OIL FILTRATION SYSTEMS®

A CLARK-RELIANCE COMPANY

# Filtering Brand New Oil – Why and How?

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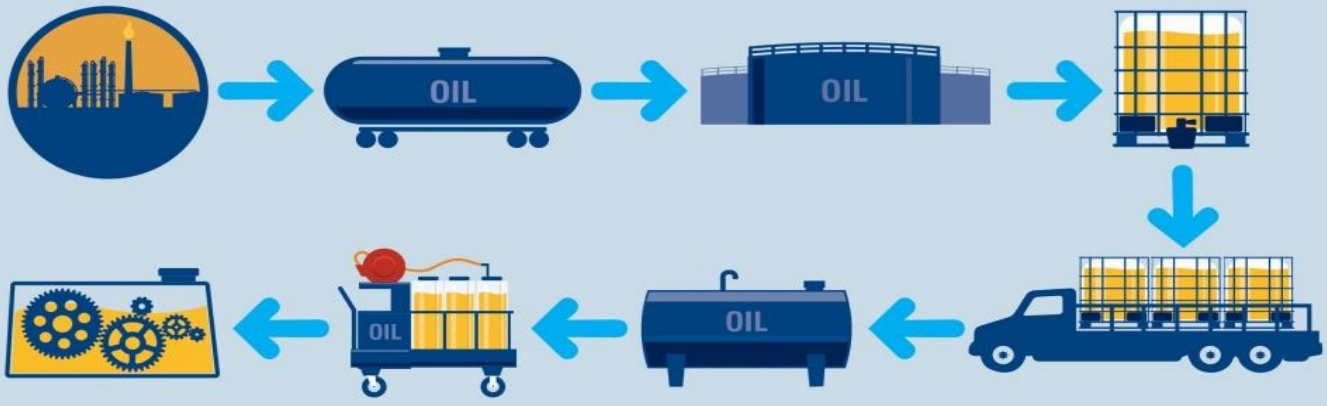





## Why Filter Brand New Oil?

Brand new hydraulic and lubrication oils typically do not meet stringent OEM cleanliness specifications.

The minute they leave the refinery or lube oil plant, they begin to pick up particulate contamination at every stage of transport, starting with the pipeline, rail car, tanker truck, plastic tote, and/or 55-gallon drum. These containers all have an inherent amount of particulate contamination in them, and depending on how well they have been pre-cleaned (if at all), they can be the source of significant contamination in the form of very fine particulates that cannot be seen with the naked eye (40-Micron and smaller).

After brand new lube oils are delivered to regional oil marketers via rail car or tanker truck, they are typically stored in large bulk tanks, and then transferred to other tanker trucks and/or plastic totes, where they pick up even more contamination. The lube oils are often pumped through hoses and piping into bulk lube oil tanks at the end user's facility. They are then transferred into smaller containers for use by oilers and operators, who then dispense oil into the individual pieces of equipment.

At every level of transport and handling, some amount of particulate contamination is introduced into the oil, and by the time the oil is ready to be dispensed into a piece of equipment a typical new oil cleanliness level is ISO 21/19/17.

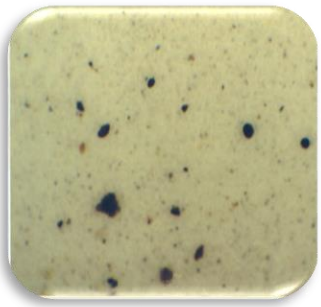
Average and typical OEM recommended cleanliness specifications for various types of rotating equipment are as follows:

| | |
|---|---|
| Servo Valves | ISO 16/14/11 |
| Roller Bearings | ISO 16/14/11 |
| Hydraulic Cylinders | ISO 17/15/12 |
| Gearboxes | ISO 17/16/13 |

Specific new oil cleanliness specifications for start-up and operation include:

| | |
|---|---|
| GE Steam Turbines (per GEK 107564) | ISO 16/14/11 |
| GE Gas Turbines (per GEK 110483a) | ISO 16/14/11 |
| Solar Hydraulic Systems (per ES 2184) | ISO 16/14/12 |
| Caterpillar (Bulk Fuels and Systems Oils) | ISO 18/16/13 |

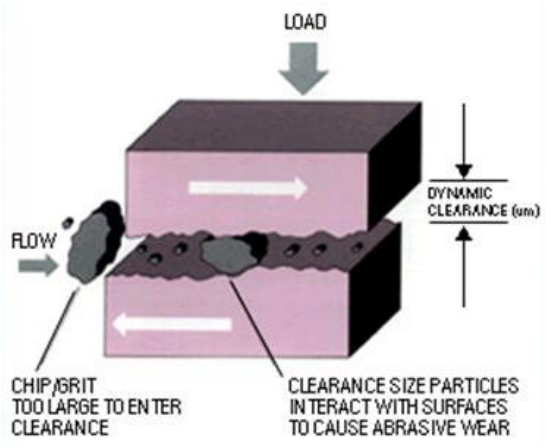
**Patch Test Results**
**Brand New Oil In Tote**
**(Before Filtration)**
**ISO 21/19/17**



**Patch Test Results**
**Brand New Oil In Tote**
**(After Filtration)**
**ISO 16/14/11**

Meeting these OEM cleanliness specifications for new oil is very important, since it can impact equipment warranties, asset longevity, and overall maintenance costs due to component repair and downtime.

If you can actually see visible contamination in a tote or drum of oil, then you can be sure there will be significant “invisible” contaminants in the oil too (<40 Micron in size). You should note that much of the damage done to rotating equipment is caused by invisible particles in the 4-6 micron size range, as those “clearance sized” particles enter the hydrodynamic lubrication layer and cause galling, pitting, and eventually cracking of the bearing surfaces.




A big challenge for reliability and maintenance personnel throughout all industries is how to ensure that their oil meets or exceeds these stringent OEM cleanliness levels, especially when their brand new oil is often 5-6 ISO codes higher than it is supposed to be (32x – 64x more particulate contamination than specified or allowed).

# How To Filter Brand New Oil

You must filter the oil in single pass at every stage of transport, and when necessary, you must implement kidney-loop filtration on bulk tanks, oil totes, and 55-gallon drums. These systems are designed for use in the most demanding and rugged applications and environments.

Even the best absolute-rated filter elements available on the market today cannot remove all particulate contamination to very low levels in a single pass. ISO 16889, which establishes a filter media's Beta efficiency rating, is a multi-pass test, and there are many variables which affect a filter element's single pass performance in real life, including:

**- Oil viscosity - Oil flow rate - Oil temperature - Amount of filter media surface area**

**Inline Filtration At Tank Farm (Offloading Rail Cars)**

By definition, a 5-Micron filter element that is rated Beta>1000 per ISO 16889 will remove 99.9% of all particles 5-Micron and larger in multi-pass, but not in single pass.

For this reason, even if it is sized properly for optimal performance, you cannot expect a single filter element installed on a dispensing line to take brand new oil from ISO 21/19/17 to ISO 16/14/11 in a single pass. That is a significant 5-6 digit change, 32 to 64 times cleaner.

So what single-pass performance and results can you expect from a filter element that is rated Beta>1000 per ISO 16889?

Filtering brand new bulk lube oils to meet or exceed OEM cleanliness levels across a wide range of conditions, has shown the following average results (assuming the filter elements are sized properly for the viscosity and flow rate):

| | |
|---|---|
| #2 Diesel Fuel | up to a 3-4 digit change in one pass |
| ISO 32-68 Oil | up to a 2-3-digit change in one pass |
| ISO 100–220 Oil | up to a 1-2 digit change in one pass |
| ISO 320-680 Oil | 0-1 digit change in one pass maximum |

Therefore, we have found that if you need to take brand new oil from ISO 21/19/17 to ISO 16/14/11 in single pass, you will likely need to install multiple filter housings in series, so the oil passes through one high efficiency filter element, then another, and possibly even another. It is not uncommon to require a 2-Stage or 3-Stage Filter Housing Assembly plumbed downstream of a pump/motor in order to achieve very low particle counts at the dispensing point. The exact size and configuration needed depends on the oil viscosity, the oil temperature, the pump flow rate, the starting oil cleanliness level, and the target oil cleanliness level.

**For optimal single-pass filtration performance, I cannot stress enough how important it is for the filters to be sized properly for the individual application.**

Another way to ensure that brand new oil meets or exceeds OEM recommended cleanliness specifications is to implement and use kidney-loop filtration on your bulk tanks, oil totes, and/or 55-gallon drums. By recirculating the oil multiple times through one or more high efficiency filter elements, you can quickly and reliably lower the particle counts in brand new oil from ISO 21/19/17 to ISO 16/14/11.

**Kidney-Loop Filtration On Bulk Lube Oil Tank**

Kidney-loop filtration systems must be configured properly for optimal performance, taking into account tank size, oil viscosity, and oil temperature. When sized properly, you can usually expect to achieve satisfactory results within 3-4 hours of continuous recirculation.

Many facilities install permanent and dedicated kidney-loop filtration systems on their large bulk tanks, continuously filtering their oil to make sure that it always meets or exceeds their target ISO cleanliness levels.


**Drum Topper Used To Filter and Dispense New Oil From 55 Gallon Drums**
*Courtesy of Lubrication Engineers®*

If your brand new oil is delivered and stored in oil totes or 55-gallon drums, then you can use a Portable Kidney-Loop Filtration System (typically a Filter Cart or Drum Topper). Alternatively, some facilities establish a permanent filtration station, and They bring oil totes or 55-gallon drums to the filtration system for recirculating and polishing the oil prior to use.

Regardless of whether kidney-loop filtration has been implemented in the bulk tanks, oil totes, or 55-gallon drums, it is important to utilize a Filter Cart (or something similar) to filter the new oil in single pass as it is dispensed into the piece of equipment. This final point of use filtration is considered by many to be the most important stage of new oil filtration.

In order to simplify the consistent filtration of brand new oil to meet or exceed stringent OEM cleanliness specifications, some facilities are also using specially engineered or custom built Lube Oil Storage Tanks. These tanks are equipped with pump/motors, controls, and filter elements capable of pumping new oil from drums or totes into the tank, allowing the operators to then dispose of the drums or totes. The new oil can then be recirculated and filtered within the tank in a kidney-loop configuration, and then dispensed through the filter using the same pump/motor and controls. These special Lube Oil Storage Tanks are available in a wide range of sizes and configurations (permanently mounted or portable) to fit virtually any application.

**Bulk Lube Oil Filtration and Dispensing System**

# SUMMARY

To ensure that the oil that you are putting into your critical rotating equipment meets or exceeds stringent OEM cleanliness levels, you need to install properly sized filters at several different points within the oil's flow path. Working your way backwards from the final point-of-use dispensing nozzle, brand new oil should be filtered downstream of every pump that moves it from Point A to Point B.

Kidney-loop filtration used on bulk tanks, oil totes, and drums is also an important and effective way to ensure that new oil is absolutely clean, since the removal of particulate contamination (even with high efficiency filter elements rated Beta>1000) is not 99.9% efficient in single pass. By recirculating the oil for a period of time in a tank, passing it through one or more filter elements at least 6-12 times, you can be assured of lowering the particle count in brand new oil from ISO 21/19/17 to ISO 16/14/11.

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