Thermocompressors
Engineered for efficiency

Recirculating and booster thermocompressor applications.

Energy-efficient steam jet compressors.
Kadant steam jet thermocompressors are designed to recirculate steam or boost lower-pressure steam for reuse in a variety of process applications in pulp and paper, petrochemical, food processing, desalination, and specialty chemical production.

**How thermocompressors work**

Thermocompressors are designed to accurately mix lower-pressure steam with higher-pressure steam. The higher-pressure motive steam entrains the lower-pressure steam and increases its pressure.

The motive steam is introduced through the nozzle of the thermocompressor. As the nozzle opens, the high velocity motive steam draws the lower-pressure steam into the thermocompressor body. An exchange of momentum occurs as the steam flows are mixed and the mixed flow is accelerated to high velocity with a uniform profile in the mixing chamber of the thermocompressor.

As the mixed flow enters the diffuser section, the diffuser flow area gradually increases to allow the velocity of the mixed flow to be reduced. As the velocity is reduced, the steam pressure increases. At the end of the diffuser, the discharge steam pressure is higher than the lower-pressure suction flow entering the thermocompressor.
High-efficiency thermocompressors

In addition to retro-fitting existing steam jet compressors, Kadant also provides high-efficiency thermocompressors for improved energy utilisation. Based on extensive product development, modeling, testing, and field applications, Kadant’s high-efficiency thermocompressor offers entrainment ratio improvements of up to 25% over conventional steam jet compressors.

Using advanced computer analysis techniques to model the intricacies of flow dynamics within the thermocompressor, Kadant custom-engineers its high-efficiency thermocompressor to optimise the nozzle position, nozzle shape, and mixing chamber entrance geometry and length. This increases the dynamic head entering the diffuser and allows for more pressure recovery. The result is less motive steam consumption, higher energy efficiency, and a wider operating range.

When applied to paper drying systems, Kadant incorporates its application expertise in paper drying steam systems to properly match the thermocompressor to the syphons, separator tanks, flow orifices, and pipelines to ensure correct thermocompressor design and performance.

High-efficiency thermocompressors that are properly integrated with the steam system and process equipment can provide significant improvements in energy conservation, including:

- Increased power generation in combined heat and power plants
- Eliminated steam venting in steam recirculation systems
- Increased range of operations for stable and efficient production

Steam Jet Thermocompressors

<table>
<thead>
<tr>
<th>Size</th>
<th>Motive (A*) DIN 2635</th>
<th>Suction/Discharge (B* &amp; C*) DIN 2633</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>Units</th>
<th>Approximate Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>DN25 PN40</td>
<td>DN50 PN16</td>
<td>132</td>
<td>583</td>
<td>656</td>
<td>1285</td>
<td>138</td>
<td>mm 64 kg</td>
<td></td>
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<tr>
<td>2.5”</td>
<td>DN25 PN40</td>
<td>DN65 PN16</td>
<td>132</td>
<td>685</td>
<td>758</td>
<td>1385</td>
<td>137</td>
<td>mm 68 kg</td>
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<tr>
<td>3”</td>
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<td>DN80 PN16</td>
<td>146</td>
<td>827</td>
<td>910</td>
<td>1895</td>
<td>165</td>
<td>mm 109 kg</td>
<td></td>
</tr>
<tr>
<td>4”</td>
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<td>DN100 PN16</td>
<td>160</td>
<td>1081</td>
<td>1173</td>
<td>2174</td>
<td>191</td>
<td>mm 129 kg</td>
<td></td>
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<tr>
<td>5”</td>
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<td>DN125 PN16</td>
<td>170</td>
<td>1324</td>
<td>1444</td>
<td>2458</td>
<td>205</td>
<td>mm 154 kg</td>
<td></td>
</tr>
<tr>
<td>6”</td>
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<td>DN150 PN16</td>
<td>171</td>
<td>1564</td>
<td>1711</td>
<td>2741</td>
<td>217</td>
<td>mm 218 kg</td>
<td></td>
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<tr>
<td>8”</td>
<td>DN125 PN40</td>
<td>DN200 PN16</td>
<td>178</td>
<td>1992</td>
<td>2186</td>
<td>3200</td>
<td>233</td>
<td>mm 354 kg</td>
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<tr>
<td>10”</td>
<td>DN200 PN40</td>
<td>DN250 PN16</td>
<td>243</td>
<td>2502</td>
<td>2807</td>
<td>4048</td>
<td>357</td>
<td>mm 596 kg</td>
<td></td>
</tr>
<tr>
<td>12”</td>
<td>DN200 PN40</td>
<td>DN300 PN16</td>
<td>291</td>
<td>3042</td>
<td>3423</td>
<td>4705</td>
<td>421</td>
<td>mm 773 kg</td>
<td></td>
</tr>
<tr>
<td>14”</td>
<td>DN200 PN40</td>
<td>DN350 PN16</td>
<td>291</td>
<td>3378</td>
<td>3751</td>
<td>5034</td>
<td>484</td>
<td>mm 818 kg</td>
<td></td>
</tr>
<tr>
<td>16”</td>
<td>DN250 PN40</td>
<td>DN400 PN16</td>
<td>319</td>
<td>4017</td>
<td>4647</td>
<td>6195</td>
<td>535</td>
<td>mm 1100 kg</td>
<td></td>
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<tr>
<td>18”</td>
<td>DN250 PN40</td>
<td>DN500 PN16</td>
<td>319</td>
<td>4537</td>
<td>5193</td>
<td>6741</td>
<td>598</td>
<td>mm 1194 kg</td>
<td></td>
</tr>
<tr>
<td>20”</td>
<td>DN300 PN40</td>
<td>DN500 PN16</td>
<td>370</td>
<td>5024</td>
<td>5743</td>
<td>7329</td>
<td>654</td>
<td>mm 1491 kg</td>
<td></td>
</tr>
<tr>
<td>24”</td>
<td>DN350 PN40</td>
<td>DN600 PN16</td>
<td>408</td>
<td>6023</td>
<td>6825</td>
<td>8436</td>
<td>764</td>
<td>mm 2042 kg</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions shown are for standard design. High-efficiency thermocompressors are custom-engineered and dimensions provided above are for reference only. Dimensions are subject to change without notice.

*Other/special connections possible upon request.
Thermocompressor Sizing

The following charts can be used to estimate the size of a thermocompressor. The size is based on the motive, suction, and discharge steam pressures and the required steam flow. The following parameters are used for these estimates:

- \( P \) = Atmospheric pressure (absolute) = 1 bar (typical)
- \( P_m \) = Motive steam pressure (absolute) = gauge pressure + atmospheric pressure
- \( P_s \) = Suction steam pressure (absolute) = gauge pressure + atmospheric pressure
- \( P_d \) = Discharge steam pressure (absolute) = gauge pressure + atmospheric pressure

\( M_m \) = Motive steam flow rate
\( M_s \) = Suction steam flow rate
\( M_d \) = Discharge (total) steam flow rate = \( M_m + M_s \)
\( E \) = Expansion ratio = \( P_m / P_s \) (should be over 1.4)
\( C \) = Compression ratio = \( P_d / P_s \) (normally less than 1.8)*
\( R \) = Entrainment ratio = \( M_s / M_m \)

**Sizing Example**

Operating Parameters:
- \( P_m \) = Motive steam pressure = 5.9 barg + 1 bar = 6.9 barg
- \( P_s \) = Suction steam pressure = 0.35 barg + 1 bar = 1.35 bar
- \( P_d \) = Discharge steam pressure = 0.75 barg + 1 bar = 1.75 bar
- \( M_s \) = Suction steam flow rate = 9.000 kg/hr

**Calculate Ratios:**

- \( E \) = Expansion ratio = \( P_m / P_s \) = 6.9 / 1.35 = 5.1
- \( C \) = Compression ratio = \( P_d / P_s \) = 1.75 / 1.35 = 1.3

Use these ratios and the sizing graph underneath to determine entrainment ratio \( R \):

\( R \) = Entrainment ratio = 1.5

**Thermocompressor Sizing Table**

<table>
<thead>
<tr>
<th>Nominal Size (inch)</th>
<th>0.5</th>
<th>0.75</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>3.0</th>
<th>5.0</th>
<th>7.5</th>
<th>10.0</th>
<th>16.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pd = TCX Discharge Steam Pressure (barg)</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>80</td>
<td>110</td>
<td>160</td>
<td>220</td>
<td>280</td>
<td>430</td>
<td></td>
</tr>
<tr>
<td>Md = Discharge Steam Flow Rate (kg/hr)</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>80</td>
<td>110</td>
<td>160</td>
<td>220</td>
<td>280</td>
<td>430</td>
<td></td>
</tr>
</tbody>
</table>

* For higher compression ratios, please contact Kadant Johnson.

**Thermocompressor Entrainment**

Determine the size of the thermocompressor using the Discharge (total) steam flow rate and the Discharge steam pressure and the Sizing Table underneath:

- For this example, the thermocompressor size = 12*

**Note:** Consult Kadant Johnson for optimum sizing and thermocompressor performance curves.

Kadant is a global supplier of high-value, critical components and engineered systems used in process industries worldwide.

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