Fisher™ TBX-T Desuperheater

Contents

Figure 1. Fisher TBX-T Desuperheater

X0162

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and operation information for the Fisher TBX-T desuperheater. Refer to separate instruction manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain a TBX-T 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

Water atomization and vaporization are key elements in any steam conditioning application. The TBX-T design incorporates a spraywater manifold of variable geometry 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. Years of research in spray atomization and vaporization were key to optimizing the water injection system. Extensive use of CFD analysis, in addition to field performance feedback, was used to validate spray system enhancements.

Table 1. Specifications for Standard Designs (Physical Specifications)

Steam Line Connection Sizes(1)

NPS 8 through NPS 48

Steam Line Connection Types

- ASME Buttweld (all sizes)
- ASME Raised Face Flanges (all sizes)
- ASME Ring Type Joint Flanges (all sizes)

Construction Materials

Steam Pipe: ■ SA105 carbon steel, ■ SA182 Grade F22 (2-1/4 Cr-1 Mo) ■ SA182 Grade F91 (9 Cr-1 Mo-V)
Nozzles: ■ S41000 stainless steel
Gaskets: ■ N06600/Graphite
Bolting: ■ SA193 Grade B7, ■ SA193 Grade B16, ■ N07718

Spraywater Connection(1)

- NPS 1 through NPS 4
- ASME Raised Face Flange (all sizes)
- ASME CL150 to CL2500

Maximum Inlet Pressures(1)

Consistent with applicable pressure-temperature ratings per ASME B16.34

Spraywater Pressure Required(2)

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

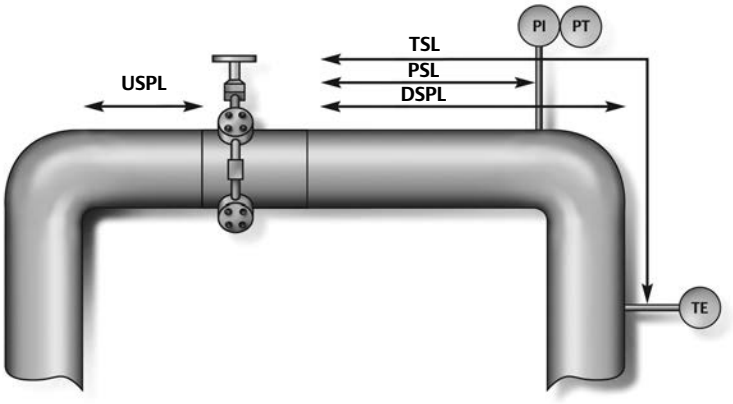
1. Do not exceed the pressure or temperature limits in this instruction manual, nor any applicable code or standard limitations.
2. A function of required turndown and equipment selection.

Educational Services

For information on available courses for Fisher TBX-T desuperheaters, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Figure 2. Typical Fisher TBX Installation



KEY:
DSPL = DOWNSTREAM STRAIGHT PIPE LENGTH
PI = PROPORTIONAL INTEGRAL CONTROLLER
PSL = PRESSURE SENSOR LENGTH
PT = PRESSURE TRANSMITTER
TE = TEMPERATURE SENSOR ELEMENT
TSL = TEMPERATURE SENSOR LENGTH
USPL = UPSTREAM STRAIGHT PIPE LENGTH

X0355

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 TBX-T desuperheater is installed where service conditions could exceed the limits of the pressure rating noted 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 sales office or Local Business Partner.

1. Before installation, all piping upstream of the valve must be blown clean so that no loose materials such as welding slag, dirt or other foreign matter, are left in the pipe. Use care to keep foreign matter out of the line openings while preparing the valve installation.

⚠ WARNING

Do not lift the desuperheater by its cooler manifold piping. Personal injury or damage to equipment could occur if the desuperheater is improperly lifted into place.

If the TBX-T is equipped with buttweld ends, the valve body must be supported using a lifting sling or other method that does not place a load or force onto the finished surface of the buttweld ends. The TBX-T does not have a stable resting condition. The valve inlet and outlet must be fully supported until fully welded (buttweld end connections) or bolted (flanged end connections) into the piping.

2. Arrange a lifting sling around the main steam pipe to safely lift the TBX-T to the pipe opening.

⚠ WARNING

Do not expose the TBX-T to undue stresses by installing it in bent pipes or flanges. Personal injury and equipment damage could result from flange sealing failure due to improper installation.

3. Flanged Connections—Grease the flange connection bolts with a high temperature thread lubricant. Install flange gaskets and connection bolts per accepted practices and tighten securely.
4. Welded Connections—Welding procedures should be in accordance with the applicable codes and the base materials. For preheat, welding electrodes, and postweld heat treatment, refer to the applicable codes and practices applicable for the specific facility. Materials are specified on the customer specification sheet.

CAUTION

Depending on desuperheater body materials used, post weld heat treating may be required. If so, damage to internal parts is possible. In general, if post weld heat treating is to be performed, all nozzles should be removed. Contact your Emerson sales office or Local Business Partner for additional information.

5. Remove the spraywater control valve and flush the cooling water line until all debris is removed from the line prior to connecting it to the TBX-T desuperheater. Use only clean sources of cooling water to reduce the possibility of nozzle clogging. A 100 mesh strainer should be installed in the water line as close to the TBX-T desuperheater as possible. Review strainer manufacturer's pressure drop curves to determine appropriate strainer body size. You may need to use a strainer that is larger than the water line size.

⚠ WARNING

Failure to use a strainer could result in nozzle clogging and subsequent property damage or loss. Uncontrolled temperatures resulting from clogged nozzles may result in equipment or process temperature limits being exceeded. Exceeding system temperature limits could result in property damage or personal injury.

6. A length of straight pipe is required downstream of the TBX-T desuperheater to ensure complete vaporization of cooling water. An example of a typical installation appears in figure 2. Consult the TBX-T cooler sizing sheet for the required distance of straight pipe. This is unique for each application and is supplied by Emerson Automation Solutions.
7. Typically, a temperature sensor should be mounted a minimum distance of 9.1 m (30 feet) downstream of the TBX-T desuperheater. This distance will vary depending on a number of factors including steam velocity and

percentage of spraywater. Consult the TBX-T cooler sizing sheet provided with the unit for this temperature sensor distance. The steam line should not have any branch lines dividing the steam flow between the TBX-T desuperheater and the temperature sensor. If you have any questions, contact your local Emerson sales office or Local Business Partner.

8. A typical installation is illustrated in figure 2. A temperature sensor (TE) measures changes in temperature and a temperature transmitter (TT) transmits the signal to the temperature control device. The output signal from the controller is sent to the positioner on the cooling water (spraywater) control valve (SWCV). The positioner's output signal strokes the SWCV open, increasing water pressure on the nozzles. Increasing water pressure upstream of the nozzles increases water flow through the nozzles.

CAUTION

Pneumatic lines (where applicable) should be thoroughly blown clean with dry air before connection. Check electronic lines for correct connection.

Maintenance

Table 2. Inspection Summary

Key	Part Description	Inspection Tips and Diagnostics	Repair	Replacement
1	Steam Pipe (not replacement part)	Inspect for erosion, thermal fatigue, and other damage.	Consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement	
2	Nozzle Body (not replacement part)	Inspect for erosion, thermal fatigue, and other damage.	Consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement	
3	Nozzle Sleeve	Inspect for particulate or magnetite buildup when spray nozzles are replaced.	Clean if necessary.	As needed
7	Nozzle Body Flange	Inspect gasket surfaces for damage that could indicate gasket leakage when spray nozzles are replaced.	Replacement Only	As needed
10	Spray Nozzle	Refer to Nozzle Maintenance Section.		Replacement every 24-36 months for optimal performance

Servicing

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **Use bypass valves or completely shut off the process to isolate the desuperheater from process pressure. Relieve process pressure from both sides of the valve. 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.**

Nozzle Maintenance and Replacement

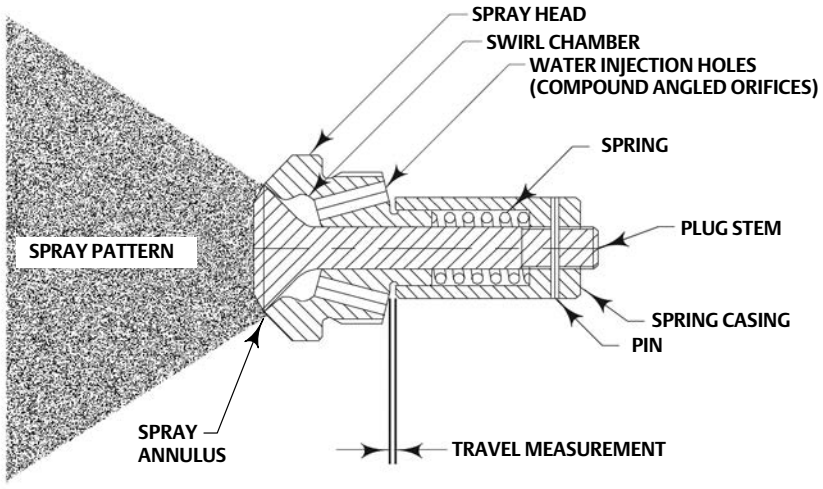
When subjected to normal operating conditions, it is possible that wear, blockage, and/or weld fatigue will occur to the nozzle assembly. During regularly scheduled maintenance, visually inspect the nozzles for wear and blockage. Your local Emerson Service Center can help to determine the extent of weld 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.

1. OPTIONAL: Figure 3 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 spray water input connection. If this spray pattern is not present, replacement is recommended.

Figure 3. Fisher AF Nozzle Cross Section



2. Loosen and remove the nozzle body flange stud nuts (key 58) and washers (key 59). Then, remove the nozzle body flange (key 20). Inspect the nozzle body flange gasket surfaces for damage. If damage is present replacement is necessary.
3. Remove the nozzle sleeve (key 37) with attached spray nozzle (key 30), nozzle sleeve gasket (key 47), and nozzle body flange gasket (key 48). Inspect the nozzle sleeve for particulate or magnetite buildup and clean if necessary.
4. Inspect the spray annulus surface, the area between the plug stem and spray head, for excessive wear, erosion/corrosion, 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.

5. Grind off the tack welds holding the nozzle (key 30) 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 from the nozzle sleeve (key 37).
6. Grind excess tack weld material off both the nozzle (key 30) and nozzle sleeve (key 37).
7. 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.
8. 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.
9. Inspect the interior of the water injection holes for buildup of particulate or magnetite. Nozzle replacement will be needed is any buildup is present.

Note

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

10. 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.

To further check, 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.

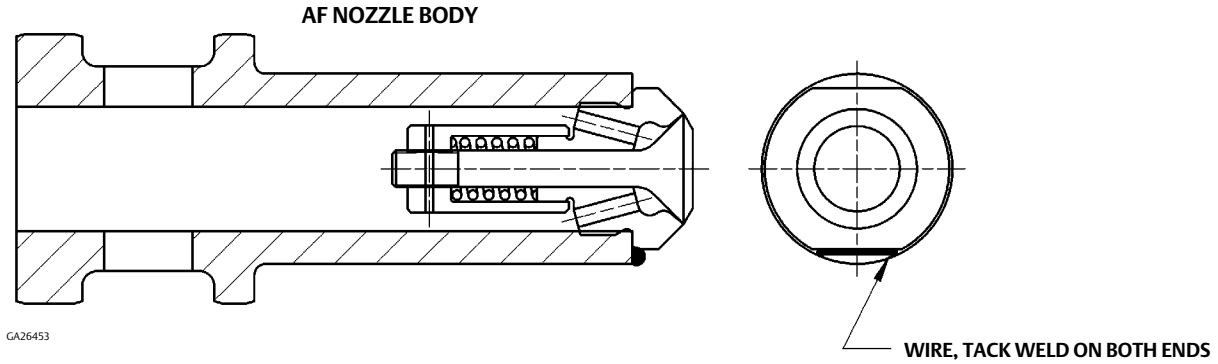
11. The travel can be determined by using a feeler gauge to measure the distance between the spray head near the water injection ports to the side of the spring casing, as outlined in figure 3. This measurement must match the factory set plug stem travel for the corresponding nozzle type as shown in table 3.

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

12. Inspect nozzle threads for damage and clean if needed. If damage is present, nozzle replacement will be necessary.
13. Rinse both the nozzle (key 30) and nozzle sleeve (key 37) to remove particulate.
14. Screw nozzle into the nozzle sleeve (key 37) and tighten just until the spray head is flat and tight against the nozzle sleeve.
15. Tack-weld a small piece of welding wire onto the nozzle sleeve (key 37) next to either of the spray head flats to prevent rotation during service; refer to figure 4. Maintain low heat to prevent distortion of the nozzle.

Figure 4. Spray Nozzle Tack Weld Location



16. Reassemble in the following order: nozzle sleeve gasket (key 47), nozzle body flange gasket (key 48), spray nozzle/sleeve assembly, nozzle body flange (key 20), washers (key 59), and stud nuts (key 58). It is recommended that the nozzle sleeve gasket and nozzle body flange gasket be replaced with new ones.
17. Torque nozzle body flange nuts as indicated in table 4.

Table 4. Recommended Nozzle Body Flange Bolting Torque

BOLT SIZE	THREADS PER INCH	RECOMMENDED BOLT TORQUE(1)	
Inch		N•m	Lbf•ft
5/8	11	170	125
3/4	10	272	200
7/8	9	394	290
1	8	550	405
1-1/8	8	746	550
1-1/4	8	990	730
1-3/8	8	1329	980
1-1/2	8	1750	1290

1. Torques for lubricated studs with heavy hex nuts.

Parts Ordering

Each TBX-T desuperheater is assigned a serial number. Refer to the serial number when contacting your Emerson sales office or Local Business Partner for technical assistance. When ordering replacement parts, refer to the serial number and key numbers for each part required. The key numbers in the Parts List and the assembly drawing in figure 5 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.

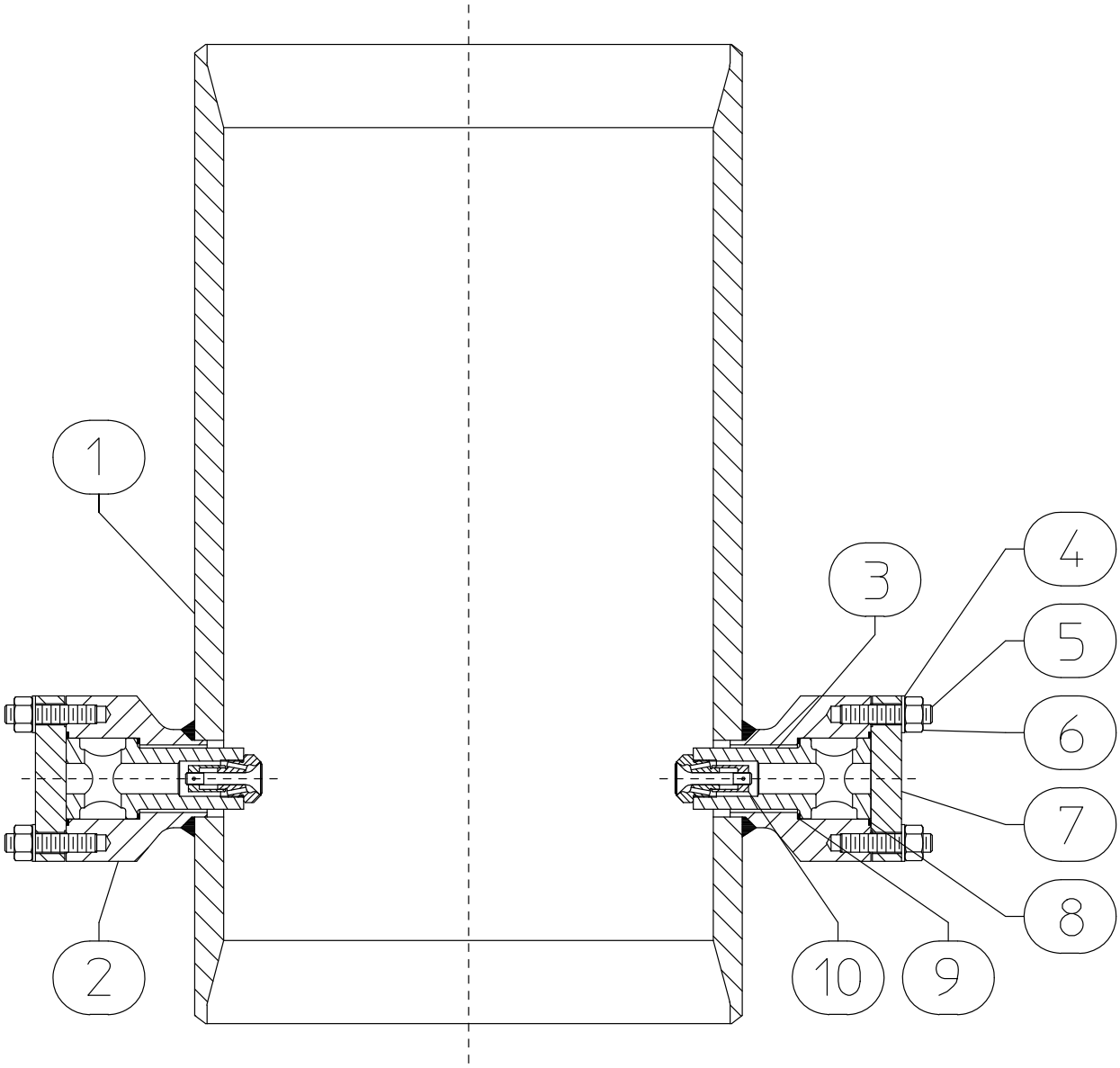
Parts List

Note
Contact your Emerson sales office or Local Business Partner for Part Ordering information.

Key	Description
1	Steam Pipe SA 105 SA 182 Grade F22 SA 182 Grade F91
2	Nozzle Body
3	Nozzle Sleeve, F22
4	Nozzle Body Flange Washer, Plated Steel
5	Nozzle Body Flange Stud SA 193 Grade B7 SA 193 Grade B16 SB 637 N07718
6	Nozzle Body Flange Stud Nut SA 194 Grade 2H SA 194 Grade 7 SB 637 N07718
7	Nozzle Body Flange SA105 SA182 Grade F22 SA182 Grade F91
8*	Nozzle Body Flange Gasket, N06600 / Graphite
9*	Nozzle Sleeve Gasket, N06600 / Graphite
10*	Spray Nozzle, S41000 SST

*Recommended spare parts

Figure 5. Fisher TBX-T Desuperheater



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