Fisher™ ATST Desuperheater

The Fisher ATST desuperheater represents the state-of-the-art solution for desuperheating applications that demand ultimate performance in atomization and rangeability. Using steam-atomized water injection, ATST nozzles form extremely fine water droplets which vaporize quickly in a wide range of steam flows and conditions.

Water atomization and vaporization are key elements in any steam temperature control application. The ATST design incorporates a unique, one-piece, steam-atomized nozzle that is enabled through additive manufacturing. The ATST nozzle uses high speed vapor to break water into a fog-like mist over a wide operating range. This mist of cooling water exiting the ATST nozzles vaporizes in a fraction of the time of traditional desuperheater nozzles. The 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 developing the steam assisted system. Extensive lab testing and field performance feedback was used to validate spray system enhancements.

The ATST is specifically designed for use in power plant interstage and final stage attemperation but can be used to precisely control steam temperature in a variety of difficult desuperheating applications including low steam velocities and wide rangeability. This advancement in attemperator nozzle technology addresses the temperature control challenges associated with regular cycling of heat recovery steam generators (HRSGs), and the widening rangeability demands on attemperators stemming from low-load plant operation and the latest advancements in combustion turbine technology.

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ATST DESUPERHEATER

Features

- Steam-Atomized Water Injection-- The ATST desuperheater (figure 1) incorporates steam-atomized nozzles (figure 2 and 3) that uses high speed vapor to break water into fine droplets over a wide operating range. These nozzles are strategically placed to achieve optimal mixing and quick vaporization at all flowing conditions
- Temperature Control Confidence-- The fine mist exiting the ATST spray nozzles results in fast vaporization without spray water fallout into downstream piping. This ensures spray water is controlling steam temperature instead of falling out and sending spray water to drains.
- Improves Steam Pipe and Liner Integrity—Liner failures and attemperator weld cracks typically occur because of overspray, degraded nozzle performance, operating below minimum attemperator spray limits, and leaking spray water valves. The ATST's combination of fine spray, even mixing of water/steam, and fast vaporization defend steam pipes and liners from overspray quenching damage. The ATST nozzle can even serve as protection against damage from leaking spray valves when the atomizing steam is flowing.
- Application Versatility--The ATST can be used in applications that do not require a steam pressure reducing valve such as interstage and final stage attemperation, or in conjunction steam pressure reducing valve. The latter can be close-coupled or separated.

(continued on page 2)

Table 1. Specifications

Connections(1)(3)

Steam Line: NPS 8 through NPS 60 (DN 200 through 1500)
Spraywater: NPS 1 through 4 (DN 25 through 100)
Atomizing Steam: NPS 1 (DN 25)

Connection Types(1)(3)

Steam Line: ■Buttweld (all sizes), ■Raised Face Flanges (all sizes), ■Ring Type Joint Flanges (all sizes)
Spraywater: ■ASME Buttweld (all sizes), ■Raised Face Flanges (all sizes), ■Ring Type Joint Flanges (all sizes), ■Socket Weld
Atomizing Steam: ■Raised Face Flanges (all sizes), ■Ring Type Joint Flanges (all sizes)

Pressure Class(1)(3)

Steam Line: According to the customer design pressure and temperature
Spraywater and Atomizing Steam: ASME CL150 to CL2500(4)

Construction Materials(5)

Desuperheater Body and Liner (if applicable):
■ Carbon Steel, ■ 2-1/4 Cr-1 Mo ■ 9 Cr-1 Mo-V ■ 9 Cr-2 W-V
Spray Nozzles: ■ R31233 Cobalt-Chrome Alloy
Gaskets: ■ N06600/Graphite
Bolting: ■ SA193 Grade B7, ■ SA193 Grade B16, ■ N07718

Maximum Inlet Pressures(1)

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

Maximum Unit Cv (for Spraywater Flow)

Contact your Emerson sales office

Spraywater Pressure Required(2)

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

Atomizing Steam Pressure Required

Atomizing steam source pressure typically should be at least 2 times the pressure of the steam to be desuperheated

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.
3. Offerings meet ASME standards. Consult your Emerson sales office for additional options.
4. Intermediate rating above CL2500 available upon request. PN ratings also available per pressure requirements of EN1092-1. Consult your Emerson sales office for additional information.
5. EN material options available upon request, consult your Emerson sales office for additional information.

Features (continued)

- Simple Maintenance--No special requirements for ATST spray nozzle replacement. After relieving process pressure simply unbolt the nozzle flange connections to access the spray nozzle and gaskets.

- Simplified Nozzle Design for More Resilient Operation--The larger flow passages and corrosion resistant material of ATST nozzles resist blockage due to spray water particulate or oxidation. With no moving parts, application wear and fatigue resistance is improved.

- Available Steam Pipe Liner--The ATST has the option of including an integral thermal liner inside the steam pipe. This construction is most used in boiler interstage attemperation applications, where the desuperheater is exposed to high thermal cycling and stress and a wide range of steam velocities. The liner protects against any potential water impingement on the steam pipe and associated thermal shock damage.

- High Rangeability to Handle Low Load Requirements--Today's Combined Cycle Power Plants are often required to operate at very low Combustion Turbine loads. This operation results in higher water input into lower steam flows – the perfect storm for overspray and quench damage in traditional attemperators. Unlike all other attemperator designs in existence today, the ATST steam-atomized attemperator does not rely on water pressure or steam velocities to generate the necessary fine spray. The fine mist created by the ATST can be injected into much lower steam velocities without sacrificing temperature control performance.

Figure 1. Fisher ATST Desuperheater Cutaway, Water Connection

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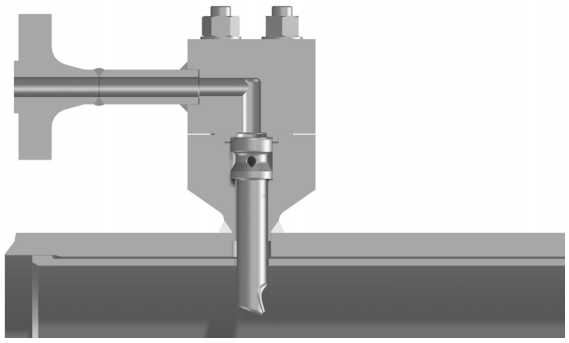
Figure 2. Fisher ATST Desuperheater Cutaway, Atomizing Steam Connection



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Principle of Operation

The primary difference in operation of the ATST compared to the Fisher TBX-T ring-style desuperheater centers around the steam atomization of the spray water.

The ATST nozzles (figure 2 and 3) function by injecting the spraywater through a series of small, high velocity jets of steam just as it exits the nozzle. The design was enabled by additive manufacturing, by which the separate water and steam passages within the nozzle are produced without the need for threads or weld joints within the nozzle assembly. This is vital for extending the life of the attemperator nozzle.

As the atomizing steam passes through the streams of water, it strips the water into minuscule droplets that are only a few microns or less in size. The result is an extremely fine mist with a vaporization rate that is unrivaled by any traditional mechanically atomized spray nozzle.

To accomplish this, the ATST nozzle requires an external source of higher-pressure steam, well above the pressure of the steam being cooled. For example, in a combined cycle power reheat (RH) interstage attemperator application, an ATST would typically draw atomizing steam from the HP system. This does mean however that typically the ATST cannot be used in the HP attemperator application due to a lack of higher-pressure steam to atomize the water. The ATST will not function properly without this atomizing steam source.

An additional benefit of this steam-atomized operation is that unlike traditional spray nozzles, the ATST is not reliant on water pressure across the nozzle to assist with atomization. That means that as the spraywater valve throttles down to low flow rates, which in turn reduces the pressure available at the nozzle, the rate of atomization and the droplet size are completely unaffected.

Figure 3. Fisher ATST Spray Nozzle

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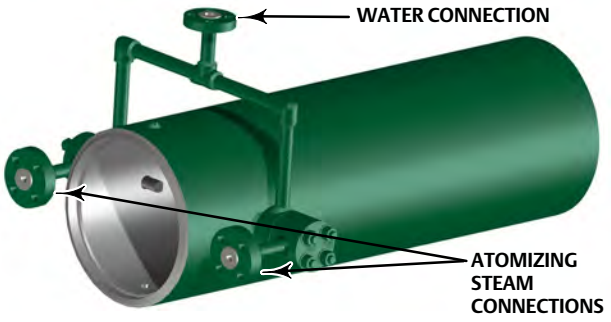
Figure 4. Fisher ATST Desuperheater Assembly



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. For each operating case, provide steam pressure and temperature at the inlet, and desired outlet temperature.
3. Spraywater pressure and temperature.
4. Atomizing steam source pressure and temperature.
5. Design conditions, if different from operating conditions.
6. Steam pipe size and schedule or nominal thickness.
7. Spraywater connection size from table 1.
8. Steam, water, and atomizing steam pipe materials.

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