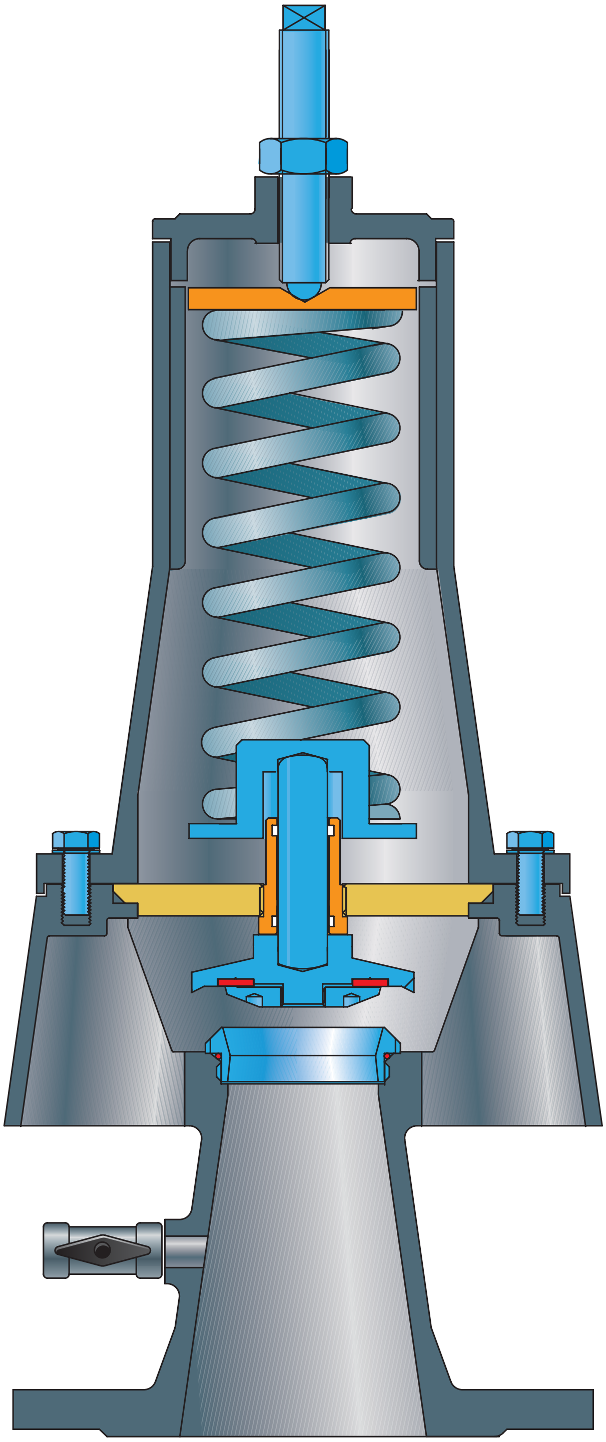
Anti water hammer valve

VRCA

This valve has been designed to avoid the effect, sometimes devastating, of water hammer in pipeline networks. The purpose is actually to prevent the pressure from rising above a preset value thanks to its capability of discharging a sufficient volume of water directly to atmosphere.



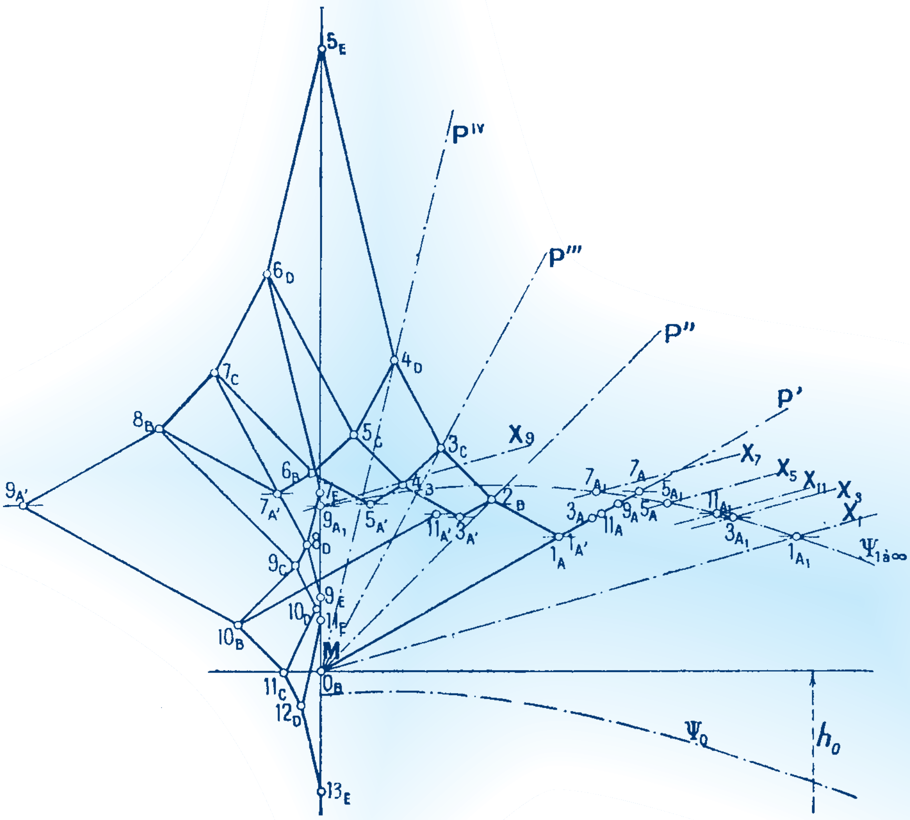
Rev. 1 on 12/11/2005

Design features

- **Solid and compact design** including the reduction cone between the inlet and the sealing seat.
- **Negligible inertia** of internal mobile parts.
- **Perfect sealing** seat and impervious to cavitation thanks to its special plane gasket.
- **Precise and perfect setting** without any hysteresis effect thanks to a spring annelaed and perfectly balanced.
- **Low overpressure values** above the preset cracking point thanks to a wide selection of springs.
- **Series PN 25** (PN 40 on request)

Principle of operation

The valve must be preset at first, simply acting on the spring, to open whenever the pressure rises above a certain value considered as critical for the system. Once the force, exerted by the compression of the spring, is lower than the water pressure acting on the obturator the latter is pushed upstream allowing the discharge of a quantity of water proportional to the water hammer itself, to close perfectly when the transient phase is gone. The spring, properly designed and sized, is driven by a threaded rod and acting by the maneuvring shaft of the obturator to withstand overpressure cushioning water hammer effects. The water tightness is obtained with a special plane gasket, fitted in the obturator and made in polyurethane impervious to scratching, and the sealing seat in stainless steel. The valve's inlet and the obturator are separated from the upper part, where the spring is located, by means of a steel plate which is also containing the sliding nut of the main shaft. This design, along with the perfect centering of the mobile block, will protect the upper part against water jets coming from VRCA's operation cycles. The valve is supplied with pressure gauge and drainage cock in order to facilitate the setting procedure directly on the field.



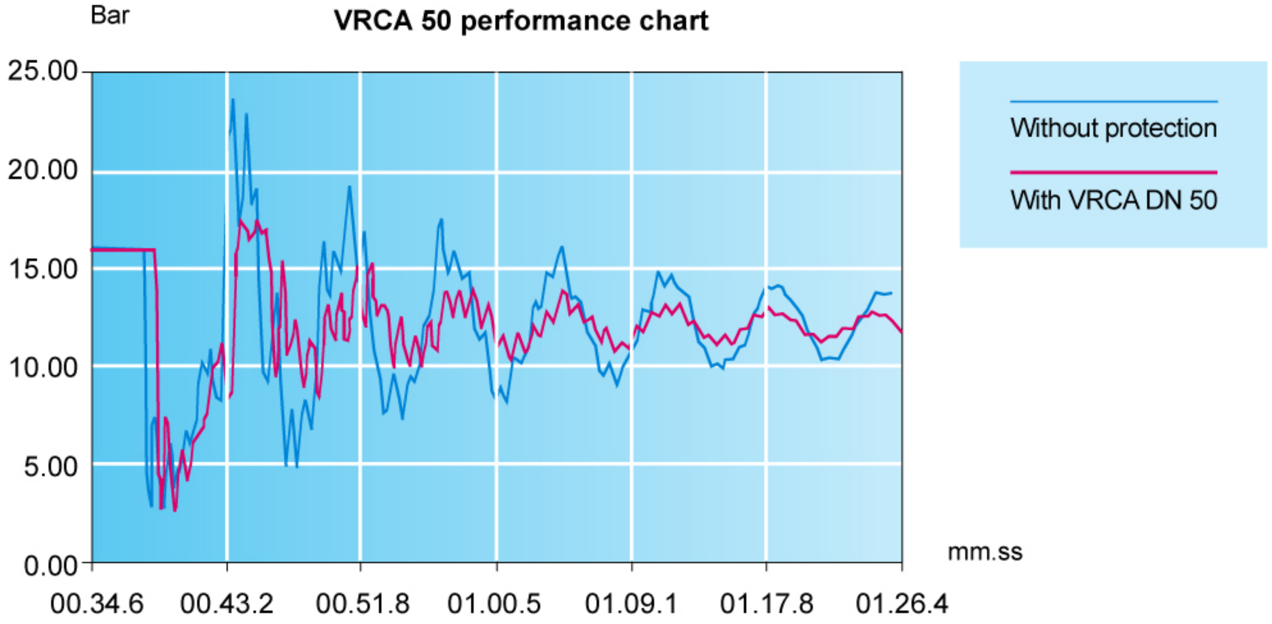
Main applications

Anti water hammer valves mod. VRCA are usually installed:

- downstream of pumping stations to cushion sudden overpressures as a result of pump start up (in case of one of more pumps in parallel). This is a perfect solution whenever the system is not equipped with soft-start or other devices to prevent water hammer during starting operations.
- downstream and upstream of main transmission lines, or pipe segments not able to endure critical conditions such as sudden and unexpected rise in pressure, to guarantee a reliable system protection.
- downstream of a PRV as a safety device.
- upstream of sectioning devices with rapid closing time.
- in general, whenever and wherever pipe bursts are expected.

Performances

Thanks to the unique design of VRCA the inertia of internal mobile components is negligible, therefore the reaction time is extremely fast, something necessary to absorb the overpressure caused by transients.
The shape of the body, the evacuation angle of the obturator and the particular machining of the sealing seat surface are the key factors that help increase the discharge coefficient. Because of that, during the operation cycles, VRCA evacutes large volumes of water wihtout any vibration, noise and with uniform distribution of outflow along the seat's profile.
These enhancements, in addition to the materials VRCA is made out of, allowed us to achieve a solution impervious to wear and cavitation, and absolutely stable in terms of frequency related problems.The internal components are easy to be maintaned without having to remove the valve from the line. VRCA high sensitivity, which is an essential technical characteristic to ensure the maximum precision, is made possible by a plane gasket in polyurethane anti deformation and anti scratching that guarantees a perfect sealing even with low pressure conditions and a great resistance in case of water not perfectly filtered.
Thanks to field measurements and data retrieved with datalogger, in some of the most important projects VRCA has bee supplied for, we were able to determine the reaction time and the real performances of our valves. Out technical department is at your complete disposal for further information.



Reaction time

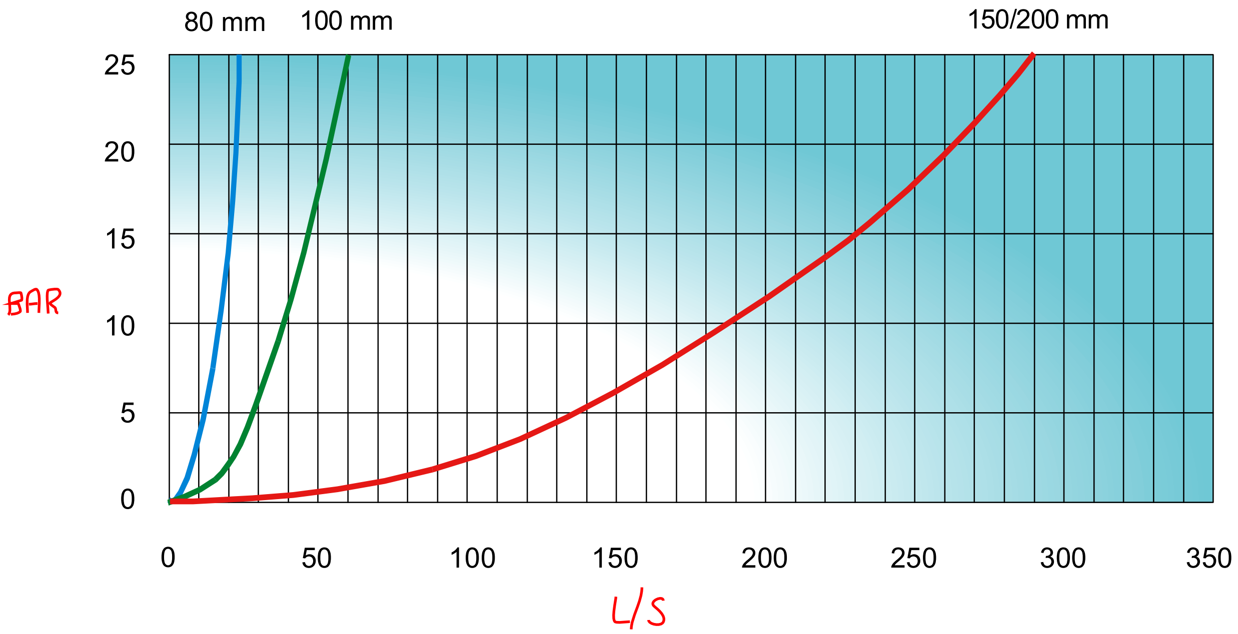
VRCA has been designed to react effectively and immediately cushioning water hammer overpressures that we are likely to find in pipeline networks. The reaction time of our valves can be computed using the following formula

$T = 0,008 * D * \sqrt{80/Pt}$

Where :
T = Time in sec
Pt = Craking pressure in m
D = Valve DN in mm

VRCA sizing chart

CSA technical department, by means of advanced simulation tools, is at your complete disposal for hydraulic modeling and transient analysis.
In the hope of making the sizing process easier, you will find below the sizing chart showing the actual VRCA performances in terms of protection capabilities. The vertical axis represents the pressure while the horizontal the flow rate of the case study, both expressed in steady state conditions. If the required value falls on the left of one of the curves that VRCA will be able to protect the system. Nevertheless we always suggest to contact our technical support for a numerical analysis.



Outflow discharge performance

The DN selection depends on the flow rate evacuated along the with the maximum overpressure value reached during opening. The relation can be expressed using the following formula.

$$D = 28,6 * \frac{\sqrt{Qs}}{Pmax^{0,23}}$$

Where :
Qs = Discharged flow rate in l/s
Pmax = Maximum overpressure during opening in m.

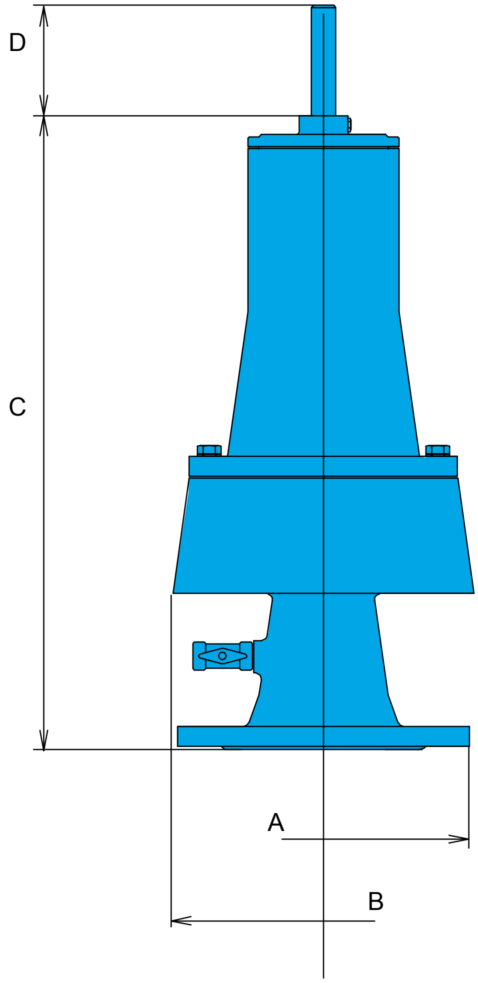
Setting

The valve setting is usually carried out at CSA testing facilities, according to the customer requirements. Yet it can be done on the field whenever conditions different than expected arise.
The technician will simply have to follow the steps:
- Close the gate valve;
-Remove the pressure gauge and hook up a testing pump to the drainage cock to bring the pressure to the desired value;
-Unscrew the sealing nut on the threaded rod;
-Turn the threaded rod clockwise to increase the cracking setpoint, anticlockwise to relief it. Just use this procedure untile the requested value is reached. Should it be close to the steady state working point we strongly recommend to stay at least 0.8-1 bar above it;
-Set the nut tight;
-Remove the testing pumps;put the gauge back in position and after that open the gate valve.

Setting range

The setting procedure, depending on the different DN, covers three pressure range:
- from 0 to 8 bar
- from 8 to 16 bar
- from16 to 25 bar

For higher values please contact us.



DN	A	B	C	D	Seat	Weight
80 mm	185	185	417	40	40	14
100 mm	235	242	540	50	62	28
150 mm	300	404	720	220	137	75
200 mm	360	404	720	220	137	79

Technical features

Body, cap and cover in GS 400-12 painted with FBE with Fludized Bed Technology *.
Sealing seat, obturator in stainless steel AISI 316.
Main shaft, threaded rod, spring housing in stainless steel AISI.
Plane gasket in polyurethane.
Spring in 55SiCr6 annelaed and impervious to hysteresis effects.
Nuts and bolts in stainless steel AISI 304.
Drainage cock in nichel plated brass.
Pressure gauge with case in stainless steel filled with glycerin.

*** New painting process**
The body and the cover undergo a protection process including:
-Metallic sandblasting to achieve a roughness value not higher than 2.5 SA;
-Electric heating in the oven to reach a temperature of 220°C;
-Painting with fluidized bed technology of the preheated components using a floating epoxy powder. The above mentioned is the only possibile process able to guarantee a minimum uniform thickness of 200 microns on the whole internal and external surface (higher thickness on request).
The powder we use is the FBE worldwide certified for potable water and in compliance with the new government regulation 174 which has replaced the 102.

Final testing

It is carried out on every single piece, even in presence of the customer if required, by means of a procedure specified by the current provisions and adjusting the setting as from the order.
During this phase we use advanced test benches provided with high frequency pressure transducers linked to a PC to save the test on a database and plot the result if necessary. On every valve, which comes with a test certificate, is hammered an identification tag showing serail number, nominal pressure, cracking pressure, for us to track it down even after years from the date of shipping.

Order definition

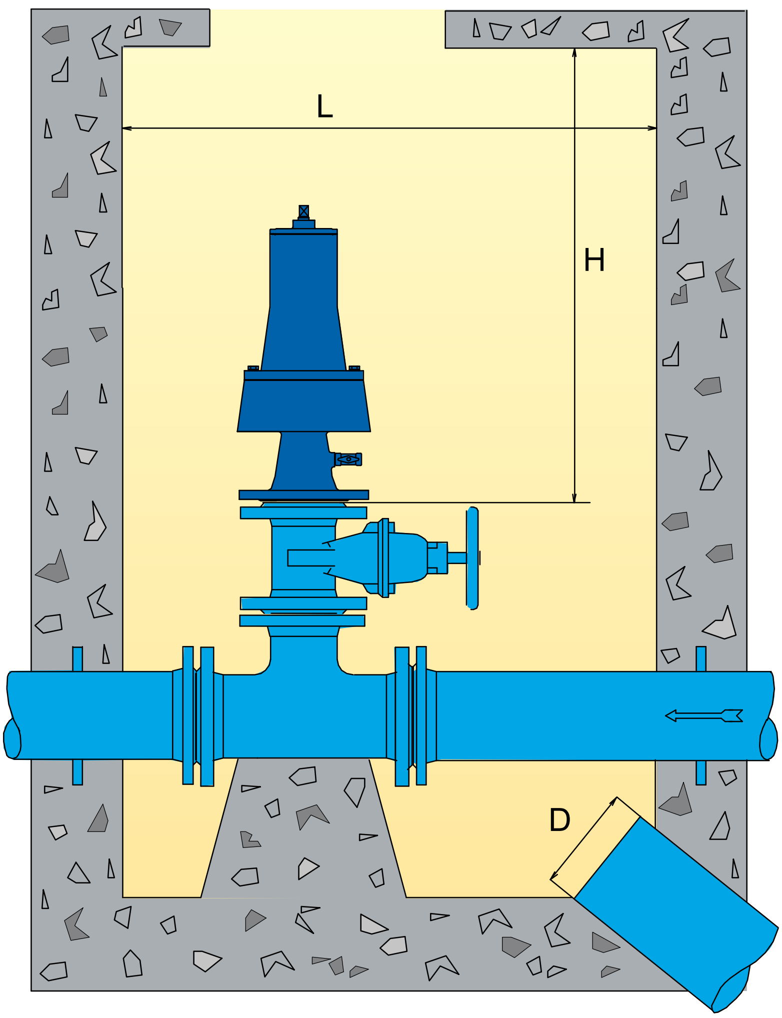
For a proper sizing of VRCA we must know the following information:
- The problem, in particular what's causing water hammer.
- The maximum pressure and flow rate, in working conditions, of the pipe or the system we have to protect.
- The cracking pressure.
- The maximum overpressure allowed during discharge.
- If requested two or more valves can be installed in parallel.

Installation

The valve must be installed in a vertical position, as close as possible to what the water hammer is coming from, and always insise a pit.
Between the valve itself and the pipe a gate valve has to be placed, that is to allow maintenance and setting operations. VRCA will evacuate large volumes of water wihtin a few seconds therefore it is very important to design a drainage system in order to convey water (in case of PRV protection it is advisable to have it in communication with the road in order to detect the mulfonctioning asap).To facilitate the design of a pit suitable for the proper installation of VRCA please refer to the picture at the bottom of the page where we suggested the correct dimensions in relation to the valve DN. In particular, as far as the drainage pipe DN, it has to be at least three times as much as the VRCA's one.
Before installing the valve please proceed with an accurate cleaning of the pipe to avoid that dirt, pebbles, debris could wear the internal surfaces.

Maintenance

VRCA doesn't require a particular maintenance having been designed to endure many workign cycles. All its internal components are replaceable from above simply removing the cover. The upper part, protected from water jets by a separation plate, doesn't usually need any inspection. What we have to make sure of is the proper sliding of the mobile block and wear of the plane gasket and sealing seat. A check out every 6 months is more than enough to test the good working of VRCA.
In case of leakage it is advisable to turn the threaded rod anticlockwise to relief the spring, therefore allowing the evacuation of large volumes of water and freeing the way for solid residual that may get trapped between the seat and the gasket.



DN	H	L	D
80 mm	1100	1300	150
100 mm	1200	1400	300
150 mm	1600	1500	500
200 mm	1600	1500	500

The indications herein given are indicative and subject to variations without notice.

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