS ATTACHED ON ONE END WITH A SHEET METAL SCREW THROUGH THE FENDER WHERE THE RUBBER TRIM IS ON THE OUTSIDE. IT WAS DOUBLED BACK AND A NAIL WAS USED WITH A TUNBUCKLE TO SNUG IT UP.



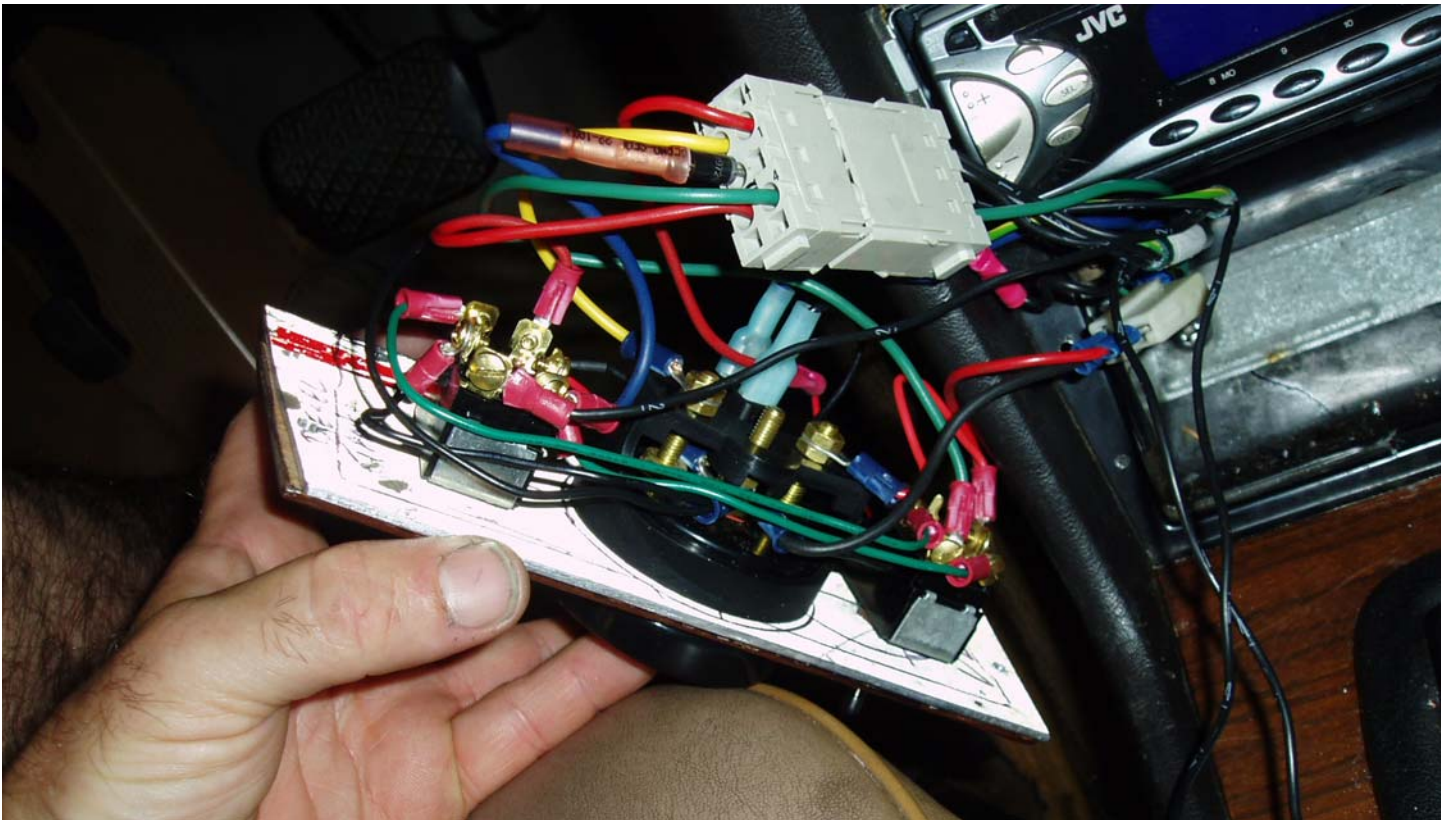
TANK DRAIN



STRAINER CUT OFF ORIGINAL TANK OUTLET



CONTROL PANEL WITH WOOD FROM ASHTRAY



CONTROL PANEL WIRING AND 5 PIN CONNECTOR



CONTROL PANEL INSTALLED AND LABELED



RELOCATED 12V OUTLET. NECESSARY TO REMOVE BALANCE CONTROL AND PLUG HOLE. 12V OUTLET CAN ALSO BE LOCATED IN PANEL WITH ANTENNA/REARLIGHT/SUNROOF CONTROL, BUT IS UNHANDY WITH SOMETHING BULKY LIKE AN INVERTER. ALSO WIRED SO HOT ALL THE TIME. STANDARD IS OFF WITH KEY.



HOSE IN HOSE CONNECTION- COMPRESSION FITTING IS DRILLED OUT TO ALLOW FUEL TUBE TO PASS THROUGH. NYLON INSERT IS USED IN COMPRESSION FITTING

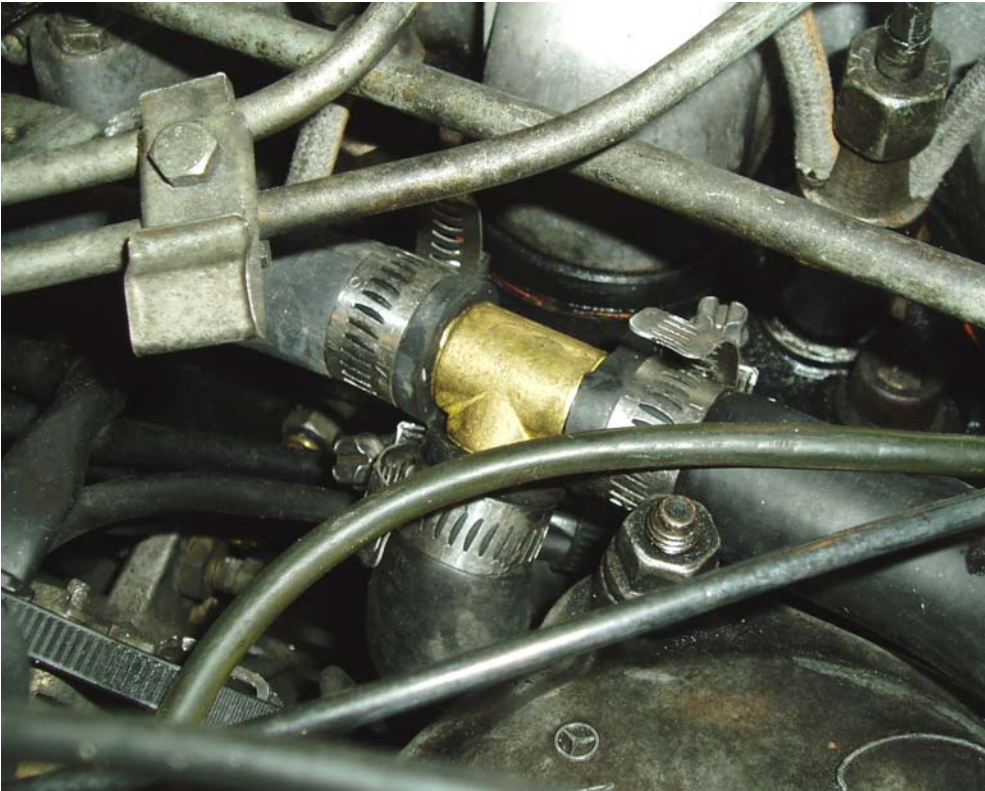


Hot coolant out of engine

To Monovalve to shutoff flow

To heated fuel filter

Then to HIH to fuel tank



CONNECTINON FOR HOT COOLANT SUPPLY FOR SYSTEM TEE'D ON DRIVES SIDE NEAR REAR OF ENGINE.



HOSES ENTERING UNDER
DRIVES SEAT HEAT
SHRINK IN PLACE AND
UNDERCOATED





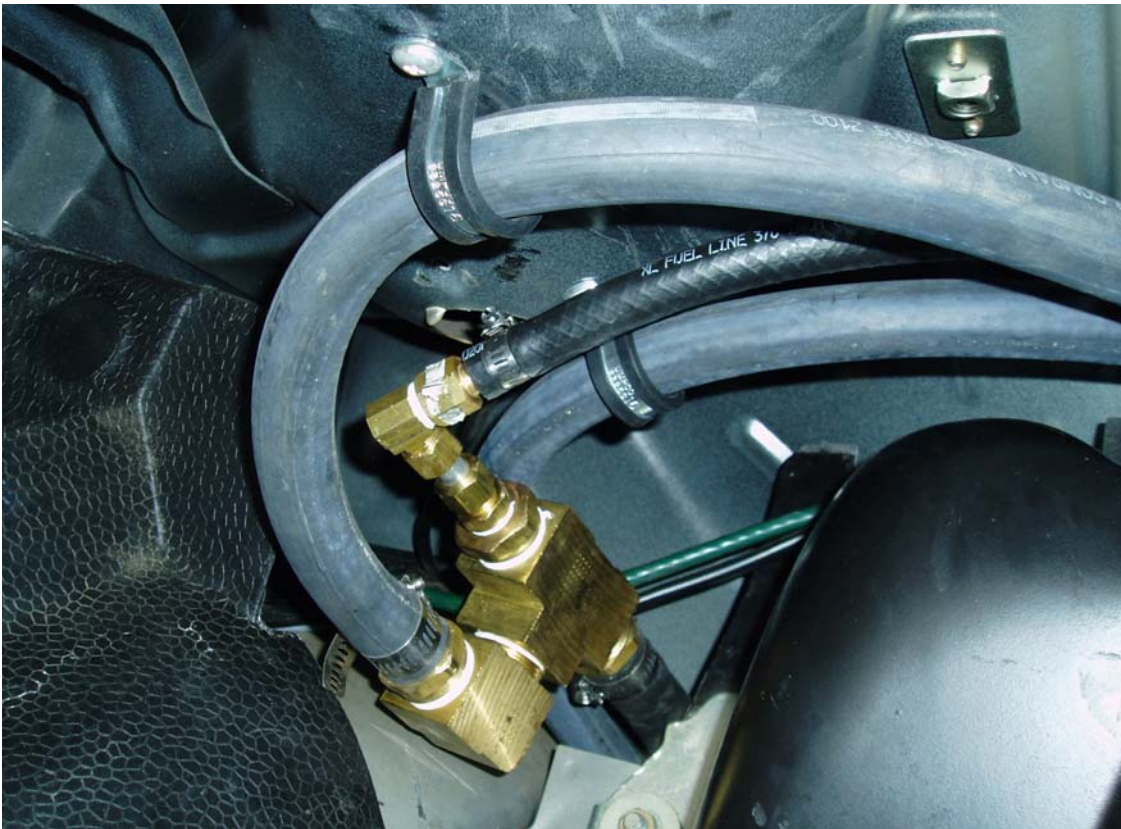
TUBES COMING IN UNDER DRIVERS SEAT AND HOLE CUT IN SIDE CHANNEL. USED HOLE SAW ON ENDS AND CUT BETWEEN WITH CUTOFF WHEEL OR SABER SAW



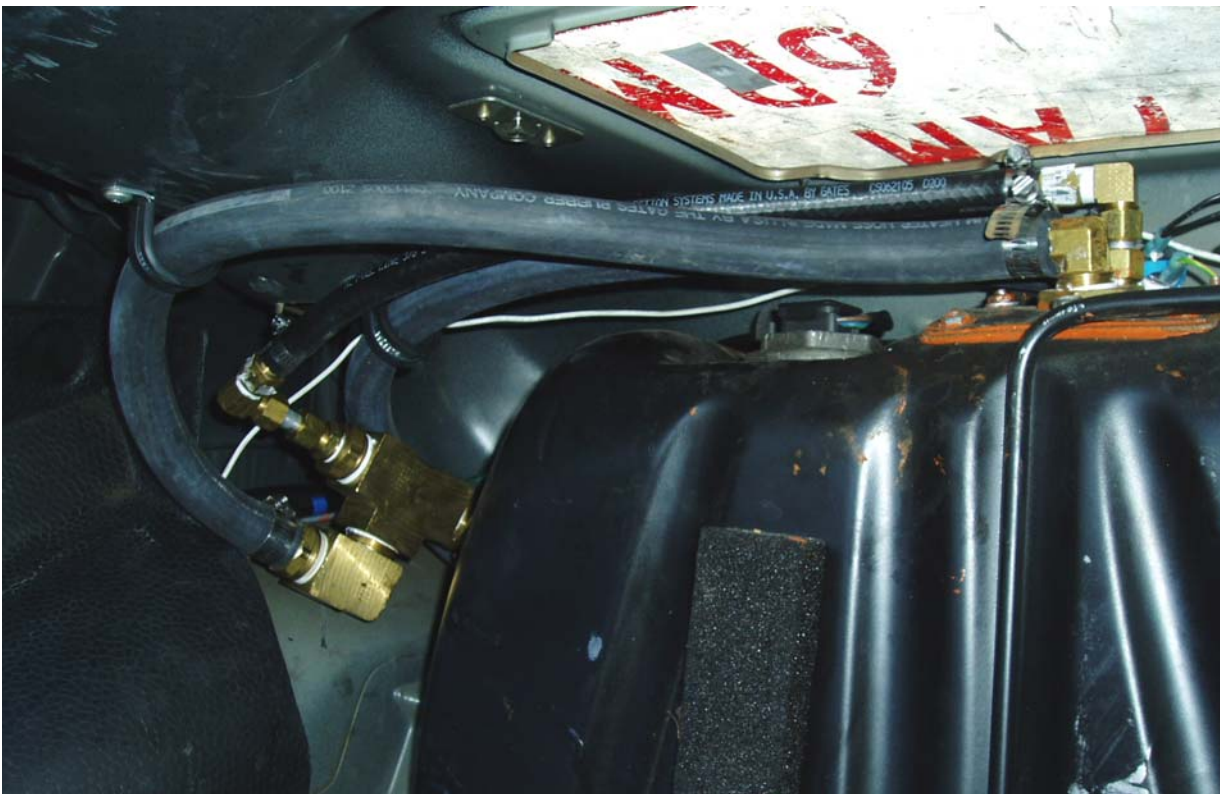
HOSES ROUTED. THIS BEND WAS VERY DIFFICULT WITH HOSE WITH ALUMINUM FUEL TUBE INSIDE



HOSES COME OUT OF SIDE CHANNEL UNDER THE REAR SEAT AND PASS DIRECTLY INTO THE TRUNK THROUGH THE ACCES FOR THE SHOCK. ALL HOLES ARE LINED TO WITH SPLIT TUBING TO PROTECT FROM CHAFING.



HIH IN TRUNK, DRIVERS SIDE.



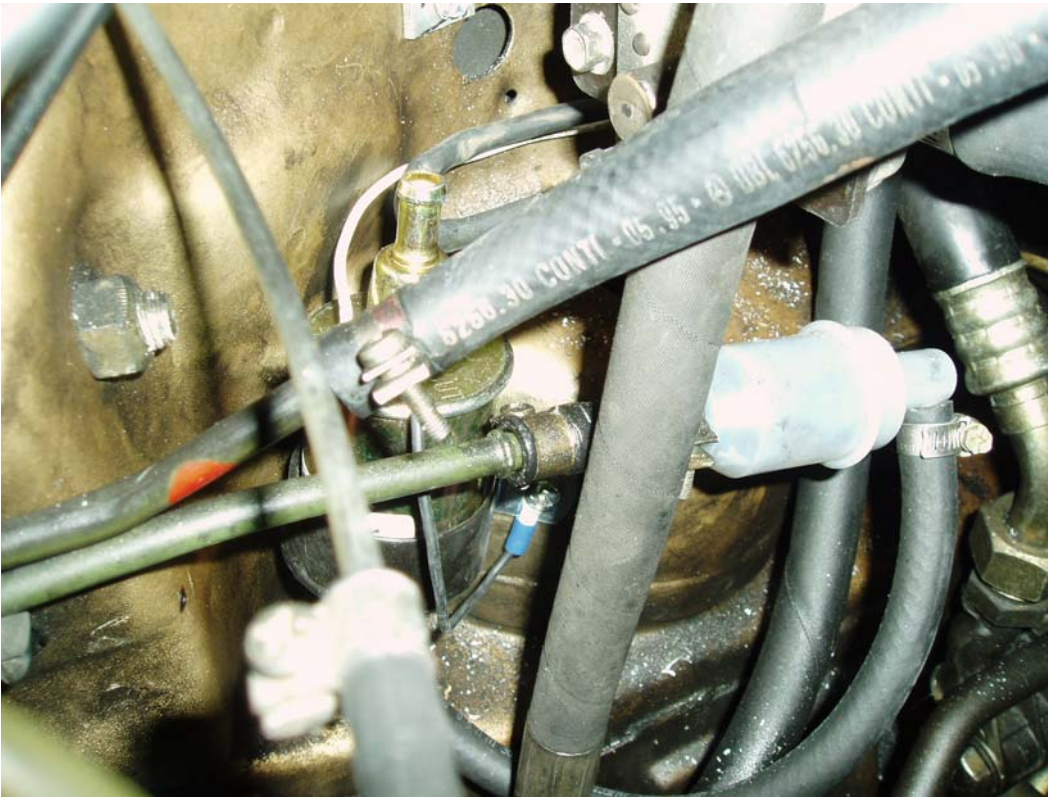
CONNECTONS TO FUEL TANK COOLANT AND FUEL. FIRST AID KIT REMOVED AND HOLE COVERED. YES, MANY OF MY ALUMINUM PARTS ARE MADE FROM A NO PARKING SIGN.



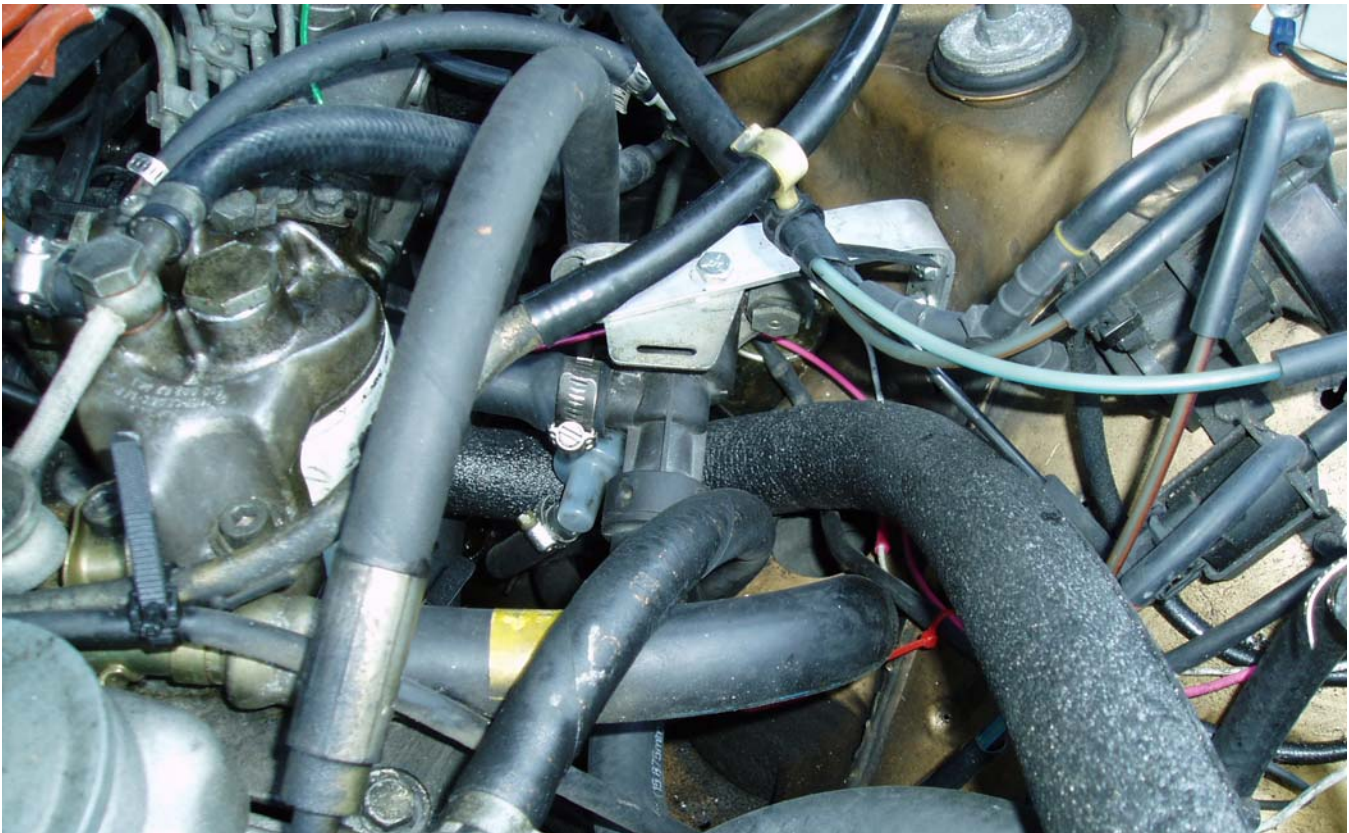
COOLANT RETURN
TEE'D IN BEFORE
AUXILLARY
COOLANT PUMP



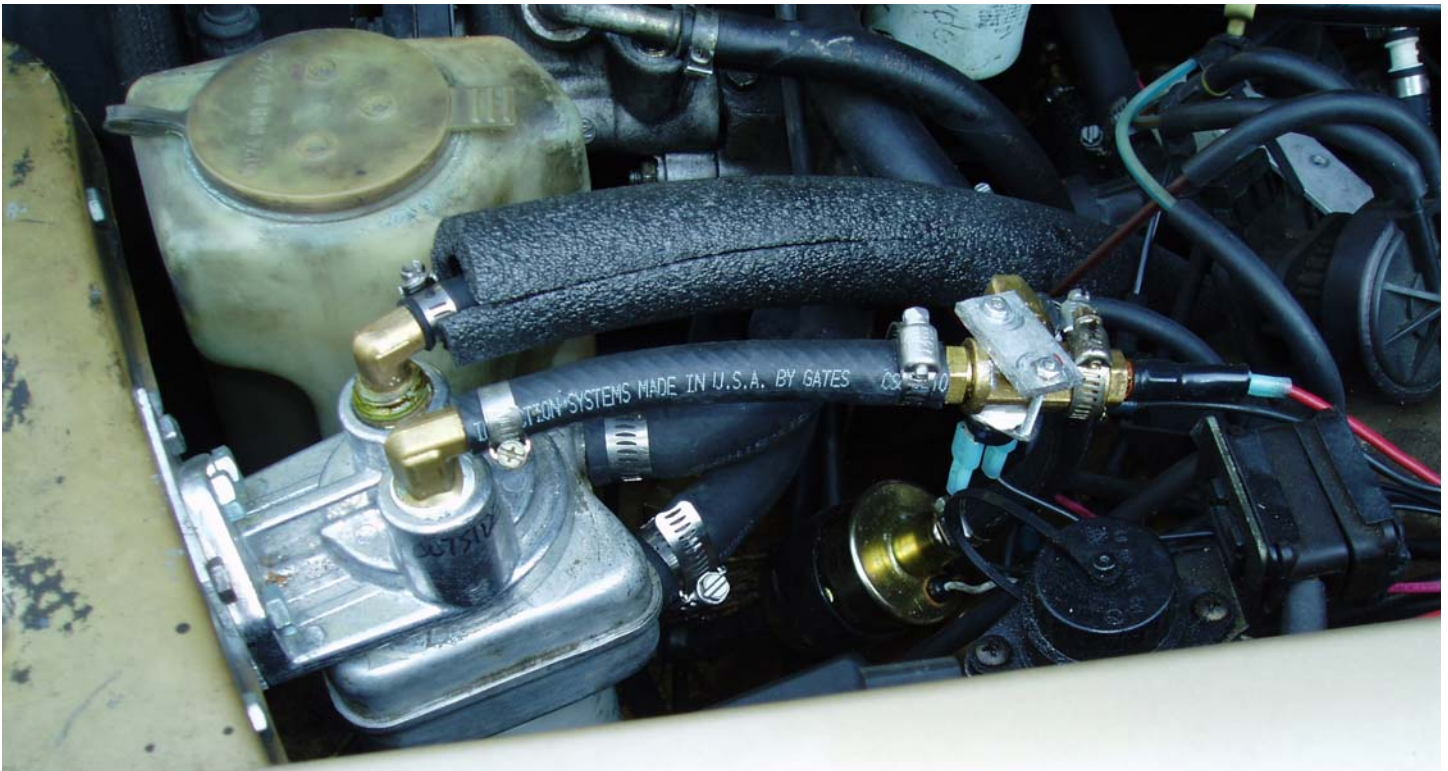
MECHANICAL LIFT PUMP
WAS REMOVED AND THE
HOLE COVERED WITH 1/4"
ALUMINUM PLATE
DRILLED TO MATCH.



DIESEL ELECTRIC FUEL PUMP MOUNTED TO INNER FENDER



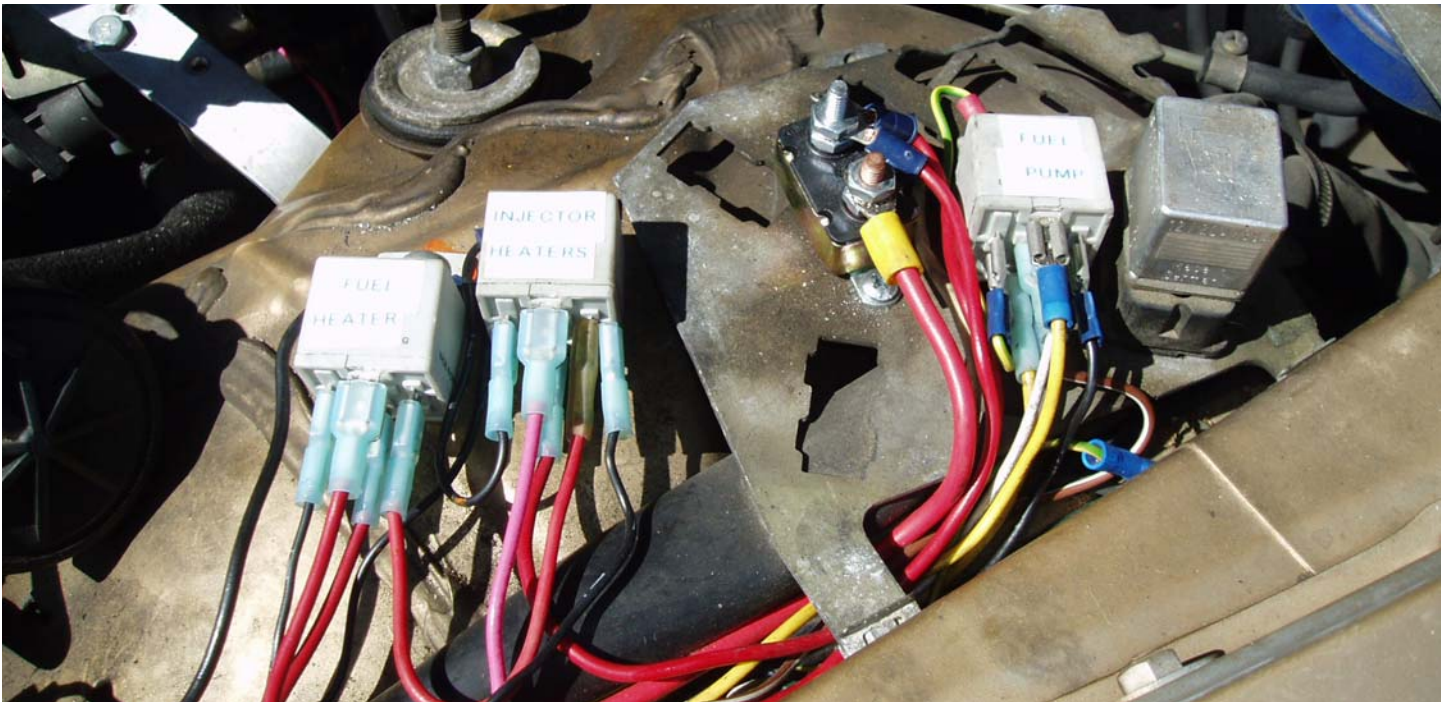
BENZ MONOVALE USED TO CUTOFF COLANT FLOW TO ALLOW DIESEL TO BE USED IN VEGOIL TANK



PLUMBING TO HEATED FILTER. GLOW PLUG LINE HEATER INSTALLED BEFORE FILTER. VEGOIL PUMP SHOWN BELOW GLOW PLUG HEATER.



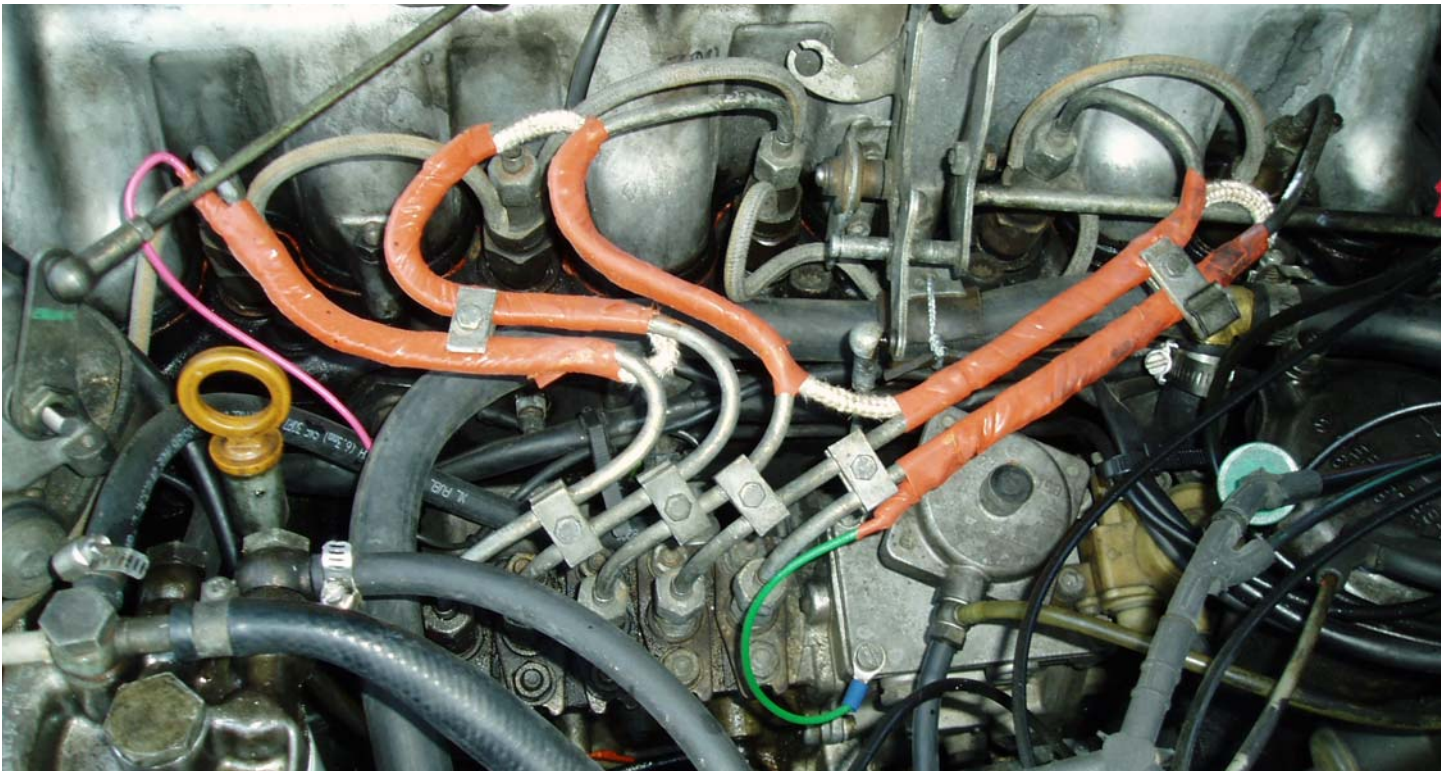
GLOW PLUG LINE HEATER AND THERMOSWITCH ALLOWS QUICKER SWITHOVER TIME



ELECTRICAL COMPONENTS GLOW PLUG FUEL HEATER RELAY, FATTYWAGON INJECTOR LINE HEATER RELAY, 30A BREAKER, FUEL PUMP RELAY IN THAT ORDER. WITH CAREFUL PLACEMENT MAYBE ALL COULD FIT UNDER THE PLASTIC COVER.



INLET BANJO FITTING THROUGH BOLT HEAD DRILLED AND TAPPED 1/8" NPT FOR CONNECTION FROM HEATED FILTER. THROUGH BOLT ON TOP OF FILTER TAPPED 5/16 UNF AND SET SCREW THREADED IN TO PLUG PURGE HOLE IN FILTER.



FATTYWAGON INJECTOR LINE HEATERS INSTALLED. ROUND EDGES OF INJECTOR LINE SPACERS SO THERE ARE NO SHARP EDGES. MEASURE THE "GAPS" AND DIVIDE THE REMAINING LENGTH BY 5 TO GET EVEN HEAT. USE A CLOTHESLINE FOR TRIAL FIT.



REED SWITCH ON FILL CAP DOOR TO ACTIVATE FILL ALARM



AND ALMOST AS IMPORTANT IS THE CUP HOLDER



