

Wind turbine gear oil conversion



Energy lives here

Why upgrade your lubricant?

When changing the oil in your wind turbine gearbox, there are a number of good reasons to upgrade to a Mobil lubricant:

- You want to extend your oil drain intervals to reduce the safety risks associated with maintenance
- Total cost of ownership calculations reveal that higher performance synthetic oil is more cost effective than conventional oil and increases your productivity
- You want the performance benefits of our next generation flagship wind turbine gear oil, Mobil SHC™ Gear 320 WT, or Mobilgear SHC™ XMP 320 gear oil, the current industry standard
- You want the global supply reliability and product consistency assured by a Mobil lubricant
- Your used oil analysis indicates your current oil is past its useful life
- You're having problems with your current oil, such as:
 - Frequent maintenance downtime for oil drains and equipment repair
 - Micropitting and scuffing issues
 - Substandard performance in challenging conditions
- Your turbine is down for other maintenance and it just makes sense to change the oil at the same time

Whatever the reason, these guidelines can assist you in the conversion process.

Preparing for conversion

Mobil engineers recommend beginning by collecting some baseline data for future investigation and troubleshooting, such as:

- Oil level and oil life
- Top ups and foam (if appeared in sight glass)
- Gear, bearing and filter conditions

Oil samples should be sent for analysis, and your Mobil lubricants representative can help you choose the appropriate test slate. If there is a used oil analysis (UOA) program already in place, review the history and note existing trends.

When changing gear oils, flushing is generally regarded as a best practice.

Compatibility and flushing

Next, your Mobil lubricants representative can determine the compatibility of the new and current oils. Because today's wind turbine gear oils are formulated with a variety of base oils and additives, they are not always compatible.

If the oils are compatible and the gearbox is relatively clean, you can drain and refill the system. However, if there are deposits present or the oils are not compatible, it's best to flush the gearbox before upgrading. Flushing is generally regarded as a best practice in any event.

Step-by-step guidelines for conversion

1. Determine compatibility of the existing and new oils. (Consult a Mobil lubricants representative.)
See Table 1 on oil compatibility conditions.
2. Run the turbine with existing oil and bring up to normal operating temperature. Obtain a 4-ounce (120 mL) oil sample to establish condition of gearbox. Document current filter life and any operating temperatures that are typically monitored.
3. Ensure cooler (if existing) is running. Drain as much oil from the gearbox as possible, including filter housings and cooling systems. Oil temperature should not be lower than 30°C.
4. Inspect the gearbox. If it contains severe deposits from wear materials, contamination and/or lubricant breakdown or aging, a system cleaner may be added to the existing oil. (For guidance on cleaner usage and type, consult a Mobil lubricants representative. It might be necessary to take oil samples before adding the cleaner.)
5. Run the oil-circulating pump until all oil has been removed from the gearbox. Stop pumping as soon as the sound indicates the gearbox is running empty.
6. Clean the filter housing of all deposits and particles.
7. Open the gearbox covers, inspect for residue (particles, sludge) and remove it as well as possible, paying particular attention to oil pockets.
8. Open all system components at their lowest level. Ideally, remove the components — such as external oil heaters, heat exchangers, oil filter housings, oil pump pressure differential switches, oil level sensors and thermostats. Clean or replace O-rings. Replace breathers with the correct desiccant type.
9. If possible, document cleanliness by taking photos of all parts.
10. If the two oils are not compatible (see Step 1), replace all removable filters so that the new oil is not contaminated by filter residue. Use filters recommended by the wind turbine manufacturer.
11. If the oils are compatible and the cleanliness is acceptable, continue with Step 17. Otherwise, continue to Step 12.
12. If a pump and high-pressure wand are available, use them to wash components. If not, proceed to Step 13.
13. Fill the gearbox with flushing oil to the minimum level for the oil circuit. Mobil engineering recommends using the same product as will be used for the final fill. Confirm the required fill volume (typically ~60 percent gearbox capacity) with the wind turbine manufacturer.



14. Circulate the flushing oil and run the turbine unloaded until reaching an oil temperature of at least 60°C/140°F. (If feasible to run turbine under load, this is acceptable.) Depending on the level of contamination, flushing should last at least one hour. If it is not practical to run the turbine unloaded, use the primary lube pump to circulate the oil. Document duration and temperature during flush. Monitor gearbox for abnormal temperature and filter plugging, and document as necessary. Maintain a supply of spare filters on-site.
15. Drain the flushing oil from the gearbox. If necessary, remove sludge carefully from the gearbox base and, if possible, take a sample. Note: It is possible to reuse flushing oil for multiple flushes to reduce costs, but consider cleanliness before each use.
16. Open access hatches and inspect for deposits from previous oil. Remove oil level control and clean carefully. Remove and clean the permanent magnet of the oil drain plug. If possible, document cleaned system with photos.
17. Replace the filters.
18. Disconnect cooler line and drain. Reconnect cooler line.
19. Fill the gearbox with Mobil lubricant. Comply with the oil cleanliness specified by the wind turbine manufacturer. Mobil recommends using filters with mesh sizes no smaller than 3 micron.*
20. Check the system for leaks and run for at least 15 minutes. Check that the oil level meets OEM requirements and then send a sample to Mobil for analysis to establish a baseline. If feasible, the baseline sample can be taken within 24 hours of the fill. (Consult a Mobil lubricants representative.)
21. Compare the baseline sample taken in Step 20 with a fresh oil sample from the drum. Continue to monitor and document performance of used oil from the gearbox over time.



Determining if flushing is required

A Mobil lubricants representative can advise if the existing and new oils are compatible, performing detailed testing, if necessary.

To determine gearbox cleanliness, reference previous inspection information and historical UOA reports. These analyses, in conjunction with compatibility testing, can help determine if flushing is required. A decision should be made after the oil has been drained and cleanliness of the gearbox and associated system components (such as filters) has been visually confirmed.

General guidelines or procedures for converting to Mobil wind turbine gear oils can be found in **Table 1**. Refer also to the wind turbine OEM procedures when available. Some variance will occur depending on whether a pumping system is used or if the oil is supplied in pails.

Table 1

Oil compatibility	Gearbox deposits/contamination	Preferred conversion approach	Alternative conversion approach
Good	No	Drain and fill	
Poor	No	Drain, flush and fill	Drain and fill (if complete drain is possible)
Good	Yes	Drain, clean, flush and fill	Drain, flush and fill (cleaning agent added to in-service oil if necessary)
Poor	Yes	Drain, clean, flush and fill	Drain, flush and fill (cleaning agent added to in-service oil if necessary)

*Note: Always use filter media recommended by the wind turbine manufacturer or filter supplier. Mobil lubricants will be pleased to offer advice when refilling or converting to Mobil gear oils. When flushing using a pumping system, consider changing the filter to a special flush filter.

Frequently asked questions about oil conversion

What level of flushing is required for wind turbine gearboxes?

The aim of flushing should be to remove as much residue and previously used oil as possible. Without flushing, pockets of oil would be left in the system, possibly including contaminants and solids that could reduce the life and performance of the new oil and even the life of key components.

Gearbox cleanliness and oil compatibility determine the extent of the flushing process, but other factors are sometimes considered, such as available time, resources and existing practices. Mobil engineers recommend a thorough flush, especially when a flushing requirement is indicated.

What flushing oil do Mobil lubricant experts recommend?

Special flushing oils can do a great job. Care needs to be taken in selecting the correct product and procedure, however, so that oil left in the gearbox from the flush will not hinder the performance of the new oil or reduce the overall viscosity (if a lower viscosity oil is used to flush the gearbox). Mobil recommends flushing with the same oil that will be used as the final fill oil. Consult a Mobil lubricants representative when using any system cleaners.

Do Mobil wind turbine lubricants need to be filtered before refilling the gearbox?

Although Mobil wind turbine gear oils are filtered to high standards during the manufacturing process, there are multiple sources for potential contamination between leaving the lube blend plant and delivery to the customer. The cleanliness of the oil upon delivery is not as important as the cleanliness as it enters the gearbox itself. Therefore, the methodology and maintenance practices used to conduct the oil change are extremely important.

The oil circulating in the gearbox should be maintained ideally at a cleanliness level of ISO 16/14/11. If the oil is simply poured into gearboxes, the cleanliness of the oil will be impaired. Introduction of the new oil should be via a closed system. This maintenance practice — coupled with good filtration, which typically includes off-line filtration — will ensure that the high cleanliness levels are maintained.

Are there any tips for proper storage and handling of wind turbine oils?

Because different oils are not always compatible, care must also be taken in handling and storage of lubricants to ensure that there is no ingress of foreign materials, which could compromise the designed performance of the lubricant.

