ENGINE COOLING INFORMATION

DEPCO PUMP COMPANY

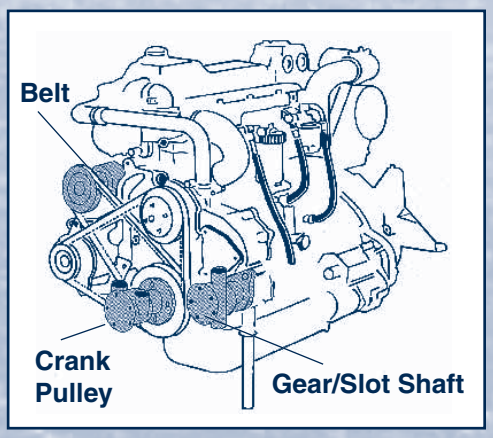
PUMP DRIVE TYPES

Belt Drive: This design is typically mounted directly on the engine. However, the pump may be mounted on the structure of the boat when the engine DOES NOT utilize flexible mountings. Below is the formula to determine required pulley diameter and pump speed.

$$\frac{\text{Drive pulley diameter}}{\text{Pump pulley diameter}} \times \text{Engine speed} = \text{Pump speed}$$

Direct Drive or Gear/Slot Shaft Drive: Direct drive pumps typically utilize a flexible coupling which allows for minor misalignments. However, excessive misalignment will cause noise, knocking, vibration, premature bearing failure, and eventually pump leakage. The gear/slot shaft drive pumps are custom designed to bolt right to the block of the engine and are difficult to misalign.

Crank Pulley/Harmonic Balancer Drive: These pumps were specially developed for high-speed operation and mount directly on the crankshaft pulley. It is necessary to attach a torque arm (bracket) to the pump to prevent its housing from spinning.



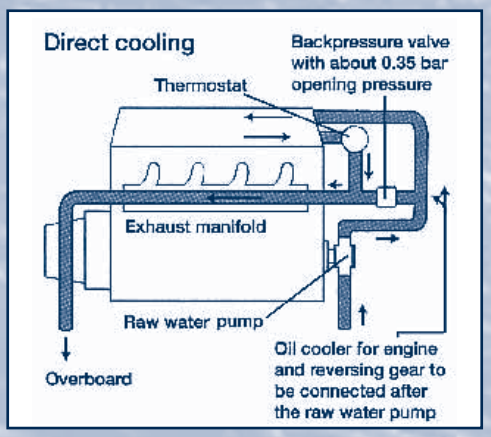
DIRECT COOLING

Raw water is forced directly through the engine block with a pump that is self-priming at all engine speeds. The outlet temperature needs to be much lower than in a heat exchanger cooled engine to reduce the formation of scale, salt deposits and thermal stresses within the cylinder block.

Lower operating temperature means that the engine performance will be considerably less efficient than heat exchanger or keel cooled systems and therefore should not be used on commercial crafts.

A marine thermostat, rather than a manually operated valve best controls engine operating temperature. For cold engine start, the thermostat will be closed and most of the cooling water will bypass the engine via a spring-loaded backpressure valve and discharge into the exhaust manifold. A small bleed hole in the thermostat will ensure a slow circulation of cooling water through the cylinder block to prevent "hot spots" while the engine is warming up.

Required flow in direct cooling systems is typically 10 GPM per 100 HP at maximum load and RPM for diesel engines. 11 GPM per 100 HP is the typical requirement for gasoline engines.

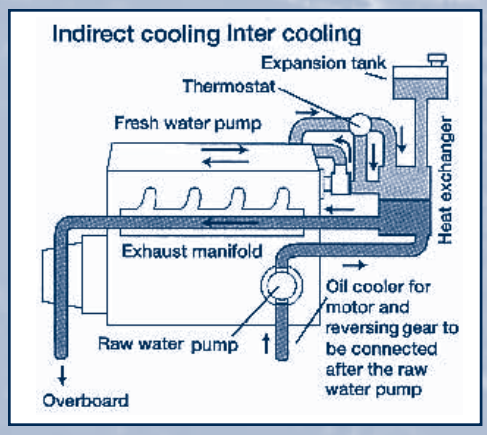


HEAT EXCHANGER COOLING

This is also known as a closed system, i.e. the primary cooling circuit is isolated from the surrounding atmosphere. A centrifugal pump circulates fresh, treated water through the cylinder block and around the tube stack of the heat exchanger. The self-priming raw water pump draws raw water (sea or lake) in and forces it through the heat exchanger's tubes where it removes the heat transmitted from the primary cooling circuit before it is discharged overboard.

The heat exchanger should be capable of handling approximately 10% more that the maximum engine heat rejection rate and should include or be fitted separately with an expansion/header tank. The recirculating pump should be located at the coldest part of the primary circuit and be able to maintain a water temperature differential of 45° F across the cylinder block at full load. A marine thermostat regulates the engine temperature to about 185° F (on most engines).

Required flow in heat exchanger cooling systems is approximately 15 GPM for every 100 HP at maximum load and RPM for diesel and gasoline engines. If an exhaust manifold is fitted in the raw water or fresh water circuit, the required flow should be increased by 10-15%. Any additional coolers, such as oil or charge air coolers, must be fitted after the pump and require 10-13 PSI of water at maximum engine RPM.



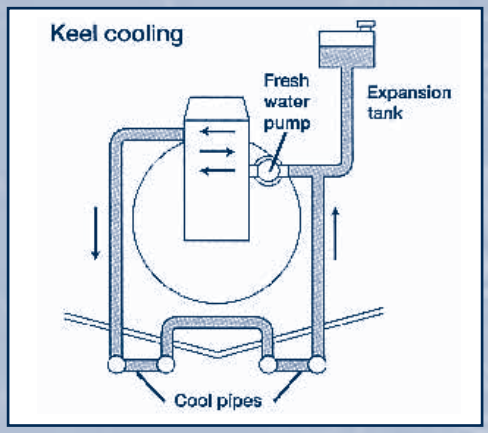
KEEL COOLING

Similar to a heat exchanger cooled system but the raw water circuit and heat exchanger have been replaced by pipes attached externally to the vessels keel or by tanks in the bottom of a steel hull vessel. The heat is transferred from the cooling water to the raw water as it passes through the pipes or steel hull tank. As in the heat exchanger system, a pump is utilized to circulate the fresh, treated water within a closed loop through the cylinder block.

Pipe bore and surface area must be adequate for effective dissipation of heat. In some installations, due to system pressure losses through keel pipes, cylinder block, and exhaust manifold, the flow capacity of a centrifugal circulating pump is insufficient. This is where a flexible impeller is the pump of choice.

Required flow in keel cooling systems is approximately 30 GPM per 100 HP at maximum engine load and RPM.

Converting a "dry" exhaust to "wet" exhaust can be achieved by installing a separate self-priming raw water pump.



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