

A photograph of two men in marine safety gear. They are wearing white hard hats with the Shell logo, yellow safety glasses, and high-visibility yellow and red life jackets. They are standing on the deck of a red ship. The man on the left is smiling and looking towards the right. The man on the right is looking towards the left. A semi-transparent white box is overlaid on the bottom left of the image, containing text.

# MARINE LUBRICANT POCKETBOOK LOCAL MARINE

FOR SMOOTHER OPERATIONS

[www.shell.com/marine](http://www.shell.com/marine)

**Shell Marine**

February 2018

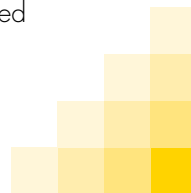




# LUBRICANTS FOR MARINE APPLICATIONS

Welcome to the Shell Marine Lubricants Pocketbook for local markets. 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.

The products listed in the pocketbook may not be available in all markets. Further details on Shell Marine lubricants and their applications can be obtained from your Shell Marine representative or by visiting [www.shell.com/marine](http://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 and SAE 50

#### 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)

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.

## Outstanding qualities

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

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



# CYLINDER OILS

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

# 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 <sup>2</sup> /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
		40°C	100°C				
<b>SHELL MELINA S 30</b>	<b>30</b>	<b>104</b>	<b>11.6</b>	<b>5</b>	<b>227</b>	<b>-18</b>	<b>888</b>

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

# 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 requirement specification (meets requirements widely).

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

# 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 S2 Z**

A heavy-duty lubricant for high performance natural gas engines that require an ash-less product. By using ash-less technology, Shell Mysella S2 Z minimises engine wear, deposits in combustion chambers and exhaust ports and viscosity increase in service.

## **SHELL MYSELLA S3 N**

A high performance quality oil blended for use in 4-stroke, spark-ignition engines that require a low-ash oil and use natural gas as fuel. Shell Mysella S3 N satisfies the new generation of stationary gas engines designed to meet the emerging legislation limiting emissions of NO<sub>x</sub> and those that use the latest lean or clean-burn technology.

## **SHELL MYSELLA S5 N**

A high performance quality oil blended for use in highly-rated, 4-stroke, spark-ignition engines that require a low-ash oil. Shell Mysella S5 N satisfies the new generation of stationary gas engines designed to meet the emerging legislation limiting emissions of NO<sub>x</sub> and those that use the latest lean- or clean-burn technology. Shell Mysella S5 N is specially developed to provide extended oil-drain intervals in those natural gas engines where oil life is a limiting operational factor.

# MEDIUM-SPEED ENGINE OILS

	SAE engine viscosity grade	Viscosity, mm <sup>2</sup> /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
		40°C	100°C				
<b>SHELL GADINIA AL 30</b>	<b>30</b>	<b>95</b>	<b>11.4</b>	<b>15</b>	<b>&gt;200</b>	<b>-18</b>	<b>893</b>
<b>SHELL GADINIA AL 40</b>	<b>40</b>	<b>140</b>	<b>14.3</b>	<b>15</b>	<b>&gt;200</b>	<b>-18</b>	<b>900</b>
<b>SHELL MYSELLA S2 Z 30</b>	<b>30</b>	<b>105</b>	<b>12</b>	<b>0</b>	<b>218</b>	<b>-21</b>	<b>885</b>
<b>SHELL MYSELLA S2 Z 40</b>	<b>40</b>	<b>135</b>	<b>13.5</b>	<b>0</b>	<b>230</b>	<b>-18</b>	<b>894</b>
<b>SHELL MYSELLA S3 N 40</b>	<b>40</b>	<b>135</b>	<b>13.5</b>	<b>5</b>	<b>230</b>	<b>-18</b>	<b>890</b>
<b>SHELL MYSELLA S5 N 40</b>	<b>40</b>	<b>125</b>	<b>13.5</b>	<b>4.5</b>	<b>264</b>	<b>-18</b>	<b>890</b>

# HIGH-SPEED DIESEL ENGINE OILS

## MULTIGRADE OILS

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

### SHELL RIMULA R1 MULTI 20W-50 (CD/SE)

A multi oil that fights engine wear and maintains the right thickness for continuous protection and consistent performance. This results in lower fuel consumption.\* Shell Rimula R1 Multi oil is suitable for non-turbocharged engines.

\*Compared with standard SAE 40 oils

### SHELL RIMULA R2 EXTRA 15W-40 (CF-4)

Keeps engines clean. Its additives ensure protection against deposits and wear, and resist thickening by heat. It is suitable for most heavy-duty applications, including turbocharged engines.

### SHELL RIMULA R2 EXTRA 20W-50 (CF-4)

Uses proven combinations of additives that react to the varying needs of your engine. They include active dispersants to keep engines clean. Each additive releases its protective energy to ensure reliable and consistent protection against deposits and wear, and to resist thickening by heat. Approved by leading engine makers and suitable for most heavy-duty applications, including turbocharged engines.



# HIGH-SPEED DIESEL ENGINE OILS

## **SHELL RIMULA R2 EXTRA 20W-50 (CF-4/228.1)**

Keeps engines clean. Its additives ensure protection against deposits and wear, and resist thickening by heat. It is suitable for most heavy-duty applications, including turbocharged engines.

## **SHELL RIMULA R3 EXTRA 15W-40 (CG-4/228.3)**

## **SHELL RIMULA R3 TURBO 15W-40 (CH-4/228.1)**

Protects against the changing needs of your driving conditions. It controls thickening and wear that can build up in the oil to provide low wear for long engine life and cleanliness to maintain engine performance.

## **SHELL RIMULA R3 X 15W-40 (CH-4/228.3)**

Protects against the changing needs of your driving conditions. It provides triple action protection: low wear for long engine life, low deposit formation to maintain performance and resistance to breakdown by heat for protection.

## **SHELL RIMULA R4 15W-40 (CI-4 PLUS)**

Adapts and protects under full range of pressures and temperatures found in modern engines. It delivers excellent

soot and viscosity control, outstanding protection against wear and exceptional versatility for multiple engine makes.

## **SHELL RIMULA R6 LM 10W-40 (CJ-4)**

Features low-SAPS additive technology and a unique anti-wear system. Its protective power is enhanced with synthetic technology, which results in a maintenance-saving long oil-drain interval capability, exceptional wear and cleanliness performance.

## **SHELL RIMULA R6 LM 10W-40 (E7/228.51)**

Features exclusive low-SAPS additive technology and a unique anti-wear system. Its protective power is enhanced with synthetic base oil technology, which results in long engine life and long oil life. Demonstrated in millions of kilometres of performance, its key benefits are low emissions to help control the blockage of exhaust filters and traps; a maintenance saving long oil-drain interval capability; exceptional wear and cleanliness performance; and versatility. It is suitable for most brands of heavy-duty diesel and natural gas engines.

# HIGH-SPEED DIESEL ENGINE OILS

## **SHELL RIMULA RT4 X 15W-40 (CI-4/E7/DH-1)**

Contains selected additives that are designed to provide Triple Protection to improve engine and oil durability in three critical areas: acid and corrosion control, reduced engine wear and deposit control. It helps to lower maintenance and increase the reliability of vehicles. It is suitable for most heavy-duty diesel engines, non-turbocharged and turbocharged alike, for on- and off-highway applications. It has a wide array of engine manufacturers' approvals.

## **SHELL RIMULA SUPER 15W-40 (CJ-4)**

Uses low-SAPS additive technology to provide protection under the most severe conditions found in modern low-emission engines. Recommended by a wide range of equipment manufacturers, Shell Rimula Super is suitable for both the latest low-emission and older model engines.

## **SHELL ROTELLA T3 FLEET 15W-40 (CK-4)**

A heavy-duty engine oil formulated to provide reliable protection and performance to fleet and off-highway equipment. It offers the convenience of a single oil suitable for engines from a wide range of manufacturers.

## **SHELL ROTELLA T4 TRIPLE PROTECTION 15W-40 (CK-4)**

A heavy-duty engine oil formulated to provide Triple Protection technology against wear, deposits and oil breakdown. Shell Rotella T4 Triple Protection oil uses advanced additive technology to protect under the most severe engine conditions found in modern, low-emission engines. Recommended by a wide range of equipment manufacturers it is suitable for both the latest low-emissions and older model equipment.

# HIGH-SPEED DIESEL ENGINE OILS

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL RIMULA R1 MULTI 20W-50 (CD/SE)</b>	<b>140</b>	<b>19</b>	<b>235</b>	<b>n/a</b>	<b>894</b>
<b>SHELL RIMULA R2 EXTRA 15W-40 (CF-4)</b>	<b>104</b>	<b>14.3</b>	<b>226</b>	<b>-33</b>	<b>890</b>
<b>SHELL RIMULA R2 EXTRA 20W-50 (CF-4)</b>	<b>162</b>	<b>18.9</b>	<b>246</b>	<b>-27</b>	<b>893</b>
<b>SHELL RIMULA R2 EXTRA 20W-50 (CF-4/228.1)</b>	<b>162</b>	<b>18.9</b>	<b>246</b>	<b>-27</b>	<b>893</b>
<b>SHELL RIMULA R3 EXTRA 15W-40 (CG-4/228.3)</b>	<b>108.5</b>	<b>14.4</b>	<b>229</b>	<b>-39</b>	<b>877</b>
<b>SHELL RIMULA R3 TURBO 15W-40 (CH-4/228.1)</b>	<b>105.1</b>	<b>14.3</b>	<b>230</b>	<b>-36</b>	<b>886</b>
<b>SHELL RIMULA R3 X 15W-40 (CH-4/228.3)</b>	<b>105.1</b>	<b>14.3</b>	<b>230</b>	<b>-39</b>	<b>886</b>

# HIGH-SPEED DIESEL ENGINE OILS

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL RIMULA R4 15W-40 (CI-4 PLUS)</b>	<b>109</b>	<b>14.7</b>	<b>230</b>	<b>-36</b>	<b>888</b>
<b>SHELL RIMULA R4 15W-40 (CI-4 PLUS) – INDIA</b>	<b>111</b>	<b>15</b>	<b>230</b>	<b>-39</b>	<b>880</b>
<b>SHELL RIMULA R6 LM 10W-40 (CJ-4)</b>	<b>96.8</b>	<b>14.5</b>	<b>244</b>	<b>-36</b>	<b>850</b>
<b>SHELL RIMULA R6 LM 10W-40 (E7/228.51)</b>	<b>82</b>	<b>13</b>	<b>251</b>	<b>-39</b>	<b>850</b>
<b>SHELL RIMULA RT4 X 15W-40 (CI-4/E7/DH-1)</b>	<b>105.1</b>	<b>14.3</b>	<b>226</b>	<b>-39</b>	<b>886</b>
<b>SHELL RIMULA SUPER 15W-40 (CJ-4)</b>	<b>116</b>	<b>15.5</b>	<b>230</b>	<b>-30</b>	<b>878</b>

# HIGH-SPEED DIESEL ENGINE OILS

	Viscosity, mm <sup>2</sup> /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C				
<b>SHELL RIMULA R4 X 15W-40</b>	<b>109</b>	<b>14.7</b>	<b>10.5</b>	<b>230</b>	<b>-36</b>	<b>881</b>
<b>SHELL RIMULA R4 L 15W-40</b>	<b>115</b>	<b>15.5</b>	<b>10.0</b>	<b>227</b>	<b>-33</b>	<b>883</b>
<b>SHELL RIMULA R6 M 10W-40</b>	<b>83</b>	<b>13.2</b>	<b>13.0</b>	<b>256</b>	<b>-36</b>	<b>848</b>
<b>SHELL ROTELLA T TRIPLE PROTECTION 15W-40</b>	<b>120</b>	<b>15.5</b>	<b>10.1</b>	<b>204</b>	<b>-30</b>	<b>879</b>
<b>SHELL ROTELLA T3</b>	<b>115</b>	<b>15.5</b>	<b>10.0</b>	<b>227</b>	<b>-30</b>	<b>879</b>
<b>SHELL ROTELLA T3 FLEET 15W-40 (CK-4)</b>	<b>115</b>	<b>15.3</b>	<b>10.0</b>	<b>236</b>	<b>-35</b>	<b>876</b>
<b>SHELL ROTELLA T4 TRIPLE PROTECTION 15W-40 (CK-4)</b>	<b>141</b>	<b>10.1</b>	<b>10.1</b>	<b>237</b>	<b>-43</b>	<b>863</b>
<b>SHELL ROTELLA T6</b>	<b>87</b>	<b>14.2</b>	<b>10.6</b>	<b>224</b>	<b>-42</b>	<b>858</b>

# HIGH-SPEED DIESEL ENGINE OILS

## MONOGRADE OILS

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.

### SHELL RIMULA R1 40 (CD/SE)

Energised Protection oils use well-proven performance additives to fight engine wear by providing reliable lubrication and consistent performance. Suitable for day-to-day use in non-turbocharged engines.

### SHELL RIMULA R2 40 (CF)

Reacts to the engine's needs to give added protection and long life. Each additive releases its protective energy when needed to ensure reliable and consistent protection against deposits and wear through tough, long-lasting action.

### SHELL RIMULA R2 40 (CF/10TBN)

### SHELL RIMULA R2 50 (CF/10TBN)

Energised Protection oils use proven combinations of additives that react to the needs of your engine. They feature an enhanced acid-control system for added protection and long life. Each dedicated additive releases its protective energy when needed to ensure reliable and consistent protection against deposits and wear through tough, long-lasting action.

# HIGH-SPEED DIESEL ENGINE OILS

## **SHELL RIMULA R3 10W (CF)**

Adapts to your needs to provide extra protection. Its active-detergent system keeps pistons and other engine parts clean, and provides protection against wear for long engine life and against deposits for efficient performance.

## **SHELL RIMULA R3+ 40 (CF/228.0)**

Adapts to your driving needs to provide extra protection and keep pistons and other engine parts clean. It provides protection against wear for long engine life and protection against deposits for efficient engine performance.

## **SHELL ROTELLA T1 40 (CF/CF-2)**

## **SHELL ROTELLA T1 50 (CF/CF-2)**

Energised Protection oils use well-proven performance additives to fight engine wear and prevent deposits, thereby providing reliable lubrication and consistent performance. They are suitable for day-to-day use in turbo- and non-turbocharged older engines.

## **SHELL SIRIUS X 30**

A top-quality lubricant in the super high performance diesel engine oil class. It is designed for the highest output, high-speed diesel engines burning distillate fuel. It is formulated to give better engine protection and longer oil-drain intervals than normal diesel engine oils. Shell Sirius X is especially suitable for the high power/weight units used in fast vessels and compact generator sets.

## **SHELL MARINE 40**

A premium-quality high-performance engine lubricant designed to meet the demanding requirements of a very wide range of high-speed marine diesel engines operating under all conditions.

# HIGH-SPEED DIESEL ENGINE OILS

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL RIMULA R1 40 (CD/SE)</b>	<b>126</b>	<b>13.5</b>	<b>250</b>	<b>-9</b>	<b>895</b>
<b>SHELL RIMULA R2 40 (CF)</b>	<b>126</b>	<b>13.5</b>	<b>250</b>	<b>-9</b>	<b>895</b>
<b>SHELL RIMULA R2 40 (CF/10TBN)</b>	<b>126</b>	<b>13.5</b>	<b>250</b>	<b>-9</b>	<b>895</b>
<b>SHELL RIMULA R2 50 (CF/10TBN)</b>	<b>179</b>	<b>17</b>	<b>252</b>	<b>-9</b>	<b>900</b>
<b>SHELL RIMULA R3 10W (CF)</b>	<b>43</b>	<b>7</b>	<b>219</b>	<b>-33</b>	<b>885</b>
<b>SHELL RIMULA R3+ 40 (CF/228.0)</b>	<b>126</b>	<b>13.5</b>	<b>250</b>	<b>-15</b>	<b>895</b>



# HIGH-SPEED DIESEL ENGINE OILS

	SAE engine viscosity grade	Viscosity, mm <sup>2</sup> /s		BN, mg KOH/g	Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
		40°C	100°C				
<b>SHELL RIMULA R3+ 30</b>	<b>30</b>	<b>93</b>	<b>11.0</b>	<b>9</b>	<b>242</b>	<b>-18</b>	<b>890</b>
<b>SHELL ROTELLA DD+ 40</b>	<b>40</b>	<b>138</b>	<b>14.4</b>	<b>8</b>	<b>250</b>	<b>-15</b>	<b>899</b>
<b>SHELL ROTELLA T1 30</b>	<b>30</b>	<b>107</b>	<b>11.9</b>	<b>7.5</b>	<b>210</b>	<b>-24</b>	<b>887</b>
<b>SHELL ROTELLA T1 40 (CF/CF-2)</b>	<b>40</b>	<b>123</b>	<b>13</b>	<b>7.5</b>	<b>225</b>	<b>-21</b>	<b>890</b>
<b>SHELL ROTELLA T1 50 (CF/CF-2)</b>	<b>50</b>	<b>175</b>	<b>16.8</b>	<b>7.5</b>	<b>230</b>	<b>-16</b>	<b>892</b>
<b>SHELL SIRIUS X 30</b>	<b>30</b>	<b>101</b>	<b>11</b>	<b>17</b>	<b>218</b>	<b>-42</b>	<b>858</b>
<b>SHELL SIRIUS X 40</b>	<b>40</b>	<b>139</b>	<b>14.0</b>	<b>17</b>	<b>230</b>	<b>-18</b>	<b>890</b>
<b>SHELL MARINE 40</b>	<b>40</b>	<b>140</b>	<b>14.5</b>	<b>10.1</b>	<b>250</b>	<b>N/A</b>	<b>897</b>

# HIGH-SPEED DIESEL ENGINE OILS

## SHELL CAPRINUS HD 40

Contains a high viscosity index mineral base oil with very good oxidation resistance and a multipurpose additive package to provide protection against wear, corrosion, fouling and oxidation.

## SHELL CAPRINUS HPD 40

A premium-grade, heavy-duty, crankcase oil that contains high viscosity index mineral oil. Although it is fortified by additives providing alkalinity, dispersancy

and resistance to oxidation, it does not contain zinc, so can be used in EMD engines fitted with silver piston-pin bearings.

## SHELL CAPRINUS XR 20W-40

## SHELL CAPRINUS XR 40

Premium-grade, heavy-duty engine oils using the latest, low-chlorine additive technology that offers both environmental benefits and improved performance.

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL CAPRINUS HD 40</b>	<b>158</b>	<b>14.6</b>	<b>235</b>	<b>-9</b>	<b>908</b>
<b>SHELL CAPRINUS HPD 40</b>	<b>160</b>	<b>14.5</b>	<b>235</b>	<b>-9</b>	<b>908</b>
<b>SHELL CAPRINUS XR 20W-40</b>	<b>132</b>	<b>15.1</b>	<b>256</b>	<b>-9</b>	<b>920</b>
<b>SHELL CAPRINUS XR 40</b>	<b>150</b>	<b>15.1</b>	<b>260</b>	<b>-9</b>	<b>908</b>

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

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

# 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 41 FLUID**

A mineral hydraulic oil manufactured to a very high level of cleanliness, and possesses improved fluid properties. AeroShell Fluid 41 contains additives which provide excellent low temperature fluidity as well as exceptional anti-wear, oxidation - corrosion inhibition and shear stability. In addition metal de-activators and foam inhibitors are included in this high viscosity index fluid to enhance performance in hydraulic applications. It is capable of wide temperature range operation. AeroShell Fluid 41 is dyed red.

# HYDRAULIC OILS

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL TELLUS S2 VX 15</b>	<b>15</b>	<b>3.7</b>	<b>200</b>	<b>-42</b>	<b>820</b>
<b>SHELL TELLUS S2 VX 22</b>	<b>22</b>	<b>4.8</b>	<b>210</b>	<b>-42</b>	<b>835</b>
<b>SHELL TELLUS S2 VX 32</b>	<b>32</b>	<b>6.1</b>	<b>215</b>	<b>-39</b>	<b>854</b>
<b>SHELL TELLUS S2 VX 46</b>	<b>46</b>	<b>7.9</b>	<b>220</b>	<b>-36</b>	<b>856</b>
<b>SHELL TELLUS S2 VX 68</b>	<b>68</b>	<b>10.5</b>	<b>230</b>	<b>-30</b>	<b>860</b>
<b>SHELL TELLUS S2 VX 100</b>	<b>100</b>	<b>14.0</b>	<b>230</b>	<b>-24</b>	<b>870</b>
<b>SHELL TELLUS S3 M 46</b>	<b>46</b>	<b>6.8</b>	<b>220</b>	<b>-33</b>	<b>865</b>
<b>SHELL TELLUS S4 VX 32</b>	<b>33.8</b>	<b>9.9</b>	<b>&gt;100</b>	<b>-60</b>	<b>890</b>
<b>AEROSHELL FLUID 41</b>	<b>14.1</b>	<b>5.3</b>	<b>105</b>	<b>-60</b>	<b>870</b>

# GEAR OILS

## MINERAL

### SHELL OMALA F 320

A premium quality, lead-free, extreme-pressure oil designed, primarily, for the lubrication of heavy-duty industrial gears. Its high load carrying capacity and anti-friction characteristics combine to offer superior performance in gears and other industrial applications. It is formulated using high viscosity index, solvent refined base oils and incorporates a special sulphur-phosphorus additive to provide an extreme pressure performance significantly better than that provided by leaded gear oils.

### SHELL OMALA S1 W 460

Quality refined, high-viscosity mineral oils formulated with a small percentage of fatty oils. They are particularly suitable for the lubrication of low-speed enclosed gears and worm drive applications. They are also suitable for the lubrication of high-temperature, high-pressure steam cylinders.

## 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.)

## SYNTHETIC

### SHELL OMALA S4 GXV

Advanced heavy-duty synthetic 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.

# GEAR OILS

## SHELL OMALA S4 GX 460 SYNTHETIC

An advanced synthetic heavy-duty industrial gear oil offering outstanding lubrication performance under severe operating conditions, including reduced friction, long service life and high resistance to micropitting for optimal gear protection.

## SHELL OMALA S4 WE 150 SYNTHETIC

An advanced synthetic heavy-duty industrial worm drive gear oil formulated using specially selected polyalkylene glycol base fluids and additives. It offers outstanding lubrication performance under severe operating conditions, including improved energy efficiency, long service life and high resistance to micropitting.

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL OMALA F 320</b>	<b>320</b>	<b>25.0</b>	<b>202</b>	<b>-18</b>	<b>903</b>
<b>SHELL OMALA S1 W 460</b>	<b>460</b>	<b>31.2</b>	<b>318</b>	<b>-6</b>	<b>318</b>
<b>SHELL OMALA S2 GX 68</b>	<b>68</b>	<b>8.7</b>	<b>&gt;230</b>	<b>-27</b>	<b>885</b>
<b>SHELL OMALA S2 GX 100</b>	<b>100</b>	<b>11.3</b>	<b>&gt;230</b>	<b>-24</b>	<b>891</b>
<b>SHELL OMALA S2 GX 150</b>	<b>150</b>	<b>14.8</b>	<b>&gt;240</b>	<b>-24</b>	<b>897</b>
<b>SHELL OMALA S2 GX 220</b>	<b>220</b>	<b>19.0</b>	<b>&gt;240</b>	<b>-18</b>	<b>899</b>



# GEAR OILS

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL OMALA S2 GX 320</b>	<b>320</b>	<b>24.2</b>	<b>250</b>	<b>-15</b>	<b>903</b>
<b>SHELL OMALA S2 GX 460</b>	<b>460</b>	<b>30.6</b>	<b>&gt;250</b>	<b>-12</b>	<b>904</b>
<b>SHELL OMALA S2 GX 680</b>	<b>680</b>	<b>42.1</b>	<b>&gt;250</b>	<b>-9</b>	<b>912</b>
<b>SHELL OMALA S4 GXV 150</b>	<b>150</b>	<b>22.0</b>	<b>240</b>	<b>-45</b>	<b>862</b>
<b>SHELL OMALA S4 GXV 220</b>	<b>220</b>	<b>30.0</b>	<b>240</b>	<b>-42</b>	<b>864</b>
<b>SHELL OMALA S4 GXV 320</b>	<b>320</b>	<b>37.0</b>	<b>240</b>	<b>-42</b>	<b>866</b>
<b>SHELL OMALA S4 GX 460</b>	<b>462.5</b>	<b>50.0</b>	<b>264</b>	<b>-36</b>	<b>864</b>
<b>SHELL OMALA S4 WE 150</b>	<b>136</b>	<b>22.5</b>	<b>268</b>	<b>-42</b>	<b>1,076</b>
<b>SHELL OMALA S4 WE 220</b>	<b>222</b>	<b>34.4</b>	<b>278</b>	<b>-39</b>	<b>1,074</b>

# 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.

### SHELL CORENA S3 R 46 SHELL CORENA S3 R 68

Premium-quality air compressor oils designed to deliver high performance lubrication of rotary sliding vane and screw air compressors. It uses an advanced additive system to provide excellent protection and performance for compressors running with oil maintenance intervals of 4,000 hours and up to 6,000 hours under certain conditions.

## 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 46 SHELL CORENA S4 R 68

Primarily advanced synthetic air compressor oils designed to deliver the highest performance lubrication of rotary sliding vane and screw air compressors. It uses a unique advanced additive system to provide excellent protection and performance for compressors running with oil maintenance intervals of 10,000 hours and up to 12,000 hours under certain conditions. Shell Corena S4 R is also perfectly suitable for applications where a synthetic bearing and circulating oil or a rust and oxidation oil (ISO VG 32-68) is required.

# AIR COMPRESSOR OILS

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL CORENA S2 P 100</b>	<b>100</b>	<b>9.2</b>	<b>240</b>	<b>-33</b>	<b>899</b>
<b>SHELL CORENA S2 P 150</b>	<b>155</b>	<b>12.1</b>	<b>240</b>	<b>-30</b>	<b>902</b>
<b>SHELL CORENA S4 P 100</b>	<b>100</b>	<b>10.2</b>	<b>260</b>	<b>-39</b>	<b>988</b>
<b>SHELL CORENA S3 R 46</b>	<b>46</b>	<b>6.9</b>	<b>230</b>	<b>-30</b>	<b>868</b>
<b>SHELL CORENA S3 R 68</b>	<b>68</b>	<b>8.9</b>	<b>248</b>	<b>-30</b>	<b>873</b>
<b>SHELL CORENA S4 R 46</b>	<b>46</b>	<b>7.5</b>	<b>230</b>	<b>-48</b>	<b>843</b>
<b>SHELL CORENA S4 R 68</b>	<b>68</b>	<b>10.2</b>	<b>248</b>	<b>-48</b>	<b>848</b>

# REFRIGERATION OILS

## SHELL REFRIGERATION OIL S2 FR-A 46 SHELL REFRIGERATION OIL S2 FR-A 68

Low-miscibility compressor lubricants intended for use in refrigeration compressors using ammonia refrigerant. It is formulated from specially refined paraffinic base oils in combination with additives selected to minimise system deposits and to provide long service life.

## SHELL REFRIGERATION OIL S4 FR-V 46

A synthetic refrigeration lubricant based on alkylated benzenes. It offers a universal solution to the lubrication requirements of most refrigeration compressors and is compatible with all commonly used refrigerants with the exception of HFCs.

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL REFRIGERATION OIL S2 FR-A 46</b>	<b>46</b>	<b>6.7</b>	<b>218</b>	<b>-39</b>	<b>859</b>
<b>SHELL REFRIGERATION OIL S2 FR-A 68</b>	<b>68</b>	<b>9</b>	<b>232</b>	<b>-39</b>	<b>862</b>
<b>SHELL REFRIGERATION OIL S4 FR-V 46</b>	<b>46</b>	<b>5.3</b>	<b>180</b>	<b>-42</b>	<b>869</b>

# 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  $-60^{\circ}\text{C}$ .

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

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

# BEARING AND CIRCULATING OILS

## MINERAL

### SHELL MORLINA S2 B 10

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

### SHELL MORLINA S2 BL 150

A special low-viscosity, solvent refined mineral oil blended with zinc-free additives to provide extended performance in the high-speed spindles of machine tools.

## SYNTHETIC

### SHELL MORLINA S4 B

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

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL MORLINA S2 B 150</b>	<b>150</b>	<b>15.0</b>	<b>262</b>	<b>-15</b>	<b>887</b>
<b>SHELL MORLINA S2 BL 10</b>	<b>10</b>	<b>2.3</b>	<b>150</b>	<b>-30</b>	<b>881</b>
<b>SHELL MORLINA S4 B 220</b>	<b>220</b>	<b>28.0</b>	<b>275</b>	<b>-45</b>	<b>854</b>
<b>SHELL MORLINA S4 B 320</b>	<b>320</b>	<b>37.0</b>	<b>275</b>	<b>-45</b>	<b>854</b>
<b>SHELL MORLINA S4 B 460</b>	<b>460</b>	<b>51.0</b>	<b>275</b>	<b>-33</b>	<b>855</b>

# TURBINE OILS

## SHELL TURBO CC 32

Developed to meet the severe demands imposed by modern, heavy-duty turbine applications. They exceed equipment manufacturers' specifications for both gas and steam turbines. A patented, metal-free additive technology ensures that these products offers substantially improved performance over conventional turbine oils. The unique combination of excellent oxidation and thermal stability, coupled with the resistance to formation of deposits and varnish, sludge control and surface properties make Shell Turbo CC oils excellent choices for emerging combined-cycle turbine technology, as well as for existing gas and steam turbine plants.

## SHELL TURBO S4 GX 32

Based on gas-to-liquids technology and developed to meet the demands of the latest high-efficiency turbine systems. Designed to offer outstanding, long-term performance under the most severe operating

conditions Shell Turbo S4 GX 32 will help to minimise wear and deposit and sludge formation, even under cyclic peak loading conditions.

## SHELL TURBO T 46 SHELL TURBO T 68 SHELL TURBO T 100

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 change interval.

Excellent

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



# TURBINE OILS

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL TURBO CC 32</b>	<b>32</b>	<b>5.45</b>	<b>218</b>	<b>-12</b>	<b>*</b>
<b>SHELL TURBO S4 GX 32</b>	<b>32</b>	<b>6.06</b>	<b>232</b>	<b>-42</b>	<b>827</b>
<b>SHELL TURBO T 32</b>	<b>32</b>	<b>5.45</b>	<b>215</b>	<b>-33</b>	<b>840</b>
<b>SHELL TURBO T 46</b>	<b>46</b>	<b>6.9</b>	<b>220</b>	<b>-27</b>	<b>858</b>
<b>SHELL TURBO T 68</b>	<b>68</b>	<b>8.95</b>	<b>240</b>	<b>-24</b>	<b>871</b>
<b>SHELL TURBO T 100</b>	<b>100</b>	<b>11.7</b>	<b>250</b>	<b>-24</b>	<b>873</b>

# TRANSMISSION OILS

## **SHELL SPIRAX S2 A 80W-90**

Blended for use in a wide variety of automotive axle units subjected to heavy-duty conditions.

## **SHELL SPIRAX S2 A 90**

## **SHELL SPIRAX S2 G 90**

Automotive gear lubricants containing multi-functional additives required for mild extreme-pressure conditions.

## **SHELL SPIRAX S3 ATF MD-3**

A premium quality automatic transmission fluid based on high viscosity index mineral oils and carefully selected additives. It is blended to meet the stringent requirements of leading automotive transmission manufacturers.

## **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.

## **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.

# TRANSMISSION OILS

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL SPIRAX S2 A 80W-90</b>	<b>146</b>	<b>14.7</b>	<b>175</b>	<b>-27</b>	<b>904</b>
<b>SHELL SPIRAX S2 A 90</b>	<b>145</b>	<b>14.3</b>	<b>180</b>	<b>-18</b>	<b>909</b>
<b>SHELL SPIRAX S2 G 90</b>	<b>145</b>	<b>14.3</b>	<b>191</b>	<b>-18</b>	<b>904</b>
<b>SHELL SPIRAX S3 ATF MD3</b>	<b>33.8</b>	<b>7.3</b>	<b>180</b>	<b>-48</b>	<b>864</b>
<b>SHELL SPIRAX S3 AX 80W-90</b>	<b>169</b>	<b>16.8</b>	<b>220</b>	<b>-30</b>	<b>900</b>
<b>SHELL SPIRAX S4 ATF HDX</b>	<b>33</b>	<b>7.2</b>	<b>152</b>	<b>-48</b>	<b>847</b>
<b>SHELL SPIRAX S4 TXM</b>	<b>60</b>	<b>9.4</b>	<b>220</b>	<b>-42</b>	<b>882</b>

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

# 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 <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL NAUTILUS PREMIUM OUTBOARD</b>	<b>38</b>	<b>7.0</b>	<b>70</b>	<b>-35</b>	<b>871</b>

# SPECIALTY

## SHELL DIALA S3 ZX-I

A premium, inhibited electrical insulating oil manufactured from specially refined mineral oils with an ultra-low sulphur content. It offers very high oxidation stability and excellent dielectric and low temperature properties. Shell Diala S3 ZX-I meets both the established and new industry copper corrosion tests.

	Viscosity, mm <sup>2</sup> /s		Flash point, °C	Pour point, °C	Density at 15°C, kg/m <sup>3</sup>
	40°C	100°C			
<b>SHELL DIALA S3 ZX-I</b>	<b>8</b>	<b>n/a</b>	<b>140</b>	<b>-60</b>	<b>881</b>

# GREASES

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

# GREASES

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



# 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				
<b>Gear check</b>	✓			✓		✓			✓		✓
<b>Thruster check</b>	✓			✓			✓		✓		✓
<b>Thermal check</b>	✓			✓		✓		✓	✓		✓
<b>Grease check</b>									✓		✓
<b>Engine check plus</b>		✓	✓				✓	✓	✓	✓	✓
<b>System check plus</b>	✓			✓			✓		✓		✓
<b>Hydraulics check plus (1)</b>	✓			✓	✓	✓			✓		✓
<b>Gear check plus (1)</b>	✓			✓		✓			✓		✓
<b>Thruster check plus</b>	✓			✓	✓		✓		✓		✓
<b>NK stern tube test (8) (9)</b>	✓			✓		✓			✓(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<sup>(1), (2)</sup> (J300–JAN2009)

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

### Notes

(1) 1 mPa·s = 1 cP; 1 mm<sup>2</sup>/s = 1 cSt

(2) All values, with the exception of the low-temperature cranking viscosity, are critical specifications, as defined by ASTM D3244<sup>(3)</sup> [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.
<b>70W</b>	-55	4.1	-
<b>75W</b>	-40	4.1	-
<b>80W</b>	-26	7.0	-
<b>85W</b>	-12	11.0	-
<b>80</b>	-	7.0	<11.0
<b>85</b>	-	11.0	<13.5
<b>90</b>	-	13.5	<18.5
<b>110</b>	-	18.5	<24.0
<b>140</b>	-	24.0	<32.5
<b>190</b>	-	32.5	<41.0
<b>250</b>	-	41.0	-

Note: 1 cP = 1 mPa·s, 1 cSt = 1 mm<sup>2</sup>/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



# 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 ( $\text{kg}/\text{m}^3$ ) or grammes per cubic centimetre ( $\text{g}/\text{cm}^3$ ).

### **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 disulfide 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

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





## Shell Marine

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[www.shell.com/marine](http://www.shell.com/marine)



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