

# Fisher™ DMA, DMA/AF, and DMA/AF-HTC Mechanically Atomized Desuperheaters

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Figure 1. Fisher DMA, DMA/AF, and DMA/AF-HTC Desuperheaters



# Introduction

## Scope of Manual

This instruction manual includes installation, maintenance, and operation information for the Fisher DMA, DMA/AF, and DMA/AF-HTC mechanically atomized desuperheaters.

Do not install, operate, or maintain these desuperheaters 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 the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your local [Emerson sales office](#) or Local Business Partner before proceeding.

## Description

DMA, DMA/AF, and DMA/AF-HTC desuperheaters (figure 1) can be used in many applications to effectively reduce the temperature of superheated steam to the desired set point. Available variations are mechanically atomized (both fixed geometry and variable geometry styles). Desuperheaters are available for installation in steam lines from DN 150 through DN 1500 (NPS 6 through 60) in diameter and are capable of maintaining steam temperatures to within 6°C (10°F) of saturation temperatures.

- **DMA**—A simple mechanically atomized desuperheater with single or multiple, fixed-geometry spray nozzles is intended for applications with nearly constant load. The DMA is installed through a flanged connection on the side of a DN 150 (NPS 6) or larger pipeline. Maximum unit  $C_V$  is 3.8.
- **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 DMA/AF desuperheater (figure 2) is installed through a flanged connection on the side of a DN 200 (NPS 8) or larger pipeline. Maximum unit  $C_V$  is 15.0.
- **DMA/AF-HTC**— The DMA/AF-HTC is functionally equivalent to the DMA/AF, however it is structurally suited for more 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 DMA/AF-HTC is suitable for other severe desuperheating application environments. The DMA/AF-HTC uses a construction optimized to move weld joints away from high stress regions.

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 which has been heated to the operating steam temperature.

The nozzle mount for the DMA/AF-HTC is engineered to minimize the potential for excitation due to vortex shedding and flow induced vibration. The DMA/AF-HTC desuperheater (figure 3) is installed through a flanged connection on a DN 200 (NPS 8) or larger pipeline. Maximum unit  $C_V$  is 15.0.

## Specifications

Specifications for the DMA, DMA/AF, and DMA/AF-HTC desuperheaters are shown in table 1 and table 2.

Table 1. Specifications

<p><b>Steam Line Sizes</b> See table 2</p> <p><b>Steam Line Connection Sizes</b> See table 2</p> <p><b>Spraywater Connection Sizes</b> See table 2</p> <p><b>Maximum Inlet Pressures<sup>(1)</sup></b> Consistent with applicable CL150, 300, 600, 900, 1500, or 2500 pressure-temperature ratings per ASME B16.34</p> <p><b>Inherent Rangeability<sup>(2)</sup></b> DMA: Up to 3:1 DMA/AF: Up to 10:1 DMA/AF-HTC: Up to 10:1</p> <p><b>Spraywater Pressure Required</b> 3.5 to 35 bar (50 to 500 psi) greater than steam line pressure</p>	<p><b>Minimum Steam Velocity</b> DMA: 9.1 m/s (30 feet per second) DMA/AF: 7.6 m/s (25 feet per second) DMA/AF-HTC: 7.6 m/s (25 feet per second)</p> <p><b>Maximum Unit C<sub>v</sub> (for Spraywater Flow)</b> DMA: 3.8 DMA/AF: 15.0 DMA/AF-HTC: 15.0</p> <p><b>Construction Materials</b> Desuperheater Body (all designs except DMA/AF-HTC): ■ Carbon steel, ■ Chrome-moly alloy steel (F22), or ■ 300 series stainless steel Desuperheater Body (DMA/AF-HTC): ■ Carbon Steel (SA105) or ■ Chrome-moly alloy steel (F22, F91) Note: NPS 3 will have body-matched cast equivalent material for nozzle mount Nozzle Material DMA: ■ 303 or ■ 316, stainless steel DMA/AF, DMA/AF-HTC: ■ 410 stainless steel</p>
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1. Do not exceed the pressure or temperature limits in this instruction manual, nor any applicable code or standard limitations.

2. Ratio of maximum to minimum controllable C<sub>v</sub>.

Table 2. Connection Sizes

DESIGN	STEAM LINE SIZE	STEAM LINE CONNECTION		SPRAYWATER CONNECTION	
		Size, NPS	Raised-Face Flange <sup>(1)</sup> Rating	Size	Raised-Face Flange <sup>(1)</sup> Rating
<b>metric</b>					
DMA	DN 150 - DN 1500	DN 80, 100, or 150	PN 20, 50, 100	DN 25, 40, or 50	PN 20, 50, 100, 150, 250, or 420
DMA/AF	DN 200 - DN 1500	DN 80 <sup>(2)</sup> , 100, 150, or 200		DN 25, 40, 50, 65, or 80	
DMA/AF-HTC	DN 200 - DN 1500	DN 80 or 100	PN 20, 50, 100, 150, 250, or 420	DN 40 <sup>(3)</sup> , or 50	PN 20, 50, 100, 150, 250, or 420
<b>ASME</b>					
DMA	NPS 6 - NPS 60	NPS 3, 4, or 6	CL150, 300, 600	NPS 1, 1-1/2, or 2	CL150, 300, 600, 900, 1500, or 2500
DMA/AF	NPS 8 - NPS 60	NPS 3 <sup>(2)</sup> , 4, 6, or 8		NPS 1, 1-1/2, 2, 2-1/2, or 3	
DMA/AF-HTC	NPS 8 - NPS 60	NPS 3 or 4	CL150, 300, 600, 900, 1500, or 2500	NPS 1-1/2 <sup>(3)</sup> , or 2	CL150, 300, 600, 900, 1500, or 2500

1. Other standard flanges and connections are also available.<sup>7</sup>

2. Consult your local [Emerson sales office](#) or Local Business Partner for acceptability of NPS 3 mounting connection for size and pressure class specified.

3. NPS 1-1/2 spraywater connection is only available for CL150 - 900.

## Principle of Operation

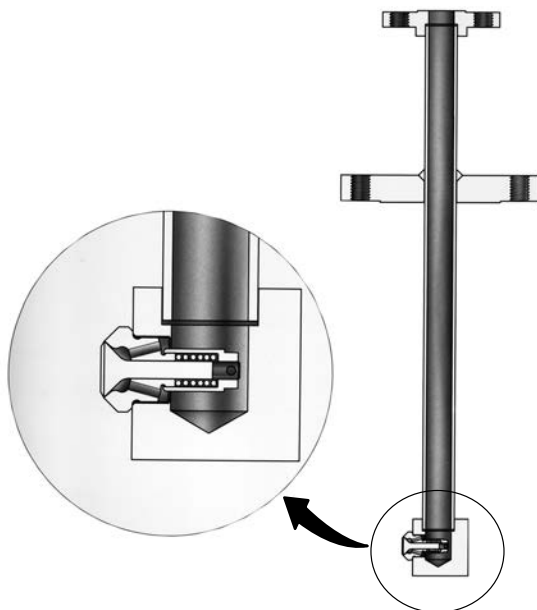
The DMA, DMA/AF, and DMA/AF-HTC desuperheaters reduce steam temperatures through the introduction of cooling water directly into the hot steam flow stream. By regulating the quantity of water that is injected, accurate downstream steam temperature can be both controlled and maintained.

The rate of vaporization, and/or cooling, is a function of droplet size, distribution, mass flow, and temperature. Steam velocity is critical and should be maintained at 6.1 to 9.1 meters per second (20 to 30 feet per second) as the minimum. Actual minimum steam velocity requirements will vary by application. As steam velocity increases, a longer distance is required to achieve homogeneous mixing and to complete vaporization.

In both DMA desuperheater nozzle styles, the spraywater quantity is controlled by an external control valve which responds to signals received from the temperature control system. The water enters the main tube of the desuperheater, passes through the spray nozzle, and discharges into the steam line as a fine, atomized spray (see figure 2).

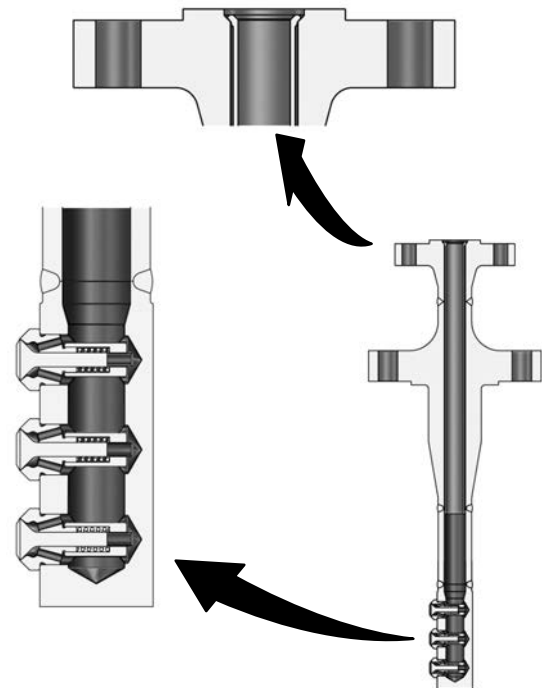
Each particular nozzle, or set of nozzles, in the sprayhead is tailored to meet a specific set of operating conditions. The nozzle design optimizes the spraywater droplet size promoting rapid atomization and complete vaporization of water in the steam flow stream to obtain precise temperature control. The DMA desuperheater uses a fixed geometry nozzle, while the DMA/AF desuperheater uses a variable geometry AF nozzle. In the AF nozzle design (see figure 5), water enters the swirl chamber via compound angled orifices, thus creating a rotational flow stream. This flow stream is further accelerated as it is forced up and out through the spray annulus. The cone-shaped plug varies the geometry of the spray annulus using a force balance principle between water pressure and the preload exerted by a helical spring. This variable geometry design sprays a thin hollow cone over a wide range of flow rates, resulting in excellent temperature control over a wide range of operating conditions.

Figure 2. Detail of Fisher DMA/AF Desuperheater



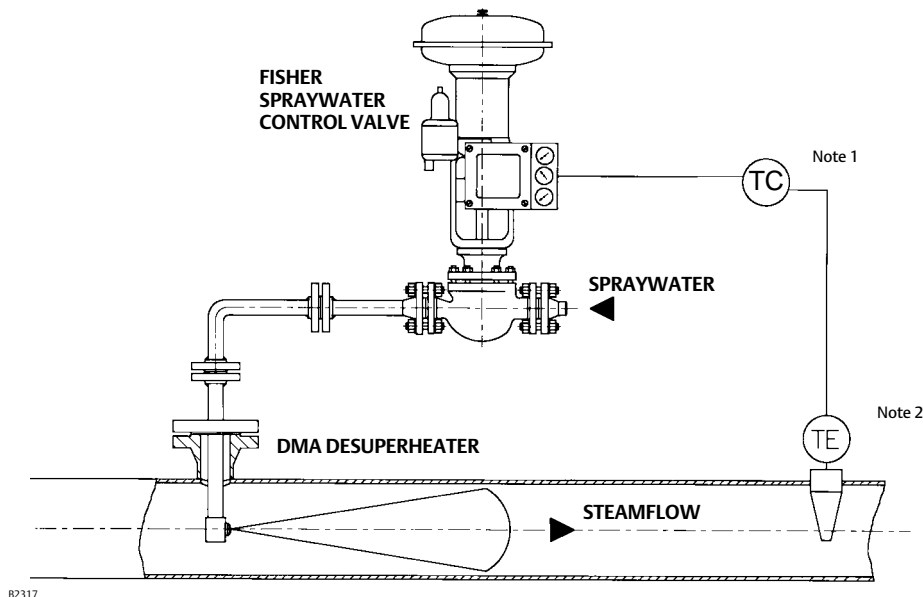
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Figure 3. Detail of Fisher DMA/AF-HTC Desuperheater



W8908-1

Figure 4. Typical Fisher DMA, DMA/AF, or DMA/AF-HTC Desuperheater Installation



- Notes:  
 1. TC - Temperature-Indicating Controller  
 2. TE - Temperature Sensor Element

## Installation

### ⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

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 in table 1 or on the 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.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

### CAUTION

When ordered, the desuperheater configuration and construction materials were selected 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 Automation Solutions sales office representative.

1. Mount the DMA, DMA/AF, or DMA/AF-HTC desuperheater in a “Tee” piece at the desired location in the pipe, in accordance with standard piping practice. The nozzle should be positioned in the top quadrant of the pipe (see figure 6 or 7 for the proper “T” length dimension).

2. Clean and flush out the cooling water line before connecting to the desuperheater. Use only clean sources of cooling water. Use of clean water decreases wear and prevents clogging of the nozzle by solid particles.

### **⚠ WARNING**

**Personal injury or property damage could result from clogging of the desuperheater. Installation of a strainer and an isolating valve on the water line between the desuperheater and the water control valve is recommended. Failure to do so may result in clogging of the desuperheater by solid particles, thus hampering temperature control of the steam.**

3. A minimum straight run of pipe is required downstream of the desuperheater to ensure complete vaporization of cooling water. Consult the desuperheater certified drawing for the required distance of straight pipe.
4. The temperature sensor should be mounted according to the manufacturer's instructions. Typical distance to the sensor is at least 9.1 meters (30 feet) downstream of the desuperheater. This distance changes with higher velocity steam flow and the percentage of spraywater required. Consult the desuperheater certified drawing for this distance.
5. There should be no branching out from or into the steam line to divide the steam flow between the temperature sensor and the desuperheater.
6. A typical installation is illustrated in figure 4. A temperature sensor element (TE) measures changes in temperature and transmits a signal to a remote temperature-indicating controller (TC) or distributed control system (DCS). The output signal from the controller is sent to the positioner on the spraywater control valve. The positioner output signal is piped to the actuator. The actuator strokes the stem/plug of the spraywater control valve, as required, to supply the required cooling water to the desuperheater to maintain temperature setpoint.

## Nozzle Maintenance and Replacement

If it is necessary to remove the DMA, DMA/AF, or DMA/AF-HTC desuperheater from service, take note of the following warning.

### **⚠ WARNING**

**Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:**

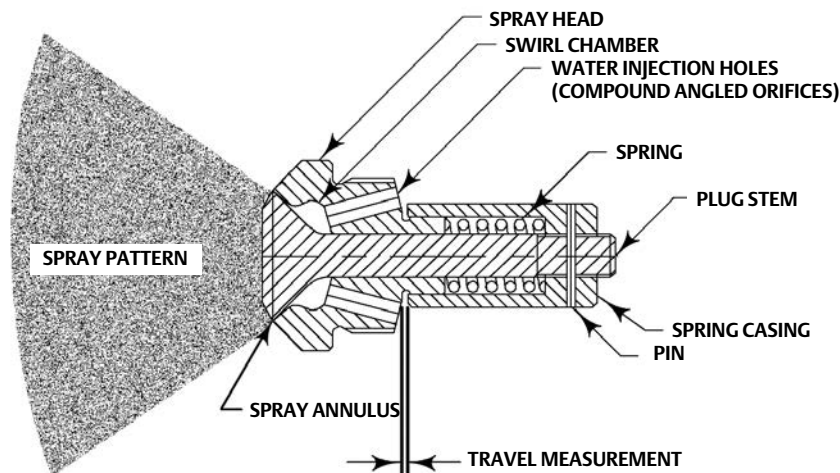
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Isolate the desuperheater from process pressure. Relieve process pressure on both sides of the desuperheater. Drain the process media from both sides of the desuperheater.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

When subjected to normal operating conditions, it is possible that wear, blockage, and/or weld fatigue will occur to the desuperheater body or nozzle assembly. During regularly scheduled maintenance, visually inspect the desuperheater welds for cracks and inspect nozzles for wear and blockage. Your local [Emerson sales office](#) or Local Business Partner can help to determine the extent of weld fatigue and the correct course of action. Poor performing nozzles or nozzle failure is typically caused by wear, corrosion, erosion, and/or blockage. The following instruction will help to determine if any of these problems are present and provide a recommended course of action for each.

### **Note**

For optimal performance, nozzles should be inspected every 18-24 months and replaced every 24-36 months.

Figure 5. Fisher AF Nozzle (DMA/AF and DMA/AF-HTC)



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## DMA/AF and DMA/AF-HTC Desuperheater Variable Geometry Nozzles

1. Inspect the spray annulus surface, the area between the plug stem and spray head, for excessive wear, erosion/corrosion, and/or blockage due to particulate. Wear is defined as any nicks, cuts, or gouges on or immediately around the spray annulus. Erosion/corrosion is defined as any form of rust or erosion of the metal on the plug stem or spray head. Blockages are defined when small particulate becomes trapped between the plug stem and spray head or spring casing and spray head. Replacement of the nozzle is recommended if any of the preceding problems are present.
2. **OPTIONAL:** Figure 5 shows the spray pattern that will need to be present during operation of the AF nozzles. Testing can be performed by attaching the existing or an alternate, similar pressure, water line to the unit. If this spray pattern is not present, replacement is recommended.
3. Grind off the tack welds holding the nozzle in place. Apply a penetrant type thread lubricant and allow to soak prior to unscrewing the nozzle. Using the provided flats on the side of the spray head, unscrew the nozzle.
4. Grind excess tack weld material off of both the nozzle and desuperheater body.
5. In the absence of external forces, the nozzle must be fully closed. If the nozzle is not fully closed, it will need to be replaced.
6. Inspect the water injection holes for reduced or non-circular shape due to erosion. Every hole must be the same size and shape. If any are over-sized or non-circular in shape, the nozzle will need to be replaced.
7. Inspect the interior of the water injection holes for buildup of particulate and/or magnetite. Nozzle replacement will be needed if any buildup is present.

### Note

Complete disassembly of the nozzle is strongly discouraged, due to individual spare parts not being available.

8. **OPTIONAL:** The internal spring may relax over time and not provide the tensile force required to shut off and control flow. If the nozzle spring is suspected of being too relaxed, then the nozzle should be replaced.

Table 3. AF Nozzle Specifications

NOZZLE TYPE	PLUG TRAVEL, INCHES
AF7	0.014
AF10	0.028
AF14	0.029
AF17	0.034
AF20	0.036
AF24	0.042
AF28	0.048
AF32	0.056
AF35	0.065
AF40	0.063
AF44	0.069

To further check the spring, the spring can be removed by first removing the pin, using a small drill bit as a punch and unscrewing the spring casing from the plug stem. The nozzle can be reassembled by following a reverse order of disassembly, taking care to line the hole in the plug stem up with the hole in the spring casing, then pressing the pin back into place through the two parts.

9. The travel can be determined by using a feeler gauge to measure the distance between the nozzle body near the water injection ports to the side of the spring casing as outlined in figure 5. This measurement must match the factory set plug travel for the corresponding nozzle type as shown in table 3.
10. Inspect nozzle threads for damage and clean if needed; if damage is present, nozzle replacement will be necessary.
11. Rinse both the desuperheater body and nozzle to remove particulate.
12. Screw nozzle into the desuperheater body and tighten just until the spray head is flat and tight against the desuperheater body.
13. Tack-weld a small piece of welding wire onto the nozzle mount next to either of the spray head flats to prevent rotation during service (refer to figure 8). Maintain low heat to prevent distortion of the nozzle.
14. Reinstall the desuperheater into the line, using a reverse order of assembly; refer to the installation instructions to complete this step. Make sure the mounting flange gasket (customer supplied) is replaced with a new one.

## DMA Desuperheater Fixed Geometry Nozzles

1. Inspect the nozzle orifice for excessive wear, erosion/corrosion, and/or blockage due to particulate. Wear is defined as any nicks, cuts, or gouges on or immediately around the orifice. Erosion/corrosion is defined as any form of rust or erosion of the metal on the nozzle. Blockages are defined when small particulate becomes trapped between the plug stem and spray head. Replacement of the nozzle is recommended if any of the preceding problems are present.

Proceed to steps 2-5 only if nozzle replacement is required.

2. Grind off the tack welds holding the nozzle in place. Apply a penetrant type thread lubricant and allow to soak prior to unscrewing the nozzle. Using the provided flats on the side of the spray head, unscrew the nozzle.
3. Rinse both the desuperheater body and new nozzle to remove particulate.
4. Screw the new nozzle into place just until it is tight in the nozzle mount.
5. Tack-weld the nozzle in place to prevent rotation during service (refer to figure 8). Maintain low heat to prevent distortion of the nozzle.
6. Reinstall the desuperheater into the line, using a reverse order of assembly; refer to the installation instructions to complete this step. Make sure the mounting flange gasket (customer supplied) is replaced with a new one.



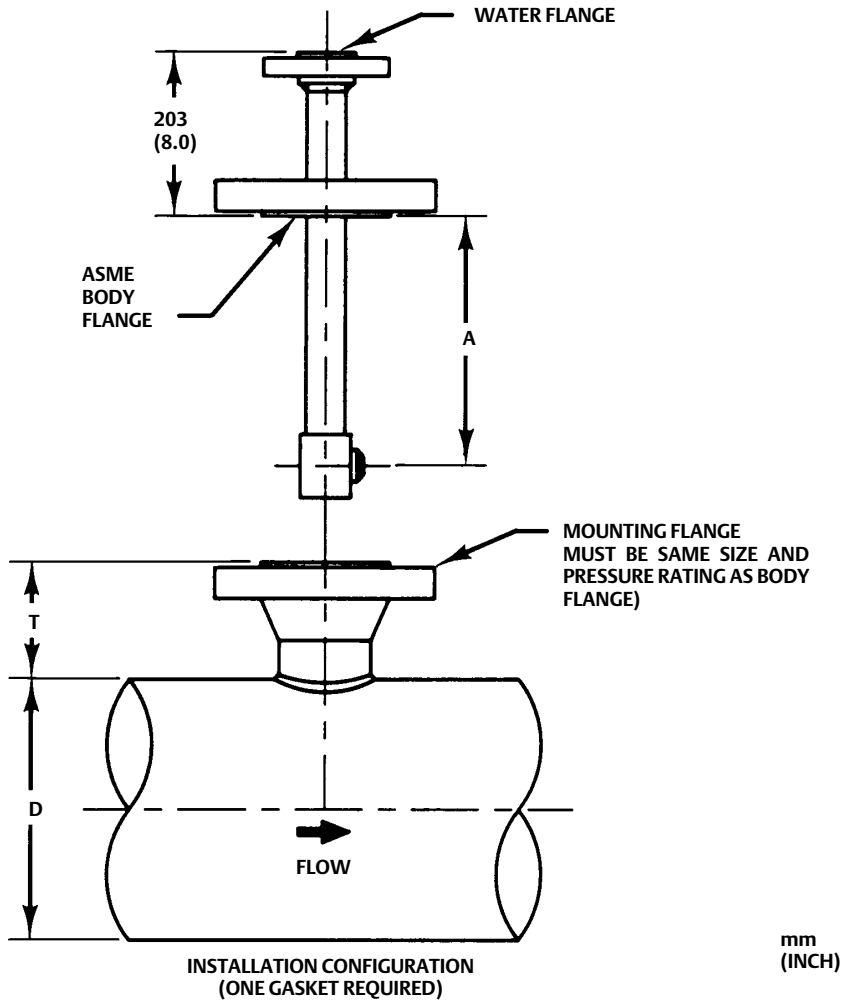
## Troubleshooting

Table 4 is intended as a basic first line troubleshooting guide. Contact your [Emerson sales office](#) or Local Business Partner for assistance if you are unable to resolve your field operation problem.

**Table 4. Troubleshooting Guide**

Problem	Corrective Action
Temperature setpoint is not reached	Check water source availability and pressure
Temperature setpoint is not reached	Check nozzle(s) for plugging
Temperature setpoint is not reached	Make sure that steam saturation pressure is not above setpoint
Temperature setpoint is not reached	Check to ensure full actuator stroke is reached on the spraywater control valve
Temperature setpoint is not reached	Check for proper orientation of nozzle in steam flow
Temperature is below setpoint	Check temperature control loop - reset
Temperature is below setpoint	Check nozzle for fouling/poor spray pattern - clean/replace
Temperature is below setpoint	Check temperature sensor location - relocate per guidelines
Temperature is below setpoint	Check for proper orientation of nozzle in steam flow
Water in steam line	Check that steam traps are functioning properly
Water in steam line when steam line isolated	Check for proper spraywater control valve actuator installation
Water in steam line when steam line isolated	Replace spraywater control valve seat and plug assembly

Figure 6. Fisher DMA and DMA/AF Dimensions (also see table 5)



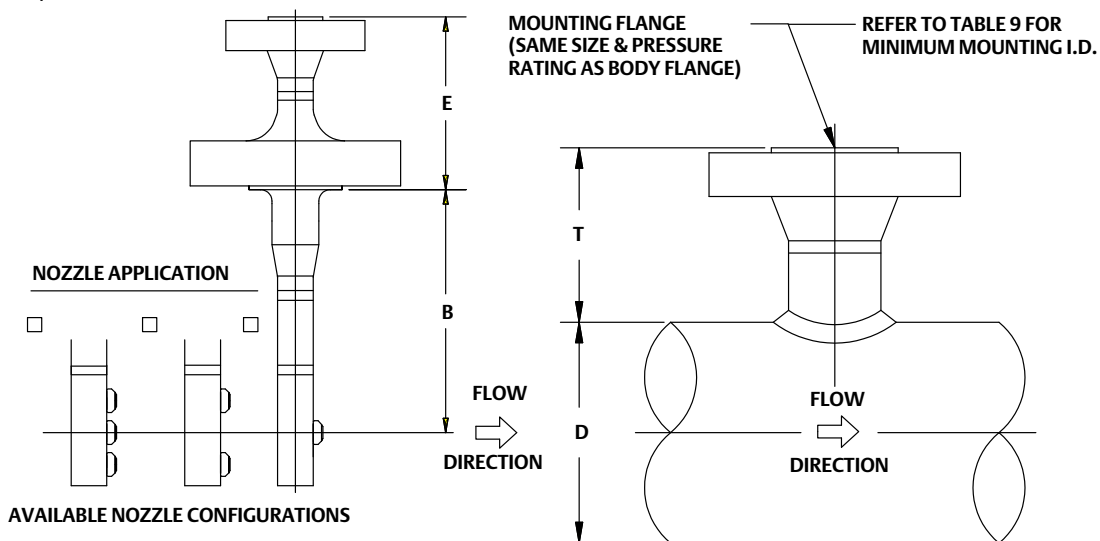
A5094-1 NOTE: ALL FLANGE BOLT HOLES STRADDLE STEAM PIPE CENTERLINE

Table 5. Fisher DMA and DMA/AF Dimensions

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

1. DMA only.  
Note: For DN 150 and 200 (NPS 6 and 8) (DMA/AF only) mounting flange, add 69.6 mm (2.75 inches) to the A and T dimensions. For CL2500 mounting, consult your local Emerson Automation Solutions sales office representative. Refer to the certified drawing to verify the inside-diameter requirements of mounting for DMA/AF.

Figure 7. Fisher DMA/AF-HTC Dimensions



GA32864-C

Table 6. Fisher 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	CL150	3 or 4	CL150	203	8
	CL300	3 or 4	CL300	203	8
	CL600	3 or 4	CL600	203	8
	CL900	3 or 4	CL900	203	8
2	CL150	3 or 4	CL150	203	8
	CL300	3 or 4	CL300	203	8
	CL600	3 or 4	CL600	203	8
	CL900	3 or 4	CL900	254	10
	CL1500	3 or 4	CL1500	254	10
	CL2500	3 or 4	CL2500	292	11.5

1. The NPS 4 DMA/AF-HTC requires a 4.00 inch minimum mounting I.D. Contact your [Emerson sales office](#) or Local Business Partner for NPS 3 DMA/AF-HTC minimum mounting I.D.¹

Table 7. Fisher DMA/AF-HTC Dimensions

D (Nominal Pipe Size)		Desuperheater Body Flange Size, NPS	B (Insertion Length)		T (Height)	
mm	NPS		mm	Inches	mm	Inches
200	8	3 or 4	356	14.00	248	9.75
250	10	3 or 4	356	14.00	216	8.5
300	12	3 or 4	444	17.50	279	11.0
350	14	3 or 4	444	17.50	267	10.5
400	16	3 or 4	444	17.50	241	9.5
450	18	3 or 4	444	17.50	216	8.5
500	20	3 or 4	444	17.50	216	8.5
550	22	3 or 4	444	17.50	216	8.5
600-900	24-36	3 or 4	444	17.50	216	8.5

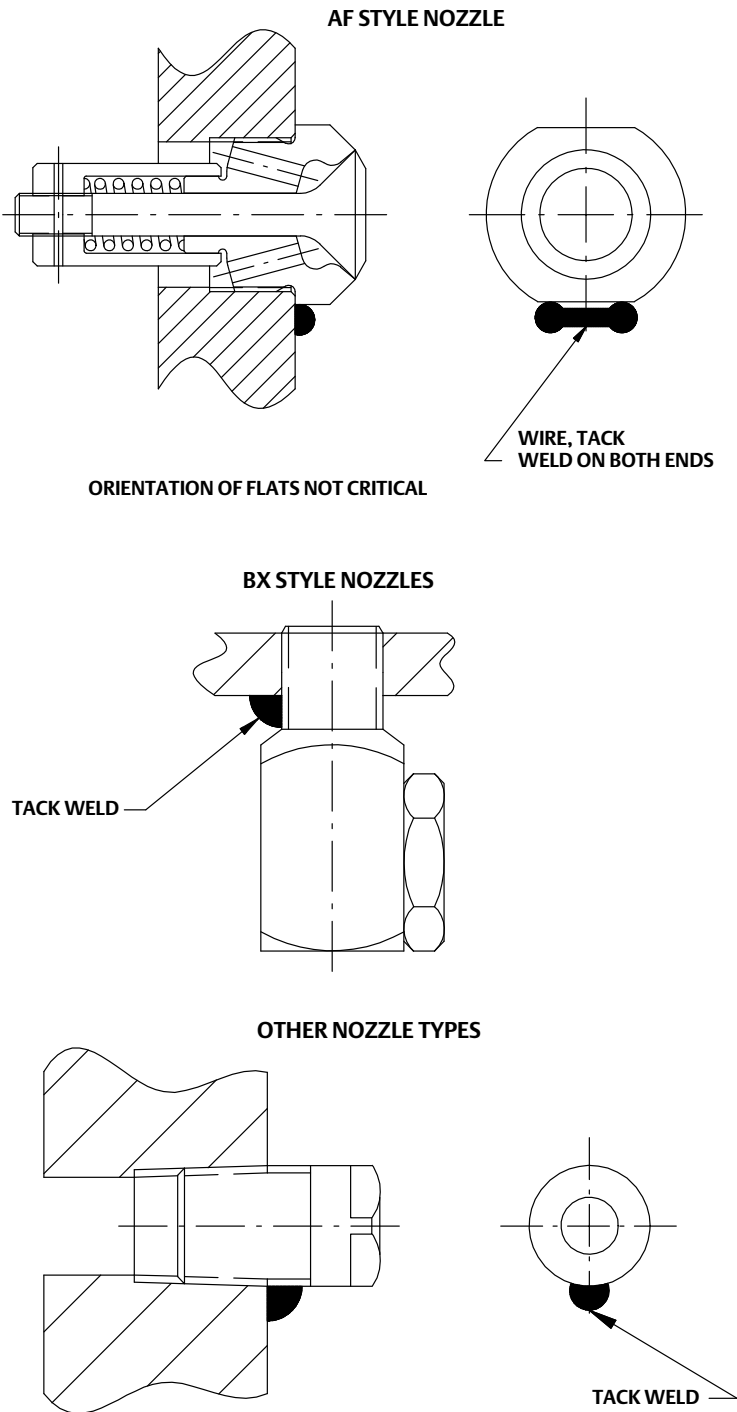
Table 8. Fisher DMA/AF Minimum Mounting I.D.

NOZZLE MODEL	VALVE BODY PIPE	MINIMUM VALVE BODY FLANGE	WATER FLANGE	MINIMUM MOUNTING I.D.	
	Size, NPS	Size, NPS	Size, NPS	mm	Inches
DMA - M Spray Nozzle	1	3	1, 1-1/2, or 2	73.66	2.9
DMA - A through DMA - U Spray Nozzle				58.42	2.3
DMA/AF-A, B, C			1	66.65	2.624
DMA/AF-D, E				73.66	2.9
DMA/AF-A, B, C, D	1-1/2	4	1, 1-1/2, or 2	77.98	3.07
DMA/AF-E				80.06	3.152
DMA/AF-F				87.33	3.438
DMA/AF-G				92.05	3.624
DMA/AF-H				97.18	3.826
DMA/AF-J				6	1, 1-1/2, or 2

Table 9. Fisher DMA/AF-HTC Minimum Mounting I.D.

NOZZLE MODEL	MINIMUM VALVE BODY FLANGE	WATER FLANGE	MINIMUM MOUNTING I.D.	
	Size, NPS	Size, NPS	mm	Inches
DMA/AF-A, B, C	3	1-1/2 or 2	66.65	2.624
DMA/AF-D, E			72.66	2.9
DMA/AF-A through H	4	1-1/2 or 2	101.6	4

Figure 8. Spray Nozzle Tack Weld Locations



GA26453-B

## Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, mention the serial number of the desuperheater. Each DMA, DMA/AF, and DMA/AF-HTC desuperheater assembly is assigned a serial number which can be found on the mounting flange. The only available replacement part for this desuperheater is the complete nozzle assembly. Whenever ordering replacement nozzles, state the complete eleven-digit part number of each nozzle required as found in the following parts list.

### WARNING

**Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher equipment, because they may void your warranty, might adversely affect the performance of the equipment, and could cause personal injury and property damage.**

## Parts List

### Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

NOZZLE TYPE	PART NUMBER
AF7	GA07205X012
AF10	GA12476X012
AF14	GA03907X012
AF17	GA11805X012
AF20	GA03901X012
AF24	GA11435X012
AF28	GA03877X012
AF32	GA12196X012
AF35	GA11788X032
AF40	GA05300X012
AF44	GA11944X012



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