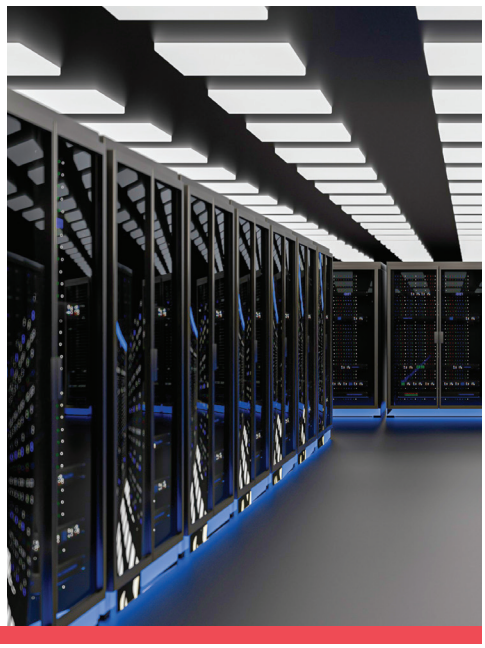
Synfluid®
Polyalphaolefins

Designed for Sustainable Performance



Chevron Phillips CHEMICAL

Performance by design.
Caring by choice.™

For extreme applications, you want a trusted performer.

Synfluid® polyalphaolefins (PAOs) are designed to meet both conventional and extreme performance requirements in a variety of applications.

Synfluid® PAOs

The proven problem solvers

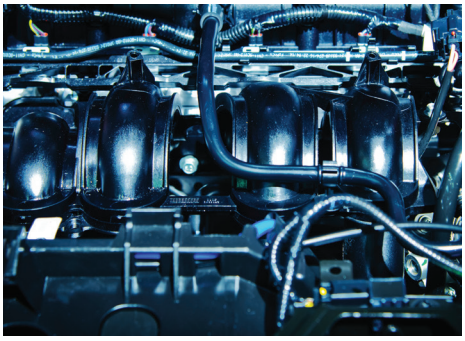
Synfluid® PAO products are trusted problem solvers in the development of new and innovative lubricants in a wide range of industries. Synfluid® PAO products' carefully designed molecules allow the user to focus on the specific performance properties needed for ever-increasing lubricant challenges. And thanks to our new Synfluid® mPAO, we now offer a broader range of viscosities. Synfluid® PAO products give you more flexibility than ever to push the limits in extreme applications.

The Synfluid® PAO product line includes low viscosity PAO 2, PAO 4, PAO 6, PAO 8, PAO 10 based on 1-decene alpha olefins ; and PAO 2.5, PAO 5, PAO 6 HVI, PAO 7, PAO 8 HVI and PAO 9 based on 1-dodecene alpha olefins. It also includes a unique set of unhydrogenated dimer products: C10 Dimer and C12 Dimer.

The Synfluid® mPAO range includes metallocene-based high viscosity mPAO 65, mPAO 100 and mPAO 150.

Synfluid®
Polyalphaolefins



Your foundation for innovation

- **High viscosity index (VI)** of our PAOs provides maximum protection in both hot and cold operating conditions
- **Low volatility and excellent thermal stability** over a wide range of temperatures
- **Outstanding oxidative and hydrolytic stability** are beneficial for achieving extended drain interval
- **High load-carrying ability**
- The ability to **retain viscosity and lubricity** in extreme temperatures
- Increased safety thanks to low flammability and high flash and fire points
- Low viscosity PAOs can be used in environmentally friendly and biodegradable fluids
- **Excellent dielectric properties** and effective liquid insulators
- All Synfluid® products are **NSF H1 and HX-1 registered** and incidental food contact certified.
- **Low friction coefficient** and fuel economy

Applications

Aviation Lubricants
The ability to retain viscosity and lubricity in extreme temperatures make our PAOs a logical choice for aviation applications.

Compressor Lubes
Superior oxidative, thermal and hydrolytic stability make our PAOs outstanding for compressor lube applications.

Dielectric Fluids
Excellent dielectric properties and long service life enable PAOs to perform as effective liquid insulators.

Drilling Fluids
Our PAOs are environmentally friendly, especially for offshore applications. As a bonus, high thermal stability results in superior performance downhole.

Engine Oils
Our PAOs are the right choice for high-performance passenger car and heavy-duty motor oils. Low volatility and excellent thermal and oxidative stability extend lubricant drain intervals and overall performance. Our PAOs' low friction coefficient boosts fuel efficiency.

Food Grade Lubricants
All Synfluid® PAOs are NSF H1 registered. These products are acceptable as a lubricant with incidental food contact (H1) for use in and around food processing areas.

Gear Oils
High thermal stability and load-carrying ability make these PAOs the superior basestocks for gear oils.

Greases
Outstanding oxidative and hydrolytic stability, and wide temperature ranges mean our PAOs are well-suited for synthetic grease applications.

Heat Transfer Fluid
Reduced volatility, better thermal stability and high flash and fire points make our PAOs superior base stock for heat transfer fluids.

Hydraulic Oils
Low flammability and good bulk modulus makes Synfluid® PAOs well-suited for hydraulic fluids.

Natural Gas Engine Oils
The high viscosity index of our PAOs provides maximum protection in both hot and cold operating conditions – a requirement of natural gas engine oils. Low volatility and excellent thermal stability are beneficial for achieving extended drain intervals in severe co-generation engine service.

Synfluid® PAO

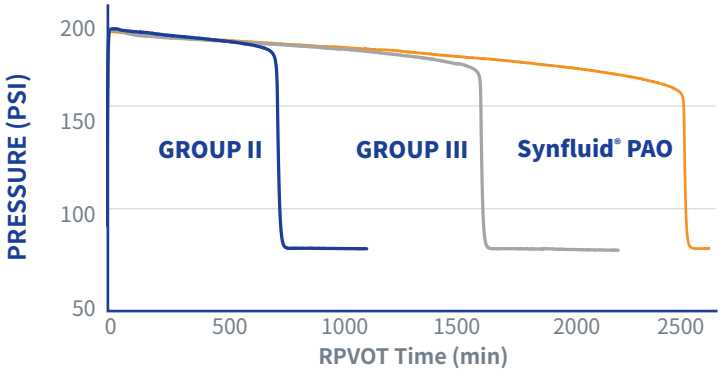
Chevron Phillips Chemical Company leads the industry in developing high quality polyalphaolefins.

PAOs are used in many synthetic products such as lubricants, greases and fluids, and have emerged as essential components in many applications. The increase in PAO applications is largely driven by the stability of the PAO molecule. This stability, along with a host of other unique performance characteristics, makes PAOs far superior to mineral oils in a variety of end uses.

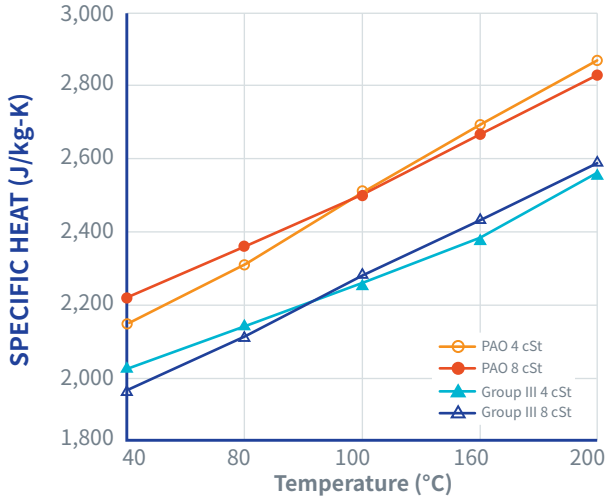
PAO advantages over mineral oils:

- Greater oxidative stability
- Superior volatility
- Excellent low-temperature viscosities
- Consistent, quality base stock
- Extremely high viscosity index
- Exceptional pour points
- Pure petrochemical feedstocks
- Low coefficient friction
- Superior thermal conductivity and heat transfer capabilities

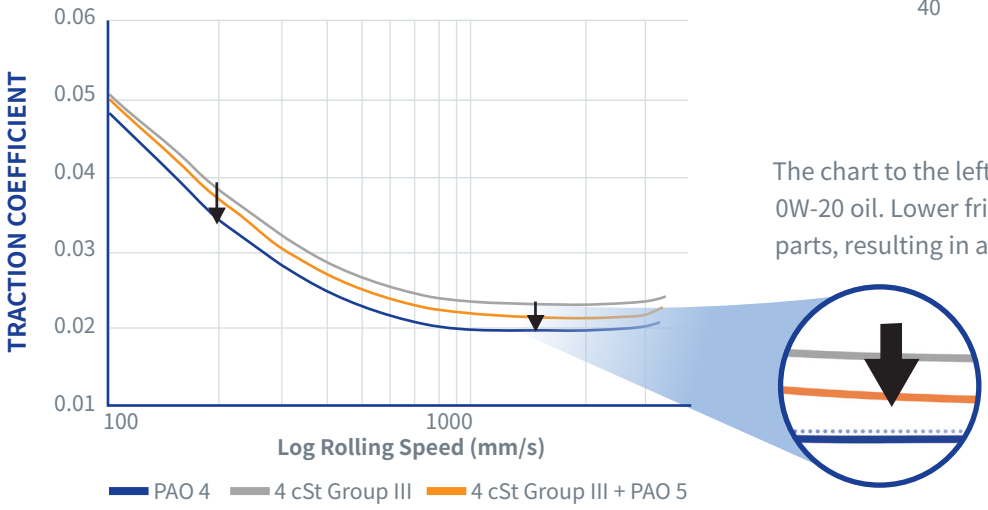
OXIDATIVE STABILITY



THERMAL CONDUCTIVITY



ENERGY EFFICIENCY



The chart to the left shows the advantages of a PAO-based 0W-20 oil. Lower friction means less work for the moving parts, resulting in an energy advantage.

PAO 4 based oil has a 14.7% lower coefficient of friction in the hydrodynamic regime compared to the Group III oil.

The advantages to PAOs are their low temperature properties and superior Noack volatility and Viscosity index.

C10 Based PAOs (Typical properties)

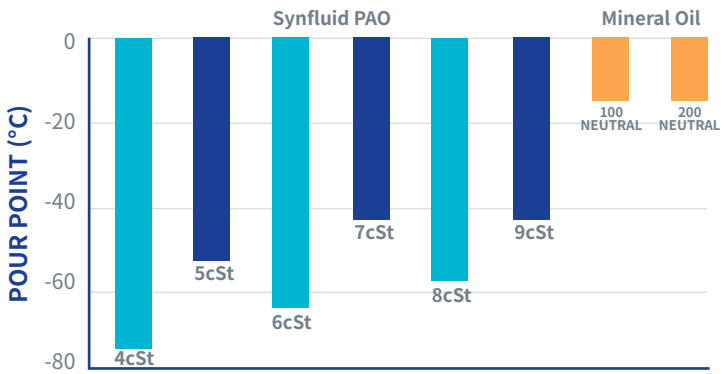
	2 cSt	4 cSt	6 cSt	8 cSt	10 cSt
Viscosity, Kinematic					
100 °C, cST	1.7	3.85	5.86	7.9	9.64
40 °C, cST	5.0	16.8	30.9	46.0	61.0
-40 °C, cST	244	2,425	7,755	17,094	30,704
Viscosity Index	—	124	137	142	141
Pour Point, °C (°F)	-73 (-99)	-72 (-98)	-65 (-84)	-60 (-75)	-58 (-72)
Flash Point (COC), °C (°F)	154 (309)	217 (423)	239 (463)	260 (500)	263 (503)
Volatility, NOACK, Wt.%	—	13.3	7.0	3.9	3.5
Specific Gravity	.798	0.819	0.828	0.8322	0.835
Density, lb/gal.	6.660	6.835	6.910	6.937	6.968

C12 Based PAOs (Typical properties)

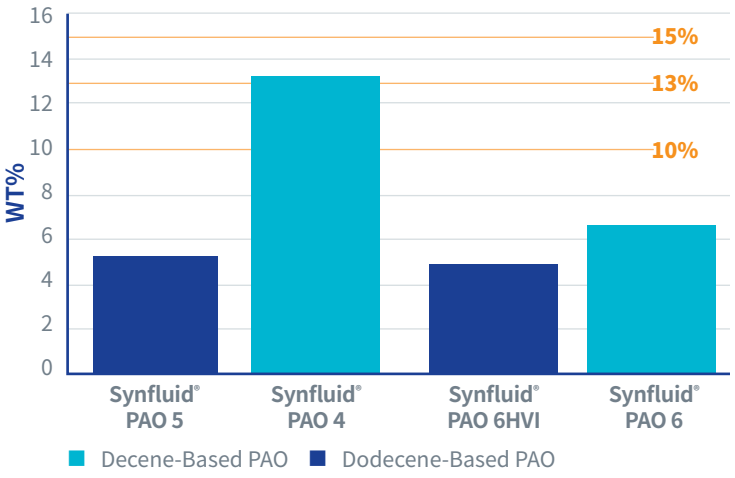
	2.5 cSt	5 cSt	6 cSt	7 cSt	8 cSt	9 cSt
Viscosity, Kinematic						
100 °C, cST	2.4	5.1	5.86	7.0	8.0	8.8
40 °C, cST	8.3	24.2	29.8	37.9	45.2	52.4
-40 °C, cST	1,811	4,809	6,728	-10,424	—	—
Viscosity Index	—	145	148	148	150	145
Pour Point, °C (°F)	-52 (-62)	-49 (-57)	-48 (-55)	-45 (-48)	-44 (-47)	-39 (-38)
Flash Point (COC), °C (°F)	178 (353)	247 (476)	249 (480)	259 (498)	266 (510)	270 (517)
Volatility, NOACK, Wt.%	—	4.9	4.9	3.7	3.4	2.4
Specific Gravity	0.807	0.824	0.827	0.830	0.831	0.8338
Density, lb/gal.	6.735	6.877	6.902	6.927	6.919	6.916

POUR POINT COMPARISON

(ASTM D97)



NOACK VOLATILITY



Synfluid® mPAO

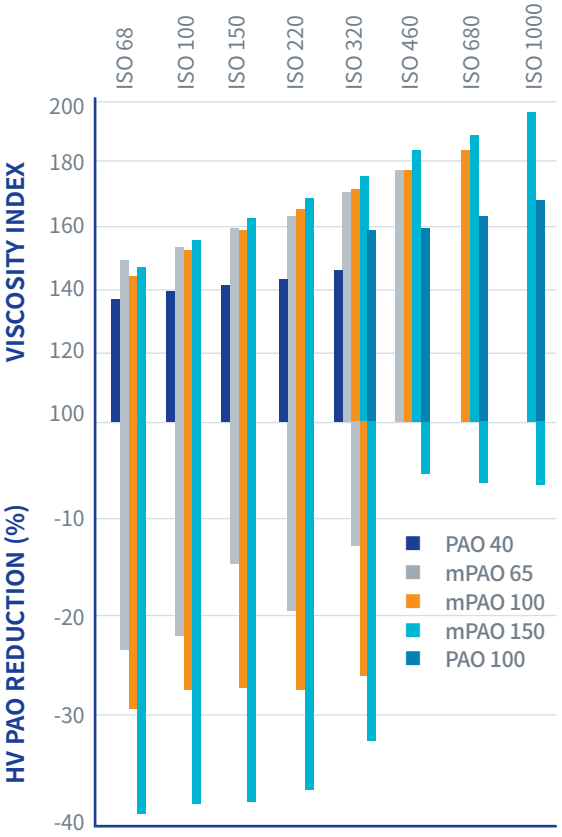
Synfluid® mPAOs are carefully designed molecules based on 1-octene.

The combination of our proprietary technology and unique feedstock gives rise to different and improved chemical structures. These structures lead to a lower pour point, higher VI, lower foaming tendency, increased air release, and excellent high-temperature and shear stability. All this gives Synfluid® mPAO significantly broader application opportunities. Best of all, it's Chevron Phillips Chemical Company's Synfluid® PAO, an industry leader with a brand you can trust.

mPAOs (Typical properties)

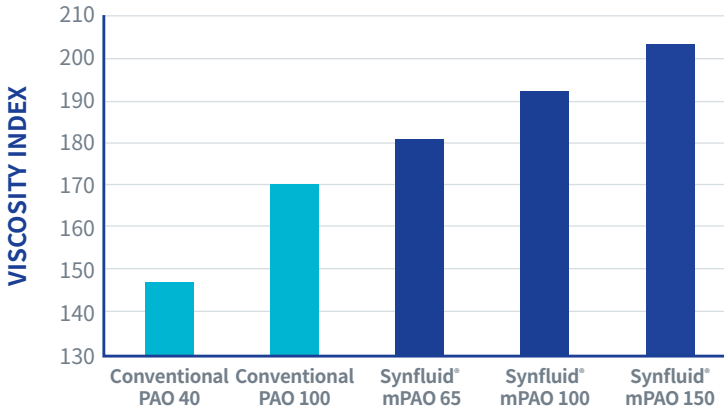
	mPAO 65 cSt	mPAO 100 cSt	mPAO 150 cSt
Viscosity, Kinematic			
100 °C, cST	65	101	154
40 °C, cST	616	1,037	1,694
Viscosity Index	178	191	204
Pour Point, °C (°F)	-43 (-45)	-39 (-39)	-36 (-32)
Flash Point (COC), °C (°F)	256 (493)	267 (512)	272 (522)
Specific Gravity	0.844	.846	.848
Density, lb/gal.	7.044	7.060	7.077

THICKENING EFFICIENCY

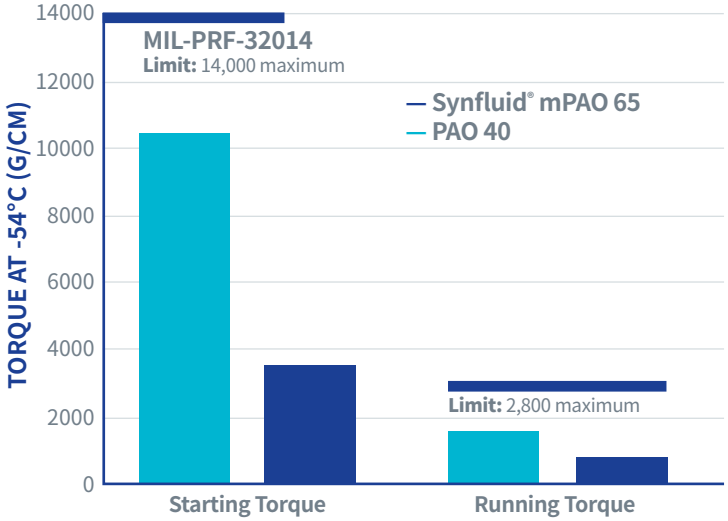


All blends made with PAO 8 to achieve the ISO targets. Similar blends could be made with other LV PAOs.

VISCOSITY INDEX



PERFORMANCE IN Li GREASE

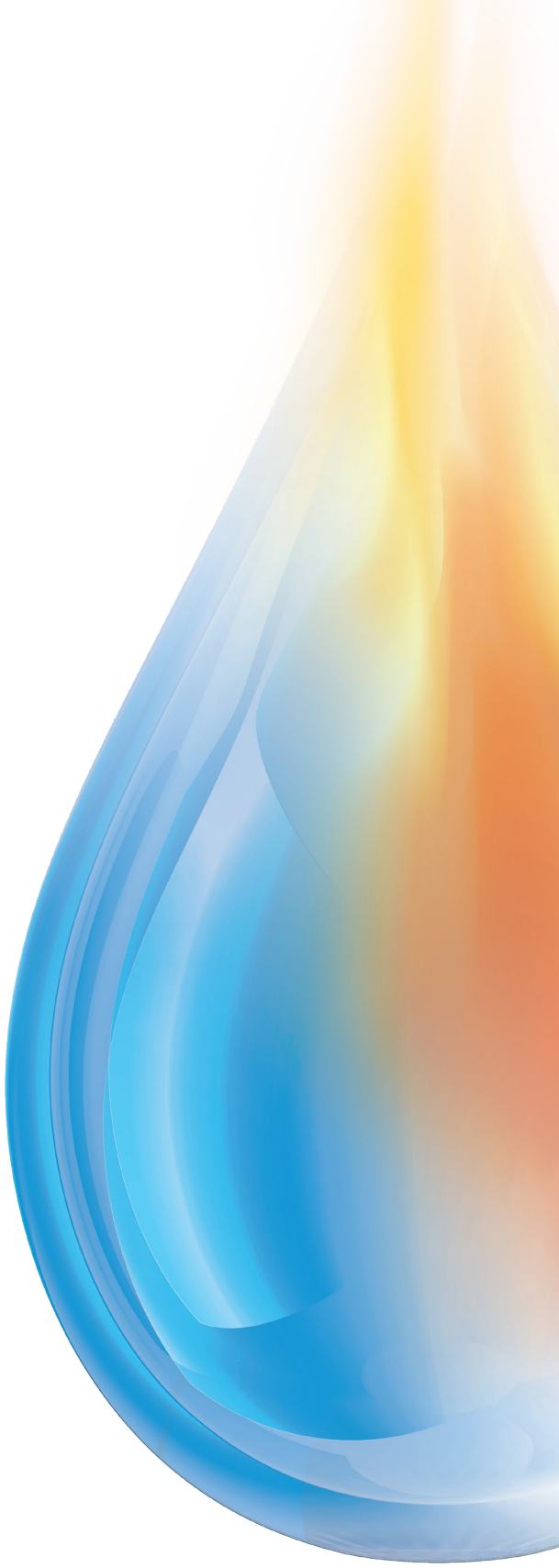


Performance by design. Caring by choice.™

Our company is designed to deliver industry-leading performance in a responsible way, caring for each other, our work, our customers and communities.

Drawing upon knowledge gained from pioneering alpha olefins, Chevron Phillips Chemical's Polyalphaolefins business produces high quality Synfluid® PAOs. Our products help reduce energy consumption in lubricant applications. Synfluid® PAOs are recognized for their performance at extreme temperatures and their environment-friendly characteristics.

The health and safety of our employees, contractors, neighbors, customers and the environment is of paramount importance to us. Our caring employees operate responsive and knowledgeable customer service, world-class experience sales team and innovative R&D and technical support teams.



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