Stag Cooling

by Chris Holbrook & Tanya Duke

Much has been written on this subject; everyone has opinions, and some ideas work better than others. Recently, the Editor of **Stag News** asked us to put pen to paper, and provide details of what each of us did to our Stags to change, and hopefully improve, our cooling systems.

Firstly, if there are overheating problems, a proper diagnosis and cure is vital before making any changes to the overall system. For example, a retarded ignition setting or lean mixture, or perhaps clogged internal waterways in the block or in the radiator core can make an engine run very hot.

Electrical Water Pump Solution

In the case of the first author's Stag, from the moment it was purchased, there didn't seem to be any particular reason for the hot running, but the engine certainly needed a rebuild as was evident from the condition of the main and rod bearings. It therefore seemed highly likely that other problems could be lurking and contributing to the hot running. We carried out a patch up operation on the bottom end, and ran the car for a couple of summers before getting down to the serious stuff.

There is also the question of how hot is too hot? The needle on the temperature gauge consistently ran at ¾ or a bit more, and it sometimes came too close to the red mark for comfort. However, is that gauge accurate?

Anyway, first we fitted a larger capacity radiator from Tony Hart, and later on headers, together with a straight through exhaust system, also from Tony Hart. The radiator certainly helped, but the exhaust also made a very big difference. The Stag exhaust manifolds are far from efficient, and getting rid of hot exhaust gasses is a high priority in getting a cool running engine. These two items alone brought the needle down to nicely below that ¾ level.

After the rebuild, the cooling system certainly settled down, and all ran well until the water pump failed. As we all know, on the Stag and TR7 this is a gear driven unit, and it turned out that the gears had been worn down to nothing. The question of course was why. Was it incorrect assembly resulting in insufficient clearance between the gears, or a lack of lubrication, or poor quality replacement parts? The car had run about 30,000 miles before failing. Replacing the pump and jackshaft did not seem an ideal answer, because the problem could possibly occur again.

We looked around for other ideas, and came across the electric pumps manufactured in Australia by Davies Craig. The cost of the pump, digital controller, and fan was comparable to the cost of a new pump and jackshaft, and very much easier to install.

The electric pump is fitted on to the bottom radiator hose, thus ensuring a good head of coolant. The thermostat was removed, because since the pump is external to the engine it cannot circulate the coolant during the warm up period with a thermostat in place. The original pump was removed, and replaced by a very nice aluminium bung made by Dave Lawrence, a TSC member, in Canada.

The Davies Craig system is controlled by a digital probe in the upper hose - Image: Terence McKillen

The fan is mounted towards the hot side of the radiator (top right looking from the front) as a pusher fan, and I have boxed in the sides of the radiator going all the way forward to the grille. The car bodywork completes the top and bottom of the box. In this way I can be sure that the vast majority of air passing through the grille does go through

Davies Craig Electric Pump # EWP115

Image daviescraig.com.au

the radiator, rather than some of it disappearing around behind headlights, etc.

There is one single temperature sensing unit which fits into the top hose, and which is connected to the controller. The controller, mounted inside the car, is in turn connected to the pump and the fan. The temperature can be set anywhere from 75^0C to 95^0C, in 5^0C increments, and the controller does the rest. Moreover, when the engine is switched off, the pump and or fan will run if needed for up to two minutes, to avoid building up heat, and the engine becoming a heat sink.

Additional cooling is achieved with TR8-type louvres in the bonnet, positioned just about above the carburettors. This is about as far back as seemed practical to ensure as much hot air would come out as possible. When the fan runs, there's quite a blow out of these louvres.

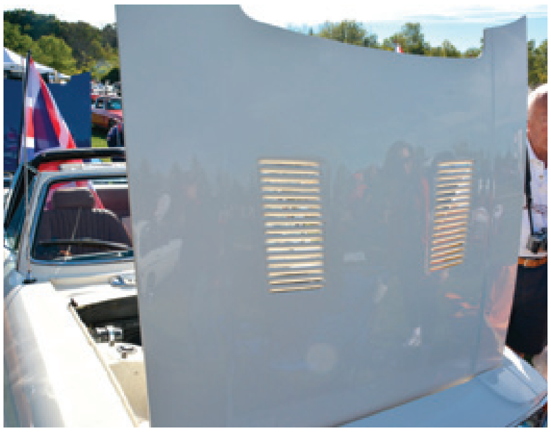
The system is really very straightforward. The electric pump cycles depending on the coolant temperature. At first it comes on, and then immediately switches off as the engine is cold. As the engine warms up, the pump switches on and off as needed, and at varying speeds, gradually staying on for longer periods of time, and running progressively faster, until the engine gets to its programmed operating temperature. The fan comes on and off as necessary, working in conjunction with the pump.

The principal risk to this seemed to be the possible failure of the switches, so we fitted two direct power leads to the battery for the pump and the fan. In the event of a switch failure, then the battery connection could be plugged in. In this event of course the pump and fan would run continuously, but the car would get home.

The system is set at 85^{0}C on the digital controller, and works really well, and we have a very happy engine.

So, my Stag cooling system comprises the following components:

- A larger capacity radiator from Tony Hart.
- Crankshaft mounted fan removed, radiator shroud removed (with a pusher fan you need all of the radiator exposed to the airflow in and out without any restriction to flow).



Additional cooling is achieved with louvres in the bonnet - Image: Terence McKillen

- Maradyne Champion Series electric fan, 14" 225 watt 17.2 amp 2135 cfm at 0" static - part number M142K. You can see this at www.maradyne.com
- Davies Craig Electric Water Pump EWP115 (the aluminium one, and the hard nylon one is in the boot as a spare) fitted in the bottom radiator hose directly below the outlet.
- Davies Craig Digital Controller 8020, with the temperature assembly fitted in the top hose. You can see the Davies Craig components at www.daviescraig.com.au
- I fitted a Stag Mk I bleed valve (fitted in the top hose of Mk I cars) on to the radiator filler plug.
- I fitted an auxiliary electric pump, also from Davies Craig, for the heater. Because the main pump cycles, it may not feed the heater very well. I also fitted a feed from the RH head to join the one from the LH head so that both feed the heater. In my installation, these two go to the auxiliary pump intake.
- The aux. pump outlet then passes through a tee piece with a threaded cap, and goes on to the heater control valve, and in to the heater box. The tee piece cap allows me to ensure the system is absolutely full as it sits just high enough to be above the bleed valve on the radiator. I can top up here and see the coolant bleed out of the valve on the radiator filler plug, thus ensuring there is little, if any, air in the system.
- Finally, I fitted an overflow pipe to the expansion bottle, which goes into a TR6 overflow bottle. The expansion bottle has its normal 20lb cap, and is completely full. As the engine warms up to normal operating temperature, coolant will flow out of the expansion bottle and into the overflow bottle, and it is then sucked back as the engine cools.

Finally, in the case of our car, we have a different set of camshafts which boost engine output considerably, a Holley 390cfm carburetor, UK spec distributor advance/retard, UK spec domed high compression pistons, Pertronix electronic ignition, as well as the exhaust upgrades mentioned earlier. Power is up quite a bit, and as we all know, more power creates more heat when it is used .... and we do use it!

However, it all seems to work very well, with the temperature gauge sitting at about ½, drifting up to about half way between ½ and ¾, and then going back down

Chris located the pump & fan controller on the side of the centre console - Image: Terence McKillen

to ½ following the fan kicking in.

Now, I realize that many of you have your engines cooling very well with the standard components and as indicated by your dashboard temperature gauge. Of course we can never be sure of the differences in how the different systems perform because these gauges can read temperature differently. The only way to make comparisons between cars is with an infra-red temperature probe. [*Differences in temperature sensors and the voltage stabilizer can also affect the gauge needle deflection* – ***Ed.***] However, the stability and controllability of this electrical system is most impressive, and the way the pump and fan continue to run after the engine is switched off to avoid the heat sink effect, is very a big advantage.

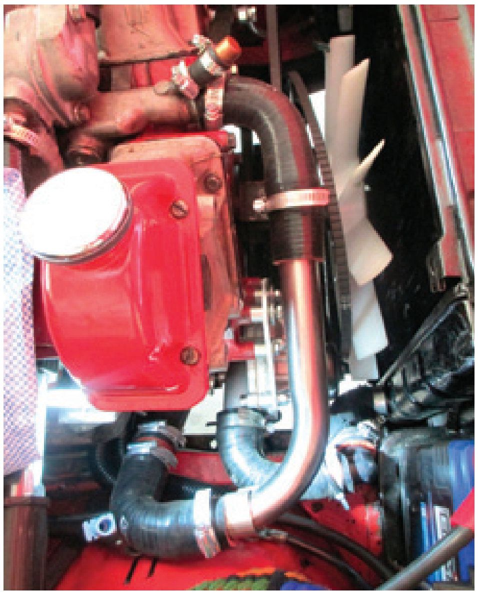
Mechanical Water Pump Solution

The second author chose to fit a belt-driven, external water pump system, as perfected by Steve Hill in the UK, ('Stagdad' on the UK SOC forum). Unfortunately, Steve has decided not to continue making the fondly nicknamed 'Daddypump'. However, he has given me permission to write about the kit, but a more detailed write-up with measurements obtained from my car might better be covered in another, separate article.

The decision to install Steve's kit came when I discovered the internal water pump and the jackshaft were not happy playmates, and were sending metal swarf into the engine. My lack of mechanical skills swung me towards installation of the Daddypump rather than replacing the internal pump and potentially, the jackshaft. Before I came to removing the internal pump, the car had given no signs of overheating but I hadn't owned it for long and hadn't yet tested it under any challenging conditions. I had the radiator flushed and repaired, but that was all. While I had the car up on axle stands I did give the cooling system a flush out and scoured out any casting sand caught behind the two engine drain blocks using the end of a coat-hanger. I installed a capillary water temperature sender/oil pressure gauge and also added a Stagweber header tank system (www.stagweber.co.uk) and plumbed it into the top radiator hose.

The kit uses a mechanical pump from a Ford Essex 3.0L V6 engine complete with a mounting plate for installation where the alternator normally sits. Make sure you get both parts of the pump (FWP 1810) and not just the front part (FWP1193). Steve also made connections to enable the cooling system to incorporate the interior heater matrix. Also provided was a bung to replace the internal water pump, various sundries and some great instructions. Other instructions with photographs, written by another Stag-owner, can be found on the SOC forum (socforum.com/forum/showthread.php?8516-Water-pump-fitting-

Mechanical pump for a 3L Ford Essex engine



External belt-driven pump in place with original lower hose connections to original radiator - Image: Tanya Duke

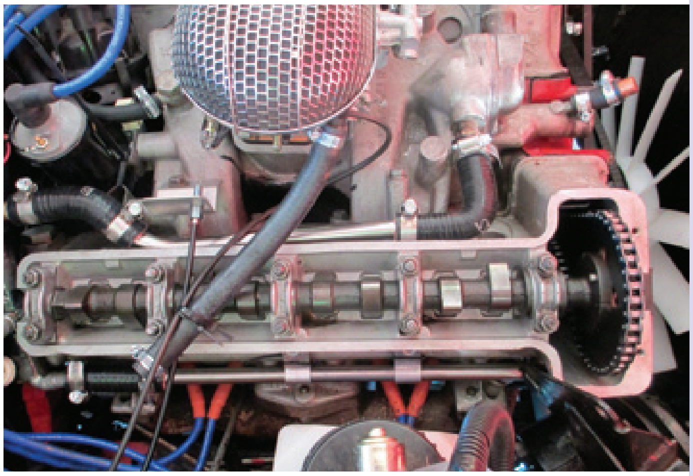
instructions&highlight=Fitting+ford+water+pump - members only). The silicon hoses were the most challenging to obtain in terms of delivery. I bought hoses from HPS Performance Silicon H oses in LA (www.hps-siliconehoses.com) for the most part, but they did not make a U- shaped hose, so I bought these from Viking Extrusions, UK (www.vikingextrusions.co.uk) but shipping took over a month to Canada.

The first job was to re-site the alternator to a higher position on the left hand side of the car. I used a bracket from Tony Hart and this continues to work fine on my car. The original water pump is removed, and the custom-made bung is placed to block the internal water pump opening to the jackshaft. In my case, after replacing the inlet manifold and filling the system with coolant, there was a leak from the pump area and I had to take off the manifold again and reposition the bung; evidently I hadn't driven it in securely enough! Some Vaseline around the bung enabled it to sit tighter and the top of the bung was now flush with the block. The bypass is blanked off with a supplied blanking plug and the thermostat remains in place. At the heater matrix end there is a bleed valve included in the connecting copper tubing situated just behind the right hand cam cover, which makes refilling the system easier.

When the thermostat is closed, coolant pumps around the heads and out the bypass just behind the thermostat, along the small metal pipe in the V to the back of the engine where it passes the heater outlet which is teed into it. If the heater is on the exit coolant from the heater joins the bypass coolant and they both travel into a new metal pipe that runs along the RHS head (attached to head bolts) towards the front of the engine where it enters the small inlet to the pump to be recirculated. When the thermostat is open, the bypass is shut off so now only the heater exit coolant will use the new pipe.

The external pump takes colder coolant from the lower radiator and pumps it higher to cool the engine banks. Hot water is directed to the radiator when the thermostat opens and to the heater matrix. The header tank cannot be installed as per the instructions which came with this particular kit. I had to get another spigot placed on the left hand side about halfway down the radiator in order to plumb the header tank correctly. If this is not done, the external pump would force coolant into the header tank.

The car ran fine once everything was installed and the cooling system was adequate, although it became marginal on hot days in standing traffic. I decided to replace the original radiator with an aluminum radiator from Wizard Cooling, in Buffalo (www.wizardcooling.com). I had to get Wizard to custom adapt the radiator before shipping which involved many e-mails back and forth to ensure measurements were correct. The radiator did require some adjustments in order to make it fit my car, but to accommodate the external pump, I found I had to get a local aluminum welder to change the lower hose spigot so that it turned about 20⁰ to the vertical as soon as it exited the radiator in order to clear the fan and pump. At this time, I replaced the lower hoses (joined with a plastic elbow) into the radiator with a custom made silicon hose that Steve had developed; expensive, but there are fewer clamps to worry about.



A new return rail runs back to the external pump while the other rail in the V goes from the bypass behind the thermostat to the back of the engine where it T-joins with the heater outlet - Image: Tanya Duke

The car now copes well with high ambient temperatures, especially when moving. The temperature gauge does start climbing if the car is stationary on a hot day, but the heat dissipates rapidly once the car is moving. The next step would be to install a supplemental electric fan in case I anticipate driving through a major town with high density traffic on a hot day; that isn't quite Saskatoon…not yet! **SN**

New silicon lower hose connecting pump to new radiator. The power steering pump is removed for clarity - Image: Tanya Duke

It would appear that the consensus here is to ensure that any underlying issues contributing to overheating are resolved first and that the standard OEM cooling system is operating properly.

Modifications from original to consider:

- *Install accurate temperature gauge or calibrate existing*
- *Add electric cooling fan*
- *Ensure radiator cowl is in place and consider adding a spoiler below front bumper to divert air through the radiator instead of spilling out under the car*
- *Possible upgrade to four-core radiator with header tank*
- *Change water pump*

The type of coolant used appears to be of far less importance - **Ed**.