Bulletin for Yarway™ Series 4300 TempLow™ Steam Desuperheater

This bulletin was prepared by Emerson.

Do not install, operate or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance.

To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings.

If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations. Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

Personal injury or equipment damage caused by sudden release of pressure may result if the desuperheater is installed where service conditions could exceed the limits given on the product nameplate. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

CAUTION

When ordered, the desuperheater configuration and construction materials were specified to meet particular pressure, temperature, pressure drop, and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your local Emerson sales office .

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Safely vent the power actuator loading pressure.**
- **Use lock-out procedures to be sure the above measures stay in effect with you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even with the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
- **Check with your process or safety engineer for any other hazards that may be present from exposure to process media.**

CAUTION

When adjusting the travel stop for the closed position of the valve ball or disk, refer to the appropriate valve instruction manual for detailed procedures. Undertravel or overtravel at the closed position may result in poor valve performance and/or damage to the equipment .

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YARWAY NARVIK SERIES 4300 TEMPLOW® STEAM DESUPERHEATER

For precise and economical control of steam temperature

GENERAL APPLICATION

Cooling of process gas or steam
Boiler superheater
Boiler reheater
Turbine bleed steam
Steam conditioning station

TECHNICAL DATA

Size:	Steam	NPS 3 (DN 80)
	Water	NPS 1 (DN 25)

FEATURES AND BENEFITS

Easy installation

- Installation in straight, vertical or horizontal pipe.
- Minimal headroom is required for mounting
- Only standard connections are involved for all sizes:
  - NPS 1 (DN 25) water;
  - NPS 3 (DN 80) steam.
- Few components are required.
- No atomizing steam or pipeliners, which complicate installation are required.
- Only 15 feet (4 to 5 meter) of straight run piping downstream.

Precision control of temperature

- Rapid evaporation of water is achieved to minimize the accumulation of water in the line.
- Control within 10°F (6°C) of saturation is possible.
- Repeatable accuracy to ±1% of the range of the temperature controller.
- Water turndown capacity of 50:1 (typically) or higher is available.

Low maintenance

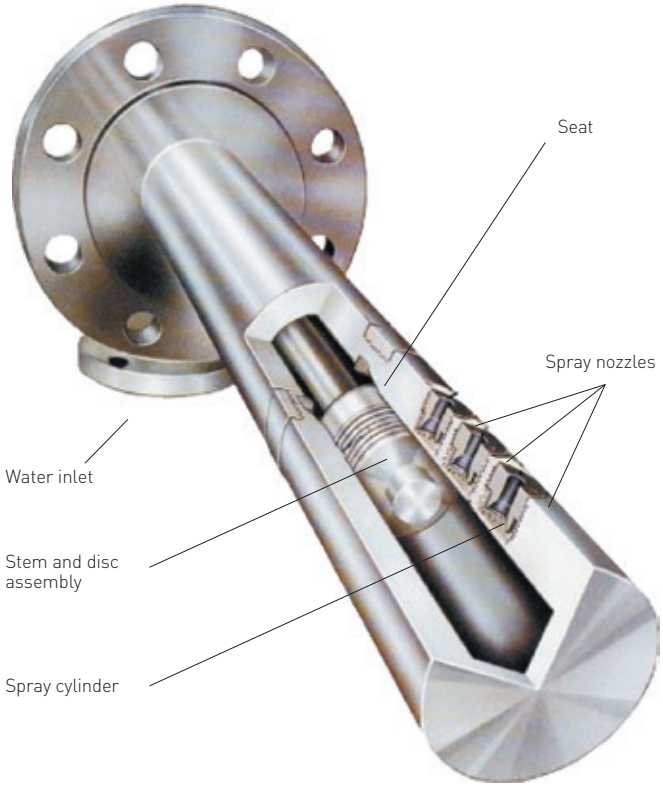
- Chrome moly body with, stainless steel internals eliminates corrosion problems.
- Hardened stainless steel nozzles minimize wear.
- Stellite seat for long life tight shut-off.

Adaptable to changing needs

- Spray cylinders unscrew from probe for easy capacity changes without changing stem/disc or seat.
- Long trim life. Pressure drop is taken across the nozzles rather than the seating surfaces.
- Actual performance depends on the application and in many instances may exceed the design characteristics above.

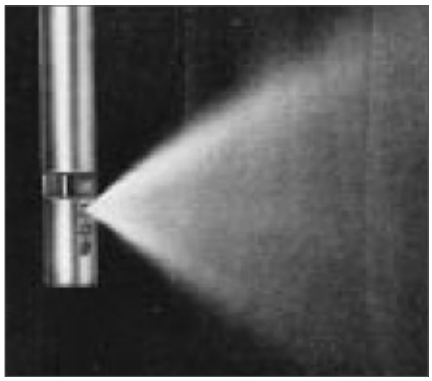
DESCRIPTION

For precise and economical control of steam temperature, the Yarway probe-type TempLow desuperheater automatically introduces cooling water into steam flow in response to a pneumatic or electric control signal.
The Yarway desuperheater represents a major advance in the design of this type or equipment. It has an unusually high turndown ratio-double that of units previously available.
This permits its use in systems with wide fluctuations in steam flow rate.
Small enough to mount through a 3-inch (DN 80) flange in the steam line, it includes features previously found only in larger, more space consuming desuperheater units.
Water pressure 50 to 1450 psi (3.5 to 100 bar) above steam pressure is employed to generate thin-film, conical sprays which are injected into the steam flow through a series of vortex spray nozzles. The fine sprays evaporate rapidly in the steam, thereby minimizing the tendency for spray water to accumulate in the line.
A separate water control valve is unnecessary because water flow control is a function of the desuperheater itself.

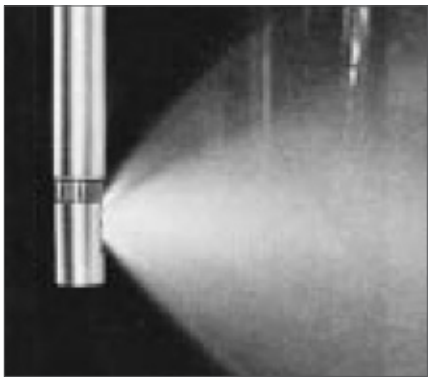


HOW IT WORKS

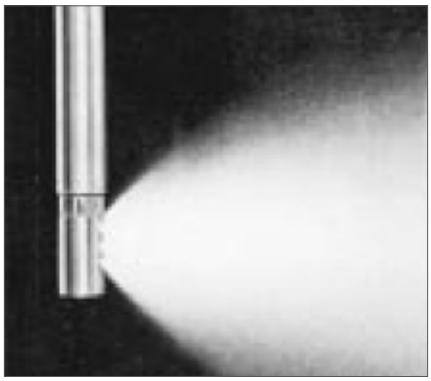
Desuperheating water, at a pressure of at least 50 psi (3.5 bar) above steam line pressure, enters the desuperheater through a 1" (DN 25) flanged water connection. The water flows down through the water jacket to the seating area above the disc, where tight water shut-off is achieved. When a reduction in steam temperature is signaled by the steam temperature control system, the actuator forces the stem/disc assembly of the desuperheater downward, progressively uncovering a series of multiple water inlet orifices which feed each vortex nozzle. As more desuperheating water is required, the disc moves further downward, bringing additional nozzles to surface.
There are multiple stages of water control to each nozzle, plus 6 to 21 vortex nozzles, which create a rotating mist of water droplets for rapid evaporation and fast response to a change in temperature control signal.
Maximum water pressure is assured at the nozzles because no upstream water control valve is utilized. This also eliminates flashing/ cavitation within the probe. Water flow is thus controlled at the point of the injection into the steam.



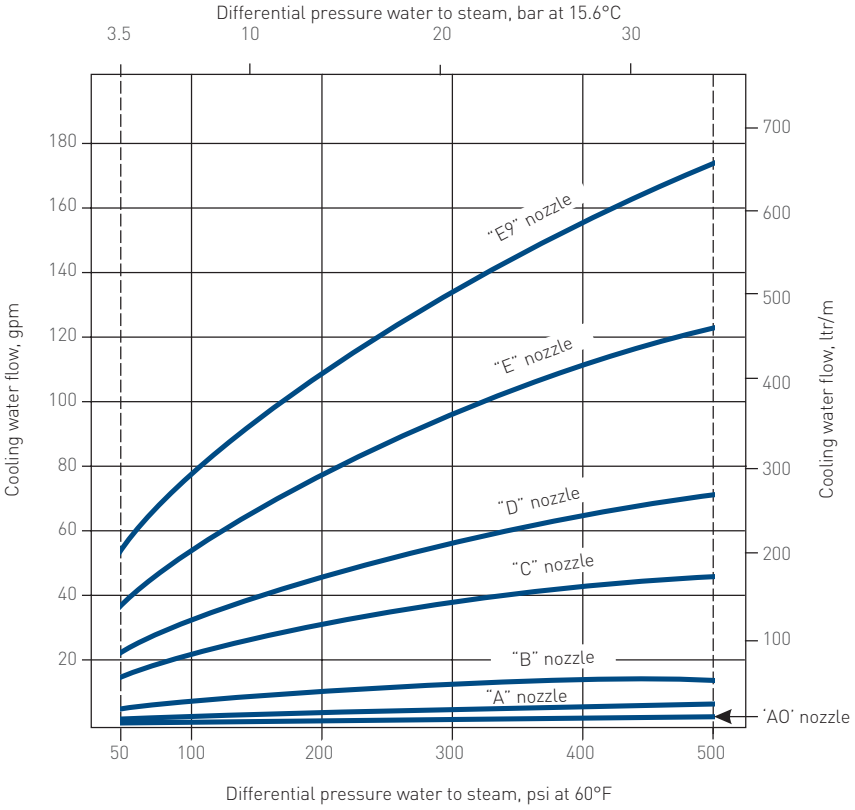
OPERATING AT 15%



OPERATING AT 50%



OPERATING AT 100%

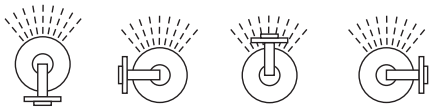


STANDARD NOZZLE FLOW CHARACTERISTICS

Nozzle style	C_v	K_v
AS6	0.09	0.07
A06	0.19	0.16
A6	0.30	0.26
B6	0.80	0.70
C6	2.10	1.80
D6	3.17	2.68
E6	5.38	4.68
E9	8.07	7.02

Top view available mounting positions

Standard



SIZING

In sizing the Desuperheater the amount of water required to meet your temperature set-point should be calculated first with the heat balance as follows:

$$Q = \frac{m_{is}}{SG \times 500} \times \frac{h_{is} - h_{os}}{h_{os} - h_{iw}}$$

$$C_v = Q\sqrt{SG/\Delta P}$$

SG = specific gravity
h_{is} = enthalpy inlet steam
h_{os} = enthalpy outlet steam
h_{iw} = enthalpy spray water
m_{is} = quantity of superheated steam (lb/hr)
Q = quantity of spray water (gpm)

$$K_V = Q\sqrt{\frac{S.G.}{\Delta P}}$$

Q = m^3/hr
S.G. = kg/dm^3
ΔP = bar

With the required quantity of spray water known as well as the differential pressure, the nozzle size can be determined with the sizing diagram. Desuperheating sizing should consider both steam turndown and water turndown capabilities.
Steam turndown is the ratio of maximum steam flow to minimum controllable steam flow (which is related to steam velocity). Typical steam turndown ratios are 10 to 1 range. An application involving high steam turndown would be cogeneration turbine bypass. Here a small amount of main steam is pressure reduced and desuperheated (TempLow) as a low flow steam supplement to the turbine exhaust to process. This small steam flow results in low steam velocities.

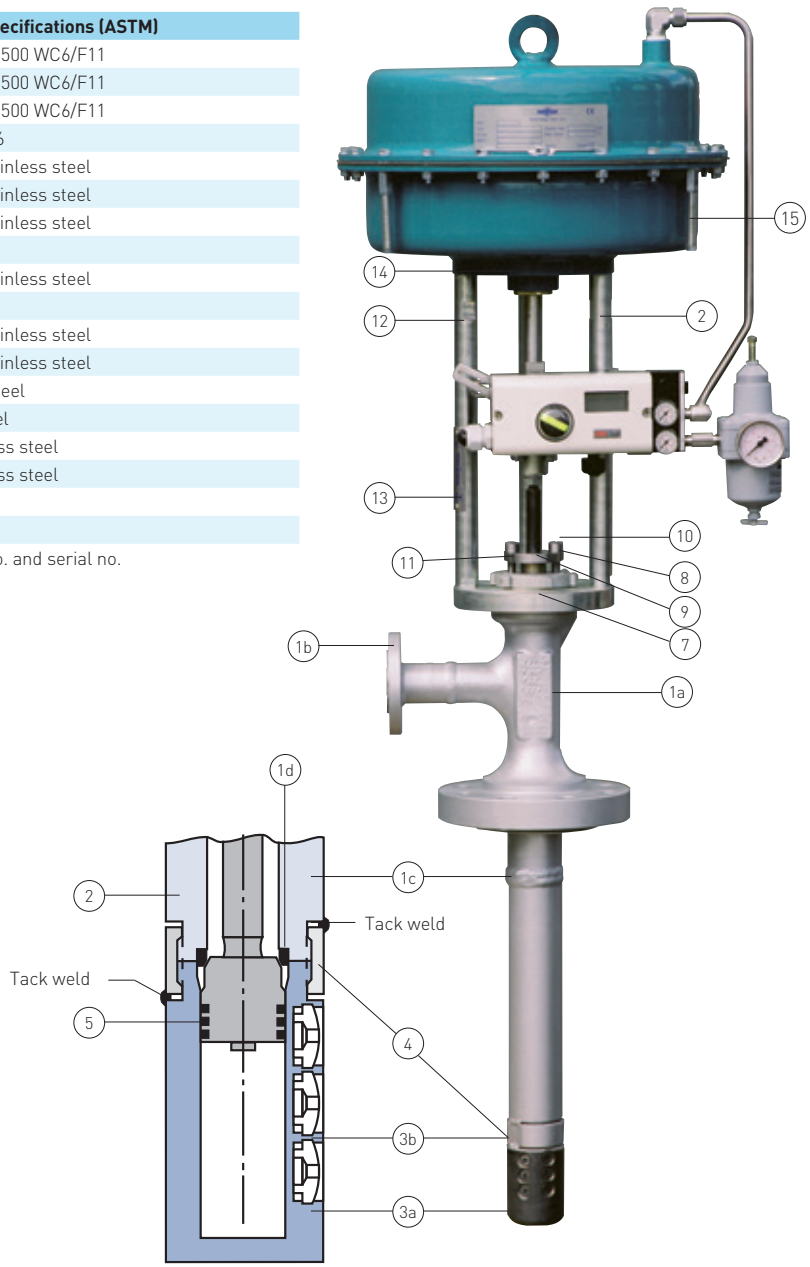
The TempLow's finely atomized water droplet is entrained in this steam stream and easily vaporized. In this same application, should the turbine trip off line, all process steam is obtained from bypassed main steam that the TempLow will then desuperheat with it's significantly larger water flow capability.
Water turndown is the maximum to minimum water flow ratio over which a finely atomized water droplet size is maintained. The TempLow water turndown ratios can reach higher than 50 to 1. The individual nozzle sizes can be arranged in over 30 variations to achieve the steam and water turndown requirements. Applications involving high water turndown would be superheater attemperation, reheat attemperation, and turbine extraction to process.

All of these applications must deal with varying inlet steam temperatures that can result in a wide range of water injection capacities.
It is these applications which benefit most from the TempLow's high water turndown capacity.

STANDARD MATERIALS OF CONSTRUCTION

Item	Name of part	Material specifications (ASTM)
1a	Body	Class 150-1500 WC6/F11
1b	Water flange	Class 150-1500 WC6/F11
1c	Water jacket	Class 150-1500 WC6/F11
1d	Seat	Stellite No.6
2*	Stem/disc	AISI 431 stainless steel
3a*	Spray cylinder	AISI 410 stainless steel
3b*	Vortex nozzle	AISI 431 stainless steel
4	Fastener ring	A182 F11
5*	Piston ring	AISI 420 stainless steel
7*	Packing set	Graphite
8	Gland packing	AISI 304 stainless steel
9*	Bushing gland	AISI 431 stainless steel
10	Cap screw	A193 B16 steel
11	Lock nut	Carbon steel
12	Data plate	AISI stainless steel
13	Drive screw	AISI stainless steel
14	Split nut stem connector	Steel
15	Actuator and accessories	As required

* Recommended spare parts. Specify spare part by item no., figure no. and serial no.



All applications can benefit from a long service life. The TempLow achieves this by having two water control areas on the disc: a tight shutoff disc surface, followed by a no flow deadband, and then a lower disc edge for uncovering the water inlet orifices. The TempLow does not experience low flow seat erosion because of the combining of the water control disc area features. All applications, especially those with high turndown needs, get a longer tight shutoff service life along with a finely atomized water spray from the TempLow's multiple water control area disc.

DIMENSIONS (based on model 20 - 90)

Item	Dimensions inch (mm)			
A (++)	32¼ (820)***			
B (++)	41¾ (1060)***			
C	150 - 1500 9⅜ (238)		2500 18 11/32 (466)	
D	6⅛ (156)			
E	ANSI	150 - 600 6¼ (159)	900 - 1500 7.0 (178)	2500 9 21/32 (245)
Z	15½ (394)**			

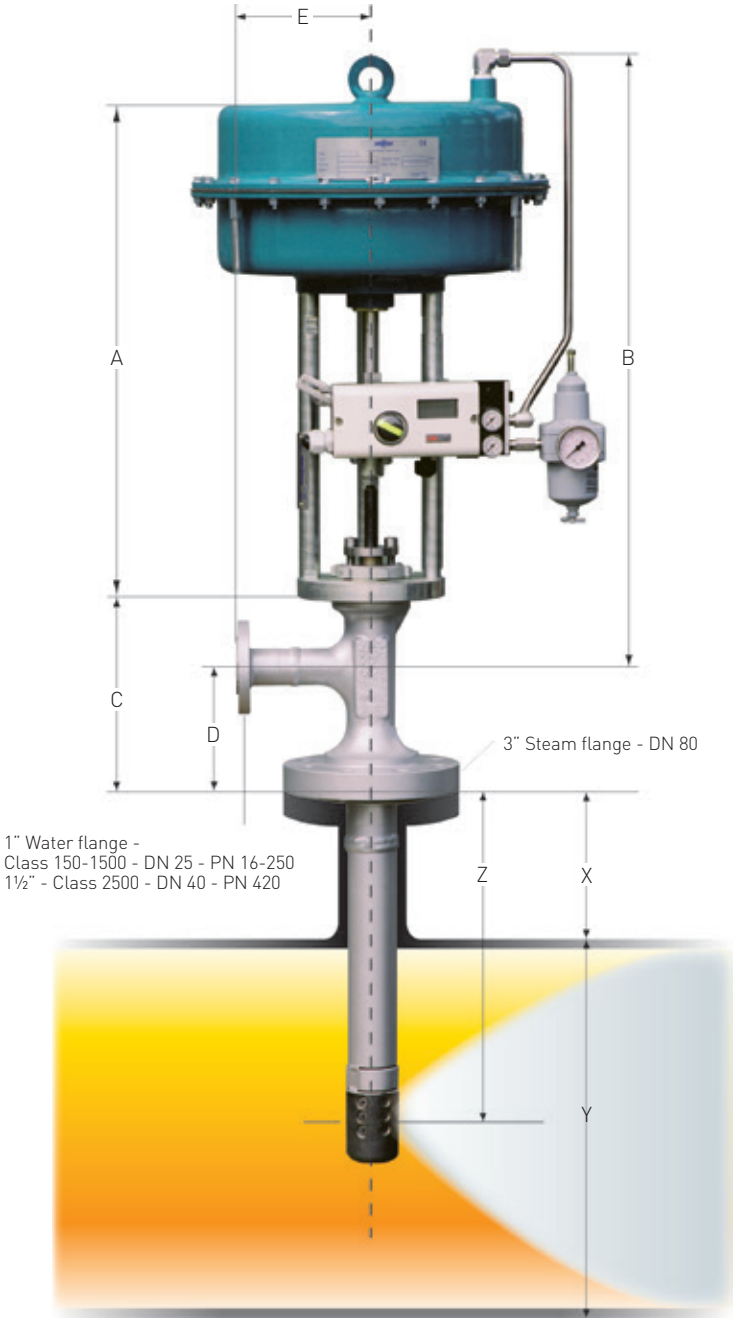
NOTES

++ Add 12" (305 mm) if side-mounted handwheel is included.

* X may vary for higher pressure classes.

** This dimension is for estimates. See Yarway certified drawing for fabrication details.

*** Can vary from this standard depending on actuator selection.



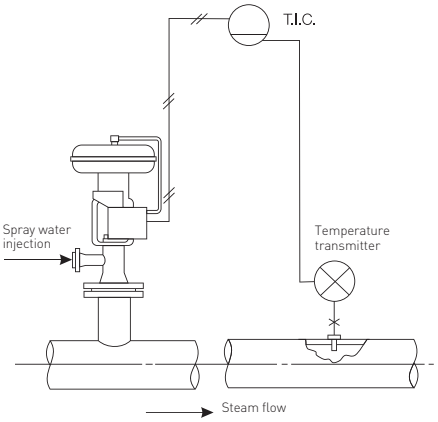
DIMENSIONS

The primary dimensional variable is the length ("X") of the 3-inch (DN 80) pipe that supports the mounting flange through which desuperheater is inserted in the steam line. This dimension varies so the nozzle portion of the spray cylinder assembly (part 3a) is always centered with respect to steam pipeline O.D. ("Y").

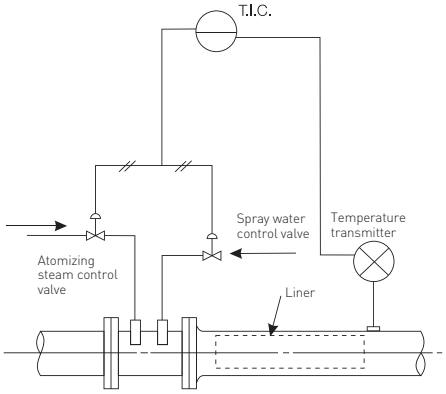
Formula: $X = Z - \frac{Y}{2}$

(X = 3¼" for pipe dia. larger than 24")*

Spray nozzle C_V (K_V) sizes vary in seven increments ("AS" to "E") depending on application requirements. The position of the nozzle around the spray cylinder can also be specified.



YARWAY SYSTEM



CONVENTIONAL SYSTEM

WEIGHTS

Figure number*	Pressure rating ASME	Weight less actuator** lb (kg)
4322	150	86 (39)
4324	300	95 (43)
4326	600	100 (45)
4328	900	116 (53)
4330	1500	132 (60)

* Add suffix A, B, C, D or E for nozzle size

** Add approx. 55 lb. (25 barg) for actuator. (See capacity curve)

NOTE

Yarway Corporation reserves the right to change the designs and materials of its products without notice.

This brochure is also applicable for Yarway models 58, 91 and 93.

USES CONVENTIONAL INSTRUMENTATION

Only conventional components are required to form the measurement/control loop associated with the desuperheater. A temperature sensor and transmitter are mounted in the line downstream of the unit. The transmitter sends changes in temperature to an indicating controller which can be mounted locally or in the control room. The controller sends a 3 - 15 psi or other pneumatic control signal, or a 4 - 20 mA DC electric control signal, to a valve actuator which then positions the stem and disc to inject the proper amount of desuperheated water to hold the desired temperature control set point.

DESUPERHEATER SPECIFICATION

The Desuperheater should be sized to meet the conditions of service on the data sheet and designed with ...

- Integral water shut off and flow control functions included with the spray nozzles.
- All water pressure reduction is taken across the spray nozzle ... no pressure reduction stages inside the body or probe.
- Direct mechanical connection of the actuator stem to the water flow control edge on the disc.
- Separate shutoff surface and water flow control edge on the disc.
- No contoured plug flow control surfaces.
- Stellite seat.
- Gasketless design.
- Spray nozzles brazed into position.
- Minimum of six individual spray nozzles.
- No spring loaded nozzles.
- Installation in vertical or horizontal piping with water spraying in direction of steam flow.
- No atomizing steam required.
- Body to be chrome-moly or stainless steel.
- Steam connection to be 3" RF flange (DN 80).
- Water connection to be 1" RF flange (DN 25 - PN 16 to PN 250) (ASME 150 to 1500).
- Temperature control to within 10°F (6°C) of saturation temperature and to within plus or minus 1% of controller range.
- Complete with actuator and positioner as per data sheet including supply air (or power), instrument signal, failure position and accessories.