YARWAY NARVIK STANDARD DUTY A.T.S.A.-TEMP DESUPERHEATER

MODEL 24/34

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 and paper industry and process gas applications

FEATURES

- Fabricated construction
- Variable nozzle type
- Wide range of K_v (C_v) capacities available
- Special nozzle combinations available
- Pressure class and connections:
  - ASME B16.34 class 150 to 1500
  - EN 1092-1 class PN 25 to 250
  - Buttweld connections to ANSI B16.25 or DIN 2559
- Materials
  - ASTM SA 105 / SA 106 Gr.B or P250GH / P235GH TC2
  - ASTM SA 182 F11 / SA 335 P 11 or 1.7335
  - Other materials upon request

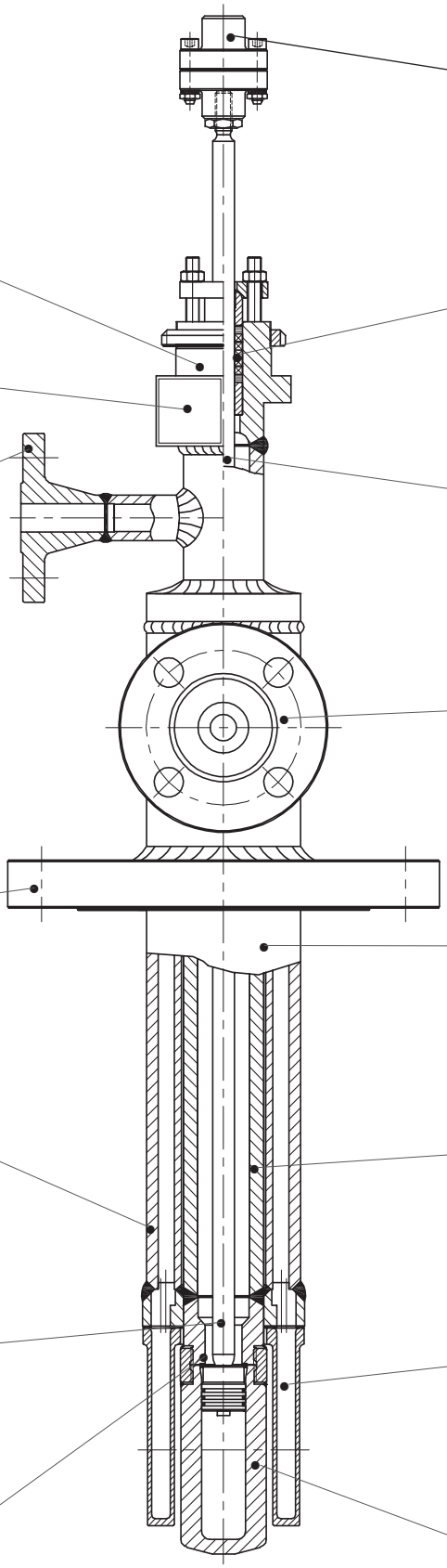
GENERAL APPLICATION

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

TECHNICAL DATA

Size: Steam NPS 6 - 8 (DN 150 - 200)
Water NPS 1 - 3 (DN 25 - 80)
Steam assist NPS 1½ - 4 (DN 40 - 100)

FIGURE 1



Universal coupling fits a variety of actuators.

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

Stuffing box contains no asbestos components.

Stainless steel nameplate

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

Water inlet flange is available to various standards
Model 24:
NPS 1 - 1½ (DN 25 - 40)
Model 34:
NPS 1½ - 3 (DN 40 - 80)

Steam assist inlet flange is available to various standards
Model 24:
NPS 1½ - 2 (DN 40 - 50)
Model 34:
NPS 2 - 4 (DN 50 - 100)

Steam flange is available to various standards
Model 24:
NPS 6 (DN 150)
Model 34:
NPS 8 (DN 200)

Fabricated body available in various materials. Construction in accordance with ASME B16.34 and EN 12516. CE-marking if required.

Steam assist extension pipe in various lengths, depending upon the installation requirements.

Body extension pipe in various lengths, depending upon the installation requirements. Valves with extension of more than 1.0 meter (40") are provided with additional stem guiding.

Stem disc construction
Model 24:
non-balanced
Model 34:
semi-balanced

Jet pipes for injection of assist steam.

Full stellite seat construction. Seat is machined for concentricity and squareness after the welding process.

High performance spray nozzles give fine atomization of injection water.

A.T.S.A.-TEMP DESUPERHEATER

(see figure 1)
The Yarway steam assist Desuperheater has been specifically developed for use on low/medium pressure applications. The fabricated construction, based on the well known Standard Duty A.T.-Temp Desuperheater, makes it easily adapted to meet various boiler codes and material specifications. The steam assist Desuperheater does not need a separate water control valve, as this is an integral feature of the Desuperheater, but does require a valve for use on the atomizing steam supply. The valve may be on-off and can be manual or actuator operated.
The unit can be operated as:
1. Multiple nozzle attemperator
2. Steam assisted unit

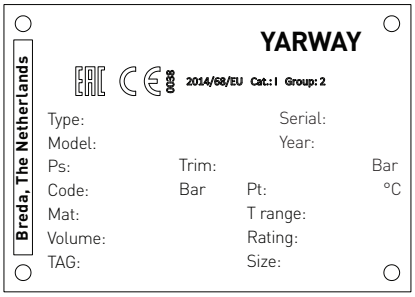


FIGURE 2

Function 1
The water amount is controlled by the position of the piston, refer to the applicable brochure.

Function 2
The duty requires steam assistance for enhanced atomization of the injected water. This mainly occurs at low flow conditions where low velocities and/or high percentage of water can lead to insufficient absorption of the injected water. The vital trim components (including spare parts) are identical to those used in the Standard/Heavy Duty A.T.-Temp Desuperheaters of which collectively more than 3800 units are in service today.

FUNCTIONAL DESCRIPTION

(see figure 3)
The assist steam is controlled by a separate on-off control valve. This control valve may be controlled by the DCS-system to switch on the main steam flow input. The assist steam enters through the steam assist inlet flange, traveling down the steam assist jacket (A) to the jet pipes (B). Each jet pipe has sufficient steam assist nozzles (C), factory controlled, to create extreme turbulence and consequently a very fine droplet size of the injected water. The atomizing steam supply should be maintained onto the Desuperheater only whilst required by the service and the switching on and off points determined by field trials.

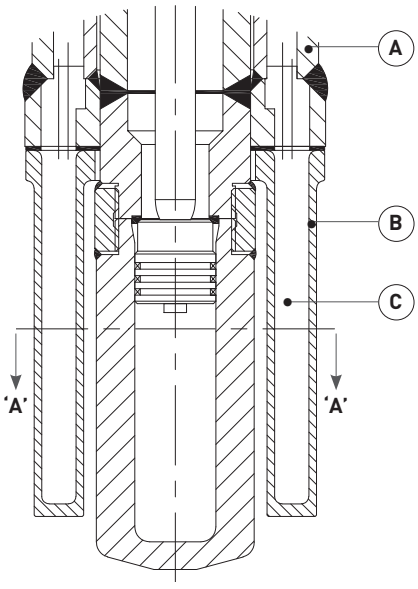
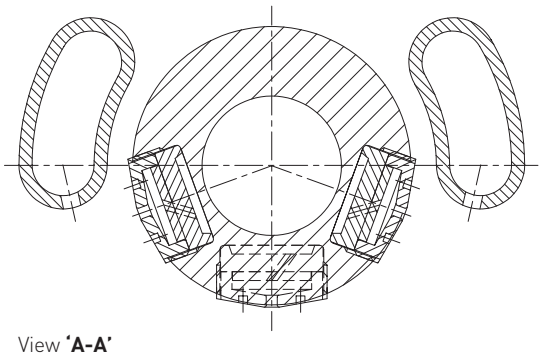


FIGURE 3



View **'A-A'**

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.S.A.-Temp Desuperheater inlet flange to steam pressure must be:

Nozzles A through Dx:	1 bar (15 psi)
Nozzles E through K:	2 bar (30 psi)

CODES AND STANDARDS

The A.T.S.A.-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.

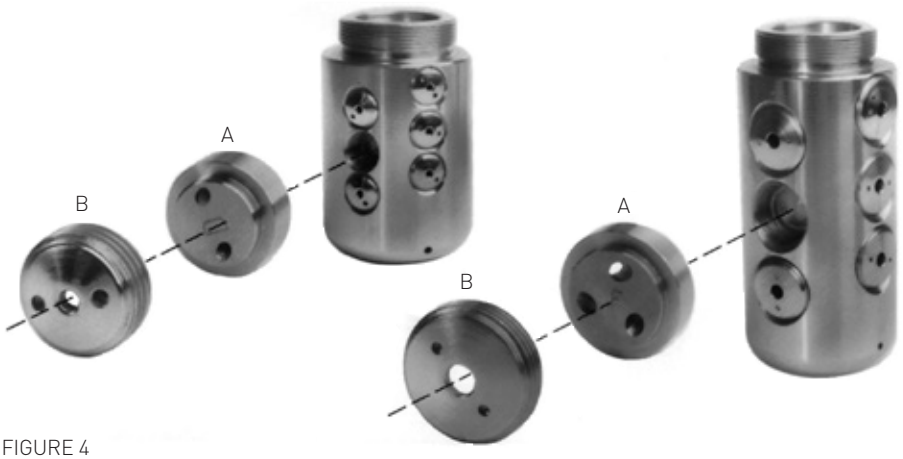


FIGURE 4

MULTIPLE NOZZLE HEADS

The A.T.S.A.-Temp Desuperheater may be equipped with a variety of spray heads.
The uniform body threading accepts spray cylinder heads with a wide range of K_v (C_v) values.
Standard configurations are with either 6 or 9 equally sized spray nozzles but combinations are available.
This feature enables the A.T.S.A.-Temp Desuperheater to be customized to specific system requirements. Consult Yarway or your local representative for details.

YARWAY NARVIK STANDARD DUTY A.T.S.A.-TEMP DESUPERHEATER
MODEL 24/34

Size	A.T.S.A.-Temp standard capacity range:					
25	6A	C_V = 0.0752	K_V = 0.0648	9A	C_V = 0.1128	K_V = 0.0972
25	6B	C_V = 0.1587	K_V = 0.1368	9B	C_V = 0.2380	K_V = 0.2052
25	6C	C_V = 0.3007	K_V = 0.2592	9C	C_V = 0.4510	K_V = 0.3888
25	6D	C_V = 0.5860	K_V = 0.5052	9D	C_V = 0.8790	K_V = 0.7578
25	6Dx	C_V = 1.1602	K_V = 1.0002	9Dx	C_V = 1.7403	K_V = 1.5003
25	6E	C_V = 1.9022	K_V = 1.6398	9E	C_V = 2.8533	K_V = 2.4597
25	6F	C_V = 2.8397	K_V = 2.4480	9F	C_V = 4.2595	K_V = 3.6720
25	6G	C_V = 6.0322	K_V = 5.2002	9G	C_V = 9.0483	K_V = 7.8003
25	6H	C_V = 9.3960	K_V = 8.1000	9H	C_V = 14.0940	K_V = 12.1500
25	6K	C_V = 13.4885	K_V = 11.6280	9K	C_V = 20.2327	K_V = 17.4420

Definition

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

Q = m^3/hr.
S.G. = kg/dm^3
Δp = bar

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

Q = US gpm
S.G. = density
Δp = psi

Flow capacity limitations are:

- Model 24 with a maximum water flow capacity of 25 m^3/hr. (110 gpm) in continuous service.
- Model 34 with a maximum water flow capacity of 50 m^3/hr. (220 gpm) in continuous service.
- Nozzle head configuration is available for 90 mm (3,54¨) stroke only.

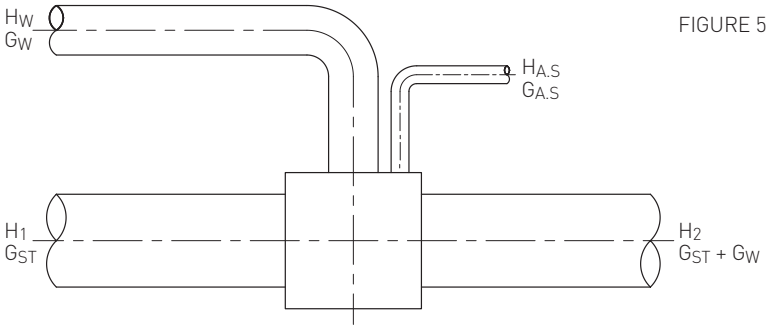


FIGURE 5

SIZING FORMULA

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

$$G_W = \frac{G_{ST}\,(H_1 - H_2) + G_{A.S}\,(H_{A.S} - H_2)}{H_2 - H_W}$$

in which:

G_W = Injection water mass
G_{ST} = Inlet steam mass
H_1 = Enthalpy of the inlet steam
H_2 = Enthalpy of the outlet steam
H_W = Enthalpy of the injection water
$H_{A.S}$ = Enthalpy of the assist steam
$G_{A.S}$ = Mass of assist steam

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 Yarway.

Water to steam ratio
This ratio is determined by dividing G_W by G_{ST}. For system steam pressures below 15 bar (217 psi), this ratio should not exceed 15% for the normal operating conditions. Systems operating between 15 and 25 bar (217 and 365 psi) can have a ratio of up to 20%. For higher pressure duties, consult Yarway.

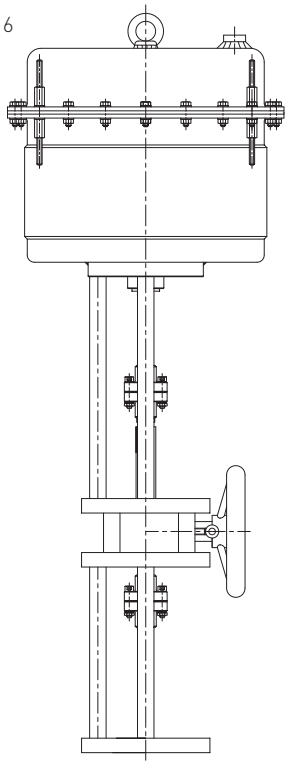
Distance to sensor
The distance from the injection point to the temperature sensor should be 12 to 15 meters (40 to 50 ft). Systems operating at pressures above 25 bar (365 psi) can have significantly less run to the sensor, consult Yarway.

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 (365 psi), 4 to 6 meters (13 to 20 ft), is an acceptable distance.

ACTUATORS

Pneumatic diaphragm
The Yarway pneumatic actuators are specifically developed for the own manufactured Desuperheaters for use on
low-, medium- and high pressure steam applications. The actuator model 20-90 for a stroke of 90 mm is 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.

FIGURE 6



ELECTRIC ACTUATORS

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

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

FIGURE 7

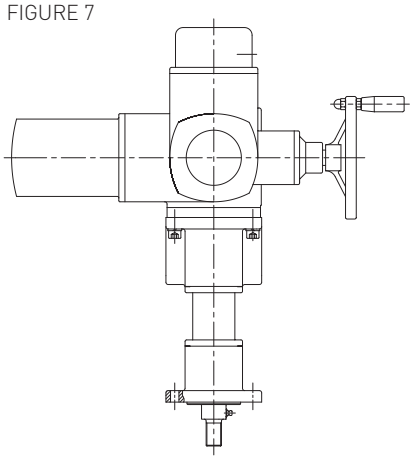
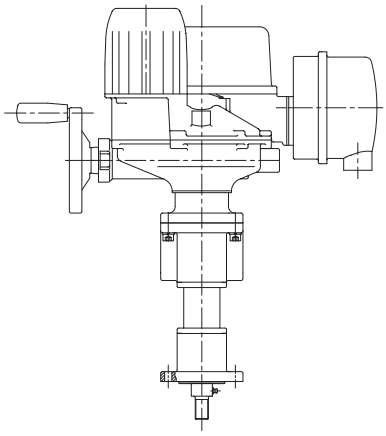


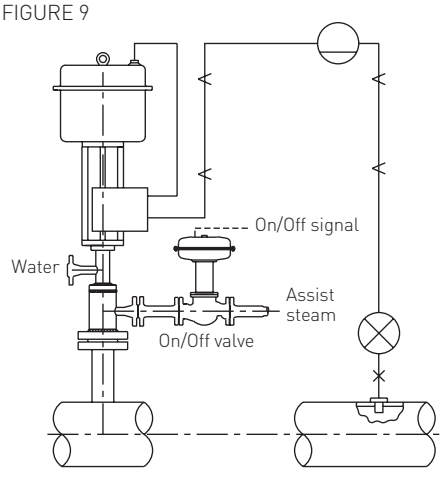
FIGURE 8



CONTROL SYSTEMS

The injection water quantity is controlled as a function of the outlet steam temperature.
The A.T.S.A.-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 9



ACTUATOR STEM FORCES

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

Model 24: P water x 62 + 1000 = Newton (P water in bar)
P water x 0.96 + 220 = lbf (P water in psi)
The maximum stem force must be limited to 15 kN (3375 lbf).

Model 34: P water x 68 + 1250 = Newton (P water in bar)
P water x 1.05 + 275 = lbf (P water in psi)
The maximum stem force must be limited to 50 kN (11240 lbf).

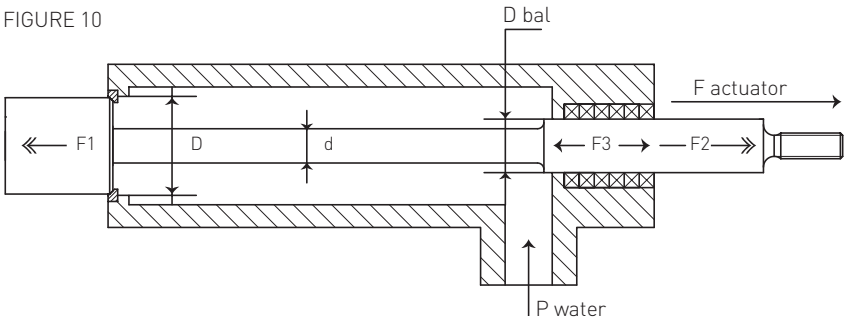
Special care should be taken when electric actuators are used. By their momenta of inertia these actuators can generate stem forces exceeding the specified nominal stem force during short intervals. Yarway supplies special spring loaded couplings for such applications.

Actuator sizing formula

Units:
D seat in cm
d stem in cm
D bal in cm
P water in bar

F1 = π / 4 (**D** seat^2 - **d** stem^2) x **P** water
F2 = π / 4 (**D** bal^2 - **d** stem^2) x **P** water
F3 = **P** water x **F** friction (+ or -).

FIGURE 10



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 (psi)
Inlet temperature	°C (°F)
Outlet temperature	°C (°F) setpoint
Steam flow max.	t / hr
Steam flow normal	t / hr
Steam flow min.	t / hr

Assist steam data

Pressure assist steam	bar (psi)
Temperature assist steam	°C (°F)

Water data

Water pressure	bar (psi)
Water temperature	°C (°F)

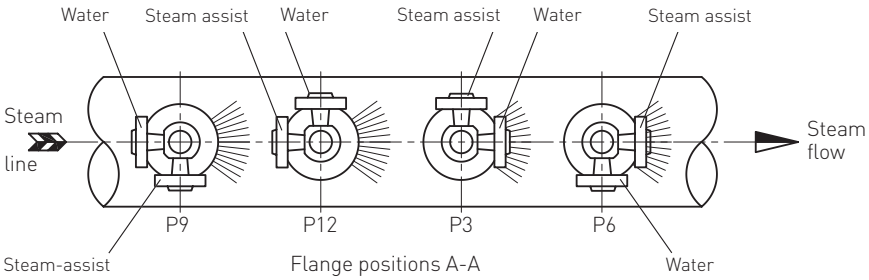
General

Pipe size	mm (inch)
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 11



Spray water must be injected with 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.S.A.-Temp Desuperheater from clogging.

TABLE 1 - STANDARD MATERIALS

Item	Name	Material	Equivalent
1+ 2	Spray nozzle assembly	AISI 410	1.4006
3	Piston ring	AISI 431 *	1.4057 *
4	Piston	AISI 431 *	1.4057 *
5	Fastener ring	SA182 F11	1.7335
6	Seat	Stellite 6	Stellite 6
7	Stem	AISI 431 *	1.4057 *
8	Seat housing	SA105	P250GH
		SA182 F11	1.7335
9	Body	SA106 Gr. B	P235GH TC2
		SA335 P11	1.7335
10	Water flange	SA105	P250GH
		SA182 F11	1.7335
11	Adaptor	SA106 Gr. B	P235GH TC2
		SA335 F11	1.7335
12	Spacer	AISI 431 *	1.4057 *
13	Packing box	SA105	P250GH
		SA182 F11	1.7335
14	Nut	A194 4H	1.4923
15	Packing set	Graphite	Graphite
16	Stud	A193 B16	1.4923
17	Gland	AISI 431 *	1.4057 *
18	Gland plate	AISI 304	1.4301
19	Name plate	SS	SS
20	Yoke nut	C. steel	C. steel
21	Coupling (zinc plated)	C. steel	C. steel
22	Support ring	SA105	P250GH
		SA182 F11	1.7335
23	Securing washer	Steel	Steel
24	Steam flange	SA105	P250GH
		SA182 F11	1.7335
25	Spiral wound gasket	St. steel/Graphite	St. steel/Graphite
26	Fixation ring	SA105	P250GH
		SA182 F11	1.7335
27	Steam assist pipe inside	SA106 Gr. B	P235GH TC2
		SA335 P11	1.7335
28	Steam assist pipe outside	SA106 Gr. B	P235GH TC2
		SA335 P11	1.7335
29	Jet pipe	17-4 PH	1.4548
30	Bolt	A193 B7	1.4923
31	Steam assist flange	SA105	P250GH
		SA182 F11	1.7335
32	Adaptor	SA106 Gr. B	P235GH TC2
		SA335 P11	1.7335

NOTE

* Nitrited

Other materials are available upon request.

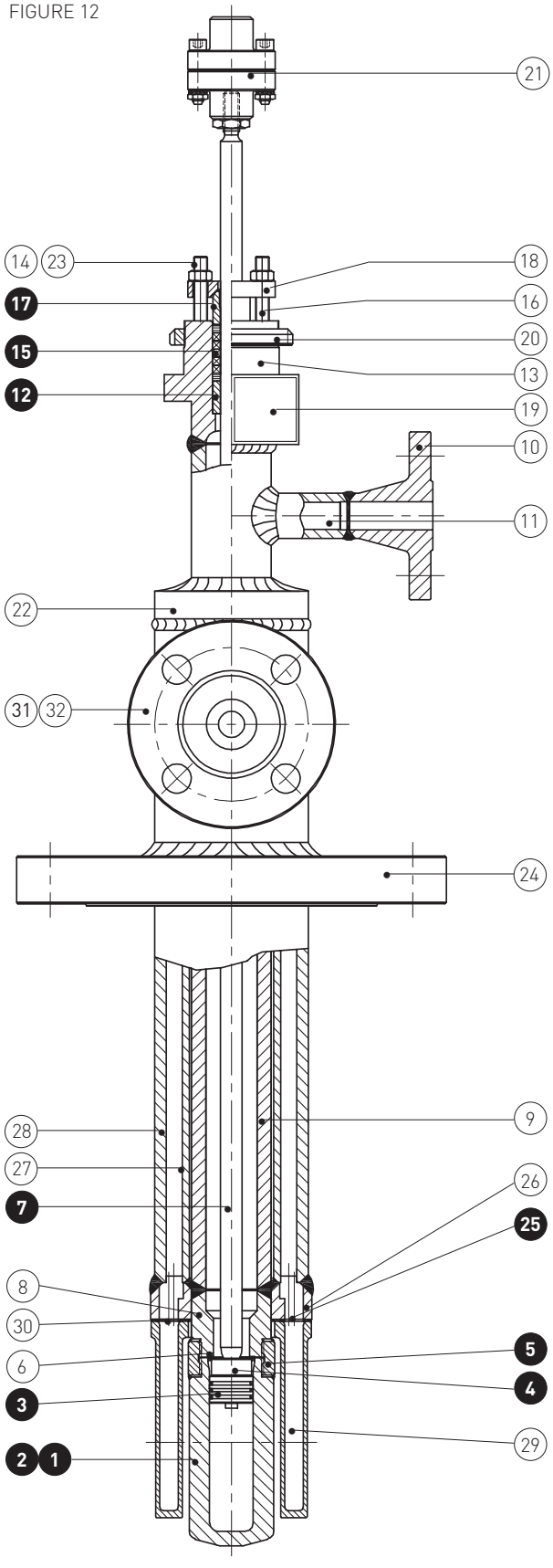
Certification:

A.T.S.A.-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.

FIGURE 12



● Recommended spares

TABLE 2 - DIMENSIONS (mm)

	Standard length for steam line sizes DN 350 (14") and higher Model 24 Qmax = 25 m³/ hr. (110 gpm)
A	599 (23½")
B	676 (26⅜")
C	290 (11⅜")
D	395 (15½")
E	210 (8⅓")
F	32 (1¼")
G	M12 x 1.75
H	M70 x 2
K	71 +/- 0.2 (2⅘")
L	Depending on size and class min. DN 150 (6")
M min.	125 (4⁹⁄₁₀")
N	122 (4⅘")
P	64 (2½")
S	150 (6")
T	250 (10")

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

TABLE 3 - FLANGE CONNECTIONS

	Model 24 Qmax = 25 m³/ hr. (110 gpm)	
Steam flange	NPS 6	class 150
		class 300
		class 600
	Other classes upon request	
	DN 150	PN 25/40
		PN 64
		PN 100
	Other classes upon request	
Water flange	NPS 1 - 1½	
	DN 25 - 40	
	Pressure classes as per requirements up to class 1500	
Steam assist flange	NPS 1½ - 2	
	DN 40 - 50	
	Pressure classes as per requirements up to class 1500	

Stroke
90 mm (3.54") for nozzles A - B - C - D - Dx - E - F - G - H - K *
min steam line size: DN 200 (8")

* and combinations

FIGURE 13

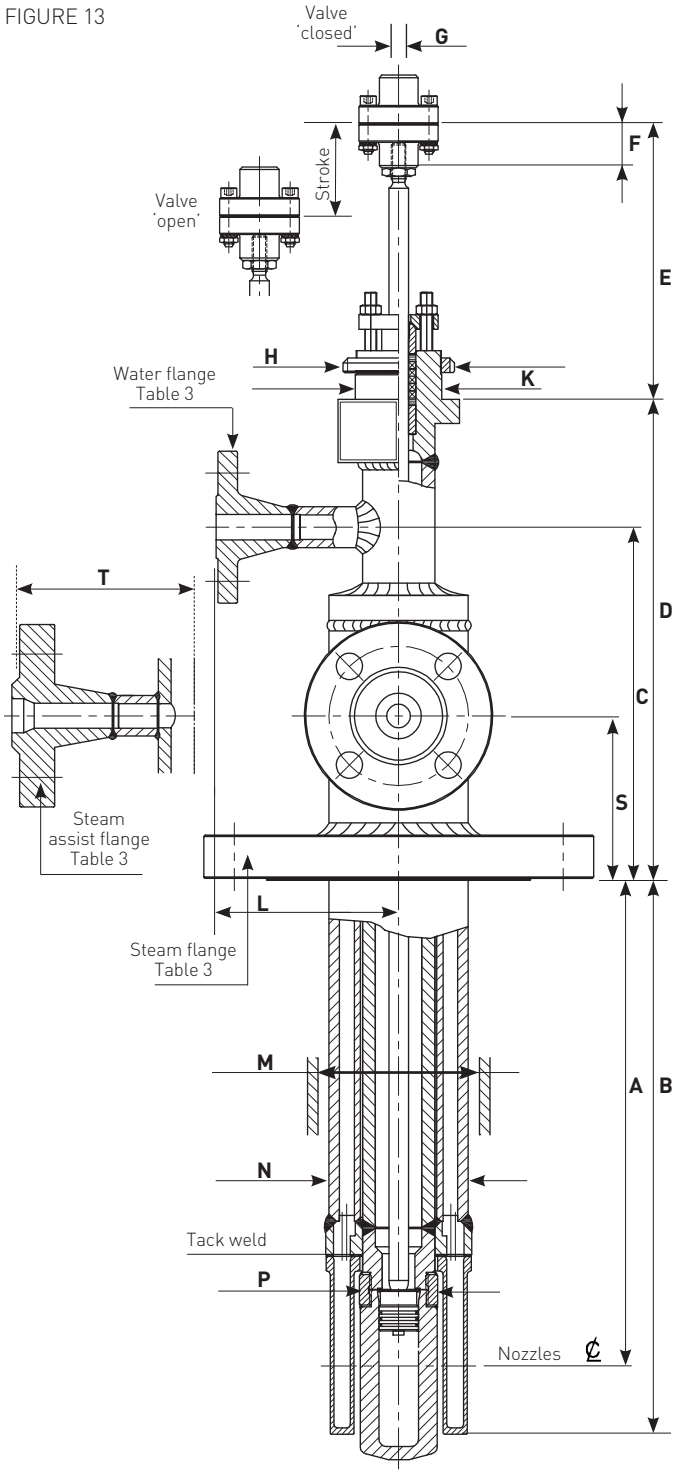


TABLE 4 - DIMENSIONS (mm)

	Standard length for steam line sizes DN 350 (14") and higher Model 34 Qmax = 50 m³/ hr. (220 gpm)
A	599 (23⅗")
B	676 (26⅗")
C	450 (17¾")
D	555 (21⅘")
E	250 (9⅝")
F	32 (1¼")
G	M16 x 2
H	M90 x 2
K	91 +/- 0.1 (3⅗")
L	Depending on size and class min. DN 200 (8")
M min.	145 (5⁷⁄₁₀")
N	141 (5¹³⁄₂₄")
P	78 (3")
S	200 (8")
T	250 (10")

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

TABLE 5 - FLANGE CONNECTIONS

	Model 34 Qmax = 50 m³/ hr. (220 gpm)	
Steam flange	NPS 8	class 150
		class 300
		class 600
	Other classes upon request	
	DN 200	PN 25/40
		PN 64
		PN 100
	Other classes upon request	
Water flange	NPS 1½ - 3	
	DN 40 - 80	
	Pressure classes as per requirements up to class 1500	
Steam assist flange	NPS 2 - 4	
	DN 50 - 100	
	Pressure classes as per requirements up to class 1500	

Stroke
90 mm (3.54") for nozzles A - B - C - D - Dx - E - F - G - H - K *
min steam line size: DN 200 (8")

* and combinations

FIGURE 14