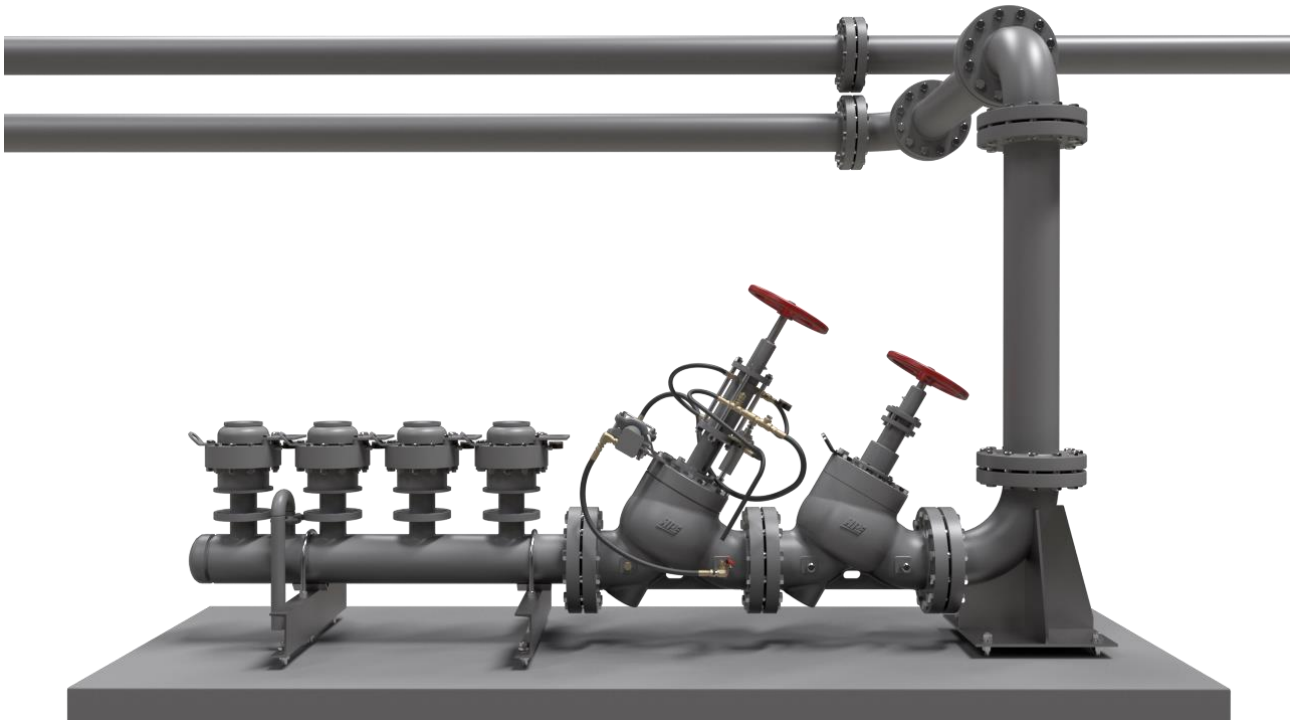


P.I. 200 SURGE ANTICIPATION VALVE STATION



PURPOSE

The purpose of the SAV station is to prevent pressure surges above the steady state pumping pressure in the event of a pump trip by entirely mechanical means thus eliminating the need for electrical systems that require a battery UPS back-up.

The graphs below show the relative effects of trip on the system with the no protection, a Surge Relief Valve only and the Surge Anticipation Valve.

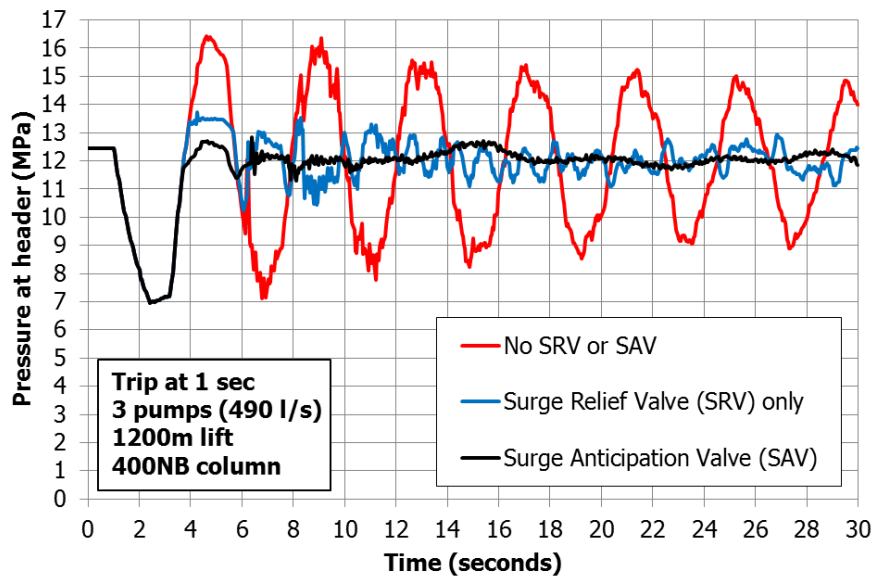


Figure 1: Simulation of a system after a trip indicating pressure fluctuations

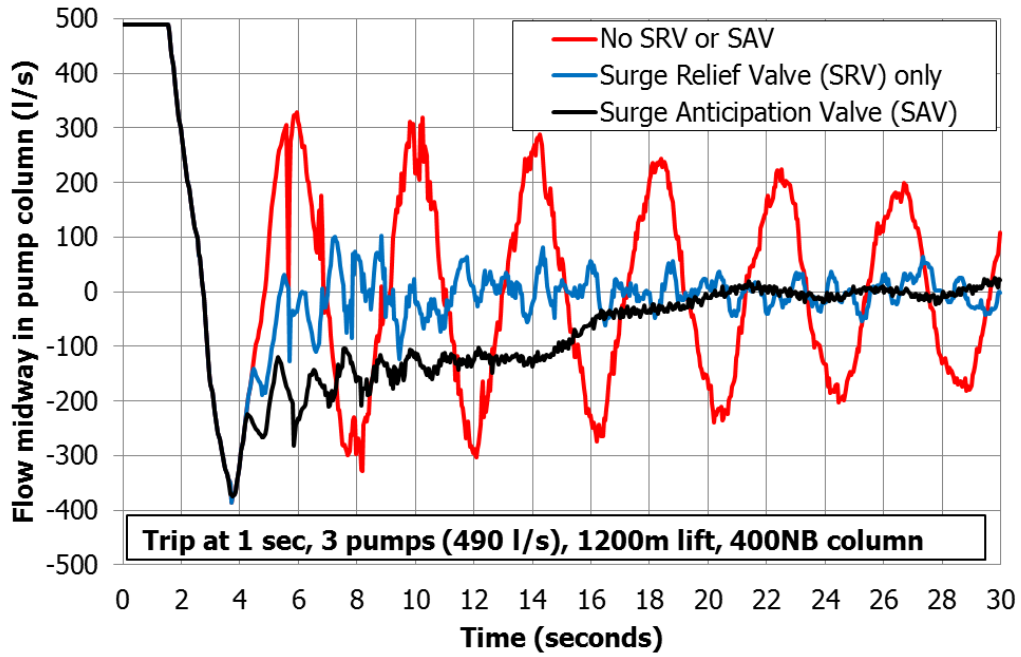


Figure 2: Simulation of system after a trip indicating mid-column flow rates

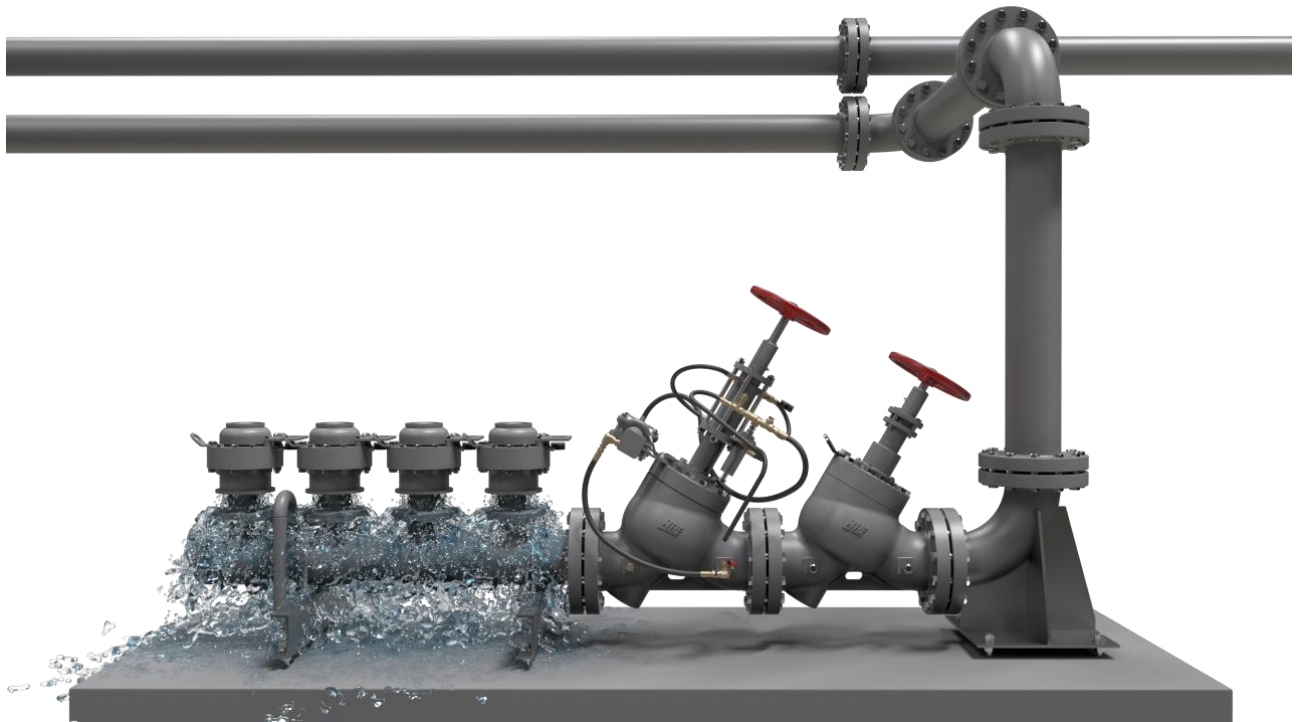


Figure 3: Water discharging

BACKGROUND

Underground pump de-watering systems need to be protected against pressure surges which increase the risk of high forces, pipe movement and pipe failure. These pressure surges occur due to rapid changes in fluid velocity; typically due to pump starts and stops--the worst case generally being uncontrolled pump stops due to a sudden loss of electrical power i.e. a pump trip.

To protect pump columns against pressure surges the following valves are available:

- Pump Control Valves (PCVs) with actuators that ensure slow fluid velocity changes when opening and closing
- Non-Return Valve (NRV) that closes fast enough to prevent reverse flow
- Air Admission Valves (AAVs), also known as Vacuum breakers or 'Snifters' which admit air into the top of column where it changes to horizontal to prevent cavitation spikes associated with 'roll back' of the fluid in the horizontal line
- Surge Relief Valves (SRVs) which eliminate excessive surge pressures above their nitrogen charge pressures
- Surge Anticipation & Isolation Valve (SAIV) which 'anticipates' a rise in pressure by sensing the initial drop in pressure immediately following a trip and opens before the pressure surge rises above the pumping pressure

If the correct number of SRVs are specified in correctly designed systems with pipe wall thickness allowances for pressure surges, SRVs can limit the pressure surges to about 1.5 to 2.0 MPa above the pumping pressure.

However, in corroded systems or those where inadequate strength remains, the SAV station can ensure the pressure never goes more than 0.5 MPa above the pumping pressure at the header. In high-velocity, critical or deteriorated systems with a history of pipe failures, upstream SRVs may be installed as a 'belts-and-braces' back-up to a SAV system.

DESCRIPTION

The Surge Anticipation Valve (SAV) station is installed in the pump chamber on the header pipe and consists of:

- One SAIV which is normally closed
- One SAPV which senses the column pressure and causes the SAIV to open when the pressure drops to a set point below the normal steady state pumping pressure
- Four downstream SRVs which are charged to a pressure below the steady state pumping pressure and relieve fluid to atmosphere when the SAIV opens
- One manifold that connects the SRVs to the upstream and downstream side of the SAIV

FEATURES

- Soft 'catch' action of the valve system minimizes pressure surges due to fluid velocity changes
- Simple mechanical design eliminates the need for instrumentation and back-up electrical power supplies
- The SAIV may be manually closed to isolate the downstream manifold for maintenance purposes
- The SAV operation can be tested with no risk of generating pressure surges by simulating a column pressure drop which allows the opening and closing times and pilot pressure to be set

and checked. The SAIV will open when the pilot set pressure is reached, the SARVs will dump water and then the SAIV will close. This can be done regularly as part of planned maintenance

- Minimum water wastage
- Based on proven HPE robust, dirt-tolerant, Y-pattern isolation valve with high-pressure throttling capability and fast-acting nitrogen charged Surge Relief valves
- Available in any pressure or flange class
- Anchored to footwall for easy maintenance and to resist transient fluid forces
- Option of Electrical Actuator override for remote monitoring and control

TECHNICAL SPECIFICATIONS

Surge Anticipation Valve Station (as shown)

Nominal Size (NB)	200
L x W x H (m)	3.7 X 1.0 X 1.4
Mass (kg)	1000 kg max.

Surge Anticipation & Pilot Valve

Nominal Size (NB)	200
Valve body	Cast steel--ASTM A216 grade WCC (equivalent BS 3100 grade A4)
Flanges	Wrought carbon steel--AISI A105 or as specified
Hubs (where applicable)	As per body
Seals	Ultra-high molecular weight polyethylene
O-rings	Nitrile--70 Shore hardness
Spindle guides	Bronze--ASTM B505C83600 (equivalent to SABS 200D or BS 1400 LG2)
Guide pins	AISI 304
Seats & poppets	AISI 431 hardened
Externally painted	Standard
Hot dip galvanized piping	As requested by customer
H/dip galvanized and externally painted	As requested by customer
Maximum working pressure (MPa)	15.3
Maximum pumping flow rate (l/s)	500
L x W x H (m)	1 x 0.5 x 1
Mass (kg)	~600
Pilot set pressure to open SAIV (minimum) (MPa)	1 - below nominal column pressure
Time to open valve (sec)	~0.5
Time to close valve (sec)	~20

Surge Relief Valves

Nominal Size (NB)	100
Downstream nitrogen charge pressure (Bar)	0, 5, 10, 15 - above SAPV trip setting