Fisher™ DVI Desuperheater Venturi Inline

Contents

Figure 1. Fisher DVI Desuperheater Venturi Inline

W5365-1

Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher DVI desuperheater venturi inline.

Do not install, operate, or maintain a DVI desuperheater 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 Emerson sales office or LocaL Business Partner before proceeding.

Description

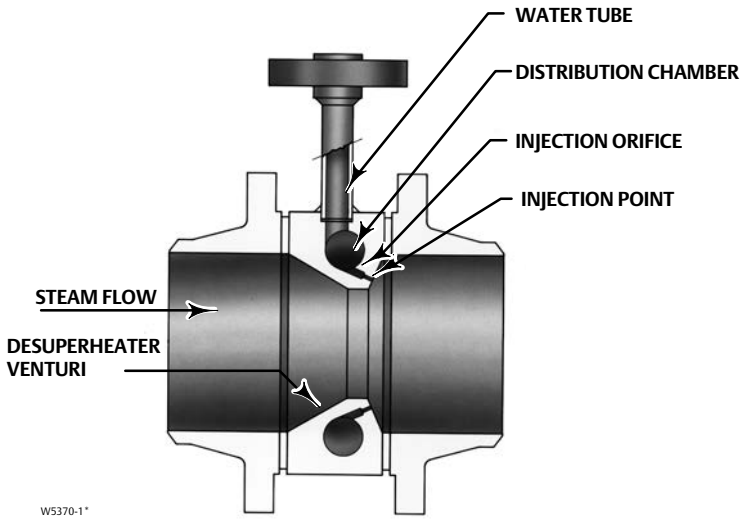
The DVI desuperheater venturi inline (figure 1) offers efficient desuperheating in steam pipelines of NPS 24 and less. It is particularly designed for rugged service conditions and can maintain final temperatures to within 6 to 8°C (10 to 15°F) of saturation. By utilizing a compact design and unique flow path, the desuperheater provides even distribution of spraywater with good turndown for a fixed orifice desuperheater. It is easily installed between any two ASME flanges up to CL1500 and NPS 24. The simple design of the desuperheater allows for virtually maintenance-free operation.

Table 1. Specifications

Steam Line Sizes NPS 1 through 24	**Maximum Inlet Pressures(1)** Consistent with applicable CL150, 300, 600, 900, or 1500 pressure-temperature ratings per ASME B16.34
Steam Line Connection Sizes Designed for water connection with NPS 1 through 24 ■ CL150, ■ 300, ■ 600, ■ 900, and ■ 1500 raised-face and ring type joint flanges	**Inherent Rangeability(2)** Up to 10:1
Spraywater Connection Sizes ■ NPS 1/2, ■ 3/4, ■ 1, and ■ 2 ■ CL150, ■ 300, ■ 600, ■ 900, and ■ 1500 raised-face and ring type joint flanges	**Spraywater Pressure Required** 3.5 to 35 bar (50 to 500 psi) greater than steam line pressure -- depending on nozzle design **Minimum Steam Velocity** 6.1 m/s (20 feet per second) -- depending on conditions

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_V.

Figure 2. Detail of Fisher DVI Desuperheater



Principle of Operation

The operation of the DVI desuperheater is quite simple. Spraywater flow is throttled by a control valve that responds to the signal generated by the temperature control loop. The spraywater enters the desuperheater water tube and then continues into the distribution chamber (see figure 2). As the chamber fills, the spraywater is forced into the injection orifices. As the flow area is reduced, the spraywater accelerates to the injection point. The accelerated flow results in a fine spray for efficient and rapid vaporization.

At the same time, the steam flow is entering the desuperheater venturi. The reduction in flow area continues until the point of water injection. This results in a higher velocity and turbulent steam flow, thus improving the mixing of the spraywater with the steam and increasing overall system turndown.

Installation

⚠ WARNING

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

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- **Use bypass valves or completely shut off the process to isolate the line from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **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.**
- **If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.**

⚠ WARNING

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.

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 Emerson sales office or Local Business Partner.

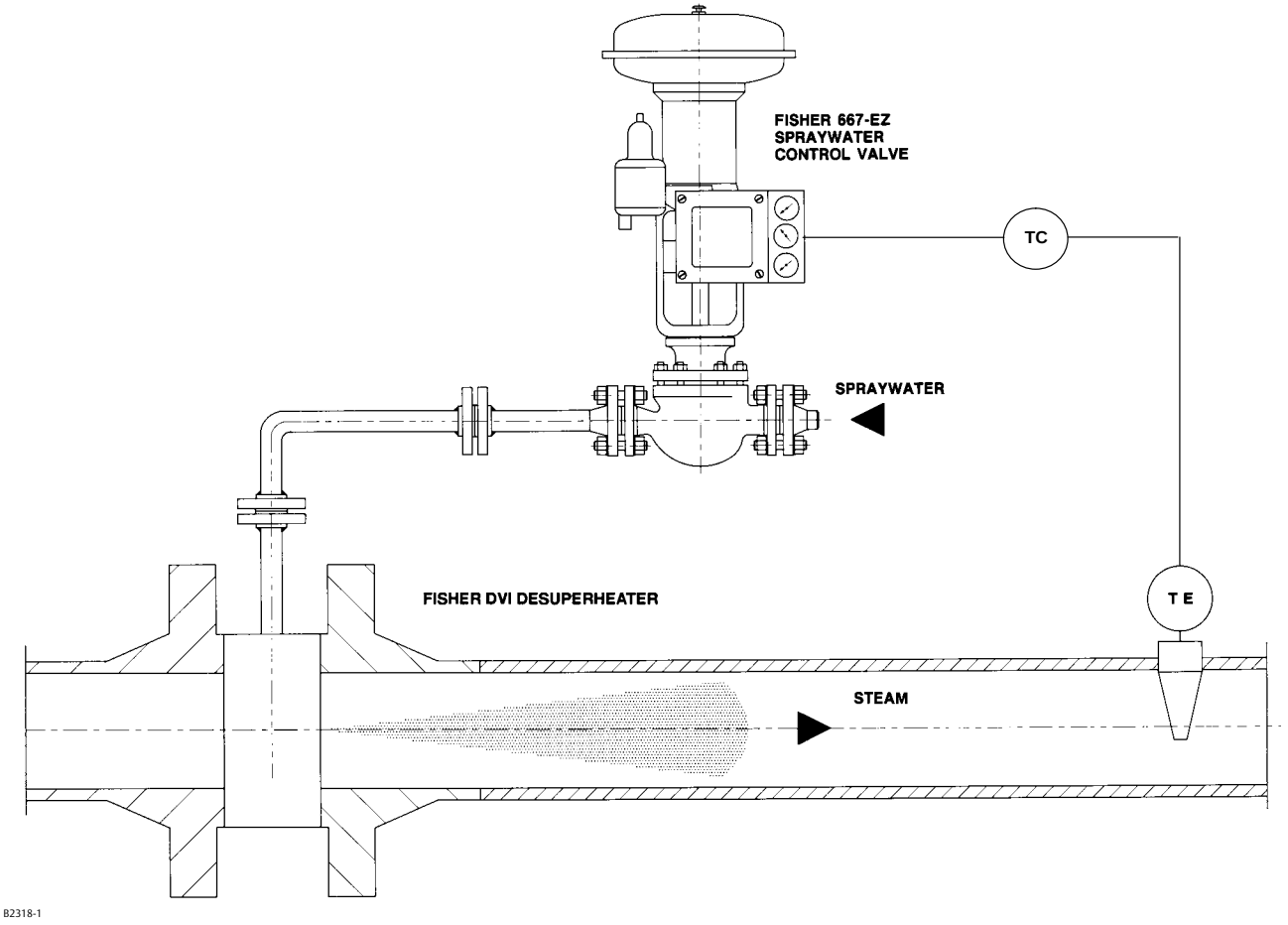
1. Mount the DVI desuperheater between two flanges with gaskets and bolt the desuperheater to the pipe in accordance with standard piping practice.
2. Clean and flush out the cooling water line before connection to the desuperheater. Use only clean sources of cooling water. Use of clean water decreases wear and prevents clogging of the desuperheater by solid particles.

Note

Installation of a strainer and isolating valve on the water line leading to the desuperheater is recommended. Failure to do so may result in clogging of the desuperheater by solid particles, thus hampering temperature control of the steam. Please consult the factory for the minimum diameter of the nozzles and recommended strainer size to assure debris will not disrupt the flow by blocking the nozzles.

3. A straight run of pipe is required downstream of the desuperheater to ensure complete vaporization of the cooling water. Consult the desuperheater sizing sheet for installation recommendations including the exact straight pipe distance required.

Figure 3. Typical Control Loop with Fisher DVI Desuperheater



4. A temperature sensor should be mounted in accordance with the manufacturer's instructions. The recommended distance from the desuperheater to the temperature sensor changes with the velocity and percentage of spraywater required. Consult the desuperheater sizing sheet for installation recommendations including the exact distance required before the temperature sensor.
5. Allow no branching out from the steam line, to divide the steam flow, between the temperature sensor and the desuperheater.

A typical control loop is illustrated in figure 3. A temperature sensor generates a signal (pneumatic or digital) through a transmitter. This signal is transmitted to the positioner on the spraywater control valve. The positioner output signal is piped to the actuator, which strokes the spraywater control valve governing the amount of spraywater flow.

Operating Instructions

Verification of Control Instrumentation

1. Connect the appropriate signal lines to the temperature transmitter, indicating control station, and valve positioner in accordance with the instrumentation manufacturer's instructions.

2. Switch the controller to manual control.
3. This instruction manual assumes a pneumatic signal of 0.2 to 1.0 bar (3 to 15 psig). If 0.4 to 2.0 bar (6 to 30 psig) or another range is used, adjust the instrument signal referenced in the following steps accordingly. Adjust the instrument signal to 0.2 bar (3 psig). Check that the water valve is completely closed. Adjust the positioner, if necessary.
4. Now adjust the instrument signal to 1.0 bar (15 psig). Check that the control valve opens to its full travel. Adjust the positioner to correct the range and re-zero if needed, by referring to step 3.
5. Thereafter, check that the controller is responding so that rising steam temperature gives an increasing instrument signal.
6. Adjust the instrument signal to 0.6 bar (9 psig).
7. Open the water supply.
8. Observe the downstream steam temperature.
9. Increase the instrument signal to 0.8 bar (11 psig). Check that the steam temperature decreases.
10. Adjust the instrument signal to 0.5 bar (7 psig) and check that the steam temperature rises.

Note

If the temperature does not fall when the instrument signal is increased, the cause may be that either the water valve has not been opened or that the steam temperature is close to saturation. If the latter is the case, set the instrument signal to 0.3 bar (4 psig) [water valve slightly open] and increase the signal to 0.4 bar (6 psig). Check if the temperature decreases.

11. When satisfactory coordination between the instrument signal and steam temperature is reached, adjust the controller in accordance with the manufacturer's instructions.
12. Switch the controller to “automatic” for automatic positioning.

Note

For more detailed calibration information, refer to the instrument manufacturer's operating instructions.

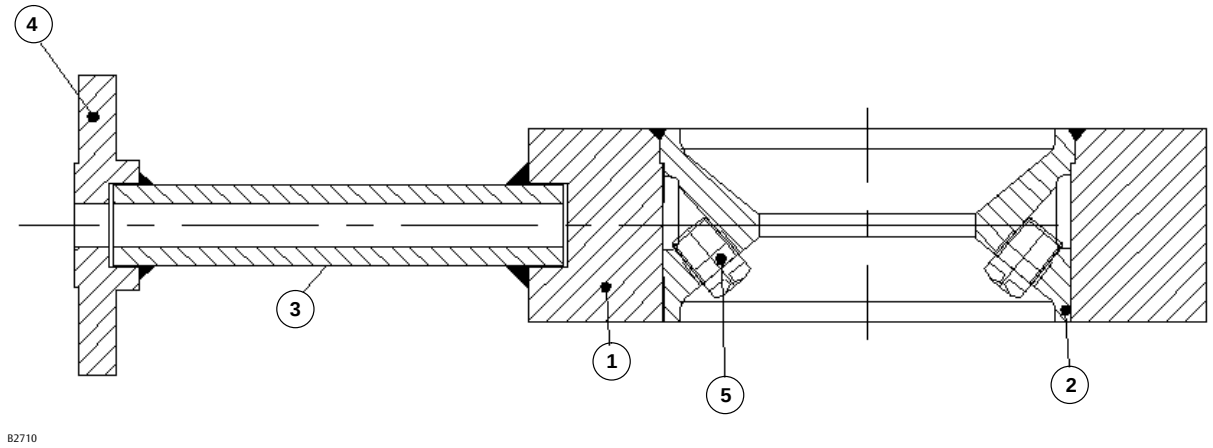
Maintenance Instructions

⚠ WARNING

Avoid personal injury from sudden release of process pressure. 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 to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator for the spraywater control valve. Be sure the actuator cannot suddenly open the valve.**
- **Completely shut off the process to isolate the DVI desuperheater from process pressure. Relieve process pressure on both sides of the desuperheater. Drain the process media from 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.**

Figure 4. Fisher DVI Desuperheater with Nozzle Cross Section



Servicing

Although the DVI desuperheater is a simple design requiring very little maintenance, in the event that the spray nozzles become clogged by debris, it may be necessary to service the unit. Prior to removal of the unit from the line, ensure that the necessary gaskets and spare nozzles (if applicable) are available for rebuild if turnaround time for the repair is critical. Review the drawing and specification sheet for clarification. If in doubt as to the construction, advise your Emerson sales office or Local Business Partner of the serial number and model number and ask for further clarification.

⚠ WARNING

Residual system pressure may be released during the following steps if the system was improperly isolated or vented. Use extreme care to prevent personal injury while loosening any fasteners in the pressure boundary.

Ensure that the weight of the unit is sufficiently supported to avoid personal injury.

1. Slowly loosen the flange stud bolts retaining the DVI desuperheater in line taking care to ensure that there is no residual pressure and that the weight of the unit is sufficiently supported to avoid personal injury. Normally the lower flange bolts will be left loosely in place during removal of the desuperheater from the line unless the location or design requires their complete removal.
2. Remove the DVI desuperheater from the line.
3. Inspect the desuperheater for cuts on the flange mating facing and repair if needed. If there is damage on the gasket surfaces that is too large for field repair, the unit may require replacement.
4. Inspect the nozzles or spray orifices. If the desuperheater has drilled holes for water injection, ream out the holes with a small drill bit or welding rod to clear all obstructions. If the desuperheater has a screwed in nozzle(s) (key 5, figure 4), cut the tack weld(s) and unscrew the nozzle(s).
5. Thoroughly flush the DVI desuperheater after cleaning. For desuperheaters using screwed in nozzles, it is recommended that the nozzles be replaced if the unit has required cleaning.
6. After cleaning the unit including all gasket surfaces, screw in the new nozzles (key 5), if applicable, and tack weld the new nozzles in place with ER309 or similar weld rod taking care not to damage any gasket surface or other nozzles.

7. When reinstalling the unit in line, take care to center the desuperheater between the steam line flanges as evenly as possible. This will help avoid leakage as well as making sure that the steam flow is not disrupted by not having the desuperheater installed evenly in the piping. Tighten the steam line flanges in accordance with good piping practice.
8. After installing the DVI desuperheater in the steam line, reconnect the water line flange connection.
9. After ensuring that the desuperheater is properly reinstalled in the pipeline, the unit may be returned to service. The desuperheater should be monitored as the unit is brought on line to ensure that there are no leaks in the connections.

Troubleshooting

The following guide (table 2) is 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 2. Troubleshooting Guide

Problem	Possible Solution
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
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 oscillates around setpoint	Tune control system parameters
Temperature oscillates around setpoint	Temperature setpoint may be too close to saturation
Water in steam line	Check that steam traps are functioning properly
Water in steam line when steam line isolated	Check for leakage of spraywater control valve
Water in steam line	Review piping configuration for downstream tees and elbows

Parts Ordering

Each DVI desuperheater is assigned a serial number that can be found on the DVI desuperheater body or on a tag attached to the water pipe. Refer to the serial number when contacting your Emerson sales office or Local Business Partner for technical assistance. When ordering a replacement nozzle, refer to the serial number and key number. The key numbers in figure 4 can be used to help in part identification.

⚠ 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 valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note
For part numbers not shown, contact your Emerson sales office or Local Business Partner.

Key	Description
1	Body
2	Venturi
3	Water Pipe
4	Water Flange
5*	Spray Nozzle

*Recommended spare parts

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