On the Waterfront

by Jim Reed

This month's agenda will conclude the section on "PVC Strength Characteristics and Typical PVC Fitting Failures" and proceed to "Pressure Surges — What Causes Them and How to Control Them".

The last area of PVC fitting failure to be discussed is mechanical failure. "Mechanical failure covers a multitude of piping failures that are unrelated to but may interact with the hydraulics of the system. One of the most common types of failure is splitting of female threaded fittings due to over-tightening. Since PVC is visco-elastic, it yields more easily on thread make-up than steel. The threads are also smoother and create less friction in make-up. It is, therefore, very easy to over-tighten PVC fittings. It is possible, with very little effort, to create circumferential stress beyond the failure limit when assembling threaded fittings. This is even more pronounced when using some thread lubricants, dopes, or sealants. The failure usually appears as a split, perpendicular to the threads, beginning at the leading edge and extending into the body of the fitting. Occasionally, a split at the base of the female threads will appear parallel to the thread direction. This will usually occur in a fitting with a shoulder or thickened place near the base of the threads and is more common when the male part bottoms against a shoulder.

A second type of mechanical failure occurs when inadequate thrust-blocking is provided. This allows excessive pressure to be placed on a fitting as the line pressure tries to displace it while the fitting is restrained by the pipe to which it is attached.

A third type of mechanical failure occurs due to improper solvent welding of improper fitting assembly. Improper penetration of pipe into socketed fittings significantly reduces the strength of the fitting. Improper solvent welding techniques can cause failures in the bonding, creating leaks or separation.

Another type of mechanical failure can occur due to temperature expansion. If sufficient expansion/contraction allowances are not made by providing expansion loops, offsets, or slip joints, severe stress can be placed on the pipe and fittings".

We will now proceed to a new section of the Keller-Bleisner study on "Designing, Operating and Maintaining Piping Systems Using PVC Fittings" titled "Pressure Surges — What Causes Them and How to Control Them".

"Few piping systems are operated under 'static' conditions for long periods of time. Hydraulic transient conditions, or 'surges', occur in every irrigation system. A pressure surge, or 'water hammer', is created any time the flowrate changes in a piping system. This may be caused by valve operation, pumps starting or stopping, line breaks, or rapid escape of entrapped air.

When a pipe contains a column of moving liquid, there is considerable kinetic energy stored in the liquid by virtue of its mass and velocity. If this velocity is suddenly decreased (by the quick closing of a valve) this energy cannot be absorbed by the liquid, since the liquid is nearly incompressible. It appears as an instantaneous shock to the pipe, which may lead

(cont'd. page 10)

(On the Waterfront cont'd.)

to excessively high pressures. This effect is greater as the pipe line is longer, the velocity change greater and the closing time of the valve shorter.''

A table in the article gives an example of the maximum pressure surge with instantaneous valve closure for water flowing in PVC pipe. In SDR 21 pipe (what we refer to as Class 200 pipe) with a velocity change from 5 feet/second to instantaneous close, a pressure surge of 80.2 psi is observed. The same situation as described above at 6 feet/second yields a 96.3 psi surge; at 8 feet/second - 128.3 psi; at 10 feet/second - 160.4 psi. The 6, 8, and 10 feet/second velocity's of flow are not recommended in system design and will be covered in next month's article.

Sod-Faced Bunkers: An Old Idea That Works Today

by Tim Scott, Asst. Lake Shore C.C.

The history of sod-faced bunkers most likely goes back to the late 1800's when the Scots lined the faces of their bunkers with sod bricks, also known as revetting. The reasons this process was used on many of the bunkers was to provide definition and the steepness helped prevent the winds from blowing the sand out. Importantly, revetting enabled the Scots to build these walls to enormous heights and had the desired effect to alter or disrupt the players swing.

Today, Muirfield in Scotland is one of only a handful of golf courses in the world that still uses revetted bunkers. In the U.S., there are some golf courses that use a variance of this method for their bunkers such as The Golf Club in Columbus, Ohio; a private club in Lake Forest, Illinois and the famed ''Devils Hole'' at Pine Valley in New Jersey.

As with the Scots and their use of sod bricks, one can also build a sod-faced bunker using sod rolls. There are advantages and disadvantages to constructing a sod-faced bunker. On the positive side, it is easy to form a bunker face with a steep angled slope and of enormous heights. By using rolls of sod, one doesn't need to worrry about trying to grow grass on the face of the bunker, which can be very difficult. The sod wall can be substituted for sand where washouts are a constant problem on bunker slopes. Also, with a steep face, one is able to reroute players to an easier exit rather than having them climb up the face and destroying it. On the downside, the amount of sod needed can be expensive and over a period of five to seven years, the sod wall may need to be rebuilt. If you plan to construct a sod-faced bunker, the following is a general guideline for this procedure.

STEP 1 — Calculation of Sod Needed.

Determine the amount of sod needed by measuring the area, length by height, where the sod wall will be built. I suggest this step first in case sod is not readily available for the project, otherwise, Step 2 can precede Step 1.

NOTE: When determining the amount of sod needed, the thickness of the sod should be taken into consideration.