Schutte & Koerting Company presents this Desuperheater Manual as a tool to provide detailed information with respect to the sizing, design, installation, operation, and maintenance of desuperheaters.

S&K understands that a manual is not a substitution for personal contact with factory personnel. Therefore, questions pertaining to this manual should be directed as follows:

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Vice President and Manager, Power & Process Business Unit

Phone: (215) 639-0900
Fax: (215) 639-1597
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Introduction

About Desuperheaters

75 Years of Service

Schutte & Koerting has manufactured desuperheating equipment for the power, process and petrochemical industries for over 75 years. Schutte & Koerting desuperheaters are designed to efficiently lower the temperature of steam, utilizing various mechanisms for cooling, based on the customer's available resources. High pressure liquid, low pressure liquid, and high pressure gas can be used to remove the necessary heat from steam or other gases.

Variety

Schutte & Koerting desuperheaters are characterized by a wide variety of models, configurations, sizes and choice of materials. S&K Desuperheaters are also characterized by having no moving parts, thus providing easy maintenance; no special supports, allowing easy installation; and thermal liners are not required except in very special applications.
Desuperheating Basics

Background
Since the advent of superheated steam over 75 years ago the need for desuperheating of such steam has been required and since that time Schutte & Koerting has been filling this need.

Superheated steam is the most efficient means in producing mechanical work. The use of superheated steam was based in the power industry for the main turbines. The superheated steam contains large amounts of potential energy. The additional energy absorbed beyond the saturation point further excites the water molecules already in the gaseous state. When applied to a turbine, the potential energy stored in the excited molecules is transformed into kinetic energy as the steam expands. In addition, superheated steam is "dry". It doesn't contain any condensate droplets that would be highly detrimental to the turbine and other mechanical equipment.

Steam can be produced with energy from various sources, including waste heat and combustible by-products, and steam is an efficient way to transfer energy. Steam applications can be broken down into two primary categories: motive power and heat transfer.

As a source of motive power, steam can be used to drive turbines which drive generators, pumps, compressors, and similar types of rotating equipment. Steam can be used in this manner to do mechanical work directly or to generate electricity for use on site or for sale back to the power grid.

Steam is also used as a source of heat energy. Steam is used to heat process fluids, air, and water. Steam's popularity as a heating medium rests on the fact that water absorbs large amounts of energy when converted into steam, and gives that heat back up again when it turns from steam to condensate. This is known as the heat of vaporization.

However, the advantages realized from the use of superheated steam for mechanical applications do not carry over to heating applications. Also, there can be distinct disadvantages in situations when superheated steam is provided to equipment not readily capable of handling such steam.

Heating
The use of superheated steam in heating applications is extremely inefficient. This is apparent by the amount of heat liberated as a function of the temperature when the steam is in the superheated state. For example, assume that steam at 165 psia and 376°F is cooled 10°F, to its saturation temperature of 366°F. The total heat liberated is 6.4 BTU/lb. However, if it is cooled 10°F further, through the saturation region, condensation occurs and the total heat liberated is 867.7 BTU/lb.

Also note that energy is not being lost in the desuperheating process. Desuperheating simply creates more steam with fewer Btu's per pound by injecting water into the steam, which evaporates to produce steam with a lower enthalpy.

In summary, the process of desuperheating converts a given amount of superheated steam into a greater amount of steam closer to the saturation point, so that the resulting steam can more readily be used for heat transfer applications.

Equipment Protection
Another area where desuperheaters are critical is in the protection of equipment that cannot handle superheated steam; for instance, when the superheated steam to a turbine generator needs to be bypassed to the main turbine condenser. Since the main turbine condenser is not designed to handle the high temperatures associated with the superheated steam, damage is avoided with the use of a desuperheater. This same principle applies to many different types of equipment and applications.
Desuperheating Basics

Applications
Desuperheaters are commonly found in industries such as Chemical, Petrochemical, Pulp & Paper, Utility, Food, Pharmaceutical, and so on — essentially anywhere there is steam.

Specifically, desuperheaters are used on inlets to heat exchangers, in lines to jacketed vessels, on turbine extraction and bypass lines, in dormitory heating systems, in services with pressure reducing valves, in emergency exhaust systems and many other places.

Desuperheating is accomplished in one of the following ways:

Direct Surface Contact – Figure 6910
This method injects water over a large surface area, whereby steam passes over, around and through water wetted packing, effectively accomplishing heat transfer by pure temperature gradients across a large surface area.

Mechanical Atomizing (Venturi) – Figures 6940, 6940M, 6950, 6952, 6953 & 6985
This process, which is the most common, utilizes velocity to shear water particles, then introduces these particles into a turbulent region where heat transfer is accomplished.

The internal design produces a lower pressure region, essentially syphoning in the cooling water. This unique design means the required water pressure need only be as high as the steam line pressure.

Steam Assist Atomizing – Figures 6970 & 6972
This method uses high pressure steam to effectively shear the water particles and then suspends the mixture for a period of time within a venturi, thus allowing more vapor / water contact.

The internal design produces a lower pressure region, essentially syphoning in the cooling water. This unique design means the required water pressure need only be as high as the steam line pressure.

Spray – Figure 6905
This process utilizes higher water pressure and the corresponding pressure differential across a nozzle as a means to shear the water particles and introduce the water into the steam.
Appendix 1

Sizing Data on S&K Desuperheaters
Appendix 1

Estimating Sizing Chart

Determination of Required Water Flow

A simple heat balance is used to determine required water flow. Calculation is as shown in the following example. Given 50,000 pph steam at 300 psig and 600° F, reduce pressure* to 50 psig and temperature to 340° F (42 superheat). To solve, check steam tables to find enthalpy of both conditions. The enthalpy for 50,000 pph, 300 psig, 600° F is 1313.6 Btu per pound. The enthalpy for 50 psig, 340° F is 1202.0 Btu per pound. To find the heat that must be removed from the steam, subtract the enthalpy of steam at 50 psig and 340° F from the enthalpy of steam at 300 psig and 600° F, as 1313.6 - 1202.0 = 111.6 Btu to be removed per pound. Given available water at 50 psig (water pressure must equal steam pressure)** and 200° F, determine the enthalpy of the water from available tables as 168.0. To find the heat to be gained by the water, subtract the enthalpy of the water from the enthalpy of the desired steam condition, such as 1202.0 - 168.0 = 1034.0 Btu. Use the following to determine pph water required to reduce steam to desired temperature.

\[
\text{Btu to be removed} \times \text{steam qty.} = \text{pph water required}
\]

\[
\text{Btu to be gained by water} = \text{pph water required}
\]

To convert pph to gpm, divide pph water by 500 x Sp. Gr., 5400 ÷ [500(0.965)] = 11.2 gpm water required.

*To reduce pressure, a reducing valve should be used not less than 5 pipe diameters upstream of the desuperheater.

**For Type 6910, 10 psi maximum above steam pressure.

NOTE: Consult capacity table in Bulletin 6D-E for proper atomizing head size for Type 6970 Desuperheater.

Refer to curve on this page for required pipe size versus steam load for Types 6910, 6940, 6950, 6952, 6953, 6970, 6980, and 6985.

For sizing of Types 6905 and 6940M, consult factory.

These curves will help to select the proper main line for desuperheated steam. They include correction for superheated steam. Using same example as noted under water calculation, note the following: To use the curves, find the steam pressure line (50 psig) and following slanting superheat correction line until it intersects line representing 42°F superheat. Follow horizontal line across to right until it intersects line representing steam flow pph (50,000 pph). This point falls between 8” and 10” (pipe ID). A 10” * unit is required if Types 6910, 6940, 6950, 6952, 6953, or 6985 is desired. A 10” pipe ring is required if Type 6970 is chosen.

* When the intersecting point falls between two ID’s, always use the larger.
Appendix 1

Pressure Drop Chart

For Types 6910, 6940, 6950, 6980 and 6985 Desuperheaters. This nomograph can be used to estimate pressure drop through S & K Desuperheaters as shown in the example: 

Example: If a Desuperheater is desired for a discharge capacity of 70,000 lb per hour steam at 100 psig, 100° F final superheat, the sizing chart, Figure 1, shows that 10" size is required. 

To determine the pressure drop:

Identify 100 psig on the discharge pressure scale at the left of the nomograph and follow line (A) to the 100° F line. Draw a horizontal line (B) to the discharge pressure scale to determine equivalent saturated pressure. From this point draw line (C) to Desuperheater size (10"). From the point of intersection of line (C) with the pivot line,
Appendix 1

Turndown Capacity

Guidelines to Minimum Distance To Temperature Element Placement

Desuperheater piping arrangement, straight length requirements, upstream and downstream, and temperature element placement have become very important parameters in desuperheating stations. Temperature element placement is, however, the most critical parameter of those listed. Table 1 should be used as a guide to minimum allowed distance to bulb, regardless of horizontal or vertical mounting. S&K normally recommends that this distance be straight. However, as long as precaution is exercised, bend and curve scan be made within 10’ to 15’ from unit discharge connection. S&K recommends five pipe diameters upstream of straight run if desuperheater is used in conjunction with pressure reducing valve.

Table 1:

<table>
<thead>
<tr>
<th>Amount of Residual Superheat, °F</th>
<th>Bulb Placement From Unit Discharge Connection, ft*</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>100</td>
<td>15</td>
</tr>
<tr>
<td>200</td>
<td>10</td>
</tr>
<tr>
<td>400</td>
<td>7</td>
</tr>
<tr>
<td>500</td>
<td>5</td>
</tr>
</tbody>
</table>

*For Types 6940, 6040M, 6952, 6953, 6970, 6985.

Calculation of Desuperheater Turndown Capacity

No desuperheater operates alone; it is always part of a system made up of many interacting components. Therefore, turndown- more properly, the ratio of maximum to minimum flows - of the desuperheater is no greater than that of the system control components. To calculate preliminary desuperheater turndown available for Types 6940, 6950, and 6972, use the following calculation: If mounted horizontally:

If mounted horizontally:

\[
\text{T.D.} = \frac{\text{operating velocity}}{\text{min. desuperheating velocity}}
\]

If mounted vertically:

\[
\text{T.D.} = \frac{\text{operating velocity}}{15 \text{ fps}}
\]

Noting that operating velocity =

\[
\frac{(\text{max. steam flow})(\text{specific volume})}{25 \text{ (cross-sectional area of pipe)}}
\]

To calculate desuperheater turndown of the Type 6970 unit, it must be noted that turndown is not a function of velocity when using the recycle feature.

\[
\text{T.D.} = \frac{\text{steam flow} + \text{atomizing steam flow}}{\text{atomizing steam flow}}
\]

(limited to a maximum of 50 to 1)

Turndown capacity available for other units (Types 6905, 6910, 6952, 6953, and 6985) are available from the factory.
Appendix 2

Figure 6905 Data

1. Outline & Dimensional Drawing
2. Piping and Instrumentation Design
Appendix 2

Fig. 6905 Mechanical Atomizing Dump Desuperheater Drawing
Appendix 2

Figure 6905 Piping and Instrumentation Diagram
Appendix 3

Figure 6910 Data

1. Outline & Dimensional Drawing

2. Piping and Instrumentation Diagram
Appendix 3

Figure 6910

<table>
<thead>
<tr>
<th>Size No.</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Width in Inches</td>
<td>17</td>
<td>17 1/2</td>
<td>20</td>
<td>22 7/8</td>
<td>26 7/8</td>
<td>31 3/8</td>
<td>39 3/4</td>
<td>44</td>
</tr>
<tr>
<td>Overall Height in Inches</td>
<td>16 1/2</td>
<td>16 5/16</td>
<td>17 3/4</td>
<td>22 1/4</td>
<td>24 3/4</td>
<td>29 1/4</td>
<td>35 1/2</td>
<td>41 3/4</td>
</tr>
</tbody>
</table>
Appendix 3

Fig. 6910 150 Class Absorption Desuperheater Drawing

NOTES:

1. TRACER IMPROPERLY DESIGNATING THE STAMP INLET AND OUTPUT CONNECTION PARTS PLACED ON THE MAIN SHEET METAL.

SECTION A-A

SECTION C-C
Appendix 3

Figure 6910 Piping and Instrumentation Diagram
Appendix 4

Figure 6940, 6940M, and 6950 Data

1. Outline & Dimensional Drawing

2. Piping and Instrumentation Diagram
Appendix 4

Figure 6940

<table>
<thead>
<tr>
<th>Size &amp; Connection</th>
<th>A</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Length 150 lb</td>
<td>B</td>
<td>11 1/2</td>
<td>15 5/16</td>
<td>20</td>
<td>24 1/8</td>
<td>30 1/16</td>
<td>41</td>
<td>49 1/2</td>
<td>59 15/16</td>
<td>72</td>
<td>81 3/4</td>
</tr>
<tr>
<td>Overall Length 300 lb</td>
<td>11 3/4</td>
<td>16 5/16</td>
<td>20 1/16</td>
<td>25</td>
<td>30</td>
<td>41</td>
<td>50 3/4</td>
<td>59 15/16</td>
<td>72</td>
<td>81 3/4</td>
<td></td>
</tr>
<tr>
<td>Overall Length 600 lb</td>
<td>12 1/2</td>
<td>16 13/16</td>
<td>20 1/16</td>
<td>25 13/16</td>
<td>31 7/8</td>
<td>41</td>
<td>49 5/8</td>
<td>62 9/16</td>
<td>73 3/8</td>
<td>81 3/4</td>
<td></td>
</tr>
<tr>
<td>Water Inlet (NPT)</td>
<td>C</td>
<td>1/4</td>
<td>1/4</td>
<td>3/8</td>
<td>1/2</td>
<td>3/4</td>
<td>3/4</td>
<td>3/4</td>
<td>1</td>
<td>1 1/4</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Flange Face to</td>
<td>D</td>
<td>2</td>
<td>2 1/2</td>
<td>2 1/2</td>
<td>3</td>
<td>4</td>
<td>5 1/4</td>
<td>7</td>
<td>8 1/2</td>
<td>9</td>
<td>10 1/2</td>
</tr>
</tbody>
</table>
Appendix 4

Fig. 6940 Venturi Desuperheater Drawing

* SIZE & CONNECTION

<table>
<thead>
<tr>
<th>SIZE &amp; CONNECTION</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVERALL LENGTH</td>
<td>11 1/2</td>
<td>15.5 1/2</td>
<td>25.5 1/4</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>WATER INLET</td>
<td>C</td>
<td>1/4</td>
<td>1/4</td>
<td>3/8</td>
<td>3/8</td>
<td>1/2</td>
<td>1/2</td>
<td>3/4</td>
<td>3/4</td>
<td>1 1/4</td>
<td>1 1/4</td>
</tr>
<tr>
<td>FLANGE FACE TO</td>
<td>D</td>
<td>1 1/8</td>
<td>2 1/2</td>
<td>2 1/2</td>
<td>3</td>
<td>4</td>
<td>5 1/4</td>
<td>7 3 1/2</td>
<td>6</td>
<td>10 3/8</td>
<td></td>
</tr>
</tbody>
</table>

* FOR OTHER SIZES AND NoTS CONTACT FACTORY.

* RECOMMENDED SPARE PARTS

<table>
<thead>
<tr>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>SET SCREW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>PIPE Plug</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Jack Nut</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Coupling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Valve Gasket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Nozzle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Water Box Gasket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Combining Tube</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Joint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Flange</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* RECOMMENDED SPARE PARTS

![Diagram of Venturi Desuperheater Drawing]
## Appendix 4

### Figure 6940M

<table>
<thead>
<tr>
<th>Size &amp; Connection</th>
<th>A</th>
<th>1/2</th>
<th>3/4</th>
<th>1</th>
<th>1 1/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>B</td>
<td>4 7/8</td>
<td>6</td>
<td>7 3/8</td>
<td>10 3/16</td>
</tr>
<tr>
<td>Overall Length 150, 300 &amp; 600 lb Flanged</td>
<td>BB</td>
<td>9 1/2</td>
<td>10 1/2</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Water Inlet (NPT)</td>
<td>C</td>
<td>1/8</td>
<td>1/8</td>
<td>1/4</td>
<td>1/4</td>
</tr>
<tr>
<td>Inlet Face to Water Inlet C/L</td>
<td>D</td>
<td>2</td>
<td>2</td>
<td>2 1/4</td>
<td>2 5/8</td>
</tr>
<tr>
<td>Flange Face to Water Inlet C/L</td>
<td>DD</td>
<td>4 5/16</td>
<td>4 1/4</td>
<td>4 9/16</td>
<td>5 1/32</td>
</tr>
</tbody>
</table>
Appendix 4

Fig. 6940M Venturi Desuperheater Drawing
Appendix 4

Figure 6950

<table>
<thead>
<tr>
<th>Size &amp; Connection</th>
<th>A</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150, 300 &amp; 600 lb Flanged</td>
<td>B</td>
<td>11 7/8</td>
<td>15 9/16</td>
<td>19 7/16</td>
<td>28 13/16</td>
<td>40 3/8</td>
<td>47 13/16</td>
<td>57 15/16</td>
<td>69 1/16</td>
<td>77 13/16</td>
</tr>
<tr>
<td>Water Inlet (NPT)</td>
<td>C</td>
<td>1/4</td>
<td>1/4</td>
<td>3/8</td>
<td>3/4</td>
<td>3/4</td>
<td>1</td>
<td>1 1/4</td>
<td>1 1/2</td>
<td></td>
</tr>
<tr>
<td>Inlet Face to Water Inlet C/L</td>
<td>D</td>
<td>1 7/64</td>
<td>1 3/8</td>
<td>7/8</td>
<td>1 9/16</td>
<td>1 7/16</td>
<td>1 5/8</td>
<td>3 1/2</td>
<td>2 3/4</td>
<td>2 11/16</td>
</tr>
<tr>
<td>Body Thickness</td>
<td>E</td>
<td>2 1/16</td>
<td>2 11/16</td>
<td>2 3/16</td>
<td>3 1/2</td>
<td>2 15/16</td>
<td>3 11/16</td>
<td>5 7/16</td>
<td>5 11/16</td>
<td>6 1/16</td>
</tr>
</tbody>
</table>
Appendix 4

Fig. 6950 Venturi Desuperheater Drawing
Appendix 4

Figure 6950 Piping and Instrumentation Diagram
Appendix 5

*Figure 6952, 6953 Data*

Outline & Dimensional Drawing
### Appendix 5

**Figure 6952**

<table>
<thead>
<tr>
<th>SIZE (INCHES)</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body O.D. A</td>
<td>3 5/8</td>
<td>5</td>
<td>6 3/16</td>
<td>8 1/2</td>
<td>10 5/8</td>
<td>12 3/4</td>
<td>15</td>
<td>16 1/4</td>
<td>18 1/2</td>
<td>21</td>
</tr>
<tr>
<td>Body Thickness B</td>
<td>2 1/16</td>
<td>2 11/16</td>
<td>2 3/16</td>
<td>3 9/16</td>
<td>2 13/16</td>
<td>3 11/16</td>
<td>5 7/16</td>
<td>5 11/16</td>
<td>6 1/16</td>
<td>6 9/16</td>
</tr>
<tr>
<td>Overall Length C</td>
<td>4</td>
<td>5 9/16</td>
<td>6 5/8</td>
<td>9 7/8</td>
<td>14 3/16</td>
<td>16 3/16</td>
<td>20</td>
<td>22 1/4</td>
<td>25 5/16</td>
<td>25 13/16</td>
</tr>
<tr>
<td>Water Inlet (NPT) D</td>
<td>1/4</td>
<td>1/4</td>
<td>3/8</td>
<td>3/4</td>
<td>3/4</td>
<td>3/4</td>
<td>3/4</td>
<td>1</td>
<td>1 1/4</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Body Face to E</td>
<td>1 7/64</td>
<td>1 3/8</td>
<td>7/8</td>
<td>1 9/16</td>
<td>1 7/16</td>
<td>1 5/8</td>
<td>3 1/2</td>
<td>2 3/4</td>
<td>2 11/16</td>
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</table>
Appendix 5

Fig. 6952 Attemperator Desuperheater Drawing
### Appendix 5

#### Figure 6953C

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<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Length 150#</td>
<td>A</td>
<td>17</td>
<td>17 3/4</td>
<td>18</td>
<td>18 3/4</td>
<td>24</td>
<td>24 3/4</td>
<td>26</td>
<td>27 1/4</td>
<td>30</td>
</tr>
<tr>
<td>Overall Length 300#</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Water Inlet</td>
<td>B</td>
<td>1/2</td>
<td>3/4</td>
<td>3/4</td>
<td>3/4</td>
<td>3/4</td>
<td>1</td>
<td>1 1/4</td>
<td>1 1/2</td>
<td>2</td>
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Appendix 5

Fig. 6953C Attemperator Desuperheater Drawing
Appendix 5

Figure 6953A & 6953D

<table>
<thead>
<tr>
<th>SIZE (INCHES)</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Length</td>
<td>A</td>
<td>11</td>
<td>11</td>
<td>16</td>
<td>18</td>
<td>21</td>
<td>23</td>
<td>26</td>
<td>29</td>
<td>33</td>
</tr>
<tr>
<td>Water Inlet</td>
<td>B</td>
<td>1/2</td>
<td>3/4</td>
<td>3/4</td>
<td>3/4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1/2</td>
</tr>
<tr>
<td>Inlet to</td>
<td>C</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>
Appendix 5

Fig. 6953A Attemperator Desuperheater Drawing
Appendix 5

Fig. 6953D Attemperator Desuperheater Drawing
Appendix 6

Figure 6970, 6972 Data

1. Outline & Dimensional Drawing
2. Piping and Instrumentation Diagram
Appendix 6

Figure 6970A & 6972A

<table>
<thead>
<tr>
<th>Unit Size No.</th>
<th>Dimensions, in Inches</th>
<th>Max Water Capacity PPH</th>
<th>Atomizing Steam Required PPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>A: 12 1/2, B: 5 11/16, C: 1 3/16, D: 5 5/8, E: 1/4, F: 3/8</td>
<td>500</td>
<td>45</td>
</tr>
<tr>
<td>1</td>
<td>A: 12 1/2, B: 5 5/16, C: 1 13/16, D: 5 3/8, E: 3/4, F: 3/4</td>
<td>1,000</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>A: 12 1/2, B: 4 15/16, C: 2 3/16, D: 5 3/8, E: 1, F: 1</td>
<td>6,000</td>
<td>550</td>
</tr>
<tr>
<td>3</td>
<td>A: 12 1/2, B: 3 7/8, C: 3 1/4, D: 5 3/8, E: 1 1/2, F: 1 1/2</td>
<td>12,000</td>
<td>1,100</td>
</tr>
<tr>
<td>4</td>
<td>A: 15 1/2, B: 4 5/8, C: 3 7/8, D: 7, E: 2, F: 2</td>
<td>24,000</td>
<td>2,200</td>
</tr>
<tr>
<td>5</td>
<td>A: 19, B: 4 1/4, C: 5 3/4, D: 9, E: 2 1/2, F: 2 1/2</td>
<td>50,000</td>
<td>4,500</td>
</tr>
<tr>
<td>6</td>
<td>A: 26, B: 5, C: 6 3/8, D: 14 5/8, E: 3, F: 3</td>
<td>100,000</td>
<td>9,000</td>
</tr>
<tr>
<td>7</td>
<td>Contact Factory</td>
<td>200,000</td>
<td>18,000</td>
</tr>
</tbody>
</table>
Appendix 6

Fig. 6970A & 6972A Atomizing Desuperheater Drawing

*LENGTH SUITABLE FOR BUTT WELD CONNECTIONS ONLY. FOR FULL LENGTH, ADD LENGTH OF WELDING IN FLANGE.

NOTE:
1. MARK NO. 2 & 9 NOT INCLUDED IN FIG. 6970A.
Appendix 6

Figure 6970C & 6972C
Appendix 6

Fig. 6972 Atomizing Desuperheater Drawing

*STANDARD EXHAUST VENT PIPES.*

**Fig. 6972 Atomizing Desuperheater Drawing**

<table>
<thead>
<tr>
<th>UNIT</th>
<th>DIMENSIONAL VALUES</th>
<th>MAX. VACUUM CHAMBER PIPING</th>
<th>RATING</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
<td>E</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>1/25</td>
<td>1.1</td>
<td>1.14</td>
<td>0.11</td>
<td>0.33</td>
</tr>
<tr>
<td>1</td>
<td>1.2</td>
<td>1.24</td>
<td>0.08</td>
<td>0.22</td>
</tr>
<tr>
<td>2/3</td>
<td>2.3</td>
<td>2.34</td>
<td>0.03</td>
<td>0.16</td>
</tr>
<tr>
<td>3</td>
<td>3.4</td>
<td>3.44</td>
<td>0.05</td>
<td>0.18</td>
</tr>
<tr>
<td>4</td>
<td>4.5</td>
<td>4.54</td>
<td>0.07</td>
<td>0.20</td>
</tr>
<tr>
<td>5</td>
<td>5.6</td>
<td>5.64</td>
<td>0.09</td>
<td>0.22</td>
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<tr>
<td>6</td>
<td>6.7</td>
<td>6.74</td>
<td>0.11</td>
<td>0.24</td>
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</table>

*LENGTHS VARY FOR BUTT WELD CONNECTIONS ONLY. FOR FLANGED UNIT, ADD LENGTH OF WELDING NOZZLES.*

* RECOMMENDED GASKET MATERIALS:

- **3** INSULATED W/ALUM
- **3** ASBESTOS KILN
- **5** M📎 AND W/FLANGE
- **5** M合规 W/FLANGE
- **5** M合规 W/FLANGE
- **7** M合规 W/FLANGE
- **7** M合规 W/FLANGE
- **7** M合规 W/FLANGE
- **7** M合规 W/FLANGE

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Appendix 6

Figure 6970D & 6972D

<table>
<thead>
<tr>
<th>Unit Size No.</th>
<th>Dimensions, in Inches</th>
<th>Max Water Capacity PPH</th>
<th>Atomizing Steam Required PPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>* 1 3/16 * 1/4 3/8</td>
<td>500</td>
<td>45</td>
</tr>
<tr>
<td>1</td>
<td>* 1 13/16 * 3/4 3/4</td>
<td>1,000</td>
<td>90</td>
</tr>
<tr>
<td></td>
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<td>270</td>
</tr>
<tr>
<td>2</td>
<td>* 2 3/16 * 1 1</td>
<td>6,000</td>
<td>550</td>
</tr>
<tr>
<td>3</td>
<td>* 3 1/4 * 1 1/2 1 1/2</td>
<td>12,000</td>
<td>1,100</td>
</tr>
<tr>
<td>4</td>
<td>* 3 7/8 * 2 2</td>
<td>24,000</td>
<td>2,200</td>
</tr>
<tr>
<td>5</td>
<td>* 5 3/4 * 2 1/2 2 1/2</td>
<td>50,000</td>
<td>4,500</td>
</tr>
<tr>
<td>6</td>
<td>* 6 3/8 * 3 3</td>
<td>100,000</td>
<td>9,000</td>
</tr>
<tr>
<td>7</td>
<td>Contact Factory</td>
<td>200,000</td>
<td>18,000</td>
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</table>
Appendix 6

Fig. 6970D & 6972D Atomizing Desuperheater Drawing
Appendix 6

Figure 6970 Piping and Instrumentation Diagram
Appendix 7

Figure 6985 Data

1. Outline & Dimensional Drawing
2. Piping and Instrumentation Diagram
Appendix 7

Figure 6985C

<table>
<thead>
<tr>
<th>Size (Inches)</th>
<th>A</th>
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<th>1 1/2</th>
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<th>3</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall 150 lb</td>
<td>B</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
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<td>24</td>
<td>28</td>
<td>30</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td>Length 300 lb</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Inlet (NPT)</td>
<td>C</td>
<td>1/8</td>
<td>1/4</td>
<td>1/4</td>
<td>1/4</td>
<td>1/2</td>
<td>1/2</td>
<td>1</td>
<td>1</td>
<td>1 1/2</td>
<td>1 1/2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Flange 150 lb</td>
<td>D</td>
<td>4 3/4</td>
<td>4 1/2</td>
<td>6</td>
<td>7 7/8</td>
<td>8 1/4</td>
<td>9</td>
<td>8 1/4</td>
<td>8</td>
<td>6</td>
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<tr>
<td>Inlet C/L 300 lb</td>
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</tr>
<tr>
<td>C/L to Water Inlet</td>
<td>E</td>
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<td>4 1/2</td>
<td>4 1/2</td>
<td>4 1/2</td>
<td>4 1/2</td>
<td>7 3/8</td>
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</tr>
</tbody>
</table>

Support Gusset 8” and Larger
Appendix 7

Fig. 6985C Annular Venturi Desuperheater Drawing

NOTES:
1. BOLT HOLES STRADDLE CENTERLINE.
2. FOR FIG. 6985C ANNULAR FRONT LENGTH B DIMENSION IS THE SAME AS THE 150W FLANGED UNIT.
Appendix 7

Figure 6985 Piping and Instrumentation Diagram