

# Design DMA, DMA/AF, DMA/AF-HTC, DSA, DVI, and TBX-T Desuperheaters

Design DMA, DMA/AF, DMA/AF-HTC, DSA, DVI, and TBX-T desuperheaters (figure 1) can be used in many applications to efficiently reduce the temperature of superheated steam to the desired set point. Available variations are mechanically atomized (both fixed geometry and variable geometry) and steam assisted. Desuperheaters are available for installation in steam lines from DN25 through DN1500 (NPS 1 through 60) in diameter and are capable of maintaining steam temperatures to within 6°C (10°F) of saturation temperatures.

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### Available Desuperheater Types

- **Design DMA**—A simple mechanically atomized desuperheater with single or multiple, fixed-geometry spray nozzles is intended for applications with nearly constant load. The Design DMA is installed through a flanged connection on the side of a DN150 (NPS 6) or larger pipeline. Maximum unit  $C_V$  is 3.8.

- **Design DMA/AF**—A variable-geometry, mechanically atomized, back-pressure-activated desuperheater with one, two, or three spray nozzles is designed for applications requiring control over moderate load fluctuations. The Design DMA/AF desuperheater (figure 2) is installed through a flanged connection on the side of a DN200 (NPS 8) or larger pipeline. Maximum unit  $C_V$  is 15.0.



Figure 1. Typical Desuperheaters



Table 1. Connection Sizes

DESIGN	STEAM LINE SIZE, NPS	STEAM LINE CONNECTION		SPRAYWATER CONNECTION		ATOMIZING STEAM CONNECTION	
		Size, NPS	ASME Pressure Rating Raised-Face Flange <sup>(1)</sup>	Size, NPS	ASME Pressure Rating Raised-Face Flange <sup>(1)</sup>	Size, NPS	ASME Pressure Rating Raised-Face Flange <sup>(1)</sup>
DMA	6 through 60	3, 4, or 6	CL150, 300, 600	1, 1-1/2, or 2	CL150 - 2500	N/A	N/A
DMA/AF	8 through 60	3 <sup>(2)</sup> , 4, 6, or 8		1, 1-1/2, 2, 2-1/2, or 3		N/A	N/A
DMA/AF-HTC	8 through 60	4	CL600, 900, 1500, or 2500	1-1/2 <sup>(3)</sup> , or 2	CL600 - 2500	N/A	N/A
DSA	8 through 60	3 <sup>(2)</sup> , 4, or 6	CL150, 300, 600, 900, or 1500	1, 1-1/2, or 2	CL150 - 2500	1, 1-1/2, or 2	CL150, 300, 600, 900, or 1500
DVI	1 through 24	1 through 24	CL150, 300, 600, 900, or 1500	1/2, 3/4, 1, or 2	CL150 - 2500	N/A	N/A
TBX-T <sup>(4)</sup>	8 through 36	8 through 36	BWE	1 through 3	CL150 - 2500	N/A	N/A

1. Other standard flanges and connections are also available.  
 2. Consult your Emerson Process Management sales office for acceptability of NPS 3 mounting connection for size and pressure class specified.  
 3. NSP 1-1/2 spraywater connection is only available for CL600 and 900.  
 4. Consult your Emerson Process Management sales office.

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● **Design DMA/AF-HTC**— The Design DMA/AF-HTC is functionally equivalent to the Design DMA/AF, however it is structurally suited for severe applications. The most common applications include boiler interstage attemperation, where the desuperheater is exposed to high thermal cycling and stress, high steam velocities and flow induced vibration. In addition to this specific application, the Design DMA/AF-HTC is suitable for other severe desuperheating application environments. The Design DMA/AF-HTC uses a forged construction optimized to move weld joints away from high stress regions. The Design DMA/AF-HTC differs from other desuperheaters whereas it requires a minimum mounting ID of NPS 4. Typically this requires using a long welding neck flange for the mounting flange.

The desuperheater design incorporates an integral thermal liner inside the desuperheater body pipe. This minimizes the potential for thermal shock when cool water is introduced to the unit that is already heated to the operating steam temperature.

The nozzle mount for the Design DMA/AF-HTC is engineered to minimize the potential for excitation due to vortex shedding and flow induced vibration. The Design DMA/AF-HTC desuperheater (figure 5) is installed through a flanged connection on a DN200 (NPS 8) or larger pipeline. Maximum unit  $C_V$  is 15.0.

● **Design DSA**—The Design DSA desuperheater uses high-pressure steam for rapid and complete atomization of spraywater in low-velocity steam lines. This desuperheater (figure 3) is installed through a flanged connection on a DN200 (NPS 8) or larger pipeline. This desuperheater is intended for applications requiring high rangeability. Maximum unit  $C_V$  is 9.97.

● **Design DVI**—This desuperheater injects spraywater in the outlet of the venturi section, assuring excellent mixing and rapid atomization. The Design DVI desuperheater (figure 6) is easily installed between flanges in DN25 through DN600 (NPS 1 through 24) steam lines. There are no moving parts, and the water injection pattern provides rapid and thorough cooling. It is intended for applications with moderate load changes and low-velocity steam. Maximum unit  $C_V$  is 9.48.

● **Design TBX-T**—The Design TBX-T desuperheater incorporates a spraywater manifold of variable geometry Type AF nozzles that produce an optimized spray pattern over a wide operating range. These nozzles are strategically placed to achieve optimal mixing and quick vaporization at all flowing conditions (see figure 4).

The Design TBX-T desuperheater can be configured with a pressure reducing valve (PRV) immediately upstream, with an integral diffuser, or as a standalone device.

## Principle of Operation

For the most efficient use of heat energy from steam, it is necessary to reduce the temperature of steam to near the saturation temperature. With steam that is at or near the saturation temperature, it is possible to recover the large amount of energy that was put into the steam when it was heated from water to steam.

The Design DMA, DMA/AF, DMA/AF-HTC, DSA, and DVI desuperheaters produce a spray of cooling water in a steam line (figure 7). The spraywater cools the steam to near the saturation temperature. The rate of cooling is dependent on spraywater droplet size, distribution, and velocity. The temperature is controlled by varying the amount of spraywater flow.

In operation, spraywater is supplied to a connection on the desuperheater. A signal from a downstream controller positions an actuator or valve to control the amount of spraywater flow for cooling. The

spraywater control valve is a separate valve in the spraywater line.

In the Design DSA desuperheater, high pressure steam is mixed with the spraywater to produce a critical or near-critical pressure drop in the atomizing steam for a very high velocity. The high velocity disperses the spraywater into very small particles for rapid cooling.

In the Design DVI desuperheater, spraywater enters the desuperheater water tube. It continues into the distribution chamber and is forced into the injection orifices. Steam enters the desuperheating venturi and is accelerated to maximize the velocity at the point of water injection. The high steam velocity and turbulent steam flow improves mixing of water and steam, increasing rangeability.

In the Design TBX-T desuperheater, spraywater is supplied to the manifold and distributed to the nozzles. These nozzles are strategically placed to achieve optimal mixing and quick vaporization at all flowing conditions. The Design TBX-T desuperheater can be configured with a pressure reducing valve (PRV) immediately upstream, with an integral diffuser, or as a standalone device. Dimensions are dependent of the design requirements. Consult your Emerson Process Management™ sales office with service conditions to obtain dimensions.

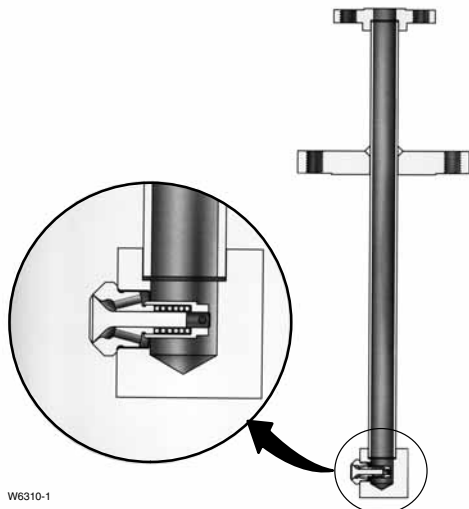


Figure 2. Design DMA/AF Desuperheater

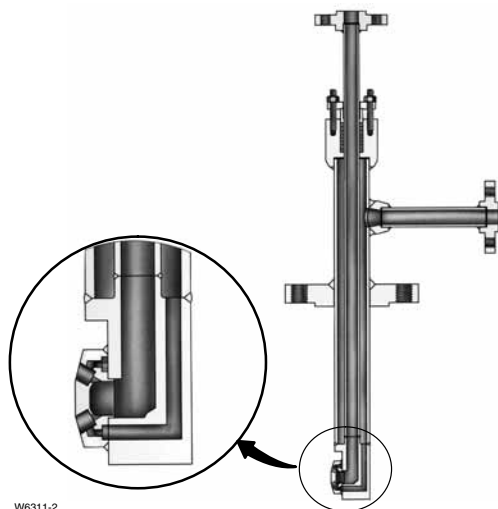


Figure 3. Design DSA Desuperheater

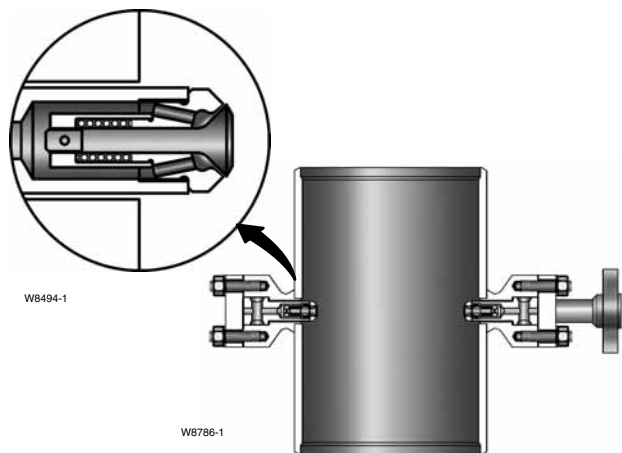


Figure 4. Design TBX-T Desuperheater

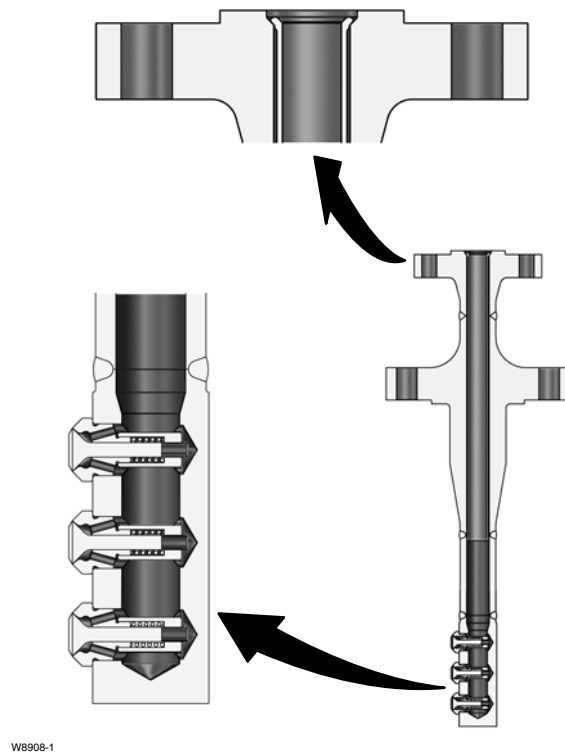


Figure 5. Design DMA/AF-HTC Desuperheater

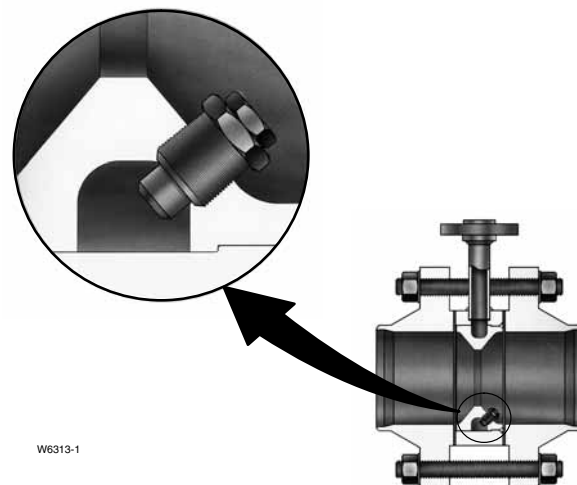
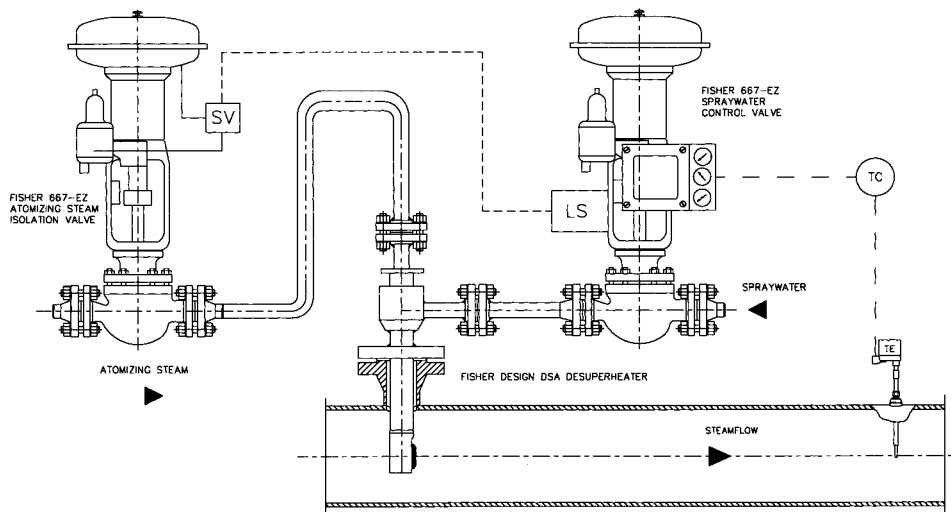
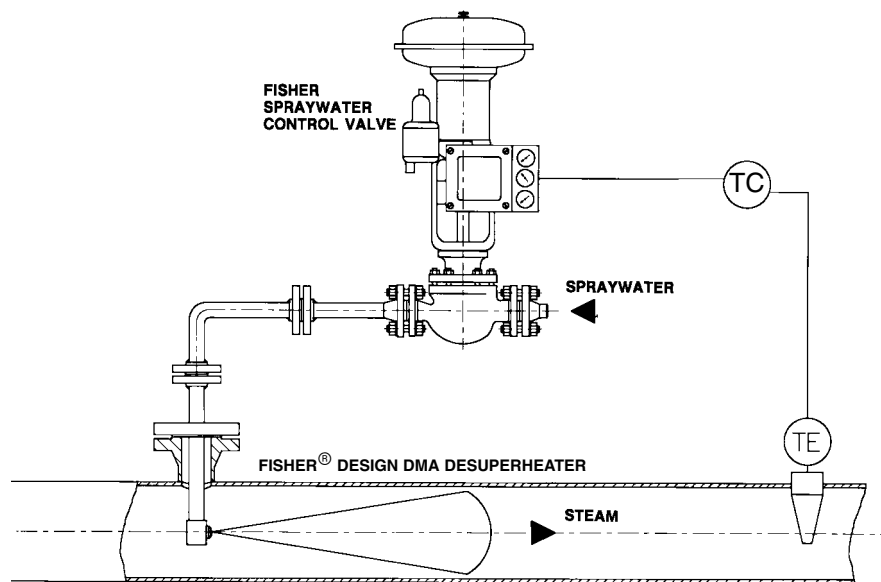


Figure 6. Design DVI Desuperheater



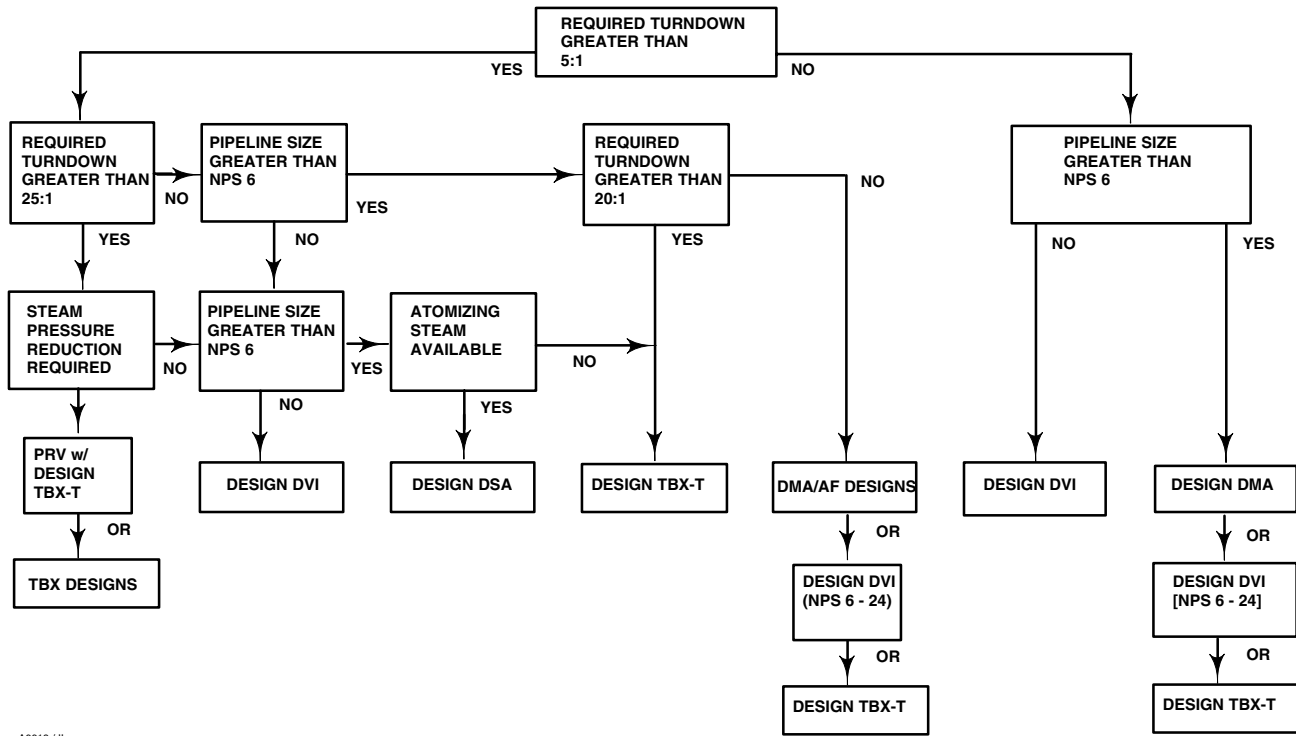
DESIGN DSA DESUPERHEATER



DESIGN DMA, DMA/AF, OR DMA/AF-HTC DESUPERHEATER

B2317 / IL

Figure 7. Typical Installation



A6619 / IL

Figure 8. Selection Flow Chart

## Ordering Information

Use the flow chart in figure 8 to select the appropriate desuperheater for your requirements. Dimensions are shown in figures 9, 10, 11, and 12. Contact your Emerson Process Management sales office for a personal computer-based desuperheater sizing program and additional information.

When ordering, specify the following information. Items 1 through 6 are required for desuperheater sizing.

1. Maximum, normal, and minimum steam flow rate.
2. Steam pressure and temperature at the inlet and outlet.
3. Spraywater pressure and temperature.
4. Atomizing steam pressure and temperature (Design DSA desuperheater only).
5. Design conditions, if different from operating conditions.
6. Steam line size.
7. Desuperheater steam connection size, type, and rating.
8. Spraywater connection size from table 1.
9. Atomizing steam connection size from table 1 (Design DSA desuperheater only).

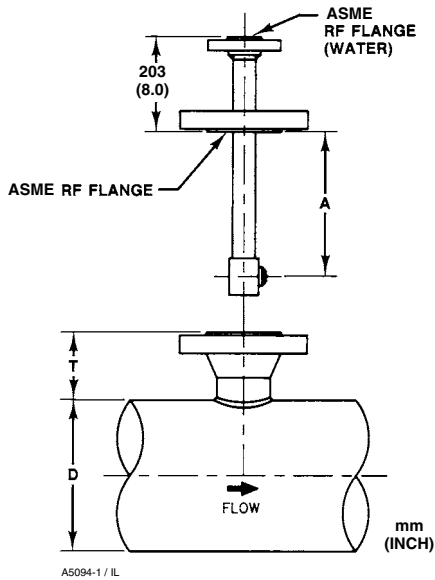


Figure 9. Design DMA and DMA/AF Dimensions  
(also see table 2)

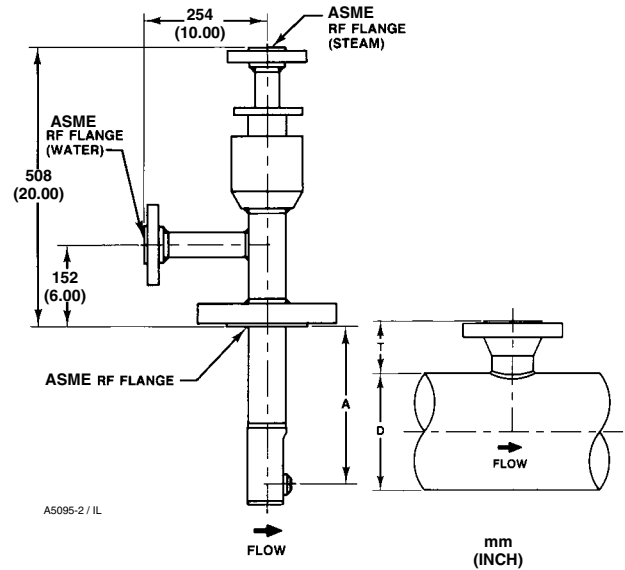


Figure 10. Design DSA Dimensions  
(also see table 3)

Table 2. Design DMA and DMA/AF Dimensions

DIMENSION				
A		D (Nominal Pipe Size), NPS	T	
mm	Inches		mm	Inches
360	14.19	6 <sup>(1)</sup>	273	10.75
		8	248	9.75
		10	216	8.50
448	17.63	12	279	11.00
		14	267	10.50
		16	241	9.50
		18	216	8.50
524	20.63	20	267	10.50
		22	241	9.50
		24	216	8.50
		>24	216	8.50

1. Design DMA only.  
Note: For NPS 6 and 8 (Design DMA/AF only) mounting flange, add 69.6 mm (2.75 inches) to the A and T dimensions. For CL2500 mounting, consult your Emerson Process Management sales office. Refer to the certified drawing to verify the inside-diameter requirements of mounting for Design DMA/AF.

Table 3. Design DSA Dimensions

DIMENSION				
A		D (Nominal Pipe Size), NPS	T	
mm	Inches		mm	Inches
360	14.19	8	248	9.75
		10	216	8.50
448	17.63	12	279	11.00
		14	267	10.50
		16	241	9.50
		18	216	8.50
524	20.63	20	267	10.50
		22	241	9.50
		24	216	8.50
		>24	216	8.50

Note: For NPS 6 mounting flange, add 69.6 mm (2.75 inches) to the A and T dimensions. For CL2500 mounting, consult your Emerson Process Management sales office.

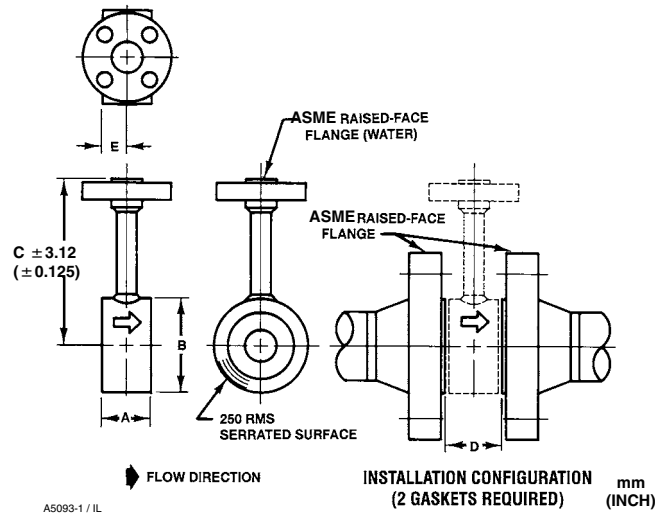
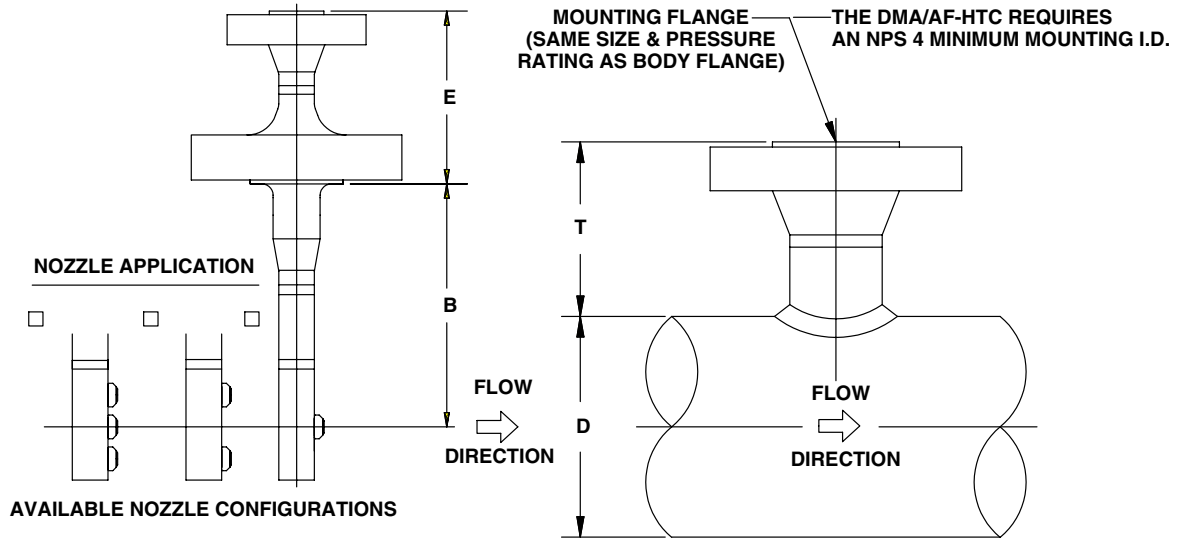


Figure 11. Design DVI Dimensions (also see table 4)

Table 4. Design DVI Dimensions

NOMINAL PIPE SIZE, NPS	A	B	C—WATER CONNECTION TO MATING FLANGE					D	E
			PRESSURE RATING						
			CL150	CL300	CL600	CL900	CL1500		
mm									
1	76	51	254	254	254	254	254	83	38
1-1/2	76	73	254	254	254	254	254	83	38
2	76	92	254	254	254	254	254	83	38
2-1/2	76	105	254	254	254	254	254	83	38
3	76	127	254	254	254	254	254	83	38
4	76	157	254	254	254	254	254	83	38
6	76	216	254	254	254	406	406	83	38
8	102	270	254	406	406	406	406	108	51
10	102	324	406	406	406	406	406	108	51
12	152	381	406	406	406	406	508	159	76
14	152	413	406	406	406	508	508	159	76
16	152	470	406	406	508	508	508	159	76
18	203	533	406	508	508	508	559	210	102
20	203	584	508	508	508	559	660	210	102
24	203	692	508	559	559	660	711	210	102
Inches									
1	3	2.00	10	10	10	10	10	3.25	1.50
1-1/2	3	2.88	10	10	10	10	10	3.25	1.50
2	3	3.63	10	10	10	10	10	3.25	1.50
2-1/2	3	4.13	10	10	10	10	10	3.25	1.50
3	3	5.00	10	10	10	10	10	3.25	1.50
4	3	6.19	10	10	10	10	10	3.25	1.50
6	3	8.50	10	10	10	16	16	3.25	1.50
8	4	10.63	10	16	16	16	16	4.25	2.00
10	4	12.75	16	16	16	16	16	4.25	2.00
12	6	15.00	16	16	16	16	20	6.25	3.00
14	6	16.25	16	16	16	20	20	6.25	3.00
16	6	18.50	16	16	20	20	20	6.25	3.00
18	8	21.00	16	20	20	20	22	8.25	4.00
20	8	23.00	20	20	20	22	26	8.25	4.00
24	8	27.25	20	22	22	26	28	8.25	4.00





GA32864-C

Figure 12. Design DMA/AF-HTC Dimensions (also see tables 5 and 6)

Table 5. Design DMA/AF-HTC Dimensions

WATER FLANGE		DESUPERHEATER BODY FLANGE <sup>(1)</sup>		DIMENSION	
Size, NPS	Pressure Rating	Size, NPS	Pressure Rating	E (Standard)	
				mm	Inches
1-1/2	CL600	4	CL600	203	8
	CL900	4	CL900	203	8
2	CL600	4	CL600	203	8
	CL900	4	CL900	254	10
	CL1500	4	CL1500	254	10
	CL2500	4	CL2500	292	11.50

1. The Design DMA/AF-HTC requires an NPS 4 minimum mounting I.D.

Table 6. Design DMA/AF-HTC Dimensions

DIMENSION						
D (Nominal Pipe Size)		Desuperheater Body Flange Size, NPS	B (Insertion Length)		T (Height)	
mm	NPS		mm	Inches	mm	Inches
200	8	4	356	14.00	248	9.75
250	10	4	356	14.00	216	8.5
300	12	4	444	17.50	279	11.0
350	14	4	444	17.50	267	10.5
400	16	4	444	17.50	241	9.5
450	18	4	444	17.50	216	8.5
500	20	4	444	17.50	216	8.5
550	22	4	444	17.50	216	8.5
600-900	24-36	4	444	17.50	216	8.5

## Specifications

### Available Types

Design ■ DMA, ■ DMA/AF, ■ DMA/AF-HTC, ■ DSA, ■ DVI, and ■ TBX-T (see the Available Desuperheater Types section for descriptions)

### Connections

See table 1

### Maximum Pressure Rating<sup>(1)</sup>

Consistent with applicable pressure-temperature ratings (as shown in table 1) per ASME B16.34

### Inherent Rangeability

Up to 50:1. The ratio of maximum to minimum controllable  $C_v$  is dependent upon the available water pressure differential

### Spray Water Pressure Required<sup>(2)</sup>

3.5 to 35 bar (50 to 500 psi) greater than steam line pressure

### Atomizing Steam (Design DSA)

Atomizing steam should be 2.0 times the pressure of the steam to be desuperheated. Amount of atomizing steam will be 10% of maximum spraywater flow

### Maximum Unit $C_v$ (for Spraywater Flow)

**Design DMA:** 3.8

**Design DMA/AF:** 15.0

**Design DMA/AF-HTC:** 15.0

**Design DSA:** 9.97

**Design DVI:** 9.48

**Design TBX-T:** Contact your Emerson Process Management sales office

### Construction Materials

**Desuperheater Body (all Designs except DMA/AF-HTC):** ■ Carbon steel, ■ Chrome-moly alloy steel (F22), or ■ 300 series stainless steel  
**Desuperheater Body (Design DMA/AF-HTC):** ■ Chrome-moly alloy steel (F22, F91)

#### Nozzle Material

*Design DMA:* ■ 303, ■ 316, or, ■ 410 stainless steel

*Design DMA/AF, DMA/AF-HTC, TBX-T, and DSA:* ■ 410 stainless steel

*Design DVI:* ■ 303 or ■ 316 stainless steel or ■ F22 venturi with drilled hole

1. Do not exceed the pressure or temperature limits in this bulletin, nor any applicable code or standard limitations.  
2. A function of required turndown and equipment selection.

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