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## Direct-Operated Steam and Mechanical-Atomizing Desuperheaters



### WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in property damage and personal injury or death.

Direct-Operated Desuperheater must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies, Inc. instructions.

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Direct-Operated Desuperheater.



Figure 1. Direct-Operated Desuperheater

## Introduction

### Scope of the Manual

This manual provides installation, operation and maintenance instructions for Spence Direct-Operated, Steam and Mechanical-Atomizing Desuperheaters.

### Product Description

The Steam and Mechanical-Atomizing Desuperheaters are designed to reduce and control the temperature of superheated steam by the controlled injection of a cooling water mist.

## Principle of Operation

### Steam-Atomizing

The desuperheater consists of a steam-atomizing injection nozzle assembly and a dual control valve.

The dual control valve consists of two valves: one for the cooling water and one for atomizing steam, operated in unison by a single diaphragm. The dual control valve is normally closed and actuated by a vapor-tension thermostat. The dual valves open on a rise in temperature and provide a balanced flow of atomizing steam and coolant to the injector nozzle.

Cooling water emerges from the nozzle in a swirling spray. Atomizing steam, issuing from the concentric impact nozzle is injected counterflow to the superheated steam to promote full evaporation.



# Direct-Operated Desuperheater

## Specifications

The specifications section on this page provides the ratings and other specifications for the direct-operated, steam-atomizing and mechanical-atomizing desuperheater.

### Available Types

1, 3, 5, 6 and 8

### Maximum Temperature<sup>(1)</sup>

750°F / 399°C

### Maximum Pressure<sup>(1)</sup>

600 psig / 41.4 bar

### Material of Construction

Stainless steel

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

As the superheated steam temperature and flow rate vary, the thermal system modulates the flow of coolant to maintain the desired temperature setpoint. Temperature will increase slightly as the load increases.

## Mechanical-Atomizing

The desuperheater consists of a mechanical-atomizing injection nozzle assembly and a water control valve.

The valve is normally closed and actuated by a vapor tension thermostat. The valve opens on a rise in temperature and provides a flow of coolant to the injector nozzle.

Cooling water emerges from the nozzle in a swirling conical spray pattern. The coolant is injected counterflow to the superheated steam to promote full evaporation.

As the superheated steam temperature and flow rate vary, the thermal system modulates the flow of coolant to maintain the desired setpoint. Temperature will increase slightly as the load increases.

## Installation



### WARNING

**Failure of the thermal system or foreign material lodged between the valve's closure members can lead to an over-temperature and/or an overpressure condition which may cause injury and/or property damage.**

**Never install a Direct-Operated Desuperheater in a system, which does not have a properly installed, code approved temperature and pressure safety valve or other approved safety device.**

**These devices must be suitable for the equipment and processes involved and in conformance to applicable codes.**

## Planning the Installation

1. Locate the injector nozzle in the superheated steam main. There should be at least 8 diameters (6 ft / 1.83 m minimum) of straight run ahead of the nozzle. The nozzle will operate in any position in a horizontal or vertical pipe. The center-to-face dimension of the flanged connection must equal that of the nozzle. This will place the nozzle on the steam main's centerline. See Figure 2.
2. Locate the thermostat well at least 20 ft / 6.1 m of pipe run downstream of the injector nozzle. The well must extend fully across the inside of the pipe.
3. Position the control valves as close as practical to the injector nozzle. Locate where they can stand upright in horizontal water and steam lines.
4. Provide 3-valve bypasses around the control valves. Provide pressure gauges to monitor steam and water pressure at the inlet of both the control valves and the injector nozzle. These gauges should have equal ranges.
5. Provide a thermometer located at the thermostat and a pressure gage to monitor steam properties.
6. Provide a suitable check valve for the water line of the control valve.

## Desuperheater Installation

1. Install the injector assembly with the nozzle outlet facing upstream.

### Note

**The injector nozzle is orificed for specific water and steam supply pressures. Verify the actual pressures against your order specification.**

# Direct-Operated Desuperheater

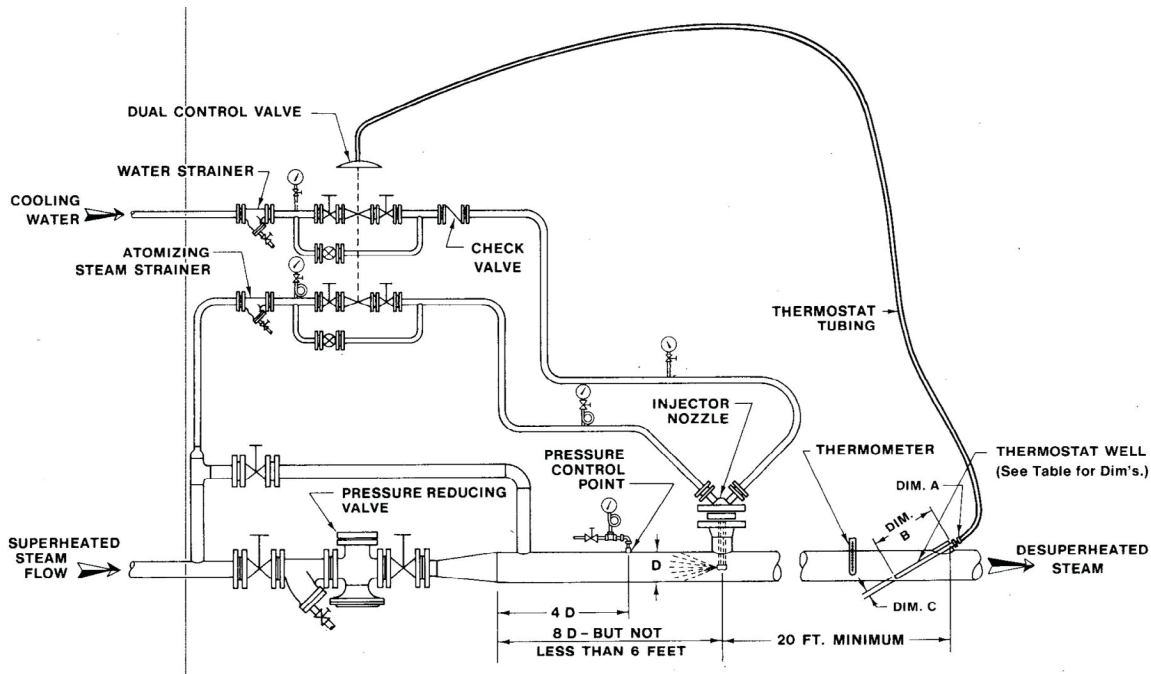


Figure 2. Direct-Operated Desuperheater Station Installation

2. Install the control valves and strainers as shown with the arrows pointing in the direction of flow. See Figure 2.
3. Install the thermostat well so that its full length extends across the inside of the pipe. Seal weld the well to the pipe.
4. Read the separate instructions supplied with the pneumatic controller. Then install the controller at a convenient location remote from the thermostat well.
5. Pour heat transfer oil into the thermostat well and install the thermostat bulb.
6. Connect the output connection of the controller to the control valves with 3/8 in. / 9.53 mm copper tubing.
7. Connect a regulated source of instrument air to the supply connection of the controller and the positioner, if required.
8. Install the required pressure gauges and thermometer as shown in Figure 2.
2. Cut in a moderate flow of superheated steam, crack open the atomizing steam bypass valve and monitor the temperature as the line warms up. Open the cooling water bypass valve slowly as required to hold the desired steam temperature.

## Note

**Do not attempt to control at or below saturated temperature. The lowest practical setting is about 10°F / -12°C above saturation.**

3. Open the dual control valve's outlet stop valves; crack the inlet stop valves. Slowly close down on the bypasses and open the inlet stop valves to bring the desuperheater on line.
4. The desuperheater is factory calibrated at the specified temperature. Always be governed by the temperature at the thermostat. The setpoint temperature can be raised (lowered) by increasing (decreasing) the compression of the adjusting spring. Remember that each increase in load will raise the temperature slightly.

## Startup and Adjustment

1. Check water and steam supply gauges to confirm proper pressures are available. If so, then blow down strainers.

# Direct-Operated Desuperheater

## Troubleshooting



### WARNING

**Steam is potentially dangerous and should be treated with respect. All installation, troubleshooting and maintenance should be performed by qualified personnel who are familiar with steam systems.**

1. Erratic control:
  - a. Faulty nozzle installation - See Installation Section.
  - b. Stuffing boxes binding - See Maintenance Section.
2. Steam temperature drops to saturation:
  - a. Water bypass valve open - Check bypass.
  - b. Faulty nozzle installation - See Installation Section.
  - c. Water valve held open by foreign matter - See Maintenance Section.
3. Steam temperature rises above normal:
  - a. Low cooling water pressure - Check pressure a source and at control valve inlet. Blow down stainer.
  - b. Injector nozzle fouled - Use bypass to apply full supply pressure. If temperature remains high, the nozzle is fouled by the foreign matter, remove mineral salts with suitable acid.

- c. Inoperative thermal system - See Maintenance Section.

## Maintenance

1. Inspection:
  - a. After the first few days of operation, and then twice a year, inspect all joints for leakage. Never allow a leak to persist.
  - b. Stuffing boxes must be set up carefully to prevent binding and erratic operation. Tighten packing nuts just enough to prevent leakage. Allow a slight seepage of condensate to keep the packing moist. (#1 desuperheaters use bellows seals in lieu of stuffing boxes).
2. Dismantling:
  - a. Under normal conditions, complete dismantling at regular intervals is not recommended.
  - b. If dismantling is required, refer to form SD 5002.
  - c. The dual control valve's stem adjustments are factory set and tested. Do not disturb the settings.

## Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the service and serial number.

 SpenceValve.com

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