

Bulletin for Yarway™ AT-38/48 Standard Duty A.T.-Temp Desuperheater

This bulletin was prepared by Emerson.

Do not install, operate or maintain this product 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 of the contents of this manual, including all safety cautions and warnings.

If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations. Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

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 on the product 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 specified 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 .

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. 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.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Safely vent the power actuator loading pressure.
- Use lock-out procedures to be sure the above measures stay in effect with you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even with the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

CAUTION

When adjusting the travel stop for the closed position of the valve ball or disk, refer to the appropriate valve instruction manual for detailed procedures. Undertravel or overtravel at the closed position may result in poor valve performance and/or damage to the equipment .

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Emerson Automation Solutions
Marshalltown, Iowa 50158 USA
Sorocaba, 18087 Brazil
Cernay, 68700 France
Dubai, United Arab Emirates
Singapore 128461 Singapore

www.Fisher.com





YARWAY MODEL AT 38/48
STANDARD DUTY A.T.-TEMP DESUPERHEATER



FEATURES

- Fabricated construction
- High quality stuffing box,
- Variable nozzle type
- Wide range of C_v (K_v) capacities available
- Special nozzle combinations available
- Non/semi balanced internals for economic actuator selection
- Pressure rating
 - ASME B16.34 Class 150 to 1500
 - EN 1092-1 PN 25 to 250
- Materials
 - ASTM SA 105 / SA 106 Gr.B or SA 182 F11 / SA 335 P11
 - 1.0460 / 1.0345 or 1.7335
 - Other materials upon request

GENERAL APPLICATION

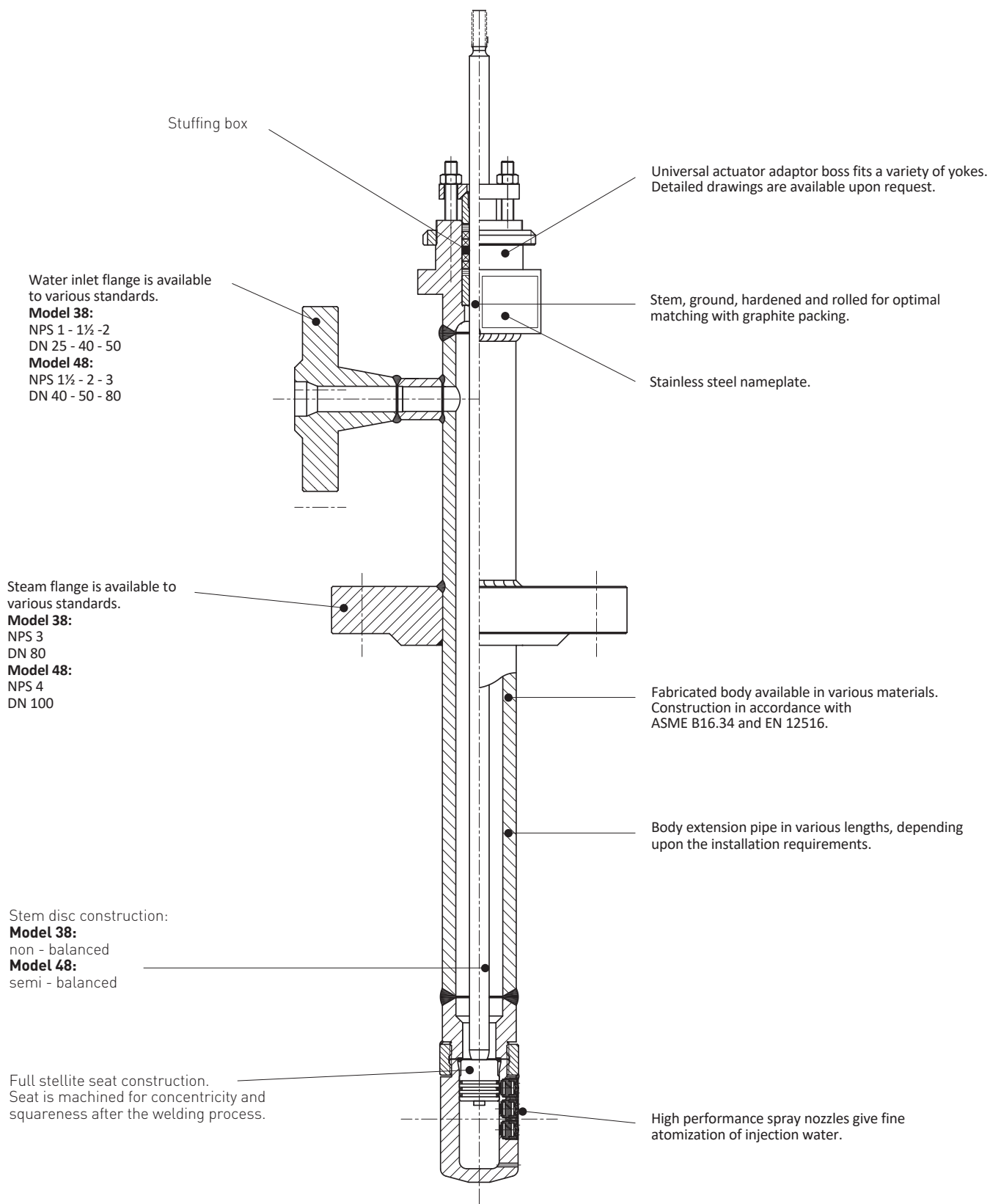
- Cooling of process steam or gas
- Boiler superheater
- Boiler reheater
- Turbine bleed steam
- Pressure reducing valve

TECHNICAL DATA

- AT 38 Steam NPS 3 / DN 80
Water NPS 1 - 1½ / DN 25 - 40
- AT 48 Steam NPS 4 / DN 100
Water NPS 1½ - 2 - 3 / DN 40 - 50 - 80

YARWAY MODEL AT 38/48
STANDARD DUTY A.T.-TEMP DESUPERHEATER

FIGURE 1



YARWAY MODEL AT 38/48

STANDARD DUTY A.T.-TEMP DESUPERHEATER

The Standard Duty A.T.-Temp Desuperheater is specifically developed for use on medium / low pressure steam applications.

The fabricated construction makes it easy adaptable to meet various boiler codes and material specifications.

The unit can also be used as a liquid into gas injector for which high grade alloy such as stainless steel is often used.

The vital trim components are identical to those used in Heavy Duty A.T.-Temp Desuperheater. More than 3800 units of both Heavy - and Standard Duty A.T.-Temp Desuperheaters are in service today.

The valve stem is rolled to obtain a smooth finish. This highly finished surface is then nitrided to give a hardness of > 1000 Vickers. The combination of these processes improves sealing tightness, whilst reducing packing friction.

Piston rings are specially hardened and subsequently nitrided and are provided with a special gas tight slot.

These rings offer excellent running properties and enable controllable C_v (K_v) values as low as 0.005 (0.0043).

SYSTEM COMPARISON

Conventional

Conventional injection water systems consist of:

- Fixed size spray nozzle
- Control valve
- Steam pipe section

The water injection quantity is regulated by the control valve. As a consequence of this flow regulation the downstream water pressure P2, varies as a function of the valve plug position. At reduced capacity the control valve starts to throttle, reducing P2 and hence the available water to steam ' Δp ', resulting in larger droplet size and poor atomization. The water evaporation rate slows down and temperature control becomes troublesome.

This typical system problem becomes compounded as nozzles and valves are usually sized for the design capacity but normally operate significantly below these design conditions. This oversizing results in a partially open control valve, even at normal operating conditions.

With reducing load, downstream water pressure P2 decays rapidly resulting in larger droplet size. Conventional systems therefore will work satisfactorily only at relatively steady load conditions.

A.T.-Temp Desuperheater

The A.T.-Temp Desuperheater valve regulates the amount of injection water by varying the number of injection nozzles. This enables the water pressure to remain constant, independently of the number of injection nozzles in operation.

This results in an excellent and near uniform spray quality over the entire operating range. Control of nozzle opening is achieved by the positioning of a piston which is operated directly by an actuator mounted onto the valve.

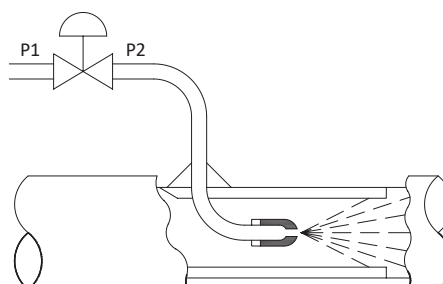
Through this simple design, there is no separate water control valve necessary.

APPLICATIONS

Yarway A.T.-Temp Desuperheaters are used for temperature control of:

- Boiler superheaters
- Boiler reheaters
- Turbine bleed steam
- Pressure reducing valve outlet steam
- Process steam
- Process gases

FIGURE 2



YARWAY MODEL AT 38/48

STANDARD DUTY A.T.-TEMP DESUPERHEATER

SUPERIOR SPRAY NOZZLE

Yarway has incorporated the latest technology in the spray nozzle design.

The high quality surface finish minimizes frictional losses, thereby ensuring that the total water to steam Δp is available for atomization of the water (see Fig. 4).

The nozzle consists of two components

A) the orifices and B) the nozzle body.

Each nozzle is served by individual feed holes in the cylinder wall. Water enters the chamber behind the orifice plate through these openings. The relatively large volume of this chamber ensures that water is proportioned evenly through each orifice.

The Δp across this orifice plate results in an increase in the fluid velocity. The water is subsequently rotated in the nozzle chamber before being emitted through the central hole. The combination of splitting the feed flow, increasing velocity and rotating effect, ensures that the water is injected into the system in a fine symmetrical hollow cone spray.

The nozzles are assembled with the spray cylinder and sealed by a vacuum brazing process. This maintains the integrity of these components even under the most extreme conditions.

Material compatibility of spray cylinder, piston and piston rings is well proven in hot/cold service conditions, as typically found in steam attemperators. This enables reliable operation over an extended period.

Surfaces are finely machined to reduce frictional losses and internal contours are so designed as to optimize water swirl action, ensuring uniform and consistent droplet size.

Minimum Δp available from the A.T.-Temp Desuperheater inlet flange to steam pressure must be:

Nozzles A through D: 1 bar

Nozzles E through K: 2 bar

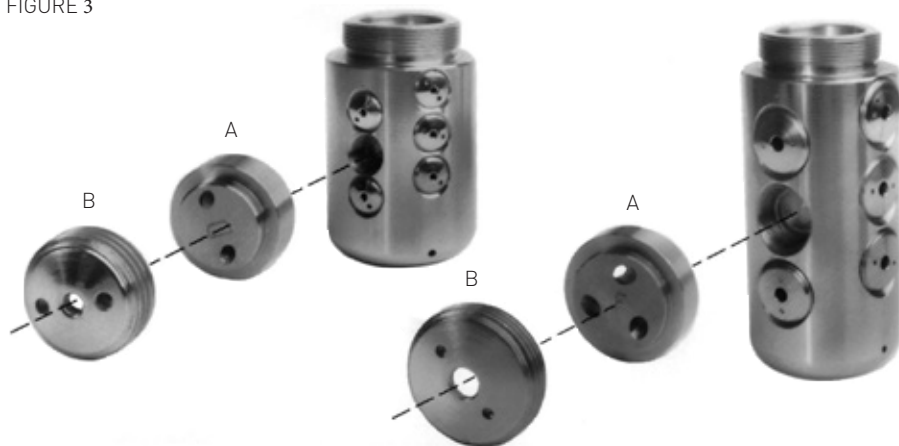
CODES AND STANDARDS

The A.T.-Temp Desuperheater is designed and manufactured to meet a wide variety of international codes and standards.

Certified acceptance documents are available upon request.

If special codes or standards are required by your local authority, then we would be pleased to discuss them.

FIGURE 3



MULTIPLE NOZZLE HEADS

The A.T.-Temp Desuperheater may be equipped with a variety of spray heads.

The uniform body threading accepts spray cylinder heads with a wide range of C_v (K_v) values.

Standard configurations are with either 6 or 9 equally sized spray nozzles but combinations are available.

This feature enables the A.T.-Temp Desuperheater to be customized to specific system requirements. Consult your local representative for details at www.emerson.com

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STANDARD DUTY A.T.-TEMP DESUPERHEATER

A.T.-Temp standard capacity range

| Type Number | Nozzle Configuration | Max Kv | Max Cv |
|-------------|-------------------------|---------|---------|
| 1 | 6A | 0,0648 | 0,0749 |
| 2 | 4A-2B | 0,0888 | 0,1027 |
| 3 | 2A-3B-1C | 0,1338 | 0,1547 |
| 4 | 1A-2B-3C | 0,1878 | 0,2171 |
| 5 | 1A-2B-1C-2D | 0,2686 | 0,3105 |
| 6 | 1A-1B-2C-1D-1Dx | 0,3721 | 0,4302 |
| 7 | 1A-2B-3C-1D-1Dx-1D | 0,5229 | 0,6045 |
| 8 | 3B-2C-1D-3Dx | 0,7403 | 0,8558 |
| 9 | 1C-2D-1Dx-2D-3Dx | 1,0474 | 1,2109 |
| 10 | 9Dx | 1,5003 | 1,7345 |
| 11 | 1B-1C-1D-1Dx-1E-1F | 0,9988 | 1,1547 |
| 12 | 1C-1D-1Dx-1E-2F | 1,3840 | 1,6000 |
| 13 | 1C-1D-1Dx-1E-2G | 2,3014 | 2,6606 |
| 14 | 1C-1D-1E-1F-1G-1H | 3,0260 | 3,4983 |
| 15 | 1D-1Dx-2F-1H-1K | 4,3549 | 5,0346 |
| 16 | 2D-1E-1G-1E-1F-1K-1H-1G | 6,1444 | 7,1034 |
| 17 | 1E-2Dx-1H-2F-3K | 8,5867 | 9,9268 |
| 18 | 1G-1F-1G-1K-2H-3K | 12,5934 | 14,5588 |
| 19 | 9K | 17,4420 | 20,1642 |

Definition

$$K_V = Q \sqrt{\frac{S.G}{\Delta p}}$$

Q = m³/hr
S.G. = kg/dm³
ΔP = bar

Flow capacity limitations are:

- Model 38 with a maximum water flow capacity of 25 m³/hr. in continuous service.
- Model 48 with a maximum water flow capacity of 50 m³/hr. in continuous service.

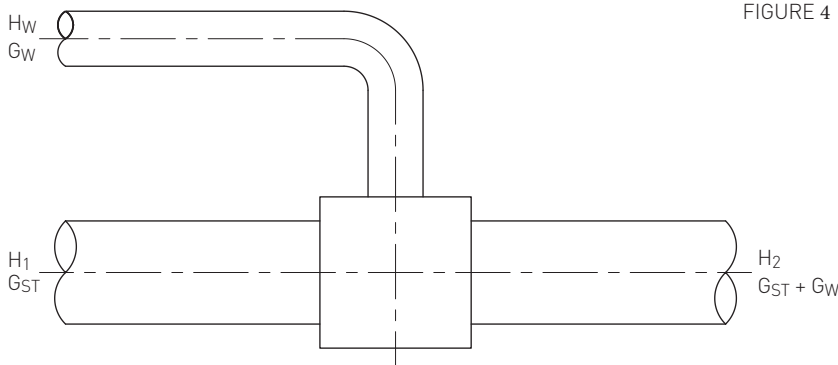


FIGURE 4

SIZING FORMULA

Every desuperheating station is a mixing point where there is a heat and mass balance. The universal formula is:

$$G_W = G_{ST} (H_1 - H_2) : (H_2 - H_W)$$

In which:

- G_W** = Injection water mass
- G_{ST}** = Inlet steam mass
- H₁** = Enthalpy of the inlet steam
- H₂** = Enthalpy of the outlet steam
- H_W** = Enthalpy of the injection water

This formula enables calculation of the quantity of water required to lower the inlet steam temperature to the set - point temperature of the outlet steam.

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STANDARD DUTY A.T.-TEMP DESUPERHEATER

IMPORTANT SYSTEM PARAMETERS

Apart from the spray quality of the atomizer (primary atomization) there are other system parameters which influence the Desuperheater stations performance. These are:

Inlet steam velocity

At high steam velocities, water droplets are easily disintegrated. This factor contributes to the overall atomization quality (secondary atomization). The minimum acceptable steam velocity varies as a function of the nozzle size and pipe diameter. In case of doubt, consult Yarway.

Water to steam ratio

This ratio is determined by dividing G_W by G_{ST} . For system steam pressures below 15 bar, this ratio should not exceed 10% for the normal operating conditions. Systems operating between 15 and 25 bar can have a ratio of up to 15%. For higher pressure duties, consult Yarway.

Distance to sensor

The distance from the injection point to the temperature sensor should be 12 to 15 meters. Systems operating at pressures above 25 bar can have significantly less run to the sensor, consult Yarway.

Required straight pipe run

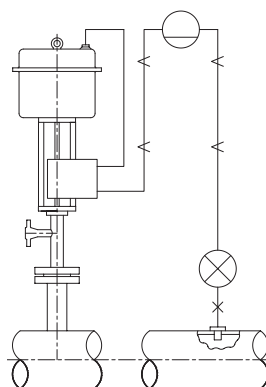
The distance from injection point to the first pipe bend is also a function of steam pressure, temperature and nozzle size. Experience has shown that in systems up to 25 bar, 4 to 6 meters, is an acceptable distance.

ACTUATORS

Control systems

The injection water quantity is controlled as a function of the outlet steam temperature. The A.T.-Temp Desuperheater actuation is compatible with conventional control systems operated from temperature transmitters, temperature indicating controllers and positioners. Fully pneumatic or fully electric systems are compatible and also combinations of the two. Exact requirements should be specified in the ordering/sizing data paragraph of this brochure.

FIGURE 5



ACTUATOR STEM FORCES

The stem forces for the Standard Duty A.T.-Temp Desuperheater are determined by the following formula:

Model 38: $P_{\text{water}} \times 62 + 1000 = \text{Newton}$ (P_{water} in bar)

The maximum stem force must be limited to 15 kN.

Model 48: $P_{\text{water}} \times 68 + 1250 = \text{Newton}$ (P_{water} in bar)

The maximum stem force must be limited to 50 kN.

Special care should be taken when electric actuators are used. By their momenta of inertia these actuators can generate stem forces exceeding the specified nominal force during short intervals. Special spring loaded couplings are supplied for such applications.

Actuator sizing formula

Units:

D seat in cm

d stem in cm

D bal in cm

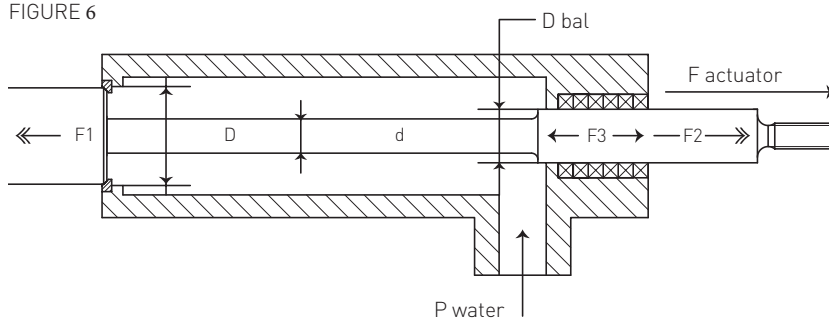
P water in bar

$$F1 = \pi / 4 (D_{\text{seat}}^2 - d_{\text{stem}}^2) \times P_{\text{water}}$$

$$F2 = \pi / 4 (D_{\text{bal}}^2 - d_{\text{stem}}^2) \times P_{\text{water}}$$

$$F3 = F_{\text{friction}} (+ \text{ or } -).$$

FIGURE 6



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STANDARD DUTY A.T.-TEMP DESUPERHEATER

ORDERING / SIZING DATA

Steam Desuperheaters are selected specifically against application data. For optimal sizing, the following comprehensive data should always be supplied.

Steam data

| | |
|--------------------|-------------|
| Inlet pressure | bar |
| Inlet temperature | °C |
| Outlet temperature | °C setpoint |
| Steam flow max. | t / hr |
| Steam flow normal | t / hr |
| Steam flow min. | t / hr |

Water data

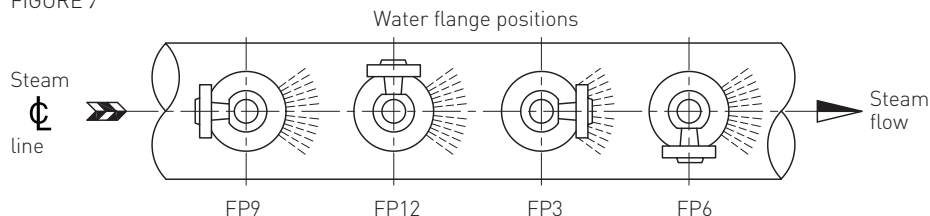
| | |
|-------------------|-----|
| Water pressure | bar |
| Water temperature | °C |

General

| | |
|---|---|
| Pipe size | mm |
| Pipe schedule | |
| Required water flange position | (9) (12) (3) (6) |
| It is essential not to over specify the required turndown ratio i.e.: | $\frac{\text{Steam flow max.}}{\text{Steam flow min.}}$ |

Otherwise this will necessitate selection of special nozzle heads which are non - stock items. Standard stock consists of nozzles with 6 or 9 equally sized atomizers giving turndown ratios of 18:1 and 27:1 respectively, on the water flow control. Experience shows that the majority of applications fall within this range.

FIGURE 7



Spray water must be injected in the direction of the steam flow. To facilitate installation of the water supply line, 4 different spray head positions are available in relation to the water connecting flange. Specification of this spray head orientation is required with the ordering data.

Yarway always recommends a strainer with a mesh size of approx. 100 μ (400 μ upon request) in the water supply line to protect the A.T.-Temp Desuperheater from clogging.

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STANDARD DUTY A.T.-TEMP DESUPERHEATER

TABLE 1 - STANDARD MATERIALS

| Item | Name | ASME | EN |
|------|-----------------------|------------------------------------|--------------------------|
| 1+2 | Spray Cylinder/Nozzle | S41000/S41000 | 1.4006/1.4006 |
| | | S41000/Alloy 6 | S41000/Alloy 6 |
| 3 | Piston ring | S43100 (1) | 1.4057 (1) |
| 4 | Piston | S43100 (1) | 1.4057 (1) |
| 5 | Fastener ring | SA182 F11 Class 2 | 1.4057 (1) |
| 7 | Stem | S43100 (1) | 1.4057 (1) |
| 8 | Seat housing | SA 105/Alloy 6 or 17% Cr | 1.0460/Alloy 6 or 17% Cr |
| | | SA182 F11 Class2/Alloy 6 or 17% Cr | 1.0460/Alloy 6 or 17% Cr |
| 9 | Body pipe | SA106 Grade B | 1.0345 |
| | | SA335 P11 | 1.7335 |
| 10 | Water flange | SA105 | 1.0460 |
| | | SA182 F11 Class 2 | 1.7335 |
| 11 | Adaptor | SA106 Grade B | 1.0345 |
| | | SA335-P11 | 1.7335 |
| 12 | Packing Box Ring | S43100 (1) | 1.4057 (1) |
| 13 | Packing box | SA105 | 1.0460 |
| | | SA182 F11 Class2 | 1.7335 |
| 14 | Nut, Hex | SA194 GR7 (4) | SA194 GR7 (4) |
| 15 | Packing set | GRAPHITE K80/K80S | GRAPHITE K80/K80S |
| 16 | Stud Bolt | SA193 GR B16 (4) | SA193 GR B16 (4) |
| 17 | Packing Follower | S43100 (1) | 1.4057 (1) |
| 18 | Packing Flange | S30400 | 1.4301 |
| 19 | Name plate | SST | SST |
| 20 | Yoke Locknut | SA105 (3) | SA105 (3) |
| 23 | Securing Washer | CARBON STEEL (2) | CARBON STEEL (2) |
| 24 | Body flange | SA105 | 1.0460 |
| | | SA182 F11 Class2 | 1.7335 |

NOTE

- (1) Nitrided
- (2) Zinc plated
- (3) NCF
- (4) ENC

Certification

A.T.-Temp Desuperheaters comply with the requirements of ASME B16.34 and EN 12516.

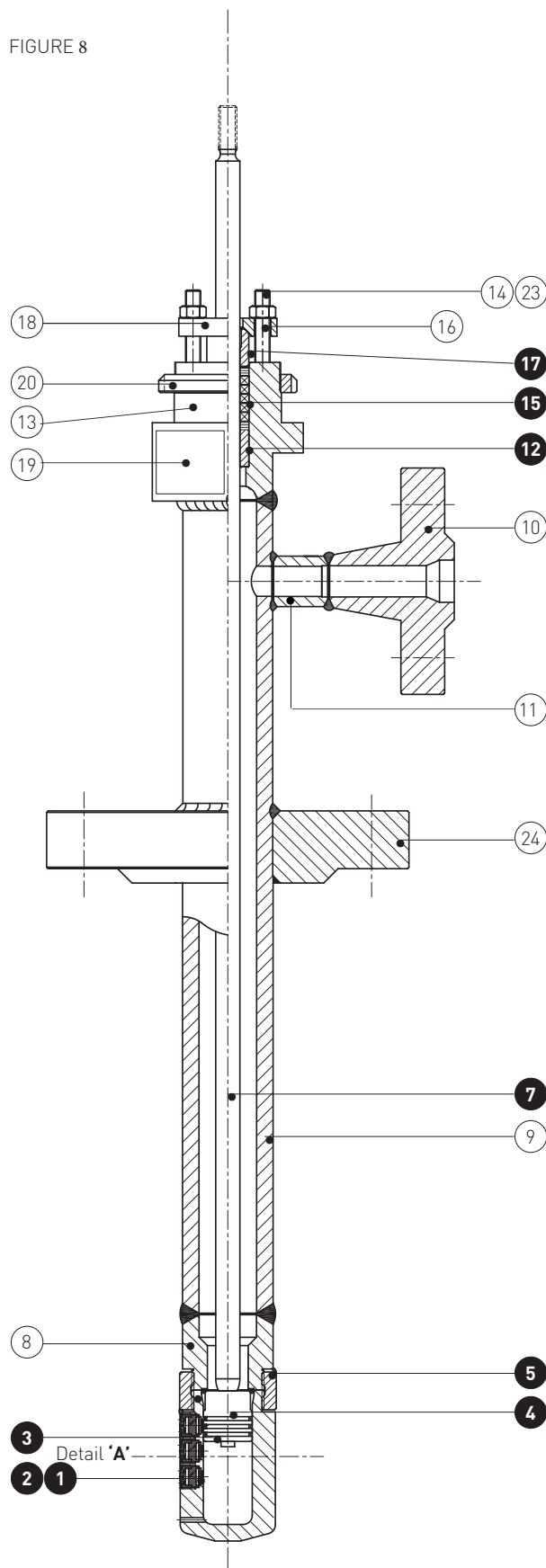
All data subject to changes.

Other materials are available upon request.

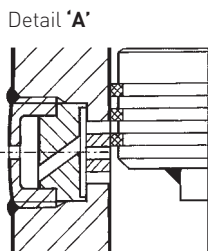
Materials and data of units supplied, may deviate from this brochure.

Please consult order documents in case of doubt.

FIGURE 8



● Recommended spares



YARWAY MODEL AT 38/48

STANDARD DUTY A.T.-TEMP DESUPERHEATER

TABLE 2 - DIMENSIONS (mm)

| | Model 38 Qmax = 25 m ³ / hr. Standard length for steam line sizes up to 12" (DN 300) | Model 48 Qmax = 50 m ³ / hr. |
|---|---|--|
| A | 55 mm travel 90 mm travel | 380 399 |
| B | 55 mm travel 90 mm travel | 436 476 |
| Option: standard length for steam line sizes 14" (DN 350) and higher | | |
| A | 55 mm travel 90 mm travel | 580 599 |
| B | 55 mm travel 90 mm travel | 636 676 |
| C | 200 | 200 |
| D | 290 | 380 |
| E | 300 | 300 |
| F | 108 | 108 |
| G | M16 X 2.00 | M16 x 2.00 |
| K | 3 9/16" Yoke Boss | 3 9/16" Yoke Boss |
| L | See table 2-1 | See table 2-2 |
| M | min. 68.0 | min. 80.0 |
| N | 60.3 x 11.1 | 73.0 x 14.0 |
| P | 64.0 | 78.0 |

STROKE

55 mm travel - Minimum pipeline diameter 6"
90 mm travel - Minimum pipeline diameter 8"

TABLE 2-1 DIMENSIONS (mm)

| | PN25/40 | PN63 | PN100 | PN160 | PN250 |
|----------------|--------------|--------------|--------------|--------------|---------------|
| DN 25 | 150 | 150 | 150 | 150 | 150 |
| DN 40 | 150 | 150 | 150 | 150 | 150 |
| DN 50 | 150 | 150 | 150 | 150 | 150 |
| L (mm) AT38 | CL150 | CL300 | CL600 | CL900 | CL1500 |
| NPS 1 | 150 | 150 | 150 | 150 | 150 |
| NPS 1-1/2 | 150 | 150 | 150 | 150 | 150 |
| NPS 2 | 150 | 150 | 150 | 200 | 200 |

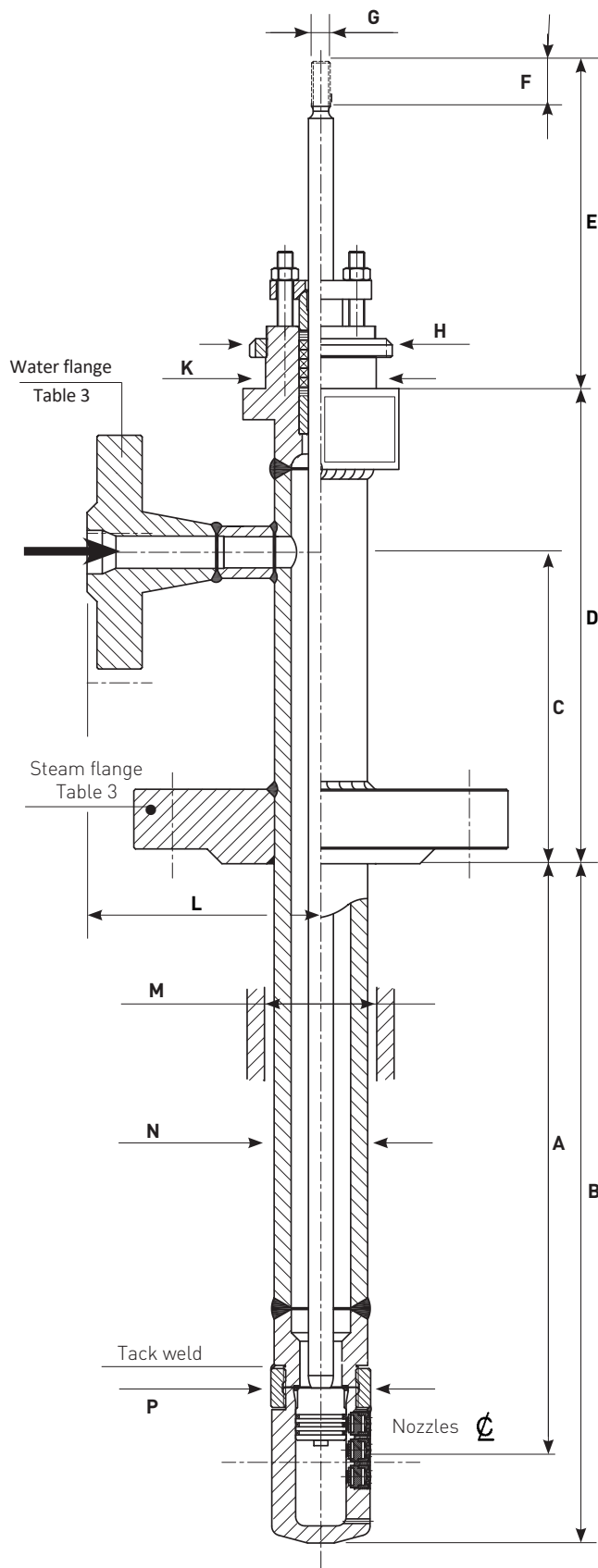
TABLE 2-2 DIMENSIONS (mm)

| | PN25/40 | PN63 | PN100 | PN160 | PN250 |
|----------------|--------------|--------------|--------------|--------------|---------------|
| DN 40 | 150 | 150 | 150 | 150 | 150 |
| DN 50 | 150 | 150 | 150 | 150 | 200 |
| DN 80 | 150 | 200 | 200 | 200 | 250 |
| L (mm) AT48 | CL150 | CL300 | CL600 | CL900 | CL1500 |
| NPS 1-1/2 | 150 | 150 | 150 | 200 | 200 |
| NPS 2 | 150 | 150 | 150 | 250 | 250 |
| NPS 3 | 200 | 200 | 200 | 250 | 250 |

TABLE 3 - FLANGE CONNECTIONS

| | Model 38 Qmax = 25 m ³ / hr. | Model 48 Qmax = 50 m ³ / hr. |
|--------------|--|--|
| Steam flange | NPS 3 Class 150 through 1500 | NPS 4 Class 150 through 1500 |
| | DN 80 PN 25 through 250 | DN 100 PN 25/40 PN 25 through 250 |
| Water flange | NPS 1 - 1½ - 2 Class 150 through 1500 | NPS 1½ - 2 - 3 Class 150 through 1500 |
| | DN 25- 40 - 50 PN 25 through 250 | DN 40 - 50 - 80 PN 25 through 250 |

FIGURE 9



YARWAY MODEL AT 38/48
STANDARD DUTY A.T.-TEMP DESUPERHEATER

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