Innophos Phosphoric Acid

**Fiberglass Reinforced Polyesters:** Tanks made of fiberglass reinforced polyester have found acceptance in the phosphoric acid industry. Polyester resins resist the corrosivity of the acid and are attractive from the standpoint of cost. Polyester tanks are generally limited to 80°C (176°F) maximum continuous service for all strengths of phosphoric acid. Some polyester resins may impart color to phosphoric acid, particularly in 105 to 115% strengths. DeraKane 411-45 and Atlac 382 resins have been used for FDA compliance. The tank should be white pigmented on the outside. Extra care must be taken in the handling of these tanks, especially during installation. Naturally, they cannot be handled like metal. A slight impact can penetrate or bruise them, causing leakage or weepage.

**NOTE:** We are not listing tank suppliers because companies involved in the fabrication of stainless steel, rubber and reinforced fiberglass polyester products are well known. For general reference, standard purchasing reference directories such as *Thomas Register* are suggested.

**Bulk Storage Heating Requirements**

The theoretical freezing points of orthophosphoric acid at various strengths are plotted in Fig. 3 and Fig. 4. 75%, 80%, 85% and 105% phosphoric acids possess the property of supercooling at lower temperatures without undergoing crystallization. The degree of supercooling is influenced by many factors and because of this, the actual point of freezing is unpredictable (See figure 3)

The construction of outside storage tanks and lines to handle these acids will depend upon the severity of the winter and strength of the acid involved.

**75% Phosphoric Acid:** The theoretical freezing point of 75% phosphoric acid is -17.8°C (0°F). However, due to the pronounced increase in viscosity at low temperatures, and since phosphoric acid is easily supercooled, practical experience indicates that much lower temperatures can be experienced without crystallization. In general, and except for situations where subzero (0°F) temperatures may be expected for several consecutive days, 75% acid may be stored in outdoor tanks with little danger of freezing.

**80% Phosphoric Acid:** Because there are many industrial applications for phosphoric acid having an assay appreciably stronger than the common 75% strength, Innophos pioneered the commercial production of 80% phosphoric acid. This acid has a theoretical freezing point of 4.4°C or 40°F (the actual point of freezing is again unpredictable). It is recommended that, if the user's location is subject to temperatures of 0°C (32°F) or less for a period of several days, outdoor installations be provided with heating facilities as described for the 85% acid.

**85% Phosphoric Acid:** Phosphoric acid of 85% strength theoretically freezes at 21.1°C (70°F). It is recommended that heating facilities be provided at all locations. Outdoor storage tanks for 85% acid should be provided with either plate coils mounted on the outside of the tank wall or steam coils several inches below the bottom of the tank. The space below the tank should be enclosed so as to permit heating the air to a thermostatically controlled 50°C (122°F). Provisions should be made for insulating the walls of the tank. Discharge lines from the tank should be equipped with either steam tracer lines or electrical heat tape. The lines should be insulated and the temperature controlled to 50°C (122°F). Pumps should be installed indoors wherever possible.

**105% Phosphoric Acid:** Phosphoric acid of 105% concentration theoretically freezes at 16°C (60.8°F). A heating source and insulation for tanks and piping should be provided as for 85% phosphoric acid. In addition the tank should be enclosed and the vent equipped with a dryer to prevent moisture absorption.

**115% Phosphoric Acid:** Polyphosphoric acid (115% H₃PO₄) will not freeze in the ordinary sense. However, it is so viscous that it must be maintained above 75°C (167°F) for easy handling and flowability. Tanks and piping should be heated and insulated. Tanks should be enclosed and the tank vents should be equipped with a dryer to prevent atmospheric moisture absorption, which can form orthophosphoric acid on the top layer.
Pipe and Fittings

All piping should be 316 ELC stainless steel and of welded and flanged construction. All tank connections should be flanged. (Welding specifications are described on pages 4 and 5). Plug and ball valves of all 316 stainless steel construction and with Teflon® sleeves or seats are recommended. Gaskets should be 1/8" thick Viton® or Teflon®.

For transfer of phosphoric acid the Wilfley "sealless" centrifugal pump is a good heavy-duty, continuously-running process pump. This pump should not be used for intermittent transfer since it will leak acid on start-up and shut-down. The LaBour self-priming centrifugal pump, located above the storage tank which can be drained back into the tank, can be used for ≤ 85% phosphoric acid. It has a suction lift of 23 maximum handling water. A vertical centrifugal pump is an excellent pump for phosphoric acid and will eliminate emissions to the environment. Vertical centrifugal pumps and Viking gear pumps are used for polyphosphoric acid transfer. The recommended materials of construction are 316 SS or Alloy 20.

Bulk Unloading Into Storage

Bulk shipments of acid are available in both tank car and tank truck quantities. Rail shipments are made in stainless steel or rubber-lined tank cars. Truck shipments are available in 316 stainless steel tank trucks.

Both types of equipment may be unloaded by either compressed air or pump. Physical facilities for receiving tank cars or tank trucks, and the location of storage tanks, vary considerably among receiving plants. Because of this, it is strongly recommended that the drawings of installations be submitted to either the carrier or to Innophos for proper selection of the unloading method.

If air pressure is selected as the method of unloading the acid from a tank truck, the A.S.M.E. name plate located on the curbside front of the trailer will indicate the maximum allowable air pressure. The maximum optimum air pressure for tank cars is 30 pse. If additional pressure is necessary for unloading the tank, an acid pump should be provided. The conditions limiting the use of air pressure for unloading are the length of pipe leading from the tank car to the storage tank and the unloading head. The unloading head may be defined as the difference between the bottom of the tank car or tank truck and the highest point of elevation. Disregarding pressure loss due to pipe line friction, the maximum unloading head for 75% phosphoric acid for each 10 psi of air pressure is 14.7 feet.

A typical unloading diagram is given in Figure 1. This diagram shows a pressure head of 17 feet. A typical installation may require 250 feet of transfer line. Under these conditions, air pressure is a feasible method of unloading a tank car.

Centrifugal chemical pumps are often selected for transferring acid from the tank car to storage and are available in many sizes. All wettable parts of the pump should be constructed of wrought or cast 316 SS (or 316 ELC SS for welded parts), or a similar corrosion-resistant material. Two types are available, self-priming and manually primed. The latter can be primed by applying air pressure to the car the same as if it were to be unloaded by air pressure.

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