

OIL MIST LUBRICATION SYSTEMS

DEP 31.29.00.30-Gen.

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design of oil mist lubrication systems which serve pumps, side entry mixers, centrifugal fans, and their Totally Enclosed Fan Cooled (TEFC) electric motor or general-purpose steam turbine drivers located in close proximity to each other. Lubrication systems for internal combustion engines and gas turbine drivers are excluded from the scope of this DEP.

This DEP shall be used in conjunction with data/requisition sheet DEP 31.29.00.93-Gen.

This DEP is a revision of the DEP of the same number dated December 2000; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them.

This DEP is intended for use in oil refineries, gas plants, chemical plants, exploration and production facilities and supply/distribution installations.

When DEPs are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regard to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

Amended per
Circular 98/08

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

Amended per
Circular 98/08

The **Manufacturer/Supplier/Vendor** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (8).

1.5 SUMMARY OF MAIN CHANGES

The previous edition of this DEP was dated December 2000. This has been a major revision and it is impractical to list the changes herein.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the DEP Administrator at standards@shell.com. Shell staff may also post comments on this DEP on the Surface Global Network (SGN) under the Standards folder.

2. GENERAL

2.1 APPLICATION

Oil mist lubrication systems may be considered in areas and/or applications where the environmental conditions will adversely affect bearing lifetime due to ingress of contaminants in the bearing housing.

The maximum benefits of oil mist lubrication (enhanced bearing reliability resulting from high standards of lubrication quality control; prevention of ingress of water and other contaminants into the bearing housing) can be achieved by either a 'pure mist' dry sump lubrication system or a 'purge mist' wet sump lubrication system. The 'purge mist' system retains the conventional constant-level oiler arrangement and uses 'purge mist' to pressurize the housing and compensate for any oil loss from the constant-level oiler.

2.2 PERFORMANCE

Compliance with this DEP does not relieve the Vendor of the responsibility for ensuring that the system and equipment furnished are properly designed and constructed and suitable for the service intended. The required lifetime, reliability and availability of the system shall be specified by the Principal and agreed with the Vendor.

2.3 CONFLICTING REQUIREMENTS

In the event of conflict between documents relating to the enquiry or order, the following hierarchy of documents shall apply:

First level: purchase order and variations thereto
Second level: data / requisition sheets and drawings
Third level: this DEP

2.4 SYSTEM DESCRIPTIONS

2.4.1 Oil mist lubrication system

An oil mist lubrication system is a means of distributing atomized oil drops (between 2 μm and 10 μm in diameter) from a central mist generator to a number of lubrication points using a dry, low-pressure [nominally 50 mbar (ga)] air stream. The normal concentration of oil mist in the transport air is approximately 6 ml/m³ (6 ppm).

2.4.2 Pure oil mist systems

Pure oil mist systems, also referred to as 'pure mist' or 'dry sump' systems, utilize a continuous oil mist flow through the bearing housing to deliver clean oil directly to the bearings and to maintain an outward flow of air from the housing to prevent the ingress of moisture and other corrosive contaminants. An oil sump is not needed.

2.4.3 Purge oil mist systems

Purge oil mist systems (also called 'purge mist' or 'wet sump' systems) use reclassified oil to maintain a constant level of oil in the sump to lubricate the bearings. The air purges the bearing housing and prevents the ingress of moisture and other corrosive contaminants.

2.4.4 Closed loop systems

Closed loop systems are either pure or purge mist systems that include an oil mist recovery and return system. Such systems may require modification of the bearing house seals to achieve positive sealing in order to prevent exposure of oil vapors to the atmosphere.

2.5 SYSTEM TYPES

2.5.1 Purge oil mist

Purge oil mist lubrication (wet sump) is an arrangement in which the oil mist purges the bearing housing to exclude moisture and contamination from the external environment. Normal bearing housing oil levels are maintained by the use of a constant level oiler in combination with an overflow device and conventional oil bath, flinger or oil rings.

Equipment with sleeve or journal bearings shall be lubricated by purge oil mist.

For product temperatures above 300 °C (572 °F), bearing housings with 'pure mist' systems may require special features to protect the bearing from being overheated by heat transfer from the product.

2.5.1.1 Equipment receiving purge mist lubrication shall have an enclosed bearing housing.

Purge oil mist lubrication shall be used:

- a. when equipment contains sleeve type bearings, gears, or other sliding surfaces;
- b. when equipment speeds are less than 600 r/min;
- c. when specified by the Principal.

Purge oil mist can be applied on bearing housings with rolling element bearings or hydrodynamic bearings.

2.5.2 Pure oil mist

Pure oil mist lubrication (dry sump) is an arrangement in which no oil level is maintained in the bearing housing. Lubrication is effected by coalescence of oil mist on rolling elements within the bearing housing.

Unless otherwise specified, equipment with anti-friction or rolling element bearings shall be lubricated with pure oil mist or directed mist lubrication.

2.5.2.1 Equipment receiving pure mist lubrication shall have an enclosed bearing housing.

Radial and thrust bearings shall be roller or ball bearings with no more than two consecutive rows, i.e. double row thrust bearing. Ball bearings shall be an open (unshielded) design.

Bearings shall have a minimum speed of 600 r/min.

Pure oil mist shall be used wherever possible.

2.5.3 Directed mist lubrication

Equipment with anti-friction bearings that are subject to high thrust loads shall be considered for directed mist lubrication. Equipment operating under any of the following conditions shall be evaluated:

- pump speed is in excess of 3800 r/min;
- equipment driver power is in excess of 150 kW (200 hp);
- pumps susceptible to cavitation or recirculation or having an operating range of +/- 40 % of best efficiency point (BEP).

Equipment with a bearing housing having large oil drain back ports that allow the mist flow to go around rather than through the bearing shall use directed mist.

If directed mist lubrication cannot be provided to an existing bearing housing, that housing shall be modified accordingly, or purge mist lubrication shall be provided.

See (6.2.1.g) for a description on making bearing housings suitable for directed mist lubrication.

The use of directed mist shall be subject to the mutual agreement between the Supplier and the Principal.

Closed loop systems may have to be selected to meet local environmental requirements or standards.

Closed loop systems are preferred in order to minimize contamination by lube oil in the vicinity of the equipment.

Closed loop systems shall be selected when rotating equipment is operated in a building. Alternative designs shall be considered if a closed loop system is not practical.

2.6 SYSTEM DESIGN DATA

The Purchaser shall provide the Vendor of the oil mist lubrication system with sufficient data relating to the equipment to be lubricated to enable him to design the system required. For each consumer in the system, this information should include the item number of the equipment, its Manufacturer's type/model identification and the serial number. The Purchaser shall also indicate which equipment is subjected to frequent stops/starts and/or shock loading.

The Vendor shall also be provided with a plot plan of the facility.

3. BASIC DESIGN

3.1 GENERAL

The design concepts discussed in this section apply to the lubrication of equipment with either rolling element bearings or sleeve bearings.

The Vendor of the oil mist lubrication system is in all cases responsible for co-ordination, and shall establish with the rotating equipment Manufacturers the oil mist lubrication requirements for each item of equipment.

3.2 SYSTEM DESIGN

Each oil mist lubrication system shall consist essentially of an oil mist generator to produce and control the oil mist, a network of distribution lines to convey the oil mist to the points of lubrication (the consumers), and reclassifiers to control the flow of or coalesce the oil.

Provision shall be made for venting the oil mist from each bearing housing, and drains shall be provided to drain the coalesced oil from 'pure mist' systems or to collect any overflow from 'purge mist' systems. Venting of oil mist into buildings shall not be allowed. Venting shall take place outside the building.

The oil mist generator shall be designed for a capacity of 125 % of the rated requirements of the system, and it shall be capable of operating satisfactorily at 50 % of its designed capacity.

Distribution lines to the consumers shall be designed to ensure that coalescing of airborne particles of oil is kept to an absolute minimum.

The design of the distribution system shall ensure that a homogeneous mixture of air and oil reaches all consumers, including the most remote, with sufficient pressure to impart a velocity to the mist adequate to generate turbulent flow through the inlet fittings at the points of lubrication. Such turbulent conditions are needed for the satisfactory wetting of the surfaces to be lubricated. The Principal shall provide a dry air supply to the oil mist console at a pressure between 4 bar (ga) [60 psig] and 7 bar (ga) [100 psig] from an appropriate instrument air header. This air supply shall be via piping installed solely for the oil mist lubrication system.

The reclassifiers shall be located at the ends of the branch lines in the mist manifold (see Appendix 1, Figure 1). The reclassified oil shall be fed to the individual bearing housings via feeder lines which shall not be more than 2.5 m long.

The oil mist console (control cabinet) and all electrical equipment and components within the system shall be suitable for the area classification, gas grouping and temperature classes specified in the data/requisition sheet.

3.3 DISTRIBUTION PIPING

A typical arrangement of the distribution pipework in an oil mist lubrication system is shown in Appendix 1, Figure 1.

The oil mist generator shall be located in a position central to the system.

The length of pipe run from the oil mist generator to the most remote consumer shall not exceed 180 m (600 ft).

Oil mist supply headers shall not be horizontal. Headers shall be run to slope continuously downwards towards the oil mist generator at a slope of 1:240. Headers should be properly braced and secured according to bracing standards included in Appendix 1, Figure 2.

Where elevation changes prevent continuous slope to the generator (e.g. where the header crosses the roadway), an automated drain leg shall be used. Drain legs should not vent to atmosphere or drain to sewer. See example in Appendix 1, Figure 3.

The riser from the oil mist generator shall enter the main header at the bottom.

Drop points shall be taken from the top of the main oil mist header. See Appendix 1, Figure 4.

Feeder lines to individual bearing housings shall be run to slope continuously and downwards towards the equipment. See Appendix 1, Figure 5.

Feeder lines shall be run direct to the point of lubrication with a minimum number of bends.

The mist supply manifold shall be accessible by the operator and located no higher than 1.8 m (6 ft) above grade.

Location of the mist supply and drain lines on the equipment shall be subject to the mutual agreement between the Supplier and the Principal.

All distribution piping shall be smooth internally and free from all projections. Before the piping is made up, care shall be taken to ensure that it is clean throughout the system.

Cut lengths of pipe and tubing shall be reamed and de-burred at each end and then blown clean. All fittings shall be blown clean.

If piping or tubing is to be stored before installation, then all open ends shall be capped and plugged. Care shall be taken to ensure that no damage occurs in storage.

All threaded connections shall be coated with a pipe sealant/lubricant before the connections are made. Sealant/lubricant paste with PTFE should be used. PTFE tape shall not be applied as it may block the opening if applied carelessly.

There shall be no valves in oil mist headers or in any of the drops.

The system shall be cleaned, tested and commissioned in accordance with Appendix 2.

Construction materials for oil mist distribution piping shall be as follows:

Table 1 Materials of construction of distribution piping

Main header/ return header	DN 50 (NPS 2) Schedule 40 galvanised carbon steel pipe, threaded NPT.
Drop lines	DN 20 (NPS 3/4) Schedule 40 galvanised carbon steel pipe, threaded NPT.
Return drop lines	DN 25 (NPS 1) Schedule 40 galvanised carbon steel pipe, threaded NPT.
Feeder lines	6 mm (1/4 in) OD, austenitic stainless steel tubing with 0.9 mm (0.04 in) minimum wall thickness, or armoured flexible hose of similar bore and material, if approved by the Principal.
Drain lines	10 mm (3/8 in) OD, austenitic stainless steel tubing with 0.9 mm (0.04 in) minimum wall thickness.
Return tubing lines	25 mm (1 in) OD austenitic stainless steel tubing with 0.9 mm (0.04 in) minimum wall thickness.
Accessories	All reclassifiers and tube fittings shall be stainless steel or other corrosion-resistant material. The size of the reclassifier shall be stamped on the hexagonal portion of the fitting at a place where it will be visible when in service.

3.4 COMPONENTS, ACCESSORIES AND UTILITIES

3.4.1 Oil mist generator

The oil mist shall be generated by means of a vortex chamber.

3.4.2 Oil mist console

The oil mist generator (OMG) shall be enclosed in a stainless steel cabinet, which shall be freestanding and provided with a hinged door with robust closures.

The cabinet shall be weatherproofed and vented, and mounted at ground level. For oil mist generators located in colder climates, sufficient insulation and heat shall be provided to maintain an internal cabinet temperature of 10 °C (50 °F). The oil mist generator shall be accessible in order to permit its on-stream inspection. All exposed steel surfaces shall be primed and finished in accordance with the Manufacturer's standards. All electrical components shall be suitable for the electrical area classification where the cabinet is installed.

See Appendix 1, Figure 6A and Figure 6B.

3.4.3 Reclassifiers

For 'pure mist' applications, mist reclassifiers shall be used.

The mist issuing from the feeder lines shall be directed through the rolling element bearing.

For 'purge mist' applications, reclassifiers shall be of the mist type.

Each lubrication point shall have its own reclassifier.

3.4.4 Bearing housings

For 'pure mist' systems, an oil sight bottle incorporating a drain valve shall be fitted to the drain connection of the housing in order to monitor, and subsequently drain, any accumulation of oil.

Existing constant-level oiler connections in the housing shall be plugged.

In 'purge mist' systems, an oil level sight assembly with overflow level control shall be provided to maintain a maximum oil level in the bearing housing.

In 'closed loop' systems the seals in the bearing housing covers shall provide positive sealing to avoid exposure of oil vapors to the atmosphere. The oil seals selected shall be designed for a service lifetime of at least 40,000 h.

3.4.5 Air

The air supplied to the mist generator shall be clean and dry; instrument air shall be used for this since plant air is normally not suitable for long-term trouble-free operation.

The air supplied to the oil mist system shall meet the following requirements:

- It shall be free from liquids and toxic, corrosive and flammable gases;
- The solids content shall be less than 0.1 g/m³ (0.1 ppm) and the particle diameter shall not exceed 3 µm;
- The dew point at the supply pressure shall always be 5 °C (9 °F) lower than the lowest annual ambient temperature.

3.4.6 Air filter

An air filter/water separator shall be provided for the inlet air supply. It shall be capable of removing 100 % of particles of size 40 µm and larger, and shall be suitable for a normal working pressure of 7 bar (ga) [100 psig].

3.4.7 Air regulator

An air regulator shall be provided to control the pressure of the air supply within the oil mist distribution system. The regulator shall be capable of accepting inlet air supplied at pressures within the range of 4 bar (ga) [60 psig] to 7 bar (ga) [100 psig].

3.4.8 Air pre-heater

A thermostatically controlled electric heater shall be provided to maintain the inlet air at operating temperature, and to limit the air temperature to a maximum of 65 °C (150 °F).

If the oil mist generator is equipped with the air preheating system at the factory, no additional user connections or installation are required.

3.4.9 Integral air/oil heater (mist generator reservoir)

Air shall be supplied at 60 °C (140 °F) to the mist generator through the air heating element, which is immersed in the oil. In this way, a reservoir oil temperature of 44 °C (110 °F) shall be achieved.

3.4.10 Oil selection

Suitable oil shall be selected and approved by the Principal in consultation with the oil mist Vendor to ensure compatibility with the oil mist generator. As a minimum, the following factors shall be evaluated in selecting the oil for mist lubrication:

- Viscosity of the oil at the temperature in the mist head;
- Surface tension of the oil;
- Compliance of the properties of the selected oil with the lubricant requirements specified by the Supplier of the system and by the Manufacturers of the connected equipment;
- Wax formation tendency of the oil at low ambient temperature, to prevent blockage of the reclassifiers;
- Pour point relative to the ambient temperature.

NOTE: In cold climates (temperatures below -25 °C (-13 °F)), synthetic oil shall be used in order to avoid having to heat-trace the oil mist headers.

3.4.11 Main/auxiliary oil mist reservoir

Main/auxiliary oil mist reservoirs shall be provided and each sized for at least 72 h of continuous operation at the rated oil mist production capacity.

The reservoirs shall be located within the oil mist console and shall each have a valved drain.

3.4.12 Oil supply reservoir

An oil supply reservoir including oil transport pump shall be provided permanently connected to the oil mist reservoir. The reservoir should be sized for at least 31 days capacity. The oil mist reservoir floor shall be sloped to a valved drain, to ensure all oil and contaminants can be drained from the reservoir.

3.4.13 Oil filter

For pumped refilling of the oil reservoir, an inlet oil filter shall be provided and installed upstream of the oil reservoir. It shall be capable of removing 100 % of particles of size 10 µm and larger.

Connections to the oil make-up reservoir shall be such as to prevent sand or dust entering the system.

3.4.14 Demisting apparatus (see 6.4.2)

Demisting apparatus must be designed for sufficient capacity and to maintain sufficient pressure at all points in the system to prevent oil mist from escaping to atmosphere. For oil mist generators installed indoors, a separate bulk oil supply tank with demisting apparatus shall be supplied.

4. INSTRUMENTATION AND CONTROL

4.1 INSTRUMENTATION

4.1.1 General

The Vendor shall make provisions for monitoring the following systems, and shall supply the necessary instrumentation unless otherwise specified in the data/requisition sheet.

4.1.2 Air system

Provision shall be made to monitor the following:

- Inlet supply pressure;
- Outlet supply pressure downstream of the air regulator;
- Air heater outlet temperature.

4.1.3 Oil system

Provision shall be made to monitor the following:

- Reservoir oil level
- Oil supply pressure
- Oil mist generator outlet pressure to main header
- Oil mist density.

4.2 CONTROLS

The Vendor shall include the following controls within the scope of supply:

- an air pressure regulator to control the pressure within the oil mist distribution system. The regulator shall be capable of accepting inlet air supplied at pressures within the range 4 bar (ga) [60 psig] to 7 bar (ga) [100 psig]
- an oil flow valve to control the density of the oil mist
- an air by-pass valve to control the oil mist pressure without increasing the oil output
- automatic control of the oil level in the reservoir of the oil mist generator.

4.3 ALARMS

Individual alarm lights shall be installed for the following functions:

- Low oil mist outlet pressure
- High oil mist outlet pressure
- Low reservoir oil level (main generator reservoir)
- High reservoir oil level (main generator reservoir)
- Low air supply temperature (air heater outlet)
- High air supply temperature (air heater outlet)
- Low oil temperature (oil supply reservoir)
- High oil temperature (oil supply reservoir)
- Low oil level (oil supply reservoir)
- High oil level (oil supply reservoir)
- High oil supply pressure
- Low oil supply pressure
- Low regulated air supply pressure
- High oil mist density
- Low oil mist density.

Alarm lights for each malfunction shall be panel-mounted and located within the oil mist console. The first alarm can be determined by scrolling the event log.

A common mist generator alarm shall be connected to the Principal's distributed control system (DCS).

The oil mist generator shall have the ability to communicate individual alarms to the Principal's DCS.

The actuation of the remote alarm in the plant control room shall also be indicated locally by a red light mounted on the top of the oil mist cabinet. Normal operation of the oil mist lubrication system shall be indicated by a green light mounted on the top of the cabinet.

The alarm and normal operation lights shall be clearly visible in all horizontal directions.

The area classification and the supply voltage for the alarm/indicator system shall be specified in the data/requisition sheet.

5. INSPECTION, TESTING AND PROTECTION OF OIL MIST CABINET

5.1 INSPECTION

The Manufacturer shall state in the proposal the inspection methods that will be applied and shall give details of the quality control procedures set up in the manufacturing facility.

The Principal shall indicate whether, and to what extent, he will witness the Manufacturer's inspections and functional testing.

5.2 TESTING

The oil mist generator shall be tested in accordance with the Manufacturer's standard shop test.

On-site functional testing of the oil mist system shall be performed in accordance with a test procedure agreed by the Principal and Vendor. All instrumentation including end devices shall be functionally tested.

5.3 PREPARATION FOR SHIPMENT

Preparation for shipment and the procedures to be followed shall be as specified by the Purchaser.

Generally, machined surfaces shall be coated with a suitable rust preventative, ends of piping and tubing shall be sealed and protected, and all pipes and tubes shall be braced and secured to prevent damage during shipment.

6. ROTATING EQUIPMENT ADAPTATION

6.1 GENERAL

It will be necessary to carry out certain modifications to the standard bearing housing arrangements of rotating equipment in order to allow operation of an oil mist lubrication system.

Centrifugal pumps may already have provisions for oil mist lubrication if so specified when purchased.

The Vendor of the oil mist lubrication system shall verify the details of necessary modifications with the Principal. Shielded or sealed bearings shall not be used. The rotating equipment Supplier shall inform the Principal about the modifications required.

Oil mist inlet connections to bearing housings shall be at least 6 mm (1/4 in) threaded NPT.

6.2 'PURE MIST' APPLICATIONS

6.2.1 Pure mist bearing housings

- a. Reclassifier fittings shall be located in the mist manifold block. For directed mist applications that require the reclassifier to be located at the bearing housing, see (6.2.1.h).
- b. Reclassifier selection for pure mist applications shall be based on calculations by the Vendor's engineering department as part of the design and engineering package.
- c. Pure mist bearing housing shall be vented so that the oil mist flow is through the bearing. Large oil drain ports around the bearings shall be plugged to ensure proper mist flow.
- d. Pure mist bearing housings shall have a clear plastic sight bottle with a 10 mm (3/8 in) stainless steel tubing vent. The sight bottle shall be installed at the bearing housing low point so that all coalesced oil drains from the bearing housing.
- e. Pure Mist Application Method 1

Mist is introduced at two locations, one on the outboard side of the thrust and one on the outboard side of the radial bearing. The mist flow is through each bearing towards the centre of the bearing housing. The mist and coalesced oil vents and drains from the bearing housing through the drain connection. This configuration is typical for overhung type API/ISO OH2 pumps and for some ANSI pumps, FD or ID fan spindle type bearing housings, or other specialized equipment. See Appendix 1, Figure 7.

- f. Pure Mist Application Method 2

Mist is introduced at one location between the thrust and radial bearings. The mist flow is through each bearing toward each bearing end cap where it vents to atmosphere through the labyrinth seal. If the bearing end caps do not have labyrinth type seals the end caps must be modified to allow the mist to vent out of the bearing housing. Coalesced oil vents and drains from the bearing housing through the drain connection. This configuration is typical for overhung type pumps and FD or ID fan spindle type bearing housings, or other specialized equipment. See Appendix 1, Figure 8.

- g. Pure Mist Application Method 3

Mist is introduced onto one side of the bearing, traverses through the bearing and vents through the shaft seal directly on the opposite side of the bearing. Coalesced oil vents and drains from the bearing housing through the drain connection. Typical applications are bearing housings of between bearing type pumps, vertical ANSI pumps and pillow block bearing housings. See Appendix 1, Figure 9 and Figure 10.

h. Pure Mist Application Method 4

This type of pure mist application is described as Directed Mist. The equipment bearing housings may require modification to provide drilled and tapped holes in the bearing housing or bearing end caps for mounting the reclassifiers. Reclassifiers are located so that the mist flow is directed at the centreline of the rolling elements. See (2.5.3) for determining when directed mist is required. See Appendix 1, Figure 11.

i. Pure Mist Application Method 5

Mist is introduced at one location between the thrust and radial bearings. The mist flow is into the radial bearing from one side and through the thrust bearing toward the bearing end cap where it vents through an opening on the bottom of the end cap to the collection container. See Appendix 1, Figure 12.

j. Pure Mist Application Method 6

Mist is introduced at two locations, one each above the thrust and the radial bearing. The mist flow is through each bearing toward the bottom of the bearing housing. The mist and coalesced oil vents and drains from the bearing housing through the drain connection. This configuration is typical for vertical type API/ISO pumps and for some ANSI pumps. See Appendix 1, Figure 13.

k. Horizontal Electric Motors – Method 7

- Horizontal electric motors shall be frame size 254 and larger [11 kW (15 hp)] with ball bearings that have a re-greaseable construction, or are designed for oil mist service.
- The re-lubrication (mist) inlet shall be in the upper bracket quadrant.
- The vent/drain outlet shall be near the 6 o'clock position. This maintains a "dry-sump" system and minimizes accumulation and churning of oil.
- Positive isolation shall be supplied between bearing and motor winding to prevent oil ingress.
- Bearings shall be open, not shielded or sealed, and be enclosed with bearings caps.
- Drain tubing shall be tubed away from the fan, into an oil collection container.
- Inlet and vent / drain hole threads shall accommodate standard pipe thread connections.
- The insulation materials shall be compatible with the oil mist. Nomex insulation, epoxy varnish and Teflon lead cable systems offer the best protection. Silicon rubber should be avoided due to potential swelling.
- The bearing cavities shall be free of grease for the oil mist to pass into and exit the bearing housing. Any small amount of residue grease will plug the vent / drain opening and prevent proper lubrication. The bearing should be installed with a preservative oil coating after tear down to remove grease from the bearings.
- The conduit box mounted on the motor shall be sealed around the wires to prevent stray mist from travelling through the conduit from the motor to the motor control centre.

See Appendix 1, Figure 14.

I. Vertical Electric Motors – Method 8

- Vertical electric motors shall be frame size 180 and larger [2.2 kW (3 hp)] with ball bearings that have a re-greaseable construction, or are designed for oil mist service.
- Vertical motors shall have the same features as described for horizontal motors in (6.2.1.k).
- Positive isolation shall be supplied between the bearing and motor winding to prevent oil ingress.
- The re-lubrication (mist) inlet shall be located above the upper and lower bearings to allow the oil mist to enter without trapping and pass down through the rolling elements of the bearings.
- The vent/drain outlet should be below the upper and lower bearings to maintain a “dry sump” system and minimize accumulation and churning of oil. However on some motors a vent can only be installed on the upper bearing and the coalesced oil drains out of the lower bearing vent/drain, which can be lower than the bearing.

See Appendix 1, Figure 15.

6.3 'PURGE MIST' APPLICATIONS

6.3.1 Purge mist bearing housings

- a. Reclassifier fittings shall be located in the mist manifold block.
- b. Where possible, purge mist bearing housings shall be equipped with oil level control devices designed to maintain the proper operating oil level in the bearing housing. The devices shall be installed in such a way that coalesced oil can be drained into an oil collection container. The devices shall have a field adjustable oil level setting that can be adjusted to limit the oil level in the bearing housing.
- c. Drilled drain plugs and automatic oilers which drain coalesced oil directly onto the equipment base plate shall not be used.
- d. Purge mist bearing housings shall be equipped with purge mist vent fill assemblies which allow easy filling and maintaining of oil levels without disconnecting the oil mist supply.
- e. Purge mist bearing housings shall have a clear plastic sight bottle, equipped with a valve. The sight bottle shall be installed at the bearing housing low point.
- f. Purge Mist Application Method 1

For machinery identified as suitable for installation of adjustable oil level sight assemblies where anticipated oil loss is minimal. This configuration does not provide a local liquid oil reserve for oil loss. Oil make up is provided by coalesced oil from the mist supply. Oil level is maintained by setting a field adjustable overflow tube to the proper operating level. A balanced reference pressure line between the air space in the bearing housing and the air space in the oil level sight assembly eliminates false oil level readings in the bearing housing. Coalesced oil and oil mist is vented from the oil level sight assembly through the oil over flow tube. Examples are small to medium HP steam turbines, between bearing pumps, and oil lubricated electric motors. Purge mist applications for gear boxes should be provided with adjustable oil level sight assemblies if possible. See Appendix 1, Figure 16.