

## PRDV steam conditioning Control Valves

PRDV control valve is a very efficient and compact equipment for steam conditioning either in turbine by-pass lines discharging to condenser or in cogeneration processes (see included layout). Conditioning includes pressure reduction and integrated desuperheating devices. Pressure reduction is obtained through three stages, except in LP applications where two stages are adequate to provide good performance and noise limitation. The **first stage** is the throttling section where flow rate is adjusted by the change of plug position inside a drilled cage. The **second stage** is a fixed resistance performed by a drilled basket, which creates a backpressure on the seat in order to reduce its velocity head and the generated noise. The **third stage** has a patented cone-shaped special designed drilled ring which contributes to noise reduction and improves the mixing of steam with the downstream injected water. Shape and orientation of this ring optimize the steam impact against the external surface of sprayed water pattern, where the biggest water drops tend to reunite and to improve the atomizing efficiency of the equipment as a whole. Desuperheating section consists of a chamber installed downstream the third stage where some spring-assisted nozzles are mounted. Great care is taken to avoid any risk of thermal shocks, including a jacketing of internal surface of injection chamber which is recommended for high pressure systems and whenever steam inlet temperature exceeds 500°C.



PRDV Control Valve  
(patented design)

### Technical characteristics:

#### Body and Bonnet:

- **Sizes:** sizes depending on service conditions
- **Ratings:** inlet section up to ANSI 2500. Outlet section up to ANSI 900 included
- **Construction:** from bar stock or forgings. Inlet connection and injection chamber are welded to main body section
- **Pressure seal design** for inlet ratings over ANSI 900
- **Materials:** carbon steel or Cr-Mo steels, F91 (9%Cr) depending on service conditions

#### Plug:

- **Unbalanced or balanced** with seal rings and pilot assisted depending on service conditions

#### Seat Ring:

- Welded-in by a double lip-seal joint which grants against thermal distortions and allows an easy removal from the body

#### Leakage Class:

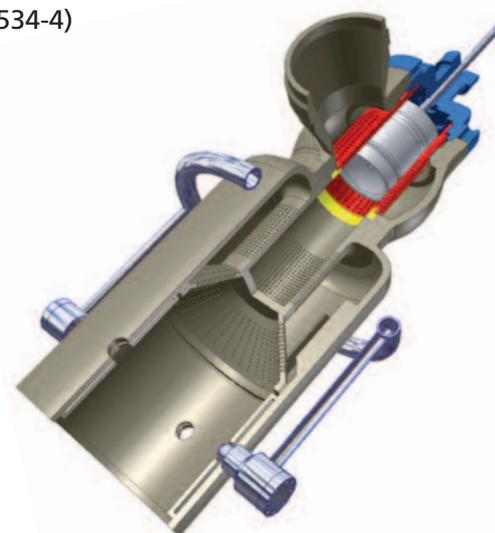
- Unbalanced and pilot assisted plug: class V (as to IEC 60534-4)
- Balanced plug with seal ring: class IVS1

#### Actuators:

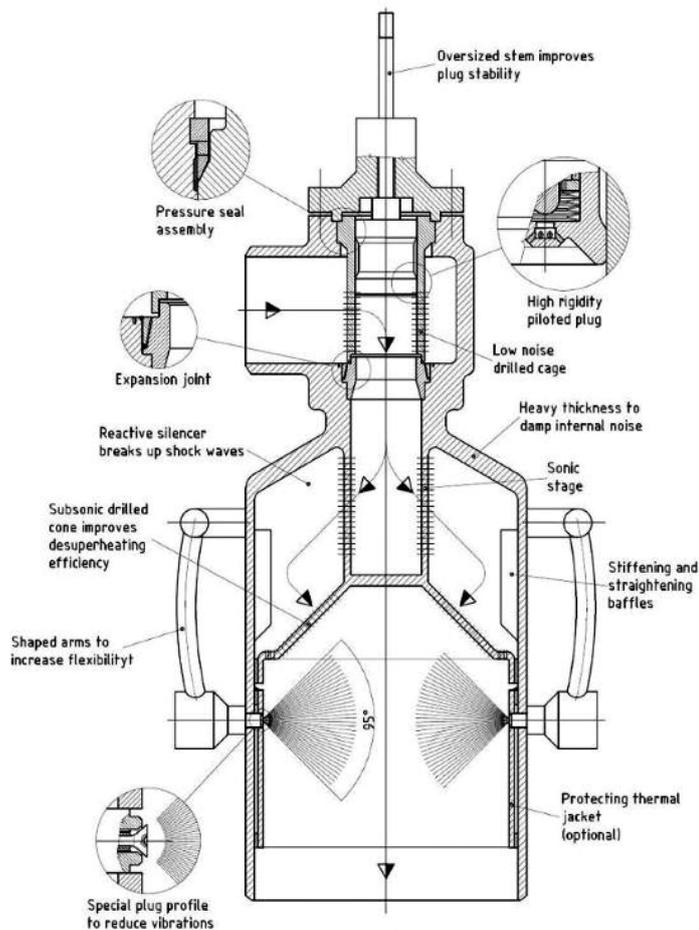
- Double effect, spring-assisted Valvitalia LPA pneumatic piston actuators are commonly used
- **Electric, electro-hydraulic and hydraulic** actuators for heavy duties control application

#### Materials:

- **Trim:** stellite or nitrided F6NM alloy steel and AISI 422 (1-4935)  
17-4-PH is used for inlet temperature up to 375°C
- **Stem:** AISI 316 or XM19 depending on service conditions
- **Packing:** pure graphite seal rings
- **Pressure seal ring:** low hardness AISI 316



PRDV Control Valve section



## Sizing and noise prediction

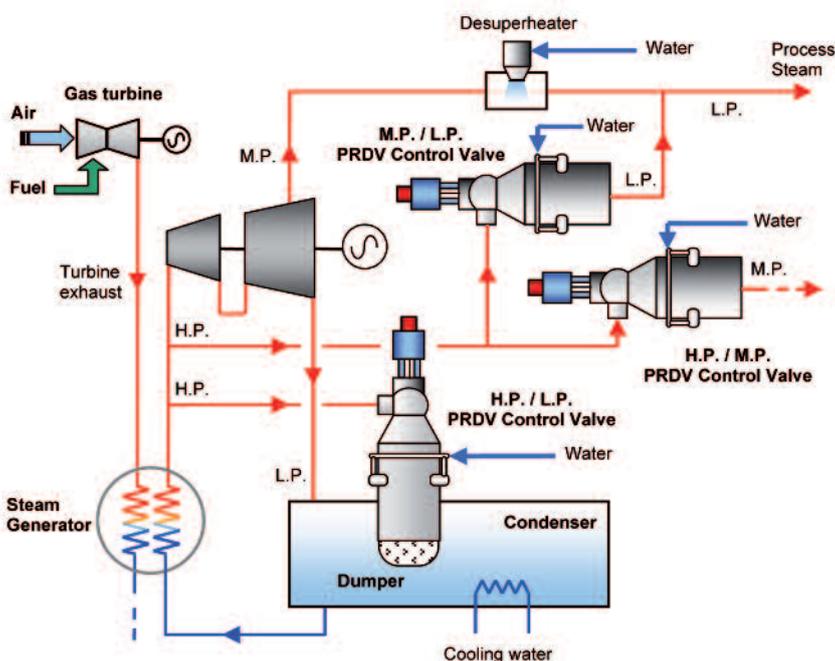
Standard well-known **sizing equations** (IEC 60534-2-1) are not applicable to PRDV control valves as a whole due to the fixed area devices assembled downstream the throttling stage. For this reason, all the stages are separately sized according to IEC equations and the selection of the whole valve is performed for each specific application. The accuracy of the combination of calculated Cv is guaranteed by the Valvitalia's deep knowledge and large experience on this matter. The total Cv of PRDV, including all downstream devices (fixed resistances), is not useful for selecting the valve.

In limit flow conditions, where flow rate does not depend on downstream pressure, the effective Cv value for predicting the flow rate is the same of first stage.

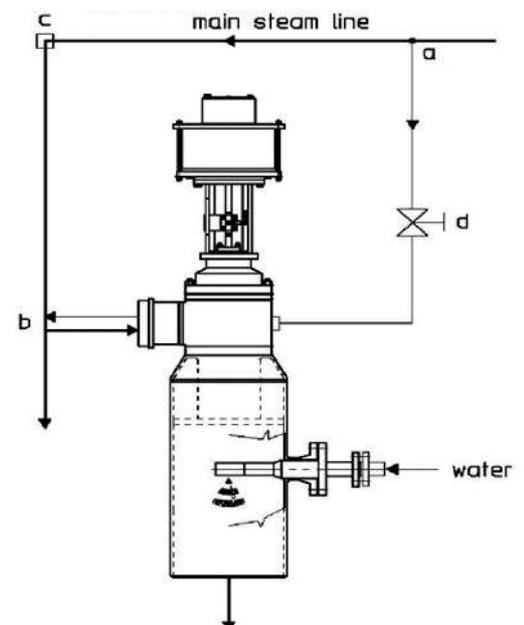
The sizing of 2<sup>nd</sup> and 3<sup>rd</sup> stage is based on the assumption that full pressure recovery occurs between the stages so to allow a complete fluid reheat after the restrictions. However, unexpected errors on fixed resistances sizing do not affect the flow rate passing through the valve as long as limit conditions are held on first stage.

To predict noise generated by PRDV control valves the basic principles of IEC 60543-8-3 standard are taken into account.

Both cone shaping of 3<sup>rd</sup> stage and the optimized steam/water mixing do contribute to the reduction of acoustic power transmitted downstream (IEC  $r_w$  factor). The overall PRDV noise calculation is made by a proprietary VALVITALIA method based on the most advanced studies supported by on-line verifications.



Steam conditioning PRDV valves in a combined cycle process plant



PRDV preheating layout – circulation type