ALCOOL

CORROSION INHIBITOR FOR ENGINE COOLING SYSTEM

Introduction

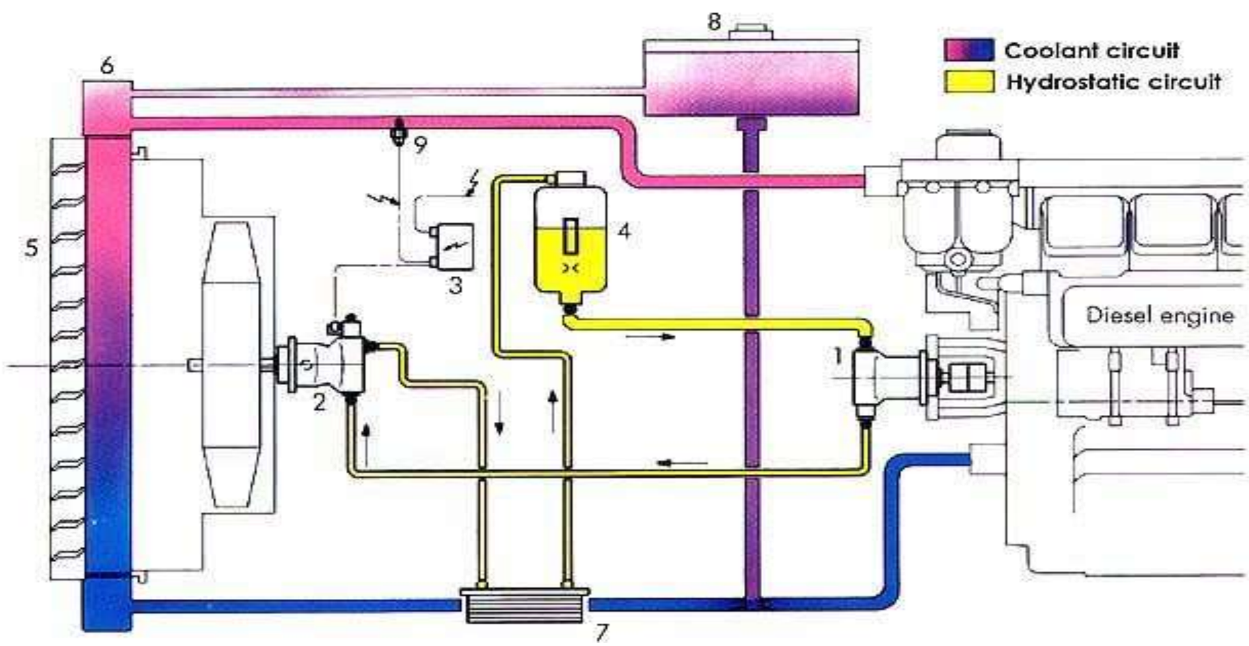
Corrosion inhibitors are used extensively in the automotive industry in plant processes associated with automobile. Inhibitors are also added to many automotive fluids, such as gasoline, oil and hydraulic brake fluid, to prevent corrosion if water is present in the system.

Applications of inhibitors for above industry falls into two categories:

1. **The protection of metal surfaces exposed to fluid system.**
2. **The protection of exterior metal surface exposed to atmospheric environment.**

Inhibitors have been used effectively to prevent corrosion in "Engine Cooling System" in which a mixture of ethylene glycol and water are used as a coolant.

Engine Cooling System:



Liquid cooling systems are employed by most engines today. For operation at temperatures below 32º F (0º C), it is necessary to prevent the coolant from freezing. This is usually done by adding some compound to depress the freezing point of the coolant. Alcohol formerly was commonly used, but it has a relatively low boiling point and evaporates quite easily, making it less desirable than organic compounds with a high boiling point, such as ethylene glycol. By varying the amount of additive, it is possible to protect against freezing of the coolant down to any minimum temperature normally encountered.

Cooling system variables

The evaluation of corrosion inhibitors for an engine cooling system requires a familiarity with the engine and its operation.

Few variables that affect the corrosion rate and the function of inhibitors are as follows:

a Plant flow
b Aeration
c Cooling system temperature
d Pressure
e Water impurities and corrosion products
f Metals, galvanic couples and crevices
g Operating conditions and maintenance of the system.

Coolant Flow: Coolant flow can vary at high speed and high flow can contribute corrosion through the entrainment of air into the coolant or from its erosive effect on metal surfaces.

Aeration: Corrosion in a cooling system is dependent on available oxygen, which is reduced during the corrosion process. Oxygen is seldom depleted in the coolant because fresh into the cooling system through the breathing action of the radiator cap with changes in temperature and pressure.

Cooling system temperature: The corrosion rate normally rises with increasing temperatures and the amount of increase depends on operating conditions and ambient temperature. Loss of inhibition at higher temperatures, some inhibitors decompose and form precipitates that coat metal surface and reduce the transfer of heat. In spite of these problems, there are inhibitor systems that perform satisfactorily under high temperature conditions.

Pressure: The pressure in a cooling system can range from a very low to about 14-15 psig, the normal radiator cap release point, but there is no apparent indication that pressure has a direct effect on corrosion or the function of inhibitors but certainly indirect effect on corrosion because it permits higher operating temperatures. Which can cause an increase in corrosion. Due to cavitation (pressure difference across the pump due to vapor bubbles) corrosion take place.

Water impurities and corrosion products: Most serious effect on corrosion and function of corrosion inhibitors is the quality of water added to the cooling system. Water impurities like chlorides, sulphates, metal ions, total solids and alkaline or acidic substances. Corrosion of different metal increases with increases the concentration of chloride and sulfate ion. Corrosion products accelerate the breakdown of ethylene glycol into acidic compounds.

Metals, Galvanic Couples, and Crevices: the cooling water system is made up of a variety of metals and polymeric materials. Different parts of engine cooling system exposed to the coolant and affected by corrosion.

Operating conditions and maintenance of the system: The manner in which engine operated and the cooling system is maintained may have a determining effect on inhibition. Some important points for Operation and maintenance of system are as follows:

1. **Periodic inspection of the cooling system.**
2. **Coolant Temperature, Level and condition.**
3. **Poor operating practices.**

Inhibitors used for engine cooling system

- Chromate Inhibitors
- Borate Inhibitors
- MBT Inhibitor for copper alloys
- Emulsifiable Oils Inhibitors.
- Mixed Inhibitors

<u>Characteristic of "ALCOOL"</u>

"**ALCOOL**" is most advanced corrosion inhibitor having high temperature stability and excellent protection against cavitation. "**ALCOOL**" is a synergistic formulation of inhibitors for complete protection of engine cooling system. In this blends of inhibitors each impart the particular function. The active ingredient protects aluminum and solder while borate works as a buffering action to maintain reserve alkalinity as well protection of ferrous metals. The salt of silicate gives general protection of ferrous metals. One of the key ingredient phosphates provides great protection of ferrous metals and aluminum as well as gives buffering action. For protection of copper and brass "ALCOOL" the synergistic formulation contains azole. To maintain reserve alkalinity, alkalinity builder also exists in formulation.

Reference: 1) NACE –Corrosion Inhibitors.
2) ALTRET Hand Book.