



AUTOMOTIVE, COMMERCIAL AND INDUSTRIAL PRODUCTS GUIDE

- Engine Oils • Automotive Gear Oils • Transmission/Power Fluids
- Industrial Fluids • Industrial Gear Oils • Metalworking Fluids
- Industrial Gas Engine Oils • Railroad Lubricants • Functional Products
- Compressor Lubricants • Process Oils • Small Engine Oils





This CITGO Lubricants product guide is your directory to CITGO fluids, greases and their applications.

Products are not available at all source points. Please check product availability and container sizes for your normal source point(s).

Technical information and assistance:

Product Answer Line

800-248-4684

lubeshelp@citgo.com

Pre-shipment inquiries:

Order Management

800-331-4068, option 1

ordermanagement@citgo.com

Pricing, availability, post-shipment inquiries:

Customer Experience

800-331-4068, option 2

lubescs@citgo.com

Properties shown are based on typical values for the product only and do not constitute a specification. The information contained herein is subject to change without notice.

The information in this book is provided with no express or implied warranty but with good faith on the basis of the most accurate information available; CITGO accepts no liability for content errors or omissions, or for damages as a result of relying on information contained within. Consult your owner's manual for proper lubricant selection.

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Please visit www.citgolubes.com for the most up-to-date information on products or for Safety Data Sheets.



Lubricants Business Unit Quality Statement

CITGO Lubricants is committed to providing our customers with the highest quality products and services. This will be accomplished by:

- Satisfying mutually agreed upon expectations and customer requirements.
- Focusing on quality, employee involvement and continuous improvement of our processes.
- Establishing and maintaining an effective quality management system in compliance with ISO 9001.

Certifications Achieved and Maintained

ISO 9001 – CITGO Lubricant Plants

ISO 9001 – LubeAlert Oil Analysis Program

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CITGO® SUPERGARD® Motor Oils

OVERVIEW



- Premium-quality engine oils designed to provide optimum performance in high-output gasoline engines (including turbocharged and supercharged) in passenger cars, vans, sport utility vehicles, and light trucks.
- The new technology incorporated in these latest-generation lubricants enables them to exceed manufacturers' performance requirements and demonstrate improved performance in today's advanced engine designs.
- Available in both single and multi-grades. Grades SAE 5W-20 and SAE 5W-30 are synthetic blends.

FEATURES & BENEFITS



- Exceed latest SAE low-temperature pumping viscosity requirements.
- Provide improved performance in foaming control.
- Provide significantly greater engine cleanliness, wear protection, and resistance to oil thickening.
- Protect against varnish buildup and sludge formation on critical engine parts.
- Control high-temperature deposits in critical ring belt area.
- Provide maximum protection against rust and corrosion.
- Meet SAE standards for high-temperature/high-shear rate viscosity.
- Extend engine life by controlling wear and deposit formation.
- Protects today's high power density engines from Low Speed Pre-ignition (LSPI) and timing chain wear.

APPLICATIONS



- Recommended for passenger cars, sport utility vehicles, and light trucks operating on gasoline.
- Recommended for use in gasoline engines which have been converted to operate on compressed natural gas (CNG), liquefied natural gas (LNG), and liquefied petroleum gas (LPG, which includes propane and butane).

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APPLICATIONS

- Service categories:

All viscosity grades are licensed for API SP and are backward compatible with prior API Service Categories (SN Plus, SM, SL, SJ and SH).

SAE 5W-20 and SAE 5W-30 are synthetic blends with API SP, Resource Conserving and ILSAC GF-6A.

SAE 10W-30: API SP, Resource Conserving, and ILSAC GF-6A.

SAE 5W-20: Meets the performance requirements of Honda SAE 5W-20 specification.

- Refer to equipment owner's manual for proper lubricant recommendation.

Note: CITGO SUPERGARD Motor Oils are not recommended for use in diesel engines. CITGO CITGARD® Motor Oils are recommended for diesel applications.

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PROPERTIES



Typical Properties for CITGO Supergard Motor Oils:

SAE Grade	5W-20	5W-30	10W-30	10W-40	20W-50	30	40
Material Code	620802001	620805001	620813001	620814001	620825001	620903001	620904001
Gravity, ASTM D4052, °API	32.3	32.9	30.6	30.7	28.8	28.7	28.0
Pounds Per Gallon	7.19	7.17	7.27	7.27	7.35	7.35	7.39
Flash Point, ASTM D92, COC, °F (°C)	439 (226)	442 (228)	450 (232)	453 (234)	473 (245)	489 (254)	500 (260)
Low Temperature Cranking, ASTM D5293							
Temperature, °F (°C)	-22 (-30)	-22 (-30)	-13 (-25)	-13 (-25)	5 (-15)	—	—
Viscosity, cP	5,970	5,200	5,770	6,000	6,120	—	—
Viscosity ASTM D445 cSt at 40°C	49.9	59.3	70	97	163	104	148
cSt at 100°C	8.15	9.8	10.4	14.1	18.1	11.8	14.7
Viscosity Index, ASTM D2270	142	151	134	149	123	103	98
Pour Point, ASTM D97, °F (°C)	-33 (-36)	-38 (-39)	-33 (-36)	-33 (-36)	-27 (-33)	-22 (-30)	0 (-18)
Color, ASTM D1500	L3.5	L3.5	L3.5	L3.5	L3.5	L3.5	L4.0
API Service Category	SP	SP	SP	SP	SP	SP	SP
Resource Conserving	Yes	Yes	Yes	No	No	No	No
ILSAC Service category	GF-6A	GF-6A	GF-6A	N/A	N/A	N/A	N/A
Ford WSS	M2C9060-A1	M2C961-A1	N/A	N/A	N/A	N/A	N/A
Chrysler MS 6395	Yes	Yes	Yes	N/A	N/A	N/A	N/A

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CITGO® SUPERGARD® Synthetic Blend SAE 10W-30 and 10W-40 Motor Oil

OVERVIEW



- Premium engine oils designed to provide optimum performance in high-output gasoline engines (including turbocharged and supercharged) in passenger cars, vans, sport utility vehicles, and light trucks.
- The new technology incorporated in these latest-generation lubricants enable them to exceed manufacturers' performance requirements and demonstrate improved performance in today's advanced engine designs.

FEATURES & BENEFITS



- Exceed latest SAE low-temperature pumping viscosity requirements.
- Provide improved performance in foaming control.
- Provide significantly greater engine cleanliness, wear protection, and resistance to oil thickening.
- Protect against varnish buildup and sludge formation on critical engine parts.
- Control high-temperature deposits in critical ring belt area.
- Provide maximum protection against rust and corrosion.
- Meet SAE standards for high-temperature/high-shear rate viscosity.
- Extend engine life by controlling wear and deposit formation.
- Protects against low speed pre-ignition (LSPI) and timing chain wear of new high power density engines.

APPLICATIONS



- Recommended for passenger cars, sport utility vehicles, and light trucks operating on gasoline.
- Licensed for API SP.
- Refer to equipment owner's manual for proper lubricant recommendation.

Note: This motor oil is not recommended for use in diesel engines.

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PROPERTIES



Typical Properties for CITGO SUPERGARD Synthetic Blend Motor Oils:

SAE Grade	10W-30	10W-40
Material Code	620853001	620854001
Gravity, ASTM D4052, °API	31.7	30.8
Pounds Per Gallon	7.22	7.25
Flash Point, ASTM D92, COC, °F (°C)	450 (232)	453 (234)
Low Temperature Cranking, ASTM D5293:		
Temperature, °F (°C)	13 (-25)	13 (-25)
Viscosity, cP	5,450	5,700
Viscosity ASTM D445		
cSt at 40°C	70.4	95
cSt at 100°C	10.8	14.2
Viscosity Index, ASTM D2270	143	154
Pour Point, ASTM D97, °F (°C)	-44 (-42)	-27 (-33)
Color, ASTM D1500	L3.0	L3.5
API Service Category	SP/Resource Conserving/ ILSAC GF-6A	SP
Chrysler MS 6395	Yes	N/A

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CITGO® SUPERGARD®

Full Synthetic Motor Oils



OVERVIEW



- Well-balanced combinations of today's highest quality synthetic base stocks and advanced additive systems that meet stringent automotive specifications, for demonstrated improved performance in today's advanced engine designs.
- Designed to provide excellent protection in today's high-performance gasoline engines (including turbocharged and supercharged) in passenger cars, vans, sport utility vehicles, and light trucks.
- Available in SAE 0W-16, 0W-20, 5W-20, 5W-30, and 10W-30 viscosity grades.
- Available in **dexos®1 Gen3** licensed SAE 0W-20 and 5W-30 viscosity grades; dexos®1 Gen3 licensed SAE 5W-20 will be available in the Fall of 2022.

FEATURES & BENEFITS



- Excellent low-temperature starting and pumpability characteristics.
- High-temperature/high-shear properties well above those of conventional oils.
- Lower volatility as compared to conventional oils.
- Excellent thermal and oxidation stability.
- Enhanced protection against varnish buildup and sludge formation in critical engine parts, for top performance and long engine life.
- Extended engine life due to control of wear and deposit formation.
- Compatible with conventional and synthetic motor oils.
- Protects today's high power density engines from Low Speed Pre-Ignition (LSPI) and timing chain wear.

APPLICATIONS



- Recommended for passenger cars, sport utility vehicles, and light trucks operating on gasoline.
- Recommended for use in gasoline engines which have been converted to operate on compressed natural gas (CNG), liquefied natural gas (LNG), and liquefied petroleum gas (LPG, which includes propane and butane).
- Service categories:
All viscosity grades meet the performance requirements for API SP and display the API Certification Mark and API Service Symbol. All viscosity grades meet the latest gasoline-fueled engine service GF-6A or GF-6B, and are resource conserving. They are recommended for use in Ford, Chrysler, Toyota, Honda, GM and other passenger car gasoline engines. (Use only recommended viscosity grades.) They have also demonstrated benefits in industry-accepted fuel economy tests.
- SAE 0W-16: An ultra-low viscosity engine oil recommended for original equipment manufacturers (OEM) such as Toyota and Honda, where an API SP/ILSAC GF-6B SAE 0W-16 is specified.
- SAE 0W-20 is recommended for original equipment manufacturers (OEM) such as Toyota and Honda where an API SP/ILSAC GF-6A, SAE 0W-20 is specified.

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APPLICATIONS



SAE Grade	0W-16	0W-20 GFX (formerly known as INTL)	0W-20 (dexos®1 Gen3)	5W-20 GFX (formerly known as INTL)	5W-20 (dexos®1 Gen3)	5W-30 GFX (formerly known as INTL)	5W-30 (dexos®1 Gen3)	10W-30
Approved and Licensed for GM dexos®1: GEN3	N/A	—	X	—	Available in the fall of 2022	—	X	N/A

Approved and/or Licensed for API

	GF-6B	GF-6A	GF-6A	GF-6A	GF-6A	GF-6A	GF-6A	GF-6A
ILSAC								
API SP Resource Conserving	X	X	X	X	X	X	X	X
API SN Plus/ Resource Conserving	X	X	X	X	X	X	X	X

The product meets or
exceeds the requirement of:

Ford WSS-M2C962-A1	X							
Ford WSS-M2C960-A1				X				
Ford WSS-M2C961-A1						X		

Recommended for use
in application requiring:

SAE 10W-30: Provides excellent performance where SAE 10W-30 engine oil is specified.

- Refer to equipment owner’s manual for proper lubricant recommendation.

NOTE: CITGO SUPERGARD Full Synthetic Motor Oils are not recommended for use in diesel engines. CITGO CITGARD® Motor Oils are recommended for these applications.

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PROPERTIES



Typical Properties for CITGO SUPERGARD Full Synthetic Motor Oils:

SAE Grade	0W-16	0W-20 GFX (formerly known as INTL)	0W-20 (dexos®1 Gen3)	5W-20 GFX (formerly known as INTL)	5W-20 (dexos®1 Gen3)	5W-30 GFX (formerly known as INTL)	5W-30 (dexos®1 Gen3)	10W-30
Material Code	620858001	620865001	620860001	620866001	620859001	620867001	620861001	620863001
Gravity, ASTM D4052, °API	36.6	35.0	36.2	34.5	35.2	34.2	35.7	34.4
Pounds Per Gallon	7.01	7.08	7.03	7.1	7.07	7.11	7.05	7.27
Flash Point, ASTM D92, °F (°C)	442 (228)	428 (220)	435 (220)	442 (228)	450 (232)	450 (232)	450 (232)	450 (232)
Low Temperature Cranking, ASTM D5293								
Temperature, °F (°C)	-31 (-35)	-31 (-35)	-31 (-35)	-22 (-30)	-22 (-30)	-22 (-30)	-22 (-30)	-13 (-25)
Viscosity, cP	4,329	5,190	4,685	5,300	3,512	4,080	3,726	3,685
Viscosity ASTM D445								
cSt at 40°C	36.5	46.0	46.1	52	48.1	58.5	55.7	62.2
cSt at 100°C	7.3	8.5	8.8	8.7	8.9	10.5	10	10.4
Viscosity Index, ASTM D2270	168	164	174	145	167	171	168	155
Pour Point, ASTM D97, °F (°C)	-49 (-45)	-33 (-36)	-49 (-45)	-33 (-36)	-44 (-42)	-27 (-33)	-44 (-42)	-44 (-42)
Color, ASTM D1500	L3.5	L3.5	L4.0	L3.5	L4.0	L3.5	L4.0	L3.0
ILSAC	GF-6B	GF-6A	GF-6A	GF-6A	GF-6A	GF-6A	GF-6A	GF-6A
API SP/Resource Conserving	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Licensed GM dexos®1 Gen3	N/A	—	Yes	—	Available in the fall of 2022	—	Yes	N/A

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CITGO® SUPERGARD® UltraLife® Motor Oils



OVERVIEW



- Premium-quality engine oils designed to provide optimum performance and improve the life of older, higher-mileage engines (including turbocharged and supercharged) found in passenger cars, vans, sport utility vehicles, and light trucks.
- Formulated with highly refined base oils and additive systems that will handle those problems associated with older, higher-mileage engines that have exceeded their warranty.

FEATURES & BENEFITS



- Provide extra wear protection.
- Provide improved seal conditioning to help reduce oil leakage and valve deposits.
- Offer excellent resistance to oil burn-off.
- Provide extra cleaning to critical engine parts.
- Help improve overall engine performance.
- Offer excellent oxidation and thermal stability to help maintain engine cleanliness and prevent deposit formation.
- Protects today's high power density engines from Low Speed Pre-ignition (LSPI) and timing chain wear.

APPLICATIONS



- Recommended for older, higher mileage, rebuilt, and new passenger cars, sport utility vehicles, and light trucks operating on gasoline.
- Licensed API SP and backward compatible with prior API Service Categories (SN Plus, SM, SL and SJ).
- Grades SAE 5W-20, 5W-30 and SAE 10W-30 are licensed ILSAC GF-6A Resource Conserving.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO SUPERGARD UltraLife Motor Oils:

SAE Grade	5W-20	5W-30	10W-30	10W-40
Material Code	620891001	620892001	620893001	620894001
Gravity, ASTM D4052, °API	32.1	32.6	30.7	31.0
Density, lb/gal at 60°F	7.20	7.18	7.27	7.25
Flash point, COC, ASTM D92, °F (°C)	450 (232)	450 (232)	450 (232)	453 (234)
Viscosity ASTM D445				
cSt at 40°C	48.8	65.7	73.5	102.0
cSt at 100°C	8.3	10.9	11.0	15.0
Viscosity Index	150	158	139	154
Pour Point, ASTM D97, °F (°C)	-42 (-41)	-38 (-39)	-44 (-42)	-38 (-39)
Low Temperature Cranking at -22 °F (-30°C), ASTM D5293, cP	6,280	6,250	—	—
Low Temperature Cranking at -13 °F (-25°C), ASTM D5293, cP	—	—	6,180	6,080
Low Temperature Pumping at -31°F (-35°C), ASTM D4684, cP	21,200	29,300	—	—
Low Temperature Pumping at -22°F (-30°C), ASTM D4684, cP	—	—	23,200	31,500
Yield Stress, Pa	<35	<35	<35	<35
Ford WSS	M2C9060-A1	M2C961-A	N/A	N/A
Chrysler MS 6395	Yes	Yes	Yes	N/A

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CITGO® SUPERGARD® UltraLife® Full Synthetic Motor Oils

OVERVIEW



- Ultra-premium quality engine oils designed to maximize the performance and longevity of older, high-mileage engines (including turbocharged and supercharged) in gasoline powered passenger cars, vans, sport utility vehicles and light trucks.
- Formulated with fully synthetic base oils and a balance of highly effective additives to maintain the engine's like-new performance and reduce the need for and expense of unexpected repairs.
- Removes the need for supplemental additives and protects warranties where fully licensed API service category SP and ILSAC GF-6A oils are required.

FEATURES & BENEFITS



- Promotes even higher mileage operation of the emissions system by retaining more than 90% of phosphorus in the oil.
- Reduces oil consumption, maintaining exceptional engine wear protection.
- Protects newer high-mileage, high-power density, direct inject engines from Low Speed Pre-ignition (LSPI) and timing chain wear.
- Prevents the production of sludge, corrosion, and deposits on engine parts increasing reliability and maintaining performance.
- Proven to protect hybrid engines (both new and high mileage) from the drastic effects of high frequency start and stop operation.

APPLICATIONS



- Recommended as premium protection for older, higher mileage, rebuilt, and new passenger cars, sport utility vehicles, and light trucks operating on gasoline.
- Licensed API SP and ILSAC GF-6A and backward compatible with prior API Service categories (SN Plus, SN, SM, SL, and SJ).
- Viscosity grades SAE 0W-20, 5W-20, and 5W-30 for coverage of newer, higher mileage, and hybrid engines.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO SUPERGARD UltraLife Full Synthetic Motor Oils:

SAE Grade	0W-20	5W-20	5W-30
Material Code	620898001	620899001	620900001
Gravity, ASTM D4052, °API	35.3	34.7	35.3
Pounds Per Gallon	7.06	7.27	7.06
Flash Point, COC, ASTM D92, °F (°C)	221 (430)	232 (450)	236 (457)
Low Temperature Cranking, ASTM D5293 Temperature, °F (°C)	-31 (-35)	-22 (-30)	-22 (-30)
Viscosity, cP	4926	5399	4518
Viscosity, ASTM D445			
cSt at 40°C	44.9	53.0	59.21
cSt at 100°C	8.7	9.0	10.4
Viscosity Index, ASTM D2270	176	154	166
Pour Point, ASTM D97, °F (°C)	-45 (-49)	-42 (-44)	-39 (-38)
Color, ASTM D1500	3.5	3.5	3.0
ILSAC	GF-6A	GF-6A	GF-6A
API SP/Resource Conserving	Yes	Yes	Yes
Ford WSS-Chrysler MS 6395	M2C962-A1 Yes	M2C960-A1 Yes	M2C961-A1 Yes

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CITGO® SUPERGARD® European Formula Motor Oils



OVERVIEW



- Premium quality, high-performance full synthetic oils specially formulated for use in certain European vehicles.
- Well balanced combinations of today's highest quality synthetic base stocks and advanced additive systems provide superior performance and protection under the most demanding driving conditions.

FEATURES & BENEFITS



- Excellent low-temperature starting and pumpability characteristics.
- High-temperature/high-shear properties superior to those of conventional oils.
- Extended drain interval capabilities.
- Lower volatility when compared to conventional oils.
- Excellent thermal and oxidation stability.
- Enhanced protection against varnish buildup and sludge formation in critical engine parts to provide top performance and long engine life.

APPLICATIONS



- For use in certain Audi, BMW, Mercedes Benz, Porsche, Volkswagen, and other European vehicles.
- Recommended for use in the following applications

Specifications	5W-30	5W-40
ACEA A3/B4-12	—	Yes
API SN	Yes	Yes
BMW LL-01	—	Yes
BMW LL-04	Yes	—
MB-229.3	—	Yes
MB-229.5	—	Yes
MB-226.5	—	Yes
MB-229.51	Yes	—
Opel GM-LL-B-025	—	Yes
Porsche A40	—	Yes
Porsche C30	Yes	—
PSA B7 12290	—	Yes
Renault RN0700	—	Yes
Renault RN0710	—	Yes
VW 502 00	—	Yes
VW 505 00	—	Yes
VW 504 00	Yes	—
VW 507 00	Yes	—

- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO SUPERGARD European Formula Motor Oils:

SAE Grade	5W-30	5W-40
Material Code	620883001	620884001
Gravity, ASTM D4052, °API	34.52	34.1
Pounds Per Gallon	7.1	7.11
Flash Point, ASTM D92, °F (°C), COC	442 (228)	450 (232)
Low Temperature Cranking, ASTM D5293 Temperature, °F (°C)	-22 (-30)	-22 (-30)
Viscosity, cP	6,030	5,935
Viscosity ASTM D445		
cSt at 40°C	67.67	82.6
cSt at 100°C	11.69	13.6
Viscosity Index, ASTM D2270	169	168
Pour Point ASTM D97, °F (°C)	-49 (-45)	-51 (-46)
Color, ASTM D1500	L2.5	L3.0

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CITGO® CITGARD® 600 Heavy Duty Engine Oils

OVERVIEW



- Superior technology to protect low-emission engines equipped with exhaust after-treatment systems and other new design features.
- High-performance formulations specifically engineered for modern engine designs and operating conditions that impose increased stress on engine oil -- an excellent choice for equipment owners needing longer engine and oil service life.
- Meet API CK-4 heavy duty requirements and major diesel engine manufacturer performance requirements.

FEATURES & BENEFITS



- Formulated to reduce oil aeration in modern engines with high-pressure fuel injection.
- Protects against viscosity breakdown resulting from high-contact timing gears.
- Double the oxidation protection of API CJ-4 engine oils on the Volvo T-13 oxidation test.
- Maintains a state-of-the-art wear control barrier in heavily loaded engine components.
- Provides advanced soot control with SootArrest™ soot dispersant chemistry.
- Extends diesel particulate filter (DPF) life by maintaining excellent cylinder condition.
- SAE 10W-30 grade improves fuel economy and cold cranking lubrication.
- Provides multiple cost-saving benefits when combined with the CITGO LubeAlert™ oil analysis program.

APPLICATIONS



- Recommended for use in heavy duty service in commercial trucks, agricultural equipment, construction equipment, stationary engines, and other diesel-fueled engine applications including Caterpillar (ECF-3), MTU 2.1, Paccar and Navistar.
- Approved for equipment requiring:

API CK-4, CJ-4, CI-4 PLUS, CI-4, CH-4/SN	Ford WSS-M2C171-F1
(SN for 15W-40 grade only)	Cummins CES 20086
Volvo/Mack/Renault - VDS-4.5/EOS-4.5/RLD-3	Detroit Diesel 93K222

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PROPERTIES



Typical Properties for CITGO CITGARD 600 Heavy Duty Engine Oils:

SAE Grade	15W-40	10W-30
Material Code	622615001	622613001
Gravity, ASTM D4052, °API	30.8	31.5
Density, lb/gal	7.28	7.25
Flash Point ASTM D92 (COC), °F (°C)	455 (235)	435 (224)
Viscosity ASTM D445		
cSt at 40°C	114.9	82
cSt at 100°C	15.7	12.0
Viscosity Index, ASTM D2270	145	141
HTHS Rate Viscosity at 150°C, ASTM D4683, cP	4.1	3.5
CCS Viscosity, ASTM D5293, cP	4,860 at -20°C	6,250 at -25°C
MRV Pumpability, ASTM D4684, cP	18,800 at -25°C	23,500 at -30°C
MRV Yield Stress, ASTM D4684	<35 at -25°C	<35 at -30°C
Pour Point ASTM D97, °F (°C)	-33 (-36)	-38 (-39)
Color, ASTM D1500	L4.0	L3.0
Sulfated Ash, ASTM D874, m%	1.0	1.0
Total Base Number, ASTM D2896, mg KOH/g	9.2	10

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CITGO® CITGARD® 600 Heavy Duty Engine Oils Monogrades

OVERVIEW



- High-quality, heavy duty crankcase oils manufactured with the latest additive technologies to provide excellent performance.
- SAE 30, 40, and 50 viscosity grades are designed with low sulfated ash to give optimal performance in Detroit Diesel two-stroke diesel engines calling for obsolete service categories CF-2 and CF.
- SAE 10W and SAE 30 viscosity grades are excellent for hydraulic applications calling for hydraulic oils with engine oil type additive systems.

FEATURES & BENEFITS



- Excellent detergency for control of exhaust port deposits in Detroit Diesel two-stroke diesel engines.
- Excellent dispersancy and oxidation resistance protect against excessive viscosity increase.
- Superior wear protection in hydraulic pumps and Detroit Diesel two-stroke diesel engines.
- Good TBN properties protect against corrosive wear.
- Proven oil consumption control in heavy duty service.
- Shear stability of monogrades assures stay-in-grade performance.
- Meet Detroit Diesel recommendations of 1.0% maximum sulfated ash for two-stroke diesel engines.

APPLICATIONS



- Recommended for use in heavy duty service in commercial trucks, agricultural equipment, construction equipment, and other diesel fueled engine, hydraulic, and transmission applications.
- Specific viscosity grades are approved for use in power-shift, manual, and hydrostatic transmissions, final drives, and hydraulic systems where the equipment manufacturer designates the use of a heavy-duty, detergent-type engine oil.
- Recommended* for equipment requiring:
Detroit Diesel Two-stroke diesel engines US CID A-A-52306
*Some performance capabilities are applicable to specific viscosity grade(s).
- Refer to equipment owner’s manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO CITGARD 600 Heavy Duty Engine Oils - Monogrades:

SAE Grade	10W	30	40	50
Material Code	622610001	622630001	622640001	622650001
Gravity, ASTM D4052, °API	31.8	28.4	27.3	26.5
Pounds Per Gallon	7.22	7.37	7.42	7.46
Flash Point, ASTM D92 (COC), °F (°C)	439 (226)	489 (254)	486 (252)	482 (250)
Viscosity ASTM D445				
cSt at 100°C	6.9	12.0	14.9	19.0
cSt at 40°C	41	102	145	212
Viscosity Index, ASTM D2270	129	106	103	100
HTHS Rate Vis at 150°C & 10 ⁶ sec ⁻¹ , cP	2.3	3.6	4.3	5.1
CCS Vis, ASTM D5293, cP at °C	4,000 at -25	NR*	NR*	NR*
MRV Vis, ASTM D4684, cP at °C	10,000 at 3,000	NR*	NR*	NR*
MRV Yield Stress, ASTM D4684, Pa at °C	<35 at -30	NR*	NR*	NR*
Pour Point, ASTM D97, °F (°C)	-38 (-39)	-11 (-24)	10 (-12)	10 (-12)
Sulfated Ash, ASTM D874, %m	0.9	0.9	0.9	0.9
TBN (Total Base No.), ASTM D2896	8	8	8	8
Color, ASTM D1500 (may vary by location)	L3.0	L3.0	L4.0	L4.0

Key Performance Claims and Applications:

Obsolete Service Categories

CF-2	—	✓	✓	✓
CF	✓	✓	✓	✓

Approvals or performances that are
Viscosity Grade specific:

US CID A-A-52306	—	✓	✓	—
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*NR = No Requirement

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CITGO® CITGARD® 700

Synthetic Blend Heavy Duty Engine Oils

OVERVIEW



- Synthetic blend engine oils that deliver the performance needed for newer engine designs, while improving performance in older engines.
- Engineered with proprietary additive technology that protects engines running at higher operating temperatures and fuel injection pressures, while meeting tighter wear limits and lower emission requirements.
- SAE 10W-30 grade assists in attaining the new Phase II fuel efficiency standards by improving fuel economy, increasing cold startup lubrication, and providing superior engine durability.

FEATURES & BENEFITS



- SAE 10W-30 offers up to 3% fuel economy advantage over conventional SAE 15W-40 viscosity grade oils.
- Maintain viscosity over extended service drain intervals.
- Up to 100% increase in oxidation protection compared to conventional CJ-4 engine oils.
- Advanced wear protection in both older and newer engines.
- Reduced air entrainment in high-pressure hydraulic fuel injection systems.
- Always follow OEM recommendations when extending oil drain intervals.

APPLICATIONS



- Recommended for superior performance for commercial trucks, agricultural equipment, construction equipment, stationary engines, and other diesel-fueled engine applications including Caterpillar ECF-3, Mercedes 228.31, MAN M3575, MTU Category 2.1, Paccar, Navistar, and Allison TES-439 (15W-40 only).
- Note: Use of diesel engine oils in automotive gasoline engines can shorten the life of catalytic converters.
- Refer to equipment owner’s manual for proper lubricant recommendation.

Approved for equipment requiring:
 API CK-4, CJ-4, CI-4 Plus, CI-4, CH-4/SN (SN applies to 15W-40 only)
 Cummins CES 20086
 Detroit Diesel DFS 93K222
 Volvo/Mack/Renault VDS-4.5/EOS-4.5/RLD-3
 Ford WSS-M2C171-F1

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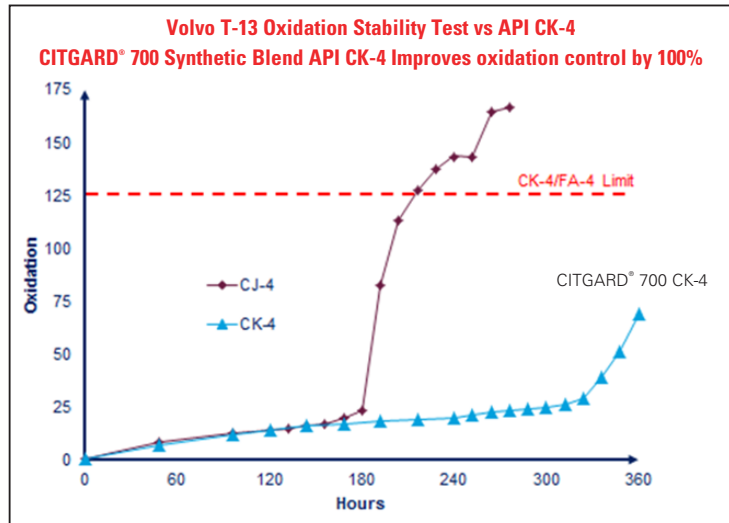
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APPLICATIONS



API Comparison Chart

Category	CITGARD® 700 Synthetic Blend API CJ-4	CITGARD® 700 Synthetic Blend API CK-4
Back serviceable	YES	YES
Viscosity grades	15W-40/10W-30	15W-40/10W-30
Fleet million mile engine test rating	Better	Best
100% improved oxidation stability	NO	YES
Greater shear stability vs. conventional API CJ-4	YES	YES
Aeration control vs. conventional API CJ-4	Better	Best
SAE 10W-30 sustains improved fuel economy through 50,000 miles	Better	Best
Compatible with conventional API CJ-4 oils	YES	YES
Best Overall Performance and Backward compatibility	Better	Best



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PROPERTIES



Typical Properties for CITGO CITGARD 700 Synthetic Blend Heavy Duty Engine Oils:

SAE Grade	10W-30	15W-40
Material Code	622721001	622723001
Gravity, ASTM D4052, °API at 60°F	31.6	30.5
Pounds/Gallon at 60°F	7.25	7.30
Specific Gravity at 60°F	0.87	0.88
Viscosity ASTM D445		
cSt at 40°C	80.9	111.9
cSt at 100°C	11.9	15.2
Viscosity Index	142	141
CCS Viscosity, cP, @ Temperature	6,159 @ -25°C	4677 @ -20°C
MRV Viscosity, cP, @ Temperature	23,250 @ -30°C	19,968 @ -25°C
MRV Yield Stress, Pa, @ Temperature	<35	<35
Pour Point, °F (°C)	-38 (-39)	-33 (-36)
Flash Point, COC, °F (°C)	435 (224)	439 (226)
Noack Evaporative, ASTM D5800, % Loss	12.0	11.0
Color, ASTM D1500	L3.0	L3.5
Total Base Number, ASTM D2896	10	10
Sulfated Ash, ASTM D874, % wt	1.0	1.0

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CITGO® CITGARD® 700 MFE Synthetic Blend Heavy Duty Engine Oil



OVERVIEW



- A new-generation engine oil for API FA-4 compliant engines; supports the Phase II fuel efficiency standards driving the need for even more fuel-efficient heavy duty engine oils, while delivering excellent wear protection and engine durability.
- Formulated with proprietary additive technology that protects engines running at higher operating temperatures and higher fuel injection pressures, while meeting tighter wear limits and lower emission requirements.
- Provides additional fuel economy compared to API CK-4 or API CJ-4 SAE 10W-30 engine oils.

FEATURES & BENEFITS



- Engineered for maximum fuel efficiency-- up to 4% fuel economy advantage over conventional SAE 15W-40 viscosity grade oils.
- Maintains viscosity over extended service intervals.
- Up to 100% increase in oxidation protection compared to conventional CJ-4 engine oils. Always follow OEM recommendations when extending oil drain intervals.
- Advanced wear protection for newer FA-4 compliant engines.
- Reduced air entrainment in high-pressure hydraulic fuel injection systems.

APPLICATIONS



- For use in API FA-4 compliant engines.
- Refer to equipment owner's manual for proper lubricant recommendation.

Approved for equipment requiring:
 Cummins CES 20087
 Detroit Diesel DFS 93K223

CITGARD® 700 MFE Synthetic Blend Heavy Duty Engine Oil vs API CK-4 or CJ-4.

	More Robust Additive System than API CJ-4 Oil	Enhanced Durability Requirements	SAE Grades	High Temperature High Shear Viscosity	Fuel Economy	Back Serviceable	Recommended by OEMs	Applications
API CK-4			0W-30 and heavier	 >3.5 cP	 Better			
API FA-4			0W-30 5W-30 10W-30	 2.9-3.2 cP	 Best			

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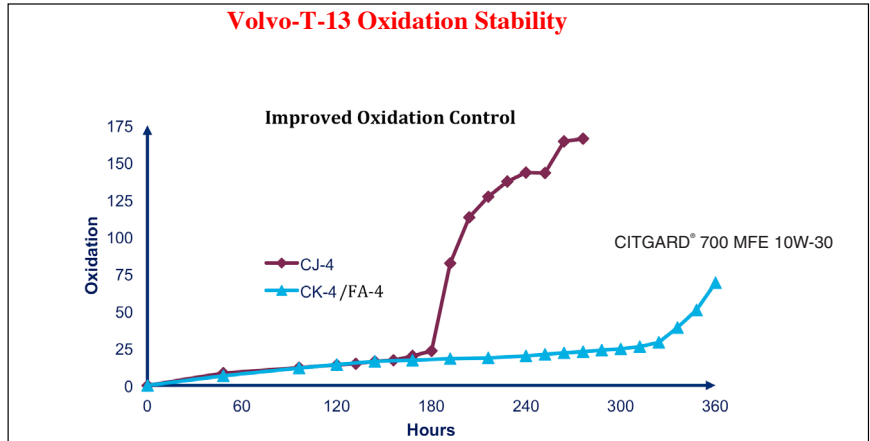
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APPLICATIONS



PROPERTIES



Typical Properties for CITGO CITGARD 700 MFE Synthetic Blend Heavy Duty Engine Oil SAE 10W-30:

SAE Grade	10W-30
Material Code	622722001
Gravity, ASTM D4052, °API at 60°F	31.5
Pounds/Gallon at 60°F	7.25
Specific Gravity at 60°F	0.87
Viscosity ASTM D445	
cSt at 40°C	66
cSt at 100°C	10.0
Viscosity Index	136
CCS Viscosity, cP, @ Temperature	5,680 @ -25°C
MRV Viscosity, cP, @ Temperature	15,500 @ -30°C
MRV Yield Stress, Pa, @ Temperature	<35
Pour Point, °F (°C)	-33 (-36)
Flash Point, COC, °F (°C)	446 (230)
Noack Evaporative, ASTM D5800, % Loss	12.7
Color, ASTM D1500	L3.5
Total Base Number, ASTM D2896	10
Sulfated Ash, ASTM D874, % wt	1.0

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CITGO® CITGARD® 1000 Full Synthetic Heavy Duty Engine Oils

Formerly CITGO® CITGARD® SynDurance® Plus Synthetic Heavy Duty Engine Oils



OVERVIEW



- Advanced fuel efficiency formula delivers maximum fuel economy, extreme cold temperature performance, and superior engine durability. A careful balance of synthetic base oil components and a shear stable viscosity modifier ensures that heavily loaded engine parts have protective oil films.
- Meet the performance requirements of newer engines operating at higher temperatures, with lower RPM, higher torque, and advanced combustion design.
- Field-tested for over a million miles with engine teardown inspections. The results indicate superior wear protection and oil consumption control, as compared to premium SAE 15W-40 viscosity grade oils.

FEATURES & BENEFITS



- Up to 4% fuel economy advantage over conventional SAE 15W-40 viscosity grade oils.
- Longer starter/battery life with reduced dependency on block heaters, resulting in lower energy costs.
- Up to 100% increase in oxidation protection compared to conventional CJ-4 engine oils (based on Volvo T-13 oxidation results). Always follow OEM recommendations when extending oil drain intervals.
- Reduced air entrainment in high-pressure fuel injection systems.
- Address the environmental challenge of reducing greenhouse gases and carbon footprint.

APPLICATIONS



Approved for equipment requiring:
 API CK-4, CJ-4, CI-4 Plus, CI-4, CH-4/SN (SN applies to 5W-40 only)
 Cummins CES 20086
 Detroit Diesel DFS 93K222
 Volvo/Mack/Renault – VDS-4.5/EOS-4.5/RLD-3
 Ford WSS-M2C171-F1

Recommended for equipment requiring:
 Caterpillar ECF-3
 Mercedes 228.31
 Paccar
 Navistar
 MAN M3575
 Allison TES 439 (5W-40 only)

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PROPERTIES

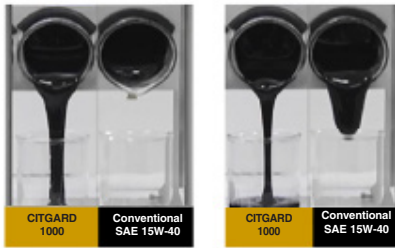


Typical Properties for CITGO CITGARD 1000 Full Synthetic Heavy Duty Engine Oils:

	5W-30	5W-40
Material Code	622676001	622677001
Gravity, ASTM D4052, °API	33.6	33.8
Pounds Per Gallon	7.14	7.14
Flash Point, COC, ASTM D92, °F (°C)	428 (220)	453 (234)
Viscosity ASTM D445		
cSt at 40°C	70	88
cSt at 100°C	11.3	14
Viscosity Index, ASTM D2270	156	163
CCS Vis, ASTM D5293, cP at °C	6,400@ -30° C	6,350 at -30°C
MRV Vis, ASTM D4684, cP at °C	21,970 at -35°C	30,060 at -35°C
MRV Yield Stress, ASTM D4684, Pa at °C	<35	<35
Pour Point ASTM D97, °F (°C)	-38°F (-39°C)	-44°F (-42°C)
TBN (Total Base No.), ASTM D2896	11	11
Color, ASTM D1500	L5.5	L5.5
NOACK Volatility, ASTM 05800, % Loss	11.5	11.9

Low Temperature Pumpability Comparison

How much wear occurs waiting on 15W-40?



Cold box testing at -22°F (-30°C) of used oil demonstrates the superior flow characteristics of CITGARD 1000 Full Synthetic 5W-40

Fuel Savings Advantage

Savings Category	Conventional 15W-40	CITGARD® 1000 5W-30	Savings*
Number of Units	100	100	
Annual Miles/Unit	100,000	100,000	
MPG	6.50	6.76	
Fuel Savings % Increase	None	4.00	
Fuel Cost	4.00	4.00	
Annual Unit Fuel Gallons	15,384	14,792	592
Annual Unit Fuel Cost	\$61,536	\$59,168	\$2,368
Fleet Annual Fuel Gallons	1,538,400	1,497,200	59,200
Total Savings			\$236,800

*Savings is example only-Individual fleet result will vary

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Manufactured in USA

C 10234

CITGO® CITGARD® 800 Synthetic Blend Heavy Duty Engine Oils

Formerly CITGO® CITGARD® CNG/LNG Engine Oils



OVERVIEW



- Specially formulated for natural gas (CNG/LNG), diesel, and gasoline fueled engines. Available in SAE 15W-40 and 10W-30 viscosity grades.
- Use CONVERGE Engine Oil Advantage to provide multi-fuel fleet with optimum performance capability without compromising overall performance.

FEATURES & BENEFITS



- Meet Cummins CES 20092.
- Excellent for fleets wanting one oil to reduce inventory in a mixed fleet with a variety of applications.
- Additive technology delivers superior oxidation and nitration protection combined with a shear-stable VI improver to maintain viscosity, ensuring wear protection in severe applications.
- This unique formulation provides superior engine deposit control, reducing the tendency for valve guttering due to higher combustion temperatures in CNG engines and oil oxidation in the higher operating temperatures of modern diesel engines.
- Field-tested up to 50,000 miles and 1000 hours with 'headroom' results that demonstrate protection against deposits, corrosion, and liner and tappet wear.
- Maintain TAN and TBN reserve for optimum protection when longer oil service life is needed.
- CONVERGE additive technology provides excellent cold-weather pumpability, foam protection, exceptional oxidation and nitration control, overall engine cleanliness, and reduced oil consumption.
- The SAE 10W-30 grade is designed to improve fuel economy and is licensed API SN service category. Gasoline-powered pickup trucks and similar vehicles can take advantage of this technology where this grade is recommended by the OEM.

APPLICATIONS



CITGARD with CONVERGE Advantage delivers:

- C** – Clean engine and corrosion protection field-tested up to 50,000 miles and 1,000 hours. ODI - extra TBN/TAN reserve to neutralize acids
- O** – Oxidation – 100% better than test limit extended to over 1,000 hours
- N** – Nitration – low nitration with extended 1,000 hours ODI
- V** – Viscosity shear stability
- E** – Extendable ODI to standardize diesel/CNG service
- R** – Reduce pressure drop in DPF and regeneration event frequency while also reducing engine wear and maintaining low iron wear out to 1000-hour ODI
- G** – Guaranteed results or money back
- E** – Eliminates the need for three different engine oils for a multi-fuel type fleet

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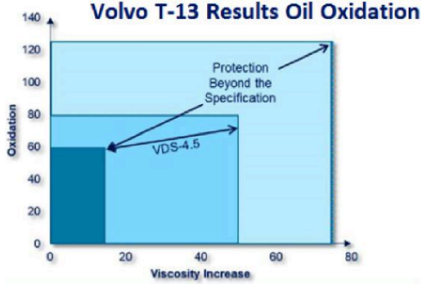
APPLICATIONS



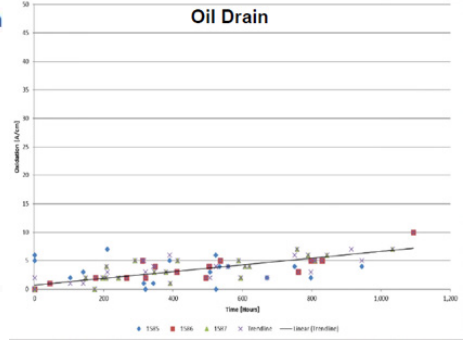
Approved for:

Cummins CES 20092
 Cummins CES 20086
 Caterpillar ECF-3

Detroit Diesel DFS 93K222
 Volvo/Mack/Renault - VDS-4.5/EOS-4.5/RLD-3
 API CK-4/SN



100% Better oxidation protection than specification 20% below Volvo VDS-4.5 limit



CITGARD 800 with Converge Technology. Field-tested to 1,000 hours with superior oxidation stability

PROPERTIES



Typical Properties for CITGO CITGARD 800 Synthetic Blend Heavy Duty Engine Oils:

SAE Grade	10W-30	15W-40
Material Code	632019	632020
Gravity, ASTM D4052, °API at 60°F	31.5	30.0
Pounds/Gallon at 60°F	7.3	7.3
Viscosity ASTM D445		
cSt at 40°C	86	124
cSt at 100°C	12.2	15.7
Viscosity Index	137	134
CCS Viscosity, cP, @ Temperature	6550 @ -25°C	5470 @ -20°C
MRV Viscosity, cP, @ Temperature	22500 @ -30°C	20000 @ -25°C
MRV Yield Stress, Pa, @ Temperature	<35 @ -30°C	<35 @ -25°C
Pour Point, °F (°C)	-42 (-44)	-39 (-38)
Flash Point, COC, °F (°C)	207 (405)	210 (410)
Noack Volatility, ASTM D5800, % Loss	11	10
Color, ASTM D1500	L4.0	L4.0
Total Base Number, ASTM D2896	10	10
Sulfated Ash, ASTM D874, % wt	0.9	0.9

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CITGO[®] SUPERGARD[®]

Air-Cooled 2-Cycle Engine Oil



OVERVIEW



- A premium-performance synthetic blend lubricant designed for use in high-performance, air-cooled two-stroke engines.
- Provides the necessary protection to keep your air-cooled, two-stroke engine running cleaner, longer, and with less smoke.

FEATURES & BENEFITS



- Engineered for lower smoke and advanced protection for air-cooled 2-cycle engines.
- Meets or exceeds the rigorous requirements of the API TC, JASO FD, and ISO-L-EGD classifications for 2-cycle air-cooled engine oils; also exceeds the performance requirements for JASO FC, FB; ISO-L-EGC and -EGB.
- Protects today's high-RPM, air-cooled 2-cycle engines against exhaust port blocking, combustion chamber and piston deposits, ring sticking and scuffing, and wear.
- Formulated with premium base oils and a low-ash additive package that provides excellent lubricity and detergency performance, surpassing the standard for preventing piston and combustion chamber deposits.
- Synthetic blend reduces exhaust smoke and prevents piston seizure and cylinder scuffing.
- Mixes readily with fuel for pre-mix type, even at low temperatures.
- Can be used in motorcycles, generators, lawnmowers, and handheld power equipment such as leaf blowers, trimmers, and chainsaws operating in hot, dirty, dusty environments and high loads for extended periods.
- JASO FD Certified.

APPLICATIONS



- Recommended for use in air-cooled, 2-cycle applications where an API TC, JASO FD, or ISO-L-EGD product is preferred. This oil supersedes previous JASO and ISO specifications.
- Can be used in either pre-mix or direct injection systems at fuel ratios up to 50:1.
- Do not use in engines requiring an NMMA[®] TC-W3[®] product.
- Refer to equipment owner's manual for proper lubricant recommendation.

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C 10009

PROPERTIES



Typical Properties for CITGO SUPERGARD Air-Cooled 2-Cycle Engine Oil:

Material Code	621611001
Gravity, ASTM D4052, °API	32.0
Density, lb/gal at 60°F	7.21
Flash Point, PMCC, ASTM D93, °F (°C)	185 (85)
Flash Point, COC, ASTM D92, °F (°C)	203 (95)
Viscosity ASTM D445	
cSt at 40°C	55
cSt at 100°C	8.5
Viscosity ASTM D2161	
SUS at 100°F	281
SUS at 210°F	54.8
Viscosity Index, ASTM D2270	129
Pour Point ASTM D97, °F (°C)	-49 (-45)
Appearance, Color	Purple
Sulfated Ash, ASTM D874, %	0.1
Total Base Number, ASTM D2896, mgKOH/g	2.2

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CITGO[®] SUPERGARD[®]

Marine Plus 2-Cycle Engine Oil



OVERVIEW



- A licensed NMMA[®] TC-W3[®] oil that effectively combats wear, scuffing, and deposit build-up, and enhances lubricity to provide longer engine life.
- Formulated for naturally carbureted outboard engines.

FEATURES & BENEFITS



- High film strength for improved lubricity provides increased engine efficiency, excellent scuffing protection of rings and cylinders, reduced bearing wear, and cleaner, better-running engines producing less smoke.
- Reduces carbon and deposit build-up on engine parts.
- Helps prevent piston ring sticking.
- Guaranteed to protect OEM engine warranties.

APPLICATIONS



- Recommended for all water-cooled or liquid-cooled 2-cycle engines requiring an NMMA TC-W3, TC-W11[®], or TC-W[®] type oil.
- Can be used in many air-cooled 2-cycle engine applications requiring API Service Category TC.
- Recommended for both direct injected and pre-mix systems.
- Provides protection for gasoline-fueled 2-cycle engines when used at the primary dilution recommended by the original equipment manufacturer.
- Refer to equipment owner's manual for proper lubricant recommendation.

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C 10007

PROPERTIES



Typical Properties for CITGO SUPERGARD Marine Plus 2-Cycle Engine Oil:

Material Code	621602001
Gravity, ASTM D4052, °API	31.5
Density, lb/gal at 60°F	7.23
Flash Point, PMCC, ASTM D93, °F (°C)	178 (81) ⁽¹⁾
Flash Point, COC, ASTM D92, °F (°C)	197 (92)
Viscosity ASTM D445	
cSt at 40°C	32.0
cSt at 100°C	5.9
Viscosity ASTM D2161	
SUS at 100°F	163
SUS at 210°F	46
Viscosity Index, ASTM D2270	130
Pour Point ASTM D97, °F (°C)	-38 (-39)
Appearance, Color	Blue/Green
Sulfated Ash, ASTM D874, %	<0.004
Total Base Number, ASTM D2896, mgKOH/g	8.6

NOTE

(1) Combustible liquid

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CITGO® SUPERGARD®

Sea & Snow® 2-Cycle Engine Oil



OVERVIEW



- A synthetic blend, low-smoke oil designed for use in high-performance air- or liquid-cooled 2-cycle engines of personal water craft (PWC) and snowmobiles.
- Provides the necessary protection to keep your snowmobile or PWC running cleaner, longer, and with less smoke.

FEATURES & BENEFITS



- Formulated primarily for use in snowmobiles and personal watercraft.
- Engineered for lower smoke and advanced protection for air-cooled 2-cycle engines.
- Synthetic blend formula meets or exceeds the rigorous requirements of the API TC, JASO FD, and ISO-L-EGD classifications for 2-cycle air-cooled engine oils.
- Protects against exhaust port blocking, combustion chamber and piston deposits, ring sticking and scuffing, and wear.
- Formulated with premium base oils and a new synthetic, low-ash additive package that provides excellent lubricity and detergency performance that surpasses standards for preventing piston and combustion chamber deposits.
- Synthetic blend reduces exhaust smoke and prevents piston seizure and cylinder scuffing.
- Mixes readily with fuel for pre-mix type, even at low temperatures.
- Can be used in motorcycles, generators, lawnmowers, and handheld power equipment such as leaf blowers, trimmers, and chainsaws.
- JASO FD Certified.

APPLICATIONS



- Recommended for use in air-cooled, 2-cycle applications where an API TC, JASO FD, or ISO-L-EGD product is preferred. This oil supersedes previous JASO and ISO specifications.
- Can be used in either pre-mix or direct injection systems at fuel ratios up to 50:1.
- May also be used in certain motorcycle engines which are liquid-cooled.
- Do not use in engines requiring an NMMA® TC-W3®, TC-WII®, or TC-W® product.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO SUPERGARD Sea & Snow 2-Cycle Engine Oil:

Material Code	621612001
Gravity, ASTM D4052, °API	32.0
Density, lb/gal at 60°F	7.21
Flash Point, PMCC, ASTM D93, °F (°C)	185 (85)
Flash Point, COC, ASTM D92, °F (°C)	203 (95)
Viscosity ASTM D445	
cSt at 40°C	55
cSt at 100°C	8.5
Viscosity ASTM D2161	
SUS at 100°F	281
SUS at 210°F	54.8
Viscosity Index, ASTM D2270	129
Pour Point ASTM D97, °F (°C)	-49 (-45)
Appearance, Color	Purple
Sulfated Ash, ASTM D874, %	0.0
Total Base Number, ASTM D2896, mgKOH/g	2.2

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CITGO® Regular Gear Oil SAE 90

Automotive Gear Oils

OVERVIEW



- Designed for some manually operated transmissions and spiral-bevel axles operating under mild conditions.
- Made from high quality, refined mineral oil and selected inhibitors. Available in SAE 90 grade.

FEATURES & BENEFITS



- Additives provide inhibition of oxidation, corrosion, and foam at levels not normally achieved with straight mineral oil.
- API Service Classification GL-1*. Friction modifiers and extreme pressure agents are not employed in GL-1 oils.

APPLICATIONS



- Recommended for use in certain transmissions, final drives, and miscellaneous applications in bearing and gear lubrication of mobile equipment where GL-1 or straight mineral oil is specified by the manufacturer.

- Refer to equipment owner's manual for proper lubricant recommendation.

*CITGO Premium Gear Oil (MP) is recommended for hypoid axles and other automotive applications requiring an extreme pressure lubricant for GL-5 service.

PROPERTIES



Typical Properties for CITGO Regular Gear Oil:

SAE Grade	90
Material Code	631502001
Gravity, ASTM D4052, °API	27.5
Density, lb/gal at 60°F	7.41
Flash Point, COC, ASTM D92, °F (°C)	420 (215)
Viscosity ASTM D445	
cSt at 40°C	200
cSt at 100°C	17
Viscosity, ASTM D2161	
SUS at 100°F	1050
SUS at 210°F	91
Viscosity Index, ASTM D2270	95
Pour Point ASTM D97, °F (°C)	0 (-18)

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CITGO® Premium Gear Oils (MP)



Automotive Gear Oils

OVERVIEW



- Multipurpose gear lubricants whose high performance level is obtained by using a sulfur-phosphorus additive system to impart extreme pressure (EP) properties to protect automotive gears which may be operated under the most severe service conditions encountered in passenger cars, trucks, farm tractors, earth-moving, construction, and heavy duty equipment.
- These additives impart anti-weld, anti-scuff, and anti-wear properties necessary in heavy duty service gear lubricants.

FEATURES & BENEFITS



- Blended to meet the multi-grade viscosity requirements described in SAE J306.
- Formulated with naturally high-VI, highly refined base oils and do not require viscosity index improvers to meet multi-grade viscometric properties.
- Viscometric properties are maintained throughout the oil's service life and are not lost through shear.
- API Service Classification: GL-5 and MT-1.
- Meets the severe gear performance requirements of SAE J2360 (formerly MIL-PRF-2105E).
- Meet Mack Trucks GO-J specification.
- SAE 80W-90 grade for use at ambient temperatures down to -15°F.
- SAE 85W-140 grade for use at ambient temperatures down to +10°F.

APPLICATIONS



- Recommended where a multipurpose gear oil meeting the requirements of SAE J2360, API GL-5, API MT-1, or Mack GO-J is required.
- For use in transmissions, differentials, final drives, and other gear cases of trucks, buses, and farm equipment.
- Recommended where EP, hypoid, or multipurpose gear oils are specified by the manufacturer.
- Refer to equipment owner's manual for proper lubricant recommendation. Equipment manufacturers' recommendations should be followed when the gear lubricant is subject to high ambient temperatures. While some gear sets are designed for year-round operation using an SAE 80W-90, others may require SAE 85W-140 for high ambient temperature operations during the hot weather months.

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PROPERTIES



Typical Properties for CITGO Premium Gear Oils (MP):

SAE Grade	80W-90	85W-140
Material Code	631310001	631320001
Gravity, ASTM D4052, °API	27	26
Density, lb/gal at 60°F	7.4	7.5
Flash Point, ASTM D92, °F (°C)	448 (231)	478 (248)
Viscosity, ASTM D445		
cSt at 40°C	139	365
cSt at 100°C	14.7	26.9
Viscosity, ASTM D2161		
SUS at 100°F	788	2010
SUS at 210°F	78.4	133
Brookfield Viscosity, ASTM D2983		
cP at -26.1°C	120,000	—
cP at -12°C	—	65,000
Viscosity Index, ASTM D2270	99	97
Pour Point ASTM D97, °F (°C)	-27 (-33)	0 (-18)
Channel Point, °F (°C), Max.	-31 (-35)	-4 (-20)
Foam Test, ASTM D892	Pass	Pass
Copper Corrosion, ASTM D130	Pass	Pass

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CITGO® CITGEAR® HD Synthetic Gear Lubricants



Automotive Gear Oils

OVERVIEW



- State-of-the-art heavy duty, synthetic gear and bearing lubricants designed for use in manual transmission, transfer cases, and differentials of passenger cars, trucks, farm tractors, construction equipment, and over-the-road trucks.
- Formulated using a unique, proprietary combination of synthetic base stocks and additives to offer maximum protection for gears and bearings over a wide range of operating temperatures.

FEATURES & BENEFITS



- Superior oxidation resistance for extended drain intervals.
- Excellent load-carrying properties (SAE 75W-90, 75W-140, and 80W-140) for maximum protection.
- High viscosity index and low pour point synthetic base stocks provide reduced friction, resulting in fuel economy potential during low-temperature start-ups or operating conditions.
- Excellent demulsibility, hydrolytically stable, and non-foaming.
- Shear-resistant for lasting viscosity performance.

APPLICATIONS



- **SAE 75W-90, 75W-140, and 80W-140 grades** are recommended for differentials (including limited-slip units), manual transmission for which hypoid-type lubricants are required, and transfer cases for heavy equipment: trucks, tractors, industrial gear drives, automobiles, and farm machinery.
- Meet or exceed the following performance requirements:
API Service Classification GL-5 and MT-1
- **SAE 50** grade is recommended for heavy duty service in manual transmissions for which the manufacturer normally recommends either engine oils or GL-1 to GL-4 lubricants. Contains anti-wear protection and rust, oxidation, foam, and corrosion inhibitors to protect bearings and synchronizers and to promote longer transmission life. Provides improved start-up, easier shifting, and less gear wear in low-temperature environments. Less friction, less drag, and improved oxidation resistance combine to provide fuel economy benefits and longer drain intervals.
- Recommended in applications calling for the following specifications:
API GL-4, MT-1

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C 10147

PROPERTIES



Typical Properties for CITGO CITGEAR HD Synthetic Gear Lubricants:

SAE Grade	75W-90	75W-140	80W-140	50
Material Code	632496001	632497001	632498001	632495001
Specific Gravity	0.865	0.869	0.867	0.857
Density, lb/gal	7.20	7.23	7.22	7.14
Viscosity, ASTM D445,				
cSt at 40°C	126	185	211	137
cSt at 100°C	16.7	25.8	25.1	17.9
Viscosity Index, ASTM D2270	144	171	150	145
Brookfield Viscosity ASTM D2983				
cP at -26°C	—	—	46,300	28,800
cP at -40°C	114,500	137,500	—	—
Pour Point ASTM D97, °F (°C)	-65 (-54)	-60 (-51)	-36 (-32)	-38 (-39)
Flash Point, ASTM D92, °F (°C)	378 (192)	370 (188)	428 (220)	507 (264)
Foam Test, ASTM D892	Pass	Pass	Pass	Pass
Copper Corrosion, ASTM D130	1A	1A	1A	1A
FZG, Failure Stage	>12	>12	>12	NA

NA = Not Applicable

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CITGO[®] SynDurance[®] Synthetic Gear Lubricants



Automotive Gear Oils

OVERVIEW



- Heavy duty, synthetic gear and bearing lubricants designed for use in manual transmissions, transfer cases and differential axles of trucks, farm tractors, construction, passenger cars and miscellaneous industrial equipment.
- Maximum protection for gears and bearings operating over a wide range of temperatures, speeds, and loads. Superb resistance to oxidation provides the benefit of extended drain intervals.
- Available in SAE 75W-90 and 80W-140 viscosity grades.

FEATURES & BENEFITS



- Superior oxidation resistance for extended drain intervals.
- Excellent load-carrying properties for maximum protection against component wear.
- High viscosity index and low pour point synthetic base stocks provide reduced fluid friction, with resultant fuel savings potential during low-temperature start-up or operating conditions.
- Excellent demulsibility (separates water readily) and does not foam.
- Shear-resistant for lasting viscosity performance.
- Provides full protection to system parts against rust and corrosion.

APPLICATIONS



- Recommended for differentials, manual transmissions for which hypoid-type lubricants are required, and transfer cases for heavy equipment: trucks, tractors, industrial gear drives, automobiles, farm machinery, etc.
- Meet or exceed the following performance requirements:
 - API Service Classification GL-5 and MT-1
 - SAE J2360; former U.S. Military Specifications MIL-L-2105D and MIL-PRF-2105E
 - DANA SHAES 256, Rev. E (75W-90)
 - DANA SHAES 429
 - Detroit Diesel DFS 93K219.01 (75W-90)
 - Mack GO-J Plus (75W-90)
 - Mack GO-J (80W-140)
 - Meritor O-76N (75W-90)
 - Meritor 076-B (80W-140)
 - Navistar MPAPS B-6821
 - International TMS-6816 (80W-140)

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Manufactured in USA

C 10015

PROPERTIES



Typical Properties for CITGO SynDurance Synthetic Gear Lubricants:

SAE Grade	75W-90	80W-140
Material Code	631809001	631814001
API Classification	GL-5	GL-5
AGMA Grade	4	5-6
Gravity, ASTM D4052, °API	33.4	31.5
Pounds Per Gallon	7.14	7.23
Flash Point ASTM D92, °F (°C)	405 (204)	410 (210)
Pour Point, ASTM D97, °F (°C)	-65 (-54)	-54 (-48)
Color, ASTM D1500	1.5	1.5
Viscosity ASTM D445		
cSt at 40°C	111	273
cSt at 100°C	15.1	29.1
Viscosity Index	143	142
Brookfield Viscosity ASTM D2270		
cP at -18°C	5,715	22,700
cP at -26°C	—	60,950
cP at -40°C	93,050	—
Foam Test, ASTM D892	Pass	Pass
Copper Corrosion, ASTM D130	1A	1A
Rust Protection, ASTM D A/B	Pass	Pass

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C 10015

CITGO® SynDurance® Synthetic MTF



Automotive Gear Oils

OVERVIEW



- A synthetic lubricant designed for fuel efficiency, extended drain intervals, and severe service in heavy duty commercial vehicle transmissions which do not require an extreme pressure (EP) transmission lubricant.
- Specially formulated to protect higher torque transmissions coupled with increased horsepower engines. Approved for use in Eaton transmissions such as Ultrashift Plus, Fuller Advantage, FR, and RT Series transmissions.
- Replaces SAE 50 transmission fluid, and is for use where SAE 50 weight was recommended.

FEATURES & BENEFITS



- Uniquely formulated to provide up to 1.5% fuel economy improvement while maintaining excellent shear stability.
- Provides high performance and extended drain capability in transmissions.
- Excellent thermal and oxidation stability resists deposit and sludge formation.
- Advanced additive system provides excellent protection from corrosion, foaming, rust, and wear.
- The use of high viscosity index synthetic base fluids allows SynDurance Synthetic MTF to provide superior high- and low-temperature performance.
- Provides friction retention, friction durability, and excellent shear stability to ensure and maintain smooth transmission operations throughout the extended drain interval.
- Formulated to reduce sump operating temperatures.

APPLICATIONS



- Recommended where low temperatures, wear, or heat present major problems and a non-EP lubricant is required. Typical usage includes transmissions, transfer cases, and wheel end hubs.
- Recommended commercial vehicle applications include line haul, vocational, off-road, pick-up and delivery, and buses.
- Approved for the following OEM specifications:
 - Eaton PS-386 (supersedes PS-164 Rev7)
 - Mack TO-A Plus
 - Meritor O-81 transfer cases
 - Navistar MPAPS B-6816 Type II
 - API MT-1
- Also recommended for: Eaton Fuller Transmissions, Volvo iShift Transmissions, Mack mDrive Transmissions, API GL-4 (transmissions) and International TMS 6816 (obsolete), ZF Freedomline (AS-Tronic) Transmissions, Meritor Transmissions (O-81), and Con Met Wheel Ends/Hubs.

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PROPERTIES



Typical Properties for CITGO SynDurance Synthetic MTF:

Material Code	631817001
SAE Viscosity Grade	75W-90
Gravity, ASTM D4052, °API	34.9
Specific Gravity at 60°F	0.85
Density, lb/gal at 60°F	7.09
Viscosities:	
at -40°, cP	51,900
at 40°C, cSt.	95.1
at 100°C, cSt.	14.8
Viscosity Index	163
Pour Point ASTM D97, °F (°C)	-44 (-42)
Flash Point, ASTM D92, °F (°C)	460 (238)

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CITGO® Final Drive Oil

OVERVIEW



- A new generation lubricant that meets the Caterpillar FD-1 specification and is designed for heavy duty construction equipment, final drives, and axles operating under severe loads and temperatures.
- Compared to TO-4 lubricants, delivers greater protection against gear and bearing fatigue resulting from the higher loads and operating conditions frequently encountered in track type equipment and large off-road haul truck final drives.
- Compatible with TO-4 lubricants in the event of lubricant mixing, with the understanding the product mixing does result in decreased level of performance.
- Should not be used in diesel engines or in compartments that contain friction materials unless recommended by the equipment manufacturer.
- Available Viscosity Grades: SAE 60.

FEATURES & BENEFITS



- Engineered for performance – meets the Caterpillar FD-1 specification and has passed the FD-1 test requirements.
- Superior protection against rust, corrosion, and foaming.
- Minimizes lubricant oxidation that results from high operating temperatures and loads.
- Superior wear protection in highly loaded bearings and gears protects against fatigue and optimizes component life.
- Up to twice the lubricant service life compared to TO-4 type lubricants. (Refer to chart for performance criteria.)
- Longer component life cycles result in improved equipment productivity and reduced equipment rebuild costs and downtime.
- Improved overall profitability, especially in high production construction, mining, and aggregate operations.

Transmission/Power Fluids

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APPLICATIONS



- Formulated to meet the performance requirements of Caterpillar FD-1 (SAE 60 grade) and Caterpillar final drives and axles, where recommended by Caterpillar.

PERFORMANCE CRITERIA	TO-4 60	CITGO FINAL DRIVE OIL
Lubricant Service Life	2000 Hours	4000 Hours*
Cat FD-1 Approval	No	Yes
Passing FD-1 Testing	No	Yes
LubeAlert HD Oil Analysis	Availability Varies	Yes
Optimum Gear & Bearing Life	No	Yes

* Lubricant Service Life is dependent on the following:

- Operating conditions, vehicle condition and maintenance practices.
- Inspect fluid levels regularly and add as needed with CITGO Final Drive Oil
- Use CITGO LubeAlert Oil Analysis program to support maximum component life

PROPERTIES



Typical Properties for CITGO Final Drive Oil:

SAE Grade	60
Material Code	63332901
Gravity, ASTM D4052, °API	27.7
Density, Pounds Per Gallon	7.40
Flash Point, COC, ASTM D92, °F (°C)	265 (129)
Viscosity ASTM D445	
cSt at 40°C	334
cSt at 100°C	25.7
Viscosity Index, ASTM D2270	100
Pour Point, ASTM D97, °F (°C)	-47 (-44)
Color, ASTM D1500	L4.0
Total Base Number, mgKOH/g D664	3.3
Foam Test, Seq. I, Tendency, mL D892	5-0
Foam Test, Seq. II, Tendency, mL D892	10-0
Foam Test, Seq. III, Tendency, mL D892	10-0
Appearance	C&B
Moisture, Hot Plate	Pass

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CITGO® QUATRASYN® Synthetic Transmission Fluid



OVERVIEW



- Fully synthetic, multipurpose heavy duty transmission fluid engineered for severe-duty service and designed for use in a variety of automatic transmission applications.
- A long history of proven performance: field tested in buses and proven for use in refuse vehicles, construction material trucks, trailers, and vehicles operating in stop-and-go conditions.

FEATURES & BENEFITS



- Unique synthetic formula with high-performance additive technology can extend fluid service life and life of key transmission components, versus conventional fluids.
- Improves maintenance efficiency by extending transmission life, resulting in reduced downtime and lower repair costs.
- Extended drain and filter change intervals result in reduced oil disposal cost; seal conditioners reduce tendency for leakage after extended service.
- Excellent deposit control reduces the tendency of fluid breakdown that leads to clutch plate glazing and results in loss of clutch plate friction control.
- Outstanding performance across a wide temperature range provides year-round capability.
- Excellent thermal and oxidation stability reduce sludge and deposit formation.
- Excellent shear stability and viscosity retention.
- Optimized traction coefficients can increase fuel economy.

APPLICATIONS



- Recommended for use in automatic transmission applications where TES-295 fluid is specified.
- Refer to equipment owner's manual for proper lubricant recommendation and warranty requirements. QuatraSyn is not an Allison-approved fluid.

Transmission/Power Fluids

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APPLICATIONS**CITGO QuatraSyn Synthetic Transmission Fluid has OEM Approval for the following:**

- ZF TE-ML 04D; 14B; 20B; and 25B

CITGO QuatraSyn Synthetic Transmission Fluid is suitable for use in where the following products are recommended:

- Allison C-4
- Allison TES- 295, TES-468 (Not suitable for use in California.)
- BMW – LT71141; 2634; ETL-7045E; -8027B
- Chrysler – ATF +3
- Ford – M; MV
- GM – III(H)
- HMC/KIA – SP-II; SP-III
- Honda – ATF Z1
- Jaguar – Idemitsu K17
- JASO – Approved 1A, M315-2004
- Land Rover – Texaco N402
- MAN - 339 V1
- MAN - 339 Z2
- Mazda – ATF M-III; ATF M-V
- Mercedes - MB 236.9
- Mercedes - MB 236.5; 6; 7; 10; 11; ATF 3403 M-115
- Nissan – Matik J; Matik K
- Subaru – ATF; ATF HP
- Toyota – T-III; T-IV; JWS 3309
- VOITH – H55.6335.XX (G607)
- VOITH North America Service Bulletins #013 and 018
- VOLVO – 97341
- VW/AUDI – G 052 025 (09M); G 052 990 (09A)
- ZF TE-ML – 04D; 14A; 16L; and 17C

CITGO QuatraSyn Synthetic Transmission Fluid is intended for use in the following universal powershift and automatic transmission applications:

- School Buses and Vans
- Refuse Fleets
- Commercial Trucks and Vehicles
- Motor Homes
- Emergency Vehicles
- On/Off-Highway Vehicles
- Inter/Intracity Buses
- Light Duty Pickup Trucks and Passenger Cars
- Recommended for use in automatic transmission applications where C-4 fluid is specified
- ZF Ecomat transmissions
- Voith DIWA Transmissions

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PROPERTIES



Typical Properties for CITGO QuatraSyn Synthetic Transmission Fluid:

Material Code	632493001
Gravity, ASTM D237, °API	35.3
Specific Gravity, D4052	0.848
Density, lb/gal	7.07
Color	Red
Flash Point ASTM D92, °F (°C)	400 (204)
Viscosity ASTM D445	
cSt at 100°C	7.53
cSt at 40°C	35.7
Viscosity Index	185
Brookfield Viscosity ASTM D2983	
cP at -40°C	12,100
cP at -20°C	1,158
Pour Point ASTM D97, °F (°C)	-62 (-52)
Total Acid Number, ASTM D664, mg KOH/gm	1.23
4-Ball Wear, ASTM D4172	
40kg, 1200 rpm, 1 hour,	0.48
Cold Cranking Simulator, ASTM D5293, cP at -30°C	2680

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Emgard[®] MTF 7011

Synthetic Manual Transmission Fluid

Material Code 632005001

January 2019 | Data Sheet Transportation Lubricants | Replaced Version August 2018

TI-EVO 2073e / Page 1 of 2

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Product Description

Emgard MTF 7011 synthetic manual transmission fluid is designed for commercial vehicle automated and manual transmissions and transfer cases which require a non-EP type lubricant.

Typical Application

Emgard MTF 7011 synthetic manual transmission fluid is recommended for typical commercial vehicle applications such as automated and manual transmissions, transfer cases, and gear boxes. It is formulated to protect transmissions that use synchronizers in high shift duty-cycle applications and have PTO (Power Take Off) options.

It is approved for use in the Detroit[™] DT12[™] transmission and other Mercedes-Benz commercial vehicle transmissions and transfer cases.

Mixing with other gear oils should be avoided. In order to fully utilize the product's benefits, a complete oil change is recommended.

Approvals and Specifications

OEM approvals:
MB-Approval 235.11

Features and Benefits

All-season lubricant, recommended for both extreme hot and cold environments.

Designed for protection of the transmission gear train used in heavy service paired with engine downspeeding conditions.

Proven additive technology for synchronizer durability and performance.

High thermal stability and protection against deposits and varnish.

Excellent rust and copper corrosion protection.

Typical Properties	Property	Unit	Method	Typical Value
	SAE Viscosity Grade	–	SAE J 300	40
			SAE J 306	75W-90
	Viscosity, 100 °C	cSt	ASTM D 445	14.6
	Viscosity, 40 °C	cSt	ASTM D 445	95.4
	Viscosity Index	–	ASTM D 2270	159
	Viscosity, - 40 °C	cP	ASTM D 2983	50,700
	Pour point	°C	ASTM D 97	-57
	Flash point	°C	ASTM D 92	237
	Density 15.6 °C	g/ml (lbs./gal (US))	ASTM D 4052	0.8465 (7.49)
	Total Acid Number	mg KOH/g	ASTM D 664	1.54

Handling

Please refer to material safety data sheet for details.

Shelf Life

The product in the original package can be stored for up to 3 years at ambient storage conditions without any deterioration.

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights, etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

January 2019

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CITGO® TRANSGARD® ATF, MERCON® V

OVERVIEW



- An advanced, extended-life automatic transmission fluid designed for Ford transmissions and transaxles; may also be used in automatic transmission units that require a fluid qualified against the Ford MERCON specification.

FEATURES & BENEFITS



- Superior cold temperature performance, boosted oxidation resistance, extended seal compatibility, and improved wear protection as compared with today's multipurpose ATFs.
- Designed to exhibit extended life compared with conventional multipurpose ATFs.
- Very shear-resistant, maintaining in-service viscosity much better than other ATFs.
- Superior frictional durability and anti-shudder performance.
- Fortified against rust, corrosion, and foaming.
- Dyed red for easy identification.

APPLICATIONS



- Recommended for use in all applications requiring MERCON V, MERCON, DEXRON®, ALLISON C-4, and JASO 1A.
- Formulated for use in most Toyota, Nissan, Honda, and other imported vehicles.
- An excellent choice for transmissions used in severe service, including passenger car and bus fleets as well as towing applications.
- Refer to equipment owner's manual for proper lubricant recommendation.

PROPERTIES



Typical Properties for CITGO Transgard ATF, Mercon V:

Material Code	633122001
Viscosities:	
cSt at 40°C	35
cSt at 100°C	7.6
Viscosity Index	189
Specific Gravity @ 60 °F	0.851
Pour Point, ASTM D97, °F (°C)	-60 (-51)
Brookfield Viscosity @ -40 °C, cP	9600
Appearance	Red

This product is approved under license number M5121002

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CITGO® TRANSGARD® ATF, TYPE F



OVERVIEW



- A red-dyed automatic transmission fluid meeting all of the requirements of Ford Specification M2C33-F, Type F.

FEATURES & BENEFITS



- A high level of oxidation resistance to prevent sludge formation and poor transmission operation, even after extended service at high temperatures.
- Good low-temperature shifting while retaining the necessary viscosity for proper operation at temperatures in excess of 300°F.
- Select anti-wear additives protect against the scuffing and wear of gears, pumps, and other critical moving parts.
- Designed with a high static coefficient of friction to provide proper and reliable operation of clutches requiring a fluid with these unique properties.
- Balanced formula prevents leakage by providing seal swell properties and preventing the deterioration of rubber seals.

APPLICATIONS



- Recommended for use in all automatic transmissions for which a Type F fluid (Ford Specification M2C33-F) is specified.
- Recommended for service fill of power steering units of many Ford passenger cars and light trucks.
- Note: Many Ford transmissions require MERCON® or Ford Specification M2C138-CJ or M2C166-H. For these applications, CITGO TRANSGARD Multi-Purpose ATF is recommended.
- Can be used in various antiwear hydraulic fluid applications.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO Transgard ATF, Type F:

Material Code	633105001
Gravity, ASTM D4052, °API	33.5
Pounds Per Gallon	7.14
Flash Point, COC, ASTM D92, °F (°C)	405 (207)
Viscosity, ASTM D445	
cSt at 100°C	7.57
cSt at 40°C	41.1
cSt at -18°C	1,040
cSt at -40°C	38,000
Viscosity Index, ASTM D2270	154
Pour Point, ASTM D97, °F (°C)	-43 (-42)
Color	Red

NOTES: (1) Ford Procedure BJ3-2; ASTM D2983, Brookfield Apparent Viscosity

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CITGO® TRANSGARD® ATF +4®



OVERVIEW



- A full synthetic automatic transmission fluid recommended for use in Chrysler vehicles. Extensively tested and approved by Chrysler under material specification MS-9602.

FEATURES & BENEFITS



- Full synthetic formulation provides outstanding protection under the most demanding conditions.
- Superior wear protection and anti-shudder durability result in a more consistent viscosity profile, providing improved shifting performance and extended transmission life.
- Improved low-temperature operating range to provide smoother shifts and reduce wear on transmission components during cold-weather operation.
- Increased oxidation and thermal stability to prevent sludge formation and maintain good transmission operation, even after extended service at high temperatures.
- Extended drain intervals, versus previous ATF+3 standard.

APPLICATIONS



- Tested and approved for use by FCA US LLC.
- Recommended for top-up and refill of all automatic transmissions in Dodge, Chrysler and Jeep vehicles where ATF+4, ATF+3, or MS 7176 is called for.
- Do not use ATF+4 where DEXRON®-III, DEXRON®-IIE, or MERCON® automatic transmission fluid is recommended.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO Transgard ATF +4:

Material Code	633179001
Gravity, ASTM D4052, °API	34.9
Pounds Per Gallon	7.08
Flash Point, COC, ASTM D92, °F (°C)	399 (204)
Viscosity ASTM D445	
cSt at 40°C	34.89
cSt at 100°C	7.4
cP at -28.9°C	2,050
cP at -40°C	9,000
Viscosity Index, ASTM D2270	190
Pour Point, ASTM D97, °F (°C)	-70 (-57)
Color	Red

Meets Specification MS-9602. ATF+4® is a trademark of FCA US LLC, used under license number 40630037.

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CITGO® TRANSGARD® CVT Fluid



OVERVIEW



- A full synthetic, continuously variable transmission (CVT) fluid specifically formulated to prolong and protect transmission life in modern, high-technology belt- and chain-driven CVTs.
- Helps maintain smooth operation, reduces transmission wear, and degrades less over time.

FEATURES & BENEFITS



- Maintains viscosity control over the life of the fluid for smooth shifting and fuel economy.
- Prevents wear in metal contacts while maintaining the proper frictional values to transfer high levels of torque and prevent shudder.
- Excellent oxidation control to maximize fluid life and maintain chemical properties.

APPLICATIONS



- Recommended for use in most foreign and domestic belt- and chain-driven CVTs and is suitable for use where CVT fluid and the following specifications are recommended:
 Audi/VW TL52180, (G052180), TL52116 (G052516)
 SUBARU i-CVT, ECVT, Lineartronic chain CVT, K0425Y0710, CV-30, NS-2
 BMW 83220136376, 83220429154, EZL 799
 Daihatsu Ammix CVTF-DC, DFC, DFE, TC
 Dodge/Jeep NS-2, CVT+4, Mopar CVT+4
 GM/Saturn DEX-CVT
 Honda HMMF (without starting clutch) HCF-2, Honda Z-1 (CV-T model, without starting clutch, not SFU for 2001-2007 Honda Fit & Jazz)
 Hyundai/Kia SP-III (CVT model), CVT-J1
 Mazda JWS 3320
 Mini Cooper EZL, EZL 799A, ZF CVT V1
 Mitsubishi DiaQueen CVTF-J1, J4, J4+, SP-III (CVT model only)
 Nissan NS-1, NS-2, NS-3
 Punch CVT
 Shell Green 1V
 Suzuki CVTF 3320, TC, NS-2, CVTF Green 1,2, 1V
 Toyota TC, FE
 Volvo CVT 4959
- DO NOT USE in non-CVT vehicles.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO TRANSGARD CVT Fluid:

Material Code	633134001
Gravity, ASTM D237, °API	35.3
Density, Pounds Per Gallon	7.1
Flash Point, P.M. D93, °C	190
Pour Point, ASTM D97, °F (°C)	-40
Viscosity ASTM D445	
cSt at 40°C	35
cSt at 100°C	7.3
Viscosity Index D2270	180
Brookfield Viscosity @ -40°C	13,000
Color	Red

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CITGO® TRANSGARD® DEXRON®-VI ATF



OVERVIEW



- A full synthetic automatic transmission fluid approved and licensed by General Motors for use in its vehicles with automatic transmissions.
- Designed to provide twice the normal service life of a DEXRON-IIIH ATF, offering enhanced performance for both new and older model transmissions.

FEATURES & BENEFITS



- Full synthetic formulation provides outstanding protection under the most demanding conditions.
- Extends fluid and transmission life, and offers the potential to extend drain intervals.
- Outstanding oxidation life and thermal stability offer resistance to sludge and varnish formation.
- Superior anti-wear protection.
- Improved low-temperature viscosity.
- Optimized frictional properties prevent shudder and extend fluid and clutch durability.
- Improved fuel economy versus DEXRON-IIIH fluids.
- Increased shear stability.

APPLICATIONS



- Recommended for use in automatic transmissions manufactured by General Motors.
- Backward compatible and can be used in all General Motors cars and trucks where DEXRON-III, DEXRON-IIIE, and DEXRON-II type fluids were called for.
- Specifically designed for use in the Hydra-Matic 6-speed transmission.
- Do not use DEXRON-VI in applications calling for Ford MERCON®, MERCON V, MERCON SP, or Type F. DEXRON-VI is not suitable for use in non-GM vehicles which called for DEXRON-III or DEXRON-II type fluids. In these applications, CITGO recommends the use of TRANSGARD Multi-Purpose ATF.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO TRANSGARD DEXRON-VI ATF:

Material Code	633140001
Gravity, ASTM D4052, °API	35.35
Pounds Per Gallon	7.05
Flash Point, COC, ASTM D92, °F (°C)	403 (206)
Pour Point, ASTM D97, °F (°C)	-65 (-54)
Viscosity, ASTM D445,	
cSt at 40°C	29.7
cSt at 100°C	6.0
Viscosity, ASTM D2983,	
cP at -20°C	1,050
cP at -40°C	10,000
Viscosity Index, ASTM D2270	150
Color	Red

This product is approved under GM License ID #J-62114.

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Manufactured in USA

C 10165

CITGO® TRANSGARD® Synthetic Multi-Vehicle High-Viscosity ATF



OVERVIEW



- Highest-quality synthetic base stocks combine with a state-of-the-art additive system to provide superior performance in automatic and powershift transmissions.
- Suitable for use in transmissions calling for Ford MERCON® V, Ford MERCON (obsolete), General Motors DEXRON® -IIIH (obsolete), and Allison C-4 type fluids.

FEATURES & BENEFITS



- Superior oxidation and thermal stability.
- Outstanding anti-wear performance for protection of transmission hardware.
- Excellent cold-temperature flow properties.
- Compatible with a wide range of seal materials to prevent transmission leaks.
- Can be used in most vehicles.
- Provides inventory optimization (multi-vehicle compatible) without the use of ATF supplements.

APPLICATIONS



Suitable for use where the following specifications are recommended:

- Ford MERCON and MERCON V* (In California, use TRANSGARD ATF, MERCON V)
- GM DEXRON -II and DEXRON -III
- Allison C-4, TES-295, and TES-389 (not OEM approved)
- BMW LT-71141, ETL-7045E, LA-2634, ETL-8072B
- Nissan/Infiniti Nissan ATF Matic D, Matic J, Matic K and Matic W
- Mitsubishi Diamond J-2, SP-II and SP-III
- Hyundai/KIA SP-II and SP-III
- Toyota/Lexus Type T, T-III and T-IV
- Honda/Acura ATF-Z1 (except in CVTs)
- Mercedes Benz 236.3; .5; .6; .7; .8; .9; .91; .10; and .11; ATF 3403 M-115
- Volkswagen/Audi G052025 (A2); G052055; G052162 (A1, A2); G052990 (A2); G055025 (A2); GUS000162
- ZF TE-ML 11A; 11B
- JASO 1A
- MAN 339A
- Mazda Type T-IV
- Subaru ATF-HP
- Renault Matic D2
- Volvo 1161521; 1161540/1161640; 1273.41

Refer to equipment owner's manual for proper lubricant recommendation.

*California law prohibits manufacturers of multi-vehicle ATF from recommending products in certain applications where the viscometrics do not match those of the official OEM specification. CITGO therefore does not recommend the use of TRANSGARD Multi-Vehicle High – Viscosity ATF in these applications in California.

Do not use in vehicles calling for Type F, DEXRON VI, MERCON SP, MERCON LV, Toyota/Lexus WS, and CVTs.

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C 10168

PROPERTIES



Typical Properties for CITGO TRANSGARD Synthetic Multi-Vehicle High-Viscosity ATF:

Material Code	633131001
Viscosity	
cSt at 40°C	35
cSt at 100°C	6.7
Viscosity Index	153
Specific Gravity @ 60°F	0.851
Pour Point ASTM D97, °F (°C)	-49 (-45)
Brookfield Viscosity @ -40°C, cP	16,280
Appearance	Red

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CITGO® TRANSGARD® Synthetic Multi-Vehicle Low-Viscosity ATF



Transmission/Power Fluids

OVERVIEW



- Combines the highest quality synthetic base stocks with a state of the art additive system to provide superior performance in automatic and powershift transmissions.

FEATURES & BENEFITS



- Superior oxidation and thermal stability.
- Outstanding anti-wear performance for protection of transmission hardware.
- Excellent low-temperature flow properties.
- Compatible with a wide range of seal materials to prevent transmission leaks.
- Can be used in most vehicles.
- Multi-vehicle compatible; enables inventory optimization without the use of ATF supplements.

APPLICATIONS



- Suitable for use where the following products are recommended:
 GM vehicles recommending AW-1, DEXRON® -III and VI* (In California, use TRANSGARD® DEXRON® VI ATF)
 BMW 83220142516, 83220397114, 83222152426, 83222289720, 83222163514, 83222305397
 MERCON® SP, LV* (Not recommended in California)
 Scion FZ
 Toyota WS (JWS 3324)
 Honda DW-1, Type 3.0, Type 3.1
 Nissan/Infiniti Matic S
 Hyundai SP-IV
 Saab 93165147-AW-1
 Mazda 6A EL, 6AX EL
 Mercedes MB 236.12; .14; .15; .41
 Mitsubishi ATF J-3, Dia Queen ATF-PA
 Porsche 00004330400
 ZF Lifeguardfluid 6, 8
- **NOTE:** California law prohibits manufacturers of multi-vehicle ATF from recommending products in certain applications where the viscometrics do not match those of the official OEM specification. CITGO therefore does not recommend the use of TRANSGARD Synthetic Multi-Vehicle Low-Viscosity ATF in these applications in California.
- Do not use CITGO TRANSGARD Synthetic Multi-Vehicle Low-Viscosity ATF in vehicles calling for Type F or CVTs.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO TRANSGARD Synthetic Multi-Vehicle Low-Viscosity ATF:

Material Code	633137001
Gravity, ASTM D287, °API	35.7
Density, Pounds Per Gallon	7.05
Flash Point, P.M. D93, °C	220
Viscosity ASTM D445	
cSt at 40°C	28
cSt at 100°C	5.8
Viscosity Index, ASTM D2270	154
Brookfield Viscosity @ -40°C	9,230
Color	Red

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CITGO® TRANSGARD® Multi-Purpose ATF



OVERVIEW



- An automatic transmission fluid designed for electronically-controlled transmissions and specifically designed for use in General Motors transmissions calling for DEXRON®-III, DEXRON-IIE, and DEXRON-II fluids.
- Can be used in Ford transmissions calling for MERCON® type ATFs. Meets the performance requirements for Allison Transmission Division (C-4) and major hydraulic pump manufacturers' requirements for anti-wear hydraulic fluids.

FEATURES & BENEFITS



- A truly multifunctional transmission fluid for passenger cars, trucks, construction and mining equipment, farm machinery and other mobile and industrial systems.
- Superior cold temperature performance characteristics.
- Wide range of seal compatibility.
- Excellent wear protection.
- Superior frictional characteristics, with excellent friction retention and smooth shifting.
- Fortified against rust and corrosion.
- Excellent oxidation resistance.
- Meets requirements for foam protection.
- Dyed red for easy identification.

APPLICATIONS



- Recommended for use in automatic transmissions manufactured by General Motors and Ford for model years 2006 and prior (except those calling for FORD Type F Fluid, MERCON SP, MERCON V, DEXRON-VI, and CVT fluids).
- Suitable for use in foreign cars and trucks requiring the use of DEXRON -III, DEXRON-IIE, DEXRON-II, and MERCON type fluids.
- Suitable for use in powershift transmissions, torque converters, hydrostatic transmissions, and applications such as air compressors, hydraulic pumps, power steering boxes, and other types of service where an ATF is recommended.
- Refer to equipment owner's manual for proper lubricant recommendation.

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C 10162

PROPERTIES



Typical Properties for CITGO TRANSGARD Multi-Purpose ATF:

Material Code	633135001
Gravity, ASTM D4052, °API	32.9
Pounds Per Gallon	7.15
Flash Point, COC, ASTM D92, °F (°C)	424 (218)
Pour Point, ASTM D97, °F (°C)	-54 (-48)
Viscosity, ASTM D445,	
cSt at 40°C	34.3
cSt at 100°C	6.95
Viscosity, ASTM D2983,	
cP at 20°C	1,020
cP at -40°C	15,100
Viscosity Index, ASTM D2270	169
Color	Red

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CITGO® TRANSGARD® Heavy-Duty Transmission Fluids



OVERVIEW



- New-generation Allison C-4 and CAT TO-4 transmission and drivetrain fluids designed for heavy-duty construction equipment powershift transmissions, final drives, and wet brakes.
- Improve transmission performance and power transfer under conditions of high horsepower output, increased loads, and higher transmission operating temperatures associated with heavy equipment, as compared to engine oil.
- Reduced maintenance costs, longer equipment life, reduced downtime, and higher production output due to reduced gear wear, improved friction control, and greater rimpull.
- Available Viscosity Grades: 10W, 30, 50 and 60.

FEATURES & BENEFITS



- Provide longer transmission life than heavy-duty engine oils.
- Base stocks and additives are carefully selected for compatibility with clutch face and seal materials.
- Offer improved performance while allowing product consolidation by meeting Allison C-4 (SAE 10W and 30 grades), Komatsu Micro-Clutch, and Caterpillar TO-4 requirements.
- Offered in four viscosity grades to meet summer and winter powershift requirements.
- Compatibility with asbestos-free clutch materials offers extended clutch life.
- Provide greater power transfer efficiency due to their physical and chemical properties.
- Rust and corrosion control protects gear cases and drive trains under the most severe conditions.
- SAE 60 grade provides the greatest fluid film thickness for wear protection during severe operation.

APPLICATIONS



- Recommended for lubrication of winch, clutch plates, gears and bearings.
- Help reduce brake chatter in wet brake applications.
- Formulated to meet the performance requirements of:
 - Allison C-4 (SAE 10W and 30 grades)
 - Caterpillar TO-4, CD/TO-2 (all grades)
 - Komatsu Micro-Clutch (all grades)

Transmission/Power Fluids

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C 10020

PROPERTIES



Typical Properties for CITGO Transgard Heavy Duty Transmission Fluids:

SAE Grade	10W	30	50	60
Material Code	633321001	633323001	633325001	633326001
Gravity, ASTM D4052, °API	31.1	31.0	27.3	25.2
Density, lbs./gallon	7.30	7.37	7.49	7.51
Flash Point, COC, ASTM D92, °F (°C)	420 (216)	446 (230)	511 (266)	532 (278)
Viscosity, ASTM D445,				
cSt at 40°C	38.1	96	209	330
cSt at 100°C	6.3	11.3	18.8	25.5
Viscosity Index, ASTM D2270	112	104	100	100
Brookfield Apparent Viscosity	23,000	80,000	45,000	139,500
ASTM D2983, cP, at Temp, °C	-35	-25	-15	-15
Pour Point ASTM D97, °F (°C)	-38 (-39)	-27 (-33)	+5 (-18)	0 (-18)
Color, ASTM D1500	L3.0	L3.5	4.0	L7.0

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C 10020



CITGO® SynDurance® Synthetic All Seasons Heavy-Duty Transmission Fluid

OVERVIEW



- A new generation of full synthetic, multi-grade transmission fluid designed for heavy duty construction equipment with powershift transmissions, hydraulic systems, final drives, and wet brakes that require Caterpillar TO-4 and Allison C-4 type fluids.

FEATURES & BENEFITS



- Multi-grade design helps reduce inventory through consolidation of viscosity grades, eliminating seasonal change-outs.
- Extends transmission life and improves overall efficiency in powershift transmissions, as compared to conventional TO-4 fluids.
- Fluid service life can also be extended when matched with CITGO LubeAlert® Oil Analysis.
- Improved cold-weather start-up performance and superior wear protection while operating at wide temperature ranges, due to multi-grade design.
- Unique product design extends clutch life and provides greater power transfer efficiency, resulting in greater productivity and reduced fuel consumption.

APPLICATIONS



- Recommended for lubrication of winch, clutch plates, gears, and bearings.
- Helps reduce brake chatter in wet brake application.
- Formulated to meet the performance requirements of:
 - Allison C-4
 - Caterpillar TO-4, CD/TO-2, TO-4M
 - Komatsu Micro-Clutch

Transmission/Power Fluids

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C 10192

PROPERTIES



Typical Properties for CITGO SynDurance Synthetic All Seasons Heavy-Duty

Material Code	622685001
Gravity, ASTM D4052, °API	32.4
Density, lbs./gallon	7.0
Flash Point, COC, ASTM D92, °F (°C)	453 (234)
Viscosity, ASTM D445,	
cSt at 40°C	107.0
cSt at 100°C	14.7
Viscosity Index, ASTM D2270	136
Brookfield Apparent Viscosity,	37,000
ASTM D2983, cP, at Temp, °C	-39
Pour Point, ASTM D97, °F (°C)	-38 (-39)
Color, ASTM D1500	L3.0

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C 10192

CITGO® TRANSGARD® Tractor Hydraulic Fluid



OVERVIEW



- Multifunctional tractor hydraulic/transmission fluid which lubricates the transmission, differential and final drive gears; acts as a power steering, power brake, power take-off and implement drive fluid; and provides a medium with the correct friction and heat transfer characteristics for proper operation of the tractor wet brakes and power take-off unit.

FEATURES & BENEFITS



- Superior extreme pressure (EP) and anti-wear performance protects tractor transmissions, axles, and hydraulic pumps.
- Exhibits frictional characteristics designed to minimize chatter while permitting the wet brakes to hold properly, and provide smooth engagement of the power take-off clutch.
- Special blend of base stocks helps maintain seals and gaskets.
- Balanced formulation provides excellent protection from rust and corrosion, as well as excellent oil oxidation stability for high-temperature service.

APPLICATIONS



- TRANSGARD Tractor Hydraulic Fluid is formulated to meet John Deere J20C and is recommended for use in applications that require:

John Deere JDM J20C
 AGCO Power Fluid 821XL
 AGCO CMS M1135
 AGCO CMS M1141
 AGCO GIMA-CMS M1143
 AGCO GIMA-CMS M1145
 Allison C-4
 API GL-4
 ASTM D6973 (Eaton 35VQ)
 Caterpillar TO-2 (obsolete)
 Case New Holland: Ford M2C134-D
 Case New Holland: FNHA 2-C-201.00
 Case New Holland: CNH MAT 3525
 Case New Holland: CNH MAT 3509
 Case New Holland: Case MS 1205

Case New Holland: Case MS 1206
 Case New Holland: Case MS 1207
 Case New Holland: Case MS 1209
 Denison Hydraulics HF-0, HF-1, HF-2
 Eaton Vickers I-286-S
 Eaton Vickers M-2950-S
 Kubota UDT
 Minneapolis Moline Q-1766, Q-1722, Q1766B
 New Holland WB NWH 410B
 Oliver Q-1705
 Volvo WB 101
 White Farm Equipment Q-1826
 ZF TE-ML 03E
 ZF TE-ML 05F
 ZF TE-ML 06K

- Refer to equipment owner's manual for proper lubricant recommendation.

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C10022

PROPERTIES



Typical Properties for CITGO TRANSGARD Tractor Hydraulic Fluid:

	TRANSgard TRACTOR HYDRAULIC FLUID
Material Code	633310001
Gravity, ASTM D4052, °API	30.5
Density, lb/gal	7.28
Flash Point, COC, ASTM D92, °F (°C)	450 (232)
Viscosity, ASTM D2983, cP	
at -20°C	3,918
at -35°C	33,480
ASTM D445	
cSt at 40°C	59
cSt at 100°C	9.7
Viscosity Index, ASTM D2270	145
Pour Point, ASTM D97, °F (°C)	-51 (-46)
Color, ASTM D1500	L1.0
ASTM D892, Sequence I, II, III	Pass
John Deere J20C Tests	
Shear Stability Test	JDQ 102 7.6

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CITGO® TRANSGARD® Synthetic Blend LOW-TEMP Tractor Hydraulic Fluid



OVERVIEW



- CITGO TRANSGARD Synthetic Blend LOW-TEMP Tractor Hydraulic Fluid is specially designed to provide outstanding low temperature fluidity under the coldest conditions, with the same performance benefits as CITGO TRANSGARD Tractor Hydraulic Fluid, but is intended for applications where a lower-viscosity fluid is desired. It should not be used at ambient temperatures above 68°F.
- Multifunctional tractor hydraulic/transmission fluid which lubricates the transmission, differential and final drive gears; acts as a power steering, power brake, power take-off and implement drive fluid; and provides a medium with the correct friction and heat transfer characteristics for proper operation of the tractor wet brakes and power take-off unit.

FEATURES & BENEFITS



- Provides excellent fluidity at low temperature to ensure good pumpability in cold weather regions.
- Special synthetic and conventional base stocks help maintain seals and gaskets.
- Superior extreme pressure (EP) and anti-wear performance protects tractor transmissions, axles, and hydraulic pumps.
- Exhibits frictional characteristics designed to minimize chatter while permitting the wet brakes to hold properly, and provides smooth engagement of the power take-off clutch.
- Balanced formulation provides excellent protection from rust and corrosion, as well as excellent oil oxidation stability for high-temperature service.

APPLICATIONS



- TRANSGARD Synthetic Blend LOW-TEMP Tractor Hydraulic Fluid is formulated to meet John Deere J20D and is recommended for use in applications that require:

John Deere J20D
Allison C-4
Caterpillar TO-2
CASE JIC 143, 144
New Holland: Case MS 1210
Eaton E-FDGN-TB002-E
Case New Holland: CNH MAT 3526
Eaton Vickers I-286-S
Eaton Vickers M-2950-S

- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO TRANSGARD Synthetic Blend LOW TEMP Tractor Hydraulic Fluid:

	SYNTHETIC BLEND LOW-TEMP TRACTOR HYDRAULIC FLUID
Material Code	633311001
Gravity, ASTM D4052, °API	32.8
Density, lb/gal	7.17
Flash Point, COC, ASTM D92, °F (°C)	415 (213)
Viscosity, ASTM D2983, cP	
at -4°F (-20°C)	1250
at -40°F (-40°C)	11,250
ASTM D445	
cSt at 40°C	35
cSt at 100°C	7.9
Viscosity Index, ASTM D2270	199
Pour Point, ASTM D97, °F (°C)	-65 (-54)
Color, ASTM D1500	L1.5
ASTM D892, Sequence I, II, III	Pass
John Deere J20D Tests	
Shear Stability Test	JDQ 102 5.6

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CITGO® CITGARD® DriveShift® Synthetic Transmission Fluid

OVERVIEW



- This full synthetic, manual transmission fluid is specifically formulated to prolong and protect transmission life in modern non-synchronized manual and automated manual (AMT) transmissions. It helps maintain smooth operation, reduces transmission wear and is capable of extending drain intervals to 500,000 miles.*

FEATURES & BENEFITS



- Capable of extending drain intervals to 500,000 miles (or 800,000 kilometers).*
- Maintains viscosity control over the life of the fluid for smooth shifting and fuel economy.
- Excellent oxidation control to maximize fluid life and maintain chemical properties.
- Resists deposit formation to protect seals.

APPLICATIONS



- CITGO CITGARD DriveShift Synthetic Transmission Fluid meets the requirements of API GL-4 and MT-1 and is suitable for use in the following applications:

DANA manual transmissions
 Detroit DT12 Automated Manual
 Eaton PS164 Rev 7
 Mack m-Drive
 Mack TO-A Plus
 Meritor O81
 Navistar/International TMS 6816

Volvo I-Shift
 Volvo 1273.05 (97305)
 Volvo 1273.07 (97307)
 Volvo 1273.15 (97315)
 Volvo 1273.18 (97318)
 Volvo 1273.19 (97319)
 ZF Freedomline manual transmissions

*Refer to equipment owner's manual for proper lubricant recommendation and for oil drain interval (ODI) guidelines.

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C 10273

PROPERTIES



Typical Properties for CITGO CITGARD DriveShift Synthetic Transmission Fluid:

Material Code	622901001
SAE Viscosity Grade	75W-90
Gravity, ASTM D287, °API	33.5
Density, Pounds Per Gallon	7.2
Flash Point, COC, ASTM D92, °C	228
Pour Point, ASTM D97, °C	-45
Viscosity, ASTM D445	
cSt at 40°C	92
cSt at 100°C	15.2
Viscosity Index, ASTM D2270	175
Brookfield Viscosity, cP, @ -40°C	115,000

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CITGO® SynDurance® 668 ATF



OVERVIEW



- Full synthetic automatic transmission fluid approved by Allison Transmission for service fill on transmissions requiring a TES 668™ approved fluid.
- Fully back compatible for transmissions requiring a TES 295®, TES 389® and TES 468® fluid.
- Heavy-duty ATF that offers extended drain intervals and demonstrates outstanding shear stability, oxidation resistance, and low-temperature fluidity.

FEATURES & BENEFITS



- Excellent shear stability and viscosity retention.
- Outstanding performance across a wide temperature range provides year-round capability.
- Excellent thermal oxidation stability reduces sludge and deposit formation.
- Optimized maintenance through extended drain intervals.
- Outstanding friction retention and friction durability.
- Excellent anti-wear and corrosion resistance properties.
- Backed by an Allison factory warranty.

APPLICATIONS



OEM Approval: Allison Transmission TES 668™, Approved (668-10052021)

- Approved for use in automatic transmission applications calling for TES 668™ fluid.
- Fully back-serviceable for transmissions requiring an approved TES 295® fluid.
- TES-668™: Next generation fluids for on-highway products including hybrids.
- SynDurance 668 is approved for:
Allison TES 668™
Volvo 97341
- Recommended for automatic transmission calling for:
Allison 1000 series™, 2000 series™,
3000 series™, 4000 series™
TES 468™ for H 40 EP™, H 50 EP™ and
eGen Flex series on highway products.
Ford M
GM DEX-IIIH / IIG / IID
JASO M315 Type 1A
- Always consult equipment owner's manual for proper lubricant recommendations and warranty requirements.
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Transmission/Power Fluids

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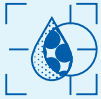
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PROPERTIES



Typical Properties for CITGO SynDurance 668 ATF:

Material Code	622686001
Gravity, ASTM D4052, °API	34.7
Pounds Per Gallon	7.1
Flash Point, COC, ASTM D92, °F (°C)	405 (207)
Viscosity, ASTM D445,	
cSt at 40°C	34
cSt at 100°C	7
Viscosity Index, ASTM D2270	168
Brookfield Viscosity ASTM D2983	
cP at 40°C	11,340
Pour Point, ASTM D97, °F (°C)	-62 (-52)
Color	Red

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Transmission/Power Fluids

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CITGO® Amplex® Oils

OVERVIEW



- High quality, medium viscosity index oils for use in general-purpose lubrication applications.

FEATURES & BENEFITS



- Made from highly refined medium viscosity index base stocks with low pour points.
- Exhibit a mild natural dispersant action, good seal swell, and excellent solvency.

APPLICATIONS



- Recommended as general purpose machinery lubricants, especially as a mild-service circulating oil, and for lubrication of plain bearings where oil is applied by manual methods.
- Recommended for lubrication of certain industrial equipment where low ambient temperatures may be encountered.

PROPERTIES



Typical Properties for CITGO Amplex Oils:

Grade	22	58	100	150
Material Code	638033001	638036001	638040001	638041001
Gravity, ASTM 4052, °API	25.0	23.0	22.5	22.0
Density, lb/gal at 60°F	7.5	7.6	7.6	7.7
Flash Point, COC, ASTM D92, °F (°C)	330 (166)	380 (193)	390 (199)	412 (211)
Viscosity ASTM D445:				
cSt at 40°C	20	59	94	141
cSt at 100°C	3.7	6.7	8.8	11
Viscosity ASTM D2161:				
SUS at 100°F	106	309	498	754
SUS at 201°F	38	49	56	64
Viscosity Index, ASTM D2270	43	47	49	42
Pour Point ASTM D97, °F (°C)	-40 (-40)	-20 (-29)	-20 (-29)	-15 (-26)
Color, ASTM D1500	L1.0	1.0	1.5	1.5

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CITGO® Sentry® Oils



OVERVIEW



- A complete line of highly refined, non-additive mineral oils for bearings and other general purpose lubrication.

FEATURES & BENEFITS



- Made with high viscosity index base stocks that have high thermal stability.
- Have the necessary characteristics to permit their use in many applications.
- Provide good lubrication with low maintenance costs.

APPLICATIONS



- Recommended for general lubrication of industrial machinery, machine tools, engine bearings, and other plant equipment where a non-additive mineral oil is desired.
- Grades 19 through 68 are recommended for heat transfer applications and in hydraulic systems where pressures or temperatures are moderate. Can be used in many applications where high oil loss makes the use of a lower-cost product desirable.
- Can be used as diluents for cutting oil bases, flushing oils, form oils for brick presses and steel concrete forms, lubricants for small electric motors, and other applications where a non-additive mineral oil is desired.

PROPERTIES



Typical Properties for CITGO Sentry Oils:

Grade	15	19	32	68	129	460
Material Code	637001001	637019001	637004001	637006001	637099001	637015001
Gravity, ASTM D4052, °API	33.1	32.9	31.0	29.9	30.5	26.5
Density, lb/gal at 60°F	7.16	7.17	7.25	7.30	7.28	7.46
Flash Point, COC, ASTM D92, °F (°C)	380 (193)	388 (198)	424 (218)	465 (241)	516 (269)	595 (313)
Viscosity:						
ASTM D445, cSt at 40°C	15.7	19	32	65.3	112	460
ASTM D2161, SUS at 100°F	90	105	158	339	600	2500
Viscosity Index, ASTM D2270	90	95	95	93	99	95
Pour Point, ASTM D97, °F (°C)	5 (-15)	5 (-15)	5 (-15)	10 (-12)	8 (-13)	10 (-12)
Color, ASTM D1500	L0.5	1.0	1.0	1.0	0.5	5.0
ISO VG No.	15	—	32	68	—	460

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CITGO® Pacemaker® Oils

OVERVIEW



- Rust- and oxidation-inhibited (R&O) general purpose lubricants manufactured with high viscosity index base stocks.
- Contain antifoam additives and readily separate from water.

FEATURES & BENEFITS



- Made from high-quality, paraffinic base stocks.
- High viscosity index imparts superior temperature-viscosity characteristics.
- Low carbon-forming tendency and excellent resistance to oxidation, rusting, and foaming ensure long service life in closed circulating systems.

APPLICATIONS



- Appropriate viscosity grade Pacemaker oils can be used as:
 - Air line oil
 - Circulating oil
 - Gear oil
 - Compressor oil
 - Rust- and oxidation-inhibited (R&O) oil
 - Low pressure hydraulic oil
 - Non-detergent oil

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PROPERTIES



Typical Properties for CITGO Pacemaker Oils:

Grade	19	32	46	68	100	150	220	320	460
Material Code	633013001	633001001	633002001	633003001	633006001	633008001	633009001	633010001	633012001
Gravity, ASTM D4052, °API	34.3	32.6	31.5	31.0	30.3	29.5	28.2	27.0	26.5
Pounds Per Gallon	7.11	7.18	7.23	7.26	7.28	7.32	7.37	7.43	7.46
Flash Point, ASTM D92, °F (°C)	395 (202)	395 (202)	395 (202)	442 (228)	442 (228)	442 (228)	442 (228)	442 (228)	579 (304)
Viscosity, ASTM D445									
cSt at 40°C	22	32	45	68	100	150	220	320	456
cSt at 100°C	4.55	5.2	6.7	8.3	10.5	16.5	18.2	23.6	30.1
Viscosity Index ASTM D2270	102	110	103	104	102	98	98	96	95
Pour Point, ASTM D97, °F (°C)	-22 (-30)	-33 (-36)	-22 (-30)	-27 (-33)	-22 (-30)	0 (-18)	0 (-18)	0 (-18)	10 (-12)
Color, ASTM D1500	L0.5	L0.5	L0.5	L0.5	L1.0	L5.0	L5.0	L5.5	L5.5
Neutralization No. ASTM D974	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Rust Test ASTM D665	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cincinnati Lamb Requirement	P-45	P-38	P-55	P-54	—	P-57	—	—	—
ISO VG No.	22	32	46	68	100	150	220	320	460
AGMA Grade	—	—	1	2	3	4	5	6	7

Notes: (1) Procedure A (distilled water) and Procedure B (synthetic sea water) - 24 hrs

(2) Procedure A (distilled water)

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CITGO® Pacemaker® T Oils

OVERVIEW



- Extra-inhibited, high-quality lubricants designed specifically as turbine oils.

FEATURES & BENEFITS



- Made from high viscosity index paraffinic base stocks processed by modern hydrotreating methods.
- High viscosity index imparts superior temperature-viscosity characteristics.
- High flash point and excellent resistance to oxidation, rusting, and foaming promote long service life in closed circulating systems.
- Pass both procedures of the ASTM D665 Rust Test and provide extended oxidation life as measured in the ASTM D943 Oxidation Test.

APPLICATIONS



- Recommended for pressure-circulation systems of direct-connected steam turbines and for the bearings of turbo-generators.
- Recommended for the lubrication of steam turbines with single-reduction gear units, as found in marine service.
- Highly recommended for use in compressor equipment, air lines, circulating oil systems, and gears where an R&O (rust- and oxidation-inhibited) type oil is specified.
- Suitable for the lubrication of industrial gas turbines and gear units.
- Pacemaker T-68 passes the Alemite test and is thus suitable for mist applications.
- Recommended for use in equipment requiring the following specifications:
 - General Electric GEK 32568 H
 - Fives Cincinnati P-38 (Grade T-32)
 - ALSTOM HTGD 90117
 - ASTM D4304 Type I, II, III
 - British Standard BS 489
 - DIN 51515 Part 1, 2
 - DIN 51524 Part 1
 - ISO 8068 TSA TGA, TGE TSE
 - ISO 11158 HH, HL
 - SIEMENS AG TLV 9013 04 Standard Thermal Stability
 - SIEMENS AG TLV 9013 05 High Thermal Stability
 - Solar ES9-244W grades C32 (150), C46 (5-215) (Grades T-32 and T-46, respectively)

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PROPERTIES



Typical Properties for CITGO Pacemaker T Oils:

Grade	T-32	T-46	T-68	T-115
Material Code	633715001	633720001	633730001	633745001
Gravity, ASTM D4052, °API	32.7	31.4	30.9	29.0
Pounds Per Gallon	7.18	7.24	7.26	7.34
Flash Point, COC, ASTM D92, °F (°C)	442 (228)	446 (230)	489 (254)	536 (280)
Viscosity ASTM D445				
cSt at 40°C	32.0	44.7	66.7	109
cSt at 100°C	5.5	6.8	8.8	12.2
Viscosity Index, ASTM D2270	107	104	105	102
Pour Point, ASTM D97, °F (°C)	-38 (-39)	-38 (-39)	-38 (-39)	0 (-18)
Color, ASTM D1500	L1.0	L1.0	L1.5	1.5
Foam Test, ASTM D892(1), Seq. I, II, III	Pass	Pass	Pass	Pass
Aniline Point, ASTM D611, °F (°C)	219 (104)	223 (106)	230 (110)	244 (118)
Neutralization No., ASTM D664	0.1	0.1	0.1	0.1
Corrosion, ASTM D130, 3 hours at 212°F	1B	1B	1B	1B
Oxidation, ASTM D943(2), hours	10,000+	10,000+	—	—
Water Separation, Dist. Water, ASTM D1401				
at 130°F (54°C)	40-40-0 (15)	40-40-0 (15)	40-40-0 (20)	—
180°F (82°C)	—	—	—	40-40-0 (20)
Rust Test, ASTM D665(3)	Pass	Pass	Pass	Pass
RPVOT, ASTM D2272, minutes	2780	2500	1160	780
ISO VG No.	32	46	68	—
AGMA Grade	0	1	2	—

Note:

- (1) 50 ml. max. at end of blowing period. No foam after 10 minutes setting.
- (2) Hours to reach acid number of 2.0 mg. of KOH per gram of oil.
- (3) Procedures A (distilled water) and B (synthetic sea water) – 24 hours.

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CITGO® Pacemaker® XL-32 Oil

OVERVIEW



- A superior-quality turbine lubricant formulated with a white mineral oil base and an additive system designed for high-temperature and long service life in steam and gas turbine applications.

FEATURES & BENEFITS



- Highly resistant to harmful sludge and varnish formation.
- Fully inhibited against high temperature oxidation, rust, and corrosion.
- Excellent water shedding properties.
- Non-silicone foam inhibitor combats excessive foaming and air entrainment.

APPLICATIONS



- Meets the specifications of all major steam turbine generator builders and is widely used by electrical generating utility companies.
- Used where high temperature resistance is required in marine turbines and reduction gears, hydraulic governor and control systems, and low-pressure hydraulic systems operating at less than 1000 psi where exceptionally long service life is required.

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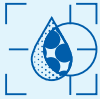
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PROPERTIES



Typical Properties for CITGO Pacemaker XL-32 Oil:

ISO VIS Grade	32
Material Code	633792001
Gravity, ASTM D4052, °API	32.3
Color, ASTM D1500	L1.0
Flash Point, ASTM D92, °F (°C)	380 (193)
Pour Point, ASTM D97, °F (°C)	-25 (-32)
Viscosity:	
ASTM D445, cSt at 40°C	32
ASTM D2161, SUS at 100°F	165
SUS at 210°F	44
Viscosity Index , ASTM D2270	110
Water Separation time, ASTM D1401, minutes at 130°F	15
Oxidation Stability, ASTM D943 Mod., hrs	10,000+
Carbon Residue, ASTM D524, m%	<0.05
Total Acid Number, ASTM D664, mgKOH/g	0.20
Rust Test, B, ASTM D665	No Rust
Foam Test, ASTM D892	Pass

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CITGO® Pacemaker® ST-32

OVERVIEW



- A synthetic gas turbine lubricant formulated to meet the demands of high-output stationary industrial gas turbines.
- High-quality synthetic base oils and carefully selected additives impart anti-wear properties, high temperature oxidation and corrosion inhibition, and rust protection.
- Exceptional low-temperature performance, with superior fluidity during cold startups and cold weather operation.

FEATURES & BENEFITS



- Exceptionally good low-temperature fluidity provides reduced wear and lowered power consumption during startup.
- High viscosity index provides excellent viscosity performance over a wide temperature range.
- High load-carrying and anti-wear characteristics for longer component life than mineral oil products.
- Miscibility and compatibility with petroleum-based lubricants and system components such as seals, paints, gaskets, and hoses.

APPLICATIONS



- Recommended for equipment requiring the following specifications:
 Fives Cincinnati P-38
 DIN 51515 Part 1
 DIN 51515 Part 2
 British Standard BS 489
 GEK 46506D
 GEK 32568F
 Alstom HTGD 90117
 Solar ES 9-224W
 Siemens TLV 901304
 Siemens TLV 901305

Note: Not intended for aviation applications.

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C 10092

PROPERTIES



Typical Properties for CITGO Pacemaker ST-32:

ISO Viscosity Grade	32
Material Code	632515001
Specific Gravity, 60°/60°F	0.853
Density, lbs/gal	7.10
Viscosity ASTM D445	
cSt at 40°C	30.5
cSt at 100°C	5.74
Viscosity Index, ASTM D2270	132
Flash Point, ASTM D92, °F (°C)	486 (252)
Pour Point, ASTM D97, °F (°C)	-71 (-57)
Copper Corrosion, ASTM D130	1A
Rust Protection, ASTM D665	
DI Water, Proc. A	Pass
Salt Water, Proc. B	Pass
Foaming Tendency, Sequence I, II, III	Pass
Neutralization Number	0.1
Four Ball Wear, ASTM D4172, 40kg, mm	0.46

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CITGO® HyDurance® AW Fluids

OVERVIEW



- Superior anti-wear hydraulic and circulating oils specially formulated to offer excellent service in high-pressure, high-output industrial hydraulic circuits.
- Chemically stable with excellent resistance to sludge formation. Exhibit excellent protection and filterability.

FEATURES & BENEFITS



- Formulated with high-quality base stocks and premium additive components.
- Thermal stability for superior resistance to heat-related sludging in sensitive electro-hydraulic servos.
- Good hydrolytic stability means they will not contribute to the formation of metal-etching acids or corrosive reactants.
- Inhibited against rusting in both fresh and sea water, passing both A and B Procedures of the ASTM D665 Rust Test.
- Excellent anti-wear protection to pumps, motors, valves, and other hydraulic circuit components. Approved against stringent equipment performance requirements.
- Resistant to foaming and will not foster abnormal air entrainment in properly designed hydraulic circuits.
- Superior demulsibility to readily separate water, permitting draining of contaminating water from circulating systems.
- Premium performance in wet and dry filterability testing.

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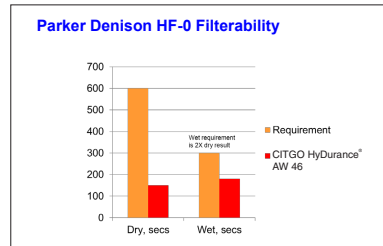
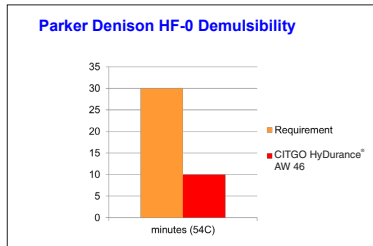
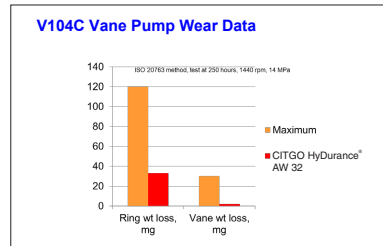
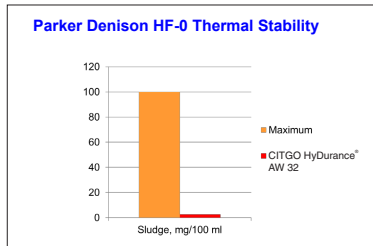
C 10203

APPLICATIONS



- Recommended for service in industrial and mobile hydraulic systems when used in accordance with equipment manufacturers' recommendations.
- Designed to provide enhanced service life to vane, piston, and gear pumps as well as other circuit components such as motors and servos.
- Recommended for use as a gear and bearing lubricant in industrial applications where rust- and oxidation-inhibited oils are required.
- Meet or exceed the following manufacturer specifications:

ASTM D6158 HM	General Motors LS-2
Fives Cincinnati P-68, 69, 70	JCMAS HK P041
Parker Denison HF-0	ISO 11158 HM
DIN 51524-2	SEB 181 222
Eaton Brochure 03-401-2010	US Steel 126, 127, 136
Bosch Rexroth RDE-90235	



PROPERTIES



Typical Properties for CITGO HyDurance AW Fluids:

Grade	22	32	46	68	100	150
Material Code	633606001	633607001	633608001	633609001	633610001	633611001
Gravity, ASTM D4052, °API	33.7	32.6	31.2	30.8	28.6	29.3
Density, lb/gal	7.13	7.18	7.24	7.26	7.36	7.33
Flash Point, ASTM D92, °F (°C)	399 (204)	417 (214)	446 (230)	468 (242)	471 (244)	500 (260)
Viscosity						
cSt at 40°C	223	32.3	46.6	68	98	149
cSt at 100°C	4.45	5.59	6.96	9.0	11.1	14.8
Viscosity Index	110	111	106	107	98	99
FZG (A/8.3/90), pass load, ISO 14635-1	12	12	12	12	12	12
Pour Point, ASTM D97, °F (°C)	-40 (-40)	-40 (-40)	-36 (-33)	-36 (-33)	-36 (-33)	-31 (-24)
Color, ASTM D1500	L0.5	L0.5	L0.5	L0.5	L3.0	L2.5
Water Separability, ASTM D1401 ⁽¹⁾	40-40-0	40-40-0	40-40-0	40-40-0	40-40-0	40-40-0
Oxidation Test, ASTM D943, Hrs.	6000	6000	6000	5000	4000	2850
Rust Test ASTM D665 A, B ⁽²⁾	Pass	Pass	Pass	Pass	Pass	Pass
Meets Fives Cincinnati Requirement	—	P-68	P-70	P-69	—	—
AFNOR NF E 48-603	HM22	HM32	HM46	HM68	HM100	HM150
ISO VG No.	22	32	46	68	100	150

Notes: (1) 30 minutes max. separation time to \leq 3ml emulsion. Test temperature is 130°F for grades up through ISO 68. Test temperature is 180°F for ISO 100 and 150.

(2) Pass - No Rust.(2) Procedure A (distilled water)

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CITGO® HyDurance® AW All Temp Fluids



OVERVIEW



- Superior, high viscosity index, anti-wear hydraulic and circulating oils formulated to provide excellent service in high-pressure, high-output industrial hydraulic circuits over wide temperature ranges.
- Chemically stable with outstanding resistance to sludge formation. Excellent anti-wear protection and filterability.

FEATURES & BENEFITS



- Formulated with high-quality base stocks and premium additive components.
- Thermal stability for superior resistance to heat-related sludging in sensitive electro-hydraulic servos.
- Good hydrolytic stability means they will not contribute to the formation of metal-etching acids or corrosive reactants.
- Inhibited against rusting in both fresh and sea water, passing both A and B Procedures of the ASTM D665 Rust Test.
- Excellent anti-wear protection to pumps, motors, valves, and other hydraulic circuit components. Approved against stringent equipment performance requirements.
- Resistant to foaming and will not foster abnormal air entrainment in properly designed hydraulic circuits.
- Superior demulsibility to readily separate water, permitting draining of contaminating water from circulating systems.
- Premium performance in wet and dry filterability testing.

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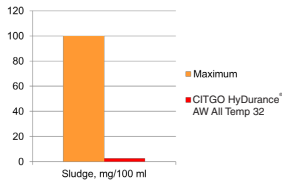
APPLICATIONS



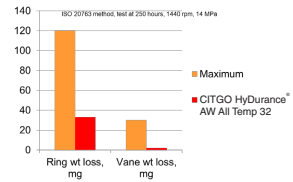
- Recommended for service in industrial and mobile hydraulic systems when used in accordance with equipment manufacturers’ recommendations.
- Designed to provide maximum service life to vane, piston, and gear pumps as well as other circuit components such as motors and servos.
- Recommended for use as a gear and bearing lubricant in industrial applications where rust- and oxidation-inhibited oils are required.
- CITGO HyDurance AW All Temp 32 Fluid is a special multi-grade anti-wear fluid meeting FMC Hi-Performance Hydraulic Oil Grade 32 requirements.
- CITGO HyDurance AW All Temp Fluids 32 and 46 offer excellent low temperature pumpability and are recommended for use in mobile and other hydraulic equipment in heavy duty all-weather service.
- Recommended for equipment requiring the following specifications:

ASTM D6158 HM	Parker Denison HF-0
ISO 11158 HV	JCMAS HK P041
DIN 51524-3 HVLP	US Steel 126, 127, 136
General Motors LS-2	SEB 181 222
Eaton Brochure 03-401-2010	Bosch Rexroth RDE-90235

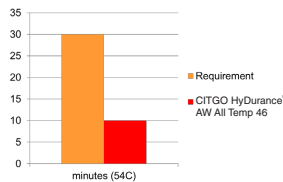
Parker Denison HF-0 Thermal Stability



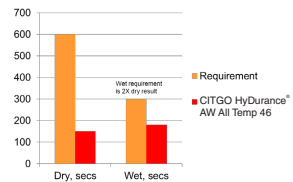
V104C Vane Pump Wear Data



Parker Denison HF-0 Demulsibility



Parker Denison HF-0 Filterability



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PROPERTIES



Typical Properties for CITGO HyDurance AW All Temp Fluids:

Grade	32 ⁽¹⁾	46	68
Material Code	633621001	633622001	633620001
ISO VG. No.	32	46	68
Gravity, ASTM D4052, °API	33.4	32.3	30.9
Density, lb/gal	7.15	7.20	7.26
Flash Point, ASTM D92, COC, °F (°C)	385 (196)	423 (217)	399 (204)
Viscosity			
cP at -40°C ⁽¹⁾	13,900	39,770	—
cP at -35°C ⁽¹⁾	7,200	18,400	59,500
cP at -20°C ⁽¹⁾	—	2,424	4,660
cSt at 40°C	31.2	46.9	68
cSt at 100°C	6.31	8.1	10.8
Viscosity Index	159	147	149
FZG (A/8.3/90), pass load, ISO 14635-1	12	12	12
Pour Point, ASTM D97, °F (°C)	-54 (-48)	-49 (-45)	-44 (-42)
Color, ASTM D1500	L1.0	L1.0	L1.0
Water Separability, ASTM D1401	40-40-0	40-40-0 (15)	40-40-0 (15)
Oxidation Test, ASTM D943, Hrs.	4800	>4800	4800
Rust Test ASTM D665 A, B ⁽³⁾	Pass	Pass	Pass

Notes: (1) Meets FMC Hi-Performance, Hydraulic Oil, Grade 32 requirements.

(2) ASTM D2893 Brookfield Viscosity.

(3) Pass - No Rust.

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CITGO® HyDurance® AW CP Fluid

OVERVIEW



- A premium multi-grade, anti-wear hydraulic fluid designed for applications where dielectric (insulating) properties are required.
- Offers wide temperature range service in mobile hydraulic equipment, particularly in low-temperature conditions where excellent cold startup hydraulic system performance is required.

FEATURES & BENEFITS



- Provides excellent service in equipment used under a wide range of operating conditions and where hydraulic system response is critical.
- High dielectric strength.
- Superior low-temperature flow and pumpability.
- Fluid film strength for warmer climates.
- Excellent anti-wear properties.
- Foam-resistant and separates water readily.
- Protects against rust and corrosion.
- Long service life.
- Excellent viscosity shear stability.



APPLICATIONS



- Recommended for most outdoor and/or mobile hydraulic equipment requiring a fluid with high dielectric strength properties such as cherry picker lift applications, including:
 - Tree trimming, fruit picking mobile equipment
 - Firefighting lift trucks, buckets, etc.
 - Aerial lift buckets
 - Mobile hydraulic systems
 - Garbage collection equipment
 - Public utility vehicles
 - Construction equipment in colder services
- Meets or exceeds the following:
 - Dielectric Strength, ASTM D877, 35 KV minimum
 - ASTM D6158 HM
 - Parker Denison HF-0
 - DIN 51524-2
 - Eaton Brochure Q3-401-2010
 - General Motors LS-2
 - JCMAS HK P041
 - ISO 11158 HM
 - SEB 181 222

• DIELECTRIC STRENGTH RATED
• WIDE TEMPERATURE PERFORMANCE

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PROPERTIES



Typical Properties for CITGO HyDurance AW CP Fluid:

Material Code	633623001
Gravity, ASTM D4052, °API	30.8
Density, lb/gal	7.26
Flash Point, COC, ASTM D92, °F (°C)	367 (186)
Color	Blue-green
Viscosity ASTM D2983:	
cP at -40°C	20,450
cP at -23°C	1,590
cP at -18°C	860
Viscosity ASTM D455:	
cSt at 40°C	25.6
cSt at 100°C	5.4
Viscosity Index, ASTM D2270	155
Pour Point ASTM D97, °F (°C)	-54 (-48)
Oxidation Test ASTM D943, hrs	2775
Rust Test ASTM D665, A and B	Pass
Water Separability, ASTM D1401, at 130°F (54°C)	40-40-0 (10)
Dielectric Strength, ASTM D877, KV, minimum	35

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Dielectric strength is extremely sensitive to humidity and contamination. Once the containers are opened, the dielectric strength cannot be expected to remain at its original value. Containers should be kept tightly sealed and stored in a dry environment. Dielectric strength rating shown in the above Typical Properties table does not apply to bulk shipments and is only applicable to containers packaged at CITGO packaging facilities.

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CITGO® HyDurance® AW NZ Fluids

OVERVIEW



- High-performance lubricants formulated with premium base stocks and ashless additives to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.
- Zinc-free; zinc compounds are regulated as priority pollutants under provisions of the Clean Water Act and SARA Title 313.

FEATURES & BENEFITS



- Low acute aquatic toxicity (as shown by LC-50 test).
- Inherently biodegradable.
- Zinc-free formulation for less impact on the environment.
- Excellent thermal stability to virtually eliminate heat-related sludge deposits.
- Provide outstanding rust and corrosion protection.
- Separate readily from water.
- Contain inhibitors to minimize foaming and air entrainment.
- Provide premium anti-wear protection to pumps, motors, and other hydraulic components.
- Offer extended fluid service life capability with a fortified premium formulation to handle severe operating conditions.



CITGO HyDurance AW
NZ 32 Fluid

APPLICATIONS



- Recommended for premium non-zinc, anti-wear protection to vane, piston, and gear pumps, motors, valves, and other hydraulic circuit components when used in accordance with manufacturer's recommendations.
- Can be used in circulating systems of machine tools, presses, air compressors, and other gear and bearing applications where rust- and oxidation-inhibited oils are required.
- Meet or exceed the stringent performance requirements of:

GM LS-2	Fives Cincinnati P-68, P-69, P-70
Eaton Brochure 03-401-2010	U.S. Steel 127, 136, 126
DIN 51524 PART 2	Parker Denison HF-0
- Can be used in applications operating in environmentally sensitive areas where the use of a zinc-free, ashless formulated fluid is desired, such as:
 - Marine – offshore rigs, tugs, dredges, hydraulic lifts, cranes, pile-drivers (note: does not meet EPA 2013 Vessel General Permit VGP EAL requirements).
 - Forestry – scalpers, excavators, wheel loaders.
 - Construction – bulldozers, graders, backhoes.
 - Mining – conveyors, crawlers, hole drillers

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PROPERTIES



Typical Properties for CITGO HyDurance AW NZ Fluids:

Grade	32	46	68
Material Code	633615001	633616001	633617001
Gravity, ASTM D4052, °API	32.3	31.2	29.3
Density, lb/gal	7.19	7.24	7.33
Flash Point, ASTM D92 (COC), °C (°F)	215 (419)	206 (403)	242 (468)
Viscosity			
cSt at 40°C	32	46	68
cSt at 100°C	5.5	6.9	8.5
Viscosity Index, ASTM D2270	110	105	94
Pour Point ASTM D97, °C (°F)	-39 (-38)	-36 (33)	-24 (-11)
Color, ASTM D1500	L1.0	L1.0	L1.5
Total Acid No., ASTM D664, mgKOH/g	0.10	0.5	0.10
Copper Corrosion, ASTM D130, 3h at 100°C	1A	1A	1A
Rust Test, ASTM D665 A, B	Pass	Pass	Pass
Four Ball Wear, ASTM D4172, at 40 kg, mm	0.70	0.55	0.50
Foam Test, Seq. I, ml	20-0	0-0	0-0
Seq. II, ml	10-0	0-0	20-0
Seq. III, ml	20-0	0-0	0-0
Water Separability, ASTM D1401, at 130°F	40-40-0	40-40-0	40-40-0

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CITGO® HyDurance® AW All Temp NZ Fluids

OVERVIEW



- High performance, zinc-free anti-wear lubricants designed to provide outstanding protection over a wide temperature range.
- Provide outstanding protection for demanding hydraulic systems operating in environmentally sensitive areas.

FEATURES & BENEFITS



- Superior, high viscosity index, zinc-free, anti-wear hydraulic and circulating oils.
- Provide excellent resistance to sludge formation and exhibit excellent filterability.
- Can be used over a wide temperature range.
- Designed to provide maximum service life to vane, piston, and gear pumps as well as other circuit components such as motors and servos.
- Can be used as a gear and bearing oil.
- Outstanding low temperature performance.
- Excellent resistance to foaming -- will not foster abnormal air entrainment in properly designed hydraulic systems.
- Inherently biodegradable and low acute aquatic toxicity.

APPLICATIONS



- Recommended for high-pressure, high-output industrial hydraulic circuits.
- Recommended for mobile and other hydraulic equipment in heavy duty all-weather service.
- Can be used in circulating systems of machine tools, presses, air compressors, and other gear and bearing applications where rust- and oxidation-inhibited oils are required.
- Meet or exceed the stringent performance requirements of:
 - GM LS-2
 - Eaton Brochure 03-401-2010
 - DIN 51524 Part 2
 - U.S. Steel 127, 136, 126
 - Parker Denison HF-0
- Can be used in applications operating in environmentally sensitive areas where the use of a zinc-free, ashless formulated fluid is desired, such as:
 - Marine – offshore rigs, tugs, dredges, hydraulic lifts, cranes, pile-drivers (note: does not meet EPA 2013 Vessel General Permit VGP EAL requirements).
 - Forestry – scalpers, excavators, wheel loaders.
 - Construction – bulldozers, graders, backhoes.
 - Mining – conveyors, crawlers, hole drillers
- Refer to equipment owner’s manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO HyDurance AW All Temp NZ Fluids:

Material Code	633612	633613	633614
ISO Vis Grade	32	46	68
Gravity, °API, ASTM D4052	34.5	33	31
Density, lbs/gal at 60°F	7.1	7.17	7.25
Specific Gravity at 60°F, ASTM D1298	0.8523	0.8602	0.8708
Flash Point (COC) , F° (C°) ASTM D92	401 (205)	403 (206)	453 (234)
Pour Point F °(C°) ASTM D97	-60 (-51)	-49 (-45)	-49 (-45)
Brookfield Viscosity ASTM D2983			
at -20°C, cP	–	2688	4650
at -30°C, cP	2260	9680	17670
at -40°C, cP	11360	–	–
Viscosity ASTM D445			
cSt at 40°C, cSt	32	46	68
cSt at 100°C, cSt	6.1	7.9	10.8
Viscosity Index, ASTM D2270	140	146	149
Water Separability, mL-mL-mL(min)ASTM, D1401 @130F°	40-40-0(15)	40-40-0(20)	40-40-0(20)
Four Ball Wear, mm D4172, 40kg	0.70	0.55	0.49
Rust Prevention ASTM D665 A/B	Pass/Pass	Pass/Pass	Pass/Pass
Copper Corrosion	1A	1A	1A
Oxidation Stability, hr ASTM D943	8000	8000	8000

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CITGO® HyDurance® AW Super NZ Fluids

OVERVIEW

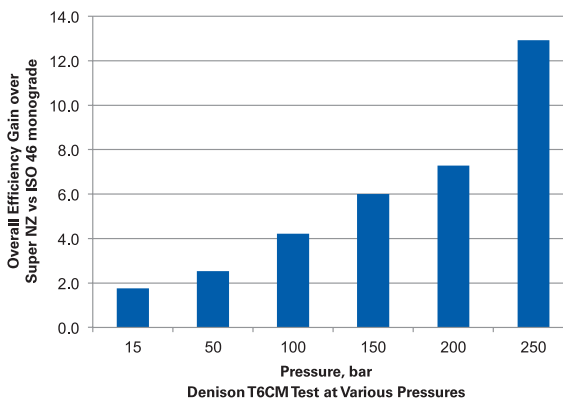


- High-efficiency hydraulic fluids for use over a wide temperature use range.
- Formulated with premium base stocks and ashless additives to provide long fluid life and outstanding protection for demanding mobile equipment hydraulic systems.
- Formulated with premium Zinc-free additive system. Zinc compounds are regulated as priority pollutants under provisions of the Clean Water Act and SARA Title 313.

FEATURES & BENEFITS



- Helps increase pump efficiency for improved productivity.
- Zinc-free and low acute aquatic toxicity (as shown by LC-50 test), for less environmental impact.
- Multi-grade performance for use over a wide temperature range.
- Excellent shear stability and thermal stability for extended fluid service life capability.
- Separates readily from water to allow draining of water from systems.
- Premium protection against rust and corrosion for harsh environments.
- Excellent foam control for dependable performance.
- Provides outstanding anti-wear protection to pumps, motors, and other hydraulic circuit components.
- Recommended for use in Hitachi excavators with 4,000-hour service intervals*.



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C 10232

APPLICATIONS



- Designed for increased hydraulic efficiency and excellent service life in vane, piston, and gear pumps, when used in accordance with equipment manufacturer recommendations.
- Highly recommended for high-pressure mobile equipment hydraulic systems operating in wide temperature range applications such as mining, construction, and logging.
- Recommended for equipment requiring the following specifications:
 GM LS-2
 Eaton Brochure 03-401-2010
 DIN 51524 PART 3
 U.S. Steel 127, 136, 126
 Cincinnati Machine P-68, P-69, P-70
 Parker Denison HF-0
 Hitachi Excavators*

*Applicable to CITGO HyDurance Super NZ only

PROPERTIES



Typical Properties for CITGO HyDurance AW Super NZ Fluids

	Super NZ 32	Super NZ
Material Code	633619001	633618001
Gravity, ASTM D4052, °API	33.4	31.5
Density, lb/gal	7.15	7.23
Flash Point, PM, ASTM D93, °F (°C)	410 (210)	385 (196)
Viscosity ASTM D445		
cSt at 40°C	32.1	53.0
cSt at 100°C	6.6	9.9
Viscosity Index, ASTM D2270	170	177
Brookfield Viscosity ASTM D2983		
cP at -20°C	1116	
cP at -30°C	3450	7,998
cP at -40°C	16890	36,392
Pour Point, ASTM D97, °F (°C)	-54 (-48)	-49 (-45)
Color	Blue	Blue
Copper Corrosion, ASTM D130, 3h at 100°C	1A	1A
Rust Test, ASTM D665 A, B	Pass	Pass
Four Ball Wear, ASTM D4172, at 40 kg, mm	0.54	0.50
Foam Test, ml, ASTM D892		
Sequence I	10-0	10-0
Sequence II	40-0	25-0
Sequence III	0-0	0-0
Water Separability @ 130F, ASTM D1401	40-40-0	40-40-0
Acute aquatic toxicity (LC-50) per OECD TG 203	Pass	Pass

Notes: Contamination with other fluids can affect environmental benefits and system performance. Contamination with zinc containing and/or emulsifiable fluids may cause foaming, premature filter saturation, and a decrease in water separability. Refer to equipment owner’s manual for proper lubricant selection.

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CITGO® HyDurance® AW Synthetic Fluids

OVERVIEW



- Premium ashless hydraulic fluids formulated with the highest quality synthetic base stocks and additives.
- Outstanding chemical stability, anti-wear protection and resistance to sludge formation.

FEATURES & BENEFITS



- Excellent low- and high-temperature performance provides a higher margin of equipment protection, beyond the capabilities of comparable mineral oils.
- The combination of synthetic base stocks and an ashless additive package provides a product with exceptional oxidation stability, allowing for extended drain and filter change intervals.
- High resistance to sludge formation helps assure clean and trouble-free operation.
- Excellent thermal and oxidative stability reduces system deposits, resulting in longer fluid life.
- High viscosity index and low pour point allow for operation over a wide temperature range without the viscosity loss problems typical of multi-grade mineral oils.
- Excellent corrosion protection.
- Exceptional demulsibility allows for the separation of large amounts of water from the system.
- Exceptional anti-wear properties.



CITGO HyDurance AW
46 Synthetic Fluid

APPLICATIONS



- Designed for use in vane, piston, and gear pumps typically found in hydraulic and circulating systems, and to provide excellent service life to pumps, servos and motors.
- Meet or exceed the following manufacturer specifications:
Eaton Brochure 03-401-2010 (formerly Vickers I-286-S, M-2950-S)
Parker Denison HF-0
Fives Cincinnati P-70 (ISO 46), P-69 (ISO 68)
U.S. Steel 127, 136

• **FULLY SYNTHETIC**
• **EXTREME TEMPERATURE PERFORMANCE**

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PROPERTIES



Typical Properties for CITGO HyDurance AW Synthetic Fluids:

Grade	46	68
Material Code	633602001	633603001
Specific Gravity, 60°/60°F	0.8498	0.8540
Density, lbs/gal	7.08	7.11
Viscosity ASTM D445		
cSt at 40°C	43.4	67.0
cSt at 100°C	7.29	10.08
Viscosity Index, ASTM D2270	131	135
Flash Point, ASTM D92, °C (°F)	266 (510)	268 (514)
Pour Point, ASTM D97, °C (°F)	-60 (-76)	-57 (-70)
Color, ASTM D1500	1.0	1.0
Brookfield Viscosity cP at -18°C	1500	2865
cP at -26°C	3340	—
Water Separation, ASTM D1401, at 130°F (54°C)	40/40/0 (5)	40/40/0 (5)
Four Ball Wear, ASTM D4172, 40kg, mm	0.60	0.58
Copper Corrosion, ASTM D130	1B	1B
Rust Protection, ASTM D665		
DI Water	Pass	Pass
Salt Water	Pass	Pass
Foam Sequence, ASTM D892, I, II, III	Pass	Pass

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CITGO® HyDurance® AW/AL HVI 100 Fluid

OVERVIEW



- A superior anti-wear and anti-leak, high viscosity index hydraulic and circulating oil formulated to provide outstanding performance under wide temperature ranges.
- Chemically stable with excellent resistance to sludge formation. Exhibits premium protection and filterability.

FEATURES & BENEFITS



- Formulated with high-quality base stocks and premium additive components.
- Contains a seal-conditioning agent to prevent and minimize minor leaks, and help provide longer seal life.
- Excellent low-temperature performance and fluidity over a wide temperature change.
- Thermal stability for superior resistance to heat-related sludging in sensitive electro-hydraulic servos.
- Good hydrolytic stability means they will not contribute to the formation of metal-etching acids or corrosive reactants.
- Inhibited against rusting in both fresh and sea water, passing both A and B Procedures of the ASTM D665 Rust Test.
- Excellent anti-wear protection to pumps, motors, valves, and other hydraulic circuit components. Approved against stringent equipment performance requirements.
- Resistant to foaming and will not foster abnormal air entrainment in properly designed hydraulic circuits.
- Superior demulsibility to readily separate water, permitting draining of contaminating water from circulating systems.
- Premium performance in wet and dry filterability testing.
- Seal conditioner for longer seal life.

APPLICATIONS



- Recommended for service in industrial and mobile hydraulic systems when used in accordance with equipment manufacturers' recommendations.
- Designed to provide enhanced service life to vane, piston, and gear pumps as well as other circuit components such as motors and servos.
- Recommended for use as a gear and bearing lubricant in industrial applications where rust- and oxidation-inhibited oils are required.

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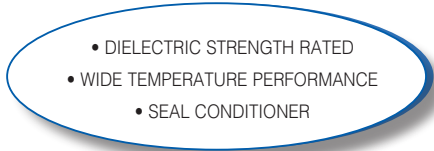
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C 10210

APPLICATIONS



- Excellent low-temperature pumpability; recommended for use in mobile and other hydraulic equipment in heavy duty all-weather service.
- Recommended for equipment requiring the following specifications:
Parker Denison HF-0
Eaton Brochure 03-401-2010



PROPERTIES



Typical Properties for CITGO HyDurance AW/AL HVI 100 Fluid:

Grade	HVI 100
Material Code	633625001
Gravity, ASTM D4052, °API	30.5
Density, lb/gal	7.27
Flash Point, ASTM D92, COC, °C (°F)	258 (496)
Viscosity ASTM D2893	
cP at -23°C	19,700
Viscosity ASTM D445	
cSt at 40°C	103.3
cSt at 100°C	14.3
Viscosity Index ASTM D2270	142
Four Ball Wear, mm, ASTM D2266	
20 kg load	0.30
40 kg load	0.46
Pour Point ASTM D97, °C (°F)	-33 (-27)
Water Separability, ASTM D1401 ⁽¹⁾	40-40-0
Rust Test, ASTM D665 A, B ⁽²⁾	Pass
Dielectric Strength, KV ASTM D877 ⁽³⁾	35
Cold Cranking Simulator, ASTM D5293, cP at -30°C	2680

Notes: (1) 30 minutes max. separation time to \leq 3 mL emulsion. Test temperature is 180°F.

(2) Pass - No Rust.

(3) Minimum dielectric strength is 28 KV when packaged by CITGO Petroleum. Dielectric strength is sensitive to humidity and contamination; opened containers may exhibit lower values. Store sealed containers properly in dry environment.

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CITGO® A/W Hydraulic Oils

OVERVIEW



- Superior anti-wear hydraulic and circulating fluids designed for service in high-pressure, high-output industrial hydraulic circuits and specially formulated with thermally stable additives.
- Outstanding chemical stability, resistance to sludge formation, and anti-wear protection.

FEATURES & BENEFITS



- Thermally stable zinc-based additives protect against heat-related sludge formation in sensitive electro-hydraulic servo valves. Ideal for high-output equipment where sustained heat is prevalent, such as CNC machine tools.
- Inhibited against rust in both fresh and sea water, and pass Procedures A and B of the ASTM D665 Rust Test.
- Resist foaming and will not foster abnormal air entrainment in properly designed hydraulic circuits.
- Readily separate water, allowing water contamination to be drained from the sump.

APPLICATIONS



- Recommended for service in vane, piston, and gear pumps when used in accordance with equipment manufacturers' recommendations.
- Designed to provide excellent service life to pumps and circuit components such as motors and servos.
- Recommended for use as a gear and bearing lubricant in industrial applications where rust- and oxidation-inhibited oils are required.
- Approved against the stringent performance requirements of:
 - Eaton Brochure 03-401-2010 (formerly Vickers 2950-S, I-286-S)
 - Fives Cincinnati P-68, P-69, and P-70
 - Parker Denison HF-0

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PROPERTIES



Typical Properties for CITGO A/W Hydraulic Oils:

Grade	32	46	68
Material Code	633491001	633492001	633493001
Gravity, ASTM D4052, °API	32.6	31.2	30.8
Density, lb/gal	7.18	7.24	7.26
Flash Point, COC, ASTM D92, °F (°C)	417 (214)	446 (230)	468 (242)
Viscosity ASTM D445			
cSt at 40°C	32.3	46.6	68
cSt at 100°C	5.59	6.96	9.0
Viscosity Index	111	106	107
Pour Point, ASTM D97, °F (°C)	-27 (-33)	-22 (-30)	-17 (-27)
Color, ASTM D1500	L0.5	L0.5	L0.5
Water Separability, ASTM D1401	40-40-0	40-40-0	40-40-0
Oxidation Test, ASTM D943, Hrs.	5000	5000	5000
Rust Test, ASTM D665 A, B	Pass	Pass	Pass
Eaton Brochure 03-401-2010	Yes	Yes	Yes
Meets Parker Denison HF-0 Requirement	Yes	Yes	Yes
Meets Fives Cincinnati Requirement	P-68	P-70	P-69
AFNOR NF E 48-603	HM32	HM46	HM68
ISO VG No.	32	46	68

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CITGO® A/W Hydraulic Oil Super MV

OVERVIEW



- A multi-grade, high-efficiency hydraulic oil formulated to provide excellent oxidation stability, rust protection, foam resistance, and performance over a wide temperature range.

FEATURES & BENEFITS



- Improved overall hydraulic efficiency.
- A special seal conditioner assists in minimizing minor leaks and providing longer seal life.
- Pour point and Brookfield viscosity demonstrate excellent low-temperature performance.
- Excellent water separation.
- Highly shear-stable formula.

APPLICATIONS



- Designed to exceed the performance requirements of:
 ASTM D6158 HV
 Parker Denison HF-0
 Eaton Brochure 03-401-2010
 ISO 11158 HV
 DIN 51524-3

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PROPERTIES



Typical Properties for CITGO A/W Hydraulic Oil Super MV:

Material Code	633935001
Gravity, ASTM D4052, °API	31.7
Flash Point, ASTM D92, °F (°C)	385 (196)
Viscosity, ASTM D445:	
cSt at 40°C	35.6
cSt at 100°C	7.9
Viscosity, ASTM D2983:	
cP at -40°F	19,800
cP at -23°F	—
Viscosity Index, ASTM D2270	202
Pour Point, ASTM D97, °F (°C)	-54 (-48)
Color, ASTM D1500	L0.5
Copper Corrosion, ASTM D130	1A
Four Ball Wear, ASTM D4172, mm Scar at 40 kg	0.4
Water Separation, ASTM D1401 @ 130°F (54°C)	Pass
Foam Tendency, ASTM D892	Pass
Rust Protection, Part A & B, ASTM D665	Pass

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CITGO® AW Mining Hydraulic Oil

OVERVIEW



- An anti-wear hydraulic and circulating oil.

FEATURES & BENEFITS



- Protection from wear, rust, and corrosion.
- Anti-foam performance.
- High viscosity index.

APPLICATIONS



- Recommended for service in surface and underground mining equipment.
- Recommended for industrial applications where an anti-wear, rust- and oxidation-inhibited oil is desired.

PROPERTIES



Typical Properties for CITGO AW 68 Mining Hydraulic Oil:

ISO Grade	68
Material Code	633592001
Gravity, ASTM D237, °API	35.3
Viscosity ASTM D445	
cSt at 40°C	71.8
cSt at 100°C	10.7
Viscosity Index	130
Pour Point, ASTM D97, °F (°C)	-31 (-35)

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CITGO® FR WG-40XD® Hydraulic Fluid



OVERVIEW



- A premium water-glycol type fire-resistant fluid designed to provide excellent performance in hydraulic systems requiring fire resistance, such as those found in steel industry operations.

FEATURES & BENEFITS



- Specially formulated to provide excellent service over a wide range of operating conditions; particularly effective in demanding steel industry applications.
- Factory Mutual approved.
- Excellent fire resistance, with no flash point or fire point.
- Meets U.S. Steel Requirement No.171.
- Meets ASTM D2882 Sperry-Vickers V104C pump test.
- Enhanced lubricity, with protection from wear, foam, and corrosion.
- Excellent heat transfer properties.

APPLICATIONS



- May be used in most types of hydraulic systems requiring fire resistance.
- Recommended for steel mills, die casting and power transmission plants
- Recommended in fire-resistant hydraulic systems operating with Eaton/Vickers, Parker/ Denison, Rexroth, and other vane and piston pumps.
- Maintenance of viscosity of CITGO FR WG-40XD is recommended as follows:

CITGO FR WG-40XD WATER ADJUSTMENT CHART						
BRIX	VISCOSITY (SUS) AT 100°F	VISCOSITY (cSt) AT 40°C	PERCENT WATER IN UNADJUSTED FLUID	GALLONS OF WATER NEEDED PER 100 GALLONS OF UNADJUSTED FLUID IN SYSTEM		CONDITION
50.0	412	82.5	28.4	18.1		SEVERE
49.5	394	78.8	29.3	17.1		
49.0	377	75.0	30.2	16.8		
48.5	358	71.2	31.2	14.4		
48.0	342	67.9	32.2	13.0		
47.5	324	64.3	33.3	11.5		
47.0	309	61.3	34.2	10.2		
46.5	294	58.4	35.3	8.8		
46.0	280	55.6	36.5	7.3		
45.5	266	52.7	37.7	5.8		
45.0	253	50.1	38.8	4.5		
44.5	241	47.7	40.0	3.0		
44.0	228	45.0	41.5	1.5		
43.5	217	43.0	42.7	0.0		
43.0	207	41.0	43.9	0.0		
42.5	197	38.9	44.5	0.0		
42.0	187	37.0	45.5	0.0		
41.5	177	34.5	-	Excess Water		
40.0	153	30.0	-	Excess Water		

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PROPERTIES



Typical Properties for CITGO FR WG-40XD Hydraulic Fluid:

Material Code	648326001
Specific Gravity, D129, at 60/60°F	1.0817
Density, lb/gal	9.018
Flash Point, COC, ASTM D92, °F (°C)	None
Viscosity, D2161, SUS at 100°F	200
Viscosity Index, ASTM D2270	180
Pour Point, ASTM D97, °F (°C)	-40 (-40)
Color	Pink
pH	9.5
Reserve Alkalinity, ASTM D1121 ⁽¹⁾	19.0
Four Ball Wear Test, ASTM D4172, 40 Kg load, Scar Dia., mm ⁽²⁾	0.66
Foam Inhibitor	Yes

Notes: (1) Milliliters of 0.1N hydrochloric acid solution required to neutralize 10 milliliters of fluid to a pH of 5.5.

(2) Test conditions: 1 hour, 130°F, 1800 rpm.

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CITGO® Glycol FR-5046HP



OVERVIEW



- A high-pressure, polymer-thickened water-glycol fluid which provides superior fire resistance at pressures in excess of 5,000 psi.
- Pump test results (Tables 1, 2, and 3) show low pump wear rates which are equivalent to or significantly better than phosphate esters and polyol esters.
- Long pump life at high pressures and excellent fire safety at lower cost than synthetic fluids.

FEATURES & BENEFITS



- **Fire Protection:** Contains sufficient water to snuff out ignition that can occur in hydraulic systems operating under high pressure when a line suddenly ruptures or fluid contacts an ignition source. Factory Mutual research tests show that thickened glycol-water fluid provides superior fire resistance compared to synthetics such as phosphate ester and polyol ester fluids.
- **Pump Performance:** Imparts the necessary lubricity, corrosion protection, and overall performance demanded of a high-pressure, anti-wear hydraulic fluid.
- **Higher Operating Temperature:** Viscosity will not drop below pump minimum requirements, even at temperatures greater than 180°F, providing greater protection where piping, cylinders, and other components are exposed to high temperatures. Bulk reservoir temperatures should be maintained as low as possible to reduce water evaporation -- preferably 135°F or less. It is important that water content be monitored and sufficient water added to maintain water content, bulk density, viscosity, and fire protection within the required range.
- **Shear Stability:** Exhibits essentially no viscosity loss (temporary or permanent) over a wide range of shear rates (Figure 1).
- Additional features include high viscosity index, low pour point, excellent heat transfer, anti-foam properties, and outstanding rust and corrosion protection.

APPLICATIONS



- Recommended for mobile equipment or stationary hydraulic systems in steel mills, foundries, die casting, power transmission plants, and similar environments and applications.
- Can be used in equipment operating in environmentally sensitive areas; FR-5046HP has been shown to have a lower environmental impact than mineral oil based products. Testing of the fluid has shown that it is relatively harmless to the aquatic species commonly tested. Additional testing has shown that FR-5046HP is relatively harmless to terrestrial species such as earthworms and plant seedlings and is readily biodegradable per OECD 301B

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APPLICATIONS



Table 1
ASTM D2882 test results

Fluid	Wear Rate (mg/hr)
Conventional water-glycol	0.65
Phosphate ester	0.05
Polyol ester	0.10
Antiwear oil	0.24
CITGO Glycol FR-5046HP	0.10

Test Conditions: Vickers 104 Vane pump run at 1250 rpm, 2,000 psi, 100 hr. with test pass criteria of 1 mg/hr wear rate max.

Table 3

Sundstrand Series 22 axial-piston pump.
CITGO Glycol FR-5046HP was also evaluated in a Sundstrand Series 22 axial-piston pump using a modified water stability test. The pump was rebuilt according to Sundstrand's Bulletin 9658 specifications. Test conditions were:

Input speed	3,100, 100rpm
Load pressure	5,000 psi
Charge pressure	200, 20 psi
Case pressure	40 psi max.
Stroke	1/2 of full
Reservoir temperature*	120, 10°F
Loop temperature*	170, 10°F
Maximum inlet vacuum	5 psi

Conditions differ from a standard test.

Test duration was 225 hours and followed the sequence: startup at 500 psi for 2 hr; break-in at 3,000 psi for 1 hr; and full load at 5,000 psi for 222 hr.

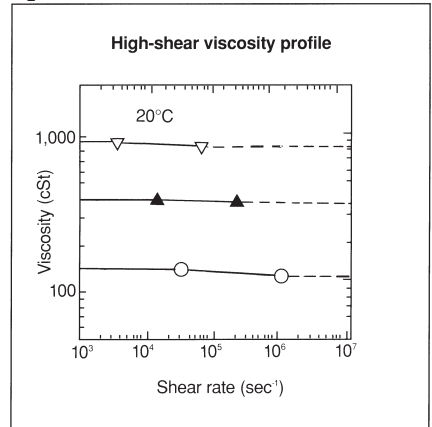
A flow degradation of 10% constitutes failure. Test data show that there was no significant flow degradation (<1%) over the full-load duration of the test. Subsequent examination of the pump components showed no significant wear or distress. These data show that high-pressure, thickened water-glycol hydraulic fluids can be used under conditions where phosphate esters and polyol esters are normally selected.

Table 2
Modified Sperry Vickers 35V25 pump test

Component	Total weight loss (mg)	
	Actual	Recommended
Ring	20	75
Vanes	6	15

*Test Conditions: 12-Vane cartridge substituted for the 10-Vane Cartridge normally used and driven at 1,800 rpm for 49 hr.

Figure 1



PROPERTIES



Typical Properties for CITGO Glycol FR-5046HP:

Material Code	648346001
Specific Gravity, ASTM D1298 (20/20°C)	1.089
Viscosity ASTM D445	
cSt at 0°C	340
cSt at 40°C	46
cSt at 65°C	22
Viscosity Index ASTM D2270	>210
pH	9.9
Pour Point, ASTM D97, °C	-50
Appearance	Red
Biodegradability, Mod. Sturm Test OECD 301B, 28 days	78%

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CITGO® Cylinder Oils

OVERVIEW



- Compounded lubricants designed for use in steam cylinders, gas compressor cylinders, and worm gear drives.

FEATURES & BENEFITS



- Formulated with high viscosity index base stocks and compounded for improved metal adhesion and lubricity.
- Provide excellent lubrication even when in contact with steam at low-to-medium pressures.

APPLICATIONS



- Recommended for the lubrication of steam cylinders over a wide range of operating conditions and steam quality.
- Recommended as lubricants for natural gas compressors having separate cylinder lubrication, especially where high-moisture natural gas is processed.
- Can be utilized in certain types of worm gear drives.

PROPERTIES



Typical Properties for CITGO Cylinder Oils:

Grade	150-5	220-5	400-5	680-7
Material Code	635013001	635015001	635017001	635023001
Gravity, ASTM D4052, °API	28.8	28.0	27.1	22.1
Density, lb/gal at 60°F	7.38	7.41	7.43	7.67
Flash Point, COC, ASTM D92, °F (°C)	493 (256)	525 (274)	585 (307)	555 (290)
Viscosity ASTM D445				
cSt at 40°C	149	216	390	652
cSt at 100°C	15	19	28	40
Viscosity ASTM D2161				
SUS at 100°F	750	—	2080	3392
SUS at 210°F	75	95	137	193
Viscosity Index, ASTM D2270	103	100	98	102
Pour Point, ASTM D97, °F (°C)	0 (-18)	16 (-9)	5 (-15)	5 (-15)
Color, ASTM D1500	L3	L3	7	D8
Fatty Oil, %	5	5	5	7
AGMA Grade	4	5	7 Comp.	8 Comp.
ISO VG No.	150	220	—	680

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CITGO® EP Compounds

OVERVIEW



- Designed for extra-duty industrial gear lubrication service in a wide variety of applications where extreme pressure (EP) load conditions prevail.

FEATURES & BENEFITS



- Formulated with highly refined base stocks and select ashless additives to provide premium EP properties and effective lubrication under most service conditions.
- Can be used in mist lubrication systems for directed delivery of the oil and control of stray mist.
- High viscosity index, excellent demulsibility, solution stability, and thermal stability.
- Excellent resistance to oxidation and foaming and are noncorrosive.

APPLICATIONS



- Recommended for lubrication of plain and antifriction bearings and gear drives that operate under extra-heavy duty conditions.
- Designed for use in steel mills, rubber mills, and similar heavy industries where ambient conditions include water, dirt, and scale.
- Formulated for the lubrication of industrial spiral bevel, helical, spur, and herringbone gears.
- Especially well-suited for use in multiple gear drives that operate at greatly increased pressure between the surfaces of the gear teeth, or where severe shock or heavy loads are encountered.
- Can be applied via misting systems.
- Suitable for use in bearing oil circulating systems.
- Formulated to meet recognized industrial gear oil requirements including:
 - DIN 51517 Part 3 CLP
 - US Steel 224
 - AGMA 9005-F16 AS
 - ISO 12925-1 CKC/CKD
 - David Brown S1.53.101 (E)
 - GM LS2 EP Gear Oil
 - Fives Group Machine Gear Oil
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO EP Compounds:

Grade	68	100	150	220	320	460	680	800
Material Code	631110001	631120001	631130001	631140001	631150001	631170001	631180001	631181001
Gravity, ASTM D4052, °API	30.6	30.2	28.0	27.5	27.0	26.3	26.8	24.0
Density, lb/gal at 60°F	7.27	7.29	7.39	7.41	7.43	7.47	7.49	7.6
Flash Point, COC, ASTM D92, °F (°C)	464 (240)	480 (250)	509 (266)	491 (255)	500 (260)	491 (255)	572 (300)	482 (250)
Viscosity, ASTM D445								
cSt at 40°C	67.5	97	147.5	215	314	435	639	805
cSt at 100°C	8.6	11.0	14.5	18.5	23.9	30.6	35.8	43.6
Viscosity Index, ASTM D2270	99	97	95	94	96	96	90	95
Pour Point, ASTM D97, °F (°C)	5 (-15)	5 (-15)	5 (-15)	5 (-15)	5 (-15)	5 (-15)	5 (-15)	5 (-15)
Color, ASTM D1500	1.0	2.5	3.0	3.0	3.5	4.0	D8.0	4.5
Copper (Cu) Corrosion, ASTM D130 ⁽¹⁾	1B	1B	1A	1B	1A	1A	2C	2C
Demulsibility, ASTM D2711B								
Water in Oil, %	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0
Total Free Water, mL	80	80	80	80	80	80	80	80
Emulsion, mL	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0
Oxidation Test ⁽²⁾	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Rust Test ASTM D665A & B	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Timken OK Load, ASTM D2782, lbs.	65	70	85	65	70	75	70	70
Four Ball EP Test, Weld, ASTM D2783, kg	250	315	315	315	315	315	315	315
Four Ball Wear at 20 kg, ASTM D4172, mm	0.29	0.30	0.29	0.23	0.21	0.20	0.35	0.35
Foam Test, ASTM D892, Seq. I, II, III	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
ISO VG No.	68	100	150	220	320	460	680	Between 680-1000
AGMA Grade	2 EP	3 EP	4 EP	5 EP	6 EP	7 EP	8 EP	Between 8 & 8A EP
Fives Cincinnati	P-63	P-76	P-77	P-74	P-59	P-35	—	—
U.S. Steel Req. No. 224	Meets	Meets	Meets	Meets	Meets	Meets	—	—

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CITGO® CITGEAR® Synthetic EP Lubricants



OVERVIEW



- Designed for highly loaded gear applications operating at high temperatures and/or very low temperatures, severe conditions, or requiring extreme pressure (EP) protection.

FEATURES & BENEFITS



- Exceptionally low pour points and high viscosity indexes, as compared to conventional, mineral oil-based products.
- The high viscosity index provides higher viscosity and greater film thickness at high temperatures, and lower viscosities for easy start-up at low temperatures.
- EP additives protect gears operating in the boundary lubrication regime and guard against failures associated with heavy loading and severe operation.
- Exhibit low foaming tendencies, high oxidation resistance, and provide excellent rust and corrosion protection.
- Lower coefficients of friction than mineral oils, providing reduced energy consumption.
- Superior heat transfer properties, as compared with conventional oils, often result in machinery operating at cooler temperatures.
- Compatible with essentially all commonly used elastomers, gaskets, and seals such as nitrile, Buna N, Viton®, Teflon®, polyethylene, fluorocarbon, polyacrylate, epoxy, and PVC. Will not deteriorate acrylic paints or lacquers.
- With proper maintenance, useful service life may be extended beyond that associated with mineral oils.

APPLICATIONS



- Recommended for gears requiring EP protection, for applications which experience a wide range of temperatures, and where a long-lasting fluid is desired for extended drain intervals.
- Especially recommended for lubricating industrial enclosed gears, sealed-for-life systems, and heavily loaded plain or roller element bearings.
- Recommended for splash lubrication, idler immersion, forced drip, and mechanical spray systems.
- No flushing or cleaning is required when converting from mineral oils to these synthetic products.
- Refer to equipment owner's manual for proper lubricant recommendation.
- Recommended for the following applications: AIST 224, ISO 12925-1 CKC/CKD, GM LS2, AGMA 9005-F16 AS, DIN 51517 Part 3, David Brown S1.53.101 (E).

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PROPERTIES



Typical Properties for CITGO Citgear Synthetic EP Gear Lubricants:

Grade	100	150	220	320	460	680
Material Code	632582001	632583001	632584001	632585001	632587001	632588001
Specific Gravity ASTM D1298	0.851	0.856	0.857	0.864	0.864	0.867
API Gravity ASTM D4052	34.7	33.8	33.6	32.3	32.3	32
Pounds Per Gallon	7.09	7.13	7.14	7.19	7.19	7.21
Viscosity, ASTM D445						
cSt at 40°C	101.4	155	220	340	434	689
cSt at 100°C	14.85	19.9	25.6	35.5	43.0	60.4
Viscosity Index ASTM D2270	153	144	148	150	152	154
Brookfield at -40 ASTM D2983	58,800	—	—	—	—	—
Flash Point, °F (°C) ASTM D92	435 (224)	432 (222)	500 (260)	464 (240)	460 (238)	457 (236)
Pour Point, ASTM D97, °F (°C)	-71 (-57)	-54 (-48)	-54 (-48)	-49 (-45)	-44 (-42)	-38 (-39)
Copper Corr. ASTM D130	1B	1B	1B	1B	1B	1B
Rust A/B ASTM D665	Pass	Pass	Pass	Pass	Pass	Pass
Demulsibility, ASTM D1401	Pass	Pass	Pass	Pass	Pass	Pass
Timken OK Load, ASTM D2782	65	65	75	75	75	75
Four Ball Weld, Kg ASTM D2783	315	315	315	315	315	315
Four Ball Wear ASTM D4172						
at 40KG	0.35	0.35	0.35	0.35	0.35	0.35
at 20KG	0.31	0.31	0.29	0.29	0.29	0.29
Foam Test, Seq. I, II, III ASTM D982	Pass	Pass	Pass	Pass	Pass	Pass
Color ASTM D1500	L1.0	L1.0	L1.0	L1.0	L1.0	L1.0
AGMA Grade	3 EP	4 EP	5 EP	6 EP	7 EP	8 EP
US Steel 224	Pass	Pass	Pass	Pass	Pass	Pass
SAE Grade	75W90	—	—	—	—	—
API Classification	GL-4	—	—	—	—	—

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CITGO® CITGEAR® Synthetic HT Lubricants

OVERVIEW



- CITGO CITGEAR Synthetic HT Gear Lubricants are fully synthetic products designed for gear applications operating at high temperatures and/or very low temperatures, severe conditions not requiring extreme pressure (EP) load protection.

FEATURES & BENEFITS



- Compared to conventional mineral oil based products, CITGEAR Synthetic HT lubricants offer exceptionally low pour points and high viscosity indexes.
- High viscosity index provides higher viscosities and protective film thickness at high operating temperatures.
- Excellent low temperature properties for easy fluid pumping and equipment start-up in extreme cold environments.
- High resistant to oxidation, provides rust and corrosion protection and low foaming tendencies.
- Lower coefficients of friction than conventional mineral oils as determined in steel on steel measurements, which provides energy savings potential.
- Higher heat transfer properties than conventional mineral oils often results in cooler running machinery.
- Compatible with most conventional mineral oils.
- Compatible with essentially all elastomers, gaskets, seals such as nitrile, Buna N, Viton®, Teflon®, polyethylene, flouorocarbon, polyacrylate, epoxy, and PVC. They will not deteriorate acrylic paints or lacquers.

APPLICATIONS



- CITGO CITGEAR Synthetic HT Lubricants are recommended for lubrication of industrial blowers such as those manufactured by GE Engery (Roots), Gardner Denver, etc., and air and natural gas compressors.
- Note: CITGO CITGEAR Synthetic EP Gear Lubricants are recommended for gears requiring extreme pressure protection.

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C 10048

PROPERTIES



Typical Properties for CITGO CITGEAR Synthetic HT Lubricants:

Grade	68	100	150	220	320	460	680	1000
Material Code	632571001	632572001	632573001	632574001	632575001	632577001	632579001	632597001
Specific Gravity, ASTM D1298	0.8465	0.8503	0.8549	0.8573	0.8588	0.8628	0.8657	0.8657
API Gravity ASTM D4052	35.6	35.0	34.0	33.6	33.2	32.5	31.9	32.4
Pounds Per Gallon	7.05	7.08	7.12	7.14	7.15	7.18	7.21	7.21
Viscosity, ASTM D445								
cSt at 40°C	61.8	91.4	161.7	229	321	460	634	1000
cSt at 100°C	9.6	13.0	20.2	26.5	34.2	44.9	57.0	84.0
Viscosity Index ASTM D2270	138	140	146	149	150	153	154	168
Flash Point, °F (°C) ASTM D92	561 (294)	550 (288)	565 (296)	554 (290)	554 (290)	540 (282)	572 (300)	572 (300)
Fire Point, °F (°C) ASTM D92	583 (306)	576 (302)	586 (308)	586 (308)	586 (308)	597 (314)	597 (314)	597 (314)
Pour Point, °F (°C) ASTM D97	-71 (-57)	-65 (-54)	-54 (-48)	-49 (-45)	-44 (-42)	-44 (-42)	-33 (-36)	-11 (-24)
Copper Corr ASTM D130	1A	1A	1A	1A	1A	1A	1A	1B
Rust A/B ASTM D665	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Demulsibility ASTM D1401	40/40/0/15	40/40/0/15	40/40/0/10	40/40/0/15	40/40/0/15	40/40/0/10	40/40/0/15	40/40/0/25
Four Ball Wear:								
at 40kg ASTM D4172	0.31	0.32	0.31	0.30	0.30	0.32	0.32	0.32
at 20kg ASTM D4172	0.21	0.21	0.21	0.20	0.23	0.22	0.24	0.31
Foam Test, Seq. I, II, III ASTM D892	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Color ASTM D1500	L1.0	L1.0	L1.0	L1.0	L1.0	L1.0	L1.0	L1.0
AGMA Grade	2	3	4	5	6	7	8	8A

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CITGO® CITGEAR® Synthetic PAG Gear Fluids



OVERVIEW



- Premium polyalkylene glycol lubricants formulated to provide excellent performance in gear boxes, worm gears, bearings, blowers, reciprocating compressors, and hydraulic systems beyond the capabilities of mineral oils.

FEATURES & BENEFITS



- Outstanding thermal and oxidative stability, and resistance to sludge and deposit formation.
- High viscosity index and low pour point values allow for a greater useable temperature range.
- Low coefficients of friction for potential energy savings.
- Excellent heat transfer properties facilitate cooler operating temperatures for machinery.
- Multipurpose industrial equipment capability.
- Compatible with most seal materials in use today; for best results contact your seal manufacturer.

APPLICATIONS



- Note: not miscible with mineral oils and not to be used as make-up for systems filled with conventional mineral oils. Mineral oils should not be used as top-off for systems which contain CITGEAR Synthetic PAG Gear Fluids. Unlike mineral oils, these fluids are hygroscopic and do not separate from water. As a result, water does not settle to the bottom of the system's reservoir.
- Designed for use in:
 - Heavy duty worm gears
 - Plain and rolling contact bearings
 - Industrial enclosed gears
 - High-temperature paper machine bearings
 - Reciprocating and rotary screw air and natural gas compressors
 - Plastic calendar operations

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PROPERTIES



Typical Properties for CITGO CITGEAR Synthetic PAG Gear Fluids:

Grade	100	150	220	320	460
Material Code	632543001	632544001	632547001	632548001	632549001
Specific Gravity	1.046	1.047	1.05	1.056	1.057
Density, lb/gal	8.69	8.72	8.75	8.78	8.80
Viscosity ASTM D445					
cSt at 40°C	107.6	154.1	222.2	301.7	390.5
cSt at 100°C	21.1	29.3	41.0	54.3	68.8
Viscosity Index, ASTM D2270	223	232	239	247	253
Pour Point, ASTM D97, °F (°C)	-54 (-48)	-49 (-45)	-44 (-42)	-44 (-42)	-38 (-39)
Flash Point, ASTM D92, °F (°C)	550 (288)	547 (286)	554 (290)	558 (292)	558 (298)
Rust Protection, ASTM D665, A/B	Pass	Pass	Pass	Pass	Pass
4-Ball Wear, ASTM D4172, mm at 40kg	0.36	0.30	0.32	0.31	0.30

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CITGO® CITGEAR® WT 320

OVERVIEW



- A synthetic gear lubricant designed specifically for wind turbine gear lubrication. Meets industrial gear oil standard DIN 51517-3.

FEATURES & BENEFITS



- Wear protection for gear and bearing components.
- Protection against micropitting.
- High viscosity index for performance over a wide temperature range.
- Oxidation stability and protection against rust and corrosion.
- Suppression of foam and air/oil dispersion.
- Seal compatibility per DIN 51517-3 and ISO 1817 (Flender).

APPLICATIONS



- Designed for wind turbine gear lubrication.
- Can be used in industrial gear applications requiring extreme pressure (EP) protection, operating under a wide range of temperatures, and where a long-lasting fluid is desired.
- CITGO CITGEAR WT 320 meets the requirements of:
 - Hansen Gearboxes
 - FAG Schaeffler bearings in wind turbines (passed 4 step test)
 - Winergy
 - Moventas
 - David Brown
- CITGO CITGEAR WT 320 is approved for use:
 - Flender gear units by Siemens MD (Rev.15)—Approval No. ACIA31-2020114-102

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PROPERTIES



Typical Properties for CITGO CITGEAR WT 320:

ISO VISCOSITY GRADE	320
Material Code	632604001
Gravity, ASTM D4052, °API	27.3
Density, lb/gal AT 60°F	7.42
Flash Point, COC, ASTM D92, °F (°C)	210 (410)
Viscosity ASTM D445	
cSt at 40°C	328
cSt at 100°C	38.2
Viscosity Index, ASTM D2270	167
Pour Point, ASTM D97, °F (°C)	-27 (-33)
Color, ASTM D1500	L1.0
Foam Test, ASTM D892, Seq. I, II, III	0-0, 10-0, 0-0
Water Separability, @180 °F, ASTM D1401	40/40/30
Former AGMA Grade	6 EP

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CITGO® CITGEAR® XCO Oils

OVERVIEW



- Premium lubricants that provide excellent bearing and gear lubrication performance in steel industry applications such as high-speed rod mills.

FEATURES & BENEFITS



- Formulated with high-quality paraffinic base oils and additive system.
- Excellent oil/water separation to allow water removal from gear and bearing systems.
- High level of wear protection for critical machinery.
- Outstanding rust and corrosion protection in wet environments.
- Excellent oxidation stability for long service life.
- Premium anti-foam properties.
- High thermal stability minimizes formation of heat-related sludge and varnishes.

APPLICATIONS



- Recommended for use in high-speed rod mill circulation systems and other gear and bearing lubrication applications.
- Recommended for use in Danieli and Morgan (Siemens AG) high-speed rod mills.

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C 10142

PROPERTIES



Typical Properties for CITGO CITGEAR XCO Oils:

Grade	100	220	320	460
Material Code	631100001	631102001	631103001	631104001
Gravity, ASTM D4052, °API	30.3	27.3	26.7	26.2
Density, lb/gal at 60°F	7.3	7.4	7.4	7.5
Flash Point, ASTM D92, COC, °F (°C)	482 (250)	522 (272)	561 (294)	554 (290)
Viscosity ASTM D445				
cSt at 40°C	92	220	320	447
cSt at 100°C	10.7	18.6	23.8	29.7
Viscosity Index, ASTM D2270	100	94	94	95
Pour Point, ASTM D97, °F (°C)	-6 (-21)	10 (-12)	10 (-12)	10 (-12)
Color, ASTM D1500	L1.0	L4.0	L4.0	L5.0
Rust Test, ASTM D665 A & B	Pass	Pass	Pass	Pass
Water Separation, ASTM D1401 at 180°F (ml Emulsion at 30 minutes)	3.0 max.	3.0 max.	3.0 max.	3.0 max.
Foam Test, ASTM D892, Seq. I, II, III	Pass	Pass	Pass	Pass
Four Ball Wear, ASTM D4172 mm @ 20 kg	0.38	0.34	0.37	0.30

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CITGO® Pacemaker® SD Oils

OVERVIEW



- High-quality circulating lubrication oils specifically designed for steel mill applications, with superior oil/water separation characteristics, oxidation stability, and rust and corrosion protection. Available in viscosity grades 220, 320, 460, and 680.
- Exceed Siemens AG requirements for Morgoil® Advanced Bearing Lubricant 'Super Demulsibility' specification.

FEATURES & BENEFITS



- Outstanding water removal characteristics.
- Long service life in circulating systems.
- Corrosion protection and foam control.
- Excellent filterability.
- Deposit control.

APPLICATIONS



- Recommended for circulating systems requiring AGMA R&O type lubricants and operating in severe conditions, such as water contamination. These products allow rapid oil separation from water at steel mill operating temperatures, especially in Siemens AG (formerly Morgan Construction Company) steel mill roll bearings.
- Can be used as:
 - Gear oils
 - Compressor oils
 - Rust- and oxidation-inhibited (R&O) oils
 - Roll bearing lubricants (blooming, slabbing, hot and cold strip mills)
 - Morgoil® lubrication system oils
 - MESTA® system oils

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C 10053

PROPERTIES



Typical Properties for CITGO Pacemaker SD Oils:

Grade	220	320	460	680
Material Code	633044001	633045001	633047001	633050001
Gravity, ASTM D4052, °API	28.2	28.2	27.6	26.6
Density, lb/gal	7.37	7.37	7.41	7.45
Flash Point, ASTM D92, COC, °F (°C)	464 (240)	464 (240)	554 (290)	554 (290)
Viscosity ASTM D445				
cSt at 40°C	220	320	460	676
cSt at 100°C	18.7	23.7	30.3	39.3
Viscosity Index, ASTM D2270	95	96	96	96
Pour Point, ASTM D97, °F (°C)	0 (-18)	5 (-15)	5 (-15)	5 (-15)
Color, ASTM D1500	4.0	4.0	4.5	4.5
Rust Test, ASTM D665 A	Pass	Pass	Pass	Pass
Demulsibility, ASTM D2711 (ml Emulsion at 125°F)	1.0 max.	1.0 max.	1.0 max.	1.0 max.
Water Separation, ASTM D1401 at 180°F (ml Emulsion at 40 minutes)	3.0 max.	3.0 max.	3.0 max.	3.0 max.
Foam Test, ASTM D892, Seq. I, II, III	Pass	Pass	Pass	Pass
AGMA Grade	5	6	7	8

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CITGO® CITGEAR® MGW-OGL

OVERVIEW



- An asphaltic, open gear lubricant designed to protect heavily loaded open gears with a heavy, dense film that includes extreme pressure additives to ensure smooth operation, even on gears that operate under harsh conditions.
- Contains a solvent for ease in handling and application.

FEATURES & BENEFITS



- Resistance to sludge and deposit formation.
- High film strength.
- Excellent wear protection.
- Extends gear life.
- Protects against rust and corrosion.
- Water wash-off protection.
- Suitable for use in airless spray systems.
- Non-chlorinated.

APPLICATIONS



- Recommended for grinding mill gear and pinion, ball grinding mill gear and pinion, girth gears, SAG mill gears, and cement kiln open gears.
- Approved by Shanghai Heavy Industries.

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PROPERTIES



Typical Properties for CITGO CITGEAR MGW-OGL:

Material Code	631056001
Texture	Smooth
Color	Black
Flash Point, ASTM D92, °F (°C) (without diluent)	475 (246)
Flash Point, ASTM D92, °F (°C) (with diluent)	240 (116)
Viscosity ASTM D445 100°C, cSt (without diluent)	1000-2300
Viscosity ASTM D445 40°C, cSt (with diluent)	900-1600
Four Ball Weld EP, ASTM D2783, kg	500
Four Ball Wear, ASTM D4172, mm	0.33
Four Ball LWI, ASTM D2783, kgf	83
Copper Corrosion, ASTM D130	3B
Rust Prevention, ASTM D665	Pass
FZG, ASTM D5182, Load Stages Passed	>12
USS Mobility, @ 0° C, gls	1.65

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CITGO® Autokut® AS Series

Metalworking Fluids

OVERVIEW



- Transparent, highly active metal removal fluids designed for severe machining operations.
- Available in four different viscosity grades to meet the requirements of a modern engineering facility.

FEATURES & BENEFITS



- Contains active sulfur and other anti-weld components.
- High lubricity.
- Low odor.
- Free of chlorinated paraffins.
- Light color aids visibility of operation.
- Contain a stable oil mist suppressant to improve working environment and worker safety.
- Improved worker acceptability.
- Improved productivity and lower operation costs.
- Excellent surface finish at high feeds and speeds.
- Reduction in disposal costs and reduced risk of rust.



NOTE: Not recommended for yellow or non-ferrous metals

APPLICATIONS



- Designed for machining operations involving alloyed, stainless and chrome steels.
- Recommended for severe machining operations such as broaching, tapping, and cold-heading.
- Lower viscosity grades are used for higher speed, lighter duty applications and higher viscosity is used for slower speed, heavier duty operations.



Material Compatibility

	Recommended	Highly Recommended
P - Steels		
M - Stainless Steel		
K - Cast Iron		

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PROPERTIES



Typical Properties for CITGO Autokut AS Series:

Grade	AS 15	AS 32	AS 46	AS 68
Material Code	639430001	639432001	639433001	639434001
Gravity, ASTM D4052, °API	33.6	31.1	29.7	28.2
Gravity, Specific, ASTM D1298, 60/60 °F	0.857	0.870	0.878	0.886
Density, lb/gal	7.2	7.3	7.3	7.4
Flash Point, COC, ASTM D92, °F (°C)	349 (176)	363 (184)	356 (180)	356 (180)
Viscosity				
cSt at 40°C	16.6	30.7	45.5	65.4
cSt at 100°C	3.8	5.6	7.1	8.9
SUS at 100°F	89	158	245	338
SUS at 210°F	39	45	50	56
Color, ASTM D1500	1.0	1.5	1.5	1.5
Pour Point, ASTM D97, °F (°C)	-45.4 (-43)	-22 (-30)	-14.8 (-26)	-14.8 (-26)
Copper Corrosion, ASTM D130, 3 hrs at 212°F	4	4	4	4
Active Sulfur	Yes	Yes	Yes	Yes
Phosphorus	No	No	No	No
Lubricity Additive	Yes	Yes	Yes	Yes

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Metalworking Fluids

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CITGO® Autokut® IS Series

Metalworking Fluids

OVERVIEW



- Non-staining metal removal oils designed for machining both non-ferrous and ferrous metals.
- Available in two viscosity grades to meet the requirements of a modern engineering facility; the lower viscosity grade is used for lighter duty applications at higher speeds, and the higher viscosity is used for heavier duty operations at slower speeds.

FEATURES & BENEFITS



- Excellent lubricity and mild extreme pressure (EP) additives.
- Compatible with most metals.
- Chlorine-free.
- Light color aids visibility of operation and is non-staining on ferrous and non-ferrous metals.
- Contain a stable oil mist suppressant to improve working environment and worker safety.
- Improved productivity and lower operation costs.
- Benefits environmental needs and reduces disposal costs.



APPLICATIONS



- CITGO Autokut IS 15 is a low-viscosity oil, primarily recommended for machining operations on aluminum and magnesium and their alloys. Also suited for deep drilling and the honing of steel, cast iron, and alloyed copper.
- CITGO Autokut IS 46 is designed for more severe duty applications and contains a high level of non-staining EP agent to permit its use over a wide variety of materials and over a wide range of cutting depths, feeds and speeds. Can also be used in turning, sawing, milling, and drilling of non-ferrous metals, some plain carbon steels, and free-machining steel alloys.



Material Compatibility

	Recommended	Highly Recommended
P - Steels		
M - Stainless Steel		
K - Cast Iron		
N - Non-ferrous		

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PROPERTIES



Typical Properties for CITGO Autokut IS Series:

Grade	IS 15	IS 46
Material Code	639440001	639443001
Gravity, ASTM D4052, °API	31.9	31.1
Gravity, Specific, ASTM D1298, 60/60°F	0.866	0.870
Density, lb/gal	7.1	7.3
Flash Point, COC, ASTM D92, °F (°C)	361 (183)	428 (220)
Viscosity ASTM D445		
cSt at 40°C	18	45
cSt at 100°C	3.9	6.9
SUS at 100°F	95	230
SUS at 210°F	39	49
Color, ASTM D1500	0.5	0.5
Pour Point, ASTM D97, °F (°C)	-44 (-42)	-6 (-21)
Copper Corrosion, ASTM D130, 3 hrs at 212°F	1B	1B
Active Sulfur	No	No
Phosphorus	No	No
Lubricity Additive	Yes	Yes

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CITGO® Autokut® Tri-Purpose

OVERVIEW

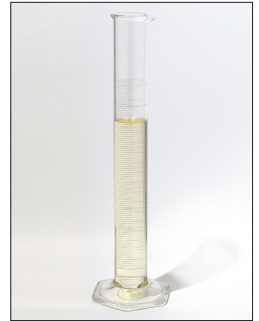


- A transparent, non-corrosive, multi-purpose cutting oil.
- Equally effective for use as a cutting oil and as a lubricant in screw machines and other automatic type machine tools.

FEATURES & BENEFITS



- Tri-functional; can be used as a gear lubricant, cutting oil, and hydraulic fluid.
- Tri-functionality reduces costs by consolidating inventory and minimizing cross-contamination risks.
- Contains a stable oil mist suppressant to improve working environment and worker safety.
- Contains advanced lubrication and anti-weld components.
- Compatible with most metals.
- Chlorine-free.
- Light color aids visibility of operation and is non-staining on ferrous and non-ferrous metals.
- Premium rust and oxidation protection.
- Improves productivity and lowers costs of operation, with improved tool life and surface finish.
- Benefits environmental needs and reduces disposal costs.
- Versatility in gear and hydraulic applications.



APPLICATIONS



- Recommended as a cutting oil, hydraulic fluid and a gear lubricant.
- Designed for automatic screw machines.
- Recommended for machining non-ferrous metals and ferrous alloys having machinability rating of approximately 50% or higher.
- Can be used in automatic screw machines and in similar equipment for: drilling, counter-boring, turning, shaving, reaming, tapping, forming, and stamping.

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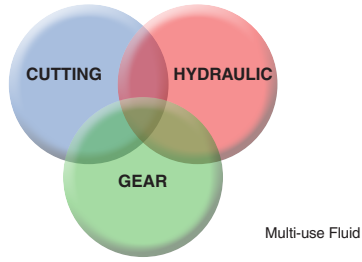
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APPLICATIONS



Material Compatibility

	Recommended	Highly Recommended
P - Steels	Recommended	
M - Stainless Steel	Recommended	
K - Cast Iron	Recommended	
N - Non-ferrous	Recommended	



Metalworking Fluids

PROPERTIES



Typical Properties for CITGO Autokut Tri-Purpose:

Material Code	639450001
Gravity, ASTM D4052, °API	32.5
Gravity, Specific, ASTM D1298, 60°F	0.863
Density, lb/gal	7.2
Flash Point, ASTM D92, °F (°C)	406 (208)
Viscosity ASTM D445	
cSt at 40°C	29.8
cSt at 100°C	5.3
Viscosity ASTM D2161	
SUS at 100°F	154
SUS at 210°F	44
Color, ASTM D1500	2.5
Pour Point, ASTM D97, °F (°C)	-38 (-39)
Copper Corrosion, ASTM D130, 3 hrs at 210°F	1B
Active Sulfur	No
Phosphorus	No
Lubricity Additive	Yes

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CITGO® Trukut® GP 205

OVERVIEW

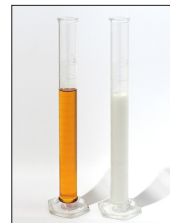


- A conventional, general purpose cutting fluid designed to be readily mixed with water to form a stable emulsion.
- Designed for a variety of machining operations and suitable for use on ferrous and non-ferrous metals.

FEATURES & BENEFITS



- Forms stable emulsions in various water qualities.
- Multi-metal and general purpose applications.
- Free of chlorinated paraffins.
- Excellent corrosion prevention and residual corrosion properties reduce the need for in-process corrosion protection fluids.
- Reliable product performance keeps machinery clean.
- Wide application range reduces the need for several products.
- Increases the time between in-process operations and protects the machine tool parts from rust.
- Reduces disposal costs.



APPLICATIONS

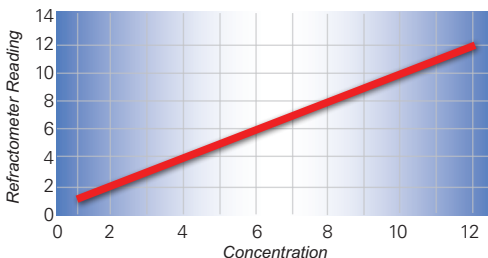


- Recommended for milling, turning, drilling, grinding, and other metalworking operations on ferrous and non-ferrous metals where efficiency of an emulsifiable oil is preferred.
- Preferred for grinding operations.

Material Compatibility

	Recommended	Highly Recommended
P - Steels	[Color gradient from blue to yellow]	
M - Stainless Steel	[Color gradient from yellow to green]	
K - Cast Iron	[Color gradient from red to green]	
N - Non-ferrous	[Color gradient from green to light green]	

Refractometer Chart



Refractometer Reading at 10% = 10.0 °Brix
 Refractometer Factor = 1.0

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Manufactured in USA

C 10184

PROPERTIES



Typical Properties for CITGO Trukut GP 205:

Material Code	639468001
Gravity, Specific, ASTM D1298, 60/60°F	0.90
Density, lb/gal	7.66
Flash Point, COC, ASTM D92, °F (°C)	320 (160)
Viscosity, cSt at 40°C	30.28
Color, ASTM D1500	L3.0
Pour Point, ASTM D97, °F (°C)	32 (0)
pH at 5% in Deionized	8.1
Copper Corrosion, ASTM D130, 3 hrs at 212°F	1B
Emulsion Stability, 24 hrs at 77°F	
Deionized Water	Pass
Hard Water	Pass
Solution Stability, 24 hrs at 30°F	Pass
Appearance	Hazy

METAL MACHINABILITY GROUPS[®]

Machining Operation	1 Non-Ferrous, Soft Metals ⁽²⁾	2 Nickel Alloys, Niralloy Steels, Cast Irons and Alloy Steels (up to 200 Brinell)	3 Stainless Steels, “Monel” Met- als, Cast Irons and Alloy Steels (200 to 300 Brinell)	4 Titanium Alloys, High Tensile Nickel Alloys, Austentic Stainless Steels, Tool Steel and High Tensile Alloy Steels (300 to 400 Brinell)
Turning, Boring, Milling, Forming, Drilling, Sawing	5-7%	5-7%	7-9%	7-9%
Tapping, Thread Rolling, Reaming, Screw Cutting, Broaching	5-7%	5-7%	8-10%	8-10%
Gear Shaping, Form and Thread Milling, Shaving, Hobbing, and Trepanning	5-7%	5-7%	8-10%	8-10%
Internal and External Grinding, Form and Thread Grinding	5-7%	5-7%	5-7%	5-7%
Stamping	10%	10%	20%	20%

Note: Dilution ratios shown are approximate and may require higher or lower water concentrations depending on a number of factors including the type of metal cut, machine speed, the severity of the operation, metal hardness, etc.

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CITGO® Trukut® HD 220

Metalworking Fluids

OVERVIEW

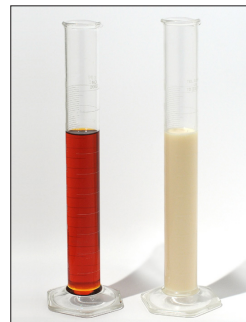


- A heavy-duty cutting and grinding fluid designed to be diluted with water to form an emulsion.
- For use on ferrous and non-ferrous metals.

FEATURES & BENEFITS



- Contains robust technology for boundary lubrication and lubricity.
- Affords efficient cooling.
- Helps prevent bacterial growth.
- Forms stable emulsions in various water qualities.
- Low-staining with multi-metal and application compatibility.
- Free of chlorinated paraffins.
- Excellent corrosion prevention properties.
- Improves tool life and surface finish.
- Increases productivity and reduces disposal costs.
- Extends odor-free sump life.
- Predictable machining performance.
- Wide application range reduces the need for several products.
- Reduces the need for in-process corrosion protection fluids.



Concentrate Diluted with Water

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APPLICATIONS

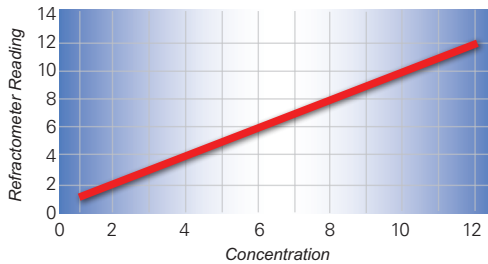


- Recommended for CNC machining where a single cutting fluid may be needed to function in a wide variety of operations and metallurgies.
- Performs well in multiple cutting operations including turning, boring, drilling, grinding, and threading.

Material Compatibility

	Recommended	Highly Recommended
P - Steels	[Color gradient from blue to yellow]	
M - Stainless Steel	[Color gradient from yellow to green]	
K - Cast Iron	[Color gradient from red to green]	
N - Non-ferrous	[Color gradient from green to light green]	

Refractometer Chart



Refractometer Reading at 10% = 10.0 °Brix
 Refractometer Factor = 1.0

Metalworking Fluids

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PROPERTIES



Typical Properties for CITGO Trukut HD 220:

Material Code	639469001
Gravity, Specific, ASTM D1298, 60/60°F	0.94
Density, lb/gal	7.83
Flash Point, COC, ASTM D92, °F (°C)	311 (155)
Viscosity, cSt at 40°C	111
Color, ASTM D1500	L5.0
Pour Point, ASTM D97, °F (°C)	32 (0)
pH at 5% in Deionized	9.0
Corrosion (modified Iron Chip Rust test)	Pass
Copper Corrosion, ASTM D130, 3 hrs at 212°F	1B
Emulsion Stability, 24 hrs at 77°F	
Deionized Water	Pass
Hard Water	Pass
Solution Stability, 24 hrs at 30°F	Pass
Appearance	Amber

METAL MACHINABILITY GROUPS[®]

Machining Operation	1 Non-Ferrous, Soft Metals ⁽²⁾	2 Nickel Alloys, Nitalloy Steels, Cast Irons and Alloy Steels (up to 200 Brinell)	3 Stainless Steels, “Monel” Met- als, Cast Irons and Alloy Steels (200 to 300 Brinell)	4 Titanium Alloys, High Tensile Nickel Alloys, Austentic Stainless Steels, Tool Steel and High Tensile Alloy Steels (300 to 400 Brinell)
Turning, Boring, Milling, Forming, Drilling, Sawing	5-7%	5-7%	7-9%	7-9%
Tapping, Thread Rolling, Reaming, Screw Cutting, Broaching	5-7%	5-7%	8-10%	8-10%
Gear Shaping, Form and Thread Milling, Shaving, Hobbing, and Trepanning	5-7%	5-7%	8-10%	8-10%
Internal and External Grinding, Form and Thread Grinding	5-7%	5-7%	5-7%	5-7%
Stamping	10%	10%	20%	20%

Note: Dilution ratios shown are approximate and may require higher or lower water concentrations depending on a number of factors including the type of metal cut, machine speed, the severity of the operation, metal hardness, etc.

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CITGO® CITCOOL® SS-HD

Metalworking Fluids

OVERVIEW

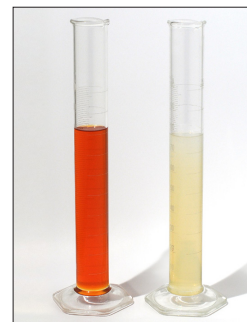


- CITGO CITCOOL SS-HD is a water extendable semi-synthetic coolant recommended for heavy-duty applications. The product is suitable for job shops where one coolant is needed to machine a variety of metals in multiple operations.

FEATURES & BENEFITS



- Forms stable emulsions in various water hardness up to 1000ppm
- Low foaming tendencies
- Medium oil content
- Free of chlorine, secondary amines, phenols, nitrates, PCB's, and heavy metals
- Product performance is constant and machine remains clean
- Reliable in-service performance and long sump life
- Heavy-duty machining capability
- Ease of disposal and friendly work environments



Concentrate Diluted
with Water

APPLICATIONS



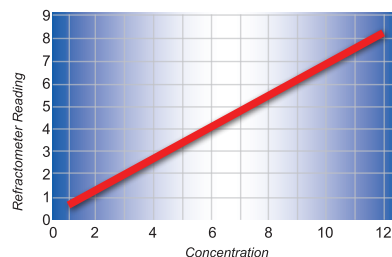
- CITGO CITCOOL SS-HD is recommended for general machining including thread cutting and forming, deep hole drilling and boring, reaming, and grinding of cast irons, ferrous alloys and stainless steels, free cutting aluminum alloys, oil resistant plastics, and other non-ferrous materials.

Material Compatibility

	Recommended	Highly Recommended
P - Steels	[Color gradient from blue to yellow]	
M - Stainless Steel	[Color gradient from yellow to orange]	
K - Cast Iron	[Color gradient from orange to red]	
N - Non-ferrous *	[Color gradient from red to green]	

*Might stain some sensitive aluminum alloys. e.g. 2000 and 7000 series

Refractometer Chart



Refractometer Reading at 10% = 6.8 °Brix
Refractometer Factor = 1.47

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PROPERTIES



Typical Properties for CITGO CITCOOL SS-HD:

Material Code	639335001
Appearance, Concentrate (neat)	Amber Fluid
Dilution (5% in DI water)	Semi-Translucent
Gravity, Specific, ASTM D1298, 60/60°F	1.02
Mineral Oil Content %	20
pH at 3% concentration	9.5 (5%)
Defoaming mL (5% in 50 ppm water)	Nil (60 sec.)

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METAL MACHINABILITY GROUPS⁽¹⁾

	1 Non-Ferrous, Soft Metals ⁽²⁾	2 Nickel Alloys, Niralloy Steels, Cast Irons and Alloy Steels (up to 200 Brinell)	3 Stainless Steels, "Monel" Metals, Cast Irons and Alloy Steels (200 to 300 Brinell)	4 Titanium Alloys, High Tensile Nickel Alloys, Austenitic Stainless Steels, Tool Steel and High Tensile Alloy Steels (300 to 400 Brinell)
Machining Operation				
Turning, Boring, Milling, Forming, Drilling, Sawing	5-7%	5-7%	8-10%	8-10%
Tapping, Thread Rolling, Reaming, Screw Cutting, Broaching	5-7%	5-7%	8-10%	8-10%
Gear Shaping, Form and Thread Milling, Shaving, Hobbing, and Trepanning	5-7%	5-7%	8-10%	8-10%
Internal and External Grinding, Form and Thread Grinding	5-7%	5-7%	5-7%	5-7%
Stamping	5-20%	5-20%	5-20%	5-20%

Notes: (1) Dilution ratios shown are approximate and may require higher or lower water concentrations depending on a number of factors including the type of metal cut, machine speed, the severity of the operation, metal hardness, etc.
(2) CITCOOL SS-HD might stain sensitive aluminum alloys such as 2000 and 7000 series alloys.

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CITGO® CITCOOL® 33

OVERVIEW

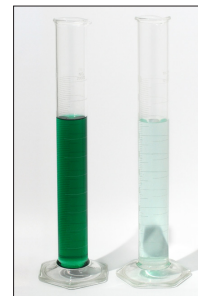


- A heavy duty synthetic coolant designed to be diluted in water to the proper concentrations to afford excellent operations in high-performance machining.

FEATURES & BENEFITS



- Balanced lubricity and boundary lubrication components.
- Readily soluble in water, with a distinct, transparent green appearance.
- Fully synthetic and oil-free.
- Contains effective bactericide and fungicide to inhibit growth in service.
- Tramp oils are readily removed, eliminating a source for bacteria and fungus to grow, resulting in no rancid odors and extending sump life.
- Improves tool life and surface finish with enhanced extreme pressure and wear protection.
- Easy mixing and clean up.
- Improved solution stability, even in hard water.
- No gummy residues.
- Eliminates oil mists in the workplace.
- Good workpiece visibility.
- Superior heat transfer to improve tool life and part tolerances.



Concentrate Diluted with Water

Metaworking Fluids

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APPLICATIONS

- Designed for use in machining titanium, ferrous metals, their alloys, and stainless steel.

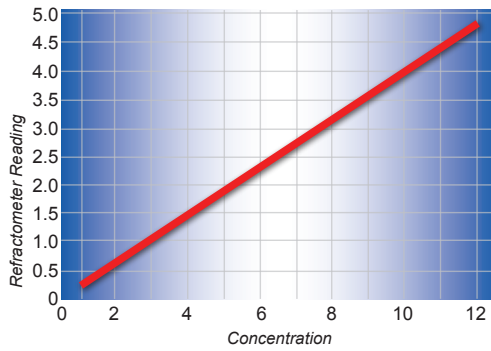


Material Compatibility

	Recommended	Highly Recommended
P - Steels	[Solid Blue]	
M - Stainless Steel	[Solid Yellow]	

*Not recommended for aluminum, magnesium and their alloys due to possible staining.

Refractometer Chart



Refractometer Reading at 10% = 3.9 °Brix
 Refractometer Factor = 2.56

Metalworking Fluids

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PROPERTIES



Typical Properties for CITGO CITCOOL 33:

Material Code	639333001
Appearance, Concentrate (neat)	Clear, Green
Dilution (5% in DI water)	Clear, Green ⁽¹⁾
Gravity, Specific, ASTM D1298, 60/60°F	1.07
Density, lb/gal	8.9
Viscosity ASTM D445, cSt at 40°C	3.7
ASTM D2161, SUS at 100°F	17
pH, Concentrate	9.5
Falex Load, 5% in tap water, ASTM D3233, lbs	4500
Rust Test, 3% in tap water, ASTM D4627	Pass
Solution Stability (5%), 24 hrs. at 30°F	No Separation
Copper Corrosion (5%), 3 hrs. at 122°F, ASTM D130	1B
Foam Test, ASTM D892	
Seq. I	90-0
Seq. II	10-0
Seq. III	20-0

Note: 1) Dilute solutions can be hazy if tap water is used depending upon water hardness.

STORAGE, HANDLING AND SPECIAL CONSIDERATIONS: Preferred storage is indoors away from sun and heat. Do not allow to freeze. Under long term storage, product may discolor.

METAL MACHINABILITY GROUPS⁽¹⁾

Machining Operation	1 Non-Ferrous, Soft Metals ⁽²⁾	2 Nickel Alloys, Nitalloy Steels, Cast Irons and Alloy Steels (up to 200 Brinell)	3 Stainless Steels, "Monel" Met- als, Cast Irons and Alloy Steels (200 to 300 Brinell)	4 Titanium Alloys, High Tensile Nickel Alloys, Austentic Stainless Steels, Tool Steel and High Tensile Alloy Steels (300 to 400 Brinell)
Turning, Boring, Milling, Forming, Drilling, Sawing	5-7%	5-7%	7-9%	7-9%
Tapping, Thread Rolling, Reaming, Screw Cutting, Broaching	5-7%	5-7%	8-10%	8-10%
Gear Shaping, Form and Thread Milling, Shaving, Hobbing, and Trepanning	5-7%	5-7%	8-10%	8-10%
Internal and External Grinding, Form and Thread Grinding	5-7%	5-7%	5-7%	5-7%
Stamping	10%	10%	20%	20%

Notes: (1) Dilution ratios shown are approximate and may require higher or lower water concentrations depending on a number of factors including the type of metal cut, machine speed, the severity of the operation, metal hardness, etc.

(2) CITCOOL 33 is not recommended for machining aluminum alloys or magnesium (due to possible staining).

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Metalworking Fluids

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CITGO® Rust-O-Lene® LT

Metalworking Fluids

OVERVIEW

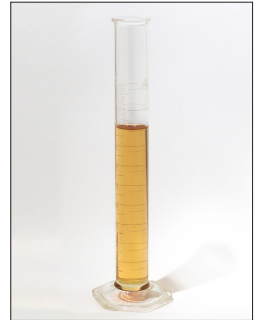


- CITGO Rust-O-Lene LT is a rust preventative oil formulated with effective rust inhibitors and high quality base oils. It exhibits excellent metal wetting and water displacement properties and is designed for temporary protection of metal parts during manufacturing and storage. CITGO Rust-O-Lene LT can also be used as a hydraulic and circulating oil where added rust protection is required.

FEATURES & BENEFITS



- May be applied by dipping, spraying or brushing
- Excellent water displacement properties
- Excellent metal wetting
- Multi-purpose fluid
- Effective application on any part configuration
- Protects parts after machining with aqueous cutting fluids
- Provides a high degree of prevention of fingerprint or perspiration acid corrosion
- Can be used as an hydraulic and circulating oil where robust corrosion protection is needed



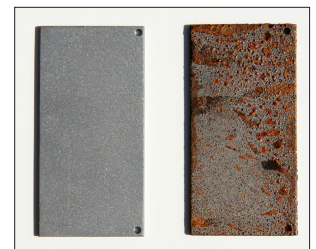
APPLICATIONS



- CITGO Rust-O-Lene LT is used for rust protection of semi-finished or finished metal parts and assemblies that require longer term protection while stored indoors.
- It can be used by hydraulic and circulating systems for industrial equipment requiring better protection from rust.

Material Compatibility

	Recommended	Highly Recommended
P - Steels	Recommended	
M - Stainless Steel	Recommended	
K - Cast Iron	Recommended	
N - Non-ferrous	Recommended	



Protected Metal

Unprotected Metal

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PROPERTIES



Typical Properties for CITGO Rust-O-Lene LT:

Material Code	639460001
Gravity, ASTM D237, °API	30
Solvent Present	No
Flash Point ASTM D92, °F (°C)	385 (196)
Viscosity ASTM D445, cSt at 40°C	52
ASTM D2161, SUS at 100°F	241
Rust Protection, Humidity Cabinet (hours)	1300

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CITGO® Rust-O-Lene® ST

Metalworking Fluids

OVERVIEW



- A rust-preventive oil formulated with highly effective rust inhibitors, a high-flash solvent and high-quality base oils.
- Provides a protective film after solvent evaporation and is designed for short-term protection of metal parts during manufacturing and storage indoors.

FEATURES & BENEFITS



- May be applied by dipping, spraying, or brushing
- Excellent water displacement properties.
- Excellent metal wetting.
- Contains high-quality base oil and a high flash point solvent carrier.
- Effective application on any part configuration.
- Protects parts after machining with aqueous cutting fluids.
- Highly effective for prevention of acid corrosion by fingerprints and perspiration.
- Forms a protective film after solvent evaporation.



APPLICATIONS



- Recommended for rust protection of semi-finished or finished metal parts and assemblies where protection is required either temporarily or in transit.

Material Compatibility

	Recommended	Highly Recommended
P - Steels	[Color gradient from blue to yellow]	
M - Stainless Steel	[Color gradient from yellow to green]	
K - Cast Iron	[Color gradient from red to green]	
N - Non-ferrous	[Color gradient from green to light green]	



Protected Metal

Unprotected Metal

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PROPERTIES



Typical Properties for CITGO Rust-O-Lene ST:

Material Code	639461001
Gravity, ASTM D4052, °API	41.6
Solvent Present	Yes
Flash Point, COC, ASTM D92, °F (°C)	160 (72)
Viscosity, ASTM D445, cSt at 40°C	3
ASTM D2161, SUS at 100°F	36
Rust Protection, Humidity Cabinet (hours)	1300

NOTE: CITGO Rust-O-Lene ST cannot be sold in the California South Coast Air Quality Management District (SCAQMD) due to the VOC level from the solvent.

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CITGO® AR Slushing Oil

Metalworking Fluids

OVERVIEW



- A light-colored, low-viscosity rust preventative coating oil.

FEATURES & BENEFITS



- Utilizes a highly effective metal protection system to provide excellent rust protection for stored steel.
- Light viscosity promotes complete surface coverage and quick drainage of excess oil.
- Low pour point facilitates cold weather storage and handling.

APPLICATIONS



- Recommended for prevention of rust on steel stored for intermediate periods under cover.

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PROPERTIES



Typical Properties for CITGO AR Slushing Oil:

Material Code	639760001
Gravity, °API ASTM D4052	32.3
Density, lb/gal	7.19
Flash Point ASTM D93, PM	360
Flash Point ASTM D92, COC	392
Fire Point ASTM D92, COC	437
Viscosity ASTM D445	
cSt at 40°C	18
cSt at 100°C	3.8
Viscosity ASTM D2161	
SUS at 100°F	95
SUS at 210°F	39
Viscosity Index ASTM D2270	98
Carbon Residue ASTM D189, WT%	0.04
Color, ASTM D1500	0.5
Pour Point ASTM D97, °F	-35
Copper Corrosion ASTM D130	1A
Rust Test ASTM D665B, Salt Water	Pass
Humidity Cabinet Test ASTM D1748, hrs.	900+

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CITGO® Quenchol®

Metalworking Fluids

OVERVIEW



- Highly stable quench oils designed especially for use in steel heat treating operations.
- Formulated with premium high viscosity index base oils and additives to provide outstanding service life and performance.

FEATURES & BENEFITS



- Excellent thermal stability and oxidation resistance.
- Premium wetting ability and cooling capability.
- Uniform heat dissipation for quality hardened steel production.
- Less viscosity change during the quenching operation, as compared to low viscosity index oils.

APPLICATIONS



- Recommended for superior service in steel quenching operations requiring a premium mineral quench oil.

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C 10058

PROPERTIES



Typical Properties for CITGO Quenchol:

	Quenchol 521	Quenchol 624
Material Code	639465001	639466001
Gravity, ASTM D4052, °API	33	31
Density, lb/gal at 60°F	7.2	7.3
Flash Point, ASTM D92, °F (°C), Min.	354 (179)	410 (210)
Viscosity ASTM D445		
cSt at 40°C	21	52.0
cSt at 100°C	4.2	7.4
Viscosity Index, ASTM D2270	104	104
Pour Point, ASTM D97, °F (°C)	16 (-9)	16 (-9)
Color, ASTM D1500	D8.0	D8.0
Quenching Time (Quenchemeter), ASTM D3520, Sec.(1)	16.1	17.0
Quenchalyzer, ASTM D6200:		
Max. Cooling Rate, °C/sec	95.79	83.74
Temp. at Max. Cooling Rate, °C	638.64	651.30
Cooling Rate at 300 °C, °C/sec	5.99	5.09
Time to reach 600 °C, sec	7.500	8.250
Time to reach 400 °C, sec	11.875	14.500
Time to reach 200 °C, sec	46.625	53.000

Note:

(1) Test method ASTM D3520 is no longer available. Values shown are for historic reference only.

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CITGO® SlideRite® Oils

Metalworking Fluids

OVERVIEW



- Industrial oils designed to prevent stick-slip problems on heavily loaded slideways of machine tools.

FEATURES & BENEFITS



- Contain special non-corrosive additives to protect against the occurrence of stick-slip.
- Impart good metal-wetting, adhesiveness, and extreme pressure (EP) characteristics to eliminate chatter and scoring in the operation of machine tool ways.
- Designed to minimize formation of emulsions that make it difficult to maintain clean and effective coolants.
- Especially recommended for use in applications where synthetic coolants or soluble oil emulsions are used.
- Light-colored to provide good visibility of slideways.
- Very mild odor.
- The ISO VG 32, 68, and 220 grades have been formulated to meet requirements of the Fives Group (formerly Cincinnati Machine) specifications covering machine tool way lubricants.

Grade

CITGO SlideRite® 32
 CITGO SlideRite® 68
 CITGO SlideRite® 220

Fives Cincinnati Specification

P-53*
 P-47
 P-50

***NOTE:** Fives Group Specification P-53 is a combination hydraulic and way oil specification.

APPLICATIONS



- CITGO SlideRite 32 is suitable for use in central systems for lubricating hydraulic pump units and slideways, and can be used where a premium grade light viscosity oil is needed.
- CITGO SlideRite 68 is suitable for use as a slideway lubricant where a heavy-medium viscosity oil is specified.
- CITGO SlideRite 220, CITGO SlideRite 320, and CITGO SlideRite 460 are suitable for use as slideway lubricants where a heavy viscosity oil is specified.

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C 10090

PROPERTIES



Typical Properties for CITGO SlideRite Oils:

Grade	32	68	220	320	460
Material Code	637203001	637210001	637220001	637320001	637460001
Gravity, ASTM D4052, °API	31.5	29.5	29.8	26.9	24.48
Density, lb/gal at 60°F	7.228	7.32	7.305	7.43	7.56
Flash Point, COC, ASTM D92, °F (°C)	392 (200)	428 (220)	455 (235)	482 (250)	455 (235)
Viscosity ASTM D445					
cSt at 40°C	32.9	69.9	220	320	460
cSt at 100°C	5.9	9.1	19.6	25.9	39
Viscosity ASTM D2161					
SUS at 100°F	169	357	1163	1482	2341
SUS at 210°F	46	57	99.2	124.1	146
Viscosity Index, ASTM D2270	123	105	100	100	124
Pour Point, ASTM D97, °F (°C)	-27 (-33)	-17 (-27)	10 (-12)	10 (-12)	10 (-12)
Color, ASTM D1500	L1.5	L2.5	L2.5	L3.5	L2.5
Texture	Tacky	Tacky	Tacky	Tacky	Tacky
ISO VG No.	32	68	220	320	460
Fives Group Specification	P-53	P-47	P-50	—	—

Note: (1) Ratio of the coefficients of kinetic friction to static friction.

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Metalworking Fluids

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CITGO® Tul-Kut® Oil Base Cutting Oil Concentrate

Metalworking Fluids

OVERVIEW



- A special additive concentrate designed for fortifying cutting oils in the field.
- Non-chlorinated formulation minimizes hazards to the environment.

FEATURES & BENEFITS



- Non-staining to yellow metals (copper and copper-containing alloys).
- Non-corrosive.
- Good solubility in mineral oil base fluids.
- Highly concentrated level of performance additive.
- Long history of proven performance.
- Non-chlorinated.

APPLICATIONS



- Recommended to reformat cutting oils.
- Generally, 3 to 5 percent of concentrate is sufficient. Higher concentrations can be used for extremely difficult machining operations.
- Can be diluted with kerosene or low-viscosity oils to compound products when customers prefer to do their own blending for honing and lapping.

PROPERTIES



Typical Properties for CITGO Tul-Kut Oil Base:

Material Code	639565001
Gravity, ASTM D4052, °API	12.0
Gravity, Specific, 60/60°F, ASTM D1298	0.986
Density, lb/gal at 60°F	8.21
Flash Point, ASTM D92, °F (°C)	400 (204)
Viscosity ASTM D445	
cSt at 40°C	370
cSt at 100°C	40
Color, ASTM D1500	D8 (Dark)
Pour Point, ASTM D97 equivalent, °F (°C)	60 (16)
Sulfur, ASTM D2622, w%	10.5
Copper Corrosion, ASTM D130 (3 hrs. at 212°F, 10% in 100 SUS at 100°F base oil)	2

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C 10181



CITGO® Pacemaker® Gas Engine Oil 15SL

OVERVIEW



- A long-life, low ash stationary natural gas engine oil formulated with synthetic base stocks and an advanced additive system.
- Provides lubrication in engines that have been converted to natural gas fuel, such as those in liquid propane (LP) and agricultural irrigation pump service.
- Excellent oxidation and nitration resistance helps avoid sludge and oil thickening, which can plug oil filters and cause excessive foaming.

FEATURES & BENEFITS



- Dramatically extended oil service life, compared with conventional engine oils.
- High shear stability.
- Special additives designed to minimize slider follower wear.
- Deposit control and wear protection of pistons, rings and liners.
- Effective oxidation and nitration control.

APPLICATIONS



- Recommended for use in stationary engines converted to natural gas, such as irrigation pump service and LP applications.
- Consult equipment manufacturer for proper lubricant selection.

PROPERTIES



Typical Properties for CITGO Pacemaker Gas Engine Oil 15SL:

SAE Grade	15W-40
Commodity Code	632056
Gravity, °API, ASTM D287	32.9
Pounds per Gallon	7.17
Flash Point, COC, °F (°C)	489 (254)
Viscosity ASTM D445	
cSt at 40°C	107
cSt at 100°C	15.1
Viscosity Index, ASTM D2270	147
Pour Point, °F (°C), ASTM D97	-49 (-45)
Color, ASTM D1500	L3.0
Sulfated Ash, m%, ASTM D874	0.45
Total Base Number, ASTM D2896	5.0
Zinc, ppm	900

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Industrial Gas Engine Oils

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C 10235

CITGO® Pacemaker® Gas Engine Oil 700 Series



OVERVIEW



- Medium ash oils formulated from high viscosity index base stocks and select additives to provide excellent wear protection and deposit control in high speed, severe-service engines.
- Contains zinc for a high level of antiwear performance. Additional antioxidant provides improved oxidation and nitration stability and resistance to thermal breakdown, needed for long service life.

FEATURES & BENEFITS



- Provide excellent valve face and seat lubrication.
- Improved engine cleanliness and sludge control performance in heavy-duty, high-temperature, and continuous operation.
- Improved resistance to oxidation and nitration.
- Better wear protection, especially in the valve train, and better protection from ring and valve sticking.
- Higher TBN offers longer oil life through greater protection against acid increase and corrosive wear.

APPLICATIONS



- Recommended for naturally-aspirated to turbocharged, medium- and high-speed, high-output four-cycle engines in field gathering service.
- Recommended for engines in cogeneration service, digester gas-fueled, dual-fueled (i.e. diesel/natural gas), and diesel-fueled service.
- For use in lean/clean burn engines; NOT recommended for engines equipped with catalytic converters.
- Can also be used to lubricate the compressor cylinders in natural gas service.

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C 10066

PROPERTIES



Typical Properties for CITGO Pacemaker Gas Engine Oil 700 Series:

Product Name	715	740
SAE Grade	15W-40	40
Material Code	632033001	632034001
Gravity, ASTM D4052, °API	30.1	30.1
Pounds Per Gallon	7.29	7.29
Flash Point, COC, ASTM D92, °F (°C), Min.	460 (238)	453 (234)
Viscosity ASTM D445		
cSt at 40°C	99.6	129.3
cSt at 100°C	13.9	13.7
Viscosity Index, ASTM D2270	141	102
Pour Point, ASTM D97, °F (°C)	-27 (-33)	5 (-15)
Color, ASTM D1500	L6.5	L6.5
Carbon Residue, % (base stock)	0.16	0.16
Sulfated Ash, ASTM D874, m%	0.90	0.90
Total Acid No., ASTM D664	1.79	1.65
Total Base No., ASTM D2896	6.5	6.5
Phosphorus, m%	0.06	0.06
Oxidation Inhibitor	Yes	Yes
Corrosion Inhibitor	Yes	Yes
Detergent-Dispersant	Yes	Yes
Metal Deactivator	Yes	Yes
Antiwear	Yes	Yes

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CITGO® Pacemaker® Gas Engine Oil 1000 Series



OVERVIEW



- Premium quality, ashless stationary natural gas engine oils fortified with a latest-generation dispersant additive package in combination with corrosion, oxidation, and foam inhibitors, and a premium antiwear additive package.
- 1000 Series has a history of outstanding performance in gas processing, gas transmission, and other applications calling for a high-quality, ashless natural gas engine oil.
- Available in a single viscosity grade at the midpoint between SAE 30 and SAE 40 grades, SAE 40, and SAE 15W-40

FEATURES & BENEFITS



- Use of high viscosity index base stocks with low carbon residue minimizes carbon and varnish formation and maximizes oil oxidation life.
- Contain no bright stock.
- Provide superior protection against ring belt and port deposits in 2-cycle engines.
- Ashless formulation provides maximum protection against spark plug fouling.
- Ashless dispersant system provides excellent cleaning action to keep piston rings free in their grooves, extending overhaul periods and engine life.
- Excellent resistance to oil nitration and oxidation.
- Promote lower oil consumption, fewer deposits, and reduced maintenance costs.
- Provide superior corrosion protection to vital engine and compressor components.

APPLICATIONS



- Recommended for naturally aspirated and turbocharged 2-cycle stationary natural gas engines.
- CITGO Pacemaker Gas Engine Oil 1035 and 1040 are specially formulated to provide enhanced low temperature properties. Excellent performance where low temperature fluidity is needed but a monograde viscosity is preferred.
- Recommended for use in two-stroke engines such as Ajax, Clark, Dresser-Rand, Cooper-Bessemer, Worthington, and Fairbanks-Morse, as well as other gas engine manufacturers requiring ashless engine oils.
- Can be used in compressor cylinder lubrication.
- Consult equipment manufacturer for proper lubricant selection.

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PROPERTIES



Typical Properties for CITGO Pacemaker Gas Engine Oil 1000 Series:

Product Name	1015	1035	1040
SAE Grade	15W-40	30/40	40
Material Code	632210001	632032001	632057001
Gravity, ASTM D4052, °API	31.6	30.8	30.8
Pounds Per Gallon	7.23	7.26	7.26
Flash Point, COC, ASTM D92, °F (°C), Min.	457 (236)	460 (238)	522 (272)
Viscosity ASTM D445			
cSt at 40°C	106	113	113
cSt at 100°C	13.9	12.9	13.5
Viscosity Index, ASTM D2270	129	107	108
Pour Point, ASTM D97, °F (°C)	-38 (-39)	-27 (-33)	-27(-33)
Color, ASTM D1500	L1.0	L1.0	L1.0
Total Acid No., ASTM D664, mg KOH/g	0.5	0.5	0.5
Total Base No., ASTM D2896, mg KOH/g	1.0	1.0	1.0
Oxidation Inhibitor	Yes	Yes	Yes
Corrosion Inhibitor	Yes	Yes	Yes
Dispersant	Yes	Yes	Yes
Antiscuff/Antiwear	Yes	Yes	Yes

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CITGO® Pacemaker® Gas Engine Oil 1400 Series



OVERVIEW



- Low ash/low phosphorus stationary natural gas engine oils formulated to provide maximum resistance to oxidation, corrosion, and foaming, and excellent antiwear performance.
- New generation oil delivers a superior level of cleanliness with excellent wear protection and a low ash formula that complies with manufacturers' warranties and non-selective catalytic converter requirements.

FEATURES & BENEFITS



- Premium high viscosity index base stocks with low carbon residue to minimize carbon and varnish formation and maximize oil oxidation life.
- Contain no bright stock.
- Promote reduced spark plug deposits.
- Contain special detergent-dispersant additive package for excellent cleaning action to keep piston rings free in their grooves, thereby extending engine overhaul periods and engine life.
- Offer excellent resistance to oxidation and nitration.
- Contain low phosphorous level; suitable for use with catalytic converter systems.
- Provide lower oil consumption and reduced maintenance costs.
- Provide excellent protection against corrosion of vital engine and compressor components.

APPLICATIONS



- Recommended primarily for use in the lubrication of spark-ignited, 4-cycle stationary natural gas engines and compressor cylinders.
- Recommended for high- and medium-speed naturally aspirated and turbo charged 4-cycle stationary natural gas engines such as those manufactured by Caterpillar and Waukesha.
- Low ash/low phosphorous formulation is suitable for use with catalytic converter systems.
- Consult equipment manufacturer for proper lubricant selection.

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PROPERTIES



Typical Properties for CITGO Pacemaker Gas Engine Oil 1400 Series:

Product Name	1415	1430	1440
SAE Grade	15W-40	30	40
Material Code	632042001	632043001	632040001
Gravity, ASTM D4052, °API	31.2	30.7	30.5
Pounds Per Gallon	7.25	7.27	7.28
Flash Point COC, ASTM D92 °F (°C)	453 (234)	475 (246)	527 (275)
Viscosity ASTM D445			
cSt at 40°C	96.2	90.7	117.4
cSt at 100°C	13.8	11.3	13.4
Viscosity Index, ASTM D2270	141	112	111
Pour Point, ASTM D97, °F (°C)	-33 (-36)	-27 (-33)	-27 (-33)
Color, ASTM D1500	L2.5	L2.5	L2.5
Sulfated Ash, ASTM D874, m%	0.5	0.5	0.5
Total Base No., ASTM D2896, mg KOH/g	4.9	4.9	4.9
Total Acid No., ASTM D664, mg KOH/g	1.2	1.2	1.2
Phosphorus, ppm	250	250	250

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CITGO® Pacemaker® Gas Engine Oil 1600 Series



OVERVIEW



- Superior low ash, low phosphorus stationary natural gas engine oils with a balanced advanced additive package for unsurpassed performance.
- New-generation oils deliver a superior level of cleanliness with excellent wear protection and a low ash formula that complies with manufacturers' warranties and non-selective catalytic converter requirements.

FEATURES & BENEFITS



- Formulated with the latest generation of additives and the highest-quality base stocks available.
- Contain special dispersants and detergents to help ensure a cleaner, longer-running engine.
- Control deposits and minimize wear of pistons, rings, and liners.
- Retain TBN to neutralize combustion acids from sour gas.
- Effectively control oxidation and nitration, which cause sludge that thickens the oil, plugs filters, and causes excessive foaming.
- Minimize valve recession to provide longer head life.

APPLICATIONS



- Suitable for a wide range of engines operating on virtually any variation of natural or synthetic gas, gas from digester or landfill sources, or fuels containing low levels of sulfur and chlorofluorocarbons (CFC). Note: In high-CFC/sour gas applications, an oil with a higher base reserve may be required.
- Recommended for high- and medium-speed 4-cycle engines manufactured by Caterpillar, Waukesha, Superior, Cooper-Bessemer, Cummins, Dresser-Rand (Categories I, II and III), and low-speed engines manufactured by Cooper-Bessemer and Worthington C4-Cycle.
- CITGO Pacemaker Gas Engine Oil 1640LP is a specially formulated SAE 40 grade product that exhibits superior low temperature properties, compared with other monograde oils. It is particularly well suited for applications where improved low temperature fluidity is needed, but a monograde oil is recommended by the engine manufacturer.

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PROPERTIES



Typical Properties for CITGO Pacemaker Gas Engine Oil 1600 Series:

Product Name	1615	1630	1640
SAE Grade	15W-40	30	40
Material Code	632047001	632045001	632046001
Gravity, ASTM D4052, °API	30.6	29.7	28.7
Pounds Per Gallon	7.27	7.31	7.35
Flash Point, COC, ASTM D92, °F (°C)	446 (230)	446 (241)	511 (266)
Viscosity ASTM D445			
cSt at 40°C	96.7	89.2	125.1
cSt at 100°C	13.6	10.9	13.3
Viscosity Index, ASTM D2270	141	107	101
Pour Point, ASTM D97, °F (°C)	-27 (-33)	-27 (-33)	-33 (-36)
Color, ASTM D1500	L5.0	L4.5	L4.5
Carbon Residue, % (base stock)	0.02	0.02	0.02
Sulfated Ash, ASTM D874, m%	0.5	0.5	0.5
Total Acid No., ASTM D664, mg KOH/g	4.0	4.0	4.0
Total Base No., ASTM D2896, mg KOH/g	0.60	0.63	0.52
Phosphorus, ppm	280	280	280

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CITGO® Pacemaker® Gas Engine Oil 1900XL Series



OVERVIEW



- Next-generation, premium-performance low ash and low phosphorus lubricant for stoichiometric and lean-burn stationary natural gas engines. Designed for highly loaded 4-cycle natural gas engines operating under severe conditions.
- Provides premium performance versus older technology lubricants in the high-nitration conditions typically found in stoichiometric engine operation.
- Meets rigorous demands of modern natural gas engines operating in a variety of natural gas fuel qualities.

FEATURES & BENEFITS



- Exceptional resistance to oxidation and nitration.
- Extended oil drain interval capability, up to twice the intervals of other premium oils operating in severe conditions. Reduced downtime and lubrication cost help maximize production and lower operating cost.
- Exceptional deposit control and protection against piston scuffing and ring and liner wear.
- TBN retention to neutralize combustion acids from sour gas.
- Minimized valve recession for longer head life.
- Improved TAN control.
- Catalyst-compatible.

APPLICATIONS



- Suitable for a wide range of engines operating on virtually any variation of natural gas or synthetic gas, gas from digester or landfill sources, or fuels containing low levels of sulfur and chlorofluorocarbons (CFC). Note: In high CFC / sour gas applications, an oil with higher base reserve may be required.
- CITGO Pacemaker Gas Engine Oil 1900XL series exhibits superior low temperature properties, compared with other monograde oils. It is particularly well suited for applications where improved low temperature fluidity is needed, but monograde oil is recommended by the engine manufacturer.

Recommended for high- and medium-speed 4-cycle engines manufactured by:

- | | |
|---------------|--|
| • Caterpillar | • Worthington (low-speed engines) |
| • Waukesha | • Cooper-Bessemer (low-speed engines) |
| • Superior | • Cummins |
| • Jenbacher | • Dresser-Rand (Categories I, II, III) |
| • Wärtsilä | |
- Pacemaker GEO 1940XL is endorsed by Caterpillar for use in CAT MaK G16CM34.
 - Consult equipment manufacturer for proper lubricant selection.

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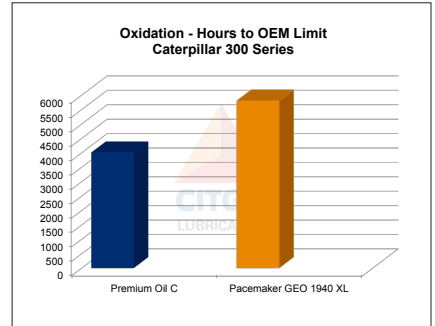
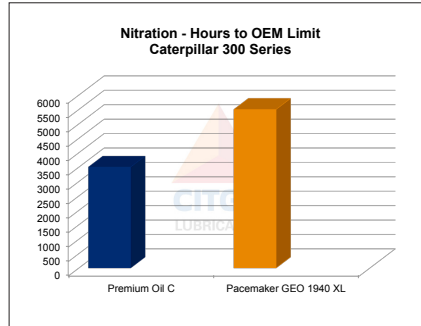
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APPLICATIONS

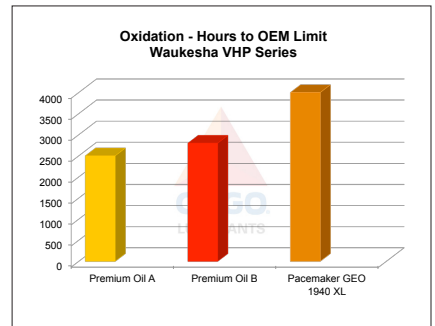
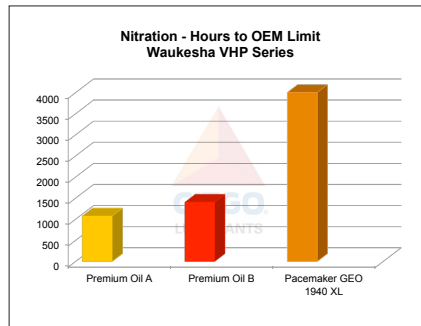


Proven in Severe Service

Caterpillar 300 Series and Waukesha VHP Series stoichiometric engines are historically severe in nitration. In field operation, results show CITGO Pacemaker GEO 1940 XL delivered up to 200% longer engine oil life compared to other premium oils.



Caterpillar 300 Series Stoichiometric Engines



Waukesha VHP Series Stoichiometric Engines

Industrial Gas Engine Oils

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PROPERTIES



Typical Properties for CITGO Pacemaker Gas Engine Oil 1900XL Series:

Product Name	1915XL	1930XL	1940XL
SAE Grade	15W-40	30	40
Material Code	632091001	632090001	632085001
Gravity, ASTM D4052, °API	31	29	28.5
Pounds Per Gallon	7.25	7.34	7.37
Viscosity ASTM D445			
cSt at 40°C	103.9	97.7	126.7
cSt at 100°C	13.9	11.5	13.6
Viscosity Index, ASTM D2270	139	106	103
Pour Point, ASTM D97, °F (°C)	-39 (-38)	-36 (-33)	-33 (-36)
Color, ASTM D1500	L4.0	L4.0	L4.0
Sulfated Ash, ASTM D874, m%	0.5	0.5	0.5
Total Base No., ASTM D2896, mg KOH/g	5.09	5.09	5.09
Total Acid No., ASTM D664, mg KOH/g	0.8	0.8	0.8
Phosphorus, ppm	280	280	280

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C 10197



CITGO® Pacemaker® Gas Engine Oil LFG LA 40

OVERVIEW



- A superior low ash, low phosphorus gas engine oil, designed for high-output, 4-cycle natural gas engines operating on landfill and digester gas.
- Demonstrated in field service to be capable of significantly extending oil drain intervals while minimizing the negative effects of ash deposits on sensitive engine components.

FEATURES & BENEFITS



- Specifically designed for high brake mean effective pressure (BMEP) engines.
- Optimized low ash formula minimizes combustion chamber deposits to maintain the power output of high BMEP engines for reduced maintenance and longer engine life.
- Specially formulated with modern chemistry to neutralize combustion acids from landfill gas and digester gas, including total organic halide as chloride (TOHCl) and H2S at moderate levels.
- Controls deposits and minimizes wear of pistons, rings and liners.
- Significantly extends drain intervals
- Excellent base retention.
- Strong corrosion resistance.

APPLICATIONS



- Recommended for a wide range of engines that operate on landfill and digester gas, including engines manufactured by Caterpillar, Waukesha, GE Jenbacher, Deutz, and Cummins.
- Approved by GE Jenbacher for use in type 2, 3, 4, and 6 engines (fuel classes B and C); appears in Technical Instruction TA 1000-1109.

Industrial Gas Engine Oils

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PROPERTIES



Typical Properties for CITGO Pacemaker Gas Engine Oil LFG LA 40:

SAE Grade	40
Material Code	632051001
Gravity, ASTM D4052, °API	29.3
Density, lb/gal at 60°F	7.33
Flash Point, ASTM D92, COC, °F (°C)	525 (274)
Viscosity ASTM D445	
cSt at 40°C	123
cSt at 100°C	13.5
Viscosity Index, ASTM D2270	105
Pour Point ASTM D97, °F (°C)	-11 (-24)
Color, ASTM D1500	L5.0
Carbon Residue, % (base stock)	0.02
Sulfated Ash, ASTM D874, %	0.55
Total Base No., ASTM D2896, mg KOH/g	5
Total Acid No., ASTM D664, mg KOH/g	1.16

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CITGO® Railroad Car Journal Oil No. 9

OVERVIEW



- A quality lubricating oil designed especially for use as a railroad car journal oil, covering a wide range of service requirements.

FEATURES & BENEFITS



- Guards against rust and corrosion under adverse conditions, especially when cars are idle.
- Low pour point and high viscosity index allow the oil to flow freely at very low temperatures, yet provide effective lubrication in high-temperature service.

APPLICATIONS



- Designed for the lubrication of locomotive and railroad car journal bearings.
- Conforms to the requirements of AAR Specification M-963-84 for 'All-Year Journal Box Lubricating Oil.'

PROPERTIES



Typical Properties for CITGO Railroad Car Journal No. 9:

Material Code	649110001
Gravity, ASTM D4052, °API	30.3
Density, lb/gal at 60°F	7.28
Flash Point, COC, ASTM D92, °F (°C)	442 (228)
Viscosity, ASTM D445	
cSt at 40°C	64
cSt at 100°C	8.8
ASTM D2161, SUS at 100°F	354
SUS at 210°F	58
Viscosity Index, ASTM D2270	110
Pour Point, Max, ASTM D97, °F (°C)	-35 (-37)
Color, ASTM D1500	L1.0

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C 10076

CITGO® RD-969 and RD-1069 Diesel Engine Oils



OVERVIEW



- High-dispersancy, reduced-ash engine oils intended for use in railroad locomotive diesel engines and other medium-speed stationary and marine diesel engines of similar design.
- Meet the LMOA Generation 6 (GE Generation IV Long Life) quality requirements with the Oronite OLOA 40000 additive system.

FEATURES & BENEFITS



- Improved detergent/dispersant dramatically improves cleanliness, with outstanding protection from deposits.
- Superior oxidation inhibition and thermal stability prevent excessive viscosity increase.
- 9 TBN designed for low and ultra-low sulfur fuels.
- Non-zinc formulation protects silver bearing materials.
- Non-chlorinated to reduce cost of recycling used oil.
- High viscosity index base oils in both grades improve oxidation resistance and low-temperature performance.
- Maximum oil drain intervals.
- Enhanced particulate matter emissions control.
- Performance capabilities:
 - LMOA Generation 6
 - EMD approved for Pointers Listing
 - GE Generation IV Long Life

APPLICATIONS



- Meet the specifications of the major railroad diesel engine builders including General Electric and Progress Rail, a Caterpillar company (formerly EMD).
- Meet the requirements of the manufacturers of many large medium-speed diesel engines used in marine and stationary service.
- Provide superior lubrication of most diesel engines used in inland marine service in towboats and work boats.

Recommended for:

General Electric diesel	EMD diesel
ALCO diesel	Enterprise diesel
Fairbanks-Morse diesel	Superior diesel
Colt Pielstick	Sulzer diesel
Baldwin-Lima-Hamilton	

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C 10073

PROPERTIES



Typical Properties for CITGO RD-969 and RD-1069 Diesel Engine Oils:

Product	RD-969	RD-1069
SAE Grade	40	20W-40
Material Code	649069001	649269001
Gravity, ASTM D4052, °API	28.7	29.3
Gravity, ASTM D1298, Specific 60/60°F	0.8833	0.8800
Density, lbs./gallon	7.35	7.33
Flash Point, ASTM D92, COC, °F (°C)	518 (270)	482 (250)
Viscosity, ASTM D445		
cSt at 40°C	144	134
cSt at 100°C	14.8	15.1
Viscosity Index, ASTM D2270	102	116
ASTM D5293, CCS, cP at -15°C	—	6,800
Pour Point ASTM D97, °F (°C)	0 (-18)	-11 (-24)
Color, ASTM D1500	D8	D8
Sulfated Ash, ASTM D874, m%	1.0	1.0
Total Acid No., ASTM D664, mg KOH/g	0.2	0.2
Total Base No., ASTM D2896, mg KOH/g	9.0	9.0
Zinc, ppm	<10	<10
Chlorine, ppm	<50	<50

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CITGO® RD-2069 LE Diesel Engine Oil



OVERVIEW



- A new-generation railroad diesel engine oil that supports the EPA Tier 4 emissions requirements and is engineered for performance in railroad locomotive diesel engines and other medium-speed stationary and marine diesel engines of similar design.
- Formulated with the latest generation of additive technology advancements with a proven track record of providing superior lubrication in a variety of diesel engines used in coastal and inland marine service.
- Approved for LMOA Generation 7 (supersedes the performance requirements of LMOA Generation 6). Uses Oronite OLOA 42015 additive system.

FEATURES & BENEFITS



- Improved detergent/dispersant dramatically improves cleanliness, with outstanding protection from deposits.
- Superior oxidation/nitration inhibition and thermal stability prevent excessive viscosity increase.
- 11 TBN designed for low and ultra-low sulfur fuels
- Non-zinc formulation protects silver bearing materials.
- Non-chlorinated to reduce cost of recycling used oil.
- High viscosity index base improves oxidation resistance and low-temperature performance.
- Maximum oil drain intervals.
- Enhanced particulate matter emissions control.
- Improved fuel economy versus single grade engines oils.
- Better cold-temperature start-up lubrication versus single-grade engine oils.
- Approved for LMOA Generation 7 (Supersedes LMOA Generation 6).

APPLICATIONS



- Meets the performance requirements of General Electric Transportation (GE) for Tier 4 locomotives and older models.
- Meets the performance requirements of Progress Rail (formerly EMD) Tier 3 locomotives and older models.

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PROPERTIES



Typical Properties for CITGO RD-2069 LE Diesel Engine Oil:

SAE Grade	20W-40
Material Code	649281001
Gravity, ASTM D4052, °API	28.7
Gravity, ASTM D1298, Specific 60/60°F	0.8820
Density, lbs./gallon	7.34
Flash Point, ASTM D92, COC, °F (°C)	496 (258)
Viscosity, ASTM D445	
cSt at 40°C	140
cSt at 100°C	15.2
Viscosity Index, ASTM D2270	110
ASTM D5293, CCS, cP at -15°C	7,800
Pour Point ASTM D97, °F (°C)	-27 (-33)
Color, ASTM D1500	L4.5
Sulfated Ash, ASTM D874, m%	1.15
Total Acid No., ASTM D664, mg KOH/g	0.7
Total Base No., ASTM D2896, mg KOH/g	11
Zinc, ppm	<10
Chlorine, ppm	<50

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CITGO® Bar & Chain Oil

OVERVIEW



- A suitable choice for home and commercial users, containing components to reduce wear, guard against rust, and enhance metal adhesion to reduce spatter.
- Designed for use over a wide temperature range.

FEATURES & BENEFITS



- Lubricates and cools chain and bar.
- Formulated to reduce spatter.
- Guards against rust.
- Provides wear protection.

APPLICATIONS



- Recommended for use in chainsaws operating over a wide temperature range.

PROPERTIES



Typical Properties for CITGO Bar & Chain Oil:

Material Code	638110001
SAE Grade	>20
Gravity, ASTM D4052, °API	28
Pounds/Gallon at 60°F	7.3
Flash Point, ASTM D92, COC, °F (°C)	284 (140)
Pour Point, ASTM D97, °F (°C)	-29 (-20)
Viscosity, ASTM D445:	
cSt at 40°C	68
cSt at 100°C	9.5
Appearance	Dark Amber

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CITGO® Chain Oils

OVERVIEW



- Chain lubricants with enhanced metal adhesion, designed for use in industrial and forestry applications to reduce wear and protect against rust.

FEATURES & BENEFITS



- Reduce friction and wear.
- Excellent protection against rust and corrosion.
- Adhesive film repels moisture and resists sling-off.
- Penetrate quickly to lubricate moving parts.

APPLICATIONS



- Industrial chains used in forestry and other industries.
- Roller pins and sprockets.
- Refer to equipment owner’s manual for proper lubricant recommendation and warranty requirements.

PROPERTIES



Typical Properties for CITGO Chain Oil:

ISO Grade	46	150
Material Code	638120	638123
Gravity, ASTM D4052, °API	33.8	29.8
Density, lb/gal at 60°F	7.13	7.31
Flash Point, COC, ASTM D92, °F (°C)	446 (230)	500 (260)
Viscosity ASTM D445		
cSt at 40°C	45.1	150
cSt at 100°C	7.4	16
Viscosity Index, ASTM D2270	129	107
Pour Point ASTM D97, °F (°C)	-27 (-33)	-22 (-30)
Color	L1.5	L1.5

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CITGO® Concrete Form Oil

OVERVIEW



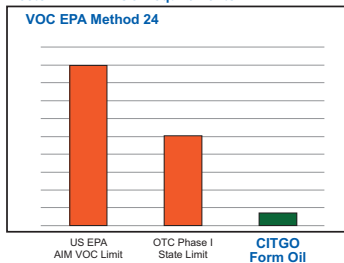
- A light-colored, non-staining, low volatile organic content (VOC) oil for use on concrete forms where an excellent surface finish is desired.

FEATURES & BENEFITS



- Formulated with high-quality base stocks and additives, including a spreading and release agent to provide excellent surface finish and even spreading of the oil on wood or steel forms, while also preventing cement from sticking to forms.
- Prevents staining, build-up, and corrosion of forms.
- Meets U. S. EPA AIM and OTC Phase I State VOC requirements.

Meets EPA AIM VOC Requirements



APPLICATIONS



- For all concrete form applications.
- Due to excellent non-staining characteristics, it is recommended for applications requiring excellent surface finish, including production of burial vaults, white stone furniture, and other specialty concrete products.
- Refer to equipment owner’s manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO Concrete Form Oil:

Material Code	643205001
Gravity, ASTM D4052, °API	27
Density, lb/gal at 60°F	7.43
Flash Point, COC, Min., ASTM D92, °F (°C)	384 (196)
Viscosity ASTM D445	
cSt at 40°C	20
cSt at 100°C	3.8
Viscosity ASTM D2161	
SUS at 100°F	106
SUS at 210°F	39
Viscosity Index, ASTM D2270	70
Pour Point, Max, ASTM D97, °F (°C)	-33 (-36)
Color, ASTM D1500	1.0
Saponification No., ASTM D94	10.8
Copper Corrosion, ASTM D130	1A

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CITGO® Diamond Oils

OVERVIEW



- Low-viscosity, light-colored, low fluid-friction lubricants, designed primarily for use in machinery in the textile industry and suitable for a number of other applications.

FEATURES & BENEFITS



- Provide lubrication and low loss of fluid friction as required for excellent performance in high-speed spindle bearings.
- Compatible with most types of filtration systems.
- Superior oxidation stability under moderate temperature conditions and excellent water separation capability make them outstanding machine oils for use where lubrication and temperature conditions are mild.

APPLICATIONS



- Recommended for general machinery lubrication, knitting machinery needle heads, textile machinery spindles and twister rings, sewing machines, and small electric motors.
- Can be used in most types of dispensing systems, including centralized mist and air-line lubricators.

PROPERTIES



Typical Properties for CITGO Diamond Oils:

Grade	12	20
Material Code	633091001	633092001
Gravity, ASTM D4052, °API	39.0	33.3
Flash Point, ASTM D92, °C	175	185
Viscosity, ASTM D445 cSt at 40°C	13.2	20
Pour Point, ASTM D97, °F (°C)	-35 (-32)	15 (-9)
Color, ASTM D1500	L0.5	L1.5
Water Separation time, ASTM D1401, Minutes at 130°F	10	30

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CITGO® Hydraulic/Press Oil 68

OVERVIEW



- Formulated with highly refined, premium base oils and an ashless anti-wear additive system to provide outstanding protection for demanding printing press hydraulic systems. Use of non-zinc type anti-wear additives is an important consideration in various press applications.

FEATURES & BENEFITS



- Contains no heavy metals.
- Offers thermal stability to virtually eliminate heat-related sludge deposits.
- Provides protection against rust and corrosion.
- Separates readily from water.
- Contains inhibitors to minimize foaming and air entrainment.
- Provides anti-wear protection to pumps, motors, and other hydraulic circuit components.
- Extends fluid service life with a balanced additive system to handle severe operating conditions.
- Contains an anti-leak agent to aid in maintaining the condition and life of elastomer materials.
- Offers great compatibility with CITGO Press Oil 68.

APPLICATIONS



- Recommended for printing press service in vane, piston, and gear pumps when used in accordance with the manufacturers' recommendations.
- Within the viscosity range covered in Goss SBM 5078 for gear and bearing lubricants; use ensures unintended mixing will not result in viscosity degradation of the lubricant covered by Goss SMB 5078.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for Hydraulic/Press Oil 68:

Grade	68
Material Code	661290001
Gravity, ASTM D4052, °API	29.3
Density, lb/gal	7.33
Flash Point, COC, ASTM D92, °F (°C)	468 (242)
Viscosity ASTM D445	
cSt at 40°C	67.6
cSt at 100°C	8.5
Viscosity ASTM D2161	
SUS at 100°F	351
SUS at 210°F	55
Viscosity Index, ASTM D2270	95
Pour Point, ASTM D97, °F (°C)	-11 (-24)
Color, ASTM D1500	L1.5
Total Acid No., ASTM D664, mg KOH/g	0.10
Copper Corrosion, 3 hr at 100°C, ASTM D130	1A
Rust Test, ASTM D665 A, B	Pass
Four Ball Wear, ASTM D2266, at 40 kg, mm	0.50
Foam Test, Seq. I, ml	0-0
Seq. II, ml	20-0
Seq. III, ml	0-0
Water Separability, at 130°F, ASTM D1401 (mL-mL-mL)	40-40-0

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CITGO® Hytherm® Oil 46



OVERVIEW



- A premium-quality heat transfer oil formulated with high viscosity index, paraffinic base stocks and a special high-temperature detergent/dispersant additive package.

FEATURES & BENEFITS



- Highly efficient heat transfer due to high specific heat and good thermal conductivity at all temperatures.
- Contains rust and oxidation inhibitors.
- A special additive package helps maintain system cleanliness and operational performance, reducing downtime and maintenance costs.

APPLICATIONS



- Meets requirements of both open and closed heat transfer systems, at temperatures up to 600°F.
- Refer to equipment owner's manual for proper lubricant recommendation.

CITGO HYTHERM OIL 46 PHYSICAL DATA

Temp., °F	Specific Gravity	Specific Heat BTU/lb/°F	Thermal Conductivity BTU/hr/ft ² /°F	Viscosity cSt
60	0.871	0.442	0.0790	175
100	0.857	0.463	0.0770	51
200	0.824	0.517	0.0738	8.0
300	0.792	0.570	0.0715	2.9
400	0.761	0.624	0.0697	1.6
500	0.731	0.678	0.0675	1.0
600	0.697	0.732	0.0647	0.8

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PROPERTIES



Typical Properties for CITGO Hytherm Oil 46:

ISO VIS Grade (SAE Grade)	48
Material Code	637130001
Gravity, ASTM D4052, °API	31.5
Density, lb/gal at 60°F	7.25
Flash Point, ASTM D92, °F	453
Viscosity ASTM D445	
cSt at 40°C	48.5
cSt at 100°C	7.0
Viscosity Index, ASTM D2270	100
Pour Point, ASTM D97, °F	16
Color, ASTM D1500	2.0
Acid No., ASTM D974	<0.01
Volume Factor, % per °F	0.033
Distillation, °F, ASTM D2887, IBP, °F	650
	5%
	734
	10%
	771
	50%
	858
	95%
	944

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CITGO® Ice Machine Oil 68

OVERVIEW



- A highly refined, pour point depressed, paraffinic oil developed for complete lubrication of ammonia compressors in industrial refrigeration systems.

FEATURES & BENEFITS



- Demulsibility properties provide quick separation of lubricant from water or refrigerant.
- Foam-inhibited with non-silicon additive.
- Helps protect against formation of harmful deposits on exhaust ports and other compressor parts.
- Protects bearings and other metal surfaces from corrosion.
- Minimizes sludge formation and varnish build-up.

APPLICATIONS



- Designed for the complete lubrication of industrial evaporating ice machines and the crankcases, cylinders, and bearings of refrigeration compressors using ammonia refrigerant.
- Meets requirements of Frick Co. Refrigeration Oil #3.
- Also recommended for general oiling of bearings, open chains, and linkages operating under conditions of mild unit loading and mild temperatures and humidity, where an additized oil is not required.

PROPERTIES



Typical Properties for CITGO Ice Machine Oil 68:

Material Code	637131001
Gravity, ASTM D4052, °API	31.0
Flash Point, ASTM D92, °F (°C)	425 (218)
Viscosity, ASTM D2161, SUS at 100°F	350
Viscosity, ASTM D445, cSt at 40°C	68
Pour Point, ASTM D97, °F (°C)	-30 (-34)
Color ASTM D1500	L0.5

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C 10122



CITGO® KOOLBLADE® Saw Guide Oils

OVERVIEW



- Premium saw guide lubricants designed for the lubrication of arbor bearings and saw guide systems which utilize thin kerf technology in cutting lumber.
- Formulated with select additives to provide wear protection, tackiness, enhanced metal-wetting ability and protection against rust and corrosion.

FEATURES & BENEFITS



- Reduces friction between the saw and guide components.
- Good metal-wetting ability.
- Emulsifies in the presence of water.
- Contains tackiness agents to resist sling-off.
- Excellent anti-wear properties for protection of moving parts.
- Protects against rust and corrosion.

APPLICATIONS



- Designed to be used in saw guides and blades, arbor bearings, saw system ways, and gears from manufacturers such as Salem, Coe Newnes/McGhee, and USNR (Schurman, Ukiah).

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Manufactured in USA

C 10252

PROPERTIES



Typical Properties for CITGO KOOLBLADE Saw Guide Oils:

ISO Grade	100	150
Material Code	638155001	638156001
Gravity, ASTM D4052, °API	30.5	29.5
Density, lbs/gallon	7.36	7.39
Flash Point, COC, ASTM D92, °C (°F)	240 (464)	254 (489)
Viscosity ASTM D445		
cSt at 40°C	100	150
cSt at 100°C	12.0	15.0
Viscosity Index, ASTM D2270	110	100
Pour Point, ASTM D97, °C (°F)	-30 (-22)	-24 (-11)
Color, ASTM D1500	L3.5	L3.5

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CITGO® North Star® Refrigeration Oil 68

OVERVIEW



- Designed with special properties to provide lubrication to refrigeration compressors.

FEATURES & BENEFITS



- Very light color.
- Very low acid number.
- Low pour and floc points.
- Excellent foam resistance.
- Good seal conditioning.
- Control stability and compatibility with refrigerants.
- Not recommended for use with hydrofluorocarbons (HFC) such as R-134A.

APPLICATIONS



- Recommended for use in refrigeration compressors and other low-temperature applications, including air conditioning systems.
- Recommended for extremely low temperature applications requiring low floc points.
- Not recommended for use with hydrofluorocarbons (HFC) such as R-134A.

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PROPERTIES



Typical Properties for CITGO North Star Refrigeration Oil 68:

Grade	68
Material Code	643108001
Gravity, ASTM D4052, °API	28.8
Density lbs/gal at 60°F	7.36
Flash Point, ASTM D92, °F (°C), COC	405 (207)
Viscosity, ASTM D445, cSt at 40°C	65
cSt at 100°F	8.3
Viscosity, ASTM D2161, SUS at 100°F	335
SUS at 210°F	54
Viscosity Index, ASTM D2270	95
Pour Point, ASTM D97, °F (°C)	-42 (-44)
Color, ASTM D1500	L0.5
Neutralization No., ASTM D974	0.01
Foam Inhibitor	Yes
Foam, ASTM D892, Sequence I	10-0
Sequence II	10-0
Sequence III	10-0

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CITGO® North Star® Refrigeration Oils

OVERVIEW



- Premium-quality naphthenic oils, blended for use in refrigeration compressors.

FEATURES & BENEFITS



- Light color.
- Low acid number.
- Low pour and floc points.
- Excellent foam resistance.
- Good seal control.
- Control stability and compatibility with refrigerants.

APPLICATIONS



- Recommended for use in refrigeration compressors and other low-temperature applications, including air conditioning systems.
- Recommended for applications in extremely low temperatures, where low-temperature fluidity and floc points of -50F or lower are required.
- Not recommended for use with hydrofluorocarbons (HFC) such as R-134A.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO North Star Refrigeration Oils:

Grade	32	54
Material Code	643102001	643105001
Gravity, ASTM D4052, °API	26.0	25.4
Density, lb/gal at 60°F	7.48	7.51
Flash Point, ASTM D92, °F (°C), COC	370 (188)	392 (200)
Viscosity, ASTM D445		
cSt at 40°C	32.0	55
cSt at 100°C	4.7	6.7
Viscosity, ASTM D2161		
SUS at 100°F	167	287
SUS at 210°F	42	48.6
Viscosity Index, ASTM D2270	33	63
Pour Point ASTM D97, °F (°C)	-44 (-42)	-49 (-45)
Floc Point, °F (°C)	-62 (-52)	-56 (-49)
Color, ASTM D1500	L1.0	L1.5
Aniline Point, ASTM D611, °F (°C)	178 (81)	181 (83)
Neutralization No., ASTM D974	0.01	0.01
Foam Inhibitor	Yes	Yes
Foam, ASTM D892:		
Sequence I	0-0	0-0
Sequence II	10-0	10-0
Sequence III	0-0	0-0

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CITGO® PackGard® Oils

OVERVIEW



- Specifically designed for packing lubrication of reciprocating, positive displacement well service plunger pumps utilized in oil and gas production.

FEATURES & BENEFITS



- Excellent metal wetting (preferential to water) and extra adhesiveness for more effective lubrication.
- Full extreme pressure (EP) wear protection, optimized with emulsification properties, guards against wear in high moisture conditions.
- Antifoam, high viscosity index, low pour point, and excellent stability over a wide range of conditions.
- Oxidation stability and rust/corrosion protection.

APPLICATIONS



- Recommended for and meets general packing lubricant requirements of most well service plunger pump manufacturers.
- Always consult your owner's manual for proper fluid recommendations and warranty requirements.

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PROPERTIES



Typical properties CITGO PackGard Oils:

ISO Grade	68	220	320
Material Code	633222001	633223001	633224001
Gravity, ASTM D237, API	31.9	28.8	34.1
Density, lb/gal	7.21	7.35	7.1
Flash Point ASTM D92, °F(°C)	428 (220)	388 (198)	430 (221)
Viscosity ASTM D445			
cSt at 40°C	68	223	321
cSt at 100°C	9.9	20.4	43
Viscosity Index	130	109	185
Pour Point ASTM D97, °F (°C)	-22 (-30)	-11 (-24)	-38 (-39)
Copper Corrosion, ASTM D 130	1A	1A	1A
Rust Test, A&B, ASTM D 665	Pass	Pass	Pass

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C 10231



CITGO® Paper Machine Oils NZ

OVERVIEW



- Heavy duty circulating oils designed for use in paper machines.
- Engineered for severe duty service.
- High temperature stability and antiwear properties for use in the demanding systems of the pulp and paper industries.
- Non-zinc additive package provides excellent performance in paper machine applications.

FEATURES & BENEFITS



- Engineered with high-quality base oils combined with high-performance additive technology.
- Excellent resistance to foaming.
- Excellent water separation properties.
- Provides rust and corrosion protection, oxidation resistance, and wear protection.

APPLICATIONS



- Recommended for paper machine dryer bearings.
- Recommended for paper machine calender roll bearings.
- Recommended for paper machine wet end systems.
- Refer to equipment owner's manual for proper lubricant recommendation.

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Manufactured in USA

C 10259

PROPERTIES



Typical Properties for CITGO Paper Machine Oils NZ:

Material Code	634616001	634621001
ISO Grade	150	220
Gravity, ASTM D237, °API	28.82	27.99
Specific Gravity, D4052	0.8826	0.8872
Density, lb/gal	7.35	7.39
Appearance	Bright & Clear	Bright & Clear
Color ASTM D1500	L2.5	L3.0
Flash Point ASTM D92, °C (°F)	258 (496)	264 (507)
Pour Point ASTM D97, °C (°F)	-27 (-17)	-18 (0)
Viscosity ASTM D445		
cSt at 40°C	157	229
cSt at 100°C	15.0	19.3
Viscosity Index ASTM D2270	95	95
Rust Test ASTM D665		
Distilled Water	Pass	Pass
Synthetic Sea Water	Pass	Pass
Copper Corrosion ASTM D130, 3hr @ 100°C	1b	1b
Water Separability @ 82°C ASTM D1401		
Oil, mL	40	40
Water, mL	40	40
Emulsion, mL	0	0
Time, min	15	15
Foaming Characteristics ASTM D892 (Tendency/Stability), mL		
Sequence I	0/0	0/0
Sequence II	0/0	0/0
Sequence III	0/0	0/0
Four-Ball Wear ASTM D4172, (1hr, 75°C, 1200 rpm, 15 kgf), mm	0.258	0.274
Four-Ball EP, ASTM D2783		
Load Wear Index, kgf	33.30	33.25
Weld Point, kgf	200	200

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CITGO® Press Oil 68

OVERVIEW



- Formulated with premium, highly refined base oils, a unique selection of performance additives, and synthetic components to meet the demanding gear and bearing lubrication requirements found in printing press systems.

FEATURES & BENEFITS



- Provides extreme pressure and anti-wear protection on gears and bearings.
- Exhibits outstanding thermal and oxidative stability.
- Provides protection against rust and corrosion.
- Helps prevent sticking of eccentrics.
- Offers increased gear protection against shock loading and wear.
- Contains inhibitors to minimize foaming and air entrainment.
- Provides excellent adhesion and cohesion on metal parts.
- Helps extend fluid service life with a balanced additive system to handle severe press operating conditions.
- Contains no heavy metals.
- Offers improved viscosity control and minimum viscosity shear.

APPLICATIONS



- Recommended for service for high-speed gearing and bearing applications found in the printing industry.
- Meets the performance requirements of Goss SBM 5078 and Man Roland Presses.

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C 10087

PROPERTIES



Typical Properties for CITGO Press Oil 68:

Grade	68
Material Code	633821001
Gravity, ASTM D4052, °API	29.2
Density, lb/gal	7.33
Flash Point, (COC), ASTM D92, °F (°C)	439 (226)
Viscosity, ASTM D445	
cSt at 40°C	68.1
cSt at 100°C	10.28
Viscosity, ASTM D2161	
SUS at 100°F	320
SUS at 210°F	62
Viscosity Index, ASTM D2270	117
Pour Point ASTM D97, °F (°C)	-27 (-33)
Color, ASTM D1500	1.0
Copper Corrosion, 3 hr at 100°C, ASTM D130	1A
Rust Test, D665 A, B	Pass
Four Ball Wear at ASTM D4172, 40 kg, mm	0.36
Four Ball Wear Index, ASTM D2783	55.5
Four Ball Wear, Index (Weld Point), Kg	250
Timken OK Load, ASTM D2782, lb.	50
Foam Test:	
Seq. I, ml	0-0
Seq. II, ml	50-0
Seq. III, ml	0-0
Tackifier	Yes

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CITGO® Rock Drill Oils

OVERVIEW



- Premium lubricants designed for the protection of pneumatic equipment subjected to excessive moisture or water spray.

FEATURES & BENEFITS



- The following features of CITGO Rock Drill Oils work to ensure outstanding equipment protection:
- Excellent metal-wetting (preferential to water) and extra adhesiveness for more effective lubrication.
- Extreme pressure (EP) wear protection, optimized with emulsification properties to help guard against wear in high-moisture conditions.
- Helps protect against rust and corrosion.
- Anti-foaming, high viscosity index, low pour point, and excellent stability enhance lubrication of pneumatic equipment over a wide range of conditions.

APPLICATIONS



- Recommended for use in rock drills, jack hammers, and other types of pneumatic percussion equipment manufactured by Ingersoll-Rand, Gardner-Denver, Mincon, and others.
- Recommended for industrial and mining equipment working in humid or wet conditions.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO Rock Drill Oils:

ISO Grade	46	100	320
Material Code	633212001	633214001	633217001
Gravity, ASTM D4052, °API	32.4	30.6	27.9
Density, lb/gal at 60°F	7.20	7.28	7.44
Flash Point, ASTM D92, °F (°C)	421 (216)	450 (232)	460 (238)
Viscosity, ASTM D445			
cSt at 40°C	49	100	305
cSt at 100°C	7.9	12.2	25.3
Viscosity Index	129	115	108
Pour Point, ASTM D97, °F (°C)	-49 (-45)	-38 (-39)	-6 (-21)
Copper Corrosion, ASTM D130	1B	1B	1B
Timken EP Test, ASTM D 2782, lbs.	45	60	60
Falex Load Test, ASTM D 3233, ft-lbs.	2000	2100	2475
Four Ball Wear, Index (Weld Point), Kg	200	250	315
Steam Emulsion Number, seconds	>1200	>1200	>1200

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CITGO® Transformer Oil N-II

OVERVIEW



- Highly refined naphthenic Type II inhibited transformer oil.
- Meets the requirements of ASTM D3487 Type II specification.

FEATURES & BENEFITS



- Excellent dielectric properties*.
- High thermal stability and resistance to oxidation.
- Rapid heat transfer properties.
- Excellent insulating properties.
- Does not contain any PCBs.
- Outstanding low-temperature properties.
- Compatible with components used in transformers.

*Note: Oil must be kept clean and dry. Contamination with any amount of water will significantly decrease the dielectric strength. Drums should be stored indoors and covered to protect oil from contamination.

APPLICATIONS



- Recommended for use in:
 - Oil-immersed transformers.
 - Circuit breakers and switches.
 - Other oil-immersed electrical equipment.
- Meets or exceeds the following requirement:
 - ASTM D3487 Type II Inhibited Oil
- Always consult your owner’s manual for proper fluid recommendations and warranty requirements.

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PROPERTIES



Typical Properties for CITGO Transformer Oil N-II:

Material Code	669490001
Gravity, ASTM D4052, °API	31.3
Specific Gravity, ASTM D4052 at 15°C	0.8811
Density, lb/gal	7.24
Flash Point ASTM D92, °F (°C)	293 (145)
Viscosity ASTM D445:	
cSt at 0°C	59.39
cSt at 40°C	9.66
cSt at 100°C	2.40
SUS at 100°F	60.3
Pour Point ASTM D97, °F (°C)	-77 (-63)
Color, ASTM D1500	L0.5
Aniline Point, ASTM D611 °F (°C)	170.5 (77.0)
Water Content, ASTM D1533, ppm	11
Corrosive Sulfur, ASTM D1275 (Method B)	Noncorrosive
Dielectric Strength @ 60 Hz, kV, ASTM D877	41
Interfacial Tension @ 25C, dynes/cm, ASTM D971	50.0
Neutralization Number mg KOH/g, ASTM D974	0.012
PCB Content, ASTM D4059, ppm	<1

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CITGO® Wireline Lubricants

OVERVIEW



- Premium viscous, tacky lubricants and sealants designed specifically for use in oil and gas well logging operations and other wireline applications where a lubricating dynamic seal is required.
- Formulated with advanced corrosion inhibitors to protect against corrosion in harsh, high-pressure down-hole environments where exposure to moisture, H₂S, and corrosive fluids occurs.
- Available in several viscosity grades for ease of application in varying temperature conditions.

FEATURES & BENEFITS



- Excellent sealing capability.
- Excellent adhesion to prevent sling off, splatter, and drip.
- Outstanding protection against corrosion.
- Ease of application.
- Excellent low-temperature performance.

APPLICATIONS



- Recommended as a lubricant/sealant for braided wirelines, cables, and slicklines used in down-hole operations including oil and gas well logging, pipe recovery, and reservoir analysis.

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C 10208

PROPERTIES



Typical Properties for CITGO Wireline Lubricants:

Material Number	637163001	637167001	637169001	63717001	637172001
Grade	68	220	460	680	1500
Specific Gravity, 60°F	0.897	0.895	0.890	0.888	0.880
Pounds per Gallon	7.47	7.45	7.41	7.39	7.33
Color	1.0	1.0	1.0	1.0	1.0
Appearance	Light Amber	Amber	Amber	Amber	Amber
Flash Point, °C (°F)	170 (340)	204 (400)	227 (440)	227 (440)	230 (446)
Viscosity:					
cSt at 40°C	68.4	220	460	680	1,500
cSt at 100°C	10.8	22.2	42.6	62.1	120
Pour Point, °C (°F)	-33 (-27)	-18 (0)	-15 (5)	-18 (0)	-21 (-6)
Rust Test, D-665B	Pass	Pass	Pass	Pass	Pass
Texture	Tacky Liquid	Tacky Liquid	Tacky Liquid	Tacky Liquid	Tacky Liquid

Material Number	637174001	637179001	637175001	637176001
Grade	5000	7500	10000	12000
Specific Gravity, 60°F	0.872	0.862	0.864	0.863
Pounds per Gallon	7.26	7.18	7.20	7.19
Color	1.0	1.0	1.0	1.0
Appearance	Amber	Amber	Amber	Amber
Flash Point, °C (°F)	230 (446)	189 (373)	230 (446)	174 (345)
Viscosity:				
cSt at 40°C	5,000	7,500	9,200	12,000
cSt at 100°C	400	674	800	1,100
Pour Point, °C (°F)	-24 (-11)	-28 (-18)	-21 (-6)	-18 (0)
Rust Test, D-665B	Pass	Pass	Pass	Pass
Texture	Tacky Liquid	Tacky Liquid	Tacky Liquid	Tacky Liquid

NOTE: These products are NOT designed to be used as wire rope lubricants on draglines, cranes, elevators, shovels, drilling rigs, suspension bridges, or cable stayed bridges.

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CITGO® CompKleen® Synthetic Cleaner

OVERVIEW



- A high-performance cleaner designed to loosen, remove, and suspend the varnish, sludge, and carbon typically found in rotary screw and rotary vane compressors. These deposits can result in operational problems, plus increased maintenance and operational cost.

FEATURES & BENEFITS



- Designed for use as a supplemental lubricant additive to remove sludge, varnish, and carbon from the compressor system while in operation.
- Virtually eliminates the need for disassembling for cleaning.
- For maximum benefit, use prior to each lubricant change.

APPLICATIONS



- Add one gallon of CITGO CompKleen Synthetic Cleaner concentrate for every 10 gallons of compressor oil in the unit; drain enough oil from the system unit to allow for the addition of the concentrate.
- Continue to operate the compressor for 40 to 60 hours, allowing the treated oil to circulate through the system to loosen, dissolve and suspend the deposits.
- It is very important that the fluid be drained from the system while hot to avoid re-depositing the contaminants. After draining the fluid, replace the filters and refill with the proper CITGO lubricant.
- Flushing the system before refilling may be necessary if the deposits were especially heavy.
- Can be used to clean and remove deposits from hydraulic systems, gear boxes, heat transfer systems, and machine tools.

NOTE: It is the user's responsibility to follow instructions, and ensure proper and complete drainage. Product sampling and testing are highly recommended. For additional technical information and assistance, please contact the CITGO Lubricants Product Answer Line at 800-248-4684 or email lubeshelp@citgo.com.

PROPERTIES



Typical Properties for CompKleen Synthetic Cleaner:

Material Code	632599001
Gravity, ASTM D4052, °API	12.2
Density, lb/gal	8.20
Color ASTM, D1500	1.0
Viscosity ASTM D445	
cSt at 40°C	66
cSt at 100°C	7.3
Flash Point PM ASTM D93, °F (°C)	410 (210)

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Manufactured in USA

C 10121

CITGO® Compressor Oils 35LP and 45LP



OVERVIEW



- High-quality, non-foaming, non-detergent compressor cylinder lubricants engineered for the requirements of air and gas compressors and older stationary natural gas engines that utilize activated clay filtration.

FEATURES & BENEFITS



- High viscosity index paraffinic base stocks with superior viscosity-temperature characteristics.
- Additives inhibit oxidation, rust, and corrosion.
- Good demulsibility characteristics.
- Low pour point for cold-climate operations.
- Low carbon-forming tendency, along with oxidation resistance, minimizes exhaust valve deposits.

APPLICATIONS



- Recommended for cylinder lubrication in reciprocating air and natural gas compressors.

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C 10139

PROPERTIES



Typical Properties for CITGO Compressor Oils 35LP and 45LP:

	35LP	45LP
Material Code	633746001	633748001
Gravity, ASTM D4052, °API	29.2	30.98
Density, lbs/gal	7.284	7.25
Flash Point, ASTM D92, °F (°C)	554 (290)	475 (246)
Viscosity ASTM D445		
cSt at 40°C	115	171
cSt at 100°C	12.3	19.0
Viscosity Index D2270	97	126
Pour Point ASTM D97, °F (°C)	-17 (-27)	-27 (-33)
Color, ASTM D1500	L2.0	L0.5
Total Acid No. mgKOH/g, ASTM D664	0.1	0.23
Foam Test, ASTM D892		
Seq. I, mL	0-0	0-0
Seq. II, mL	0-0	0-0
Seq. III, mL	0-0	0-0
RPVOT, Oxidation, ASTM D2272, minutes	320	525

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CITGO® Compressor Oil 7585



OVERVIEW



- Designed to provide excellent protection against oxidation and corrosion for reciprocating compressors operating in sour, wet, high-pressure natural gas service.

FEATURES & BENEFITS



- Formulated to a high viscosity index to provide both good start-up viscosity under low-temperature conditions and high film strength under high-temperature operating conditions.
- Contains a special additive system to reduce lubricant displacement by water or liquid hydrocarbons, resist the corrosive effects of hydrogen sulfide and other sour gas components, and fight deposit formation to ensure compressor cleanliness.
- Tolerates a wide variety of natural gas quality.
- Excels where once-through lubrication is needed in wet acidic gas service.

APPLICATIONS



- Recommended for single- and multi-stage reciprocating compressors in raw, scrubbed, or processed natural gas service.
- Used for compressing production natural gas, high-pressure carbon dioxide, hydrogen sulfide, refinery tail gas, and wellhead gas, where the gas stream may be wet and dirty.

PROPERTIES



Typical Properties for CITGO Compressor Oil 7585:

Material Code	637141001
Gravity, ASTM D4052, °API	28.8
Flash Point ASTM D92, °F (°C)	410 (210)
Viscosity ASTM D445	
cSt at 40°C	267
cSt at 100°C	24.0
Viscosity Index, ASTM D2270	120
Pour Point ASTM D97, °F (°C)	14 (-10)

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CITGO® CompressorGard® DE

OVERVIEW



- Premium diester base stocks and the latest developments in additive technology satisfy the lubrication requirements for most air compressors in service today.

FEATURES & BENEFITS



- Engineered to provide oxidation and thermal characteristics superior to mineral oils.
- Better low-temperature fluidity for cold climate operations.
- Better thermal conductivity reduces lubricant operating temperatures, extending fluid service.
- Less wear due to lower friction coefficient.
- Greater resistance to thermal or mechanical stress reduces deposits, sludge, and lacquer, especially in heat exchangers, reducing maintenance.
- Reduced oil carryover and valve deposits due to low vapor pressure and increased solvency.
- Cleaner valves result in reduced maintenance and reduced risk of compressor fires or explosions caused by these deposits.

APPLICATIONS



- CITGO CompressorGard DE 32 and 68 are recommended for use in oil-flooded rotary vane and screw type air compressors where these viscosities are needed.
- CITGO CompressorGard DE 125 and 150 are designed for both the crankcase and cylinder lubrication of reciprocating compressors, where low volatility and excellent thermal and oxidation stability provide for significantly cleaner discharge valves.

MATERIALS COMPATIBILITY

Materials

Seals

Paints

Plastics

Recommended

Fluorocarbon, Fluorosilicone, Nitrile Buna N (>30%), Polysulfide, Teflon, Viton®

Epoxy, Oil Resistant Alkyd

Celcon, Delrin, Fluorocarbon, nylon

Not Recommended

Butadiene, Butyl, Ethyl Propylene, Isoprene, Natural Rubber, Neoprene, Nitrile Buna N (<30%), Polyacrylate, Polyacrylic, SBR Rubber

Acrylic, PVC

Polystyrene, PVC, ABS, polycarbonate

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PROPERTIES



Typical Properties for CITGO CompressorGard DE:

ISO Viscosity Grade	68	100	125	150
Material Code	632525001	632526001	632527001	632528001
Specific Gravity	0.9642	0.9592	0.9617	0.949
Gravity, ASTM D4052, °API	15.2	16.0	15.5	17.5
Density, lb/gal	8.03	7.99	8.02	7.93
Viscosity				
cSt at 40°C	62.0	94.7	120.3	149.5
cSt at 100°C	7.00	9.40	14.32	12.3
Viscosity Index	55	67	119	61
Flash Point, ASTM D92, °F (°C)	522 (272)	554 (290)	532 (278)	511 (266)
Fire Point, ASTM D92, °F (°C)	561 (294)	572 (300)	554 (290)	568 (298)
Pour Point, ASTM D97, °F (°C)	-38 (-39)	-33 (-36)	-38 (-39)	-33 (-36)
Color, ASTM D1500	L1.0	L1.0	L1.0	L1.0
Carbon Residue, ASTM D524, %	0.09	0.09	0.09	0.09
Four Ball Wear, ASTM D4172				
mm at 20 Kg	0.60	0.42	0.59	—
mm at 40 Kg	0.68	0.68	0.66	0.44

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CITGO® CompressorGard® GE

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 Sulair 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

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CITGO® CompressorGard® H-Series



OVERVIEW



- Formulated with the highest-quality synthetic base stocks to address thermal degradation and deposit formation commonly observed in reciprocating compressors operating in natural gas compression service.

FEATURES & BENEFITS



- Protection against wear and deposits.
- Excellent protection against rust and corrosion in the presence of hydrogen sulfide.
- Excellent low-temperature service.
- Will not poison catalysts.

APPLICATIONS



- Designed for use in reciprocating compressors in hydrogen and natural gas service.
- Can be used in the compression of gas streams that come in contact with catalyst beds.

PROPERTIES



Typical Properties for CITGO CompressorGard H-Series:

ISO Viscosity Grade	100	220
Material Code	632566001	632568001
Gravity, °API	37.15	35.55
Viscosity ASTM D445		
cSt at 40°C	105	225
cSt at 100°C	14.45	25.6
Viscosity Index	141	144
Flash Point, ASTM D92, °F (°C)	518 (270)	558 (292)
Pour Point, ASTM D97, °F (°C)	-54 (-48)	-54 (-48)
Rust Prevention, ASTM D665 A	Pass	Pass
Foam, Sequence I	10/0	10/0
Sequence II	15/0	15/0
Sequence III	0/0	0/0
Water Separation, ASTM D1401, at 180°F (82°C)	40/40/0 (5)	40/40/0 (10)

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CITGO® CompressorGard® IPG

OVERVIEW



- A high-quality polyether polyol synthetic compressor lubricant engineered for the compression of propane.

FEATURES & BENEFITS



- Offers good water separation characteristics, excellent wear protection, and oxidation resistance.
- Miscible with propane in the low-temperature areas of the system, such as the expansion valve and evaporator, for efficient cooling.
- Naturally high viscosity index as compared to mineral oils provides enhanced lubrication through increased viscosity at high temperatures.

APPLICATIONS



- Recommended for use in rotary screw, vane, and reciprocating compressors in propane refrigeration service.

PROPERTIES



Typical Properties for CITGO CompressorGard IPG:

ISO Viscosity Grade	100	150
Material Code	632546001	632556001
Gravity, ASTM D4052, °API	10.6	10.3
Density, lb/gal	8.29	8.31
Specific Gravity	0.99	0.998
Flash Point, ASTM D92, °F (°C)	525 (274)	518 (220)
Viscosity, ASTM D445		
cSt at 40°C	100	155
cSt at 100°C	17.5	26
Viscosity Index, ASTM D2270	192	206
Pour Point, ASTM D97, °F (°C)	-49 (-45)	-38 (-39)
Water Separation, ASTM D1401, 82°C (180°F)	Pass	Pass
Foam Test, ASTM D892, Sequence I, II, III	Pass	Pass
Four Ball Wear, ASTM D4172, mm Scar	0.49	0.49
Copper Corrosion, ASTM D130	1A	1A

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CITGO® CompressorGard® PAG



OVERVIEW



- Designed for high-pressure reciprocating compressors operating with natural gas, carbon dioxide, hydrogen, helium, nitrogen, ammonia, and other polar gasses.

FEATURES & BENEFITS



- Resistance to hydrocarbon dilution and absorption of the gas stream prevents condensed hydrocarbon liquids in the cylinder area from washing the lubricant from the cylinder walls. Other lubricants which absorb these liquids lose viscosity, which can result in severe mechanical damage.
- High viscosity index and low pour points allow usage over a wide temperature range.
- Permit reduced maintenance costs and decreased downtime due to improved lubrication.
- Minimize problems in separators, meters, filters, and other downstream components due to lower lubricant consumption.
- Allow easier handling and lower disposal costs.
- Reduce absorption of lubricating oil into the gas at higher pressures.
- Minimize viscosity degradation when saturated with high-pressure gas.
- Provide excellent resistance to wash-off by liquid hydrocarbon gases.
- Offer compatibility with well bore fluids and treating chemicals, thereby reducing well impairment incidents.

APPLICATIONS



- Recommended for flooded rotary screw and vane compressors used for compressing natural gas, carbon dioxide, and other gaseous hydrocarbons.
- When proper viscosity grade is selected, suitable for use as a reciprocating compressor cylinder lubricant when processing these and other gases requiring chemical resistance.
- Refer to equipment owner's manual for proper lubricant recommendation.

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PROPERTIES



Typical Properties for CITGO CompressorGard PAG:

ISO Viscosity Grade	100	150	220
Material Code	632538001	632348001	632595001
Gravity, °API	4.2	3.7	3.5
Specific Gravity	1.04	1.05	1.05
Density, lb/gal. 60/60°F	8.67	8.71	8.73
Viscosity, ASTM D445			
cSt at 40°C	107	154.1	220
cSt at 100°C	21.1	29.3	41.05
Viscosity Index, D2270	223	232	241
Flash Point, ASTM D92, °F (°C)	555 (291)	547 (286)	554 (290)
Pour Point ASTM D97, °F (°C)	-54 (-48)	-49 (-45)	-49 (-45)
Color, ASTM D1500	L0.5	L0.5	L0.5
Copper Strip Corrosion, ASTM D130	1A	1A	1A
Rust Protection, ASTM D665A	Pass	Pass	Pass
Four Ball Wear, ASTM D4172 mm @ 40 kg	0.64	0.63	0.83
Foam Resistance, ASTM D892 Sequence I, II, III	Pass	Pass	Pass
Carbon Residue, mg	0.01	0.01	0.01

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CITGO® CompressorGard® PAO



OVERVIEW



- High-quality polyalphaolefin (synthesized hydrocarbon) base fluids with technologically advanced additives to provide effective and efficient compressor performance.
- Available in ISO grades 32, 46, 68, 100, and 150.

FEATURES & BENEFITS



- Reduced danger of compressor fire and explosions that result from deposit formation.
- Outstanding oxidation and thermal stability.
- Exceptionally low pour point.
- Low varnish-forming tendencies.
- Wide operating temperature range.
- High viscosity index.
- Excellent anti-wear properties.
- Extended service life.
- Lower maintenance costs.
- Excellent rust protection.
- Fully compatible with elastomers, paints, seals, and petroleum oil.
- Low toxicity.
- Excellent demulsibility.

APPLICATIONS



- Designed for use with rotary vane, rotary screw, and centrifugal compressors.
- In rotary vane and rotary screw compressors, ideal to guard against sludge and varnish deposit formation and accumulation that occurs when oil is injected directly into the high-temperature airstream. The cleaner compressor interior results in reduced component wear and increased safety and efficiency.
- In centrifugal (dynamic) compressors, the proven additive package and low vapor-forming tendencies ensure excellent performance over an extended drain interval, as compared to petroleum oil. Often remotely located and mated with integral gear sets, centrifugal compressors require a lubricant with good load-carrying ability and low foaming tendencies.

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PROPERTIES



Typical Properties for CITGO CompressorGard PAO:

ISO Grade	32	46	68	100	150
Material Code	632531001	632532001	632533001	632534001	632535001
API Gravity	36.6	35.8	36.4	35.8	34.8
Specific Gravity	0.842	0.847	0.843	0.847	0.851
Density, lb/gal, 60/60°F	7.01	7.04	7.02	7.04	7.09
Viscosity, ASTM D445					
cSt at 40°C	30.22	43.38	66.33	98.35	153.98
cSt at 100°C	5.77	7.48	10.26	14.10	20.22
Viscosity Index, ASTM D2270	136	139	141	147	152
Flash Point, ASTM D92, °F (°C)	522 (272)	504 (262)	543 (284)	550 (288)	550 (288)
Pour Point, ASTM D97, °F (°C)	-87 (-66)	-71 (-57)	-65 (-54)	-65 (-54)	-54 (-48)
Color, ASTM D1500	L0.5	L0.5	L0.5	L0.5	L0.5
Copper Corrosion, ASTM D130	1B	1B	1B	1B	1B
Rust Protection, ASTM D665					
DI Water	Pass	Pass	Pass	Pass	Pass
Salt Water	Pass	Pass	Pass	Pass	Pass
Four Ball Wear, ASTM D4172, mm at 40 Kg	0.41	0.42	0.30	0.32	0.33
Foam Resistance, ASTM D892, Sequence I, II, III	Pass	Pass	Pass	Pass	Pass
Water Separation, ASTM D1401					
at 130°F (54°C)	40/40/0 (5)	40/40/0 (10)	40/40/0 (10)	—	—
at 180°F (82°C)	—	—	—	40/40/0 (10)	40/40/0 (15)
Carbon Residue, mg	0.02	0.02	0.04	0.03	0.04

CompressorGard PAO lubricants are not compatible with silicone or polyalkylene glycol compressor lubricants. Consider CompressorGard PAG lubricants when compressing gases with condensed hydrocarbon liquids.

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CITGO® CompressorGard® PS 68



OVERVIEW



- A premium synthetic-blend compressor lubricant formulated with ultra-high purity hydrotreated base stocks and a proprietary synthetic component to aid in controlling sludge and deposit formation in compressor applications.
- Designed specifically for use in compressor applications, but can be used in multi-purpose applications.

FEATURES & BENEFITS



- Resists fluid breakdown caused by high operating temperatures.
- Improves condensate separator efficiency due to excellent demulsibility.
- Reduces fluid carryover and make-up oil costs due to low-volatility, ultra-high purity hydrotreated mineral oils, and synthetic base stocks.
- Reduces and controls deposits with high-performance, ashless additives.
- Improves equipment reliability by eliminating harmful varnish, sludge, and carbon deposits on rotors and separators.

APPLICATIONS



- Recommended for rotary vane, rotary screw, and centrifugal compressors.
- Suitable for hydraulic applications where anti-wear hydraulic oils are called for.
- Suitable for bearing applications.

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PROPERTIES



Typical Properties for CITGO CompressorGard PS 68:

ISO Viscosity Grade	68
Material Code	632482001
Specific Gravity ASTM D1298 60/60°F	0.884
Density, lb/gal	7.37
Viscosity ASTM D445	
cSt at 40°C	65.18
cSt at 100°C	8.38
Viscosity Index, ASTM D2270	97
Flash Point, ASTM D92, °C (°F)	260 (500)
Pour Point ASTM D97, °C (°F)	-36 (-33)
Color, ASTM D1500	0.5
Water Separation, ASTM D1401, 130°F (54°C)	40/40/0 (5)
Four Ball Wear, ASTM D4172, mm at 40 kg.	0.48
Copper Strip Corrosion, ASTM D130	1A
Rust Protection, ASTM D665	
DI Water, Proc. A	Pass
Sea Water, Proc. B	Pass
Foam, ASTM D892, Sequence I, II, III	Pass

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CITGO® CompressorGard® SS



OVERVIEW



- Semi-synthetic lubricants specially formulated for rotary screw and reciprocating compressors in natural gas service. Recommended where superior thermal and oxidation stability compared to conventional petroleum products is desired. Available in ISO 100, 150, and 220 viscosity grades.

FEATURES & BENEFITS



- Balanced additive system inhibits rust and corrosion, reduces bearing wear, minimizes foaming, and inhibits the corrosive effects of hydrogen sulfide for longer component life.
- Low vapor pressure helps reduce oil carryover to the compressed gas stream.
- Enhanced oxidation and thermal stability to help reduce valve deposit formation, lowering the risk of fires and reducing valve maintenance.
- Wide operating temperature range due to high viscosity index and low pour point.
- Compatible with the same system elastomers and seals as are used with petroleum products.

APPLICATIONS



- Recommended for use in rotary screw, vane, and reciprocating compressors in natural gas service.

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PROPERTIES



Typical Properties for CITGO CompressorGard SS:

ISO Viscosity Grade	100	150	220
Material Code	632554001	632555001	632557001
API Gravity, °API ASTM D287	29.41	27.6	29.4
Density, lb/gal	7.33	7.36	7.33
Specific Gravity, 60°/60°F	0.879	0.884	0.879
Flash Point, ASTM D92, °F (°C)	504 (262)	504 (262)	518 (270)
Viscosity			
cSt at 40°C	99	154	227
cSt at 100°C	15.1	20.1	28.85
Viscosity Index, D2270	161	151	166
Pour Point, ASTM D97, °F (°C)	-38 (-39)	-36 (-38)	-17 (-27)
Copper Corrosion, ASTM D130	1B	1B	1B
Four Ball Wear, 1200 rpm, ASTM D4172, mm Scar at 40kg	0.48	0.45	0.33
Rust Test, ASTM D665	Pass	Pass	Pass
Foam Test, ASTM D892			
Sequence I	0/0	0/0	0/0
Sequence II	10/0	10/0	20/0
Sequence III	0/0	0/0	0/0

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CITGO® CompressorGard® XA 200



OVERVIEW



- Designed for use in reciprocating compressors subjected to sour, wet, high-pressure gases found in refineries, gas compression stations, and fertilizer plants.

FEATURES & BENEFITS



- State-of-the-art premium rust and corrosion inhibitor; does not contain barium.
- Outstanding demulsification properties.
- Excellent thermal and hydrolytic stability.
- Resistance to gelling when contaminated with water.
- Quick release of entrained gases.
- Resistance to corrosive attacks by hydrogen sulfide, wet carbon dioxide, and other sour gas components.

APPLICATIONS



- Recommended for use in reciprocating compressors subjected to high-pressure carbon dioxide and hydrogen sulfide service, in urea fertilizer compression synthesis-gas compression, refinery tail-gas compression, wellhead gas compression and high-pressure sulfur dioxide applications.

PROPERTIES



Typical Properties for CITGO CompressorGard XA 200:

Material Code	632558001
API Gravity, ASTM D4052	31.8
Density, lb/gal	7.26
Flash Point, ASTM D92 (COC) °F (°C)	468 (242)
Viscosity ASTM D445	
cSt at 40°C	195
cSt at 100°C	22
Viscosity Index, ASTM D2270	136
Pour Point, ASTM D97, °F (°C)	-17 (-27)
Color, ASTM D1500	0.5
Copper Corrosion, ASTM D130, 3h at 100°C	1A
Rust Test, ASTM D665 A, B	Pass
Foam Test, ASTM D892, Sequence I, II, III	Pass

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CITGO® Gascom® R Oil

OVERVIEW



- Formulated to satisfy the lubrication requirements of gas compressors used for wet, scrubbed, or processed gases.

FEATURES & BENEFITS



- High viscosity index base stocks and special lubricity additives reduce lubricant displacement by water and/or liquid hydrocarbons.
- Tolerates a wide variety of gas quality.

APPLICATIONS



- Recommended for single- or double-acting reciprocating compressors in raw, scrubbed, or processed natural gas service.
- Can be used as a mild stamping and drawing lubricant where enhanced lubricity is needed.

PROPERTIES



Typical Properties for CITGO Gascom R Oil:

ISO VIS Grade	220
Material Code	637142001
Specific Gravity, 60°/60°F	0.8838
Gravity, ASTM D4052, °API	28.6
Flash Point ASTM D92, °F (°C)	450 (232)
Viscosity ASTM D445	
cSt at 40°C	234
cSt at 100°C	20.4
Viscosity ASTM D2161	
SUS at 100°F	1350
SUS at 210°F	100
Viscosity Index, ASTM D2270	100
Pour Point ASTM D97, °F (°C)	5 (-9)
Color, ASTM D1500	4.0

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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 10101

CITGO® Pacemaker® HV Oils



OVERVIEW



- High-quality petroleum fluids with high boiling range and low vapor pressure, designed especially for use in high-vacuum pump applications where a high-quality mineral oil is required.

FEATURES & BENEFITS



- High initial boiling points and low vapor pressures.
- Produced with special processes and quality assurance procedures to help ensure excellent vacuum pump performance.
- Inherently high oxidation resistance, thermal stability, and low chemical reactivity.
- Special product handling assures very low moisture and volatiles contamination that could adversely affect vapor pressure characteristics.

APPLICATIONS



- CITGO Pacemaker HV-39 is designed for direct-drive vacuum pumps such as Welch, Yellow Jacket, Precision, Leybold-Heraeus, Edwards and Alcatel, where lower viscosity vacuum pump oil is required to prevent heat build-up, provide high ultimate vacuum, and handle high-vacuum pump speeds.
- Pacemaker HV-68 is designed for belt-driven vacuum pumps such as Welch and Cenco.
- Note: Keep containers of CITGO Pacemaker HV Oils tightly sealed and stored in areas that do not have wide variations in temperature.
- Refer to equipment owner's manual for proper lubricant recommendation.

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C 10086

PROPERTIES



Typical Properties for CITGO Pacemaker HV Oils:

Grade	HV-39	HV-68
Material Code	634104001	634105001
Gravity, ASTM D4052, °API	31.7	32.3
Density, lb/gal at 60°F	7.22	7.2
Flash Point, COC, ASTM D92, °F (°C)	435 (224)	465 (241)
Viscosity ASTM D445		
cSt at 40°C	42	67.7
cSt at 100°C	6.4	9.2
Viscosity ASTM D2161		
SUS at 100°F	218	338
SUS at 200°F	47	54
Viscosity Index, ASTM D2270	101	113
Pour Point, ASTM D97, °F (°C), Max.	+5 (-15)	0 (-18)
Color, ASTM D1500	L0.5	L0.5
Neutralization No., ASTM D974, mg KOH/ml	<0.05	<0.05
Copper Corrosion, ASTM D130, 3 hours at 100°C	1A	1A
Carbon Residue, ASTM D4530, wt, %	<0.01	<0.02
Vapor Pressure, ASTM D5190, Torr. @ 100°F (37°C)	0.00025	0.00065

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C 10086



CITGO® Procoil® Oils

Process Oils

OVERVIEW



- Highly refined, light-colored, very low sulfur, paraffinic process oils.

FEATURES & BENEFITS



- Low volatility, low aromaticity and high flash points.
- Very light color and excellent antioxidant response.
- High viscosity index for relatively low rate of viscosity change with changes in temperature.

APPLICATIONS



- Recommended as carriers, diluent oils, processing aids, or functional oils in a wide range of formulations and chemical processes where superior stability, high flash, low pour, and low volatility are desired.

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Manufactured in USA

C 10125

PROPERTIES



Typical Properties for CITGO Procoil Oils:

	910	915	920	935	950
Material Code	627910001	627915001	627920001	627935001	627950001
Gravity, ASTM D4052, °API	34.7	32.9	32.0	31.4	30.5
Specific Gravity 60/60°F	0.852	0.861	0.866	0.870	0.873
Pounds Per Gallon	7.09	7.17	7.21	7.23	7.27
Flash Point, ASTM D92, °F (°C)	400 (205)	415 (214)	455 (235)	440 (227)	510 (265)
Viscosity, ASTM D2161:					
SUS at 100°F	107	156	220	320	500
SUS at 210°F	40.1	43.9	49	54	64
Viscosity, ASTM D445:					
cSt at 40°C	20.4	30.2	42.3	62	108
cSt at 100°C	4.15	5.25	6.45	8.4	12
Viscosity Index, ASTM D2270	106	105	102	104	99
Aniline Point, ASTM D611, °F (C)	227 (108)	221 (105)	227 (108)	231 (111)	245 (118)
Carbon Residue, ASTM D4530	0.01	0.01	0.02	0.02	0.03
Total Acid Number, ASTM D664	0.05	0.05	0.05	0.05	0.05
Pour Point, ASTM D97, °F (°C)	5 (-15)	5 (-15)	0 (-18)	5 (-15)	10 (-12)
Color, ASTM D1500	L0.5	L0.5	L0.5	L0.5	0.5
Molecular Weight, ASTM D2502	370	410	440	477	535
Sulfur, ASTM D2622, wt%	0.002	0.002	0.001	0.002	0.002

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API GUIDE TO CERTIFICATION MARKS, SERVICE SYMBOLS, & CATEGORIES

IDENTIFY QUALITY MOTOR OILS FOR GASOLINE-POWERED VEHICLES. OILS DISPLAYING THESE MARKS MEET PERFORMANCE REQUIREMENTS SET BY U.S. AND INTERNATIONAL VEHICLE AND ENGINE MANUFACTURERS AND THE LUBRICANT INDUSTRY. HUNDREDS OF COMPANIES WORLDWIDE PARTICIPATE IN THIS VOLUNTARY PROGRAM, WHICH IS BACKED BY A MARKETPLACE SAMPLING AND TESTING PROGRAM.



The API Certification Mark, also known as the “Starburst”

An oil displaying this mark meets the current ILSAC GF-6A engine protection standard and fuel economy requirements of the International Lubricant Specification Advisory Committee (ILSAC), a joint effort of U.S. and Japanese automobile manufacturers. This mark cannot be applied to oils of the 0W-16 viscosity grade. Automobile manufacturers recommend oils that carry the API Certification Mark “Starburst.” See the ILSAC STANDARD FOR PASSENGER CAR ENGINE OILS chart on the next page for descriptions of current and obsolete ILSAC standards.

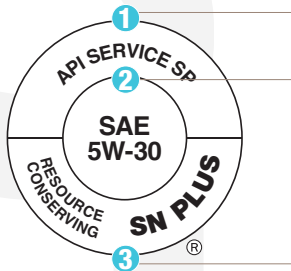


The API Certification Mark, also known as the “Shield”

An oil displaying this mark meets the current ILSAC GF-6B engine protection standard and fuel economy requirements of the International Lubricant Specification Advisory Committee (ILSAC). This mark can only be applied to oils having a viscosity grade of 0W-16. Automobile manufacturers recommend oils that carry the API Certification Mark “Shield.”

API'S SERVICE SYMBOL

IDENTIFY QUALITY MOTOR OILS FOR GASOLINE- AND DIESEL-POWERED VEHICLES. OILS DISPLAYING THESE MARKS MEET PERFORMANCE REQUIREMENTS SET BY U.S. AND INTERNATIONAL VEHICLE AND ENGINE MANUFACTURERS AND THE LUBRICANT INDUSTRY. HUNDREDS OF COMPANIES WORLDWIDE PARTICIPATE IN THIS VOLUNTARY PROGRAM, WHICH IS BACKED BY A MARKETPLACE SAMPLING AND TESTING PROGRAM.



The API Service Symbol, also known as the “Donut”

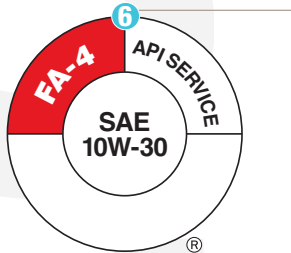
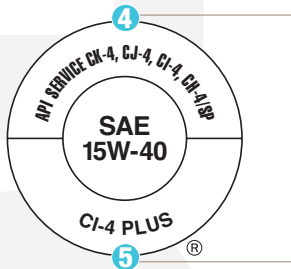
1. Performance Level Motor oils designed for cars, vans, and light trucks with gasoline engines fall under API’s “S” (Service) categories. Motor oils designed for heavy-duty trucks and vehicles with diesel engines fall under API’s “C” (Commercial) categories. Please see the Gasoline Engines and Diesel Engines charts on the next pages for descriptions of current and obsolete API service categories.

2. Viscosity Grade The measure of an oil’s ability to flow at certain temperatures. Vehicle requirements may vary. Follow your vehicle manufacturer’s recommendations on SAE oil viscosity.

3. Resource Conserving “Resource Conserving” applies to oils intended for gasoline-engine cars, vans, and light trucks. Widespread use of “Resource Conserving” oils may result in an overall savings of fuel in the vehicle fleet as a whole.

4. Multiple Performance Levels Oils designed for diesel engine service might also meet gasoline engine service. For these oils the designation is “C” category first followed by the “S” category. “C” category oils have been formulated primarily for diesel engines and may not provide all of the performance requirements consistent with vehicle manufacturers’ recommendations for gasoline fueled engines.

5. PLUS Classifications API currently licenses two PLUS classifications for use in the lower portion of the API Donut: CI-4 PLUS and SN PLUS. CI-4 PLUS identifies oils formulated to provide a higher level of protection against soot-related viscosity increase and viscosity loss due to shear in diesel engines. When originally introduced, CI-4 PLUS identified CI-4 oils meeting a higher level of performance. CK-4 and CJ-4 oils include all CI-4 PLUS performance requirements. When originally introduced, SN PLUS identified API SN oils meeting a higher level of performance. API SP oils include all SN PLUS requirements.



6. The API Service Symbol with FA-4 FA-4 and the FA-4 Donut identify certain XW-30 oils specifically formulated for use in select high-speed four-stroke cycle diesel engines designed to meet 2017 model year on-highway greenhouse gas (GHG) emission standards. API FA-4 oils are not interchangeable or backward compatible with API CK-4, CJ-4, CI-4 with CI-4 PLUS, CI-4, and CH-4 oils. Refer to engine manufacturer recommendations to determine if API FA-4 oils are suitable for use.

The current and previous ILSAC standards and API Service Categories are listed here. Vehicle owners should refer to their owner's manuals before consulting these charts. Oils may have more than one performance level. For automotive gasoline engines, the latest ILSAC standard or API Service Category includes the performance properties of each earlier category and can be used to service older engines where earlier category oils were recommended.

ILSAC STANDARD FOR PASSENGER CAR ENGINE OILS

Name	Status	Service
GF-6A	Current	Introduced in May 2020, designed to provide protection against low-speed pre-ignition (LSPI), timing chain wear protection, improved high temperature deposit protection for pistons and turbochargers, more stringent sludge and varnish control, improved fuel economy, enhanced emission control system protection and protection of engines operating on ethanol-containing fuels up to E85.
GF-6B	Current	Applies only to oils having an SAE viscosity grade of 0W-16. Introduced in May 2020, designed to provide protection against low-speed pre-ignition (LSPI), timing chain wear protection, high temperature deposit protection for pistons and turbochargers, stringent sludge and varnish control, improved fuel economy, emission control system protection and protection of engines operating on ethanol-containing fuels up to E85.
GF-5	Obsolete*	Use GF-6A where GF-5 is recommended.
GF-4	Obsolete	Use GF-6A where GF-4 is recommended.
GF-3	Obsolete	Use GF-6A where GF-3 is recommended.
GF-2	Obsolete	Use GF-6A where GF-2 is recommended.
GF-1	Obsolete	Use GF-6A where GF-1 is recommended.










* Obsolete on May 1, 2021

GASOLINE ENGINES (Follow your vehicle manufacturer's recommendations on oil performance levels)

Category	Status	Service
SP	Current	Introduced in May 2020, designed to provide protection against low-speed pre-ignition (LSPI), timing chain wear protection, improved high temperature deposit protection for pistons and turbochargers, and more stringent sludge and varnish control. API SP with Resource Conserving matches ILSAC GF-6A by combining API SP performance with improved fuel economy, emission control system protection and protection of engines operating on ethanol-containing fuels up to E85.
SN	Current	For 2020 and older automotive engines.
SM	Current	For 2010 and older automotive engines.
SL	Current	For 2004 and older automotive engines.
SJ	Current	For 2001 and older automotive engines.
SH	Obsolete	CAUTION: Not suitable for use in most gasoline-powered automotive engines built after 1996. May not provide adequate protection against build-up of engine sludge, oxidation, or wear.
SG	Obsolete	CAUTION: Not suitable for use in most gasoline-powered automotive engines built after 1993. May not provide adequate protection against build-up of engine sludge, oxidation, or wear.
SF	Obsolete	CAUTION: Not suitable for use in most gasoline-powered automotive engines built after 1988. May not provide adequate protection against build-up of engine sludge.
SE	Obsolete	CAUTION: Not suitable for use in most gasoline-powered automotive engines built after 1979.
SD	Obsolete	CAUTION: Not suitable for use in most gasoline-powered automotive engines built after 1971. Use in more modern engines may cause unsatisfactory performance or equipment harm.
SC	Obsolete	CAUTION: Not suitable for use in most gasoline-powered automotive engines built after 1967. Use in more modern engines may cause unsatisfactory performance or equipment harm.
SB	Obsolete	CAUTION: Not suitable for use in most gasoline-powered automotive engines built after 1951. Use in more modern engines may cause unsatisfactory performance or equipment harm.
SA	Obsolete	CAUTION: Contains no additives. Not suitable for use in most gasoline-powered automotive engines built after 1930. Use in modern engines may cause unsatisfactory performance or equipment harm.

DIESEL ENGINES (Follow your vehicle manufacturer's recommendations on oil performance levels)

Category	Status	Service
CK-4	Current	API Service Category CK-4 describes oils for use in high-speed four-stroke cycle diesel engines designed to meet 2017 model year on-highway and Tier 4 non-road exhaust emission standards as well as for previous model year diesel engines. These oils are formulated for use in all applications with diesel fuels ranging in sulfur content up to 500 ppm (0.05% by weight). However, the use of these oils with greater than 15 ppm (0.0015% by weight) sulfur fuel may impact exhaust aftertreatment system durability and/or oil drain interval. These oils are especially effective at sustaining emission control system durability where particulate filters and other advanced aftertreatment systems are used. API CK-4 oils are designed to provide enhanced protection against oil oxidation, viscosity loss due to shear, and oil aeration as well as protection against catalyst poisoning, particulate filter blocking, engine wear, piston deposits, degradation of low- and high-temperature properties, and soot-related viscosity increase. API CK-4 oils exceed the performance criteria of API CJ-4, CI-4 with CI-4 PLUS, CH-4, and CH-4 and can effectively lubricate engines calling for those API Service Categories. When using CK-4 oil with higher than 15 ppm sulfur fuel, consult the engine manufacturer for service interval recommendations.
CJ-4	Current	Introduced in 2010. For high-speed four-stroke cycle diesel engines designed to meet 2010 model year on-highway and Tier 4 non-road exhaust emission standards as well as for previous model year diesel engines. These oils are formulated for use in all applications with diesel fuels ranging in sulfur content up to 500 ppm (0.05% by weight). However, the use of these oils with greater than 15 ppm (0.0015% by weight) sulfur fuel may impact exhaust aftertreatment system durability and/or drain interval. API CJ-4 oils exceed the performance criteria of API CI-4 with CI-4 PLUS, CI-4, CH-4, CG-4, and CF-4 and can effectively lubricate engines calling for those API Service Categories. When using CJ-4 oil with higher than 15 ppm sulfur fuel, consult the engine manufacturer for service interval.
CI-4	Current	Introduced in 2002. For high-speed, four-stroke engines designed to meet 2004 exhaust emission standards implemented in 2002. CI-4 oils are formulated to sustain engine durability where exhaust gas recirculation (EGR) is used and are intended for use with diesel fuels ranging in sulfur content up to 0.5% weight. Can be used in place of CD, CE, CF-4, CG-4, and CH-4 oils. Some CI-4 oils may also qualify for the CI-4 PLUS designation.
CH-4	Current	Introduced in 1998. For high-speed, four-stroke engines designed to meet 1998 exhaust emission standards. CH-4 oils are specifically compounded for use with diesel fuels ranging in sulfur content up to 0.5% weight. Can be used in place of CD, CE, CF-4, and CG-4 oils.
CG-4	Obsolete	CAUTION: Not suitable for use in most diesel-powered automotive engines built after 2009.
CF-4	Obsolete	CAUTION: Not suitable for use in most diesel-powered automotive engines built after 2009.
CF-2	Obsolete	CAUTION: Not suitable for use in most diesel-powered automotive engines built after 2009. Two-stroke cycle engines may have different lubrication requirements than four-stroke engines, so the manufacturer should be contacted for current lubrication recommendations.
CF	Obsolete	CAUTION: Not suitable for use in most diesel-powered automotive engines built after 2009. Later "C" category oils are usually suitable or preferred for diesel automotive engines for which "CF" oils were specified. Older equipment and/or two-stroke diesel engines, especially those calling for monograde products, may however require "CF" category oil.
CE	Obsolete	CAUTION: Not suitable for use in most diesel-powered automotive engines built after 1994.
CD-II	Obsolete	CAUTION: Not suitable for use in most diesel-powered automotive engines built after 1994.
CD	Obsolete	CAUTION: Not suitable for use in most diesel-powered automotive engines built after 1994.
CC	Obsolete	CAUTION: Not suitable for use in most diesel-powered engines built after 1990.
CB	Obsolete	CAUTION: Not suitable for use in most diesel-powered engines built after 1961.
CA	Obsolete	CAUTION: Not suitable for use in most diesel-powered engines built after 1959.
FA-4	Current	API Service Category FA-4 describes certain XW-30 oils specifically formulated for use in select high-speed four-stroke cycle diesel engines designed to meet 2017 model year on-highway greenhouse gas (GHG) emission standards. These oils are formulated for use in on-highway applications with diesel fuel sulfur content up to 15 ppm (0.0015% by weight). Refer to individual engine manufacturer recommendations regarding compatibility with API FA-4 oils. These oils are blended to a high temperature high shear (HTHS) viscosity range of 2.9cP–3.2cP to assist in reducing GHG emissions. These oils are especially effective at sustaining emission control system durability where particulate filters and other advanced aftertreatment systems are used. API FA-4 oils are designed to provide enhanced protection against oil oxidation, viscosity loss due to shear, and oil aeration as well as protection against catalyst poisoning, particulate filter blocking, engine wear, piston deposits, degradation of low- and high-temperature properties, and soot-related viscosity increase. API FA-4 oils are not interchangeable or backward compatible with API CK-4, CJ-4, CI-4 with CI-4 PLUS, CH-4, and CH-4 oils. Refer to engine manufacturer recommendations to determine if API FA-4 oils are suitable for use. API FA-4 oils are not recommended for use with fuels having greater than 15 ppm sulfur. For fuels with sulfur content greater than 15 ppm, refer to engine manufacturer recommendations.

Category									
Full Synthetic	CITGARD® 1000 Full Synthetic 5W-30 5W-40	JT-8 Synthetic 5W-40	Delvac™ 1 ESP 5W-30 5W-40 Turbo Diesel Truck 5W-40 Delvac™ Extreme 10W-30 15W-40	Rotella® Rotella® T-6 10W-40 5W-40 15W-40 Rotella® T-6 Multi-Vehicle 5W-30	Delco® 400 XLE 10W-30 15W-40 Delco® 400 SDE 10W-30 Delco® ADF 600 10W-30 15W-40	Vector® Long Drain CK-4/ISN 5W-30 Vector® CK-4/ISN 5W-40	Guardol XT™ Full Synthetic 5W-40 Guardol FE® Full Synthetic (FA-4) 5W-30	Premium Blue™ Extreme Full Synthetic 5W-40	Duron UHP Full Synthetic 5W-30 5W-40 Duron UHP ES Full Synthetic 10W-30 10W-40 Duron Advanced Synthetic 5W-30 (FA-4)
Synthetic Blend API CK-4	CITGARD® 800 Synthetic Blend 10W-30 15W-40 CITGARD® 700 Synthetic Blend 10W-30 15W-40	JT-8 Synthetic Blend SHD 10W-30 10W-40 15W-40	Delvac™ Modern CNG/LNG 15W-40 (800 only) Delvac™ 1300 Super 10W-30 15W-40	Rotella® T-5 Synthetic Blend 10W-30 15W-40	Delco® 400 XLE 10W-30 15W-40 Delco® 400 SDE 10W-30 Delco® ADF 600 10W-30 15W-40	Vector® Multi- Fuel CK-4/NG 10W-30 (800 only) 15W-40 (800 only) Vector® Long Drain CK-4 10W-30 Vector® CK-4 15W-40	Guardol ECT® Synthetic Blend 10W-30 15W-40 Guardol Fleet EC™ 10W-30	Premium Blue™ One Solution GEN2 Synthetic Blend 10W-30 (800 only) 15W-40 (800 only) All-Terrain Synthetic Blend 10W-30	Duron SHP Synthetic Blend 10W-30 15W-40
Synthetic Blend API FA-4	CITGARD® 700 MFE Synthetic Blend 10W-30	N/A	Delvac™ Extreme FE 10W-30 Delvac™ Super FE 10W-30	Rotella® T-5 Ultra Synthetic Blend 10W-30	Delco® 400 ZFA 10W30	Vector® 10W-30 FA-4	Guardol FE® Synthetic Blend 10W-30	Premium Blue 8700 FE Synthetic Blend 10W-30	Duron Advanced Synthetic Blend 10W-30
Conventional	CITGARD® 600 10W-30 15W40	N/A	Delvac™ HDEO 10W-30 15W-40	Rotella® T-4 10W-30 15W-40 Rotella® T-4 NG Plus 15W-40 (800 only) Rotella® T-3 Fleet 15W-40	Delco® 400 SDE 15W-40 Ursa Super Plus EC 15W-40	CRB Multi CK-4 10W-30 15W-40	Guardol Eco™ 15W-40 Guardol® NG-D 15W-40 (800 Only) Guardol Fleet EC™ 15W-40	All Terrain 15W-40	Duron HP 15W-40

SAE J300 — SAE VISCOSITY GRADES FOR ENGINE OILS

SAE Viscosity Grade	Low-Temperature Cranking Viscosity ⁽³⁾ (mPa*s) Max	Low-Temperature Pumping Viscosity ⁽⁴⁾ (mPa*s) Max with No Yield Stress	Low-Shear-Rate Kinematic Viscosity ⁽⁵⁾ (mm ² /s) at 100°C Min	Low-Shear-Rate Kinematic Viscosity ⁽⁵⁾ (mm ² /s) at 100°C Max	High-Shear-Rate Kinematic Viscosity ⁽⁵⁾ (mPa*s) at 100°C Min
0W	6200 at -35	60 000 at -40	3.8	—	—
5W	6600 at -30	60 000 at -35	3.8	—	—
10W	7000 at -25	60 000 at -30	4.1	—	—
15W	7000 at -20	60 000 at -25	5.6	—	—
20W	9500 at -15	60 000 at -20	5.6	—	—
25W	13 000 at -10	60 000 at -15	9.3	—	—
8	—	—	4.0	<6.1	1.7
12	—	—	5.0	<7.1	2.0
16	—	—	6.1	<8.2	2.3
20	—	—	6.9	<9.3	2.6
30	—	—	9.3	<12.5	2.9
40	—	—	12.5	<16.3	3.5 (0W-40, 5W-40, and 10W-40 grades)
40	—	—	12.5	<16.3	3.7 (15W-40, 20W-40 and 25W-40, 40 grades)
50	—	—	16.3	<21.9	3.7
60	—	—	21.9	<26.1	3.7

Notes — 1 mPa*s = 1 cP; mm²/s = 1 cSt

- All values, with the exception of the low-temperature cranking viscosity, are critical specifications as defined by ASTM D3244 (see text, Section 7.)
- ASTM D5293: Cranking viscosity — The non-critical specification protocol in ASTM D3244 shall be applied with a P value of 0.95.
- ASTM D4684: Note that the presence of any yield stress detectable by this method constitutes a failure regardless of viscosity.
- ASTM D445
- ASTM D4683, ASTM D4741, ASTM D5481, or CEC L-36-90.

SAE J306 — AUTOMOTIVE GEAR LUBRICANT VISCOSITY CLASSIFICATION

SAE Viscosity Grade	Maximum Temperature for a Viscosity of 150 000 cP, °C ^(1,2)	Kinematic Viscosity at 100°C, cSt ⁽³⁾ Minimum ⁽⁴⁾	Kinematic Viscosity at 100°C, cSt ⁽³⁾ Maximum
70W	-55 ⁽⁵⁾	4.1	—
75W	-40	4.1	—
80W	-26	7.0	—
85W	-12	11.0	—
80	—	7.0	<11.0
85	—	11.0	<13.5
90	—	13.5	<18.5
110	—	18.5	<24.0
140	—	24.0	<32.5
190	—	32.5	<41.0
250	—	41.0	—

NOTE—1cP = 1 mPa*s; 1 cSt = 1mm²/s

- Using ASTM D 2983.
- Additional low-temperature viscosity requirements may be appropriate for fluids intended for use in light duty synchronized manual transmissions. See text.
- Using ASTM D 445.
- Limit must also be met after testing in CEC L-45-A-99. Method C (20 hours.)
- The precision of ATSM Method D2983 has not been established for determinations made at temperatures below -40°C. This fact should be taken into consideration in any producer-consumer relationship.

*SAE J2360 replaced MIL-PRF-2105E as a world-wide standard for Automotive Gear Lubricants for Commercial and Military use. The gear lubricant shall meet the limits for classification described in SAE J306.

PRODUCT INFORMATION



CITGO® TRANSGARD® MULTI-VEHICLE AUTOMATIC TRANSMISSION FLUIDS

CITGO
LUBRICANTS

CITGO TRANSGARD Multi-Vehicle Low and High-Viscosity Automatic Transmission Fluids are formulated with full-synthetic base stocks, combined with a proprietary additive package to provide superior performance of automatic and powershift transmissions. With outstanding wear protection, excellent flow properties, superior oxidation control, thermal stability and application versatility, these fluids help to extend the useful life of the equipment/application.

TRANSGARD Synthetic Multi-Vehicle Low-Viscosity ATF

- Full synthetic formulation with proprietary additive package
- Superior oxidation and thermal stability
- Outstanding anti-wear performance for protection of transmission hardware
- Excellent low-temperature flow properties
- Compatible with a wide range of seal materials to help prevent transmission leaks
- Compatible with a wide range of vehicles – without the need for ATF supplements - enabling inventory optimization

Suitable for use where the following ATF products or specifications are recommended:

Bentley	PY112995PA	Jaguar	02JDE 26444
BMW / Mini	ATF 3+		Jaguar Fluid 8434
	81 22 9 400 272 / 275		JLM 20238
	81 22 9 407 858 / 859		JLM 20292
	83 22 0 024 249 / 359		JLM 21044
	83 22 0 026 922		WSS-M2C922-A1
	83 22 0 142 516	JASO	M315 Class 1A LV
	83 22 0 397 114	Land Rover	AW-1
	83 22 0 402 413		023288 / 023289
	83 22 0 403 248		TYK500050
	83 22 0 403 249		LR0022460 ; LV
	83 22 0 152 426	Maserati	231603
	83 22 2 289 720	MAN	339A
	83 22 2 163 514	Mazda	ATF F-1
	83 22 2 305 396 / 397		ATF FW 6A EL
	83 22 2 355 599		ATF FW 6AX EL
	83 22 7 542 290		JWS 3317
	83 22 7 407 765		ATF M-5, XT-9-QMM5
	83 22 9 407 807		ATF M-III

Chrysler / Dodge / Jeep	+		ATF Type T-IV
	+2	Mitsubishi	Dia Queen J2
	+3		Dia Queen J3
	+4		Dia Queen ATF-PA
	AS68RC ATF		Dia Queen SP, MS991156
	MB 236.12		Dia Queen SP-II
	05127382AA		Dia Queen SP-III
	68043742AA		Dia Queen SP-IV
	68157995AA	Nissan / Infinity	Matic - D
	SP-III		Matic - J
Mercedes / Daimler	MB 236.10		Matic - K
	MB 236.11		Matic - S
	MB 236.12		Matic - W
	MB 236.14	Porsche	000 043 204 41
	MB 236.15		000 043 205 09
	MB 236.41		000 043 205 28
	MB 236.5		000 043 304 00
Ford / Lincoln / Mercury	MERCON LV*		999 917 547 00 (A2)
	MERCON SP	Peugeot / Citroen	Z 000169756
	WSS-M2C922-A1	Renault	Matic D2
	XT-10-QLV (LV)	Saab	Type - IV (JWS 3309)
	XT-2-QDX (M)		93 165 147 - AW-1
	XT-2-QSM (Syn)	Subaru	ATF HP
	XT-5-QM or -DM (V)		K0140Y0700
	XT-6-QSP or -DSP (SP)	Suzuki	ATF 3314
	XT-8-QAW (Premium)		ATF 3317
	XT-9-QMM5 (FRN5)	Toyota / Lexus / Scion	Scion FZ
GM / GMC / Opel / Saturn	AW-1		ATF Type WS (JWS 3324)
	DEXRON II		ATF Type D-II
	DEXRON IID		ATF Type T
	DEXRON IIE		ATF Type T-III
	DEXRON III G		ATF Type T-IV
	DEXRON III H	Volkswagen / Audi	G 052 025 A2
	DEXRON VI*		G 052 055
	19 40 700		G 052 162 (-A1, -A2)
	19 40 767		G 052 533
	21005966		G 052 990 (A2)
	22717466		G 055 005 (-A, A2)
	88863400		G 055 025 (A2)
	88863401		G 055 540 (A2)
	88900925		G 060 162 (A1, A2, A6)

	9986195		G US 000 162
	T-IV	Volvo	AW1
	Type A Suffix A		1161521
Honda / Acura	DW-1		1161540 / 1161640
	ATF Z-1 (except in CVTs)		31256774, 31256775
	ATF Type 3.0 (08200-916-A)	ZF	ZF Lifeguardfluid 6
	ATF Type 3.1 (08200-9017)		ZF Lifeguardfluid 8
Hyundai / Kia	ATF Red-1K		ZF Lifeguardfluid 9
	JWS-3309T-4		TE-ML 11A
	NWS-9638 T-5		TE-ML 11b
	040000C90SG		
	UM040 CH20 Red-1		
	SP-II		
	SP-III		
	SP-IV / SPH-IV		
	SP-IV-M		
	SP-IV-RR		
Idemitsu	ATF K17		
Isuzu	08200-9001		

* California law prohibits manufacturers of multi-vehicle ATF from recommending products in certain applications where the viscometrics do not match those of the official OEM specification. CITGO does not recommend the use of TRANSGARD Multi-Vehicle High-Viscosity ATF in these applications in California.

Do not use CITGO TRANSGARD Synthetic Multi-Vehicle Low-Viscosity ATF in vehicles calling for Type F, CVTs and DCT.

Typical Properties for CITGO TRANSGARD Synthetic Multi-Vehicle Low-Viscosity ATF

Material Code	633137001
Gravity, ASTM D287, °API	35.7
Density, Pounds Per Gallon	7.05
Flash Point, P.M. D93, °C	220
Viscosity ASTM D445	
cSt at 40°C	28
cSt at 100°C	5.8
Viscosity Index, ASTM D2270	154
Brookfield Viscosity @ -40°C	9,230
Color	Red

PRODUCT INFORMATION



CITGO
LUBRICANTS

TRANSGARD Synthetic Multi-Vehicle High-Viscosity ATF

- Full synthetic formulation with proprietary additive package
- Suitable for use in transmissions requiring Ford MERCON® V, Ford MERCON (obsolete), General Motors DEXRON® -IIIH (obsolete), and Allison C-4 type fluids
- Superior oxidation and thermal stability
- Outstanding anti-wear performance for protection of transmission hardware
- Excellent high-temperature flow properties
- Compatible with a wide range of seal materials to help prevent transmission leaks
- Compatible with a wide range of vehicles – without the need for ATF supplements - enabling inventory optimization

Suitable for use where the following ATF products or specifications are recommended:

BMW / Mini	81 22 9 400 272 / 275	Jaguar	02JDE 26444
	81 22 9 407 858 / 859		Jaguar Fluid 8434
	83 22 0 024 249 / 359		JLM 20238
	83 22 0 026 922		JLM 20292
	83 22 0 402 413		JLM 21044
	83 22 0 403 248		WSS-M2C922-A1
	83 22 0 403 249	JASO	M315 Class 1A
	83 22 7 542 290	MAN	339A
	83 22 7 407 765	Mazda	ATF F-1
	83 22 9 407 807		JWS 3317
Chrysler / Dodge / Jeep	+		ATF M-5, XT-9-QMM5
	+2		ATF M-III
	+3		ATF Type T-IV
	+4	Mitsubishi	Dia Queen J2
	AS68RC ATF		Dia Queen SP, MS991156
	SP-III		Dia Queen SP-II
Mercedes / Daimler	MB 236.10		Dia Queen SP-III
	MB 236.11	Nissan / Infinity	Matic - D
	MB 236.5		Matic - J
Ford / Lincoln / Mercury	WSS-M2C922-A1		Matic - K
	XT-2-QDX (M)	Porsche	000 043 204 41
	XT-2-QSM (Syn)		000 043 205 09
	XT-5-QM or -DM (V)		000 043 205 28
	XT-8-QAW (Premium)		999 917 547 00 (A2)
	XT-9-QMM5 (FRN5)	Peugeot / Citroen	Z 000169756

GM / GMC / Opel / Saturn	DEXRON II	Renault	Matic D2
	DEXRON IID	Saab	Type - IV (JWS 3309)
	DEXRON IIE	Subaru	ATF HP
	DEXRON IIIG		K0140Y0700
	DEXRON IIHH	Suzuki	ATF 3314
	19 40 700		ATF 3317
	19 40 767	Toyota / Lexus / Scion	ATF Type D-II
	21005966		ATF Type T
	22717466		ATF Type T-III
	88900925		ATF Type T-IV
	9986195	Volkswagen / Audi	G 052 025 A2
	T-IV		G 052 055
	Type A Suffix A		G 052 162 (-A1, -A2)
Honda / Acura	ATF Z-1 (except in CVTs)		G 052 990 (A2)
Hyundai / Kia	ATF Red-1K		G 055 025 (A2)
	JWS-3309 T-4		G US 000 162
	UM040 CH20 Red-1	Volvo	1161521
	SP-II		1161540 / 1161640
	SP-III	ZF	TE-ML 11A
Idemitsu	ATF K17		TE-ML 11b
Isuzu	08200-9001		

Do not use in vehicles calling for Type F, DEXRON VI, MERCON SP, MERCON LV, Toyota/Lexus WS, CVTs and DCTs.

Typical Properties for CITGO TRANSGARD Multi-Vehicle High-Viscosity ATF:

Material Code	633131001
Viscosity	
cSt at 40°C	35
cSt at 100°C	6.7
Viscosity Index	153
Specific Gravity @ 60°F	0.851
Pour Point ASTM D97, °F (°C)	-49 (-45)
Brookfield Viscosity @ -40°C, cP	16,280
Appearance	Red

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Always refer to equipment owner's manual for proper lubricant recommendation.

OEMs have not evaluated nor approved this product in the application where "Suitable for Use" has been identified.

CITGO recommends checking your automatic transmission fluid levels on a regular interval as part of an effective preventive maintenance program. Always follow OEM recommendations for your fluid interval replacement. Severe driving conditions such as sustained heavy traffic and pulling heavy loads may warrant frequent changes of automatic transmission fluid.

The term “synthetic lubricant” can apply to a wide range of non-petroleum derived materials used as lubricant base stocks. The most common are synthetic hydrocarbons, the polyalphaolefins, or PAOs. These oils are very similar chemically to petroleum base oils (mineral oils), but because they are synthesized from specific starting materials, they are typically very uniform in molecular size and shape and do not contain the impurities often found in mineral oils, including wax molecules. PAOs are better at low temperature due to the absence of wax (low pour point) and better at high temperature due to superior thermal and oxidative stability. They also have higher viscosity indexes than mineral oils, making them applicable over a wider range of temperatures. Because PAOs are so commonly used in lubricant formulations, the API gave them their own base oil group – API Group IV.

All other synthetic lubricant base stocks fall into another API base oil group – Group V. Those materials include various types of esters, polyalkylene glycols (PAGs), alkylated aromatics, etc. Each type of synthetic fluid has advantages and disadvantages. One of the biggest challenges is compatibility. Compatibility not only between the various fluid types, but also compatibility with seals and other elastomeric or plastic components, compatibility with paints and coatings, and even sometimes compatibility with the metallic parts being lubricated. In general, mineral oils, PAOs, and most esters are miscible and compatible. However, most PAGs are not compatible with mineral oils or PAOs, and mixing can have disastrous results. Esters can be very aggressive towards elastomers and plastics as well as paints and coatings. The use of an ester based lubricant may require that the seals in the equipment be changed to a more resistant elastomer. PAGs can also be aggressive towards seals and paints, and special elastomers may be needed.

The use of synthetic lubricants is often done to extend the oil change interval. If the oil change interval is based on oil thermal or oxidative degradation of the oil, then the use of a synthetic lubricant is likely justified, and will lower overall operating cost. However, if the oil change interval is based on contamination of the lubricant with water, wear metals, environmental contaminants, etc., then using a synthetic lubricant will likely not extend the service interval. In fact, contamination of certain types of esters with water can result in hydrolysis, the breakdown of the ester into the organic acid and alcohol components from which it was made. That breakdown can result in an increase in acid number, component corrosion, viscosity loss, and other negative impacts.

Selecting a synthetic lubricant can be a daunting task. Many factors must be considered when selecting the appropriate type of synthetic fluid for a specific application. As stated above, PAO based products are the most common synthetic lubricants. Many PAO based lubricants also contain some type of ester fluid to improve the solubility of additives in the finished lubricant. These PAO/ester products find service in a wide range of applications, ranging from industrial gear oils to compressor fluids. Ester based synthetic fluids are used in some air compressor fluids where the discharge temperature is high and the solvency of the ester fluid helps to reduce deposits and keep critical surfaces clean. PAG fluids are often used in compressor fluids for natural gas or other hydrocarbon gases. PAG fluids are more resistant to dilution by the hydrocarbon gases, and tend to maintain viscosity better under operating conditions.

Factors to take into consideration when selecting a synthetic lubricant include:

Viscosity grade and viscosity index – Most synthetic lubricants have a higher viscosity index compared to mineral oil based products. It may be possible to use a lower viscosity grade synthetic that maintains viscosity better at higher temperatures.

Thermal and oxidative stability – If the lubricant is to be used at high temperature, a product with excellent thermal and oxidative stability should be selected.

Low temperature properties – If the synthetic lubricant is being considered for low temperature applications, the pour point of the product must be considered.

Flammability – Some synthetic lubricants offer reduced flammability, due to higher flash and fire points compared to mineral oils of similar viscosity grade.

Lower tendency to form deposits – Due to their superior solvency, ester based fluids tend to remove existing deposits and reduce the formation of new deposits. PAG based fluids are also very resistant to the formation of deposits. PAO based fluids can actually have a higher deposit formation tendency due to their inherently poorer solvency compared to many other types of lubricants.

Material compatibility – Compatibility with elastomers and plastics, paints and coatings, and the metals being lubricated must be considered when selecting a synthetic lubricant.

Adverse reactions – Reactions such as hydrolysis of ester based fluids must be considered when selecting a synthetic lubricant.

Miscibility – Some synthetic fluids are not miscible with mineral oils or other synthetics, making a change more difficult. A proper change-over procedure must be followed in those cases.

Cost – The cost of the synthetic lubricant must be balanced against the potential for a longer oil change interval or improved operating conditions of the equipment. Synthetic lubricants are often well worth the additional initial cost.

Compatibility of Common Elastomers and Plastics with CITGO Products

Elastomer/Plastic	Abbreviation	Trade Names	Mineral Oil	Synthetic Hydrocarbon	Synthetic Ester	Polyalkylene Glycol	Water/Glycol
Polycrylate	ACM	Example Products	HyDurance AW, Pacemaker T, EP Compound	CITGEAR Synthetic EP, CITGEAR Synthetic HT, CompressorGard PAO	CompressorGard DE	CompressorGard PAG, CITGEAR Synthetic PAG	FR WG-40XD, Glycol FR-5046HP
Ethylene-Acrylic	AEM	HyTemp	Very Good	Good		Good	
Ethylene-Propylene-Diene Monomer	EPDM	Vamac	Good	Poor	Poor	Excellent to Good	Recommended
Fluoroelastomers	FKM, FPM	Duttral, Nordel, Vistalon	Poor				
Nitrile (Acrylonitrile-Butadiene)	NBR, XNBR, HNBR	Viton, Fluorel	Very Good	Very Good	Very Good	Excellent to Good	Suitable
Perfluoroelastomers	FFKM	NBR, Purbunan, Buna-N, Chemigum, Hycar, Paracril, Nipol, Krynac, Europrene	Good	Good	Poor to Good	Fair	Suitable
Polychloroprene	CR	Kaltrez, Paraffluor	Very Good	Very Good			
Silicones	MQ, VMQ, PMQ, FVMQ	Neoprene	Fair	Fair to Good	Poor	Good	Suitable
Styrene-Butadiene	SBR	VMQ	Poor to Good	Poor to Good	Poor to Fair	Good to Excellent	
Polyester		SBR, Buna-S	Poor	Poor to Good	Poor	Poor	Suitable
Polytetrafluoroethylene	PTFE		Good	Good	Poor to Fair		
Polyamide	PA	Teflon	Very Good	Very Good	Very Good		Suitable
Polycarbonate	PC	Nylon, Zytel	Poor to Good	Poor to Good	Poor		
Natural Rubber	NR		Good				
Polyethylene	PE (LDPE, HDPE)		Poor to Fair	Poor to Fair	Poor		Suitable
Polypropylene	PP		Good	Good	Good		
Butyl Rubber	IIR		Good to Poor				
Polyvinyl Chloride	PVC		Very Poor to Poor	Very Poor to Poor	Poor to Fair		
Chlorosulfonated Polyethylene	CSPE, CSM	PVC	Poor to Good	Poor to Good	Poor		
Polyether Ester	TPC-ET	Hypalon	Fair				
Polyurethane	PU	Hyrel	Good				
Polyoxymethylene, Polyacetal, acetal resin, polytrioxane, paraformaldehyde, and paraformaldehyde	POM		Good to Fair				
Fluorosilicone	FSI	Delrin, Kapial, Celcon, Hostaform and Ultraform	Excellent - Good				
Ethylene-Propylene Rubber	EPR		Good			Excellent	Good
Fluorovinyl Methyl Silioxane	FVMQ	Fluorosilicone	Poor	Poor			
			Good to Excellent				

Compressor OEM Fluid Cross-reference

OEM	Product Name	CITGO Product Name	Mat. Code	Competitive Product Co
Atlas Copco	Atlas Copco HD Roto Fluid	CompressorGard PAO 46	632532001	Mineral Special Processed Oil, ISO 46
	Atlas Copco HD Roto Fluid Plus	CompressorGard PAO 46	632532001	Group III, ISO 46
	Atlas Copco Paroil M	CompressorGard PAO 46	632532001	Mineral Oil, anti-wear, ISO 46
	Atlas Copco Paroil S 46	CompressorGard PAO 46	632532001	PAO, ISO 46
	Atlas Copco Paroil S 68	CompressorGard PAO 68	632533001	PAO, ISO 68
	Atlas Copco Roto-H Plus	CompressorGard PAO 32	632531001	Mineral oil, ISO 32
	Atlas Copco Roto-Inject	CompressorGard PAO 46	632532001	Ashless, AW mineral oil, ISO 46
	Atlas Copco Roto Xtend Duty Fluid	CompressorGard PAO 46	632532001	PAO, ISO 46
Atlas Copco Roto Xtreme Duty Fluid	No Product		Polyol Ester, ISO 46	
Champion	RotorLub 8000	CompressorGard PAO 46	632532001	PAO, ISO 46
	RotorLub 4000FG	Clarion CompressorGard 46	632541009	PAO, ISO 46, Food Grade
	RotorLub 4000	CompressorGard PAO 46	632532001	Mineral Oil, ISO 46
	CompAir CN 300	No Product		Naphthenic mineral oil, ISO 100
Compair/Kellogg	CompAir CS 100	CompressorGard DE 32	632523001	Diester, ISO 32
	CompAir CS 200	CompressorGard DE 68	632525001	Diester, ISO 68
	CompAir CS 300	CompressorGard DE 100	632526001	Diester, ISO 100
	CompAir CS 400	CompressorGard DE 150	632528001	Diester, ISO 150
	CompAir Hydrovane 2000	CompressorGard DE 100	632526001	Rotary compressor mineral oil, ISO 100; [Kellogg-American (A CompAir Co.) recommends an ISO 100 diester for Hydrovane Rotary Vane 3 HP to 50 HP comp. - check if mineral oil was previously used; drain and flushing recommended]
Compair/LeROI	CompAir LeRoi Complube 10	CompressorGard PAO 46	632532001	PAO/Polyol ester mixture, ISO 46
	CompAir LeRoi RVL 5	CompressorGard PAO 100		PAO/ester, ISO 100
	CompAir LeRoi SSL-46 Plus	CompressorGard PAO 46	632532001	PAO, ISO 46
	CompAir LeRoi SSL-50	CompressorGard PAO 46	632532001	Semi-synthetic; PAO Mineral Oil blend, ISO 46

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Compressor OEM Fluid Cross-reference - (Cont'd.)

OEM	Product Name	CITGO Product Name	Mat. Code	Competitive Product Co
Gardner Denver	Gardner Denver Aeon 500	CompressorGard PAO 100	632534001	Mineral oil, ISO 100 - for reciprocating compressors
	Gardner Denver Aeon 800	CompressorGard PAO 46	632532001	R&O, Mineral oil, ISO 46 - for rotary screw compressors
Ingersoll-Rand	Gardner Denver Aeon 2000	CompressorGard PAO 46	632532001	R&O Mineral oil, ISO 46
	Gardner Denver Aeon 4000	CompressorGard PAO 46	632532001	Mineral/synthetic blend, ISO 46
	Gardner Denver Aeon 5000	CompressorGard DE 68	632525001	Diester, ISO 68 - for reciprocating compressors
	Gardner Denver Aeon 6000 FG	Clarion CompressorGard 46	632541009	USDA H1, FDA 21CFR 178.3570, PAO, ISO 46
	Gardner Denver Aeon 9000 SP	CompressorGard PAO 46	632532001	PAO, ISO 46
	Ingersoll-Rand All Season Select	CompressorGard DE 100	632526001	Diester, ISO 100
	Ingersoll-Rand OCV-Zero Fluid	No Product		ISO VG 15, diester fluid
	Ingersoll-Rand Original SSR Coolant	CompressorGard DE 68	632525001	Diester, ISO 68, discontinued product
	Ingersoll-Rand Pro-Tec	CompressorGard PAO 46 (stationary compressor)	632532001	
	Ingersoll-Rand Pro-Tec	CITGARD 600 10W (portable compressor)	622610001	
Ingersoll-Rand Rotalube 1000	CompressorGard PAO 46	632532001	Mineral oil, ISO 46	
Ingersoll-Rand SL-200	HyDurance AW NZ 46	633616001	For Oil-Free Sierra Compressors, Mineral oil, SAE 20, ISO 46, Ashless Hydraulic	
Ingersoll-Rand SSR Ultra Coolant	CompressorGard GE 46	632591001	Polyalkylene glycol/ester, 56.2 cSt at 40C	
Ingersoll-Rand SSR Ultra Plus Coolant	CompressorGard GE 32	632580001	Polyolester, ISO 32	
Ingersoll-Rand T-30 Select	CompressorGard DE 150	632528001	Diester, ISO 150	
Ingersoll-Rand Techtrial Gold	CompressorGard GE 32	632580001	Polyalkylene glycol/polyol ester, ISO 32	
Ingersoll-Rand XL-300	CompressorGard PAO 150	632535001	R&O Mineral oil, ISO 150, discontinued product	
Ingersoll-Rand XL-700	CompressorGard DE 100	632526001	Diester, ISO 100	
Ingersoll-Rand XL-740 HT	CompressorGard DE 150	632528001	Diester, ISO 150	

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Compressor OEM Fluid Cross-reference - (Cont'd.)

OEM	Product Name	CITGO Product Name	Mat. Code	Competitive Product Co
Kaeser	Kaeser Sigma 4000 M-100	Pacemaker T-115, CompressorGard PAO 100	633745001, 632534001	Mineral/synthetic blend (5-10% polyol ester), ISO 100
	Kaeser Sigma 4000 M-150	Pacemaker T-150, CompressorGard PAO 150	633750001, 632535001	Mineral/synthetic blend (5-10% polyol ester), ISO 150
	Kaeser Sigma 4000 M-460	Pacemaker T-46, CompressorGard PAO 46	633720001, 632532001	Mineral/synthetic blend, ISO 46
	Kaeser Sigma 8000 S-100	CompressorGard DE 100	632526001	Diester, ISO 100
	Kaeser Sigma 8000 S-150	CompressorGard DE 150	632528001	Diester, ISO 150
	Kaeser Sigma 8000 S-320	CompressorGard PAO 32	632531001	PAO, ISO 32
	Kaeser Sigma 8000 S-460	CompressorGard PAO 46	632532001	PAO, ISO 46
	Kaeser Sigma 8000 S-680	CompressorGard PAO 68	632533001	PAO, ISO 68
	Leroi SSL-32	CompressorGard PAO 32	632531001	Mineral Oil, not sure what vis grade, no web information available, cross reference info conflict
	Leroi SSL-46	CompressorGard PAO 46	632532001	PAO ISO /mineral oil blend, 35 centistokes @ 40C
Quincy	Leroi SSL-50	CompressorGard PAO 46	632532001	PAO/mineral oil blend, 37 centistokes @ 40C
	Leroi SSL-68 HT	No Product		Polyol ester, ISO 68
	Quincy Quin-Cip 100	CompressorGard PAO 100	632534001	R&O Mineral oil for reciprocating compressors, ISO 100 - small recip, discharge less than 150°C
	Quincy Quin-Cip 32	CompressorGard PAO 32	632531001	R&O Mineral oil for reciprocating compressors, ISO 32 - small recip, discharge less than 150°C
	Quincy Quin-Cip 68	CompressorGard PAO 68	632533001	R&O Mineral oil for reciprocating compressors, ISO 68 - small recip, discharge less than 150°C
	Quincy Quin-Syn	CompressorGard PAO 46	632532001	PAO, ISO 46
	Quincy Quin-Syn F	Clarion CompressorGard 46	632541001	PAO, ISO 46, H-1
	Quincy Quin-Syn HP	CompressorGard GE 46	632591001	Polyol ester, ISO 46
	Quincy Quin-Syn PG	CompressorGard GE 46	632591001	Polyalkylene glycol/ester, ISO 46
	Quincy Quin-Syn Plus	Clarion CompressorGard 46	632541001	Food Grade PAO, ISO 46
Quincy Quin-Syn IV	CompressorGard PAO 46	632532001	Mineral oil/synthetic PAO blend, ISO 46	
Quincy Quin-Syn XP	No Product		Polyol ester, ISO 68	

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Compressor OEM Fluid Cross-reference - (Cont'd.)

OEM	Product Name	CITGO Product Name	Mat. Code	Competitive Product Co
Sullair	Sullair 24KT	No Product		Silicon, ISO 32
	Sullair AWF	CITGARD 600 10W	622610001	Mineral oil, extends warranty to 5 years, 5W-20
	Sullair AWF	CompressorGard PAO 46	632532001	Mineral oil, extends warranty to 5 years, 5W-20
	Sullair SRF 1/4000	CompressorGard PAO 46	632532001	Paraffinic Mineral oil viscosity 30-40 cSt at 40C
	Sullair SRF II/8000	CompressorGard PAO 46	632532001	Paraffinic Mineral oil viscosity 35.6 cSt at 40C
	Sullair Sullube	CompressorGard GE 32	632580001	Polyalkylene glycol/ester blend, SAE 5W-20
	Sullair Sullube 32	CompressorGard GE 32	632580001	Polyalkylene glycol/ester blend, ISO 32, renamed Sullube
	Sullair Sullube 60	No Product		Polyalkylene glycol/ester blend, ISO 68
	Sullivan-Palatek AFX 32	CompressorGard GE 46	632591001	Polyol Ester blend, ISO 46
	Sullivan-Palatek Palasyn 45	CompressorGard PAO 46	632532001	PAO, ISO 46
	Sullivan-Palatek Pallube 32	CompressorGard GE 32	632580001	Polyalkylene glycol/ester blend, ISO 32

Before making any recommendations or cross reference recommendations for CITGO products, it is strongly suggested that the requirements of the specific compressor application be reviewed. In some cases, the wrong product may be in service, thus crossing the product to an applicable CITGO product may lead to future compressor problems or even compressor failures.

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CITGO Technical Bulletin

Understanding the ISO 4406 Lubricant Cleanliness Rating System



It is estimated that 70-80% of hydraulic component wear can be traced to solid particle contamination. The most common source of these particles is wear debris from pumps, valves, cylinder rods, the sticking of valves, and oxidation. Particulate contamination interferes with a lubricant's ability to provide friction and wear protection. Controlling the level of particulates in a lubricant will improve a system's performance and reduce downtime. A primary step toward gaining control over wear problems is to determine how many particles are present in the lubricant and of what size.

The most widely used method to represent fluid cleanliness is the ISO 4406 Code Level of the ISO Cleanliness Rating System. This method of identifying the level of contaminants in a fluid uses a three-digit X/Y/Z code where X represents particles larger than 4 μm , Y represents particles larger than 6 μm , and Z represents particles larger than 14 μm . Using Chart 1 you can determine the cleanliness level of a given fluid. If, for example, a fluid had X (>4 μm) = 1895 particles per milliliter, Y (>6 μm) = 152 particles per milliliter, and Z (>14 μm) = 14 particles per milliliter, the fluid would have an ISO 4406 cleanliness rating of 18/14/11. The range between the upper and lower limits for each code number is listed in Chart 1 and limits increase per code by a factor of two. This means that for each increase of one ISO code number, the number of particles approximately doubles. The lower the code numbers, the cleaner the fluid. Note that it is common for certain applications to refer to ISO cleanliness results with only two codes. In this case, the number of particles at a size of 4 μm is irrelevant, and the two-number code refers to the number of particles larger than 6 μm and 14 μm , respectively.

Chart 2 illustrates some recommended cleanliness code levels for selected types of hydraulic components. Some caution should be taken when extracting samples for particle counting of any fluid. The sample should be as representative of the entire system as possible, and the sample container should be extremely clean (preferably meeting the ISO 3722 'super clean' standard). Many containers are certified clean but are not clean from solid particulate; they are biologically clean (sterile), but may contain many particles. ISO Standard 3722 should be followed for certifying bottle cleanliness.

CHART 1 ISO 4406 Code Levels		
ISO Code	Particle count range (per ml)	
	Minimum (included)	Minimum (excluded)
1	0.01	0.02
2	0.02	0.04
3	0.04	0.08
4	0.08	0.16
5	0.16	0.32
6	0.32	0.64
7	0.64	1.3
8	1.3	2.5
9	2.5	5.0
10	5.0	10
11	10	20
12	20	40
13	40	80
14	80	160
15	160	320
16	320	640
17	640	1300
18	1300	2500
19	2500	5000
20	5000	10,000
21	10,000	20,000
22	20,000	40,000
23	40,000	80,000
24	80,000	160,000
25	160,000	320,000
26	320,000	640,000
27	640,000	1,300,000
28	1,300,000	2,500,000

Chart 2 Recommended Cleanliness Code Levels

Pump Type	PRESSURE, PSI		
	<2000	2000-3000	>3000
Fixed gear	20/18/15	19/17/15	18/16/13
Fixed vane	20/18/15	19/17/14	18/16/13
Fixed piston	19/17/15	18/16/14	17/15/13
Variable vane	18/16/14	17/15/13	-
Variable piston	18/16/14	17/15/13	16/14/12

Valve Type	PRESSURE, PSI	
	2000	>3000
Directional (solenoid)	20/18/15	19/17/14
Pressure control (modulating)	19/17/14	18/16/13
Flow control (standard)	19/17/14	19/17/14
Check	20/18/15	20/18/15
Cartridge (screw-in)	18/16/13	17/15/12
Cartridge (slip-in)	20/18/15	19/17/14
Proportional directional (throttle)	18/16/13	17/15/12
Proportional pressure control	18/16/13	17/15/12
Proportional cartridge	18/16/13	17/15/12
Servo	16/14/11	15/13/10

Actuator Type	PRESSURE, PSI		
	1000	2000	>3000
Cylinder	20/18/15	20/18/15	20/18/15
Vane motor	20/18/15	19/17/14	18/16/13
Axial piston motor	19/17/14	18/16/13	17/15/12
Gear motor	21/19/17	20/18/15	19/17/14
Radial piston motor	20/18/14	19/17/13	18/16/13

Measurement of particle contamination within a lubricant is usually performed by light-detecting automatic particle counters. These counters use the properties of light to perform counts and are highly sensitive to sample preparation. However, even using proper sample preparation techniques, particle counters can detect phantom particles that cannot be removed by filtration. This results in high particle detection that is a function of the formulation of the lubricant itself, and not of the cleanliness of the fluid.

It is important to note that there are other methods of performing particle counting that are not susceptible to phantom counts, so there is always a check that can be performed against light detecting automatic particle counters should results come into question. The reason for the popularity of light-detecting automatic particle counters is the speed of the test compared to more labor-intensive, yet more accurate, testing.

Light-detecting particle counters use a beam of light to quantify the contamination level of fluids; , when particles block the path of the beam of light, a count is made. However, the path of the light beam can be disturbed by means other than particles. For example, water droplets in oil will deflect the light beam, and will be counted as a particle and increase the ISO code. Water, although a contaminant of the lubricant, is not a particulate in the traditional sense as it cannot be captured and removed by filtering.

Test results indicate that silicone antifoam agent produces phantom counts in light-detecting particle counters. Silicone antifoams work by forming an insoluble micelle within air bubble walls that causes the thinning and collapse of the air bubble wall. These insoluble micelles are what the particle counter is reading as particles. Much like water, these micelles will not be collected by a filter and reform after passing through a filter. Silicone antifoams are common in lubricants, so consideration must be given before ISO cleanliness testing can be put into perspective.

Knowing that phantom counts can occur can save you loads of frustration and money attempting to filter lubricants that are actually clean. CITGO's technical help team can always assist in interpreting ISO cleanliness results, and help to explain whether results are due to cleanliness or due to formulation. Please contact the CITGO Lubricant Product Answer Line at 1-800-248-4684 or lubeshelp@citgo.com for help interpreting ISO cleanliness, or for further explanation.

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CITGO Technical Bulletin

Use of Fire Resistant Hydraulic Fluids



The use of industrial fluid power or hydraulics has increased substantially – not only in U.S. industry but also in worldwide industry. In addition to this increase in fluid power usage, we have seen some rather drastic changes in the operating conditions of industrial hydraulic circuitry.

Increased production demands, larger work pieces, and higher output machinery have all had the net effect of elevating hydraulic system operating pressures in most industries. This, in itself, has imposed greater performance demands on hydraulic fluids. Fluids that were designed to perform at 1000 psi cannot adequately satisfy the requirements of today's pressures of 2000 psi and higher.

With these changes in hydraulic system conditions, we also find a substantial increase in the volumes of fire resistant fluids being employed by industry. This has been brought about, in part, by increased regulations at all levels of government to insure safe working conditions. In addition to these regulatory codes, management has a keen awareness of the devastating cost resulting from plant fires. As system pressures go higher, the chance of hydraulic line rupture increases and the potential for fire becomes greater. Therefore, a modern fire resistant hydraulic fluid must offer the consumer not only maximum fire protection, but must also give him the optimum lubrication and wear protection necessary for pumps and other hydraulic hardware running at these elevated pressures.

CITGO FR WG-40XD[®] and FR-5046HP are water-glycol fire resistant fluids developed and designed specifically to operate in high system pressures in the 2000 and 5000 psi range respectively. CITGO Glycol FR-5046HP is specifically formulated to meet the high pressure requirements for mobile equipment and meets the specification for Caterpillar where a water-glycol product is required. These unique formulations contain more than a sufficient amount of water to prevent the propagation of fires in the event of a hydraulic line rupture near an ignition source. Moreover, CITGO Glycol FR fluids have all the necessary lubrication and anti-wear properties required of a hydraulic fluid for service in high-pressure, high-output systems. Other advantages include:

- Excellent corrosion protection – both liquid and vapor phase – to the metals commonly used in hydraulic systems.
- The superior heat transfer characteristics of water.
- The viscosity-temperature properties, combined with a very low pour point, prevent or minimize cavitation and cold start pump wear problems associated with fluids having poorer viscosity-temperature properties.
- Compatible with most conventional seals, gaskets, and O-rings.
- Can be satisfactorily mixed with other water-glycol type fluids.
- Resistant to oxidation and chemical breakdown.
- Will not separate with normal use and storage.

FIRE RESISTANCE

Fire resistance is imparted to CITGO FR WG-40XD® and FR-5046HP through the water content which creates a snuffing blanket of steam if the fluid comes in contact with an ignition source. Because of the water content, these products have the ability to prevent flame propagation when a fire occurs. CITGO FR WG-40XD® and FR-5046HP have been tested and approved by Factory Mutual Research.

In order to insure continued fire resistance, the water content of CITGO Glycol FR fluids must be maintained above 35%. This is true of any water-glycol fluid. In order to insure against excessive water evaporation in open hydraulic systems, operating temperatures should be maintained as low as possible and should not exceed 150°F (65.5°C).

Water control methods are provided in this bulletin for the addition of water to a particular fluid in service.

HEAT TRANSFER

Water and water containing compositions such as CITGO Glycol FR fluids are superior heat transfer media. Water-glycol fluids have marked advantages over mineral oils or synthetic FR fluids in this respect.

SHEAR STABILITY

CITGO Glycol FR fluids contain water-soluble polymers which give the fluids their viscosity properties. The close tolerances in hydraulic pumps and other hardware have a tendency to break down certain polymers. This action is mechanical shearing. The special polymers used in formulating CITGO Glycol FR fluids are completely resistant to this mechanical shearing, and the fluids will not undergo viscosity change due to shearing.

VISCOSITY INDEX

The viscosity index of a fluid defines the degree to which the fluid resists thinning out at elevated temperatures. In the viscosity index rating system, the lower the VI number of an oil or fluid, the greater the differential between the fluid's viscosity measured at 100°F and its viscosity measured at 210°F. Therefore, fluids with high VI numbers show a much lower viscosity difference than low VI fluids.

CITGO Glycol FR fluids have viscosity indexes of 180 and 210 respectively when tested using the ASTM D2270 procedure. Shown below is a comparison between CITGO Glycol FR fluids and other commonly used hydraulic fluids.

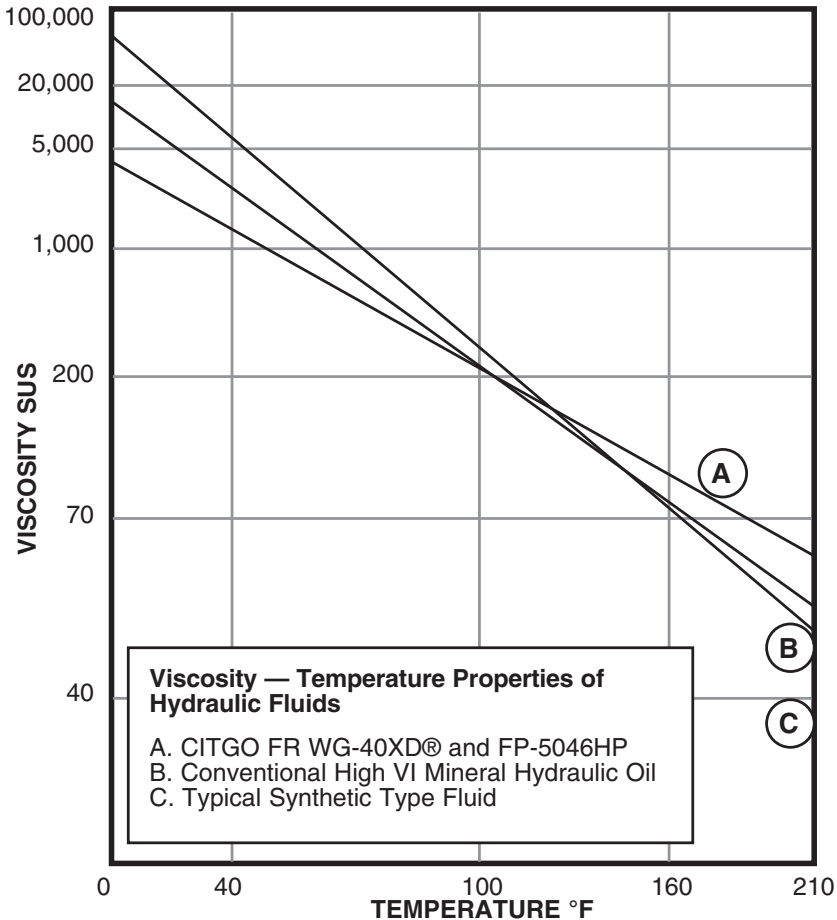
Fluid Type	Viscosity Index
R & O Oil	95
A/W Hydraulic Oil	95
Automatic Transmission Fluid	160
10W-30 Motor Oil	140
Synthetic FR Fluid	70
CITGO FR WG-40XD®	180
CITGO Glycol FR-5046HP	>210

The temperature-viscosity relationship of CITGO Glycol FR fluids assures the user of minimum fluid thin-out at operating temperatures, hence, better lubricity.

POUR POINT

The pour point of a fluid is the measured temperature at which the fluid will no longer flow under prescribed test conditions. CITGO Glycol FR fluids have pour points below -40°F. In addition, these fluids can be repeatedly frozen and thawed without any loss whatsoever in homogeneity. The excellent low-temperature flow properties of CITGO Glycol FR fluids, coupled with high viscosity indexes, offer the user the maximum in fluid performance over a wide temperature range. The excellent low-temperature properties minimize pump problems on cold start and the high VI assures adequate viscosity and lubricity at running conditions.

The following chart illustrates the fluidity characteristics of CITGO FR WG-40XD® and FR-5046HP compared with other fluid types.



CORROSION PROTECTION

CITGO Glycol FR fluids are formulated with special corrosion inhibitors to provide corrosion protection in both the liquid phase and the vapor phase. Vapor phase protection is especially desirable when machines do not operate around the clock or are subject to short- and long-term shutdowns. CITGO Glycol FR fluids provide corrosion protection to aluminum, copper, brass, cast iron, steel and other metals commonly used in hydraulic circuitry.

LUBRICITY CHARACTERISTICS

A high level of anti-wear protection is built into CITGO Glycol FR fluids. This permits usage in hydraulic systems operating up to 5000 psi (with FR-5046HP), providing the hydraulic pumps are designed to operate on water-glycol fluids. Prior to converting any system to a water-glycol fluid from a conventional or synthetic fluid, the equipment manufacturer should always be consulted to make sure that the circuit hardware is suitable for water-glycol fluids.

The excellent anti-wear properties of CITGO Glycol FR fluids have been well demonstrated in actual field performance and in laboratory testing. The fluids meet all specifications of U.S. Steel Requirement No. 171, including the ASTM D2282 2000 psi pump test. The following chart compares CITGO Glycol FR fluids to other hydraulic fluids in this high pump. CITGO Glycol FR fluids offer the maximum wear protection available in a water-glycol hydraulic fluid.

COMPATIBILITY WITH OTHER WATER-GLYCOLS

CITGO Glycol FR fluids are compatible with and miscible in other water-glycol fire resistant fluids. This assumes that the competitive fluid has been adequately maintained with the proper amount of water and rust inhibitor and is reasonably free of contamination.

It is highly recommended that all systems containing a competitive water-glycol fluid be laboratory-tested by CITGO prior to installing CITGO Glycol FR fluids. These fluids will be tested for the following properties:

1. Water content
2. Rust inhibitor level
3. Viscosity
4. Dirt level
5. Particle size

Your CITGO representative will be glad to initiate this work including all necessary sample containers, labels, etc.

SYSTEM CONVERSION

When converting a system to CITGO Glycol FR fluids from either a conventional mineral oil based fluid or another type of fire resistant or synthetic fluid, it is important that the following procedures be used. Compliance with these conversion procedures will permit the changeover to proceed with minimum difficulty and will extend the service life of the fluid.

1. Make absolutely sure that the pump on the equipment is suitable for water-glycol service. Consult the manufacturer.
2. Completely drain all fluid from the sump, lines, coolers, actuators, etc. Wipe clean.

3. Remove any interior paint which is not compatible with water-glycol type fluids. Sand blast sump interior down to white metal and apply water-glycol compatible paint system.
4. Replace any seals or O-rings that are not generally recommended for water-glycol fluids.
5. Reconnect lines, accumulators, coolers, etc., using either Teflon pressure tape or a suitable pipe joint compound. Make sure any grease used is water resistant.
6. Replace any filters which are not suitable for water-glycol service. If there is any doubt, the filter supplier should be contacted for recommendations.
7. Install a mesh strainer on the pump inlet. Usually a 60-mesh screen is adequate. **DO NOT PUT A FILTER ON THE PUMP INLET.** Due to the high bulk density of water-glycol fluids and the resultant suction lift demands, the pump inlet must never be restricted without prior discussion with the pump manufacturer. Cavitation can result from a restricted pump inlet.
8. When converting from a conventional petroleum fluid, perform step 2, fill system with CITGO Glycol FR fluid to a minimum level to maintain pump suction and operate the system for 30 minutes at reduced pressures. When converting from a synthetic type or oil-synthetic fluid, first perform step 2, then pre-flush the system with a light, straight mineral oil. Repeat step 2 and then flush with CITGO Glycol FR fluid.
9. Drain system immediately and fill to operating level with CITGO Glycol FR fluid.
10. Where a system already contains another water-glycol fluid, it is permissible to start using CITGO Glycol FR fluid directly as makeup providing the existing fluid is of an acceptable cleanliness level and contains the proper amount of water and rust inhibitor. Prior to adding CITGO Glycol FR fluid to a system containing another water-glycol fluid, it is strongly recommended that the fluid in the system first be analyzed by CITGO's laboratory. Your CITGO representative will furnish all necessary bottles, labels, etc., to facilitate this testing.
11. Start up the system and slowly bring it up to normal operating system pressure and conditions.
12. Periodically check filters and strainers for the first few weeks of operation. These components could get clogged with sludge and deposits resulting from the flushing of the system fluid. If the system has been changed from an oil or synthetic type fluid, the CITGO Glycol FR fluid may take on a pink, milky appearance. This is normal and will occur with any water-glycol fluid. This is due to slight emulsification of oil or synthetic fluid left in the system after flushing. Normally this emulsion will break, allowing free oil to be skimmed from the surface in the sump if it is mineral oil or drained from the bottom if it is a synthetic.

TOXICITY AND HANDLING

CITGO Glycol FR fluids contain no nitrosamines or other established or suspected carcinogens.

CITGO Glycol FR fluids contain diethylene glycol. Should either of these products be ingested or swallowed, vomiting should be induced immediately, and a physician should be contacted at once. Breathing of the vapors should be avoided. These products could cause skin irritation or sensitization so it is recommended that plastic or rubber gloves be utilized in handling. After handling, washing with soap and water is recommended.

CITGO Glycol FR fluids contain a basic amine type corrosion inhibitor. Compounds of this type will cause eye irritation. In case of contact, rinse the eyes with large amounts of cool water and contact a physician at once.

CITGO Glycol FR fluids are slippery liquids and spills constitute a safety hazard. Small spills should be cleaned up immediately by either washing/hosing with water or by treating the affected area with commercially available spill absorbents. Large spills must be treated like a petroleum spill.

SEAL AND O-RING COMPATIBILITY

CITGO Glycol FR fluids can be operated with a wide variety of seal and gasket materials. Elastomers such as natural rubber, Buna N, Buna S, and Neoprene are unaffected by the fluid. Materials such as Viton[®], Teflon, and other similar types are also satisfactory. The only seal and gasket configurations not acceptable are leather, cork, cellulose, or other substances which will absorb water and either swell or deteriorate as a result.

RESERVOIR PAINTS AND COATINGS

All water-glycol type fluids will tend to dissolve or deteriorate many conventional paints and coating systems commonly used in sumps and reservoirs. When converting any system over to CITGO Glycol FR fluids, any paint or coating used in the system which is known to be incompatible with water-glycol systems should be removed and replaced with a coatings system which is compatible with water-glycols. Several of the leading paint suppliers manufacture systems which are acceptable for water-glycol usage. These suppliers should be contacted for application and paint types to be used.

PIPE JOINT COMPOUNDS AND GREASES

CITGO Glycol FR fluids – and all other water-glycol fluids – may dissolve or soften certain pipe thread dopes. It is recommended that either Teflon pressure tape or pipe compounds which have water-glycol compatibility be used.

The use of soda-based greases in and around hydraulic circuits should be avoided due to their propensity to emulsify with water-glycol fluids. Grease selection should be restricted to greases having good water tolerance such as lithium, calcium, or aluminum complex.

WATER CONTROL AND MAKEUP

It is necessary to maintain the water level of CITGO Glycol FR fluids within the recommended limits. Excessive water reduces the fluid's viscosity and its ability to lubricate and to seal internal pump clearances. The latter leads to fluid backwash. Insufficient water will nullify the fluid's fire resistance as well as raise its viscosity and bulk density, both of which will contribute to pump cavitation.

Three acceptable methods may be used to control the water level of CITGO Glycol FR fluids: 1) indirectly by viscosity determination, 2) by refractometer or Brix reading and 3) directly by laboratory methods using the Karl Fischer titration. The water level of CITGO Glycol FR fluids cannot be determined by distillation procedures. The viscosity approach is not applicable to systems containing more than trace amounts of oil or systems where the fluid is not predominantly CITGO Glycol FR fluid. Portable viscosity gauges to determine viscosity at machine-side are available at nominal cost. It is important that the gauges be standardized for CITGO Glycol FR fluid. The following tables can be used with acceptable accuracy to determine the amount of water required to adjust the fluid to acceptable limits. Only distilled, deionized, or controlled boiler feed water should be used as makeup. The use of hard tap water, well water, or spring water should be avoided since the dissolved minerals in these waters will react with the additive system in the fluid, causing fluid haziness and formation of soap-like insoluble material. Never use water that has been processed through a water softener.

BRIX READINGS VS. % WATER AND VISCOSITIES FOR CITGO FR WG-40XD®

This chart is only valid when the system contains entirely CITGO FR WG-40 XD®

CITGO FR WG-40XD WATER ADJUSTMENT CHART

BRIX	VISCOSITY (SUS) AT 100 F	VISCOSITY (cSt) AT 40 C	PERCENT WATER IN UNADJUSTED FLUID	GALLONS OF WATER NEEDED PER 100 GALLONS OF UNADJUSTED FLUID IN SYSTEM	CONDITION	
50	412	82.5	28.4	18.1	SEVERE LEVEL	
49.5	394	78.8	29.3	17.1		
49	377	75	30.2	15.8		
48.5	358	71.2	31.2	14.4		
48	342	67.9	32.2	13		
47.5	324	64.3	33.3	11.5		
47	309	61.3	34.2	10.2		
40.5	294	58.4	35.3	8	MODERATE LEVEL	
46	280	55.6	36.5	7.3		
45.5	266	52.7	37.7	5.8		
45	253	50.1	38.8	4.5		
44.5	241	47.7	40	3		
44	228	45	41.5	1.5		NORMAL
43.5	217	43	42.7	0		
43	207	41	43.9	0		
42.5	197	38.9	44.5	0		
42	187	37	45.5	0		
41.5	177	34.5		Excess Water	SEVERE LEVEL	
40	153	30	-	Excess Water		

Reference Information

BRIX READINGS VS. % WATER AND VISCOSITIES FOR CITGO GLYCOL FR-5046HP

This chart is only valid when the system contains entirely CITGO Glycol FR-5046HP

BRIX #	% WATER	VIS. cSt 40°C	VIS. SUS 100°F	WATER ADJUSTMENT PER 100 GALLONS OF FLUID
50	29.2	66.6	328	15
49.5	30	63.8	315	14
49	30.8	61	302	13
48.5	31.6	58.1	288	11
48	32.4	55.5	275	10
47.5	33.2	52.9	262	9
47	34	50.6	251	8
46.5	34.9	48.1	239	7
46	35.7	45.9	229	6
45.5	36.6	43.8	218	4
45	37.4	41.8	209	3
44.5	38.2	39.8	198	2
44	38.9	38	190	OK
43.5	39.7	36.2	182	OK
43	40.5	34.6	174	OK
42.5	41.3	33.1	166	OK
42	42.1	31.6	158	OK
41.5	42.9	30.1	152	-1
41	43.7	28.8	145	-3
40.5	44.6	27.3	137	-4
40	45.3	26.1	132	-5
39.5	46.1	25	126	-6
39	46.9	23.9	120	-8
38.5	47.7	22.7	115	-9
38	48.5	21.7	110	-10
37.5	49.3	21	106	-11
37	50.1	19.8	101	-12

Reference Information

Fluids with viscosity below 31.6 cSt at 40°C or Brix readings below 42.0 contain excess water and only new CITGO Glycol FR-5046HP should be used as makeup. Only distilled, deionized, or steam condensate water should be used.

For systems larger or smaller than 100 gallons, use appropriate multiples or fractions for water addition based on the actual amount of fluid in the system.

ALKALINITY CONTROL

CITGO Glycol FR fluids contain alkaline corrosion inhibitors. The fluids are blended to contain a surplus of the additive, called the alkaline reserve. The inhibitors will slowly evaporate from the fluid, providing vapor phase protection. The hotter the system operating temperature, the greater the evaporation loss. The inhibitor loss usually goes hand in hand with the water evaporation loss.

As a rule of thumb, if system operating temperatures are maintained at 120°F or lower, and a normal amount of new CITGO Glycol FR fluid is being added as makeup, no alkaline adjustment will be necessary. Conversely, in systems running at higher temperatures, the inhibitor loss may occur at a greater rate than normal new fluid makeup can replenish. When this occurs, a portion or all of the fluid may require replacement.

The amount of inhibitor in CITGO Glycol FR fluid is a measurement of the alkaline content of the fluid. It is defined technically as the number of milliliters of 0.1N hydrochloric acid necessary to neutralize 100 ml of fluid to a pH of 5.5. This can only be determined by a laboratory titration. The normal alkaline reserve of new CITGO Glycol FR fluid ranges from 160 to 180 ml of 0.1N hydrochloric acid required to neutralize 100 ml of the fluid to the pH of 5.5. It is safe to continue to use CITGO Glycol FR fluid so long as the alkaline content does not fall below 120 in the titration.

If the user of CITGO Glycol FR fluid suspects his inhibitor loss may be excessive due to high operating temperatures and lacks the laboratory equipment necessary to check the alkaline reserve, the CITGO representative will arrange for sampling of systems and a CITGO laboratory analysis of the fluids.

GOOD FLUID MAINTENANCE

CITGO Glycol FR fluids will retain their optimum fire protection, impart excellent resistance against rusting and corrosion, and prolong the service life of hydraulic components only with good fluid maintenance. Proper water content assures fire resistance. Maintaining the alkaline reserve gives maximum corrosion protection. Proper filtration of dirt and sludge is essential for a well maintained fire resistant fluid.

CITGO has provided the consumer with superior products in CITGO Glycol FR fluids. Poor or inadequate fluid maintenance will result in reduced fluid performance and can certainly lead to reduced or lost production and costly downtime.

CITGO Technical Bulletin

Water Glycols Compatibility



Water-glycol fluids are excellent fire-resistant fluids. They are normally used in applications where there is the possibility of exposure of the fluid to high temperatures or open flames. They can be used at lower ambient temperatures where fluids are likely to be subjected to cold weather. However, these fluids should not be used where bulk fluid temperatures will exceed 150°F, as the water evaporation will result in an increase in viscosity as well as the loss of fire resistance. Water-glycol fluids are compatible with standard seals, but may react with certain metals. Care must be taken with pump choices or where pump limitations are suitable and require no boundary lubrication.

MATERIAL COMPATIBILITY

MATERIAL	FR-40 XD® FR WG-40XD	INVERT EMULSIONS	HWCF	PHOSPHATE ESTERS	POLYOL ESTERS	OIL SYNTHETICS
Elastomer, Neoprene	Y	Y	Y	N	N	N
Elastomer, Buna "N"	Y	Y	Y	N	Y	N
Elastomer, Butyl	Y	N	Y	Y	N	N
Elastomer, E.P.R.	Y	N	Y	Y	N	N
Elastomer, Polyurethane	*	*	*	N	Y	N
Elastomer, Silicone	Y	Y	Y	Y	Y	Y
Elastomer, Teflon	Y	Y	Y	Y	Y	Y
Elastomer, Viton	Y	Y	Y	Y	Y	Y
Filter Media, Cellulosic, Phenolic Treated	Y	Y	Y	Y	Y	Y
Filter Media, Fiberglass	Y	N	Y	Y	Y	Y
Metals, Ferrous	Y	Y	Y	Y	Y	Y
Metals, Bronze	* 1	Y	* 1	Y	* 1	Y
Metals, Zinc	N	Y	N	Y	Y	Y
Metals, Cadmium	N	Y	N	Y	Y	Y
Metals, Lead	N	N	N	Y	N	Y
Metals, Brass, Copper	Y	Y	Y	Y	Y	Y
Metals, Aluminum, Unanodized	N	Y	N	Y	Y	Y
Metals, Aluminum, Anodized	Y	Y	Y	Y	Y	Y

Y = Compatible * = Low or marginal compatibility N = Not compatible

* 1 = Bronze with lead content over 20 percent limited to °120F

Reference Information

COMPARATIVE VISCOSITY CLASSIFICATIONS

ISO Viscosity Grade

	22	32	46	68	100	150	220	320	460
Vis. @ 40 °C									
Min. cSt	19.8	28.8	41.4	61.2	90	135	198	288	414
Max. cSt	24.2	35.2	50.6	74.8	110	165	242	352	506
Vis. @ 100 °F				No Requirement*					
Min. SUS	96	135	191	280	410	615	900	1310	1880
Max. SUS	115	164	234	345	500	750	1110	1600	2300
Vis. @ 100 °C				No Requirement*					
Min. cSt	4.0	4.97	6.22	7.96	10.30	13.56	17.50	22.40	28.30
Max. cSt	4.5	5.61	7.05	9.09	11.82	15.51	19.96	25.50	32.30

AGMA Lubricant Number

	1	2	3	4	5	6	7
Vis. @ 40 °C							
Min. cSt	41.1	61.2	90	135	198	288	414
Max. cSt	50.6	74.8	110	165	242	352	506
Vis. @ 100 °F			No Requirement*				
Min. SUS	193	284	417	626	918	1335	1919
Max. SUS	235	347	510	765	1122	1632	2346
Vis. @ 100 °C			No Requirement*				
Min. cSt	6.22	7.96	10.30	13.56	17.50	22.40	28.30
Max. cSt	7.05	9.09	11.82	15.51	19.96	25.50	32.30

*Viscosities given are not required; however, for "informational purposes," viscosities listed are calculated assuming an oil with V.I. of 95.

Metal Removal Fluid Application Guide – Water Miscible Products

Materials	Operation									
	Indexable tooling	HSS Drilling	Deep Hole Drilling	Cut Tap	Form Tap	End milling	Reaming	Hobbing	Sawing	Grinding
P Steels	Plain Steels	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	TRUKUT GP 205
	Low Alloy	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	TRUKUT GP 205
	High Alloy	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	TRUKUT GP 205
	Steel Castings	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	TRUKUT GP 205
M Stainless Steels	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	TRUKUT GP 205
K Cast Iron	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	CITCOOL SS-HD	TRUKUT GP 205
N Non Ferrous	Aluminum Alloys, Copper Alloys	TRUKUT HD 220 TRUKUT GP 205	TRUKUT HD 220	TRUKUT HD 220	TRUKUT HD 220	TRUKUT HD 220 TRUKUT GP 205	TRUKUT HD 220	TRUKUT HD 220	TRUKUT HD 220 TRUKUT GP 205	TRUKUT GP 205
	Heat-Resistant Superalloys (nickel-based)	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	TRUKUT GP 205
H Hard Metals	High Hardness Alloys, Work Hardening Alloys	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	CITCOOL 33 CITCOOL SS-HD	TRUKUT GP 205

The product recommendations on this chart are general guidelines. Consult the CITGO Product Answer Line with details of your specific operation and metallurgy. CITGO never recommends mixing competitive metalworking products with CITGO metalworking products. Some product changes may require sampling of the existing fluid and extensive cleaning and flushing of the system.

Metal Removal Fluid Application Guide -- Straight (Neat) Oils

Materials		Operation						
		Screw Machine Operations	Swiss Machining Operations	Deep Hole / Gun Drilling	Thread Forming	Gear Hobbing	Gear Shaping	Grinding
P Steels	Plain Steels	AUTOKUT Tri-Purpose	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT IS 15
	Low Alloy	AUTOKUT Tri-Purpose	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT IS 15
	High Alloy	AUTOKUT Tri-Purpose	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT IS 15
	Steel Castings	AUTOKUT Tri-Purpose	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT IS 15
M Stainless Steels		AUTOKUT Tri-Purpose	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT IS 15
K Cast Iron		AUTOKUT Tri-Purpose	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT IS 15
N Non Ferrous	Aluminum Alloys, Copper alloys	AUTOKUT Tri-Purpose	AUTOKUT IS Series	AUTOKUT IS Series	AUTOKUT IS Series	AUTOKUT IS Series	AUTOKUT IS Series	AUTOKUT IS 15
S HRSA	Heat-Resistant Superalloys (nickel-based)	AUTOKUT Tri-Purpose	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT IS 15
H Hard Metals	High Hardness Alloys, Work Hardening Alloys	AUTOKUT Tri-Purpose	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT AS Series	AUTOKUT IS 15

The product recommendations on this chart are general guidelines. Consult the CITGO Product Answer Line with details of your specific operation and metallurgy. CITGO **never** recommends mixing competitive metalworking products with CITGO metalworking products. Some product changes may require sampling of the existing fluid and extensive cleaning and flushing of the system.

Metal Removal Fluid Application Overview

Product Type	CITGO Products	Typical Applications
Straight oils	Autokut IS	Multiple metals
	Autokut AS	Ferrous alloys
	Autokut Tri-Purpose	Screw Machine
Soluble Oils	Trukut GP 205	Multiple metals*
	Trukut HD 220	Multiple metals
Semi-Synthetic	CITCOOL SS-HD	Multiple metals*
Synthetic	CITCOOL 33	Ferrous applications






*Use Trukut HD 220 or Autokut IS for 2000 & 7000 series aluminum, as these grades are susceptible to staining.

Metals Machinability Ratings

Non-Ferrous (rating >100%)	Ferrous (rating 100-70%)	Ferrous (rating 70-50%)	Ferrous (rating 50-40%)	Ferrous (rating <40%)	Non-Ferrous (rating <100%)
Most Wrought Aluminums	1112*	1020 - 1070	13xx, 2330, 2340	Most Stainless Steels	Titanium
Most Cast Aluminums	1016 - 1030	2317, 31xx, 41xx	2512, 3310	2515, 3310	Ti-5Al-2.5Sn
Leaded Brass	1109 - 1144	4027 - 4047	3240, 4340, 48xx	50100, 51100, 52100	Ti-6Al-4V
Magnesium Alloys	4023, 4024, 5120	43xx, 46xx, 51xx	61xx, 8645, 8650	9315	Ti-6Al-6V-2Sn
Zinc	Cast Steel	86xx, 87xx	8750, 9445	Tool Steel	Ti-8Al-1Mo-1V
Silicon Bronze	Cast Iron	91xx, 98xx	1008, 1010, 1015		Ti-8Mn
Brass	Stainless Iron	Ductile Iron	1050, 1070		Ti-13V-11Cr-3Al
			3310, 18-8		Nickel
			Wrought Iron		Copper

*Machinability rating is determined by normal cutting speed, surface finish, and tool life. Ratings are normalized to the machinability of 1112 steel, which has been benchmarked as 100% by the American Iron and Steel Institute. Metals with a rating lower than 100% are less machinable than 1112; metals with a rating greater than 100% are more machinable than 1112.

Stationary Natural Gas Engine Oil Cross Reference

				
Pacemaker GEO 1940XL	Pegasus 1005	HDAX 9200 LA	EI Mar LA 4 EXD	No Product
Pacemaker GEO 1640	Pegasus 805 Ultra	HDAX 5200 LA	EI Mar LA 4	Mysella S5 N40
Pacemaker GEO 1440	Pegasus 805,	HPLX 3200 LA 40	EI Mar Low Ash	Mysella S3 N40
Pacemaker LFG LA 40	Pegasus Ultra 605	HDAX LFG 6500	EI Mar LF-D	Mysella S5 S
Pacemaker GEO 740	Pegasus 710	HDAX 5300 MA 40	EI Mar Mid Ash	Mysella S3 S
Pacemaker GEO 1000	Pegasus 801	HDAX 5100, Ashless	EI Mar Ashless, Supreme	Mysella S2 Z

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CITGO STATIONARY NATURAL GAS COMPRESSOR LUBRICANT CHART

ATTRIBUTE	4 STROKE GAS ENGINE OIL	COMPRESSOR OIL	SWEET GAS	SOUR GAS	HYDROCARBON DILUTION RESISTANT	HIGH MOISTURE GAS	ANTI-EMULSION FORMULA	BETTER COLD CLIMATE FLOW
COMPRESSORGARD PAG		X	X	X	X	X	X	X
CITGEAR SYNTHETIC PAG		X	X	X	X	X	X	X
COMPRESSORGARD PAO		X	X	X	X	X	X	X
CITGEAR SYNTHETIC HT		X	X	X	X	X	X	X
COMPRESSOR OIL 35LP, 45LP		X	X			X	X	X
PACEMAKER OILS 100, 150, 220		X	X			X	X	
CYLINDER OIL 150-5, 220-5		X	X	X		X	X	
COMPRESSORGARD XA200		X	X	X		X		

CITGO STATIONARY NATURAL GAS COMPRESSION APPLICATION CHART

Product	2 STROKE GAS ENGINE OIL	4 STROKE GAS ENGINE OIL	SWEET GAS	SOUR GAS	FORMULATED FOR LFG/ BIOGAS	ANTI-EMULSION ENGINE & COMPRESSOR OIL	HIGH NITRATION CONDITIONS	HIGH OXIDATION CONDITIONS	EXTENDED OIL LIFE CAPABILITY	CATALYST COMPATIBLE	ASHLESS, <0.1%	LOW ASH, 0.4-0.6%	MID ASH, 0.7-0.9%
Low Ash													
PACEMAKER GEO 1900XL		X	X	X			X	X	X	X		X	
PACEMAKER GEO 1600		X	X	X			X	X	X	X		X	
PACEMAKER GEO 1400		X	X	X					X	X		X	
PACEMAKER GEO LFG LA		X		X	X			X	X	X		X	
Mid Ash													
PACEMAKER GEO 700		X	X	X				X	X				X
Ashless													
PACEMAKER GEO 1000	X		X						X		X		

Reference Information

Pacemaker GEO Application Chart

ENGINE/MANUFACTURER	STROKE PER CYCLE	PACEMAKER GEO LFG LA	PACEMAKER GEO 1000	PACEMAKER GEO 1400	PACEMAKER GEO 1600	PACEMAKER GEO 1900XL
CATERILLAR						
GCM34	4			X	X	X
G3600	4			X	X	X
G3500	4			X	X	X
G3400	4			X	X	X
G3300	4		X	X	X	X
MWM TCG SERIES, NATURAL GAS	4				X	X
MWM TCG SERIES, BIOGAS	4	X				
PERKINS, NATURAL GAS	4				X	X
PERKINS, BIOGAS	4	X				
FAIRBANKS MORSE						
	2		X			
GENERAL ELECTRIC						
JENBACHER, NATURAL GAS	4				X	X
JENBACHER, BIOGAS	4	X				
WAUKESHA YGF F18, H24, L36, P48 G, GL, GLD	4			X	X	X
WAUKESHA YGF GSI, GSD	4			X	X	X
WAUKESHA VHP F3521, L5790, L7042, P9390 G, GSI, GL	4			X	X	X
WAUKESHA VHP F3514, F3524, L5794, L7044, GSI, L5774, L5794, LT	4			X	X	X
WAUKESHA VHP 5794, 7044GSI WITH FACTORY SUPPLIED CATALYST	4			X	X	X
WAUKESHA 275 GL/GL+ 12V, 16V	4			X	X	X
WAUKESHA APG 16V150LTD 18V220GL	4			X	X	X
WAUKESHA COGENERATION	4			X	X	X
WAUKESHA BIOGAS	4	X				
SUPERIOR 825, 125GTD, 165GTD	4					
AJAX DPC 140LE, 180LE, 280LE, 360LE, 540LE, 720LE, 2200LE SERIES, 2800LE SERIES, C 302, E 565	2		X			
MTU						

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Pacemaker GEO Application Chart

ENGINE/MANUFACTURER	STROKE PER CYCLE	PACEMAKER GEO LFG LA	PACEMAKER GEO 700	PACEMAKER GEO 1000	PACEMAKER GEO 1400	PACEMAKER GEO 1600	PACEMAKER GEO 1900XL
4000L61 / L62 / L63	4				X	X	X
4000 L32 / L33	4					X	X
4000 L64	4						X

SIEMENS

DRESSER RAND CATEGORY I	4				X	X	X
DRESSER RAND CATEGORY II	4				X	X	X
DRESSER RAND CATEGORY III	4					X	X
GUASCOR	4				X	X	X
CLARK	2			X			
WORTHINGTON, 2 STROKE	2			X			
WORTHINGTON, 4 STROKE	4				X	X	X

WÄRTSILÄ

	4					X	X
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CITGO Technical Bulletin

EPA finalized amendments to the NESHAP for stationary reciprocating internal combustion engines (RICE)

On January 14, 2013, the Environmental Protection Agency finalized amendments to the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for stationary reciprocating internal combustion engines (RICE) and amendments to the NSPS (New Source Performance Standards) applicable to Stationary Engines. These final amendments address several issues affecting RICE engine owners and operators. The full compliance date for these rules was October 19th, 2013 for owners of Spark Ignition (SI) stationary engines.

Reference Information

For reference, these rules are codified in the Federal Register at;

- 40 CFR Part 63 Subpart ZZZZ (NESHAP)
- 40 CFR Part 60 Subpart JJJJ (NSPS for SI engines)

These final amendments have determined that certain classifications of SI engines typically used in sparsely populated areas for oil and gas production can comply with these rules by maintenance practices, instead of emissions based performance standards. This is in addition to SI engines that were previously eligible for compliance with maintenance practices. To determine whether your engine is eligible for compliance by maintenance practices, please contact your EPA compliance representative.

One of the requirements of compliance by maintenance practices is that the owner/operator change oil every 1440 or 2160 hours, depending on engine size. Drains can be extended beyond 1440 or 2160 hours, if the operator can provide supporting oil analysis records that the oil remains within the EPA’s condemning limits;

Total Acid Number (TAN)	Increase of 3.0 mgKOH/g from TAN when oil is new
Viscosity	Change of ±20% from new oil viscosity
%Water Content (By Volume)	Greater than 0.5%

As per the rules referenced the previous table;

- Oil analysis must be performed and conducted at the same frequency specified for oil changes.
- If the oil is condemned, the oil must be changed within 2 business days. The operators or the owners must keep the records of all the oil analysis.

The EPA can levy fines up to \$25,000 if QUAD Z guidelines are not followed.

The EPA's condemning limits are relatively wide and CITGO encourages engine owners/operators to also keep in consideration the engine manufacturer's recommendations for oil change limits. CITGO's GEO LubeAlert oil analysis program for natural gas engine oils includes a number of important tests that can aid in NESHAP compliance as well as provide early detection of critical equipment issues.

CITGO has anticipated your extra testing needs, and we stand ready to assist our LubeAlert users with the EPA requirements referenced above.

Please contact our Product Answer Line at 1-800-248-4684 with any additional questions.



CITGO Lubricants Technology

CITGO SENSITIVE PRODUCTS LIST

The following list contains products which CITGO has determined are sensitive in nature. Repackaging of the products on this list is either *prohibited*, or requires CITGO approval. The reprinting of labels is also *prohibited* or subject to approval.

MYSTIK® LUBRICANTS

Mystik® fluid lubricants are *prohibited* from being repackaged. The printing of Mystik® labels is also prohibited.

CLARION® LUBRICANTS

Clarion® lubricants are *prohibited* from being repackaged. The printing of Clarion® labels is also prohibited.

MILEMASTER® LUBRICANTS

Repackaging of MileMaster Products is **permitted**.

MYSTIK® GREASES

The repackaging of Mystik® JT-6 greases is *prohibited*. The repackaging or the printing of labels of the following non-JT-6 Mystik® greases requires approval from CITGO Technical Services.

Mystik AluPlex™ Plunger Low Temp #000	655564002
Mystik AluPlex™ Plunger #000	655565002
Mystik AluPlex™ Plunger #00	655566002
Mystik CalSuPlex® Multi-Purpose #2	655582002
Mystik CalSuPlex® 5% Moly #2	655542002
Mystik Railroad Traction Motor Gear	655780002
Mystik LithoPlex™ 3% Moly #1	655351002
Mystik LithoPlex™ 3% Moly #2	655352002
Mystik LithoPlex™ 5% Moly #1	655356002
Mystik LithoPlex™ 5% Moly #2	655357002
Mystik LithoPlex™ Mining #2	655358002

Mystik LithoPlex™ Mining #1	655360002
Mystik LithoPlex™ Multi-Purpose #0	655342002
Mystik LithoPlex™ Multi-Purpose #1	655341002
Mystik LithoPlex™ Multi-Purpose #2	655340002
Mystik LithoPlex™ Pellet Mill #2	655437002
Mystik LithoPlex™ Multi-Purpose Red #2	655387002
Mystik LithoPlex™ Red Tacky #1	655343002
Mystik LithoPlex™ Red Tacky #2	655344002
Mystik LithoPlex™ Industrial #1	655366002
Mystik LithoPlex™ Industrial #2	655367002
Mystik LithoPlex™ Plunger 320 #000	655538002
Mystik LithoPlex™ Plunger 320 #00	655539002
Mystik LithoPlex™ Power Tool #2	655572002
Mystik LithoPlex™ Dye Free #1	655435002
Mystik High Speed Coupling Grease	655231002
Mystik Lithium Extreme Pressure #00-000	655771002
Mystik Lithium Extreme Pressure #0	655210002
Mystik Lithium Extreme Pressure #1	655211002
Mystik Lithium Extreme Pressure #2	655212002
Mystik Curve Rail #1	655532002
Mystik Curve Rail #0	655531002
Mystik Centralized System #0-00	665023002
Mystik Cotton Picker #00	665101002
Mystik General Purpose #2	665150002

CITGO INDUSTRIAL FLUIDS

The following CITGO Industrial Fluids are *prohibited* from repackaging and the printing of labels:

CITGO HyDurance™ AW CP Fluid	633623001
CITGO HyDurance AW/AL HVI-100	633625001
CITGO FR WG-40XD® Hydraulic Fluid	648326001
CITGO Glycol FR-5046HP	648346001

The following CITGO Industrial Fluids require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO HyDurance™ AW NZ Fluid 32	633615001
CITGO HyDurance™ AW NZ Fluid 46	633616001
CITGO HyDurance™ AW NZ Fluid 68	633617001
CITGO HyDurance™ AW All Temp NZ Fluid 32	633612001
CITGO HyDurance™ AW All Temp NZ Fluid 46	633613001
CITGO HyDurance™ AW All Temp NZ Fluid 68	633614001
CITGO HyDurance™ AW Super NZ Fluid 32	633618001
CITGO HyDurance™ AW Super NZ Fluid	633619001
CITGO HyDurance™ AW Synthetic Fluid 46	633602001

CITGO HyDurance™ AW Synthetic Fluid 68	633603001
CITGO Pacemaker® T-32	633715001
CITGO Pacemaker® T-46	633720001
CITGO Pacemaker® T-68	633730001
CITGO Pacemaker® T-115	633745001
CITGO Pacemaker® ST-32	632515001
CITGO Pacemaker® XL 32	633792001
CITGO Pacemaker® XL Ultra 32	633794001
CITGO Paper Machine Oil NZ 150	634616001
CITGO Paper Machine Oil NZ 220	634621001

CITGO INDUSTRIAL GEAR OILS

The following CITGO Industrial Gear Oils require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO CITGEAR® OGL-A	631051001
CITGO CITGEAR® MGW-OGL	631056001
CITGO CITGEAR® SYNTHETIC EP 100	632582001
CITGO CITGEAR® SYNTHETIC EP 150	632583001
CITGO CITGEAR® SYNTHETIC EP 220	632584001
CITGO CITGEAR® SYNTHETIC EP 320	632585001
CITGO CITGEAR® SYNTHETIC EP 460	632587001
CITGO CITGEAR® SYNTHETIC EP 680	632588001
CITGO CITGEAR® SYNTHETIC HT 68	632571001
CITGO CITGEAR® SYNTHETIC HT 100	632572001
CITGO CITGEAR® SYNTHETIC HT 150	632573001
CITGO CITGEAR® SYNTHETIC HT 220	632574001
CITGO CITGEAR® SYNTHETIC HT 320	632575001
CITGO CITGEAR® SYNTHETIC HT 460	632577001
CITGO CITGEAR® SYNTHETIC HT 680	632579001
CITGO CITGEAR® SYNTHETIC HT 1000	632597001
CITGO CITGEAR® SYNTHETIC PAG 100	632543001
CITGO CITGEAR® SYNTHETIC PAG 150	632544001
CITGO CITGEAR® SYNTHETIC PAG 220	632547001
CITGO CITGEAR® SYNTHETIC PAG 320	632548001
CITGO CITGEAR® SYNTHETIC PAG 460	632549001

CITGO SMALL ENGINE OILS

The following CITGO Small Engine Oils require approval from CITGO Technical Services before repackaging or the printing of labels.

CITGO Multi-Purpose Air-Cooled 2-Cycle Engine Oil	621610001
CITGO SUPERGARD® Air-Cooled 2-Cycle Engine Oil	621611001
CITGO SUPERGARD® Marine Plus 2-Cycle Engine Oil	621602001

CITGO AUTOMOTIVE GEAR OILS

The following CITGO Automotive Gear Oils are *prohibited* from repackaging and the printing of labels:

CITGO SynDurance® Synthetic Gear Lubricant 75W-90	631809001
CITGO SynDurance® Synthetic Gear Lubricant 80W-140	631814001

The following CITGO Automotive Gear Oils require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO CITGEAR® Synthetic HD Gear Lubricant 75W-90	632496001
CITGO CITGEAR® Synthetic HD Gear Lubricant 75W-140	632497001
CITGO CITGEAR® Synthetic HD Gear Lubricant 80W-140	632498001
CITGO CITGEAR® Synthetic HD Gear Lubricant 50	632495001

CITGO ENGINE OILS (PCMO)

The following CITGO Engine Oils (PCMO) require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO SUPERGARD® Full Synthetic Motor Oil 0W-16	620858001
CITGO SUPERGARD® Full Synthetic GFX Motor Oil 0W-20	620865001
CITGO SUPERGARD® Full Synthetic Motor Oil 0W-20 dexos®	620860001
CITGO SUPERGARD® Full Synthetic GFX Motor Oil 5W-50	620866001
CITGO SUPERGARD® Full Synthetic Motor Oil 5W-20 dexos®	620859001
CITGO SUPERGARD® Full Synthetic GFX Motor Oil 5W-30	620867001
CITGO SUPERGARD® Full Synthetic Motor Oil 5W-30 dexos®	620861001
CITGO SUPERGARD® Full Synthetic Motor Oil 10W-30	620863001

CITGO ENGINE OILS (HDEO)

The following CITGO Engine Oils (HDEO) require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO CITGARD® 1000 Synthetic Engine Oil 5W-30	622676001
CITGO CITGARD® 1000 Synthetic Engine Oil 5W-40	622677001

CITGO TRANSMISSION/POWER FLUIDS

The following CITGO Transmission / Power Fluids are *prohibited* from repackaging and the printing of labels:

CITGO TRANSGARD® ATF, MERCON® V	633122001
CITGO TRANSGARD® ATF +4®	633179001
CITGO TRANSGARD® DEXRON®-VI ATF	633140001
Emgard® MTF 7011 Synthetic Manual Transmission Fluid	632005001
CITGO SynDurance® Synthetic MTF	631817001
CITGO SynDurance® 668 Automatic Transmission Fluid	622686001

The following CITGO Transmission / Power Fluids require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO QuatraSyn® Synthetic Transmission Fluid	632493001
CITGO TRANSGARD® Synthetic Multi-Vehicle High-Viscosity ATF	633131001
CITGO TRANSGARD® Synthetic Multi-Vehicle Low-Viscosity ATF	633137001
CITGO SynDurance® All Seasons Heavy-Duty Transmission Fluid	622685001

CITGO RAILROAD LUBRICANTS

The following CITGO Railroad Lubricants require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO Railroad Car Journal Oil No. 9	649110001
CITGO RD-969 Diesel Engine Oil	649069001
CITGO RD-1069 Diesel Engine Oil	649269001
CITGO RD-2069 LE Diesel Engine Oil	649281001

CITGO FUNCTIONAL PRODUCTS

The following CITGO Functional Products are *prohibited* from repackaging and the printing of labels:

CITGO Transformer Oil N-II	669490001
CITGO Ice Machine Oil 68	637131001
CITGO North Star® Refrigeration Oil 68	643108001
CITGO North Star® Refrigeration Oil 32	643102001
CITGO North Star® Refrigeration Oil 54	643105001

The following CITGO Functional Products require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO Press Oil 68	633812001
CITGO Wireline Lubricant 220	637167001
CITGO Wireline Lubricant 680	637170001
CITGO Wireline Lubricant 1500	637172001
CITGO Wireline Lubricant 5000	637174001

CITGO Wireline Lubricant 7500	637179001
CITGO Wireline Lubricant 10000	637175001
CITGO Wireline Lubricant 12000	637176001

CITGO METALWORKING FLUIDS

All CITGO Metalworking Fluids require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO Autokut [®] AS 15	639430001
CITGO Autokut [®] AS 32	639432001
CITGO Autokut [®] AS 46	639433001
CITGO Autokut [®] AS 68	639434001
CITGO Autokut [®] IS 15	639440001
CITGO Autokut [®] IS 46	639443001
CITGO Autokut [®] Tri-Purpose	639450001
CITGO Trukut [®] GP 205	639468001
CITGO Trukut [®] HD 220	639469001
CITGO CITCOOL [®] SS-HD	639335001
CITGO CITCOOL [®] 33	639333001
CITGO Rust-O-Lene [®] LT	639460001
CITGO Rust-O-Lene [®] ST	639461001
CITGO AR Slushing Oil	639760001
CITGO Quencho [®] 521	639465001
CITGO Quencho [®] 624	639466001
CITGO SlideRite [®] Oil 32	637203001
CITGO SlideRite [®] Oil 68	637210001
CITGO SlideRite [®] Oil 220	637220001
CITGO SlideRite [®] Oil 320	637320001
CITGO Tul-Kut [®] Oil Base Cutting Oil Concentrate	639565001

CITGO INDUSTRIAL GAS ENGINE OILS

All CITGO Industrial Gas Engine Oils require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO Pacemaker [®] GEO 15SL	632056001
CITGO Pacemaker [®] GEO 715	632033001
CITGO Pacemaker [®] GEO 740	632034001
CITGO Pacemaker [®] GEO 1015	632210001
CITGO Pacemaker [®] GEO 1035	632032001
CITGO Pacemaker [®] GEO 1040	632057001
CITGO Pacemaker [®] GEO 1415	632042001
CITGO Pacemaker [®] GEO 1430	632043001
CITGO Pacemaker [®] GEO 1440	632040001
CITGO Pacemaker [®] GEO 1615	632047001

CITGO Pacemaker® GEO 1630	632045001
CITGO Pacemaker® GEO 1640	632046001
CITGO Pacemaker® GEO 1915 XL	632091001
CITGO Pacemaker® GEO 1930 XL	632090001
CITGO Pacemaker® GEO 1940 XL	632085001
CITGO Pacemaker® GEO LFG LA 40	632051001

CITGO COMPRESSOR LUBRICANTS

The following CITGO Compressor Lubricants are *prohibited* from repackaging and the printing of labels:

CITGO Pacemaker® HV-39	634104001
CITGO Pacemaker® HV-68	634105001

The following CITGO Compressor Lubricants require CITGO Technical Services approval before repackaging or the printing of labels:

CITGO CompKleen® Synthetic Cleaner	632599001
CITGO CompressorGard® DE 68	632525001
CITGO CompressorGard® DE 100	632526001
CITGO CompressorGard® DE 125	632527001
CITGO CompressorGard® DE 150	632528001
CITGO CompressorGard® GE 32	632580001
CITGO CompressorGard® GE 46	632591001
CITGO CompressorGard® H 100	632566001
CITGO CompressorGard® H 220	632568001
CITGO CompressorGard® IPG 100	632546001
CITGO CompressorGard® IPG 150	632556001
CITGO CompressorGard® PAG 100	632538001
CITGO CompressorGard® PAG 150	632348001
CITGO CompressorGard® PAG 220	632595001
CITGO CompressorGard® PAO 32	632531001
CITGO CompressorGard® PAO 46	632532001
CITGO CompressorGard® PAO 68	632533001
CITGO CompressorGard® PAO 100	632534001
CITGO CompressorGard® PAO 150	632535001
CITGO CompressorGard® PS 68	632482001
CITGO CompressorGard® SS 100	632554001
CITGO CompressorGard® SS 150	632555001

CITGO Technical Bulletin

Lubricant Storage and Handling and Shelf Life Guidelines



Key Storage and Handling Tips

Proper storage and handling of lubricants is crucial to maintaining the product integrity. There are five key factors to proper lubricant storage: keep it clean, keep it cool, keep it dry, know how to spot contamination, and practice FEFO (first expired, first out) inventory management.

Keep It Clean

Contamination is generally thought of as particulate (dust, dirt, etc.) and water. It can come from ambient air, precipitation, or dirty transfer equipment. All transfer equipment should be labeled or color coded for a specific product and dedicated to that product. Pumps and hoses should

be dedicated or well flushed between product transfers. Store product handling equipment in a cabinet to minimize the chance of contamination. Keep drums indoors. In-use drums should have a desiccant filter breather attached to the drum's small bung opening. Drums stored outdoors should be stored on their sides and have the bungs positioned at the 3:00 and 9:00 positions to reduce drum "breathing" during temperature cycles.

Keep It Cool

The optimum storage temperature for most lubricants is 32–77°F. Temperature extremes and proximity to sources of heat should be avoided. Products containing water (emulsifiable metalworking fluids, fire resistant hydraulic fluids) must be kept from freezing. Exposure to direct sunlight should be avoided. Temperature cycling will cause drums to "breathe," when they expand and contract, which can draw in dirt and moisture from the air during contraction. This can occur even when drums are sealed.

Keep It Dry

Water contamination reduces oil life and equipment life through increased wear, corrosion, oxidation, additive depletion, increased viscosity, and filter plugging. Pumps, hoses, and other transfer equipment must be kept dry. Lubricants can absorb water from humid air and condensation. Do not wash down drums that are in storage. Drums stored on the ground or bare concrete will rust more quickly. Drums should be stored on racks, wooden blocks, or pallets.

Know How to Spot Contamination

New oil should be bright and clear. Contamination with water can cause a hazy or milky appearance, especially as the oil cools. Hazy appearance or significant sediment in the bottom of the container can indicate particulate contamination. A significant change in color may indicate oxidation or mixing with a different oil. The presence of gel or a sticky residue at the bottom of a container may indicate additive separation. A pungent odor may indicate oxidation or bacterial contamination (especially water-containing metalworking products). Normal lubricant aging is typically indicated by a gradual color change, minor settling of additives, or minor surface oil separation in grease.

Practice FEFO (First Expired, First Out) Inventory Management

The stock with the earliest expiration date should be used first, regardless of when it was received, to avoid excessive aging of product. Follow the shelf life guidelines below. The CITGO trace code includes date information. The trace code format is four or five numbers (batch number), letter (usually O or C indicating the blend plant location), and four digits indicating the date. The date format is the Julian date – the three-digit numerical day of the year followed by the last digit of the year.

Best in Class Storage and Handling Considerations

Lube Room Design

A well-designed lube room is one which holds the right amount – enough to cover the needs plus some contingency, but not so much that the product is held beyond its shelf life. The lube room should be well-organized, with space for totes and drums, shelves for storage of pails, cans, tubes, etc., and storage cabinets for in-use containers and grease guns.

Bulk Oil Storage

Bulk oil storage tanks should be sized to hold the appropriate volume. Tank size can be determined by analyzing the rate of consumption, based on normal use and any emergency situation that might arise. It should also take into account the normal product delivery time. This information allows for proper bulk oil tank sizing.

Packaged Lubricant age

Packaged lubricants should be stored indoors, out of exposure to precipitation, and out of direct sunlight. Climate controlled storage is best, but not always possible. The storage location must be away from any heat sources. Drums should be stored on their sides, with the bungs at the 3:00 and 9:00 positions to keep them covers with lubricant, reducing the breathing of atmospheric air as the drums warm and cool. Metal containers should not be placed directly on bare ground or concrete. Wood blocks or pallets should be used to keep containers elevated. If the containers must be stored outdoors, a lean-to cover or waterproof tarpaulin can be used to protect them from weather and sunlight. Product containers should be positioned to make all labels visible. Follow FEFO (first expired, first out) inventory management practices.

Packaged lubricants must be handled safely. Drums of oil or grease typically weigh about 450 pounds. Grease kegs weigh about 130 pounds. Use hydraulic lifts, chain-operated hoists, forklifts, drum dollies, etc. to handle drums. Pails of oil or grease weigh about 35 pounds. Never allow drums to be dropped. Dropping can cause the welded seams to leak. Workers handling drums and other containers should wear steel-toe shoes to protect against possible injury from a drum or other container dropped or rolled on their foot.

New Oil Receiving

It is important to keep accurate records of the receipt of oil deliveries. There should be a written receiving procedure. As a minimum, keep a record of the following information: Date, Material Code and Full Product Name, Volume Received (Bulk), Number and Size of Containers, Person Performing the Receipt. A current SDS for each product should be on file. Storage areas for packaged product should be labeled with the material code and product name of the product to be stored. Bulk storage tanks, nozzles, and valves should be labeled with the material code and product name.

Product Dispensing

Bulk oil containers should be fitted with a sight glass or other level measuring device, a desiccant filter breather to keep particulate and moisture contamination out of the container, and dry-break hose connectors. Containers used for transport and top-up of lubricants should be labeled with the material code and product name. The container should have a built-in spout and the capability of being sealed when not in use.

Grease Handling and Storage

Store grease containers in a cool, clean, dry indoor area. Keep containers tightly covered. Wipe off container edges before opening to remove product. Minor separation of oil from grease is normal and expected. The oil that may separate from grease upon storage can be mixed back into the grease using a clean spatula or similar tool. If grease becomes cold in storage, place it in a warm location for a sufficient time to bring it to a satisfactory temperature for dispensing. Never use a drum heater or place grease in a hot room. All grease handling tools (spatulas, pumps, follower plates, etc.) must be clean before using in contact with grease. The surface of grease in a partially used container should be level and smooth, with any void spaces filled in. Grease tubes should be stored upright with the removable cap up.

Shelf Life Guidelines

Lubricant shelf life is very sensitive to storage and handling. Air, light, moisture, and temperature can all have negative effects on the condition of unused lubricants.

Even if a stored product still meets its original specifications, consideration should be given to whether it meets the OEM, licensing, or performance requirements of the equipment in which it will be used, particularly if the equipment is under warranty, as specifications and performance categories change over time.

The below chart should be used as a starting point for considering the suitability of stored products. The CITGO Product Answer Line is available by phone and email to help you make such assessments.

Type of product	Expected shelf life in optimal conditions	Special considerations	Common signs of possible storage instability
Heavy Duty Engine Oils (Diesel Engines)	5 years	Ensure product meets specifications for intended use	Significant sediment (more than a trace) Cloudy appearance (moisture) Strong odor (oxidation, contamination)
Passenger Car Motor Oils (Gasoline Engines)	5 years	Ensure product meets specifications for intended use	Significant sediment (more than a trace) Cloudy appearance (moisture) Strong odor (oxidation, contamination)
4-Cycle Small Engine Oils	5 years	Ensure product meets specifications for intended use	Significant sediment (more than a trace) Cloudy appearance (moisture) Strong odor (oxidation, contamination)
2-Cycle Small Engine Oils	2 years	Ensure product meets specifications for intended use	Thickening or volume loss due to evaporation of solvent

Industrial Gas Engine Oils	5 years	Ensure product meets specifications for intended use	Significant sediment (more than a trace) Cloudy appearance (moisture) Strong odor (oxidation, contamination)
Railroad Engine Oils	5 years	Ensure product meets specifications for intended use	Significant sediment (more than a trace) Cloudy appearance (moisture) Strong odor (oxidation, contamination)
Manual and Automatic Transmission Fluids	5 years	Ensure product meets specifications for intended use	Significant sediment (more than a trace) Cloudy appearance (moisture) Strong odor (oxidation, contamination)
Automotive Gear and Axle Lubricants	5 years	Ensure product meets specifications for intended use	Significant sediment (more than a trace) Cloudy appearance (moisture) Strong odor (oxidation, contamination)
Tractor Transmission / Hydraulic Fluids	5 years	Ensure product meets specifications for intended use	Significant sediment (more than a trace) Cloudy appearance (moisture) Strong odor (oxidation, contamination)
Process Oils	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
General Purpose Oils	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Bearing and Circulating Oils	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Mineral and Synthetic Turbine Oils	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Mineral and Synthetic Hydraulic Fluids (except food grade)	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Fire-resistant Water Glycol Hydraulic Fluids (including food grade)	2 years	Avoid freezing temperatures, as water component may separate	Product Separation
Mineral and Synthetic Industrial Gear Oils (except food grade)	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Cylinder Oils	2 years	Avoid freezing temperatures, as water component may separate	Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Open Gear Lubricants	2 years		Loss of volume due to solvent evaporation
Air Compressor Lubricants (except food grade)	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)

Natural Gas Compressor Lubricants	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Industrial Gas Compressor Lubricants	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Refrigeration Compressor Lubricants (except food grade)	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Metalworking Fluids (neat)	3 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Metalworking Fluids (emulsifiable)	2 years	Avoid freezing temperatures, as water may separate	Product separation
Greases: Lithium, Lithium Complex, Calcium, Calcium Sulfonate	3 years	Store containers upright to minimize oil separation Store tubes upright to prevent leakage	Excessive oil separation Significant change in consistency from original NLGI grade Color or odor change
Greases: Aluminum Complex	1 year	Store containers upright to minimize oil separation Store tubes upright to prevent leakage	Excessive oil separation Significant change in consistency from original NLGI grade Color or odor change
Food Grade Lubricants	5 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Food Grade Greases: Aluminum Complex	1 year	Store containers upright to minimize oil separation Store tubes upright to prevent leakage	Excessive oil separation Significant change in consistency from original NLGI grade Color or odor change
Food Grade Greases: Calcium and Calcium Sulfonate	3 years	Store containers upright to minimize oil separation Store tubes upright to prevent leakage	Excessive oil separation Significant change in consistency from original NLGI grade Color or odor change
Vegetable Oil Based Biodegradable Lubricants	2 years		Cloudy appearance (moisture) Color or odor change (oxidation, contamination)
Other types of lubricants not listed	Contact the CITGO Product Answer Line at 800-248-4684 or lubeshelp@citgo.com		

CITGO Technical Bulletin

How to Take a Sample



Oil and grease samples should be representative of the system from which they are taken. This can be accomplished by following a few procedures.

Fluid samples:

1. Ideally the equipment being sampled should be at operating temperature prior to collecting the sample. This will assure that any insoluble and semi-soluble materials are suspended evenly throughout the system. Samples taken from equipment that has been inactive for long periods are likely not representative.
2. If possible, take the sample while the machine is in operation, from an area of active flow and *before* the filter.
3. Do not collect a sample from a reservoir shortly after an oil change or the addition of a large amount of make-up oil.
4. Samples for ongoing analysis should always be taken in the same manner and from the same point.
5. Do not take samples from the fluid surface or from the very bottom of the reservoir unless you desire identification of a contaminant layer occurring there.
6. Always use a new clean, dry sample bottle. Make sure contamination does not enter the container while the sample is being taken. Dust and rain can cause misinterpretations.
7. Complete all applicable fields on the identification form (Technical Service Request or LubeAlert sample label). *The oil must be properly identified.* Hours on the oil and make up oil can help determine the severity of the wear metal results. Add a note if the sample was taken under special circumstances, such as from the oil filter or after failure.
8. Send in the sample promptly. Do not save samples to send in multiple samples together. Prompt analysis is necessary to identify critical issues in equipment.
9. Follow up on any recommendation that is made in the report. Data trend analysis can be helpful for identifying equipment issues.

Sample Container: Appropriate containers can be provided by CITGO. Store them in a clean, dry place until ready to use them. Contact your CITGO Account Manager for assistance.

Sample Size: Investigative analysis typically requires more fluid than routine monitoring programs – therefore, a one-quart sample for fluids is normally required. A seven-pound sample (approximately equal to a gallon in volume) is normally required for grease. Your CITGO representative can advise you if a larger sample is required.

Sample Identification: A copy of the Express Test or Technical Service Request (TSR) form (provided by your CITGO Account Manager) must be included with the sample. The sample must be labeled with the TSR number, the marketer's name and contact information, and the name of the end user. If multiple samples are submitted for the same request, they must be clearly distinguished from one another.

Sampling Methods



Sample (Vacuum) Gun Method: Used correctly, a sample gun (or 'vampire') allows the user to draw representative oil samples quickly and with a minimum amount of effort.

Measure a sufficient length of new clean tubing to reach from the gun into the equipment's sump or reservoir. Since the tubing is supplied in coils, it may be necessary to straighten it. If the unit has a dipstick, the tubing should be measured against the dipstick to assure proper length.

Note: Install new tubing after each use to avoid sample cross contamination.

Good practice dictates the use of a new length of tubing for each sample. An ample supply of tubing should be maintained for planned sampling and any unexpected sampling needs.

Loosen the nut on the sample gun head, insert one end of the tubing through the nut to about 1/2 inch past the threaded part of the gun head and tighten the nut. Screw a clean bottle into the gun adapter.

Holding the pump upright, fill the bottle to within 1/2 inch of the top. Break the vacuum by partially unscrewing the bottle or using the vacuum button. Remove the bottle, screw the cap on tightly, and wipe the bottle clean. Fill out the bottle label as necessary and affix it to the bottle.

Sample Valve/Petcock Method: Care should be taken to install the valve at the proper point in the lube system (consult equipment dealer or manufacturer). If the valve or petcock outlet is internally threaded, a pipe plug should be installed; if externally threaded, a pipe cap should be installed. This will also keep out dirt and debris. If no plug or cap is installed, the valve handle should be secured to prevent accidental opening and loss of fluid during operation. The valve exterior and area around it should be wiped or brushed clean prior to drawing a sample. Drain about one quart of fluid into a suitable container; this oil may be discarded or returned to the reservoir. This procedure clears the valve of sediment or stagnant fluid. Now catch the sample in a new clean, dry bottle, filling it to within 1/2 inch of the top. Screw the cap on tightly and wipe the bottle clean. Fill out the bottle label as necessary and affix it to the bottle.

Oil Drain Method: Clean the area around the drain plug thoroughly to avoid sample contamination. Drain at least one quart of fluid into a suitable container; this oil may be discarded or returned to the reservoir. Place a clean, dry sample bottle in the oil stream and fill to within 1/2 inch of the top. Screw the cap on tightly and wipe the bottle clean. Fill out the bottle label as necessary and affix it to the bottle.

DO NOT HOLD SAMPLES – SHIP THE SAME DAY THEY ARE TAKEN.

Grease samples:

Used grease: Collecting enough of the used grease out of an application can be challenging. Available techniques include the use of a small pointed spatula, a flat spatula, a scraper, straw, spoon, or any other tool that might aid in the removal of a representative sample from the application.

Tools must be clean and kept from any contamination during sample collection. The Grease Thief device is available but may require specialized testing equipment.

The sample should be placed in a clean, dry container and properly labeled. When collecting a used grease sample, a sample of the unused, new grease should accompany the used grease sample for comparison with the used product.

Unused grease: Whether sampling an unused grease for testing compatibility or to determine if it meets specifications, it may need to be removed from a large container such as a pail or drum. Use a large, clean spatula or scraper and place the sample into a clean, dry container. A sample of seven pounds, approximately 1 gallon, is required for testing. Properly label the container. Contact your CITGO Account Manager for assistance.

Sample Container: A clean, dry container should be used. A 1-quart minimum, preferred 1-gallon paint can is recommended. Contact your CITGO Account Manager for assistance.

Sample Identification: A copy of the Express Test or Technical Service Request (TSR) form (provided by your CITGO Account Manager) must be included with the sample. The sample must be labeled with the TSR number, the marketer's name and contact information, and the name of the end user. If multiple samples are submitted for the same request, they must be clearly distinguished from one another.



CITGO Technical Bulletin

Taking a Sample from Bulk Tanks



Whether freestanding or a delivery compartment, bulk tanks must be sampled at times for validation of product integrity. Proper technique is vital for ensuring that the sample is representative of the product being sampled.

Safety:

Appropriate personal protective equipment (PPE) is necessary when there is a risk of contact with oil. The complete list of requirements may vary by work site and conditions, but typically include protective eyewear, gloves, hard hat, and steel-toed shoes. You should also review the product SDS for any unexpected hazards, especially when sampling an unfamiliar product.

Sample Containers:

Always use a new, clean, dry sample bottle that is designed for use as an oil sample bottle. Appropriate sample bottles can be provided by CITGO; contact your CITGO Account Manager for assistance. Store empty sample bottles in a clean, dry place until ready to use them.

Procedure:

1. Carefully open the tank's sample valve and drain enough product to purge the oil that has been sitting in the line and valve. A five-gallon bucket is typically sufficient for this.
2. Without closing the valve completely, uncap the sample container, fill it with the oil being sampled, and flush it by emptying it into the waste bucket to remove any dust and contaminants that may have been present in the bottle.
3. As the oil continues to flow from the valve, refill the container no more than approximately 80%, leaving room for expansion. Sampling should not occur while there is a risk of contamination entering the container; dusty, windy conditions and rain can cause misinterpretations.
4. Close the tank valve and recap the sample bottle. Wipe any oil from the outside of the bottle.
5. Label the sample bottle clearly for proper identification, including the product name and grade, the date of sampling, and a description of the source (tank name or number, compartment number, etc.).
6. If the sample is to be sent for analysis, send it promptly and according to the guidance provided by your CITGO Account Manager or Technical Service Representative. If the sample has been taken as a retain, store it in a dark, dry place with as little temperature fluctuation as possible; ideal storage temperature is between 32-77°F. Retains should be kept where they cannot be accessed by unauthorized personnel.

CITGO Technical Bulletin

Field & Operations Safety and Personal Protective Equipment



Introduction to Field & Operations Safety and Personal Protective Equipment

CITGO is committed to working safely and promoting safety wherever its employees and partners operate. This guide to work site safety is intended as a general introduction to safe practices in both everyday operations areas and the field.

Training

Training is an important first step for site safety. Even repeating training that you have completed in the past can be a helpful reminder of the hazards you may face and how to respond to unplanned or unexpected circumstances.

- Have you participated in site safety training for your regular job site(s) in the last year?
- Is specific training needed before you visit a customer site (harness safety, ladder safety, etc)?
- Will you need to arrive early for required site-specific safety training?
- Do you need special training from an outside agency (mine safety, etc)?

Planning a Customer Visit

Ensuring that you and the customer have the same goals, expectations, and plan for the visit will help lead to the most productive and satisfying outcome for all parties.

- What is the goal/intended outcome of the visit?
- Do your team and the customer's team have the same expectation of how the visit will go?
- Do you have a plan for the work to be done?
- What can you learn ahead of time about the site, equipment, and lubrication systems?
- Are you prepared with the knowledge and tools needed to inspect the equipment?

Personal Protective Equipment (PPE)

Customer sites may have very specific requirements, so always determine in advance whether these requirements exist and whether you must purchase or can borrow the proper equipment. It's recommended to keep a basic kit at the ready to cover most industrial environments:

- Hard hat (some sites may have color requirements)
- Safety glasses (if you use prescription safety glasses, ensure that you have side shields)
- Steel-toed shoes (some sites require metatarsal protection as well)
- Fire-resistant (FR) clothing (some sites may only require an FR jacket; check ahead of time or be prepared with FR coveralls as well)
- Work gloves
- Hearing protection (determine the most comfortable style for you and keep multiple pairs of earplugs on hand)
- High-visibility vest

Alertness

Maintaining a high level of alertness and personal awareness when on site can help close gaps that training can't or didn't cover, and can prevent injury.

- Are you actively looking for hazards?
- Are you listening for alarms?
- Do you smell smoke or anything unusual?
- Do you feel as well as you did when you arrived, or have you begun feeling dizzy, faint, or otherwise unwell?

Observations

There are many safety considerations and potential hazards at any work site. Here are a few to be aware of:

- Escape route
- Shelter points
- Slip hazards
- Trip hazards
- Overhead hazards
- Hot surfaces
- Moving parts
- Electrical hazards
- Climbing hazards
- Walkways
- Handrails

To learn more about hazards and safety preparedness, visit the Occupational Safety and Health Administration online at [osha.gov](https://www.osha.gov) and the National Safety Council at [nsc.org](https://www.nsc.org).



CITGO[®] LUBRICANTS COMPATIBILITY CHART

CITGO[®] Lubricants Marketer Packaging Guidelines

Instructions for Proper Handling of CITGO Lubricants

CITGO Lubricants must be handled with care to assure product integrity, package identity and correct fill. Your customers deserve the type, grade and quantity of lubricant specified. Those engaged in CITGO Marketer packaging operations must ensure all facilities meet acceptable standards and are operated in a careful, professional manner.

1. RECEIVING

Lubricants are to be transported in appropriate containers or vessels including compartments, manifolds and unloading lines that have been thoroughly drained and flushed in accordance with industry standards.

When delivery is made, Marketer Packager personnel are to be on-hand to ensure products are unloaded into proper tank storage.

The CITGO Lubricants Compatibility Chart should be referenced to determine the product off-loading order. In general, within product categories, follow lower viscosity grades with higher viscosity grades and lighter colored oils with darker colored oils.

Pumps should be reversible to allow lines to be "blown" or cleared in order to minimize line flush and product contamination.

A sample should be taken either from the hose nozzle or from the manifold after two (2) full manifold volumes have passed through. Inspect sample for evidence of water or other contamination. If needed, drain off additional product until product sample is clear. A retain sample of at least eight (8) ounces of each product delivered shall be retained for a minimum of six (6) months. This sample should be labeled with the product name and grade, date received and the CITGO bill of lading number.

2. BULK STORAGE AND HANDLING

Tankage and related equipment must be constructed and maintained to prevent contamination of the contents and clearly marked for easy identification of contents. Facilities must be provided for pumping tank completely empty and for cleaning when required. When changing tank service, consult with CITGO regarding the need for tank cleaning.

Receiving lines shall be clearly marked and dedicated for each product family. Refer to the CITGO Lubricants Compatibility Chart.

Lines to filling equipment are to be clearly marked for product identification. Lines, pumps and meters should be dedicated by product family.

A schematic of the repackaging facility shall be provided to CITGO. This schematic will clearly illustrate tankage, lines, hoses, valves, pumps, meters and other significant plant features. An update of this schematic is to be provided to CITGO whenever a significant change is made to the bulk or repackaging facility.

3. CONTAINER STORAGE AND INSPECTION

Empty containers shall be stored under cover in a manner to protect the appearance of the containers and prevent rust, corrosion or deterioration of the container. Containers are to be inspected immediately

prior to being filled to ensure there has been no accumulation of moisture or solid debris. This inspection shall be performed with lighting adequate to clearly inspect the entire interior.

Color of containers shall conform to CITGO standards per Exhibit "B" of the Lubricant Packaging and Trademark Agreement.

Labels are to be stored indoors.

4. FILLING

Marketer Packager is responsible to fill authorized packages as provided by Exhibit "A" of the Lubricant Packaging and Trademark Agreement with proper quantity to ensure that all applicable federal, state and local weights and measures requirements are met. A screen or filter, 60-mesh or finer, is required downstream from the filling line pump.

The filling operation is to be under cover in a dust-free area. A sample (8-oz. minimum) must be retained from each packaging lot for a period of six (6) months.

5. LABELING

Labels are to be purchased from Reliance Label Solutions and applied in accordance with CITGO Lubricants container decorating instructions.

6. MEASURING EQUIPMENT

Measuring equipment must be accurate, well maintained and certified by state or local authorities as required. Provisions must be made for temperature correction of volume measurements.

7. RECORDKEEPING

Books or logs shall be kept so that a clear record of the following is maintained:

- | | |
|--|--------------------------------|
| Every Product | Every Filling Run |
| • Product name and grade | • Product name and grade |
| • Date and bill of lading number – carrier | • Date and lot number assigned |
| • Receiving tank | • Tank drawn from |
| • Volume of tank before and after delivery | • Number and type of container |

8. STORAGE AT EXTREME TEMPERATURES

Exposure of lubricants to either abnormally high or low temperatures can result in temporary or permanent damage, depending upon the nature and composition of the product. The optimum storage temperature for most lubricants is 32°F to 77°F. Refer to CITGO Technical Bulletin, "Lubricant Storage and Handling and Shelf Life Guidelines" on MarketNet.

Reference Information

Container Decorating Instructions



LABELS

Only CITGO Lubricants authorized container labels are permitted. Labels and product information will be provided by CITGO.

The current CITGO approved label specifications are as follows:

Each set - 1 label 9-7/8" x 8-1/4" and 1 label 1-7/8" x 8-1/4"

These labels are printed five colors on computer printable vinyl. The labels use a special permanent adhesive with an application temperature range of 7°F to +133°F, but should be stored in a controlled, room-temperature environment. Shelf life of these labels should be approximately one (1) year.



DRUMS

Layout and Positioning

Labels will be positioned as shown.

The top edge of the large CITGO label should be placed 1/2" below the flange of the small bung. The top edge of the small label should be placed 1" below the top drum rim, lined up with the large label on top. (Note: For drums filled on pallets: The top edge of the small label should be placed 1" below the top drum rim, centered below the small bung.)

Container Color Code

55 Gallon/400 Pound

ALL unless otherwise noted: Bottom, body and chimes Steel Shipped Container Institute (SSCI) Tomato Red (Red #103) with white head.

FRONT

55 GALLON DRUM FLANGE SEALS (LITHOGRAPHED)



DRUM FLANGE SEALS

Drum seals provided by CITGO at its option. When not available, plain or non-lithographed seals may be used.



PAILS

Center and apply CITGO pail label on one side of the pail between bail handle. Center and apply form label on opposite side of the pail between bail handle. Apply lid with the pour spout centered on the bail handle opposite of the form label. Dispose of strip label.

Container Color Code

5 Gallon/35 Pound

SSCI Tomato Red (Red #103) for body and head

For further technical assistance or questions, please contact the CITGO Lubricants Product Answer Line at 800-248-4684 or lubeshelp@citgo.com. For label assistance or questions, please contact CITGO Lubricants Customer Experience at 800-331-4068, option 2 or LubesCS@citgo.com.



**PRODUCT NAME
CHANGES**
JOIN THE GREAT GREASE MOVE

WHO MOVED MY GREASE?!

Let's make things simpler and build a stronger brand together.

Starring Les Friction

Old Material #	Old Description	New Material #	New Description
Mystik Products			
655566001	CITGO® Aluminum Complex PL #00	655566002	Mystik® AluPlex® Plunger #00
655565001	CITGO Aluminum Complex PL #000	655565002	Mystik AluPlex Plunger #000
655564001	CITGO Aluminum Complex PL #000 Arctic	655564002	Mystik AluPlex Plunger Low Temp #000
655542001	CITGO UltraLife® CSEP 5M #2	655542002	Mystik CalSuPlex® 5% Moly #2
655582001	CITGO Calsuplex MP #2	655582002	Mystik CalSuPlex Multi-Purpose #2
655531001	CITGO RR Curve Winter No.0	655531002	Mystik Curve Rail #0
655532001	CITGO RR Curve Summer No.1	655532002	Mystik Curve Rail #1
655231001	CITGO Premium Coupling	655231002	Mystik High Speed Coupling
655210001	CITGO Premium Lithium EP #0	655210002	Mystik Lithium Extreme Pressure #0
655211001	CITGO Premium Lithium EP #1	655211002	Mystik Lithium Extreme Pressure #1
655212001	CITGO Premium Lithium EP #2	655212002	Mystik Lithium Extreme Pressure #2
655771001	CITGO Premium Lithium EP Semi-Fluid	655771002	Mystik Lithium Extreme Pressure #00-000
655351001	CITGO Lithoplex® CM #1	655351002	Mystik LithoPlex 3% Moly #1
655352001	CITGO Lithoplex CM #2	655352002	Mystik LithoPlex 3% Moly #2
655356001	CITGO Lithoplex HM #1	655356002	Mystik LithoPlex 5% Moly #1
655357001	CITGO Lithoplex HM #2	655357002	Mystik LithoPlex 5% Moly #2
655435001	CITGO Lithoplex WPM No.1	655435002	Mystik LithoPlex Dye Free #1
655366001	CITGO Lithoplex ST #1	655366002	Mystik LithoPlex Industrial #1
655367001	CITGO Lithoplex ST #2	655367002	Mystik LithoPlex Industrial #2
655360001	CITGO EP Mining Grease #1	655360002	Mystik LithoPlex Mining #1
655358001	CITGO EP Mining Grease #2	655358002	Mystik LithoPlex Mining #2
655341001	CITGO Lithoplex MP #1	655341002	Mystik LithoPlex Multi-Purpose #1
655340001	CITGO Lithoplex MP #2	655340002	Mystik LithoPlex Multi-Purpose #2
655387001	CITGO Lithoplex MP Red #2	655387002	Mystik LithoPlex Multi-Purpose Red #2

Reference Information

CITGO Petroleum Corporation
Houston, Texas

Customer Experience Line
1-800-331-4068
LubesCS@CITGO.com

Product Answer Line
1-800-248-4684
lubeshelp@CITGO.com

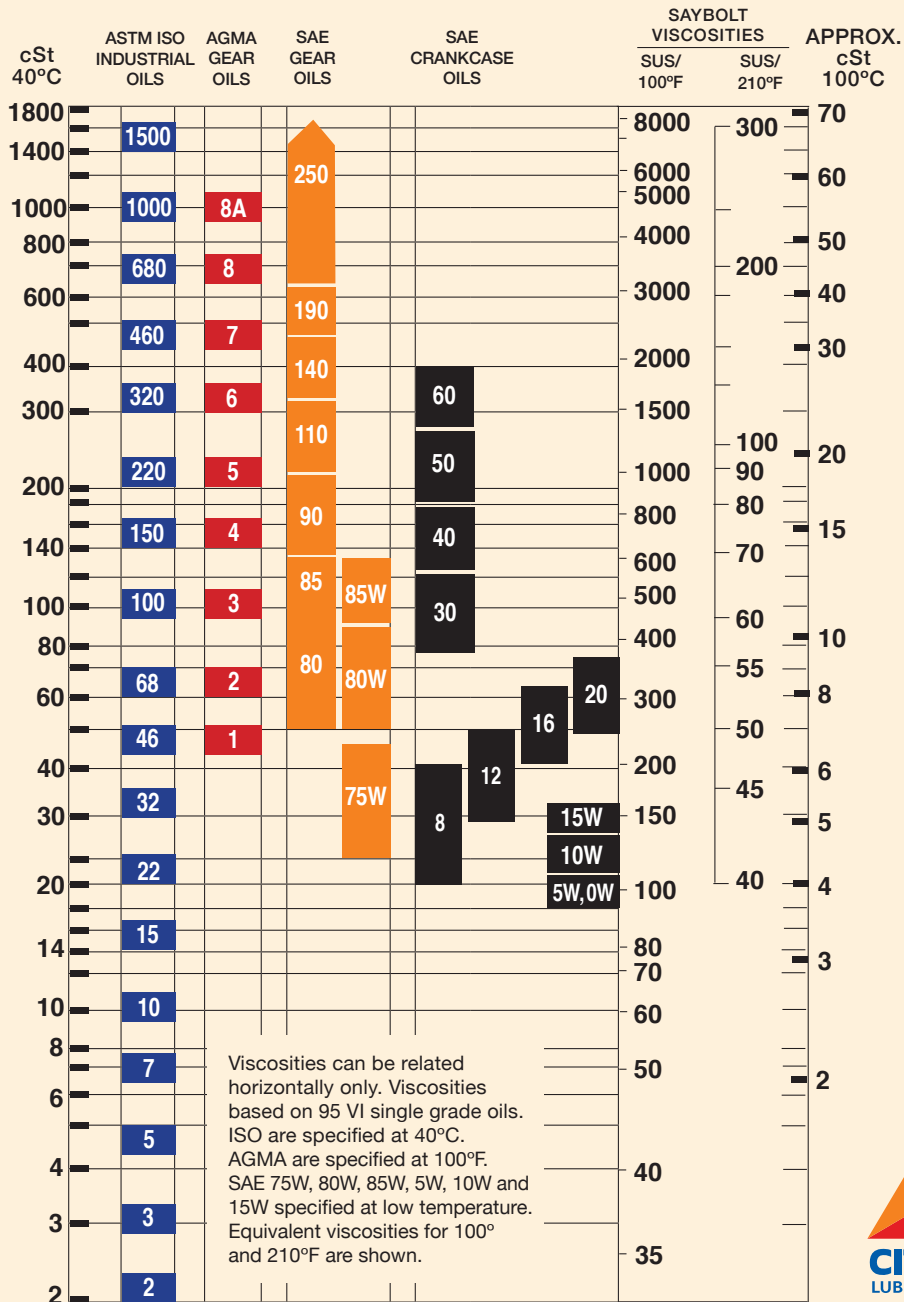
Online at
www.mystiklubes.com

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CIT-8341

Old Material #	Old Description	New Material #	New Description
655343001	CITGO Lithoplex RT #1	655343002	Mystik LithoPlex Red Tacky #1
655344001	CITGO Lithoplex RT #2	655344002	Mystik LithoPlex Red Tacky #2
655437001	CITGO Lithoplex PM #2	655437002	Mystik LithoPlex Pellet Mill #2
655539001	CITGO Lithoplex PL #00	655539002	Mystik LithoPlex Plunger 320 #00
655538001	CITGO Lithoplex PL #000	655538002	Mystik LithoPlex Plunger 320 #000
655572001	CITGO Lithoplex PTG #2	655572002	Mystik LithoPlex PowerTool #2
655780001	CITGO Jet Lubricant TM	655780002	Mystik Railroad Traction Motor
Mystik JT-6® Products			
655451001	CITGO SynDurance® ST Synthetic 460 #1	655451002	Mystik JT-6 Synthetic 460 #1
655424001	CITGO SynDurance Premium Synthetic 460 #00	655424002	Mystik JT-6 Synthetic 460 #00
655427001	CITGO SynDurance Premium Synthetic 460 #2	655427002	Mystik JT-6 Synthetic 460 #2
655429001	CITGO Lithoplex EM Full Synthetic #2	655429002	Mystik JT-6 Synthetic Electric Motor #2
The Following Products Have Been Merged with Another Product Above			
CITGO SUPERGARD® Marine Plus		Mystik JT-6 Marine Multi-Purpose #2	
CITGO SynDurance ST Synthetic 460 #1		Mystik JT-6 Synthetic 460 #1	
CITGO SynDurance ST Synthetic 460 #2		Mystik JT-6 Synthetic 460 #2	
CITGO SynDurance Premium Synthetic 460 #00 Red		Mystik JT-6 Synthetic 460 #00	
CITGO OverDrive HD®		Mystik LithoPlex Industrial #2 (CITGO Lithoplex ST #2 formula)	
The Following Products Have Been Eliminated			
CITGO SynDurance ST Synthetic 220		Eliminated	

Approximate Equivalence of Viscosity Grading Systems



Reference Information



LM 180402001

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CITGO® A/W Hydraulic Oils Super MV	107-108	CITGO® Gascom® R Oil	224
CITGO® AW Mining Hydraulic Oil	109	CITGO® Glycol FR-5046HP	112-113
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CITGO® Autokut® IS Series	134-135	CITGO® HyDurance® AW CP Fluids	93-94
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CITGO® Bar & Chain Oil	178	CITGO® HyDurance® AW NZ Fluids	95-96
CITGO® Chain Oil	179	CITGO® HyDurance® AW Super NZ Fluid	99-100
CITGO® CITCOOL® 33	145-146-147	CITGO® HyDurance® AW Synthetic Fluids	101-102
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