Process Automation

IMI CCI

DAM-B
Steam attemperator

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DAM-B

Steam attemperator

Attemperation is the primary technique used for controlling the degree of superheat in a boiler or a Heat Recovery Steam Generator (HRSG). This is achieved through a controlled injection of water into the superheated steam. Attemperators are typically installed between superheater stages in order to regulate the output temperature of the boiler/HRSG, as well as protect any secondary superheater pipes from damage owing to excessive heat.

The temperature controller for this attemperator (called inter-stage) bases its temperature regulation on input from a temperature transmitter placed on the boiler/HRSG output. A secondary attemperator (called final stage) is often placed after the inter stage temperature transmitter in order to prevent thermal damages to the steam turbine during start-up.

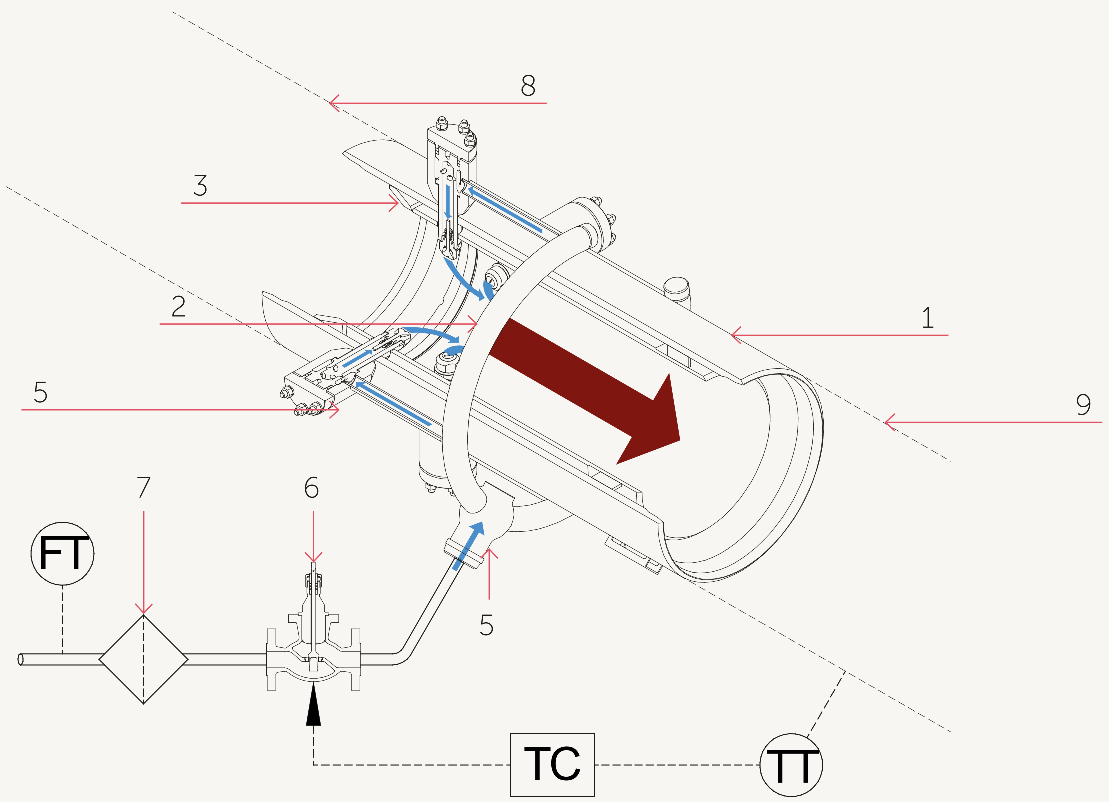
The final stage attemperator ensures that the steam temperature upstream the turbine does not rise too fast. The DAM-B is a high performing ring style attemperator with a welded flow profiling liner for superior evaporation and performance. It complies with all existing standards and is always pressure tested on both the steam side as well as the water sid

Key features

The DAM-B attemperator is installed in the steam pipe with a number of water atomising nozzles attached.

The size of the nozzles, their number and insertion length may differ depending on steam desuperheating needs and steam pipe diameter.

- The DAM-B is able to handle severe thermal cycling.
- The nozzles receive water from a common spray water pipe encircling the steam pipe, supplying water evenly across the nozzles.
- Spray water flow is controlled via an external spray water valve connected to the DAM-B water connection piece. This valve is regulated via a temperature control system that uses the downstream steam temperature to determine the amount of spray water needed. The placement of the temperature transmitter and the installation of the steam pipe are of critical importance for achieving accurate steam temperature regulation. For more information see IMI CCI document 'II500.12: System Design Considerations - DAM-B'.
- A flow profiling liner is welded to the inside of the DAM-B body to improve system turndown and to protect the steam pipe against thermal shock and erosion in the downstream pipe.



1. DAM body.
2. Water pipe.
3. Liner.
4. Water connection piece.
5. Spray nozzle.
6. Spray water control valve.
7. Strainer.
8. Upstream steam pipe.
9. Downstream steam pipe.

TT. Temperature sensor/ transmitter
TC. Temperature control.
FT. Spray water flow transmitter.

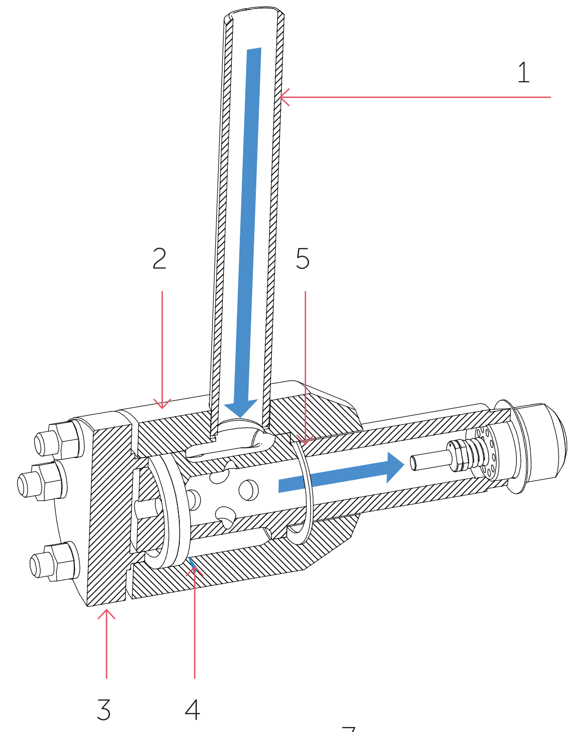
Benefits

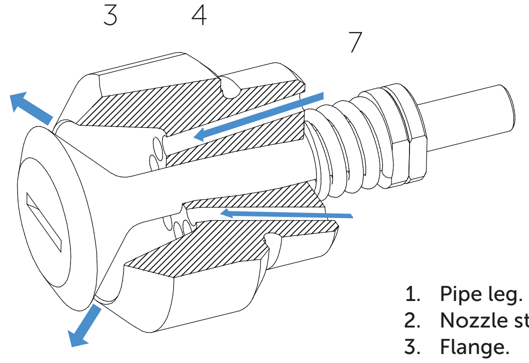
- Designed to handle large spray water flow quantities.
- Distributes the spray water evenly in the steam desuperheater.
- Negligible pressure drop in the steam line.
- Welded profiling liner installed as standard.
- Nozzle design prevents flashing inside the nozzle.
- Each nozzle maintains a certain water atomisation pressure at any flow condition.
- Can be redesigned as flow meter.

Spray nozzle

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.

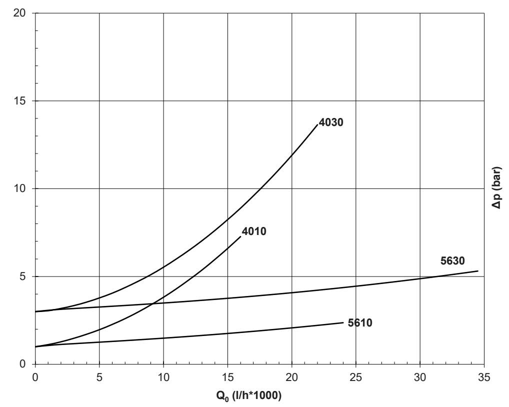




1. Pipe leg.
2. Nozzle stud.
3. Flange.
4. Packing.
5. Gasket.
6. Nozzle holder.
7. Spray water atomising nozzle.

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).



General product specification

Capacity
Unlimited (Depends on size and number of orifices).

Pressure class
DIN PN 16-320
ANSI 150-2500.

Materials
Steam pipe material is adapted to connecting pipe material.

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

Alternatively, nozzles and springs can be made available in inconel, suitable for high temperature applications and conditions without water injection.

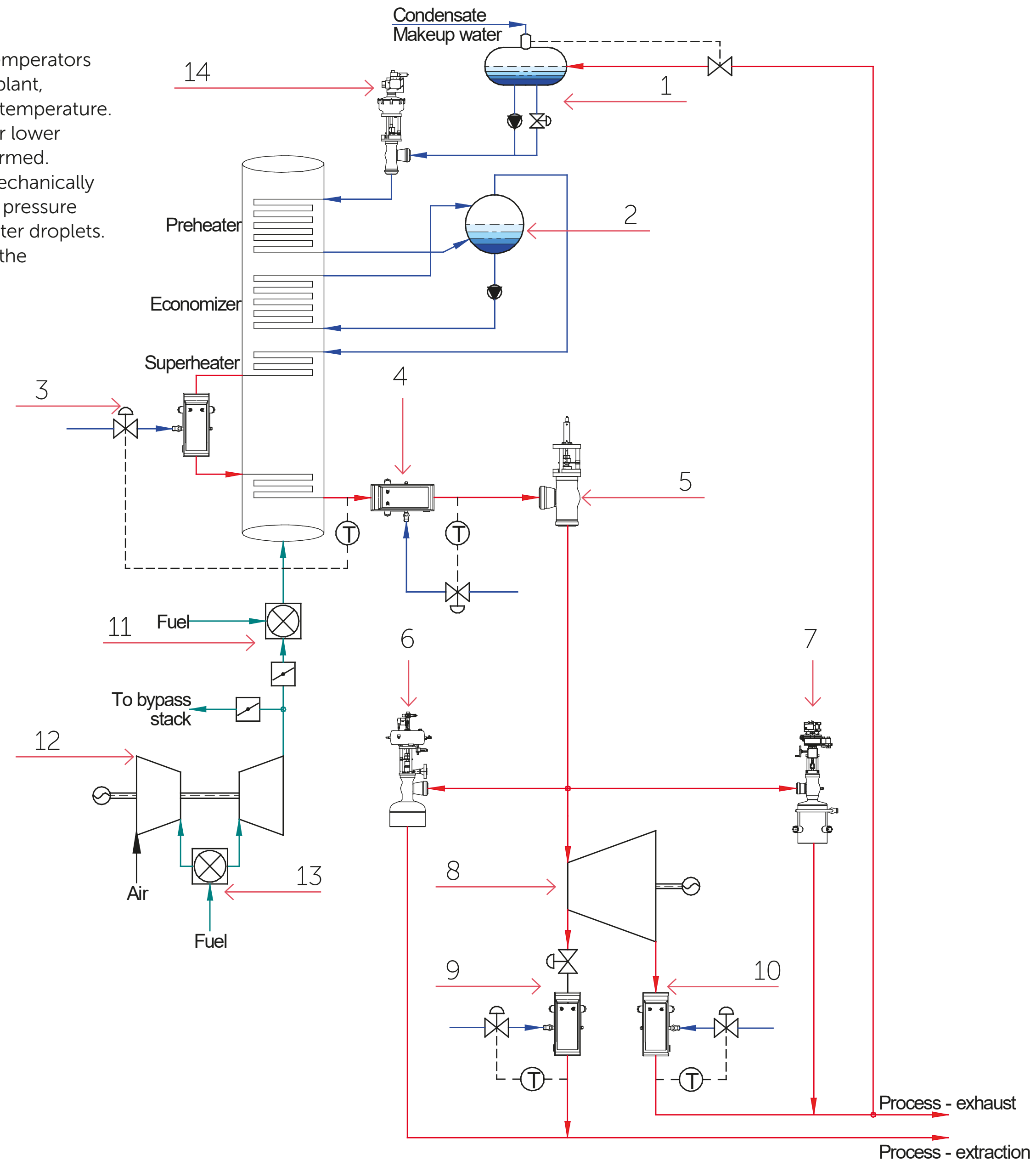
Rangeability
Nozzle turndown: Limited only by turndown of selected water control valve.

System turndown: Minimum steam velocity depends on pressure, temperature and superheat, but should typically not be below 6-8 m/s (20-25 ft/s)

Example

The example below shows two attemperators (3 and 4) installed in a desalination plant, controlling the steam turbine input temperature. More attemperators can be used for lower pressure stages if reheating is performed.
As the DAM-B attemperators are mechanically atomising, they do not require high pressure atomising steam to vaporise the water droplets. Steam that can instead be used for the desalination plant.

1. Feed water tank.
2. Drum.
3. Inter-stage attemperator.
4. Final stage attemperator.
5. Main stop valve.
6. HP/IP bypass.
7. HP/LP bypass.
8. Backpressure steam turbine.
9. DAM extraction desuperheater.
10. DAM exhaust desuperheater.
11. Supplementary ring.
12. Gas turbine.
13. Firing chamber.
14. Feed water control valve



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