



For use in systems with wide fluctuations in steam flow rate.

Features and Benefits

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 of 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 (NW 80) flange in the steam line, it includes features previously found only in larger, more space-consuming desuperheater units. Water pressure 50 to 1600 psi [3.4 to 110 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.

Easy Installation

- Installation in straight, vertical or horizontal pipe.
- Minimal headroom is required for mounting the unit in line.
- Only standard connections are involved for all sizes:
 - 1-inch [NW 25] water;
 - 3-inch [NW 80] steam.
- Few components are required.
- No atomizing steam or pipeliners (which complicate installation) are required.
- Only 15 feet of straight run piping down stream.

Actual performance depends on the application and in many instances may exceed the design characteristics above.



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 $\pm 1\%$ of the range of the temperature controller.
- Water turndown capacity of 300:1 or higher.

Low Maintenance

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

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.



Total Flow Control Solutions™

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Operation

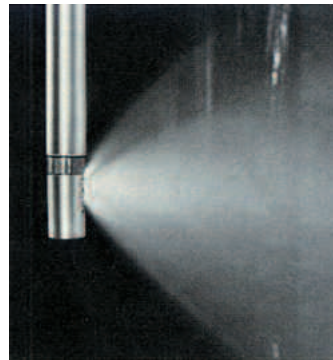
Desuperheating water, at a pressure of at least 50 psi above steam line pressure, enters the desuperheater through a 1" [NW 25] flanged water connection. The water flows down through the water jacket to the seating area above the disc, where tight water shutoff is achieved. When a reduction in steam 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.

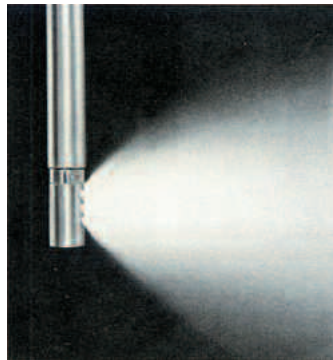
Maximum water pressure is assured at the nozzles because no upstream water control valve is utilized. This also eliminates flashing/cavitation within the probe. Water flow is thus controlled at the point of the injection into the steam.



Operating at 15%



Operating at 50%

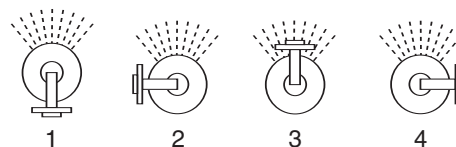


Operating at 100%

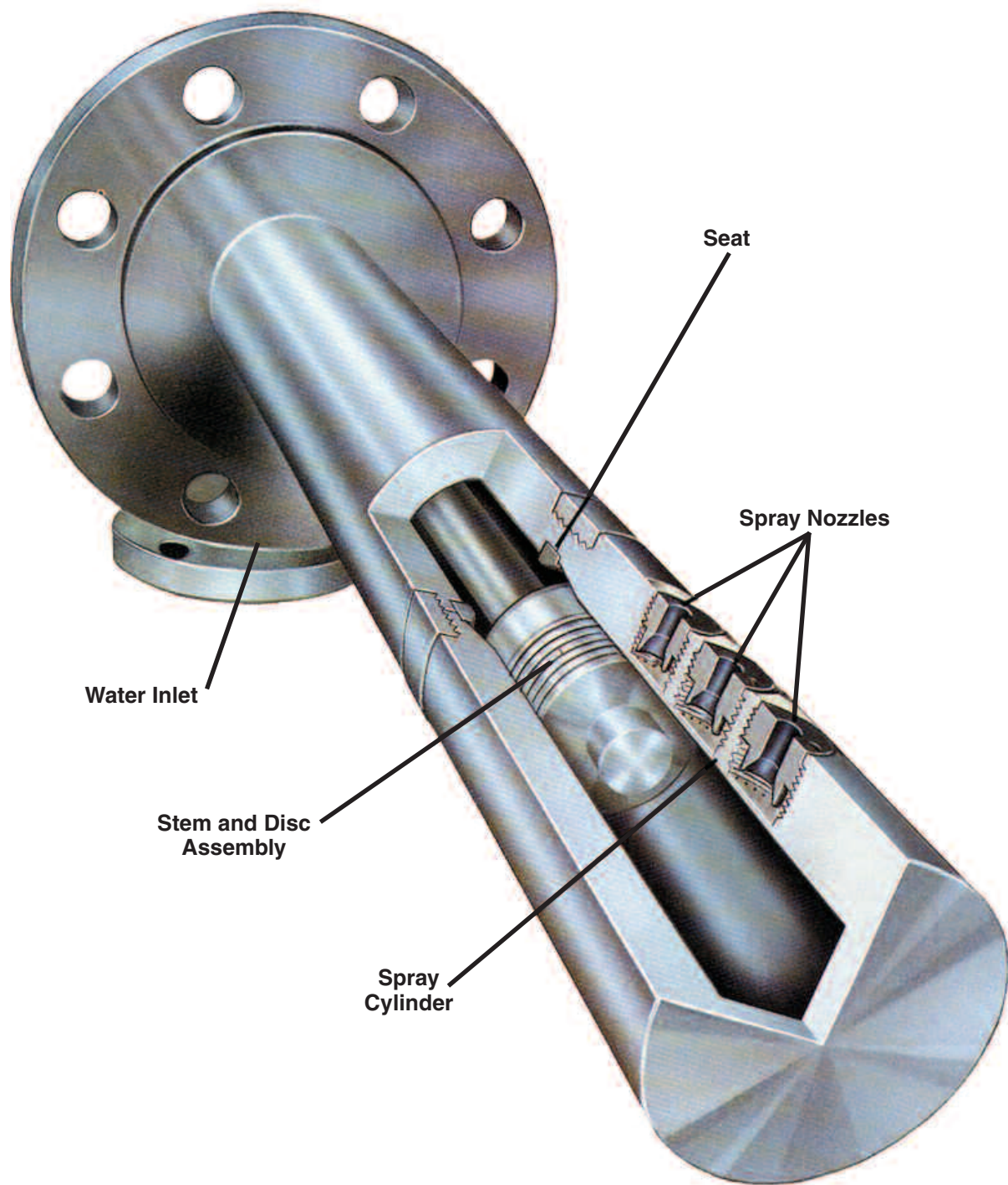
Standard Nozzle Flow Characteristics

Nozzle Style	C _v	K _v
AS6	0.09	0.07
AO6	0.19	0.16
A6	0.30	0.26
B6	0.80	0.70
C6	2.10	1.80
D6	3.10	2.68
E6	5.32	4.60
E9	7.75	6.70

Standard



Top View
Available Mounting Positions



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:

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

$$C_v = Q \sqrt{SG/DP}$$

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)

With the required quantity of spray water known as well as the differential pressure, the nozzle size can be determined with the sizing diagram.

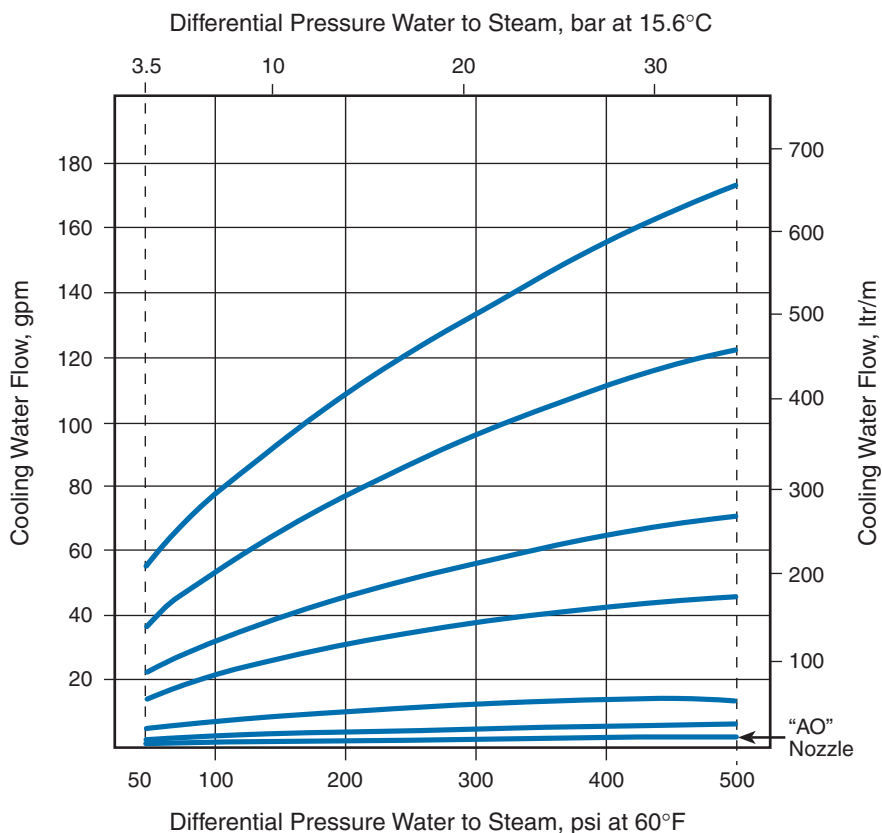
Desuperheating sizing should consider both steam turndown and water turndown capabilities.

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 its 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 300 to 1. The individual nozzle sizes can be arranged in over 52 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.

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.

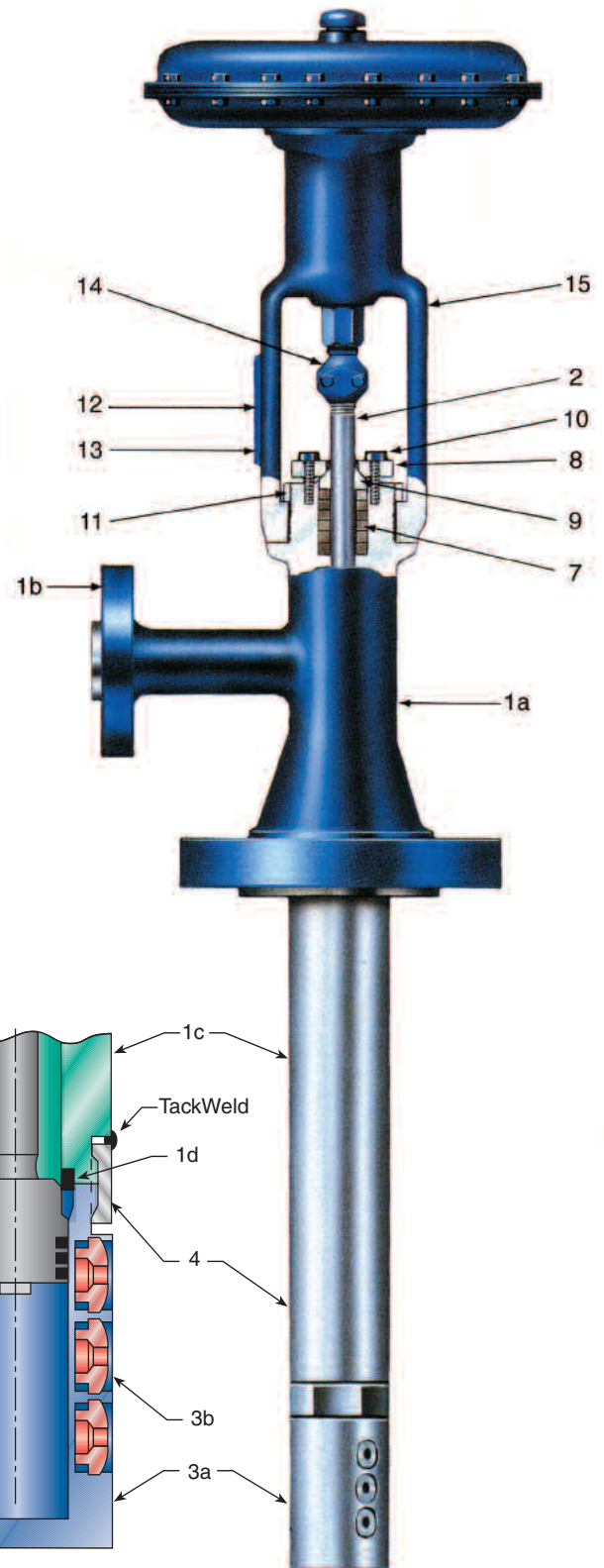


Standard Materials of Construction

Item	Name of Part	Material Specifications (ASTM)
1a	Body	Class 150-1500 WC6/F11, F22 Class 2500 CF8C/F347
1b	Water Flange	
1c	Water Jacket	
1d	Seat	Stellite No. 6
2	Stem/Disc	AISI 410 Stainless Steel
3a	Spray Cylinder	AISI 410 Stainless Steel
3b	Vortex Nozzle	AISI 416 Stainless Steel
4	Fastener Ring	AISI 410 Stainless Steel
5'	Piston Ring (Qty. 3)	AISI 420 Stainless Steel
7'	Packing Set	Graphite
8	Gland, Packing	AISI 416 Stainless Steel
9	Bushing, Gland	AISI 416 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

Note

1. Recommended Spare Parts. Specify Spare Part by Item No., Figure No., and Serial No.



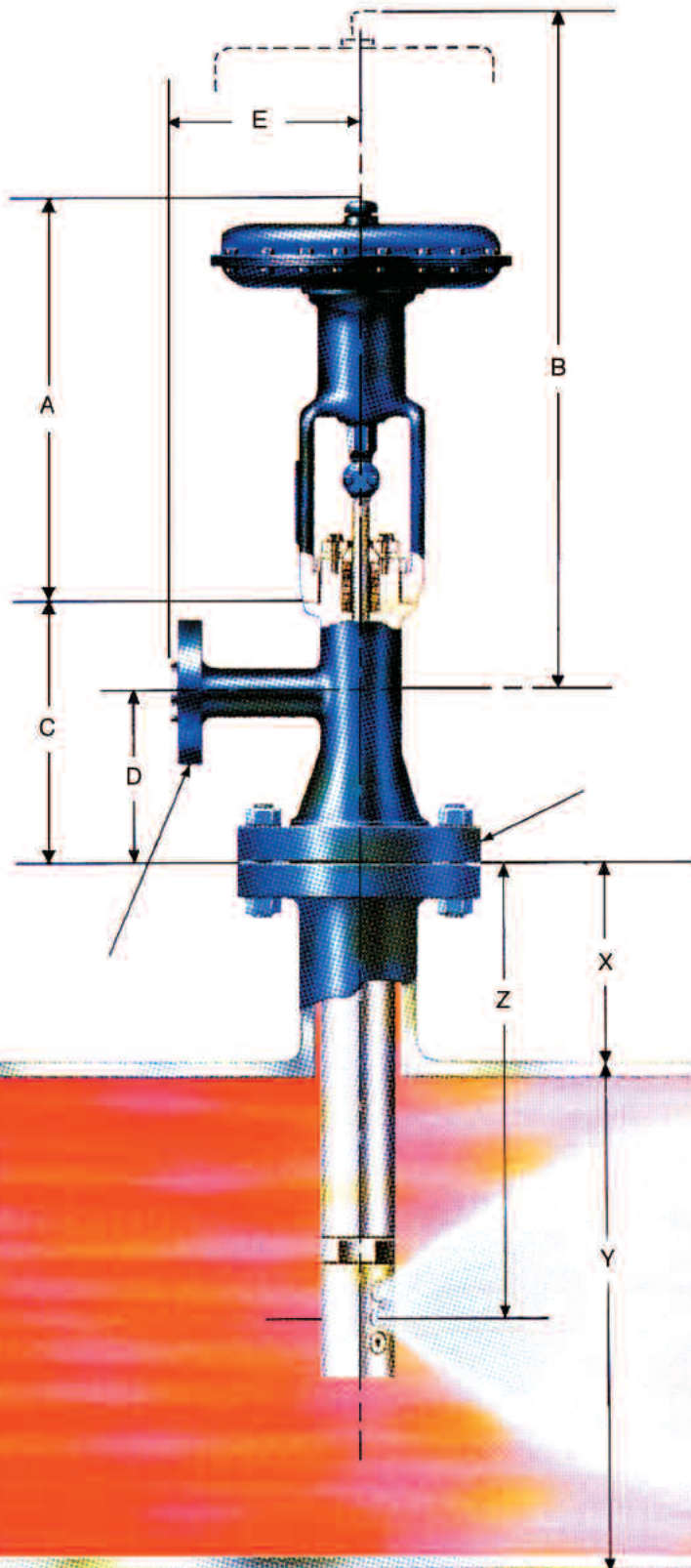
Dimensions

The primary dimensional variable is the length (“X”) of the 3-inch pipe that supports the mounting flange through which the 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”).

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

(X = 3 1/4” for pipe dia. larger than 24”) 7

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.



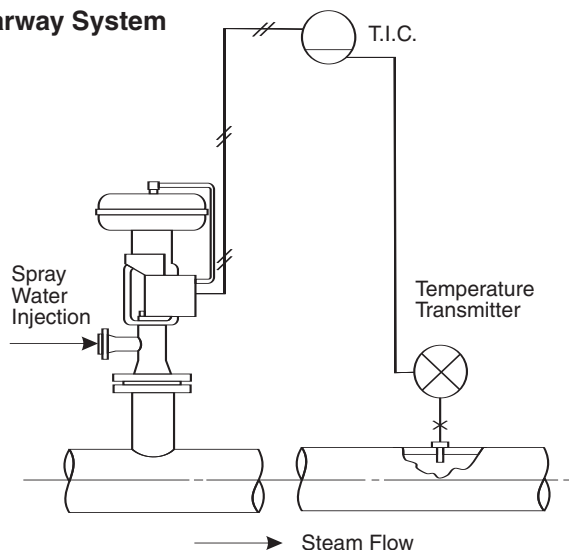
Dimensions

Item	Dimensions, in. [mm]
A ²	26 ³ / ₄ [679] ³
B ²	35 ⁷ / ₈ [911] ³
C	
150-1500	9 ³ / ₈ [238]
2500	18 ¹¹ / ₃₂ [466]
D	6 ¹ / ₈ [156]
E (ANSI)	
150-600	6 ¹ / ₄ [159]
900-1500	7 [178]
2500	9 ²¹ / ₃₂ [245]
Z	15 ¹ / ₂ [394] ⁴

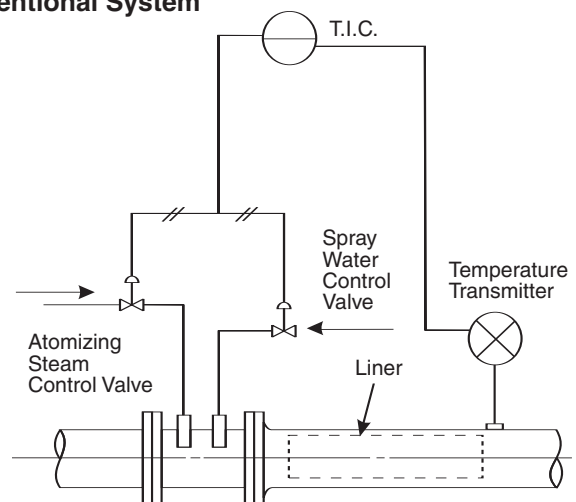
Notes

1. X may vary for higher pressure classes.
2. Add 12” [305 mm] if top-mounted handwheel is included.
3. Can vary from this standard depending on actuator selection.
4. This dimension is for estimates. See Yarway certified drawing for fabrication details.

Yarway System



Conventional System



Weights

Figure Number ¹	Pressure Rating ASME	Weight Less Actuator, ² lb (kg)
4322	150	86 (39)
4324	300	95 (43)
4326	600	100 (45)
4328	900	116 (53)
4330	1500	132 (60)
4332	2500	176 (80)

Notes

1. Add suffix A, B, C, D or E for nozzle size.
2. Add approx. 55 lb. for actuator. (See capacity curve, page 4).

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 shutoff 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.
- Class V shut-off of cooling water.
- Body to be chrome-moly or stainless steel.
- Steam connection to be 3" RF flange.
- Water connection to be 1" RF flange (ANSI 150 to 1500), 1 1/2" RF flange (ANSI 2500).
- 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.

Information Required for Sizing Yarway Desuperheaters

Company _____ Date _____
 Address _____
 City _____ State _____ Zip _____
 Name _____
 Telephone _____ Fax _____
 Project _____ Tag Number _____
 Location _____ Quantity _____

Conditions of Service	Units ¹	Maximum	Normal	Minimum
<input type="checkbox"/> Inlet = mis	Steam Flow	()		
<input type="checkbox"/> Outlet = mos				
Inlet Steam	Pis = Pressure	() ²		
	Tis = Temperature	()		
Outlet Steam	Pos = Pressure	() ² same as inlet pressure		
	Tos = Temperature	()		
Inlet Water	Piw = Pressure	() ²		
	Tiw = Temperature	()		

Steam Pipe Size and Schedule _____

Application:

Turbine Exhaust to Process Superheater Attenuation
 Turbine Bypass to Condenser Reheat Attenuation
 Turbine Bypass to Process Turbine Blade Washing
 Details or Special Instructions (see below)

Actuation:

Pneumatic Electric Hydraulic

Air Supply _____ to _____ PSIG Electrical Supply _____ (VAC/PH/HZ)

Supply Failure Open Close Last

Instrument Signal 3-15 psig 4-20 mADC

Increasing Signal to Open Close

Manual Operator (Handwheel) No Top Side

Instrumentation (Transmitters & Controllers) by Yarway Yes No

Details or Special Instructions: _____

Notes

- Units - U.S. (Lbm/hr, PSIA, °F)
SI [Kg/hr, Bara, °C]
- Pressure - specify if absolute "a" or gage "g"
- Nomenclature Examples:
mis = mass flow inlet steam
Tos = Temperature outlet steam

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