Steam Injection

Humidifiers

- For use with steam boilers
- Suitable for a wide range of applications
Humidify with pressurized boiler steam

SUITABLE FOR A WIDE RANGE OF APPLICATIONS

Steam Injection humidifiers from DriSteem use steam from an external source, such as an in-house boiler or a district steam system. DriSteem’s Steam Injection humidifiers are adaptable to virtually any size application, and a wide variety of models accommodate a broad range of steam absorption requirements.

STEAM JACKETED DISPERSION TUBE MODELS FOR DUCTS AND AIR HANDLERS

Single-tube, Mini-bank®, and Multi-tube humidifiers are designed for ducts and air handlers, and capable of a wide range of guaranteed non-wetting distances.

AREA-TYPE FOR OPEN SPACES

Area-type Steam Injection humidifiers are designed for open spaces such as warehouses and manufacturing spaces that do not have a duct system. The steam discharged from the humidifier is quietly dispersed by a fan without introducing water droplets into the air.

Figure 2-1: DriSteem Steam Injection Humidifiers

- **Single-tube humidifiers** are suitable for duct applications.
- **Area-type humidifiers** disperse steam into open spaces using a fan.
- **Mini-bank and Multiple-tube humidifiers** expand ducted and AHU application flexibility with additional dispersion tubes and assembly options.
PROVEN PERFORMANCE

- 304 stainless steel construction allows instantaneous heat-up, which minimizes condensation and eliminates cold start-up spitting.
- 304 stainless steel separator removes entrained condensate with proven centrifugal design.
- Lightweight construction requires no special supports or hangers.
- Bronze modulating steam control valves:
  - Rangeability between 13:1 and 205:1 provides enhanced controllability at minimum controllable flow.
  - Wide Kv selection permits close matching to humidifier output capacity for precise control and no valve hunting.
  - Valves are independent from separators for easy removal.
- Pressure drop allowance of 345 kPa provides control reliability at high entering steam pressure and low dispersion-side pressure.
- Tight sealing meets ANSI Class V requirements. Ultra low steam leakage on shutoff improves system efficiency.

APPLICATION FLEXIBILITY

- Wide range of models and non-wetting distances meet virtually any humidification need.
- Numerous valve Kv choices permit close matching to actual job requirements.
- Steam is dispersed through vertical or horizontal ducts or directly into a space.

ADDED FLEXIBILITY WITH OPTIONAL STAINLESS STEEL COMPONENTS

Single-tube, Mini-bank, and Multiple-tube humidifiers are available with options for applications requiring all stainless steel construction.

- Stainless steel components reduce corrosion potential and are compatible with steam derived from DI/RO water.
- Modulating electric and pneumatic stainless steel valves are manufactured to precise tolerances, with some configurations capable of achieving the highest turndown ratio in the industry.
- Stainless steel component options:
  - 316 stainless steel separator and dispersion tubes
  - Stainless steel steam control valves
  - 304 or 316 stainless steel interconnecting piping
  - Stainless steel strainers and thermostatic traps

GUARANTEED ABSORPTION

- Cataloged and guaranteed steam absorption (non-wetting) distances
- Steam-jacketed dispersion tubes are fitted with calibrated tubelets ensure uniform steam dispersion across the duct
- Thermal-resin tubelets have exceptional ability to trap noise generated by the valve
- Published absorption tables for sizing and selecting the correct humidifier
- DriSteem’s DriCalc® software is available for computer calculation of non-wetting distances and system selection
Steam injection humidifiers

**FIGURE 4-1: STEAM INJECTION HUMIDIFIER MODELS**

**SINGLE-TUBE HUMIDIFIER**
- Suitable for small- to medium-capacity systems, 0.7 – 238 kg/h
- Moderate to long non-wetting distance
- Pre-assembled separator/tube assembly
- See Pages 7-11

**MINI-BANK HUMIDIFIER**
- Suitable for small-capacity systems, 0.7 – 38 kg/h
- Short to moderate non-wetting distance
- Sized for small ducts
- Pre-engineered and pre-assembled header/tube assembly, ready for mounting and hookup
- See Pages 12-15

**MULTIPLE-TUBE HUMIDIFIER**
- Suitable for small- to large-capacity systems, 2.3 – 1809 kg/h
- Sizes to fit small ducts and large air handlers
- Short to moderate non-wetting distance
- Field assembled (with interconnecting piping and header supplied by contractor)
- Maxi-bank™ option:
  - Pre-assembled, except when either dimension is 2490 mm or more
  - Includes 304 stainless steel header, with option for 316 stainless steel
  - Includes black iron piping, with options for 304 or 316 stainless steel
- See Pages 16-22

**AREA-TYPE HUMIDIFIER**
- Suitable for medium-capacity systems, 0.8 – 130 kg/h
- Used in open spaces
- Application-dependent non-wetting distances
- See Pages 23-25

All Steam Injection humidifiers show here, except Area-type, are available with options for applications requiring all stainless steel construction.
Steam injection humidifier components

1. **Steam jacket**
   A chamber that jackets the inner dispersion tube with hot steam to eliminate condensation and dripping.

2. **Steam separator**
   Separates steam from condensate.

3. **Deflector plate**
   Inside the steam separator, deflects condensate into a circular pattern and toward the drain.

4. **Multi-baffle plate**
   Allows only steam to rise into the upper region of the separator.

5. **Internal drying tube**
   Excludes any remaining condensate, allowing only dry steam to leave the separator.

6. **Steam valve**
   Controls the amount of steam allowed into the dispersion tube.

7. **Dispersion tube**
   Provides uniform steam dispersion across the duct width.

8. **Thermal-resin tubelet**
   Unique tubelets extend into the dispersion tube center so only the hottest, driest steam is discharged into the air. These tubelets also have an exceptional ability to trap noise generated by the valve, making DriSteem's Steam Injection humidifiers the quietest in the industry.

9. **Steam trap**
   Allows only condensate to pass to the condensate return system.

See Figure 6-1 for a description of how these components operate together.
Principle of operation

1. Boiler steam enters the humidifier at line pressure and flows through a chamber (jacket) surrounding an inner dispersion tube. The jacket of steam preheats the dispersion tube so that when steam enters the dispersion tube (at Step 5 below) it does not condense as it would if the tube were cold, thereby eliminating condensation and dripping.

2. After flowing through the steam jacket, steam with entrained condensate slows from entering the larger space of the separator and from hitting the perimeter deflector plate, and begins to spin and separate.

3. Separated steam rises through slots in the multi-baffle plate to the separator upper region, and enters the internal drying tube that excludes any remaining condensate, allowing only dry steam to leave the separator.

4. Separated condensate drains from the separator to the steam trap.

5. The steam valve controls the amount of steam allowed into the preheated dispersion tube. The steam valve is typically controlled in one of two ways:
   - By a signal from a building automation system
   - By a humidity controller connected to the steam valve

6. Steam is discharged uniformly through the tubelets into the airstream.

About right-hand and left-hand discharge:
Imagine you are standing in the duct where the Steam Injection humidifier is to be installed, with airflow blowing into your face:
- Specify the humidifier with right-hand discharge if the separator is on your right.
- Specify the humidifier with left-hand discharge if the separator is on your left.
For consistency, humidifier drawings in this catalog are shown with right-hand discharge.
Single-tube humidifiers are preassembled and suitable for small-capacity applications where available non-wetting distance is not critical.

See "Added flexibility with optional stainless steel components" at the bottom of Page 3.

### Table 7-1: Single-tube humidifier standard dispersion tube face lengths

<table>
<thead>
<tr>
<th>Table model</th>
<th>Face lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>150 mm to 3658 mm in 13-mm increments</td>
</tr>
<tr>
<td>70</td>
<td>457 mm to 4877 mm in 13-mm increments</td>
</tr>
<tr>
<td>80</td>
<td>610 mm to 4877 mm in 13-mm increments</td>
</tr>
</tbody>
</table>

**Notes:**
- See dimension drawing in Figure 8-1.
- End support brackets are provided only on tube lengths of 305 mm or longer.

### Table 7-2: Single-tube humidifier shipping weights

<table>
<thead>
<tr>
<th>Separator*</th>
<th>Tube size</th>
<th>Weight/305 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg</td>
<td>no.</td>
</tr>
<tr>
<td>5</td>
<td>10.9</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>14.5</td>
<td>70</td>
</tr>
<tr>
<td>7</td>
<td>14.7</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>23.8</td>
<td>80</td>
</tr>
</tbody>
</table>

* Includes control valve, drain trap, and strainer

### Table 7-3: Single-tube humidifier dispersion tube capacities

<table>
<thead>
<tr>
<th>Face length (mm)</th>
<th>Model 60 tubes kg/h</th>
<th>Model 70 tubes kg/h</th>
<th>Model 80 tubes kg/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;610</td>
<td>consult factory</td>
<td>consult factory</td>
<td>—</td>
</tr>
<tr>
<td>610 to 890</td>
<td>up to 81</td>
<td>up to 81</td>
<td>up to 159</td>
</tr>
<tr>
<td>915 to 1220</td>
<td>81</td>
<td>up to 95</td>
<td>up to 204</td>
</tr>
<tr>
<td>&gt;1220</td>
<td>81</td>
<td>113</td>
<td>238</td>
</tr>
</tbody>
</table>

**FIGURE 7-1: SINGLE-TUBE HUMIDIFIER**
FIGURE 8-1: SINGLE-TUBE HUMIDIFIER DIMENSIONS

Notes:
* See Pages 26 and 27, and see Note 5 in Figure 10-1 for more information about traps and trap piping.
* Dashed lines indicate provided by installer; right-hand discharge shown.
* Typical installation shown; see additional installation configurations in Steam Injection Humidifiers Installation, Operation, and Maintenance Manual.
### Table 9-1: Single-tube humidifier dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Valve size</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>
</tr>
</thead>
<tbody>
<tr>
<td>5-60</td>
<td>15</td>
<td>15</td>
<td>127</td>
<td>203</td>
<td>248</td>
<td>343</td>
<td>51</td>
<td>40</td>
<td>100x100</td>
</tr>
<tr>
<td>6-60</td>
<td>15</td>
<td>15</td>
<td>152</td>
<td>210</td>
<td>267</td>
<td>381</td>
<td>51</td>
<td>40</td>
<td>100x100</td>
</tr>
<tr>
<td>6-70</td>
<td>15</td>
<td>20</td>
<td>152</td>
<td>210</td>
<td>267</td>
<td>419</td>
<td>51</td>
<td>40</td>
<td>100x100</td>
</tr>
<tr>
<td>7-60</td>
<td>20</td>
<td>15</td>
<td>178</td>
<td>222</td>
<td>279</td>
<td>419</td>
<td>51</td>
<td>40</td>
<td>100x100</td>
</tr>
<tr>
<td>7-60</td>
<td>30</td>
<td>15</td>
<td>178</td>
<td>222</td>
<td>279</td>
<td>445</td>
<td>51</td>
<td>40</td>
<td>100x100</td>
</tr>
<tr>
<td>7-70</td>
<td>20</td>
<td>20</td>
<td>178</td>
<td>222</td>
<td>279</td>
<td>457</td>
<td>51</td>
<td>40</td>
<td>100x100</td>
</tr>
<tr>
<td>7-70</td>
<td>30</td>
<td>20</td>
<td>178</td>
<td>222</td>
<td>279</td>
<td>483</td>
<td>51</td>
<td>40</td>
<td>100x100</td>
</tr>
<tr>
<td>8-80</td>
<td>20</td>
<td>40</td>
<td>203</td>
<td>273</td>
<td>349</td>
<td>495</td>
<td>51</td>
<td>40</td>
<td>152x152</td>
</tr>
<tr>
<td>8-80</td>
<td>30</td>
<td>40</td>
<td>203</td>
<td>273</td>
<td>349</td>
<td>521</td>
<td>51</td>
<td>40</td>
<td>152x152</td>
</tr>
<tr>
<td>8-80</td>
<td>35</td>
<td>40</td>
<td>203</td>
<td>273</td>
<td>349</td>
<td>508</td>
<td>51</td>
<td>40</td>
<td>152x152</td>
</tr>
<tr>
<td>8-80</td>
<td>35</td>
<td>40</td>
<td>203</td>
<td>273</td>
<td>349</td>
<td>533</td>
<td>51</td>
<td>40</td>
<td>152x152</td>
</tr>
</tbody>
</table>

* Variable from 0 mm to 51 mm in addition to duct/AHU wall thickness.
Single-tube humidifier field piping example

**FIGURE 10-1: SINGLE HORIZONTAL DISPERSION TUBE HUMIDIFIER INSTALLED IN A DUCT WITH HORIZONTAL AIRFLOW**

Notes:
1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. Horizontal airflow (shown):
   - Slightly better mixing with less visible vapor travel occurs when discharged steam blows against the airflow, rather than with the airflow. When using noninsulated steam jackets in a horizontal airflow (as shown above), position tubelets (steam orifices) so they face into the airflow. However, if the dispersion tube has an insulated jacket, the discharged steam must blow with the airflow to avoid condensation that may occur when discharged steam contacts the cooler insulated jacket. When using insulated steam jackets in a horizontal airflow, position tubelets so they discharge steam with the airflow, and add 610 mm to the non-wetting distance.
4. Vertical airflow:
   - Always position tubelets pointing up when installing in a vertical airflow.
   - If steam jackets are insulated, install humidifier only in a vertical upflow application, and add 610 mm to the non-wetting distance.
   - Do not install insulated jackets in a vertical downflow application.
5. Center tube within face height.
6. If steam pressure is less than or equal to 103.4 kPa, use a float and thermostatic (F&T) trap for the humidifier.
   - If steam pressure is greater than 103.4 kPa, use an inverted bucket trap for the humidifier.
   - If lifting condensate, use an inverted bucket trap and check valve regardless of steam pressure. Inverted bucket traps may require priming after seasonal shutdown.
7. Models with optional stainless steel components:
   - Use stainless steel thermostatic traps and stainless steel piping. Provide a 305 mm minimum drop plus a cooling leg at least 610 mm long before the trap as shown in Figure B-1.
8. All models and trap types:
   - During consistent load, there may not be enough pressure in the separator trap to lift condensate from the separator.
9. Steam valve and strainer sizes are provided by DriCalc (Note 7). You may also contact your DriSteem representative for valve and strainer sizing, or access the steam valve and strainer calculator on www.dristeem.com.
**Notes:**
- The above data apply to all air velocities up to 7.6 m/s, and are based on air leaving the zone of humidification at conditions of 13 °C and the stated % RH. The blue lines in the graph refer to the sample exercise described below.
- Add 610 mm to the non-wetting distance when using insulated jackets.

**PROVEN PERFORMANCE**

Assume the air entering the humidifier is 5% RH, the air leaving the zone of humidification needs to be 80% RH, and the duct height is 457 mm.

The blue lines in Figure 11-1 are provided for this exercise:

To determine the non-wetting distance for a Single-tube humidifier and the conditions above, enter the non-wetting distances graph at the Entering RH of 5%. Proceed vertically to intersect the 80% Leaving RH slope, then read horizontally to the right to intersect the Duct height column for an 457 mm duct. The non-wetting distance is approximately 3050 mm.

**Important notes**
- Final equipment selection should account for condensate loss. See the DriSteem Design Guide for steam loss tables.
- See “Steam absorption considerations” on Page 15.
Mini-bank humidifier

The Mini-bank humidifier is designed for use in small ducts. It is a pre-engineered and pre-assembled header/tube assembly, ready for mounting and hookup.

Slimline dispersion tubes with laboratory-tested, optimum tube spacing promote rapid steam absorption without excessive static pressure loss or heat gain.

Precision orifices spaced 25 mm apart ensure proportional steam dispersion along the entire tube length.

See "Added flexibility with optional stainless steel components" at the bottom of Page 3.

**FIGURE 12-1: MINI-BANK HUMIDIFIER**

**FIGURE 12-2: MINI-BANK HUMIDIFIER DIMENSIONS**

Notes:
- See Pages 26 and 27, and see Note 5 in Figure 14-1 for more information about trap types and piping.
- Dashed lines indicate provided by installer; right-hand discharge shown.
Table 13-1: Mini-bank humidifier specifications

<table>
<thead>
<tr>
<th>Face height mm</th>
<th>Required number of tubes</th>
<th>Face width</th>
<th>Shipping weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>150-230</td>
<td>2</td>
<td>150 mm to 1220 mm in 13-mm increments</td>
<td>Tubes: (0.4 kg per tube meter)</td>
</tr>
<tr>
<td>250-305</td>
<td>3</td>
<td></td>
<td>Remaining components (separator, valve, traps, etc.): 3.8 kg</td>
</tr>
<tr>
<td>330-380</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400-460</td>
<td>5</td>
<td>For face dimensions larger than 1220 mm x 610 mm (w x h), use Multiple-tube humidifier.</td>
<td></td>
</tr>
<tr>
<td>480-535</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>560-610</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: See Figure 12-1 for face height and face width.

Table 13-2: Mini-bank humidifier air pressure loss

<table>
<thead>
<tr>
<th>Air velocity mm</th>
<th>Static pressure loss Pa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Insulated</td>
</tr>
<tr>
<td>2.5</td>
<td>9.95</td>
</tr>
<tr>
<td>3.8</td>
<td>17.42</td>
</tr>
<tr>
<td>5.1</td>
<td>32.35</td>
</tr>
</tbody>
</table>

Table 13-3: Mini-bank humidifier dimensions

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>38</td>
<td>318</td>
<td>127</td>
<td>45</td>
<td>165</td>
<td>140</td>
<td>64</td>
</tr>
</tbody>
</table>
**Notes:**

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. **Horizontal airflow** (shown):
   Slightly better mixing, with less visible vapor travel, occurs when discharged steam blows against the airflow rather than with the airflow. Therefore, when using noninsulated steam jackets in a horizontal airflow (as shown above), position dispersion tubelets (steam orifices) so they face into the airflow.

   However, if the dispersion tube has an insulated jacket, the discharged steam must blow with the airflow to avoid condensation that may occur when discharged steam contacts the cooler insulated jacket. When using insulated steam jackets in a horizontal airflow, position dispersion tubelets so they discharge steam with the airflow, and add 610 mm to the non-wetting distance.

   **Vertical airflow:**
   Always position tubelets (steam orifices) pointing up when installing in a vertical airflow.

   If steam jackets are insulated, install humidifier only in a vertical upflow application, and add 610 mm to the non-wetting distance. Do not install insulated jackets in a vertical downflow application.

4. Center tube assembly within face height.

5. For steam pressure less than or equal to 103.4 kPa, use a float and thermostatic (F&T) trap for the humidifier.

   If lifting condensate, use an inverted bucket trap and check valve regardless of steam pressure. Inverted bucket traps may require priming after seasonal shutdown.

   During consistent load, there may not be enough pressure in the separator trap to lift condensate from the separator.

   **Models with optional stainless steel components:**
   Use only stainless steel thermostatic traps and stainless steel piping. Provide a 305 mm minimum drop to trap plus a 610 mm minimum cooling leg before the trap, as shown in Figure 8-1.

6. See condense drain piping and trapping information on Pages 26 and 27.

7. See the DriCalc Installation Guide library and/or the Steam Injection Humidifiers Installation, Operation, and Maintenance Manual (available at www.dristeem.com) for more installation instructions. DriCalc is DriSteem’s free sizing and selection software; see DriCalc on www.dristeem.com.

8. Steam valve and strainer sizes are provided by DriCalc (Note 7). You may also contact your DriSteem representative for valve and strainer sizing, or access the steam valve and strainer calculator on www.dristeem.com.
Mini-bank humidifier non-wetting distances

FIGURE 15-1: MINI-BANK HUMIDIFIER NON-WETTING DISTANCES

Notes:

• The above data apply to all air velocities up to 7.6 m/s and are based on air leaving the zone of humidification at conditions of 13 °C and the stated % RH.

• Add 610 mm to the non-wetting distance when using insulated jackets.

STEAM ABSORPTION CONSIDERATION

1. Non-wetting distance is the dimension downstream from the humidifier to the point where wetting will not occur, although steam wisps may be present. Solid objects at duct air temperature, such as coils, dampers, fans, etc., downstream from this dimension will remain dry.

2. CAUTION! Non-wetting distances described in this catalog do not apply when installing a Steam Injection humidifier upstream from filter media. If you need to install a Steam Injection humidifier upstream from filter media, consult your representative or DriSteem directly for special recommendations.

3. Note that the rise (Δ) in RH (the difference between entering and leaving RH) has a direct bearing on the non-wetting distance. As the rise increases, more vapor needs to be dispersed into the air, which increases the non-wetting distance.

4. Uneven airflow over the dispersion assembly’s cross-section can result in nonuniform steam-and-air mixing, which increases the non-wetting distance.

Determining non-wetting distance

See Page 11 for important notes and for instructions on using the graph above to determine non-wetting distance.
Multiple-tube humidifiers are best suited for large-capacity applications with short to moderate non-wetting distance requirements. Multiple-tube humidifiers disperse steam evenly across an entire duct width and height. Multiple-tube humidifier components are shipped loose for on-site assembly. All header and interconnecting piping is supplied by the contractor.

The Maxi-bank option (see Figure 21-1) features a stainless steel header and black iron interconnecting piping; it ships completely assembled and ready for installation, except when either dimensions is 2490 mm or more.

See “Added flexibility with optional stainless steel components” at the bottom of Page 3.

Notes:
* See Pages 26 and 27, and see Note 4 on Page 19 for more information about trap types and piping.
* See Note 1 on Page 19 for dispersion tube positioning.
* Tubes should span at least 90% of coil or airstream width.
* Dashed lines indicate provided by installer (see Maxi-bank option in Figure 21-1). Right-hand discharge shown.

FIGURE 16-1: MULTIPLE-TUBE HUMIDIFIER WITH MAXI-BANK OPTION

FIGURE 16-2: MULTIPLE-TUBE HUMIDIFIER
Multiple-tube humidifier dimensions and specifications

Table 17-1: Multiple-tube humidifier minimum tube spacing

<table>
<thead>
<tr>
<th>Tube model</th>
<th>Minimum tube spacing (X*)</th>
<th>Minimum tube spacing (X*)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Multiple-tube humidifier</td>
<td>Multiple-tube humidifier with optional stainless steel piping</td>
</tr>
<tr>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>60</td>
<td>152</td>
<td>229</td>
</tr>
<tr>
<td>70</td>
<td>229</td>
<td>229</td>
</tr>
<tr>
<td>80</td>
<td>229</td>
<td>305</td>
</tr>
</tbody>
</table>

* See Figures 20-1 and 21-1 for center-to-center distance X.

Table 17-2: Multiple-tube humidifier header sizes

<table>
<thead>
<tr>
<th>Total capacity</th>
<th>Header size</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg/h</td>
<td>DN</td>
</tr>
<tr>
<td>up to 127</td>
<td>38*</td>
</tr>
<tr>
<td>up to 222</td>
<td>50</td>
</tr>
<tr>
<td>223 to 444</td>
<td>80</td>
</tr>
<tr>
<td>445 to 790</td>
<td>100</td>
</tr>
<tr>
<td>791 to 1248</td>
<td>125</td>
</tr>
<tr>
<td>1249 to 1809</td>
<td>150</td>
</tr>
</tbody>
</table>

* Non Maxi-bank only

FIGURE 17-1: MULTIPLE-TUBE HUMIDIFIER DISPERSION TUBE DIMENSIONS

Table 17-3: Single-tube humidifier dimensions

<table>
<thead>
<tr>
<th>Tube model</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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DN</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>60</td>
<td>15</td>
<td>48</td>
<td>21</td>
<td>29</td>
<td>51</td>
<td>102</td>
<td>102x102</td>
<td>38</td>
</tr>
<tr>
<td>70</td>
<td>20</td>
<td>67</td>
<td>21</td>
<td>48</td>
<td>76</td>
<td>102</td>
<td>102x102</td>
<td>38</td>
</tr>
<tr>
<td>80</td>
<td>40</td>
<td>76</td>
<td>27</td>
<td>64</td>
<td>89</td>
<td>140</td>
<td>152x152</td>
<td>38</td>
</tr>
</tbody>
</table>
### Table 18-1: Multiple-tube humidifier separator dimensions and weights

<table>
<thead>
<tr>
<th>Separator size</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>Shipping weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>248</td>
<td>127</td>
<td>140</td>
<td>15</td>
<td>4.1</td>
</tr>
<tr>
<td>6</td>
<td>267</td>
<td>152</td>
<td>137</td>
<td>20</td>
<td>9.5</td>
</tr>
<tr>
<td>7</td>
<td>279</td>
<td>178</td>
<td>140</td>
<td>20</td>
<td>10.9</td>
</tr>
<tr>
<td>8</td>
<td>349</td>
<td>203</td>
<td>175</td>
<td>40</td>
<td>19.5</td>
</tr>
<tr>
<td>9</td>
<td>362</td>
<td>229</td>
<td>178</td>
<td>50</td>
<td>23.6</td>
</tr>
</tbody>
</table>

* Includes control valve, drain trap, and strainer.

### Table 18-2: Multiple-tube humidifier dispersion tube face widths and tube weights

<table>
<thead>
<tr>
<th>Tube model</th>
<th>Tube weight per 305 mm (kg)</th>
<th>Face lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>0.34</td>
<td>150 mm to 3658 mm in 13-mm increments</td>
</tr>
<tr>
<td>70</td>
<td>0.45</td>
<td>457 mm to 4877 mm in 13-mm increments</td>
</tr>
<tr>
<td>80</td>
<td>0.68</td>
<td>610 mm to 4877 mm in 13-mm increments</td>
</tr>
</tbody>
</table>

Notes:
- See face widths in Figure 16-2.
- For face widths not listed, consult factory.

### Table 18-3: Multiple-tube humidifier dispersion tube capacities

<table>
<thead>
<tr>
<th>Face width (mm)</th>
<th>Model 60 and 70 tubes (kg/h)</th>
<th>Model 80 tubes (kg/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;610</td>
<td>consult factory</td>
<td>–</td>
</tr>
<tr>
<td>610 to 890</td>
<td>up to 81</td>
<td>up to 159</td>
</tr>
<tr>
<td>915 to 1220</td>
<td>up to 95</td>
<td>up to 204</td>
</tr>
<tr>
<td>&gt;1220</td>
<td>113</td>
<td>238</td>
</tr>
</tbody>
</table>
NOTES FOR FIGURES 16-2, 20-1, AND 21-1

1. Horizontal airflow (shown)
   Slightly better mixing with less visible vapor travel occurs when discharged steam blows against the airflow, rather than with the airflow. When using noninsulated steam jackets in a horizontal airflow (as shown in the drawings), position dispersion tubelets (steam orifices) so they face into the airflow. However, if the dispersion tube has an insulated jacket, the discharged steam must blow with the airflow to avoid condensation that may occur when discharged steam contacts the cooler insulated jacket. When using insulated steam jackets in a horizontal airflow, position dispersion tubelets so they discharge steam with the airflow, and add 610 mm to the non-wetting distance.

   Vertical airflow
   Always position tubelets (steam orifices) pointing up when installing in a vertical airflow. If steam jackets are insulated, install humidifier only in a vertical upflow application and add 610 mm to the non-wetting distance. Do not install insulated jackets in a vertical downflow application.

2. Jacket piping size:
   - DN15 pipe thread for Model 60 tubes
   - DN20 pipe thread for Model 70 tubes
   - DN40 pipe thread for Model 80 tubes

3. After humidifier is installed, secure steam jacket piping to tube header.

4. If steam pressure is less than or equal to 103.4 kPa, use float and thermostatic (F&T) traps for the humidifier. If steam pressure is greater than 103.4 kPa, use inverted bucket traps for the humidifier. If lifting condensate, use an inverted bucket trap and check valve regardless of steam pressure. Inverted bucket traps may require priming after seasonal shutdown.
   During consistent load, there may not be enough pressure in the separator trap to lift condensate from the separator.

   Models with optional stainless steel components:
   Use only stainless steel thermostatic traps and stainless steel piping. Provide a 305 mm minimum drop to trap plus a 610 mm minimum cooling leg before the trap as shown on Pages 26 and 27.

5. Due to the pressure drop across the valve, the steam pressure at the header trap is minimal; therefore, you cannot lift condensate or return condensate to a pressurized return by steam pressure from this trap. On small headers (DN50 or less in diameter), this trap may be omitted.

6. See "Condensate drain piping and trapping" on Pages 26 and 27.
Notes:
1. To avoid metal fatigue, allow for thermal expansion of dispersion tubes.
2. Dashed lines indicate provided by installer (see Maxi-bank option in Figure 21-1). Right-hand discharge shown.
3. See the DriCalc Installation Guide library and/or the Steam Injection Humidifiers Installation, Operation, and Maintenance Manual (available at www.dristeem.com) for more installation instructions. DriCalc is DriSteem’s free sizing and selection software; see DriCalc on the www.dristeem.com Tools page.
4. Steam valve and strainer sizes are provided by DriCalc (Note 3). You may also contact your DriSteem representative for valve and strainer sizing, or access the steam valve and strainer calculator on the www.dristeem.com Tools page.
5. See Pages 26 and 27 for more information about trap types and piping.
FIGURE 21-1: MULTIPLE-TUBE HUMIDIFIER WITH MAXI-BANK OPTION, TOTAL TUBE LENGTH LESS THAN OR EQUAL TO 45' (13.7 M) IN A DUCT, HORIZONTAL AIRFLOW

Notes:
1. To avoid metal fatigue, allow for thermal expansion of dispersion tubes.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. See the DriCalc Installation Guide library and/or the Steam Injection Humidifiers Installation, Operation, and Maintenance Manual (available at www.dristeem.com) for more installation instructions. DriCalc is DriSteem’s free sizing and selection software; see DriCalc on www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc (Note 3). You may also contact your DriSteem representative for valve and strainer sizing, or access the steam valve and strainer calculator on www.dristeem.com.
5. See Pages 26 and 27 for more information about trap types and piping.
Notes:
- The above data apply to all air velocities up to 7.6 m/s, and are based on air leaving the zone of humidification at conditions of 13 °C and the stated % RH.
- Add 610 mm to the non-wetting distance when using insulated jackets.

DETERMINING NON-WETTING DISTANCE

See Page 11 for important notes and for instructions on using the graph above to determine non-wetting distance.

See "Steam absorption considerations" on Page 15.
The Area-type humidifier is designed for open spaces, such as warehouses and manufacturing spaces. The steam discharged from the humidifier is dispersed by the fan. The Area-type humidifier quietly distributes steam without introducing water into the air.

**Notes:**
1. Dashed lines indicate provided by installer.
2. See the DriCalc Installation Guide library and/or the Steam Injection Humidifiers Installation, Operation, and Maintenance Manual (available at www.dristeem.com) for more installation instructions. DriCalc is DriSteem’s free sizing and selection software; see DriCalc on www.dristeem.com.
3. Steam valve and strainer sizes are provided by DriCalc (Note 2). You may also contact your DriSteem representative for valve and strainer sizing, or access the steam valve and strainer calculator on www.dristeem.com.
Steam discharged from the humidifier turns into a fog that is lighter than air. Should this fog contact any solid surface before it is absorbed, it may collect as water and drip. Observe the minimum non-wetting distances for rise, spread, and throw in Table 24-1.

### Table 24-1: Rise, spread, and throw minimum non-wetting distances (nonpressurized steam)

<table>
<thead>
<tr>
<th>Maximum steam capacity</th>
<th>16 °C</th>
<th>30% RH</th>
<th>40% RH</th>
<th>50% RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg/h</td>
<td>m</td>
<td>m</td>
<td>m</td>
<td>m</td>
</tr>
<tr>
<td>20</td>
<td>0.3</td>
<td>0.6</td>
<td>1.8</td>
<td>0.3</td>
</tr>
<tr>
<td>34</td>
<td>0.9</td>
<td>0.9</td>
<td>2.4</td>
<td>0.9</td>
</tr>
<tr>
<td>45</td>
<td>1.2</td>
<td>1.2</td>
<td>3.1</td>
<td>1.2</td>
</tr>
<tr>
<td>68</td>
<td>1.8</td>
<td>1.5</td>
<td>3.7</td>
<td>1.8</td>
</tr>
<tr>
<td>90</td>
<td>2.1</td>
<td>2.1</td>
<td>4.0</td>
<td>2.4</td>
</tr>
<tr>
<td>102</td>
<td>2.1</td>
<td>2.1</td>
<td>4.0</td>
<td>2.4</td>
</tr>
<tr>
<td>110</td>
<td>2.4</td>
<td>2.4</td>
<td>4.6</td>
<td>2.7</td>
</tr>
<tr>
<td>130</td>
<td>2.7</td>
<td>2.7</td>
<td>5.2</td>
<td>3.1</td>
</tr>
<tr>
<td>136</td>
<td>2.7</td>
<td>2.7</td>
<td>5.2</td>
<td>3.1</td>
</tr>
</tbody>
</table>
FIGURE 25-1: AREA-TYPE HUMIDIFIER

![Area-type humidifier diagram]

Table 25-1: Area-type humidifier dimensions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>686</td>
<td>357</td>
<td>122</td>
<td>183</td>
<td>241</td>
</tr>
</tbody>
</table>
Condensate drain piping and trapping

FIGURE 26-1: CONDENSATE DRAIN PIPING AND TRAPS FOR STEAM INJECTION HUMIDIFIERS

P-TRAP DIMENSIONS

CONDENSATE OUTLET

DROP

SEAL

LIFTING CONDENSATE

From P-trap or mechanical trap

CONDENSATE PUMP*

MECHANICAL TRAP DIMENSIONS

CONDENSATE OUTLET

DROP

Drip

F&T trap (shown) or inverted bucket trap

COOLING LEG

STAINLESS STEEL COMPONENTS MODEL

CONDENSATE OUTLET

DROP

Drip

Stainless steel thermostatic trap

TYPICAL MODEL

CONDENSATE PUMP

NOTES:
- Use condensate pump rated for 100 °C and suitable for lifting 16 L/m at required head (60 kPa). Stainless steel condensate pump recommended when pumping condensate from systems using optional stainless steel components.
- If wasting condensate to drain, temper condensate to local code to prevent damage to drain plumbing.
- Dashed lines indicate provided by installer.
### Table 27-1: Condensate drain piping and traps for Steam Injection humidifiers

<table>
<thead>
<tr>
<th>Area-type humidifier</th>
<th>Single-tube, Mini-bank, and Multiple-tube humidifiers</th>
<th>Typical model</th>
<th>Models with optional stainless steel components</th>
<th>Typical model</th>
<th>Models with optional stainless steel components</th>
<th>Piping from header</th>
<th>Models with optional stainless steel components</th>
<th>Piping from separator**</th>
<th>Models with optional stainless steel components</th>
<th>Piping from separator***</th>
<th>Models with optional stainless steel components</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-trap water seal</td>
<td>Do not use</td>
<td>Do not use</td>
<td>Do not use</td>
<td>Do not use</td>
<td>Do not use</td>
<td>Use with minimum: Drop 203 mm Seal: 254 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F&amp;T trap</td>
<td>Use if steam pressure is ≤103.4 kPa: Drop: 305 mm Drip: 102 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Do not use</td>
<td>Use only if not lifting condensate and steam pressure is ≤103.4 kPa: Drop: 305 mm Drip: 102 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inverted bucket trap*</td>
<td>Do not use</td>
<td>Use only if not lifting condensate and steam pressure is &gt;103.4 kPa: Drop: 305 mm Drip: 102 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel thermostatic trap</td>
<td>Do not use</td>
<td>Use with stainless steel piping with minimum: Drop: 305 mm Drip: 102 mm Cooling leg: 610 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use with stainless steel piping with minimum: Drop: 12&quot; (305 mm) Drip: 102 mm Cooling leg: 610 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Do not use</td>
<td>Use with stainless steel piping with minimum: Drop: 305 mm Drip: 102 mm Cooling leg: 610 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Do not use</td>
<td>Use with stainless steel piping with minimum: Drop: 305 mm Drip: 102 mm Cooling leg: 610 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Return condensate to boiler via nonpressurized return line?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Return condensate by condensate pump?</td>
<td>Yes**</td>
<td>Yes</td>
<td>Yes**</td>
<td>Yes</td>
<td>Yes**</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drain condensate to open drain?</td>
<td>Yes1</td>
<td>Yes1</td>
<td>Yes1</td>
<td>Yes1</td>
<td>Yes1</td>
<td>Recommended1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes:</td>
<td>* Trap may require priming after seasonal shutdown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>** DriSteem recommends using a stainless steel condensate pump when pumping condensate from systems using optional stainless steel components.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>*** During consistent load, there may not be enough steam pressure in the separator to lift condensate from the separator using steam.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>† If wasting condensate to drain, temper condensate to local code to prevent damage to drain plumbing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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