

# Effective Use of Pilot-Operated Control Valves in Dirty Crude Oil Applications

## BENEFITS

- Piping system allows use of pilot-operated control valves with little or no maintenance
- Standpipe keeps foreign material out of the pilot supply line
- Self-contained pilot-operated valves require no external power source
- Can be installed in a variety of piping configurations



## APPLICATION

A pilot-operated control valve is a self-acting pressure control valve used for backpressure, pressure reduction and pump bypass. In liquid applications involving crude oil pipelines, the degree of cleanliness of the crude oil is not always well known, with foreign material often found in the product. In addition to pipelines, foreign materials are also encountered in tanker off-loading operations or other processes involving product movement.

## CHALLENGE

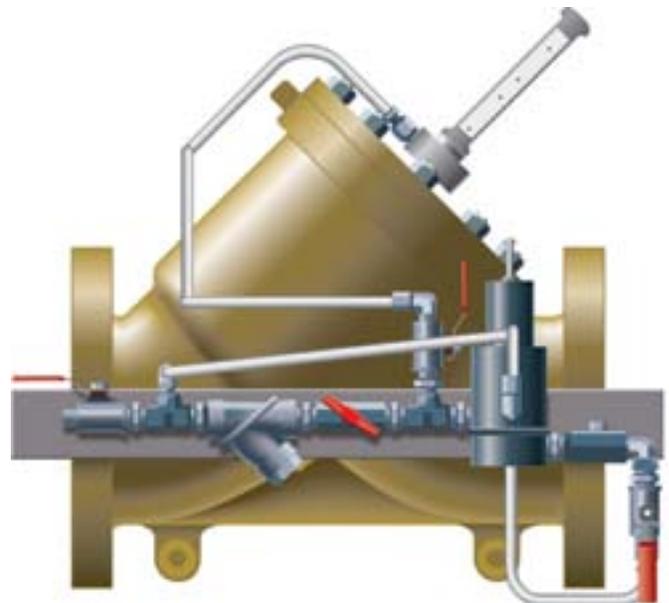
Foreign material such as sand, pipe scale, rocks, metal chips, and other debris can be troublesome for self-contained pilot-operated valves. These valves are often as small as  $\frac{3}{8}$ " in diameter, making them susceptible to blockage. This is why many potential users avoid their use in crude oil applications.

Foreign materials can cause blockage, leading to unplanned maintenance and downtime. If undetected, these materials can be a major safety hazard. If foreign material accumulation becomes excessive, the pilot will become inoperable, failing to control pressure within a process.

As a result, the majority of existing pilot-operated valve applications are on clean products where the standard pilot supply strainer is adequate. Electrically-operated valves are often used in crude oil applications, but they are slower operating, and typically require external power.

Daniel innovates pilot operated control valve design to solve dirty crude oil application blockage challenges with proven results

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New design features make Daniel 700 Series Pilot-Operated Control Valves less susceptible to blockage in dirty crude oil applications, reducing maintenance costs and unplanned shutdowns.

## SOLUTION

Illustrated in the Standard Installation schematic, Daniel 700 Series pilot-operated crude oil valve system employs a ½" blow down valve, a 1" strainer and a ½" sensitivity control needle valve in the pilot supply lines. The pilot sense line is integral to the valve and connected downstream of the "X" Port Ball Block / Blowdown Valve. Upstream of the control valve are the standpipe / reservoir arrangements which have proven effective in preventing the pilot control loop from foreign material.

Why is this effective?

1. The properly sized standpipe is large enough to act as a settling tank.
2. The pilot control loop is approximately 1-3 US GPM. (Varies: the bigger the valve the higher the flow rate.)

The velocity (ft/sec) in the standpipe is very low compared to the velocity in the main line. Therefore, most foreign material will not enter the standpipe. If it does, it will drop back into the main line. This only applies to a standpipe mounted integrally to the main line.

Three arrangements of standpipes are possible:

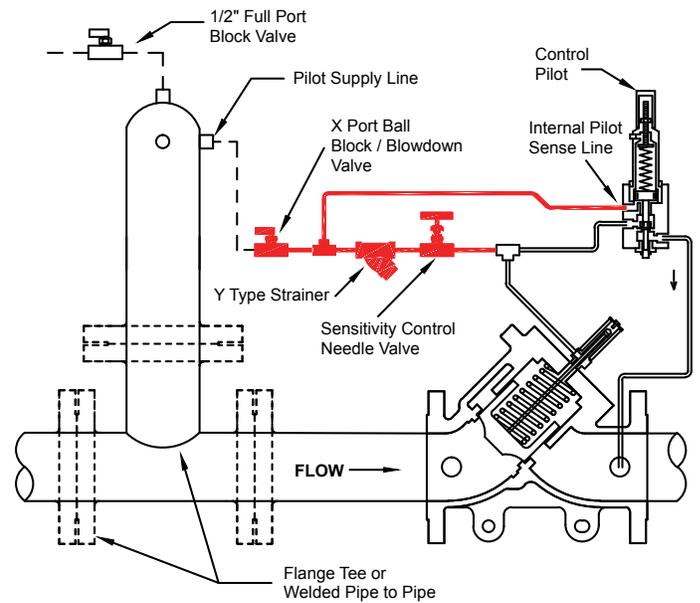
1. A vertical pipe welded into the main line
2. A pipe tee with an extended pipe
3. A separate pipe-mounted standpipe / reservoir, illustrated in the Alternate Installation diagram

The Standard Arrangements 1 and 2 are the most efficient, as they are self-cleaning. Most foreign material, should it enter the standpipe, will drop back into the main line. Either of these two arrangements is recommended.

Arrangement 3 is recommended for existing valve installations where it is not practical to cut into the main line. A blow down valve is required in the bottom of the standpipe for this arrangement, and it must be opened periodically to dissipate all accumulated foreign material. An air vent valve at the top of the standpipe is used to dissipate air on initial startup, and air that may accumulate during normal operation.

On products with higher vapor pressure, the standpipe should be used with caution. If the temperature is high and / or the line pressure is low, the standpipe could become a vapor trap and interfere with the operation of the control valve.

### Standard installation



### Alternate installation

