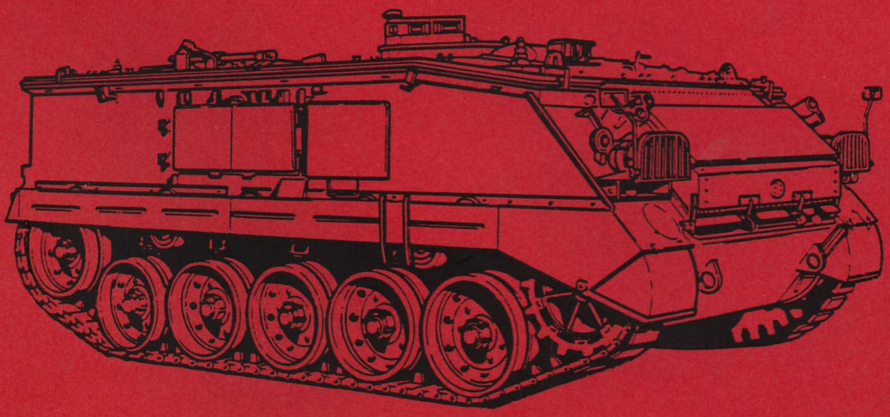
School of Electrical and Mechanical Engineering
BORDON HAMPSHIRE.

WARNING!
This is not a TQM authorised document — the information may have been superseded.

FV 430 SERIES



SEME REF NO: V2/18

CHAPTER 3

Cooling System

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

3.1 COOLING SYSTEM LAYOUT AND CONSTRUCTION

See Figs 3.1 and 3.2.

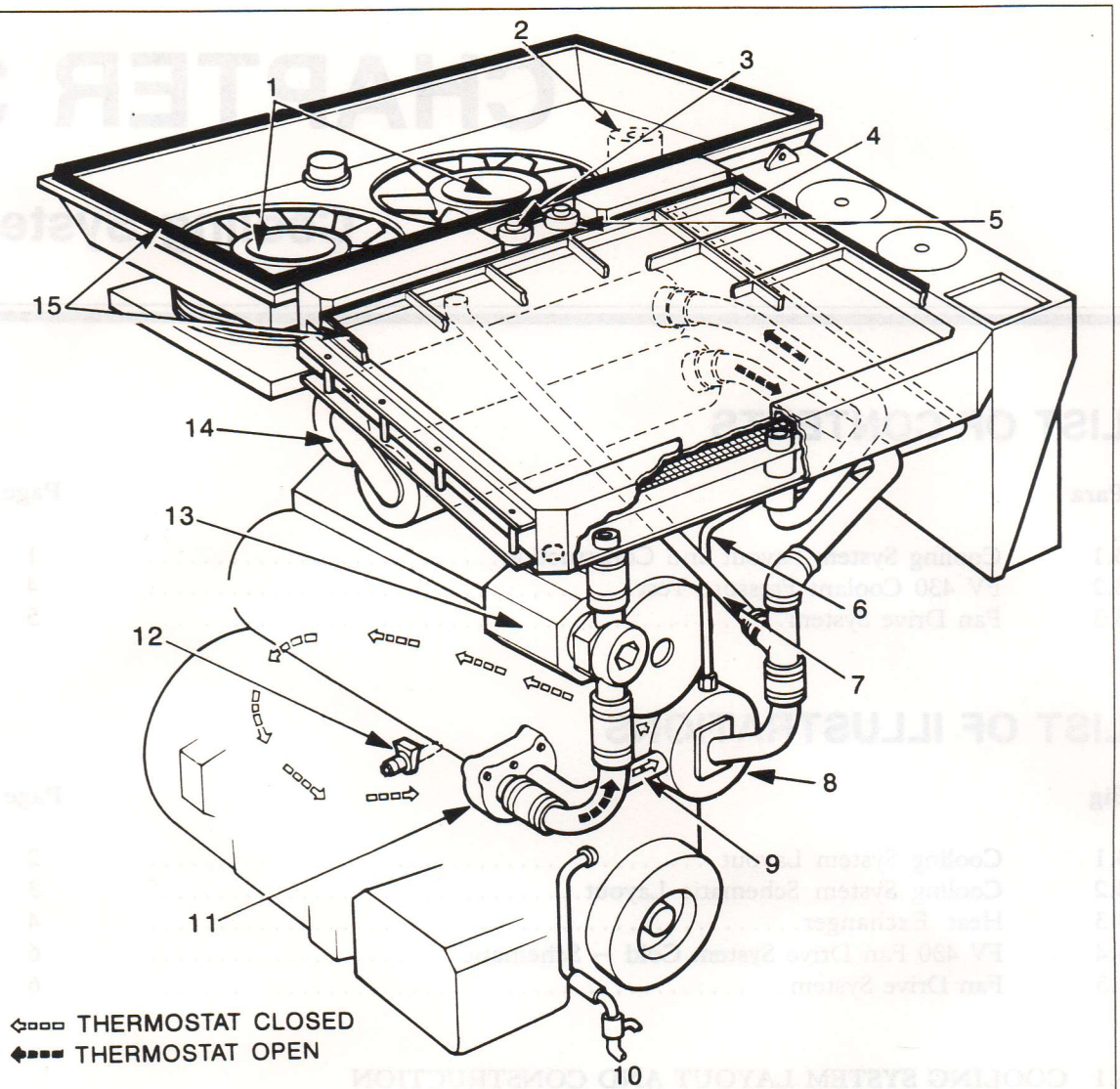
The cooling system follows normal cooling system layout with some minor differences. The normal coolant temperature should be 180—200° F, with a maximum of 220° F.

a. The **radiator** is of the two-pass type. The lower header tank being divided, separating the upper and lower matrices, and the upper header tank linking both matrices. The coolant enters the lower half of the lower header tank, passes up through the lower matrix into the upper header tank, back down the upper matrix into the upper half of the lower header tank, then exits round the system.

b. **Pressure, Vacuum Relief Valve.** The combined valve is situated on the upper radiator header tank. The pressure valve should open at 9·5—10·5 lbs/in^2 and the vacuum valve should open at 1 lb/in^2 below atmospheric.

c. **Coolant Pump.** The pump is of the centrifugal type and is driven from the air crankshaft, via the Rootes blower. The pump has two inlets and one outlet, one inlet from the heat exchanger and the other from the by-pass circuit.

d. **Thermostat.** This is a wax type thermostat and is situated on the right hand side of the engine below the fuel injection pump. The thermostat housing has two outlets, one to the radiator, the other to the by-pass circuit.

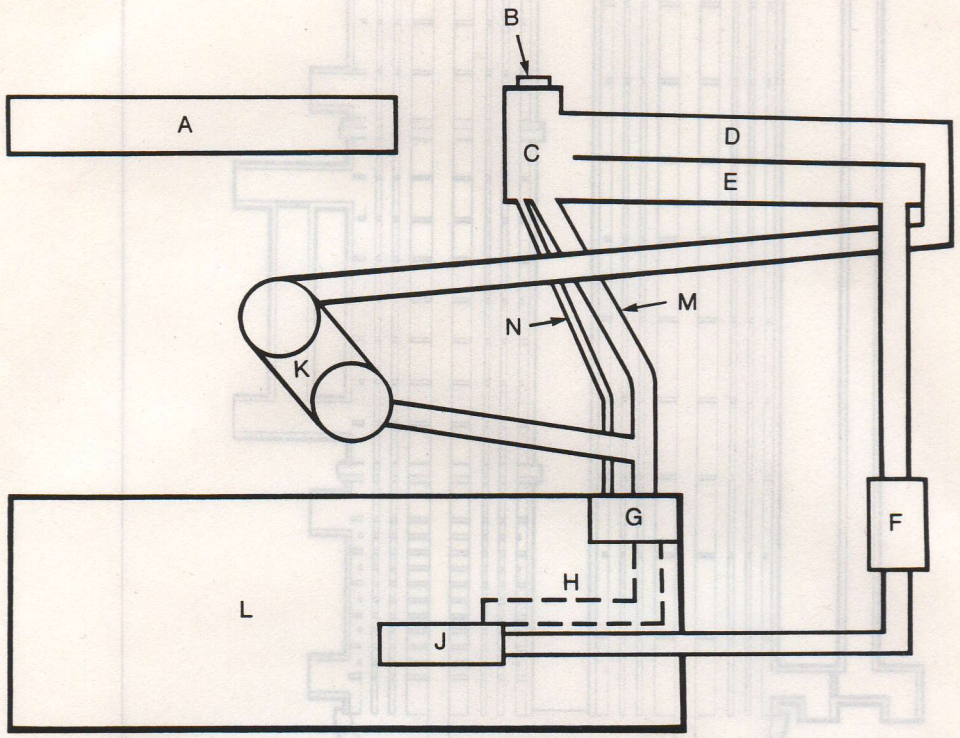


1. **Fans**
2. **Expansion Tank**
3. **PVRV**
4. **Two Pass Radiator**
5. **Filler Cap**
6. **Vent Pipe**
7. **Balance Pipe**
8. **Coolant Pump**
9. **Thermostat By-Pass**
10. **Drain (from cyl block)**
11. **Thermostat**
12. **Drivers Temp Gauge Sender Unit**
13. **Hydraulic Fan Controller**
14. **Heat Exchanger**
15. **Rubber Sealing Strip**

Fig 3.1 Cooling System Layout

e. **Balance Pipe.** This pipe is situated between the coolant pump inlet and the underside of the header tank. It acts as a relief line should there be any resistance to flow through the radiator or heat exchanger, either due to a blockage or increased flow at high engine revs, or if the level of coolant in the radiator is too low.

f. **Vent Pipe.** The vent pipe is a small bore copper tube fitted between the top of the pump and the underside of the upper header tank, to prevent air locks or cavitation of the pump when refilling the system.



A. Fans
B. PVRV
C. Header Tank
D. Upper Matrix
E. Lower Matrix
F. Fan Controller
G. Coolant Pump
H. Thermostat By-Pass
J. Thermostat
K. Heat Exchangers
L. Engine
M. Balance Pipe
N. Vent Pipe (Anti-cavitation)

Fig 3.2 Cooling System Layout — Schematic

g. **Heat Exchanger.** See Fig 3.3. This consists of four units, one for each of the following: gearbox, steering unit, engine and hydraulic fan drive. They are clamped together to form two cylinders. There is a transfer tank at one end, and an inlet and outlet head at the other. The coolant flows through numerous tubes mounted axially on the units, in through the rear cylinder, through the transfer tank, and out through the front cylinder. Each oil section has its own oil inlet and outlet unions. The baffles which support the tubes ensure that maximum contact between oil and coolant tubes is maintained. The gearbox and engine units have relief valves to by-pass their respective sections should they become blocked.

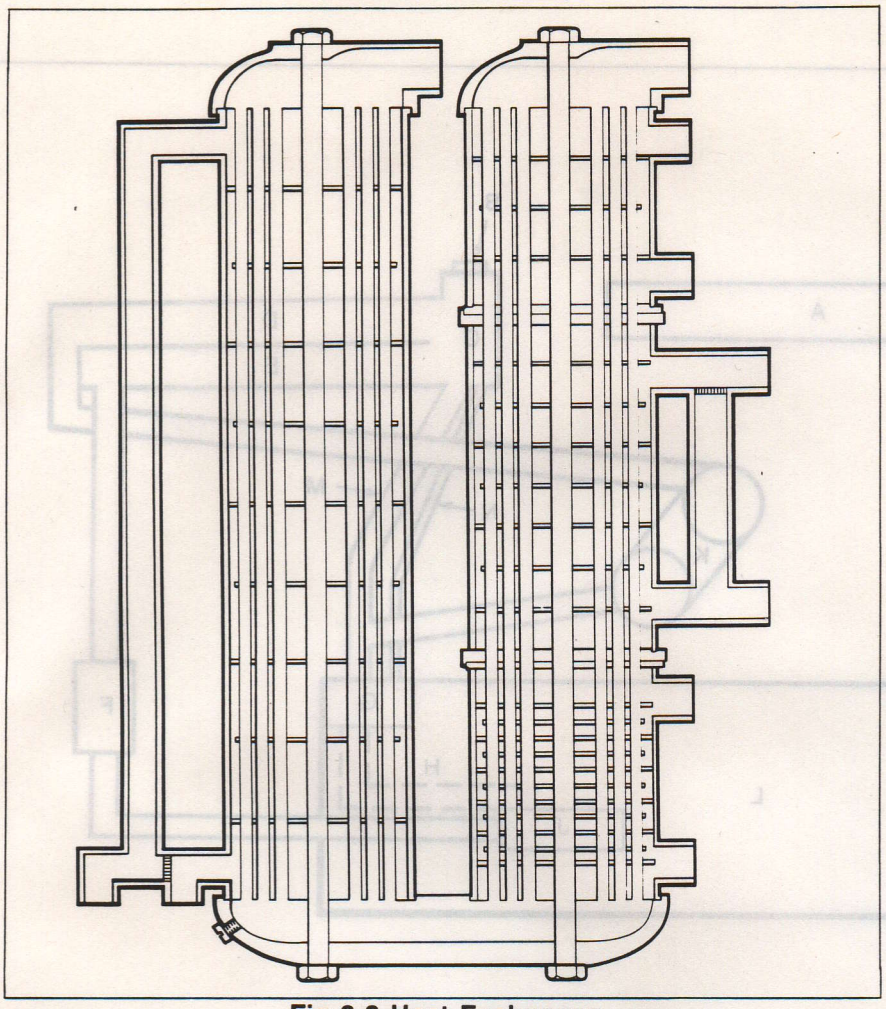


Fig 3.3 Heat Exchanger

3.2 FV 430 COOLANT PRESSURE TEST

a. **Cold Test**

(1) Check SG reading and coolant level.

(2) Check cap seal and pressure tester, by pressurising cap above radiator PRV operating pressure.

(3) Remove rad cap. Fit tester to rad PVRV outlet tube, operate tester pump, gauge should read 1 lbf/in^2 $\pm$ ·5.

(4) Apply tester to rad filler neck and pressurise to maximum reading. This should be between 9·5 and 10·5 lbf/in^2. The system should hold this pressure for 15 minutes.

If pressure loss occurs during this test, suspect an external or internal leak, or PVRV or rad cap seat faulty.

b. **Hot Test**

(1) Release pressure and refit tester to filler neck.

(2) Start engine and run to normal working temperature — 180° to 200° F. Pressure and temperature should rise at the same rate.

(3) **Symptoms of Defects**

(a) A sudden pressure loss indicates a leak caused by heat, which can be either internal or external.

(b) A fluctuating needle gauge indicates cooling system open to combustion pressure.

3.3 FAN DRIVE SYSTEM

See Figs 3.4 and 3.5.

a. **Description.** The fans are driven hydraulically and the system comprises a pump, a motor for each fan, a controller unit, and a tank for the fluid. The fluid is passed through a section of the heat exchanger before being returned to the tank. The system is illustrated in Fig 3.3.

The fan speed can vary in two ways:

(1) At constant temperature due to engine speed variation.

(2) At constant speed due to coolant temperature variation.

Therefore, fan speed is controlled by coolant temperature and engine speed.

The pump is shaft driven from the rear end of the air crankshaft.

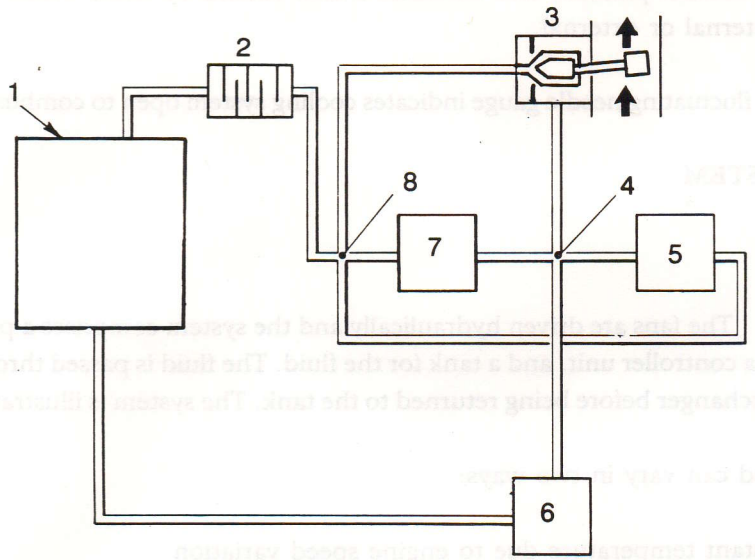
The controller is connected in both the coolant and the hydraulic circuits and operates thermally. The thermostatic element on the controller is immersed in coolant which, as it gets hot, causes the element to expand and gradually restrict the flow between the inlet and outlet ports, which are in the hydraulic circuit.

b. **Operation.** When the engine is started from cold, the pump is rotated and fluid is drawn from the tank and delivered into the circuit. As the passage between the controller inlet and outlet ports is almost fully open most of the fluid is returned to the tank, via the heat exchanger, so by-passing the fan motors.

When the coolant temperature nears that to which the controller is pre-set, the expanding element begins to close the passage between inlet and outlet ports, and more fluid is diverted through the fan motors which begin to rotate faster.

The heat of the coolant continues to close the passage causing the speed of the fans to increase until sufficient cooling is obtained to maintain the coolant at the pre-selected temperature.

An adjustable stop screw is provided to set the minimum fan speed. The screw is adjusted so that while the engine is running and the coolant temperature is not high enough to operate the control unit element, the fans are rotated slowly to ventilate the power pack compartment.



1. Tank
2. **Heat Exchanger**
3. **Fan Controller**
4. **1st Four Way Junction Pressure Test Point**
5. **R/H Fan Motor**
6. **Hyd Pump**
7. **L/H Fan Motor**
8. **2nd Four Way Junction**

Fig 3.4 Fan Drive System

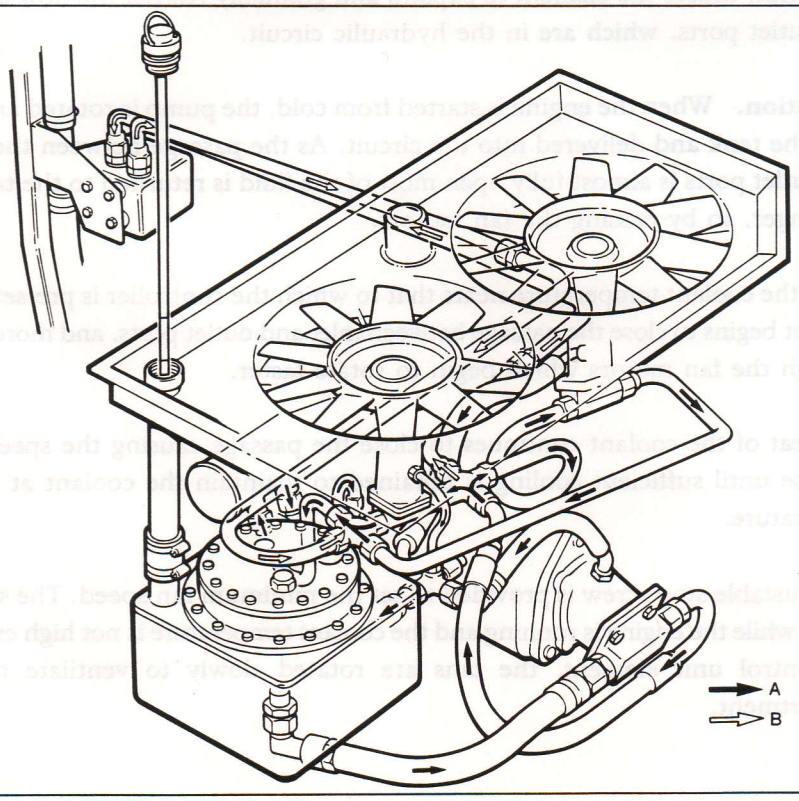


Fig 3.5 Fan Drive System