

to exhibit a very low swelling power. And yet many elastomers in contact with liquid water for long periods of time, particularly at high temperatures, can absorb very large amounts. The explanation of this apparent anomaly lies in the fact that typical vulcanizates contain small amounts of extremely hydrophilic materials. Water can be imbibed to form a colloidal dispersion of droplets, which also contain hydrophilic impurities. The osmotic action of these hydrophilic materials within the water droplets provides the driving force for entry of more water. The elastic properties of the elastomer matrix provide some resistance to continued enlargement of the droplets. Different elastomers vary widely in their tendency to imbibe water by this two-phase mechanism (5).

LEAKAGE PROBLEM

Ever since ethylene glycol was first used as an antifreeze/coolant for internal combustion engines about 40 years ago, the problem of "glycol creep" has been a major concern to engine operators. "Glycol creep" may be defined as the common tendency of coolant leaks to appear in a seemingly "tight" cooling system shortly after the installation of ethylene glycol-based antifreeze.

External coolant leakage resulting from "glycol creep" is at best a costly nuisance, resulting in high coolant make-up and requiring tightening or replacement of hose clamps. Since external leakage of glycol antifreeze can often go undetected by the operator for long periods of time, there is a very serious danger that coolant loss will continue until there is insufficient coolant in the engine and severe overheating occurs with resulting engine damage.

Internal leakage of glycol-based coolant can be catastrophic. The glycol reacts with lubricating oil to form sludge and varnish which increase oil viscosity, plug oil passages, cause piston rings and pins to "freeze," and, in many cases, cause seizure of the engine.

While it is certainly true that seals and sealing systems have been vastly improved in recent years, the problem of coolant leakage remains a serious one, particularly for the operator of heavy-duty equipment. For example, a 1966 survey conducted by the Regular Common Carrier Conference (RCCC) showed 74% of the truck operators surveyed considered internal leakage of coolant to be a serious maintenance problem in their operation. This internal leakage problem appears to occur in all types of diesel engines. Leakage is most common past cylinder head seals, injector tubes, and cylinder liners.

In the past few years, methoxypropanol-based antifreeze coolant has replaced glycol-based antifreeze in many truck and off-the-road fleet operations. Methoxypropanol has been shown to minimize the progressive engine damage associated with internal leakage of glycol-based coolant. Also, the distinctive odor of methoxypropanol makes detection of external leaks much easier.

While the movement from glycol to methoxypropanol coolant in heavy-duty equipment means less severe results

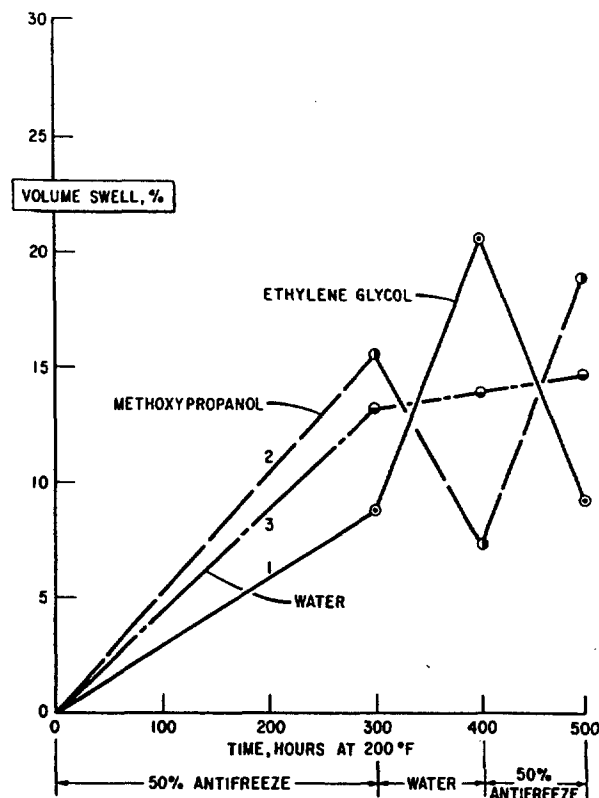


Fig. 2 - Buna-N "O" ring (engine manufacturer A)

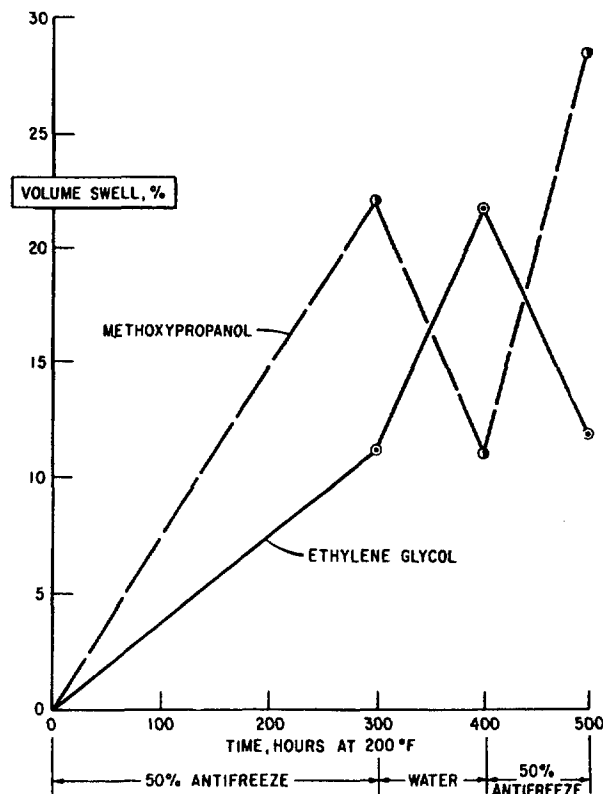


Fig. 3 - Buna-N "O" ring (engine manufacturer B)