AIMCAL

- Benefits of modern vacuum pumping systems for WEB applications
- Maintenance and CoO of vacuum pumping systems for WEB applications

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160 Years of Vacuum Innovation

Historical Milestones

1850
- Working independently of each other, company founders Ernst Leybold in Cologne and Wilhelm Carl Heraeus in Hanau lay separate foundations for subsequent high-tech firms.

1906
- Professor Gaede develops the first high-vacuum devices in Cologne.

1946
- Professor Auwärter leaves the vacuum-technology department at Heraeus and founded with Emil Georg Bührle the Gerätebau-Anstalt Balzers.

1967
- Leybold merges with Heraeus Hochvakuum to form Leybold-Heraeus.

1987
- Degussa AG becomes sole owner of Leybold-Heraeus, changing to Leybold AG.

1994
- Acquisition of Leybold AG by Oerlikon-Bührle Group.

1996
- Rebranding to unaxis.

2000
- Start of manufacturing in China.

2005
- New Board of Directors.

2006
- New axis.

2008
- Successful performance and product innovations despite worldwide crisis.

2009
- Extension of manufacturing in Tianjin, China.

2010
- New MAGITEGRA TMP and third China Extension.

2011
- New DRYVAC screw pump technology launched.

2016
- Leybold merges with Heraeus Hochvakuum to form Leybold-Heraeus.

2020
- Topmet 1650.
<table>
<thead>
<tr>
<th>Section</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Benefits of modern vacuum pumping systems for WEB applications</td>
</tr>
<tr>
<td>2</td>
<td>Maintenance and CoO of vacuum pumping systems for WEB applications</td>
</tr>
</tbody>
</table>
Agenda

1. Benefits of modern vacuum pumping systems for WEB applications
### Expectation for vacuum systems

<table>
<thead>
<tr>
<th>OEM</th>
<th>vs.</th>
<th>End-user</th>
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</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>=</td>
<td>Reliability</td>
</tr>
<tr>
<td>Good application support</td>
<td>≠</td>
<td>Good service support</td>
</tr>
<tr>
<td>Low initial costs</td>
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<td>Low follow-up costs</td>
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<td></td>
<td>≠</td>
<td>Low noise emission</td>
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<tr>
<td>Solid construction</td>
<td>≠</td>
<td>Small footprint</td>
</tr>
<tr>
<td>Traditional System</td>
<td>Current System</td>
<td>Modern System</td>
</tr>
<tr>
<td>--------------------</td>
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</tr>
<tr>
<td><img src="image1.png" alt="Traditional Pump" /></td>
<td><img src="image2.png" alt="Current Pump" /></td>
<td><img src="image3.png" alt="Modern Pump" /></td>
</tr>
</tbody>
</table>

- **Traditional System**: All pumps have **dynamic shaft seals** and the booster stages have to be exchanged every 2 years. Oil sealed pump protected by dust filter, but normal exchange like mentioned in the manual is required.
  - **high cost impact**
  - **oil leakage**
  - **unplanned down times**

- **Current System**: Booster pumps without shaft seal to avoid regularly exchange. Oil sealed pump protected by dust filter, but normal exchange like mentioned in the manual is required.
  - **low cost impact**

- **Modern System**: All pumps are hermetically sealed and have no dynamic sealing to atmosphere. All pumps are dry pumps. Pumps running with PFPE oil are absolutely service free for 4 years.
  - **no cost impact**
## Cost of Ownership

<table>
<thead>
<tr>
<th>Traditional System</th>
<th>Current System</th>
<th>Modern System</th>
</tr>
</thead>
<tbody>
<tr>
<td>System:</td>
<td>System:</td>
<td>System:</td>
</tr>
<tr>
<td>2xRA9001</td>
<td>2xWH7000</td>
<td>2xWH7000</td>
</tr>
<tr>
<td>2xWA2001</td>
<td>2xWS2001</td>
<td>2xWH2500</td>
</tr>
<tr>
<td>2xSV630B</td>
<td>2xSV630B</td>
<td>2xDV650</td>
</tr>
<tr>
<td>4XDIP20000</td>
<td>4XDIP20000</td>
<td>4XDIP20000ECO</td>
</tr>
<tr>
<td>Required power below 10mbar: 76.5kW</td>
<td>Required power below 10mbar: 75kW</td>
<td>Required power below 10mbar: 52kW</td>
</tr>
<tr>
<td>Energy costs per year: 39,000€ ($39,000)</td>
<td>Energy costs per year: 38,000€ / ($38,000)</td>
<td>Energy costs per year: 26,000€ / ($26,000)</td>
</tr>
</tbody>
</table>

220 working days; 24h operation; 96% uptime; 10ct/kWh
Cost of Ownership

All new pumps are controlled with electronics to run at the best performance point. This provides only power when it is needed.

For Fore-vacuum pumps this is done via FC. For Diffusion pumps this is done via thermal control.

Higher initial cost for Dry pumps with FC and Diffusion pumps with thermal control. Up to $12,000 energy costs savings and additional savings for maintenance free pumps leads to a return on investment below two years.

Problem: End-user does not have the choice of vacuum systems.

Solution: OEM can offer a more expensive system as an option. End-user can pro-actively ask for such a „low follow-up cost“ solution.
## Noise Emission

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<tr>
<td><img src="image1.png" alt="Traditional System Image" /></td>
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</tr>
</tbody>
</table>

**System:**
- 2xRA9001 [82dB(A)]
- 2xWA2001 [80dB(A)]
- 2xSV630B [75dB(A)]

*Noise emission below 10mbar: App: 88dB(A)*

Unpleasant stressful noise level

**System:**
- 2xWH7000 [63dB(A)]
- 2xWS2001 [75dB(A)]
- 2xSV630B [75dB(A)]

*Noise emission below 10mbar: App: 82dB(A)*

Average industrial noise level

**System:**
- 2xWH7000 [63dB(A)]
- 2xWH2500 [63dB(A)]
- 2xDV650 [62dB(A)]

*Noise emission below 10mbar: App: 70dB(A)*

Pleasant noise level

*60dB(A) is a level of normal conversation!*
<table>
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<tr>
<td>2xSV630B</td>
<td>2xSV630B</td>
<td>2xDV650</td>
</tr>
<tr>
<td>Length: 5.5m (18ft)</td>
<td>Length: 5.3m (17ft)</td>
<td>Length: 3.2 (11ft)</td>
</tr>
<tr>
<td>Footprint: 10m² (108ft²)</td>
<td>Footprint: 9.5m² (102ft²)</td>
<td>Footprint: 5.8m² (62ft²)</td>
</tr>
</tbody>
</table>

Vacuum system saves 40% installation space
Summary

New vacuum systems offer a lot of advantages

For OEM:

✓ Offer a more reliable system
✓ Offer “maintenance free system” as a competitive advantage
✓ Offer a pumping system with lower noise level as a competitive advantage
✓ Offer “dry systems” as an option to show customers innovation and flexibility
✓ Offer a more modern looking pumping system that fits to the modern design of the coater

For End-user:

✓ More up-time with static sealing (low maintenance; no oil leakage)
✓ Saving energy costs up to $12,000 per year
✓ Saving maintenance costs
✓ Saving maintenance time = more up-time
✓ Creating a more comfortable working environment with lower noise levels
✓ Less floor space needed for your system
Agenda

2

Maintenance and CoO of vacuum pumping systems for WEB applications
Maintenance of Traditional Pumping System

Pumps need regular oil exchange > approx. every 6 months

**Total material/5 years** | **Total labor/5 years**
---|---
710 L & 70 hours

- Per year
  - 44 L
- Total/year: 142 L
- Total/5 years: 710 L

**Oil consumption:**
- 2 x 9,000 m³/h
- 2 x 2,000 m³/h
- 2 x 750 m³/h
- 88 L

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"AIMCAL" and "Oerlikon Leybold Vacuum" logos are present on the page.
Maintenance of Traditional Pumping System

Dust filter consumption:

<table>
<thead>
<tr>
<th>Total material/5 years</th>
<th>Total labor/5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>710 L</td>
<td>Per 1 year</td>
</tr>
<tr>
<td></td>
<td>10 hours</td>
</tr>
</tbody>
</table>

- Regular replacements of paper filters
- > approx. every 6 months
- 4 pcs

Total/5years: 20 pcs
## Maintenance of Traditional Pumping System

- **Shaft seals on blowers and oil filters on rotary vane pumps:**
  - Approx. every 24 months
  - 2 x 750 m³/h
  - 16 pcs per 2 years
  - Filter consumption: Total/5 years = 40 pcs
  - Consumption of shaft seal kit: Total/5 years = 8 pcs
  - 2 x 9,000 m³/h
  - 2 x 2,000 m³/h

<table>
<thead>
<tr>
<th>Total material/5 years</th>
<th>Total labor/5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>710 L</td>
<td>70 hours</td>
</tr>
<tr>
<td>20 pcs</td>
<td>10 hours</td>
</tr>
<tr>
<td>8 pcs</td>
<td>20 hours</td>
</tr>
<tr>
<td>40 pcs</td>
<td>40 hours</td>
</tr>
<tr>
<td><strong>Total/5 years:</strong></td>
<td>8 pcs</td>
</tr>
</tbody>
</table>
**Maintenance of Traditional Pumping System**

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<tbody>
<tr>
<td>710 L</td>
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<td>10 hours</td>
</tr>
<tr>
<td>8 pcs</td>
<td></td>
<td>24 hours</td>
</tr>
<tr>
<td>40 pcs</td>
<td></td>
<td>40 hours</td>
</tr>
<tr>
<td>6 units</td>
<td></td>
<td>140 hours</td>
</tr>
</tbody>
</table>

**Total/5years** 6 units

Use genuine OEM parts for service and extend MTBM!
Reduce system down time and increase production up time!
Maintenance of Modern Pumping System

- Maintenance free for four (4) years.
- Pumps are operating with PFPE synthetic oil
- Overhaul required in five (5) years.
CoO Comparison

T € / ($) vs years

- Modern
- Traditional
Thank you very much.