

## Oil Mist Lubrication for the Process Industry

Douglas C. Branham

Oil mist is an automated, centralised lubrication technology that automatically and continuously delivers lubricant to machinery bearings. Oil mist lubrication is a proven technology that delivers financial, practical and environmental benefits. When used, equipment failures are reduced which lowers operating and maintenance costs. Consumption, discharge and disposal of used lube oil are also reduced. Financial payback on the investment in oil mist systems is quick (6 months to 2 years) and a low risk. Oil mist for machinery has become the preferred approach to bearing lubrication in the hydrocarbon processing industry around the world.

Oil mist is a proven lubrication technology that provides substantial advantages over conventional lubrication techniques such as oil splash and grease. It is an automated, centralized lubrication technology that automatically and continuously delivers lubricant to machinery bearings. The heart of an oil mist system is the vortex generator that utilizes the energy of compressed instrument air to atomize oil into micron size particles. The lean mixture of oil and air produced by the generator is known as oil mist (1::200,000). The oil particles form a stable suspension that can be conveyed over considerable distances (180 meters), through piping and tubing, to the points requiring lubrication. Oil mist systems can provide lubrication to eighty pumps and their drivers. These systems have few moving parts which makes them quite reliable.

Oil mist is used to lubricate antifriction or rolling element bearings of all types. The most common applications in refineries and petrochemical plants are the bearings in pumps and their electric motor drivers. In addition, oil mist is used to purge gearboxes and the bearing houses of small steam turbines with sleeve bearings. Oil mist systems have been used in the hydrocarbon processing industry since the mid-1960's. Large-scale, console oil mist systems are now found in most hydrocarbon processing regions around the world. It is estimated that there are over 60,000 machines lubricated by oil mist systems in the hydrocarbon processing industry worldwide.

### Benefits of Oil Mist Systems

Oil mist systems are easily economically justified, being well documented in technical papers by end-users, bearing manufacturers and in university research. They say that bearings lubricated with oil mist have longer life than bearings lubricated with oil sump or grease with a

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**Bearings lubricated with oil mist have longer life than bearings lubricated with oil sump or grease. Longer bearing life means fewer equipment failures, fewer unplanned interruptions to production, and lower maintenance costs.**

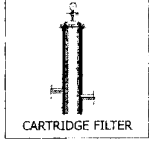


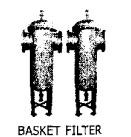
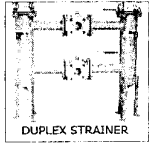





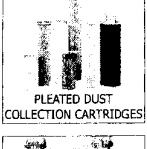
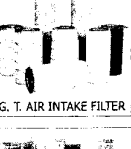




90% reduction in lubrication related bearing failures. Longer bearing life means fewer equipment failures, fewer unplanned interruptions to production, and lower maintenance costs. A bearing failure can lead to an equipment overhaul costing on average \$10,000, not including lost production. Fewer failures also mean greater unit availability, reduced exposure to safety concerns, and reduced risk of fire. A 35% reduction in seal failures has also been documented. The savings will result in a payback period of 6 months to 2 years. This combined with a twenty-year life for oil mist lubrication systems and low system operating cost means that the investment is high return and low risk.

There are a number of practical and technical reasons that oil mist works so well. They are as follows:

- ❖ Bearings run 15°C cooler. Lower bearing operating temperatures mean longer life. A rule of thumb is that bearing life is doubled for every 15°C that the operating temperature is lowered.
- ❖ Oil mist lubrication is contaminant free. The oil mist particle size is 1 to 3 microns diameter so there are no large particulates in the mist. This means that the lubrication is ultra pure.
- ❖ Contamination in lube sumps is not present with pure oil mist lubrication. Documented research has shown that it is common to have high contamination levels in oil sumps even though bearing housing seals are in place and recommended oil change intervals are followed. Oil mist ensures that the right amount of the correct lubricant is continuously applied without error. The automated systems remove much of the human potential for error. No longer is the bearing dependent on someone ensuring that proper oil level is maintained, not too high or too low, or that the proper re-greasing technique and interval have been followed.
- ❖ External contaminants such as water vapor and particulate matter are excluded from the bearing housing because the mist system operates at a slight positive pressure.
- ❖ The need to change pump bearing housing sump oil is eliminated because with pure oil mist there is no oil sump.
- ❖ The bearing surfaces and internal surfaces of the bearing housing are always coated with oil,

**Modern oil mist systems are microprocessor controlled. The microprocessor controllers have self-contained troubleshooting and data collection functions that provide efficient root cause failure analysis and dependable operation. Because modern oil mist systems are centralized and equipped with these advanced control and monitoring techniques, minimal manpower is required to oversee system operation.**

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hence here is no possibility of corrosion. This is particularly important as it applies to stand-by (redundant) equipment. It is always ready for operation.

### Operational Aspects and Recommended Practices

Modern oil mist systems are microprocessor controlled. This means that the central, vortex mist generators are extremely reliable and have proven exceptional performance in harsh environments. These systems operate in the hot and humid climates of the Middle East and the extreme cold of the Tar Sanda of northern Canada. The microprocessor controllers have self-contained troubleshooting and

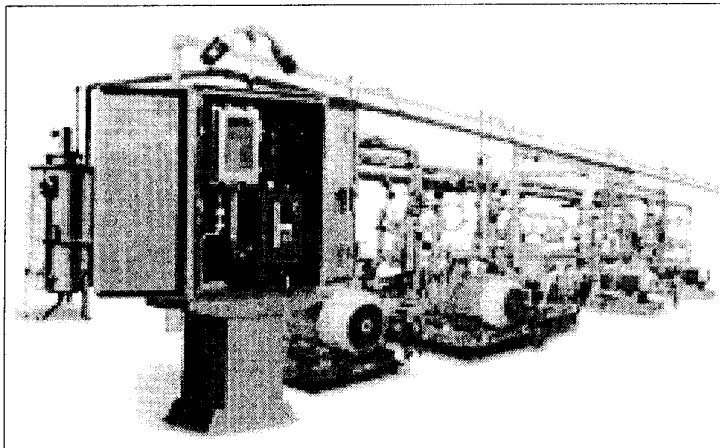
data collection functions that provide efficient root cause failure analysis and dependable operation. Because modern oil mist systems are centralized and equipped with these advanced control and monitoring techniques, minimal manpower is required to oversee system operation. Maintenance and

operations staffing can be optimized with oil mist as fewer personnel are required (66% less) for lubrication related duties and equipment repair. Operators and maintenance personnel can be re-directed towards more pro-active and more value-added assignments such as producing on-spec product.

Today's oil mist systems reduce oil consumption and are environmentally friendly. Most systems being installed are one-way, that is, the applied oil is not recycled. In these systems, 40% less oil is consumed than that needed with sump lubrication. In addition, the latest application techniques allow for recovery up to 40% of the lubricant. Some users report a 70% reduction in lubricant purchases with routine collection of the coalesced oil from one-way systems.

When a company or a facility is striving to achieve maximum recycling, i.e. minimum discharge of hydrocarbon and elimination of waste oil, closed-loop oil mist systems are typically used. This technology was introduced to the hydrocarbon processing industry in 1993. With closed-loop oil mist technology, essentially all the coalesced oil and oil mist is captured and recycled, upto 90%. In this case, there is full reuse of the lubricating oil. If magnetic seals are used, upto 99% of the oil is recovered. This technology has allowed oil mist to be used inside buildings, confined spaces and on machinery manufacturer's test stands.

The American Petroleum Institute (API) and the Process Industry Practices (PIP) group support the use of oil mist. In their "Recommended Practices for Machinery Installation and Installation Design" specification (API RP-686, PIP REIIE 686), the API and PIP recommend oil mist systems for stored machinery. Oil mist is recommended when equipment is to be stored for a period longer than six months from time of shipment from the manufacturer to time of commissioning. In the API specification for pump design, API-610, oil mist lubrication is listed as an option for lubrication. The API also recommends oil mist in API-RP-751, "Safe Operation of Hydrofluoric Acid Alkylation Units," where it is written, "Alternative lubrication systems, such as oil



mist, may be beneficial in reducing bearing failures that could cause seal failures." This statement means that these technical groups believe oil mist leads to improved machinery reliability.

With regard to electrical classifications, oil mist generating consoles certified by third parties to NEC, IEC and ATEX standards are available. It is not necessary to request special designs for particular projects as equipment is already approved for use in areas classified as hazardous. Many oils may be used but high-performance lubricants specifically designed for use in oil mist systems are preferred by the manufacturers. However, waxy oils, oils with detergent or antifoam additives and oils with low solubility properties should be avoided.

Oils formulated with mineral and PAO based oils must have sufficient diester additives to ensure that the additives do not fall out of suspension and plug the systems. The diesters also ensure that all metal surfaces are fully wetted.

The preferred oils are from diester base stocks with advanced additive systems. They have significant performance

advantages in oil mist systems when compared to other lubricants such as mineral and PAO based lubricants. But, lubricant properties, which are targeted for performance in flooded lubrication, may not work well in oil mist systems.

### Conclusion

As the use of oil mist has grown, pump and electric motor manufacturers now provide bearing housings designed specifically for oil mist lubrication. Pump and electric motor manufacturers that have a significant presence in the hydrocarbon processing industry supply equipment ready for oil mist lubrication. To avoid extra field preparatory work, the user should specify oil mist lubrication at the beginning of the purchasing process.

### References

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