

BioBlend White Paper:

A Guide to Converting to BioBlend Biodegradable Lubricants

Flushing Procedures with the use of BioBlend SynLube LFC5111 Flushing Compound

Congratulations on your decision to use BioBlend product technology and do your part to protect your equipment investment, and the environment you live and work within. Your decision will support your company's green and sustainability initiatives, reduce our dependency on foreign oil, and minimize your carbon footprint.

The life of any lubricating oil depends on many factors including; operating conditions, operating environments, system cleanliness, maintaining proper oil fill levels, and minimizing both internal and external contaminant sources. Regardless of the lubricant you're converting from/to, optimum lube performance can best be achieved by removing as much of the current conventional petroleum, synthetic, or bio-based lubricant as possible.

Based on the current operating condition of your system, a simple lubricant '**drain and fill**' may suffice. It is important to remember to drain the used lubricant contained within the oil lines and any system componentry (*as applicable*) and replace used oil filters with new oil filters at the time of the '**drain and fill**' oil change.

To optimize new BioBlend lubricant performance, and to achieve the optimum oil drain interval under your systems operating conditions, BioBlend recommends a preventative maintenance approach using an ongoing **Oil Analysis Program** to monitor the condition of the oil before and after the oil change, as well as throughout the life-cycle of the lubricant while in service. This is the only way you can react to identified contamination and wear problems, and minimize the potential for unexpected system failure.

While a '**drain and fill**' approach is simple, and offers your lowest cost and time commitment option, sometimes optimum lubricant performance will not be achieved using this standard approach due to operational difficulties caused by a contaminated system, or a system with heavy deposits (*sludge, varnish, other oxidation by-products, dirt, wear metals, etc.*). In these cases the mechanical lubrication system must be completely cleaned of deposits (*i.e. flushed*) prior to draining the existing lubricant to safely and effectively remove the contaminants often present in these deposits. System operators do not need the potential mechanical complications that can arise if the contaminants and deposits within the system become entrained in the oil after being removed by the new BioBlend replacement oil - where they're free to constantly circulate about the system.

Many new oils, especially bio-based lubricant technologies, do a significantly better job of cleaning metal surfaces, and keeping metal surfaces clean during operation, than the lubricants they replace. This is particularly true when replacing conventional mineral oil lubricants (*i.e. petroleum products*). New oil cannot be expected to halt the debilitating impact of pre-existing deposits and contamination, any better than an oil could be expected to fix a pre-existing leak.

Planning & Preparation

Proper planning and preparation is needed to make an efficient change or conversion from conventional petroleum or synthetic lubricants to biodegradable BioBlend lubricants - and thus meet the standards of biodegradability required in North America. Considerations include:

- 1) Optimally, lubricant system change-outs should be done inside, and at an ambient temperature of at least 68°F (20°C).

- 2) You'll be taking multiple oil samples and thus need to plan accordingly. Make sure you have the appropriate number of BioBlend sampling kits (*i.e. clean, 4 ounce, plastic oil sample bottles*). You also need to have a marker to properly identify and label the oil samples correctly. For instance:
 - a) **Sample #1:** 'Prior' to adding BioBlend LFC5111 Flushing Compound to the existing fluid lubricant, and after the oil is brought up to normal operating temperature, a sample of the existing used oil should be taken from the fluid reservoir. This aids you in quantifying the condition of the oil and lubrication system prior to implementing any oil change protocols.
 - b) **Sample #2:** After you have treated the oil with BioBlend LFC5111 Flushing Compound and run the system for the prescribed flushing period – a used oil sample with the flushing compound in it should be taken from the fluid reservoir. This helps you quantify the condition of the lubrication system after the cleansing and decontamination flushing phase - and provides insights on the equipments operating condition.
 - c) **Sample #3:** immediately after opening the new oil container, and prior to any new oil being added to the lubrication system, a new oil sample should be taken from the new oil container. This provides you a baseline (*i.e. starting point*) on the new BioBlend oil being put into service.
 - d) **Sample #4:** It makes good sense to take an oil sample from the fluid reservoir after ~24 hours of normal operation on the new oil fill. This will give you an idea of how much contamination still remains in the system, and will allow you to verify that the majority of the LFC51111 Flushing Compound has been effectively removed.
 - e) Ongoing or periodic used oil samples of your selected BioBlend oil should be taken at intervals prescribed by your BioBlend Distributor - based on your unique application and/or situation. This is necessary to aid you in establishing a safe and effective oil drain interval on your select biodegradable BioBlend fluid.

- 3) It is strongly recommended that you use a desiccant filter for open hydraulic systems.

- 4) Use quality filters according to the manufacturer's recommendations. The filter should conform to standard 18.22 and be able to retain condensation. Keep in mind that in most cases any water content over 1000 ppm is considered damaging.

- 5) Make sure you have:
 - a) Enough BioBlend LFC5111 Flushing Compound on hand to treat the total oil volume at 5%.
 - b) Enough new BioBlend lubrication oil to fill the oil reservoir and all associated lubricant lines and componentry.
 - c) New filters (*or filter cartridges*). Remember, based on the condition of your system, one replacement filter may not be enough. Plan ahead and have a minimum of two new filters – or more for systems with high levels of oil oxidation by-products and contaminants.

Flushing Guidelines

To optimize the performance of the new BioBlend lubricant and ensure an effective cleansing of lubrication systems when heavy deposits are already in place, BioBlend recommends the use of **SynLube LFC5111 Flushing Compound**. BioBlend SynLube LFC5111 Flushing Compound is fully compatible with most petroleum and synthetic lubricants, and will present no problems when making a change to biodegradable BioBlend lube technologies. The only notable exception is systems currently using polyalkyleneglycol (PAG) base oils as PAG's are incompatible with almost all other oils, including other PAG's.

When it's determined to be necessary to clean and flush a lubrication system in order for you to obtain maximum effectiveness of your selected BioBlend product, please follow these guidelines and use BioBlend SynLube LFC5111 Flushing Compound.

STEP 1: Run your equipment with its current charge of 'used' oil for at least 30 minutes (*the goal is to bring the oil up to normal operating temperature*).

Oil Sample #1: Fill an oil sample bottle or BioBlend test kit/oil sample bottle with existing oil from your lube oil reservoir and return to BioBlend, or your select oil analysis laboratory. This will provide you a baseline of the current used oils condition.

STEP 2: **Gradually** add SynLube LFC5111 Flushing Compound as a pre-drain treatment to the existing oil to no more than 5% of 'total reservoir capacity', installing a fresh oil filter at time of LFC5111 treatment.

RESERVOIR CAPACITY	RECOMMENDED SYNLUBE LFC5111 TREAT RATE (5% max)
1 gallon	0.05 gallons (6.4 ounces)
5 gallons	0.25 gallons (32 ounces)
10 gallons	0.5 gallons
50 gallons	2.5 gallons
100 gallons	5 gallons

STEP 3: Run the system for a 'minimum' of 10 hours while monitoring the filters pressure differential for signs of filter clogging. For optimal decontamination of the system - run the LFC5111 Flushing Compound treated lubrication system for 100 hours.

NOTE: IT IS IMPORTANT TO MONITOR FILTERS! The superior cleansing ability of LFC5111 Flushing Compound will dissolve old oil deposits, gunk and varnish left by use of petroleum and synthetic products with no harm to seals or paint. IT CLEANS AS YOU USE IT!

STEP 4: Completely drain the lubricating oil system, and replace the oil filter/cartridge with a new oil filter/cartridge. Every lubrication system is unique and may have a unique system configuration. The following protocol should be applied - in general - when draining the existing oil with the LFC5111 Flushing Compound treatment as a means to affect as complete an oil drain as possible.

- 1) Put system componentry in the optimized position to facilitate the draining of the still warm, used lubricating fluid.
- 2) Take an oil sample of the used oil at the pressure control connection.

Oil Sample #2: Fill a BioBlend test kit/oil sample bottle with the current existing oil with the LFC5111 Flushing Compound mixed in it and return to BioBlend, or your select oil analysis laboratory. This will provide you a snapshot of the degree of cleaning achieved by using the LFC5111 Flushing Compound in your existing oil.

- 3) Open the main oil reservoir and empty it by completely 'pumping out' the reservoir until it is empty.
 - i) This is important in that many times the oil reservoir has 'nooks and crannies' where the oil will not flow down to the oil drain plug – typically located at the lowest point in the hydraulic system. The only way to remove 'trapped oil' is by vacuuming out the hydraulic oil reservoir.
- 4) When the oil reservoir is pumped out and empty, remove the oil reservoir drain plug and make sure you have drained all used oil from the reservoir completely. If accessible, and if required, manual cleaning of the oil reservoir may be warranted.

- 5) Disconnect the suction line to the pump, directly at the pump.
- 6) Disconnect the suction lines of the feed pump and the cooler pump (*if applicable*) and empty completely.
- 7) Disconnect and remove the main filter (*and filter cartridges if they are inserts*).
- 8) Disconnect the pressure hose from the cooler pump.
- 9) Using air pressure - empty the cooler to the hydraulic reservoir.
- 10) Replace all filters/filter cartridges with new filters/cartridges.
- 11) Inspect all system hoses and or fluid supply piping – replacing any that are damaged.
- 12) The objective is to '*completely*' drain the entire lubrication system, lines, and componentry.
 - i) If sludge is present in the oil reservoir after draining, use manual cleaning methods to remove as much of the sludge as is feasibly possible.
 - ii) Varnish compounds will be dissolved in the warm oil. If this oil is allowed to cool, oxidation by-products (*varnish*) will settle and coat metal surfaces – thus the need to conduct the oil change with the oil at, or as near to operating temperature, as possible.
 - iii) All used oil should be disposed of as waste oil in accordance with local and state regulations and/or mandates.

STEP 5:

Oil Sample #3: Fill an oil sample bottle or BioBlend test kit/oil sample bottle with new BioBlend oil directly from the container after you open it, and return to BioBlend, or your select oil analysis laboratory. This will provide you a baseline of the new BioBlend oil being put into service.

Make sure oil drain stops are put back in place and tightened securely. Fill the lubricating oil system with the recommended new biodegradable BioBlend fluid. Make sure that the lubricating oil reservoir is filled to the appropriate level, and that the oil volume necessary to fill all lube lines – and associated componentry - is also taken into consideration.

STEP 6: If possible run the equipment at idle, or in an unloaded mode, to ensure that the replacement BioBlend lube oil safely travels throughout the lubricating system. Recheck the oil reservoir fill level to make sure it's still full after the system has had some operational time. Sometimes when a complete lubricating system drain is achieved it takes additional oil to completely fill up the oil lines, and to replace any oil that traditionally becomes trapped during a simple drain and fill protocol.

STEP 7: Operate equipment normally.

- Continue to monitor differential oil pressures across your oil filter since biodegradable BioBlend oils have a higher degree of solvency than conventional petroleum oils, and some synthetics (*like PAO's for instance*).
- The ongoing detergency nature of biodegradable oils serves a great purpose by continuing to work hard to restore, and maintain, a clean and functional lubrication system.
- After a change to biodegradable BioBlend oils, varnish deposits not loosened during the initial flushing phase may loosen, become entrained in the fresh oil fill, and cause circulation problems.

Continue to check and monitor changes in oil pressure across the oil filter to prevent the filter(s) from plugging, and keeping the lube system from going into bypass (*if plumbed to allow for oil bypass*). A recirculation filtration system to achieve a level of oil system cleanliness meeting the OEM's guidelines, and in accordance with applicable

ISO standards, is recommended. With hydraulics, for example, the general objective is to reduce the amount of contaminant particles greater than 5 microns in size.

Oil Sample #4: Fill an oil sample bottle or BioBlend test kit/oil sample bottle with the newly installed BioBlend oil after ~24 hours of operation, and return to BioBlend, or your select oil analysis laboratory. This will give you an idea of how much contamination still remains in the system, and will allow you to verify that the majority of the LFC51111 Flushing Compound has been effectively removed.

STEP 8: Consult your BioBlend distributor or representative to set up an ongoing oil analysis program. Sample frequency, to include specific recommended tests, can be recommended based on your equipment needs and unique operating conditions.

STEP 9: To gain the ultimate in your biodegradable lubricant performance you may REPEAT the flushing procedure after six months of normal operation.

Please feel free to contact your BioBlend account representative, or a BioBlend corporate representative, with any additional questions you may have. We appreciate the opportunity to be of service to you.

BioBlend Renewable Resources, LLC made their lubricant debut in the field in 2001. Since then, we've continued our bio-lubes innovation quest expanding our product line to include not only the most advanced biobased lubricant technologies available, but also food grade and synthetic lubricants. BioBlend's goal is to provide environmentally responsible products and solutions to a wide range of industries. Our customers come to us from every corner of the earth and in every industry: drilling, mining, construction, agriculture, marine, food processing, government, and many more. The BioBlend team has a wealth of experience in lubricants, manufacturing, and distribution. The company also has the venture capital backing of Archer Daniels Midland (NYSE: ADM) and Quest Technology Ventures.

- ✓ **Made in the United States of America**
- ✓ **Renewable**
- ✓ **Readily Biodegradable**
- ✓ **Minimally Toxic**
- ✓ **Sustainable**
- ✓ **Performance Driven**
- ✓ **Cost Competitive**

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