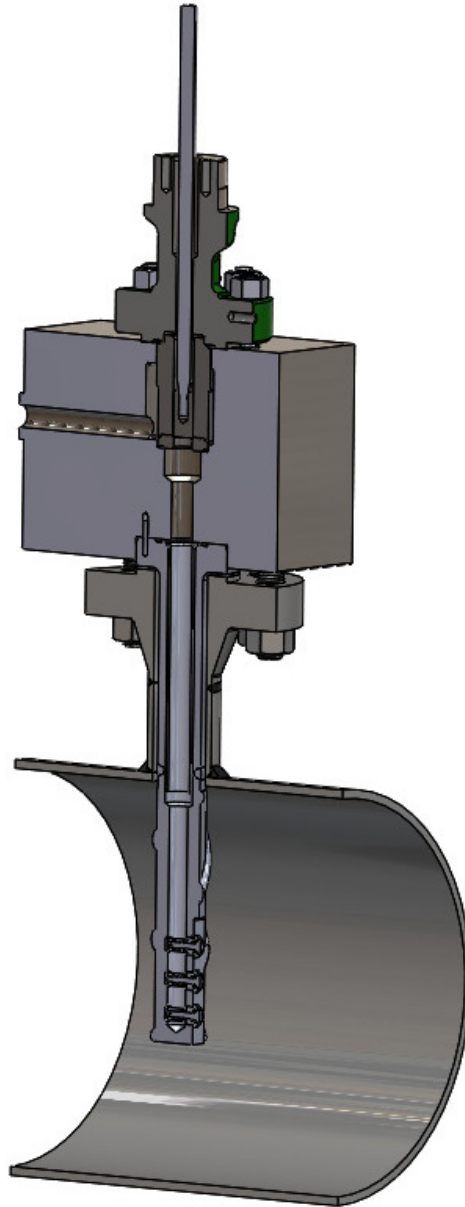


Fisher™ DFA Variable Geometry Desuperheater



General Application

The Fisher DFA (Desuperheater with Flexible Architecture) can be used in many applications to efficiently control the spraywater and reduce the temperature of superheated steam to the desired set point. The valve is available with a wide range of standard and anti-cavitation trim styles. The desuperheater is mechanically atomized with a variable geometry nozzle. Desuperheaters are available for installation in steam lines from DN200 through DN1500 / NPS 8 through 60 in diameter and are capable of maintaining steam temperatures to within 6°C / 10°F of saturation temperatures.

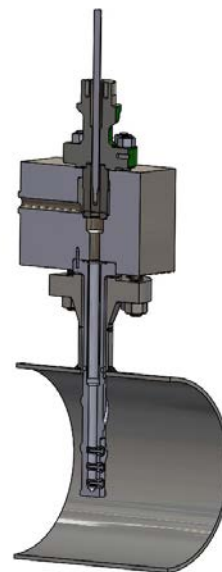
- **DFA** — The Fisher DFA desuperheater's flexible architecture incorporates both a water control element and a variable-geometry mechanically atomized, self-contained desuperheater for moderate to high flow variation. It is installed through a flanged connection on the side of an NPS 8 or larger pipeline.

This unit offers separate desuperheating and spray water control elements packaged together to match many of the standard face-to-face dimensions offered in today's marketplace. The angle body can be offered to match most ASME pressure classes with either BWE or Flanged configurations. Multiple trim configurations can be offered and include equal percentage, linear, anti-cavitation micro-flat, Cavitrol™ III and multi-stage micro-flat trim styles.

The desuperheater is a variation of the DMA/AF-HTC. This device can be used in less severe applications, such as temperature control to paper machines to more severe applications such as boiler interstage attemperation.

Similar to the DMA/AF-HTC, the DFA uses a construction optimized to move weld joints away from high stress regions.

Figure 1. Fisher DFA Variable Geometry Desuperheater



X0838

DFA CONSTRUCTION INCLUDES VALVE BODY, TRIM AND INSERTION STYLE DESUPERHEATER (PIPE NOT INCLUDED)

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 DFA shares vortex suppressor geometry with the DMA/AF-HTC, which is engineered to minimize the potential for excitation due to vortex shedding and flow induced vibration.

The desuperheater (Figure 3) is installed through a flanged connection on a DN 200 / NPS 8 or larger pipeline. Maximum nozzle C_v is 15.0.

Table 1. Specifications

Available Configurations ⁽¹⁾ and Valve Sizes	Spray Nozzle Capacities ⁽⁷⁾
■ DFA valve body style: Angle Common Characteristics: Designed according to ASME B16.34 Valve-Flanges, Threaded and Welding End	0.25 to 15.0 C _v
End Connections Styles ⁽¹⁾	Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4
See Tables 2 and 3.	Class V only
Maximum Inlet Pressure and Temperature ^(1,2,6)	Flow Characteristics ⁽⁴⁾
Flanged, Socketwelding or Buttwelding: Consistent with CL150, 300, 600, 900, 1500 and 2500 according to ASME B16.34, unless limited by maximum pressure drop or material temperature capabilities.	Standard Cages: ■ Linear, ■ Equal Percentage, ■ Modified Equal Percentage ⁽⁵⁾ Cavitrol III: Linear Micro-Flat (with or without liner): Linear
Section I Compliance	Flow Direction
Compliance with ASME BPVC Section I or ASME B31.1 can be fulfilled by ordering the item with the optional assembled hydrostatic test and a special ASME B16.34 tag. Contact your Emerson sales office for guidance.	All: Flow down
Maximum Pressure Drop ⁽¹⁾	Flow Coefficients
Valve with Cavitrol III Cage: 149 bar / 2160 psi for two-stage and 207 bar / 3000 psi for three-stage cage. Consult Bulletin 80.2:030, Fisher Cavitrol III One-, Two- and Three-Stage trims (D100196X012), for more information. Anti-cavitation MicroFlat: <51.7 bard / <750 psid	See Table 9 and also Fisher Catalog 12.
Inherent Rangeability	Port Diameters, Valve Plug Travel and Stem Diameters
Up to 50:1. The ratio of maximum to minimum controllable C _v is dependent upon the available water pressure differential.	See Table 9.
Spray Water Pressure Required ⁽³⁾	Bonnet Style and Mounting ⁽¹⁾
6.9 bar / 100 psi above steam pressure	Standard Bonnet Yoke Temperature Limit: Standard bonnet with cast iron yoke is limited to 537°C / 1000°F

- continued -

Table 1. Specifications (continued)

Packing Arrangements	Construction Materials
■ Single, ■ Double and ■ Leakoff standard graphite packing or optional ■ ENVIRO-SEAL™ and ■ HIGH-SEAL packing systems. See Bulletin 59.1:061, Fisher ENVIRO-SEAL and HIGH-SEAL Packing System for Sliding-Stem Valves (Live-Loaded) (D101633X012).	Valve Body and Bonnet⁽⁸⁾: ■ SA105 (Carbon Steel), ■ SA-182 Grade F22 (2.25Cr-1Mo), ■ SA-182 Grade F91 (9Cr-1Mo-V) Trim: See Table 5 Other Parts: See Table 4⁽⁸⁾ Desuperheater Body (DFA)⁽⁸⁾: ■ SA105 (Carbon Steel), ■ SA-182 Grade F22 (2.25Cr-1Mo), ■ SA-182 Grade F91 (9Cr-1Mo-V) Note: Will have body-matched cast equivalent material for nozzle mount. Nozzle Material ■ S41000 SST or ■ N07718
Approximate Weight	Material Temperature Capabilities ⁽¹⁾
See Table 10.	See Table 4.
1. Do not exceed the pressure or temperature limits in this bulletin, nor any applicable code or standard limitations. 2. EN (or other valve body material) ratings and end connections can usually be supplied; consult your Emerson sales office. 3. A function of required turndown and equipment selection. 4. Special characterized cages are available. Contact your Emerson sales office. 5. Modified equal percentage characteristic is equal percentage for the first 75% of travel, then opens quickly for additional capacity. 6. Inlet and outlet of DFA must have the same pressure class rating. 7. Custom nozzle configurations can be supplied, consult your Emerson sales office. 8. Consult your Emerson sales office for special trim and valve body material availability.	

Table 2. Available Spraywater Inlet Connections

Inlet Size, NPS	ASME Pressure Rating ^(2,4)	Spraywater Connection Styles ^(1,2,3)
1, 1-1/2 and 2	CL150 to 2500	RF, RTJ, BW and SW
1. End connection style abbreviations: RF-Raised Face, RTJ-Ring Type Joint, BW-Butt weld, SW-Socket Weld. 2. EN (or other valve body material) ratings and end connections can usually be supplied; consult your Emerson sales office. 3. Socket weld available on NPS 1, 1-1/2 and 2 only. 4. Inlet and outlet of DFA must have the same pressure class rating.		

Table 3. Available Desuperheater Body Connections

DESIGN	STEAM LINE SIZE, NPS	STEAM LINE CONNECTION		
		Size, NPS	ASME Pressure Rating ^(1,2)	Connection Styles
DFA	8 to 60	3 or 4	CL150 to 2500	RF and RTJ
1. Steam line connection pressure rating must match the valve inlet connection pressure rating.				
2. Inlet and outlet of DFA must have the same pressure class rating.				

Features

- **Valve Plug Stability** — Rugged seat guided and cage guiding provides increased valve plug stability, which reduces vibration and mechanical noise.
- **Full Pressure Drop Capability** — Rugged construction allows full pressure drop capability.
- **Quick Change Trim** — Maintenance is simple and can easily be performed using common tools. Trim components can be quickly removed and changed with no need for special tools.
- **Cost-Effective Trim Operation and Maintenance Economy** — Increased wear resistance of hardened stainless steel trim means longer-lasting service. When inspection or maintenance is necessary, the body can stay in the pipeline during removal of trim parts. And, trim inventory costs are cut because dimensional standardization permits use of most standard easy-e™ or HP trim parts.
- **Short Nozzle Replacement Turnarounds** — Nozzles can be easily removed, maintained or replaced without having to replace the entire unit.
- **Accurate Temperature Control Near Saturation** — Optimized spray pattern with AF nozzle technology allows for a wide operating range to achieve optimal mixing and quick vaporization at all flowing conditions.
- **Flexible Architecture** — Custom designed bodies with a probe-style desuperheater, matched with multiple trim styles, to meet almost any face-to-face, piping or application requirements.
- **Cracked Weld Avoidance** — DFA desuperheater uses a forged construction, optimized to move weld joints away from high stress regions.
- **Managing Large Temperature Reductions** — Nozzles in multiple configurations capable of providing large amounts of spraywater to cool steam to required temperature.
- **Thermal Cycling** — The desuperheater design incorporates an integral thermal liner inside the desuperheater body pipe to minimize the potential for thermal shock when cool water is introduced.
- **Minimize Vibration-Related Failures** — The nozzle mount for the Fisher DFA desuperheater is engineered to minimize the potential for excitation due to vortex shedding and flow induced vibration.

Table 4. Fisher DFA Construction Materials and Temperature Capabilities for Parts Other than Valve Body and Trim

PART		MATERIAL		STEAM DESIGN TEMPERATURE RANGE ⁽⁵⁾	
				°C	°F
Valve plug stem		S20910		-198 to 593	-325 to 1100
Spring-loaded valve plug seal	Back-up ring	S41600 (416 SST)		-29 to 427	-20 to 800
		S31600 (316 SST)		-198 to 593	-325 to 1100
	Retaining ring	S30200 (302 SST)		-254 to 593	-425 to 1100
	Seal ring	PTFE with N10276 Spring		-73 to 232 ⁽²⁾	-100 to 450 ⁽²⁾
	Anti-extrusion rings	PEEK (PolyEtherEtherKetone)		-73 to 316	-100 to 600
Cage gasket		N06600/Graphite		-240 to 593	-400 to 1100
Seat ring gasket		Flexible Graphite (standard), CL150 to CL600 N06600/Graphite, CL900 to CL2500		-240 to 593	-400 to 1100
Valve Body-to-bonnet bolting ⁽¹⁾	Studs	Steel SA193-B7	All valve body materials	-29 to 427	-20 to 800
	Nuts	Steel SA194-2H			
	Studs	Steel SA193-B16	F91 valve body materials	-29 to 482 ⁽³⁾	-20 to 900 ⁽³⁾
	Nuts	Steel SA194-7			
	Studs	Steel SA193-B16	F22 valve body materials CL600 and below	-29 to 566	-20 to 1050
	Nuts	Steel SA194-7			
	Studs	Steel SA193-B16	F22 valve body materials CL900 and above	-29 to 510	-20 to 950
	Nuts	Steel SA194-7			
	Studs	N07718 SST	F22 and F91 valve body materials	-29 to 593	-20 to 1100
	Nuts	Steel SA194-7			
Packing		Graphite		-198 to 593 ⁽⁶⁾	-325 to 1100 ⁽⁶⁾
Packing follower, spring or lantern ring		S31600 Stainless steel		-254 to 593	-425 to 1100
Packing box ring		S31600 Stainless steel		-254 to 593	-425 to 1100
Packing flange, studs or nuts		Steel		-29 to 427	-20 to 800
		S31600 Stainless steel		-198 to 593	-325 to 1100

1. Valve body materials with which these bolting materials may be used are shown in parentheses.

2. If used with PEEK anti-extrusion rings, PTFE/Carbon seal ring may be used in temperatures up to 316°C / 600°F for non-oxidizing service or up to 260°C / 500°F for oxidizing service.

3. B16 studs are rated to 510°C / 950°F for NPS 1 CL300, NPS 2 CL600 and all NPS CL900 and above.

4. Except 371°C / 700°F for oxidizing service.

5. Temperature capabilities must be based on steam design temperature, not spraywater temperature.

6. 1000°F temperature limit at the packing applies (per D101986X012). The 1100°F is a system temperature which will not violate the 1000°F at the packing.

Table 5. Fisher DFA Trim Material Combinations

TRIM	VALVE BODY MATERIALS	PRESSURE CLASS AVAILABILITY ⁽¹⁾	VALVE PLUG	CAGE	SEAT RING	STEAM DESIGN TEMPERATURE RANGE			
						°C		°F	
						Min	Max	Min	Max
Standard Plug and Cage									
291	SA105, F22 and F91	CL150 to CL2500	S41600	CB7Cu-1 H1075	S41600	-29	427	-20	800
292A	F22 and F91	CL150 to CL600	S31600 with CoCr-A seat and guide	R30006	R30006	427	593	800	1100
292B	F22	CL900 to CL2500	S31600 with CoCr-A seat and guide	F22/Nitrided	S31600/ CoCr-A	427	593	800	1100
292C	F91 only	CL900 to CL2500	F91 with CoCr-A Seat and guide	F91/Nitrided	F91 with CoCr-A	427	593	800	1100
Standard Cage, Anti-Cav Micro-Flat Plug									
293	SA105, F22 and F91	CL150 to CL2500	S44004	17-4 PH H1075	S44004	-29	427	-20	800
294A	F22	CL150 to CL2500	R30006	F22/Nitrided	R30006	427	593	800	1100
294B	F91 only	CL150 to CL2500	R30006	F91/Nitrided	R30006	427	593	800	1100
Cavitrol III Cage, Standard Plug									
295B ⁽²⁾	SA105, F22 and F91	CL150 to CL600	420SST	17-4 H1075	17-4 H900	-29	427	-20	800
295A	SA105, F22 and F91	CL900 to CL2500	S44004	17-4 H1075	S44004	-29	343	-20	650
296	SA105, F22 and F91	CL150 to CL2500	410 / CoCr-A Seat and Guide	422/Nitrided	410 / CoCr-A	427	593	650	1100
Cavitrol III Cage, Micro-Flat Plug ⁽²⁾									
295A	SA105, F22 and F91	CL150 to CL2500	S44004	17-4 H1075	S44004	-29	343	-20	650
297	F22 and F91	CL150 to CL2500	R30006	422/Nitrided	R30006	427	593	650	1100
1. Pressure class at the inlet to the water control valve. 2. Consult your Emerson sales office for these trim options.									

Principle of Operation

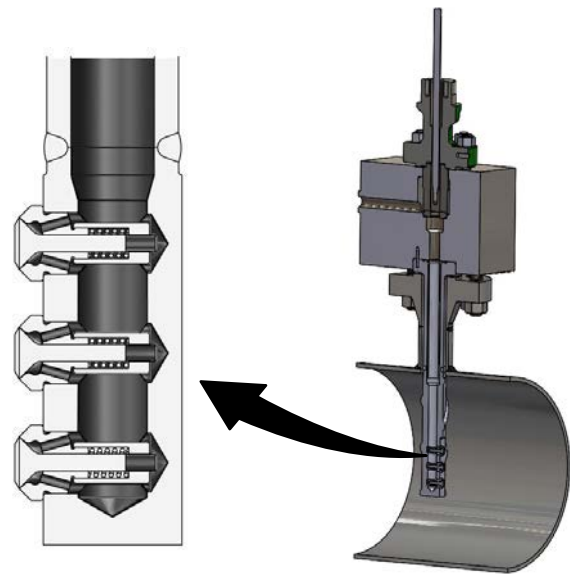
For the most efficient use of heat energy from steam, it is necessary to reduce the temperature of steam to near the saturation temperature. With steam that is at or near the saturation temperature, it is possible to recover the large amount of energy that was put into the steam when it was heated from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

- Improve thermal efficiency of heat transfer processes by using steam near saturation.
- Control unintentional superheat from pressure reduction of the steam.
- Protect downstream equipment and piping from elevated temperatures and pressure.

DFA desuperheaters produce a spray of cooling water in a steam line (Figure 3). The spraywater cools the steam to near the saturation temperature or to a custom setpoint. The rate of cooling is dependent on spraywater droplet size, distribution, flow turbulence of the steam and velocity. The temperature is controlled by varying the amount of spraywater flow.

The desuperheater utilizes the proven, spring-loaded AF nozzle to provide a uniform hollow cone spray pattern over a wide range of flow conditions. The water is injected through holes drilled at a compound angle to induce spin as the AF nozzle plug is opened with increasing water pressure.

Figure 2. Fisher DFA Desuperheater



The design of the AF nozzle is such that water flows only after sufficient backpressure is available to provide a good spray pattern. The full opening of the AF nozzle is limited by a travel stop to keep the spring within its proper working range and to maintain the water film thickness at the necessary thickness for proper atomization.

In operation, spraywater is supplied to a connection on the desuperheater. The body, trim, insertion length and face-to-face can be custom engineered for specific needs. This offers convenient replacement of common products on the market today without the need for piping modifications.

Figure 3. Typical DFA Installation

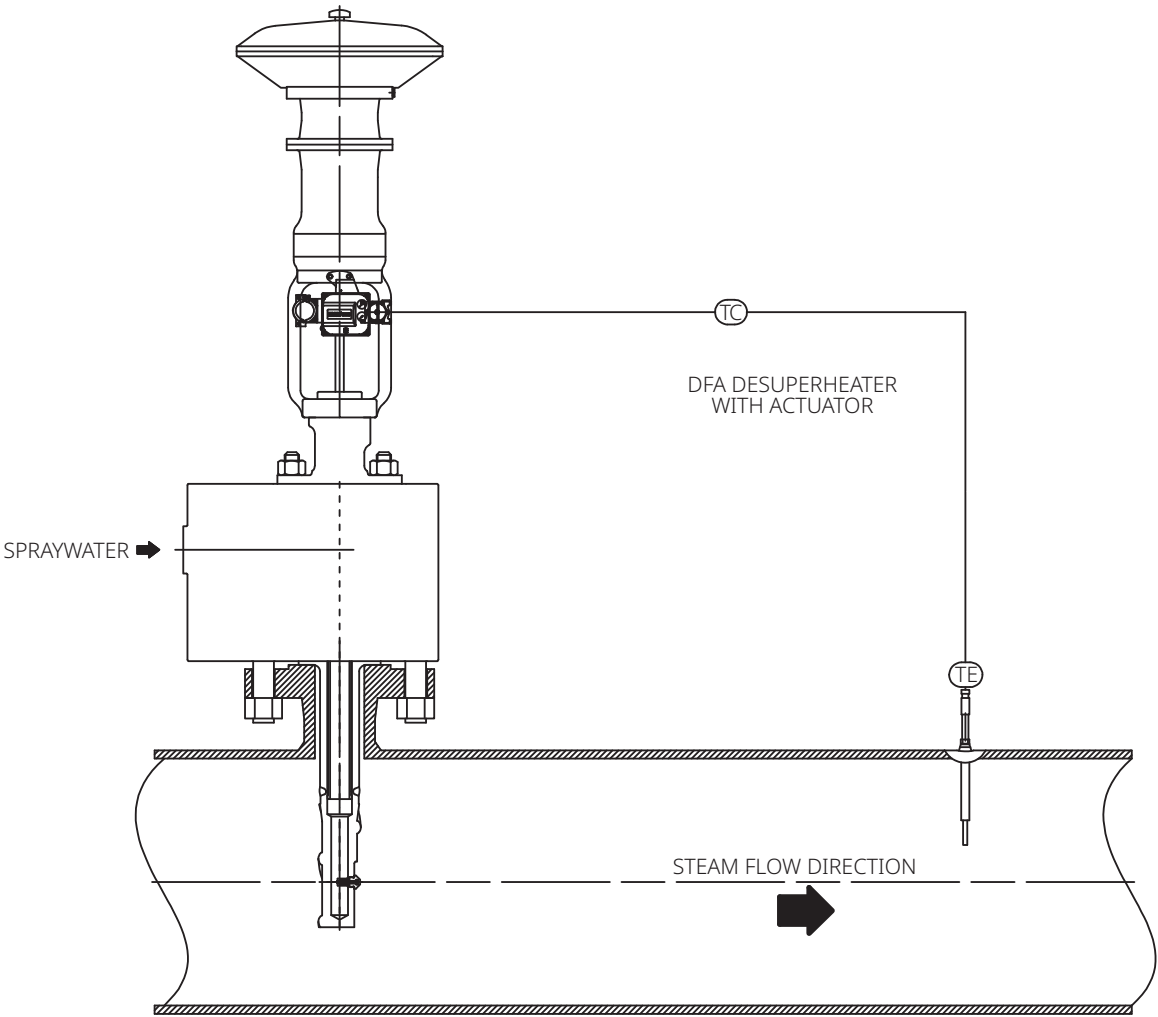
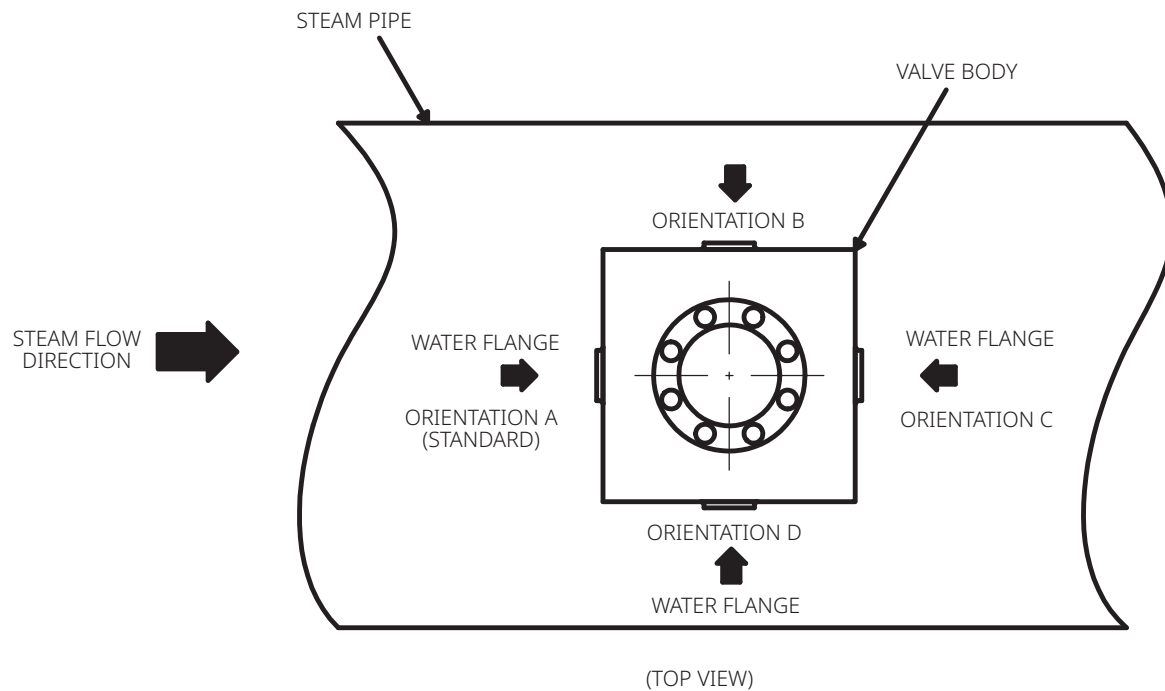


Figure 4. DFA Orientation Options

Ordering 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. Design conditions, if different from operating conditions.
5. Steam line size.
6. Desuperheater steam connection size, type and rating.
7. Spraywater connection size from Table 3.
8. Face-to-face dimension (if replacing existing unit).
9. Water flange orientation (see Figure 4).

Figure 5. Fisher DFA Desuperheater Dimensions (also see Tables 6 and 7)

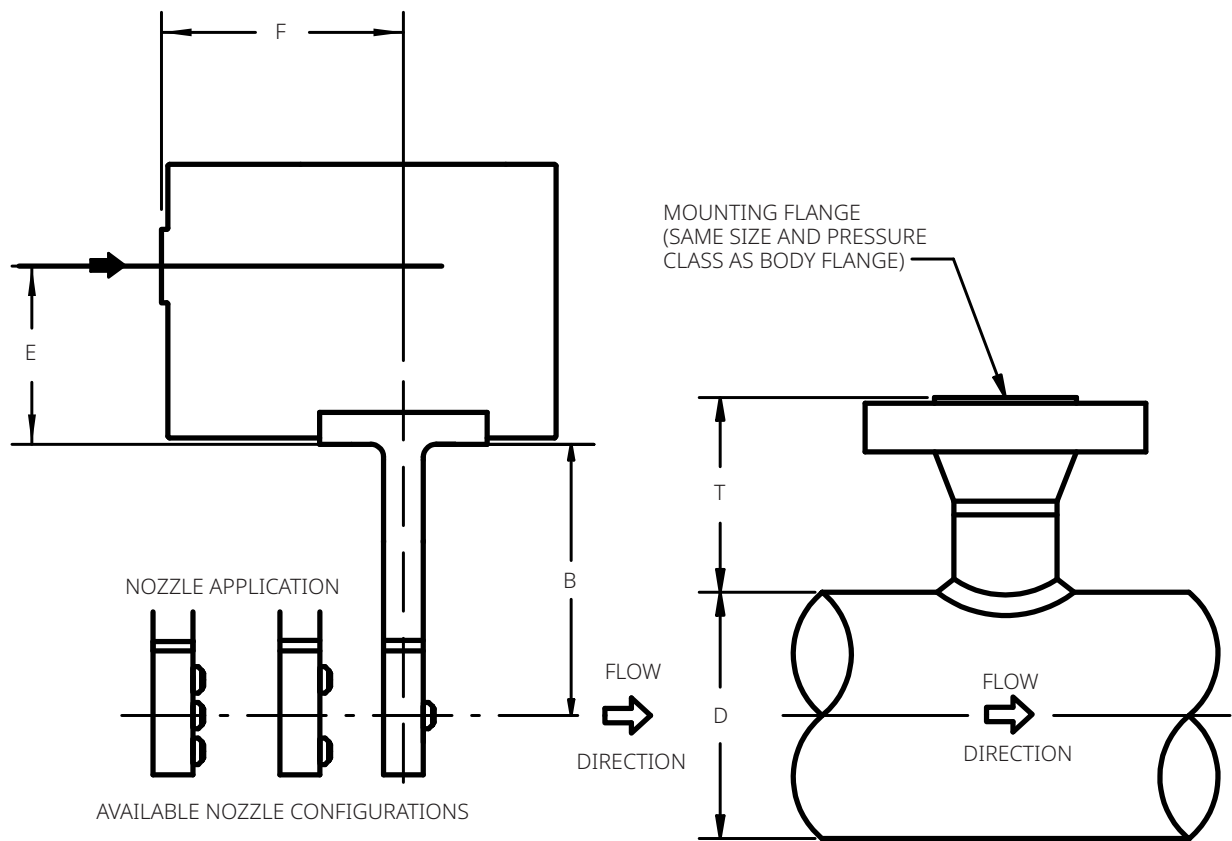


Table 6. Standard Fisher DFA Desuperheater Dimensions

DESUPERHEATER BODY FLANGE ⁽¹⁾		E INLET CENTERLINE TO OUTLET FLANGE FACE ⁽²⁾		F INLET FLANGE FACE TO OUTLET CENTERLINE ⁽²⁾	
Size, NPS	Pressure Rating	mm	in.	mm	in.
3 and 4	CL150 to 1500	152	6	229	9
	CL2500	178	7	241	9.5

1. The NPS 4 DFA requires a 4.00 in. minimum mounting I.D. Contact your [Emerson sales office](#) for NPS 3 DFA minimum mounting I.D.

2. For different centerline to flange face distances, contact your [Emerson sales office](#).

Table 7. Fisher DFA Desuperheater Installation Dimensions

DESUPERHEATER BODY FLANGE SIZE, NPS	("D" DIMENSION) PIPE LINE	("B" DIMENSION) INSERTION LENGTH		("T" DIMENSION) T-HEIGHT	
	Size, NPS	mm	in.	mm	in.
3 and 4	8	330	13.00	222	8.75
	10	362	14.25	222	8.75
	12	387	15.25	222	8.75
	14	400	15.75	222	8.75
	16	425	16.75	222	8.75
	18	445	17.50	216	8.50
	20	451	17.75	222	8.75
	22	451	17.75	222	8.75
	24, 26, 28	451	17.75	222	8.75
	30 or larger	448	17.63	219	8.63

Table 8. Fisher DFA Desuperheater Minimum Mounting I.D.

Minimum Body Flange	Nozzle Model	Minimum Mounting I.D.
3	DFA - A, B, C	2.624
3	DFA - D, E	2.9
4	DFA - A through H	4

Table 9. Typical Valve Flow Coefficients⁽¹⁾ - Flow Down (Without Liner)

WATER CLASS	VALVE TRIM SIZE, NPS	TRIM TYPE	CHARACTERISTIC ^(2,3)	PORT		TRAVEL		MAXIMUM Cv
				mm	in.	mm	in.	
CL150 to 600	1, 1-1/2	Standard	Equal Percentage	33.3	1.3125	19.1	0.75	19
			Linear	33.3	1.3125			22.3
		M-Flat	Linear	6.3	0.25	19.1	0.75	0.292
				9.5	0.375			0.873
				12.7	0.5			1.76
				19.1	0.75			3.38
				19.1	0.75	28.6	1.125	4.46
	2	Standard	Equal Percentage	33.3	1.3125	19.1	0.75	26.8
				47.6	1.875			47.2
			Linear	33.3	1.3125			37.6
				47.6	1.875			52.5
		M-Flat	Linear	6.3	0.25	19.1	0.75	0.292
				9.5	0.375			0.873
				12.7	0.5			1.76
				19.1	0.75			3.38
				19.1	0.75	28.6	1.125	4.46
				25.4	1			7.81
				28.6	1.125			10.49
CL900 to 1500	1, 1-1/2	Standard	Modified Equal Percentage	19.1	0.75	28.6	1.125	10.7
			Equal Percentage	19.1	0.75	19.1	0.75	5.58
		Cavitrol III 2-Stage	Linear	22.2	0.875	38.1	1.5	7.39
		Micro-Flat	Linear	9.5	0.375	19.1	0.75	0.961
				12.7	0.5			1.71
				19.1	0.75			2.92
	2	Standard	Modified Equal Percentage	19.1	0.75	28.6	1.125	10.7
				25.4	1			21
				31.8	1.25			31
				38.1	1.5	38.1	1.5	48
			Equal Percentage	19.1	0.75	19.1	0.75	5.58
				25.4	1			9.5
				31.8	1.25			13
				38.1	1.5	28.6	1.125	35
		Cavitrol III 2-Stage	Linear	44.4	1.75	50.8	2	14
		Cavitrol III 3-Stage	Linear	25.4	1	50.8	2	6.73
		Micro-Flat	Linear	25.4	1	28.6	1.125	7.61

- continued -

Table 9. Typical Valve Flow Coefficients⁽¹⁾ - Flow Down (Without Liner) (continued)

WATER CLASS	VALVE TRIM SIZE, NPS	TRIM TYPE	CHARACTERISTIC ^(2,3)	PORT		TRAVEL		MAXIMUM Cv
				mm	in.	mm	in.	
CL2500	1, 1-1/2	Standard	Modified Equal Percentage	19.1	0.75	28.6	1.125	9.73
			Equal Percentage	19.1	0.75	19.1	0.75	5.38
		Cavitrol III 2-Stage	Linear	22.2	0.875	38.1	1.5	6.91
		Micro-Flat	Linear	9.5	0.375	19.1	0.75	0.961
				12.7	0.5			1.71
				19.1	0.75			2.92
	2	Standard	Modified Equal Percentage	19.1	0.75	28.6	1.125	10.7
				25.4	1			21
				31.8	1.25			31
				38.1	1.5	38.1	1.5	36.8
			Equal Percentage	19.1	0.75	19.1	0.75	5.58
				25.4	1			9.5
				31.8	1.25			13
				38.1	1.5	28.6	1.125	31.5
		Cavitrol III 2-Stage	Linear	44.4	1.75	50.8	2	14
		Cavitrol III 3-Stage	Linear	25.4	1	50.8	2	6.73
		Micro-Flat	Linear	25.4	1	28.6	1.125	7.61

1. See Catalog 12 for a complete listing of flow coefficients.
2. Characteristic is equal percentage through 75% of travel.
3. Micro-Flat Anti-Cavitation trims use a shutoff port diameter which is 0.125 in. larger than the flowing port diameter. Use the shutoff port diameter for actuator sizing.

Table 10. Fisher DFA Weights⁽¹⁾

OUTLET CONNECTION	INLET CONNECTION	CLASS	APPROXIMATE WEIGHT	
			kg	lbs
3	1	600	128	283
		1500	183	403
		2500	253	558
	1-1/2	600	137	301
		1500	193	426
		2500	273	602
	2	600	138	304
		1500	206	454
		2500	287	633
4	1	600	179	394
		1500	224	494
		2500	312	688
	1-1/2	600	191	420
		1500	237	522
		2500	337	743
	2	600	193	425
		1500	253	558
		2500	354	781
1. Desuperheater section weighs about 11.4 kg / 25 lbs.				

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