

## CHAPTER 3

# GREASES

### Introduction

1. There are locations on every aircraft and aero engine installation, where grease is the preferred method of lubrication. Grease will lubricate moving parts, will help to exclude dust and grit, and can also act as a seal against the ingress of moisture. With their high retentive properties greases are used in applications where oil would not be retained, or where a continuous supply of fresh lubricant is not provided. Most bearings that are not supplied by an oil circulating system, are lubricated with grease. A single application of grease to a bearing or surface, can afford sufficient lubrication for long periods, and in the case of pre-packed bearings, for life. Grease however, cannot replace oil where heat is required to be dissipated by the lubricant, or where undesirable materials need to be flushed away by a circulatory system.

### Composition

2. Grease is a composition of a thickening or gelling agent and a liquid lubricant. It ranges in texture from a semi-fluid to a semi-solid, and may contain additives that will give it the special qualities required for particular applications. There are two categories of thickening agents, these are:

- Soap.
- Non-soap or gel.

3. **Soap.** The soaps, or metallic soaps, as they are sometimes referred to, were the original thickening agents and are still extensively used. They are made by processing certain alkalis and fatty acids. The most common alkalis used are calcium (lime), lithium and aluminium hydroxides. Each alkali, when combined with one of the many fatty acids, will make a metallic soap base that has particular properties.

4. **Non-soap gel.** The non-soap or gel thickeners were researched and developed to satisfy the requirements for greases with high temperature performance capabilities. They are processed from certain clays, Bentonite, and Hectorite clays are the most common. Silica Gel and some organic substances, such as substituted urea are also processed as non-soap thickening agents.

5. Each soap or non-soap base is combined with the selected mineral, vegetable or synthetic lubricating oil to produce the required grease.

### Additives

6. To further improve the natural properties of a grease; additives are included in its composition. They may be extreme pressure, anti-oxidant or anti-seize additives.

7. Extreme pressure additives are required where continuous heavy loads are imposed on bearings or surfaces that are grease lubricated. These conditions could, **IF THE WRONG GREASE IS USED**, cause the boundary lubrication to rupture and allow surface to surface contact, promoting wear and possible seizure.

8. Anti-oxidant additives are required to retard oxidation which will always occur when greases and oils are exposed to heat, although some are more susceptible to oxidation than others. Oxidation adversely affects the structure of the grease, one of the results being the formation of acid, which would cause corrosion on some metal surfaces. This process may start at room temperature, consequently an anti-oxidant will help to prolong shelf life.

9. The anti-seize additives are graphite and molybdenum disulphide. They have a flaky or lamina structure, the particles of which when rubbed together interlock to form a very good anti-friction surface. They are stable at high temperatures, and are used where boundary lubrication or fretting corrosion is a problem.

### Requirements

10. To ensure that a grease will perform to a required standard, it is subjected to a number of tests during its manufacture. These will include tests for consistency, which is its firmness or hardness. If a grease is too hard, it will not release sufficient oil for lubrication purposes, if it is too soft it will not stay in place. The importance of this becomes apparent with a grease lubricated bearing, the grease must both lubricate and remain in position at all speeds and temperatures.

11. Another test is to establish the drop point, or melting point. A sample of grease is heated in a small cup with a hole in its bottom. The point at which the first droplet of grease falls through the hole is the drop point temperature. The result will help to determine the working temperature range of the grease. It follows that the maximum working temperature is always well below the drop point.

12. Further tests will be carried out for oxidation, and separation, which is the amount of oil separation from the grease whilst it is in storage. There is also a test to ascertain the load carrying capacity, this is particularly important for extreme pressure greases.

13. These and other tests are required for a grease to qualify for a particular specification.

### Types and Uses

14. **Calcium base greases.** Calcium (lime) soap base greases although highly resistant to the effects of water, include water in their composition, which is necessary to keep them structurally stable. However, high temperatures tend to evaporate the water binder, and cause the grease to break down into its oil and base components. Its use is therefore limited to the lower temperature range. Their water resistant qualities make calcium base greases ideal for use in a marine environment.

15. **Soda base grease.** Soda (Sodium) soap base greases perform well at high temperatures, and exhibit good structural stability. However, the soda soap is soluble in water, and is easily washed away. Soda base greases are not suitable in wet conditions, and their Service use is very limited.

16. **Lithium base greases.** Lithium soap base greases have the advantage of being both water resistant, and also of being able to withstand fairly high temperatures. They are often used as multi-purpose greases, and have a wide Service use.

## Identification

17. A grease can be identified only by the authorized markings on its container. The appearance of a grease should not be used as a method of identification.

TABLE 4.3.1 AVIATION GREASES

NATO CODE NUMBER	JOINT SERVICE NOMENCLATURE	REMARKS
G 357	XG 273	Lubrication for Bowden cables.
G 353	XG 276	For splines – heavily loaded sliding surfaces.
G 366	XG 284	General purpose a/c and helicopter anti-fretting.
G 354	XG 287	A/c gears – actuators – highly loaded mechanisms.
G 395	XG 293	A/c multipurpose – gear boxes – accessories.
	XG 344	Lubricant for certain turbine engine starters.
S 270	ZX 13	Anti seize grease for sparking plug threads.

18. The following is an explanation of Joint Service nomenclature.

**LG – Calcium base grease.** Consisting mainly of calcium (lime) soap and mineral oil. These greases have good water resistant properties. Suited for use in a marine environment.

**XG – miscellaneous greases.** Includes greases made from unspecified soaps, such as those of aluminium or lithium. The group also includes greases containing synthetic oils, graphite, fatty oils, or other additives.

**Numbers.** The numbers following the letters are known as the Penetration number, and are an indication of the consistency of a grease. It is arrived at by submitting a sample of the grease to a test which determines how firm or how soft a grease is at a selected temperature. The softer the grease, the higher the number.

**ZX – Speciality, miscellaneous.** This designation covers those products that are not covered by other groups. It includes cutting oils, anti-seize compounds and oils for special lubricating and damping purposes.

**PX – Protective, miscellaneous.** Covers a range of corrosion preventive compounds and oils used for temporary protection of metal equipment. Temporary does not refer to the length of time that it is effective as a corrosion preventive but that it is easily removed.

**Note.** The numbers following the ZX and PX do not relate to any physical characteristics of the material but are identification numbers only.

### **Contamination**

19. Care must be taken to prevent contamination of greases by water or other fluids, dirt and grit etc. It is therefore essential that grease guns, dispensing equipment, and containers are kept clean and lids replaced after use. Any form of contamination can destroy some particular quality of a grease rendering it unfit for use.

20. Deterioration may occur through separation of the oil and soap at high temperatures, particularly with low temperature greases. Greases should therefore be stored in a cool place.



This file was downloaded  
from the RTFM Library.

Link: [www.scottbouch.com/rtfm](http://www.scottbouch.com/rtfm)

Please see site for usage terms,  
and more aircraft documents.