Effectiveness of Paper Dryer Journal Insulating Sleeves
Effectiveness of Insulating Sleeves

- Greg Wedel – Kadant Johnson Inc.
- Jerry Timm – Kadant Johnson Inc.
Dryer Journal Insulating Sleeves
Dryer Journal Insulating Sleeves
Dryer Journal Insulating Sleeves
Without a Dryer Journal Insulating Sleeve

• Increase heat transfer through dryer journals
• Increase heat transfer to the bearings
• Increase bearing race temperature
• Increase heat transfer to oil lubrication system
• Increase tendency for oil carbonizing
• Increase dryer journal thermal response
Cracked Dryer Bearing Inner Race

Courtesy Society of Tribologists and Lubrication Engineers
Pilot Test Dryers
### JOCO 6000 Pilot Test Dryer

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>1.8 m</td>
<td>72”</td>
</tr>
<tr>
<td>Face</td>
<td>8.76 m</td>
<td>345”</td>
</tr>
<tr>
<td>Speed</td>
<td>2000 mpm</td>
<td>6560 fpm</td>
</tr>
<tr>
<td>Pressure</td>
<td>11 bar</td>
<td>160 psig</td>
</tr>
<tr>
<td>Condensing</td>
<td>49 kg/hr-m²</td>
<td>10 lb/hr-ft²</td>
</tr>
<tr>
<td>Syphon</td>
<td>Rotating or stationary</td>
<td></td>
</tr>
</tbody>
</table>
Dryer Journal Insulating Sleeves
No Dryer Journal Insulating Sleeve

3.45 bar steam pressure
Dryer Journal Insulating Sleeve

3.45 bar steam pressure
## Dryer Journal Insulating Sleeves

<table>
<thead>
<tr>
<th>Dryer Sleeve Configuration</th>
<th>Dryer Steam Pressure bar (psia)</th>
<th>Journal Temperature under the Bearing °C (°F)</th>
<th>Heat Transfer to the Bearing kW (Btu/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No sleeve</td>
<td>3.45 (50)</td>
<td>110 (230)</td>
<td>2.6 (8840)</td>
</tr>
<tr>
<td>No sleeve</td>
<td>6.90 (100)</td>
<td>130 (266)</td>
<td>3.3 (11288)</td>
</tr>
<tr>
<td>Sleeve</td>
<td>3.45 (50)</td>
<td>66 (150)</td>
<td>1.0 (3400)</td>
</tr>
<tr>
<td>Sleeve</td>
<td>6.90 (100)</td>
<td>71 (160)</td>
<td>1.2 (4080)</td>
</tr>
</tbody>
</table>
Dryer Journal Insulating Sleeves

![Graph showing bearing temperature over elapsed time with and without insulating sleeves.]

- **Bearing Temperature, °C**
  - 0
  - 30
  - 60
  - 90
  - 120

- **Elapsed Time, Minutes**
  - 0
  - 10
  - 20
  - 30
  - 40
  - 50
  - 60

- **Legend:**
  - **With Sleeve**
  - **No Sleeve**
Dryer Journal Insulating Sleeves
Dryer Journal Insulating Sleeves
No Insulating Sleeve

![Graph showing temperature over time for journal, oil inlet, oil outlet, and oil DT with a pressure of 6.9 bar.](image)
Partially Sealed Insulating Sleeve (6.9 bar)

Temperature, °C

Time, minutes

Journal

Oil Inlet

Oil Outlet

Oil DT

6.9 bar
Sealed Insulating Sleeve

![Graph showing temperature change over time with different labels for Journal, Oil Inlet, Oil Outlet, and Oil DT. The graph indicates temperature in degrees Celsius and time in minutes. The pressure is 6.9 bar.]
Dryer Journal Temperature

Journal Insulating Sleeve Configuration

- None
- Leaky
- Sealed

Journal Temperature, °C

Bar Graph:
- 3.45 bar
- 6.9 bar
Heat Transfer to Dryer Bearing

![Bar chart showing heat transfer to dryer bearing with different insulating sleeve configurations and pressures.](chart.png)
Lubrication Oil Temperature Rise

![Graph showing lubrication oil temperature rise over time, with actual and calculated lines.](image)
Effect of Dryer Speed

![Graph showing the effect of dryer speed on oil temperature rise. The graph plots dryer speed (rpm) on the x-axis and oil temperature rise (°C) on the y-axis. Three lines represent different conditions: sleeve, 3.45 bar; no sleeve, 3.45 bar; and no sleeve, 6.9 bar. The graph indicates that as dryer speed increases, oil temperature rise decreases.]
Summary

- Effectiveness of the insulating sleeves
  - No insulating sleeve
  - Non-vented and improperly sealed sleeve
  - Vented, properly sealed sleeve

- Effect of insulating sleeves
  - Decrease bearing race temperature
  - Decrease heat transfer to the bearings
  - Decrease heat transfer to oil lubrication system
  - Reduced tendency for oil carbonizing
  - Reduced dryer journal thermal response
Summary

• For steam pressures below 5 bar (75 psig):
  - Heat flow < 2.6 kW (9000 Btu/hr)
  - May operate a dryer without an insulating sleeve
  - Carefully control warm-up procedures

• For steam pressures over 5 bar (75 psig)
  - Recommend insulating sleeves
  - Heat flow << 2.6 kW (9000 Btu/hr)
Effectiveness of Paper Dryer Journal Insulating Sleeves