

TurboCool™ Comparison Guide

Quick Reference Table

	Mineral Oil	Original TurboCool™ / HD	TurboCool™ 32/46	TurboCool™ PG
	Typical Properties	Superseded	Current	Current
ISO Viscosity	32	32 / 46	32 / 46	25
Viscosity @ 100°C	6.0	5.6 / 6.8	6.06 / 7.50	4.9
Viscosity Index	91	107 / 97	139 / 139	131
Oil Life	Up to 1 year 8k hrs	Up to 3 years 24k hrs	Up to 3 years 24k hrs	3+ years 24k+ hrs
Oil Base	MO	Synthetic Hydrocarbon/Ester	GTL	PAG/POE
Oil Group	I	II	III+	V
Foaming Tendency	**	***	*****	*****
Air Release	***	*****	*****	*****
Lubricity	***	***	***	*****
Varnish Resistance	**	**	***	*****
Conductivity	Low	Low	Low	High
Polarity	Non-Polar	Non-Polar	Non-Polar	Polar
Cross Compatibility*				
Mineral Oil	Yes	Yes	Yes	No
PAO Oil	Yes	Yes	Yes	No
Ester Oil	Yes	Yes	Yes	Yes
PAG Oil	No	No	No	Yes

*See section below on compatibility for additional guidance and limitations.



Difference: TurboCool™ 32 versus TurboCool™ PG

The primary difference between the new TurboCool™ 32 and TurboCool™ PG is the base oil composition, in which the polyalkylene glycol base fluid is made up of polar molecules. Polyalkylene glycol itself has nearly zero varnish potential but when oxidation by-products are generated in the form of sludge or varnish, they are also polar in nature, allowing them to dissolve back into the lubricant and helping to prevent the possibility of deposition and subsequent varnish formation. This natural solvency characteristic leads TurboCool™ PG to have an excellent overall resistance to varnish formation as the oxidation particles remain trapped in suspension in the lubricant instead of being able to deposit on system surfaces. TurboCool™ 32 on the other hand relies on a robust system of specialized additives to enhance the fluids oxidative stability in preventing the formation of these by-products. The lifetime of any hydrocarbon based lubricating oil will be limited by its capability to continue to resist oxidation particles and prevent varnish deposits. If varnishing issues are suspected in a machine, additional testing with ASTM D7843 membrane patch colorimetry can be performed to verify the varnish tendency of the lubricant.

Definitions and Notes:

ISO Viscosity:

For any FS-Elliott centrifugal compressor which requires an ISO 32 lubricant as the original fill, you can either continue to use TurboCool™ 32 in place of the Original TurboCool™ or optionally, you can switch the machine to the alternative TurboCool™ PG. You will note that TurboCool™ PG has a lower base kinematic viscosity at 40°C rating of 25 cSt. The PAG base of the oil has a higher viscosity index which means that the viscosity changes at a lower rate as a function of temperature. The important part to note is that the kinematic viscosity at 100°C is similar to that of the standard TurboCool™ 32 giving it similar flow and pressure characteristics in the oil system at operating pressure.

Oil Life:

Like Original TurboCool, TurboCool™ 32 and 46 retain a typical useful life of up to 3 years or 24,000 hours. The new TurboCool™ PG is expected to have a typical useful life in excess of 3 years or 24,000 hours. As always, operational and environmental conditions for each individual compressor will necessarily dictate the actual useful life of the compressor lubricant being used which is why we stress the importance of regular oil sampling either with the FS-Elliott program or the end user's internal program.

The typical properties to verify at every oil sampling interval to ensure useful life are the Acid Number, ISO Cleanliness and Oxidation Levels. Typically, an oil should be condemned if the viscosity varies greater than +25%/-10% of the original ISO rating or an Acid Number increase is greater than 0.4 mg KOH/g.

Oil sampling will also measure the levels of moisture, wear metals, and other contaminants which can help to address potential problems before they can impact system operation.



Oil Groups:

The American Petroleum Institute (API) categorizes base oil groups based on source, manufacturing type and properties. The first three groups are crude oil derived. Group IV is limited to polyalphaolefins and Group V is for materials not otherwise categorized in the first four groups.

API BASE OIL CATEGORIES				
	Base Oil Category	Sulfur (%)	Saturates (%)	Viscosity Index
Mineral	Group I (solvent refined)	> 0.03	and/or < 90	80 to 120
	Group II (hydrotreated)	< 0.03	and > 90	80 to 120
	Group III (hydrocracked)	< 0.03	and > 90	> 120
Synthetic	Group IV	PAO Synthetic Lubricants		
	Group V	All other base oils not included in Groups I, II, III, or IV		

TurboCool™ 32 and 46 are categorized as a "Group III+" in marketing as they are a high viscosity index base oil, but unlike a standard Group III, they are derived from a Gas-To-Liquids process that begins life as natural gas instead of crude oil.

TurboCool™ PG is predominantly comprised of polyalkylene glycol base fluid but also has a polyol ester component. Both base fluids are categorized as Group V synthetics.

Foaming Tendency:

Small amounts of air in oil aren't uncommon, particularly if the oil is expected to become agitated, such as in a gear system. However, as oil becomes more aerated, air bubbles will rise to the surface. Depending on the surface tension, these bubbles will either burst or stay intact in the form of foam.

ASTM D892 test determines the foaming tendency and stability, that can potentially lead to inadequate lubrication, pumping cavitation or overflow loss through breathers. Foam tendency is reported as Sequences type and foam formation on the data sheet in mL of foam stability.

TurboCool™ products all contain non-silicone anti-foaming agents to control the formation of foam in the lubricants.



Air Release:

Air release is related to foaming tendency in that it concerns the amount of air that is entrained in the lubricant and how quickly it is released. Trapped air in lubricants can cause cavitation in the oil system, degradation of lubricity or loss of thermal properties. ASTM D3427 test determines air entrainment as the volume of air in a sample after leaving to separate in a vessel such as an inverted beaker. TurboCool™ products have been developed to ensure good air release to minimize entrainment.

Conductivity:

In some special cases, compressors may suffer from electrostatic discharge issues. One way to combat this problem is to add grounding rings to the drive shaft of the motor or airend to help ground static electrical discharge. This can further be addressed by using a lubricant with high conductivity to ensure any static built up is efficiently discharged into the compressor body and into ground.

TurboCool™ 32 has relatively low electrical conductivity, but this is normally not a concern for most applications. Alternatively, if there are continued electrostatic discharge issues, the machine can be changed to TurboCool™ PG which has a very high electrical conductivity value. Like the solubility properties of TurboCool™ products, this an inherent property of the base oils from which they are manufactured.

Compatibility:

While we do not recommend mixing oils, the basic oil types listed in the quick reference table are theoretically compatible on a low level. With regards to TurboCool™ products, please adhere to the following guidelines:

1. Trace amounts of previous lubricant in the compressor oil system are expected to exist when changing the lubricant. TurboCool™ products are compatibility tested with each other for up to 10% by volume mixture showing no detrimental effects, though mixture ratio and residual fluid condition can impact on the overall life of the lubricant in the system.
2. TurboCool™ 32 and TurboCool™ 46 can be used as top off oil in Original TurboCool™ and TurboCool™ HD if necessary.
3. The use of TurboCool™ CC is recommended between every lubricant drain and fill as part of the preventative maintenance process to maintain the cleanliness of the oil system and resolubilize any varnish deposits prior to draining in systems running hydrocarbon lubricants (not for use with TurboCool™ PG).
4. TurboCool™ CC is highly recommended when switching from a petroleum-based lubricant to TurboCool™ PG to ensure a clean varnish free compressor prior to fill.
5. Never mix any other lubricant or additive with TurboCool™ FG as this will invalidate the NSF food safety rating of the lubricant.

