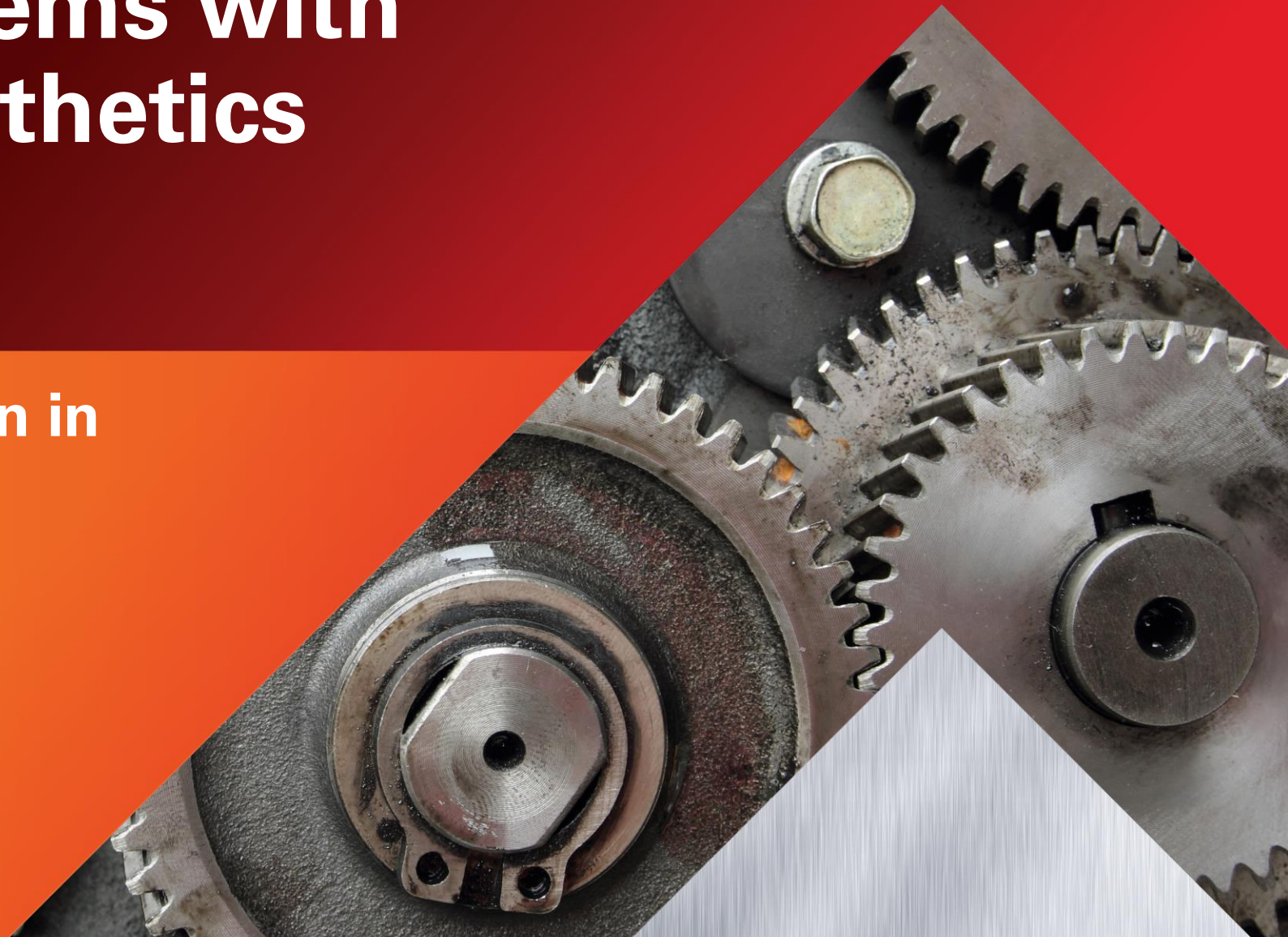
# Solving Problems with Industrial Synthetics

**The webinar will begin in less than 10 minutes.**



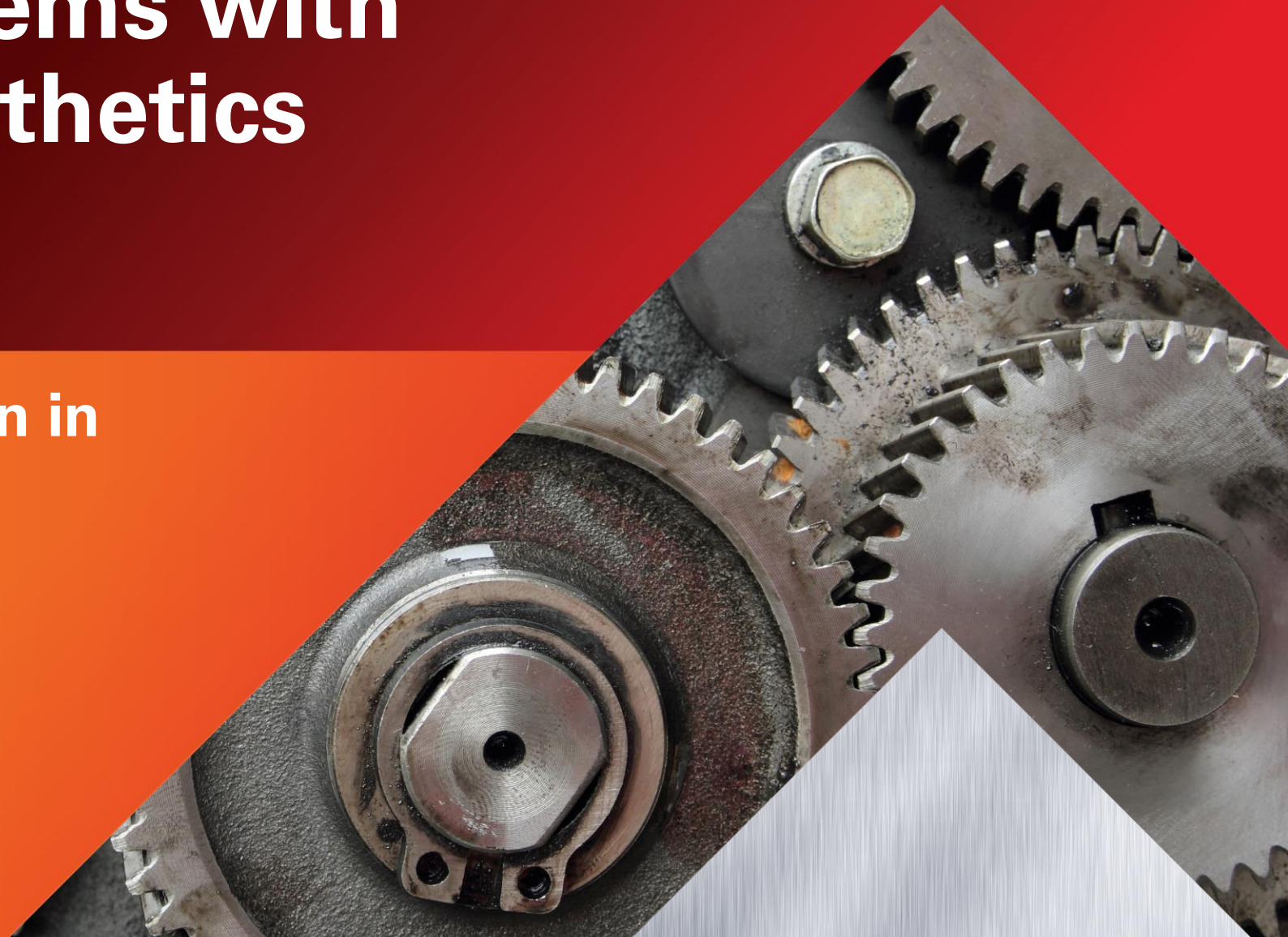
Mystik LUBRICANTS

CITGO LUBRICANTS

clarion LUBRICANTS

# Solving Problems with Industrial Synthetics

**The webinar will begin in less than 5 minutes.**



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# Webinar starting soon; until then…

## TEST YOUR KNOWLEDGE

What is the best seal material to use with diester fluids?

- Polychloroprene (CR) – Neoprene
- Natural Rubber (NR)
- Styrene-Butadiene (SBR) – Buna-S
- Fluoroelastomer (FKM, FPM) – Viton

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# Webinar starting soon; until then…

## TEST YOUR KNOWLEDGE

Which of the following synthetic fluid types has the best solvency?

- Diester (DE)
- Silicone
- Polyalphaolefin (PAO)
- Polyalkylene Glycol (PAG)

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# Webinar starting soon; until then…

## TEST YOUR KNOWLEDGE

Which of the following products is not recommended for use in worm gears?

- Cylinder Oils
- CITGEAR Synthetic PAG
- CITGEAR Synthetic EP
- CITGEAR Synthetic HT

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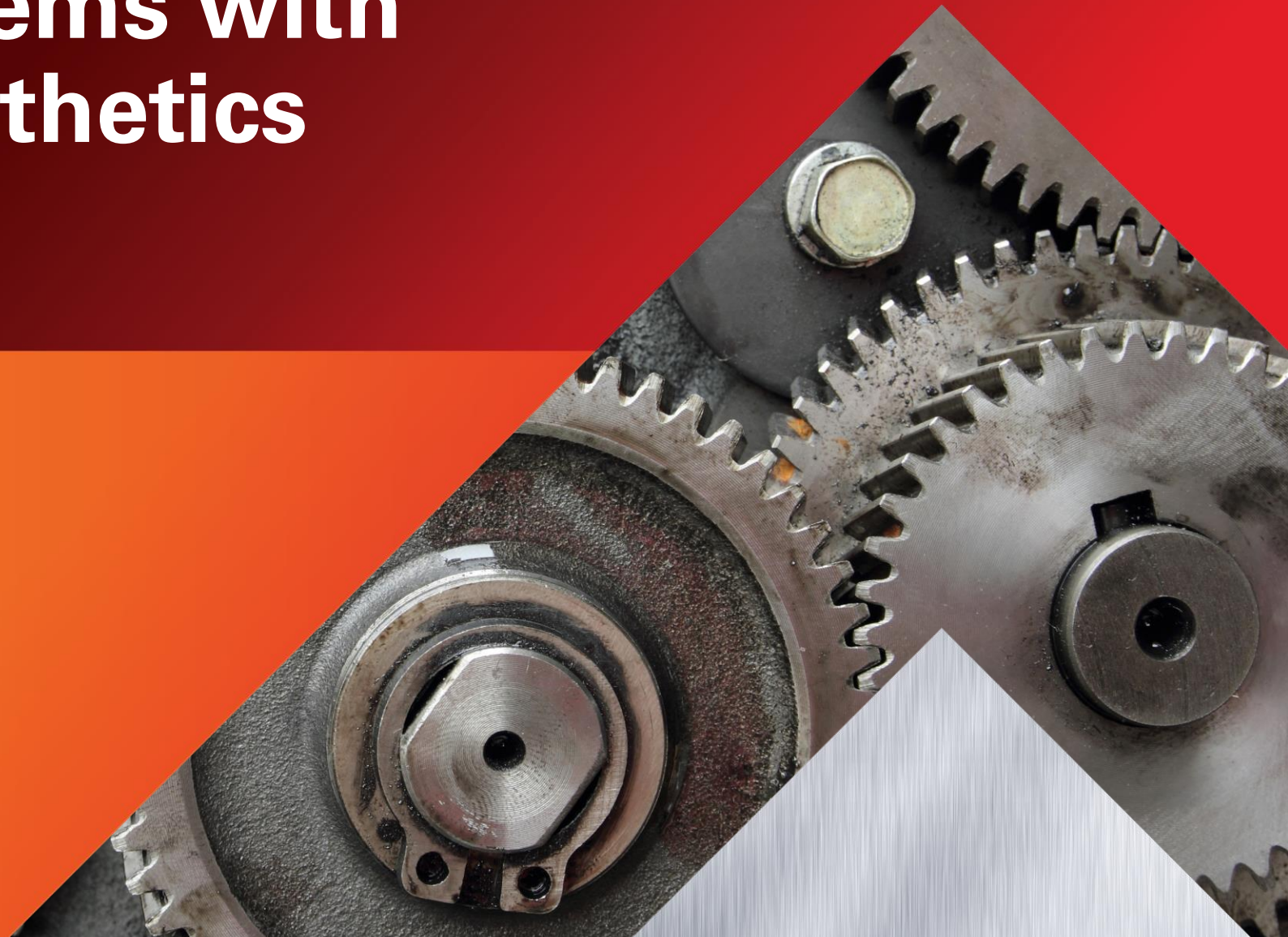
# Solving Problems with Industrial Synthetics



Mystik LUBRICANTS

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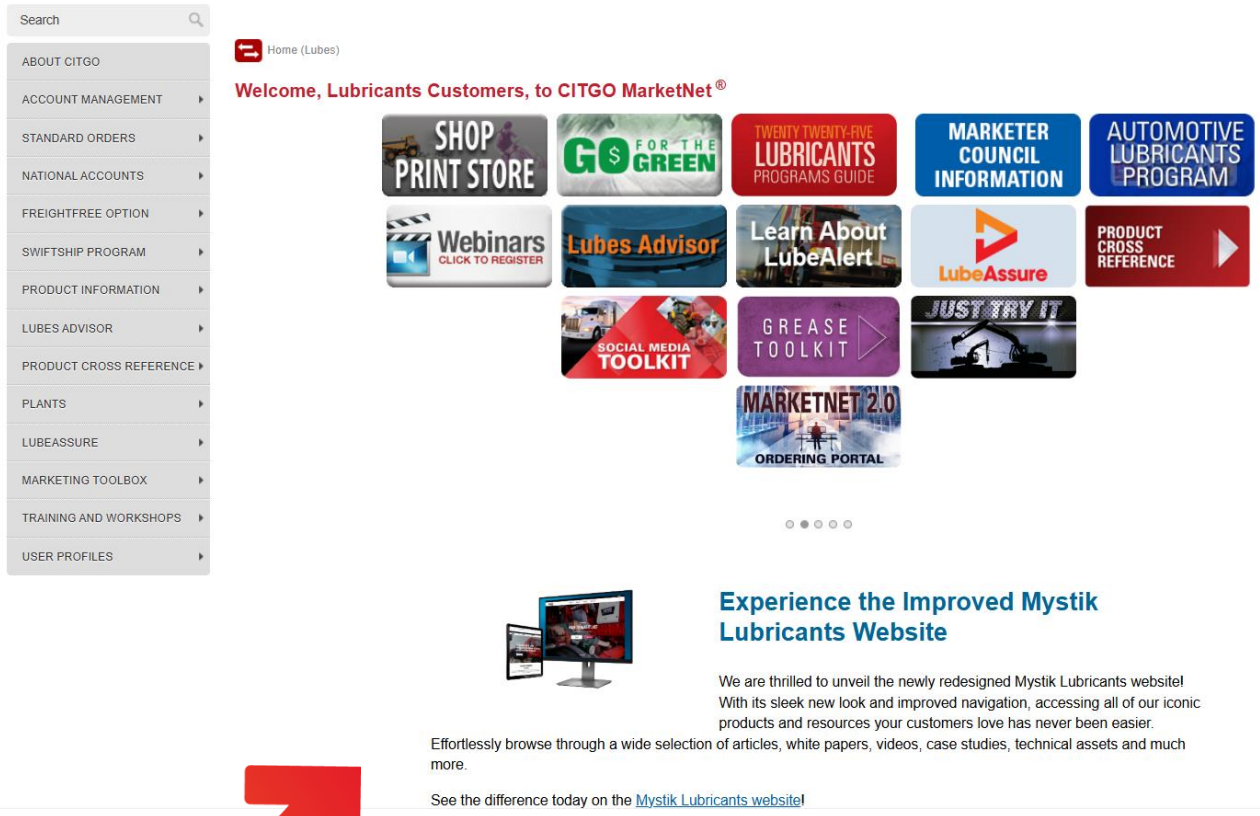
# Amber Fessler - NLGI CLGS; STLE CLS & OMA-I

- CITGO Senior Sector Manager
- Materials Engineer
- 13 Years of Experience in Lubricants
- STLE Certified
  - Certified Lubrication Specialist
  - Oil Monitoring Analyst I
- NLGI Certified
  - Certified Lubricating Grease Specialist

# Want Resources?

- Program Guides
- Support Literature
- Social Media Resources
- Webinars



# Future Webinars

**Dec 15:** Guiding Customers and Solving Problems with PI Sheets

# Matthew Gerber – STLE CLS & OMA-I

- CITGO Sr. Product Specialist
- B.S. Mathematics & Chemistry
- M.S. Mathematics
- 13 Years of Experience in Lubricants
- 10 Years of Laboratory Experience

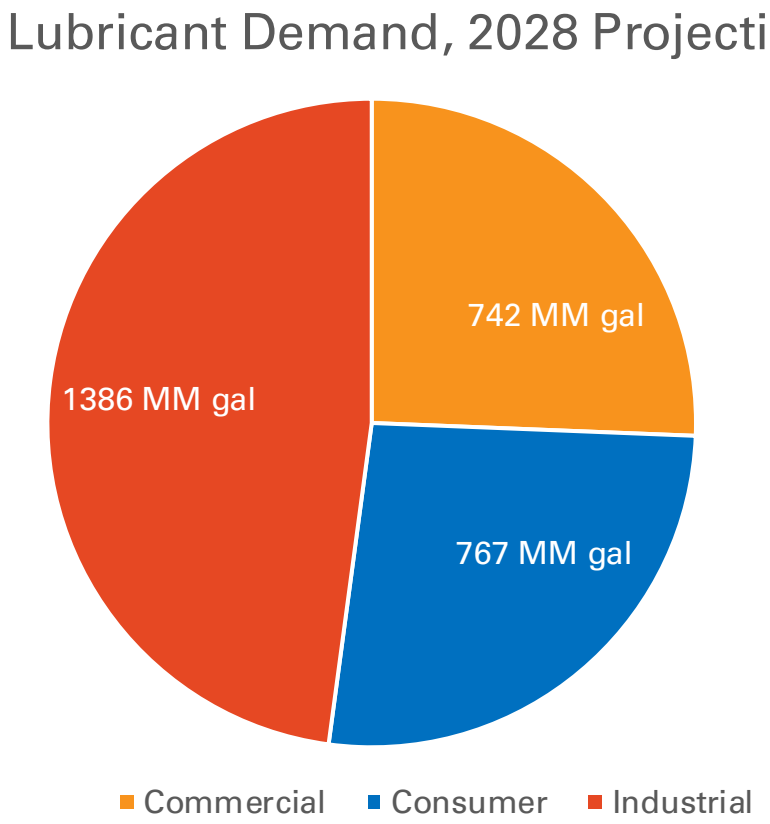
# David Turner – NLGI CLGS, STLE CLS & OMA-I

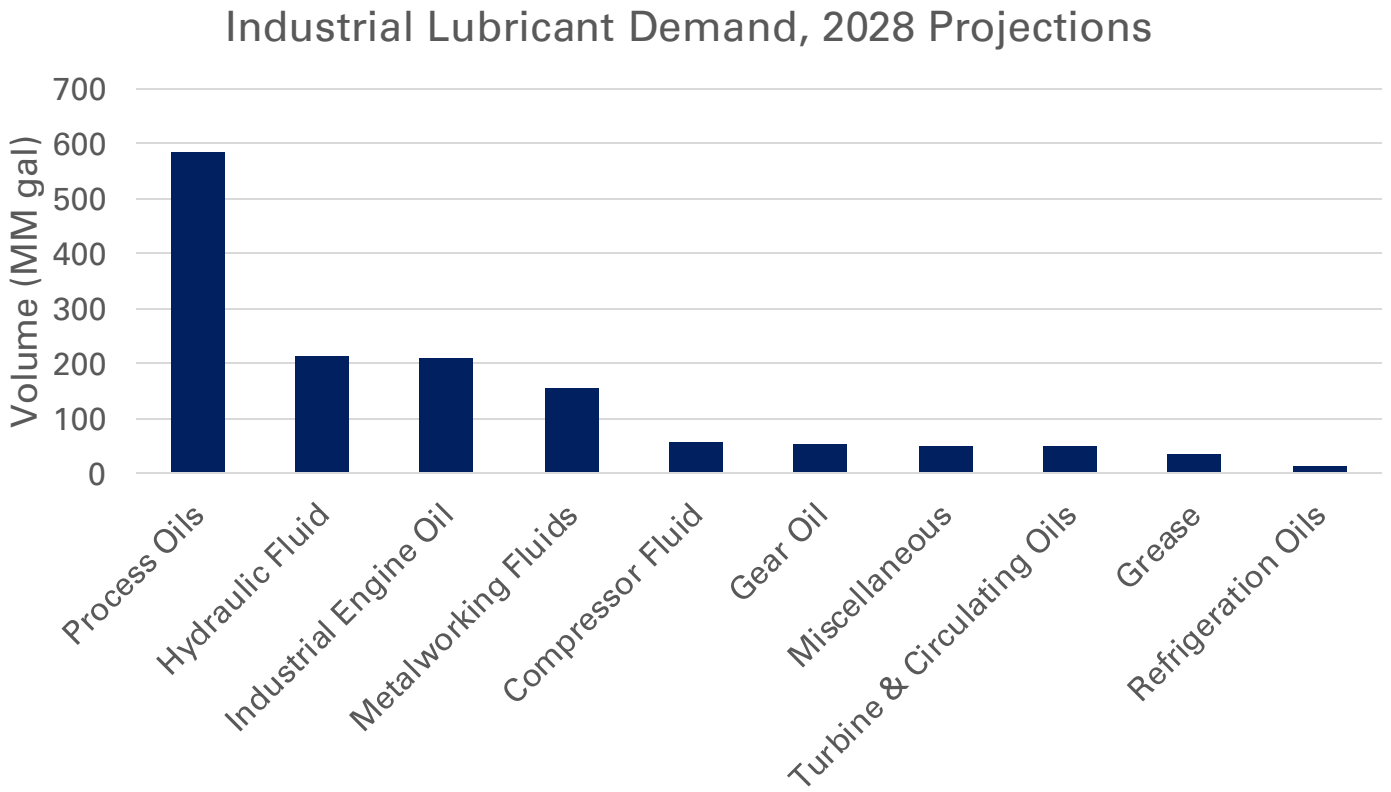
- CITGO Senior Sector Manager
- Chemical Engineer
- 40+ Years Experience in Lubricants
- Active in STLE, NLGI, and ASTM

# Agenda

- Market Information
- What are Synthetics?
- Synthetic Lubricant Applications
- Problem Solving
- Synthetic Lubricant Offerings
- Resources

# North American Lubricants Market Overview



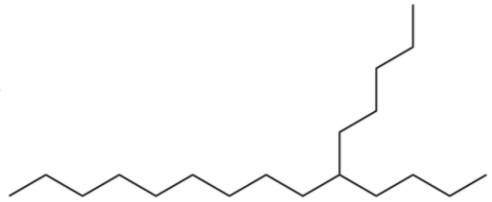



# API Base Oil Groups

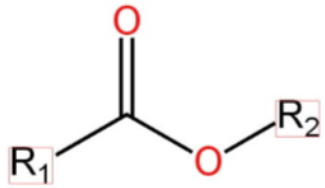
| Group | Manufacturing Process | Sulfur, %wt | | Saturates, %wt | Viscosity Index |
|---|---|---|---|---|---|
| I | Solvent Refining | >0.03 | And / Or | <90 | 80 - 119 |
| II | Hydro-processing | ≤0.03 | And | ≥90 | 80 - 119 |
| III | Severe Hydrocracking | ≤0.03 | And | ≥90 | ≥120 |
| IV | Chemical Synthesis | Polyalphaolefins (PAOs) | | | |
| V | Various | All Stocks Not Included in Groups I-IV | | | |

# Common Synthetic Base Stocks

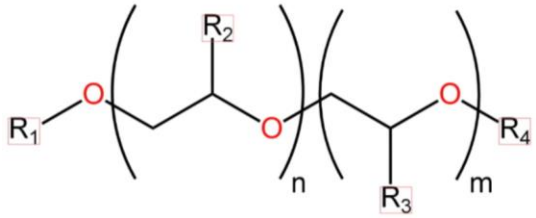
**Polyalphaolefin (PAO)**
Synthetic hydrocarbon with straight and branched carbon chains



**Diester (DE)**
Formed by reacting an organic acid with an alcohol




**Polyalkylene Glycol (PAG)**
Polymerization product of ethylene oxide and propylene oxide



# What are Synthetic Lubricants?

Formulated with base stocks other than mineral oil

Used in applications where extreme conditions exist, especially in extremes of high or low temperature

**PROS**

- Extremely low pour points
- High flash points
- Typically higher VI than mineral oils
- Superior oxidation and thermal stability
- Improved lubricity

**CONS**

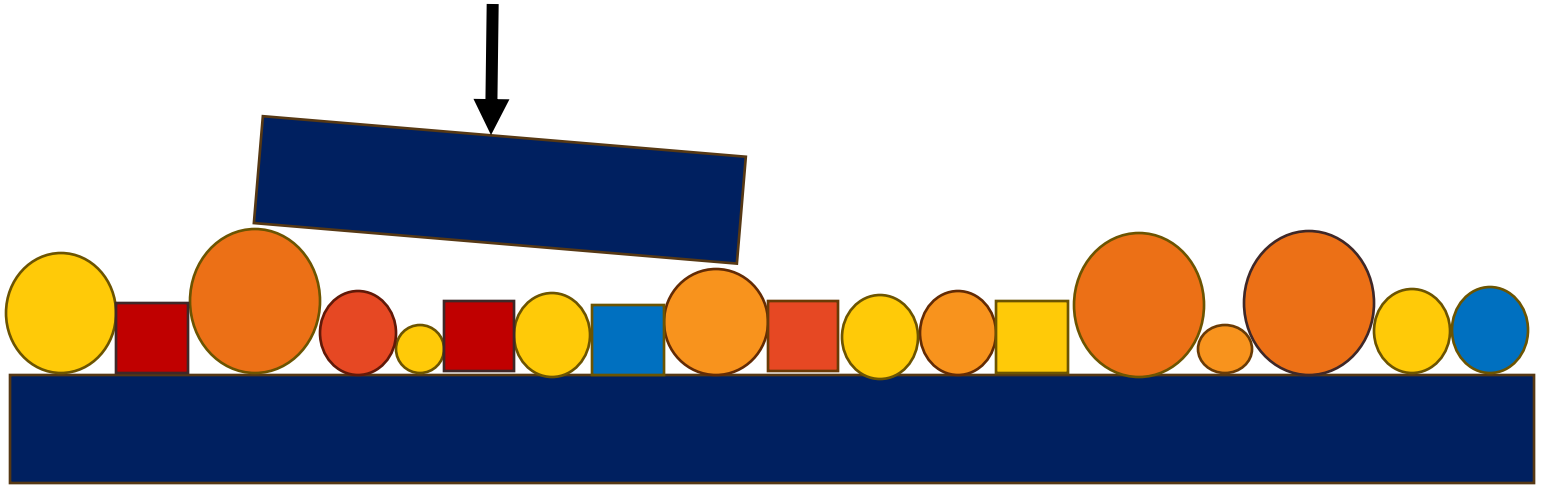
- Decreased additive response
- Elastomer incompatibility
- Hydrolytic stability of some esters
- More costly

# Why Do We Use Synthetics?

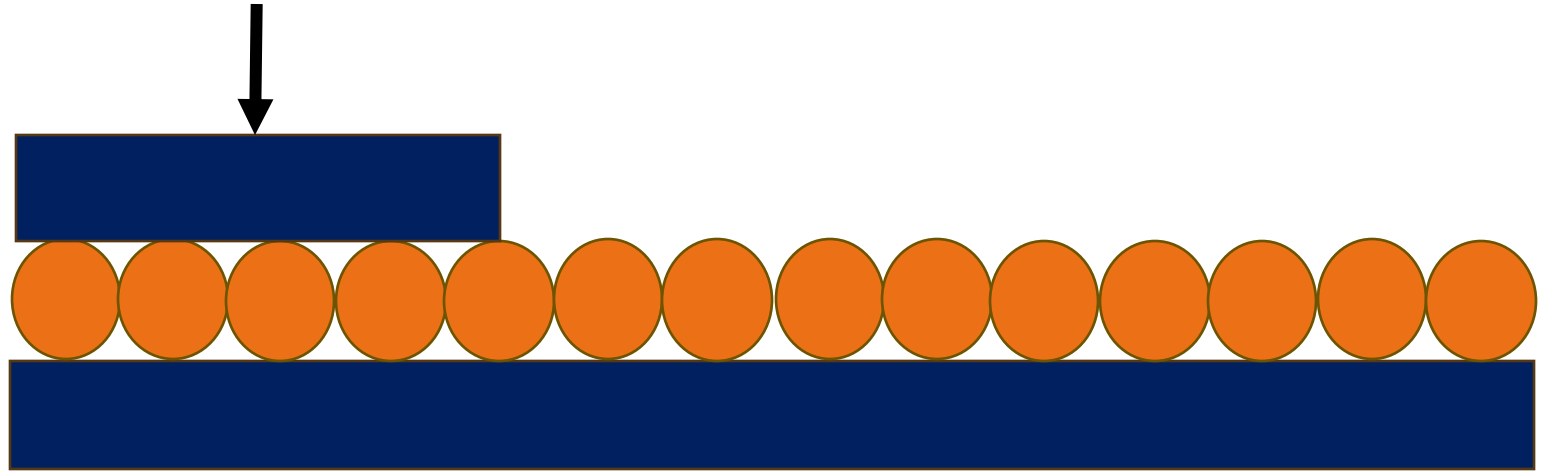
- Thermal and oxidative stability
- Wide operating temperature range due to their higher viscosity index, lower pour point, and often higher flash point
- Improved oxidative stability
- Uniform size, providing high film strength
- The coefficient of friction of synthetic fluids is typically lower than that of mineral oils due to the uniform molecular size

# Film Strength

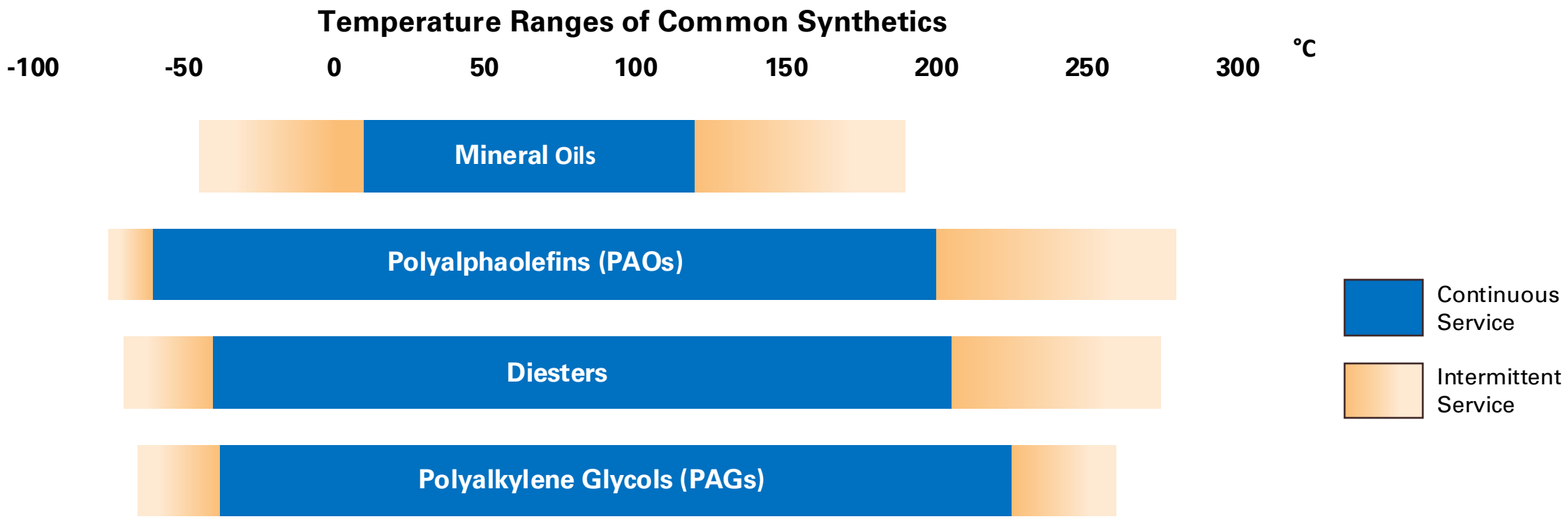
**Mineral Oils**



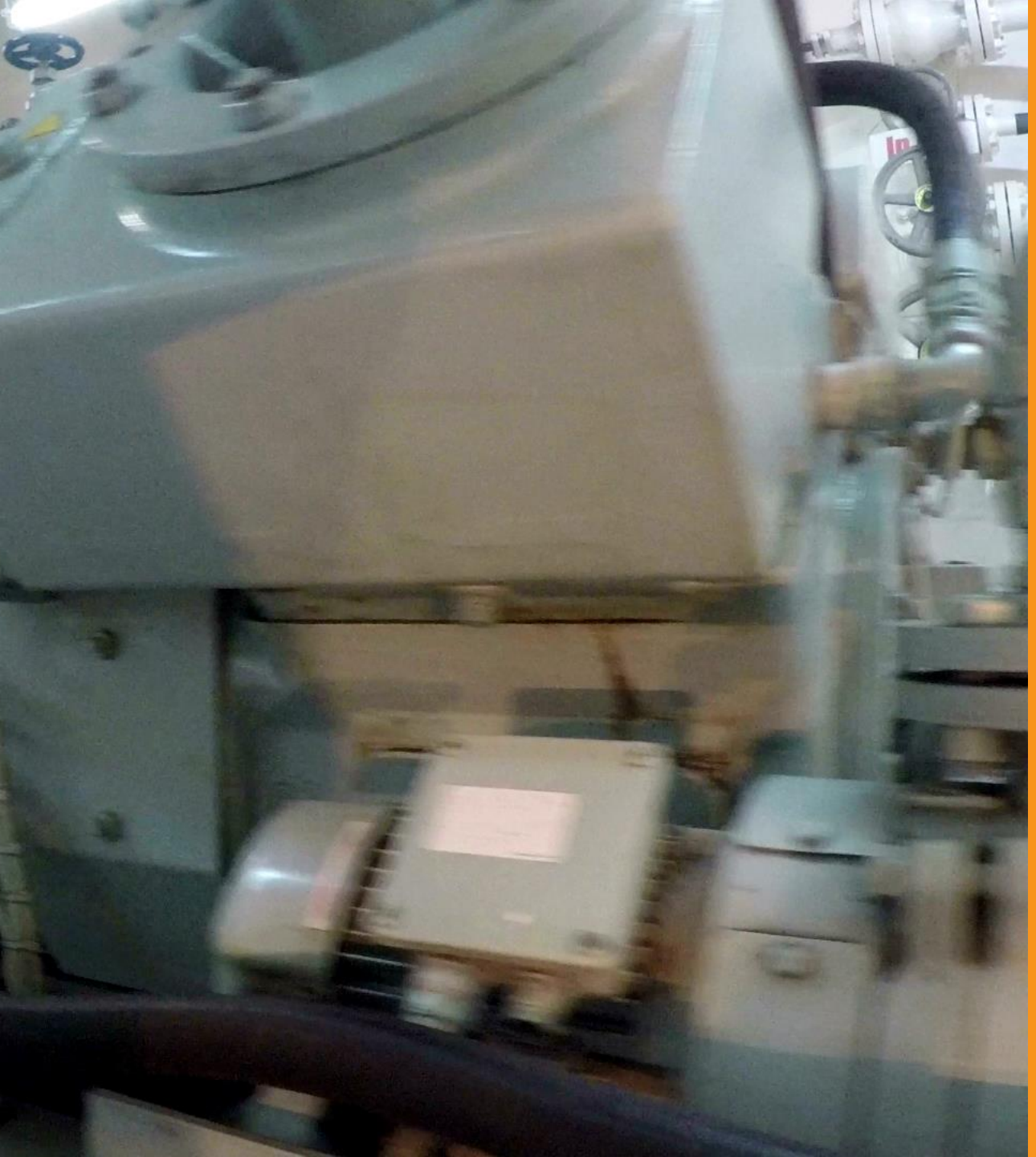
**Synthetic Lubricants**



# Temperature Ranges of Synthetics



# Synthetic Lubricant Applications



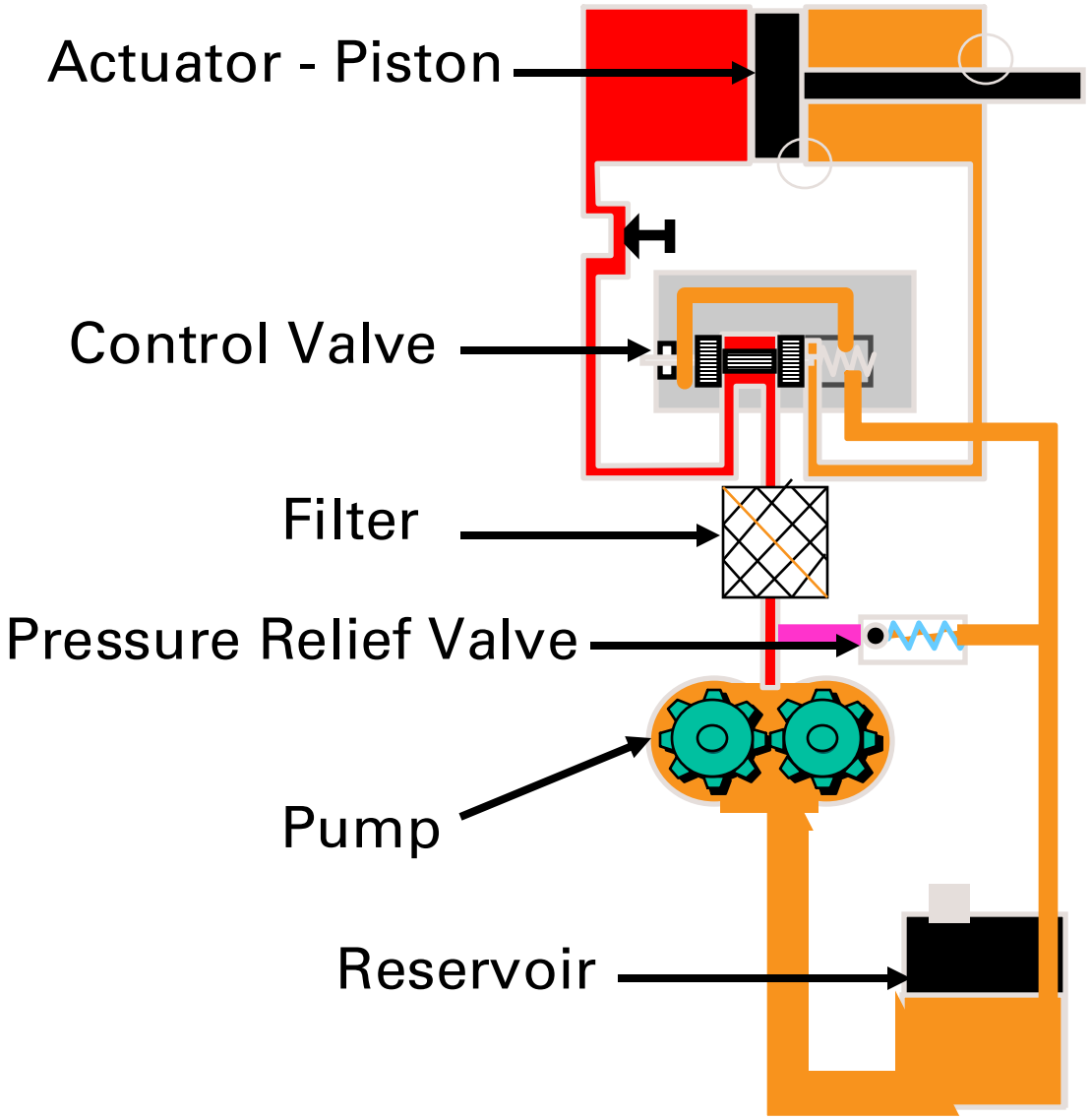
# Compressors

- A critical piece of equipment in an industrial plant
- Take air or compression gas and increase its pressure
- Different compressor types
  - Positive Displacement
    - Rotary Screw, Rotary Vane, Reciprocating
  - Dynamic
    - Centrifugal, Axial

# Gears

- Rotating parts with interlocking teeth
- Main function is to transmit power from one shaft to another
- Other functions:
  - Altering Speed
  - Altering Torque
  - Changing direction of rotation
- Different gear types for different purposes
  - Spur, helical, bevel, hypoid, worm, etc.

# Hydraulic Systems



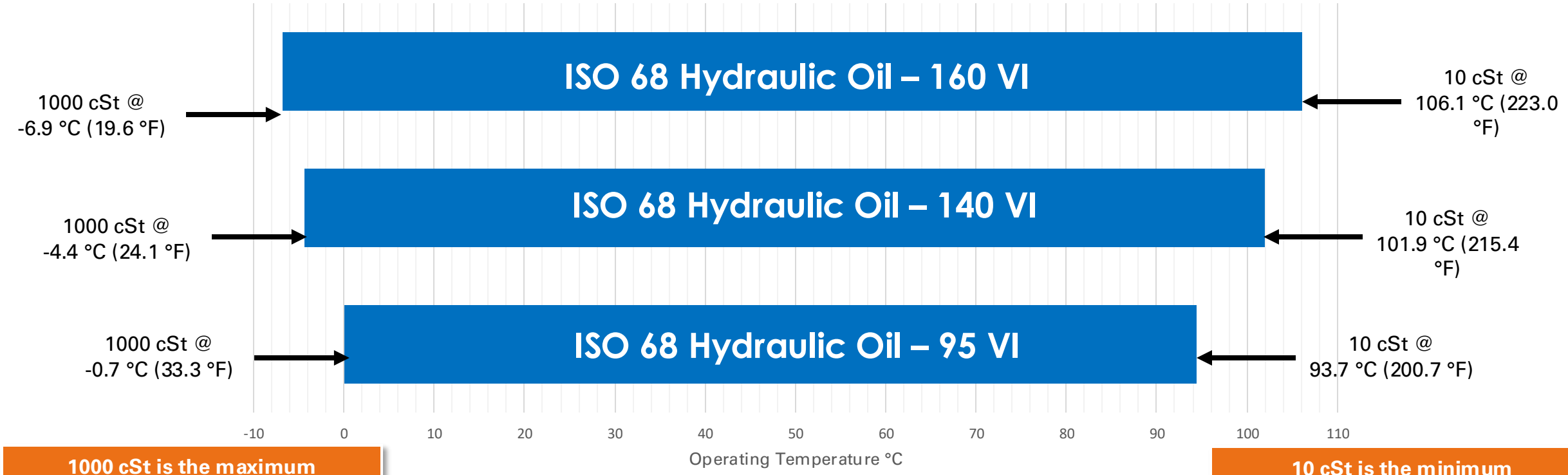

- Hydraulics are the liquid counterpart of pneumatics.
- Hydraulic fluids serve several purposes:
  - Transmit Power
  - Lubricate and Prevent Wear
  - Transfer Heat
  - Seal out contaminants

# Turbines

- Used for power generation
- Rotary engine powered by gas or liquid
- Various types:
  - Hydroelectric
  - Steam, gas, combined cycle

# Problem Solving

# Temperature Operating Window – Effect of VI




**1000 cSt is the maximum recommended viscosity to secure pumpability**

**10 cSt is the minimum recommended viscosity to secure lubrication**

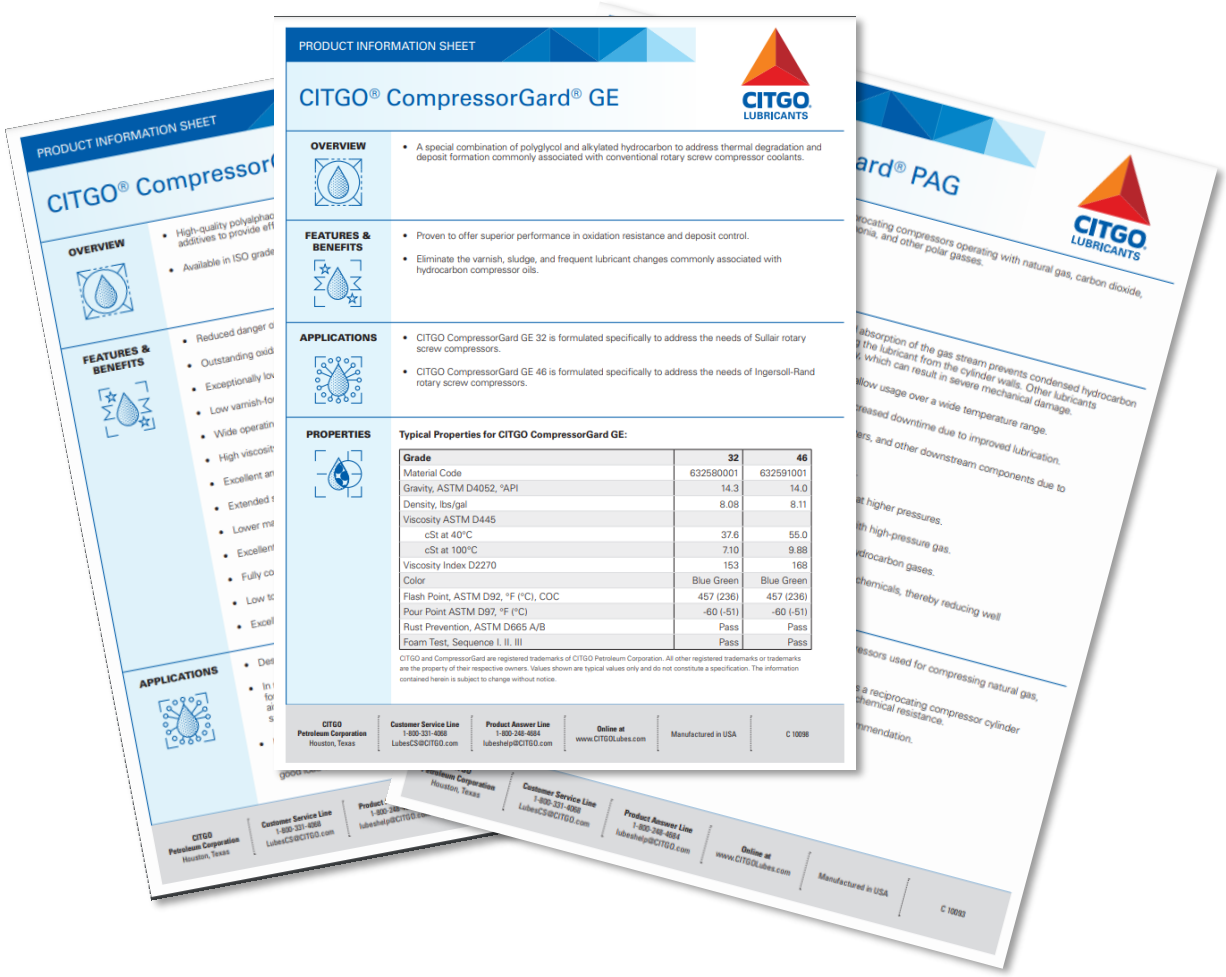
# Application Considerations

| | | |
|---|---|---|
| Lubricant Cost | PAO | Good |
| Operating Temp | DE | Better |
| Deposit Control | GE | Best |

# Compatibility of Base Oil Types

| | Mineral Oil | PAO | Ester | PAG |
|---|---|---|---|---|
| Mineral Oil | | | | |
| PAO | | | | |
| Ester | | | | |
| PAG | | | | |

# Customer Concerns & Challenges


PRODUCT INFORMATION SHEET

CITGO® CompressorGard® GE

CITGO LUBRICANTS

**OVERVIEW**

- A special combination of polyglycol and alkylated hydrocarbon to address thermal degradation and deposit formation commonly associated with conventional rotary screw compressor coolants.

**FEATURES & BENEFITS**

- Proven to offer superior performance in oxidation resistance and deposit control.
- Eliminate the varnish, sludge, and frequent lubricant changes commonly associated with hydrocarbon compressor oils.

**APPLICATIONS**

- CITGO CompressorGard GE 32 is formulated specifically to address the needs of Sullair rotary screw compressors.
- CITGO CompressorGard GE 46 is formulated specifically to address the needs of Ingersoll-Rand rotary screw compressors.

**PROPERTIES**

**Typical Properties for CITGO CompressorGard GE:**

| Grade | 32 | 46 |
|---|---|---|
| Material Code | 632580001 | 632591001 |
| Gravity, ASTM D4052, °API | 14.3 | 14.0 |
| Density, lbs/gal | 8.08 | 8.11 |
| Viscosity ASTM D445 | | |
| cSt at 40°C | 37.6 | 55.0 |
| cSt at 100°C | 7.10 | 9.88 |
| Viscosity Index D2270 | 153 | 168 |
| Color | Blue Green | Blue Green |
| Flash Point, ASTM D92, °F (°C), COC | 457 (236) | 457 (236) |
| Pour Point ASTM D97, °F (°C) | -60 (-51) | -60 (-51) |
| Rust Prevention, ASTM D665 A/B | Pass | Pass |
| Foam Test, Sequence I, II, III | Pass | Pass |

CITGO and CompressorGard are registered trademarks of CITGO Petroleum Corporation. All other registered trademarks or trademarks are the property of their respective owners. Values shown are typical values only and do not constitute a specification. The information contained herein is subject to change without notice.

CITGO Petroleum Corporation, Houston, Texas | Customer Service Line 1-800-331-4068, LubesCS@CITGO.com | Product Answer Line 1-800-248-4684, lubeshelp@CITGO.com | Online at www.CITGOLubes.com | Manufactured in USA | C 10098

CompressorGard GE meets Sullair and Ingersoll-Rand specs

**Will this damage my compressor?**

No, CITGO compressor lubricants are high-quality, synthetic base stocks.

**How long does the oil last?**

Depends on the application, but you can generally expect a year's service life or longer

**Product Availability**

Swiftship: We have it in stock and can ship today!

**Cost**

Significantly less than the OEM fluid

**Outsourcing**

You can deliver to them vetted and approved high-quality compressor lubricants

TEMPERATURE

OEM RECOMMENDATION

COMPRESSION GAS

ISSUES

# SELECTING THE CORRECT LUBRICANTS

FACTORS TO CONSIDER

CURRENT LUBRICANT

SPECIAL REQUIREMENTS

PRESSURE

# Product Offerings

# Synthetic Lubricants - Hydraulic

## CITGO HyDurance AW Synthetic

- Polyalphaolefin (PAO) based
- Ashless anti-wear package
- Maximum service life in vane, piston, and gear pumps
- Excellent thermal and oxidative stability
- Excellent corrosion protection
- High viscosity index
- Wide temperature range performance

ISO 32 and 46

# Synthetic Lubricants - Turbine

**CITGO Pacemaker ST-32**

- Synthetic Gas Turbine Lubricant
- Formulated with synthetic PAO fluids
- Includes a solvency-enhancing additive
- High viscosity index
- Excellent oxidation and thermal stability
- Excellent rust and corrosion prevention
- Excellent water separation
- Excellent foam resistance and air release properties
- Antiwear properties for use in geared turbines

ISO 32

**Not for use in aeroderivative or aviation engines!**

# Industrial Synthetic Lubricants - Gear

| CITGEAR Synthetic EP | CITGEAR Synthetic HT | CITGEAR Synthetic PAG Gear Fluids |
|---|---|---|
| Intended for severe temperature applications (wide ranges)<br><br>Recommended for gears requiring EP protection<br><br>Especially recommended for lubricating industrial enclosed gears and heavily loaded plain or roller element bears.<br><br>ISO 100, 150, 220, 320, 460, 680 | For operations at severe high or low temps<br><br>Non-EP AGMA Lubricants<br><br>Can be used in worm gears and industrial blowers<br><br>Can be used in compressor applications (higher P, check downstream catalysts if used in a compressor)<br><br>ISO 68, 100, 150, 220, 320, 460, 680, 1000 | Polyalkylene Glycol (PAG) based<br>Gear boxes, worm gears, bearings, blowers, and hydraulic systems<br><br>High Viscosity Index and low pour point<br>Heat transfer properties<br><br>**Hygroscopic**<br><br>Not compatible with mineral oils<br><br>ISO 100, 150, 220, 320, 460 |

# Synthetic Lubricants – Air Compression

## CompressorGard PAO

- Based on Polyalphaolefin (PAO) base fluids
- Outstanding thermal and oxidation stability and deposit control
- Rotary vane, rotary screw, and centrifugal compressors
- ISO 32, 46, 68, 100, and 150

## CompressorGard DE

- Based on Diester base fluids
- Increased thermal and oxidation stability and deposit control
- Rotary vane, rotary screw & reciprocating compressors
- Check seal and paint compatibility
- ISO 32, 68, 100, 125 and 150

## CompressorGard GE

- Based on PAG / Alkylated hydrocarbon base fluids
- Excellent thermal and oxidation stability and deposit control
- ISO 32 for Sullair Rotary Screw Compressors
- ISO 46 for Ingersoll-Rand Rotary Screw Compressors

**GOOD** **BETTER** **BEST**

# Product Highlight – CompressorGard DE

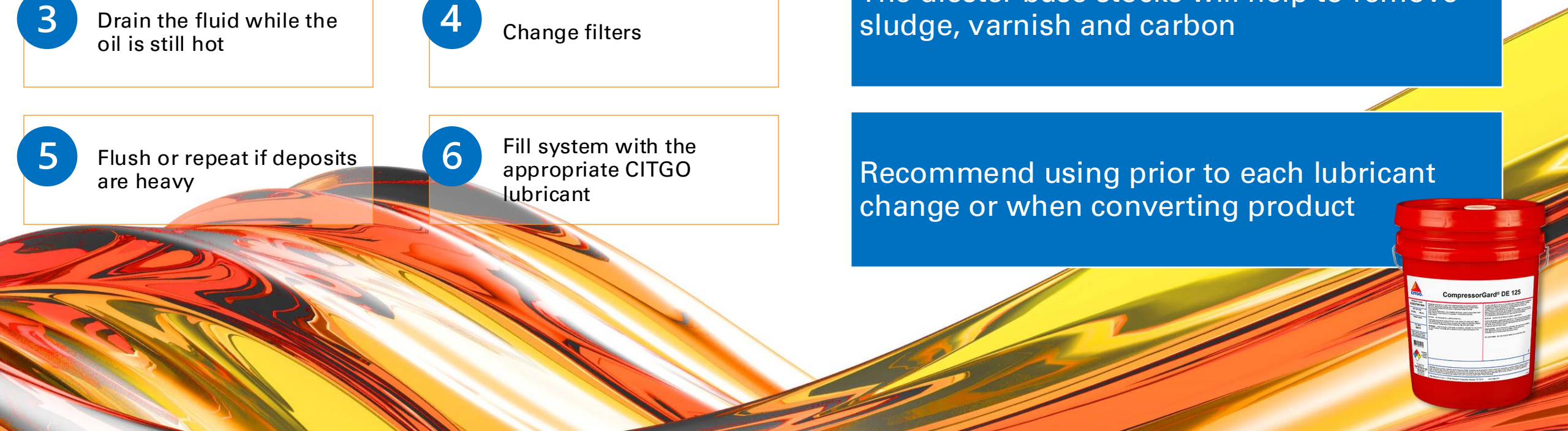
## System Cleaning:

1. Add 1 gallon CompressorGard DE for every 10 gallons of oil in the unit
2. Run for 48 – 72 hours
3. Drain the fluid while the oil is still hot
4. Change filters
5. Flush or repeat if deposits are heavy
6. Fill system with the appropriate CITGO lubricant

CompressorGard DE products are also great lubricants to use as a system cleaner for hydraulic systems, gearboxes and heat transfer systems!

The diester base stocks will help to remove sludge, varnish and carbon

Recommend using prior to each lubricant change or when converting product



# Synthetic Lubricants – Natural Gas Compression

**CompressorGard H**

- Polyalphaolefin (PAO) base fluids
- Excellent thermal and oxidation stability and deposit control
- Excellent low-temperature service
- Reciprocating compressors
- Hydrogen, natural gas, sour gas

ISO 100 and 220

**CompressorGard PAG**

- Polyalkylene Glycol (PAG) base fluids
- Reciprocating, rotary screw, and rotary vane compressors
- Natural gas, $CO_2$, $H_2$, He, $N_2$, $NH_3$, other polar gases
- Resistant to gas absorption and hydrocarbon dilution
- Maintain viscosity better than mineral oil or PAO based fluids

ISO 100, 150, and 220

# Synthetic Lubricants – Propane Refrigeration

## CompressorGard IPG

- Based on PAG synthetic fluid
- High viscosity index – increased viscosity at high temperature
- Excellent R&O, antiwear, and water separation properties
- Reciprocating, rotary screw, and rotary vane compressors
- R-290 Propane ($C_3H_8$) refrigerant

ISO 100, 150

# Synthetic Lubricants - Food Grade

**Clarion Synthetic Refrigeration Fluid**

- Refrigeration compressor lubricant
- Excellent low-temperature properties
- Outstanding thermal and oxidation stability
- Compatible with most common refrigerants
- NSF H1

ISO 68

**Clarion CompressorGard**

- Air compressor lubricant
- Superior protection against wear, rust, and corrosion
- Ideal over a wide temperature range
- Recommended as a hydraulic fluid where extreme temperatures exist
- NSF H1

ISO 32, 46, 68

# Synthetic Lubricants - Food Grade

**Clarion Synthetic Gear Fluids**

- Extreme pressure gear lubricant
- Exceptional heat resistance and low temperature fluidity
- Designed for use in can seamers
- NSF H1

ISO 150, 220, 320, 460

**Clarion SynBar Fluids**

- Barrier fluid for mechanical seals
- Compatible with most seal materials
- Excellent low-temperature fluidity and high-temperature stability
- NSF H1

ISO 5, 22

# Synthetic Lubricants - Environmental

**Clarion Green Synthetic Fluids**

- Zinc-free, anti-wear hydraulic fluids
- Readily biodegradable
- Meets 2013 EPA VGP requirements for Environmentally Acceptable Lubricants
- Non-toxic per LC-50 Aquatic Toxicity Test

ISO 22, 32, 46, 68

**Clarion Green Synthetic Gear Fluids**

- Zinc-free, extreme-pressure gear lubricants
- Readily biodegradable
- Meets 2013 EPA VGP requirements for Environmentally Acceptable Lubricants
- Non-toxic per LC-50 Aquatic Toxicity Test

ISO 150, 220, 320

# Synthetic Lubricants – Grease

## Mystik JT-6 Synthetic Greases

- Industrial greases
- Lithium complex thickener
- PAO base fluid
- Robust additive package

ISO 100, NLGI #1

ISO 220, NLGI #2

ISO 460 NLGI #1 and #2

## Mystik JT-6 Synthetic 460 #00

- Lithium complex thickener
- PAO base fluid
- Robust additive package
- Specifically formulated for the lubrication of heavy-duty trailer wheel bearing hub units operated under a wide range of conditions.

ISO 460, NLGI #00

## Mystik JT-6 Synthetic Electric Motor Grease

- Lithium complex thickener
- PAO base fluid
- R&O additive package
- Designed for the lubrication of electric motor bearings

# Why do We Sell ISL?

- You should always look to improve your customer's operation, and synthetics are simply the best lubricants: better lubricity, better temperature resistance.

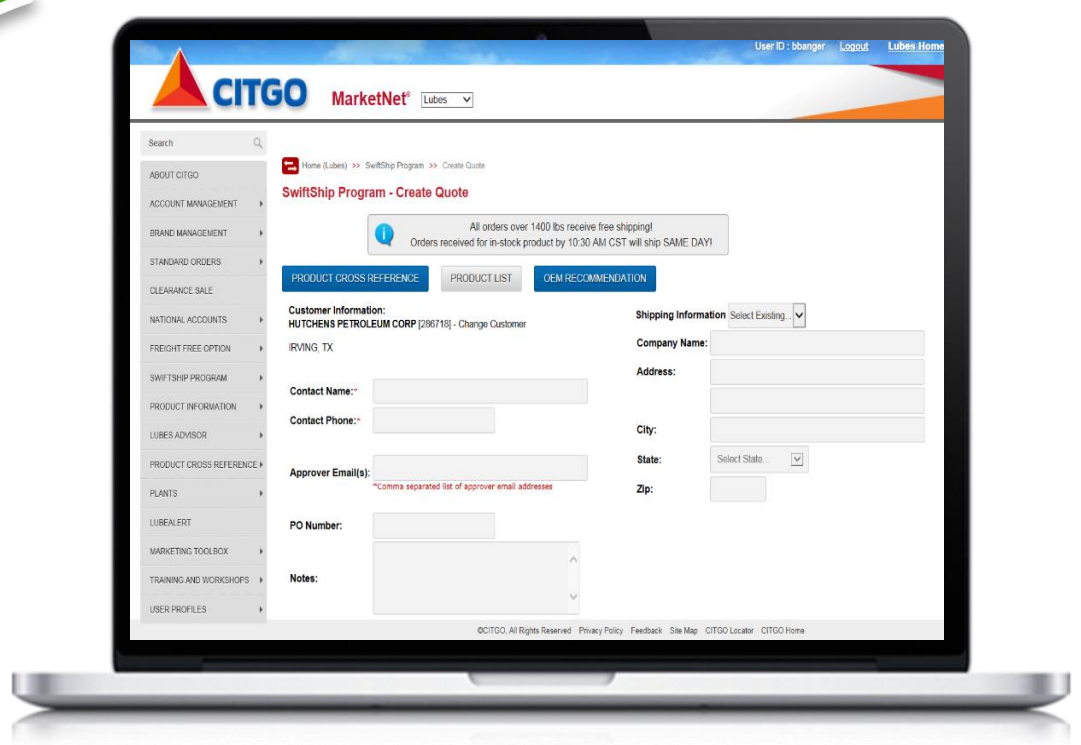
- Synthetics are typically less labor-intensive.

- These are more technologically sophisticated products; thus, they command a higher price and a higher gross profit margin.

# Resources

# MarketNet

- Product Guides
- PI, SDS
- Technical Bulletins
- Product Flyers and Brochures
- OEM Recommendations
- Cross Reference Tool
- Equipment Reference Tool
- Webinars



# SwiftShip

- Orders received for In-Stock Product by 10:30 a.m. CST will Ship Same Day!
- 3-4 Day Ship Times Out of Oklahoma City (determined by distance)
- SwiftShip Flexibility to Address (to your facility or direct ship to your customer)
- Expedited Shipping Available for Pails and Gallon Cases
- Floor Stock & Real-Time Visibility
- Instant visibility of Pricing & Real-Time Freight Rates

# Literature

## Support Material

SwiftShip 101 – How-To Guide

Heavy Industry Application Guide

Air Compressor Application Guide

Gears & Bearings Application Guide

# Questions?

Please post your questions using the Q&A function.

**For technical inquiries or issues:**
Lubes Answer Line 800-248-4684
lubeshelp@citgo.com

CITGO LUBRICANTS


# Thank You!

See you next time