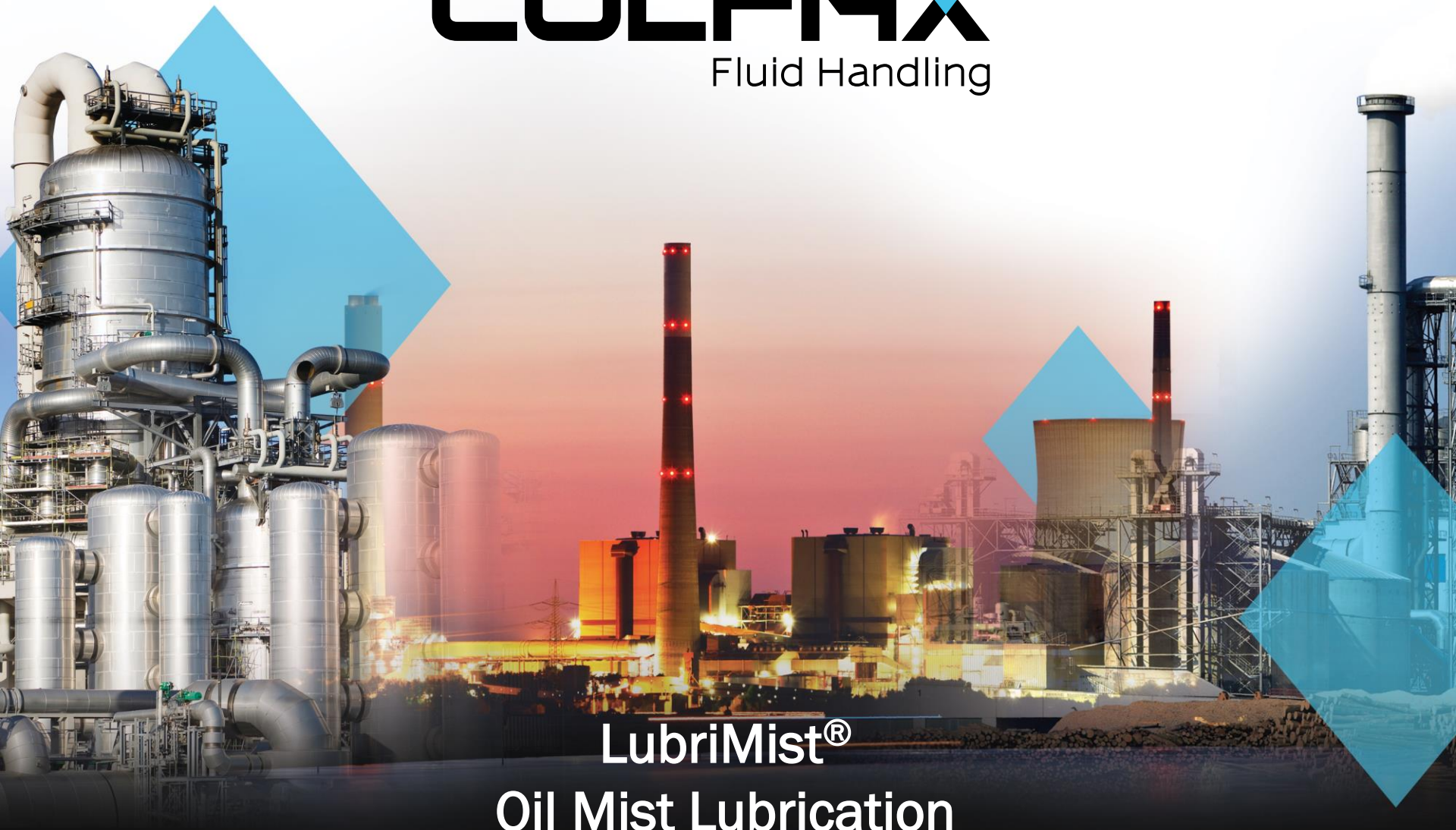
COLFAX
Fluid Handling



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

Colfax Businesses

COLFAX Fluid Handling

RELIABILITY SERVICES

- Clarus
- COT-Puritech
- Lubrication Systems Company

COLFAX PUMPS DIVISION

- Allweiler
- Imo AB
- Houttuin
- Rosscor
- Imo Pump
- Warren Pumps
- Tushaco

In absence of Oil Mist

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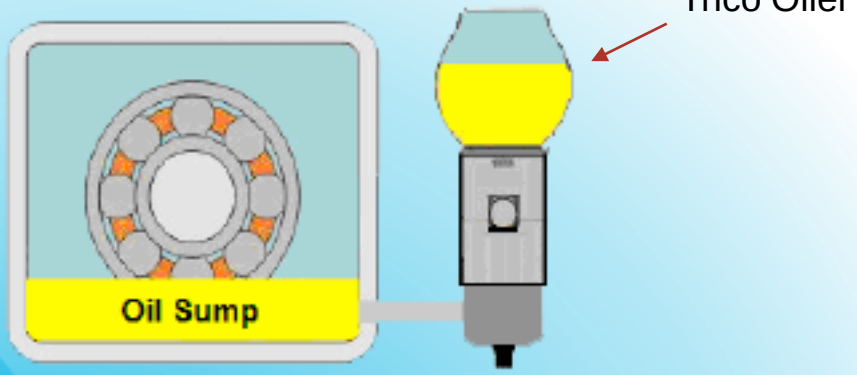
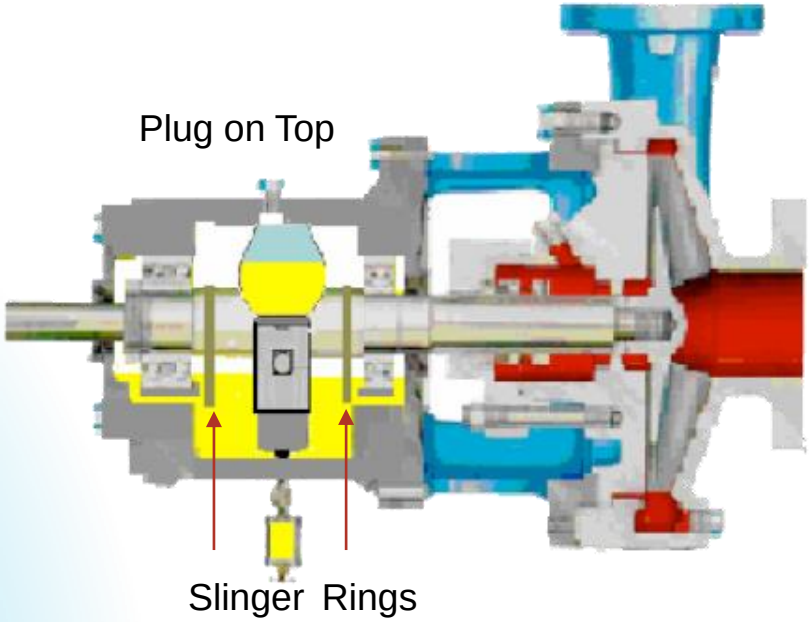
Fluid Handling

Typical Sump Lubrication





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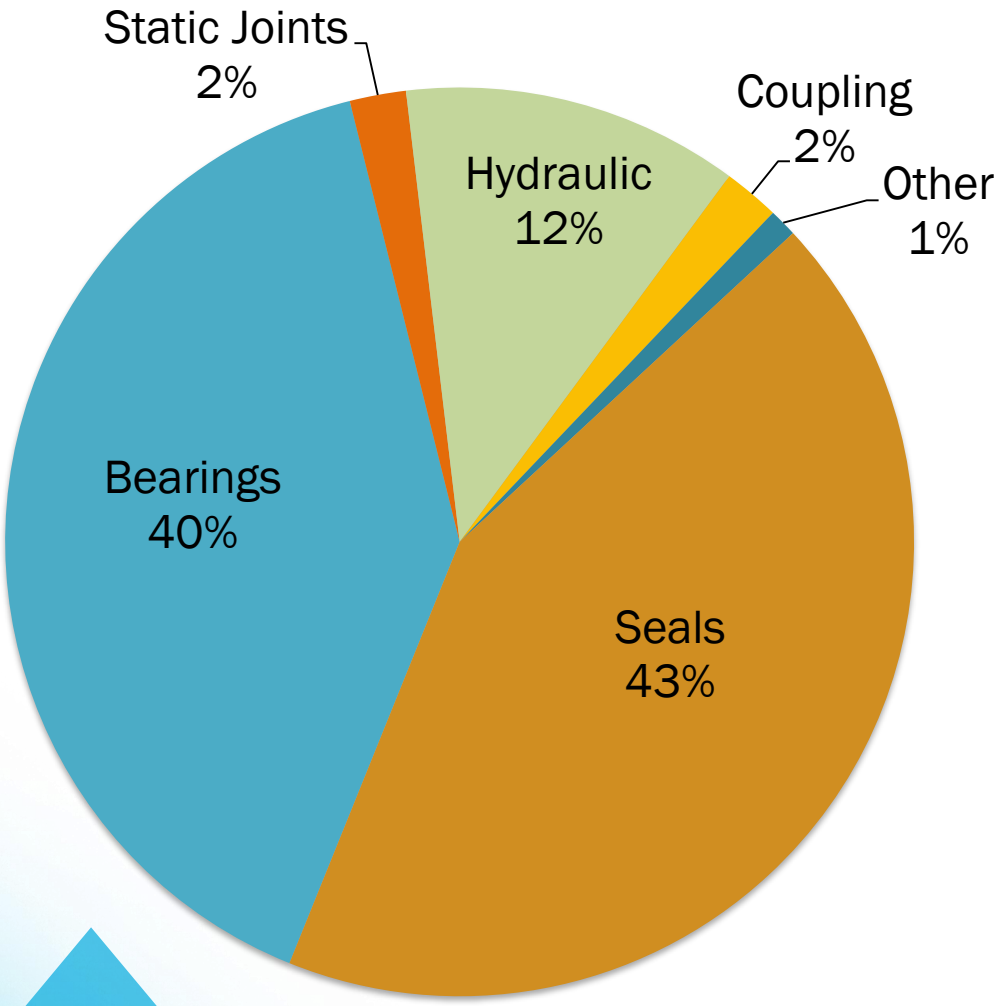
Why Pumps Fail?



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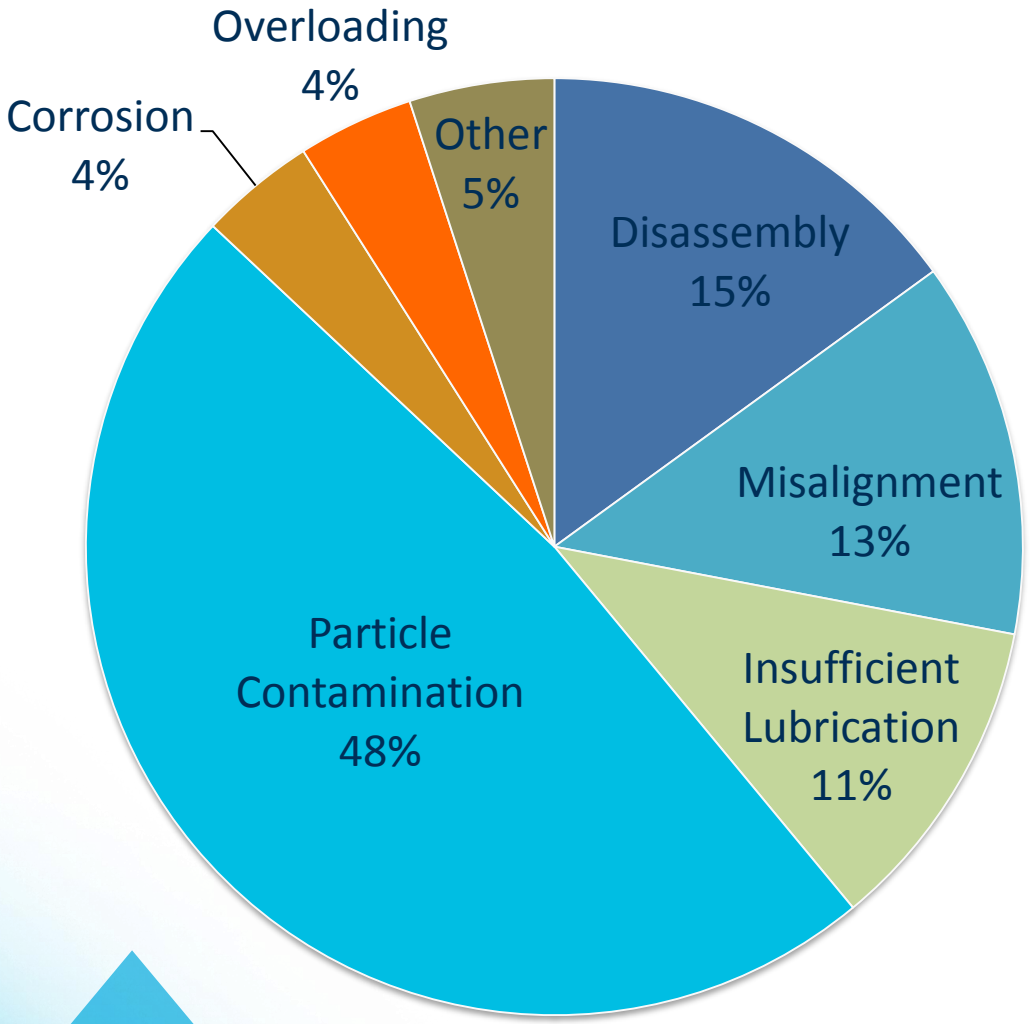
Why Bearings Fail



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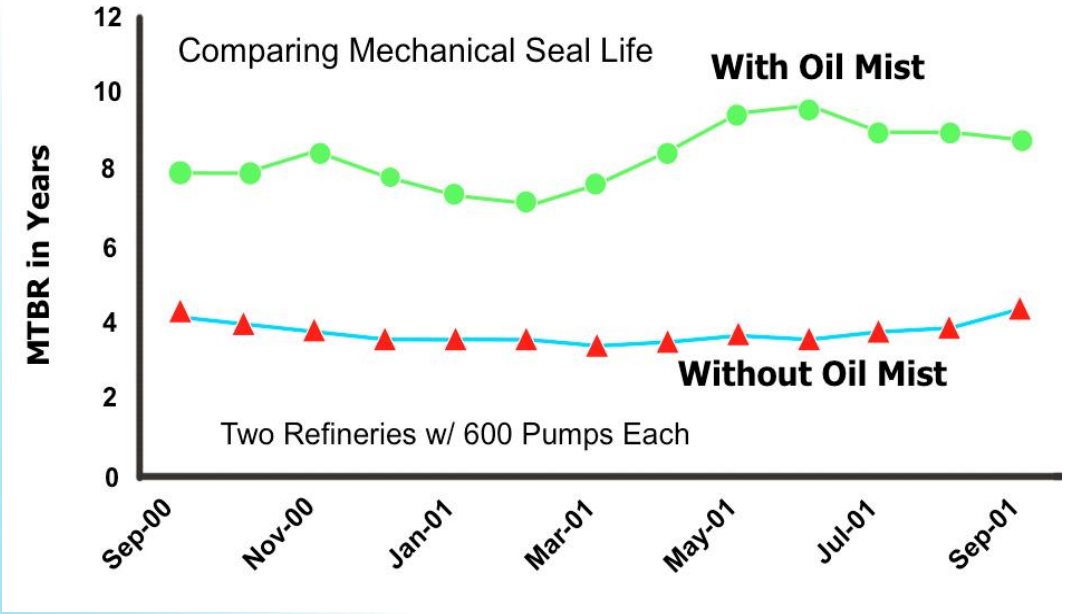
Fluid Handling

Why Mechanical Seals Fail?



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Oil Mist Generation & Delivery

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Fluid Handling

What do you need to generate Oil Mist?

Instrument air, i.e. dry air:

- Minimum supply pressure: 40 PSI, 2.81 kg/cm^2
- Maximum supply pressure: 150 PSI, 10.54 Kg/cm^2
- 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

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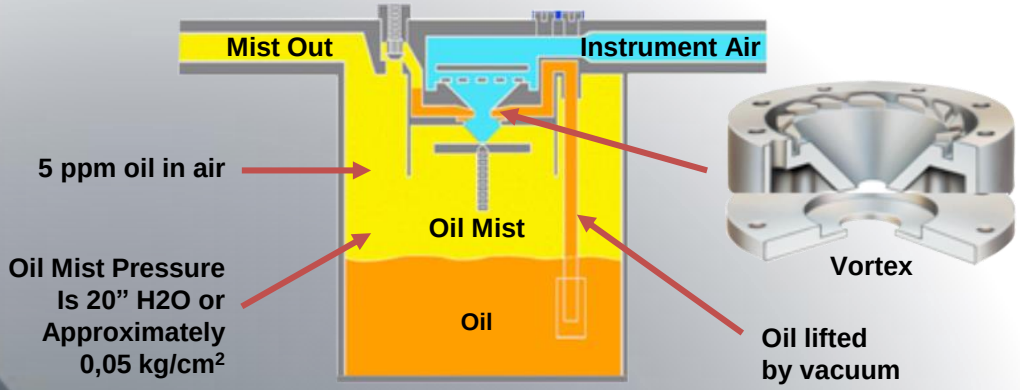
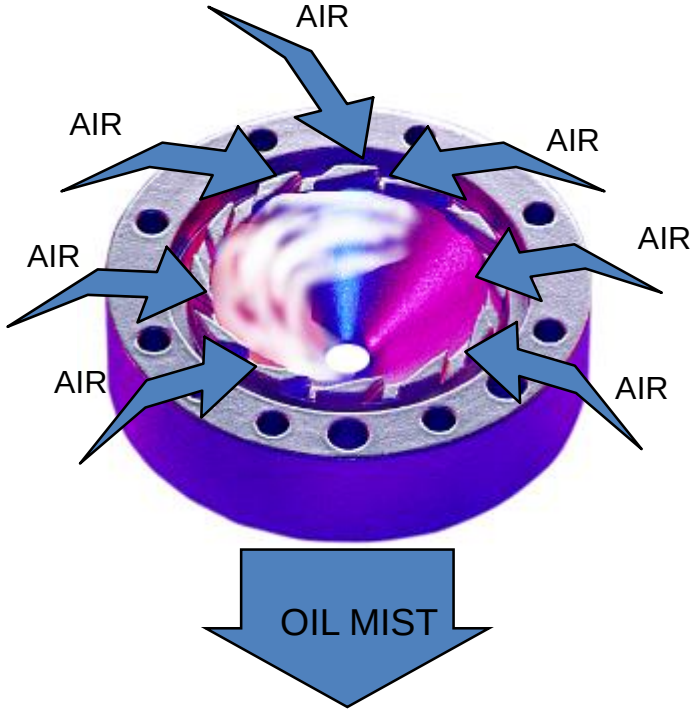
What is Oil Mist?





Oil mist will not support combustion or explode.

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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

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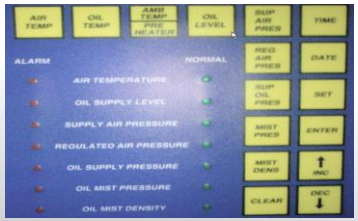
Fluid Handling

IVT Oil Mist Generator



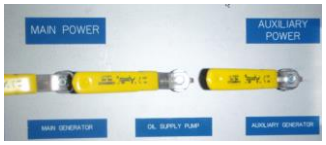
Embedded PC Monitoring
+/- 50 Set Points

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

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Oil Mist Delivery

Oil Mist Particle Sizes

Application & Lubrication

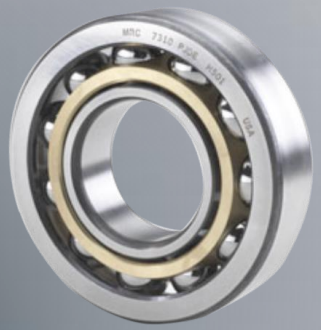
15 Microns

Above Wet Mist For Lubrication

Generation & Distribution

3 Microns

Below Dry Mist For Conveying



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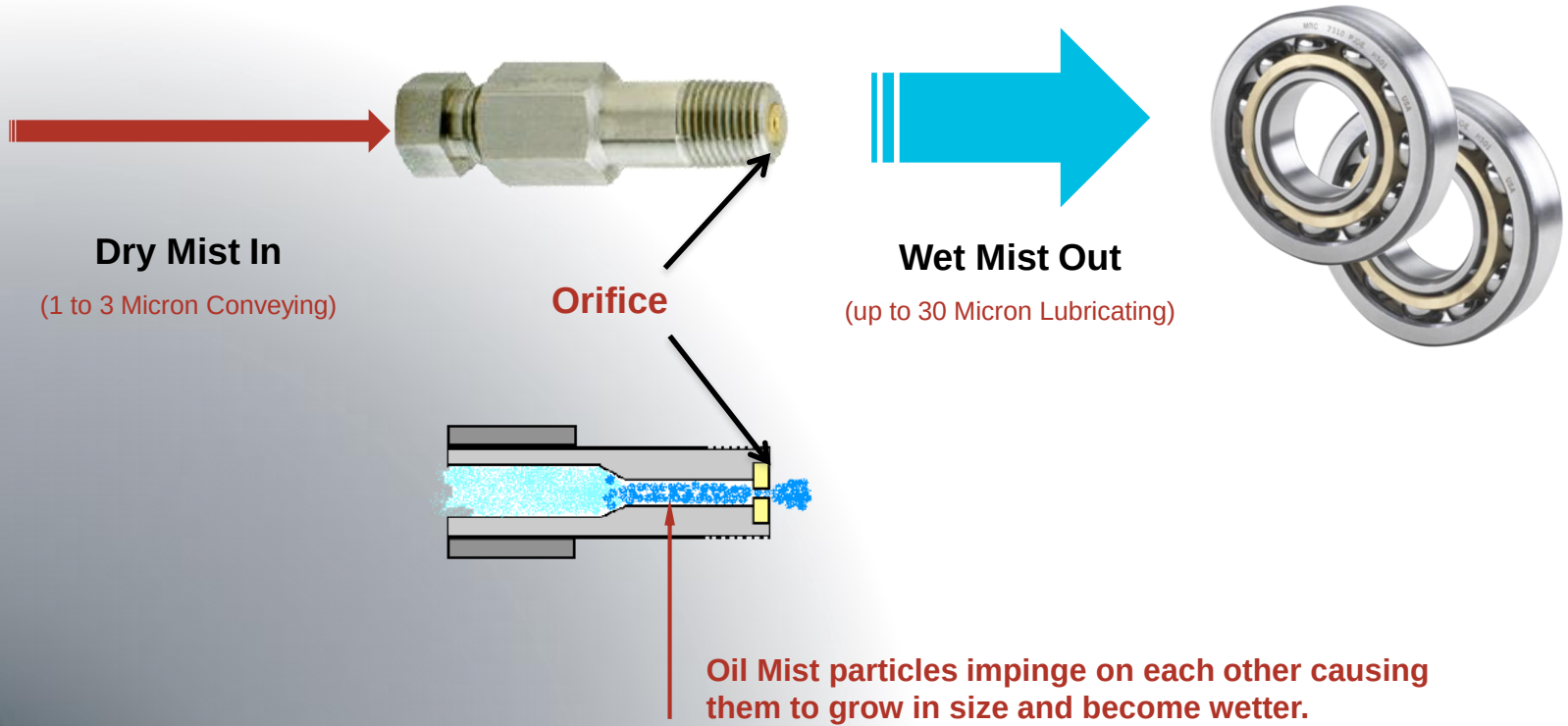
Converting Oil Mist

Oil Mist Lubrication



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Oil Mist Benefits

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Fluid Handling

The impact of Oil Mist

Oil Mist is the Ultimate Oil Filter

- **Typical cleanliness level**
  ISO 4406 16/13/10

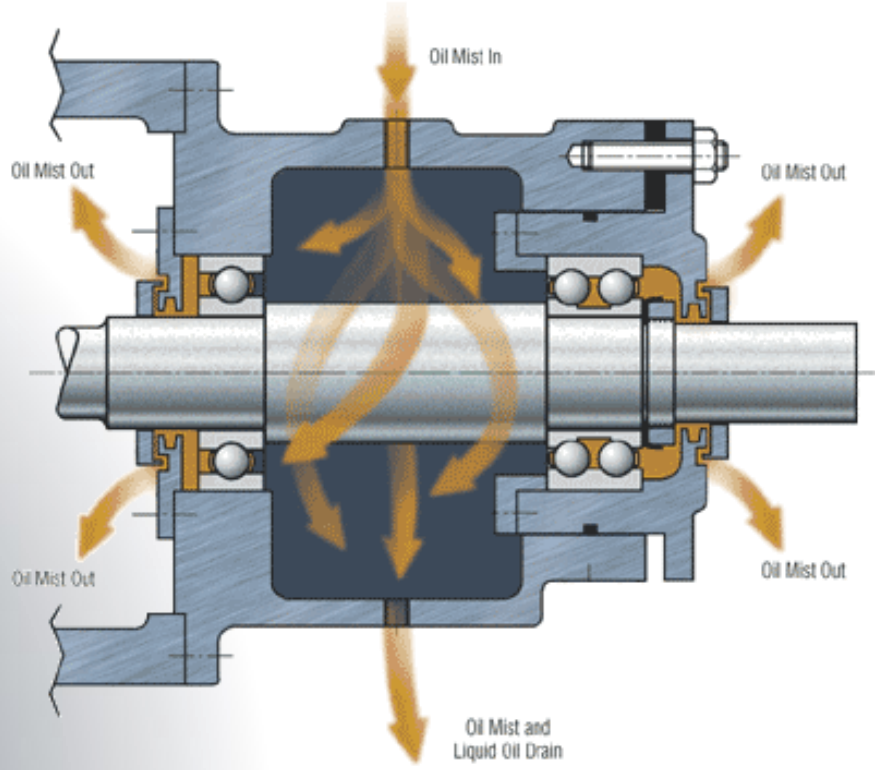
Beyond pre-filtrating the oil and the air in the mixture, the cyclone generated in the Vortex separates the particulate from the Oil Mist fed to the system.

COLFAX Fluid Handling

The impact of Oil Mist

Oil Mist is the Ultimate Bearing Protector

- **Positive Pressure 50mbar**



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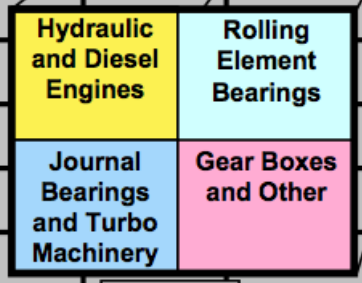
Fluid Handling

The impact of Oil Mist

Estimated Life Extension Table

Existing Machine Cleanliness (ISO Code)	Targeted Cleanliness Level (ISO Code)																			
	20/17		19/16		18/15		17/14		16/13		15/12		14/11		13/10		12/9		11/8		10/7	
26/23	5	3	7	3.5	9	4	>10	5	>10	6	>10	7.5	>10	9	>10	>10	>10	>10	>10	>10	>10	>10
	4	2.5	4.5	3	6	3.5	6.5	4	7.5	5	8.5	6.5	10	7	>10	9	>10	10	>10	>10	>10	>10
25/22	4	2.5	5	3	7	3.5	9	4	>10	5	>10	6	>10	7	>10	9	>10	>10	>10	>10	>10	>10
	3	2	3.5	2.5	4.5	3	5	3.5	6.5	4	8	5	9	6	10	7.5	>10	9	>10	>10	>10	>10
24/21	3	2	4	2.5	6	3	7	4	9	5	>10	6	>10	7	>10	8	>10	10	>10	>10	>10	>10
	2.5	1.5	3	2	4	2.5	5	3	6.5	4	7.5	5	8.5	6	9.5	7	>10	8	>10	10	>10	>10
23/20	2	1.5	3	2	4	2.5	5	3	7	3.5	9	4	>10	5	>10	6	>10	8	>10	9	>10	>10
	1.7	1.3	2.3	1.5	3	2	3.7	2.5	5	3	6	3.5	7	4	8	5	10	6.5	>10	8.5	>10	10
22/19	1.6	1.3	2	1.6	3	2	4	2.5	5	3	7	3.5	8	4	>10	5	>10	6	>10	7	>10	>10
	1.4	1.1	1.8	1.3	2.3	1.7	3	2	3.5	2.5	4.5	3	5.5	3.5	7	4	8	5	10	5.5	>10	8.5
21/18	1.3	1.2	1.5	1.5	2	1.7	3	2	4	2.5	5	3	7	3.5	9	4	>10	5	>10	7	>10	10
	1.2	1.1	1.5	1.3	1.8	1.4	2.2	1.6	3	2	3.5	2.5	4.5	3	5	3.5	7	4	9	5.5	10	8
20/17			1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4	9	5	>10	7	>10	9
			1.2	1.05	1.5	1.3	1.8	1.4	2.3	1.7	3	2	3.5	2.5	5	3	6	4	8	5.5	10	7
19/16					1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4	9	6	>10	8
					1.2	1.1	1.5	1.3	1.8	1.5	2.2	1.7	3	2	3.5	2.5	5	3.5	7	4.5	9	6
18/15							1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	5	3	7	4.5	>10	6
							1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	3.5	2.5	5.5	3.7	8	5
17/14									1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5	6	3	8	5
									1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	4	2.5	6	3.5
16/13											1.3	1.2	1.6	1.5	2	1.7	3	2	4	3.5	6	4
											1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.8	3.7	3	4.5	3.5
15/12													1.3	1.2	1.6	1.5	2	1.7	3	2	4	2.5
													1.2	1.1	1.5	1.4	1.8	1.5	2.3	1.8	3	2.2
14/11															1.3	1.3	1.6	1.6	2	1.8	3	2
															1.3	1.2	1.6	1.4	1.9	1.5	2.3	1.8
13/10																	1.4	1.2	1.8	1.5	2.5	1.8
																	1.2	1.1	1.6	1.3	2	1.6



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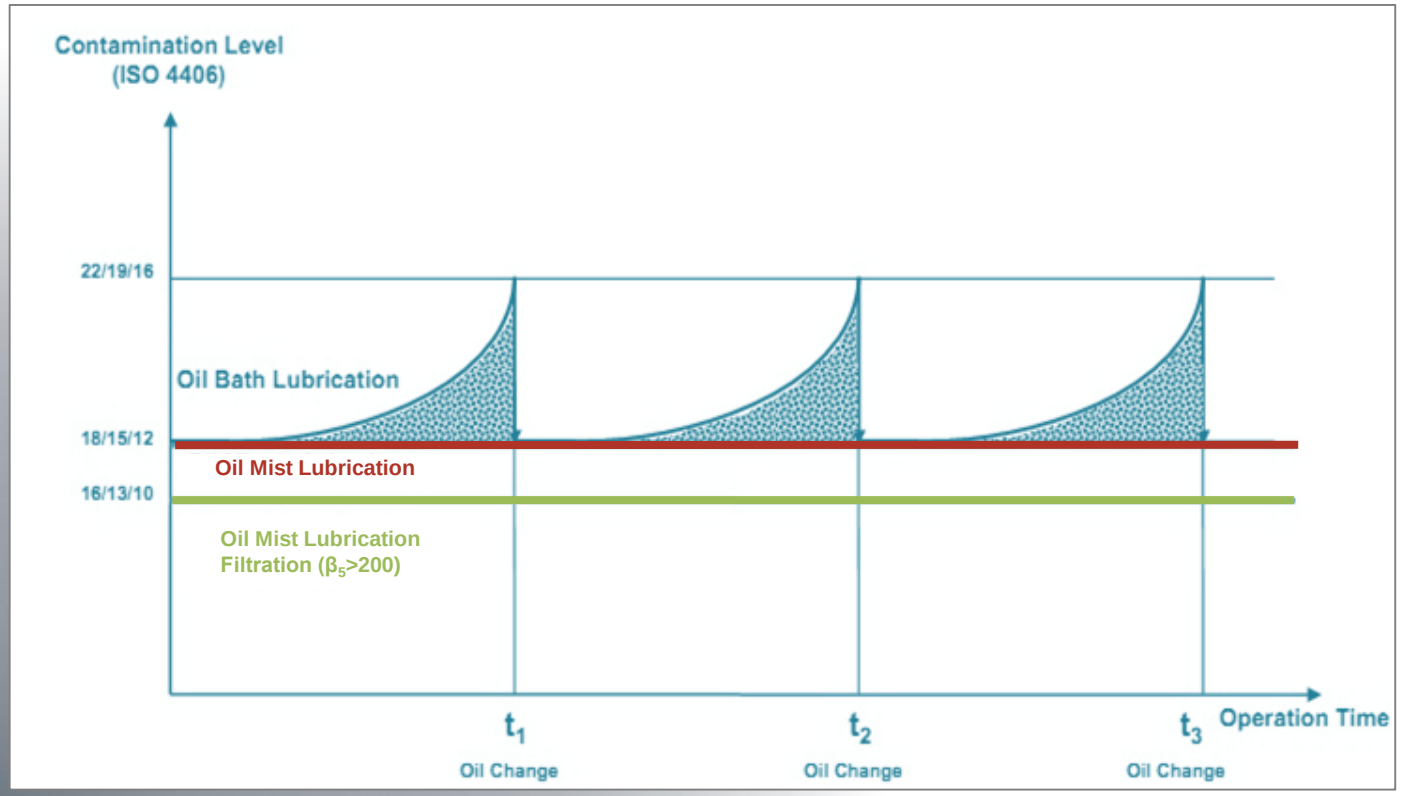
Superior Cleanliness Levels



COLFAX
Fluid Handling

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

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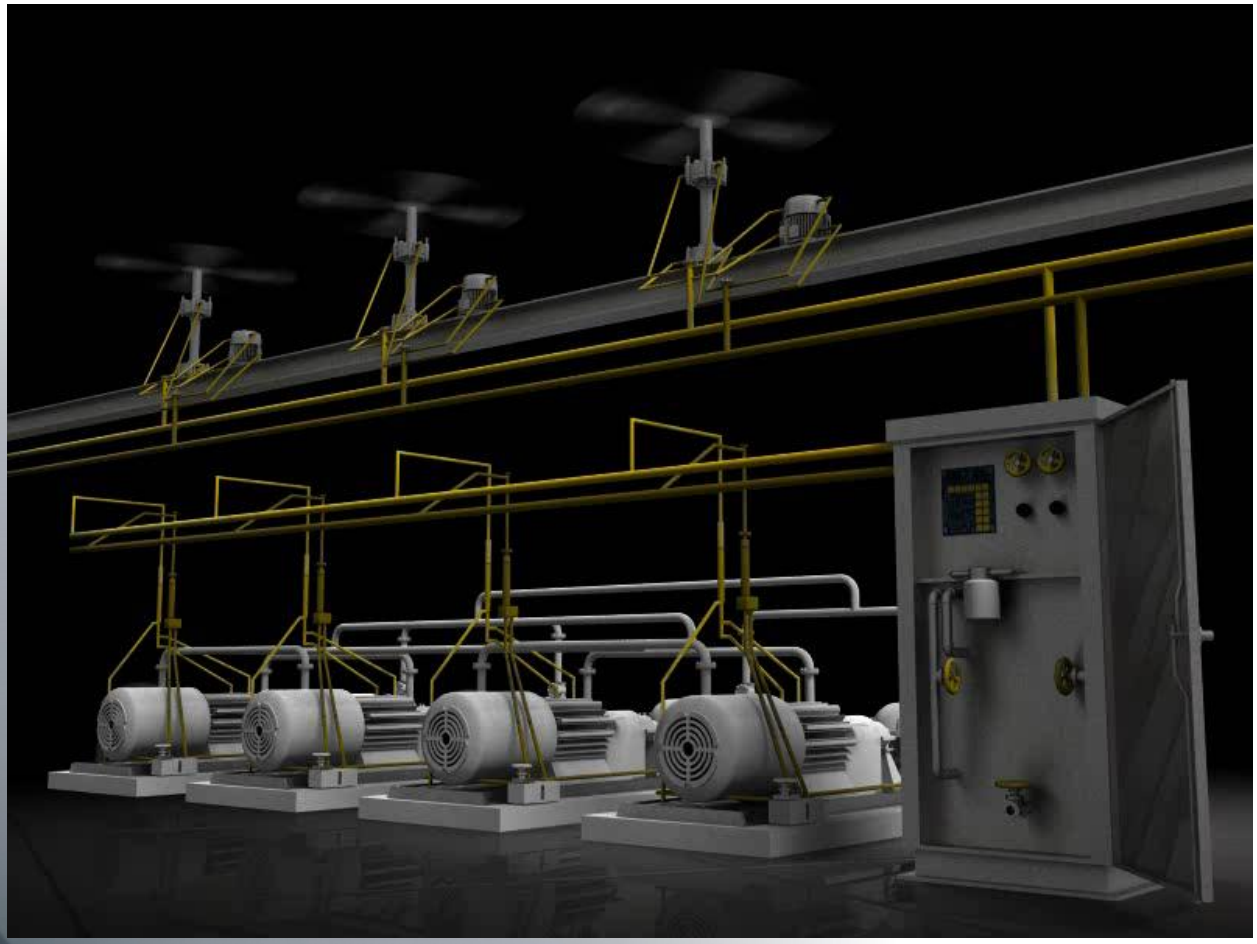
Fluid Handling

How does an Oil Mist system look like?



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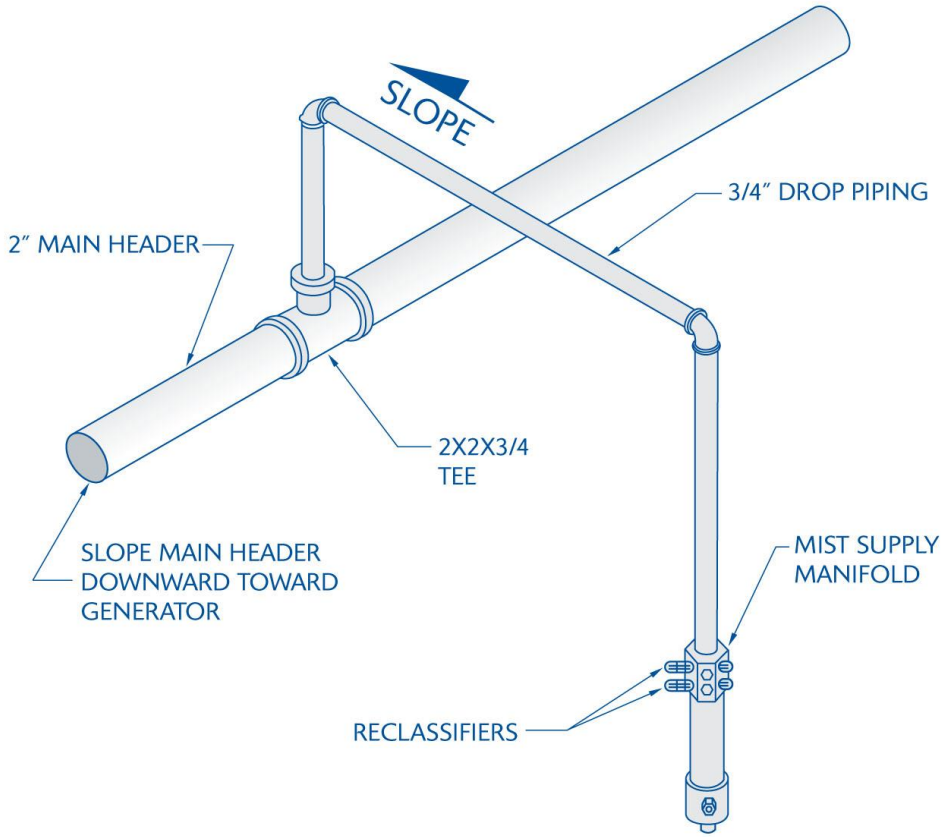
Fluid Handling

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



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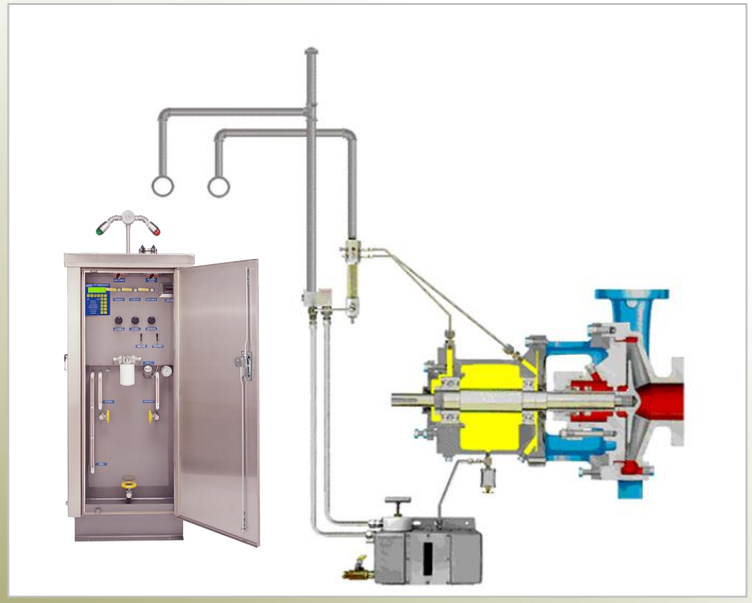
Mist System Designs

Closed Loop System



Open Loop System

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Oil Mist Installed

Applying Oil Mist

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Fluid Handling

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

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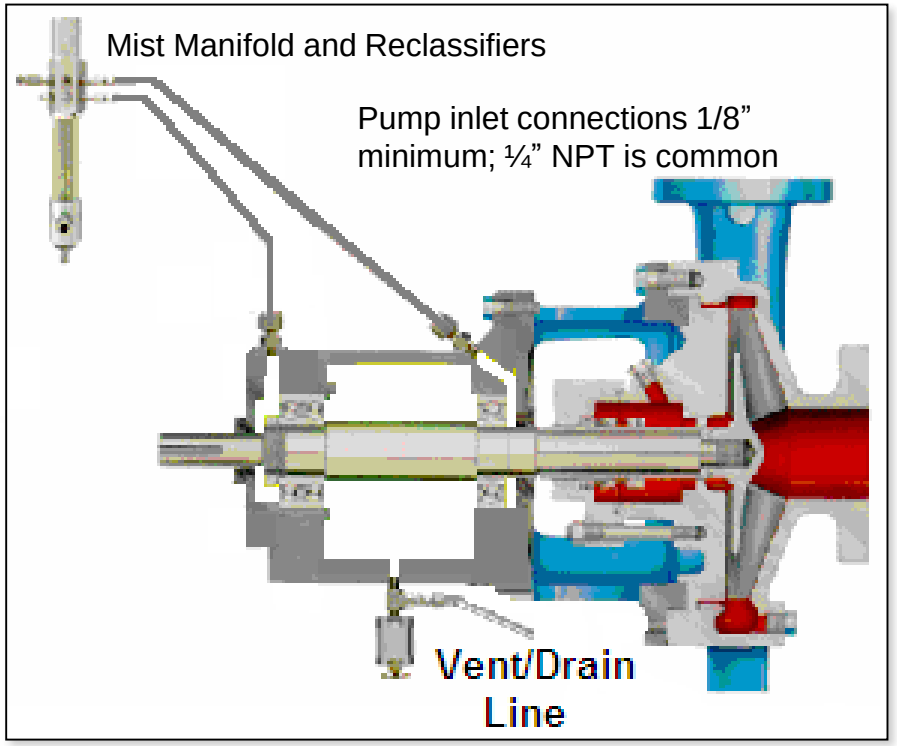
Pure Oil Mist

Pure mist lubricates operating equipment and protects and preserves standby equipment



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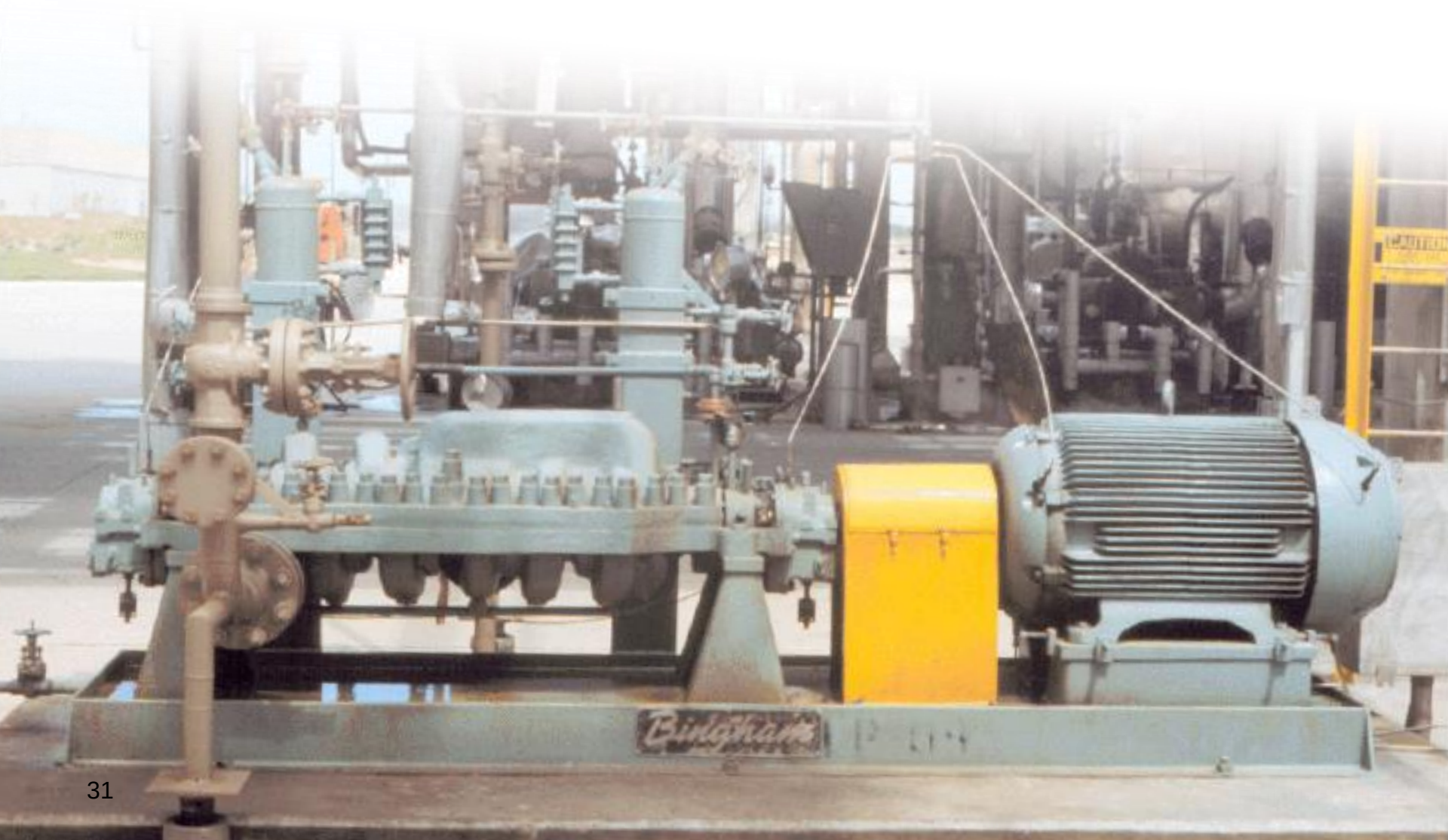
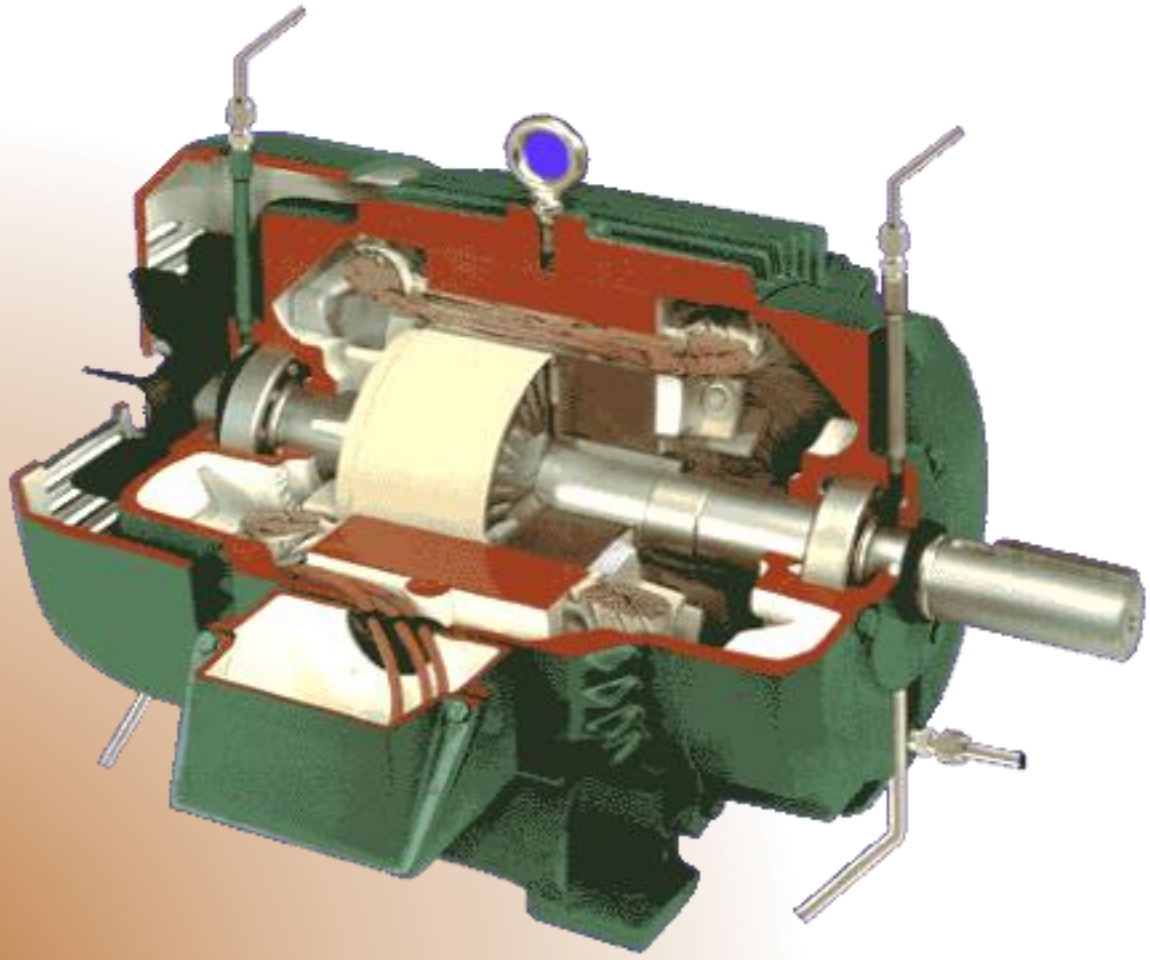
Between Bearing Pump & Motor Driver



Motors



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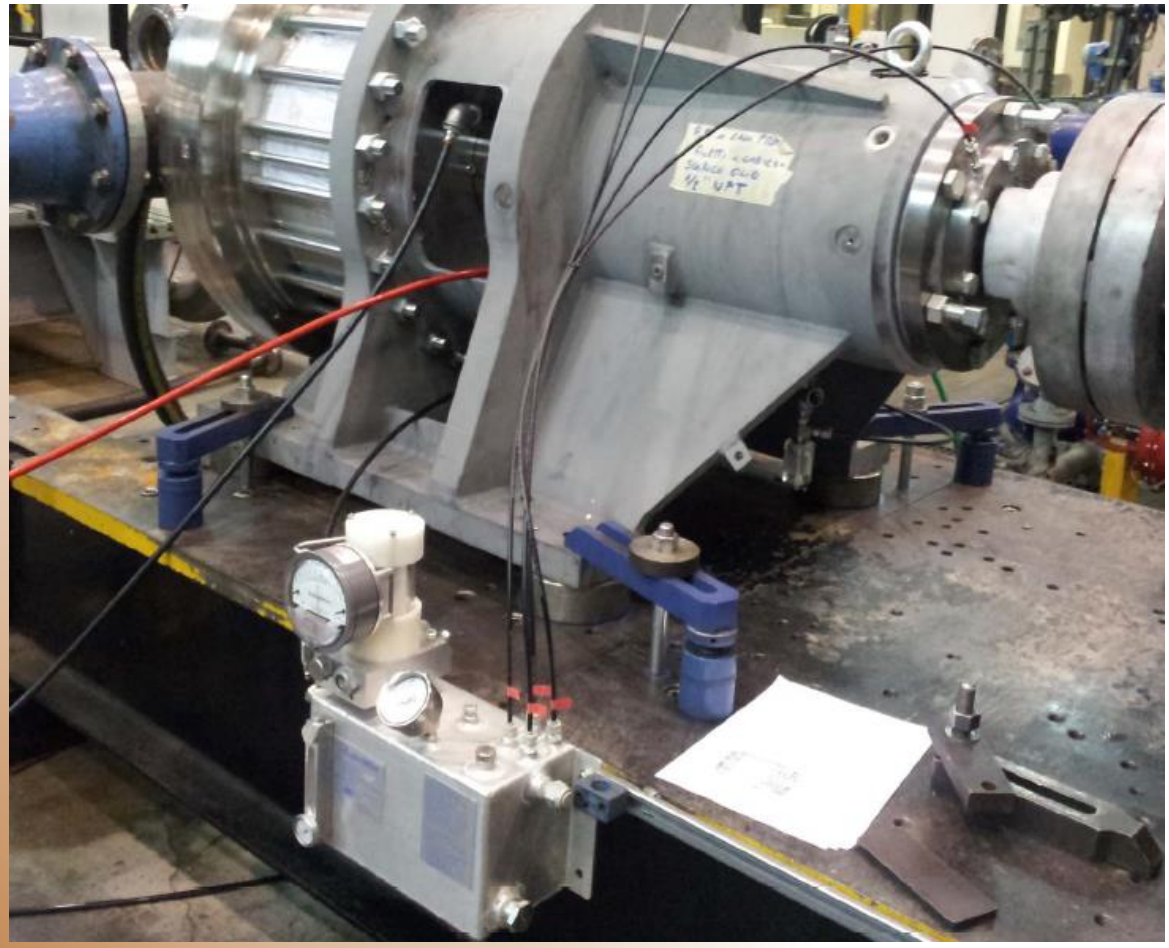
Liquid Ring Compressors



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Pillow Block Bearings

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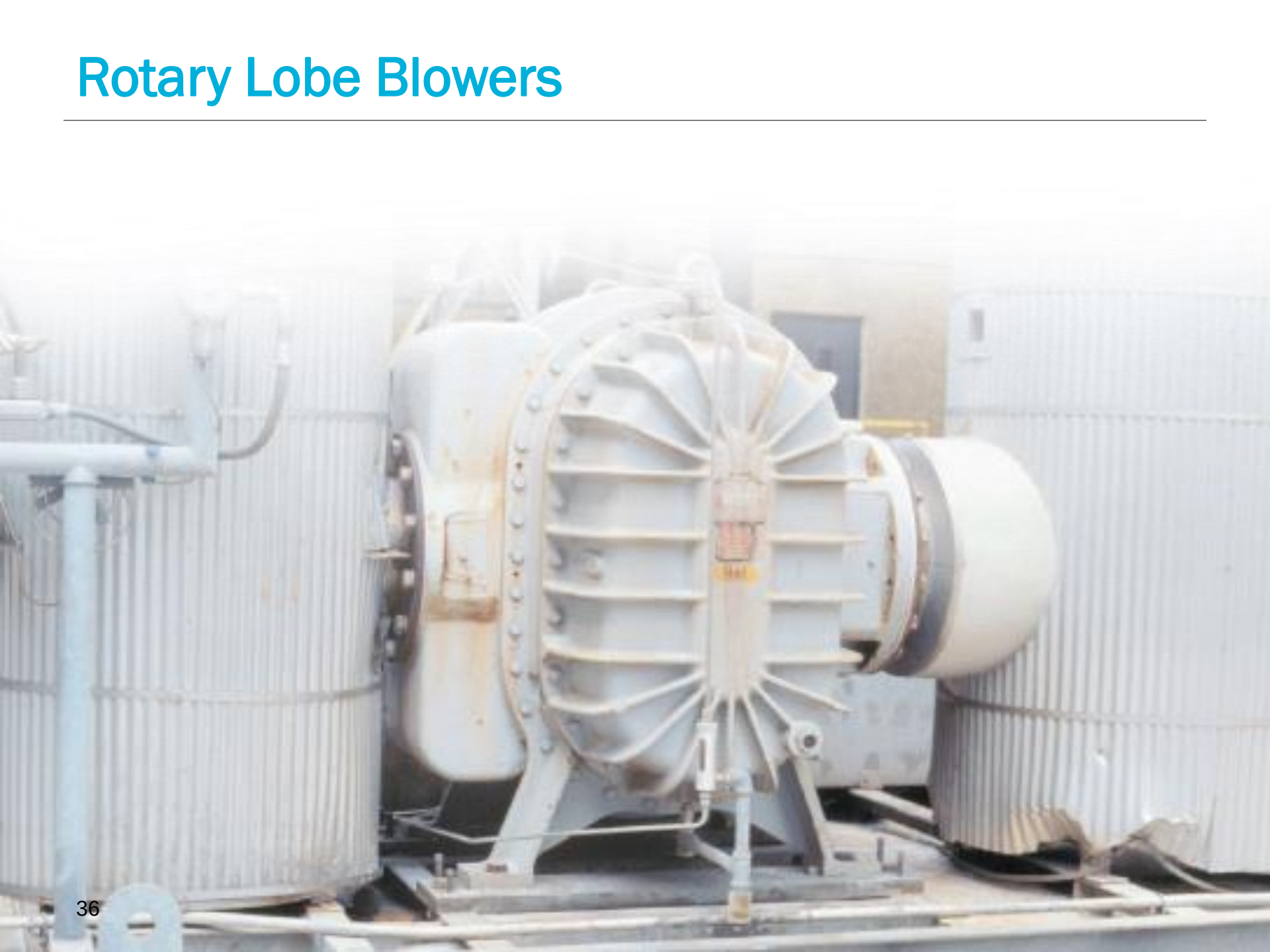
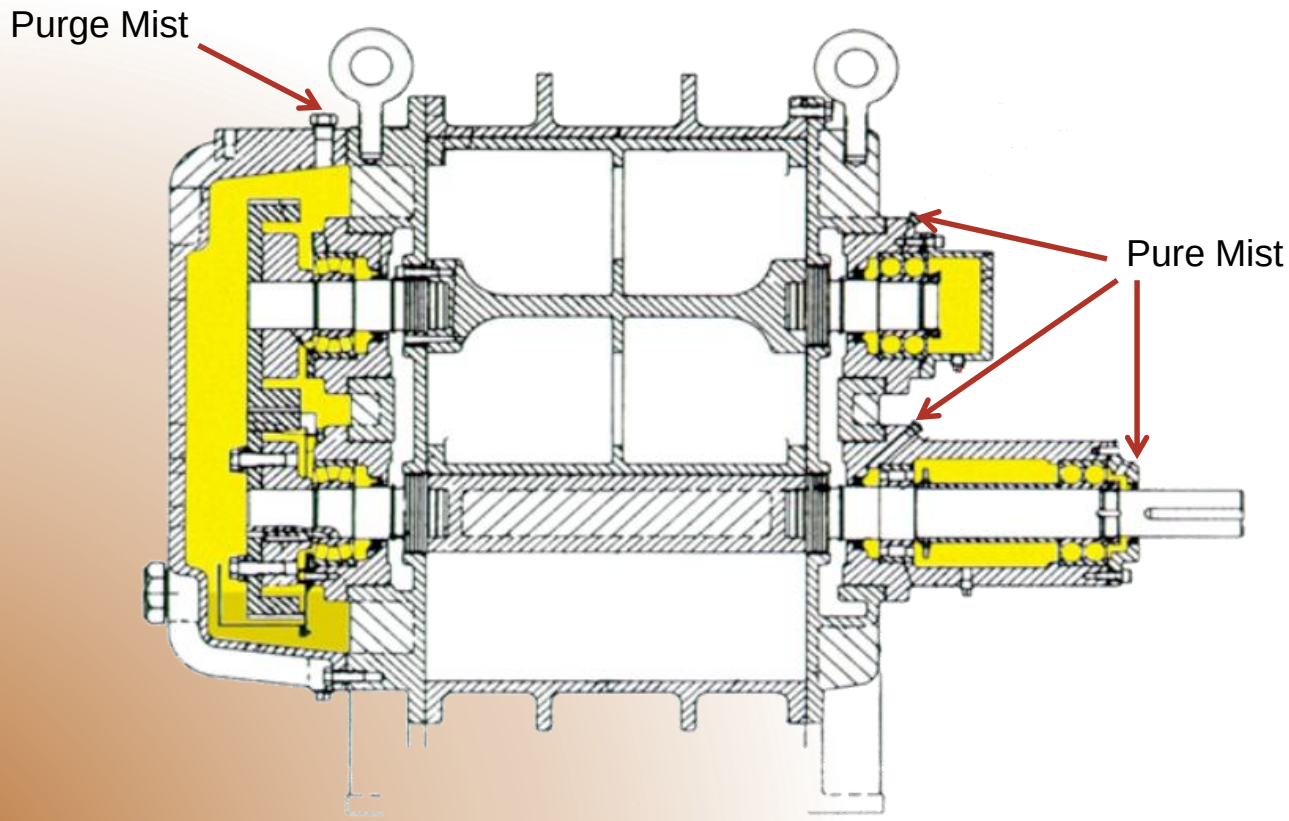
OH Pump, Turbine Driver & Gear Box

Rotary Lobe Blowers



Rotary Lobe Blowers

Pure & Purge Mist Application



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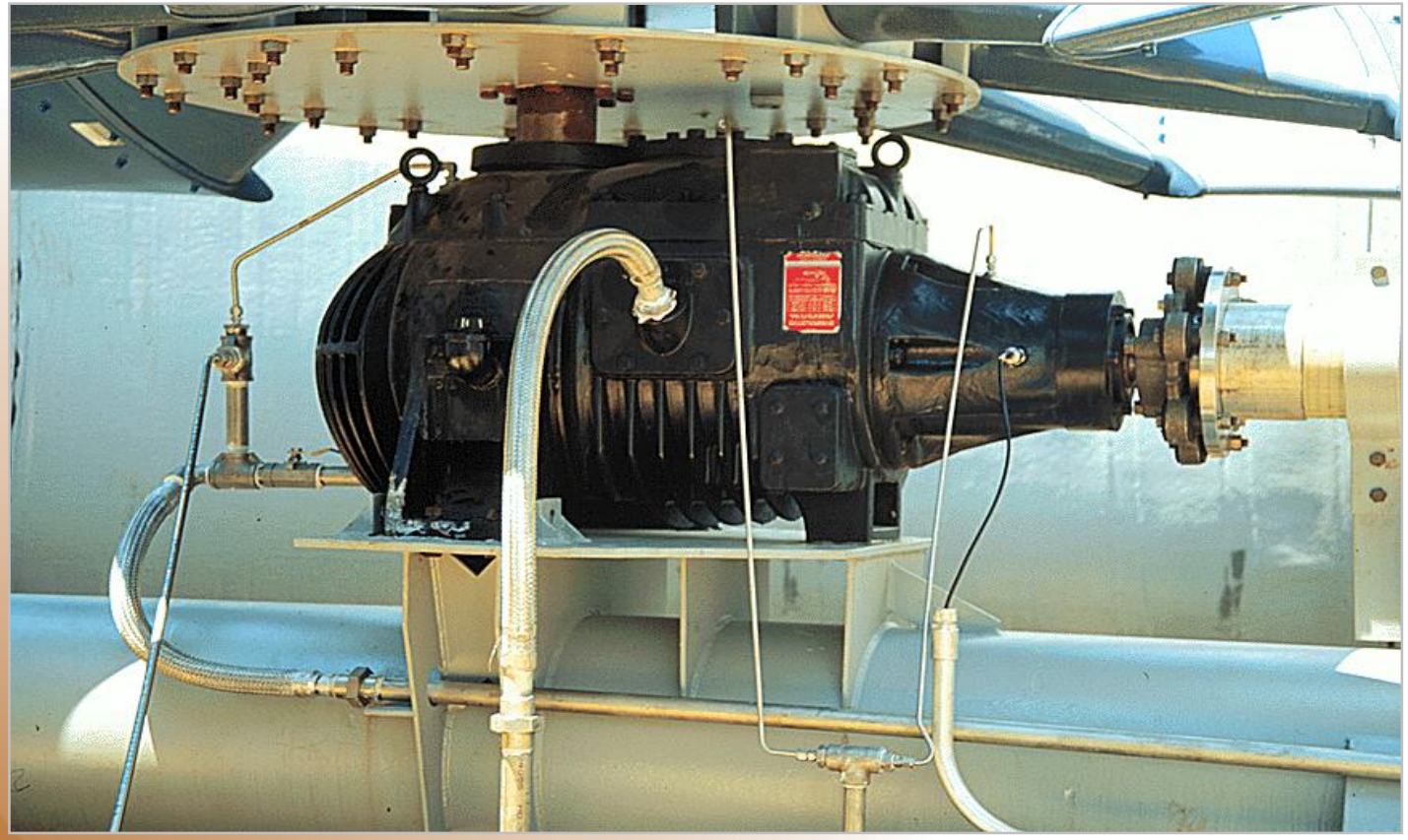
Cooling Tower Gear Box



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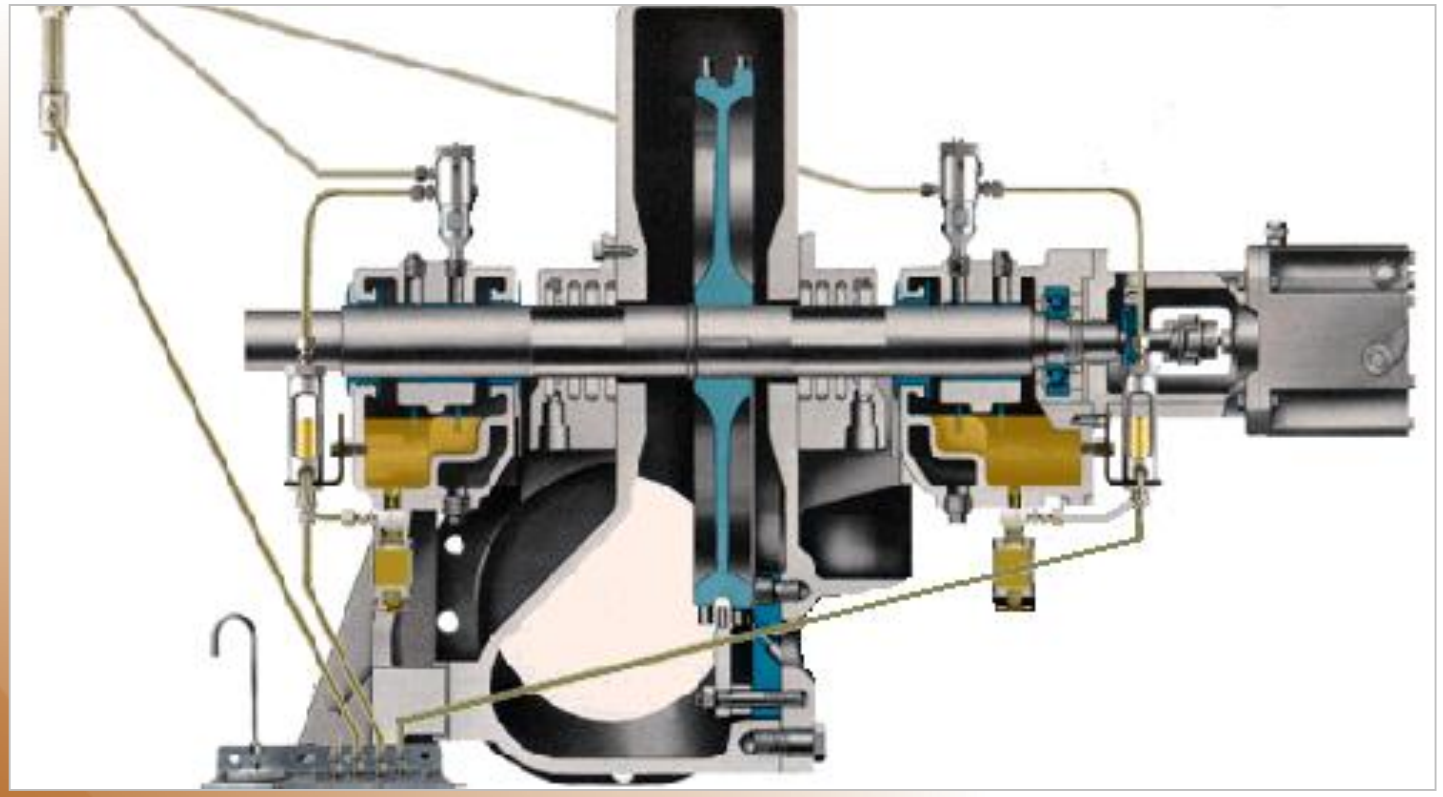
Steam Turbine



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Machinery Storage

Machinery Preservation Yard

Aerial View of Oil Mist Preservation Yard in Thailand

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Long Term Storage

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Economic Justification

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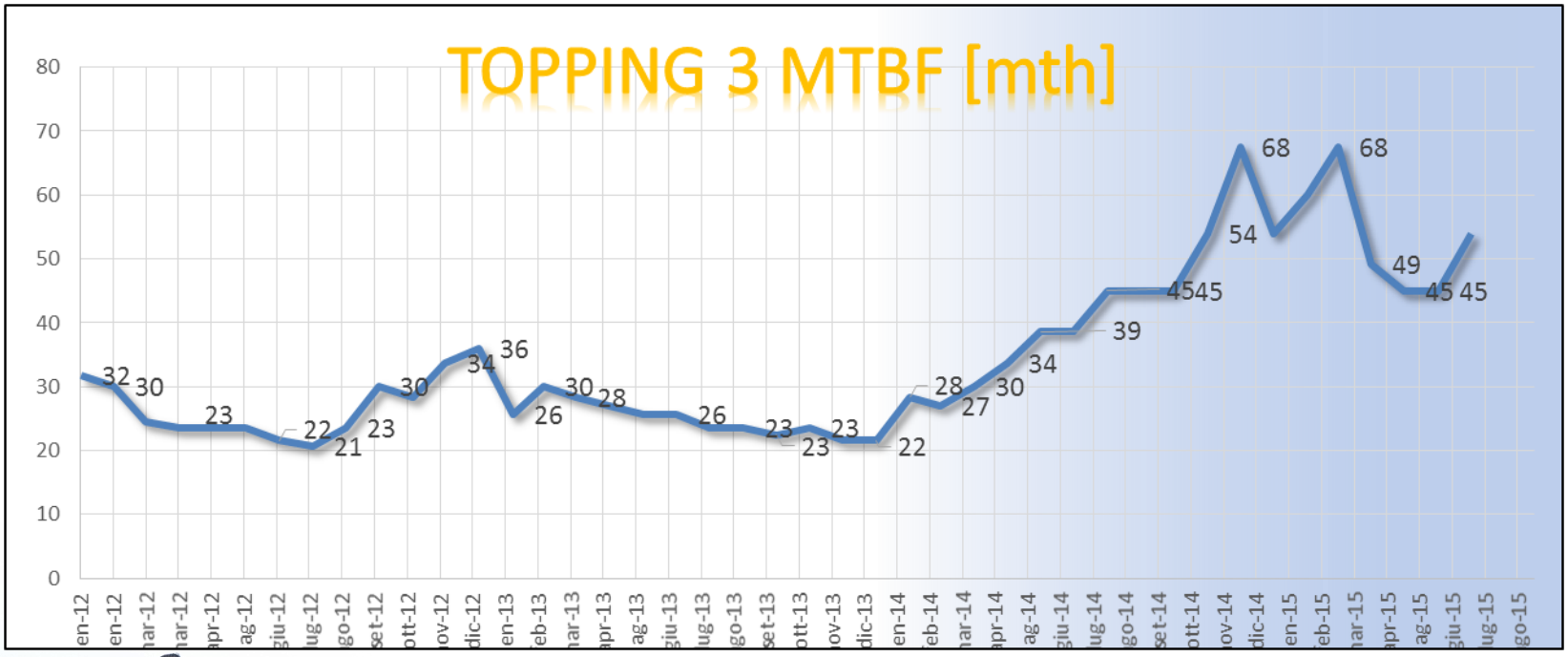
Data gathering – real case studies



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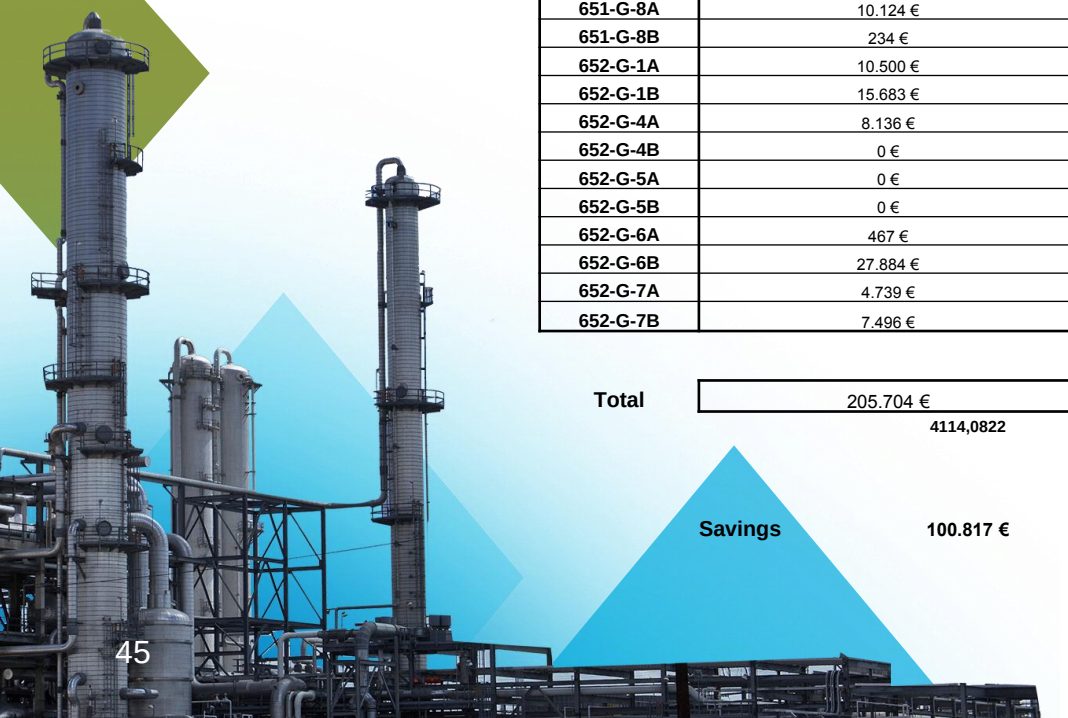
Fluid Handling

Data gathering – real case studies

Maintenance Cost Analysis

UNIT TAG	MAINTENANCE COSTS 2 YEARS BEFORE OIL MIST	MAINTENANCE COSTS 2 YEARS AFTER OIL MIST
611-G-1A	14.868 €	6.936 €
611-G-1B	11.242 €	8.814 €
611-G-1C	463 €	0 €
611-G-2A	10.909 €	0 €
611-G-2B	267 €	0 €
611-G-2C	14.463 €	601 €
611-G-6	7.256 €	0 €
611-G-4A	6.753 €	6.365 €
611-G-4B	1.915 €	310 €
611-G-3A	27.441 €	19.438 €
611-G-3B	24.715 €	321 €
651-G-2A	147 €	257 €
651-G-2B	0 €	5.991 €
651-G-8A	10.124 €	842 €
651-G-8B	234 €	10.097 €
652-G-1A	10.500 €	9.302 €
652-G-1B	15.683 €	1.889 €
652-G-4A	8.136 €	0 €
652-G-4B	0 €	0 €
652-G-5A	0 €	3.689 €
652-G-5B	0 €	0 €
652-G-6A	467 €	6.716 €
652-G-6B	27.884 €	4.796 €
652-G-7A	4.739 €	11.562 €
652-G-7B	7.496 €	6.961 €
Total	205.704 €	104.887 €
	4114,0822	2097,737
Savings	**100.817 €**	**49%**



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Investment calculator

LubriMist®

COLFAX Fluid Handling | SICELUB® LUBRITECH®

Insert Data | Clean Form

MTBF, Repair Costs Analysis & Benefits Installation of Lubrimist® Systems.

Customer _____

Date _____

Current Situation		
Pumps		
Turbines		
Motors		
Total of Equipments		
MTBF	**[Mo]**	
Annual Failures		
Cost Repair Average	EUR	
Annual Repair Total Costs	**EUR**	
Lube Failures		
Oil Lubricats Consuption*	Lt	

Situation after Lubrimist System		
Pumps		
Turbines		
Motors		
Reliability Multiplicator		
Improvement Percenatge	**%**	
New MTBF	**[Mo]**	
Annual Failures		
Cost Repair Average	EUR	
Annual Repair Total Costs	**EUR**	
Lube Failures		
Oil Lubricats Consuption**	Lt	
Oil Recovery (65%)	Lt	
Real Oil Consuption	Lt	

*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.

Estimated Benefits

Savings on Repair Costs		EUR/yr	
Annual Failures difference		%	
Savings in Oil lubricant	Lt/yr		
	EUR/yr	EUR/Lt	
Savings in Energy (2%)	kW (AVG)		?
	EUR/yr	EUR/kW	
Savings in cooling water	m3/yr		
	EUR/yr	EUR/m3	
Manpower reduction	h/yr		
	EUR/yr	EUR/h	
Estimated Total Savings**		**EUR/yr**	

**these are just considerations and estimates and do not commit in anything the Group companies that make use of this projection tool.

Non Quantificable Benefits

Insurance Costs
Work place safety
Automation
Positive Environmental Impact

LubriMist®

Investment Calculation

MTBF, Repair Costs Analysis & Benefits Installation of Lubrimist® Systems.

Investment Estimation

Commonly the number of mist distributors is the number of pumps.

COLFAX Fluid Handling

Reference Information

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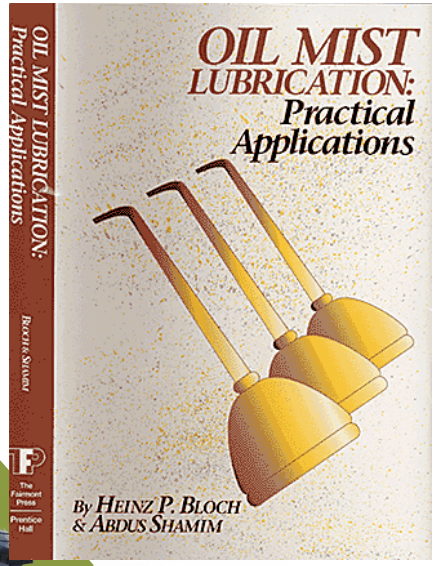
Fluid Handling

References



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

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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.


Practical Experience with Oil Mist Lubrication

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OIL MIST LUBRICATION FOR

THE PETROCHEMICAL INDUSTRY

by
Charles A. Towne
Consultant
Houston, Texas

from
Proceedings of 11th International Pump Users Symposium.

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Questions?

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