Installation User Manual

Desuperheaters

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Table of contents

1 Typical installation manual of the Desuperheater

1.1 General

If possible, do install the desuperheater in horizontal piping. However, it is also possible to install the desuperheaters in vertical piping with flow upwards.

- ☞ Don't install the desuperheater in elbows.
- ☞ Only use clean water or condensate as spray water. As it always is a risk for impurities, we recommend you to install a strainer in the cooling water line upstream the Desuperheater or Spray Water Valve.
- ☞ Contaminated cooling water may increase wear on the Desuperheater valve trim and lead to clogging by solid particles.
- ☞ Max acceptable particle size is 100 - 200 microns/0.004 - 0.008", depending on type of spray water nozzle.

If a water shut-off valve will be installed upstream the desuperheater distance between the desuperheater and the shut-off valve has to be sufficient. When the valve is closed, the water trapped between desuperheater and valve can heat up and increase the volume and pressure. This will damage the internal trim of the desuperheater. A sufficient water leg will absorb the expansion or a small relief valve installed in between valve and desuperheater will ease the pressure build-up.

Install manually operated shut-off and relief valves in the system to ensure a safe and easy service and maintenance of the control elements.

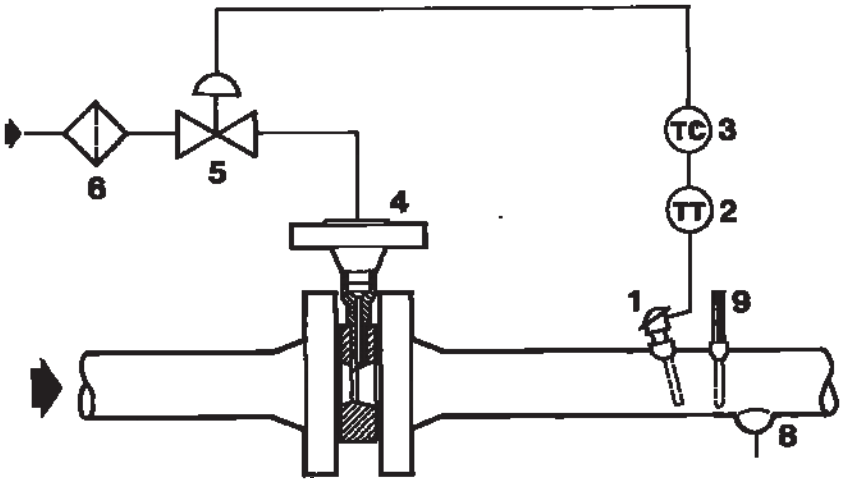

Fig 1 Typical installation of desuperheater Model 901

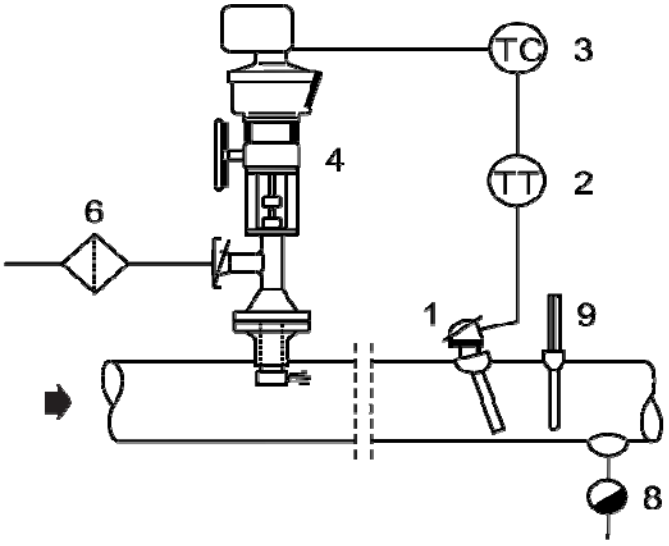

Fig 2 Typical installation of desuperheater Model 902

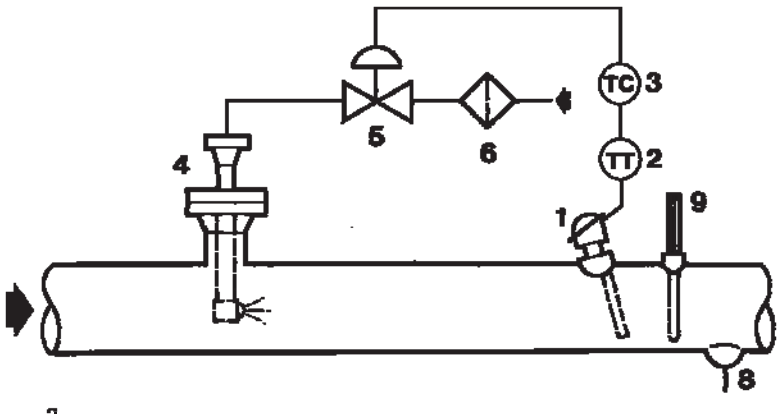

Fig 3 Typical installation of desuperheater Model 903

1.2 Straight Pipe runs Upstream/Downstream the Desuperheater

The installation point must be selected carefully. This is especially important in cases where the steam velocity is low and the desired steam temperature is close to saturation.

☞ Generally a straight pipe run of at least 10 m/33 ft is required.

Straight pipe run upstream the desuperheater:
6 pipe diameters, or 4 m/14 ft for pipes DN 700 /28" or larger.

Straight pipe run downstream the desuperheater:
Minimum 6 m/19 ft

☞ Always consult KOMOTO if it proves difficult to follow these directions.

1.3 Distance to temperature sensor

It is very important to install the temperature sensor where it, in a representative manner, can measure the temperature that shall be controlled.

☞ There must be no branches entering or leaving the steam line between the desuperheater and the temperature sensor.

☞ Temperature measurements must only be made in a location where all injected water has evaporated, and the steam is absolutely dry. Our experience shows that the evaporation distance is controlled by different parameters, such as:

- Atomization of the water
- Steam flow path
- Steam velocity and steam pressure
- Differential temperature $\mathbf{t_2 - t_s}$, i.e. the difference in temperature between the desuperheated steam and the saturation temperature of the steam.
- Cooling water temperature $\mathbf{t_w}$ and how close it is to the saturation temperature $\mathbf{t_s}$.
- **As a general guideline**, use the following distance from desuperheater to temperature sensor:

☞ Minimum 12 m/40 ft if no protective sleeve for the thermowell is used.

☞ Minimum 8 m/30 ft if a protective sleeve for the thermowell is used.

The temperature sensor shall be installed according to the supplier's instruction.

☞ Always consult KOMOTO if it proves difficult to follow these instructions.

1.4 Thermowell sleeve

To keep the thermowell absolutely dry, even if the spray water has not evaporated completely, a Protective thermowell sleeve can be used.

KOMOTO has developed a Protective thermowell sleeve, which has been proven to provide protection against water particles as well as a representative steam temperature measurement without any significantly longer response time.

The benefit with a Protective thermowell sleeve is that the distance from the water injection nozzle to the thermowell can be decreased.

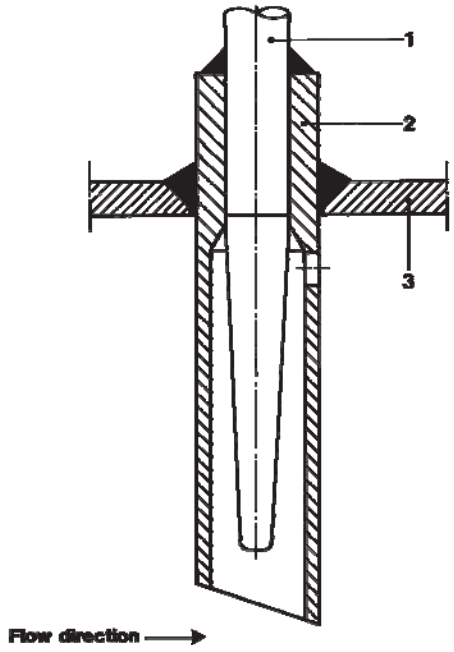

Fig 4 Thermowell sleeve < 1. Thermowell 2. Sleeve 3. Pipe wall >

1.5 Downstream Piping Material

We recommend you to use 6 m/19 ft of downstream piping in low alloy material when the steam temperature before cooling is > 400°C /750°F.

1.6 Drains

It is essential to keep free water out of the steam system.
The main sources for free water are:

- Condensate build-up. E.g., during start-up and pressurizing of the system.
- Excessive spray water injection. E.g., leaking spray water valves, or a not functioning temperature control system.

☞ Free water in the steam system causes noise, mechanical damage and makes temperature measurement difficult.

The desuperheater performs an important function in the steam system, it is therefore essential to protect the downstream system from damages caused by a malfunctioning temperature control system. Therefore, it is necessary to have drains downstream the desuperheater.

The following are examples of drain arrangements for different piping arrangements.

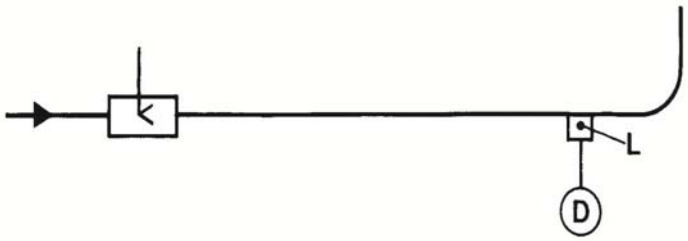

Fig 5 Desuperheater installed in a horizontal pipe
L Drip leg (or drainpot)
D Drainage system

Fig 6 Desuperheater installed in a vertical flow-down pipe

☞ Note: This installation is not recommended.

Preferred installations are acc.
to figs 11 and 13.

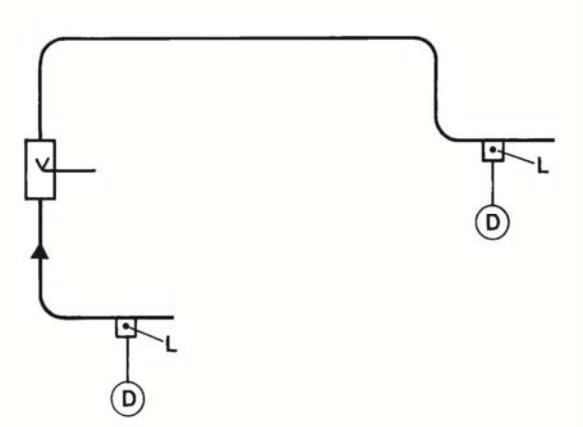

Fig 7 Desuperheater installed in a vertical flow-up pipe

L Dripleg (or drainpot)
D Drainage system

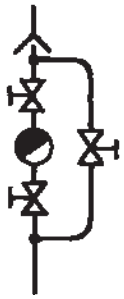

Fig 8 Drainage system

The dripleg shall have a diameter of 0.5 x pipe diameter. The height of the dripleg shall be between 300 and 600 mm /1 - 2 ft.

1.7 Liner

In most applications liners are not necessary. However, in some cases liners are beneficial and improve both performance and lifetime of the piping.

Examples of applications where liners are recommended:

- System turndown requires increased steam velocity at the water injection point. See section 1.3.
- Boiler applications
- When the temperature difference between the uncooled steam and the spray water is more than 250°C/450°F.

2 Temperature Control System

A desuperheater cools superheated steam by injecting water.
The desuperheater is specially designed to create a spray pattern that will ensure fastest possible evaporation of the injected water.

When designing a control system it is important to understand that the desuperheater is the tool that executes the actual water injection for the temperature reduction.

The temperature controller gives the input to the desuperheater (or the spray water valve) on how much to open or close. The desuperheaters only do what they are told to do. I.e. the temperature control loop must operate correctly in order for the desuperheater to achieve the desired temperature reduction.

A successful temperature control system is a result of several considerations:

- A closed loop control system shall be used, only when the downstream temperature can be accurately measured and used for feedback.
- A feed forward control system shall be used when accurate temperature measurements can't be made.
- Temperature measurements must only be made in a location where all injected water has evaporated, and the steam is absolutely dry.
- The temperature at the measuring point shall be at least 5°C/9°F above saturation temperature to be able to control the temperature.
- Turndown requirement and capability of desuperheater and spray water valves.
- Available spray water pressure and temperature.
- The piping arrangement must allow for required straight run and distance to the temperature sensor.
- Piping arrangement must allow for proper draining in case of malfunction of temperature control system.
- An interlock shall be used, so the desuperheater and the spray water valve automatically will close if and when the steam flow in the pipe stops.
- If possible – avoid using a separate pressure reducing valve upstream the spray water valve in case of high spray water pressure. If you must use it – p nozzle 40 bar/60 psi – take great care in designing the control system and consider the response times in different control loops.
- Prevent particles in the water from damaging the valve or nozzles by installing a strainer upstream the spray water control valve in the

spray water supply line.

☞ Max acceptable particle size is 100 - 200 microns, depending on type of spray water nozzle used.

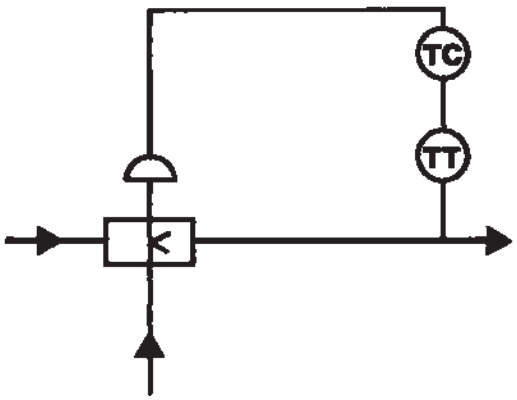

Fig 9 Feedback control – example

TC Temp. Contr.
TT Temp. Transmitter

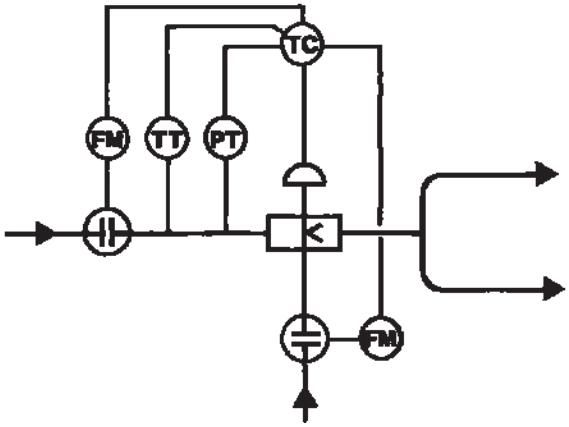

Fig 10 Feed forward control – example

FM Flow meter
PT Pressure transmitter

3 Vibration and Noise

There are normally very few problems regarding vibration and noise caused by the desuperheater. Do, however, consider the following in respect of the water piping to the desuperheater:

- The inlet piping shall have a straight run of at least 6 x inlet diameter. A bend that is closer to the inlet must have a radius of at least 5 x inlet diameter – see also section 2.
- Avoid S-bends and other multi-elbow arrangements in different projections close to the desuperheater.
- The water velocity must not exceed 5 m/s (16 ft/sec) in the piping system. 3 m/s (9 ft/sec) is recommended for normal operating condition.

4 Fixpoints

The piping system must be so designed that the desuperheaters and spray water valves will not be used as a fixpoint.

5 Accessibility

Space must be provided for service and maintenance of the desuperheater. If it is installed in a pipe rack or other location that is difficult to reach, you need to provide a platform around the desuperheater as well as a safe route to it. The platform shall be sufficiently large to accept a minimum of two persons and temporary storage of desuperheater internals.

☞ Consider also the transport of heavy spares.

A bracket or other arrangement for a lifting device shall also be available. The capacity shall be at least 100 kg/220

KOREA : KOREA MOTOYAMA INC.

448-331 Hakwoon-ri, Yangchon-Eup,

Kimpo City, Kyunggi-Do,Korea

Tel : 82-32-568-2745

Fax : 82-2-2636-2793

E-mail : info@komoto.co.kr

Web : http://www.komoto.co.kr

JAPAN : MOTOYAMA INC.

14-26, 1-Chome, Haginaka,

Ohtaku, Tokyo, Japan

Tel : 81-03-3732-3696

Fax : 81-03-3738-9371