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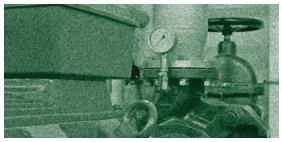
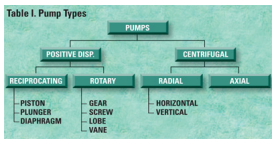


Your site's pumping equipment calls for special treatment when it comes to lubrication. What you don't know about it could break the real 'heart' of your system.

(Author's Note: Much of the information in this series is based on the practical knowledge of real-world lubrication professionals. Once such expert is Mark Kavanaugh, who has over 42 years of experience in large manufacturing operations, and is currently responsible for coordinating the lubrication of thousands of pieces of rotating equipment in a refinery. Mark is certified as a CLS, MTL I and MLA II.)

Pumps are an integral part of any manufacturing plant. Most operations have to move fluids from point to point. Some large end-users, like chemical plants and refineries, have thousands of pumping systems. Pump operation and maintenance should never be taken for granted. Often referred to as the "heart" of a plant, pumps are key com-ponents in a site's overall reliability program. Table I lists various pump types classified as either positive displacement or centrifugal. This article will focus on centrifugals.



Centrifugal pump considerations

The centrifugal pump family includes radial-flow types (the most common) and axial-flow types.

- A radial-flow centrifugal pump uses a rotating impeller to create centrifugal force on a fluid, creating energy that results in flow. The flow is accelerated in a radial, outward motion by the

pump impeller into a diffuser or volute chamber and exits into downstream piping.

- An axial-flow centrifugal pump develops flow from the lifting or propelling effect of the vanes on the impeller.
- In a mixed-flow variation of the radial- and axial-flow types, pressure is developed both by centrifugal force and the lifting effect of the vanes.

The two types of radial pumps are ANSI (based on the American National Standards Institute Pump Standard) and API (based on standards of the American Petroleum Institute). Standardiz ed dimensions for ANSI pumps include:

1. The distance between the suction and discharge nozzle centerlines
2. The height of the pump coupling
3. Location of the pump hold-down bolts

ANSI pumps are usually smaller, overhung units for light-duty types of service. API pumps (which meet API's higher standards) are typically used in heavier-duty services than ANSI pumps. There's a movement to combine both ANSI and API Standards into one standard for the U.S.

ANSI pumps have both radial and thrust rolling-element bearings. Typically, the radial bearings are single-row, deep-groove ball bearings. The thrust bearings are either paired angular-contact or double-row angular-contact ball bearings.

API pumps typically incorporate double-row, deep-groove ball bearings and angular-contact ball bearings for thrust load. For larger API heavy-duty pumps, radial bearings are cylindrical—*for their greater load-carrying ability*
—and thrust bearings are paired tapered-roller types for thrust loads.

Sealing for general service is moving more toward bearing isolators or magnetic seals. Lip seals are no longer approved for API pumps, but are still used in some ANSI pumps. For pumping environmentally unfriendly fluids, mechanical seals are used.

Lubrication selection guidelines

Most pumps are lubricated with rust and oxidation inhibited oils (R&O) that also have small amounts of antifoam and demulsifier additives. Some pump manufacturers recommend antiwear (AW) additives, but most use R&O oils.

Viscosity is the most important criteria in the selection of the proper pump lubricant. Table II lists guidelines on the proper viscosity selection for rolling-element bearings.

Table II. Viscosity Guidelines for the Lubrication of Rolling-Element Bearings ***(Source: Heinz Bloch)***

Bearing Operating Temperature, F	Ball/Cylindrical Bearings	Other Bearing Types
150 F	VG 46	VG 68
175 F	VG 68	VG 100
190 F*	VG 100	VG 150

*Synthetics such as PAOs are usually recommended at this temperature.

The most common viscosity used for centrifugal pump rolling-element bearings is ISO VG 68. In some colder climates, ISO VG 32 is used.

Lubrication application methods

The proper *application* of lubricants is as important as the correct lubricant *selection*. The methods used are:

- Bath
- Bath with slinger ring
- Circulation system
- Pure mist
- Purge mist

Bath method…

The most common centrifugal-pump lubrication-application system is the oil bath fed by a bottle oiler. In some cases, depending on the amount of oil in the bearing housing, a slinger or flinger may be required to properly lubricate the bearing. Figure 1 depicts an oil bath in a centrifugal pump. When lubricating solely with an oil bath, the oil level should be maintained so it covers half the lower ball. In Fig. 1, the radial bearing is a deep-groove single-row ball type, and the thrust bearings are paired angular-contact ball bearings.

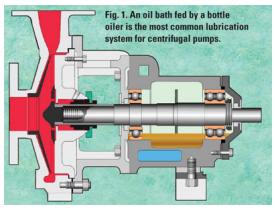


Fig. 1. An oil bath fed by a bottle oiler is the most common lubrication system for centrifugal pumps.

The Trico bottle oiler is the most common method used in establishing an oil bath. An oil sight glass made of acrylic is attached to the bottom of the oiler reservoir. This type of sight glass is useful in observing the color of the oil—*and, in turn, helping to determine when to drain water and debris from the bottom of the reservoir.*

Figure 2 shows how a bottle oiler maintains the oil level in an oil bath. As the oil level drops in the reservoir, the oiler feeds additional oil and breaks the seal in the bulb, introducing air, which allows oil to flow from the bulb. When the correct level is reached, the seal stops the oil flow.

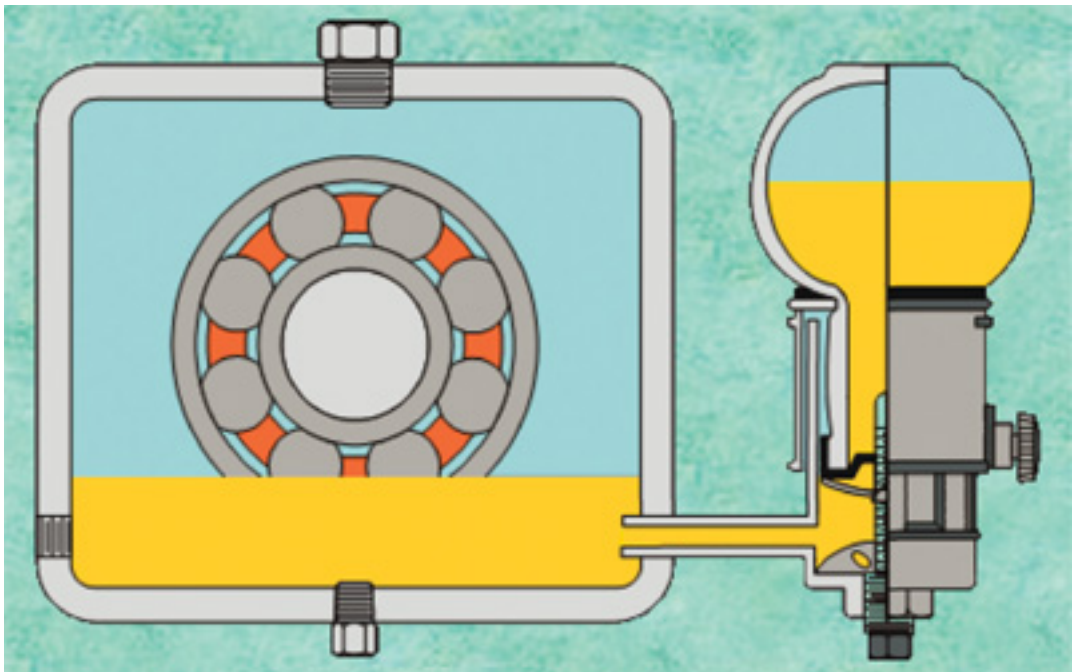


Fig. 2. How a bottle oiler maintains the oil level in oil-bath lubrication systems *(Source: Trico Mfg.)*

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Fig. 3. Based on the color of the desiccant, this breather needs to be changed.

Fig. 4. Technicians passed by this bottle oiler many times before noticing that what appeared to be the right oil level was really a crust in a completely dry reservoir.

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