Silent Check Valves

Silent check valves are used within pump discharge lines on Standard Vertical Turbine Pump Stations and Effective Vertical Turbine Pump Stations to limit and strongly curtail the possibility of water hammer and its effects on piping, pressure vessels, valves, and sensing equipment.
In order to discuss silent check valves, we must first lay some groundwork regarding water hammer and its effect on systems and equipment. There is a considerable amount of energy contained within moving water. A practical example of this can be seen on a golf course at the site of a pressurized line break. Evidence of this energy is canyons cut in turf and soil, pieces of pipe or fittings strewn around, and large holes bored under concrete cart paths.
When moving water is confined within a pipe, the energy is contained. When it escapes, the energy escapes with it. Pipe does have pressure limits. PVC irrigation piping comes in several classes, 125 PSI, 160 PSI, 200 PSI, schedule 40 and schedule 80. Since many golf course applications of PVC pipe use class 200, we will concentrate on this class of pipe for our discussions. Class 200 pipe has a one minute burst pressure of 630 PSI. That is, class 200 PVC pipe is rated to burst if the pipe is subjected to a pressure of 630 PSI for a period of one minute or more.

Quite frequently pressure surges from water hammer can be 600 PSI over the normal pressure contained within the pipe. If the normal pressure in the pipe is 120 PSI, then the water hammer over-pressure of 600 PSI will be added to the 120 PSI working pressure, for a total of 720 PSI. While this pressure may only last for a fraction of a second, it is well above the rated burst pressure of class 200 pipe. Even one such occurrence can cause pipe to burst.
Water hammer is most frequently caused by a too rapid closure of a valve in the system. A gate valve being spun shut, a quarter turn valve such as a ball valve or butterfly valve being closed quickly under flow, or a check valve slamming closed after a reverse flow has occurred.
Swing check valves (in which the disc is hinged at the top and rotates upward under flow) when installed on pump discharges, close in a manner similar to that of a screen door on a windy day. Usually by the time a swing check valve slams closed, a reverse flow through the check valve and pump has been established. Reverse flow becomes established because a relatively long time is required for the disc to swing down from its open position near the top of the valve body to its closed position against the seat.

Double door check valves are similar to swing check valves in that each half of the disc must rotate 90° from being parallel with flow to resting against the seat. These valves can slam shut and can cause water hammer.

Silent check valves, however, operate differently than either a swing check or a double door check. There are no hinges and the disc is not rotated to allow water to pass. The movement of the disc from open to closed is lateral (in line with water flow) instead of rotational. Motion of the

disc is similar to that of a globe style valve. Within a globe valve, the entire disc travels away from the seat rather than rotating out of the way.

While it is still possible for some water to flow backwards through a silent check valve from the time the pump is shut off until the valve closes, the reverse flow through the valve is very small and only a bump will be heard on valve closure instead of a slam. A water hammer of 50 to 70 PSI overpressure may exist instead of one from 400 to 600 PSI.