

ENGINEERED FOR YOUR MACHINE

OEM PRODUCTS

LUBRICANTS BROCHURE

REVISION 01



**BELL OEM
PRODUCTS**

BELL
Lubricants

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Bell Lubricants Recommendations in accordance with Bell Equipment specifications

The recommendations provided herein are given in good faith and on the basis of the best information available at the time of issue. It is the responsibility of the user to ensure that the products are used in the applications for which they are intended, and no legal liability therefore is accepted by Bell Lubricants.

Bell Service Bulletin:

Benefits of using a combination of low sulphur fuels with high quality lubricating oils

Use of Bell recommended oils ensures efficient performance and optimum protection of the engine. However, the use of low sulphur fuels with recommended oil provides maximum benefit. Sulphur in diesel forms sulphuric acid that play a major role in increasing engine wear. On the other hand, low sulphur diesel forms less sulphuric acid when combusted which leads to lower engine wear rates, reduced harmful exhaust emissions, improved combustion properties and longer engine life. Sulphur in diesel leads to the formation of sulphate particulates. In the engine oil, these cause depletion of additives and reduced oil life.



BELL OEM MACHINES

BELL

ARTICULATED DUMP TRUCK



ENGINE	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
C-series	Mineral Engine Oil 15W-40	BN005542	MB 228,3 API CI-4 ^{Plus}
E&D-series ^{Unregulated}	Semi Synthetic Engine Oil 10W-40	BN005546	MB 228,5 API CJ-4
E-series ^{Stage V} (is also backward compatible)	Full Synthetic Engine Low SAPS Engine Oil 10W-40	910425	MB 228,51 API CK-4

-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
Mineral Engine Oil 15W-40										
Semi Synthetic Engine Oil 10W-40										
Full Synthetic Engine Oil 10W-40										

COOLANT	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
C & D-series	Extended Life Coolant-Premix 50	BN005609	MB 326.3 (325.3 ^{Pre-mixed})
E-series	Extended Life Coolant-Premix 50 ^{Ultra}	BN038232	MB 326.5 (325.5 ^{Pre-mixed})

TRANSMISSION	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
C,D & E-series	Syn ATF Ultra	BN005549	TES 668

TRANSFER CASE	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
C-series	Syn ATF Ultra	BN005549	TES 668
D-series	Syn ATF Ultra	BN005549	TES 668
B60D-B60E	Gear Oil Limited Slip 80W-90	BN005575	API GL-5 LS
E-series	Syn ATF Ultra	BN005549	TES 668
E-Series Kessler	Gear Oil Limited Slip 80W-90	BN005575	API GL-5 LS

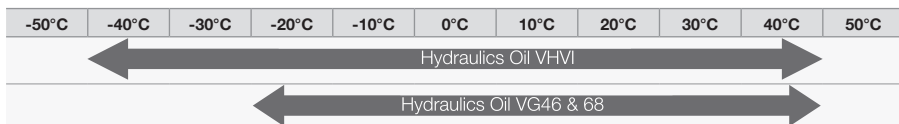
ARTICULATED DUMP TRUCK

AXLES	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
C,D & E-series, B60D, B35-B60E E-series B30E PIN3	Gear Oil Limited Slip 80W-90	BN005575	API GL-5 LS
D-series, B35-B50D TF302 T. Truck and 2806E Hauler	Super Gear Oil SAE 80W	BN035704	API GL-4/ API GL-5

WDB COOLING	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
B40D Brake cooling reservoir	UTTO Ultra	BN089901	ZF TE-ML
B60D & E-Series	E# WDB Plus	BN061186	Dextron III (G) Plus special additive Dextron III (H) plus special additive

DRY DISC BRAKES	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
B40C & B35C	Brake Fluid	BN005559	SAE J 1704 DOT 4

HYDRAULICS	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
C & D-series	Hydraulics Oil VHV1	BN005557	ZF TE-ML-09,11&14
D & E-series	Hydraulics Oil VG 46	BN005603	DIN 51524-2 & 3
D & E-series	Hydraulics Oil VG 68	BN005598	DIN 51524-2



GREASE	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
General (Pin, Bushes) Auto greasing, etc	Multi Purpose Grease	BN005568	NLGI 2
General (Pin, Bushes) Auto greasing, etc	Multi Purpose Grease Plus	BN089919	KP2K-20 D51502
Drivetrains (TPO Propshaft-High Temperature)	Grease-High Temperature	BN005770	NLGI 2 (ASTM D217)

MOTOR GRADER



ENGINE	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
G140,G160,G200 Stage 3A	Mineral Engine Oil 15W-40	BN005542	CES20076/77/78
G140,G160,G200 Stage 5	Low SAPS Engine Oil 15W-40	BN056204	CES20086

-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
Mineral Engine Oil 15W-40 Low SAPS Engine Oil 15W-40										

COOLANT	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
G140,G160,G200 Stage 3A & 5	Extended Life Coolant -Premix 50 Ultra	BN038232	Cummins 14603

TRANSMISSION	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
G140,G160,G200 Stage 3A & 5	UTTO Ultra	BN089900	API GL-4/2F TE-ML

AXLES - DIFFERENTIAL AND TANDEMS	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
G140,G160,G200 Stage 3A & 5	UTTO Ultra	BN089900	API GL-4/2F TE-ML

HYDRAULICS	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
G140,G160,G200 Stage 3A & 5	HVI Ultra	BN049359	DIN51524-3/GM LS-2

-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
HVI Ultra										

CIRCLE DRIVE BOX	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
G140,G160,G200 Stage 3A & 5	Manual Transmission Oil 75w-90 Fully-Synthetic	BN005595	API GL-5/MT1

GREASE 3A & STAGE 5	RECOMMENDATIONS	PART NUMBER	SPECIFICATION
Grease Pin & Bushes, etc	Multi Purpose Grease Plus	BN089918	KP2K-20
Wheel Bearings & P/Shfts	Multi Purpose Grease Plus	BN089918	KP2K-20
Slew Ring Internal Bearing	Multi Purpose Grease Plus	BN089918	KP2K-20
Slew Ring Gear & Pinion Gear	Slew Ring Grease	BN031576	NLGI 2

TRACKED CARRIERS



ENGINE		RECOMMENDATIONS					PART NUMBER		SPECIFICATION		
TC11/TC07		Low SAPS Engine Oil 15W-40					N/A		CES20086		
-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C	
Low SAPS Engine Oil 10W-40											
COOLANT		RECOMMENDATIONS					PART NUMBER		SPECIFICATION		
TC11/TC07		Coolant-Premix 50 Ultra					BN038232		CES14603		
HYDRAULICS		RECOMMENDATIONS					PART NUMBER		SPECIFICATION		
TC11/TC07		Hydraulic Oil VG 46					BN005603		DIN51524-2/ SAUER DAFOSS		
-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C	
Hydraulics Oil VG46											
DRY DISC BRAKES FINAL DRIVE		RECOMMENDATIONS					PART NUMBER		SPECIFICATION		
TC11/TC07		Transfluid TO-4					910337		API GL-4		
GREASE		RECOMMENDATIONS					PART NUMBER		SPECIFICATION		
TC11/TC07		Multi Purpose Grease					BN038823		NLGI 2		
TC11/TC07		Multi Purpose Grease Plus					BN089918		KP2K-20		

HAULAGE TRACTOR



1406 / 1736A/AF				RECOMMENDATIONS						PART NUMBER
Series - I, II, III & V				Mineral Engine Oil 15W-40						BN005542
Series - IV				Semi Synthetic Engine Oil 10W-40						BN005546

-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
Mineral Engine Oil 15W-40										
Semi Synthetic Engine Oil 10W-40										

COOLANT				RECOMMENDATIONS						PART NUMBER
Series - I, II, III, IV				Extendant Life Coolant-Premix 50						BN005612
Series - V				Extendant Life Coolant-Premix 50 Ultra						BN038232

TRANSMISSION				RECOMMENDATIONS						PART NUMBER
Automatic (Series I)				Torque Fluid 434						BN005590
Automatic (Series II & MKII)				Syn ATF Ultra						BN005549

TRANSFER BOX				RECOMMENDATIONS						PART NUMBER
Series - I, II, III, IV, V				Gear Oil Limited Slip 80W-90						BN005575

AXLES				RECOMMENDATIONS						PART NUMBER
Series - I, II, III, IV, V				Gear Oil Limited Slip 80W-90						BN005575

HYDRAULIC				RECOMMENDATIONS						PART NUMBER
Series - I, II, III, IV, V				Hydraulic Oil VG 68						BN005598

-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
Hydraulics Oil VG46 & 68										

GREASE				RECOMMENDATIONS						PART NUMBER
Series - I, II, III, IV, V				Multi Purpose Grease						BN005567
Series - I, II, III, IV, V				Multi Purpose Grease Plus						BN089918

TRI-WHEELER LOADERS



ENGINE	RECOMMENDATIONS	PART NUMBER
A-series, E-series	Mineral Engine Oil 15W-40	BN005542
F-series	Semi Synthetic Engine Oil 10W-40	BN005546

-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
Mineral Engine Oil 15W-40										
Semi Synthetic Engine Oil 10W-40										

COOLANT	RECOMMENDATIONS	PART NUMBER
F-series	Extendant Life Coolant-Premix 50	BN005612

AXLES / WHEELS	RECOMMENDATIONS	PART NUMBER
A-series, E-series & F-series	Gear Oil Limited Slip 80W-90	BN005575

PARK BRAKING HOUSING	RECOMMENDATIONS	PART NUMBER
A-series, E-series & F-series	Mineral Engine Oil 15W-40	BN005542

HYDRAULICS	RECOMMENDATIONS	PART NUMBER
A-series, E-series & F-series	Hydraulic Oil HVI Ultra	BN049359

-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
Hydraulic Oil HVI Ultra										

GREASE	RECOMMENDATIONS	PART NUMBER
A-series, E-series & F-series	Multi Purpose Grease	BN005567
A-series, E-series & F-series	Multi Purpose Grease Plus	BN089918

BELL F & A



ENGINE			RECOMMENDATIONS								PART NUMBER
Skogger, FastFell, UltECO Slew Loader, CanePro & LogPro			Mineral Engine Oil 15W-40								BN005542
-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C	
											
COOLANT			RECOMMENDATIONS								PART NUMBER
Skogger, FastFell, UltECO Slew Loader, CanePro & LogPro			Extended Life Coolant-Premix 50 Ultra								BN033232
AXLE			RECOMMENDATIONS								PART NUMBER
Skogger, FastFell, UltECO Slew Loader, CanePro & LogPro			Gear Oil Limited Slip 80W-90								BN005575
FINAL DRIVE			RECOMMENDATIONS								PART NUMBER
Skogger, FastFell, UltECO Slew Loader, CanePro & LogPro			Gear Oil Limited Slip 80W-90								BN005575

BELL F & A



GEARBOX				RECOMMENDATIONS				PART NUMBER			
Skogger				Gear Oil Limited Slip 80W-90				BN005575			
HYDRAULICS				RECOMMENDATIONS				PART NUMBER			
Skogger, FastFell, UltECO Slew Loader, CanePro & LogPro				Hydraulic Oil HVI Ultra				BN049359			
-50°C	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C	
											
GREASE				RECOMMENDATIONS				PART NUMBER			
Skogger, FastFell, UltECO Slew Loader, CanePro & LogPro				Multi Purpose Grease				BN005568			
Skogger, FastFell, UltECO Slew Loader, CanePro & LogPro				Multi Purpose Grease Plus				BN089919			



MINERAL ENGINE OIL 15W-40

DESCRIPTION

Bell Mineral Engine Oil 15W-40 is an advanced engineered high-performance SAE 15W-40 crankcase engine oil (HPDO) designed to the unique requirement of the South and Sub-Saharan African markets. The product has been re-engineered to not only to meet the technologies of yesteryear but also the current technologies set by American, European, and Asian OEM's for engines burning high or low sulphur diesel fuel (depending on the area of operation).

It ensures excellent control over soot induced wear, high temperature piston deposits, bore polishing, corrosion, foaming, oxidation stability and ensures superior engine cleanliness at extended drain intervals reducing the total cost of ownership.

APPLICATION

Bell Mineral Engine Oil 15W-40 is now a Mid to Low SAPS (Sulphated Ash, Phosphorous & Sulphur) oil making it suitable for the latest EURO V and EURO VI heavy duty diesel engines fitted with emission control systems using DPF, SCR, DOC and EGR technologies. It is also suitable for older turbocharged and naturally aspirated diesel engine generations for both on-highway and off-highway applications operating on high or low sulphur diesel fuel.

Bell Mineral Engine Oil 15W-40 has been so uniquely formulated that it is also a high-performance petrol engine lubricant as it conforms to API SN performance level. This makes

Bell Mineral Engine Oil 15W-40 and all round multi-functional fleet lubricant.

PERFORMANCE LEVEL

Daimler DTFR 15C100 (MB 228.31) API CK-4/CJ-4/CI-4 plus/CI-4, API SN/SL, ACEA E7/E9-16, JASO DH-2, MAN 3275, Renault VI RLD-2, Volvo VDS-4.5, Cummins CES 20086, Caterpillar ECF-3, DDC93K222, Deutz DQC-111LA, Ford WSS-M2C171-F1, Scania E7.

PERFORMANCE LEVEL

- Exceeds all major American, European, and Asian OEM and Industry specifications.
- Compatible with emission control systems.
- Excellent performance with extended oil drain intervals on low emission engines.
- Exceptional soot dispersancy, preventing deposits on critical engine components.
- Excellent TBN retention effectively neutralizing the acidic by-products of combustion.
- Superior deaeration and anti-foam characteristics for accurate operation of hydraulically actuated fuel injection systems.

TYPICAL CHARACTERISTICS

Property	Methods	Units	Typical
SAE No.	-	-	15W-40
Viscosity @ 40°C	ASTM D445	cSt	119
Viscosity @ 100°C	ASTM D445	cSt	15
Viscosity Index	ASTM D2270	-	132
Flash Point	ASTM D92	°C	232
Pour Point	ASTM D5950	°C	-27
Total Base No.	ASTM D2896	mgKOH/g	10.3
Sulphated Ash	ASTM D874	% m/m	1.0





DESCRIPTION

Bell Semi Synthetic Engine Oil 10W-40 Bell Semi Synthetic Engine Oil 10W-40 is a high performance SAE 10W-40, synthetic based, heavy duty diesel engine crankcase oil designed for severe On-and Off-Highway applications. It is designed to address the concerns of European engine manufacturers regarding the sensitivity of vehicle control systems to the sulphated as content of the lubricant.

Bell Semi Synthetic Engine Oil 10W-40 provides excellent protection against acid corrosion, harmful deposits and wear which allows for extended oil drain performance. Bell Semi Synthetic Engine Oil 10W-40 is a single oil solution for different OEM technologies where EURO 2, 3 and 4 emission standards are conformed too.

APPLICATION

Bell Semi Synthetic Engine Oil 10W-40 is designed for use in the latest generation European and American modern low emission diesel engines. Bell Semi Synthetic Engine Oil 10W-40 meets or exceeds the performance requirements of the following OEM's: Cummins, Daimler, DAF, Iveco, Mack, Renault, Volvo, Japanese OEM's.

PERFORMANCE LEVEL

API CI-4/CH-4/CG-4/SL, ACEA E4/E7-16, JASO DH-1, Global DHD-1, Daimler DTFR 15B120 (MB 228.5), MAN M3277, Cummins CES 20078, DQC III-18, MTU DDC T3, MTU Type 2, Renault RLD-2, Volvo VDS-3

BENEFITS

Exceeds OEM warranty requirements. Compatible with engine management devices and exhaust after-treatment systems. Exceeds Euro-3 and future proposed European OEM requirements. Excellent low temperature properties - immediate protection on start-up. Optimal oil consumption due to inherent low volatility, resulting in reduced emissions. Superior lubrication - reduced wear and increased engine life. Exceptional engine cleanliness due to excellent soot handling characteristics.

TYPICAL CHARACTERISTICS

Parameters	Methods	Units	Typical Results
SAE No.	-	-	10W-40
Viscosity @ 40°C	ASTM D445	cSt	93
Viscosity @ 100°C	ASTM D445	cSt	14.5
Viscosity Index	ASTM D2270	-	150
Flash Point	ASTM D92	°C	240
Pour Point	ASTM D5950	°C	-30
Total Base No.	ASTM D2896	mgKOH/g	12.6
Sulphated Ash	ASTM D874	% m/m	1.7





FULLY SYNTHETIC ENGINE OIL 10W-40 LOW SAPS

ENGINE: STAGE IIIA, IIIB, IV, V
TIER 3, 4i, 4F, 5

DESCRIPTION

Bell Fully Synthetic Engine Oil 10W-40 Low SAPS is synthetic technology engine oil formulated with Strong Tech™ technology, engineered to stay stronger for longer, forming a uniquely strong fluid film to extend drain intervals and engine life, maximize performance and keep your business and your trucks moving. This helps in extending engine life and reduces the total cost of ownership.

Bell Fully Synthetic Engine Oil 10W-40 low SAPS oil that is suitable for Euro VI and Euro V heavy duty diesel applications including modern, high-output, low emission engines fitted with emission control systems using DPF, SCR, DOC and EGR technologies. It is also suitable for older turbocharged and naturally aspirated diesel engine generations, both on-highway and off-highway, running on high or ultra-low Sulphur diesel and biodiesel. Suitable for OEMs requiring below specifications for their CNG vehicles.

Bell Fully Synthetic Engine Oil 10W-40 low SAPS 10W-40 is approved Daimler Truck Fluid Release (DTFR) 15C110, fully backward compatible and suitable for use for vehicles recommending the previous Daimler MB 228.51 specification. Fully backward compatible with previous E6-16, E7-16 and E9-16 classifications.

BENEFITS

Up to 0,6% additional reduction of fuel consumption compared to oils of the same viscosity grade. Significant reduction of residues in engines and turbochargers. Provides environmental benefits due to reduced fuel consumption and longest oil drain intervals. Excellent ageing stability. Protects exhaust gas aftertreatment systems because of a low content of sulphated ash, phosphorus and Sulphur (Low-SAPS). Excellent wear protection even under high loads. Fulfills all latest ACEA Ex specifications (ACEA E11/E9/E8/E7/E6/E4) in combination with API CK-4. Offers a wide application profile, excellent rationalization product for mixed fleets

SPECIFICATIONS:

API CK-4, ACEA E11, E8, E7, JASO DH-2, Cummins CES 20086, Deutz DQC IV-18 LA, DTFR 15C110 (MB 228.51), Mack EOS-4.5, MTU Oil Category 3.1, Renault RLD-3, Volvo VDS-4.5

TYPICAL PHYSICAL CHARACTERISTICS

Parameters	Method	Unit	Typical Value
Appearance	-	-	Bright & Clear
Density @15°C	ASTM D 4052	g/cm3	0.868
Kinematic Viscosity @100°C	ASTM D 445	mm2/s (cSt)	14.2
Viscosity Index	ASTM D 2270	-	152
Flash Point COC	ASTM D 92	°C	> 220
TBN	ASTM D 2896	mgKOH/g	≥ 10
CCS at -25°C	ASTM D5293	mPa*s	6400
Pour Point	ASTM D 97	°C	-39





DESCRIPTION

Bell Semi Synthetic Engine Oil 15W-40 Low SAPS It's tough out there and getting tougher for your commercial transport business. The world is changing at breakneck speed, throwing an ever-growing, intense set of external challenges and pressures your way. Yet, in the face of all this, you are relied upon to get the job done. The same is true of your truck.

APPLICATION

Bell Engine oil 15W-40 Low SAPS is a premium engine oil formulated with Strong Tech™ technology, engineered to stay stronger for longer, forming a uniquely strong fluid film to extend drain intervals and engine life, maximize performance and keep your business and your trucks moving. This helps in extending engine life and reduces the total cost of ownership.

Bell Engine oil 15W-40 Low SAPS is a low SAPS oil that is suitable for Euro VI and Euro V heavy duty diesel applications including modern, high-output, low emission engines fitted with emission control systems using DPF, SCR, DOC and EGR technologies. It is also suitable for older turbocharged and naturally aspirated diesel engine generations, both on-highway and off-highway, running on high or ultra-low Sulphur diesel and bio-diesel.

PERFORMANCE LEVEL

API CK-4, ACEA E7, E9, Cummins CES 20086, Deutz DQC III-10 LA, Mack EOS-4.5, MB-Approval 228.31, MTU CAT, Renault RLD-3 2.1, Renault RLD-3, Volvo VDS-4.5, CAT ECF-3, DAF, Detroit Diesel DFS93K222, Ford WSS M2C171-F1, MAN M 3775.

BENEFITS

- Maintains oil at optimal viscosity levels, delivering optimal lubrication to prevent unplanned breakdowns.
- Better fluid film resistance under severe mechanical stress to deliver enhanced engine durability.
- Longer Drain Interval and Engine Life
- Effectively combats high concentration of soot build ups, critical to prevent loss of vehicle horsepower.
- Good low temperature viscosity for improved lubrication during start-up.

TYPICAL PHYSICAL CHARACTERISTICS

Parameters	Method	Units	Typical
Appearance	-	-	Bright & Clear
Density @ 15C	ASTM D 4452	g/cm ³	0,875
Kinematic Viscosity at 100°C	ASTM D 445	Mm ² /s	15,5
Viscosity Index	ASTM D 2270	-	138
Flash Point COC	ASTM D 92	C	>220
TBN	ASTM D 2896	mgKOH/g	9.7
CCS at -20°C	ASTM D 5293	mPa*s	5.500
Pour Point	ASTM D 2896	C	-36





HYDRAULIC OIL VHVI

DESCRIPTION

Bell Hydraulic Oil VHVI is formulated from solvent refined base oils, viscosity index improvers, foam and oxidation-resistant fluid having frictional characteristics suitable for automatic transmissions designed to use Type G and Type F automatic transmission fluids and Ford specification ESW-M2C 33-G fluids.

Bell Hydraulic Oil VHVI is dyed red like any other ATF fluid.

APPLICATION

Bell Hydraulic Oil VHVI is intended for the following components of many commercial vehicles and off-highway equipment.

- heavy-duty transmissions
- power steering systems
- hydraulics and hydrostatic systems where Allison C-3 or C-4 fluid is recommended

Do NOT use in systems with silver-coated bearings

FEATURES & BENEFITS

This product is used primarily for some commercial transmissions and certain manual gearboxes and power steering units. Bell Hydraulic Oil VHVI is recommended for the automatic transmissions of Ford and other vehicles such as Leyland, Mazda, Volvo and older Toyota models.

PRODUCT SPECIFICATIONS

- Ford ESW-M2C 33-G
- Denison HF-0
- Allison C4
- General Motors Type F and G
- ZF TE-ML-09,11 & 14
- Caterpillar T0-2
- Voith

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
Viscosity	cST @ 40°C	39
Viscosity	cST @ 100°C	8.2
Viscosity Index	-	190
Flash Point	°C	190
Pour Point	°C	-40
Colour	-	Red
Density @ 20°C	kg/m ³	864





DESCRIPTION

Bell Hydraulic Oil HVI Ultra is ultra high VI, "super-stabilised", semi-synthetic anti-wear hydraulic fluid designed and formulated specifically to reduce energy consumption in hydraulic oil systems, especially those found in mobile earthmoving equipment.

Bell Hydraulic Oil HVI Ultra is specifically designed to meet the requirements of modern hydraulic systems, including those where the equipment manufacturer specifies the use of anti-wear-type hydraulic fluids. It contains a balanced selection of additives that affords multi-metal compatibility, anti-rust, anti-corrosion, anti-foam, and anti-wear protection. These are combined to maintain the good air-release and water separation properties of the highly refined base oils employed in the formulation.

APPLICATION

Bell Hydraulic Oil HVI Ultra is intended for:

- tri-wheelers with Poclain wheel motors
- hydraulic systems
- lightly to moderately loaded spur and bevel gears
- compressors (including certain rotary and other compressors)
- industrial torque converters

Do NOT use in systems with silver-coated bearings

PRODUCT SPECIFICATIONS

- AFNOR NFE 48-690/ 1 (Dry & Wet)
- AFNOR NFE 48-603
- ISO 11158 HV
- GM LS-2
- Eaton 03-401-2010
- (supersedes Vickers I-286-S & M-2950-S)
- DIN 51524 Part III
- Sauer Danfoss 520L0463
- US Steel 126, 127 and 136
- JCMAS HK
- Parker Denison HF0/ HF1/ HF2
- MAG IAS (Cincinnati Milacron) P-68/ P-69/ P-70

FEATURES & BENEFITS

Bell Hydraulic Oil HVI Ultra retains viscosity/ temperature characteristics in service.

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
ISO VG	-	68
Viscosity	cST @ 40°C	66
Viscosity	cST @ 100°C	12.2
Viscosity Index	-	170
FZG load test	kg	12





HYDRAULIC OIL VG 46

DESCRIPTION

Bell Hydraulic Oil VG 46 is a high quality, rust and oxidation-inhibited oil having anti-foam properties. It contains an anti-wear additive that combines the functions of lubricating and hydraulic oils in a single product.

APPLICATION

Bell Hydraulic Oil VG 46 is intended for:

- heavy systems
- lightly to moderately loaded spur and bevel gears
- compressors (including certain rotary and other compressors)
- machine tool and other bearings
- industrial torque converters
- hydraulics couplings

Do NOT use in systems with silver-coated bearings

FEATURES & BENEFITS

Bell Hydraulics Oil VG 46 can be used in the hydraulic systems of automotive and earthmoving equipment wherever SAE 15W engine oils are normally specified or preferred due to local conditions.

Bell Hydraulic Oil can be used to good advantages in rotary sliding vane sticking is experienced with other lubricants.

PRODUCT SPECIFICATIONS

- Parker Denison HF0/HF1/HF2
- MAG IAS (Cincinnati Milacron) P-68/P-69/P-70
- AFNOR NFE 48-690/1 (Dry & Wet)
- AFNOR NFE 48-603
- ISO 11158 HM
- Eaton 03-401-2010
- DIN 61524 Part II
- Sauer Danfoss 520L0463
- US Steel 126, 127 and 136
- JCMAS HK
- SABS 1218-1984

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
ISO VG	-	46
Viscosity	cST @ 40°C	46
Viscosity	cST @ 100°C	6.9
Viscosity Index	-	105
Pour Point	°C	-15
Density @ 20°C	kg/m ³	870





DESCRIPTION

Bell Hydraulic Oil VG 68 is a high quality, rust and oxidation-inhibited oil with very high viscosity index and excellent anti-rust, anti-oxidation and anti-foam-ing properties. It contains anti-wear additives and combines the functions of lubricating and hydraulic oils in a single product.

APPLICATION

Bell Hydraulic Oil VG 68 is intended for:

- hydraulic systems
- lightly to moderately loaded spur and bevel gears
- compressors (including certain rotary and other compressors)
- machine tool and other bearings
- industrial torque converters
- hydraulic couplings

Do NOT use in systems with silver-coated bearings

FEATURES & BENEFITS

Bell Hydraulic Oil VG 68 can be used to good advantage in rotary sliding vane pumps where vane sticking is experienced with other lubricants.

PRODUCT SPECIFICATIONS

- Parker Denison HF0/HF1/HF2
- MAG IAS (Cincinnati Milacron) P-68/ P-69/ P-70
- AFNOR NFE 48-690/ 1 (Dry & Wet)
- AFNOR NFE 48-603
- ISO 11158 HM
- Eaton 03-401-2010
- DIN 51524 Part II
- Sauer Danfoss 520L0463
- US Steel 126, 127 and 136
- JCMAS HK
- SABS 1218-1984

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
ISO VG	-	68
Viscosity	cST @ 40°C	64
Viscosity	cST @ 100°C	8.6
Viscosity Index	-	105
Pour Point	°C	-15
Density @ 20°C	kg/m3	880





GEAR OIL LIMITED SLIP 80W-90

AXLES:

B25D, B30D, B35D (NON WDB),
B40D (MERITOR WDB),
B25E, B30E > PIN 3, B30E 4x4,
B35E, B40E, B45E 4x4,
B45E, B50E, B60E

TRANSFER CASE:

KESSLER, B45E 4x4, B60E

DESCRIPTION

Bell Gear Oil Limited Slip 80W-90 with EP additives for the rigorous demands of manual transmissions, drive axles and final drives. Effective wear protection and friction reduction.

Engen Gearlube EP 90 LS series is a heavy-duty automotive gear oil that have been formulated with special friction modifiers to provide limited-slip differentials with the required controlled frictional properties as well as ensuring smooth operation that is chatter and squawk-free.

The API GL-5 performance load carrying additives ensure good protection against scoring.

BENEFITS & FEATURES

- Prevents chatter/squawk in the limited slip unit.
- Provides controlled frictional properties.
- Enables satisfactory lock-up of the clutch pack, without scoring.

APPLICATION

Designed for limited-slip differentials fitted to certain high performance motor car, bakkie and commercial vehicles where maximum traction must be provided to the drive wheels. It will provide maximum power for performance vehicles when used on adverse slippery road surface conditions created by water, ice or oil deposits. Additionally, it will enable commercial vehicles with limited-slip differentials, to cope with roads or tracks constructed with sand or gravel, without unwanted wheel spin and undesirable chatter and squawk from the differential clutch packs.

STORAGE & HANDLING

Avoid elevated temperatures (exceeding 100°C) and contact with water and other fluids. Do not store in open or unlabelled containers. Store away from strong oxidising agents or combustible material.

PERFORMANCE LEVEL

Meets or exceeds the following Industry Standards:

- API GL-5
- MIL-L-2105B

Meets or Exceeds Approvals & Specifications:

- ZF TE-ML-05C, 12C, 16E, 21C
- VW TL-754
- GMC Spec No: 998035
- Ford ESW-M2C 119 A/104 A plus
- Mack GO-F

ENGEN GEARLUBE EP 90 LS

Parameters	Methods	Units	Typical Values
SAE No.	-	-	90
Viscosity @ 40°C	ASTM D445	cSt	175
Viscosity @ 100°C	ASTM D445	cSt	16,4
Viscosity Index	ASTM D2270	-	98
Pour Point	ASTM D5950	°C	-21
Timeken OK Load	ASTM D2782	kg	18





DESCRIPTION

Bell Gear Oil 85W-140 is a sulphur/phosphorous type, multipurpose, extreme pressure mineral gear oil with high load-carrying properties.

APPLICATION

Bell Gear Oil 85W-140 has been developed for:

- Spiral bevel and moderately offset hypoid axles operating under various combinations of high speed, low speed, high torque and shock load service conditions
- Transmission of automotive equipment operating under the API service conditions quoted

FEATURES & BENEFITS

Bell Gear Oil 85W-140 is NOT recommended for automotive synchromesh gearboxes or final drives where GL-4 oils with milder extreme pressure properties are recommended.

PRODUCT SPECIFICATIONS

- API GL-5
- MIL-L-2105D
- ZF TE-ML 01, 05, 07

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
SAE No.	-	85W-140
Viscosity	cST @ 40°C	366
Viscosity	cST @ 100°C	26.6
Viscosity Index	-	97
Pour Point	°C	-12
Flash Point (COC)	°C	180
Density @ 20°C	kg/m ³	902





GEAR OIL LIMITED SLIP 85W-140

DESCRIPTION

Bell Gear Oil Limited Slip 85W-140 is a premium quality, multipurpose gear lubricant containing sulphur-phosphorus EP additives developed to meet the rigorous demands of commercial-fleet manual transmissions, drive axles and final drives.

APPLICATION

This product is also suitable for similar components of farm and earth moving equipment and passenger cars. When properly applied at the intervals recommended by car manufacturers, this oil complies with new car warranty requirements.

Bell Gear Oil Limited Slip 85W-140 is recommended for smooth efficient operation of limited slip (LS) differentials.

FEATURES & BENEFITS

Bell Gear Oil Limited Slip 80W-90 has the following features and benefits:

- Resistance to high temperature oxidation
- Multipurpose capability minimises misapplication
- Protection against wear and scoring under all operating conditions including high torque - shock loading
- protection against rust and corrosion in wet operating conditions.

Bell Gear Oil Limited Slip 85W-140 is suitable for initial fill, top-up and refill of manual gearboxes, gear-cases of semi-automatic transmission where EP gear oils are recommended, as well

as drive axles and final drives of passenger cars, bakkies, trucks and earth moving, mine and farm equipment.

The exceptional chemical and thermal stability of this oil permit its use at intermittent bulk oil temperature up to 150° C with appropriate drain and refill schedules.

PRODUCT SPECIFICATIONS

- API GL-5
- MIL-L-2105B
- ZF TE-ML-05C, 12C, 16E and 21C
- VW TL-754
- GMC Spec No: 998035
- Ford ESW-M2C 119 A and 104 a plus
- Mack G0-F

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
SAE No.	-	85W-140
Viscosity	cST @ 40°C	366
Viscosity	cST @ 100°C	26.6
Viscosity Index	-	97
Pour Point	°C	-12
Flash Point	°C	180
Density @ 20°C	kg/m ³	902





DESCRIPTION

Bell Super Gear Oil is a multipurpose gear and transmission oil with borate-enhanced EP properties. special borate-based additive provides additional protection of gears against wear (scoring, pitting, ridging, rippling), optimum friction coefficient as well as protection of the synchronizer ring against wear.

APPLICATION

Super Gear Oil is intended for:

- Tractor transmissions and hydraulic systems
- differentials equipped with wet brakes.
- drive train systems
- take-off clutches
- torque converters
- gear units of certain commercial and construction vehicles
- Final Drives

FEATURES & BENEFITS

Bell Super Gear Oil can serve as a replacement for all oils, other than engine oil, used in agricultural tractors.

It can be used in wet brake and many drive train applications and is specially formulated for good:

- chatter suppression
- low temperature performance
- anti-foam properties

PRODUCT SPECIFICATIONS

- Allison C-3 & C-4
- MASSEY FERGUSON M1143
- Ford M2C134-A/B/C/D
- API GL-4 & GL-5
- Renault
- Caterpillar TO-2
- KUBOTA, DEUTZ, FIAT
- John Deere J20C
- JJ Case MS 1207, MS 1210 -B6

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS		
Property	Units	Typical
Viscosity @ 100°C	mm ² /s	14.2
Viscosity @ 40°C	mm ² /s	82.5
Viscosity Index	-	160
Pour Point	°C	-32
Flash Point (COC)	°C	230
Density @ 20°C	kg/m ³	882





CUTTER BAR OIL

DESCRIPTION

Bell Cutter Bar Oil is a specially formulated mineral oil designed to lubricate the cutting chain, cutter bar and drive gear on Industrial and Light duty Chain Saws. It contains heavy metal free anti wear and adhesive additives to ensure that adequate lubricant adheres to the moving surfaces. In these all-loss systems, the lubricant is expelled into the environment and heavy metals such as zinc get absorbed by growing plants and thus get into the food chain. Chainsaw Lubricant MF does not contain any of these potentially harmful compounds. It inherently flows easier providing instant lubrication on start-up and less load and wear on the oil pump. This results in less down time (chain sharpening), maintenance (cleaning) and cost (replacement of chain and bar).

APPLICATION

Chainsaw Lubricant MF is designed for use in heavy duty industrial and forestry clearing applications but can also be used in light duty domestic applications. It is recommended for use in the latest generation of high speed/high power to weight ratio chain saws, running with chains speeds in excess of 20 m/s.

BENEFITS

Extended chain and cutter bar life. Less down time. Lower maintenance. Heavy metal free. Environmentally friendly. Cleaner working. On stringing. Super adhesive and cohesive properties.

TYPICAL PHYSICAL CHARACTERISTICS

Property	Test Method	Units	Typical Results
ISO Viscosity Grade	ISO 3448	-	150
Viscosity @ 40 C	ASTM D445	cSt	135
Viscosity @ 100°C	ASTM D445	cSt	14
Viscosity Index	ASTM D2270	-	100
Flash Point	ASTM D92	C	250
Pour Point, (typical)	ASTM D5950	C	-6
Density	ASTM 51757	g/ml	0,880





DESCRIPTION

Bell Synthetic Manual Transmission Oil 75W-90 is a fully-synthetic, multi-grade gear oil designed for use in gearboxes and differentials operating under a wide range of ambient temperatures.

APPLICATION

Bell Synthetic Manual Transmission Oil 75W-90 is intended for most heavy duty and passenger cars differentials requiring API GL-5 or MT1 level of extreme pressure protection.

FEATURES & BENEFITS

Bell Synthetic Manual Transmission Oil 75W-90 exceeds both API GL-5 gear oil requirements and enhanced features and benefits such as:

- Retention of full lubrication characteristics down to temperatures of -40°C
- Enhanced thermal stability with resultant longer drain interval capabilities and improved component cleanliness even under severe operating conditions
- Outstanding shear stability
- Excellent high temperature gear score performance with resultant longer differentials service life
- Better fuel consumption especially during low temperature operation

PRODUCT SPECIFICATIONS

- SAE 75W-90, SAE J2360
- API GL-5/MT1
- ARVIN MERITOR O76-N
- MAN 341 Type E3
- MAN 342 Typ M3
- MB-Approval 235.8
- MIL-PRF-2105E, SCANIA STO 1:0
- ZF TE-ML 02B, 05B, 12L, 12N, 16F, 17B, 19C, 21B
- DAF Performance
- MACK GO-J Performance
- Renault note technique B0032/2 annex 3 Performance

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents. Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
Density @ 15°C	kg/m ³	870
Viscosity	cST @ 40°C	101
Viscosity	cST @ 100°C	15.1
Viscosity Index	-	157
Flash Point	°C	>200
Pour Point	°C	-51





BRAKE FLUID DOT 4

DESCRIPTION

Bell Brake Fluid DOT 4 complies with the National Compulsory Standard Specification for Hydraulic Brake Fluids.

APPLICATION

- The DOT 4 product is intended for systems where operating temperatures can rise to above 260°C but will not exceed 270°C
- The grade number allocated to this product reflects the maximum permissible operating temperature
- This grade is a heavy duty product and is equally suitable for hydraulic clutch systems where operating temperatures are generally below those in brake systems

FEATURES & BENEFITS

- Bell Brake Fluid DOT 4 is not a mineral oil, but somewhat toxic hydraulic fluids, blended from glycols and selected additives. Skin and eye contact should be avoided. If swallowed obtain medical assistance. Avoid spillage onto vehicle paintwork which can be damaged if left in contact with the product.
- The fluid is fully compatible with the natural rubber seals of automotive brake systems.
- The product is hygroscopic (absorb water) and should be replaced annually, especially in coastal areas, to prevent rusting of components and possible brake failure due to water vapour in the system. Containers must be kept tightly sealed.

PRODUCT SPECIFICATIONS

- U.S. Federal FMVSS No. 116 DOT 4
- S.A Government Mandatory requirement

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL PHYSICAL CHARACTERISTICS

Property	Units	Typical
Dry Equilibrium Reflux Boiling Point	°C	270
Wet Equilibrium Reflux Boiling Point	°C	170
Viscosity	cST @ 100°C	1.5
Viscosity	cST @ -40°C	1100
Neutrality	pH	8





DESCRIPTION

Bell Torque Fluid 434 is a multipurpose gear and transmission oil whose viscosity is equivalent to SAE 30 oil. It can be used in many drive train applications and is specially formulated for good chatter suppression, low temperature performance & anti-foam properties.

APPLICATION

Bell Torque Fluid 434 can be used for the following applications where the grade is specified:

- hydraulic systems
- heavy duty drive train and hydraulic systems
- torque converters
- gear units of certain commercial and construction vehicles

FEATURES & BENEFITS

Bell Torque Fluid 434 is been specifically formulated to meet Caterpillar's TO-4 specification for transmissions/drive train oils (TDTO). Bell Torque Fluid 434 meets the API CF specification requirements.

PRODUCT SPECIFICATIONS

- Caterpillar TO-4
- Allison C-4
- Sperry Vickers M2950-5
- ZF - TE - ML 03-04

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
SAE No.	—	30
Viscosity	cST @ 40°C	106
Viscosity	cST @ 100°C	11.6
Viscosity Index	—	96
Flash Point	°C	228
Pour Point	°C	-15
Total Base No.	mgKOH/g	10.5
Density @ 20°C	kg/m ³	892





UNIVERSAL TRACTOR FLUID

WET DISC BRAKE:

B40D (MERITOR)

Super high-performance oil (UTTO/MFO) for use in transmission and hydraulic systems with integrated wet brakes, clutches and differentials for agricultural and construction machinery.

DESCRIPTION

Universal Tractor Fluid is a super high performance oil (UTTO/MFO) for use in transmission and hydraulic systems with integrated wet brakes, clutches and differentials for agricultural and construction machinery. A careful selection of base oils and additive technology guarantees an excellent wear protection, a good viscosity and temperature and best friction property.

APPLICATION

Universal Tractor Fluid special additive components guarantee outstanding deceleration performance combined with a high capacity of noise suppression over the full oil drain.

Also gearboxes or combined gearbox-hydraulic systems of agricultural and construction machinery with fill instruction HD-engine oil SAE 10W-30 or gear oils SAE 75W-80acc. to API GL-4 can be filled using Universal Tractor Fluid alternatively. Universal Tractor Fluid is miscible and compatible with conventional branded gear oils. However, mixing with other gear oils should be avoided in order to fully utilise the product's benefits. A complete oil change is recommended when converting to Universal Tractor Fluid.

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn. Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable. Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL CHARACTERISTICS

Property	Units	Typical
Density at 15°C	DIN 51757	0.880 g/ml
Colour	DIN ISO 2049	2 ASTM
Flash Point, CoC	DIN ISO 2592	230°C
Pour Point	DIN ISO 3016	-42°C
Kinematic Viscosity at 40°C	DIN 51562-1	56 mm ² /s
Kinematic Viscosity at 100°C	DIN 51562-1	9.3 mm ² /s
Viscosity	Index DIN ISO 2909	147

ADVANTAGES/BENEFITS

- excellent protection from wear
- excellent protection from sludge, deposits and lacquering
- good anti-corrosion performances
- reduces brake chattering and squeaking
- optimum viscosity-temperature behaviour
- applicable as all season lubricants
- good synchromesh performance
- good seal and yellow metal compatibility
- miscible and compatible with other branded engine oils and gear oils





DESCRIPTION

Bell UTTO Ultra is a multipurpose gear and transmission oil with a viscosity equivalent to that of a SAE 10W-30 engine oil or SAE 75W-80 gear oil.

APPLICATION

Bell UTTO Ultra is intended for:

- tractor transmissions and hydraulic systems
- axles equipped with wet disc brakes
- drive train systems
- gear units of certain commercial and construction vehicles

PERFORMANCE LEVEL

APPROVED

ZF TE-ML, API GL-4

RECOMMENDATIONS

API GL-4, ZF TE-ML 03E, 05F, 06K, 17E, 21F, AGCO Powerfluid 821 XL, AGCO Q-186 (White farm), ALLISON C-4, CASE MS1206, 1207, 1209, 1210, 1230, CLAAS/ LANDIN/ SAME-Transmission, CNH MAT 3505, 3506, 3509, 35025, 3526, 3540, DIN 51524: HLP (-D), FNHA 2C-200.00, 201.00, FORD M2C48-C3, ESN M2C86-B/C, M2C 134-D, JOHN DEERE JDM J20C, DANA-OHTM-UTTO, VALTRA G2-08, VOLVO WD 101, KUBOTA UDT FLUID, MASSEY FERGUSON CMS M1145, 1143, 1134, NH 410C, 410B, SAE J300: 10W-30, SAE J306: 75W-80, SDFG OT 1891 A, VALTRA G2-B10.

BENEFITS

Bell UTTO Ultra can serve as a replacement for all oils, other than engine oil, used in agricultural tractors. This type of oil is sometimes also referred to as Universal Tractor Transmission Oil or UTTO. It can be used in wet brake and many drive train applications and is specially formulated for good:

- chatter suppression
- low temperature performance
- anti-foam properties

TYPICAL CHARACTERISTICS

Property	Units	Typical
SAE No.	-	10W-30
Viscosity	cSt @ 40 °C	64
Viscosity	cSt @ 100 °C	9.5
Viscosity Index	-	130
Flash Point	°C	-42





SYN ATF ULTRA (TES668)

TRANSMISSION TRANSFER CASE:

D-SERIES, GEAR RATIO
E-SERIES, GEAR RATIO

KESSLER

"HIGH SPEED REVERSE"

DESCRIPTION

Bell Syn AFT Ultra (TES668) is a fully synthetic fluid designed to meet the demanding requirements of modern heavy duty automatic transmission operating under severe conditions.

APPLICATION

Bell Syn ATF Ultra (TES668) is recommended for use in modern high-performance trucks, buses, utility vehicles, haulers, vans and other equipment requiring Allison TES 668 performance level.

PERFORMANCE LEVEL

- Allison TES 668
- It is backwards compatible with TES 295 approved fluid

BENEFITS

Bell Syn ATF Ultra has been formulated to meet the extended drain requirements of the latest model medium and heavy-duty Allison Transmissions:

- Excellent seal compatibility
- Stringent cold
- Increased durability
- Protects against thermal breakdown at high temperatures while still providing outstanding performance at ambient temperatures as low as -50°C
- It offers outstanding gear shifting and power transfer performance.

TYPICAL CHARACTERISTICS

Property	Units	Typical
Density at 15 °C	kg/m3	851
Viscosity	cSt @ 40 °C	34.3
Viscosity	cSt @ 100 °C	6.9
Viscosity Index	-	169
Flash Point	°C	210
Pour Point	°C	-51





DESCRIPTION

Bell E# WDB Plus is a semi-synthetic, high performance, multipurpose automatic transmission fluid (ATF). It provides outstanding performance in automatic transmissions and power steering units where General Motors Dexron III-G and the older Dexron III-F, II-E or II-D fluids are specified. It is also suitable for used in applications calling for Allison TES 389 performance levels. Its properties make it suitable for use in specific wet disc brake applications as well.

APPLICATION

Bell E# WDB Plus is primarily used in Bell designed sealed Wet Disc Brake (WDB) systems of the Bell B35E to B60E articulated dump trucks. This oil is not suitable for use in axles which use a common brake and axle oil.

PERFORMANCE LEVEL

DEXRON III-G, MERCON, Allison C-4, ZF TE-ML 02F, 03D, 14A, 17C, Voith 55.6335, MAN 339 Type F, Mercedes 236.1.

BENEFITS

- Allison C-3 & C-4
- MASSEY FERGUSON M1143
- Ford M2C134-A/B/C/D
- API GL-4 & GL-5
- Renault
- Caterpillar TO-2
- KUBOTA, DEUTZ, FIAT
- John Deere J20C
- JJ Case MS 1207, MS 1210 -B6

TYPICAL CHARACTERISTICS

Property	Units	Typical
Viscosity	mPa.s @ -40 °C	40 000
Viscosity	cST @ 40°C	38
Viscosity	cST @ 100°C	8.1
Viscosity Index		194
Flash Point	°C	190
Pour Point	°C	-36





EXTENDED LIFE COOLANT-PREMIX 50

DESCRIPTION

Extended Life Coolant-Premix 50 is a nitrite-, amine-, phosphate-, silicate-, and borate-free coolant based on ethylene glycol.

APPLICATION

Bell Extended Life Coolant-Premix 50 gives outstanding protection against frost, corrosion and overheating in all modern engines, but especially highly loaded aluminium engines.

It effectively protects against corrosion and deposits in the cooling system with its vital parts, the coolant channels in the block and cylinder head, the radiator, the water pump and the heater core.

It is Ready to Use and no water must be added.

FEATURES & BENEFITS

It is recommended that the antifreeze in a cooling system be replaced annually. Before a cooling system is filled with Bell Extended Life Coolant-Premix 50 it should be drained and thoroughly flushed with clean water. Do not top up with plain water but use the same product as used for the initial fill.

DO NOT MIX DIFFERENT BRANDS OF ANTIFREEZE.

PRODUCT SPECIFICATIONS

- MB 326.3 (325.3)
- MAN 324 SNF
- MTU MTL 5048
- ASTM D 1384, ASTM D 2570, ASTM D 2809 and ASTM D 4340
- VW/ Audi/ Seat/ Skoda TL 774 - D/F
- Porsche

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL PHYSICAL CHARACTERISTICS

Property	Units	Typical
Viscosity	cSt @ 20°C	3,0 - 5,0
Density	kg/l @ 20°C	1,067
Ash Content	% m/m	0.6
Freezing Point	Min. °C	-37





DESCRIPTION

Bell Extended Life Coolant-Premix 50 Ultra

is a ready to use High Performance coolant constructed on a 50:50 mix of Ethylene Glycol and deionized water. The corrosion inhibitor is based on Organic Acid Technology and silicates (Si-OAT). It provides excellent protection

against corrosion, cavitation erosion, water pump wear as well as system fouling. It's very low depletion rate ensures effective long-term corrosion protection of aluminium, iron, steel, copper, solder alloys and other materials found in the cooling circuit. It provides excellent engine and cooling system protection for up to 4 years.

Supercool NG is free of phosphate, nitrites, borates and amines. It provides freezing protection down to -37°C and meets the requirements of ASTM D 3306, ASTM D 4985, SAE J1034, China GB 29743-2013 and SANS 1251:2005.

APPLICATION

Bell Extended Life Coolant Premix 50 Ultra is ready to use, and no water must be added. It can be used in all Heavy-duty diesel engines fitted with "wet or dry" liners, in both on and off-highway service, light-duty commercial as well as passenger car diesel and petrol engines. It effectively prevents deposits and being pre-diluted there is no chance of under or overdosing. It is strongly recommended that the system be

thoroughly flushed with clean water before filling with a fresh charge of Supercool NG.

Warning: Harmful if swallowed. Keep out of the reach of children.

PERFORMANCE LEVEL

ASTM D3306, ASTM D4985, SAE J1034, China GB 29743-2013, SANS 1251:2005, Daimler DTFR 29C120 (MB 325.5), MAN 324 Type Si-OAT, Cummins CES 14603, Deutz DQC CC-14, Liebherr Minimum LHO-1-COL3A, Porsche From MY 1996, VW/Audi/Seat/Skoda/Lamborghini/Bentley, Bugatti TL 774-G

BENEFITS

- Provides protection for up to 5 years
- Ready to use and eliminates incorrect mixing ratios.
- Suitable for all water-cooled diesel and petrol combustion engines.
- Protection against deposits, cavitation and corrosion in cylinder heads and radiators made of alloy.
- Extended service life, resulting in reduced downtime and maintenance costs.
- Protects against freezing down to -37°C.
- Increases boiling point to above 110°C.

DO NOT MIX DIFFERENT BRANDS OF ANTIFREEZE.

TYPICAL PHYSICAL CHARACTERISTICS

Parameters	Methods	Units	Typical Results
Density @ 20°C	ASTM D1122	Kg/l	1.123
Colour	Visual	-	Pink
Freezing Point, min	ASTM D3321	°C	-37
pH	ASTM D1287	-	8.2 - 8.6
Reserve Alkalinity	ASTM D1121	mL	8.0 - 11.0





SLEW RING GREASE

DESCRIPTION

Bell Slew Ring Grease is a smooth-textured, functional polymer based dual thickened lithium-calcium, resilient ultra heavy duty grease of NLGI 2 consistency, which combines the performance advantages of both lithium and calcium greases. It boasts exceptional Extreme Pressure (EP) additives, outstanding film thickness enhancement through advanced polymer technology to reinforce boundary lubrication scenarios built around a high viscosity base oil, oxidation, rust and corrosion inhibitors and is fortified with proprietary dual solid friction reduction additives. Ultimate wear protection, water washout and spray off resistance, along with enhanced rust inhibition. It has an operating temperature range of -15°C to 130°C.

APPLICATION

Bell Slew Ring Grease is recommended for use as chassis grease and it is dynamic for "off-road" applications in civil engineering (pin and bush) and agriculture. Further applications include lubrication of industrial plain and anti-friction bearings where severe or shock loads are experienced.

Exceptional in applications involving oscillating or limited relative motion, where fretting corrosion is likely to occur.

FEATURES & BENEFITS

- **Ultra high** shock load capability
- Superior resistance to water washout and spray off.
- Multi application convenience.
- Resilient wear, oxidation and rust protection.
- Dual solid lubricants for reduced friction and energy savings.

TYPICAL PHYSICAL CHARACTERISTICS

Property	Test Method	Units	Typical Results
NLGI Grade	ASTM D217	-	2
Thickener Type	-	-	Lithium Calcium
Colour	Visual		Grey / Black
Penetration, @ 25°C Worked	ASTM D217	0.1 mm	280
Dropping Point	IP 396	°C	190
Viscosity of Base Oil @ 40°C	ASTM D445	cSt	1 000
4-Ball Wear, Scar diameter	DIN 51350:4	mm	<0.3
4-Ball EP Weld Point	DIN 51350:5	kg	800
Timken OK Load	IP 326	Lbs	>60
Proprietary Dual Solid Additives (Includes Molybdenum Disulphide)	Calculate	%	5 (min)



MULTI PURPOSE GREASE



DESCRIPTION

Bell Multi Purpose Grease is a smooth textured, NLGI 2 Lithium 12 hydroxystearate based grease which contain an EP (extreme pressure) additive, oxidation, rust, and corrosion inhibitors. This grease provides exceptional wear protection, good water wash resistance, low temperature dispensing and long life in bearings operating at elevated temperatures.

APPLICATION

Bell Multi Purpose grease can be used wherever an extreme pressure grease of this type and grade is required or preferred and is recommended for the long term lubrication of equipment operating within a temperature range of 12°C to 130°C. Some of its usages include:

- general purpose automotive and chassis applications
- machine tool applications
- industrial antifriction and plain bearings

Bell Multi Purpose grease should be used with caution in automotive wheel bearings where peak operating temperatures may exceed 130°C due to heat transfer from adjacent disc brakes.

FEATURES & BENEFITS

Some of the benefits are:

- Excellent pumpability
- Shock Load capability
- Multipurpose convenience
- Superior wear protection
- Very good resistance to water wash

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn. Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL PHYSICAL CHARACTERISTICS

Property	Units	Typical
NLGI Grade	-	2
Thickener Type	-	Lithium
Colour	-	Brown
Penetration, @ 25°C Worked	0.1 mm	280
Dropping Point	°C	192
Viscosity of Base Oil @ 40°C	cSt	190
4-Ball wear, Scar diameter	mm	0.5
4-Ball EP Weld Load	N	3000
Timken OK Load	Lbs	60





MULTI PURPOSE GREASE PLUS

DESCRIPTION

Multi Purpose Grease Plus is long life, part synthetic, multi polymer-based lithium-calcium heavy duty grease specifically designed for farm equipment, agricultural, forestry machinery, general automotive and chassis lubrication. It is also recommended for the lubrication of industrial plain and anti-friction bearings even where severe or shock loads are experienced.

Scientifically designed with multiple polymers, this grease is selfsealing which assists in keeping the lubricant in, and contaminants out. It gives unparalleled protection of lubricated parts subjected to vibration, shock loading, high temperatures and high levels of contaminants such The technology used covers a wide range of applications in the mining and construction equipment which is exposed high levels of water and dust contamination. It contains extreme pressure additives as well as oxidation, rust and corrosion inhibitors. Whilst providing exceptional wear protection, good water resistance and rust inhibition, it can be dispensed at low temperatures and provides good service life in applications operating at elevated temperatures.

FEATURES & BENEFITS

- Synthetic Performance.
- Multipurpose convenience.
- Excellent pumpability.
- Shock load capability.
- Enhanced oxidative stability.
- Superior wear and rust protection.
- High resistance to water wash and chemical process water.
- Extended service life & re-lubrication intervals.

APPLICATION

Multi Purpose Grease Plus is designed to meet most agricultural and forestry equipment applications requiring a lithium or calcium based NLGI 2, multipurpose, extreme pressure grease and is coloured red for easy identification. Some of the many applications are Wheel bearings, steering boxes, propeller shaft universal joints, chassis, water pumps, 5th wheel, brake cams, roller and ball bearings, plain bearings, ball joints, splines and slides.

Other industrial applications include machine tools, electric motor bearings, geared couplings at normal speeds, vibrating shafts and sliding mechanisms. Especially suited for wet applications and areas where chemical process water makes contact with the grease. Whilst it is generally compatible with all lithium, calcium and lithium-calcium greases, advice should be obtained before mixing it in applications containing other greases.

Wide operating temperature range -15°C to 140°C.

PERFORMANCE LEVEL

Meets or exceeds the following Industry Standards:

- DIN 51502, KP2K-20
- ISO 12924, L-XB(F)CHB2



ENGEN GEARLUBE EP 90 LS			
Parameters	Methods	Units	Typical Values
DIN Classification	DIN 51502 DIN 51825	-	KP2K-20
ISO Classification	ISO 12924	-	L-XB(F)CBH2
NLGI Grade	ASTM D217	-	2
Thickener Type	-	-	Lithium Calcium
Colour	Visual	-	Red
Base Oil Type	-	-	Semi-synthetic
Penetration, @ 25°C Worked	ASTM D217	0.1 mm	280
Dropping Point	IP 396	°C	190
Viscosity of Base Oil @ 40°C	ASTM D445	cSt	660
4-Ball Weld Load	DIN 51350:4	N	4000
4-Ball Wear Scar 40kg/1hr	DIN 51350:5	mm	0.5
20,000 Strokes Worked Penetration	ASTM D217	% Change	10
Shell Roll Stability – 24hrs	ASTM D1831	% Change	10
Density	IP PM-CS/03	g/ml	0.96

All technical data is provided for reference only. These characteristics are typical of current production. Whilst future production will conform to PETRONAS' specification, variations in these characteristics may occur.

HEALTH, SAFETY AND ENVIRONMENT

This product is unlikely to present any significant health and safety hazards when used in the recommended application. Avoid contact with skin. Wash immediately with soap and water after skin contact. Do not discharge into drains, soil or water. For further detail regarding storage, safe handling, and disposal of product, please refers to product SDS.

Safety Data Sheets are available for all our products and should be only be consulted for appropriate information regarding storage, safe handling and disposal of the product. No responsibility shall be taken by either Engen or its subsidiaries and related holding corporation for any loss or injury or any direct, indirect, special, exemplary, consequential damages or any damages whatsoever, whether in action of contract, negligence or other tortuous action, in connection or resulting from abnormal use of the materials and/or information, from any failure to adhere to recommendations, or from hazards inherent in the nature of the materials and/or information.

All products, services and information supplied are under our standard conditions of sale. Please consult with any of our local representative in the event you require any further information.





HIGH TEMPERATURE GREASE

GREASE:

B35D, B40D, B45D, B50D,
B35E, B40E, B45E, B50E, B60E

DESCRIPTION

Bell High Temperature Grease is a premium industrial grease made from synthetic hydrocarbon fluid, a non-soap bentonite thickener and selected additives. It is characterised by low and high temperature lubricating ability, well beyond mineral oil-based greases. It exhibits outstanding low torque, long lubricant life, low bearing wear, high load carrying ability, corrosion protection and good water resistance.

APPLICATION

Bell High Temperature Grease is recommended for wide temperature range, multi-service applications in plain and anti-friction bearings, wheel bearings, gears, slides, cams and other services where friction reduction and low wear is required. It is particularly suitable for hot electric motors, fans and bearings in paper mill and plastics production equipment. In sub-zero temperature service it finds application in freezer plants and outdoor mobile equipment.

Bell High Temperature Grease application temperature range is nominally -40 °C to 180 °C.

BENEFITS

Bell High Temperature Synthetic grease has the following features and benefits:

- Good oxidation and thermal stability
- Excellent rust and corrosion protection
- Extended lubrication intervals and equipment life
- It also offers excellent mechanical stability

TYPICAL PHYSICAL CHARACTERISTICS

Property	Test Method	Units	Typical Results
NLGI Grade	ASTM D217	-	2
Thickener Type	-	-	Organophylic Bentonite
Colour	Visual	-	Beige
Penetration, @ 25°C Worked	ASTM D217	0.1 mm	265 - 295
Dropping Point	IP 396	°C	Non-melt
Viscosity of Base Oil @ 40°C	ASTM D445	cSt	100
Viscosity of Base Oil @ 40°C	ASTM D445	cSt	16
Base Oil	-	-	PAO
4-Ball Weld Load	DIN 51350:4	N	2600



SUPER HEAVY DUTY GREASE



DESCRIPTION

Bell Super Heavy Duty Grease is a high performance multi-purpose grease containing solid lubricants. It is manufactured from solvent refined oils and it incorporates multi-functional extreme pressure additives as well as rust/corrosion inhibitors, anti-oxidation additives and molybdenum disulphide. Its service temperature range is between -15°C and 130°C.

APPLICATION

It is recommended for the long term lubrication of industrial and automotive equipment where heavy loading and/or shock loads are encountered and can be used for:

- General purpose automotive and chassis applications including fifth wheels, kingpins, steering and universal joints
- Bulldozers, front-end loaders and other construction equipment
- Mining equipment
- Other applications include Constant velocity joints (CVJ), machine tools, geared couplings at normal speeds, vibrating shafts and sliding mechanisms

FEATURES & BENEFITS

Bell Super Heavy Duty Grease provides emergency run properties because of its molybdenum disulphide content, which plates out onto metal surfaces to form a solid lubricating film that reduces friction and wear between lengthy re-greasing intervals.

PRODUCT SPECIFICATIONS

- NLGI 2
- Lithium Moly Based EP

STORAGE & HANDLING

Use PVC, nitrile or other oil resistant gloves and protective clothing to prevent skin contact. Where eye contact is a potential hazard, goggles should be worn.

Avoid temperatures above 80°C and strong oxidizing agents.

Ambient temperatures and atmospheric pressures normally encountered within buildings or roofed-over outdoor storage areas are acceptable.

Avoid entering areas where mists or vapours have built up as a result of abnormal temperatures or pressures without the proper breathing equipment and protective clothing.

TYPICAL PHYSICAL CHARACTERISTICS

Property	Units	Typical
NLGI Grade		2
Thickener Type		Lithium Calcium
Colour		Grey/Black
Penetration, @ 25°C Worked	0.1 mm	280
Dropping Point	°C	190
Viscosity of Base Oil @ 40°C	cSt	430
4-Ball wear, Scar diameter	mm	0.46
4-Ball EP Weld Point	kg	380
Timken OK Load	Lbs	55
Proprietary Dual Solid Additives (Molybdenum Disulphide)	%	5

15kg
BN005601

50kg
BN005600

180kg
BN006362

NOTES



Solvents

BELL



BATTERY TERMINAL PROTECTOR

Battery Terminal Protector is an aerosol spray that protects battery terminals against corrosion. This is a clear spray and can be used on both terminals.

• APPLICATION

Battery Terminal Protector should be sprayed over terminals after they have been cleaned.

• FEATURES & BENEFITS

- Protects terminals and all metal surfaces against corrosion.
- Suitable for home, car and industrial use.

300ml BN024669



BRAKE CLEANER

Bell Brake Cleaner is a heavy duty brake system cleaning spray for cleaning drum and disk brake systems without disassembly.

• APPLICATION

Brake Cleaner is primarily used on drum and disk brakes, brake cables, rotors and disk pads / drum lining surfaces.

• FEATURES & BENEFITS

- Reduce brake squeal.
- Improve brake performance.
- Fast drying. No residue.
- Removes brake pad phenolic resins, dust and other degradation products.

500ml BN024671



CHROME COMPOUND

Bell Chrome Compound is an anti-seize compound for all threads.

• APPLICATION

Chrome Compound should be applied to all threads and surfaces where a low break out torque is required.

• FEATURES & BENEFITS

- Effective as an anti-seize up to 1500°C.
- Low break out torque.

0.5kg
BN024672

ENGINE CLEANER & DEGREASER



Bell Engine Cleaner and Degreaser is a highly concentrated degreasing agent.

• APPLICATION

Bell Engine Cleaner and Degreaser is suitable for all workshop applications.

• FEATURES & BENEFITS

- Heavy duty emulsifiable solvent cleaner.
- Dissolves oils and greases and emulsifies it so that it can be rinsed off with water.



WATER-BASED CLEANER



Bell Water-based Cleaner is a water based degreasing agent.

• APPLICATION

Bell Water-based Cleaner is suitable for removing grease, oils and soils from engine components.

• FEATURES & BENEFITS

- Environmentally friendly.
- Rinse oil, grease and solvents off components with water.





EXTREME CLEANER

Bell Extreme Cleaner is a powerful multi purpose detergent cleaner in a trigger pump spray bottle.

• APPLICATION

Bell Extreme Cleaner is an environmentally friendly multi-purpose cleaner for the car, home, office and workshop.

Household

Removes stubborn stains, oil, grease, grit and grime from appliances, kitchens, floors, bathrooms, sinks, mirrors, windows, tiles and fabrics.

Outdoor

Cars, engines, workshops, tools.

• FEATURES & BENEFITS

- Contains no abrasives, ammonia or bleach.

750ml BN024677



ELECTRICAL CLEANER

Bell Electrical Cleaner a high di-electric strength cleaner especially developed for the electronics industry.

• APPLICATION

Bell Electrical Cleaner can be used on a variety of applications like:

Electronics

Computers, PC boards, relays.

Electrical

Switches, electro-mechanical devices.

Telecommunications

Tranceivers, connectors.

Avionics

Radar, navigational equipment.

Home

DVD and Blue Ray Players, audio equipment, TV sets.

Office

Telephone, switchboards, calculators, computer keyboards and electronic equipment.

• FEATURES & BENEFITS

- Leaves no residue.
- Fast drying.
- Non Flammable.

750ml BN024681

RUBBER GREASE



Bell Rubber Grease is an inorganically thickened vegetable-oil based grease fortified with extreme pressure and anti-corrosion additives.

• APPLICATION

Bell Rubber Grease should be used when assembling rubber components such as hydraulic brake, clutch and suspension rubbers to prevent swelling or hardening. Lubricating plastic and rubber components such as o-rings, valves, diaphragms and cup and seals.

• FEATURES & BENEFITS

Compatible with natural and synthetic rubbers.



MULTI-PURPOSE LUBRICANT



Bell Multi-Purpose Lubricant is a rust penetrant and moisture disperant that leaves an anti-corrosive film.

• APPLICATION

Bell Multi-Purpose Lubricant has excellent cleaning properties on electrical switchgear.

• FEATURES & BENEFITS

- Non Flammable.
- Excellent cleaning properties on electrical switchgear.
- Meets MIL-C-16173D specification
- Safe for underground mine applications or environments where explosive conditions exist.



TECHNICAL INFORMATION

PETROLEUM PRODUCTS - COMMON TERMS

ABRASIVE WEAR

Wear between two surfaces in relative motion due to particles (three body) or surface roughness (two body).

ACID NUMBER

A measure of the amount of potassium hydroxide (KOH) needed to neutralise all or part of the acidity of a petroleum product.

ADDITIVE

Any material added to a base stock to change its properties, characteristics or performance.

ADHESIVE WEAR

Wear caused by metal-to-metal contact, characterised by local welding and tearing of the surface. Also known as "galling".

ANILINE POINT

The lowest temperature at which equal volumes of aniline and hydrocarbon fuel or lubricant base stock are completely miscible. A measure of the aromatic content of a hydrocarbon blend, used to predict the solvency of a base stock or the cetane number of a distillate fuel.

ANTI-FOAM AGENT

An additive used to suppress the foaming tendency of petroleum products in service. May be a silicon oil to break up surface bubbles or a polymer to decrease the number of small entrained bubbles.

ANTI-STATIC ADDITIVE

An additive that increases the conductivity of a hydrocarbon fuel to hasten the dissipation of electrostatic charges during high-speed dispensing, thereby reducing the fire/explosion hazard.

ANTIWEAR AGENT

An additive or its reaction products which form thin, tenacious films on highly loaded parts to prevent metal-to-metal contact.

APPARENT VISCOSITY

A measure of the viscosity of a non-Newtonian fluid under specified temperature and shear rate conditions.

BLACK OILS

Lubricants containing asphaltic materials, which impart extra adhesiveness, that are used for open gears and steel cables.

BLOW-BY

Passage of unburned fuel and combustion gases past the piston rings of internal combustion engines, resulting in fuel dilution and contamination of the crankcase oil.

BOUNDARY LUBRICATION

Lubrication between two rubbing surfaces without the development of a full-fluid lubricating film. Occurs under high loads and requires the use of antiwear and extreme-pressure (EP) additives to prevent metal-to-metal contact.

BRINELLING

Denting caused by impact of one bearing component against another while stationary.

BRIGHT STOCK

A heavy residual lubricant stock with low pour point, used in finished blends to provide good bearing film strength, prevent scuffing and reduce oil consumption. Usually identified by its viscosity in SUS @ 210°F or cSt @ 100°C.

BROMINE NUMBER (VALUE)

The percentage of bromine that will be absorbed by a chemically unsaturated substance (base oil, vegetable oil, rubber, etc.) in a given time under arbitrary conditions. A measure of unsaturation.

PETROLEUM PRODUCTS - COMMON TERMS

BROOKFIELD VISCOSITY

A measure of apparent viscosity as determined by the Brookfield viscometer at a controlled temperature and shear rate.

CAMS

Eccentric shafts used in most internal combustion engines to open and close valves.

CARBON RESIDUE

Coked material remaining after an oil has been exposed to high temperatures under controlled conditions.

CATALYTIC CONVERTER

An integral part of vehicle emission control systems since 1975. Oxidising converters remove hydrocarbons and carbon monoxide (CO) from exhaust gases, while reducing converters control nitrogen oxide (NOx) emissions. Both use noble metal (platinum, palladium or rhodium) catalysts that can be “poisoned” by lead or phosphorous compounds in the fuel or lubricant.

CAVITATION

The formation and subsequent collapse of vaporous cavities within a liquid, caused by vigorous movement or vibration within the liquid.

CAVITATION DAMAGE

An erosion process in which metal is slowly removed by cavitation.

CENTIPOISE

Measurement unit of absolute (or dynamic) viscosity of a fluid. One centiPoise (cP) equals 0.01 Poise and is equivalent to one milliPascal-second (mPa-s) in SI units. See definition of Poise in this section.

CENTISTOKE

Measurement unit of kinematic viscosity of a fluid. One centiStoke equals 0.01 Stokes and is equivalent to one mm²/sec in SI units. See definition of Stoke in this section.

CETANE INDEX

A value calculated from the physical properties of a diesel fuel to predict its cetane number.

CETANE NUMBER

A measure of the ignition quality of a diesel fuel, as determined in a standard single cylinder test engine, which measures ignition delay compared to primary reference fuels. The higher the cetane number, the easier a high-speed, direct-injection engine will start and the less “white-smoking” and “diesel-knock” after startup.

CETANE NUMBER IMPROVER

An additive (usually an organic nitrate) that boosts the cetane number of a fuel.

CLOUD POINT

The temperature at which a cloud of wax crystals appears when a lubricant or distillate fuel is cooled under standard conditions. Indicates the tendency of the material to plug filters or small orifices under cold weather or operating conditions.

COLD CRANKING SIMULATOR (CCS)

An intermediate shear rate viscometer that predicts the ability of an oil to permit a satisfactory cranking speed to be developed in a cold engine.

COMPRESSION RATIO

In an internal combustion engine, the ration of the volume of combustion space at bottom-dead-centre to that of top-dead-centre.

COPPER STRIP CORROSION

A qualitative measure of the tendency of a petroleum product to corrode pure copper.

TECHNICAL INFORMATION

PETROLEUM PRODUCTS - COMMON TERMS

CORROSION INHIBITOR

Additive that protects lubricated metal surfaces from chemical attack by water or other corrosive contaminants.

CORROSIVE WEAR

Wear caused by chemical reaction.

CROWN

The top of the piston in an internal combustion engine above the fire ring, exposed to direct flame impingement.

DEMULSIBILITY

A measure of a fluid's ability to separate from water.

DENATURANTS

Toxic or noxious components used in fuel ethanol to make it unfit for use as a beverage.

DENSITY

Mass per unit volume.

DETERGENT

Substance added to fuels or lubricants to keep engine parts clean. In motor oil formulations commonly used detergents are metallic soaps with reserve basicity to neutralise acids formed during combustion.

DETERGENT/DISPERSANT

An additive package that combines a detergent with a dispersant.

DETONATION

Uncontrolled burning of the last portion (end gas) of an air/fuel mixture in the cylinder of a spark-ignition engine. Also known as "knock" or "ping".

DILUTION OF ENGINE OIL

Contamination of crankcase oil by unburned fuel, leading to reduced viscosity and flash point. May indicate component wear or fuel system maladjustment.

DISPERSANT

An additive that helps keep solid contaminants in a crankcase oil in colloidal suspension, preventing sludge and varnish deposits on engine parts. Usually non-metallic ("ashless") and used in combination with detergents.

DISTILLATION

The basic test used to characterise the volatility of a gasoline or distillate fuel.

ELASTOHYDRODYNAMIC LUBRICATION (EHL)

A lubrication regime characterised by high unit loads and high speeds in rolling elements where mating parts deform elastically due to the incompressibility of the lubricant film under very high pressure.

EMISSIONS (MOBILE SOURCES)

The combustion of fuel leads to the emission of exhaust gases that may be regarded as pollutants. Water and CO₂ are not included in this category but CO, NO_x and hydrocarbons are subject to legislative control. All three are emitted by gasoline engines. Diesel engines also emit particulates that are controlled.

EMISSIONS (STATIONARY SOURCES)

Fuel composition can influence emissions of sulphur oxides and particulates from power stations. Local authorities control the sulphur content of heavy fuel oils used in such applications.

EMULSIFIER

Additive that promotes the formation of a stable mixture, or emulsion, of oil and water.

PETROLEUM PRODUCTS - COMMON TERMS

END POINT

Highest vapour temperature recorded during a distillation test of a petroleum stock.

ENGINE DEPOSITS

Hard or persistent accumulation of sludge, varnish, lacquer and carbonaceous residues due to blow-by of unburned or partially burned fuel, or the partial breakdown of the crankcase lubricant. Water from the condensation of combustion products, carbon, residues from fuel or lubricating additives, dust and metal particles also contribute.

EP AGENT (EXTREME PRESSURE ADDITIVE)

Lubricant additive that prevents sliding metal surfaces from seizing under extreme pressure conditions.

EPA COMPLEX MODEL

More restrictive than the simple model and contains limits on RVP, oxygen, olefins, benzene, sulphur and T-90.

EPA SIMPLE MODEL

Used to define reformulated gasoline effective January 1, 1995. The model includes RVP and oxygen content requirements to reduce volatile organic compound emissions. It caps oxygen, benzene, sulphur, olefins and T-90 content at levels equal to or lower than a refiner's 1990 baseline.

EROSION

Wearing away of a surface by an impinging fluid or solid.

EXHAUST GAS RETICULATION (EGR)

System to reduce automotive emission of nitrogen oxides (Nox). It routes exhaust gases into the carburettor or intake manifold where they dilute the air/fuel mixture and reduce peak combustion temperatures, thereby reducing the tendency for Nox to form.

EROSION

Wearing away of a surface by an impinging fluid or solid.

EXHAUST GAS RETICULATION (EGR)

System to reduce automotive emission of nitrogen oxides (Nox). It routes exhaust gases into the carburettor or intake manifold where they dilute the air/fuel mixture and reduce peak combustion temperatures, thereby reducing the tendency for Nox to form.

FAS

Free alongside. An import/export term.

FOS

Free on board. An import/export term.

FOT

Free on truck. An import/export term.

FALSE BRINELLING

Fretting of one bearing component against another. May appear as a dent but original surface is worn away.

FATIGUE

Cracking, flaking or spalling of a surface due to stresses beyond the endurance or elastic limit of the material.

FERROGRAPHY

Magnetic particle analysis.

FLASH POINT

Minimum temperature at which a fluid will support instantaneous combustion (a flash) but before it will burn continuously (fire point). Flash point is an important indicator of the fire and explosion hazards associated with a petroleum product.

TECHNICAL INFORMATION

PETROLEUM PRODUCTS - COMMON TERMS

FLUID FRICTION

Occurs between the molecules of a gas or liquid in motion and is expressed as shear stress. Unlike solid friction, fluid friction varies with speed and area.

FRETTING

Wear resulting from small-amplitude motion between two surfaces. May produce wear material in the form of red or black oxide.

FRICTION

Resistance to motion of one object over another. Friction depends on the smoothness of contacting surfaces as well as the force with which they are pressed together.

FROST

Field of micropits. Form of microadhesive wear.

FUEL ETHANOL

Ethanol (ethyl alcohol – C_2H_5OH) with impurities, including water but excluding denaturants.

GALLING

See adhesive wear.

GASEOUS FUELS

Liquefied or compressed hydrocarbon gases (propane, butane or natural gas), which are finding increasing use in motor vehicles as replacements for gasoline and diesel fuels.

GASOLINE

A volatile mixture of liquid hydrocarbons containing small amounts of additives and suitable for use as a fuel in spark-ignition, internal combustion engines.

GASOLINE/ETHANOL BLEND

A spark-ignition automotive engine fuel containing denatured fuel ethanol in a base gasoline. It may be leaded or unleaded.

GRAVITY

An arbitrary scale expressing the gravity, or density, of liquid petroleum products in terms of API degrees. Relationship of the API scale to specific gravity is expressed by the equation $^{\circ}API = (441.5/sp\ gr\ 60/60F) - 131.5$. ASTM D 287 is the standard method for determining API gravity by means of a hydrometer.

GROSS ADDITIVE TREATMENT COST (GATC)

The cost of additive in one volume unit of finished product, not including base fluid credit or shipping costs.

GROSS DELIVERED TREATMENT COST (GDTC)

The cost of additive in one unit volume of finished product including shipping cost but not base fluid credit.

HIGH TEMPERATURE HIGH SHEAR RATE (HTHS) VISCOSITY

A measure of a fluid's resistance to flow under conditions resembling highly loaded journal bearings in fired internal combustion engines, typically $1\ million\ s^{-1}$ @ $150^{\circ}C$.

HYDROFINISHING

A process for treating raw extracted base stocks with hydrogen to saturate them for improved stability.

HYDROLYTIC STABILITY

Ability of additives and certain synthetic lubricants to resist chemical decomposition (hydrolysis) in the presence of water.

INDUCTION PERIOD

In an oxidation test, the time period during which oxidation proceeds at a constant and relatively low rate. It ends at the point where oxidation rate increases sharply.

TECHNICAL INFORMATION

PETROLEUM PRODUCTS - COMMON TERMS

INHIBITOR

Additive that improves the performance of a petroleum product by controlling undesirable chemical reactions, i.e. oxidation inhibitor, rust inhibitor, etc.

INSOLUBLES

Contaminants found in used oils due to dust, dirt, wear particles or oxidation products. Often measured as pentane or benzene insolubles to reflect insoluble character.

IODINE NUMBER (VALUE)

The percentage of iodine that will be absorbed by a chemically unsaturated substance (base oil, vegetable oil, rubber, etc.) in a given time under arbitrary conditions. A measure of unsaturation.

KINEMATIC VISCOSITY

Measure of a fluid's resistance to flow under gravity at a specific temperature (usually 40°C or 100°C).

LANDS

The circumferential areas between the grooves of a piston.

LEAD

Commonly-used name for tetraethyl or tetramethyl lead, an additive used in gasoline to improve octane ratings. Elemental lead is commonly used in sleeve bearing and bushing alloys.

LUBRICATION

Control of friction and wear by the introduction of a friction-reducing film between moving surfaces in contact. May be a fluid, solid or plastic substance.

MORPHOLOGY

Pertaining to structure or form.

MULTIGRADE OIL

Engine or gear oil that meets the requirements of more than one SAE viscosity grade classification and that can be used over a wider temperature range than a single grade oil.

NAPHTHENIC

A type of petroleum fluid derived from naphthenic crude oil containing a high proportion of closed-ring methylene groups.

NET ADDITIVE TREATING COST (NATC)

The cost of additive in one unit of finished product including base fluid credit but not shipping costs.

NET DELIVERED TREATING COST (NDTC)

The cost of additive in one unit of finished product including base fluid credit and shipping costs.

NEUTRALISATION NUMBER

A measure of the acidity or alkalinity of an oil. The number is the mass in milligrams of the amount of acid (HCl) or base (KOH) required to neutralise one gram of oil.

NEUTRAL OIL

The basis of most commonly used automotive and diesel lubricants, they are light overhead cuts from vacuum distillation.

NEWTONIAN FLOW

Rheological characteristic of a fluid where the rate of shear is directly proportional to the shearing force, as with straight grade oils that do not contain a polymeric viscosity modifier. When rate of shear is not directly proportional to the shearing force flow is non-Newtonian, as it is with oils containing viscosity modifiers or a soot-laden used engine oil.

TECHNICAL INFORMATION

PETROLEUM PRODUCTS - COMMON TERMS

NITRATION

The process whereby nitrogen oxides attack petroleum fluids at low temperatures, often resulting in viscosity increase and deposit formation.

OCTANE NUMBER

A measure of a fuel's ability to prevent detonation in a spark-ignition engine. Measured in a standard single-cylinder, variable compression ratio engine by comparison with primary reference fuels. Under mild conditions the engine measures Research Octane Number (RON), under severe conditions Motor Octane Number (MON). Where law requires posting of octane numbers on dispensing pumps the Antiknock Index (AKI) is used. This is the arithmetic average of RON and MON, $(R + M)/2$.

OCTANE REQUIREMENT (OR)

The lowest octane number reference fuel that will allow an engine to run Knock-free under standard conditions or service. OR is a characteristic of each individual engine.

OCTANE REQUIREMENT INCREASE (ORI)

As deposits accumulate in the combustion chamber the ORI of an engine increases, usually reaching an equilibrium value after 10,000 to 30,000 km. ORI is a measure of the increase, which may be in the region of three to ten numbers.

OXIDATION

Oxygen atoms attack and break bonds between other atoms in molecular chains. The process is accelerated by heat, light, metal catalysts and the presence of water, acids or solid contaminants. Leads to increased viscosity and deposit formation.

OXIDATION INHIBITOR

Substance added in small quantities to a petroleum product to increase its oxidation resistance, thereby lengthening its service or storage life. Also called antioxidant.

OXIDATION STABILITY

Resistance of a petroleum product to oxidation and, therefore, a measure of its potential service or storage life.

OXYGENATE

An oxygen-containing, ashless organic compound, such as alcohol or ether, that can be used as a fuel or fuel supplement.

OXYGENATED FUEL

Fuel for internal combustion engines that contains oxygen combined in the molecule, e.g. alcohols, ethers and esters. Term also applies to blends of gasoline with oxygenates, e.g. Gasohol, which contains 10% by volume anhydrous ethanol in unleaded gasoline.

OZONE AND CO-NONATTAINMENT AREAS

Any area of the continental U.S. that does not meet the 1990 Clean Air Act requirements for carbon monoxide or ground-level ozone pollutants.

PARAFFINIC

A type of petroleum fluid derived from paraffinic crude oil and containing a high proportion of straight-chain saturated hydrocarbons. Often susceptible to cold-flow problems.

PERCENTAGE PERMANENT VISCOSITY LOSS (PPVL)

Measure of the PVL related to the viscosity of fresh oil. Equals PVL divided by fresh oil viscosity, multiplied by 100.

PETROLEUM PRODUCTS - COMMON TERMS

PERCENTAGE TEMPORARY VISCOSITY LOSS (PTVL)

Difference between the viscosity of an oil measured at low and high shear rates, divided by viscosity measured at low shear rate, multiplied by 100. All viscosities must be measured at the same temperature and using the same units (cSt or cP).

PERMANENT VISCOSITY LOSS (PVL)

Irreversible reduction in lubricant viscosity due to mechanical shear in engines or laboratory test rigs. PVL equals the difference between the fresh oil viscosity and that of the degraded oil, both measured at the same temperature.

PITTING

Surface cavities in metal. May be related to fatigue, overload or corrosion.

PLASTIC FLOW

Surface deformation of metal as a result of yielding under heavy load.

POISE (P)

Measurement unit of a fluid's resistance to flow, i.e. viscosity, defined by the shear stress (in dynes/cm²) required to move one layer of fluid along another over a total layer thickness of one centimetre at a velocity of one centimetre per second. This viscosity is independent of fluid density and directly related to flow resistance.

POLISHING (BORE)

Excessive smoothing of the surface finish of a cylinder bore or liner in an engine to a mirror-like appearance, resulting in depreciation of ring sealing and oil consumption performance.

POSITIVE CRANKCASE VENTILATION (PCV)

System for removing blow-by gases from the crankcase and returning them through the carburettor intake manifold to the combustion chamber where the recirculated hydrocarbons are burned. A PCV valve controls the flow of gases from the crankcase to reduce hydrocarbon emissions.

POUR POINT

An indicator of the ability of an oil or distillate fuel to flow at cold operating temperatures. It is the lowest temperature at which the fluid will flow when cooled under prescribed conditions.

POUR POINT DEPRESSANT

Additive used to lower the pour point or low temperature, low shear rate fluidity of a petroleum product.

PRE-IGNITION

Ignition of the air/fuel mixture in a gasoline engine before the spark plug fires. Often caused by incandescent fuel or lubricant deposits in the combustion chamber, it wastes power and may damage the engine.

PUMPABILITY

The low temperature, low shear stress-shear rate viscosity characteristics of an oil that permits satisfactory flow to and from the engine oil pump and subsequent lubrication of moving components.

REFINING

A series of processes to convert crude oil and its fractions into finished petroleum products, including thermal cracking, catalytic cracking, polymerisation, alkylation, reforming, hydrocracking, hydroforming, hydrogenation, hydrogen treating, Hydrofining®, solvent extraction, dewaxing, de-oiling, acid treating, clay filtration and deasphalting.

REFINING

A process of reclaiming used lubricant oils and restoring them to a condition similar to that of virgin stocks by filtration, clay absorption or more elaborate methods.

PETROLEUM PRODUCTS - COMMON TERMS

RIDGING

In gear teeth, a form of plastic flow characterised by a rippled appearance on the tooth surface.

RING STICKING

Freezing of a piston ring in its groove in a piston engine or reciprocating compressor due to heavy deposits in the piston ring zone.

RINGS

Circular metallic elements that ride in the grooves of a piston and provide compression-sealing during combustion. Also used to spread oil for lubrication.

ROLLING AND PEENING

In gear teeth, a form of plastic flow that gives the surface a hammered appearance. Metal may be rolled over the tooth tips.

RUST PREVENTATIVE

Compound for coating metal surfaces with a film that protects against rust. Commonly used to preserve equipment in storage.

SCRATCHING

Fine abrasive furrows in the direction of sliding.

SCUFFING

Abnormal engine wear due to localised welding and fracture. It can be prevented through the use of antiwear, extreme pressure and friction modifying additives.

SEM

Scanning electron microscope.

SHEAR STABILITY INDEX (SSI)

A measure of an oil's irreversible viscosity loss attributable to the viscosity modifier when the oil is subjected to engine operation or special test conditions. Also sometimes called Permanent Shear Stability Index (PSSI), SSI is defined by the equation:

$$SSI = 100(V_o - V_s) / (V_o - V_b)$$

where: V_o = viscosity of the unsheared oil
 V_s = viscosity of the sheared oil
 V_b = viscosity of the base oil.

SLUDGE

A thick, dark residue, normally of mayonnaise consistency, that accumulates on non-moving engine interior surfaces. Generally removable by wiping unless baked to a carbonaceous consistency, its formation is associated with insolubles overloading the lubricant.

SOLVENT EXTRACTION

Refining process used to separate reactive components (unsaturated hydrocarbons) from lubricant distillates in order to improve the oil's oxidation stability, viscosity index and additive response.

SOLVENT REFINING

A process of extracting lubricant base stocks from stripped heavy gas oil or other heavy, stripped crude streams using selective solvents such as furfural or phenol.

SPALLING

Severe damage characterised by large pits, cavities and related cracks. Related to overload and fatigue.

TECHNICAL INFORMATION

PETROLEUM PRODUCTS - COMMON TERMS

STOKE (St)

A unit of measure of kinematic viscosity defined by the ratio of the fluid's dynamic viscosity to its density. Usually expressed as centistokes (cSt), where 1 Stoke = 100 cSt and 1 cSt = 1 mm²/s.

SYNTHETIC LUBRICANT

Lubricating fluid made by chemically reacting materials of a specific chemical composition to produce a compound with planned and predictable properties.

TEMPORARY SHEAR STABILITY INDEX (TSSI)

The measure of the viscosity modifier's contribution to an oil's percentage viscosity loss under high shear conditions. Temporary shear loss results from the reversible lowering of viscosity in high shear areas of an engine, an effect that can positively influence fuel economy and cold cranking speed.

TEMPORARY VISCOSITY LOSS (TVL)

The difference between dynamic viscosity measured at high shear rate compared to that determined at low shear rate. Both viscosities are measured at the same temperature.

TRIBOLOGY

The science of the interactions between surfaces moving relative to each other, including the study of lubrication, friction and wear.

VALVE LIFTER

Sometimes called a "cam follower", a component in engine designs that use a linkage system between a cam and the valve it operates. The lifter typically translates the rotational motion of the cam to a reciprocating linear motion in the linkage system.

VAPOUR PRESSURE – REID (RVP)

A measure of the pressure of vapour accumulated above a sample of gasoline or other volatile fuel in a standard bomb at 100°F (37.8°C). Used to predict the vapour locking tendencies of a fuel in a vehicle's fuel system. Controlled by law in some areas to limit air pollution from hydrocarbon evaporation while dispensing.

VARNISH

A thin, insoluble, non-wipeable film occurring on interior engine parts. Can cause sticking and malfunction of close-clearance moving parts. Called lacquer in diesel engines.

VISCOSITY

A measure of a fluid's internal resistance to flow.

VISCOSITY INDEX (VI)

The relationship of viscosity to the temperature of a fluid. It is determined by measuring the kinematic viscosities of the oil at 40 and 100°C and using tables or formulae included in ASTM D 2270. High viscosity index fluids tend to display less change in viscosity with temperature than low viscosity index fluids.

VISCOSITY MODIFIER

Lubricant additive, usually a polymer, whose function is to provide beneficial rheological properties to lubricating oils, such as reducing the tendency of an oil's viscosity to change with temperature.

WHITE OIL

Highly refined lubricant stock used for special applications such as cosmetics and medicines.

ZINC (ZDP or ZDDP)

Commonly used name for zinc dithiophosphate a chemical antiwear agent and oxidation inhibitor.

ABBREVIATIONS OF ORGANISATION NAMES

AAM	Alliance of Automotive Manufacturers
ACC	American Chemistry Council
ACEA	Association des Constructeurs Européens del' Automobile
ACS	American Chemical Society
AFNOR	Association Française de Normalisation
AGMA	American Gear Manufacturer's Association
AHEM	Association of Hydraulic Equipment Manufacturers
ANFAVEA	Automotive Manufacturer's Association (Brazil)
ANSI	American National Standards Institute
APE	Association of Petroleum Engineers (USA)
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
ATC	Technical Committee of Petroleum Additive Manufacturers
ATIEL	Association Technique del' Industrie Européenne des Lubrifiants
BHRA	British Hydromechanics Research Association
BLF	British Lubricants Federation
BNP	Bureau de Normalisation des Pétroles
BSI	British Standards Institution
BTC	British Council of the Motor and Petroleum Industries (CEC member)
CARB	California Air Resources Board
CEC	Conseil Européen de Coordination les Développements des Essais de Performance des Lubrifiants et des Combustibles pour Moteurs (Coordinating European Council)
CEC Finland	Finnish Petroleum Federation (CEC member)
CEC / SB	Conseil Européen de Coordination / Société Belge (CEC member)
CEFIC	European Chemical Industry Council
CEN	Conseil Européen de Normalisation
CIMAC	International Council on Combustion Engines
CLR	Cooperative Lubrication Research
CMA	Chemical Manufacturer's Association (renamed ACC)
CONCAWE	Conservation of Clean Air and Water (Europe)
CRC	Coordinating Research Council (USA)
CUNA	Commissione Tecnica di Unificazione nel l'Autoveicolo (CEC member)
DIN	Deutsches Institut für Normung
DKA	Deutscher Koordinierungsausschuss für die Entwicklung von Prüfverfahren für Kraft- und Schmierstoffe (CEC member)

ABBREVIATIONS OF ORGANISATION NAMES

ECE	Economic Commission for Europe
EEB	European Environmental Bureau
EEC (CEE)	European Economic Community (Conseil Européen Economique)
EFTC	Engine Fuels Technical Committee (of CEC)
ELTC	Engine Lubricants Technical Committee (of CEC)
EMA	Engine Manufacturer's Association
EPA	Environmental Protection Agency
ETLP	Engine Tests of Lubricants Panel (of IP)
FZG	Forschungstelle für Zahnrad und Getriebbau
GFC	Groupement Française de Coordination (CEC member)
GRPE	Groupe des Rapporteurs pour la Pollution et l'Énergie
IchemE	Institute of Chemical Engineers (UK)
ICOMIA	International Council for Marine Industry Associations
IFP	Institut Française du Pétrole
IGL	Investigation Group – Lubricants (of CEC)
ILMA	International Lubricant Manufacturer's Association
ILSAC	International Lubricant Specification Advisory Committee
IP	Institute of Petroleum (UK)
ISO	International Organisation for Standardisation
JAMA	Japanese Automobile Manufacturer's Association
JARI	Japanese Automobile Research Institute
JASO	Japanese Automobile Standards Organisation
JAST	Japanese Society of Tribologists
JIS	Japanese Industrial Standards
JSAE	Japanese Society of Automotive Engineers
LRI	Lubricants Review Institute (USA)
MITI	Ministry of International Trade and Industry
NCM	National Comité Motorproeven (Netherlands) (CEC member)
NLGI	National Lubricating Grease Institute (USA)
NMMA	National Marine Manufacturer's Association
NPRA	National Petroleum Refiner's Association
PAJ	Petroleum Association of Japan
SAE	Society of Automotive Engineers
SMR	Svenska Mekanisters Riksförbund (CEC member)
SNV	Schweizerische Normenvereinigung (CEC member)
STLE	Society of Tribologists and Lubrication Engineers
TUV	Technischer Überwachungs Verein (Germany)

LUBRICANT BASICS - VISCOSITY

ABSOLUTE AND KINEMATIC VISCOSITY

When a fluid is subjected to external forces it resists flow due to internal friction. Viscosity is the measure of this internal friction.

Kinematic viscosity is a measure of the resistive flow of a fluid under the influence of gravity. When two fluids of equal volume are placed in identical capillary viscometers and allowed to flow by gravity, a viscous fluid takes longer than a less viscous fluid to flow through the capillary. If one fluid takes 200 seconds to complete its flow and another fluid takes 400 seconds, the second fluid is twice as viscous as the first on a kinematic viscosity scale.

Absolute viscosity, sometimes called dynamic or simple viscosity, is the product of kinematic viscosity and fluid density.

Absolute Viscosity = Kinematic Viscosity x Density

The dimension of kinematic viscosity is L^2/T , where L is a length and T is a time. Commonly, the centistoke (cSt) is used. The SI unit of kinematic viscosity is mm^2/s , which is 1 cSt. Absolute viscosity is expressed in units of centipoise (cP). The SI unit of absolute viscosity is the millipascal-second (mPa-s), where 1 cP = 1 mPa-s.

Other common but obsolete units of kinematic viscosity are Saybolt Universal Seconds (SUS) and Saybolt Furoi Seconds (SFS). These units can be converted to centistokes by following the instructions in ASTM D 2161.

NEWTONIAN AND NON-NEWTONIAN FLUIDS

The relationship in which viscosity is a constant regardless of shear stress or rate of shear is called Newton's Viscosity Law. Many common solvents, mineral base oils, synthetic base fluids and fully formulated single-grade oils obey Newton's Viscosity Law and are called Newtonian fluids.

Non-Newtonian fluids can be defined as those for which viscosity is not a constant but varies based upon the rate of shear or the shear stress at which it is measured. The majority of modern motor oils are multi-viscosity-grade oils that are formulated with high molecular weight polymers called viscosity modifiers. The viscosities of such oils decrease with an increase in shear rate. These are called "shear-thinning" fluids. Other examples of non-Newtonian fluids are ceiling paint, quicksand and rubber cement.

VISCOSITY MEASUREMENT TECHNIQUES

Viscometers can be classified into three major types:

1. **Capillary Viscometers** measure the flow rate of a fixed volume of fluid through a small orifice at a controlled temperature. The rate of shear can be varied from near zero to 106 s⁻¹ by changing capillary diameter and applied pressure. Types of capillary viscometers and their modes of operation are:
 - **Glass Capillary Viscometer** (ASTM D 445) – Fluid passes through a fixed-diameter orifice under the influence of gravity. The rate of shear is less than 10 s⁻¹. All kinematic viscosities of automotive fluids are measured by capillary viscometers.
 - **High Pressure Capillary Viscometer** (ASTM D 4624 & D 5481) – Applied gas pressure forces a fixed volume of fluid through a small-diameter glass capillary. The rate of shear can be varied up to 106s⁻¹. This technique is commonly used to simulate the viscosity of motor oils in operating crank shaft bearings. This viscosity is called high-temperature high-shear (HTHS) viscosity and is measured at 150°C and 106 s⁻¹. HTHS viscosity is also measured by the Tapered Bearing Simulator (ASTM D 4683) and the Ravenfield Tapered Plug viscometer (ASTM D 4741) (see below).

2. **Rotary Viscometers** use the torque of a rotating shaft (at constant rotational speed) or the flow. rotational speed of the rotating shaft (at constant shear stress) to measure a fluid's resistance to flow. The Cold Cranking Simulator (CCS), Mini-Rotary Viscometer (MRV), Brookfield Viscometer, Tapered Bearing Simulator (TBS) and Ravenfield Tapered Plug Viscometer are all rotary viscometers. Rate of shear can be changed by changing rotor dimensions, the gap between rotor and stator wall and the speed of rotation.
 - **Cold Cranking Simulator** (ASTM D 5293) – The CCS measures an apparent viscosity in the range of 500 to 200,000 cP. Shear rate ranges between 104 and 105 s⁻¹. Normal operating temperature range is 0 to -40°C. The CCS has demonstrated excellent correlation with engine cranking data at low temperatures. The SAE J300 viscosity classification specifies the low-temperature viscometric performance of motor oils by CCS limits and MRV requirements.
 - **Mini-Rotary Viscometer** (ASTM D 4684) – The MRV test, which is related to the mechanism of pumpability, is a low shear rate measurement. Slow sample cooling rate is the method's key feature. A sample is pretreated to have a specified thermal history which includes warming, slow cooling and soaking cycles. The MRV measures an apparent yield stress, which, if greater than a threshold value, indicates a potential air-binding pumping failure problem. Above a certain viscosity (currently defined as 60,000 cP @ -30°C by SAE J300), the oil may be subject to pumpability failure by a mechanism called "flow limited" behaviour. An SAE 10W oil, for example, is required to have a maximum viscosity of 60,000 cP @ -30°C with no yield stress. This method also measures apparent viscosity under shear rates of 1 to 50 s⁻¹.
 - **Brookfield Viscometer** - Determines a wide range of viscosities (1 to 105 P) under low rate of shear (up to 102 s⁻¹). ASTM D 2983 is used primarily to determine the low temperature viscosity of automotive gear oils, automatic transmission fluids, torque and tractor fluids and industrial and automotive hydraulic fluids. Test temperature is held constant in the range -5 to -40°C. ASTM D 5133, the Scanning Brookfield technique, measures the Brookfield viscosity of a sample as it is cooled at a constant rate of 1°C/hour. Like the MRV, ASTM D 5133 is intended to relate to an oil's pumpability at low temperatures. The test reports the gelation point, defined as the temperature at which the sample reaches 30,000 cP. The gelation index is also reported and is defined as the largest rate of change of viscosity increase from -5°C to the lowest test temperature. This method is finding application in engine oils and is required by ILSAC GF-2.
 - **Tapered Bearing Simulator** (ASTM D 4683) and Ravenfield Tapered Plug Viscometer (ASTM D 4741) - These techniques also measure high-temperature high-shear-rate viscosity of motor oils (see High Pressure Capillary Viscometer). Very high shear rates are obtained by using an extremely small gap between the rotor and stator wall.
3. **Miscellaneous Instruments** operate by a number of principles, for example, the falling time of a steel ball or needle in a fluid, the vibration resistance of a probe and the pressure applied to a probe by a flowing fluid.

VISCOSITY INDEX

Viscosity Index (VI) is an empirical number indicating the degree of change in viscosity of an oil within a given temperature range. It is determined by measuring the kinematic viscosities of the oil at 40 and 100°C and using the tables or formulae included in ASTM D 2270. A high VI signifies a relatively small change in viscosity with temperature, whereas a low VI reflects a large viscosity change with temperature. Most mineral base oils have a VI between 0 and 110 but the VI of synthetic fluids often exceeds 120. The incorporation of polymers often increases the VI of the base oils to over 110.

SAE has not used VI to classify motor oils since 1967 because the term is technically obsolete. However, API 1509 describes a base oil classification system using VI as one of several parameters to provide guidelines for base oil interchange and viscosity grade read-across.

MAJOR TYPES OF VISCOSITY MODIFIERS

Chemical structure and molecular size are the most important elements of the molecular architecture of viscosity modifiers. Many types of viscosity modifiers are available and choice depends on the particular circumstances.

Viscosity modifiers available today all consist of aliphatic carbon-to-carbon backbones. The major structural differences lie in the side groups, which differ both chemically and in size. These variations in chemical structure are responsible for various properties of viscosity modifiers such as oil thickening ability, viscosity-temperature dependency, oxidation stability and fuel economy characteristics.

Polyisobutylene (PIB or Polybutene) – The predominant viscosity modifiers at the end of the 1950s, PIB types have since been replaced by other viscosity modifier types because they generally do not provide satisfactory low temperature and diesel performance. However, low molecular weight PIBs are still widely used in automotive gear oils.

Polymethacrylate (PMA) – PMA viscosity modifiers contain alkyl side chains that interfere with the formation of wax crystals in the oil, thereby providing excellent low-temperature properties.

Olefin Copolymer (OCP) – OCP viscosity modifiers are widely used for motor oils due to their low cost and satisfactory engine performance. Various OCPs are on the market, differing mainly in molecular weight and the ratio of ethylene to propylene.

Esters of Styrene Maleic Anhydride Copolymers (Styrene Esters) – Styrene esters are multifunctional premium viscosity modifiers. A combination of various alkyl groups imparts excellent low-temperature properties to oils containing these products. Styrene ester viscosity modifiers have been used in fuel-economy motor oils and are still used extensively in automatic transmission fluids and as pour point depressants.

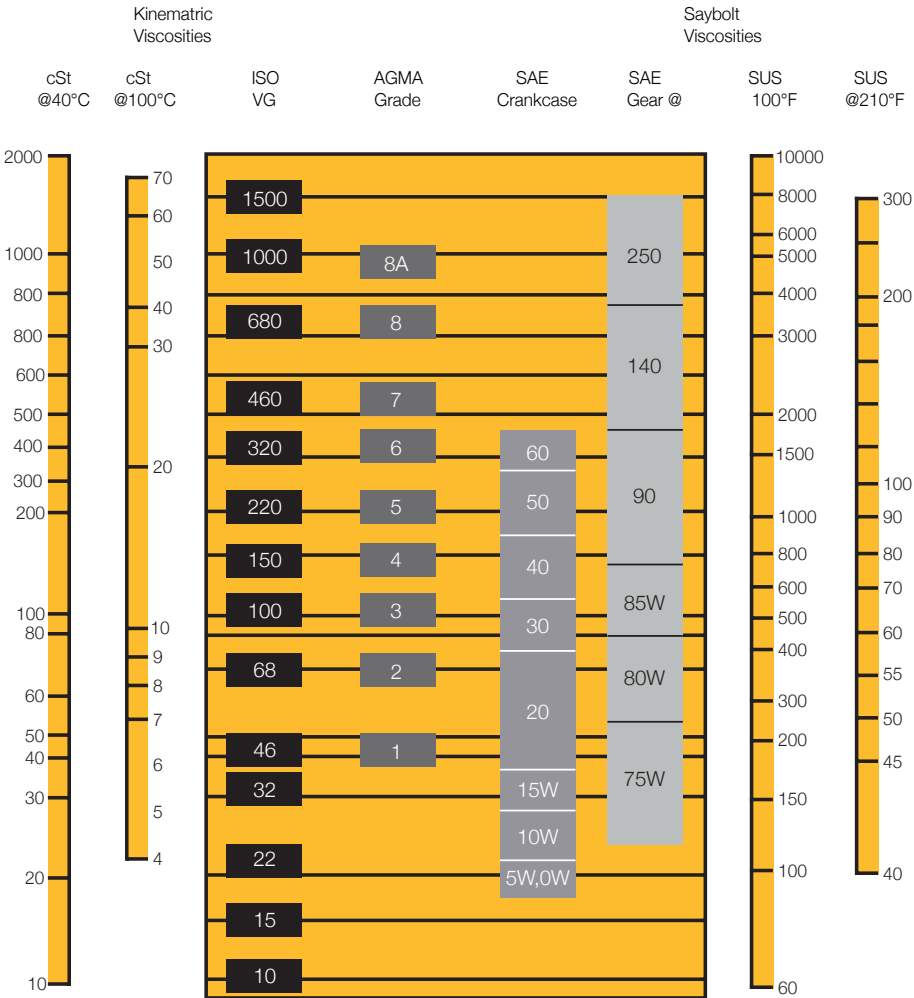
Hydrogenated Styrene-Diene Copolymers – Hydrogenated styrene-diene (isoprene or butadiene) viscosity modifiers are characterised by fuel economy benefits, good low-temperature viscometrics and good high-temperature engine performance.

Hydrogenated Radial Polyisoprene (STAR) - Hydrogenated radial polyisoprene viscosity modifiers demonstrate good shear stability at relatively low temperature rates compared to other viscosity modifier types. Their low-temperature properties are similar to those of OCP viscosity modifiers.

VISCOSITY

Viscosity is the measurement of a fluid's resistance to flow. The common metric unit of absolute viscosity is the poise, which is defined as the force required to move a fluid surface of one square centimetre in area, past a parallel point at a speed of one centimetre per second, with the surfaces separated by a fluid film one centimetre thick. In addition to kinematic viscosity, there are other methods for determining viscosity, including Saybolt Universal Viscosity (SUV), Saybolt Furol viscosity, Engler viscosity, and Redwood viscosity. Since viscosity varies in inversely with temperature, the value must always be reported at the temperature at which it is tested.

COMPARATIVE VISCOSITY CLASSIFICATIONS



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BELL

Lubricants



All dimensions are shown in millimetres, unless otherwise stated between brackets.
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