

**Lubrizol**



# *Fluid Technology for Industrial Gear Oils*

STLE Toronto Section  
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# Industrial Gear Oil Applications



*Mining and quarries*



*Steel mills*



*Indoor mixing gearboxes*



*Sugar mills*



*Wind turbines*



*Extruders & gearboxes*



*Outdoor mixing gearboxes*



*Steel rolling mill gearboxes*

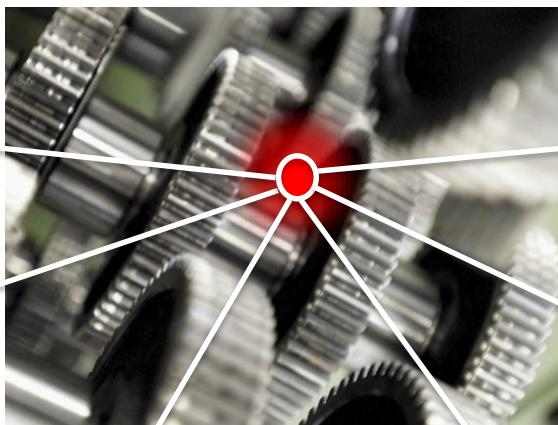
**IGO fluids see harsh conditions: high loads and speeds, high temperatures, and high contamination environments**

# Emerging Industrial Gear Trends

*IGO formulated to meet the modern demands*



*White Etching Cracks*



*Increased Productivity*

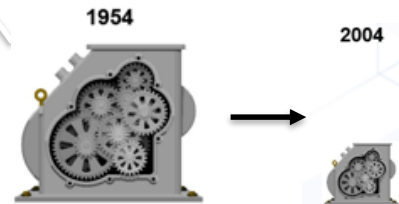


*Improved Bearing Protection*



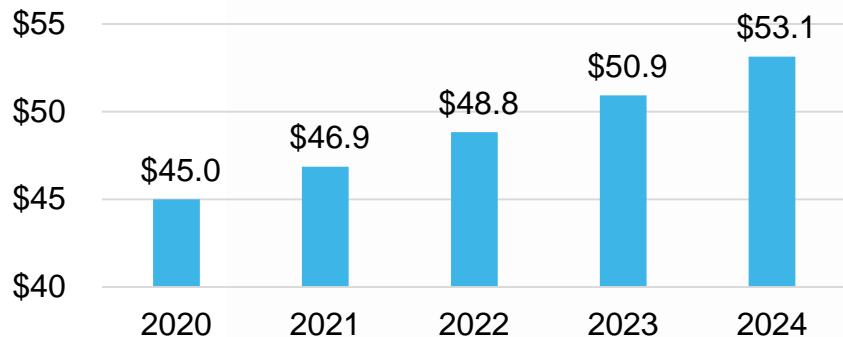
*Micropitting protection*

*Smaller Gearboxes = Higher Power density*



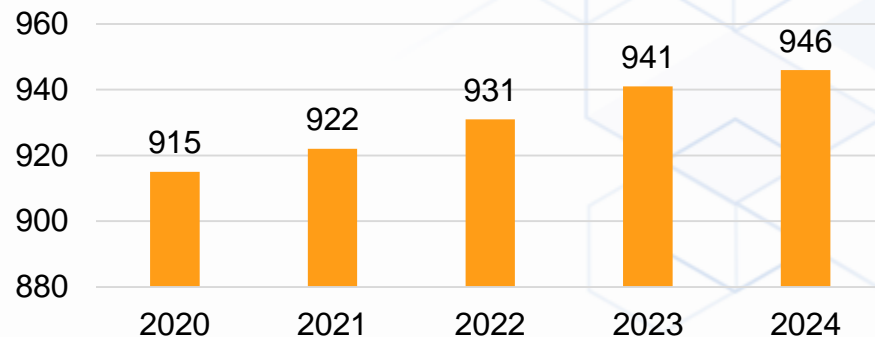
# Industrial Gearbox and Gear Oil Growth

Global Industrial Gearbox Market  
(\$ bn)



CAGR 4.22%

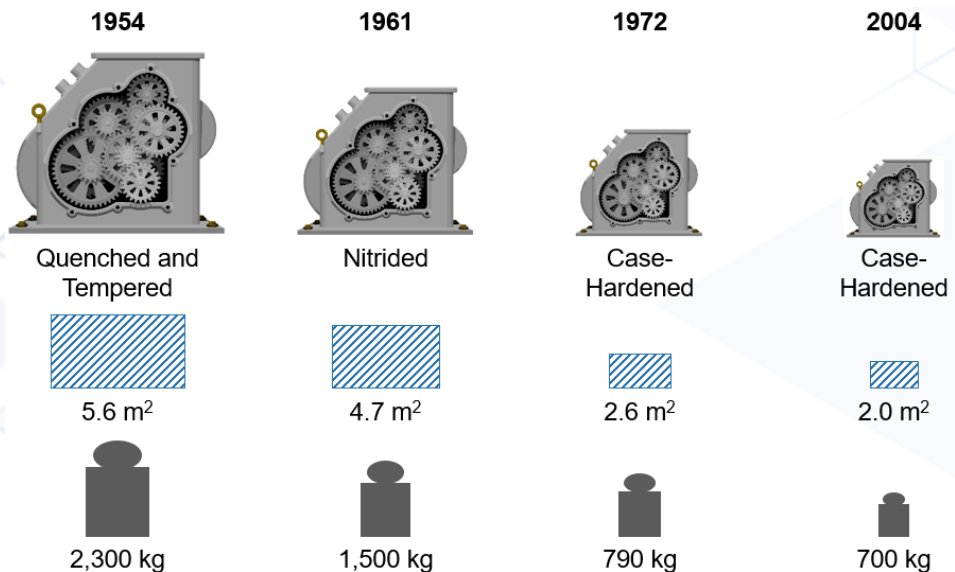
Global Industrial Gear Oil Market  
(KTONNES)



CAGR 0.84%

**Industrial gear oil market is growing at a slower rate than industrial gearboxes**

# Evolution of Industrial Gear Box Sizes



- Gearboxes are getting smaller than before to increase efficiency
- Sump sizes are getting smaller
- Gear oil tends to get hotter than before in the smaller sumps

# Oil Life vs. Higher Operating Temperature

- Higher operating temperature can adversely impact oil life
  - Additive packages get used up faster
    - Depleted additive package can cause durability issues like scuffing, micropitting
  - Viscosity of the fluid changes with temperature leading to poor film thickness
    - Poor film thickness impacts tribological properties leading to untimely failure of parts
- Reducing operating temperature by even a few degrees can help maintain the oil life longer and ensure the durability of gearboxes

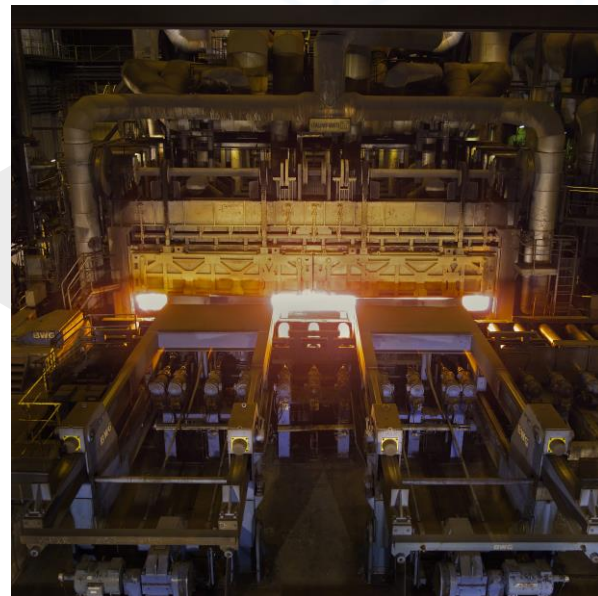
# Cost of Gearbox Downtime | Case Study



## Case Study: Cost of Gearbox Failure in a Steel Mill

Source: Major Global Steel Manufacturer

<u>Minimum</u> production downtime	<b>2.5-3 hours</b>
<u>Minimum</u> production downtime cost	<b>\$200,000 per hour</b>
<b>TOTAL</b>	<b>\$600,000</b>



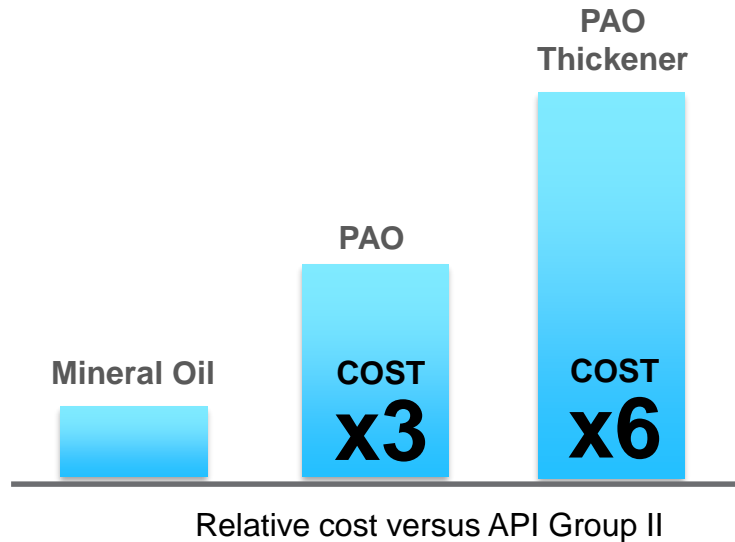
This does not include parts or labor costs.  
Labor costs can be excessive if contractors are required to make the repairs.  
Downtime costs do not increase linearly with mill size; they increase exponentially.

The background is a vibrant blue gradient with a complex pattern of overlapping, semi-transparent white and light blue geometric shapes, including hexagons and lines, creating a sense of depth and technical precision.

# How to solve the issue of high operating temperature?



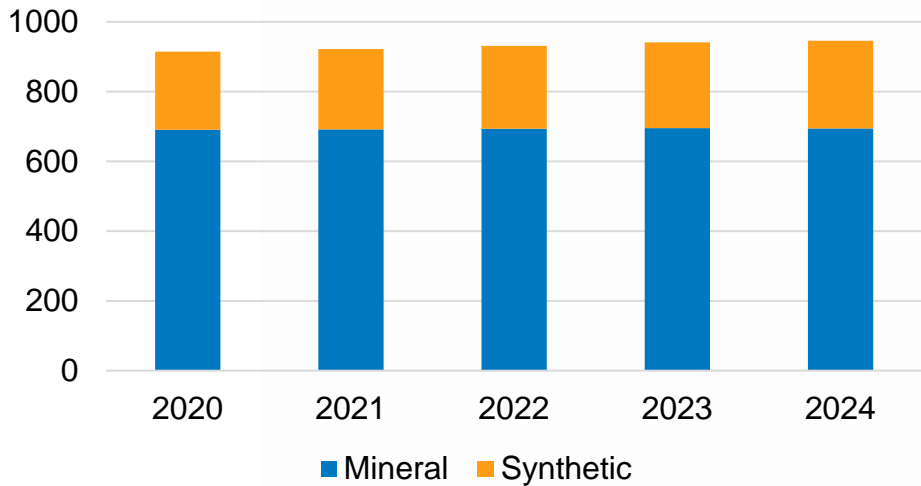
# Common Ways to Solve This Issue



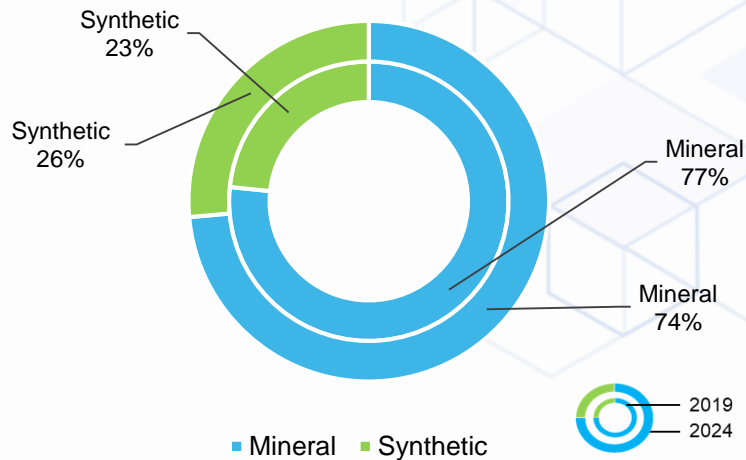
**Switching to a full-synthetic formula thickened with PAO100 or mPAO150 is costly!**

# Synthetic IGO Market is Growing

Global IGO, KTONNES



Mineral vs Synthetic Split



**Synthetic IGO lubricants set to grow at +5.2% CAGR**

# Alternative Way to Formulate Synthetic IGOs

Formulation	Wt%
PAO-6	32.2
PAO-100	66
Performance Additive	1.8



Formulation	Wt%
PAO-6	74.5
LUCANT™	23.7
Performance Additive	1.8

**Superior thickening efficiency of LUCANT™ reduces treat rate**

# Introducing LUCANT™

**LUCANT™ is a versatile polymer with superior thickening efficiency and shear stability**

- Excellent performance in low traction/high efficiency, thermal and oxidative stability, NSF H1 approved
- Versatile applications include industrial gear oil, automotive gear oil, open gear lube and hydraulic fluid



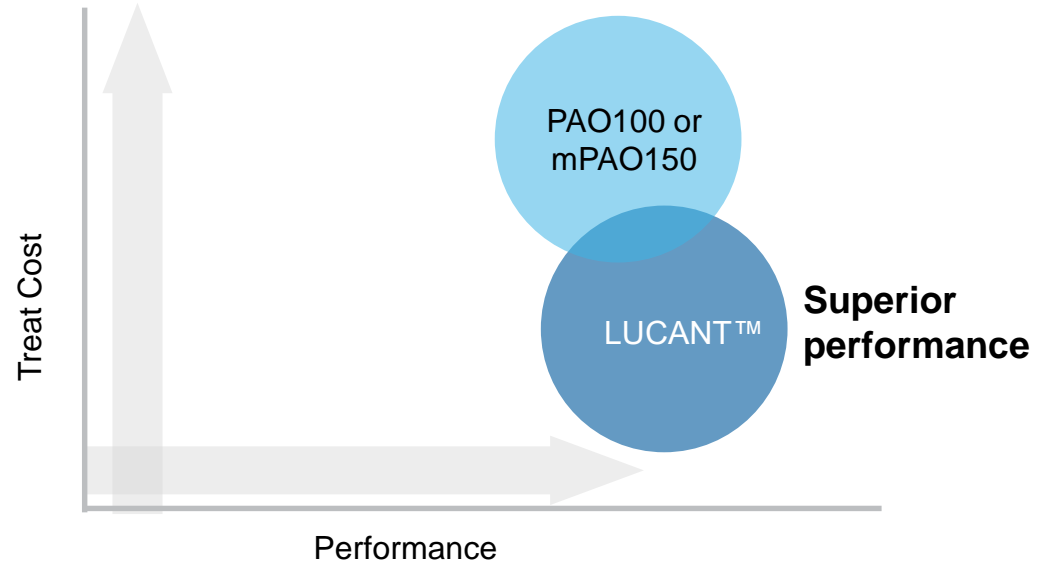
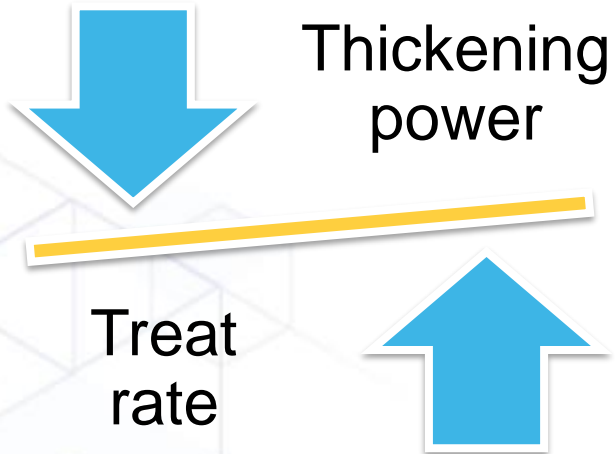
*Statistically Validated*



*Scientifically Proven*

**Serves as a viscosity modifier and base oil**

# Treat Cost vs. Performance

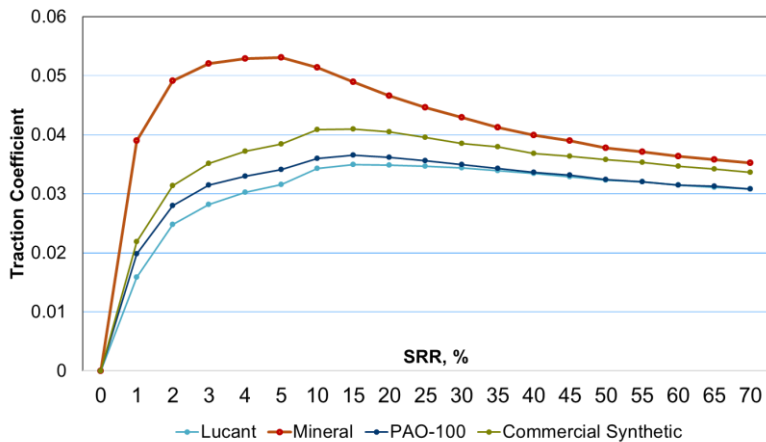


**Superior performance for synthetic IGOs**

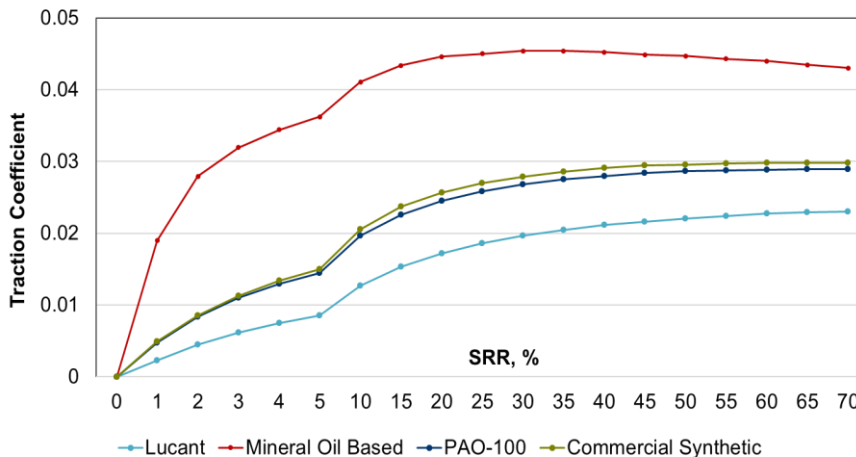
# Traction Coefficient Data



Traction Coefficients versus Slide-Roll Ratio (%) at 40°C



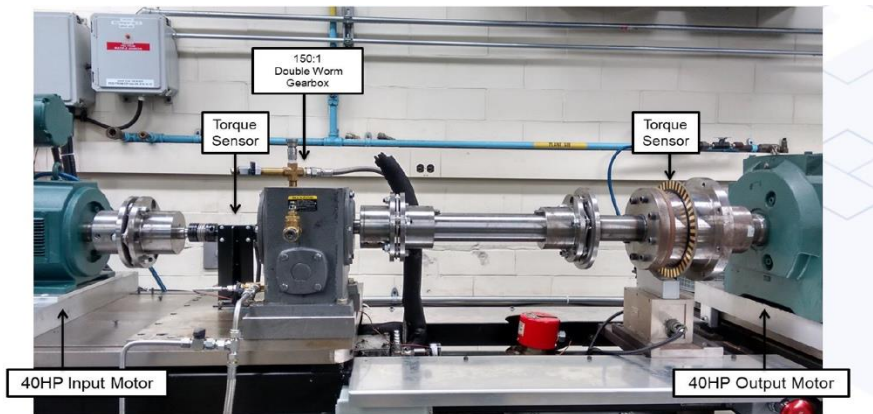
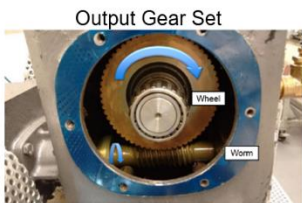
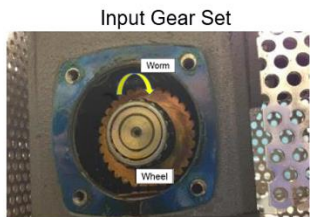
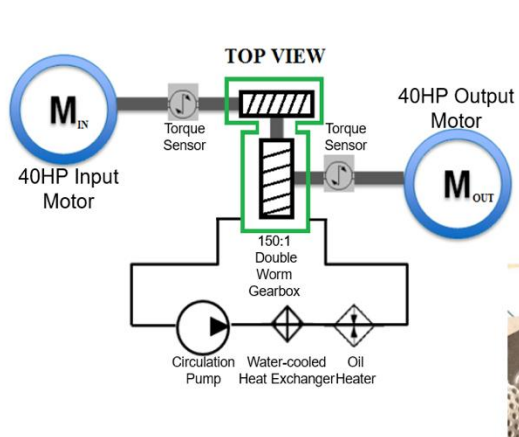
Traction Coefficients versus Slide-Roll Ratio (%) at 100°C



**LUCANT™ helps lower traction coefficient of the fluids**



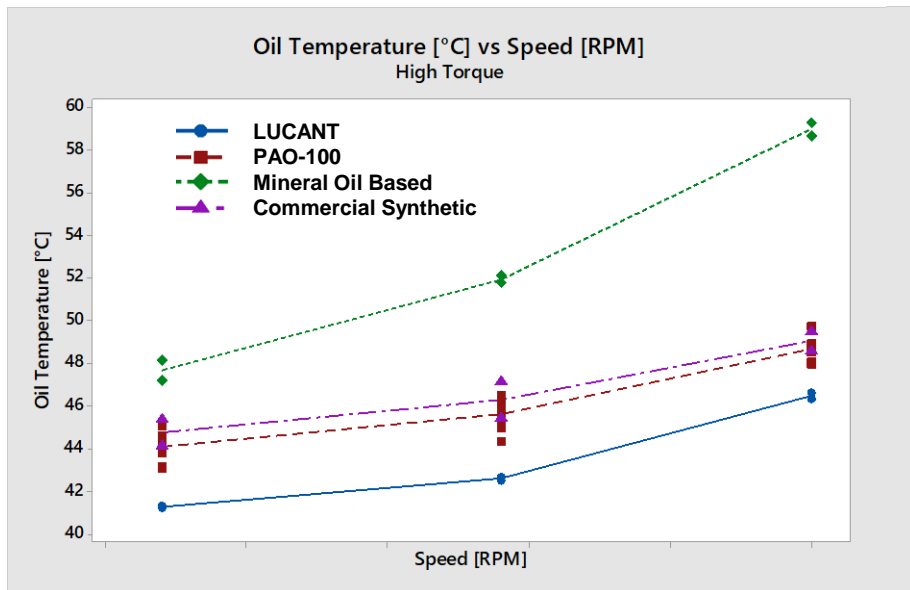
# Test Rig Configuration



Test rig developed to differentiate fluids



# Temperature Reduction with LUCANT™



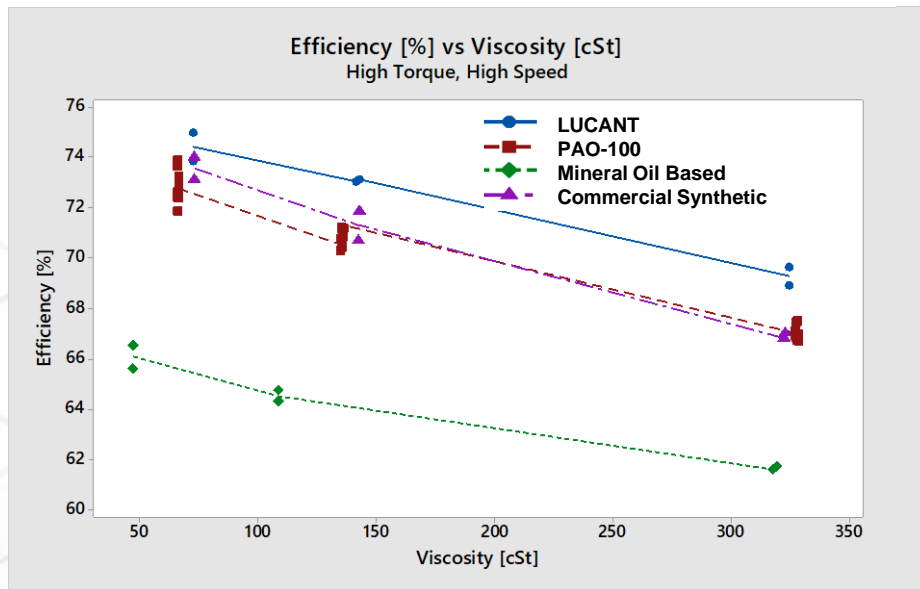
- LUCANT™ runs significantly cooler than a mineral oil based formula
- LUCANT™ based formula runs somewhat cooler than other synthetics

**LUCANT™ based formulation dissipates heat easily and keeps oil cooler**





# Efficiency Improvement with LUCANT™



**A clear advantage in efficiency was seen with LUCANT™ when comparing formulations thickened with other thickener types**

- Up to 2% improvement over other synthetics
- Up to 8.5% improvement over mineral oil based reference

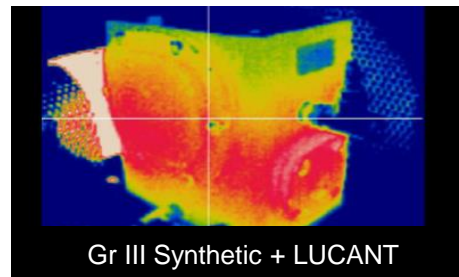
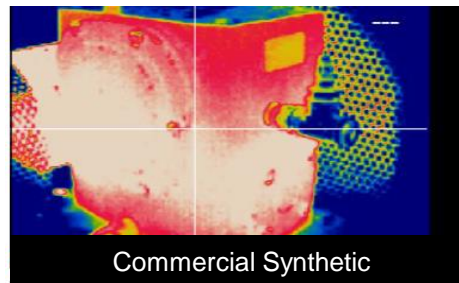
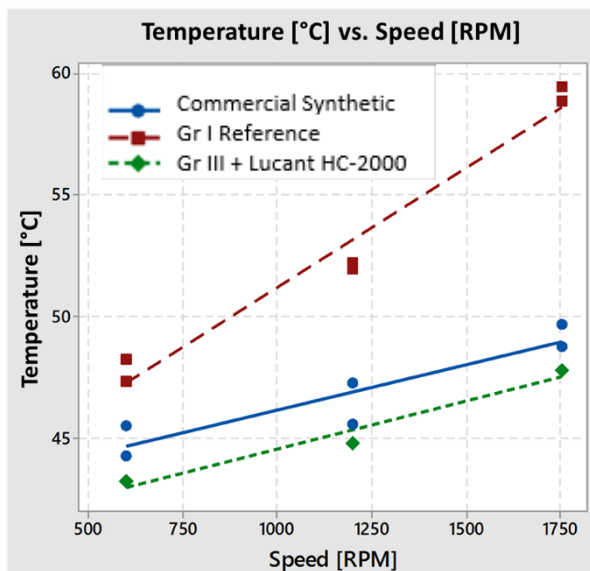
**LUCANT™ based formula improves efficiency**





# Formulating Cost-effective Synthetic Gear Oil with LUCANT™

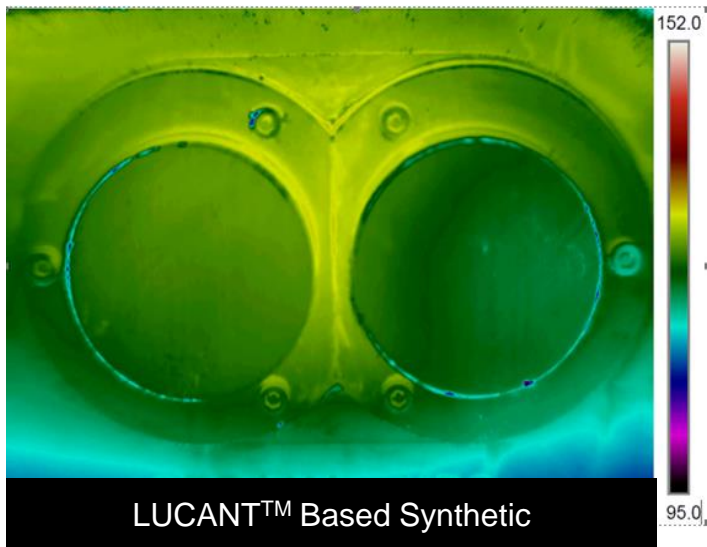
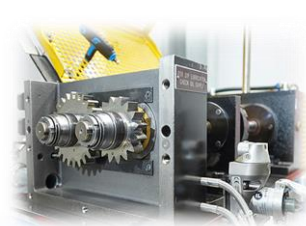
# Synthetic Formulation with Group III Base Oil



**LUCANT™ produces a significant cooling effect**



# Temperature Reduction in FZG Test



**LUCANT™ based formula produces 17 °C cooling compared to standard gear oil**



# Formulation Shape and Cost Impact

	Synthetic with PAO	With LUCANT™ HC-2000	With LUCANT™ HC-1100	With LUCANT™ HC-600
Viscosity Grade	ISO VG 320	ISO VG 320	ISO VG 320	ISO VG 320
Base Oil	32.8 wt% PAO	74.5 wt% 6 cSt GIII	71.0 wt% 6 cSt GIII	66.0 wt% 6 cSt GIII
Additive	1.8 wt% LZ performance additive	1.8 wt% LZ performance additive	1.8 wt% LZ performance additive	1.8 wt% LZ performance additive
Thickener	66 wt% PAO 100	23.7 wt% LUCANT™ HC-2000	27.2 wt.% LUCANT™ HC-1100	32.2 wt.% LUCANT™ HC-600

**30% – 40%** cost savings with LUCANT™

LUCANT™ offers a cost effective way to get synthetic like performance

# In Summary



- LUCANT™ is a versatile performance polymer
- Performance enhancement in Industrial Gear Oil, Open Gear Lube, Hydraulic fluid and Automotive Gear Oil with LUCANT™



**Scientifically  
Proven**



**Statistically  
Validated**



**Global  
Availability**

**You CAN, with LUCANT™!**



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