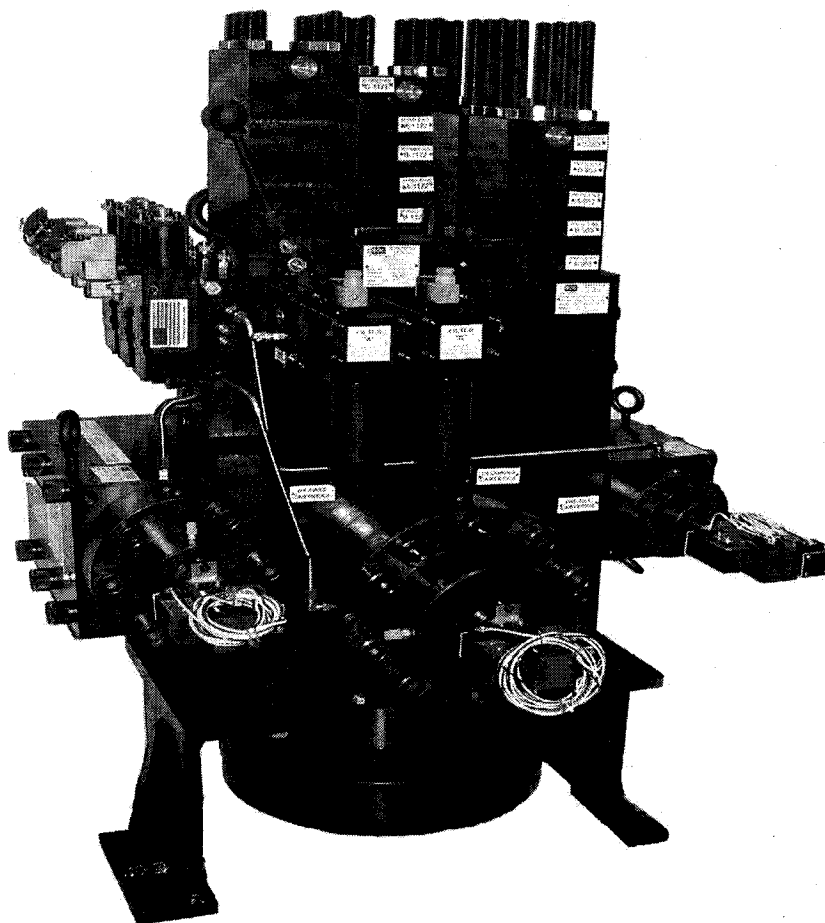


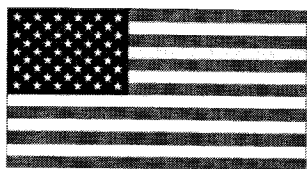


Water Hydraulics, Inc.

High Pressure Water – DV Series –



Quad-STM Poppet Cartridge
*Zero Leakage, Media Piloted
Raw Water Operation*



Proudly Made in USA

Visit Us on the Web At:
www.bocwaterhydraulics.com

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P.O. Box 1028
Salem, Ohio 44460

DV Series - Decoking Valves

The process of 'decoking' often uses high pressure water through nozzle jets to create a cutting action. The control of the high pressure water is critical to the operation and longevity of the system. Control valves must be designed for high pressure water service and properly sized for the required flow. Generous porting and other passageways must be provided to maintain proper fluid velocities throughout the valve. Managing decompression velocity and shock are critical control variables that must be considered in prudent valve design. Rapid changes in fluid pressure creating high velocity changes can cause dissolved air to precipitate from solution and cause damage similar to that produced by cavitation. Unfortunately, many valve systems fail to properly 'manage' decompression velocity, thereby causing short valve life.

Often decoking control valves use standard or semi standard two-way water valves that are air diaphragm or air cylinder operated. Various methods of pneumatic/electric synchronization between bypass and main valves are used to meet various control requirements. These units cause system shock, poor or no pre-filling, improper synchronization, extreme internal wear and consequently, high maintenance costs. Proper design considerations start with the decoking water. Coke fines included in the water make the media a cutting fluid. Short stroke spindle lift valves create high velocities through the seating area and valve body resulting in erosion of both.

BOC recognizes the need for a long lasting, reliable control valve package that can withstand the long term adversity of decoking applications. Building upon a successful track record of supplying innovative high pressure water cartridge valves to fulfill the need to control descaling water flows in the steel industry, BOC has introduced its DV Series valve line to meet the needs of the refining industry. The **BOC Decoking Valve** is a true high pressure water cartridge valve utilizing our proven **Quad-S** cartridge technology. A single, properly sized cartridge element is dedicated to each function; **bypass, cutting and pre-filling**. A series of innovative stack orifice plates are used to reduce pressure and control fixed flow rates. All components are manufactured with high quality materials and are designed to withstand the harshest water flows.

Each valve application is engineered to meet your requirements. Typically, customers require that valves 'bolt up' to existing field piping envelopes. Our design team can package our modular technology to fit any need. No piping changes are required to install a **BOC Decoking Valve**. If feasible, we often include each cartridge in its own '2 way' bolt on package to facilitate on-going maintenance and service. Each valve system design is optimized to meet operational as well as maintenance requirements.

BOC Water Hydraulics uses the best materials, process, and design techniques available today to build an extremely long-lasting valve. All internal parts are of various stainless steel grades, many with special heat treating to high Rockwell levels to withstand the erosive effects of water flows. Valve housing and valve caps are made from forged steel and are protected with our unique **Ollinite**® corrosion and erosion resistance treatment. This proprietary process hardens the housing to high hardness levels and prevents any surface corrosion.

Reducing pressure in by-pass and pre-filling flow paths is also particularly hard on valve components. **BOC's** orifice plates are also protected and hardened with the **Ollinite**® process. Discharge plates are constructed from high strength, heat treated stainless steel. Furthermore, all orifice plates are mounted externally on the valve for ease of maintenance.

Cartridge technology is only as reliable as the pilot valve that controls its operation. BOC controls all cartridge operations with its rugged and field proven **V010 Series** packed spool directional valve line. The **V010 Series** valve has been in service for many years in the steel industry, providing reliable piloting pressures in extremely dirty and caustic environments. Each cartridge element opening and closing speed is controlled via metering flows through its corresponding V010 pilot valve. Solenoid air pilots provide reliable shifting action to the V010 spool actuators. All pilot valves are mounted in conveniently serviceable areas on the valve. Gauging is supplied to confirm proper operation of piloting signals.

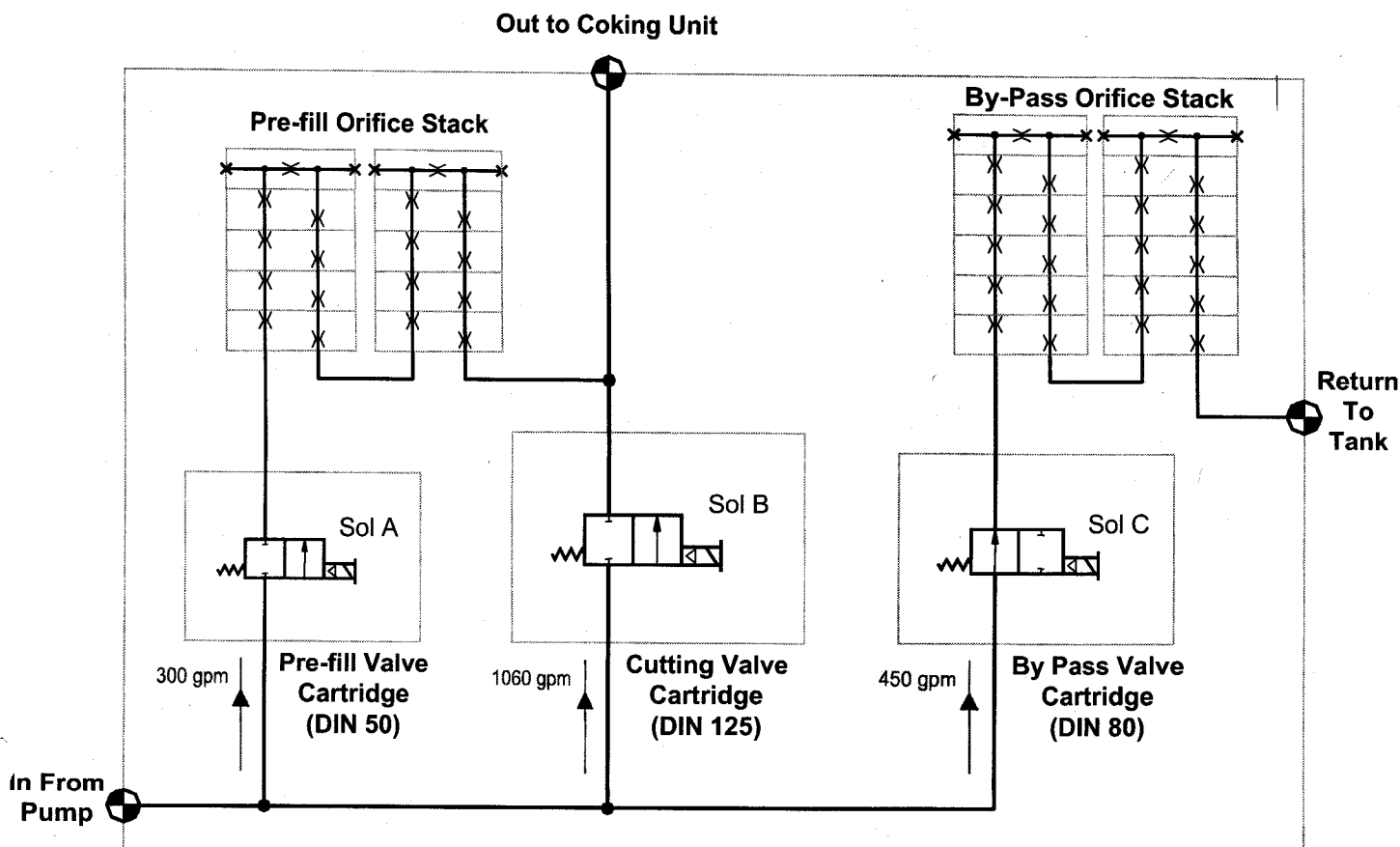
BOC Water Hydraulics can accommodate a host of individual requirements. BOC can supply the valve with position indication, pressure switches, or any other instrumentation that may be required for safe and reliable operations. Please consult factory for additional information regarding special requirements.

Typical Sequence of Operations

Prior to the decoking process beginning, the bypass valve is open and the pump is running. Pump flow is through the bypass circuit. The bypass circuit must be properly designed to provide adequate minimal pump flow for cooling of the pump and a staged "breakdown" orifice assembly to dissipate the horsepower/pressure energy gradually. Fluid velocity and pressure drop are directly related. As pressure drop increases so does velocity. In the bypass mode the entire system pressure (5000 psi) is decreased to tank pressure (0) creating a delta P of 5000 psi. A valve alone will never withstand the velocity created by a delta P of 5000 psi. The "breakdown" orifice assembly eliminates high velocity erosion and decompression shock when shifting from decoking to bypass. The "breakdown" orifice assembly stages the system pressure drop (5000 psi to 0) over a series of orifices each sized for 200-300 psi pressure drop. The bypass valve has minimal delta P and therefore normal design velocity.

The decoking process begins by opening the prefill valve to fill the decoking system and lance. Proper prefilling purges air in the piping which eliminates system shock caused by rapid high pressure compression of the air column contained in the system piping and lance. Once the system is filled, the main control valve opens, the bypass valve closes and decoking commences. Valve poppet acceleration and deceleration must be controlled during the opening and closing. Valve opening and closing times should be limited to 0.5 to 1.0 seconds.

Typical Schematic Pump and Cutting Water Control



Cutting Valve Cartridges

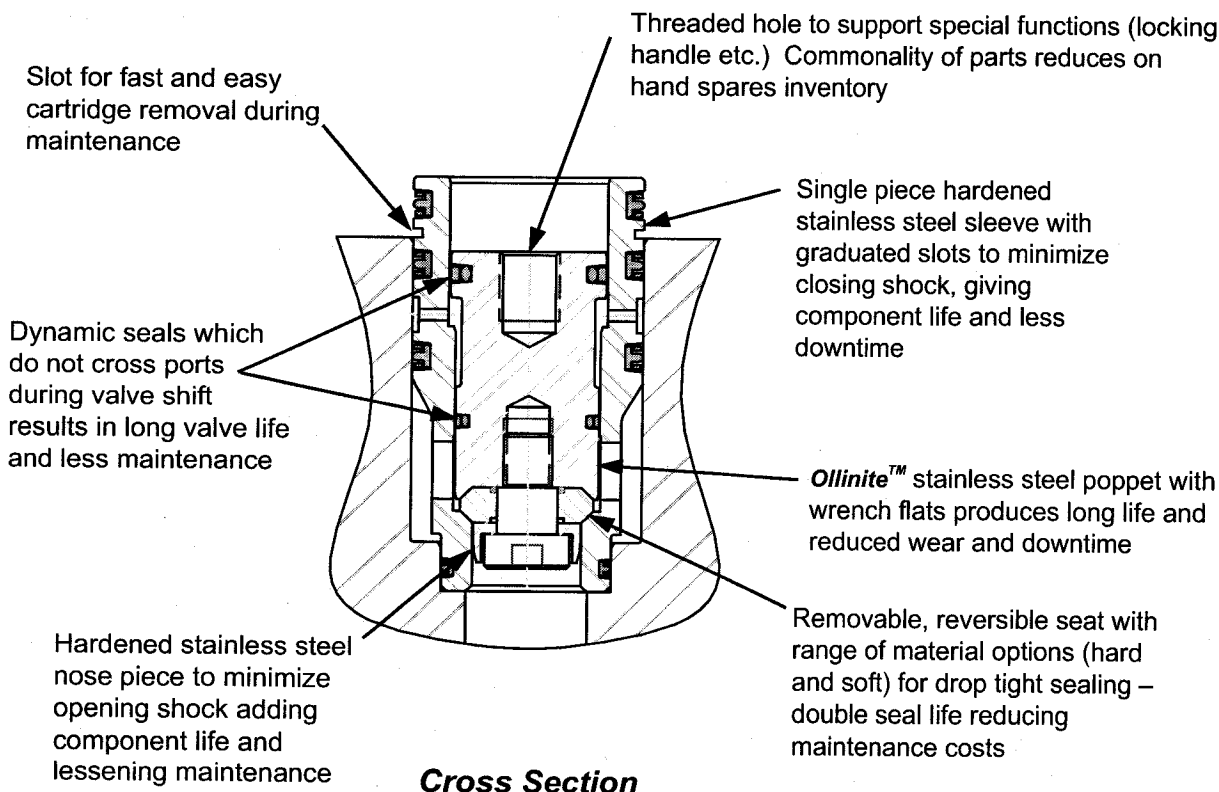
All decoking valves use **Quad-S™** (Stainless Steel, Soft Shift), zero leakage, 2-way, poppet cartridge elements for primary valve action. The **Quad-S™** cartridge offers numerous benefits over other spool or poppet type designs as highlighted below. High quality materials of construction and precision machining combine to make a long lasting valve cartridge.

Maintenance features of the cartridge are far superior to other valves. Features include such innovations as slots in the valve cap and cartridge sleeve for ease of field service. If maintenance is required, the valve cap is quickly and easily removed. The single piece sleeve then protrudes out of the valve housing and can be easily extracted using the slot. In most instances, it will only be necessary to remove the poppet. Poppet removal is accomplished simply by installing a bolt in the threaded hole on top of the poppet and pulling. In all cases, the valve is extremely more economical to service than traditional spool type valves with external air operators which require costly repairs on a frequent basis.

Different size cartridge elements can be combined to create a multi-function valve. For example, the valve shown herein contains a DIN 125 cartridge for main flow to the cutting head, a DIN 80 cartridge for pump by-pass flow, and a DIN 50 cartridge for header pre-fill flow.

All cartridges are capable of raw water operation up to 6000 psi. **Quad-S™** cartridges are available in sizes ranging from Din 16 (3/4") up through Din 200 (8").

Quad-S™ Cartridge **(Stainless Steel, Soft Shift)**



Pressure Reducing Orifice Stacks

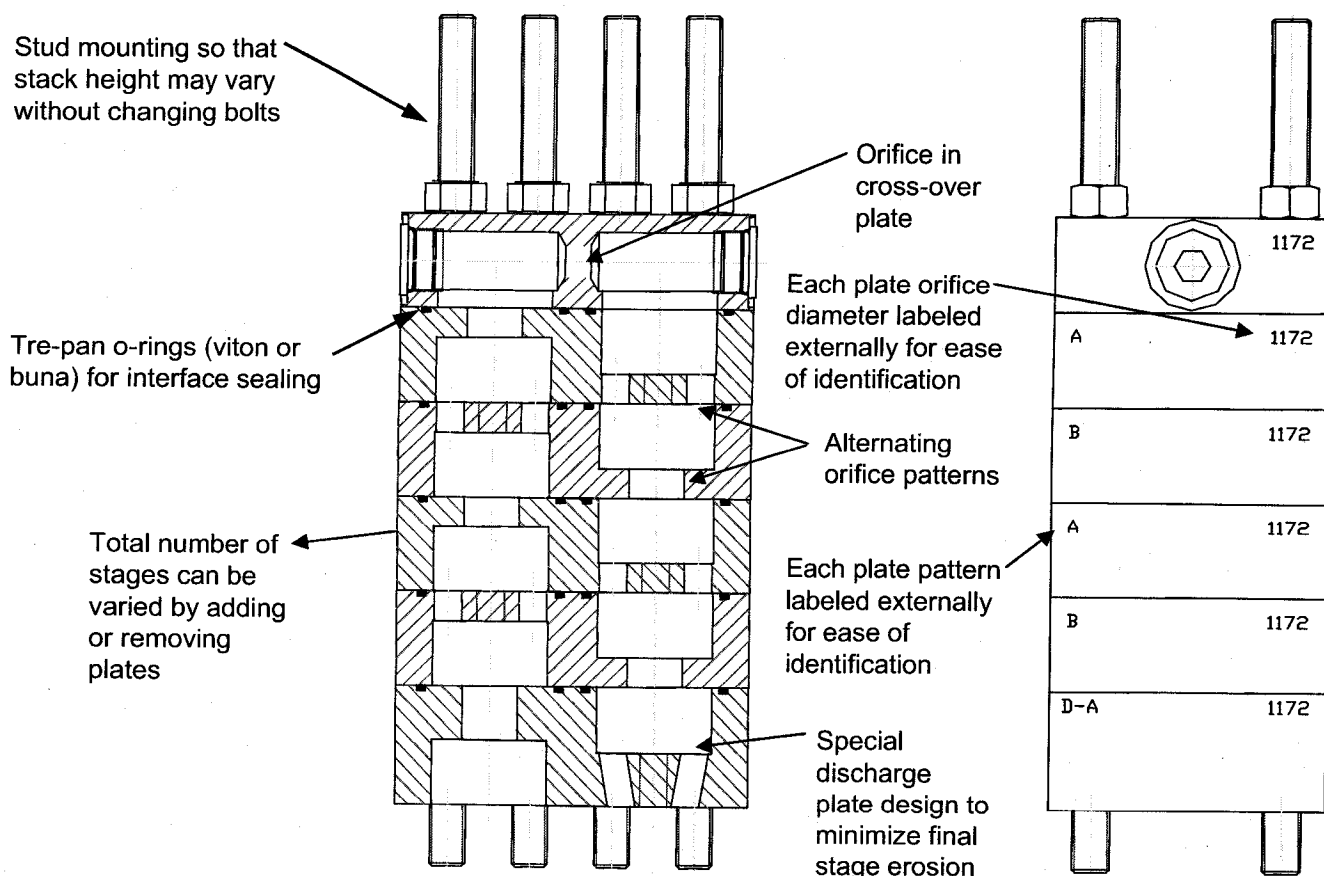
Reducing pressure and controlling desired high pressure velocity flow can be extremely challenging in commercial applications. If pressure drops are too large per stage, then water jet forces cut and erode away equipment from the inside out. If pressure drops are too low, then desired flow rates are not achieved and supported equipment is in danger of sustaining damage from overheating. BOC's manifold mounted, stacked orifice plate assemblies are a solution for both problems. With our unique orifice assemblies, customers can 'dial' in required flow performance by simply changing stack height or by changing out orifice plates.

Frequently pressure reducing fixed orifice type equipment can not be serviced in the field. Pressure reducing plates are often welded into the pressure housing, or in some cases, integrally installed in valves or other flow control equipment. If maintenance is required, entire units must be swapped out. Not so with BOC's approach to orificing. The orifice stacks can be quickly disassembled, inspected and re-assemble right in the field. Field personnel can change plates as wear exceeds specifications and pressure drop decreases. In short, the headaches associated with expensive maintenance are no longer.

All orifice stack components are constructed from heat treated and hardened stainless steel or from **Ollinite™** steel. Given the high quality of materials and construction, individual stack plates will last years in continuous flow application when properly sized.

Plates are available in 1" through 3" sizes. Various orifice diameters are available depending on flow characteristics and other field requirements.

Pressure Reducing Orifice Stacks



Cross Section

Pilot Valves

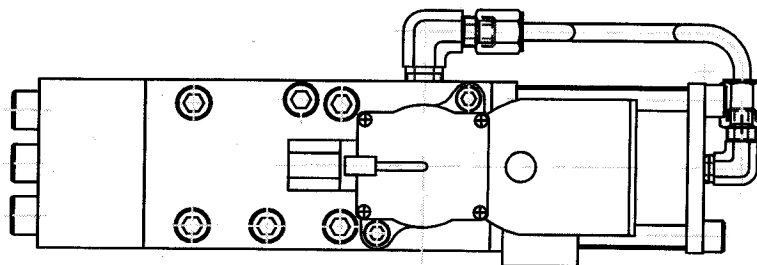
All DV Series valves use BOC's 10 gpm, 3/2 way, air operated, packed spool type, directional control valve for main valve pilot operation. The valve is designed and built specifically for the challenges of piloting decoking valves. The valve is field proven and rated to 6000 psi in raw water applications. Normally closed or normally open versions are available. Valve envelope is as shown below.

Key features include a balanced spool for maximum seal life. The valve also incorporates an integral air cylinder with dual springs for positive shifting force. Air pressures of 90 psi is recommended to ensure positive shift. The resulting value is through flawless performance and minimal downtime

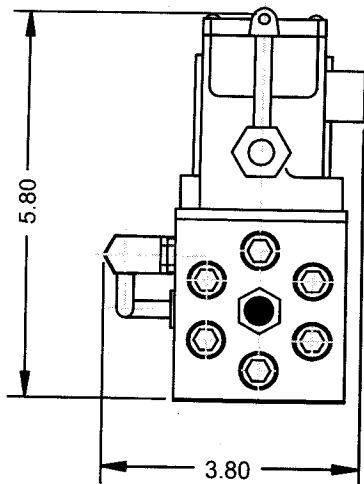
Pilot filtration to 100 microns or less is recommended. A variety of filtering options exist, including external or internal filtration.

The valve contains all stainless steel internals. Valve cap and housing are protected with *Ollinite™* to prevent corrosion and erosion from raw water operations. Housing mounting pattern conforms to NPFA, D05 standards. Higher pressure applications (>3000 psi) use six (6) mounting bolts.

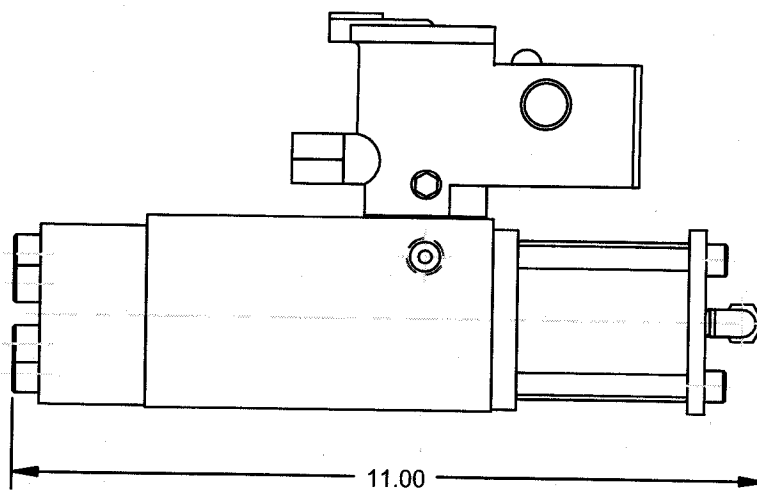
3/2 Way, Air Operated, Packed Spool Type, Pilot Valve



PLAN VIEW
- TOP -



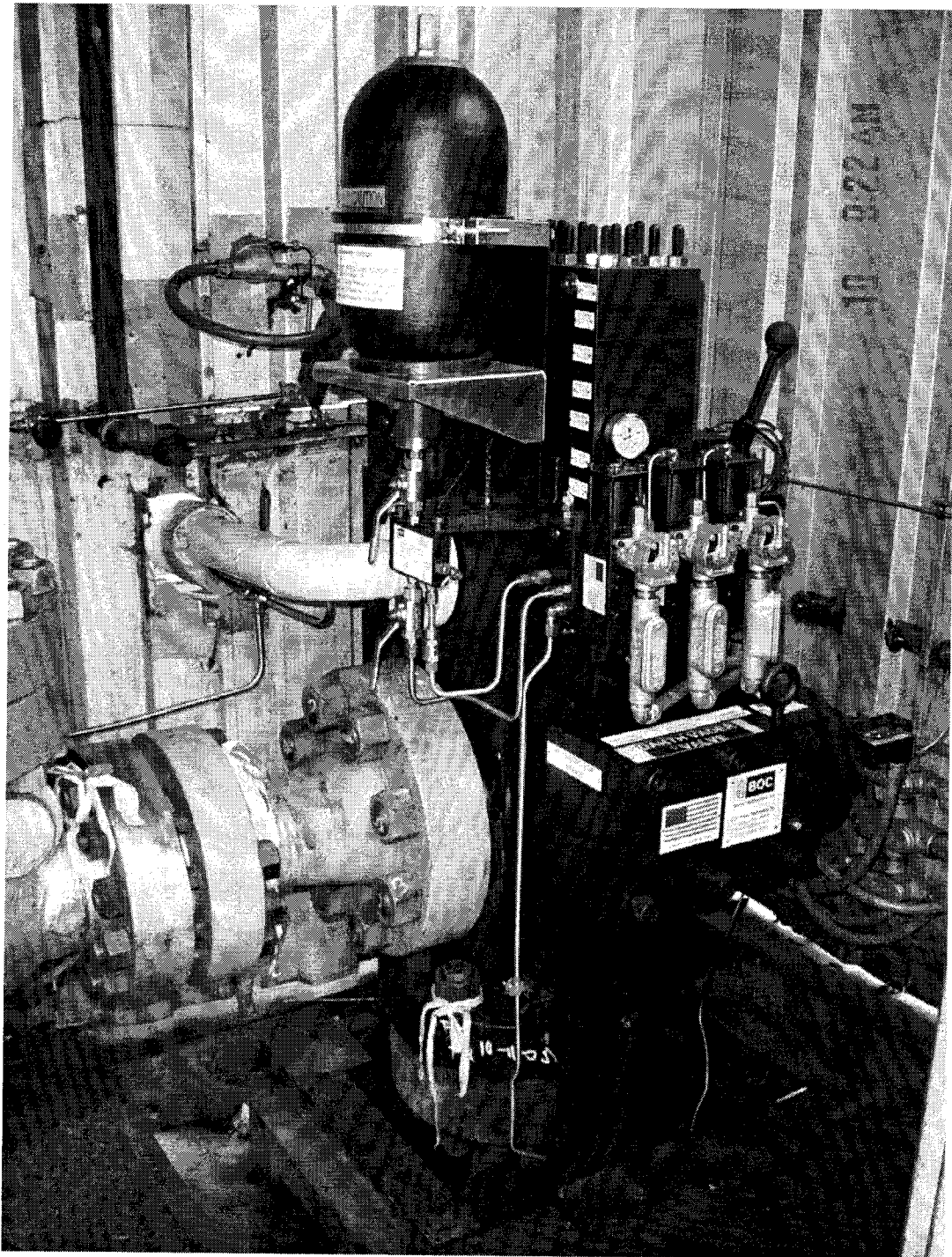
ELEVATION VIEW
- END -



ELEVATION VIEW
- SIDE -

Typical Installation

6" Decoking Valve – The valve pictured below incorporates a DIN 125, 2 Way, Normally Closed cartridge valve for cutting water flow control. The valve also includes a DIN 80, 2 Way, Normally Open cartridge valve for pump by-pass and a DIN 50, 2 Way, Normally Closed cartridge valve for header pre-fill. Flange orientation and size matches the mounting envelope of the previously installed valve.



Ordering Information

| DIN CARTRIDGE SIZE | |
|--------------------|-------------|
| (mm) | *Flow (gpm) |
| 050 | 250 |
| 080 | 519 |
| 100 | 800 |
| 125 | 1230 |
| 150 | 1770 |

* Flow rate though cartridge at 20 ft/sec velocity

| APPLICATION | |
|-------------|------------------------|
| F01 | Single Stage Operation |
| F02 | Multi Stage Operation |

| SEAT TYPE | |
|-----------|-----------------------------|
| 2 | Hard Seat (Stainless Steel) |
| 3 | Other - Specify |

| PILOT SECTION | |
|---------------|-----------------------------------|
| 0 | Valve without Pilot Section |
| 1* | With Air Solenoid Op. Pilot Valve |

* Pilot Valve Normally Open - Descale Valve Normally Closed

**DECOKING
VALVE**

DV 125/80/50 - F01 - 21 - 624 / 999

| FLANGE SIZE | |
|-------------|-----------------|
| 3 | 3" Nominal Pipe |
| 4 | 4" Nominal Pipe |
| 6 | 6" Nominal Pipe |
| 8 | 8" Nominal Pipe |

| FLANGE RATING | |
|---------------|----------|
| 6 | 600 lb. |
| 9 | 900 lb. |
| 1 | 1500 lb. |
| 2 | 2500 lb. |

| OPTION CODES | |
|--------------|--------------------------|
| EXP | Explosion Proof |
| PI | Position Indication |
| DXF | Duplex Pilot Filtration |
| 24VDC | Special Solenoid Voltage |
| 0 | Other - Consult Factory |

| FLANGE TYPE - BORE | |
|--------------------|------------------|
| 1 | XS Short Flange |
| 2 | X Strong Flange |
| 3 | XX Strong Flange |
| 4 | Sch 160 Flange |

Factory Assistance - Call
Phone: 330-332-4444
Fax: 330-332-1650