Technical Specifications
Rev. C - 09/2023

Masoneilan™ DSH Series

Desuperheater

Baker Hughes™

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Overview

The DSH Desuperheater serves as a means of controlling steam temperature, mainly in boiler and Heat Recovery Steam Generator (HRSG) applications, and process applications such as steam turbine extraction and exhaust to process within the power industry. The Masoneilan DSH is designed to meet ASME B31.1, and can be manufactured under ASME Boiler & Pressure Vessel Code Section 1 welding S-Stamp to comply with installations within the boiler or HRSG boundary limits.

During operation of the DSH Desuperheater, steam enters the DSH and atomized water is sprayed into the flow to reduce the steam temperature, as the water evaporates into the process steam. The spray water is controlled by a separate water supply valve, in response to a control loop that monitors downstream pressure.

Within the DSH Series, there is both a flow profiler style (DSH-110) and a liner style desuperheater (DSH-120).

Each design of the DSH Desuperheater is available in either a carbon steel or chrome-moly construction and can be modified to meet various temperature and environment conditions.

Model Number

Build a typical model number table that reflects:

- DSH-110: Flow Profiler style
- DSH-120: Liner Style

Specifications

Body:

- Material
  - Carbon Steel
  - Chrome-Moly

Size

- 4 inch to 48 inch
- Larger Sizes available upon request

Ratings

- ANSI 150-2500
- Higher Ratings available upon request

End Connections

- Buttweld
- RF and RTJ Flange

Nozzles

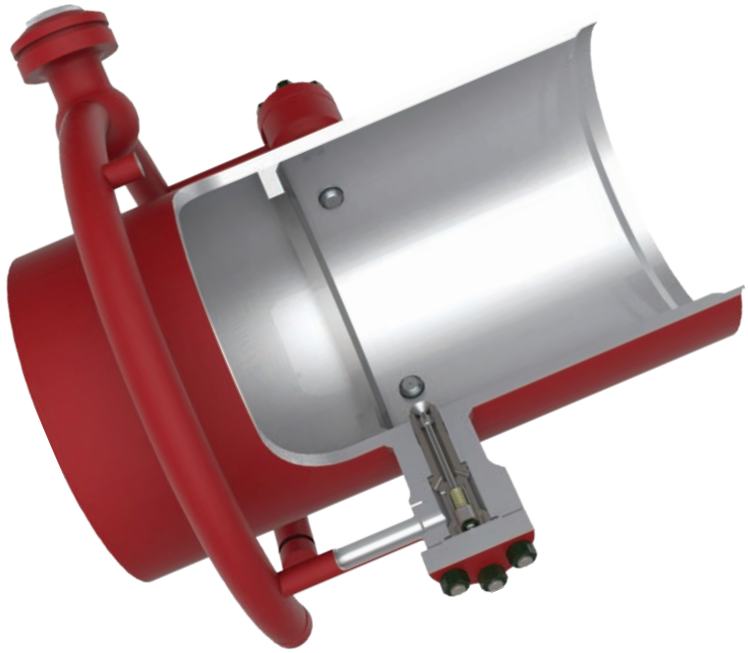
- C_V = 0.4, 0.8, 1.5, 3.0, 5.0, 10.0
- Nozzle Quantity ranging from 1 to 8+ depending on water quantity required per application for a total system C_V ranging from 0.4 up to 80+

Water Manifold

- Sizes 1 inch to 6 inch
- End Connections: ASME (RF, RTJ, SWE, BWE)

DSH Flow Profiler Technology

The Flow Profiler is a Masoneilan differentiated feature that is installed upstream of the spray water nozzles in the desuperheater pipe. It directs the flow towards the center of the pipe while creating a turbulent mixing zone, and then permits flow expansion just prior to the spray water nozzles to optimize mixing of the spray water and the steam. The flow profiler also limits large temperature gradients at the pipe surface of the desuperheater and reduces the thermal stress on the spray water nozzles extending the life of the product. Figure 1 below shows the simulation of the desuperheater's performance and demonstrates how the high temperatures and large thermal gradients are kept away from the pipes inner surface, as well as away from the nozzles. Additionally, it is shown the nozzles provide adequate mixing and the steam reaches a new uniform temperature within a short distance.



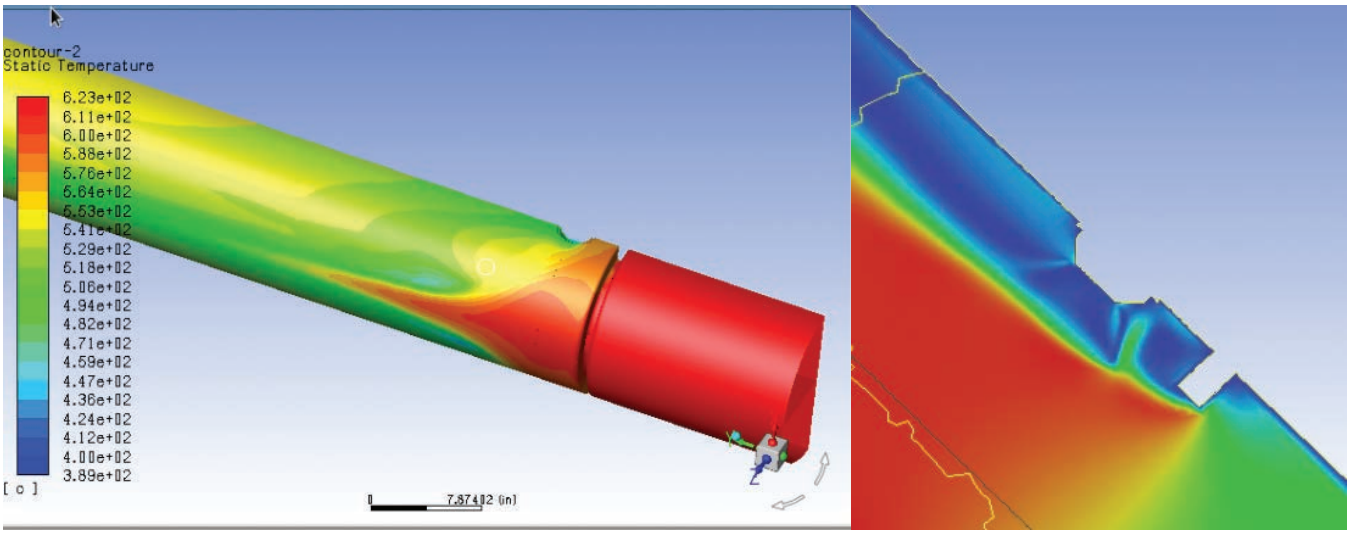
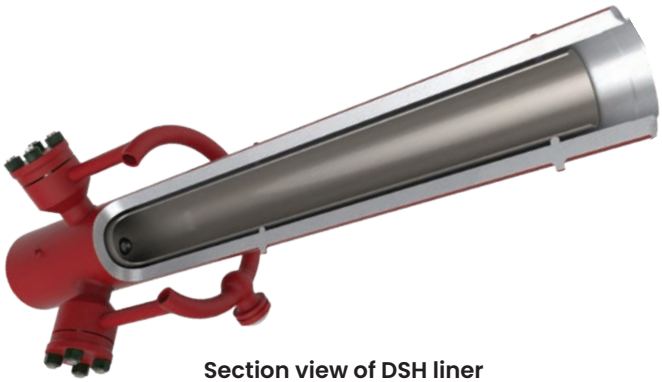


Figure 1 : Mixing, limiting temperature gradients

Liner Technology

Liner style desuperheaters utilize an internal liner welded into the mainline as a means of protecting the desuperheater housing against water impingement and thermal shock where spray water is injected. The liner is suspended from the desuperheater housing by allowing a small clearance between the outside surface of the liner and the inside surface of the main desuperheater pipe. The liner allows the main pipeline to avoid stresses associated with sharp temperature gradients and extends the life of the product while also reducing downtime, maintenance costs, and risks of failure.

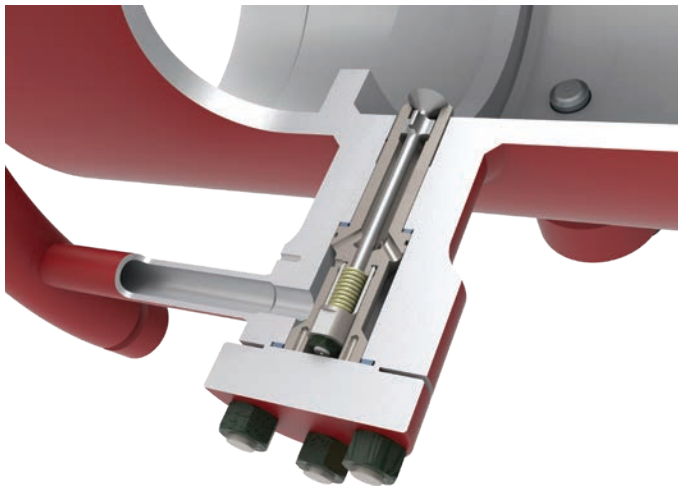


Section view of DSH liner

DSH liner, external view

Hollow Cone Spray Nozzles

The DSH Series desuperheaters are designed to provide a superior primary spray water atomization thanks to the design and geometry, while assuring optimal droplet size to allow for the most efficient mixing of water and steam. This allows the desuperheater to create a consistent thermal distribution, with the desired steam temperature, within three meters, when used with an appropriate control feedback and valve system. The design allows for minimal regions with widely varying temperatures, and keeps the nozzles themselves protected from sharp temperature gradients.



DSH Series Nozzles

The water manifold system is comprised of the spray nozzles, nozzle housing assemblies, and water manifold piping. The water manifold system is designed to the requirements of ASME B31.1, and can also be manufactured to comply with AMSE Boiler and Pressure Vessel Code Section 1 for installations within the boiler or HRSG boundary limits. The available water manifold pipe sizes and connections are listed in the Specification section on page 2. The flange connection, when applicable, shall be in accordance with ASME B16.5.

In standard DSH systems, water is injected into the steam by a spring loaded, variable geometry spray nozzle with a hollow cone spray pattern. The available spray water nozzles sizes, along with their flow vs. pressure differential curves, are shown in Figure 2. Contact Baker Hughes engineering for use of different nozzle for special applications.

Sizes and Connection Types

DSH Series Desuperheaters are available from 4 inch up to 48 inch diameter. Desuperheaters can be engineered to desired lengths and are available with buttweld connections and raised flange connections. Water manifold connections can also be specified with options shown in the Specification section on page 2.

Precise Temperature Control

The DSH Series Desuperheater is intended to be placed in conjunction with a downstream temperature probe and a feedback system signaling a control valve upstream of the water manifold. With years of research, Baker Hughes engineers have worked to optimize the manifold and nozzle delivery system to maximize performance of the desuperheater. For recommendations on probe locations and appropriate feedback loops, see the **SteamForm™** Installation Guide for more details.

Avoid Cavitation and Flashing

The DSH Series desuperheater is designed to allow proper drainage of condensate, and avoid any flashing causing damage to the flow profiler, liner, or nozzles. The nozzles are also designed, when used with a proper control valve and feedback system, to avoid excess water being sent into the main pipeline.

Spray Nozzle Flow Capacity

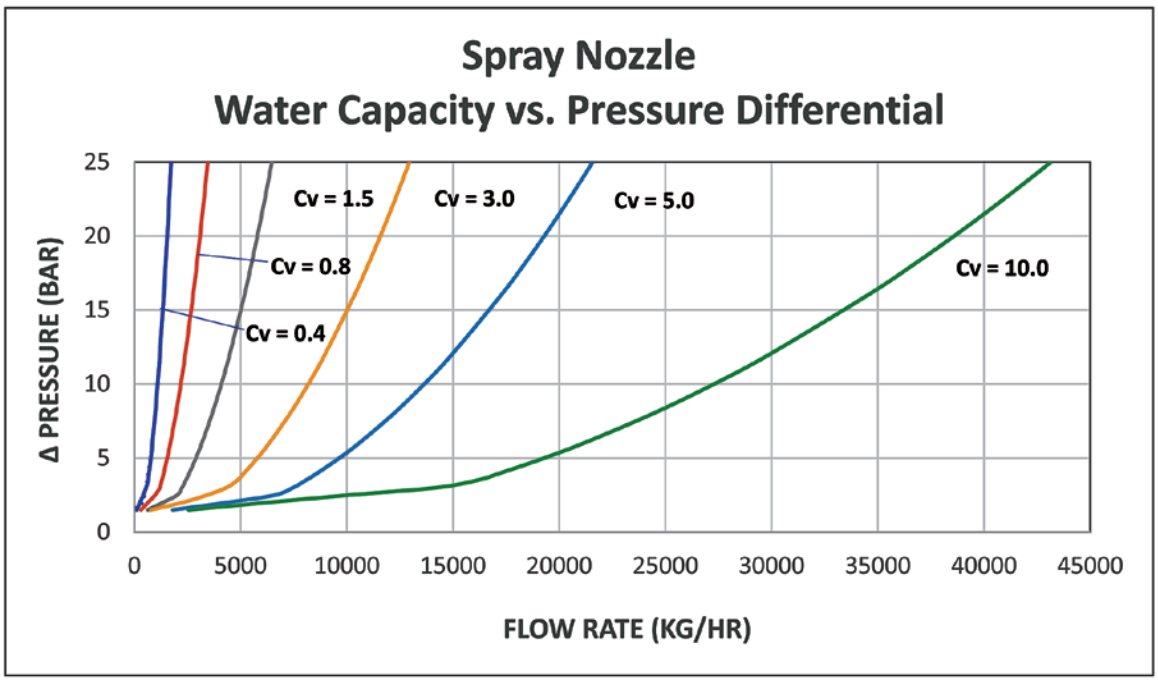
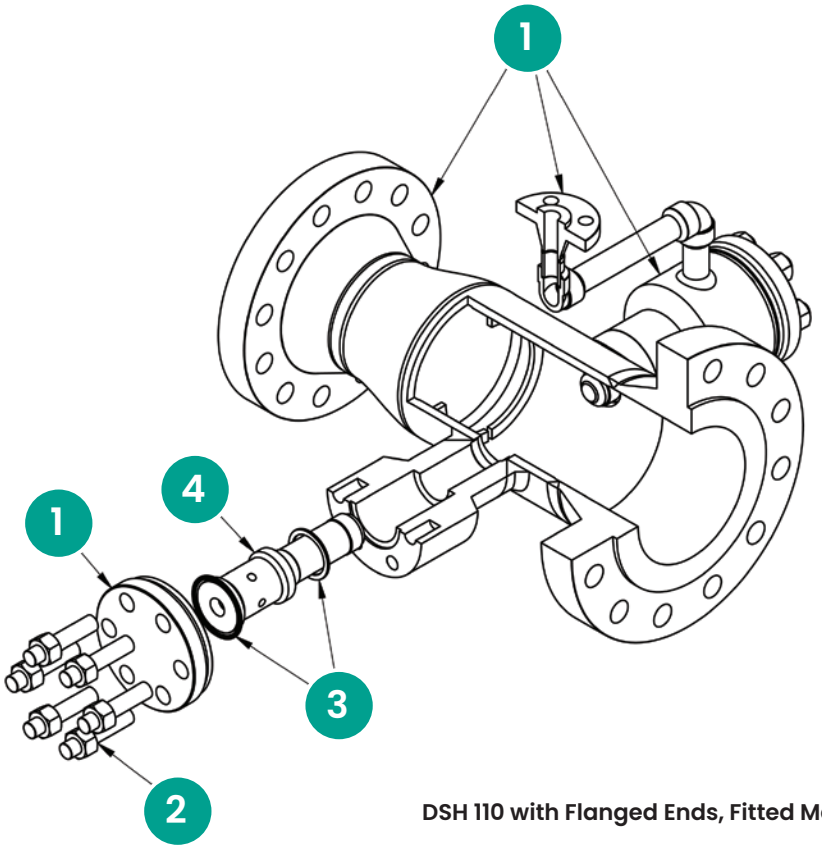
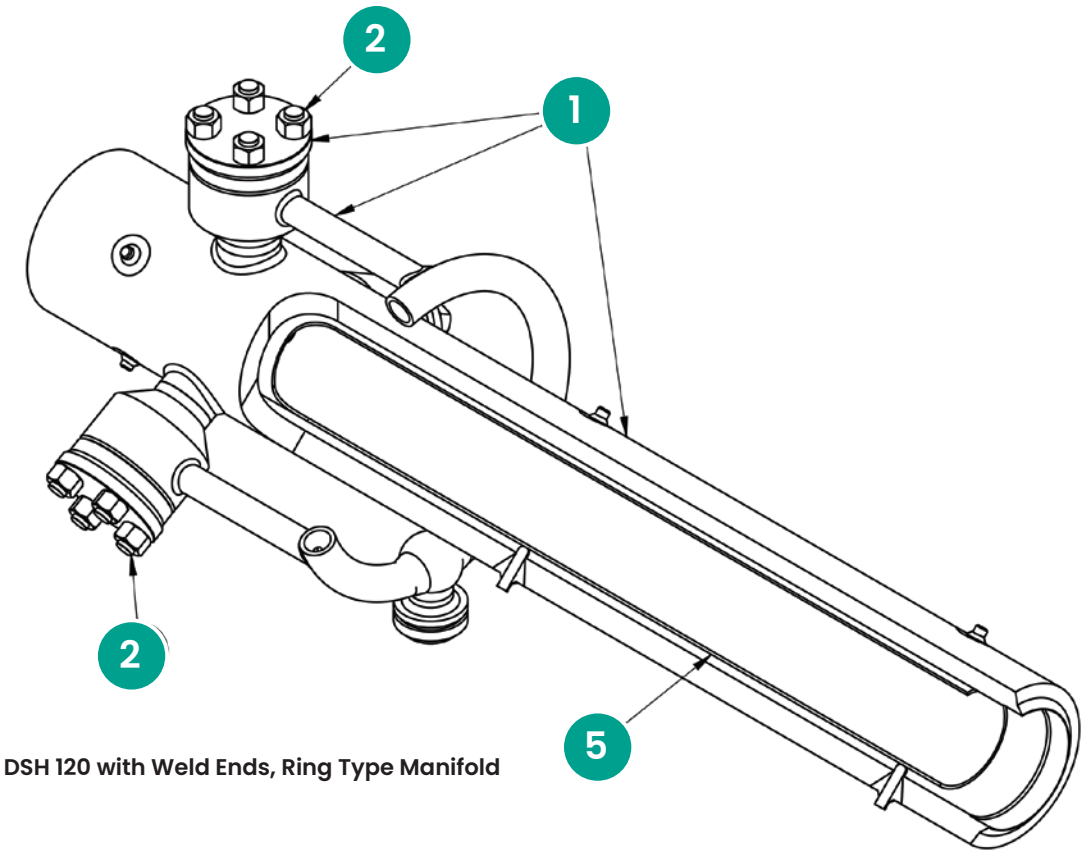


Figure 1: Spray Nozzle Flow Capacity

Materials of Construction



DSH 110 with Flanged Ends, Fitted Manifold



DSH 120 with Weld Ends, Ring Type Manifold

Materials of Construction

Ref. No.	Description	Temperature Limit	Available Materials	
1	STEAM HEADER / WATER MANIFOLD / NOZZLE HOUSINGS	427°C [800°F]	Carbon Steel	ASTM A106 Gr B
				ASTM A105
				ASTM A105 N
				ASTM A234 Gr WPB
				ASTM A515 Gr60 / 65 / 70
		510°C [950°F]	1-1/4Cr 1/2Mo	ASTM A335 Gr P11
				ASTM A336 Gr F11
				ASTM A182 Gr F11
				ASTM A234 Gr WP11
				ASTM A387 Gr 11 CL 2
		565°C [1050°F]	2-1/4Cr 1Mo	ASTM A335 Gr P22
				ASTM A336 Gr F22
				ASTM A182 Gr F22
				ASTM A234 Gr WP22
				ASTM A387 22 CL 2
		649°C [1200°F]	9Cr 1Mo V	ASTM A335 Gr P91
				ASTM A336 Gr F91
				ASTM A182 Gr F91
				ASTM A234 WP91
				ASTM 387 Gr 91
		649°C [1200°F]	9Cr 1/2Mo 1-3/4W	ASTM A335 Gr P92
				ASTM A336 Gr F92
				ASTM A182 Gr F92
				ASTM A234 WP92
2	NOZZLE STUD/ NUT	427°C [800°F]	ASTM A193 B7 / ASTM A194 Gr 2H	
		649°C [1200°F]	ASTM A193 B16 / ASTM A194 Gr 4 / 7	
3	NOZZLE GASKETS	649°C [1200°F]	316L + GRAPHITE	
4	SPRAY NOZZLE ASSEMBLY	649°C [1200°F]	410 STAINLESS STEEL / INCONEL SPRING	
5	THERMAL LINER (DSH-120)	649°C [1200°F]	ASTM A387 Gr 22 CL2	
			ASTM A335 P22	

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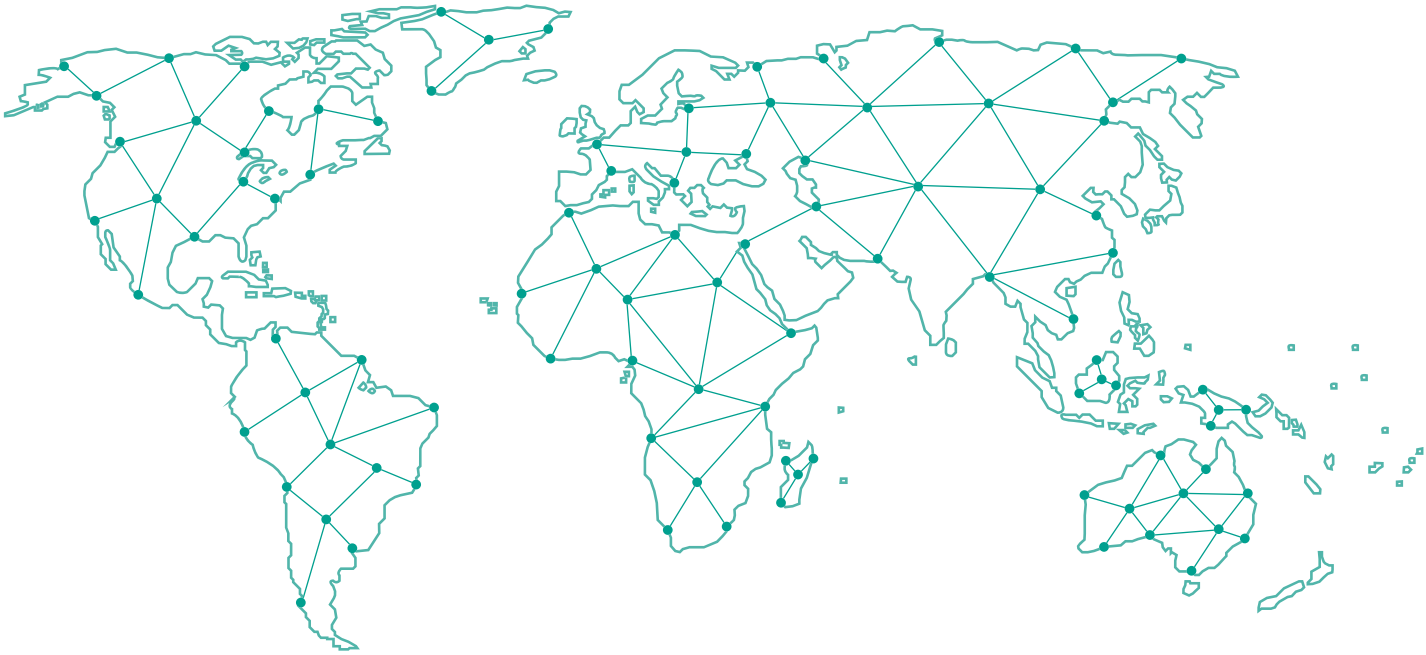

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