



MARINE LUBRICANTS POCKETBOOK

FOR SMOOTHER OPERATIONS

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Shell Marine

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LUBRICANTS FOR MARINE APPLICATIONS

Welcome to the Marine Lubricants Pocketbook from Shell Marine. Shell has, over many years, developed a comprehensive portfolio of exceptional lubricants, many of which have multiple functions or specialised applications for the marine industry. This pocketbook is designed as a useful and quick reference for personnel responsible for engineering operations and maintenance in the marine sector. The pocketbook provides only a summary of Shell's main lubricant grades at the time of printing and contains typical physical characteristics along with brief product and application descriptions.

Further details on Shell Marine lubricants and their applications can be obtained from your Shell Marine representative or visit www.shell.com/marine.



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MARINE DIESEL ENGINES

OIL REQUIREMENTS

SLOW-SPEED CROSSHEAD (2-STROKE)

Cylinder oil

- Protection from all effects of oil stress
- Combustion acid neutralisation
- Scuffing prevention
- Good film strength
- Piston, ring and scavenge port cleanliness
- Anti-wear properties
- SAE 40, SAE 50 and SAE 60

System oil

- Good film strength
- Resistance to corrosion
- Excellent crankcase cleaning effect
- Able to separate from water and insolubles by centrifuging
- Extreme pressure properties
- Rust and oxidation prevention
- Resistant to microbial degradation
- SAE 30

TRUNK PISTON (4-STROKE)

Crankcase

- Protection from all effects of oil stress
- Controls piston land and ring deposits to prevent ring sticking
- Resistance to corrosion
- Neutralises combustion acids
- Scuffing prevention
- Extreme pressure properties
- TBN retention and consumption control
- Excellent detergency effect
- SAE 30 and SAE 40

Classification of marine diesel engines

Type	Slow speed	Medium speed	Medium to high speed	High speed
Speed (rpm)	65–150	230–750	600–1,200	1,200–2,250
Bore (mm)	260–1,000	300–650	200–400	100–200

CYLINDER OILS

SHELL ALEXIA

Shell Alexia S3 (BN25)

A cylinder oil for use in low-speed, 2-stroke diesel engines burning low-sulphur and distillate fuels with up to 0.5% sulphur. These fuel types are expected to be used in sulphur Emission Control Areas. Shell Alexia S3 has been engineered to offer excellent cleanliness and protection for all engine types. Approved by MAN Diesel & Turbo, MHI and Wärtsilä.

Shell Alexia S4 (BN60)

A cylinder oil for use in all 2-stroke low-speed diesel engines burning low-sulphur heavy fuel oil. Approved by MAN Diesel & Turbo, MHI and Wärtsilä.

Shell Alexia 50 (BN70)

Shell's main grade cylinder oil for most low-speed, 2-stroke diesel engines burning heavy fuel oil with up to 3.5% sulphur. Millions of running hours have seen Shell Alexia 50 deliver exceptionally clean pistons and rings. Approved by MAN Diesel & Turbo, MHI and Wärtsilä.

Shell Alexia S6 (BN100)

A high-performance cylinder oil designed to offer enhanced protection in the most demanding new or modified low-speed 2-stroke diesel engines. A cylinder oil developed to protect from cold corrosion and to reduce the cost of maintaining new and modified engines. Approved by MAN Diesel & Turbo, MHI and Wärtsilä.

Shell Alexia 140 (BN140)

High-performance cylinder oil designed for use under conditions of extreme oil stress requiring high alkalinity and detergency. It has been engineered to offer excellent performance for the newest, more demanding 2-stroke diesel engines under challenging operational conditions. It is also ideal for use in onboard cylinder oil mixing systems in combination with lower BN Shell Alexia cylinder oils or Shell Melina system oils.

Outstanding qualities

- Operational simplicity
- Outstanding neutralisation of combustion products
- Excellent piston ring and cylinder wear rates
- Superior deposit control

CYLINDER OILS

	SAE engine viscosity grade	Viscosity index	BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
SHELL ALEXIA S3	50	>95	25	235	-15	908
SHELL ALEXIA S4	40	>95	60	>210	< -6	926
SHELL ALEXIA 50	50	>95	70	>205	< -6	932
SHELL ALEXIA S6	50	>95	100	>210	< -6	954
SHELL ALEXIA 140	60	>95	140	>225	< -6	975

Note: For detailed application advice based on your specific engine type and operating conditions, please refer to manufacturers' guidelines.

SYSTEM OIL

SHELL MELINA S 30

A premium-quality SAE 30 system oil for crosshead engines that can also be used in many different items of marine equipment, such as certain gears and ancillary equipment, to rationalise the number of grades of lubricant carried on board ship.

Outstanding qualities

- Wear protection
- Engine cleanliness
- Multifunctional: stern tubes, gears and general
- Excellent crankcase cleaning effect
- Able to separate from water and insolubles by centrifuging

	SAE engine viscosity grade	Viscosity, mm ² /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
		40°C	100°C				
SHELL MELINA S 30	30	104	11.6	5	227	-18	888

MEDIUM-SPEED ENGINE OILS

SHELL ARGINA S

Shell Argina S2 40 (SAE 40, BN20)

A multifunctional crankcase lubricant for highly rated medium-speed diesel engines operating on residual, blended or distillate fuels with sulphur content <2.0%.

Shell Argina S3 30 (SAE 30, BN30)

Shell Argina S3 40 (SAE 40, BN30)

Multifunctional crankcase lubricants for highly rated medium-speed diesel engines operating on residual fuel with sulphur content <3.0%.

Shell Argina S4 40 (SAE 40, BN40)

A multifunctional crankcase lubricant for highly rated medium-speed diesel engines operating under high-stress conditions and on residual fuel with sulphur content >2.0%.

Shell Argina S5 40 (SAE 40, BN55)

A multifunctional crankcase lubricant for highly rated medium-speed diesel engines operating under high-stress conditions and on residual fuel with sulphur content >3.0%. Designed for the latest high-output, low-oil-consumption engines.

MEDIUM-SPEED ENGINE OILS

SHELL ARGINA S

- Optimised to resist oxidation and maintain BN to reduce the amount of oil sweetening that is required
- Very effective level of detergency leading to exceptionally clean crankcase, valve deck and pistons
- The formulation has been further optimised to reduce deposits in critical areas, e.g., piston undercrown.
- Well-balanced high-detergency/low-dispersancy formulation to effectively release contaminants and water in centrifugal separators
- The oils have a comprehensive range of engine manufacturers' approvals.

	SAE engine viscosity grade	Viscosity, mm ² /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
		40°C	100°C				
SHELL ARGINA S2 40	40	131	13.7	20	230	-21	900
SHELL ARGINA S3 30	30	105	11.9	30	210	-21	900
SHELL ARGINA S3 40	40	130	13.7	30	230	-21	905
SHELL ARGINA S4 40	40	127	13.7	40	230	-21	910
SHELL ARGINA S5 40	40	123	13.7	55	230	-21	920

MEDIUM-SPEED ENGINE OILS

SHELL GADINIA S3 30 (SAE 30)

SHELL GADINIA S3 40 (SAE 40)

High quality, multifunctional diesel engine lubricants designed for the most severe service main propulsion and auxiliary marine trunk piston engines burning distillate, hybrid and biofuels with a sulphur content up to 1%.

- Optimised for use in non-engine applications like gearboxes, clutches, deck machinery and stern tubes
- Very high load carrying capacity (FZG Gear Machine) – Failure Load Stage 12 (ISO 1435-1 A/8.3/90)

- Improved cleanliness performance and enhanced lube oil consumption control
- Excellent wear protection
- Shell Gadinia S3 is approved by leading trunk piston engine manufacturers.

Shell Gadinia S3 has a comprehensive set of non-engine approvals, including from Simplex B&V; Ortlinghaus; Stromag; Reintjes; Renk, Rheine; Renk, Augsburg; Siemens/Flender; MAN Alpha (meets requirements); CLP requirement specification (meets requirements widely); and VDL requirements specification (meets requirements widely).

	SAE engine viscosity grade	Viscosity, mm ² /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
		40°C	100°C				
SHELL GADINIA S3 30	30	104	11.9	12	210	- 21	890
SHELL GADINIA S3 40	40	128	13.7	12	230	- 21	890

MEDIUM-SPEED ENGINE OILS

SHELL GADINIA AL 30 (SAE 30) SHELL GADINIA AL 40 (SAE 40)

Advanced lubricants for medium-speed trunk-piston engines running on distillate fuel. Specially designed to control oil consumption in modern engines where liner lacquering is a potential problem. Suitable for use in certain gears and ancillary equipment. Approvals: Rolls-Royce Bergen, Deutz AG, MAN Diesel & Turbo, Wärtsilä NSD, MaK and Simplex.

- Reduce lacquer
- Lower lubricant consumption
- Increased engine reliability

SHELL MYSELLA S3 N 40

A high-performance natural gas engine oil for lean-burn, spark-ignition 4-stroke engines requiring low-ash oil.

SHELL MYSELLA S5 N 40

The highest performance natural gas engine oil for use in highly rated spark-ignition 4-stroke engines requiring low ash oil. It is specially developed to provide extended drain oil intervals.

	SAE engine viscosity grade	Viscosity, mm ² /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
		40°C	100°C				
SHELL GADINIA AL 30	30	95	11.4	15	>200	-18	893
SHELL GADINIA AL 40	40	140	14.3	15	>200	-18	900
SHELL MYSELLA S3 N 40	40	135	13.5	5	230	-18	890
SHELL MYSELLA S5 N 40	40	125	13.3	4.5	264	-18	890

HIGH-SPEED DIESEL ENGINE OILS

MULTIGRADE OILS

SHELL RIMULA R4 X 15W-40

(USA, Shell Rotella T Triple Protection 15W-40)

SHELL RIMULA R4 L 15W-40 (LOW-SAPS)

(USA, Shell Rotella T3 15W-40)

SHELL RIMULA R6 M 10W-40 (SYNTHETIC)

(USA, Shell Rotella T6 5W-40)

High-performance engine oil for highly rated high-speed diesel engines that meet the latest API and ACEA specifications.

- Suitable for engines burning distillate fuels with a sulphur content of up to 1.0 %wt.
- Outstanding engine cleanliness
- Superior wear control
- Excellent oxidation resistance

HIGH-SPEED DIESEL ENGINE OILS

	Viscosity, mm ² /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C				
SHELL RIMULA R4 X 15W-40	109	14.7	10.5	230	-36	881
SHELL RIMULA R4 L 15W-40	115	15.5	10.0	227	-33	883
SHELL RIMULA R6 M 10W-40	83	13.2	13.0	256	-36	848
SHELL ROTELLA T TRIPLE PROTECTION 15W-40	120	15.5	10.1	204	-30	879
SHELL ROTELLA T3	115	15.5	10.0	227	-30	879
SHELL ROTELLA T6	87	14.2	10.6	224	-42	858

HIGH-SPEED DIESEL ENGINE OILS

MONOGRADE OILS

SHELL RIMULA R3+ 30 (USA, Shell Rotella T1 30)

SHELL ROTELLA DD+ 40

SHELL SIRIUS X 40

Monograde heavy duty diesel engine oils.

Performance specifications

Typical specifications are API CF; ACEA E3-96; MB 228.3; MAN Diesel & Turbo 3275; Ruston; Wärtsilä; NSD; Volvo VDS-2; MTU approved (Type II high-performance category); CWEC approved (Cummins Wärtsilä Engine Company); MWM Deutz approved (high output, high speed, e.g., TBD 620); meets the requirements of Caterpillar 3600 Series.

	SAE engine viscosity grade	Viscosity, mm ² /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
		40°C	100°C				
SHELL RIMULA R3+ 30	30	93	11.0	9	242	-18	890
SHELL ROTELLA DD+ 40	40	138	14.4	8	250	-15	899
SHELL SIRIUS X 40	40	139	14.0	17	230	-18	890
SHELL ROTELLA T1 30	30	107	11.9	7.5	210	-24	887

ENVIRONMENTALLY ACCEPTABLE LUBRICANTS

VGP 2013 COMPLIANT

All Shell Naturelle products meet current EPA-VGP 2013 requirements.

SHELL NATURELLE S4 STERN TUBE FLUID 100

A non-emulsifying fluid made from fully saturated esters. Approved by the major stern tube and seal manufacturers. EU Ecolabel certified guaranteeing VGP compliance. Designed to offer superior lubrication and resistance to hydrolysis.

SHELL NATURELLE S4 GEAR FLUID

A fully saturated ester based gear fluid for use in thrusters and propulsion drives, and certain stern tube designs. Superior load-carrying performance while maintaining biodegradability. EU Ecolabel registered for VGP 2013 compliance.

SHELL NATURELLE HF-E

A synthetic ester based advanced hydraulic fluid for use in applications requiring VGP compliance. Approved for use in major manufacturers' stabilisers and controllable-pitch propellers, and holding ISO 15380 (HEES) and DIN 51524 part 2 and 3. EU Ecolabel registered for VGP 2013 compliance.

SHELL NATURELLE GREASE S5 V120P

An advanced biodegradable extreme-pressure grease for use in plain and roller bearings, and for general vessel lubrication. Approved by major rudder carrier manufacturers. EU Ecolabel registered for VGP 2013 compliance.

SHELL NATURELLE S2 WIRE ROPE LUBRICANT A

A high-performance fully biodegradable lubricant for use on wire ropes, cables and open gears offering high resistance to water wash-off while maintaining outstanding adhesion properties. Complies with the VGP 2013 requirements.

ENVIRONMENTALLY ACCEPTABLE LUBRICANTS

	Viscosity, mm ² /s		Flash point, °C)	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL NATURELLE S4 STERN TUBE FLUID 100	100	13.7	>230	-30	941
SHELL NATURELLE S4 GEAR FLUID 68	68	11.0	>180	-24	909
SHELL NATURELLE S4 GEAR FLUID 100	100	14.0	280	-24	919
SHELL NATURELLE S4 GEAR FLUID 150	150	18.0	280	-24	927
SHELL NATURELLE HF-E 46	47	9.4	322	-42	921
SHELL NATURELLE HF-E 68	68	12.3	320	-42	924

	Base	NLGI	Average dropping point, °C	Operating temperature, °C
SHELL NATURELLE GREASE S5 V120P 2	Lithium	2	180	-35 to +100
SHELL NATURELLE S2 WIRE ROPE LUBRICANT A	Calcium	1-2	120	-20 to +100

HYDRAULIC OILS

SHELL TELLUS S2 VX

High-performance hydraulic fluids providing outstanding protection and performance across a wide range of temperatures. They resist breakdown under heat or mechanical stress and are ideally suited to most equipment subjected to a wider range of ambient or operating temperatures where ISO HV hydraulic fluids are recommended.

SHELL TELLUS S3 M 46

A premium zinc-free anti-wear formulation used where ISO HM hydraulic oils are recommended.

SHELL TELLUS S4 VX 32

Advanced technology to meet the requirements of extremely low ambient temperature conditions.

AEROSHELL FLUID 41

Excellent low-temperature properties and super-clean levels.

HYDRAULIC OILS

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL TELLUS S2 VX 15	15	3.7	200	-42	820
SHELL TELLUS S2 VX 22	22	4.8	210	-42	835
SHELL TELLUS S2 VX 32	32	6.1	215	-39	854
SHELL TELLUS S2 VX 46	46	7.9	220	-36	856
SHELL TELLUS S2 VX 68	68	10.5	230	-30	860
SHELL TELLUS S2 VX 100	100	14.0	230	-30	870
SHELL TELLUS S3 M 46	46	6.8	220	-33	865
SHELL TELLUS S4 VX 32	33.8	9.9	>100	-60	890
AEROSHELL FLUID 41	14.1	5.3	105	<-60	870

GEAR OILS

MINERAL

SHELL OMALA S2 GX

High-quality, extreme-pressure (EP) oils for the lubrication of heavy-duty marine gearboxes. Their high load carrying capacity, protection against micropitting and compatibility with seals and paints combine to offer excellent performance in enclosed gear applications. (Specific grades are approved by Siemens AG for use in Flender, helical, bevel, planetary and marine gear units.)

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL OMALA S2 GX 68	68	8.7	>230	-27	885
SHELL OMALA S2 GX 100	100	11.3	>230	-24	891
SHELL OMALA S2 GX 150	150	14.8	>240	-24	897
SHELL OMALA S2 GX 220	220	19.0	>240	-18	899
SHELL OMALA S2 GX 320	320	24.2	250	-15	903
SHELL OMALA S2 GX 460	460	30.6	>250	-12	904
SHELL OMALA S2 GX 680	680	42.1	>250	-9	912

GEAR OILS

SYNTHETIC

SHELL OMALA S4 GXV

Advanced synthetic heavy-duty marine gear oil offering outstanding viscosity index and low-temperature fluidity, low foaming tendency and extended compatibility with seals and paints.

SHELL OMALA S4 WE 220

An excellent anti-oxidation synthetic polyalkylene glycol gear lubricant for operating temperatures up to 200°C or steel-on-bronze applications.

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL OMALA S4 GXV 150	150	22.0	240	-45	862
SHELL OMALA S4 GXV 220	220	30.0	240	-42	864
SHELL OMALA S4 GXV 320	320	37.0	240	-42	866
SHELL OMALA S4 WE 220	222	34.4	278	-39	1,074

AIR COMPRESSOR OILS

MINERAL

SHELL CORENA S2 P

Premium-quality mineral oils with excellent oxidation stability for use in reciprocating air compressors with discharge temperatures up to 220°C.

SYNTHETIC

SHELL CORENA S4 P

A high-performance synthetic lubricant for use in reciprocating air compressors operating under the severest conditions.

SHELL CORENA S4 R

A fully synthetic lubricant for use in oil-flooded screw or rotary vane air compressors. Shell Corena S4 R 68 meets the requirements of ABB for the VTR.4 type turbocharger 5,000-hour oil-drain interval and is approved by GEA Westfalia separators.

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL CORENA S2 P 100	100	9.2	240	-33	899
SHELL CORENA S2 P 150	155	12.1	240	-30	902
SHELL CORENA S4 P 100	100	10.2	260	-39	988
SHELL CORENA S4 R 46	46	7.7	230	-45	843
SHELL CORENA S4 R 68	68	10.2	248	-45	848

REFRIGERATION OILS

SHELL REFRIGERATION OIL S4 FR-F

A polyol ester refrigeration oil for use with environmentally friendly HFC refrigerant gases R23, R134a, R404a, R410 and R507.

SHELL REFRIGERATION OIL S4 FR-V

A high-performance universal alkylated benzene refrigeration oil suitable for reciprocating, centrifugal and rotary compressors using R22 or R717 down to evaporator temperatures of -60°C .

	Viscosity, mm^2/s		Flash point, $^{\circ}\text{C}$	Pour point, $^{\circ}\text{C}$	Density at 15°C , kg/m^3
	40°C	100°C			
SHELL REFRIGERATION OIL S4 FR-F 32	31	6.0	>220	-54	1,018
SHELL REFRIGERATION OIL S4 FR-F 68	66	8.8	>230	-42	991
SHELL REFRIGERATION OIL S4 FR-F 100	94	10.7	>230	-42	984
SHELL REFRIGERATION OIL S4 FR-V 32	29	4.1	180	-45	870
SHELL REFRIGERATION OIL S4 FR-V 68	68	6.2	190	-39	871

GAS COMPRESSOR OILS

SHELL GAS COMPRESSOR OIL S4 PV 190

A versatile polyalkylene glycol cylinder lubricant for reciprocating compressors handling hydrocarbon and other gases.

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL GAS COMPRESSOR OIL S4 PV 190	190	36.0	262	-30	1,056

BEARING AND CIRCULATING OILS

MINERAL

SHELL MORLINA S2 B 150

A mineral bearing oil giving excellent water shedding and corrosion protection.

SYNTHETIC

SHELL MORLINA S4 B

A fully synthetic anti-wear bearing oil approved for Alfa Laval separators (ISO 220).

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL MORLINA S2 B 150	150	15.0	262	-15	887
SHELL MORLINA S4 B 220	220	28.0	275	-45	854
SHELL MORLINA S4 B 320	320	37.0	275	-45	854
SHELL MORLINA S4 B 460	460	51.0	275	-33	855

TURBINE OILS

SHELL TURBO T

Specialist oils that meet the demands of high-output steam turbines. Meets ISO 8068 L-TSA, L-TGA type B and DIN 51515 L-TD. Shell Turbo T 68 meets the requirements of ABB for VTR.4 type turbocharger 1,000 hour oil-drain interval.

Excellent

- thermal stability
- demulsibility
- air release
- resistance to foaming
- rust and corrosion protection.

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL TURBO T 32	32	5.45	>215	<-33	840
SHELL TURBO T 46	46	6.9	>220	<-27	858
SHELL TURBO T 68	68	8.95	>240	<-24	871
SHELL TURBO T 100	100	11.7	>250	<-24	873

TRANSMISSION OILS

SHELL SPIRAX S4 ATF HDX

A superior-quality automatic transmission fluid suitable for heavy duty transmissions.

SHELL SPIRAX S4 TXM

A premium "universal transmission oil" designed for use in transmissions, hydraulic systems, oil-immersed brakes and other ancillary systems.

SHELL SPIRAX S3 AX 80W-90

A high-performance API GL-5 gear and axle oil for moderate to heavily loaded gear applications requiring SAE 80W-90 oil.

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL SPIRAX S4 ATF HDX	33	7.2	152	-48	847
SHELL SPIRAX S4 TXM	60	9.4	220	-42	882
SHELL SPIRAX S3 AX 80W-90	169	16.8	220	-30	900

HEAT TRANSFER FLUID

SHELL HEAT TRANSFER OIL S2

A heat transfer fluid for use in indirect closed fluid heat transfer systems with bulk temperatures up to 320°C.

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL HEAT TRANSFER OIL S2	29	5.1	208	-12	857

OUTBOARD 2-STROKE ENGINE OIL

SHELL NAUTILUS PREMIUM OUTBOARD

A high-performance lubricant for superior protection of all gasoline outboard 2-stroke motors.

Approved to NMMA TC-W3.

	Viscosity, mm ² /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m ³
	40°C	100°C			
SHELL NAUTILUS PREMIUM OUTBOARD	38	7.0	70	-35	871

GREASES

SHELL GADUS S2 V220 0	Extreme-pressure grease for highly loaded centralised systems.
SHELL GADUS S2 V220 1	Extreme-pressure grease for highly loaded centralised systems.
SHELL GADUS S2 V220 2	High-viscosity base oil multipurpose grease for high loads.
SHELL GADUS S2 A320 2	Extreme-pressure grease withstands water washout while retaining protection.
SHELL GADUS S2 V220AD 2	High-viscosity base oil and mixed lithium–calcium thickener with molybdenum disulphate.
SHELL GADUS S2 V220AC 2	High-viscosity base oil and mixed lithium–calcium thickener.
SHELL GADUS S2 V100 3	General-purpose grease for use in large electric motors.
SHELL GADUS S3 HIGH SPEED COUPLING GREASE	Special grease for flexible gear couplings.
SHELL GADUS S3 V220C 2	High-viscosity base oil multipurpose grease for high loads.
SHELL GADUS S3 T220 2	Top-performing, high-temperature, extreme-pressure multipurpose grease.
SHELL GADUS S5 V100 2	Synthetic, lithium complex extreme-pressure grease with a wide operating temperature range.
SHELL GADUS S2 OG 40	Superior performance open-gear grease.
SHELL GADUS S2 OG 50	Superior performance open-gear grease.

GREASES

	Base	NLGI grade	Average dropping point, °C	Operating temperature, °C
SHELL GADUS S2 V220 0	Lithium	0	–	–20 to +120
SHELL GADUS S2 V220 1	Lithium	1	180	–20 to +120
SHELL GADUS S2 V220 2	Lithium	2	180	–20 to +120
SHELL GADUS S2 A320 2	Calcium	2	85	–10 to +60
SHELL GADUS S2 V220AD 2	Lithium–calcium	2	175	–10 to +120
SHELL GADUS S2 V220AC 2	Lithium–calcium	2	180	–20 to +120
SHELL GADUS S2 V100 3	Lithium	3	180	–20 to +130
SHELL GADUS S3 HIGH SPEED COUPLING GREASE	Lithium	1	>150	–30 to +120
SHELL GADUS S3 V220C 2	Lithium complex	2	240	–25 to +140
SHELL GADUS S3 T220 2	Diurea	2	260	–20 to +160
SHELL GADUS S5 V100 2	Lithium complex	2	260	–50 to +150
SHELL GADUS S2 OG 40	–	–	–	–
SHELL GADUS S2 OG 50	–	–	–	–

GREASE COMPATIBILITY CHART

	ALUMINIUM COMPLEX	CALCIUM	CALCIUM COMPLEX	CLAY	LITHIUM	LITHIUM COMPLEX	POLYUREA
ALUMINIUM COMPLEX	–	●	●	●	●	●	●
CALCIUM	●	–	●	●	●	●	●
CALCIUM COMPLEX	●	●	–	●	●	●	●
CLAY	●	●	●	–	●	●	●
LITHIUM	●	●	●	●	–	●	●
LITHIUM COMPLEX	●	●	●	●	●	–	●
POLYUREA	●	●	●	●	●	●	–

● Compatible ● Borderline ● Incompatible

This chart is a guide and testing may be required to assess compatibility.

SHELL RAPID LUBRICANT ANALYSIS (RLA)

Shell RLA is the oil condition monitoring service that helps you to keep your vessels running smoothly by identifying potential oil or equipment failures before they become critical. It acts as an early-warning system that aims to give you peace of mind knowing that your equipment and lubricants are in optimum working order.

The Shell RLA service is available to all Shell Marine customers worldwide.

Shell RLA offers the simplified test suites shown in the table overleaf. This arrangement provides good flexibility and enables you to select best test suites for your machinery:

- **Test** provides cost-effective condition monitoring tests for all vessel equipment types.

- **Check** test suites are suitable for most equipment with a medium impact of failure.
- **Check Plus** test suites offer advanced diagnosis at equipment level and an enhanced test sequence suitable for equipment that is critical to the safe operation of a vessel.

SHELL RLA TEST SUITES

	Viscosity		TBN	TAN	Clean ISO 4406	Water		Flash point, °C	ICP	IC/DP/MD	WPI
	40°C	100°C				%vol	ppm				
Engine test		✓	✓			✓		✓	✓		
Shaft test (1)	✓			✓		✓			✓(2)		
System test	✓			✓		✓			✓		
Engine check		✓	✓			✓		✓	✓	✓	✓
Shaft check (1)	✓			✓		✓			✓(2)		✓
System check	✓			✓		✓			✓		✓
Fridge check (3)	✓			✓			✓		✓		
Gas engine check (4)		✓	✓	✓		✓			✓	✓	
Turbine check	✓			✓		✓			✓(5)		✓
EMD engine check		✓	✓			✓		✓	✓(6)	✓	✓
Cylinder check			✓			✓			✓(7)		✓
Hydraulic check	✓			✓		✓			✓		✓

(1) Also includes heptane insolubles; (2) ICP with nickel; (3) includes degas; (4) includes oxidation and nitration; (5) Ca in ppm; (6) Zn in ppm; (7) Zn and P in ppm

SHELL RLA TEST SUITES CONT.

	Viscosity		TBN	TAN	Clean ISO 4406	Water		Flash point, °C	ICP	IC/DP/ MD	WPI
	40°C	100°C				%vol	ppm				
Gear check	✓			✓		✓			✓		✓
Thruster check	✓			✓			✓		✓		✓
Thermal check	✓			✓		✓		✓	✓		✓
Grease check									✓		✓
Engine check plus		✓	✓				✓	✓	✓	✓	✓
System check plus	✓			✓			✓		✓		✓
Hydraulics check plus (1)	✓			✓	✓	✓			✓		✓
Gear check plus (1)	✓			✓		✓			✓		✓
Thruster check plus	✓			✓	✓		✓		✓		✓
NK stern tube test (8) (9)	✓			✓		✓			✓(2)		

(1) Also includes heptane insolubles; (2) ICP with nickel; (3) includes degas; (4) includes oxidation and nitration; (5) Ca in ppm; (6) Zn in ppm; (7) Zn and P in ppm; (8) includes oxidation; (9) includes direct reading ferrography

LUBRICANT VISCOSITY CLASSIFICATIONS

SAE VISCOSITY CLASSIFICATIONS

Engine oils

The most widely used system for engine oil viscosity classification is that established by the Society of Automotive Engineers (SAE) in the USA. In this system, two series of viscosity grades are defined: those containing the letter W and those without the letter W.

Grades with the letter W are intended for use at lower temperatures and are based on a maximum low-temperature viscosity, a maximum borderline pumping temperature and a minimum viscosity at 100°C. Oils without the letter W, intended for use at higher temperatures, are based on their viscosity at 100°C only.

A "multigrade" oil satisfies the viscosity requirements of one of the W grades at low temperatures and one of the non-W grades at high temperatures.

LUBRICANT VISCOSITY CLASSIFICATIONS

SAE VISCOSITY GRADES FOR ENGINE OILS^{(1), (2)} (J300–JAN2009)

SAE viscosity grade	Low-temperature(°C) cranking viscosity ⁽³⁾ (mPa·s)	Low temperature (°C) pumping viscosity ⁽⁴⁾ , mPa·s ⁽⁴⁾	Low-shear-rate kinematic viscosity ⁽⁵⁾ , (mm ² /s) at 100°C		High-shear-rate viscosity ⁽⁶⁾ , mPa·s at 150°C
	Max.	Max. with no yield stress	Min.	Max.	Min.
0W	6,200 at -35	60,000 at -40	3.8	–	–
5W	6,600 at -30	60,000 at -35	3.8	–	–
10W	7,000 at -25	60,000 at -30	4.1	–	–
15W	7,000 at -20	60,000 at -25	5.6	–	–
20W	9,500 at -15	60,000 at -20	5.6	–	–
25W	13,000 at -10	60,000 at -15	9.3	–	–
20	–	–	5.6	<9.3	2.6
30	–	–	9.3	<12.5	2.9
40	–	–	12.5	<16.3	3.5 (0W-40, 5W-40, and 10W-40 grades)
40	–	–	12.5	<16.3	3.7 (15W-40, 20W-40, 25W-40, 40 grades)
50	–	–	16.3	<21.9	3.7
60	–	–	21.9	<26.1	3.7

Notes

(1) 1 mPa·s = 1 cP; 1 mm²/s = 1 cSt

(2) All values, with the exception of the low-temperature cranking viscosity, are critical specifications, as defined by ASTM D3244⁽³⁾ [see text, Section 3]

(3) ASTM D5293: Cranking viscosity – The non-critical specification protocol in ASTM D3244 shall be applied with a P value of 0.95.

(4) ASTM D4684: Note the presence of any yield stress detectable by this method constitutes a failure regardless of viscosity.

(5) ASTM D445

(6) ASTM D4683, CEC L-36-A-90 (ASTM D4741) or ASTM D5481

LUBRICANT VISCOSITY CLASSIFICATIONS

AUTOMOTIVE GEAR LUBRICANTS

This classification is based on the lubricant viscosity measured at low and/or high temperatures. It should be noted that there is no relationship between the SAE engine oil and gear oil classifications. A gear lubricant and an engine oil having the same viscosity will have widely different SAE grade designations, as defined in the two classifications.

AXLE AND MANUAL TRANSMISSION LUBRICANT VISCOSITY CLASSIFICATION SAE J306 JUNE 2005.
SAE J306 REVISED JUNE 2005 AUTOMOTIVE GEAR LUBRICANT VISCOSITY CLASSIFICATION

SAE viscosity grade	Maximum temperature for viscosity of 150,000 cP, °C	Kinematic viscosity at 100°C, cSt	
		Min.	Max.
70W	-55	4.1	-
75W	-40	4.1	-
80W	-26	7.0	-
85W	-12	11.0	-
80	-	7.0	<11.0
85	-	11.0	<13.5
90	-	13.5	<18.5
110	-	18.5	<24.0
140	-	24.0	<32.5
190	-	32.5	<41.0
250	-	41.0	-

Note: 1 cP = 1 mPa·s, 1 cSt = 1 mm²/s

LUBRICANT VISCOSITY CLASSIFICATIONS

ISO VISCOSITY CLASSIFICATION

The ISO viscosity classification uses centistoke (cSt) units and relates to the viscosity at 40°C. It consists of a series of 18 viscosity brackets between 1.98 and 1,650.0 cSt each of which is defined by a number. The numbers indicate, to the nearest whole number, the mid-points of their corresponding viscosity brackets.

ISO viscosity grade	Mid-point viscosity at 40°C, cSt	Kinematic viscosity limits at 40°C, cSt	
		Min.	Max.
ISO VG 2	2.2	1.98	2.42
ISO VG 3	3.2	2.88	3.52
ISO VG 5	4.6	4.14	5.06
ISO VG 7	6.8	6.12	7.48
ISO VG 10	10	9.00	11.00
ISO VG 15	15	13.50	16.50
ISO VG 22	22	19.80	24.20
ISO VG 32	32	28.80	35.20
ISO VG 46	46	41.40	50.60
ISO VG 68	68	61.20	74.80
ISO VG 100	100	90.00	110.00
ISO VG 150	150	135.00	165.00
ISO VG 220	220	198.00	242.00
ISO VG 320	320	288.00	352.00
ISO VG 460	460	414.00	506.00
ISO VG 680	680	612.00	748.00
ISO VG 1000	1,000	900.00	1,100.00
ISO VG 1500	1,500	1,350.00	1,650.00

LUBRICANT VISCOSITY CLASSIFICATIONS

NLGI GREASE CLASSIFICATION

The commonly used grease consistency classification is that established in the USA many years ago by the National Lubricating Grease Institute (NLGI). This classifies greases solely in terms of their hardness or softness; no other property or performance level is taken into consideration. The classification consists of a series of consistency ranges, each of which is defined by a number (or numbers) from 000 to 6. The consistency is defined by the distance in tenths of a millimetre that a standard cone penetrates a sample of the grease under standard conditions at 25°C.

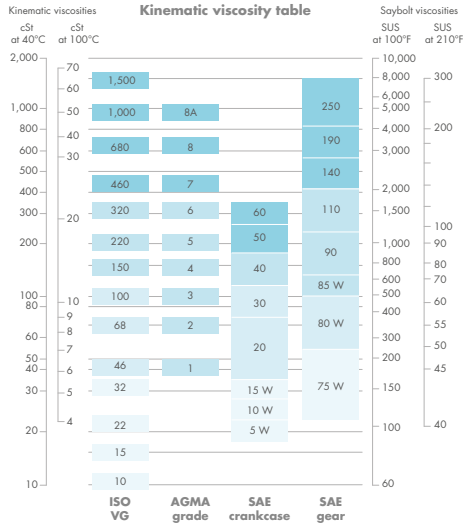
AMERICAN GEAR MANUFACTURERS ASSOCIATION CLASSIFICATION AGMA 250.04

Industrial enclosed gear drives

Grade No.	ASTM worked penetration at 25°C, dmm
000	445–475
00	400–430
0	355–385
1	310–340
2	265–295
3	220–250
4	175–205
5	130–160
6	85–115

AGMA lubricant No.	ISO viscosity grade
1	46
2	68
3	100
4	150
5	220
6	320

VISCOSITY COMPARISON CHART



GLOSSARY

SYMBOL	CHEMICAL ELEMENT
Ag	Silver
Al	Aluminium
B	Boron
Ba	Barium
Ca	Calcium
Cr	Chrome
Cu	Copper
Fe	Iron
Mg	Magnesium
Mn	Manganese
Mo	Molybdenum
Na	Sodium

SYMBOL	CHEMICAL ELEMENT
Ni	Nickel
P	Phosphorous
K	Potassium
Pb	Lead
S	Sulphur
Sb	Antimony
Si	Silicon
Sn	Tin
Ti	Titanium
V	Vanadium
Zn	Zinc

GLOSSARY

A

ABRASION

In gears, a type of wear caused when hard particles are trapped between the gear teeth.

ACID

Any substance capable of producing hydrogen ions in solution. An acid will be neutralised by a base.

ACIDITY

In lubricants, the acidity denotes the presence of acidic constituents whose concentration is usually defined in terms of an acid number.

ADDITIVE

A substance added to a lubricant to improve its properties or impart new characteristics.

AIR RELEASE

The ability of a fluid to allow the escape of air entrained within it. Anti-foaming additives are included in some lubricant formulations to suppress foam formation.

ANTI-SCUFFING ADDITIVE

An additive included in some lubricant formulations that is absorbed on to metal surfaces to prevent direct metal-to-metal contact.

ANTI-WEAR ADDITIVE

An additive included in some lubricant formulations to reduce friction and wear.

APPARENT VISCOSITY (OF A GREASE)

The observed viscosity of a grease that varies with both temperature and flow rate.

AROMATIC

An organic chemical compound built mainly of carbon and hydrogen atoms, and containing one or more rings of carbon atoms in which there are some double bonds between adjacent carbon atoms.

ASPHALTENE

Large and complex chemical compounds in which sulphur, nitrogen, vanadium and nickel are built into aromatic structures. They occur predominantly in heavy residues such as residual fuel and bitumen.

GLOSSARY

ASH

Some additives, particularly metallic detergent additives, leave behind a powdery residue after combustion. This residue is known as ash and it can cause engine malfunction if allowed to build up in the combustion chamber.

ASH (SULPHATED)

The ash content of an oil, determined by charring the oil and breaking down the residue with sulphuric acid and evaporating to dryness. Expressed as percentage by mass.

B

BASE STOCK (BASE OIL)

Refined petroleum oil used in the production of lubricants and other products. The base stock may be used alone or blended with other base stocks and/or additives to manufacture a finished lubricant.

BIODEGRADABILITY

The capacity of a substance to be broken down by the biological action of living organisms.

BLEEDING

Separation of oil from grease. Some bleeding is desirable because it provides continuous oil lubrication to bearings.

BORE POLISHING

A condition that may occur in the cylinders of turbocharged engines when the cylinder walls appear highly polished. Bore polishing often leads to an increase in oil consumption and wear, and to a decrease in engine efficiency.

BOUNDARY LUBRICATION

A lubrication regime in which the film of lubricant is so thin that surface-to-surface contact takes place over a large area and the load is carried by a very thin film of lubricant.

C

CALCIUM BASE GREASE

A grease made from a lubrication fluid thickened with calcium soap. Calcium base grease is highly resistant to water but unstable at high temperatures.

GLOSSARY

CALCULATED CARBON AROMATICITY INDEX (CCAI)

The CCAI is a number calculated from an empirical formula indicating the ignition quality of a residual fuel. Only the fuel's density and viscosity are required. The formula was derived by Shell Research. The higher the CCAI value, the worse the ignition quality.

CARBON RESIDUE

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

CAVITATION

The formation of pockets of air or vapour in a fluid when the pressure on the fluid is reduced.

CCAI

See calculated carbon aromaticity index.

CETANE INDEX

Cetane index is used as a substitute for the cetane number of diesel or distillate fuel. The cetane index is calculated based on the fuel's density and distillation

range and is a measurement of the combustion quality of diesel fuel during compression ignition.

COMPATIBILITY

The ability of substances to exist together without damaging each other.

CORROSION INHIBITOR

An additive included in some lubricant formulations to help the lubricant protect against corrosion.

D

DEMULSIFICATION

The separation of an emulsion into its component liquids.

DENSITY

Mass per unit volume. Standard units are kilogrammes per cubic metre (kg/m^3) or grammes per cubic centimetre (g/cm^3).

DETERGENT

An additive included in most engine oil formulations to inhibit deposit formation and protect the lubricated surfaces.

GLOSSARY

DEW POINT

The temperature at which water vapour starts to condense.

DISPENSABILITY

The property of a grease that governs the ease with which it may be transferred from its container to its point of application.

DISPERSANT

An additive included in some lubricant formulations to hold insoluble contaminants in suspension.

DISTILLATE

Any product obtained by condensing the vapours distilled from a refining process.

DROPPING POINT

Lowest temperature at which a grease is sufficiently fluid to drip, as determined by test method ASTM D566 or ASTM D2265. This test helps determine whether a grease will flow or not from a bearing at the operating temperature.

DYNAMIC VISCOSITY

The viscosity of a fluid defined as the shear stress (the force causing movement between adjacent layers of fluid) divided by the rate of shear (the difference in speed between adjacent layers of fluid).

E

ENGINE DEPOSITS

Accumulations of sludge, varnish and carbonaceous residues caused by blow-by of unburned and partially burned fuel, or from partial breakdown of the crankcase lubricant. Water from the condensation of combustion products, carbon, residues from fuel or lubricating oil additives, dust and metal particles also contribute.

EMULSIFICATION

The forming of an emulsion.

EXTREME PRESSURE (EP) ADDITIVE

An additive included in some lubricant formulations to provide extra protection against wear. Under heavy loads, EP additives form a protective chemical film on the surfaces in contact.

GLOSSARY

F

FILM STRENGTH

The ability of a film of oil or grease to resist rupture due to load, speed, temperature or shock loading.

FILTERABILITY

The ability of a liquid to pass freely through a filter without clogging it.

FLAMMABILITY

How easily something can be ignited and burned.

FLASH POINT

The lowest temperature of a liquid at which the vapour above the liquid can be ignited by an open flame.

FRICTION

The force that resists relative movement between two surfaces in contact.

FUEL INJECTION

The introduction of fuel under pressure directly into the cylinders of an internal combustion engine.

FZG GEAR TEST RIG

A method for determining the load carrying capacity of lubricants. Calibrated spur gears are operated at fixed speeds and controlled initial oil temperatures for 15-min stages. The load on the gear teeth is increased at each stage. Lubricant performance is judged by the number of stages run up to a defined weight loss of the test gears or visual assessment of damage to the tooth flanks. The maximum number of stages is 12.

G

GRAVITY

For petroleum products only, the mass/volume relationship expressed as

$$\text{Specific gravity} = \frac{\text{mass/unit volume product at } 60^{\circ}\text{F}}{\text{mass/unit volume water at } 60^{\circ}\text{F}}$$

$$\text{API gravity} = \left(\frac{141.5}{\text{specific gravity at } 60^{\circ}\text{F}} \right) - 131.5$$

GLOSSARY

GREASE

A lubricant with a semi-solid consistency produced by dispersing a thickening agent in a base oil.

H

HIGH VISCOSITY INDEX (HVI)

An HVI oil is one having a viscosity index of between about 85 and 115.

HYDROCARBONS

Chemical compounds that consist entirely of carbon and hydrogen. They form the basic components of all fuels and lubricants derived from petroleum.

HYDRODYNAMIC LUBRICATION

The lubrication regime that provides the best lubricating conditions and exists when two moving surfaces are completely separated by a relatively thick film of lubricant.

I

IMMISCIBLE

Incapable of being mixed to form a homogeneous fluid (or mixture), e.g., oil plus water.

INCOMPATIBILITY

Incompatibility occurs when a mixture of two lubricants results in physical properties or performance being markedly inferior to those of both individual products. Performance or properties inferior to one of the products but superior to the other may be due to simple mixing and is not considered evidence of incompatibility.

INHIBITOR

A substance that is added in a small proportion to a lubricant to prevent or retard undesirable changes in the quality of the lubricant or in the condition of the equipment in which the lubricant is used.

INSOLUBLES

Contaminants found in used oils such as dust, dirt, wear particles and/or oxidation products, which are often measured as pentane or benzene insolubles to distinguish the different types of insoluble matter.

GLOSSARY

ISO 8217

The international standard Petroleum products – Fuels (Class F) – Specification for marine fuels defines a range of fuel grades that meet the requirements for marine fuels supplied on a worldwide basis for consumption on board ships. The standard sets out the required properties of the fuels at the time and place of custody transfer. The current version of the standard was published in 2012.

ISO VISCOSITY GRADE (ISO 3104)

A measure of the viscosity of a lubricant at 40°C, as specified in the viscosity grading system laid down by International Standards Organization.

K

KINEMATIC VISCOSITY

A definition of viscosity commonly used by lubricant manufacturers. It is equal to the dynamic viscosity of a liquid divided by its density.

L

LACQUER

A hard, shiny, transparent surface coating usually found in engines and derived from the breakdown products of fuel and lubricant.

LITHIUM BASE GREASE

A product prepared from a lubricating fluid thickened with lithium soap. Lithium base grease resists both heat and moisture.

LOW VISCOSITY INDEX (LVI)

Low viscosity index oils have a viscosity index of less than about 30.

M

MECHANICAL STABILITY

The ability of a grease to resist structural breakdown when mechanically worked.

MINERAL OIL

Oil derived from fractionating and purifying crude oil.

GLOSSARY

MISCIBLE

Descriptive of substances, usually liquids, that mix together to form a homogeneous fluid.

MIXED BASE GREASE (MIXED SOAP GREASE)

A grease made by co-crystallisation of two or more metallic soaps, usually lithium and calcium.

MONOGRADE

An oil with a viscosity that satisfies the requirements of only one grade of the SAE grading system.

MULTIGRADE

A term used to describe an oil for which the viscosity/temperature characteristics are such that its low- and high-temperature viscosities fall within the limits of two different SAE grades.

N

NAPHTHENIC BASE STOCK

A type of base stock prepared from naphthenic crudes containing a high percentage of ring-type asphaltic hydrocarbons. They are characterised by high specific gravity and a low viscosity index.

NITRATION

The process whereby nitrogen oxides attack petroleum fluids at high temperature, often resulting in viscosity increases and deposit formation.

NLGI NUMBER

A numerical scale for classifying the consistency or stiffness range of lubricating greases.

NON-SOAP THICKENER

A substance such as clay, silica gel, carbon black or any of several specially treated or synthetic materials that can be either thermally or mechanically dispersed in liquid lubricants to form lubricating grease. Also called synthetic thickener. Certain types are called inorganic thickeners.

O

OIL-IMMERSED BRAKES

An automotive braking system installed in the vehicle gearbox or rear axle rather than at the wheels.

GLOSSARY

OIL MIST LUBRICATION

A system of lubrication used in some gearboxes in which the lubricant is atomised and sprayed into the gearbox in a stream of dry compressed air.

OIL SEPARATION

In greases, the separation of the base oil from the thickener.

OXIDATION STABILITY

The ability of a chemical to resist chemical breakdown by the action of oxygen.

P

PENETRATION

A measure of the consistency (hardness) of a grease. All penetration measurements are on an inverse scale to consistency, i.e., the softer the consistency, the higher the penetration number.

PITTING

In gears, a type of wear in which cracks develop in gear teeth because of metal fatigue caused by overloading.

POLYALPHAOLEFIN (PAO)

A synthetic hydrocarbon with a defined molecular structure. Their low- and high-temperature and viscosity-temperature characteristics are better than for mineral oils.

POLYMER

A chemical compound of large molecular size that is built up from numerous smaller molecules linked together.

POUR POINT

The lowest temperature at which an oil will just flow.

POUR POINT DEPRESSANT

An additive included in some lubricant formulations to minimise the tendency of an oil to congeal when it is cooled.

PUMPABILITY

The characteristic of an oil or grease that ensures satisfactory flow to and from the engine oil pump and subsequent lubrication of moving components.

GLOSSARY

R

REFINING

A series of processes for converting crude oil to finished petroleum products, including thermal cracking, catalytic cracking, polymerisation, alkylation, reforming hydrocracking, hydroforming, hydrogenation, hydrogen treating, solvent extraction, dewaxing, deoiling, acid treating, clay filtration and deasphalting.

RESIDUAL FUEL OIL

Very heavy fuel oils produced from the residue of the fractional distillation process rather than from the distilled fractions. This is a term for fuel oil mainly comprising the residues remaining after refining crude oil. Shell marine residual fuels oils are called Shell MFO.

RING STICKING

The situation when the piston grooves become sufficiently full of deposits to prevent the piston rings from moving freely.

RUST INHIBITOR

An additive in some lubricant formulations to restrict rust formation on lubricated surfaces.

S

SAE SYSTEM

A system devised by the Society of Automotive Engineers for classifying engine and automotive gear lubricants according primarily to their viscosity.

SAPONIFICATION

The chemical conversion of a fatty acid and base or alkali into a soap. A common process in grease manufacture.

SCUFFING

In gears, a type of wear which develops when direct metal-to-metal contact takes place between gear teeth.

SHEAR STABILITY

The ability of a liquid to resist being degraded by mechanical shearing forces. Also refers to the ability of a grease to resist changes in consistency.

SILICONE

A complex synthetic polymer composed of repeated silicon containing units and often used where a chemically inert lubricant is required.

GLOSSARY

SLUDGE

A black sooty deposit that usually forms in engines as a result of oil oxidation and ineffective dispersancy.

SOAP

A compound formed by the reaction between a metal hydroxide (such as lime) and a fatty acid (an organic acid derived from natural fats), e.g., lithium, calcium soaps in grease.

SODIUM BASE GREASE (SODA GREASE)

A grease prepared from a lubricating fluid thickened with sodium soap, stable at high temperatures but washing out in moist conditions.

SOLID LUBRICANT

Any class of lubricants in which the reduction of friction and wear during sliding is caused by making the shearing take place within the crystal structure of a material with low shear strength in one particular plane. Examples include graphite, molybdenum disulphide and certain soaps. Lubricating grease is not a solid lubricant, but may contain solid lubricants as additives.

SOLVENT EXTRACTION

Refining process used to separate reactive components (unsaturated hydrocarbons) from lubricant distillates to improve the oxidation stability, viscosity index and response to additives.

SPARK IGNITION

The system of ignition used in a petrol engine whereby a fuel-air mixture is ignited by an electric spark.

SPECTROGRAPHIC OIL ANALYSIS

A sophisticated analytical technique for determining the types and quantities of elements in an oil sample.

SPLASH LUBRICATION

A system of lubrication in which a machine part travels through an oil bath and, in so doing, splashes lubricant onto nearby surfaces requiring lubrication.

SPRAY LUBRICATION

A system of lubrication in which the lubricant is sprayed directly on to the surfaces to be lubricated.

GLOSSARY

STABILISER

An additive that may be included in some grease formulations to ensure that the base oil and the thickener form a stable mixture with uniform composition.

STATIC FRICTION

The force that tends to prevent one body sliding over another.

SYNTHETIC

Produced artificially rather than occurring naturally.

T

TACKINESS ADDITIVE

An additive that may be included in the formulation of lubricants for slideways and open gears to help the lubricant adhere more effectively.

THERMAL CONDUCTIVITY

The ability of a material to conduct heat.

THERMAL STABILITY

The ability of a substance to resist degradation owing to the effects of heat.

THICK FILM LUBRICATION

The same as hydrodynamic lubrication.

THICKENING AGENT

A substance used in making greases that is mixed with base oil to produce a stable semi-solid product.

TOTAL ACID NUMBER (TAN)

TAN is a measure of the acidity of a lubricant, usually expressed in terms of the amount of alkali needed to neutralise it. A measurement of TAN can give an indication of the deterioration of an oil in service due to oxidation.

TOTAL BASE NUMBER (TBN)

TBN is a measure of the reverse of basicity of a lubricant. A measurement of TBN can often give important information about the depletion of basic additives.

TOXICITY

The capacity of a substance to harm living organisms.

GLOSSARY

V

VARNISH

A hard, shiny, transparent surface coating sometimes found in engines and derived from the breakdown products of fuel and lubricant.

VISCOSITY

Resistance to flow relating to the thickness of the fluid.

VISCOSITY INDEX (VI)

An arbitrary number that indicates how the viscosity of a fluid varies with changes in temperature. A fluid with a viscosity that is relatively sensitive to changes in temperature has a low viscosity index.

VISCOSITY INDEX IMPROVER (VII)

An additive that may be added to some lubricating oils to make their viscosity less sensitive to changes in temperature.

VOLATILITY

The tendency of an oil to evaporate on heating.

W

WATER RESISTANCE

The ability of a lubricant to withstand the addition of water to the lubricant system without adverse effects.

WATER SEPARABILITY

The ability of a lubricating oil to shed any water with which it has become intimately mixed.

X

XHVI

A registered trademark used to describe Shell manufactured synthetic base oils with an exceptionally high viscosity index.

Y

YIELD POINT

The point at which a grease just begins to flow when pressure is applied to it.

Z

ZDDP

Commonly used name for zinc dithiophosphate, an anti-wear/oxidation inhibitor additive.

TEST METHOD BODIES

ACEA	Association des Constructeurs Européens d'Automobiles
ANSI	American National Standards Institute
APE	Association of Petroleum Engineers (USA)
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials (now ASTM International)
ATC	Technical Committee of Petroleum Additive Manufacturers in Europe
ATIEL	Association Technique de l'Industrie Européenne des Lubrifiants
BTC	British Technical Council of the Motor and Petroleum Industries (member CEC)
CCMC	Comité des Constructeurs d'Automobiles du Marche Commun (replaced by ACEA)
CEC	Coordinating European Council for the Development of Performance Tests for Fuels, Lubricants and Other Fluids
DIN	Deutsches Institut für Normung eV (German Institute for Standardization)
EFTC	Engine Fuels Technical Committee (of CEC)
ELTC	Engine Lubricants Technical Committee (of CEC)
FZG	Forschungsstelle für Zahnräder und Getriebebau
IP	Institute of Petroleum (UK)
ISO	International Organization for Standardisation
MIL	US military specifications
NLGI	National Lubricating Grease Institute (USA)
CIMAC	Conseil International des Machines a Combustion
SAE	Society of Automotive Engineers
STLE	Society of Tribologists and Lubrication Engineers

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