COOLING SYSTEM

Deltic engines are cooled by circulating a mixture of 30% inhibited ethylene glycol and 70% distilled, soft or artificially softened water through the system. After passing through the engine, the coolant and oil are cooled by being passed through a heat exchanger, efficient running temperatures being maintained by thermostatic valves, one to each system.

The inhibited Ethylene Glycol should be to British Standard, BS3150A or its equivalent.

Circulation

The coolant is circulated by a centrifugal pump which is mounted on the auxiliary gearbox at the free end of the bottom crankcase. The pump delivers coolant to the turbine inlet casing from which, it passes through the exhaust elbows to the exhaust manifolds.

After passing through the exhaust manifolds, the coolant enters the cylinder blocks at their driving ends and cools successively the inlet end of the liner, the combustion zone and the exhaust end of the cylinder liners. Each liner is surrounded by annular coolant jackets, through which the coolant circulates from passages and galleries in the block. Subsequently the coolant is directed through passages in the block to a common outlet gallery. From the three cylinder blocks, coolant enters a cored passageway in the sandwich piece and passes to the outlet which is sited on 'A' side of the engine. In the installation system, the coolant passes to a thermostatic valve, to a heat exchanger and back to the engine driven coolant pump. The thermostatic valve divides the flow between a by-pass, to the pump inlet, and the heat exchanger.

Housings for connecting pressure gauge pipes are provided on all engines. Provision may be made for the connection of temperature and pressure warning and/or shut down switches.

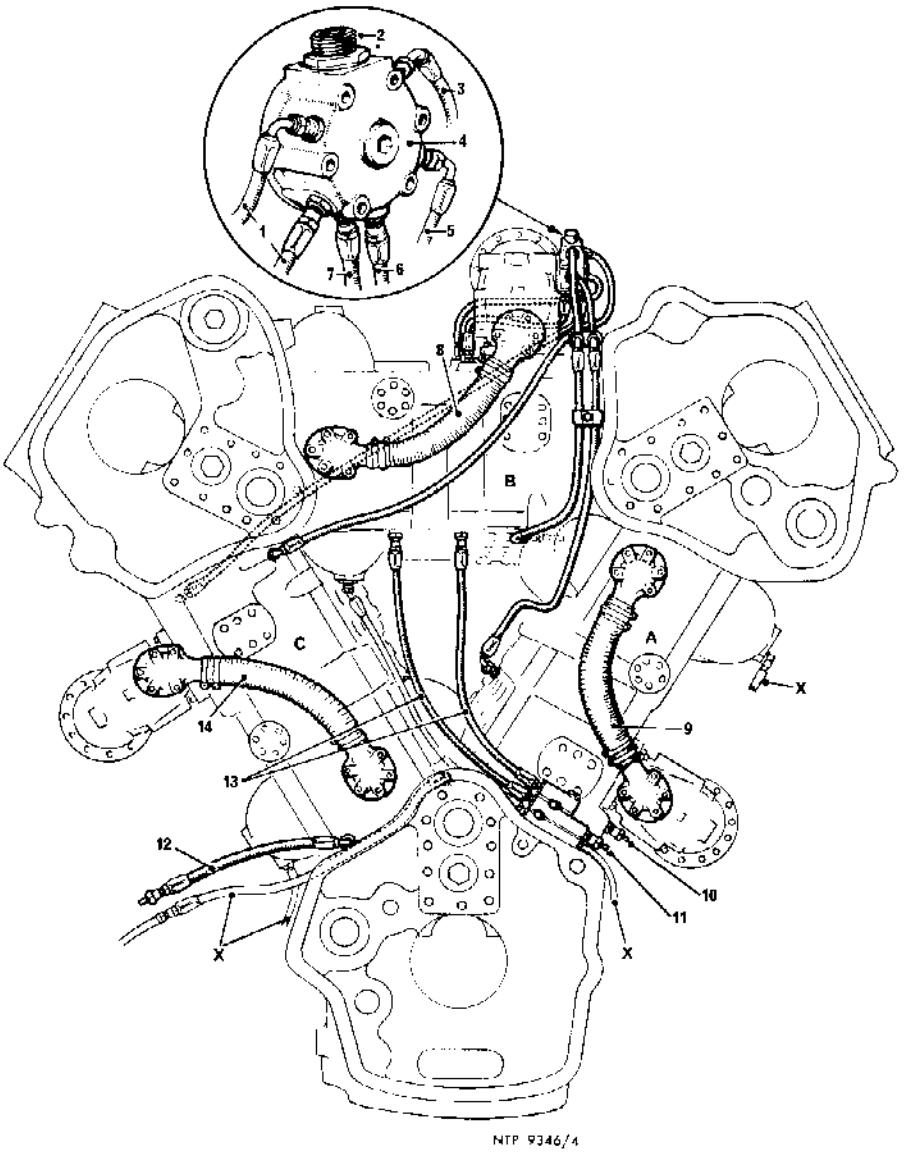
Vents and Drains

Vents from the cylinder blocks are connected to a collector box mounted at the free end of 'B' exhaust manifold, the highest point of the engine system. The outlet from the collector box is connected to the header tank.

Drains are situated at the lowest point of the cylinder blocks near the drive end, the drains on 'B' block being connected by pipes to unions on a junction block at the drive end of 'A' block.

Coolant Pump

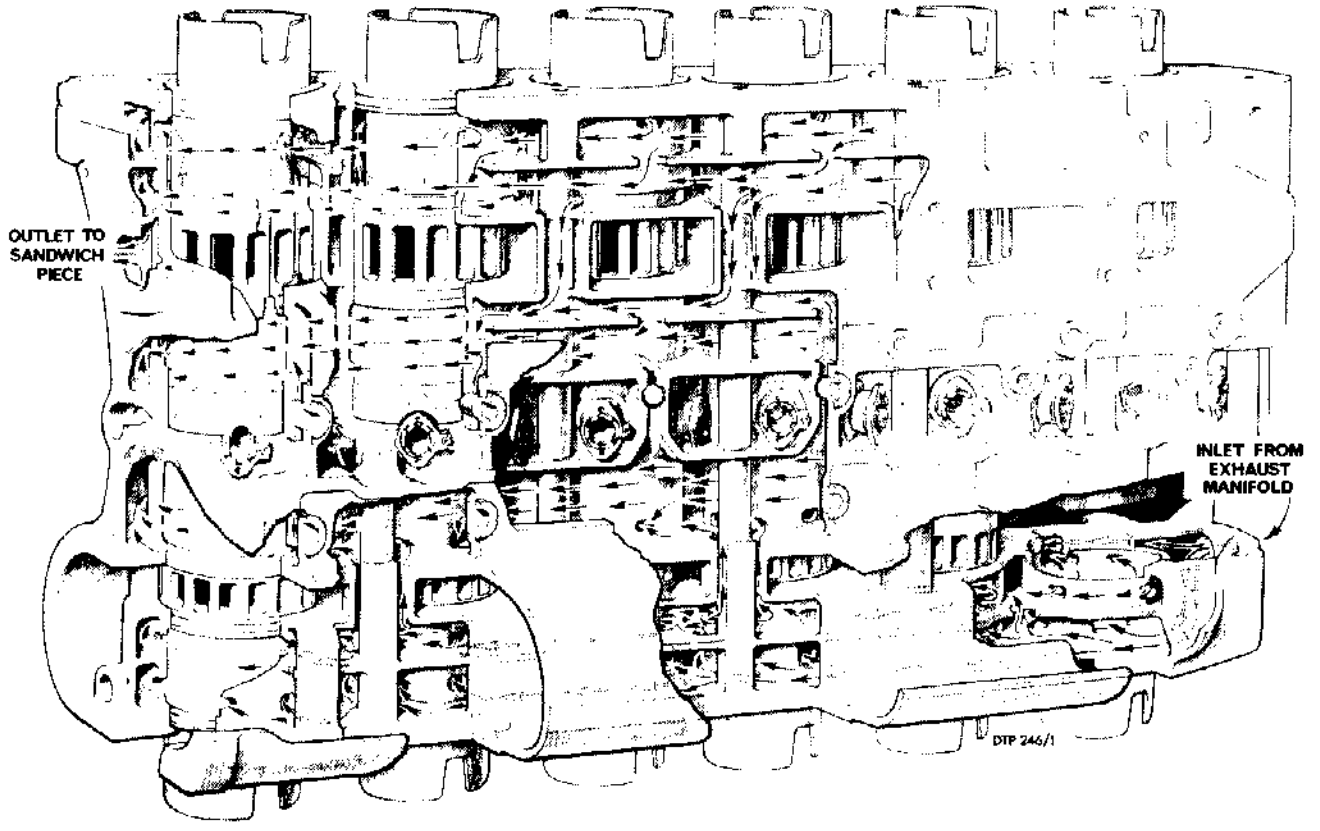
The coolant is circulated by a centrifugal pump which is mounted on the auxiliary gearbox. The impeller shaft is supported and located by a ball bearing and has a roller bearing mounted on the engine side of the drive gear. The roller bearing being lubricated by oil thrown from the gears.



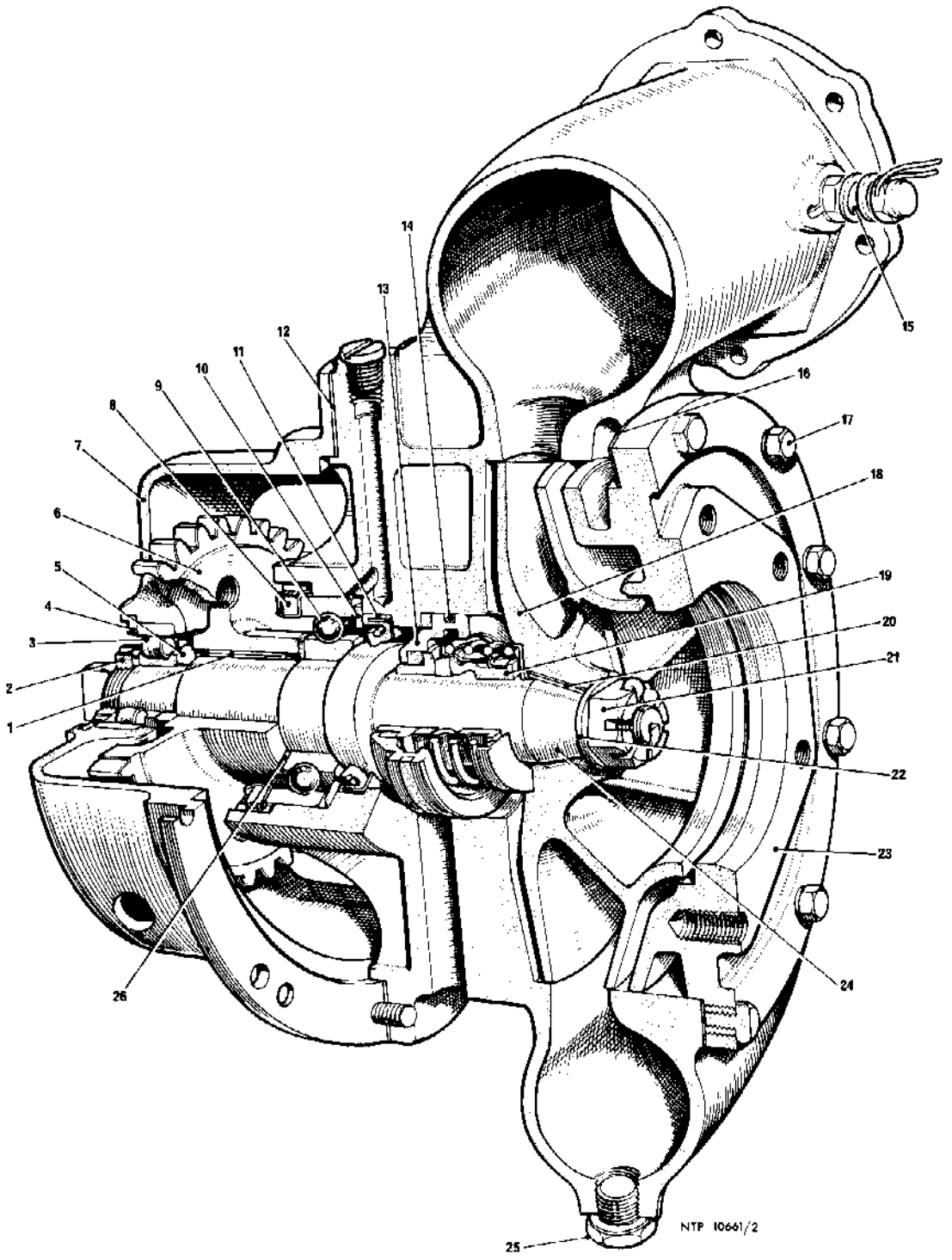
1. Vent pipes from 'A' cylinder block
2. Vent connection to header tank
3. Vent pipe from drive-end 'C' block
4. Vent collector box
5. Vent pipe from free-end 'B' block
6. Vent pipe from free-end 'C' block
7. Vent pipe from drive-end 'B' block
8. Coolant pipe 'B' exhaust manifold to 'B' block
9. Coolant pipe 'A' exhaust manifold to 'A' block
10. Blanking nipple, 'A' block drain
11. Blanking nipple, 'B' block drains
12. Drain pipe with blanking nipple, 'C' block
13. 'B' block drain pipes to Item 11
14. Coolant pipe 'C' exhaust manifold to 'C' block

A. 'A' cylinder block
B. 'B' cylinder block
C. 'C' cylinder block
X. Air inlet manifold drain pipes

COOLANT PIPES

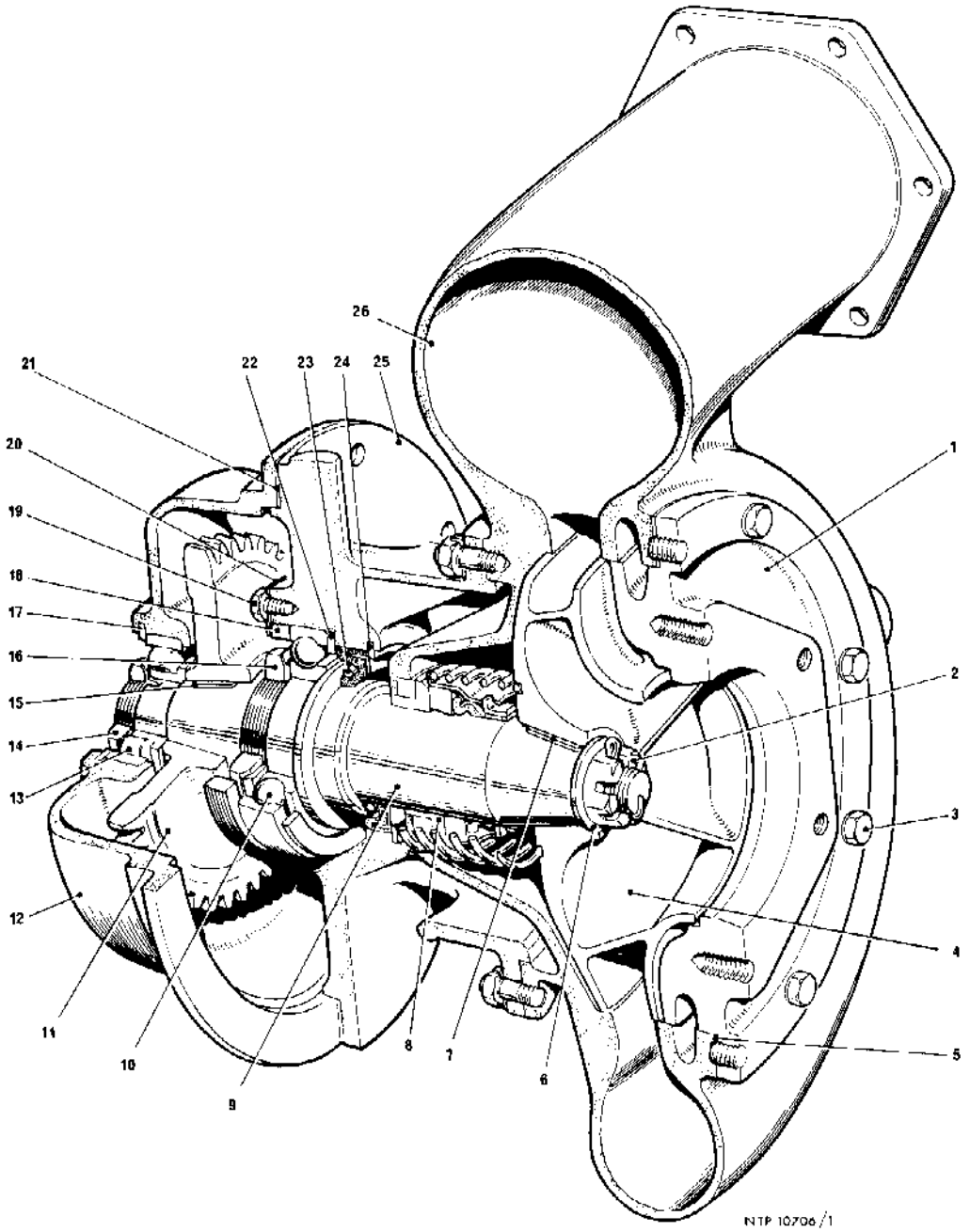


CIRCULATION THROUGH CYLINDER BLOCK



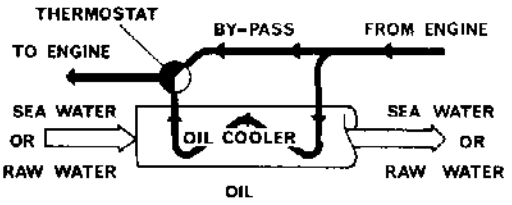
1. Woodruff key
2. Ring nut
3. Roller bearing
4. Circlip
5. Abutment washer
6. Driving gear
7. Bearing housing
8. Ring nut
9. Ball bearing
10. Oil ring
11. Oil seal
12. Jointing washer
13. Seal housing
14. 'O' ring
15. Pressure connection
16. Jointing washer
17. Set bolt
18. Impeller
19. Seal assembly
20. Woodruff key
21. Slotted nut
22. Plain washer
23. Impeller cover
24. Impeller shaft
25. Drain plug
26. Distance piece

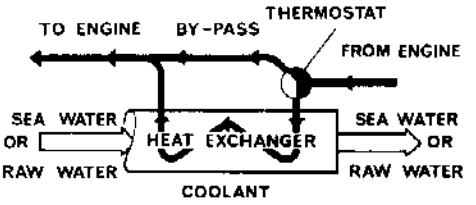
COOLANT CIRCULATING PUMP

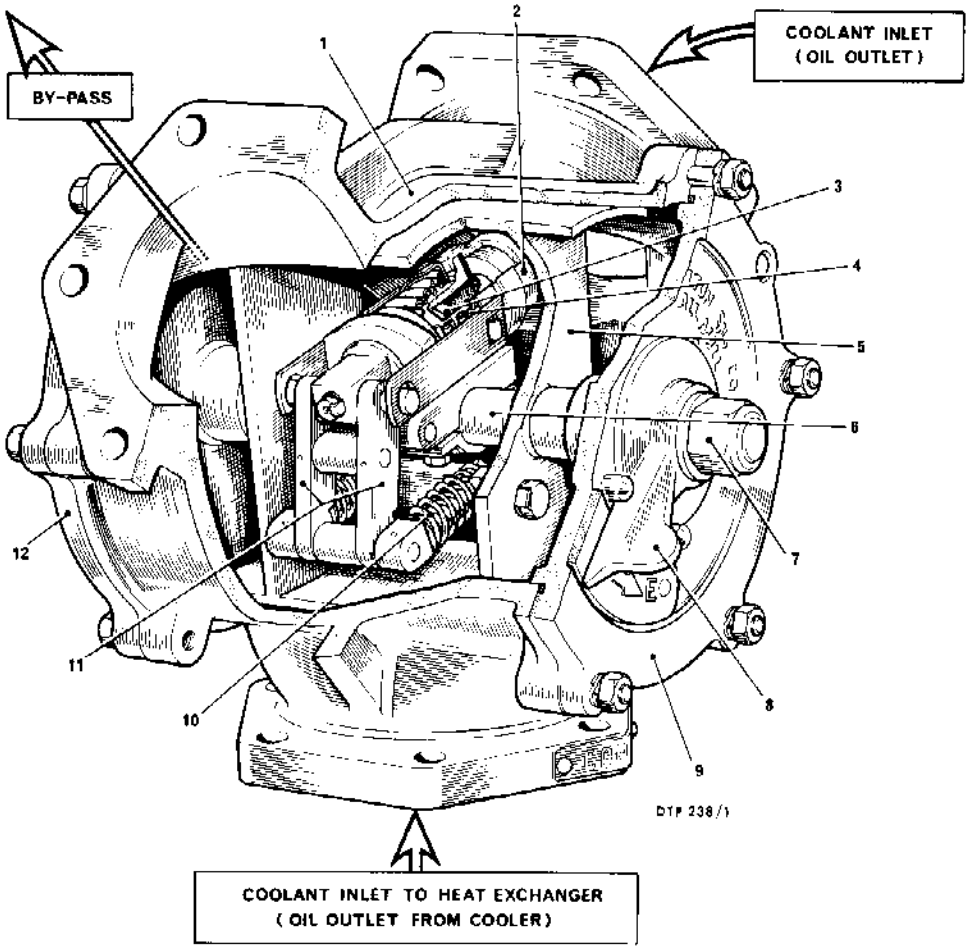


1. Impeller cover
2. Slotted nut
3. Setbolt
4. Impeller
5. Joint washer
6. Washer
7. Woodruff key
8. Seal assembly
9. Impeller shaft
10. Ball bearing
11. Driving gear
12. Bearing housing
13. Roller bearing
14. Ring nut
15. Woodruff key
16. Ring nut
17. Circlip
18. Ring nut
19. Nut
20. Locking plate
21. Joint washer
22. Oil ring
23. Oil seal
24. Circlip
25. Housing
26. Casing

SEA WATER PUMP







1. Body
2. Wax Filled Capsule
3. Plunger
4. Return Springs
5. Rotor Valve
6. Spindle
7. Lock Nut
8. Emergency Setting Lever
9. Front Cover
10. Override Springs
11. Pivot Links
12. Rear Cover

THERMOSTATIC VALVE

Oil is prevented from contaminating the coolant by a "Gaco" seal, and coolant from contaminating the oil by a spring loaded carbon seal bearing on a ceramic seal plate. A leak-indicating drain is connected with an annular space between the two seals. A plug at the bottom of the volute casing enables the pump to be drained of residual coolant after the engine has been drained.

Provision is made for a pressure point in the volute casing adjacent to the outlet flange.

Raw or Sea Water Pump

In appropriate installations a raw or sea water circulating pump is mounted on the auxiliary gearbox at the free end of the bottom crankcase. It is a centrifugal type of pump similar in construction to that of the coolant circulating pump.

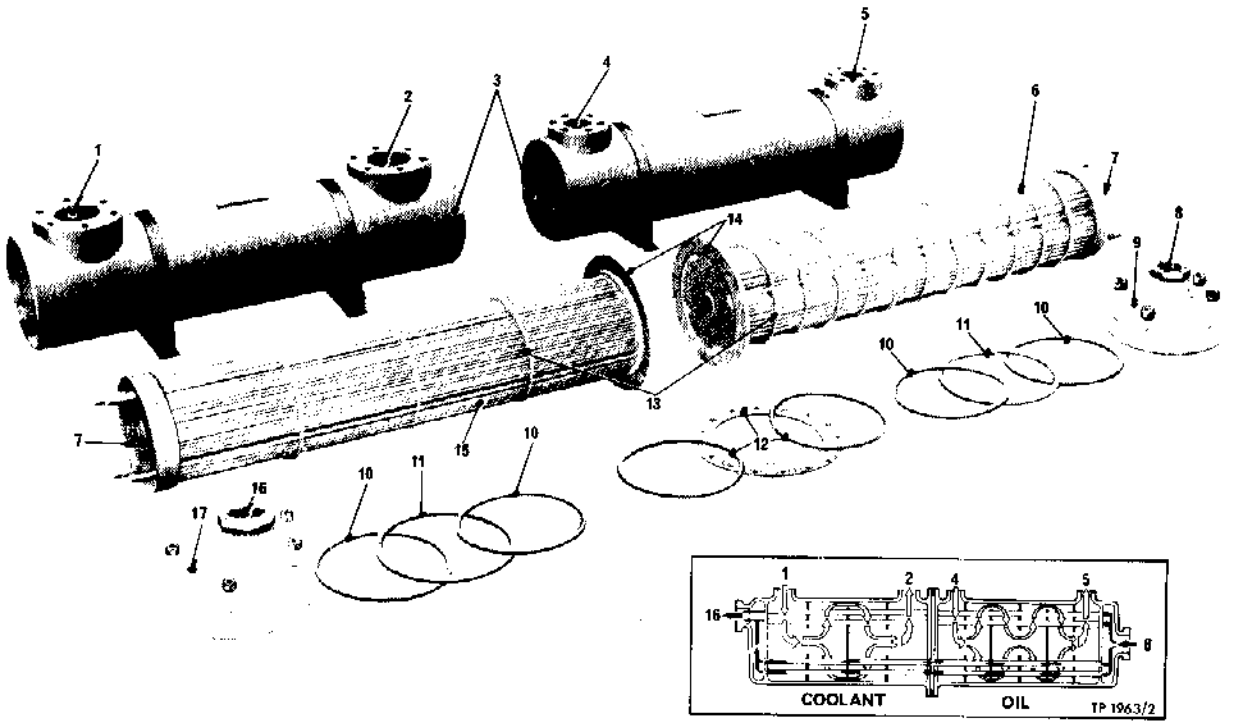
The pump delivers the raw or sea water to the heat exchanger and oil cooler. After passing through the heat exchanger and oil cooler of a marine installation the sea water is discharged overboard. On static industrial installations the raw water can be passed either through a waste recovery plant or a separate cooling system.

Thermostatic Valves

Thermostatic valves regulate the temperature of the coolant and of the oil by dividing the flows in relative and varying proportions between the coolant heat exchanger and a by-pass, and between the oil cooler and a by-pass respectively.

Since the temperature of the coolant as it leaves the engine is critical, and is liable to rise quickly on an increase in load, the coolant thermostatic valve is fitted at the inlet to the heat exchanger.

The unit consists of a thermally controlled rotary valve housed in a cylindrical casting which has three equally spaced ports in the circumference. The rotary valve controls two of the ports, one being connected to the radiator the other to a by-pass, the third port is always open. The valve is so designed that whatever the division of the flow, the total outlet area is always equal to that of the inlet area. From the accompanying illustration it can be seen that the rotary valve is mounted in a bearing at either end and is actuated by a spring loaded wax filled capsule supported on the centre spindle. Expansion of the wax within the capsule, due to a rise in temperature of the liquid passing through the thermostat causes the operating rod of the capsule to move. In the case of the oil thermostat, the operating rod of the capsule is linked direct to the rotary valve while in the case of the coolant thermostat, a spring loaded link is interposed between the capsule operating rod and the rotary valve. This spring loaded link acts as a safety device so that, should the rotary valve become seized the capsule can expand without causing damage to the unit.



1. Coolant inlet
2. Coolant outlet
3. Tubular casings
4. Lubricating-oil inlet
5. Lubricating-oil outlet
6. Oil cooling element
7. Expansion-end tube plate
8. Sea-water inlet
9. End cap inlet end
10. Synthetic rubber joint ring
11. End cap sealing rings
12. Fixed-end joint rings
13. Circular baffles
14. Fixed end tube plates
15. Coolant heat-exchanger element
16. Sea-water outlet
17. End cap - outlet end

HEAT EXCHANGER AND OIL COOLER

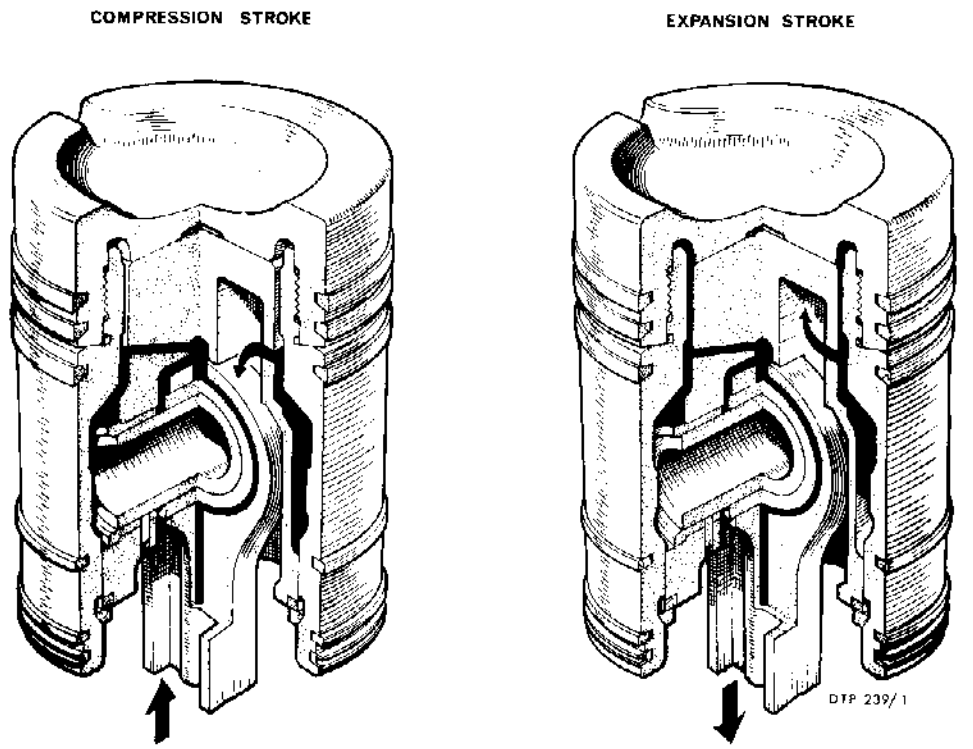


DIAGRAM OF PISTON COOLING

coolant thermostat, a spring loaded link is interposed between the capsule operating rod and the rotary valve. This spring loaded link acts as a safety device so that, should the rotary valve become seized the capsule can expand without causing damage to the unit. In normal operation this spring loaded link can be considered as a solid link, no compression of the springs taking place. In an emergency, the thermostat can be set to give full cooling by moving the Emergency handle on the outside of the casing to the emergency 'E' position. The valve may be re-set for normal cooling by moving the emergency handle back to its normal position.

The illustration of the Thermostatic valves shows an end view of the thermostat with the outlets marked 'By-pass' and 'Cooler' and two sectioned views of, at the left a 4½in coolant thermostat and at the right a 3in oil thermostat.

No adjustment is provided on this type of the thermostat, the temperature range to be covered being allowed for by the constitution of the wax within the capsule, should a thermostat become defective, it should be replaced by a serviceable item and the defective unit returned to the manufacturers.

Piston Cooling

Main pressure oil, flowing from the small end bearing to the space between the piston body and the gudgeon pin housing, is used to conduct heat from the piston. As the oil is shaken from end to end of this space by the reciprocating motion of the piston, the heat gained near the crown is subsequently given up to the piston skirt and then conducted away through the cylinder walls. Drain oil is spilled into the centre of the gudgeon pin housing and splashed on to the cylinder walls.

Coolant Differential Pressure Switch

On certain installations, a pressure switch is mounted on a bracket adjacent to the coolant circulating pump. The switch is of the differential pressure type.

The unit comprises a flanged circular casing having two unions which are connected by flexible pipes with the inlet and outlet of the coolant pump and an electrical cable connection with the cables connected to a warning light on the engine control panel. On some installations, the pressure switch is wired into the engine shut-down system. The operating mechanism, housed within the casing, consists of a spring-loaded operating beam which actuates a micro-switch. Two diaphragms, supported by pressure plates, are positioned on either side of the operating beam, each diaphragm being in contact with opposing sides of the beam through operating studs.

Operation

Pump outlet pressure is felt on the diaphragm which is deflected lifting the pressure plate against the operating beam causing the beam to pivot in the pivot block and break the micro-switch contacts. The pump outlet pressure, as transmitted to the beam, is opposed by the pump inlet pressure acting on the diaphragm and by the spring which is adjusted so that if the pressure differential between pump inlet and pump outlet falls to 2 lb/in^2,

the spring pressure will cause the operating beam to move and close the micro-switch contacts thus illuminating the warning light on the control panel.

When used in conjunction with the engine shut-down controls, the switch is wired into a solenoid which actuates the engine shut-down mechanism when the differential pressure across the coolant circulating pump falls to 2 lb/in^2.

The micro-switch is provided with one pair of contacts which are normally open and one pair which are normally closed and is wired up according to the requirements of the installation.