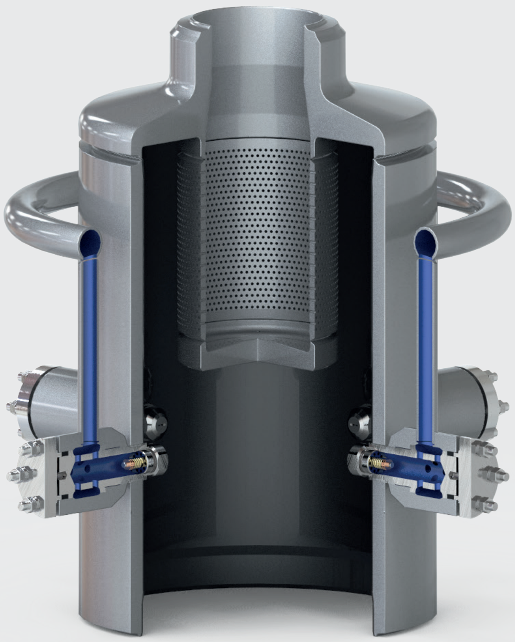
DAM-D



Engineering
GREAT Solutions

Steam Desuperheater

DAM-D: Steam Desuperheater

The desuperheater DAM-D is typically used in combination with a steam pressure reducing valve to create a steam conditioning valve. The VLR steam conditioning valve uses the DAM-D as its desuperheating component. The DAM-D can be welded to the outlet or installed close downstream from the steam pressure reducing valve. Apart from providing desuperheating functionality to the upstream pressure reducing valve, the DAM-D also straightens the often very non-uniform flow patterns that are created by the pressure reducing valve. The DAM-D also reduces noise and creates a backpressure that reduces or eliminates high velocity in the valve's outlet.

The DAM-D steam desuperheater is used in desuperheater applications where large spray water flows are required.

Key features

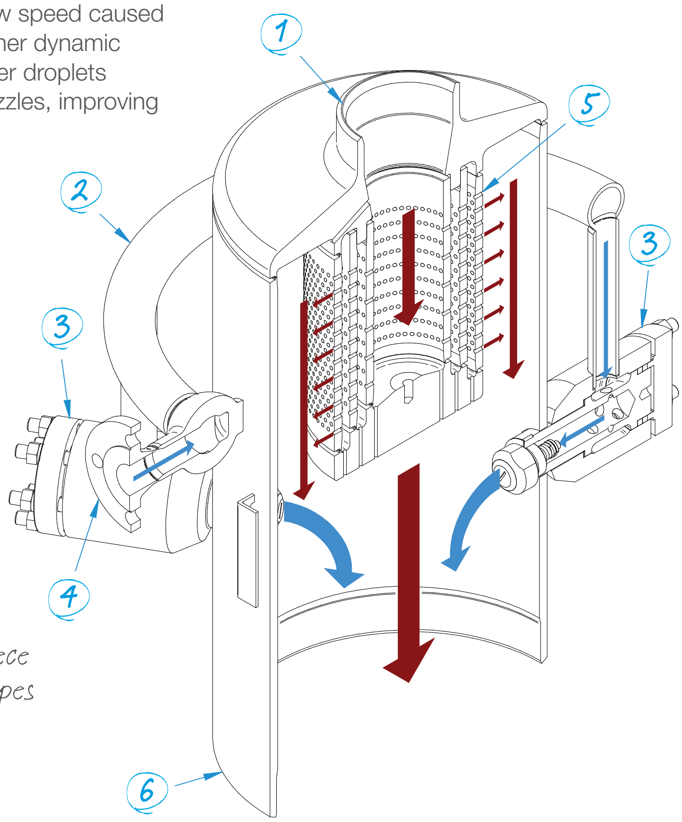
The DAM-D desuperheater consists of two stages. The first stage, the pressure reducing stage, consists of one or several perforated cylinders installed directly after the desuperheater inlet.

The second stage consists of a series of mechanically opening spray nozzles inserted in to the desuperheater outlet. The size of nozzles, their number and insertion length may vary depending on steam desuperheating needs. In case of large pipes, they may use multiple insertion lengths in order to improve coverage. The spray nozzles receive water from a common water pipe encircling the desuperheater. The spray water flow must be controlled externally through a water control valve.

> **Pressure reduction**
Pressure reduction in the desuperheater depends on the number of pipes installed after the inlet, as well as their drill patterns. Placing the pipes in the DAM-D reduces the necessary outlet size of the upstream pressure control valve when installed separately. It can also provide this feature to an existing pressure control valve when a secondary pressure reducing stage is desired.

> **Flow pattern**
The pressure reducing pipes straighten the often non-uniform flow patterns created by the upstream pressure control valve, and create a backpressure that reduces and/or eliminates high velocities in its outlet.
They also redirect the flow towards the center of the pipe and water away from the pipe wall, removing the need for a thermal liner.
The increased steam flow speed caused by the pipes creates higher dynamic forces acting on the water droplets injected by the spray nozzles, improving their evaporation.

> **Noise abatement**
The multiple pressure-reducing pipes serve as a diffuser, where the steam flow is broken up into a great number of partial fluid jets. This improves the rapid dissipation of kinetic energy in the steam, resulting in a substantially reduced emission of noise and vibration.



1. Steam inlet
2. Water pipe
3. Spray nozzle
4. Water connection piece
5. Pressure reducing pipes
6. Steam outlet

Benefits

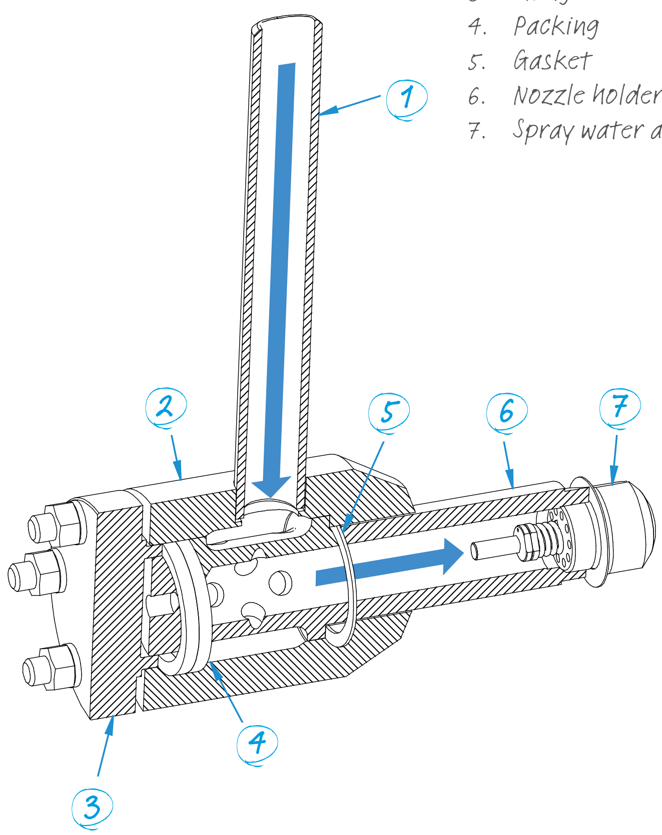
- > Flow pattern eliminating the need for thermal liner
- > Nozzle prevents flashing
- > Each nozzle maintains a differential pressure for water atomisation regardless of flow rate
- > Designed to handle large spray water flow quantities
- > Distributes water evenly over the cross section of the steam
- > Prevents water impingement on downstream piping (candy striping)
- > Nozzle assembly includes a thermal barrier preventing thermal shock between the water and the hot outlet
- > Connections customised for the application
- > Provides up to three pressure reducing stages as standard
- > Reduces upstream valve outlet size

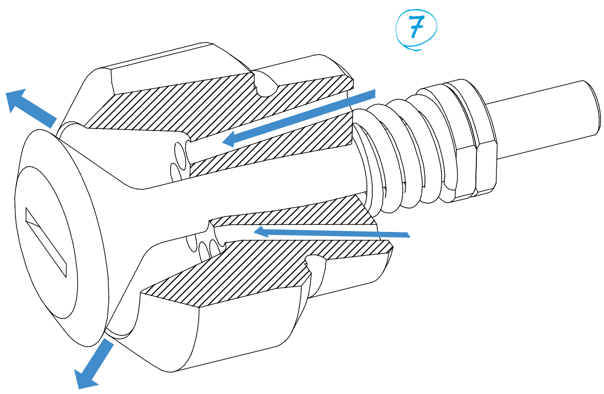
Spray nozzles

The atomising spray nozzle is housed inside a nozzle holder inserted into the pipe outlet. Water is routed through the pipe leg and the nozzle chamber before being supplied to the spray nozzle.

- > The nozzle itself has a spring loaded plug which extends as the pressure in nozzle holder increases. The amount of water being injected by each nozzle is determined by a number of factors, including the diameter of the nozzle body opening, adjustment of the spring, and the pressure differential between the steam pipeline and the water pipeline.
- > The cooling water enters the inner nozzle chamber through a number of water channels. Water is rotated around the nozzle plug thanks to the special arrangement of the water channels. The plug and the seat are designed to create maximum water velocity at the nozzle edge point. The high velocity of the water when it leaves the nozzle guarantees fine atomisation, quickly evaporating the spray water.
- > In order to maintain a specific opening water pressure inside the inner nozzle chamber, the nozzle plug is preloaded by a spring. The force required to open the nozzle is set by the adjustment nut.
- > As the nozzles spray perpendicular to the steam flow, the high relative velocity of water to steam creates an efficient secondary level of atomisation.

1. Pipe leg
2. Nozzle stud
3. Flange
4. Packing
5. Gasket
6. Nozzle holder
7. Spray water atomising nozzle





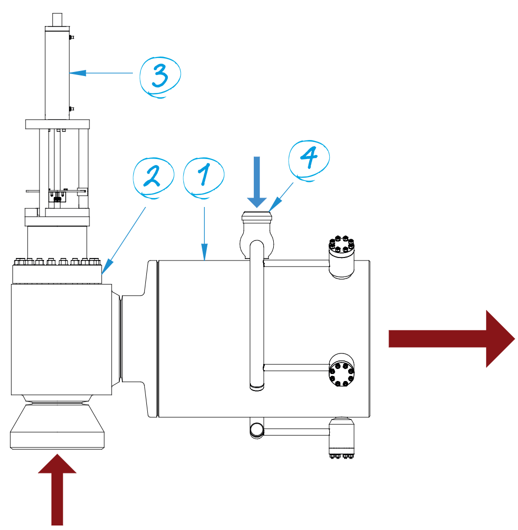
Configurations

> **Welded to a pressure control valve**
The DAM-D is often used in combination with a pressure reducing control valve as a desuperheating component. It can be welded directly to the outlet of the valve, creating a complete steam conditioning valve. Common examples can be seen in the examples below.

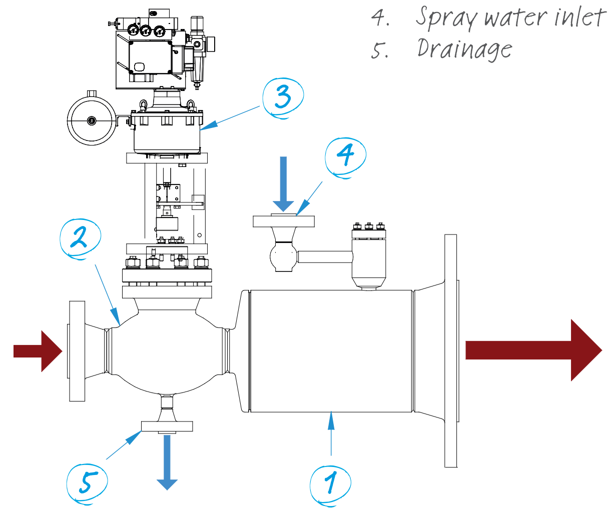
> **Alternative set-up**
An alternative to using DAM-D is using a VLB.

- **DRAG® + DAM-D**
  A desuperheater welded to the outlet of a DRAG® pressure control valve.
- **VSG-C + DAM-D**
  A desuperheater welded to the outlet of a VSG pressure control valve.

1. DAM-D desuperheater
2. Pressure control valve
3. Actuator
4. Spray water inlet
5. Drainage



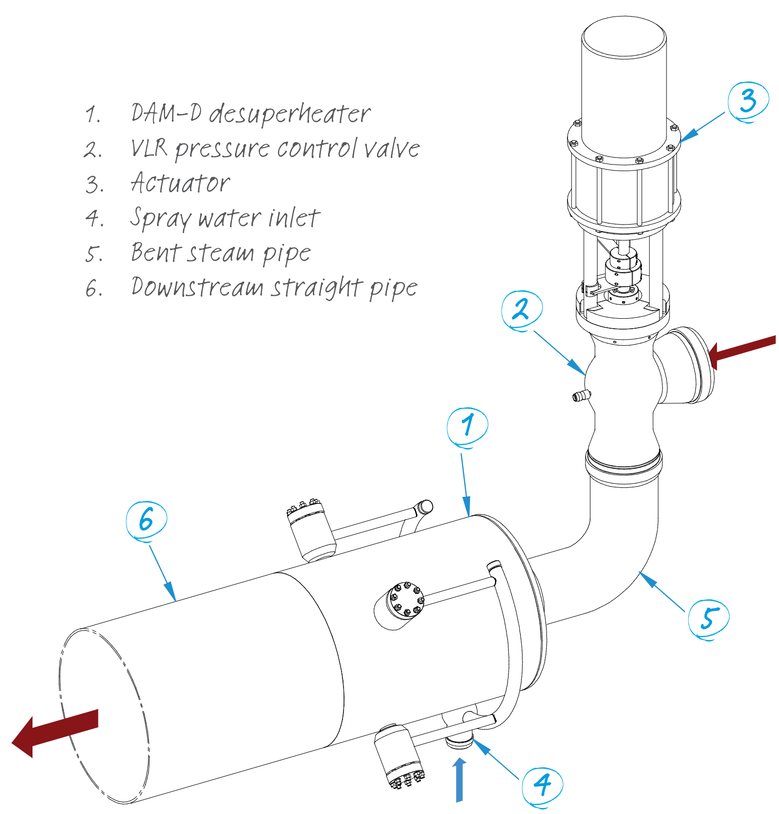
DRAG® + DAM-D



VSG-C + DAM-D

> **DAM-D with separate pressure control valve**
This is an example where a bent pipe separates the VLR pressure control valve and the desuperheater. The DAM-D requires a minimum distance of straight pipe for the injected water droplets to completely evaporate, and for the temperature control system to function reliably. More information on desuperheater/valve installations can be found in II500.00 - Installation Guidelines. In this case the pressure control valve had to be placed just before a bend, but the desuperheater still has a recommended length of downstream straight pipe.

1. DAM-D desuperheater
2. VLR pressure control valve
3. Actuator
4. Spray water inlet
5. Bent steam pipe
6. Downstream straight pipe



General product specification

Capacity
Unlimited (Depends on size and number of orifices)

Materials
Steam pipe material is adapted to connecting pipe material.

Nozzles and springs are made from X19CrMoVNb11.1* as standard

Rangeability
Nozzle turndown:
Limited only by turndown of selected water control valve.
System turndown:
Minimum steam velocity or temperature control is typically 4-6 m/s (13-20 ft/s) downstream depending on steam pressure

Pressure class
DIN PN 16-320
ANSI 150-2500

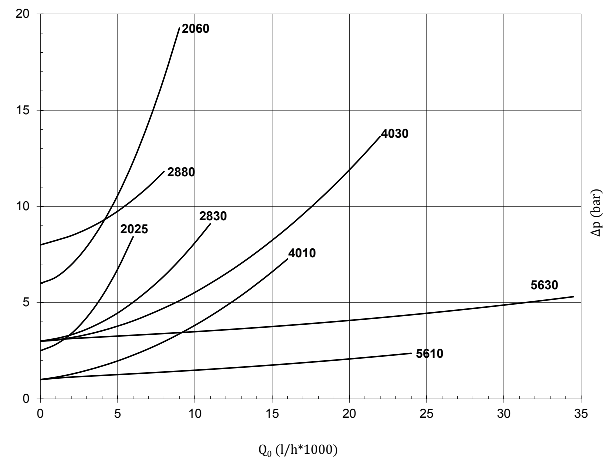
*Alternative nozzle and spring material in Inconel is available for high temperature applications and conditions without water injection.

Opening Pressure (OP) nozzle specification

Spring-loaded OP nozzles come in a number of sizes with different capacities and opening pressures.

Opening pressure (Δp) is defined as the pressure differential between the water inlet and the DAM outlet.

Q_0 = Required cooling water flow (l/m)

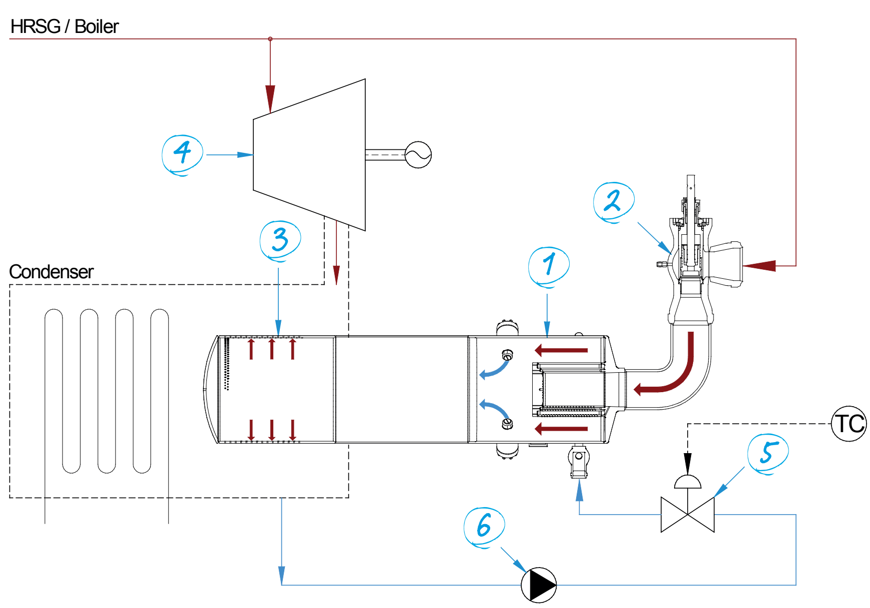


Capacity curves for a single nozzle with standard spring settings

Example

In applications where the steam pipe configuration makes it impossible to use a complete steam conditioning valve such as the VLB, it is possible to use a VLR steam pressure reducing valve and a DAM-D desuperheater welded to the pipe and achieve the same function. In this case the pressure reducing valve is installed perpendicular to the desuperheater, with a 90° bended steam pipe connecting the two.

Spray water is injected into the steam using a series of mechanically atomising spray nozzles encircling the desuperheater outlet. The spray water flow is controlled by a water control valve connected to the DAM-D water inlet pipe.



1. DAM-D desuperheater
2. VLR pressure reducing station
3. Dump tube
4. Steam turbine
5. Spray water control valve
6. Condensate pump

TC. Temperature control

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