



Chevron

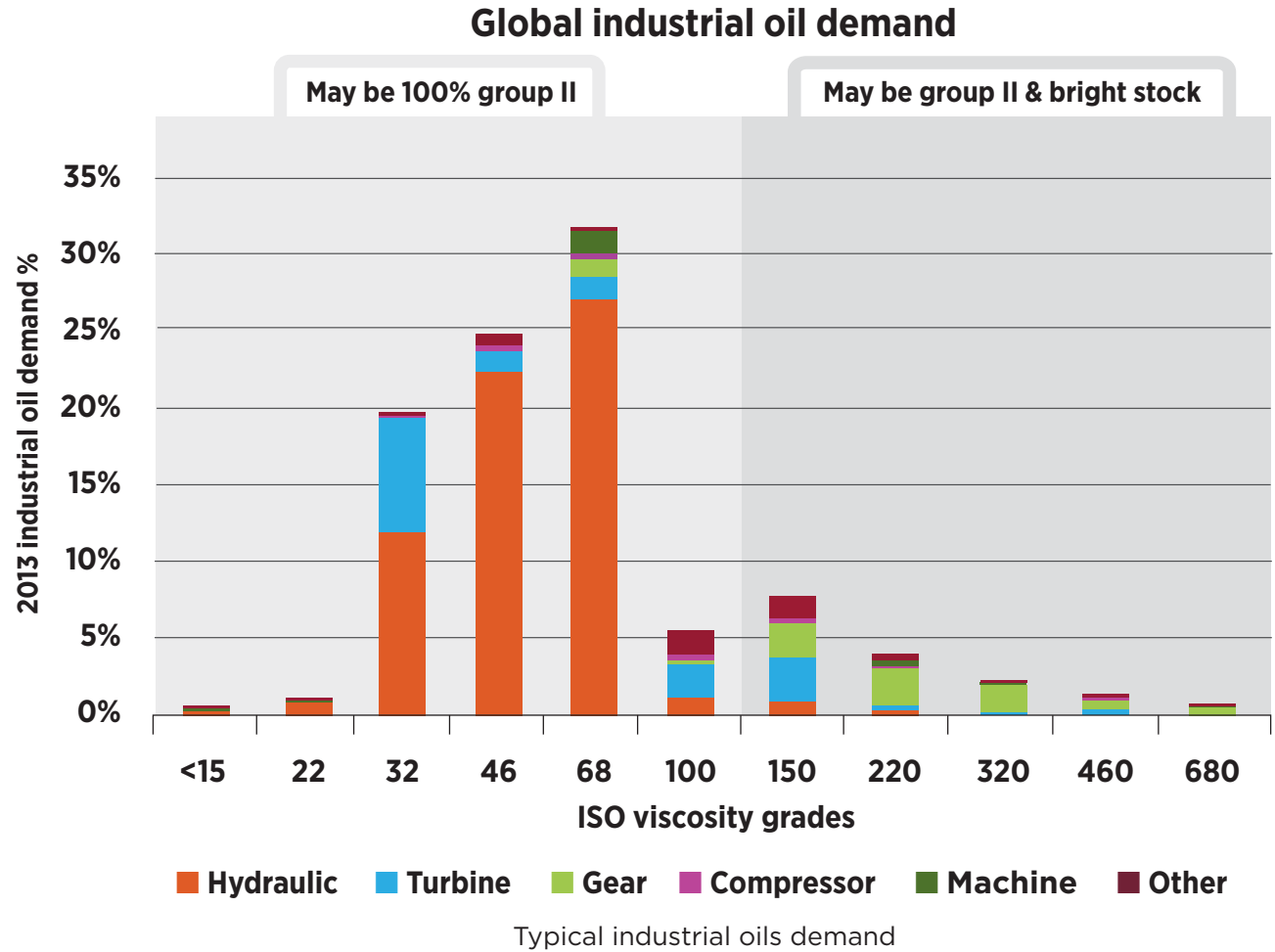
group II base oils

optimise industrial oils

chevron group II, the main line base oil for industrial oils

Most industrial oil applications perform significantly better when blended with Chevron Group II base oils over those formulated with Group I.

>95%
of industrial oil demand can be formulated with Chevron Group II



group II base oils

Increasing productivity for your industrial oil customers and you

Few product categories are as diverse in their performance demands as industrial equipment. From sewing machines to turbine engines, each has unique lubrication needs, but their operators all have the same goal – increasing productivity and reducing downtime. Chevron Group II base oils can help you deliver both to your customers.

More than 90% of all lubricants can be formulated with our Group II. So, with Chevron base oils in your supply chain, you can meet the needs of tightening AEO specifications and formulate high performing industrial lubricants while minimising tankage requirements.



Chevron Group II base oils have the right combination of properties to maximise equipment protection, while extending oil life.

Product	Typical treat rate, wt%*
Hydraulic oil	~ 1%
Turbine oil	~ 1-2%
Compressor oil	~ 1-2%
GF-5 5W-30	~ 10%
CJ-4 10W-30	~ 15-20%

Industrial oil formulations may be as much as 99% base oil, so the base oil's quality is critically important to the finished oil's performance.

*VM, demulsifier, and anti-foaming agents are not included.

group II base oils

5 base oil attributes that are key to industrial oil performance

Properties that improve industrial oil performance

In many industrial applications, oils formulated with Chevron premium base oils can dramatically improve performance over Group I formulations — with minimal or no cost increases. Due to the chemical and physical properties of Chevron Group II base oils, lubricants blended with them can withstand tougher operations and environments, including higher operating temperatures, smaller sumps, higher power densities, longer drain intervals, lighter materials, and more compact designs than their Group I counterparts. Why? They possess five base oil attributes that are key to industrial oil quality.

1. Wide viscosity range

Viscosity is the most important property of an oil. It measures the oil's resistance to flow (shear stress) under certain conditions. Industrial oils have to perform in a broad spectrum of operating environments and consequently, are produced in a broader viscosity range than automotive lubricants.

Viscosity requirements for industrial oils range from ISO 10 to greater than ISO 3200. However, more than 72% of industrial oil demand falls between ISO 32 to ISO 100, which can be fully satisfied by Chevron Group II base oils. By switching these formulations from Group I to Group II, in most applications, oil life will be significantly extended with minimal or no requalification cost. Group III oils, by contrast, have limited applicability due to their low viscosity.

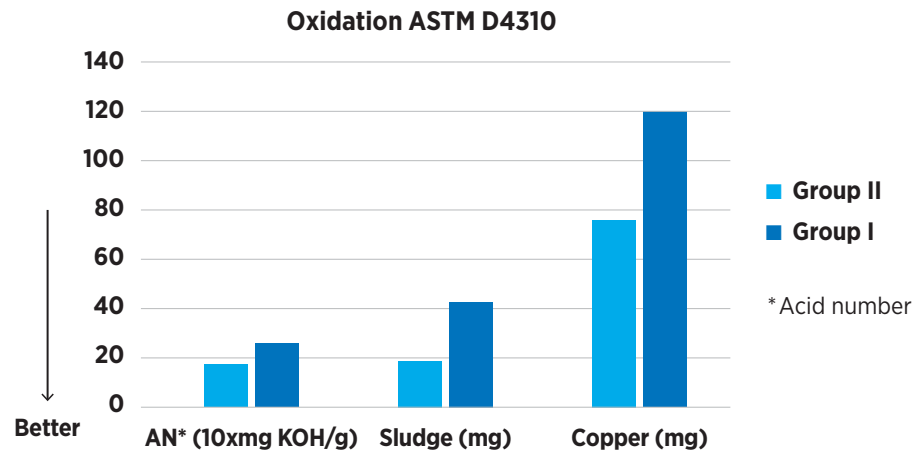


base oil properties that improve performance

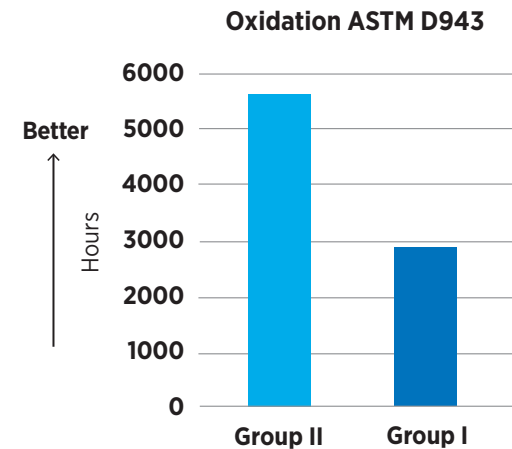
2. Excellent oxidative and thermal stability

Oxidative and thermal stability are key to extending oil life. When oxidative and thermal stability are poor, higher operating temperatures lead to the formation of undesirable compounds that are either soluble and/or insoluble. Soluble acidic products may increase the viscosity of the oil and corrode the system, while

insoluble products (e.g. gum, sludge, varnish) may increase wear and will eventually plug lines and valves and reduce clearances, which could lead to system failure. Chevron Group II base oils have excellent oxidation stability. Turbine oils formulated with Group II can have 300%, or more, longer life than their Group I-based counterparts.



Group II formulations have lower sludging and corrosion tendencies than Group I formulations when subjected to oxidizing conditions.

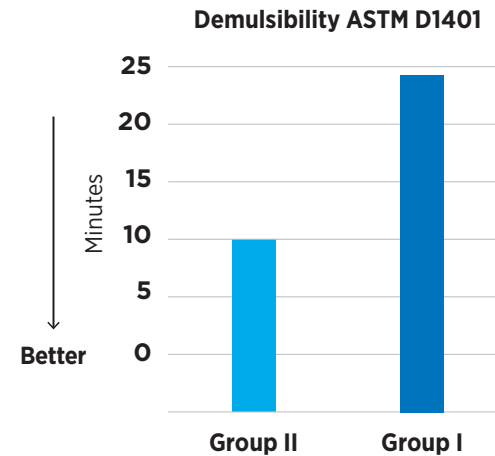


Lubricants blended with Group II have much better oxidation stability than those blended with Group I.

base oil properties that improve oil performance

3. Water separability

The ability of an oil to “shed” or separate from water is particularly important for applications where the possibility of incursion of water into the system is very high, such as steam and hydro- electric turbine oils, circulating oils and hydraulic fluids. In these situations the oil must be able to separate water rapidly and cleanly. By draining separated water from the system, operators can extend the life of the lubricant and possibly prevent rust and corrosion from forming. Due to their very high levels of saturated hydrocarbons and very low levels of polar compounds, Chevron Group II base oils separate from water more rapidly than Group I base oils.



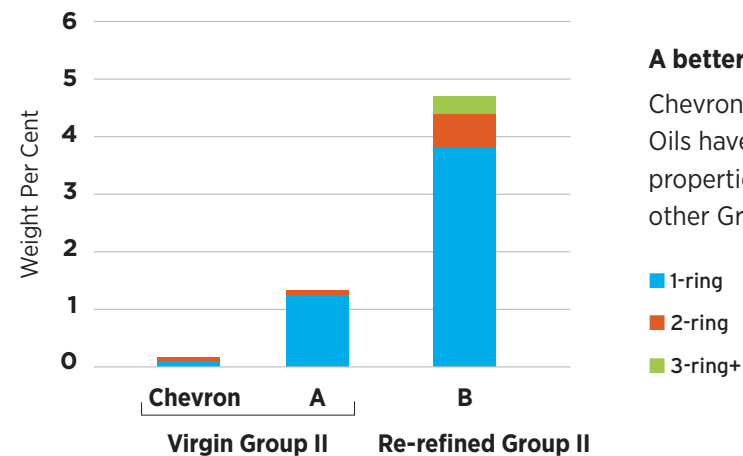
Group II oils separate from water twice as fast as Group I.

In ASTM D1401, test oil and distilled water are blended, brought to test temperature and then stirred at 1,500 rpm for 5 minutes. The separation of oil and water is tested at prescribed intervals.

4. Low-temperature properties

Group II base oils have excellent low-temperature properties, and because of their extremely low residual normal-paraffin content, they respond more readily to pour point depressants than Group I base oils. In applications where sub-zero performance is not needed, Group IIs are frequently the base oil of choice. As long as arctic temperatures are not the challenge, expensive PAOs are not required if Group II base oils are available.

Aromatic group type analysis of 4 cSt Group II base oils



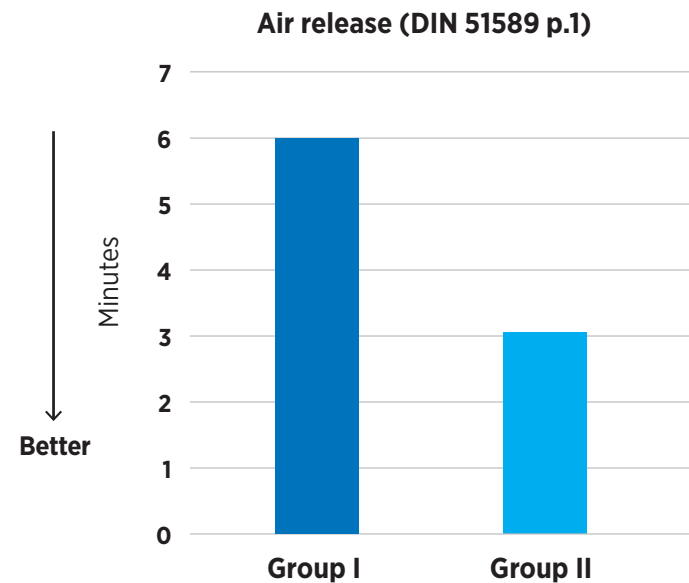
A better group II

Chevron Group II Base Oils have better properties than many other Group II base oils.

base oil properties that improve performance

5. Air release

All oils absorb air. Air entrainment is the dispersion of tiny air bubbles throughout the bulk fluid. This is very problematic for hydraulic systems – systems that depend on the oil being incompressible in order to properly transmit power. Additionally, dissolved air can cause pump cavitation, excess wear and erratic movement of machine parts. Hydraulic fluids, circulating oils and turbine oils made with Chevron Group II base oils have better air-release times than those blended with Group I as measured by ASTM D3427.



group II performance

hydraulic oils had longer oil life

1. Hydraulic Oils

Hydraulic oils accounts for 60% of the world's industrial oil demand. Group II base oils are a good fit for the application as most of the volumes fall within the ISO 32-68 range. Group II based formulations deliver higher oxidation stability, better or more rapid water separation and lower foaming tendency than Group I.



Group I vs. group II in hydraulic fluids - same additive package and treat rate.

The hydraulic oils formulated with Group II had higher oxidation stability and enhanced water separability, which translates into longer oil life.

Hydraulic Oils		ISO 32		ISO 46	
Test	ASTM#	Group I	Group II	Group I	Group II
RPVOT*, min to 25 psig drop	D2272	360	449	323	419
TOST**, hrs to 2 TAN	D943	2,520	5,917	2,016	6,460
Foaming, Seq. I, II, III	D892				
Sequence I		10/0	0/0	0/0	0/0
Sequence II		30/0	0/0	30/0	0/0
Sequence III		50/0	10/0	10/0	0/0

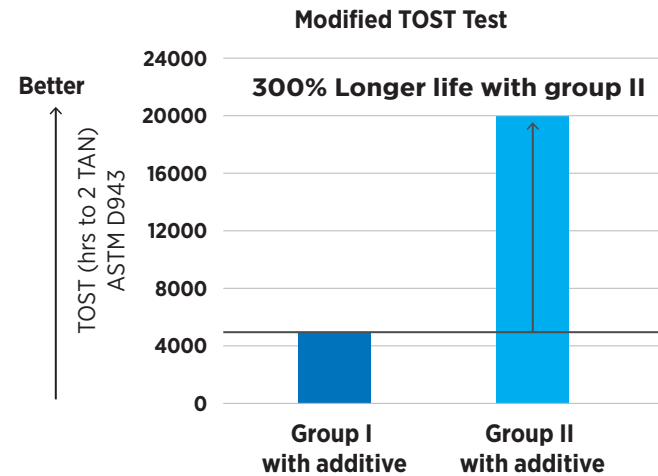
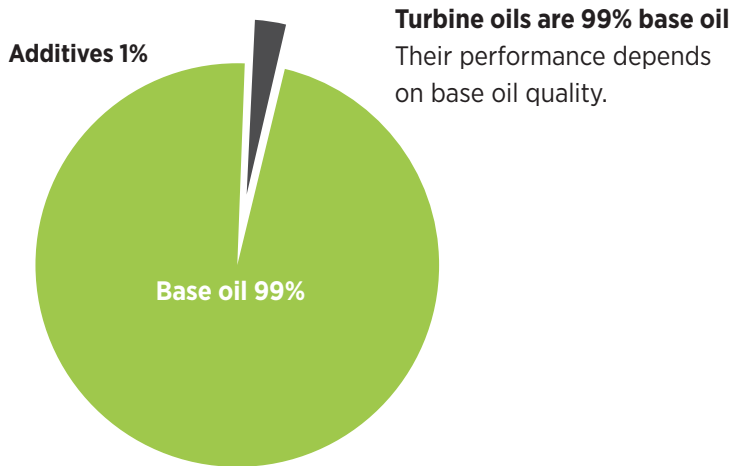
*Rotating Pressure Vessel Oxidation Test

** Turbine Oil Stability Test

group II performance significantly improves turbine oil life

2. Power generation turbine oils

Turbine oil, in both gas and steam power generation systems, provides clean and cool lubrication to bearings and frequently acts as the working fluid in associated hydraulic systems. Most turbine engines require oils in the ISO 32 or 46 viscosity grades. When turbine oils are formulated with Group II base oils they have much longer life than when formulated with Group I. As with hydraulic oils, Group II based turbine oils will separate rapidly from water or air with no or minimal assistance from demulsifying additives or anti-foaming agents.



Turbine oil life extended 300% with Chevron Group II

When turbine oils are re-formulated with Group II base oils, TOST values will improve significantly. Extending oil life so dramatically may come at the cost of varnish and sludge. However, experienced additive companies know how to optimise formulas for long oil life.

group II performance in user field trials NGEOs had longer oil life

3. Natural gas engine oils (NGEOs)

Gas engines used in industrial applications operate at high loads, high temperatures and for long periods of time, while exposing the oil to severe oxidation and nitration conditions. They are often in remote locations and must run with minimal operator attention.

Engine reliability is critical. There are no industry-wide tests for evaluating NGEO performance. Lubricant marketers have to prove the performance of their lubricants in onsite field tests. OEM oil approvals are granted only following successful field trials.



Lubricants blended with Chevron Group II base oils routinely gain OEM approvals because they deliver:

- Correct viscosity
- Excellent oxidation stability and longer oil life
- Improved engine cleanliness

Manufacturer/Model	Caterpillar G3516 TALE	
	Group I	Group II
Rated Load	1150Hp @ 1200rpm	1150Hp @ 1200rpm
Load	89.5%	88.4%
Oil Drain Interval	924 hours	1,489 hours
Piston Deposits, Demerit (lower is better)	98.22	44.26

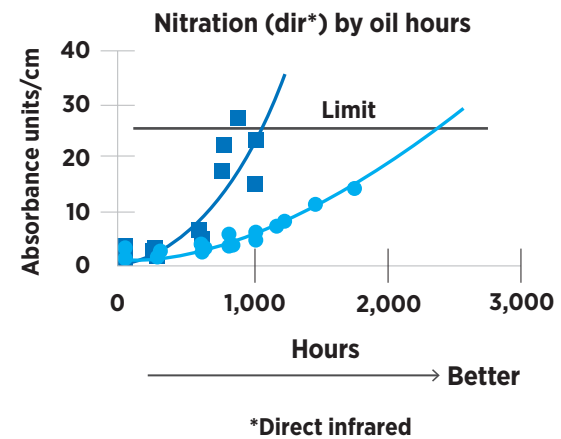
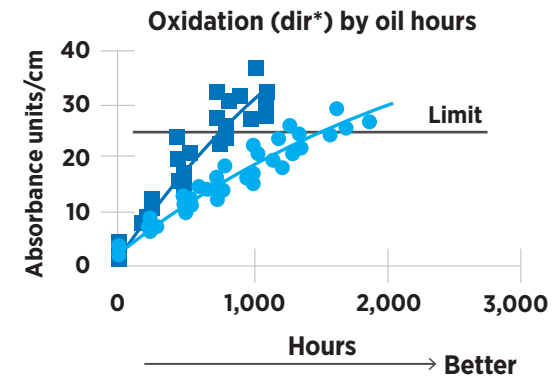
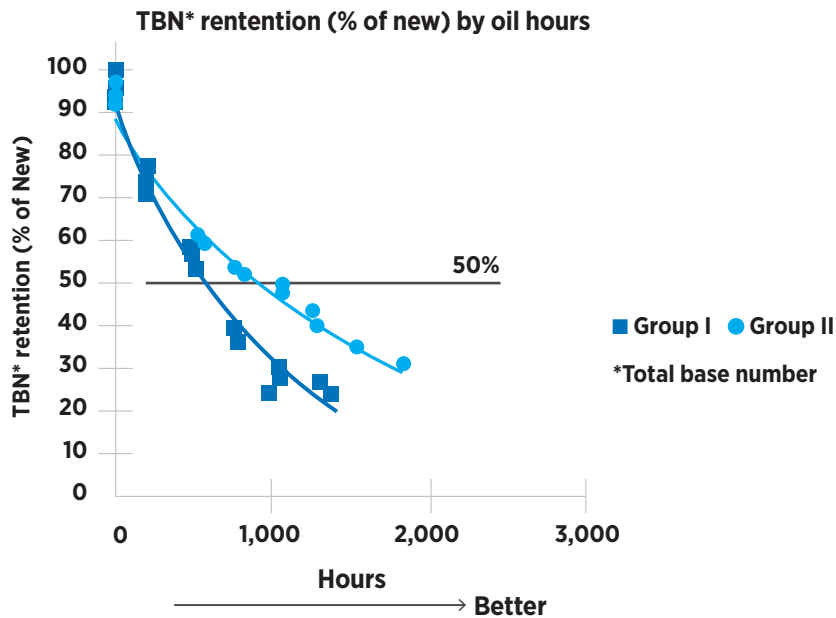
Group II outperforms group I in natural gas engine oils


The Group II formulation lasted 61% longer and had less than half the deposits of the Group I blend.

group II performance

better oxidation stability, TBN retention and nitration control

A back-to-back field test compared two NGEOs, one made with Chevron Group II and the other with Group I. Each ran over 8,000 hours in a natural gas pipeline operation. Chevron's Group II showed far greater oxidation stability, TBN retention and nitration control, with less than half the piston deposits – and, it did so with drain intervals that were 50 percent longer.



An aerial photograph of a silver tanker truck driving on a two-lane asphalt road that curves through a lush green landscape. The sun is low on the horizon, creating a warm, golden glow over a body of water in the distance. The sky is filled with soft, orange and yellow clouds. The truck is positioned in the lower right quadrant of the frame, moving away from the viewer along the curve of the road.

**globally available,
regionally approved,
& ready for delivery**



Let's talk about your business.

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