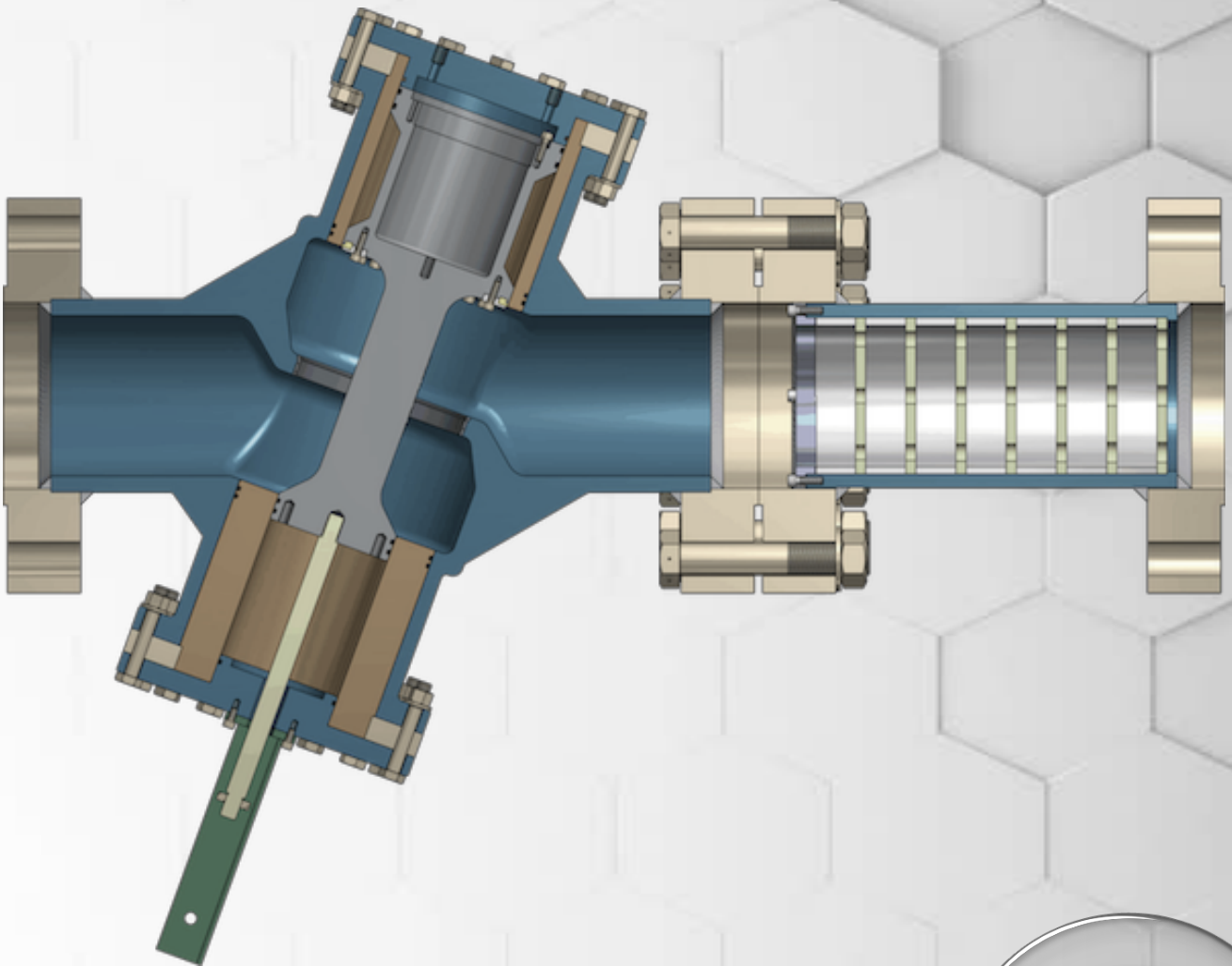


Hydrocore Limited Presents

Hydrocore™ Angular Shock Prevention System



Hydrocore™ Angular Shock Prevention System



APPLICATION

Areas of Application

The Hydrocore™ shock prevention valve prevents the occurrence of water hammer when:

- The entire pump station trips.
- The last of the running pumps trips.
- A pump operator abruptly switches the last running pump.

UNIQUENESS

The Hydrocore™ shock prevention system is a unique solution for high-pressure vertical or inclined pumping

COLUMN DRAINING

The Hydrocore™ shock prevention valve is used as the column drain valve, enabling cavitation-free draining of the pump discharge column.

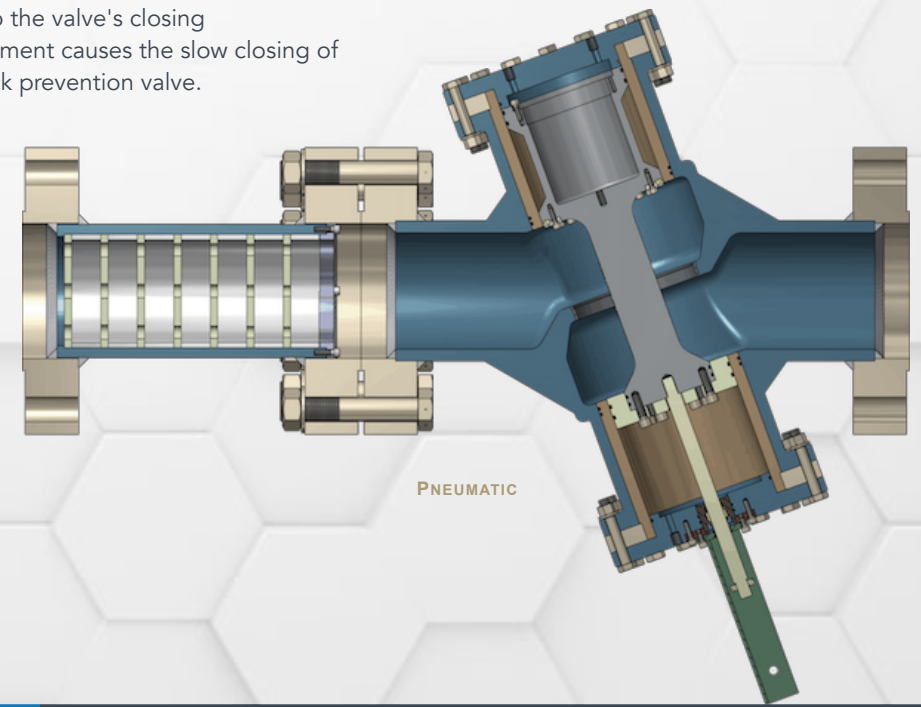
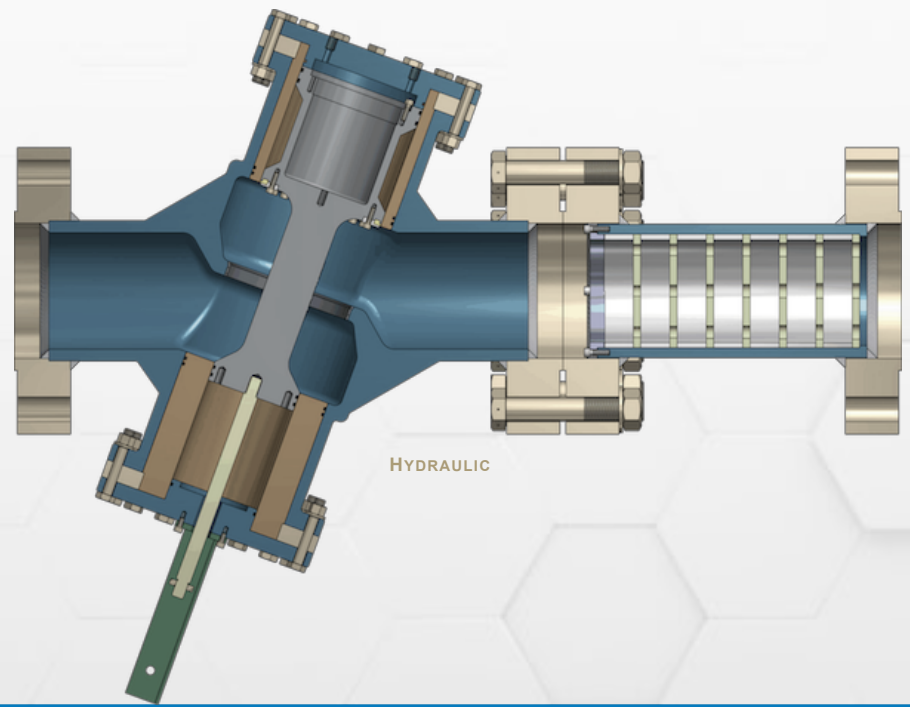
THE CONTROL SYSTEM

The control system consists of:

- N/O timer switch closes on pump trip occurrence and reopens after a short interval.
- N/C Solenoid valve, causing the instantaneous opening of the shock prevention valve when the timer switch closes.
- The N/C solenoid valve closes after a short time interval and fluid entering slowly to the valve's closing compartment causes the slow closing of the shock prevention valve.

PRINCIPLE OF OPERATION

The shock prevention valve instantaneously opens on pump trip occurrence, to enable a flow passage to the station's reservoir and to avoid abrupt stoppage of the reversing flow, with no need for actuators, pilots, sophisticated instruments or an external power source.



Hydrocore™ Angular Shock Prevention System

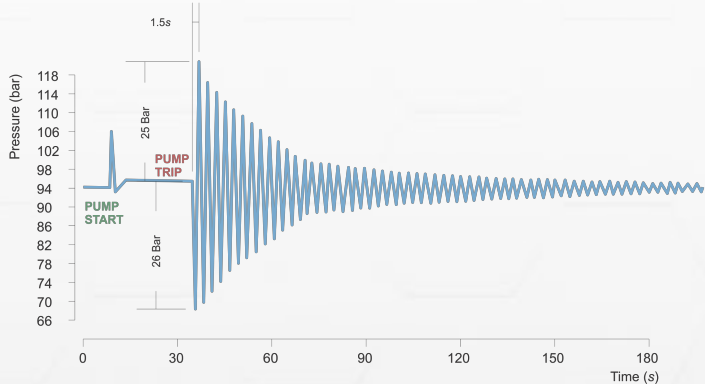


PRESSURE TRANSIENT FOLLOWING A PUMP TRIP

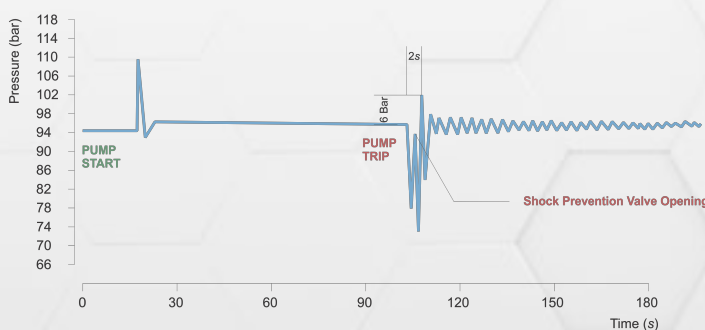
The graphs below demonstrate how the Hydrocore™ Shock Prevention Valve compares to not having a safety valve installed in the event of a pump trip. When the pump trips it creates a

water hammer in the system which can cause havoc if the shock is not minimized. The Hydrocore™ Shock Prevention Valve functions in conjunction with the Hydrocore™ Energy Dissipater and the Hydrocore™ Non-slam Check Valve. These valves alleviate any shock in the system.

PUMP TRIP W/O SHOCK PREVENTION SYSTEM



PUMP TRIP WITH NGD SHOCK PREVENTION SYSTEM



QUANTITY OF DRAINED WATER
The amount of water flowing to the drain on each operation of S.P.V is:

$$V = Q * (T1 + T2) / 1000$$

- V [m3] - Volume of water
- Q [l/s] - Flow rate of water
- T1 [sec] - Opening time of the S.P.V
- T2 [sec] - Closing time of the S.P.V

Example:

Q = 75 lit/sec T1=1 T2=20

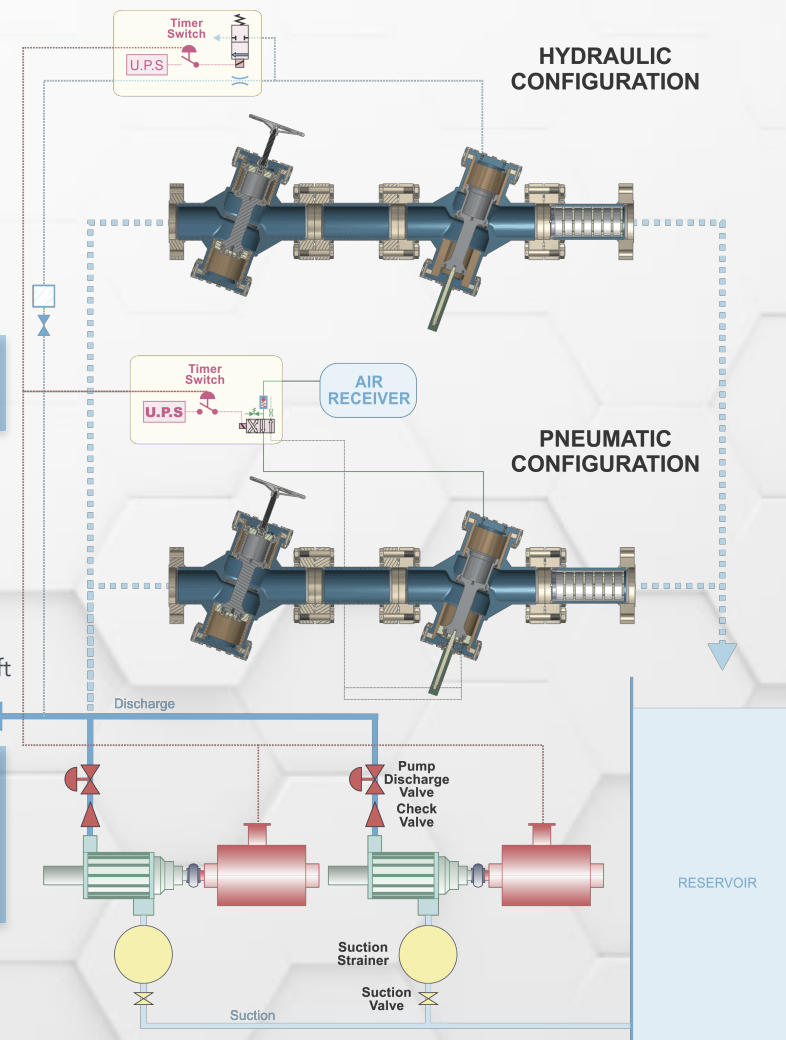
HEAD LOSS

The head loss in the shaft column on each operation of S.P.V is:

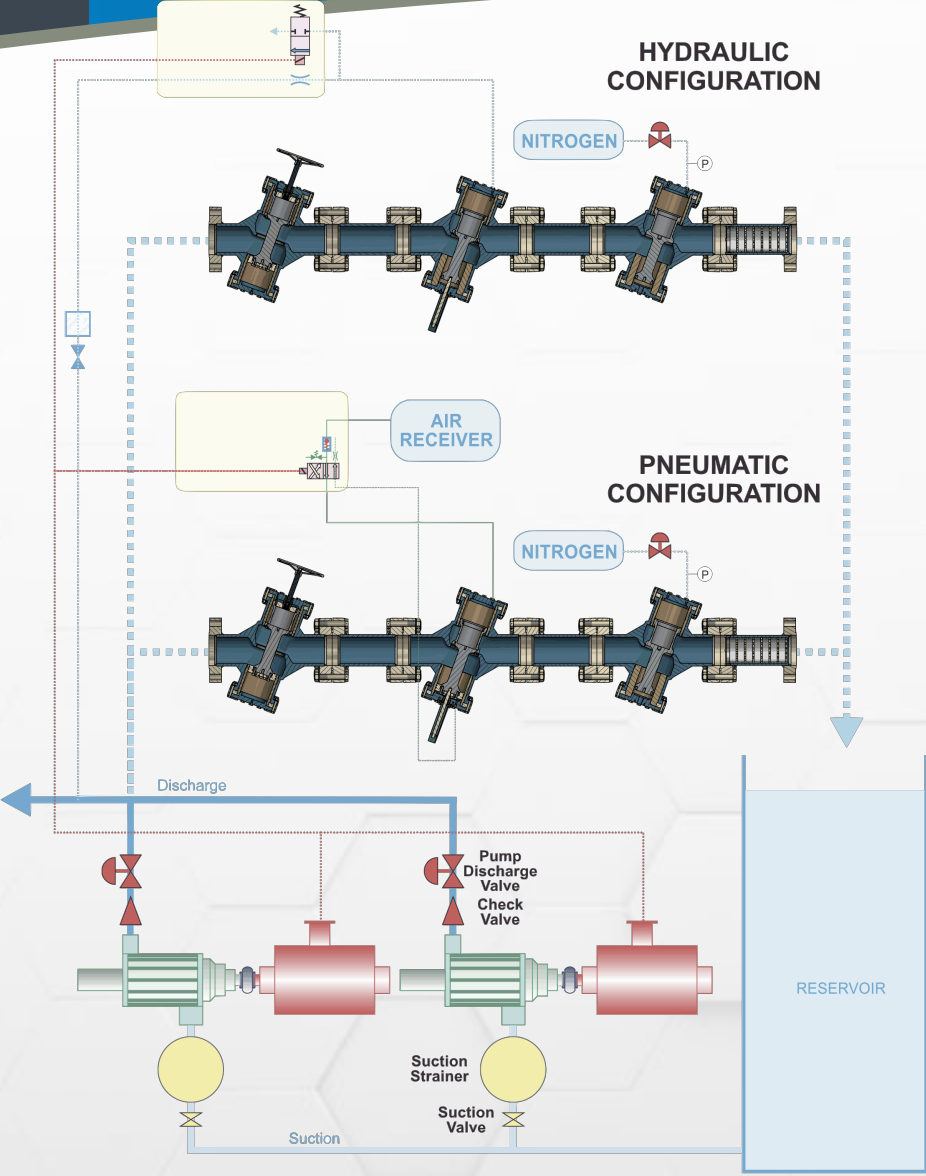
- $H = V / [0.785 * (D/1000)^2]$
- H [m] - Head loss
- V [m3] - Volume of water
- D [mm] - Inside diameter of the shaft column

Example:

V = 1.575 m3
D = 260 mm
 $H = 1.575 / [0.785 * (260/1000)^2] = 29.68m$



Hydrocore™ Angular Alternate Shock Prevention System



DESCRIPTION

The alternative to the current Hydrocore Shock Prevention System is one that does not require a U.P.S. Instead, the system uses a Hydrocore Nitrogen Pressure Relief valve that is nominally closed. The set relief pressure is set to be 10% lower than the nominal pressure of the column. In the event of a pump trip the Hydrocore Shock Prevention valve opens fully. This in turn causes the Hydrocore Nitrogen Pressure Relief to open fully as well. Once the pressure in the column drops below the Hydrocore Nitrogen Pressure Relief valve set relief pressure the valve closes. There are several advantages and disadvantages with regard to this alternative.

ADVANTAGES

- No need for a U.P.S. This alleviates the problem of the U.P.S. failing due to lack of maintenance.

DISADVANTAGES

- The need for an extra valve (i.e. a Pressure Relief Valve).
- There is no way to drain the column.
- there is a concern of a nitrogen leak.

