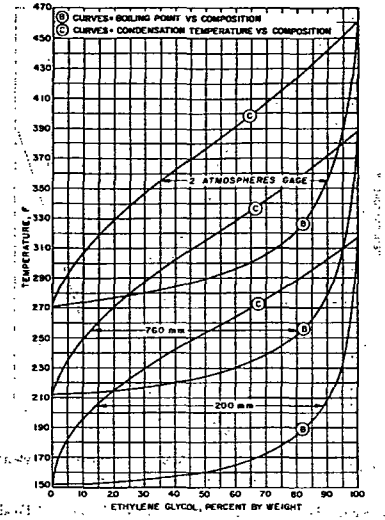

Fig. 11 .... Boiling Point and Condensation of Aqueous Solutions of Ethylene Glycol

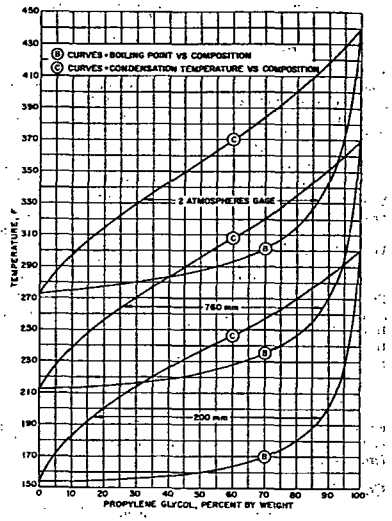

Fig. 12 .... Boiling Point and Condensation of Aqueous Solutions of Propylene Glycol

two facts, namely, the proximity of the values for propylene glycol to water (when compared with ethylene glycol) and the fact that propylene glycol values show a maximum around the 70–75 percent concentration level. This combination of factors makes it somewhat difficult to ascertain the propylene glycol content of solutions by specific gravity measurements. Control by refractive index measurement or Karl Fischer analysis for water are the perferred laboratory methods for determining the composition of propylene glycol solutions.

The conversion of specific gravity to density is affected by multiplying the appropriate value from Fig. 13 or 14 by the density of water at the 60 F reference temperature (62.37 lb per cu ft).

Figs. 15 and 16 show the viscosity, in centipoises, as a function of composition at different temperature levels for ethylene and propylene glycol-water systems. The most notable consideration in these plots is the significantly higher viscosity for the propylene glycol solutions, particularly at low temperatures.

Figs. 17 and 18 give the specific heat values versus temperature at various concentrations for aqueous solutions of ethylene glycol and propylene glycol. These figures show that, on an equivalent percent by weight basis, propylene glycol solutions generally have slightly higher values of specific heat than ethylene glycol, though solutions of either glycol are not as efficient as water alone for heat transfer applications.

Figs. 19 and 20 give the thermal conductivity values as a function of temperature for various aqueous ethylene glycol and propylene glycol solutions. These plots indicate that the thermal conductivity of the glycols decrease with increase in temperature, but that dilution with water offsets this effect to some degree.

Additional physical property data can be obtained upon request from the various suppliers of ethylene glycol and propylene glycol.

Approach to Corrosion Inhibition

Commercial ethylene or propylene glycol, when pure, is generally less corrosive to the common metals of construction than water itself. Aqueous solutions of these glycols, however, assume the corrosivity of the water from which they are prepared and may become increasingly corrosive with use, if not properly inhibited. This is because glycols, like most other organic compounds, are subject to oxidation by air to acidic end products. The amount of oxidation is influenced by such factors as temperature, the degree of aeration, and, to some extent, even the particular combination of metal components to which the glycol solution is exposed.

As pointed out in the reference literature,[8,9] the concept of corrosion inhibition is, perhaps, most easily understood in fundamental terms by classifying additives either as: (a) corrosion inhibitors or (b) environmental stabilizers and adjusters. Corrosion inhibitors are considered to function by forming a surface barrier which protects the metal from attack. These barriers are usually formed by mechanisms such as adsorption of the inhibitor by the metal, or by reaction of the inhibitor with the metal or perhaps the incipient reaction product. In most cases, the metal surfaces are covered by films of their oxides, and the inhibitor serves to reinforce this film.

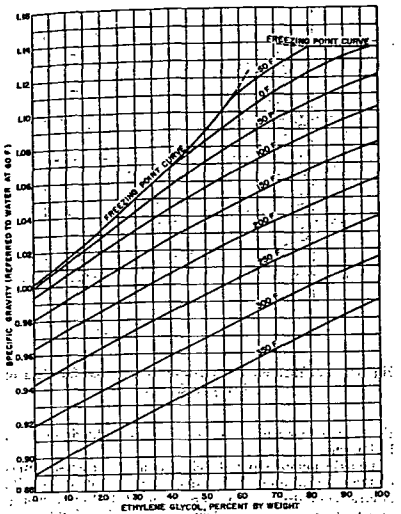

Fig. 13 .... Specific Gravity of Aqueous Solutions of Ethylene Glycol

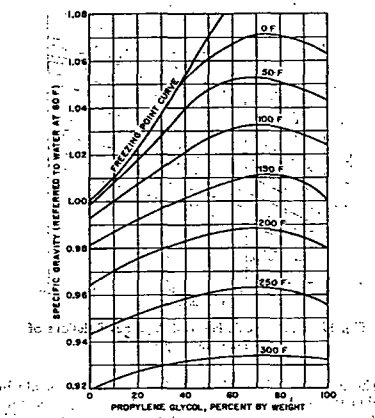

Fig. 14 .... Specific Gravity of Aqueous Solutions of Propylene Glycol

Environmental stabilizers or adjusters, while not corrosion inhibitors in the strict sense of the word, function to decrease corrosion by stabilizing or favorably altering the overall environment. An alkaline buffer, such as borax, is a simple example, since its prime purpose is to maintain an alkaline condition (*pH* above 7). Some chelating agents may function as stabilizers by removing from the solution certain deleterious ions that might otherwise act to accelerate the corrosion process or mechanism; however caution must be exercised in their use.

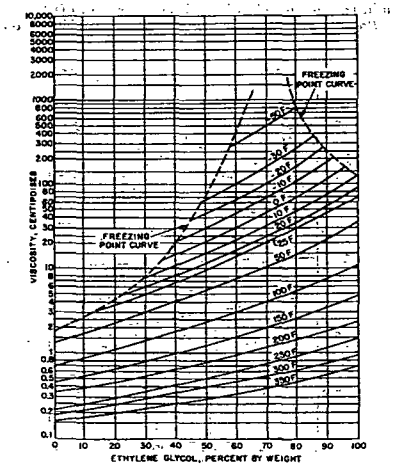

Fig. 15 .... Viscosity of Aqueous Solutions of Ethylene Glycol

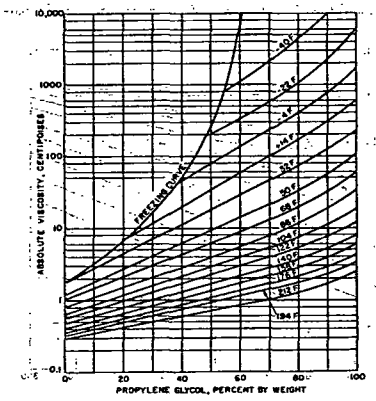

Fig. 16 .... Absolute Viscosity of Aqueous Solutions of Propylene Glycol