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. A 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, eg 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

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

GREASE DEFINITIONS

Consistency – is the degree of hardness of a grease and may vary considerably with temperature. This has been classified by the National Lubricating Grease Institute (NLGI) into the following categories:

NLGI GRADE	PENETRATION @ 25°C (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

Oil Separation – is the percentage of oil which separates from the grease under static (eg. storage) conditions. It cannot predict separation tendencies in use under dynamic conditions.
High Temperature Stability – is the ability of a grease to retain it's consistency, structure and performance at temperatures above 125°C.

GREASE SERVICE CLASSIFICATION

There are 5 categories for Automotive Service Greases developed by the NLGI. The classification (ASTM D 4950) covers greases designed for the lubrication of chassis components and wheel bearings of passenger cars, trucks and other vehicles. The NLGI classifies automotive service greases into two main groups. Chassis greases, designed by the prefix L and Wheel Bearing greases designated by the prefix G.

These are shown in the following table.

CATEGORY	SERVICE	PERFORMANCE
LA Chassis	Frequent relubrication intervals (<3200 km). Mild duty (non-critical applications).	Oxidation resistant, shear stable, and corrosion and wear protective.
LB Chassis	Prolonged relubrication intervals (>3200 km). Mild to severe duty (high loads, vibration, exposure to water).	Oxidation resistant shear stable, and corrosion and wear protective even under heavy loads and in presence of aqueous contamination. Temperature range: -40˚C to 120˚C
GA Wheel Bearings	Frequent lubrication intervals. Mild duty (non-critical applications).	Temperature range: -20˚C to 70˚C
GB Wheel bearings	Mild to moderate duty (cars, trucks in urban and highway service).	Oxidation and evaporation resistant, shear stable and corrosion and wear protective. Temperature range: – 40˚C to 120˚C with occasional excursions to 160˚C.
GC Wheel Bearings	Mild to heavy duty (vehicles in frequent stop-and-go service, trailer hauling, mountain driving, etc)	Oxidation and evaporation resistant, shear stable, and corrosion and wear protective. Temperature range: – 40˚C to 120˚C with frequent excursions to 200˚C.

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 straight Lithium, Lithium Complex and Calcium Complex greases remain stable for a long time. Aluminium Complex greases tend to set and harden, but remain stable. Bentone and Barium greases tend to soften on aging. Based on these observations: The shelf life of most Penrite greases is about 5 years.However, Steering Box Lubricant and Semi Fluid Grease only have a 2 year shelf life.

GREASE TYPES

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

THICKENER	DROP POINT°C	MAX SERVICE CONTINUOUS OPERATING TEMP°C	HIGH TEMP USE	STRUCTURE	SHEAR STABILITY	WATER RESISTANCE
Calcium	100	<80	☐	☐	◯	■
Lithium	160 - 200	125	■	☐	■	■
Calcium complex	>260	150	■	☐◿	■	■
Lithium complex	>240	160	■	☐	■	■
Aluminium complex	>260	150	■	☐◸	■	■
Barium complex	>200	150	■	◹	◯	■
Polyurea	>230	150	■	■	■	■
Bentone	NA	150	■	☐	◯	■
Sodium	170 - 190	125	■	◹	■	☐

☐ Very Poor ☐ Poor ◯ Fair ■ Good ■ Excellent
◿ Buttery ☐ Smooth ◹ Fibrous ◸ Gel ■ Opaque

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 incompatible, the mixture will not meet the properties of the individual greases and in some cases, the greases will fall apart. The below table provides a rough guide.

It is strongly advised that, in all cases, the old grease be purged or cleaned out from the system before a new one is introduced. However, compatibility between greases is 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		✔	✔	✔	●	✘	✔	✘	✘
Lithium	✔		✔	✔	●	●	✔	✘	●
Calcium Complex	✔	✔		●	✘	●	●	✘	✘
Lithium Complex	✔	✔	●		●	●	✔	✘	●
Aluminium Complex	✘	●	✘	●		✘	●	✘	✘
Barium Complex	✘	●	●	●	✘		●	✘	✘
Polyurea	✔	✔	●	✔	●	●		✘	✘
Bentone	✘	✘	✘	✘	✘	✘	✘		✘
Sodium	✘	●	✘	●	✘	✘	✘	✘	

✔ Compatible ✘ Incompatible I Borderline

GREASE APPLICATIONS

Greases are used instead of oils in many applications. They find use 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 bearings*

*(Note that extreme pressure greases are not generally recommended in electric motors.)

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