Jefe Talleres Diesel — Cojimbo

M.I. 1748
Rev. A*

ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION
SERVICE DEPARTMENT
MAINTENANCE INSTRUCTION

ENGINE COOLANT

DESCRIPTION

Coolant is circulated throughout the engine to provide the means for heat transfer from the engine components. Water, corrosion inhibitor and, in some applications, antifreeze are used in coolant solutions.

Because the function of the coolant is so necessary to the operating efficiency of the engine, it is important that the selection of a coolant solution be carefully considered.

COOLANT SOLUTIONS

A coolant suitable for use in EMD engine cooling systems must meet four basic requirements:

1. It must adequately transfer heat energy through the cooling system.
2. It must not form scale or sludge deposits in the cooling system.
3. It must not cause corrosion within the cooling system.
4. It must not deteriorate any of the cooling system seal materials.

These requirements are normally satisfied by combining a suitable water with a reliable corrosion inhibitor. Certain operating conditions may dictate the use of antifreeze-coolant. In this case the basic requirements can be satisfied with a combination of suitable water and an ethylene-glycol type antifreeze which contains an adequate corrosion inhibitor. However, the use of antifreeze involves special consideration regarding Items 1 and 3 above. This will be discussed in detail under "Antifreeze."

It should be recognized that coolants which perform satisfactorily in other applications may not be satisfactory for use in EMD engine cooling systems. Differences in coolant volume-to-cooling system surface area ratios, coolant velocities, temperatures, and the types of materials employed make such comparisons meaningless.

The formulation of "home made" inhibitors and antifreezes is not recommended since such compounds are difficult to monitor and control. The ready availability of suitable proprietary products makes these practices uneconomical and impractical.

Water quality should be evaluated whenever a new water source is to be used, or when changes in existing water sources occur. Likewise, quality of the coolant solution should be tested when a new engine is put into service, and at regular intervals thereafter. The quality of coolant should always be known and should be maintained as required.

WATER

The water used in the cooling system of EMD engines should be of such quality that it does not contain excessive solids, hardness salts, or corrosive elements such as chlorides. Water containing these constituents in undesirable amounts can either be softened or de-ionized to make it suitable for use. Steam condensate is also suitable for use in the cooling system as an equivalent to distilled water.

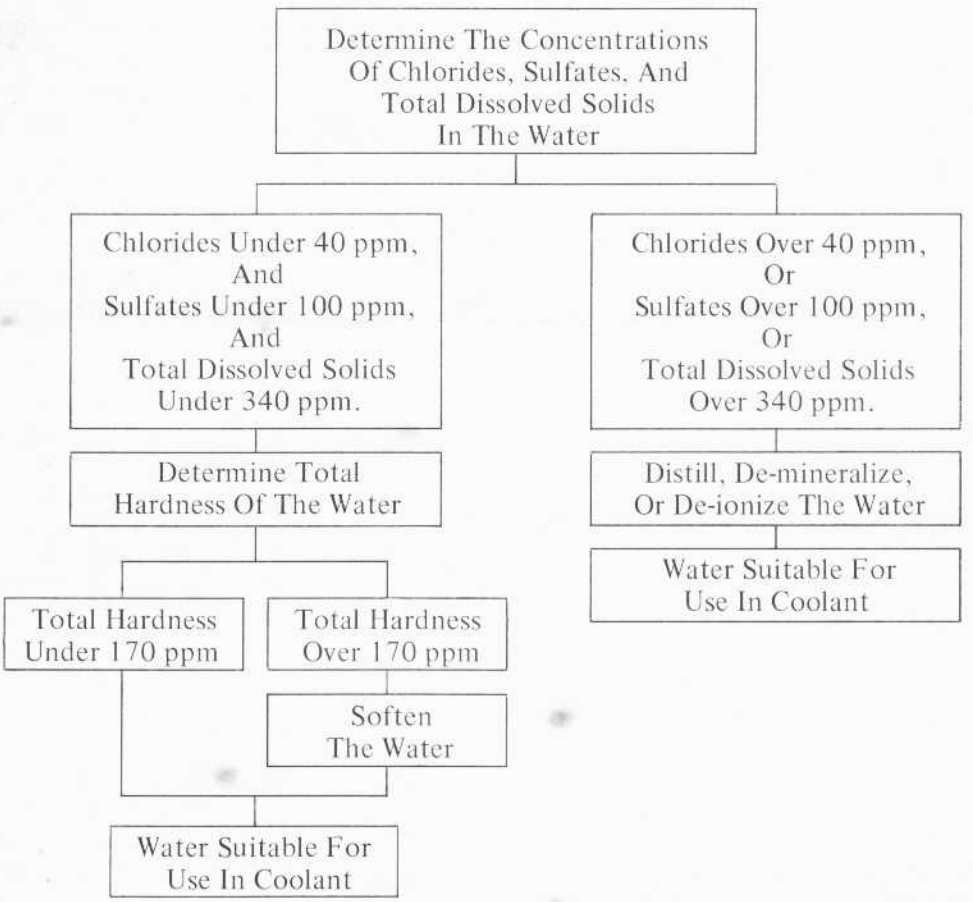
*This publication supersedes all information previously released regarding engine coolants.

TABLE 1

	PARTS PER MILLION	GRAINS PER GALLON
Chlorides (Maximum)	40	2.5
Sulfates (Maximum)	100	5.8
Total Dissolved Solids (Maximum)	340	20
Total Hardness (Maximum)	170	10

Refer to Table 2 for evaluation of water intended for use in a coolant solution.

TABLE 2



Water within the limits given in Table 1 is considered suitable for the formulation of engine coolant.

Water exceeding these limits can cause scale and sludge deposits, corrosion, or a combination of these.

INHIBITOR

CAUTION: Uninhibited water should never be used to fill a cooling system (even temporarily) because of the possibility of rapid corrosion and rusting. This applies to all uninhibited water but is especially true for distilled, de-ionized, or demineralized waters, including steam condensate. Prior to application, the water should be mixed with the inhibitor or inhibited antifreeze which is to be used in the coolant.

Two basic types of inhibitors, chromate and borate-nitrite, are the most commonly used in EMD cooling systems. Environment restrictions in some localities have led to the development of a non-polluting silicate-nitrite inhibitor. It is considered non-polluting because it does not contain chromium or boron.

NOTE: The units of measure throughout this publication are those commonly used in the United States.

Dry Measure:

16 Ounces = 1 Pound

Liquid Measure:

32 Ounces = 1 Quart

4 Quarts = 1 Gallon

CHROMATE TYPE

Chromate type inhibitors are generally furnished in the form of powder or pellets. The pH of these inhibitors, when mixed with water, ranges from 7.5 to 9.0. The recommended inhibitor dosage for an initial fill is .6 ounces per gallon (4500 ppm). Thereafter, the inhibitor concentration should be maintained above .4 ounces per gallon (3000 ppm). Dissolve the inhibitor in water before adding it to the cooling system. When coolant is lost from the system, the makeup coolant should contain inhibitor in the recommended dosage (.4 ounces/gallon).

Chromate type inhibitors should not be used in cooling systems containing ethylene-glycol type antifreeze. The use of chromate with ethylene-glycol may, under certain conditions, result in an insoluble sludge forming in the cooling system.

BORATE-NITRITE TYPE

Borate-nitrite type inhibitors are furnished in the form of powder, pellets, and liquids. The pH of these inhibitors, when mixed with water, ranges from 8.5 to 10.0. They also contain a dye, which is distinctive in color and stable at 190° F. The recommended inhibitor dosage for the powder or pellets at the initial fill is 1.0 ounces per gallon of water (7500 ppm). Dissolve the inhibitor in water before adding it to the cooling system. Thereafter, the inhibitor concentration should be maintained above .75 ounces per gallon (5625 ppm).

The recommended dosage of liquid inhibitor for an initial fill is 3.0 fluid ounces per gallon. Thereafter, the inhibitor concentration should be maintained above 2 fluid ounces per gallon. When coolant is lost from the system the makeup coolant should contain inhibitor in the recommended 2 fluid ounces per gallon dosage.

SILICATE-NITRITE TYPE

Silicate-nitrite type inhibitors are supplied in liquid form. The pH of these inhibitors, when mixed with water, ranges between 9.0 and 11.0. They also contain a distinctive color dye, which is stable at a temperature of 190° F. The recommended dosage of inhibitor for an initial fill is 3.0 fluid ounces per gallon. Thereafter, the inhibitor concentration should be maintained above 2 fluid ounces per gallon. When coolant is lost from the system, the makeup coolant should contain inhibitor in the recommended 2 fluid ounces per gallon dosage.

Experience to date has shown that the performance of this inhibitor is more sensitive than chromates and borate-nitrites to fluctuations in concentration levels. Therefore, the concentration of silicate-nitrite solutions must be carefully monitored during service.

Silicate-nitrite type inhibitors are considered non-polluting because they do not contain chromium or boron. However, federal, state, and local pollution restrictions should be investigated before discharging these inhibitors.

INHIBITOR GUIDELINES

1. The recommended inhibitor concentrations have been found suitable for most corrosion inhibitors. However, the user should always contact the inhibitor supplier for recommendations as to the proper concentration level for his application.

2. When used in EMD systems, inhibitors should contain specific concentrations of a strong tracer element to help determine the degree of water contamination in lube oil analysis.

3. It is important that the inhibitor concentration be determined with a test method recommended by the supplier. Most suppliers are prepared to furnish a kit for this purpose.

4. Safety and hygienic precautions should always be exercised when handling corrosion inhibitors to avoid possible irritation of eyes, nose, and skin. This is especially important when handling chromate inhibitors.

5. The chemicals in corrosion inhibitors are slowly depleted in service. The effective life of an inhibitor depends on such factors as the cooling system condition, hours of operation, coolant and metal temperatures, aeration, and rate of contamination of the coolant. As a general rule the coolant should be discarded at least annually, and the cooling system filled with new inhibited coolant.

6. Draining an inhibited coolant from one engine and reusing in another is a poor practice that can cause corrosion.

7. Most manufacturers advise against mixing of different brands of corrosion inhibitors. This restriction recognizes the fact that some corrosion inhibitors may not be compatible with other brands. This incompatibility may lead to foaming, precipitation, or accelerated corrosion. EMD concurs with the manufacturer's advice in this respect.

8. Prior to fleetwide application of a new inhibitor formulation, it is advisable to test these formulations in a few engines. This will determine whether the inhibitor is compatible with the operating environment to which it will be exposed.

ANTIFREEZE

ALCOHOL TYPE

Alcohol type antifreeze is not recommended for use in EMD engine cooling systems because of the high coolant operating temperatures.

ETHYLENE-GLYCOL TYPE

Where EMD engine cooling systems must be protected from freezing, ethylene-glycol type antifreeze is recommended. This type of antifreeze must contain a balanced blend of inhibitor ingredients to prevent corrosion. This antifreeze also must contain a distinctive color dye that is stable at a temperature of 190° F.

Ethylene-glycol type antifreeze should be used at concentrations between 33% and 68% by volume, as required to prevent freezing. Antifreeze concentrations below 33% do not provide sufficient inhibitors to give adequate corrosion protection. Using antifreeze concentrations above 68% will raise the freezing point and will not provide good heat transfer. Because antifreeze affects heat transfer rates, it should not be used without prior consultation with EMD Service representatives regarding the specific engine installation and possible engine derating requirements.

The corrosion inhibitors incorporated in antifreeze are slowly depleted in service. How long these inhibitors will remain effective depends on factors, such as, the cooling system condition, hours of operation, coolant and metal temperatures, aeration, and rate of contamination of the solution. Usually the antifreeze manufacturers recommend using their products for only one year.

In special applications involving large capacity systems, such as EMD engines, the antifreeze solutions may be usable for a longer period of time. The customer should contact the manufacturer for instructions which may include periodic tests of the antifreeze solution by the manufacturer.

Chromate type inhibitors should not be used in cooling systems containing ethylene-glycol type antifreeze. The use of chromate with ethylene-glycol, under certain conditions, may result in insoluble sludge forming in the cooling system.

Fig. 1 depicts the freezing points of typical ethylene-glycol antifreeze and water solutions. The freezing points of specific brands may vary slightly from prints shown on the graph. However, the graph is sufficiently accurate for use in estimating antifreeze requirements, regardless of brands.

ETHYLENE-GLYCOL TYPE WITH DE-IONIZED WATER

Because hardness, total solids, and corrosiveness of water varies throughout the United States, antifreeze containing inhibitors and de-ionized water should be used in areas where the water does not meet the standards listed under "Water." This type of antifreeze contains the proper amount of ethylene-glycol to protect the cooling system from freezing to -40° F.

Most manufacturers advise against the addition of supplemental inhibitors or additives to either fresh or used antifreeze solutions. They also advise against mixing of different antifreeze brands. These restrictions recognize the fact that some supplemental inhibitors, additives, and antifreeze brands contain materials which may not be compatible with the corrosion inhibitors initially incorporated in the antifreeze. The addition of these compounds could increase corrosion in the cooling system. EMD concurs with the antifreeze manufacturer's advice.

Some antifreeze manufacturers market inhibitor concentrates specifically designed for reinhibiting their antifreeze. These inhibitors are designed only for their antifreeze and should be added only on their advice.

Some brands of antifreeze contain anti-leak compounds which may cause plugging and eventually reduce the heat transfer qualities of the cooling system. EMD advises against the use of antifreeze containing anti-leak compounds.

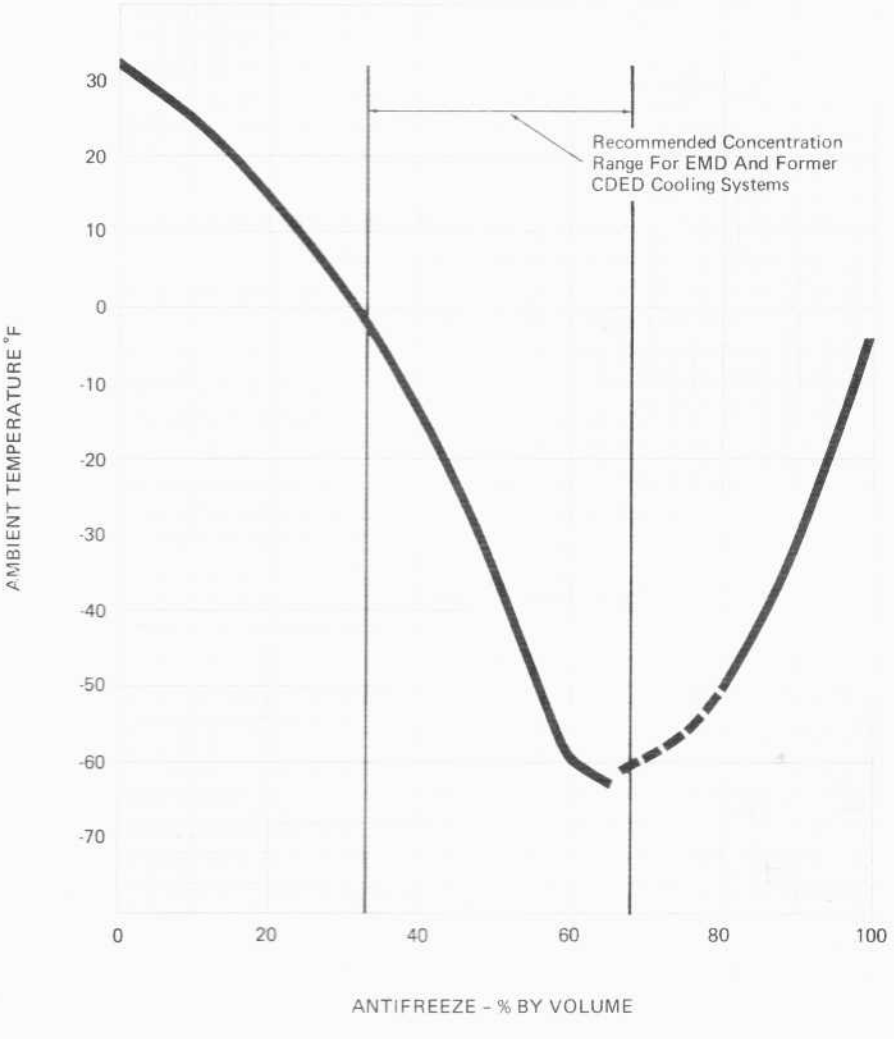


Fig. 1 – Freezing Points Of Aqueous Solutions Of Ethylene-Glycol Antifreezes