LubriMist®
Oil Mist Lubrication
Colfax Businesses

**Colfax Fluid Handling**
World leader in the development, engineering, manufacturing, distribution, service and support of fluid-handling systems for critical applications in key industries.

**Approximate Historical Annual Revenue**: $690 Million

**ESAB**
Excellence in welding and cutting solutions for manufacturing, fabrication and maintenance applications across a broad spectrum of industries.

**Approximate Historical Annual Revenue**: $1.7 Billion

**Howden**
Precision air and gas handling equipment for challenging applications, from heavy duty fans to rotary heat exchangers to process gas compressors.

**Approximate Historical Annual Revenue**: $900 Million
In absence of Oil Mist
Typical Sump Lubrication

Trico Oiler

Plug on Top

Slinger Rings
Why Pumps Fail?

- **Bearings**: 40%
- **Hydraulic**: 12%
- **Seals**: 43%
- **Static Joints**: 2%
- **Coupling**: 2%
- **Other**: 1%
Why Bearings Fail

- Particle Contamination: 48%
- Disassembly: 15%
- Misalignment: 13%
- Insufficient Lubrication: 11%
- Other: 5%
- Overloading: 4%
- Corrosion: 4%

Other: 5%
Why Mechanical Seals Fail?

Comparing Mechanical Seal Life

With Oil Mist

Without Oil Mist

MTBR in Years

Two Refineries w/ 600 Pumps Each

Sep-00 Nov-00 Jan-01 Mar-01 May-01 Jul-01 Sep-01
Oil Mist Generation & Delivery
What do you need to generate Oil Mist?

- Instrument air, i.e. dry air:
  - Minimum supply pressure: 40 PSI, 2.81 kg/cm²
  - Maximum supply pressure: 150 PSI, 10.54 Kg/cm²
  - Humidity: Maximum recommended dew point -4° C below minimum all-year temperature.

- Paraffinic or synthetic oil ISO VG 32-150
- No EP Additives or Viscosity Modifiers
What is Oil Mist?

Oil mist will not support combustion or explode.

Oil Mist Pressure Is 20” H2O or Approximately 0,05 kg/cm²

5 ppm oil in air

Oil lifted by vacuum

OIL MIST

Air

Air

Air

Air

Air

Air

Air
What is Oil Mist?

- Oil Mist Density: 1 part oil of 200,000 parts air (5ppm)
- Very homogeneous particle size
- Oil particles are 3 microns maximum (Dry Mist)
- Generator outlet pressure 20” water column (50mbar)
- Average temperature 17°C
- Clean mixture
- Non flammable
- Non toxic
- Ability to convey 150m with minimum condensation
Embedded PC Monitoring
+/- 50 Set Points
Common Alarm to DCS

Simple Manual Controls

Oil Tanks
Main - 34 ltr (9 USG)
Auxiliary - 34 ltr (9 USG)
Bulk Storage – 285 ltr (75 USG)

Simple Switch-Over from Main to Auxiliary Oil Tanks for Maintenance or Repair

Oil Filter, Pressure Gauge, Oil Tanks Sight Gauges, Drain & Fill Connections
Oil Mist Delivery

Oil Mist Particle Sizes

Application & Lubrication

15 Microns
Above Wet Mist For Lubrication

Generation & Distribution

3 Microns
Below Dry Mist For Conveying
Oil Mist Lubrication

Dry Mist In
(1 to 3 Micron Conveying)

Oil Mist particles impinge on each other causing them to grow in size and become wetter.

Wet Mist Out
(up to 30 Micron Lubricating)
Oil Mist Benefits
The impact of Oil Mist

Oil Mist is the Ultimate Oil Filter

Typical cleanliness level
ISO 4406 16/13/10

Beyond pre-filtrating the oil and the air in the mixture, the cyclone generated in the Vortex separates the particulate from the Oil Mist fed to the system.
The impact of Oil Mist

Oil Mist is the Ultimate Bearing Protector

Positive Pressure 50mbar
The impact of Oil Mist

### Estimated Life Extension Table

<table>
<thead>
<tr>
<th>Existing Machine Cleanliness (ISO Code)</th>
<th>Targeted Cleanliness Level (ISO Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/23</td>
<td>20/17</td>
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<tr>
<td>25/22</td>
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<td>24/21</td>
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<td>17/14</td>
<td>11/8</td>
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<td>16/13</td>
<td>10/7</td>
</tr>
</tbody>
</table>

- **Hydraulic and Diesel Engines**
- **Rolling Element Bearings**
- **Journal Bearings and Turbo Machinery**
- **Gear Boxes and Other**

*Example*
Superior Cleanliness Levels

Contamination Level (ISO 4406)

- Oil Bath Lubrication
- Oil Mist Lubrication
- Oil Mist Lubrication Filtration ($\beta_5 > 200$)
Temperature Benefits

- Bearing temperatures decline typically 8-10 degrees Celsius with pure oil mist versus liquid oil lube.

- For every 10 degree drop, the bearing $L_{10}$ life increases 11%.
Other benefits

- Resulting from MTBF increase:
  - Plant availability – reduced loss of profit
  - Reduced maintenance costs
  - Reduced insurance premiums
- Automation of the lubrication process
- Lower consumption of lube oil, cooling water, energy
- Increased personal safety
- Increased asset safety
Distribution System Layout
How does an Oil Mist system look like?
Application Drops

Each piece of equipment to be lubricated should be installed with a drop point originating from the upper header and terminating at the mist manifold.
Mist System Designs

Closed Loop System

Open Loop System
Oil Mist Installed
Applying Oil Mist
Applying Oil Mist

Purge Mist
- Also called “wet sump”
- Used to protect the bearing housing
- Not primary means of lubrication

Pure Mist
- Also called “dry sump”
- Oil mist provides lubrication
- No oil sump for lubrication
Pure Oil Mist

Pure mist lubricates operating equipment and protects and preserves standby equipment.
Between Bearing Pump & Motor Driver
Liquid Ring Compressors
Pillow Block Bearings

Oil Mist Inlet

Oil Mist Outlet

Oil Mist Inlet
OH Pump, Turbine Driver & Gear Box
Rotary Lobe Blowers
Rotary Lobe Blowers

Pure & Purge Mist Application

Purge Mist

Pure Mist
Cooling Tower Gear Box
Steam Turbine
Machinery Storage

Machinery Preservation Yard

Aerial View of Oil Mist Preservation Yard in Thailand
Long Term Storage
Economic Justification
Data gathering – real case studies

TIPPING 3 MTBF [mth]

- 32 30 23 22 21 23 30 36 36 26 30 28 26 23 23 22 27 30 34 39 45 45 68 68 54 49 45 45
## Maintenance Cost Analysis

<table>
<thead>
<tr>
<th>UNIT TAG</th>
<th>MAINTENANCE COSTS 2 YEARS BEFORE OIL MIST</th>
<th>MAINTENANCE COSTS 2 YEARS AFTER OIL MIST</th>
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<tbody>
<tr>
<td>611-G-1A</td>
<td>14.868 €</td>
<td>6.936 €</td>
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<tr>
<td>611-G-1B</td>
<td>11.242 €</td>
<td>8.814 €</td>
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<tr>
<td>611-G-1C</td>
<td>463 €</td>
<td>0 €</td>
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<tr>
<td>611-G-2A</td>
<td>10.909 €</td>
<td>0 €</td>
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<tr>
<td>611-G-2B</td>
<td>267 €</td>
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<tr>
<td>611-G-2C</td>
<td>14.463 €</td>
<td>601 €</td>
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<td>611-G-6</td>
<td>7.256 €</td>
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<td>611-G-4A</td>
<td>6.753 €</td>
<td>6.365 €</td>
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<td>611-G-4B</td>
<td>1.915 €</td>
<td>310 €</td>
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<td>611-G-3A</td>
<td>27.441 €</td>
<td>19.438 €</td>
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<td>611-G-3B</td>
<td>24.715 €</td>
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<td>651-G-2A</td>
<td>147 €</td>
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<td>651-G-2B</td>
<td>0 €</td>
<td>5.991 €</td>
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<td>651-G-8A</td>
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<td>651-G-8B</td>
<td>234 €</td>
<td>10.097 €</td>
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<td>652-G-1A</td>
<td>10.500 €</td>
<td>9.302 €</td>
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<td>652-G-1B</td>
<td>15.683 €</td>
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<td>652-G-4A</td>
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<td>652-G-4B</td>
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<td>652-G-5A</td>
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<td>3.689 €</td>
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<td>652-G-5B</td>
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<tr>
<td>652-G-6A</td>
<td>467 €</td>
<td>6.716 €</td>
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<td>652-G-6B</td>
<td>27.884 €</td>
<td>4.796 €</td>
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<td>652-G-7A</td>
<td>4.739 €</td>
<td>11.562 €</td>
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<td>652-G-7B</td>
<td>7.496 €</td>
<td>6.961 €</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>205.704 €</strong></td>
<td><strong>104.887 €</strong></td>
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**Savings:**
- **100.817 €**
- **49%**
**Investment calculator**

**LubriMist**

**MTBF, Repair Costs Analysis & Benefits**

**Installation of Lubrimist® Systems.**

<table>
<thead>
<tr>
<th>Customer</th>
<th>Date</th>
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</thead>
</table>

**Current Situation**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>MTBF</th>
<th>Annual Failures</th>
<th>Cost Repair Average</th>
<th>Annual Repair Total Costs</th>
<th>Lube Failures</th>
<th>Oil Lubricants Consumption*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumps</td>
<td></td>
<td></td>
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<tr>
<td>Turbines</td>
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<tr>
<td>Motors</td>
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<tr>
<td>Total of Equipments</td>
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**Estimated Benefits**

<table>
<thead>
<tr>
<th>Benefit Description</th>
<th>EUR/yr</th>
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<tbody>
<tr>
<td>Savings on Repair Costs</td>
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</tr>
<tr>
<td>Savings in Oil lubricant</td>
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<tr>
<td>Savings in Energy (2%)</td>
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<tr>
<td>Savings in cooling water</td>
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<tr>
<td>Manpower reduction</td>
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<tr>
<td>Estimated Total Savings**</td>
<td>EUR/yr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non Quantifiable Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance Costs</td>
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<tr>
<td>Work place safety</td>
</tr>
<tr>
<td>Automation</td>
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<tr>
<td>Positive Environmental Impact</td>
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</tbody>
</table>

**Situation after Lubrimist System**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>New MTBF</th>
<th>Annual Failures</th>
<th>Cost Repair Average</th>
<th>Annual Repair Total Costs</th>
<th>Lube Failures</th>
<th>Oil Lubricants Consumption**</th>
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*Calculated for pumps with 5 lt carter and 4 oil changes in a year.

**Considering that the shaft diameter average of the equipments is 70mm and have 3 bearings.

Commonly the number of mist distributors is the number of pumps.
Reference Information
Pure Mist is Preferred

The most important characteristics of pure mist is that bearing operating temperatures and friction in rolling element bearings is reduced. Hence a lower operating temperature equates to longer bearing life and lower energy loss equates to savings, page 217.

8º to 10º C cooler, page 218

20% to 25% less friction, page 218
References

Pure Mist is Preferred

**Reliability:** Documented evidence proves that pumps can run more than eight hours after the oil mist flow has ceased. Improved reliability of Oil Mist Generators supports pure oil mist.

**Back-Up Units:** Usually installed for emergency purposes when pure mist is used on a large scale.
Questions?

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