

WVO/WMO HP Fuel Line Heating Block for the Lister CS

by Wilhelm J van Dyk

This short description describes how to make an energy efficient Heated Fuel Line for the Lister CS Diesel engine to heat WVO or WMO to an expectable temperature for combustion. There are various other methods available, but I wanted to use excising heat as far as possible before using the minimum amount of electrical energy for final heating.

Amendment: *Due to the fact that this system heats the fuel above 90°C and I'm yet to see proof of higher temperatures being beneficial, I'm not going to implement Electrical Heating at this stage, but I might in the future. I left the figures for using Stainless Steel Wire to make an element in this document for your info should you decide to make one yourself.*

Legality: You can make the Lister CS Head Heating Block for personal use, but if you want to make/sell it commercially, I want to see bucks getting thrown my way! ;-)

Firstly, some accumulated useful information, courtesy from a thread at the following forum that a lot of people participated in:

<http://www.microcogen.info/index.php?topic=52.0>

Please note that some of the figures below has not been verified!

High Pressure Fuel Line/ Pipe diameters:

OD:	5mm	(0.197")
ID:	1.5mm	(0.059")
Length:	550mm	(21.65") (<i>Mine was 750mm</i>)
Volume:	972μ	(972mm ³ or 0.033 fluid oz.)
Pressure:	90bar	(1323psi)

Electric Heater Element for HP Line:

Approximately 100W are needed to get a temperature of 77 to 93°C (170-200°F)

100W = 1 44 at 12Vdc or 2 88 at 24Vdc

Stainless Steel Wire properties:

25 gauge SS wire @ 0.457mm (.0180")	= 1 36/foot (1foot = 304.8mm)
22 gauge SS wire @ 0.643mm (.0253")	= 0 68/foot (1foot = 304.8mm)

Flashpoint of diesel in open air is about 350°C

Normal diesel exhaust temperatures are between 254 to 284°C (490-545°F) from this document:

<http://www.inchem.org/documents/ehc/ehc/ehc171.htm>

Main objective of exercise:

As previously stated, I wanted to make use of the existing heat coming off the engine, to heat my WVO/WMO and only use electrical heating as a last resort to bring the temperature up to an acceptable level, with “as few watts” as possible and with some room to spare if I decide to increase the temperature in the future.

I run my generator setup as a backup system and it does not run for extended periods of time at this stage.

This means that it has to get up to operating temperature as quickly as possible from start-up if I want it to be fuel sufficient and last a long time.

I start/shutdown on diesel fuel and run WVO as the main fuel.

Problems I’ve been experiencing:

With conventional heating of the fuel supply pipe coiled around the exhaust, my problem was that at the time the fuel entered the high pressure pipe to the injector, it had already cooled down considerably and it had to be heated again. Even if I insulate the pipes!

I suppose one can heat the WVO around the exhaust to such a degree that it would still be acceptable at the injector, but I think that’s asking for trouble as the temperature will have to be very high! (I was concerned about boiling oil, scouring and such, also mentioned in the forum) The next acceptable solution was to heat the WVO up with an electrical heater element/tape around the HP pipe just before the injector, but I first wanted to try a different approach.

The plan:

I left my LP-line pre-heating coil around the exhaust to allow the WVO to be more viscous when it entered the Injector Pump, but now I didn’t have to worry about getting it to a higher than acceptable temperature for the pump.

I decided to make use of the area on the head where the original fuel filter was fitted, as it got quite hot to the touch and after fitting a thermostat to my system, the time it took to reach its maximum temperature was dramatically increased.

I wanted to use this “free heat” first, before using the smallest amount of energy possible, to finally get the fuel to injector temperature electrically.

I vision a block of metal with a recess and the HP-pipe clamped between the head and this piece of metal.

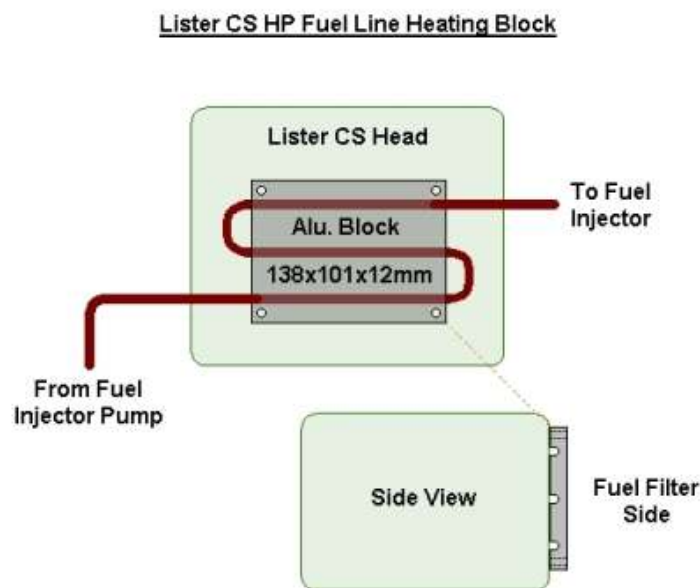
There was concerns about what the extra length of the HP-pipe would do, but my pipe is now 300mm longer (from 750mm to 1050mm) and from what I can tell, it made no difference.



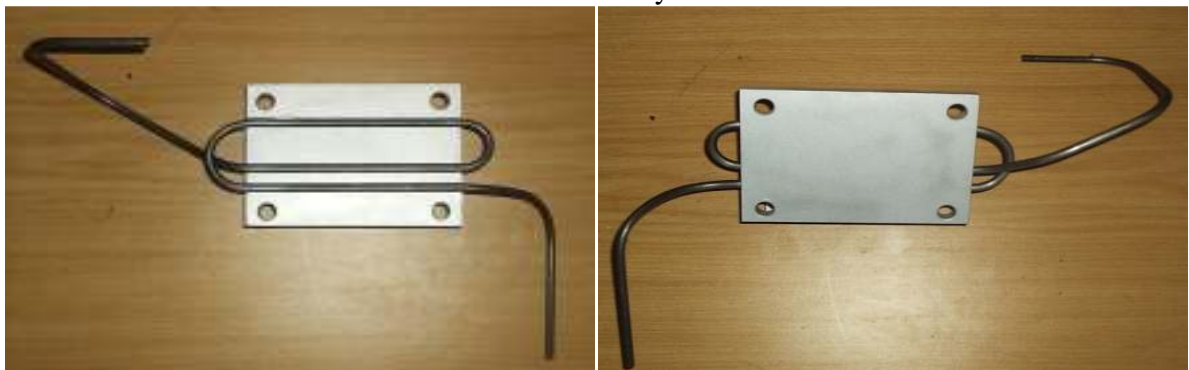
The Project/Exercise:

Firstly, the old saying, “A picture tells a thousand words!”

This was the original drawing, but the final product was slightly altered to accommodate the fuel pipe more efficiently: (Explained further down)



The next two pictures show the aluminium block with the pipe fitted, but the connector ends was not made off yet:



Please note: The way I had to run the pipe so that the radius of the half circles (180° bends) could be at its biggest to prevent “kinking” of the HP-pipe. Three grooves were cut where the pipes was recessed into the aluminium.

This is two pictures of the aluminium block heater fitted to the engine:



2nd note: I used some Silicone Heat Transfer Compound in between the aluminium block heater and the Lister CS head. (The stuff used for electronic components when you mount them to heat sinks)

My fuel filter housing is mounted on the cover of the water jacket to allow for the engine mounted fuel tank to “gravity feed” correctly, but it can just as well be mounted on the head as well, if one use longer studs or bolts, with the heat-block sandwiched in between.

Some temperature readings on efficiency:

I started the engine on diesel fuel and let it run with a 1500W load until my thermostat opened at 82°C after 15 minutes running.

I then changed over to WVO, leaving it with the same load and took the following reading:

Temperatures after 30minutes of running on WVO:

(My siphon flow water tank was only starting to get hot at the 1st ¼ or so from the top)

LP line entering Exhaust Heating Coil (Supply pipe):	15°C
LP line between Exhaust Heating Coil & Injector Pump:	75°C
HP line between Injector Pump & Alu. Heating Block:	30°C
HP line between Alu. Heating Block Injector:	93°C

Please note: These temperatures were taken with a IR “Heat Gun” and I’m not entirely sure about its accuracy!

Conclusion:

I think I’ve achieved my goal, but only time would tell if the system will last. I do think however that heating My fuel line with this method does have the advantage that it will still work to a degree if the electrical heater fails, if and when I fit one.

Further tests will be done in the future and I’ll amend this document accordingly.

I hope this might help someone one day,

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