SMITH PUMPS

WATER IN LOW-PRESSURE LIQUID CARBON DIOXIDE

In tanks used to supply circulating systems, which are seldom if ever completely emptied, water builds up. Obviously there is very little free water in the usual delivery of low-pressure liquid Carbon Dioxide. However, any small amount of water that eventually accumulates within the storage tank would be in the form of ice crystals, due to the temperature (around 0°F.). Since ice floats on liquid CO_2, the ice crystals collect at the liquid-vapor interface within the storage tank of the circulating system.

If the tank is not allowed to become empty, every load of CO_2 delivered may add more water. More and more ice crystals collect at the liquid-vapor interface. As long as the tank does not go empty, no trouble will be caused by the presence of the build-up of ice crystals.

A sample of CO_2 taken from such a tank and analyzed for water content will probably not show the true proportion of water in the tank, because most of the water is concentrated as ice crystals only at the liquid-vapor interface.

If the user of the circulating system sometimes does not order a load of CO_2 before the tank runs dry, considerable trouble can be caused. Eventually, the liquid-vapor interface gets down to the level of the tank liquid outlet, and all parts of the circulating system become "slugged" with ice crystals quite suddenly.

If there is a strainer ahead of the pump, the strainer screen will become clogged with ice crystals, and the pump will be forced to run dry. However, it is difficult to prove this point to a customer, as by the time he or your serviceman gets the strainer open, its temperature will have warmed up to the point where the ice crystals have melted. Just a little water will be present at the bottom of the strainer body, and the strainer screen will appear to be very clean.

Some of the ice crystals will be small enough to pass through the strainer screen. It is quite probable that due to centrifugal action of the pump shaft, they will concentrate around the shaft rather than being pumped through. The mechanical shaft seal has friction, possibly sufficient to warm the ice crystals up enough so that they will melt and become water. Should this happen, the Carbon Dioxide also in the pump will react with the water to form carbonic acid. Due to the high pressure, this carbonic acid will be many times stronger than carbonic acid at ordinary atmospheric pressures. The strong acid will corrode the pump shaft and mechanical shaft seal parts, and in severe cases,

other parts of the pump as well. The corrosion looks like rust, and it will quickly cause a shaft leak. In severe cases, it will cause a general deterioration of all the other pump parts as well.

It is very important that the operators of a circulating system never allow their tanks to become empty, because of the problems associated with ice build-up within them. We cannot overstress this point.

Ice sometimes enters CO_2 tanks in other ways than as an "impurity" in the CO_2. Here are a few examples:

(1) The fill line is rather long and is not tightly capped after each use. In humid areas, water will accumulate in this line, and the next time the tank is filled, the water will enter the tank.

(2) Delivery trucks sometimes have liquid hoses, which are blown-down after each use, and the ends not tightly capped. Blow-down results in low temperatures, of the order of -100°F., within hoses. After blow-down, moist air enters and the water it contains immediately condenses as ice or liquid, depending upon the temperature. Accumulations of water will be expected in the low portions of the liquid hose, as the hose is stored on the truck. When the next tank is filled with CO_2, these accumulations of water will enter the tank.

To prevent such troubles, all liquid fill lines and hoses should be tightly capped after use and to make absolutely certain, if permitted, they should be left slightly pressurized with CO_2 vapor.

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