# Constant Level Oilers – Vented Versus Non-Vented?

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Constant level oilers have been utilized on process pumps for over 60 years. Over the years, advances in seal technology and more focus towards contamination control has brought forward new advancement in constant level oiler technology. In this paper you will learn the importance of maintaining proper level of lubrication with constant level oilers. Different types of oilers will be covered and how avoiding installation and application errors can maintain proper quantity as well as quality of oil. Data on how one company was able to save substantial amount of dollars by integrating non-vented oilers on their ANSI process pumps will also be presented.

## Oil Sump Lubrication

There are many types of methods utilized in providing bearing lubrication in industrial equipment. Oil sump lubrication is the most common method incorporated into the design of pumps, blowers, gearboxes and other rotating equipment. The primary purpose of oil is to separate the roller elements and raceway contact surfaces, lubricate the sliding surfaces within the bearings, and provide corrosion protection and cooling.

The most common form of bearing lubrication is direct contact. As the shaft rotates the rolling elements in the bearing make contact with a level of oil. Since it is critical that an effective oil film be maintained between the rolling element and the race of the bearing, only enough contact between the bearing and the surface of the oil as necessary to provide the bearing with lubricant is required. If the level of lubricant is too high or too low excessive heat will be generated accelerating the degradation of the oil and shortening the life of the bearing.

## Quantity of Oil

The most critical elements of lubrication are quality and quantity. Without one the other is significantly affected. Having the proper quantity of poor quality oil is no better than having an insufficient quantity of high quality oil. Having the proper quantity of oil is even more important than maintaining the quality of the oil. Oil sump lubrication does not require that a specific level be maintained for proper bearing load only that oil levels do not reach critically low or high points. (Figure 1)

In a low level operating condition the bearing will not receive enough lubricant necessary for proper film strength - a precursor to surface contact, skidding, and possible catastrophic failure. Without enough oil to prevent friction, thermal runaway can happen quickly to a steel bearing. As the temperature of the bearing increases, the ball and race both expand which creates and even tighter fit. This increases the temperature even more, and the cycle continues to a rapid, catastrophic failure.

In a high level operating condition churning of the lubricant will occur, accelerating the oxidation rate due to excessive air and elevated temperatures. It is a common mistake to

believe that more is better - especially when it comes to oil sump lubrication. Too much oil can affect the operation of oil rings, flingers, and direct bearing contact. Another result of high lubricant levels is leaking seals.

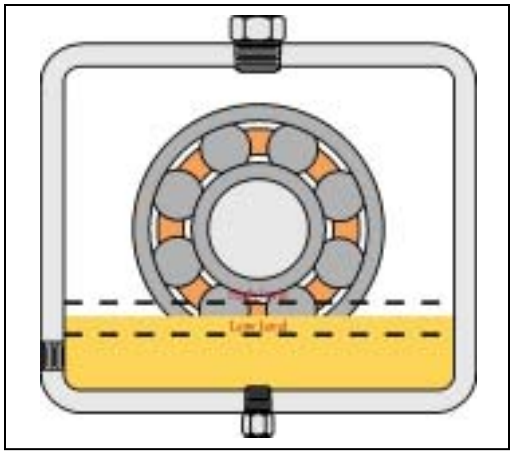

**Figure 1.Typical oil level conditions**

## Maintaining Proper Level – Constant Level Oilers

Maintaining the proper quantity of lubricant is perhaps the easiest means of increasing lubrication life and effectiveness. Consult with your equipment manufacturer for recommended oil levels, optimum lubricating equipment, and preferred practices. A general guideline is to maintain minimal contact with the lubricating element. Rolling element bearings should not be submerged more than one-half the diameter of the rolling element (ball) at the deepest point of submersion in static condition.

One of the most widely used methods of maintaining the proper level lubricant in a bearing housing is the constant level oiler. (Figure 2) The constant level oiler replenishes oil lost by leakage through seals, vents, and various connections and plugs in the bearing housing. Once the proper level has been set replacing the oil in the reservoir is the only required maintenance.

Constant level oilers have a “control point” that must align with the proper oil level of the equipment. The oiler is installed on the equipment and oil is filled to the proper level. All constant level oilers require air to function properly. If the oil level within the sump lowers, the seal at the control point is broken allowing air to enter the reservoir displacing the oil until the seal is re-established. If the constant level oiler is set correctly and there is oil in the reservoir, the equipment will always have the optimum oil level within the sump.

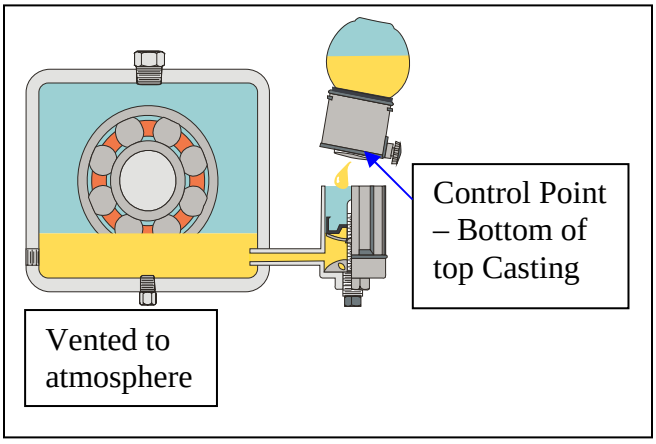


**Figure 2.Cross section of typical oil sump lubrication with constant level Oiler**

## Types of Constant Level Oilers

Constant level oilers can be put into two categories: Vented and Non-Vented. Within these two categories there are two types of designs: Adjustable and fixed. As mentioned previously, all oilers require air to function properly. In vented types of oilers, the air comes from the atmosphere. In non-vented types, the air necessary for proper operation is the same air found within the sump.

Vented types of oilers have been around for over 60 years and the most widespread type currently in use. For many years they have provided great value in maintaining proper oil levels, extending equipment life. Advancements in seal technology and more awareness to contamination control as brought forward improvements in constant level oilers. Vented type of oilers will provide the proper quantity of oil but not necessarily proper quality of oil. Pressure differentials between the equipment housing and surrounding atmosphere is a leading cause of contamination ingression. Equipment operation where housing temperature fluctuations occur during frequent on/off running conditions, process fluid temperature changes, outdoor use, and air flow over the equipment create this atmospheric exchange as pressure is equalized. During this air exchange, contamination from surrounding environment is “breathed” into the oil sump.

Non-vented oilers do not exchange air with the atmosphere. A common type uses a pressure balance line that connects the air within the oiler base to the air within the sump. (Figure 3) Non-vented types of oilers operate under the same principle as vented. The “control point” is set to align with the desired oil level and if the level lowers, air enters the reservoir displacing the oil until the seal is re-established.

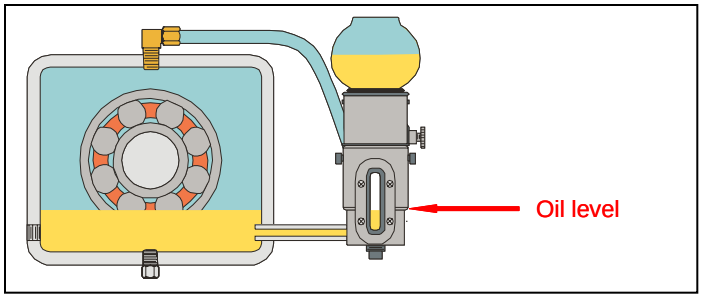


**Figure 3. Non-Vented Oiler with Pressure Balancing Line**

An adjustable type of oiler typically has a range of ¾" vertical adjustment to meet the desired oil level. Many older types of rotating equipment do not have a port at the desired oil level requiring an adjustable type. A fixed type of oiler needs to be mounted at a port located at the desired oil level. (Figure 4).

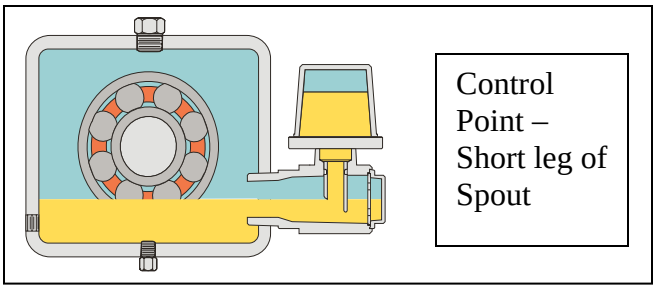


**Figure 4. Fixed type of Oiler Mounted at Centerline of Desired Oil Level**

## Application – Constant Level Oilers

Determining which type of oiler to use for each application requires consideration of the surrounding environment, type of seals, and design of housing including port locations and vents. In highly contaminated environments, it is recommended that a Non-vented type of oiler be installed to minimize particulate and moisture ingression. Other sources of ingression are through seals and vents (located on the top of the housing).

Certain types of seals are better at preventing ingression but still vent to the outside to accommodate the pressure differential. Some seals are not capable of handling the pressures due to equalization and would require an expansion chamber.

Bearing isolators are used to prevent lubricant leakage and contaminant ingression. Labyrinth type bearing isolators are the most widely used on modern designed rotating equipment. Bearing isolators allow increase pressure created by normal operation to vent through the seal and proven to be very effective at reducing contamination ingression. The rotor and stator are not in contact, which allows for the venting to occur while preventing wear – prolonging the life of the seal. When bearing isolators are used, it is recommended that the vent plug be removed and replaced with a plug and a non-vented type of oiler installed.

Lip seals can also be very good at preventing contamination, however being a contacting type design, eventual wear to the seal allows for contamination ingression and oil leakages. When lip type seals are used, either vented or non-vented oilers can be used, but an expansion chamber is recommended if a non-vented oiler is used and the housing vent is replaced with a plug. An expansion chamber has a rolling diaphragm to accommodate the pressure increase alleviating the pressure to the lip seals.

Face (Magnetic) seals are used to prevent damage to bearings due to contamination and lubricant leakage. Face seals are characterized by optically flat stationary and rotating faces loaded together by magnetic force or springs. With magnetic type of seals a non-vented type of oiler is recommended and an expansion chamber may be required if seals are no capable of handling increase pressures.

Selecting an adjustable or fixed type of oiler is dependent on the design of the housing and whether a port at the desired oil level in the proper size is available. Many users prefer the fixed type when feasible due to limited installation errors.

## Installation – Constant Level Oilers

The leading causes of incorrect oil sump levels include the following:

- Incorrect oiler settings
- Pressure differential (vented types only)
- Oiler location
- Blocked or plugged fittings
- Improper filling methods

**Incorrect Oiler Settings**

Review the instruction sheets provided with the oiler for better understanding of how to adjust and set the device for proper use. Understanding where the control point is can greatly reduce problems associated with high and low oil levels. On adjustable type of oilers knowing the adjustment parameters relative to the port and oil level are equally important. A vertical stem pipe is used on the most commonly used vented type of oiler. This stem pipe serves two purposes: 1) sets the level via wing nuts and 2) breaks any meniscus that may form due to surface tension. Many users throw this stem pipe away which could prevent feeding and cause a low oil level condition. Latest design non-vented oilers have easier installation instructions and verification of proper setting can be done via a sight gauge.

**Pressure Differential (Vented types only)**

Airflow across equipment housings generated by fans, blowers and even the equipment motor can be sufficient to create pressure differential between bearing housing and the oiler reservoir causing the oiler to feed and potential overfill condition. As discussed previously, equipment operating temperature changes can also create pressure differentials. Pressure increases/decreases can be controlled by closing the housing

through the use of non-vented oilers, replacement of vents with expansion chambers and proper seal selection.

**Oiler Location**
Location of the oiler relative to shaft rotation can effect how a constant level oiler dispenses. The recommended placement is on the side of the equipment facing the direction of the shaft rotation at the bottom when using the side mount. Oil is pushed up into the reservoir versus pulled away which can cause feeding and an overfill condition. (Figure 5)

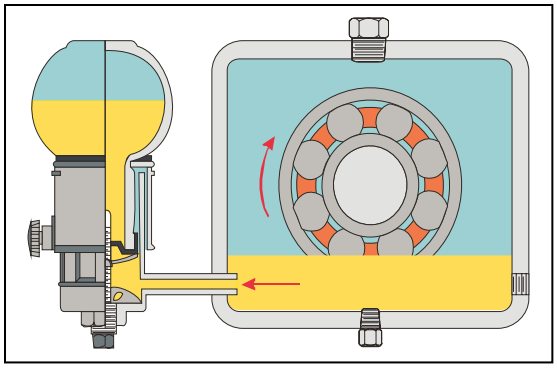

**Figure 5. Correct Mounting of Oiler Relative to Shaft Rotation**

**Blocked or Plugged Fittings**
It is important to check the connection fitting between the oiler and the housing to verify that there is no blockage. When oil becomes oxidized or contaminated, it can easily plug this fitting. If this occurs, the oiler will not feed and the level can become low. This is easy to check by removing the oiler during oil changes and looking at the fitting opening.

**Improper Filling Methods**
When filling through the top of the equipment, knowing the required oil volume is necessary to achieve the preset level. If the oil quantity is known, then this method is considered to be a safe filling procedure. However, more times then not, the oil quantity is unknown and is haphazardly filled through the top, using a sight gauge to determine the level. Unfortunately, this will result in a high fluid level due to residual lubricant draining from the internal components such as a shaft or gear.

Proper filling can be achieved through the surge body when a sight gauge is present. The sight gauge provides a visual aid for achieving the predetermined fluid level in the sump. Filling, without a sight gauge can cause overfilling of the oil sump and surge body. An indication of overfilling will become evident if fluid begins flowing from the surge body once the reservoir is replaced. To adjust for overfilling, drain the lubricant from the sump until the constant level oiler begins feeding, and reaches the preset level.
In addition, excessive refilling of the reservoir will also have a negative effect on the oil level. Each time the reservoir is removed and replaced, a small amount of lubricant is added to the oil sump level. Overtime, this will increase the fluid level. To combat this

incidence, refill the reservoir only when it is half full or less. This will help minimize unnecessary filling.

## Case Study: Vented vs. Non-Vented

A major chemical company located in the South was looking to replace their vented oilers with non-vented oilers on 900 horizontal process pumps. Their reasons for changing were based on better service life, decrease maintenance costs and increase plant up-time. A total of one hundred oilers have been converted to non-vented type and the vent cap on the housing removed and placed with a blank plug. Bearing Isolators are used providing the necessary pressure relief due to temperature fluctuations. Contamination ingression was severely decreased and current oil change intervals have been extended from every 8 months to every 2 years. Typical oil changes have a cost of $150 per pump for labor and materials. A total savings of $15,000 per year is realized in oil changes alone not including increase up-time for these 100 pumps. Potential savings is $135,000 per year with non-vented oilers installed on all 900 pumps.

## Conclusion

Constant level Oilers are an easy and effective method of maintaining proper oil level in equipment. Avoiding application and installation errors is critical for ensuring optimum performance of the oiler and the equipment. Standardizing on non-vented Oilers will provide not only proper quantity of oil but quality of oil resulting in cleaner oil and measurable cost savings.