

CLEANLINESS AND QUALITY PROGRAM

TOP TIER MARKETERS

KEEPING THE
WORLD
RUNNING
SMOOTHLY.





CLEANLINESS AND QUALITY PROGRAM

The Phillips 66 Lubricants Marketer Operations Standard (MOS) has been in place since 2006. It was established to communicate the requirements and best practices for handling Phillips 66 Lubricants. The standard is designed based on guidelines set forth by the American Petroleum Institute (API) in API Recommended Practice 1525. The program is a requirement for Phillips 66 marketers to ensure clean, top-quality products are delivered to all end users. Superior performance as specified by the MOS identifies the marketer as a Phillips 66 Top Tier Marketer, a group that now numbers over 180 companies.

Phillips 66 has an established program to routinely inspect and monitor its Marketers to ensure proper storage and handling practices. Recommendations for improvements, upgrades and corrective actions are provided on an as-needed basis. We ensure that our Marketers make required adjustments when procedures change due to product upgrades or tighter industry standards. Because product cleanliness is the cornerstone of good lubrication, there has been a lot of focus on ISO Cleanliness Standards and filtration by manufacturers and other industry segments. Phillips 66 deals with the entire cradle-to-grave process to ensure its lubricants will perform as intended. The following are just a few items in place to make sure the customer gets the best lubricants on the market.

DEDICATED ABOVE-GROUND BULK STORAGE TANKS

Bulk storage tanks must be professionally labeled to include not only product identification but also required state and federal information. Tanks are equipped with a suitable connection for taking samples for quality-control auditing, and vented with a system to prevent moisture, particulates and other contamination. Phillips 66 has an established compatibility guide to assist marketers and end users with finished-lubricant handling and loading sequences. Each facility that handles Phillips 66 bulk lubricants must employ dedicated transfer systems assigned to each product class.

FILTRATION AT MAJOR BULK FACILITIES

Phillips 66 has worked with key Marketers and end users to add filtration to their bulk storage tanks for over a decade. This ensures any contamination of new oils that may have occurred between our finished-lubes supply plant and the end user is efficiently removed. Phillips 66 offers technical resources to assist with any filtering needs.

SAMPLE RETAINS OF BULK-LUBRICANT DELIVERIES ARE A KEY COMPONENT TO QUALITY CONTROL AT PHILLIPS 66

Samples of finished fluids are taken upon receipt of product from the Phillips 66 lubricant supply point. When deliveries are made to an end user, another sample is also taken. This process ensures representative samples are available should questions arise regarding lubricant quality. In such situations a fast and efficient way to resolve the matter is already in place. Top Tier Marketers who repackage Phillips 66 Lubricants take retains following this procedure also.

Requirements are also in place for the handling process, from loading Phillips 66 Marketer bulk delivery equipment to product transfers at the customer's storage tank. Optionally, Phillips 66's Top Tier Marketers' delivery trucks may incorporate on-board filtration to provide assurance that the delivered product is free of any contaminants at the time of delivery.

ALL MARKETERS WHO HANDLE PHILLIPS 66 LUBRICANTS MUST DOCUMENT THEIR HANDLING PROCESS. DOCUMENTATION SHALL INCLUDE INFORMATION ABOUT THE FOLLOWING POLICIES AND PROCEDURES:

- Health, safety and environmental information and compliance
- Handling and storage
- Receiving
- Chain of custody
- Delivery
- Packaging

CLEANLINESS FACTS

There has been a lot of discussion in the industry about particle counting and its relationship to perceived fluid cleanliness. When it is necessary to do particle-count testing on heavy-duty lubricants, keep in mind that the high levels of performance additives in these fluids often return false positives, i.e., yield a high particle-count result. Affected products include diesel engine oils, power transmission fluids and hydraulic tractor fluids. These types of fluids typically give a high particle count when analyzed with an optical counter.

Some of the performance additives contained in these fluids, antifoam agents in particular, are not fully soluble in oil and thus will give false positives when using an optical particle counter. That is, the particle counter cannot distinguish between an abrasive particle and certain performance additives. Even some polymeric materials can give false positives.

As an example, all Phillips 66-branded tractor hydraulic fluids are formulated with high levels of antifoam to meet specific OEM performance requirements. This leads to “elevated” particle counts that will not adversely affect product performance. The customer needs to be aware of this when discussing ISO Cleanliness with respect to Heavy-Duty Commercial Lubricants.

Performance additives that are polar will tend to gather and form larger particles of the type registered by an optical counter. These particles when filtered become much smaller and the particle count is reduced. This gives the impression of “cleaning” the fluid when in fact the additives have simply been re-dispersed.

The following chart shows the drastic difference in results when samples are not prepared and analyzed properly for ISO cleanliness codes. This is especially true when analyzing heavy-duty fluids. With proper dilution and methodology, the results will give a true and accurate value as to actual harmful particles.

ADDITIVE INTERFERENCE ON P66 HEAVY-DUTY LUBRICANTS

PRODUCT	ISO CODE WITH ADDITIVE INTERFERENCE 1	ISO CODE WITHOUT ADDITIVE INTERFERENCE 2	PATCH TESTING
Powerdrive 10W	23/23/20	17/15/12	15/14/11
Powerdrive 30W	24/23/19	17/15/13	15/14/11
Powerdrive 50W	23/23/19	18/15/12	15/14/11
Guardol ECT 15W-40	23/21/16	19/16/12	16/15/12
Powertran	24/23/16	18/17/14	17/15/12

1. These are test results using undiluted sample preparation.
2. These are test results using dilution sample preparation method (ASTM 7647).



TERMINOLOGY/DEFINITIONS:

“**Clean**” **fluid:** A relative term that tends to be used carelessly throughout the industry. Determining whether a lubricant is considered “clean” depends on whether the lubricant is new or in-service, the lubricant type, and the intended application.

“**Dirty**” **fluid:** This is also a relative term that tends to be used carelessly. Determining whether a lubricant is considered “dirty” depends on the same variables mentioned above.

Polishing: This refers to reducing the particle count of new oil.

Industrial lubricants: These lubricants typically contain low levels of additives and are used in various applications. The most popular include hydraulic oils, R&O/turbine oils, gear oils and grease. Niche products include metalworking, slideway and insulating oils.

Heavy-duty lubricants: These typically contain high levels of additives and are used in mobile applications in the mining and construction industries. Products included in this family are engine oils, tractor hydraulic fluids and TO-4 fluids.

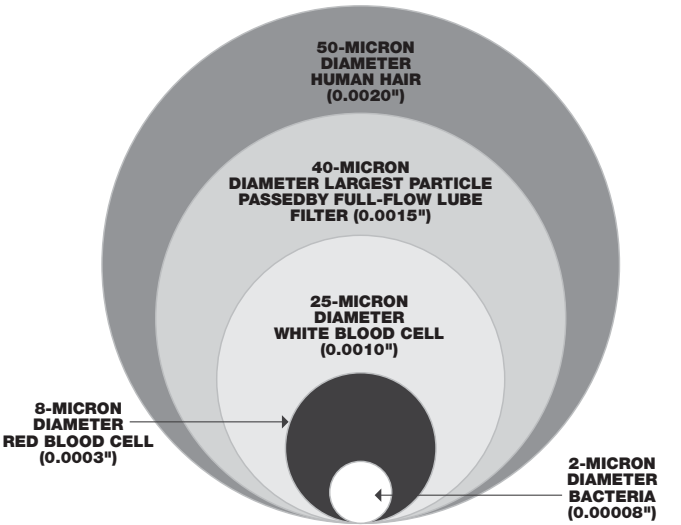
Optical particle counter: This instrument uses a light to create particle shadows on a photocell detector that can relate the size of the shadow to the size of the particle. The shadows can be cast by water, air or even additives, which can artificially increase the particle count.

Patch test: A method of determining particle count by diluting a certain sample volume in solvent before pulling it through a specified micron filter patch. Then, the particles are manually counted using a microscope.

LNF (LaserNet Fines): LNF is an instrument used to provide highly accurate particle counts and particle shape classifications (cutting, severe sliding, fatigue, nonmetallic, fibers or water droplets) with proper fluid conditioning. The instrument uses a pulsed laser diode to capture the images of the particles.

ISO 4406:99 Rating: The reporting standard for fluid cleanliness. A range number is assigned particle count values from micron levels greater than 4, 6 and 14. See table at right.

Additive interference: The artificial increase in ISO 4406 rating (particle count) when measuring highly additized fluids such as heavy-duty lubricants. Typically the anti-foam (silicone compounds and acrylates) causes the most substantial interference when creating insoluble micelles to collapse foam. This can be mitigated by using more accurate particle-counting methods and/or by pre-treating with solvent according to ASTM 7647.



ISO 4406 CHART		
Range Number	Number of particles per mL	
	More than	Up to and including
24	80,000	160,000
23	40,000	80,000
22	20,000	40,000
21	10,000	20,000
20	5,000	10,000
19	2,500	5,000
18	1,300	2,500
17	640	1,300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64

ISO R₄/R₆/R₁₄

This format represents the number of particles greater than 4, 6 and 14 microns in one milliliter of sample.

FILTRATION OF PHILLIPS 66 LUBRICANTS

Absolute Filter Rating: The size of the largest particle that will pass through the filter or screen.

Beta Ratio: A value that is related to filter efficiency (see table below) that is determined by the ISO 16889:1999 standard for multi-pass testing. In simple terms, it is the ratio of upstream particles greater than a certain micron rating to downstream particles greater than a certain micron rating.

If a higher beta ratio is used, the oil will not need to make as many passes through the filter nor kidney loop for an extended period. This can save customers time, but may cost more up front.

CONTAMINANT CHALLENGE (PARTICLES/mL)	DOWNSTREAM FLUID QUALITY (PARTICLES/mL)	BETA RATIO	% EFFICIENCY
1,000,000	500,000	2	50
	50,000	20	95
	13,000	75	98.7
	5,000	200	99.5
	1,000	1,000	99.9

P66 Recommendation. In general, Phillips 66 recommends limiting the micron size to **7 microns** for **heavy-duty** lubricants and **5 microns** for **industrial** lubricants. Depending on temperature, flow rate and other special considerations, Phillips 66 may allow alternative filter recommendations. Contact the local lubricant engineer or P66 Technical Services to discuss additional filtration methods in detail.

PHILLIPS 66 LUBRICANTS ULTRA-CLEAN FLUIDS

The most effective way to ensure ultimate fluid cleanliness is to filter at the final point of putting the fluid in service. However, Phillips 66 does offer select fluids such as “Ultra-Clean” directly from our facilities, and has been doing so since 2007. The following industrial products are considered “Ultra-Clean” according to their respective ISO Cleanliness Code:

- Megaflow AW Ultra-Clean Hydraulic Oil – 17/15/11
- Ultra-Clean Multipurpose R&O Oil – 17/15/11
- Ultra-Clean Spindle Oil – 17/15/11
- Ultra-Clean Turbine Oil – 18/16/13

These Ultra-Clean products are filtered at 5 microns before being packaged into sealed containers. Bulk Ultra-Clean products are also available and are delivered using dedicated transportation. The Ultra-Clean products provide the same performance as their parent product, plus the benefit of polishing for use in applications that are more sensitive to particle contamination.

Phillips 66 makes every effort to supply clean, high- performing lubricants to the end user. The information provided here about industry methods and procedures is intended to help you make an informed decision when implementing lubrication programs. ISO particle counting can be a very good tool, but fluid type and measurement technique need to be factored in when interpreting results. Phillips 66 has a warranty policy for its manufactured fluids and our Top Tier Marketer program ensures they are delivered to exacting specification.



SOLUTIONS FOR THE DAILY GRIND.

Phillips 66® Lubricants offers a complete line of products for a wide variety of industries.
Check with your supplier today for more information and product availability.



For more information, call our Technical Hotline at 877.445.9198 | PHILLIPS66LUBRICANTS.COM