Narvik-Yarway covers requirements for Desuperheaters, pneumatic actuators, strainers with a wide range of models, sizes and materials to satisfy all the specifications of the power-pulp & paper industry and process gas applications.

**Features**
- Forged construction
- High quality stuffing box, containing no asbestos
- Variable nozzle type
- Wide range of \( C_v (K_v) \) capacities available
- Special nozzle combinations available
- Semi balanced internals for economic actuator selection
- ‘Narvik’ pneumatic actuator available
- Pressure class and connections:
  - ASME B16.34 class 900 to 2500
  - EN 1092 PN 160 - 400
- Materials
  - ASTM SA 182 F22 or 1.7383
  - ASTM SA 182 F347H or 1.4550
  - ASTM SA 182 F91 or 1.4903
  - Other materials upon request

**Technical data**
- **Size**
  - Steam 3" (DN 80)
  - Water 1"-1½" (DN 25-40)
  - Steam 4" (DN 100)
  - Water 1½"-2"-3" (DN 40-50-80)

**General application**
- Cooling of process steam or gas,
- Boiler superheater,
- Boiler reheater,
- Turbine bleed steam and
- Pressure reducing valve

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Universal actuator adaptor boss fits a variety of yokes. Detailed drawings are available upon request.

Stem, ground, hardened and rolled for optimal matching with graphite packing.

Symmetrical body forging in various materials. Construction in accordance with ASME B16.34 and EN. CE-marking, if required.

Fig. 1
The Narvik-Yarway Heavy Duty A.T. - Temp Desuperheater is specifically developed for use on medium / high 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 Narvik-Yarway Standard 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 finish of Ra < 0,1 µ. 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. Improvement of their performance is realized by applying Venturi type pipeline sections. Narvik-Yarway has for such conditions, a Venturi type Desuperheater available and more information is contained in a separate brochure.

**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**

Narvik-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.
Superior spray nozzle

Narvik-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 Dx : 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.

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 Cv (Kv) 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 Narvik-Yarway or your local representative for details.
Heavy Duty A.T. - Temp Desuperheater
Model: 18/54 and 28/64

**Definition**

\[ K_v = Q \sqrt{\frac{\text{S.G.}}{\Delta p}} \]

- \( Q = \text{m}^3/\text{hr.} \)
- \( \text{S.G.} = \text{kg/dm}^3 \)
- \( \Delta p = \text{bar} \)

**Table: A.T. - Temp standard capacity range:**

<table>
<thead>
<tr>
<th>Size</th>
<th>( C_v )</th>
<th>( K_v )</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>0.0752</td>
<td>0.0648</td>
</tr>
<tr>
<td>6A</td>
<td>0.0752</td>
<td>0.0648</td>
</tr>
<tr>
<td>6B</td>
<td>0.1587</td>
<td>0.1368</td>
</tr>
<tr>
<td>6C</td>
<td>0.3007</td>
<td>0.2592</td>
</tr>
<tr>
<td>6D</td>
<td>0.5860</td>
<td>0.5052</td>
</tr>
<tr>
<td>6Ex</td>
<td>1.1602</td>
<td>1.0002</td>
</tr>
<tr>
<td>6E</td>
<td>1.9002</td>
<td>1.6398</td>
</tr>
<tr>
<td>6F</td>
<td>2.8397</td>
<td>2.4480</td>
</tr>
<tr>
<td>6G</td>
<td>6.0322</td>
<td>5.2002</td>
</tr>
<tr>
<td>6H</td>
<td>9.3960</td>
<td>8.1000</td>
</tr>
<tr>
<td>6K</td>
<td>13.4885</td>
<td>11.6280</td>
</tr>
<tr>
<td>9A</td>
<td>0.1128</td>
<td>0.0972</td>
</tr>
<tr>
<td>9B</td>
<td>0.2380</td>
<td>0.2052</td>
</tr>
<tr>
<td>9C</td>
<td>0.4510</td>
<td>0.3898</td>
</tr>
<tr>
<td>9D</td>
<td>0.8790</td>
<td>0.7578</td>
</tr>
<tr>
<td>9Dx</td>
<td>1.7403</td>
<td>1.5003</td>
</tr>
<tr>
<td>9E</td>
<td>2.8533</td>
<td>2.4557</td>
</tr>
<tr>
<td>9F</td>
<td>4.2595</td>
<td>3.6720</td>
</tr>
<tr>
<td>9G</td>
<td>9.0483</td>
<td>7.8003</td>
</tr>
<tr>
<td>9H</td>
<td>14.0940</td>
<td>12.1500</td>
</tr>
<tr>
<td>9K</td>
<td>20.2327</td>
<td>17.4420</td>
</tr>
</tbody>
</table>

Flow capacity limitations are:
- Model 18/54 with a maximum water flow capacity of 25 m\(^3\)/hr. in continuous service.
- Model 28/64 with a maximum water flow capacity of 50 m\(^3\)/hr. in continuous service.

**Fig. 5**

Every Desuperheating station is a mixing point where there is a heat and mass balance.

The universal formula is:

\[ G_w = \frac{\text{Gst} \cdot (h_1-h_2)}{(h_2-hw)} \]

In which:

- \( G_w \) = Injection water mass
- \( \text{Gst} \) = Inlet steam mass
- \( h_1 \) = Enthalpy of the inlet steam
- \( h_2 \) = Enthalpy of the outlet steam
- \( hw \) = Enthalpy of the injection water

**Sizing formula**

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.

**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 Narvik-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 Narvik-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

Pneumatic diaphragm
The Narvik-Yarway Pneumatic actuators are specifically developed for their own manufactured Desuperheaters for use on low-, medium- and high pressure steam applications. The actuator models: 20-55 for a stroke of 55 mm and 20-90 for a stroke of 90 mm are suitable for operation under severe environmental conditions, e.g. at low or high temperatures or humidities. The actuator sets the valve in the closed position in the event of air failure. Other proprietary makes, and/or ‘failsafe’ requirements are available upon request. Valve positioners are available in pneumatic or electro-pneumatic operation, depending upon customer preference. Additional options are, for example, feedback transmitters and limit switches.

Electric actuators
Because of the adapted trim construction the A.T. Temp Desuperheater can be equipped with ‘low-thrust’ electric actuators.

Each actuator - valve assembly is fully function tested at the Narvik-Yarway factory. A functional test certificate is issued for all valves supplied.

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.
Actuator sizing formula

Units:

- D seat in cm
- d stem in cm
- D bal in cm
- P water in bar

\[
F_1 = \frac{\pi}{4} (D_{\text{seat}}^2 - d_{\text{stem}}^2) \times P_{\text{water}}
\]

\[
F_2 = \frac{\pi}{4} (D_{\text{bal}}^2 - d_{\text{stem}}^2) \times P_{\text{water}}
\]

\[
F_3 = P_{\text{water}} \times F_{\text{friction}} (+ \text{ or } -)
\]

Actuator stem forces

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

Model 18/54:

\[P_{\text{water}} \times 36 + 1000 = \text{Newton (P water in bar)}\]

The maximum stem force must be limited to 15 kN.

Model 28/64:

\[P_{\text{water}} \times 68 + 1250 = \text{Newton (P water in bar)}\]

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 stem force during short intervals. Narvik-Yarway supplies special spring loaded couplings for such applications.

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
- 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 waterflange position (9) (12) (3) (6)

It is essential not to over specify the required turndown ratio i.e.:

Steam flow max.
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.

Water flange positions

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.

Narvik-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.
Table 1 - Standard materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Standard</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 + 2</td>
<td>Spray nozzle assembly</td>
<td>AISI 410</td>
<td>1.4006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inconel 718</td>
<td>Inconel 718</td>
</tr>
<tr>
<td>3</td>
<td>Piston ring</td>
<td>AISI 431 *</td>
<td>1.4057 *</td>
</tr>
<tr>
<td>4</td>
<td>Piston</td>
<td>AISI 431 *</td>
<td>1.4057 *</td>
</tr>
<tr>
<td>5</td>
<td>Fastener ring</td>
<td>SA182 F11</td>
<td>1.7335</td>
</tr>
<tr>
<td>6</td>
<td>Seat</td>
<td>Stellite 6</td>
<td>Stellite 6</td>
</tr>
<tr>
<td>7</td>
<td>Stem</td>
<td>AISI 431 *</td>
<td>1.4057 *</td>
</tr>
<tr>
<td>9</td>
<td>Body</td>
<td>SA182 F22</td>
<td>1.7383</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SA182 F347H</td>
<td>1.4550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SA182 F91</td>
<td>1.4903</td>
</tr>
<tr>
<td>10</td>
<td>Water flange</td>
<td>SA182 F22</td>
<td>1.7383</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SA182 F347H</td>
<td>1.4550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SA182 F91</td>
<td>1.4903</td>
</tr>
<tr>
<td>12</td>
<td>Spacer</td>
<td>AISI 431 *</td>
<td>1.4057 *</td>
</tr>
<tr>
<td>14</td>
<td>Nut</td>
<td>A194 4H</td>
<td>1.4923</td>
</tr>
<tr>
<td>15</td>
<td>Packing set</td>
<td>Graphite</td>
<td>Graphite</td>
</tr>
<tr>
<td>16</td>
<td>Stud</td>
<td>A193 B16</td>
<td>1.4923</td>
</tr>
<tr>
<td>17</td>
<td>Gland</td>
<td>AISI 431 *</td>
<td>1.4057 *</td>
</tr>
<tr>
<td>18</td>
<td>Plate</td>
<td>AISI 304</td>
<td>1.4301</td>
</tr>
<tr>
<td>19</td>
<td>Name plate</td>
<td>SS</td>
<td>SS</td>
</tr>
<tr>
<td>20</td>
<td>Nut</td>
<td>C. steel</td>
<td>C. steel</td>
</tr>
<tr>
<td>21</td>
<td>Coupling (Zinc plated)</td>
<td>C. steel</td>
<td>C. steel</td>
</tr>
<tr>
<td>23</td>
<td>Securing washer</td>
<td>Steel</td>
<td>Steel</td>
</tr>
<tr>
<td>24</td>
<td>Nut</td>
<td>A194 B8C</td>
<td>1.4923</td>
</tr>
<tr>
<td>25</td>
<td>Gasket</td>
<td>SS/Graphite</td>
<td>SS/Graphite</td>
</tr>
<tr>
<td>26</td>
<td>Stud</td>
<td>A193 B8C</td>
<td>1.4923</td>
</tr>
</tbody>
</table>

* Nitrided

**Note**

Other materials are available upon request.

**Certification:**

A.T. - Temp Desuperheaters are approved by authorized authorities to comply with the requirements of ASME B16.34 and EN 12516.

All data subject to changes.

Materials and data of units supplied, may deviate from this brochure. Please consult order documents in case of doubt.

---

**Fig. 13**

**Detail ‘A’**

Flange connection for model 54/64

**Detail ‘B’**

Recommended spares
Table 2 - Dimensions (in mm)

<table>
<thead>
<tr>
<th>Model 18/54</th>
<th>Model 28/64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qmax = 25 m³/hr.</td>
<td>Qmax = 50 m³/hr.</td>
</tr>
</tbody>
</table>

| A | A through Dx | 380 \( \pm 0 / -0.2 \) | 399 \( \pm 0 / -0.2 \) |
| B | A through Dx | 438 | 476 |
| C | 200 | 250 |
| D | 305 | 355 |
| E | 210 | 250 |
| F | 32 | 32 |
| G | M12 x 1.75 | M18 x 2.00 |
| H | M8 x 2.00 | M90 x 2.00 |
| K | 81 \( \pm 0 / -0.2 \) | 91 \( \pm 0 / -0.2 \) |
| L | Depending on size and class 150 | Depending on size and class 200 |
| M min. | 68.0 | 80.0 |
| N | 60.3 x 12.6 * | 73.0 x 14.0 ** |
| P | 64.0 | 78.0 |

Note
Dimensions may be subject to change without prior notification. Narvik-Yarway will provide a certified dimensional drawing upon request.

* Model 54: 61 mm
** Model 64: 77 mm

Table 3 - Flange connections

<table>
<thead>
<tr>
<th>Model 18/54</th>
<th>Model 28/64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qmax = 25 m³/hr.</td>
<td>Qmax = 50 m³/hr.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Steam flange</th>
<th>3”</th>
<th>4”</th>
</tr>
</thead>
<tbody>
<tr>
<td>class 900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>class 1500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>class 2500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DN 80</td>
<td>PN 160</td>
<td>PN 100</td>
</tr>
<tr>
<td>PN 250</td>
<td>PN 160</td>
<td>PN 250</td>
</tr>
<tr>
<td>PN 400</td>
<td>PN 250</td>
<td>PN 400</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water flange</th>
<th>1”-1½”</th>
<th>1½”-2”-3”</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN 25-40</td>
<td>DN 40-50-80</td>
<td></td>
</tr>
<tr>
<td>Pressure class</td>
<td>Pressure class</td>
<td></td>
</tr>
<tr>
<td>as per water data requirements</td>
<td>as per water data requirements</td>
<td></td>
</tr>
</tbody>
</table>

Note
Other pressure classes upon request.

Stroke:
- 55 mm for nozzles A - B - C - D - Dx
min. steam line size: 6” (DN 150)
- 90 mm for nozzles E - F - G - H - K
min. steam line size: 8” (DN 200)