# V12 cooling system upgrades via Norman Lutz.

By NORMAN A LUTZ.

In 1966 at the tender age of 23, after recently graduating and having gainful employment, I purchased my first Jaguar, a 1964 E FHC Vin# 8601188, to satisfy my need for speed.

A membership of the Jaguar Car Club of Victoria followed, as member #62.

At that time the club was very sportingly orientated with Autokhana's, track days and a team participation in the yearly 6 hour relay, exactly the environment a young guy with a fast car felt at home in.

But every silver lining has to have a cloud, right!

I had a car that whilst travelling long distances at speeds in excess of 100mph performed flawlessly, but in slow moving city traffic or on the track ran exceedingly hot, just quite not boiling, until you stopped and it dropped heaps of water out the overflow.

That we had hot spots in the head that super heated the water to create steam that ejected boiling water seemed fairly obvious. The fact that the system was pressurized at only 4psi did not help as it provided very little head room over the normal 100C boiling point.

The installation of a 7lb cap off the later 4.2 did little to help, reinforcing my belief that the water wasn't doing an adequate job.

Unfortunately around 18 months after purchase, I wrote the car off, definitely solved the overheating problem.

Subsequent purchase in 1968 of a 1966 4.2 FHC, Vin #1E21003, got me back into the fray with the same old overheating problem.

As a mechanical engineer I felt there had to be a logical answer to this problem and decided to remove the new log style manifold that had replaced the old two piece one with the separate water rail as used on the 3.8.

The water ports in the head were identical.

I decided to borrow a friends 3.8 for some trials, as the bolt on water rail allowed quick change of orifice size.

Three spacer plates were made with identical holes with a total area of 0.887sq.in. (0.3sq.in.ea.) equal to that of the area of the thermostat and bolted between the intake manifold and water rail.
The vehicle was extensively road tested thru a hot summer and very little improvement was noted. I then remembered some experiments we did in college with water and electricity, both these “fluids” reacted in the same way, always taking the path of least resistance.

This made me think that at low rpm the water flow might be greater thru the front of the head than at the rear.

The area of the water rail outlets were 0.60sq.in. each but only 0.5sq.in. at the head face.

The rear spacer was opened up to 0.50sq.in. and spacers with an area of 0.25sq.in.in the centre and 0.13sq.in the front ports was inserted for a total of 0.88sq. in.

This approximated the thermostat area

Road testing showed that the boiling problem was to all intents eliminated.

These tests in 1968-69 led to my modification of the V12 E in the 70’s

NB. Jaguar XK engines continued to have cooling problems until the end of production in 1987.

The V12 had cooling problems for its 25 year life.

# COMPONENTS OF JAGUAR V12 ENGINE

## COOLING SYSTEM

## CARBURETTOR - E TYPE / XJ12

| ITEM | BORE IN. | AREA IN. |
|---|---|---|

| | | |
|---|---|---|
| TOP RADIATOR HOSE | 1.25 | 1.23 |
| THERMOSTAT HOUSING OUTLET | 1.00 | 0.79 |
| THERMOSTAT BORE | 1.06 | 0.89 |
| WATER TRANSFER PIPE | 0.90 | 0.64 |
| WATER MANIFOLD HOLES (x 4) | 0.70ea . | 0.39 x 4 = 1.56sq.in. |

We can see that the water manifold feed to the transfer pipe is 0.39 x 4 = 1.56 sq.in.

This means that neither the water manifolds nor the thermostat have any control over water
Flow thru the head.

# FI JAGUAR V12 ENGINE

| ITEM | BORE IN. | AREA IN. |
|---|---|---|
| TOP RADIATOR HOSE | 1.25 | 1.23 |
| THERMOSTAT WATER HOUSING | 1.00 | 0.79 |
| THERMOSTAT BORE | 1.06 | 0.89 |
| WATER TRANSFER PIPE | 0.645 | 0.33 |
| WATER MANIFOLD HOLES (x 4) | 0.70ea. | 0.39 x 4 = 1.56sq.in |

Now we see that the area of the transfer pipe is less than the area of one water manifold hole.

It is clear that the front manifold are a of 0.78sq.in is more than double that of the transfer pipe, so restrictors In the front manifold are needed to get a more even temp throughout the head.

SEE "MATHEMATICAL ANAYSIS OF JAGAUAR V12 COOLING SYTEM"

# MATHEMATICAL ANALYSIS OF JAGUAR

# V12 CARBURETTOR COOLING SYTEM

By Norman A LUTZ

## MODIFICATIONS

| ITEM | DIA. . IN. | AREA. SQ.IN. |
|---|---|---|
| THERMOSTAT HOUSING OUTLET | 1.00 | 0.79 |
| THERMOSTAT | 1.06 | 0.89 |
| WATER TRANSFER TUBE | 0.90 | 0.64 |
| WATER MANIFOLD PORT(S) | 0.70 | 0.39 (x4) |
| | TOTAL | 1.56 |

Manifold port restrictors sized as follows,

| | | |
|---|---|---|
| 1st - OR FRONT HOLE | 0.125 | 0.012 |
| 2nd - HOLE | 0.50 | 0.20 |
| 3rd - HOLE | 0.50 | 0.20 |
| 4th - OR REAR HOLE - STD | 0.70” | 0.39 |
| TOTAL PORT AREA OF F & R MANIFOLDS IS | | 0.80 |

EQUAL TO THE WATER OUTLET AREA

GIVING 16% TO THE FRONT AND 74% TO THE REAR

REV: A NOV 1, 2010

# MATHEMATICAL ANALYSIS OF JAGUAR

# V12 FI ENGINE COOLING SYTEM

By Norman A LUTZ

## STG 1. MODIFICATIONS

| ITEM | DIA. IN. | AREA. SQ.IN. |
|---|---|---|
| WATER OUTLET | 1.00” | 0.79 |
| THERMOSTAT | 1.063 | 0.89 |
| WATER TRANSFER TUBE | 0.645” | 0.33 |
| WATER MANIFOLD PORT(S) | 0.700” | 0.39 (x4) |

To achieve adequate water flow thru rear of head, port area of front water manifold should not exceed 50% that of transfer pipe.

You will also see that the area of the transfer pipe is less than 50% of the outlet area, not a good thing.

By installing restictor plugs in front manifold we can direct water to the rear of the head to produce a more effective cooling outcome.

Front manifold ports sized as follows,

| | | |
|---|---|---|
| 1ST - FRONT HOLE | 0.125” | 0.012 |
| 2ND – HOLE | 0.50 | 0.20 |
| | | ——— |

| | | |
|---|---|---|
| | TOTAL | 0.21 |

THE STG. 1 MOD IS SUITABLE FOR MOST DRIVERS.
GIVING 36% FLOW TO THE FRONT AND 64% T0 THE REAR

FOR THOSE THAT USE THEIR CARS IN A SUSTAINED HIGH SPEED CRUISE MODE OR THE OCCASIONAL TRACK DAY THE STG 2 MOD IS RECOMMEND..

# STG 2 MODIFICATIONS

This stage removes the standard water transfer tube and adds a large bore tube for maximum flow.

The front water manifold is as per STG 1.

The transfer bore of the water manifold(s) is 0.860 for an area of 0.58 sq in. so we add a restrictor to the rear manifold as follows.

| ITEM | DIA IN. | AREA SQ.IN. |
|---|---|---|
| WATER MANIFOLD PORT(S) | 0.70” | 0.39 x 2 |
| MANIFOLD TRANSFER PORT | 0.86” | 0.58 |
| 3rd - HOLE | 0.50” | 0.20 |
| 4th - OR REAR HOLE - STD | 0.70” | 0.39 |
| | | ——— |
| This now gives us a total port area in the rear manifold of | | 0.59 |
| TOTAL PORT AREA OF F & R MANIFOLDS IS | | 0.80 |

EQUAL TO THE WATER OUTLET AREA

GIVING 16% TO THE FRONT AND 74% TO THE REAR