Rotary Joints and Condensate Evacuation Systems
Effective condensate evacuation
Rotary Joints and Condensate Evacuation Systems

The rotary joint and syphon is one of the most important components of the drying section of a paper machine. Right selection and implementation significantly impacts maximum capacity realisation, operational flexibility and hence economy of operation. This happens by ensuring proper condensate evacuation from the drying cylinders with as few constraints as possible. Forbes Marshall rotary joints and syphons come from our 70 years experience of revamping and designing steam and condensate systems. These joints are designed for the best life, reliability and economy.

Benefits of a Good Rotary Joint and Syphon System

- No Condensate Accumulation in Dryers
- Maximum Steam Pressure Availability in Dryers
- Maximum Dryer Surface
- Maximum Drying Rate
- No Leakages from Joints
- Maximum Production
- Low Pressure Drops
- Best Economy

Benefits

- Three times the normal seal life
- 2 year seal guarantee
- Low differential pressure requirement
- Higher dryer surface temperatures

Seal

The sealing effectiveness of a rotary joint is the indication of its efficiency.

Features

- Optically lapped surfaces - no leakages
- Enhanced seal life through -
  - Perfect alignment through use of split collars
  - Low wear and tear
  - Optimum spring forces
  - Antimony impregnated carbon seals
  - Very high wear resistance
Condensate Behaviour Inside a Dryer

Condensate behaviour inside a dryer is a very significant factor in choosing the right syphon design. Condensate behaviour can be divided into 3 stages, puddling, cascading and rimming.

**Machine Speed**
- **0-200 MPM**
- **0-660 FPM**

**Machine Speed**
- **200-250 MPM**
- **660-820 FPM**

**Machine Speed**
- **250 MPM and above**
- **820 FPM and above**

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**Puddling**
At low speeds, the condensate accumulates at the dryer bottom. Differential pressure is needed to push the condensate up to the dryer center and then out.

**Cascading**
During puddling and cascading, the best condensate evacuation happens when the syphon tip is submerged in condensate. This is known as a flooded syphon. Condensate in the syphon is a solid column of water and can be discharged through a trap.

**Rimming**
At higher speeds, the condensate travels along the dryer surface, forming a rim. This requires a higher differential pressure to overcome additional centrifugal forces.

During rimming, the syphon shoe is positioned just above the condensate layer and some quantity of steam is allowed into the syphon along with the condensate. This drastically reduces the density of steam and water column in the syphon, thereby reducing the differential pressure requirement. This is known as blowthrough.
In a 175 TPD kraft machine in Egypt, the dryer surface temperatures varied between 60 and 80 deg C. After replacing existing syphons with Forbes Marshall FBS rotary joints and syphons, the temperatures improved to between 100 to 120, indicating an average 35 deg C improvement.

At a 140 TPD kraft unit in Vapi, Forbes Marshall FBS rotary joints and syphons increased the average dryer surface temperatures by 25 deg C. Now the machine is operating with a differential temperature of 27 deg C between steam and dryer surface.

By replacing rotary syphons at a mill in central India with Forbes Marshall high speed stationary (HSS) rotary joints and syphons along with Forbes Marshall Turbymax™, the dryer surface temperatures improved from an average of 80 deg C to 95 deg C.

Here, the machine production improved from 175 to 190 TPD. Also, the writing/printing 500 mpm machine is now running with a drying rate of 22 in pre-size press and 24 in post-size press section.

Dryer surface temperatures improved from 55 to 65 deg C by changing from traditional scoop type syphons to Forbes Marshall high speed stationary (HSS) rotary joints and syphons.
Fixed Bend Syphon - with and without shoe
Upto 450 MPM

High Speed Stationary Syphon - Hydroplaning Shoe, Cantilever, Additional Guide Support
Upto 2000 MPM speed

Turbumax™ for Uniform Temperature Distribution - Above 550 MPM

*Refer to page 6 for details
## Selection Guide

<table>
<thead>
<tr>
<th>Machine Speed</th>
<th>Drive</th>
<th>Type of Joint &amp; Syphon</th>
<th>Type of Condensate Evacuation System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 250 MPM</td>
<td>Geared or silent drive</td>
<td>Forbes Marshall Fixed Bend Syphon</td>
<td>Trapping Module</td>
</tr>
<tr>
<td>250 to 450 MPM</td>
<td>Geared or silent drive</td>
<td>Forbes Marshall Fixed Bend Syphon with shoe</td>
<td>Blow through</td>
</tr>
<tr>
<td>450 to 550 MPM</td>
<td>Silent drive only*</td>
<td>Forbes Marshall High Speed Stationary Syphon</td>
<td>Blow through</td>
</tr>
<tr>
<td>550 MPM and above</td>
<td>Silent drive only</td>
<td>Forbes Marshall High Speed Stationary Syphon</td>
<td>Blow through</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with TurboMax™</td>
<td></td>
</tr>
</tbody>
</table>

* For geared machines in this range, Forbes Marshall HSS can be installed with external customised mounting brackets. Alternatively, Forbes Marshall Rotary Syphons can be used.

<table>
<thead>
<tr>
<th>Type of Joint &amp; Syphon</th>
<th>Blow Through Percentage</th>
<th>Differential Pressure Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forbes Marshall FBS with trapping module</td>
<td>1.5%</td>
<td>0.45 kg/cm² g</td>
</tr>
<tr>
<td>Forbes Marshall FBS with shoe</td>
<td>20%</td>
<td>0.35 kg/cm² g</td>
</tr>
<tr>
<td>Forbes Marshall HSS</td>
<td>15%</td>
<td>0.25 kg/cm² g at low speeds. Reduces at higher speeds.</td>
</tr>
</tbody>
</table>