

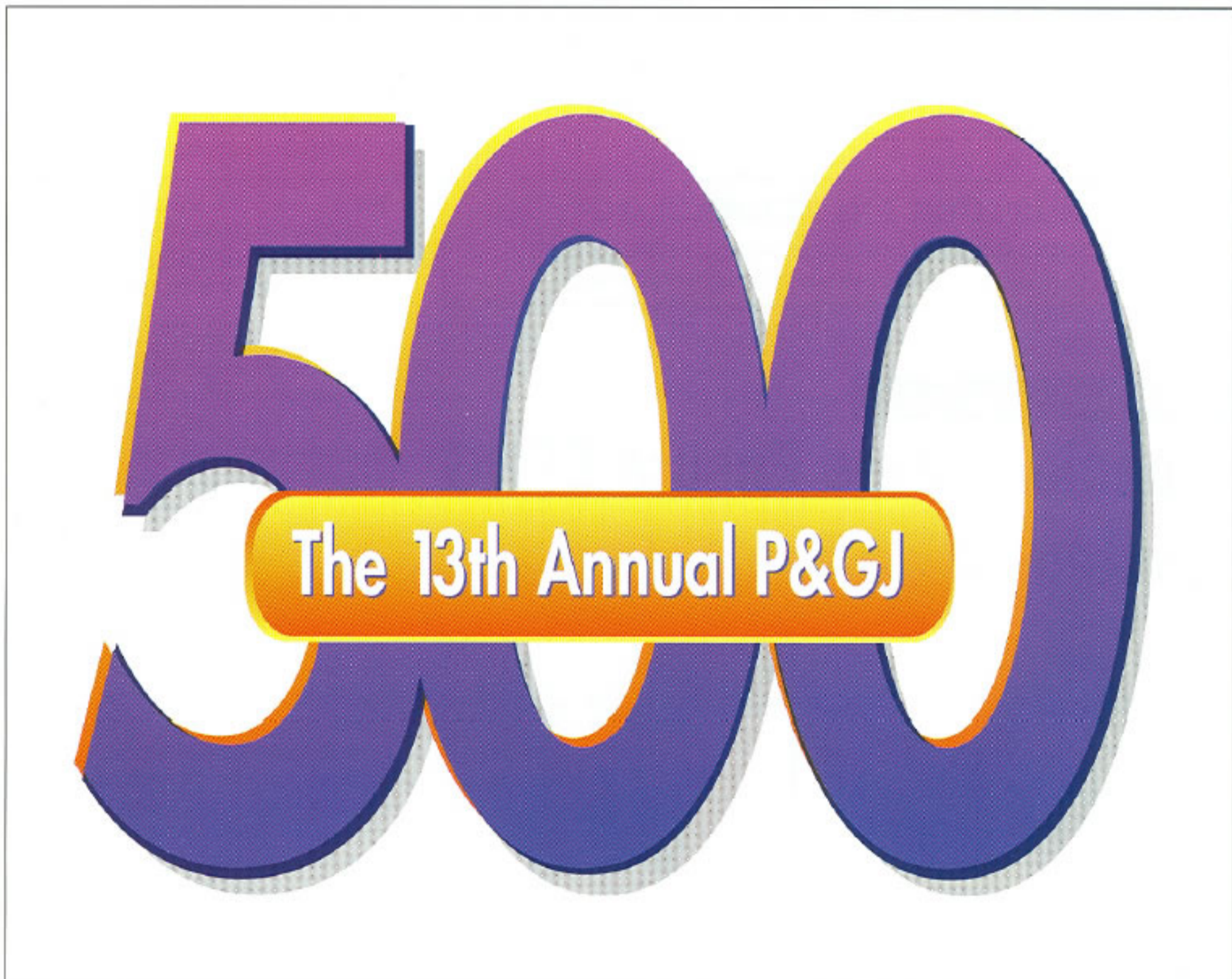
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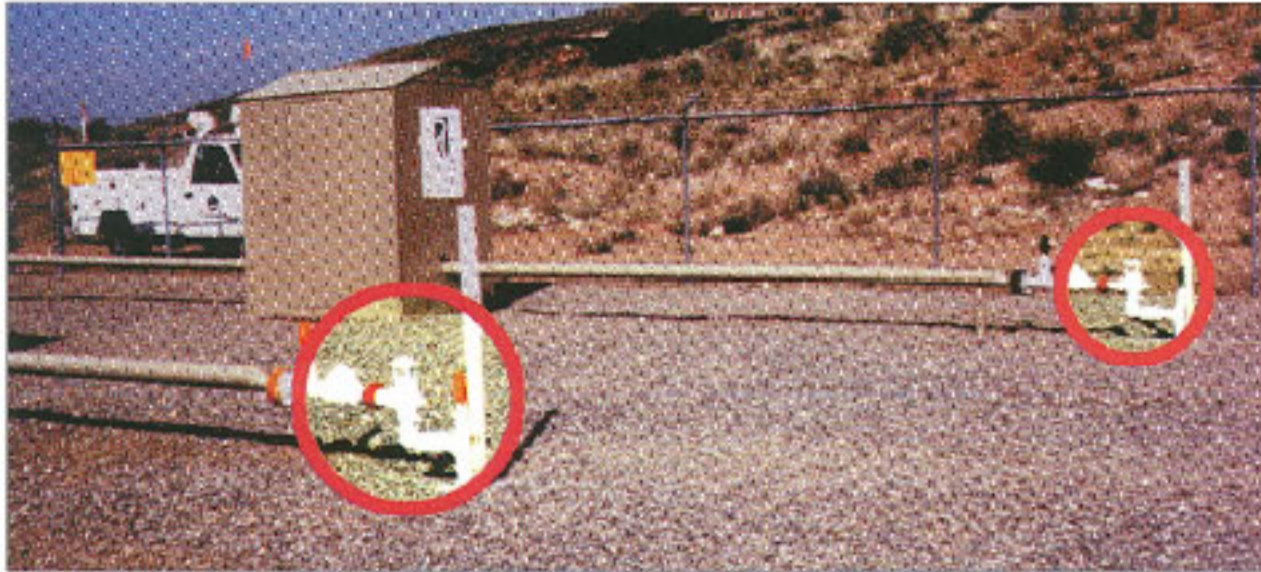
The 500 Report Of The Leading U.S. Energy Pipeline Companies



- Top 300 Leading Gas Utilities By Customers
- Top 100 Natural Gas Pipelines By Mileage
- Top 100 Liquids Pipelines By Barrels Moved
- Special Valves Ensure EPNG System-Wide Protection

Rupture Pin's

Emergency Shutdown Valve



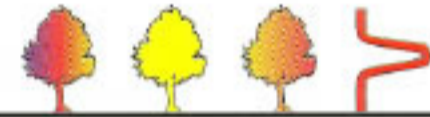
Rupture Pin's EMERGENCY SHUTDOWN VALVE solves gathering system MAOP Compliance Problems. In the event of a valve or regulator failure, gas from a compressor or gas well will not overpressure the system. As an added benefit, the standard valve is velocity sensitive. Accordingly, if an operator puts the gas line on stream too quickly – for example by rapidly opening a ball valve – the ESV valve closes immediately. This will eliminate meter pegging, blown mercury and deformed orifice plates.



RUPTURE PIN TECHNOLOGY, INC.

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- Thousands in successful installations
- Closes bubble tight in milliseconds
- Only one moving valve part – the piston
- The precise Rupture Pin is both the sensor and actuator
- Field resettable in minutes without fugitive emissions
- Accuracy of set point $\pm 5\%$
- Pressures from 8 ounces to 20,000 PSI
- Sizes from 1/4" to 24"



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AND VACUUM PROBLEMS
WITH ENVIRONMENTALLY
CORRECT SOLUTIONS**

Technology Report

Special Valves Ensure EPNG System-Wide Protection

By
John R. Maillie
Manager of Technical Services
Field Services Division
El Paso Natural Gas company
and
Raymond E. Duran
Lead Technician
Aztec Pipeline District
El Paso Natural Gas Company
Farmington, New Mexico



■ As the methods and technology for gathering and transporting natural gas continue to evolve, El Paso Natural Gas Company (EPNG) has faced numerous operational challenges. Prior to the late 1980's, wellsite pressure was maintained by EPNG, so control of maximum allowable operating pressures (MAOP) to ensure the compliance and integrity of the company's system piping was not a problem. However, when operational changes required EPNG to move downstream to the meter run, the company no longer had control at the wellsite. As a result of the potential for wellsite equipment failures, MAOP immediately came to the attention of EPNG.

EPNG established a technical committee in 1990 to research alternative methods to keep system piping below the MAOP. The committee immediately identified several priorities for any over-pressure protection device:

- Reliability
- Low maintenance
- Operating safety
- Environmental protection

Pipeline Safety Regulations

(U.S. Department of Transportation, Research and Special Programs Administration, Revised Oct. 1, 1992). In part, they state:

192.621(a) "No person may operate a segment of a high pressure distribution system at a pressure that exceeds the lowest of the following pressures, as applicable:..."

192.621(a)(5) "The pressure determined by the operator to be the maximum safe pressure after considering the history of the segment, particularly known corrosion and the actual operating pressures."

192.621(b) "No person may operate a segment of pipeline to which paragraph (a)(5) of this section applies, unless over-pressure protection devices are installed on the segment in a manner that will prevent the maximum allowable operating pressure from being exceeded, in accordance with 192.195."

192.195 "...Each pipeline that is connected to a gas source so that the maximum allowable operating pressure could be exceeded as the result of pressure control failure or of some other type of failure must have a pressure relieving or pressure limiting devices."

Over-Pressure

Department of Transportation regulations governing the maximum allowable operating pressure of high-pressure gas systems are clear about over-pressure.

The directive EPNG issued to the committee was also clear: the company will control the operating pressure of gas entering its pipeline system.

Options

EPNG employees met with representatives from several manufacturers to research methods and equipment for controlling pipeline pressure.

Several options were considered, including standard relief valves, pilot-operated check and globe valves, rupture discs and electronic pressure-control systems. However, none was selected due to excessive costs of material, installation, annual inspection and maintenance, combined with concerns about reliability and environmental protection. The search continued.

A representative of Rupture Pin Technology, Oklahoma City, described the company's products (see *Pipeline and Gas Journal*, October 1992) in a meeting at EPNG's office at Bloomfield, N.M. During the technical discussion, the conversation turned to the possibility of using the rupture pin valve, but operating in reverse. That is, using it to enable a valve to operate in the open position and but close instantaneously to a bubble-tight seat at an exact set point.

Solutions

Working with Rupture Pin™ Technology, EPNG installed and evaluated a prototype Excess Pressure – Emergency Shut-Down Valve in June 1991. The valve was specifically designed to prevent over-pressuring of downstream piping. By November the EP-ESVs were being installed throughout the gathering system on a systematic basis.

Currently, EPNG has installed some 1,000 EP-ESV valves based on the prototype design to enhance the compliance of its pipeline. Another 500 or so EP-ESV valves have been installed to date in and around Farmington by independent gas producers and operators contracting with EPNG for transport of natural gas.

In nearly 2 years of field operations, the EP-ESV valves EPNG installed have proven their effectiveness in providing over-pressure protection for gas piping. Installed on the upstream side of meter runs, the valves protect downstream piping, as well as expensive gas measurement equipment, in the event of regulator or throttling valve failure (Fig. 1).

Rupture Pin EP-ESV valves are also sensitive to velocity. Accordingly, if an operator puts the gas line on-stream too quickly — for example, by rapidly opening a ball valve — the EP-ESV valve closes immediately. This eliminates meter over-range, blown mercury and deformed orifice plates. Field experience has also shown that EP-ESV valves close to shut off flow in the event of a pipe rupture downstream of the valve installation. Pin color coding and the fact that pins are not interchangeable at different pressures assures the correct pin is used during resetting.

Resetting the piston quickly without major disruption or gas loss, while protecting personnel — and the envi-

Fig. 1

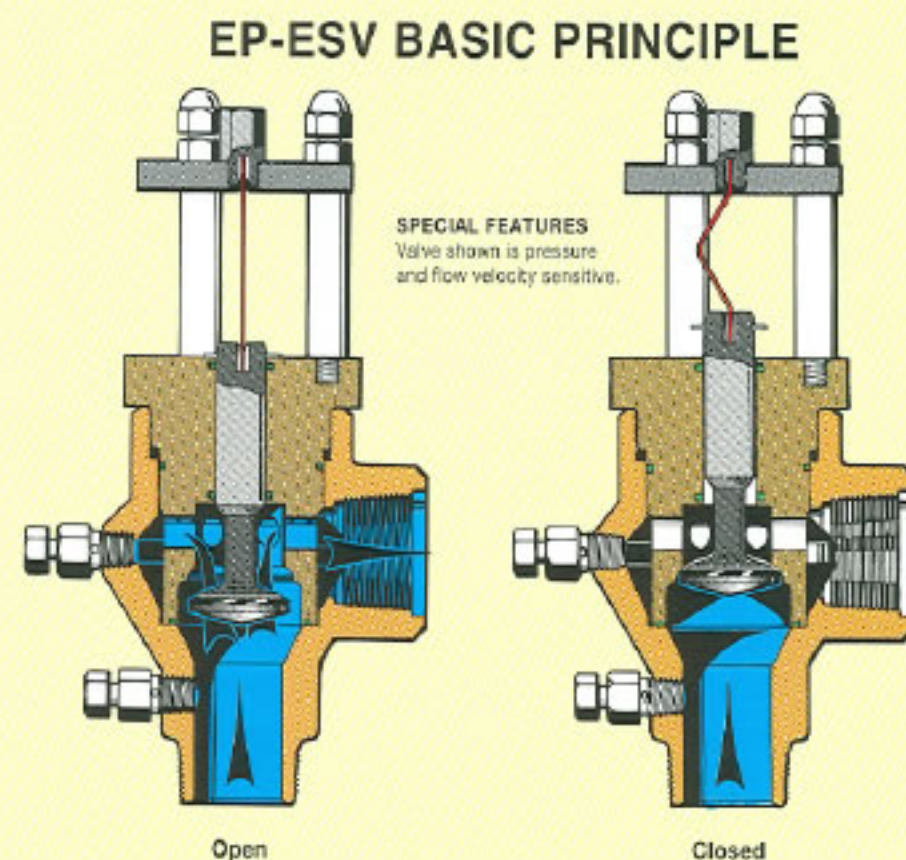
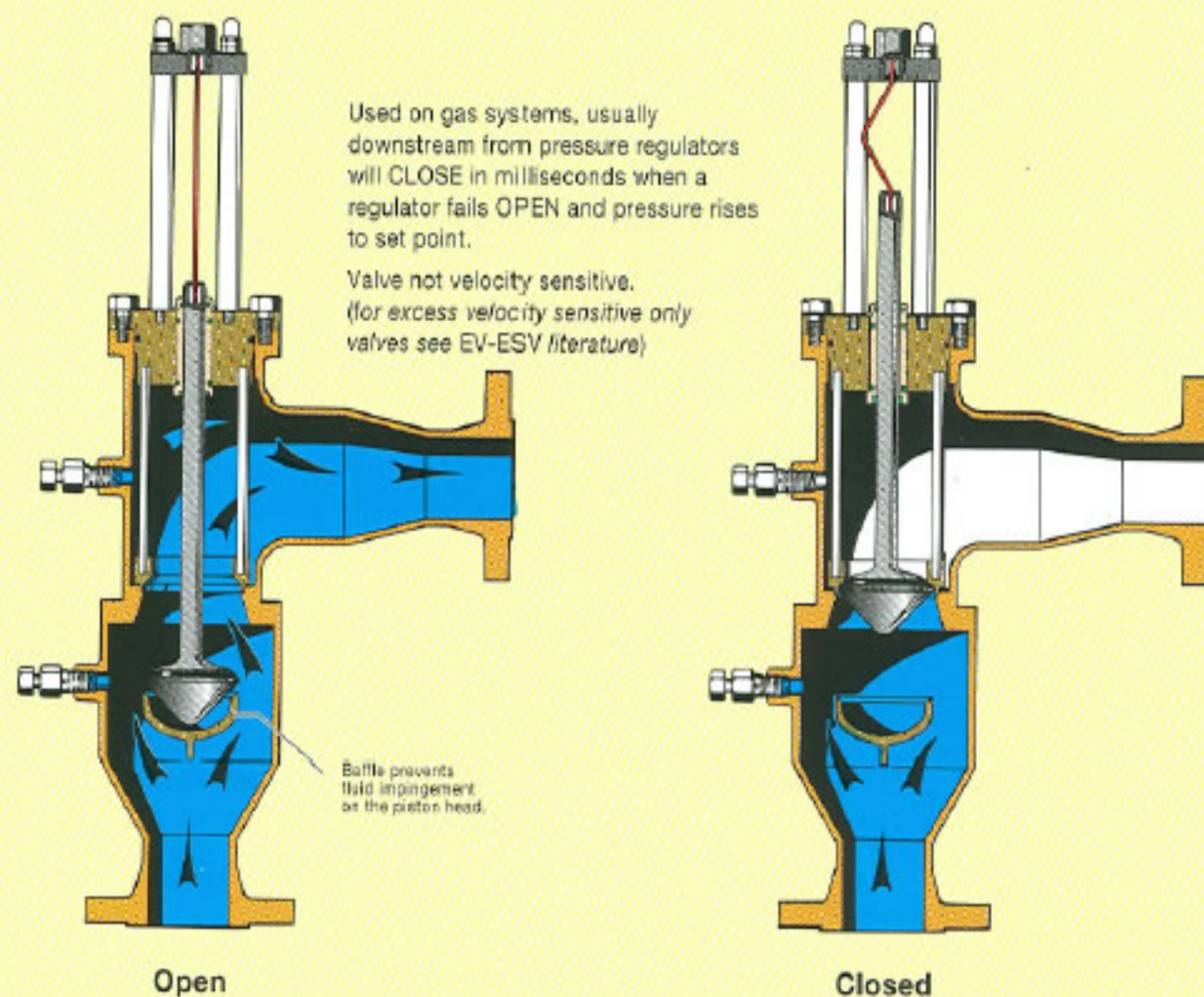


Fig. 2



ronment — from fugitive emissions, was in keeping with the committee's maintenance and safety mandates. Other factors leading to the selection of EP-ESV valves included their extreme accuracy, ability to operate in temperature extremes and capacity for handling contaminants and liquids introduced into the gas stream during upsets.

With the EP-ESV valves judged by EPNG's committee to have met all requirements and test evaluations, the company recently decided to expand the project to cover additional gathering systems. EPNG also considers the Rupture Pin EP-ESV valves a cost-effective method for protecting its system piping.

The EP-ESV valves EPNG selected for its systems operate at an accuracy of plus or minus 5 percent of set points ranging from delivery line pressures of 125 p.s.i. to 675 p.s.i., protecting the gathering system from high delivery pressure or wellhead pressures. Field trials have also shown that ambient temperature variations, mechanical shock and pressure pulses do not cause rupture pin fatigue or inaccurate closing. The valves can be reset in minutes, without dismantling the valve or opening the line, thus eliminating the risk of fugitive emissions.

EPNG also requires over-pressure protection at central delivery points, where large volumes of gas are delivered into its pipeline system. Due to the increased flow volume at these points, the pipe diameter is generally 4 inches or larger. As a result, the EP-ESV valves used in this application are modified to eliminate their sensitivity to velocity. This was accomplished by installing a baffle under the piston head to eliminate direct flow impingement (Fig. 2).

Operating Principle

The principle behind the EP-ESV valve design (Fig. 1) is to hold a piston, subject to the system pressure, off seat with a pin that precisely senses axial force. When the axial force reaches an exact, critical value (*governed by Euler's Law*), the pin buckles and the piston instantly moves to its full closed position. Factors controlling the precise closing point are the area of the piston stem on which the system pressure acts (*acting force*) and the characteristics (*resisting force*) of the pin.

The accuracy of EP-ESV valves is reliant primarily upon rupture pins having strict parameters of metallurgy, heat treatment, diameter and length. Other factors affecting valve performance include the precise holding of the pin ends, the axial alignment of the end holding recesses and orienting the device consistent with factory tests to take into account the weight of the piston on the pin.

EP-ESV valves have only one moving part, the piston. In effect, the expendable, precision Rupture Pin functions as both the valve's sensor and actuator. Visual inspection for pin buckling indicates closure. However, remote indication of closing is also possible. Because the pin buckling mechanism is a direct, mathematical application of Euler's Law relating to slender columns, valve closing occurs in milliseconds — much faster than pilot — or electronic sensor-based designs are capable of closing. **P&GJ**