Bulletin for Yarway™ Model 25 VenTemp™ 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:

- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.**
- **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.**
- **Use lock-out procedures to be sure the above measures stay in effect with you work on the equipment.**
- **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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YARWAY NARVIK MODEL 25 VEN-TEMP DESUPERHEATER

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

- Forged construction
- Low pressure loss over the desuperheater station
- Water pressures marginally above steam pressure
- Venturi nozzle type
- Wide range of C_v (K_v) capacities available
- Pressure class and connections:
  - ASME B16.5 class 150 to 2500
  - EN 1092-1 class PN 25 to 400
  - Buttweld connections to ASME B16.25 or DIN 2559
- Materials
  - ASTM SA105, SA182 F11, SA182 F22 or SA182 F91
  - P250GH, 1.7335 or 1.7380
  - Other materials upon request

MAIN APPLICATIONS

Cooling of process steam or gas with relatively constant loads. Cooling of steam or gas in combination with pressure reducing stations.

TECHNICAL DATA

Sizes:	Steam DN 40 - 400 (NPS 1½ - 16) Water DN 15 - 50 (NPS ½ - 2)

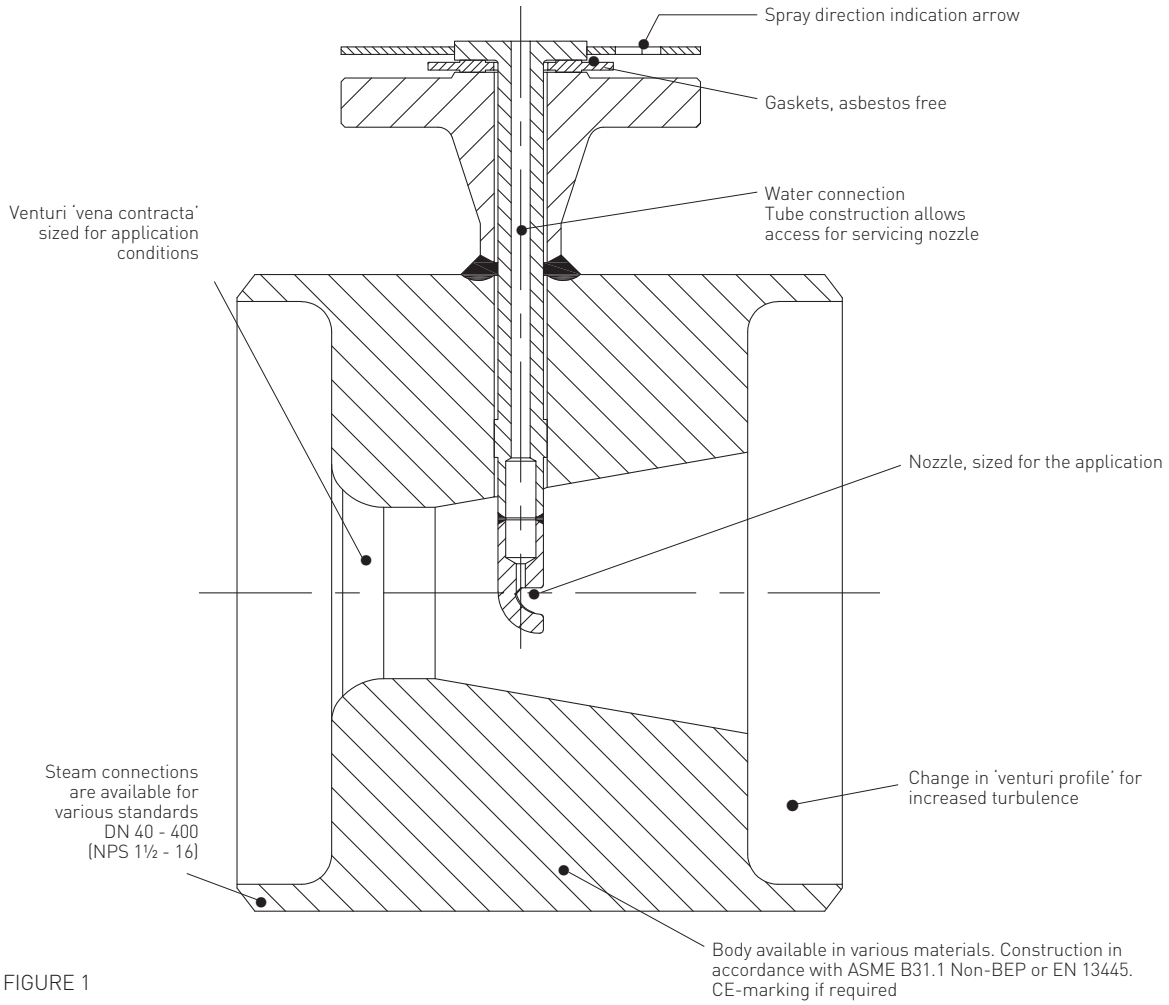


FIGURE 1

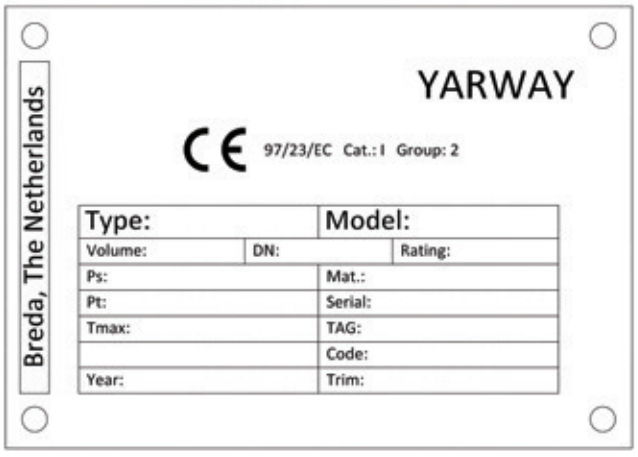
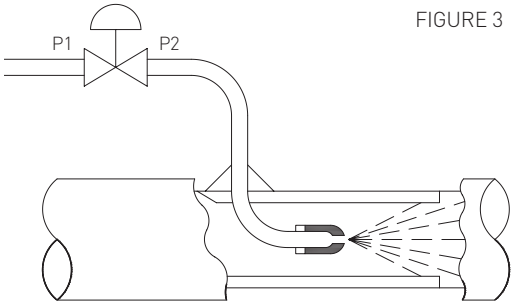


FIGURE 2 - EXAMPLE OF NAME PLATE

CE Marking and PED Category depends on line size and pressure and will be determined when ordered

The Ven-Temp Desuperheater is designed primarily for use in low capacity superheated steam systems where the load is fairly constant. The design provides a simple, cost conscious but effective method of steam temperature control.
The Ven-Temp Desuperheater utilizes turbulence in the steam main to facilitate atomization and absorption of the injection water. This turbulence is contrived through a venturi line restriction which has an interrupted internal profile, with the inlet having a conventional venturi form. Minimum controllable C_v (K_v) values as low as 0.008 (0.007) are available.

FIGURE 3



SYSTEM COMPARISON

Conventional (Fig. 3)
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.

Ven-Temp Desuperheater
Superheated steam flowing along the steam main, enters the Ven-Temp Desuperheater throat increasing its velocity, whilst reducing its pressure. This change from static to dynamic pressure is utilized to disintegrate the conical water spray, issuing from the injection nozzle. Directly after the throat area, the venturi profile is interrupted and the flow area drastically increased, resulting in intense turbulence and enhanced, mixing of water and steam. The outlet steam temperature is controlled by regulating the flow of cooling water by means of a conventional control valve. A suitable water control valve is available from Yarway upon request. The actuation loop consists of a temperature sensor (1), transmitter (2), controller (3) and control valve with positioner (4) also electric systems are compatible and combinations of the two.

The Ven-Temp Desuperheater may be installed after a pressure reducing valve (5). As the pressure transmitter (6), controller (7) are behind the Ven-Temp Desuperheater this increases the available pressure drop hence the turndown ratio (see Figure 4).

Applications
Yarway Ven-Temp Desuperheaters are used for temperature control of:
- Process steam
- Process gases
- Pressure reducing valve outlet steam.

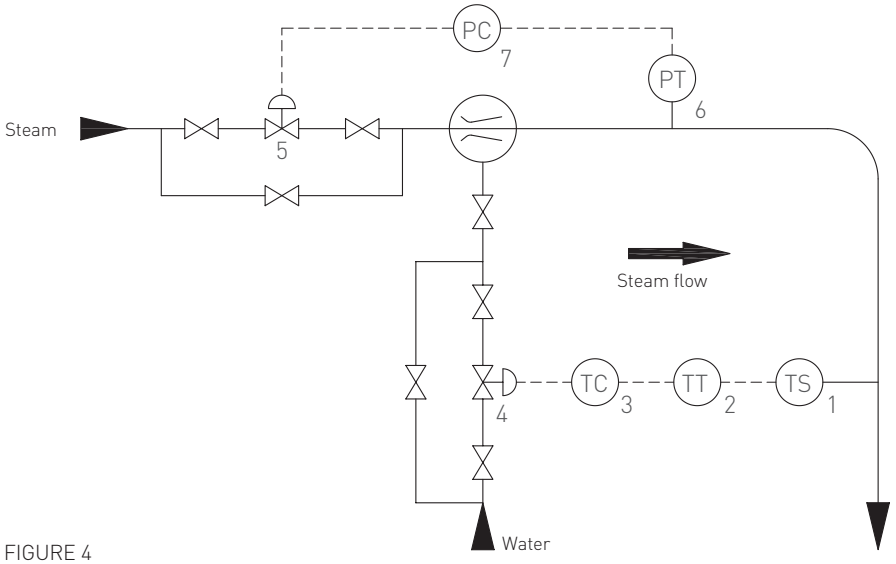


FIGURE 4

Yarway has incorporated the latest technology in the spray nozzle design. The high quality surface finish minimizes frictional losses, thereby ensuring that the optimal water to steam Δp is available for atomization of the water.

- Rapid mixing of the water and steam, hence efficient evaporation. This enables short straight pipe runs both upstream and downstream of the injection point, thus simplifying many installations.
- A high water to steam ratio is possible, resulting in a high enthalpy change across the injection point.

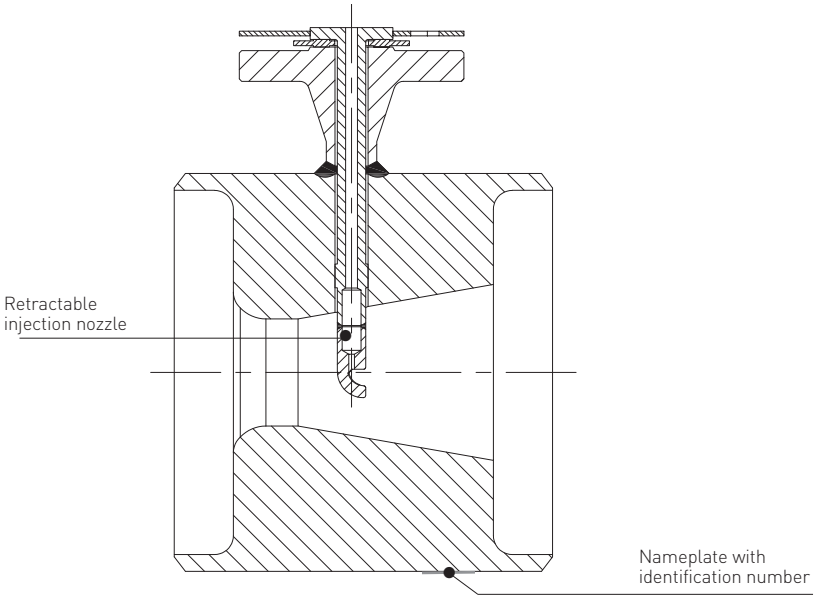


FIGURE 5

SIZING FORMULA

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

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

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

The minimum permanent pressure loss in the steam line is approx. 0.05 bar. This pressure drop is required to achieve the secondary atomization. At higher flow, the pressure drop increases. The minimum required water pressure at the injection nozzle inlet is as least 0.4 bar above the inlet steam pressure.

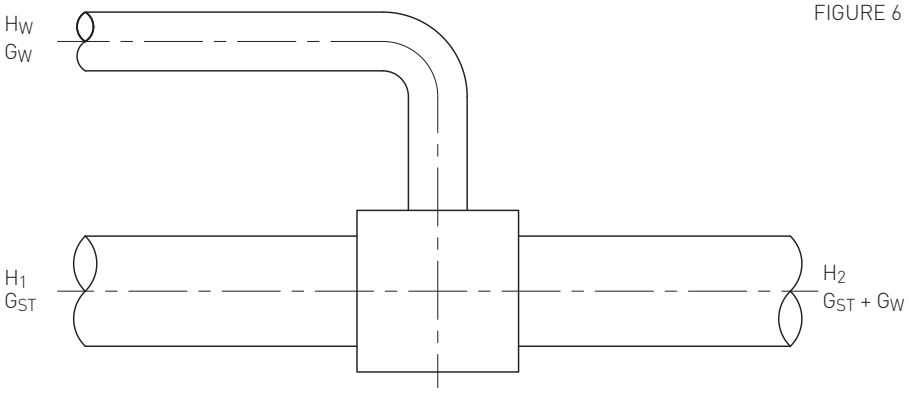


FIGURE 6

CODES AND STANDARDS

The Ven-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.

VEN-TEMP STANDARD CAPACITY RANGE

Size nozzle	Min K_v-value	Max K_v-value	Min dia vena-contracta (mm)
⅛	0.007	0.567	21
¼	0.057	0.760	32
⅜	0.831	1.232	36
½	1.103	2.209	50
¾	2.576	5.941	58
1	8.602	12.723	82

Other C_v / K_v values upon request

Definition

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

Q = m^3/hr.
S.G. = kg/dm^3
ΔP = Bar

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:

Distance to sensor
The distance from the Ven-Temp Desuperheater to the temperature sensor should be 12 to 15 meters, although the distance specific to the application is advised by Yarway at the enquiry stage. Longer distances will ensure that full evaporation of the water will take place at lower steam velocities.

Required straight pipe run
The minimum pipe run, required downstream, varies with each individual application and is specified by Yarway at the enquiry stage. This straight run is needed to prevent erosion due to impingement of water droplets against pipewalls, valves and fittings. Upstream straight run is normally 2 x D and the outlet straight run 4 meters, as a minimum.

For applications outside these limitations, consult Yarway or your local representative.

Spray water must be injected in the direction of the steam flow.
Yarway always recommends a strainer with a mesh size of approx. 100 µ in the water supply line to protect the injection system from clogging.

ORDERING/SIZING DATA

The Ven-Temp Desuperheater works optimally under their design conditions. A minimum differential in static pressure is required to maintain the velocity at such a level that proper mixing of water and steam is achieved.

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

Turndown ratio
It is essential not to over-specify the maximum quantity of steam and this rule applies generally to any Desuperheater selection.

Water/steam ratio
$G_{ST} : G_W \approx 5 : 1$
Above this ratio, proper evaporation of the injection water cannot always be guaranteed.

Consult Yarway.

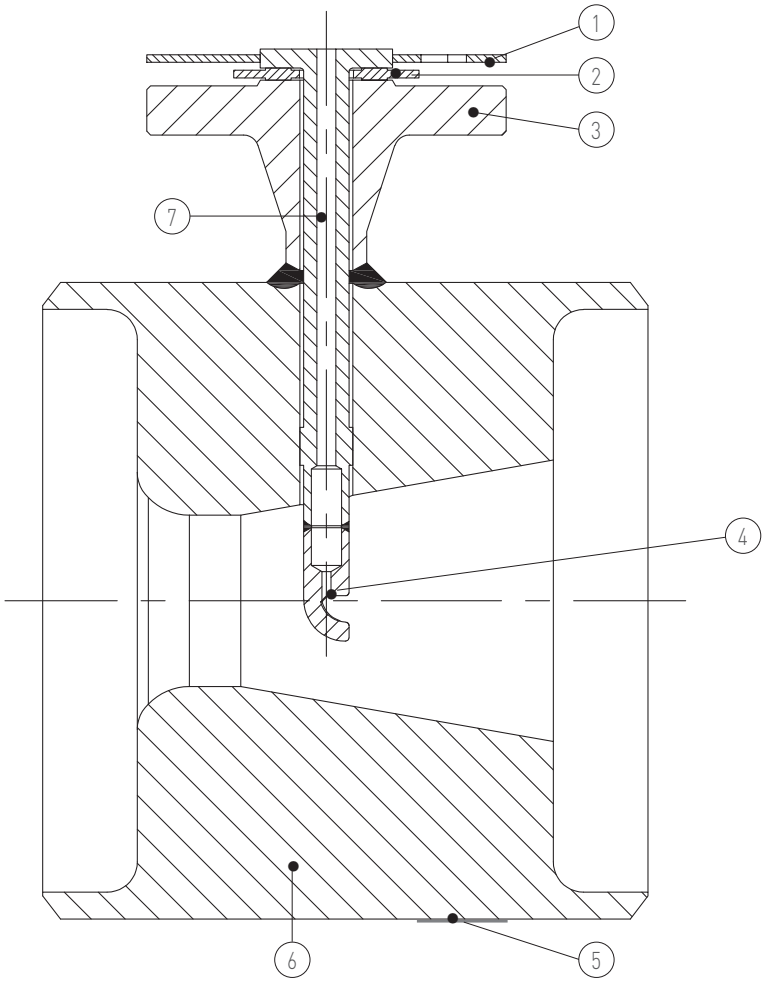


FIGURE 7

TABLE 1 - STANDARD MATERIALS

		Carbon steel		Low alloy		High alloy	
Item	**Name**	**ASTM**	**EN**	**ASTM**	**EN**	**ASTM**	**EN**
1	Spray direction indicator						
2	Gasket	St.st./Graphite	1. 4541/Graph.	St.st./Graphite	1.4541/Graph.	St.st./Graphite	1.4541/Graph.
3	Water flange	SA 105	P250GH	SA 182 F11	1.7335	SA 182 F22	1.7380
4*	Nozzle	SA 182 F316	1.4401	SA 182 F316	1.4401	SA 182 F316	1.4401
5	Nameplate	St. steel	St. steel	St. steel	St. steel	St. steel	St. steel
6	Body	SA 105	P250GH	SA 182 F11	1.7335	SA 182 F22	1.7380
7*	Nozzle pipe	SA 182 F316L	1.4404	SA 182 F316L	1.4404	SA 182 F316L	1.4404

* Supplied as assembled spare part

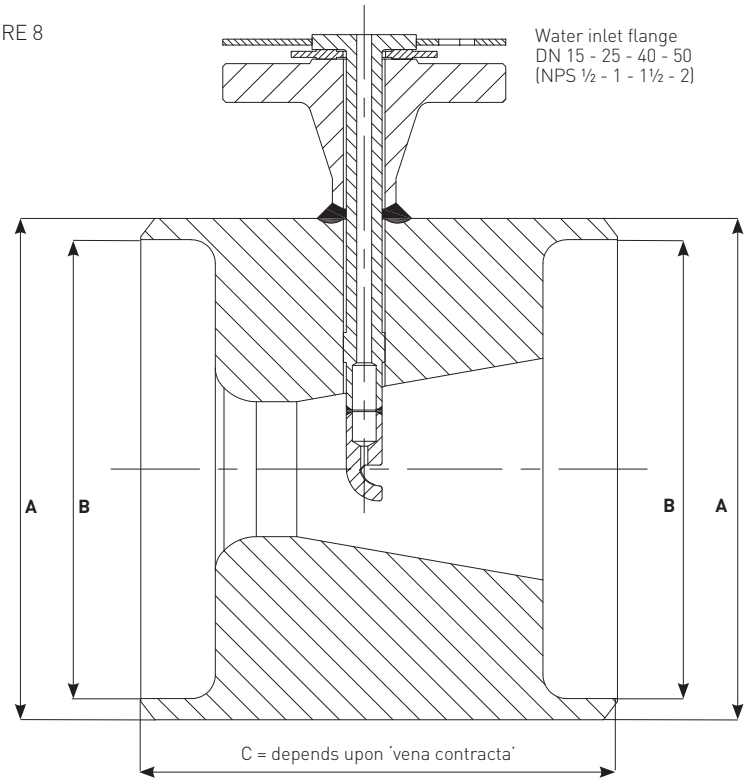
NOTE

Other materials are available upon request

CERTIFICATION

Ven-Temp Desuperheaters are approved by authorized authorities to comply with the requirements of ASME B31.1 Non-BEP or EN 13445 and PED.
All data subject to changes.

FIGURE 8



NOTES

- Dimensions may be subject to change without prior notification and depending to the standards (flanged - butt weld, etc.)
- Other pressure classes upon request.
- Yarway will provide an order related certified dimensional drawing upon request.

TABLE 2 - DIMENSIONS (mm)

Steam connection size	Body class (ANSI)	Water connection size	Water connection flange class (ANSI)	A	B
DN 40	150	DN 15	150, 300, 600	Ø48.26	Ø38.10
(NPS 1½)	300	(NPS ½)	900, 1500, 2500	Ø48.26	Ø38.10
	600			Ø48.26	Ø38.10
	900			Ø48.26	Ø34.80
	1500			Ø48.26	Ø34.80
	2500			Ø48.26	Ø28.40
DN 50	150	DN 15	150, 300, 600	Ø60.32	Ø50.80
(NPS 2)	300	(NPS ½)	900, 1500, 2500	Ø60.32	Ø50.80
	600			Ø60.32	Ø50.80
	900			Ø60.32	Ø47.50
	1500			Ø60.32	Ø47.50
	2500			Ø60.32	Ø38.10
DN 80	150	DN 25	150, 300, 600	Ø88.90	Ø76.20
(NPS 3)	300	(NPS 1)	900, 1500, 2500	Ø88.90	Ø76.20
	600			Ø88.90	Ø76.20
	900			Ø88.90	Ø72.90
	1500			Ø88.90	Ø69.90
	2500			Ø88.90	Ø57.20
DN 100	150	DN 25	150, 300, 600	Ø114.30	Ø101.60
(NPS 4)	300	(NPS 1)	900, 1500, 2500	Ø114.30	Ø101.60
	600			Ø114.30	Ø101.60
	900			Ø114.30	Ø98.30
	1500			Ø114.30	Ø91.90
	2500			Ø114.30	Ø72.90
DN 150	150	DN 40	150, 300, 600	Ø168.27	Ø152.40
(NPS 6)	300	(NPS 1½)	900, 1500, 2500	Ø168.27	Ø152.40
	600			Ø168.27	Ø152.40
	900			Ø168.27	Ø146.10
	1500			Ø168.27	Ø136.40
	2500			Ø168.27	Ø111.0

Steam connection size	Body class (ANSI)	Water connection size	Water connection flange class (ANSI)	A	B
DN 200	150	DN 40	150, 300, 600	Ø219.07	Ø203.20
(NPS 8)	300	(NPS 1½)	900, 1500, 2500	Ø219.07	Ø203.20
	600			Ø219.07	Ø199.90
	900			Ø219.07	Ø190.50
	1500			Ø219.07	Ø177.80
	2500			Ø219.07	Ø146.10
DN 250	150	DN 50	150, 300, 600	Ø273.05	Ø254.00
(NPS 10)	300	(NPS 2)	900, 1500, 2500	Ø273.05	Ø254.00
	600			Ø273.05	Ø247.70
	900			Ø273.05	Ø238.00
	1500			Ø273.05	Ø222.30
	2500			Ø273.05	Ø184.20
DN 300	150	DN 50	150, 300, 600	Ø323.85	Ø304.80
(NPS 12)	300	(NPS 2)	900, 1500, 2500	Ø323.85	Ø304.80
	600			Ø323.85	Ø298.50
	900			Ø323.85	Ø282.40
	1500			Ø323.85	Ø263.40
	2500			Ø323.85	Ø218.90
DN 350	150	DN 50	150, 300, 600	Ø355.60	Ø336.60
(NPS 14)	300	(NPS 2)	900, 1500, 2500	Ø355.60	Ø336.60
	600			Ø355.60	Ø326.90
	900			Ø355.60	Ø311.20
	1500			Ø355.60	Ø288.80
	2500			Ø355.60	Ø241.30
DN 400	150	DN 50	150, 300, 600	Ø406.40	Ø387.40
(NPS 16)	300	(NPS 2)	900, 1500, 2500	Ø406.40	Ø387.40
	600			Ø406.40	Ø374.70
	900			Ø406.40	Ø355.60
	1500			Ø406.40	Ø330.20
	2500			Ø406.40	Ø276.10

B = maximum inside diameter according to ASME B16.34 table A-1