Daimler Ferret fuel & lubricant capacities

Capacities	Imperial	U.S.A.	Metric (litres)
Engine lubrication system (dry sump)	3 gal	3½ gal	13.64
Engine cooling system	4½ gal	5½ gal	20.46
Fuel Tank - total including 3 gal reserve	21 gal	25¼ gal	95.5
Fluid coupling	9¾ pints	11¾ pints	5.52
Gearbox	1¼ gal	1½ gal	5.7
Transfer box	6 pints	7¼ pints	3.41
Inner tracta joint housings, including bevel boxes	3 pints	3½ pints	1.7
Outer tracta joint housings, including road wheel hubs	1½ pints	1¾ pints	0.85
Brake fluid supply tank	1¼ pints	1½ pints	0.71
Air cleaner	4 pints	5 pints	2.28
Steering cross-shaft bevel box (lower)	1½ pints	1¾ pints	0.85
Steering bevel box (upper)	1½ pints	1¾ pints	0.85

Unit conversion factors

British volume units are based on the Imperial Gallon which is *not the same size* as the US gallon. Here is the conversion information for British, US, and metric measures.

Metric	**Metric**	**Imperial**
1 cu cm [cm^3]		0.0610 in^3
1 cu decimetre [dm^3]	1,000 cm^3	0.0353 ft^3
1 cu metre [m^3]	1,000 dm^3	1.3080 yd^3
1 litre [L]	1 dm^3	1.76 pt
1 hectolitre [hl]	100 L	21.997 gal
Imperial	**Imperial**	**Metric**
1 cu inch [in^3]		16.387 cm^3
1 cu foot [ft^3]	1,728 in^3	0.0283 m^3
1 fluid ounce [fl oz]		28.413 ml
1 pint [pt]	20 fl oz	0.5683 L
1 gallon [gal]	8 pt	4.5461 L
American Units	**Imperial**	**Metric**
1 fluid ounce	1.0408 UK fl oz	29.574 ml
1 pint (16 fl oz)	0.8327 UK pt	0.4731 L
1 gallon	0.8327 UK gal	3.7854 L

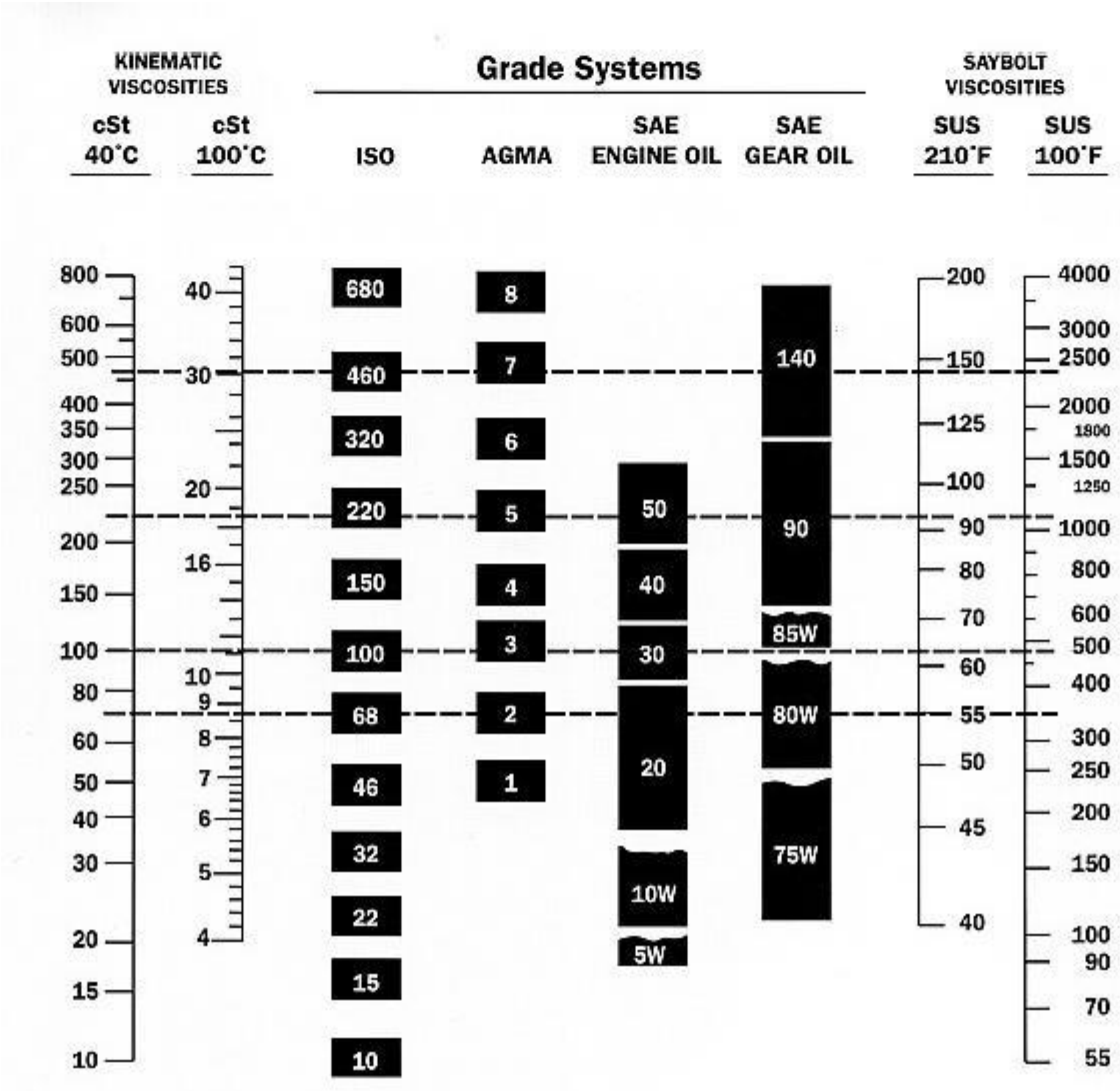
The old military codes OMD-110 and OEP-220 are catalogue codes used by NATO military services to describe a standard for POL (Petrols, Oils, Lubricants) products. OM is Oil – Mineral; D is detergent; EP is Extreme Pressure; OF is oils – Fatty, e.g. castor oil, and OX (Oils - Synthetic) e.g. hydraulic oil]. The number 110 is not assigned on a logical basis, and changes when a new contractor supplies the specified oil. 110 was replaced a great many years ago by OMD-80, which was itself replaced maybe a couple od decades ago with OMD-90. These oils may be classified differently, but they are exactly the same specification (SAE 30).

In a hypoid axle the teeth mesh in a hyperboloid configuration. The propshaft and axle shaft axes do not intersect - the prop will normally enter the axle casing below the centreline. The teeth in hypoid gears have a sliding contact which is less efficient than a spiral bevel, but more efficient than a worm. The greater tooth contact area makes up for the poorer efficiency by increasing durability, though they can be hard on oil due to the high pressure shear between the teeth. Because of the sliding contact that hypoid gears make, their hydrodynamic contact pressure is higher. Extreme pressure gear oil was devised to cope with the peculiar sliding contact between hypoid gear teeth. Hypoid axles tend to be quieter and smoother than spiral bevel axles and bigger ratios can be achieved. They also take up less space than bevel or straight-cut gears.

Oils are made from base stocks, refined and then mixed with additives to improve them. The API (American Petroleum Institute) devised the GL system in 1969 in order to standardise the numerous equipment manufacturers, government and military automotive transmission oil specifications. Definitions were written for six grades of oil, designated GL-1 to GL-6 which varied according to the severity of operation and type of gear. GL-1 was for the mildest of conditions for use in spiral bevel and worm gears, GL-6 the most severe used in high offset hypoid differentials where there is a significant proportion of sliding as well as rolling friction. GL-4 differs from GL-5 by the amount these additive chemicals are mixed into the oil. The additives prevent friction wear, but the sulphur-containing components can attach 'yellow metal' components. To achieve the GL-4 rating, the EP oil has to pass the ASTM D-130 test. This test determines how reactive the sulphur is against a polished copper strip. During the test, the strip is also subjected to heating to simulate the running conditions in the gear box.

Gear oil formulations contain yellow metal corrosion inhibitors (also called copper passivators) to prevent corrosion of yellow metal components. Gear oil standards will also commonly include copper corrosion tests. It is important, however, when choosing a gear oil to ensure it has an appropriate GL rating and Viscosity grade.

Common examples of Extreme Pressure additives are molybdenum disulphide, graphite, sulphurised olefins and dialkyldithiocarbamate complexes. Sulphur-phosphorus EP additives are somewhat corrosive to yellow metals (those that contain copper) particularly at temperatures higher than 60 °C. Depending upon the amount used, sulphur-phosphorus EP additives may not be compatible with oils containing zinc anti-wear (AW) additives. That is why it is not recommended to mix AW gear oils with EP gear oils. Why use copper-containing materials for gears in the first place? Brass and bronze are easy to machine into different shapes and yet have good strength and hardness. It all comes down to economics.



Viscosities can be related horizontally only. For example, the following oils have similar viscosities: ISO 460, AGMA 7 and SAE GEAR OIL 140.

The viscosity/temperature relationships are based on 95 VI oils and are usable only for mono grade engine oils, gear oils and other 95 VI oils.

Crankcase oils and gear oils are based on 100°C viscosity. The "W" grades are classified on low temperature properties. ISO oils and AGMA grades are based on 40°C viscosity.

10.3 SAE Viscosity Classifications

10.3.1 The American SAE (SAE J-300) Classifications of Engine and Gear Oils are made on the basis of viscosity characteristics only, they consist of numerical series, one for engine oils and another for gear oils. The two series are not related and are such that an engine oil and a gear oil that have the same viscosity when measured by a Standard Method will have a totally different SAE number.

10.3.2 Where the SAE number includes the letter W (Winter grade), limiting values for viscosity are given. Maximum viscosity values for tests at specified lower temperatures are detailed together with a minimum viscosity at the specified higher temperature.

10.3.3 When an SAE classification is shown with two numbers e.g., SAE 10W-30, this indicates that the oil is a multigrade and has the viscosities equivalent to the "W" grade when determined at the lower temperatures and the viscosity characteristics of the non "W" grade at operating temperatures.

10.3.4 In some circumstances, SAE numbers are used incorrectly to classify other types of lubricating oil. This practice should not be followed as the oil so classified may not necessarily meet all the viscosity requirements for the given number. Lubricating oils other than automotive oils should be classified in accordance with the ISO VG Classification as shown in **10.2**.

10.4 Engine Oils

SAE Number	Viscosity Range			
	Low Temperature Cranking Viscosity	Low Temperature Pumping Viscosity With No Yield Stress	Low Shear Rate Kinematic Viscosity at 100°C	
	Centipoise Max	Centipoise Max	Centistokes Min	Centistokes Max
0W	6,200 at –35°C	60,000 at –40°C	3.8	-
5W	6,600 at –30°C	60,000 at –35°C	3.8	-
10W	7,000 at –25°C	60,000 at –30°C	4.1	-
15W	7,000 at –20°C	60,000 at –25°C	5.6	-
20W	9,500 at –15°C	60,000 at –20°C	5.6	-
25W	13,000 at –10°C	60,000 at –15°C	9.3	-
16			6.1	< 8.2
20			6.9	< 9.3
30			9.3	<12.5
40			12.5	<16.3
50			16.3	<21.9
60			21.9	<26.1

Multigrade oils were first developed some 50 years ago to avoid the old routine of using a thinner oil in winter and a thicker oil in summer. Multigrade oils are loaded with plastic long chain polymers, to hold the viscosity with temperature. They should not be used in gearboxes, since the plastic will not survive the mechanical forces and will be rapidly reduced to their base stock - a 15W/40 will become merely SAE 15 very rapidly.