

Service Life for Pinch Valves

Control of Slurries

by **LARRY SCHNEIDER, Chief Engineer, The Red Valve Company
Carnegie, Pennsylvania**

MANY WASTEWATER treatment plants are adopting automatic flow controls. The purpose is to upgrade existing facilities or improve operation and final BOD in plants now in design. Some of the control schemes have resulted in a maintenance nightmare, while others have been quite successful.

The Red Valve Company of Carnegie, Pennsylvania, for over 20 years, has made valves to handle the flow control of slurries. Many of these slurries are as severe as can be passed through a pipeline. Those engineers familiar with pinch valves on mining and chemical slurries have adopted similar methods to control raw sewage, lime, and recycled sludge in wastewater treatment plants.

A recent investigation was made to determine the durability and performance of four separate pinch valves in Pennsylvania sewage treatment plants. The valves were jacket actuated and made by

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the Red Valve Company.

Jacket actuation is much simpler than a piston or diaphragm actuated type of control valve (figure 1). A jacket actuated pinch valve operates on the principal of air or hydraulic pressure being applied to a valve jacket. The build-up in pressure collapses the rubber sleeve to close off the process fluid.

The advantages of such a simple arrangement are that there are no bearings to seize or wear out and no packing or "O" rings to leak from repeated cycling or gritty material. Valves throttling raw sewage are also often in undesirable locations. Links and levers, typical of most

automatic valves, require constant lubrication.

Exteriors must also be cleaned of caked lime, scum, or loose debris, which may be resting on the pipeline. A copper tube or pipe is the only connection to a jacket type of pinch valve. External maintenance is, therefore, eliminated.

Newell Sewage Treatment Plant, Fayette County

A 4" pinch valve was installed in the Newell plant in 1967. The valve controls the amount of raw, un-screened, undegritted sewage influent to the plant (figure 2).

A flow controller is set at a 0.5 mgd and flow is measured with a magnetic flow meter. High surges are backed up and temporarily stored. Peak loads are released during low flow periods.

The chart shown in figure 3 is a typical period from 7:00 a.m. to 2:00 p.m. Flows were relatively steady throughout the period. There were no extremely high surge loads typical of morning and noon. All related plant equipment also operated on a steadier basis.

The valve was not removed from the line for inspection. After nine years of operation all parts were functioning properly. Only a coarse debris basket was ahead of the valve. Sleeve wear from grit and garbage grindings therefore, was anticipated.

In actual service, however, a pinch valve has less wear than any other type of valve and no wear was observed after nine years.

There was also no external maintenance or lubrication to the valve, even though it was in an underground valve pit.

McCandless Township Plant, Allegheny County

The McCandless Township plant was built in 1965 (figure 4). A 12" diameter pinch valve was used in the same manner as in the Newell Sewage Treatment Plant.

Due to the larger size and higher

About the Author

Larry Schneider is a member of Pennsylvania Professional Engineers Society, American Society of Mechanical Engineers, and the Water Pollution Control Federation. He has been involved with all types of control valves for 16 years. These include butterfly valves, ball valves, plug valves, check valves, and nuclear valves.

He is currently employed as Chief Engineer for the Red Valve Company of Carnegie, Pennsylvania.

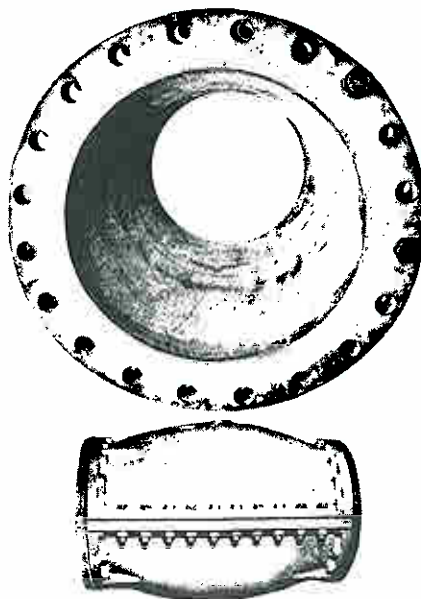


FIGURE 1. A jacket-actuated pinch valve has a "clean-thru" bore. There are no internal or external parts in the valve which can cause a maintenance problem.

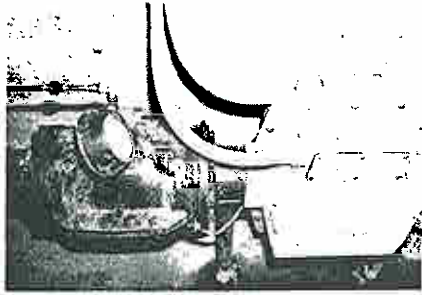


FIGURE 2. Pinch Valve installed in Newell, Pennsylvania Plant for nine years. Continuous throttling of raw unscreened sewage enabled steady plant flows.

pressure drop across the valve, water was used to actuate the valve. Water is incompressible and will stabilize any sleeve instability which could occur by using a large valve at highly throttled positions.

After seven years the valve was removed from the line (figure 5). A casting defect had abraded the rubber on the exterior of the sleeve. The defective cast iron housing was immediately replaced with a correct cast aluminum housing.

The rubber sleeve showed no signs of wear from sewage grit or

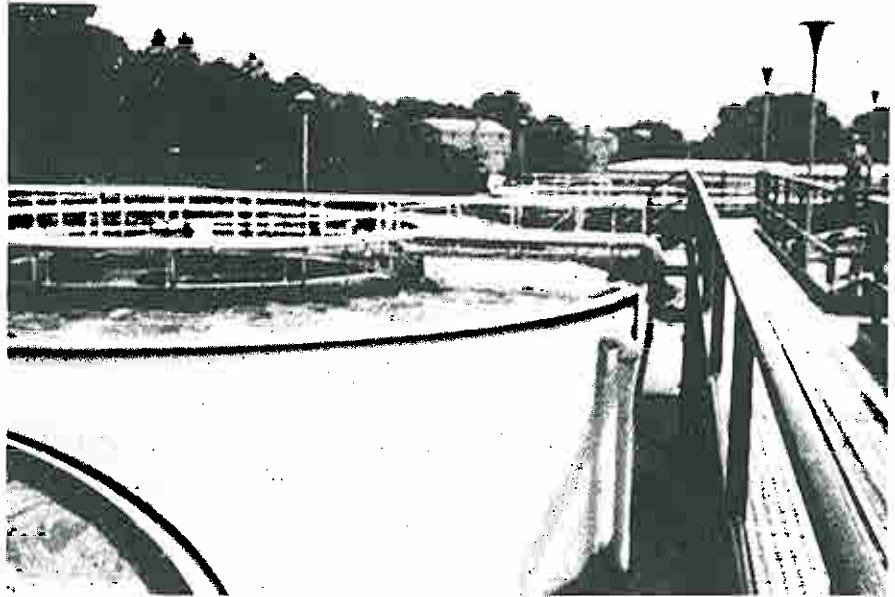


FIGURE 4. Above-ground sedimentation tanks at the McCandless Township Wastewater Treatment Plant. Pinch valves control the flow to the tanks.

any foreign material. A thorough inspection also revealed that the natural rubber material had shown no signs of deterioration or signs of chemical attack by grease or oil.

The sleeve was dissected and all nylon reinforcement, bonding, and internal ply were completely intact. The sleeve went through

millions of operating cycles and was in continuous motion for about eight years.

**Hatfield Township Plant,
Montgomery County**

The pinch valves at the Hatfield Township Plant were the subject of an article in the October, 1975,

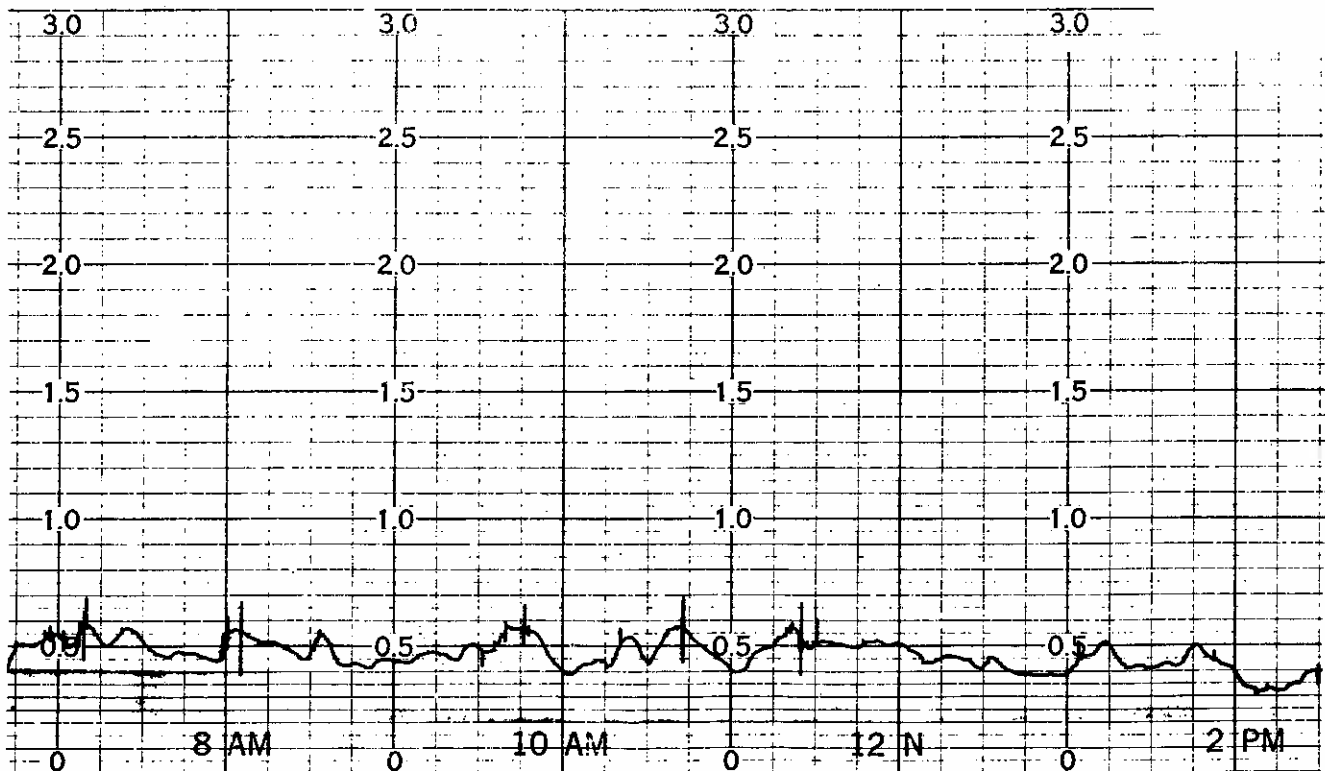


FIGURE 3. Influent flow chart for a portion of one day at the Newell Wastewater Treatment Plant. Pinch valve prevented large surges by continuous throttling.

Water Pollution Control Federation *Highlights*.

Two 18" diameter pinch valves with cast iron bodies and pure gum rubber sleeves were installed in 1970 to control the flow of raw sewage into the plant (Figure 6). Flow was estimated to be two to three MGD and was measured with a magnetic flow meter.

Pressure drops across the valves went as high as 75 percent of the upstream head. There was no grit

removal system other than what settled out during the limited time in the flow equalization tank.

Some difficulties were encountered in this application. The valves were highly throttled and pressure drop greatly exceeded the 25 percent usually recommended for jacket actuated pinch valves. Cavitation and flutter of the pinch valve sleeve resulted. Partially closing the downstream gate valves applied sufficient back pressure to the

pinch valves and stopped all flutter.

A hydraulic actuation system was added at a later date. Hydraulic fluid is incompressible, and any instability inherent with high pressure drops can be dampened.

An inspection of the sleeve after one year of operation revealed no damage or wear. New sleeves were reinstalled in the valves and have been operating since 1972.

Flow has been ideally equalized through the plant by using pinch valves. The flow chart in figure 7 is a plot of flow for several days through the plant vs. the estimated influent to the plant over the same time periods.

The pinch valves have controlled flow and equalized the operation of all related plant chemical feed equipment. Plant engineers estimate an energy savings of 200,000 KW HR/YR.

Lowther Street Plant, Dauphin County

Two 14" x 8" reduced port valves were installed at Harrisburg to control the flow of sewage through the plant. A reduced port valve has an hour glass cross section with flanges that match the pipe diameter and a reduced venturi throat that match the flow requirements (figure 8).

Throttled flow was calculated to be 2 mgd at 30 feet head pressure drop. A full bore 18" valve would have been throttled at an undesirable 95 percent closed for most of the day. An 8" valve had the correct flow opening and would throttle between 30 percent and 70 percent open.

Using the reduced port sleeve allowed the use of an 18" valve with 18" flanges with an 8" throat to handle the flow rate. The sleeve is easily replaced if new flow requirements increase as new communities use the sewage treatment plant.

The Harrisburg valves have been operating successfully since 1972. A magnetic flow meter is used to measure the flow of sewage through the plant. The flow signal is converted to a 3-15 psi air signal

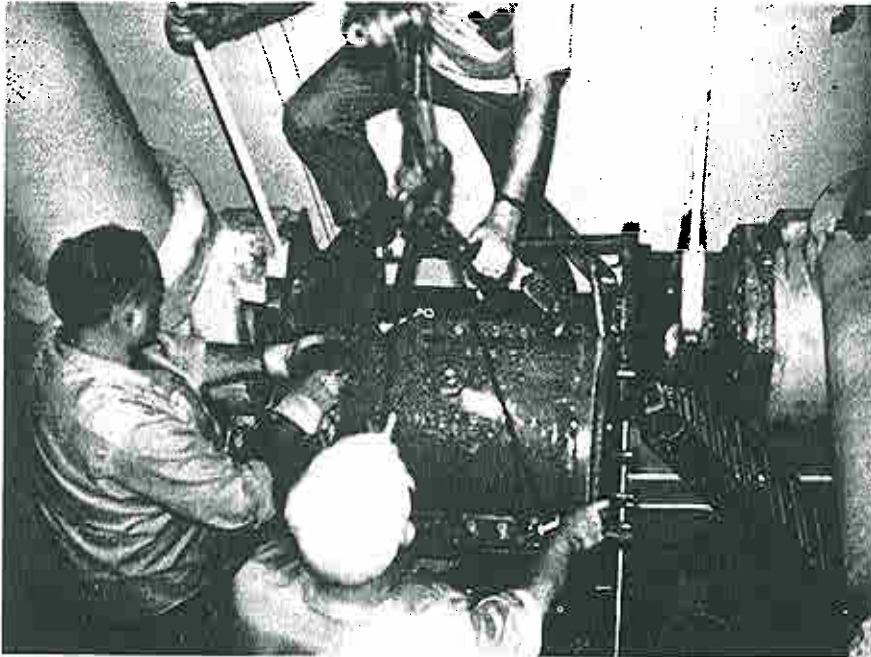


FIGURE 5. Pinch Valve at McCandless Township Plant is removed after seven years. Sleeve material was pure gum rubber and showed no chemical attack or abrasive wear from grit or solids.

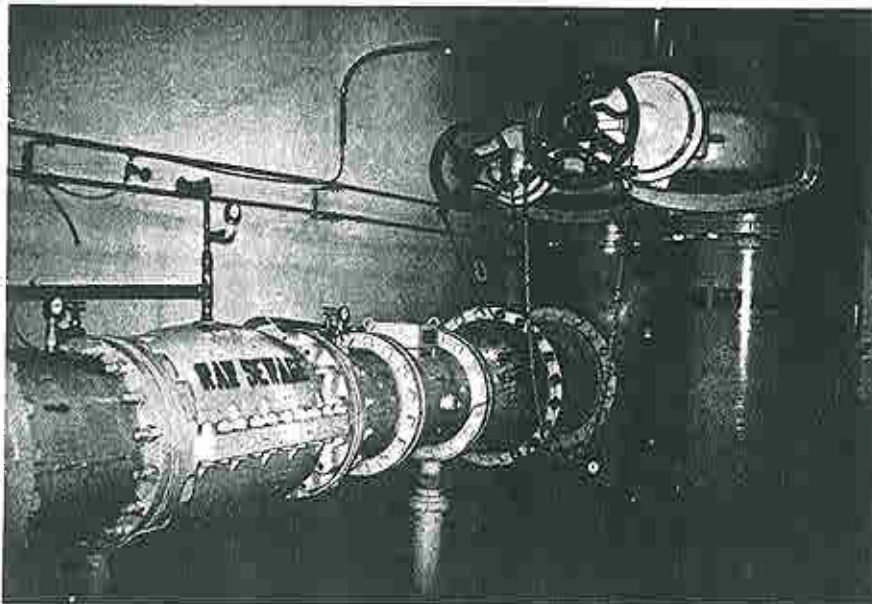


FIGURE 6. Pinch Valves Installed at the Hatfield Township Wastewater Treatment Plant.

which operates the pinch valve. A booster relay is used to convert the instrument signal to a control pressure sufficient to operate the valve.

Although hydraulic tanks were supplied with the valves, the air system was never converted to hydraulic. The valves are highly throttled at 500 gpm for the majority of the week.

In spite of the extremely high velocities of grit and sand through

a highly throttled valve, no wear on the pinch valve sleeve has occurred in four years. Future requirements probably will be less severe as flows increase and throttling is in a more ideal control range.

The valves in the four Pennsylvania plants prove that raw sewage can be successfully throttled. The pinch valves never clogged, jammed, caked with grease, or deteriorated in the sleeve rubber.

Many valves have been in service for longer time periods in other sections of the country. The life of a pinch valve can and will equal the design life of the wastewater treatment plant.

A savings of thousands of dollars per year in operation costs can be realized by allowing the wastewater plant to operate at a steady rate. Overall plant size can also be reduced since equipment does not see peak and start-up loads.

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(Continued from page 13)

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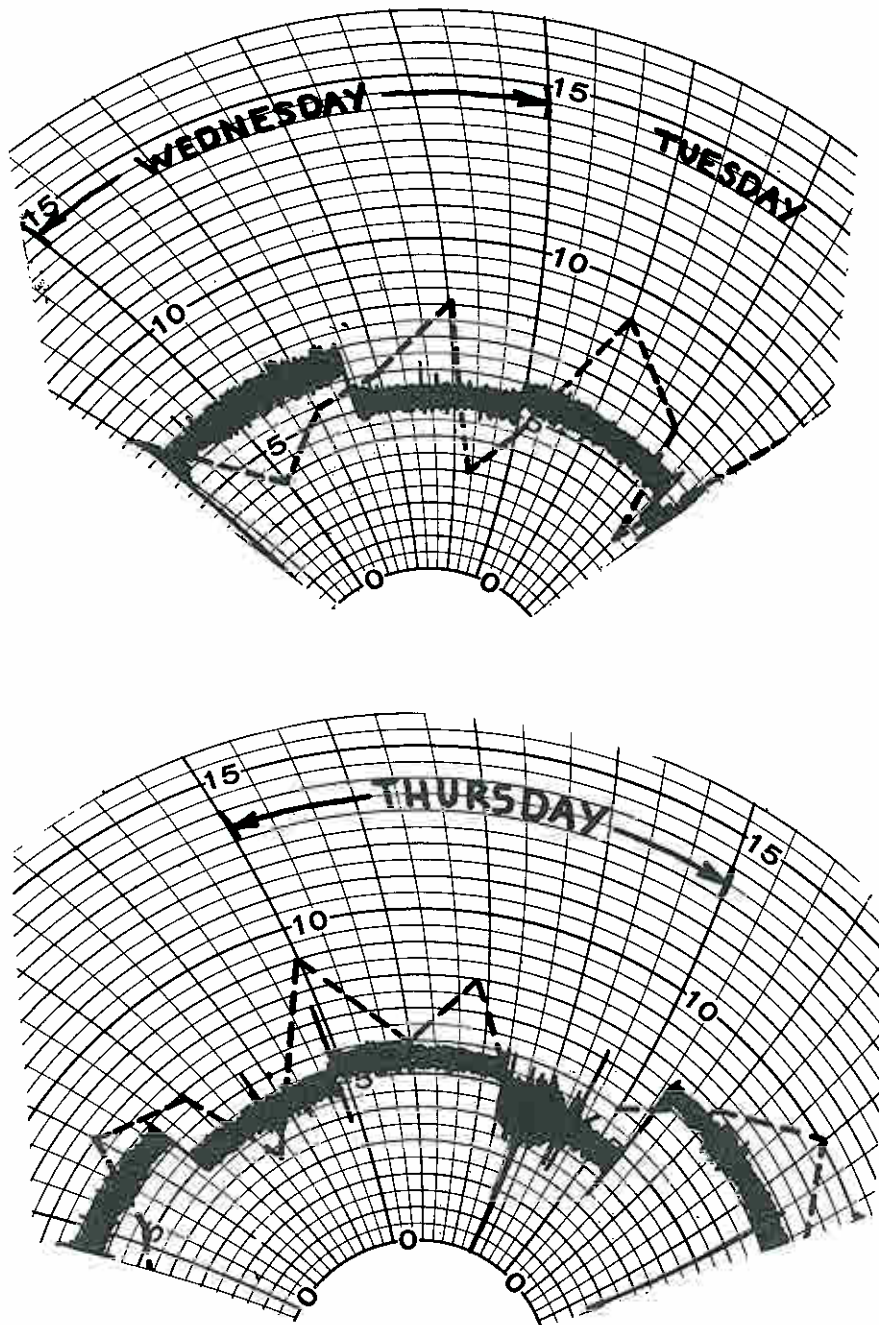


FIGURE 7. Hatfield Township Sewage Plant Estimated Influent Before Pinch Valve (Dotted Line) and Measured Influent After Pinch Valve (Solid Line)