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PRECISION LUBRICANTS

TECHNICAL RESOURCE

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SAE Viscosity Grades for Engine Oils

SAE is an abbreviation for the Society of Automotive Engineers. The SAE developed a classification system to define the viscosity, or thickness, of the oil. This system has been progressively modified over the years. It defines “operating” engine oil viscosities for different grades and contains specifications for “cranking” viscosity and pump ability at start up, the “W” grades or winter. A multi-grade oil is one that meets both a “W” or low temperature viscosity requirement and also a 100°C operating temperature requirement. For engine oils there is a specification that must be met at 150°C, known as a High Temperature/ High Shear (HT/ HS) viscosity. This is to simulate what happens in high stress areas of the engine e.g. bearings. Centipoise (cP) and Centistokes (cSt) are the units each is measured in. In addition, gear oils require a KRL test. This is a severe oil shear test, and the oil must stay in grade or within a nominated range after shear. Its severity is the main reason why 75W-x gear oils are expensive as these are difficult to make. SAE Viscosity has little relevance to industrial oils but some compressor oils are stated as meeting SAE 30 for example.

API Engine Service Classifications

API is an abbreviation for American Petroleum Institute. In 1970 along with the SAE and ASTM (American Society for Testing and Materials), they established the API Service Classification System to define the performance level of a given oil, unrelated in the main, to oil viscosity. The API requirements ‘S’ for Spark Ignition (petrol) and ‘C’ for Compression Ignition (diesel).For more information please refer to the API Classification chart (‘S’ and ‘C’ Service charts.)

ACEA Engine Service Classifications

ACEA is an abbreviation for Association des Constructers Europeans de 1”Automobile. This classification system is the European equivalent of the API classification system, but is stricter and has more severe requirements. Hence the oil meets both API and ACEA specifications uses a better additive package than one that is designated to meet only API specifications. Unlike the API, ACEA has three main groups – “A/B” for gasoline and light duty (passenger car, 4WD etc.) diesel engines, “C” for light duty three way catalyst (TWC) and diesel particulate filter (DPF) compatible oils and “E” for heavy duty diesel engines.

ILSAC Engine Service Classifications

ILSAC is an abbreviation for (International Lubricants Standardisation and Approval Committee) includes the major automobile manufacturers that manufacture vehicles in the USA. This includes the Japanese manufacturers. Effectively, ILSAC specifications are the fuel economy version of the API specifications.

Base Oils

All oils must contain base oils! They go with the additives mentioned previously. Not all base oils are created equally however. the API classifies these into 6 main groups.

Group	Sulphur %	Saturates %	VI	Manufacturing Method
I	>0.03	<90	80-119	Solvent Refined
II	<0.03	>90	80-119	Hydro-processed
III	<0.03	>90	120+	Severely hydro-processed
IV	Poly Alpha Olefins (PAO)			Oligomerization (man-made)
V	All Others (including Esters)			Various
VI	Poly Internal Olefins (PIO)			Oligomerization (man-made)

Group 1 and Group 2 base oils are considered mineral. Synthetic base oils start at Group 3 and continue to Group 6. Some of the benefits of synthetics is their quality and purity. Synthetic base oils contain less impurities such as sulfur and wax that are commonly found in mineral based oils. Synthetic base oils give outstanding lowerer viscosity performance and are becoming more commonly used. They naturally have a higher viscosity index which stops them from becoming too thick when cold and too thin when at normal operating temperature. Hence synthetic oils flow more easily on start up providing engine protection when it is most needed.

FUNCTIONS OF A LUBRICANT

To properly lubricate, an oil or grease must:

Lubricate Parts and Prevent Wear
This is the basic function of all oils. Keeping the moving parts separated. In general the thicker the oil film, the better the wear protection, but the oil additives also play an important role. Modern additives often allow an oil of slightly lesser viscosity to be used and still provide the same level of protection.

Reduce Friction
The film of oil reduces friction simply because there is no metal-to-metal contact. The heavier the oil though, the greater the drag and hence more heat may be generated. Correct oil selection is therefore a balance of what is needed to protect the component without generating excessive drag.

Protect Against Rust and Corrosion
As oils degrade they form corrosive by-products so the oil contains anti-corrosion and acid neutralizing additives to protect components.

Keep Components Clean
Oils need to be very stable under heat and not cause system deposits. Different oils will last different lengths of time in a given application.

Be Compatible with Seals
The oil must lubricate and not cause deterioration of seals.

Prevent Foam
Foam reduces the lubrication properties of the oil, therefore industrial oils must be resistant to foaming or be able to 'release' any foam quickly.

Engine Oil Functions

Permit Easy Starting
Most wear occurs in an engine at start up. Therefore, the oil must have the correct low temperature viscosity to flow quickly to the bearings and valve train to prevent wear. Some engines require low viscosity oils to start at all, especially some of the new diesel engines found in four wheel drives, where the oil is used to operate the pump to prime the fuel injectors.

Cool the Engine
At least 40% of the engine is cooled by the oil, not the radiator system. This means the oil is always under heat stress (oxidation) as it transfers heat from hot spots back to the sump. This includes main and big end bearings, the crankshaft, rods, other bearings plus timing gear and pistons.

Reduce Combustion Chamber Deposits
Some oil will always reach the combustion chamber - either via the cylinder walls or via the valves. It is then burned off with the fuel. So it must burn clean enough that it does not build up on valve seats or pistons tops which can cause problems.

SERVICE CLASSIFICATIONS - PETROL

API Engine Service Classifications
'S' Service Classifications

Classification	Description	Related Specifications
SP	API Service SP. Starting May 1, 2020,	ILSAC GF-6A and ILSAC GF-6B
SN+	Introduced November 9, 2017 a new classification that may be used in conjunction with API SN and API SN with Resource Conserving.	ILSAC GF-5
SN	Introduced in October 2010 for 2011 and older vehicles, designed to provide improved high temperature deposit protection for pistons, more stringent sludge control, and seal compatibility. API SN with Resource Conserving matches ILSAC GF-5 by combining API SN performance with improved fuel economy, turbocharger protection, emission control system compatibility, and protection of engines operating on ethanol-containing fuels up to E85.	ILSAC GF-5
SM	Meets 2004-on requirements of Automotive manufacturers. XW-20 and XW-30 grades have chemical limits.	ILSAC GF-4
SL	Introduced July 2001. For all automotive engines presently in use. SL oils are designed to provide better high temperature deposit control and lower oil consumption. Meets 2001-2004 on requirements of Automotive manufacturers.	ILSAC GF-3
SJ	Introduced in 1997 (First available 15 October 1996). Provides improvements over SH in oil volatility, filter-ability, gelation, deposits and catalyst compatibility. SJ oils are been tested in accordance with the Chemical Manufacturers Association (CMA) Code of Practice and may be used where earlier categories have been recommended. Meets 1998-2000 requirements of Automotive manufacturers.	ILSAC GF-2
SA to SH	Are obsolete	
SH*	Introduced 1994. Exceeds SG in deposit control, oil oxidation, wear, rust and corrosion. SH oils are rested in accordance with the Chemical Manufacturers Association (CMA) Code of Practice, and may be used where earlier categories have been recommended. Meets 1994-1997 requirements of Automotive manufacturers.	MIL-L-46152E ILSAC GF-1
SG*	Introduced 1989. Provides improved control of engine deposits, oil oxidation, and engine wear compared to previous categories. Also provides protection against rust and corrosion. Meets 1989-1993 requirements of Automotive manufacturers.	Ford: ESE-M2C-153E GM: 6048M MIL-L-46152D
SF*	Introduced 1980. Provides oxidation stability and anti-wear performance compared to SE. Also provides protection against engine deposits, rust and corrosion. Meets 1980-1988 requirements of Automotive manufacturers.	GM: 6048M, Chrysler: MS 6395 Ford: ESE-M2C-153B/C/D
SE*	Introduced 1972. Provides more protection against oil oxidation, high temperature engine deposits, rust and corrosion compared to SD or SC. Meets 1972-1979 requirements of Automotive manufacturers	Ford: ESE-M2C-101C GM: 6136M, MIL-L-46152A
SD*	Introduced in 1968, and meets 1968-1971 requirements of Automotive manufacturers.	
SC*	Introduced in 1964, and meets 1964-1967 requirements of Automotive manufacturers.	
SB*	For minimum Duty Petrol Engines. Some antioxidant and anti-scuff properties.	Inhibited oil (non-detergent)
SA*	For Utility Petrol and Diesel Engines. Oil without additive.	Straight mineral oil.

SERVICE CLASSIFICATIONS - ILSAC

Service Classifications

Classification	Description
GF-6A and GF-6B	ILSAC GF-6A, GF-6B, and API Service SP. Starting May 1, 2020, ILSAC GF-6A provides a new basis for issuance of a license to use the API Certification.
GF-5	Introduced in October 2010 for 2011 and older vehicles, designed to provide improved high temperature deposit protection for pistons and turbochargers, more stringent sludge control, improved fuel economy, enhanced emission control system compatibility, seal compatibility, and protection of engines operating on ethanol-containing fuels up to E85.
GF-4	Is equivalent to API SM.
GF-3	Is equivalent to API SL plus the Sequence VI B fuel economy engine test.
GF-2	Is equivalent to API SJ plus the Sequence VI A fuel economy engine test.
GF-1*	Is obsolete - API SH plus the Sequence VI fuel economy engine test.

*Obsolete

ILSAC grades only apply to viscosities XW-20 and XW-30. GF-4 has introduced a phosphorus limit of 0.08% maximum and a sulphur limit of 0.2% maximum. ILSAC, API and ACEA specifications require a large range of engine tests and laboratory tests on the oil. Parameters such as high and low temperature wear, oxidation, soot control, oil thickening, deposit control, volatility, stay in grade performance, fuel economy, chemical composition and many others are tested against limits and rates.

In the case of the API, the oil specifications become more severe as the letters climb the alphabet,e.g. SL is more severe than SJ. This is not necessarily the case with ACEA as their specifications are more application specific.

The standard, known as ILSAC GL-1, was issued in October 1990 and revised in October 1992. An upgraded standard, known as ILSAC GL-2, was commercially released in 1996 and ILSAC GF-3 was released in 2000.

SERVICE CLASSIFICATIONS - ACEA

ACEA Engine Service Classifications

Classification	Description
A1/B1	For use in gasoline and light duty diesel engines capable of using low friction, low viscosity, and low HT/HS shear (2.9 to 3.5cP) oils. A fuel economy specification, this oil may not be able to be used in all engines.
A3/B3	Stable, stay in grade oil intended for use in high performance gasoline and diesel engines or extended drain intervals.
A3/B4	For use in direct injection diesel engines where special oils may be required, but also suitable for applications described under A3/B3.
A5/B5	Similar to A3/B3 but for engines capable of using low friction, low viscosity and low HT/HS oils. May be unsuitable for use in some engines.
C1	Stable, stay in grade oil of A5/B5 performance level and a phosphorus limit of 0.05% (low SAPS). These oils cannot meet API SM.
C2	Stable, stay in grade oil of A5/B5 performance and mid-SAPs (Phosphorus 0.08%)
C3	Stable, stay in grade oil with mid-SAPs (phosphorus 0.08&). These oils may also meet A3/B4 and API SM. HT/HS>3.5Cp.
C4	Stable, stay in grade oil similar to CI but with tighter volatility limits and no lower limit on phosphorus.
E2	General purpose oil for naturally aspirated and turbocharged diesel engines, medium to heavy duty service and mostly normal drain intervals.
E4	Stable, stay in grade oil more severe than E7, for significantly extended oil drain intervals. Usually synthetic or predominantly synthetic. Also for Euro 3 and Euro 4 engines.
E6	As for E4 but with chemical limits to allow use in engines with particulate filters and SCR Nox reduction systems. Only for diesel with >50ppm sulphur. 1.0% ash, 0.08% phosphorus.
E7	Designed for use in Euro 1, Euro 2 and Euro 3 emission diesel engines in severe heavy duty service and extended drain intervals where allowed. More severe than E2/E3 but not as severe as E4.
E9	E9 Stable, stay-in-grade oil providing effective control with respect to piston cleanliness and bore polishing. It further provides excellent wear control, soot handling and lubricant stability. It is recommended for highly rated diesel engines meeting Euro I, Euro II, Euro III, Euro IV, Euro V and Euro VI emission requirements and running under severe conditions, e.g. extended oil drain intervals according to the manufacturer's recommendations. It is suitable for engines with or without particulate filters, and for most EGR engines and for most engines fitted with SCR NOx reduction systems

Note: ACEA Specification oils have tighter shear stability and oil volatility requirements than equivalent API specification oils.

"C and F" Service Classification

Classification	Description	Related Specifications
FA-4	API Service Category FA-4 oils are specifically formulated for use in select high-speed four-stroke cycle diesel engines designed to meet 2017 model year on-highway greenhouse gas (GHG) emission standards.	
CK-4	API Service Category CK-4 describes oils for use in high-speed four-stroke cycle diesel engines designed to meet 2017 model year on-highway and Tier 4 non-road exhaust emission standards as well as for previous model year diesel engines.	PC-11, ACEA:, E9 – 12
CJ-4	Released in 2006 for 15ppm maximum fuel sulphur. Enhanced wear, protection 1.0% ash maximum.	US EPA '07
CI-4 PLUS	As per CI-4 but with further restrictions on after shear viscosity and performance. (released September 2004) Aust. 2008.	CI-4, Global: DHD-1, JASO: DH1, ACEA: E7-08, E5-02, E3-96
CI-4	High speed four stroke engines fitted with cooled EGR (released Dec 2001) and using low-sulphur fuel.	CI-4, Global: DHD-1, JASO: DH1, ACEA: E7-08, E5-02, E3-96
CH-4	High speed four stroke engines meeting 1998 emission standards (less than 0.5% fuel sulphur).	ACEA: E7-04, A3, B3, E2 Global: DHD-1, JASO: DH-1
CG-4	Severe Duty four stroke engines meeting 1994 emission standards (less than 0.5% fuel sulphur).	
CA to CF-4	Are obsolete	
CF-4*	Severe Duty four stroke diesel engine service for lower emission diesel engines (from 1988).	US Military: MIL-L-2104E and MIL-L-46152E
CF-2*	Severe duty two stroke diesel engine service from 1994.	
CF*	Off road indirect injection diesel engines and others using a broad range of fuel types including high sulphur. May be used to replace API CD oils.	CD
CE*	Turbo/Supercharged heavy duty diesels from 1983.	
CD-II*	API CD plus Detroit Diesel 6V53T approval for two stroke engines.	CD, Detroit Diesel: 6V-53T MIL-L-2104D
CD*	Severe duty diesel, including turbo.	Caterpillar Series 3, MIL-L-2104C/D MIL-L-45199
CC*	Moderate to severe duty diesel and gasoline service.	MIL-L-2104B, 1964
CB*	Moderate duty, lower quality (high sulphur) fuel.	MIL-L-2104A Supp. 1
CA*	Light duty, high quality fuel.	MIL-L-2104A, 1954

SAE VISCOSITY GRADES - ENGINE OILS

Engine Oil Viscosity Classification SAE J300

SAE Viscosity Grade	Low Temperature (^{O}C) Cranking Viscosity 2,mPa-s Max	Low Temperature (^{O}C) Pumping Viscosity 3, mPa-s Max With No Yield Stress	Kinematic Viscosity 4 (mm2/s) at 100 ^{O}C Min	Kinematic Viscosity 4 (mm2/s) at 100 ^{O}C Max	High Shear Viscosity 5 mPa-s at 150 ^{O}C and 106s1Min
0W	6200 at - 35	60,000 at - 40	3.8	-	-
5W	6600 at - 30	60,000 at - 35	3.8	-	-
10W	7000 at - 25	60,000 at - 30	4.1	-	-
15W	7000 at - 20	60,000 at - 25	5.6	-	-
20W	9500 at - 15	60,000 at - 20	5.6	-	
25W	13000 at - 10	60,000 at - 1.5	9.3	-	-
20	-	-	5.6	<9.3	2.6
30	-	-	9.3	<12.5	2.9
40	-	-	12.5	<16.3	2.9 0W-40, 5W-40, 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

Industrial Oils
There are many different types of industrial oils. Let's take a little time to look at some of them.

Hydraulic Oils
The primary application of hydraulic oil is to transmit force applied at one point in a system to another. As well as this it must also protect seals, lubricate and transfer heat.

The viscosity of the oil is important to ensure efficient power transfer. Too heavy and high-pressure drops may occur, the system becomes sluggish and power usage increases. If too low, then wear can be a problem, efficiency decreases and leaks may occur. Typically these products contain anti wear, anti-rust/ corrosion and anti-oxidation inhibitors. These may be ash-less (non-metallic) or use a zinc di-thiophosphate type anti-wear system. Some older higher zinc additives can be corrosive to silver. Hydraulic oils can be a 'mono-grade' (HM) or 'multi-grade' (HV) type.

Industrial Gear Oils
Typically API GL-3 oils which use low doses of conventional sulphur-phosphorus additives. They tend to be straight mono grade oils.

Compressor Oils
Compressors may use a multitude of products, depending on the type of compressor and its service. Types of oils include:

Conventional motor oils
Non-metallic hydraulic oils
Ash-less engine oils
Specialised fluids (mineral or synthetic)
Automatic transmission fluids
Refrigeration oils

The use of the wrong oil can cause wear, failure, carbon build up and even reaction with the gas being compressed, so great care must be taken when recommending fluids.

Heat Transfer Fluids
As the name suggests they transfer heat in a system. They must be highly oxidative stable to minimize build-up of carbon deposits (which of course inhibit heat transfer).

Cutting Fluids
These fluids may either be 'neat fluids' which are straight petroleum oils with specialised additives or 'soluble oils' which are designed for use in water. They are used for many different machining applications and come in a wide range of viscosities and additive types. Some are clear, some not. Use of the wrong type of oil can lead to bit wear problems or staining of the metal surfaces. Some fluids contain a biocide additive to control bacterial growth.

Transformer Oils
Highly specialised fluids used in electrical transformers. They are characterised by extremely low water content and good oxidation stability.

White Oils
Ever wonder what baby oil is? Highly refined mineral oil, 100% paraffinic and approved by health and food authorities. Used by the food and cosmetic industry as a lubricant or carrier fluid.

Process Oils
Straight oils used in various industrial processes such as in rubber or as flushing fluids. Large quantities of these are used by heavy industry.

API GEAR CLASSIFICATIONS

API Gear Lubricants Service Classifications
For conventional gear oils the following classifications are typically used by the API to identify gear oil performance standards:

Axle and Manual Transmission Lubricants SAE J308

Classification	Description	Related Specifications
MT-1	For non-synchronized manual transmissions in buses and trucks at a higher level than GL-4.GL-2, GL-3 and GL-6 are not normally used for automotive applications. Protection against the combination of thermal degradation, component wear and oil seal deterioration. May or may not contain EP additives. Non synchronized manual transmission used in buses and heavy duty trucks	
GL-6*	For severe service involving high offset hypoid gears. Often used to describe oils used in limited slip differentials. Hypoid gears with very high pinion offset	
GL-5	Equivalent to PRF-2105E. Primary field service recommendation for passenger cars and trucks worldwide. Contains higher concentration of EP additives. Equivalent to MIL-L-2105 B/C/D. Hypoid and all other types of gears in severest service including shock loading. Primary field service recommendation for most passenger cars and trucks.	MIL-PRF--2105E
GL-4	Contains EP additives. Equivalent to MIL-L-2105B and is usually satisfied by a 50% GL-5 additive level. Manual transmissions and trans axles, spiral bevel and hypoid gears in normal service without shock loading	MIL-L-2105B
GL-3*	Contains a mild EP additive. Manual transmissions and spiral bevel final drives under moderate service conditions	
GL-2*	Usually contains fatty materials. Worm drives and some individual gear boxes	
GL-1	Straight mineral oil without additive. Some automotive manual transmissions under mild service	

* Obsolete

MIL-PRF-2105E – designed by the US military it takes conventional GL-5 and adds more demands to the specification. Most hypoid oils conform to this standard. Now superseded by SAE J2360 (2003).

Transmission Fluids

Automatic Transmission Fluid (ATF) is a critical fluid for lubricating your car's transmission. Modern vehicles require increasingly new and more complex additive systems for the transmission to perform at its optimum efficiency.

Selection of the correct type is essential to achieve smooth operation and durability when coupled to today's fuel efficient engines. Early automatic transmission designs evolved from 2, 3 & 4 speed gear ratios.

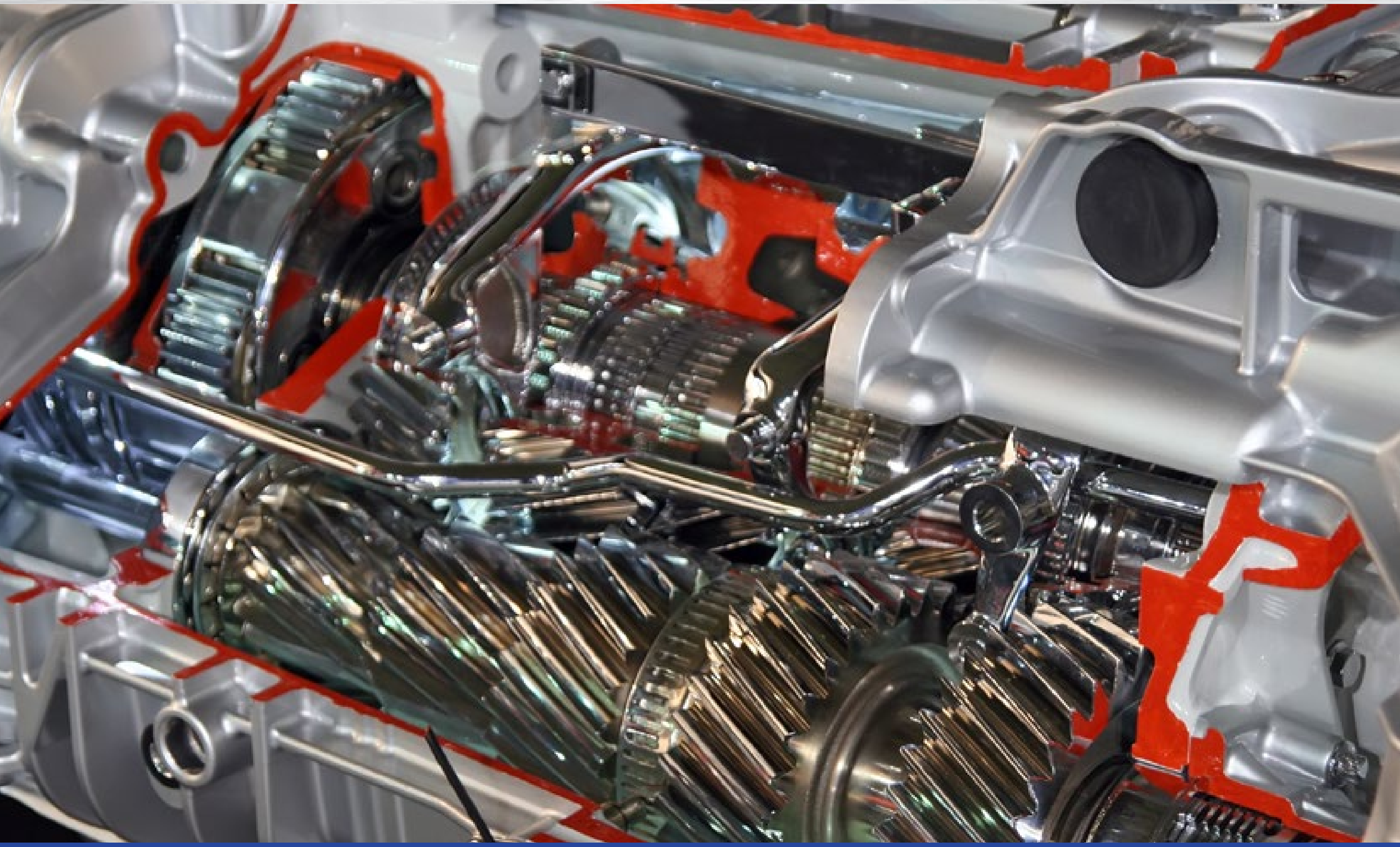
Whereas modern automatic transmissions have gear ratios ranging from 5, 6,7,8,9 and 10, all these transmissions require a complex computer management system coupled with the engine's management system to accommodate high power whilst greatly improving drive-ability and fuel efficiency.

As transmissions have become more sophisticated, the advent of synthetic base fluids as well as advanced additive technology is required to ensure continuous smooth shifting under all driving conditions.

The increased complexity of ATF's has seen the appearance of a variety of technologies introduced into the automotive and commercial vehicle markets e.g. Continuously Variable Transmission (CVT) and Dual Clutch Transmission (DCT), requiring specialised fluids that are not compatible with other automatic transmissions or fluids.

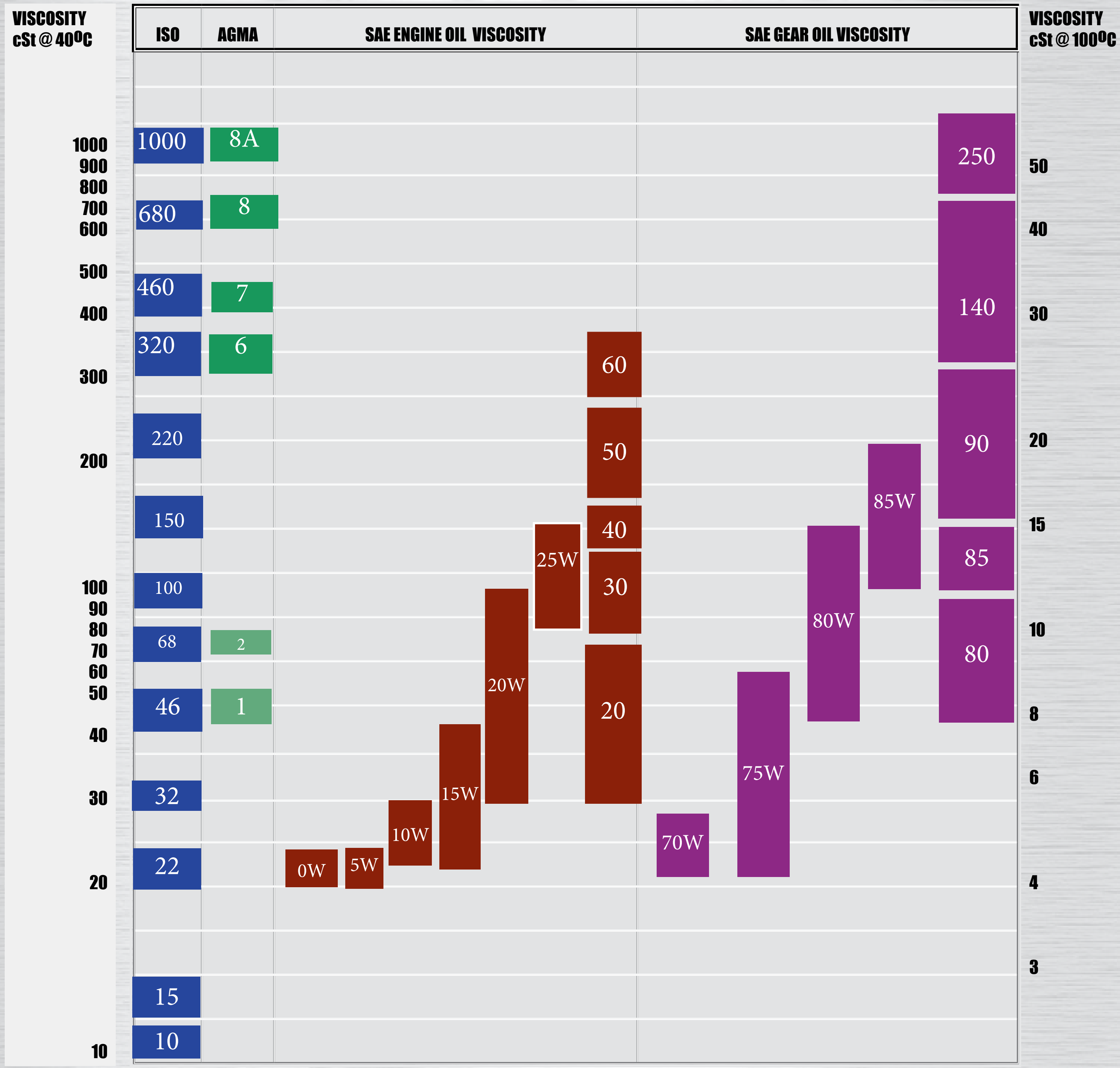
With RPL's advanced fluid additive systems we have a wide range of ATF fluids to suit most vehicle applications, we recommend that you consult our website or call your RPL representative to assist with selection of the correct fluid application.

Heavy transport transmissions found in light trucks, freighters and buses are also becoming more specialised with evolving specifications and fluids. We strongly also recommend that you consult our website or call your RPL representative to assist with selection of the correct fluid application.



VISCOSITY CHART

Comparing relative viscosities against various testing methods.



Winter (W) grade oil viscosities are also defined at low temperatures as well as minimum viscosities at 40ºC (shown here). This chart gives an approximate comparison between different commonly used viscosity classification systems.

GREASE AND SEMI FLUIDS

Greases

Greases are defined as solid or semi-solid materials produced by the dispersion of a thickening agent in a liquid lubricant (like adding a sponge to water). Greases are manufactured in either a grease kettle or in a contactor. Soap based grease uses a thickener made by reacting a metallic hydroxide with a fatty acid, which is where we get our basic types from, e.g. lithium soap. Non-soap greases include silica, polyurea and clay (bentone). Depending on what the grease needs to achieve, different thickener and base oils can be used.

Grease Characteristics

The most important factors affecting the properties and characteristics of a grease are:

- Amount and type of thickener
- Additives
- Environment (water, heat and low temperature)

Grease is expected to:

- Reduce friction and wear
- Provide corrosion protection
- Seal bearings from water and contaminants
- Resist leakage, dripping and throw-off
- Resistance change in structure or consistency during service
- Maintain mobility under conditions of application
- Be compatible with seals
- Tolerate or repel moisture

NLGI – Grade Penetration @25oC (1/10th mm)

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 (block grease)	85 - 115

Grease Compatibility

Occasionally, grease substitution in an application may be necessary to correct problems arising from the original product in service. If the thickeners are chemically incompatible, the mixture will not meet the properties of the individual greases and in some cases, the greases will fail and cause premature component wear.

It is strongly advised that, in all cases, the old grease be purged or cleaned out from the system before a new grease is introduced. However, compatibility between greases may also be temperature dependent. As the temperature rises, the problems associated with incompatibility also increase. With unknown competitors' products, it is strongly advised to treat them as incompatible.

	Calcium	Lithium	Calcium Complex	Lithium Complex	Aluminium Complex	Barium Complex	Polyurea	Bentone	Sodium
Calcium	□	□	□	□	O	X	□	X	X
Lithium	□	□	□	□	O	O	□	X	O
Calcium Complex	□	□	□	O	X	O	O	X	X
Lithium Complex	□	□	O	□	O	O	□	X	O
Aluminium Complex	X	O	X	O	□	X	O	X	X
Barium Complex	X	O	O	O	X	□	O	X	X
Polyurea	□	□	O	□	O	O	□	X	X
Bentone	X	X	X	X	X	X	X	□	X
Sodium	X	O	X	O	X	X	X	X	□

Key: □ **Compatible** **O Borderline** X **Incompatible**

Grease Types

There are many types of greases which are shown below. As can be seen they have different properties which helps to define where they are best suited.

Thickener	Drop Point °C	Max Service Continuous Operation Temp °C	High Temperature Use	Structure	Shear Stability	Water Resistance
Calcium	100	<80	Very Poor	Smooth	Fair	Good
Lithium	160 - 200	125	Good	Smooth	Good	Good
Calcium Complex	>260	150	Excellent	Smooth/ Buttery	Good	Excellent
Lithium Complex	<240	160	Excellent	Smooth	Excellent	Excellent
Aluminium Complex	>260	150	Excellent	Smooth/ Gel	Good	Excellent
Barium Complex	>200	150	Good	Fibrous	Fair	Excellent
Polyurea	>230	150	Excellent	Opaque	Good	Excellent
Bentone	NA	150	Excellent	Smooth	Fair	Good
Sodium	170 - 190	125	Good	Fibrous	Good	Very Poor

Grease Applications

Greases are used instead of oils in many applications where:

A good seal from the elements is required
Leakage is a problem
Exposed gears or chains are used and water wash-off is a problem
Less frequent application of lubricant is possible due to isolation or inaccessibility

Some examples where greases are used include:

Wheel bearings
Universal joints
Chassis lubrication
Track rollers
Rolling bearings
Shackles and pins
CV Joints
Electric motor bearing*

* Note: Extreme Pressure greases are not generally recommended in electric motors.

Grease Shelf Life

The shelf life of any grease is affected by the type and amount of thickener used, consistency of the grease, manufacturing method employed and the formulation complexity. Generally Lithium. Lithium Complex and Calcium Complex greases remain stable for a long time.

Aluminum complex greases tend to set and harden, but remain stable. Bentone and Barium greases tend to soften on ageing.

Based on these observations

The shelf life of most RPL greases is about 5 years. However, Steering Box Lubricant and Semi Fluid Grease only have a 2 year shelf life.

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