SPECIFICATION DATA
D400-2016-R0

NOZZLE SPRAY DESUPERHEATER STATION

SERIES

D400

CONTENTS

PERFORMANCE

- High efficiency atomization.
- High rangeability variable area spray unit.
- Accurate and repeatable control of fluid temperature to within 6C° providing appropriate installation and instrumentation are used.
- High spray water pressure capability.

DESIGN

- Wide variation
- Wide range of available nozzle sizes.
- Erosion resistant materials of construction.
- Minimum number of components.
- Ease of installation.
- Low maintenance featured.
- Fully rationalized.
- Wide range of actuating mechanism available.
- Excellent swirled discharge nozzle.

TECHNICAL DATA

- Section of equipment the selection of optimum equipment and appropriate piping Plan are necessary for realization of excellent temperature control. Direction for the selection of equipment and precautions for the piping plan are given in the following paragraph.

1 Desuperheater when selecting an desuperheater, it is necessary to know the type of equipment for which the superheated steam is used. Particularly, it is important to know the operation conditions such as the range or load fluctuation of the down-stream equipment and the allowable range of drain. It is also necessary to predict the cooling water condition, auxiliary steam condition, and the transient conditions at start and stop of the plant. Thus, when designing a new plant, the planner is required to make delicate considerations on the design of the desuperheater. It is desirable that the selection of the desuperheater and the composition of the control loop be determined through detailed discussion with the maker.

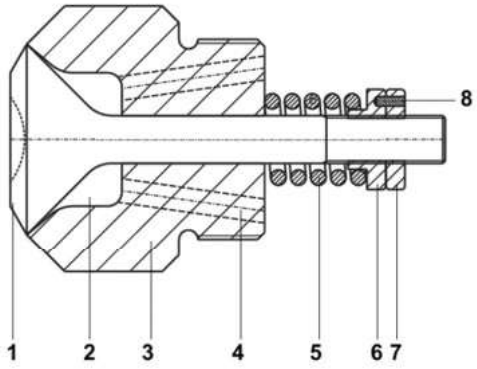
2 Control range required for the valve in order to achieve a stable temperature control, the plan must be worked out so that the cooling water control valve can be smoothly operated over the entire range of load. The valve is required not only to control the cooling water needed during high load operation but also to sufficiently control the minimum volume of water during low load operation which is calculated through the enthalpy method. Generally, the steam temperature at the inlet of desuperheater tends to decrease with decrease in load, and the turn-down ratio required for the cooling water control valve(ratio of minimum controllable value Cv and maximum valve Cv) is considerably greater than the turn-down ratio of desuperheater.

D410S

- Maintains a constant water atomization at any flow condition.
- "Flash-proof" – The design prevents water from atomizing inside the nozzle regardless of cooling water temperature.

GENERAL

- The steam desuperheater D410S consists of a tube-shaped body with a flange for bolting of the desuperheater to the insertion stud that is welded to the steam pipe. The water inlet is also flanged, at 90° angle to the desuperheater, to facilitate service access.



1 Nozzle plug
2 Inner nozzle chamber
3 Body
4 Water channels
5 Spring for pressure control
6 Adjustment nut
7 Lock nut
8 Pin

Fig 1 – nozzle head cross section

FUNCTION

- The D410S injection nozzle is screwed onto the body and secured by a lock washer – see fig1.
- The cooling water enters the inner nozzle chamber in the desuperheater through the flange. In the inner nozzle chamber the water is induced to fast rotation around the control plug by the special arrangement of the admission holes. The angle of the nozzle seat is slightly different from the nozzle holder so that the water velocity will accelerate the whole time and reach its maximum as it leaves the nozzle. These two design details – fast rotation and high velocity of the water when it leaves the nozzle – guarantees a fast evaporation of the injected cooling water.
- In order to maintain a constant pressure inside the injection nozzle, the latter is preloaded by a spring calibrated in function of the water/steam differential pressure.
- Thanks to this design characteristic, any load variation in the external water control valve is immediately compensated for by a change of the orifice section of the nozzle, assuring optimum water atomization at all times.
- We recommend you to protect the desuperheater from unnecessary wear and clogging by installing a filter between the D410S and the water valve.

D410V

- High efficiency – by use of full pressure drop at all flow conditions.
- Single nozzle – a unique design that guarantees a fine water dispersion over the entire control range.
- Tight shut-off – single seated design to prevent leakage of water into the steam pipe. Thus no upstream stop valve required.
- High reliability – the selection of seat material and a hard nitrided control plug guarantee high operational reliability, a long operational life span and low operational and maintenance costs.

GENERAL

- The desuperheater D410V represents a new design for mechanical atomization of the injected spray water. The D410V meets the market demand for desuperheaters giving a better operational economy and more efficient temperature control.
- The D410V provides precise and economical control of the steam temperature by injecting cooling water into the steam flow through a unique single nozzle design. The nozzle produces a spray pattern in the shape of a whirling cone of droplets. Vaporization is almost instantaneous as the water is injected into the steam flow. The single nozzle design eliminates the effect of large water drops build-up. A phenomenon that can occur when different spray patterns collide in a multi nozzle unit.
- The D410V design eliminates the need for any separate water control valve, since this function is built into the desuperheater.
- The D410V is available in six different sizes and each size in two versions depending on the pressure differential between the spray water and the steam header.

FUNCTION

- In D410V the cooling water passes the seat through a specially designed nozzle head where the differential pressure between steam / cooling water is transformed into kinetic energy. The cooling water flows, at high velocity from the seat and via a slit in the plug, tangentially into a chamber where it is brought to fast rotation before being ejected into the steam as a, very finely dispersed, cone shaped spray.

D410M

- Each nozzle prevents flashing inside the nozzle
- Each nozzle maintains a certain water atomization pressure at any flow condition.
- No pressure drop in the steam line
- Designed to handle large spray water flow quantities
- Distributes the spray water evenly in the steam desuperheater

GENERAL

- The steam desuperheater D410M is used in desuperheater applications where large spray water flows are required for cooling of the steam.
- The D410M is part of the steam line with a number of water atomizing nozzles, Variable-nozzle, attached to it.
- The nozzles are connected to a common spray water pipe connection. The spray water flow is controlled by a separate spray water control valve. A liner can be installed in the D410M to improve the system turn down or to protect the steam line.
- The D410M can easily be adapted for any special requirement, such as incorporation of separate emergency cooling arrangement or split range operation.

OPERATING PRINCIPLE, VARIABLE-NOZZLE

- The Variable-nozzle is a variable orifice, mechanically atomizing nozzle – see fig1.
- The Variable-nozzle body (3) is screwed into the nozzle holder which houses the nozzle and distributes the water to the nozzle.
- The cooling water enters the inner nozzle chamber (2) in the Variable-nozzle through the admission holes (4). In the inner nozzle chamber the water is rotated around the control plug (1) thanks to the special arrangement of the admission holes. The angle of the nozzle seat is slightly different from the control plug so that the water velocity will increase during its travel through the nozzle and reach its maximum as the water leaves the nozzle.
- These two design features – rotation and high velocity of the water when it leaves the nozzle – guarantee a fine atomization which provides fast evaporation of the cooling water.
- In order to maintain a minimum pressure inside the inner nozzle chamber the control plug of the nozzle is preloaded by a spring (5). The force required to open the nozzle is set by adjusting the nut (6). The setting of the opening force is determined by the differential pressure between the cooling water and the steam and, when applicable, the temperature of the cooling water, to avoid flashing inside the nozzle.
- The control characteristics of the Variable-nozzle compensates for any load variation in the external water control valve by changing the orifice section of the nozzle, assuring optimum water atomization within the load range.

D420 (VENTURI TYPE)

- The venturi design – with a sharp edge on the steam entry side – provides good atomization of the cooling water and fast evaporation.
- Requires little service – has no moving parts.
- Simple and space saving installation – is as standard fitted between flanges but can also be delivered with weld ends

GENERAL

- The Steam Desuperheater D420 is designed for the attemperation of steam in pipe lines of small dimensions – sizes DN 25 - 100 mm / 1" - 4". The amount of cooling water supplied is controlled by an external water valve.

DESIGN

- The Steam Desuperheater is made for installation in steam pipes, sizes DN 25 - 100 mm / 1" - 4". It is highly reliable and is manufactured from few components. The latter contributes to a low service requirement. The injection nozzle is dimensioned for each specific installation to ensure best possible operating range. The D420 is, as standard, mounted between flanges but can also be delivered with weld ends for welding to the pipe.

FUNCTION

- The cooling water enters the nozzle via the water flange. The pressure difference over the nozzle, between the cooling water and the steam, should to ensure good controllability and satisfactory atomization of the injected cooling water not be above 5 bar / 58 psi. For a short period only, e.g. at start-up or shut-down a higher pressure drop can be permitted.
- The venturi design – with the sharp edge against the flow - guarantees a high steam velocity and well atomized cooling water in the point of injection.
- The well atomized cooling water is carried downstream by the vortex created when the steam leaves the sharp edge. This is a guarantee for a fast evaporation without risk of water impingement on the pipe wall.

STANDARD SPECIFICATION

	D410S	D410M	D420
Turndown Ratio	25:1	25:1	5:1
Type of Atomization	Velocity	Velocity	Mechanical
Minimum Outlet Temperature	Sat. + 6 °C	Sat. + 6 °C	Sat. ±8 °C
Mounting Orientation	Horizontal	Horizontal	Horizontal
ANSI Pressure Class	Max. 600LBS	Max. 2500LBS	Max. 2500LBS
Main Header Size	6" ~ 36"	6" ~ 36"	1" ~ 4"
End Connections	Flanged or Welding	Flanged or Welding	Flanged or Welding
Velocity Limits	8~100m/sec~	8~100m/sec	Up to 12~100m/sec
Pressure Drop	3 psi nominal	3~5 psi nominal	Negligible
Required Coolant Pressure Steam Line Pressure	Min. 5barg	Min. 5barg	Min. 5barg
Distance to Temperature Sensor (DTS)	12m	12m	12m
Min. Straight Pipe Distance (Upstream)	7m	7m	7m

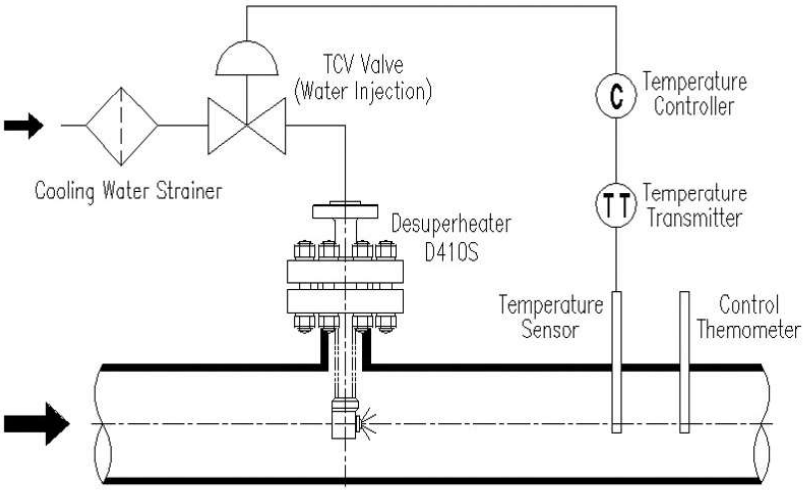
D410S
Single Spray Variable
Nozzle Type

D410M
Multiple Spray Variable
Nozzle Type

D420
Venturi
Nozzle Type

INSTALLATION OF THE D410S

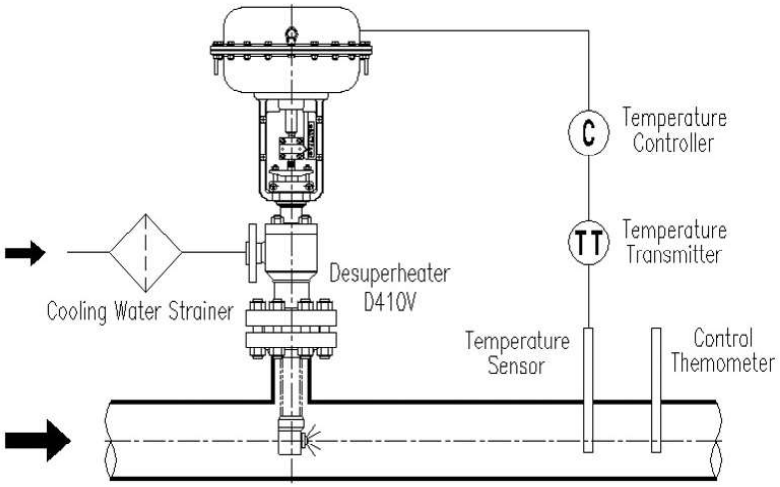
Select the installation point carefully, This is especially important in cases where the steam velocity is low and the steam temperature is close to saturation. It is equally important to install the temperature sensor where it, in a representative manner, can sense the temperature that shall be controlled. See separate instruction for desuperheater installation.



Typical Installation of D410S

INSTALLATION OF THE D410V

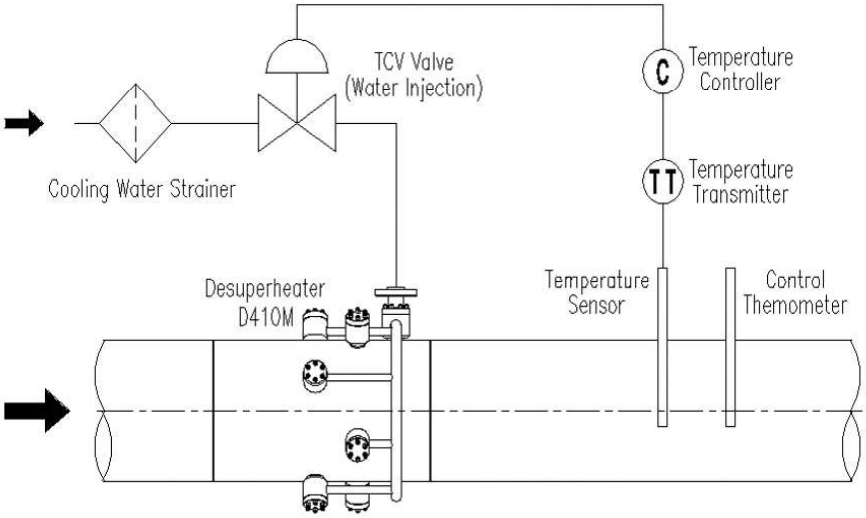
The D410V is mounted perpendicular to the steam pipe. It is obtainable with two types of connections to the steam header.



Typical Installation of D410V

INSTALLATION OF THE D410M

Select the location of installation carefully. This is especially important in cases where the steam velocity is low and the steam temperature is close to saturation. Straight pipe runs upstream and downstream are very important as well as the distance between the temperature sensor and the D410M.

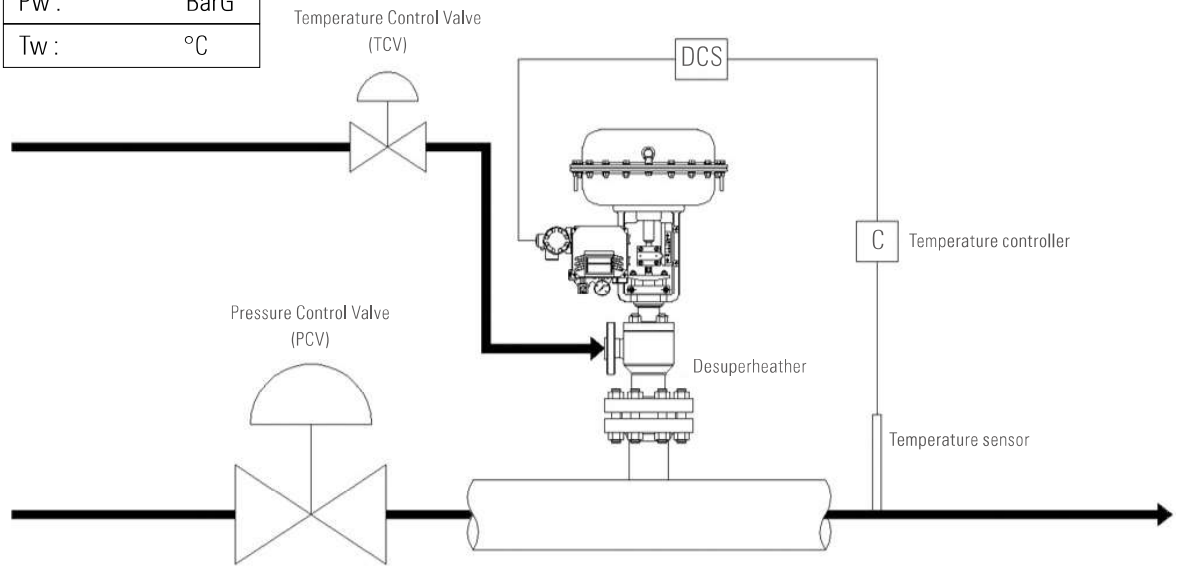


Typical Installation of D410M

DATA NECESSATY FOR SIZING D400 TYPE DESUPERHEATER

Please provide the following data, and **DJC** will select the optimum desuperheating nozzle.
*Provide either the inlet or outlet steam flow rate, and **DJC** will calcutate the Qw.

Coolant Conditions	
Pw :	BarG
Tw :	°C



Inlet Steam Conditions	
Max :	kg/h
Min :	kg/h
P1 ::	BarG
T1 :	°C

Outlet Steam Conditions	
Pw :	BarG
Tw :	°C

1 Application :

2 Main header size and schedule : inches Sch