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NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Boeing Service Letter dated August 12, 1993

(11 Pages)

BOEING

SERVICE LETTER

Customer Services Division

FIELD SERVICE ENGINEERING ☐ BOEING COMMERCIAL AIRPLANE GROUP ☐ P.O. BOX 3707 ☐ SEATTLE ☐ WASHINGTON 98124-2207

[redacted]

707-SL-20-12
727-SL-20-22
737-SL-20-27
747-SL-20-44
757-SL-20-22
767-SL-20-22
ATA: 2030-23
August 12, 1993

SUBJECT: SUMMARY OF MOST COMMONLY USED GREASES ON BOEING AIRPLANES

MODEL: 707, 727, 737, 747, 757, 767

APPLICABILITY: All

SUMMARY:

The purpose of this service letter is to describe the basic properties, composition, characteristics, and general applications of the four greases most commonly used on Boeing airplanes, and give examples of specific applications.

DISCUSSION:

Boeing uses a variety of grease types for lubricating a wide range of components on the various airplane models. However, for the vast majority of applications, only four different types of grease are employed. These commonly used grease types are listed below and are discussed in detail in the attachment to this service letter.

1. MIL-G-23827
2. MIL-G-21164
3. MIL-G-81322
4. BMS 3-24

SUGGESTED OPERATOR ACTION:

This information is provided for reference only and no change or action is required as a result of the release of this service letter. Any specific grease application should be per the appropriate maintenance manual (chapter 12 and/or 20), maintenance planning document, or component/overhaul manual.

RELATED INFORMATION:

This information was derived from several sources, including the internal Boeing Design Manual, internal Boeing experiments, MIL specifications, and lubrication sections in applicable Boeing maintenance manuals for each of the airplane models listed above.

[redacted]
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707/727/737/747/747-400/757/767
Service Engineering Managers

LJH/jf

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

References

a) QPL-23827-21
b) QPL-21164-23
c) QPL-81322-17
d) BMS 3-24, QPL Rev A

Limitations

No attempt is made in this document to provide detailed chemical or performance comparisons for any of the greases discussed, nor is any specific application recommended or implied. All specific applications should be per the appropriate maintenance manual, maintenance planning document, and/or component/overhaul manual. Furthermore, any apparent grease usage overlap in the specific examples given below, is due to empirical testing and analysis done during the design of specific components/systems.

Grease Types

Following are the greases that will be discussed in this attachment:

MIL-G-23827
Aeroshell Grease 7, Royco 27, Braycote 627, Exxon 627, Supermil Grease A72832, TG-11900 Low Temp Grease EP, Batco 23827, Castrolease AI Grease, Convoy 27, 827 Grease, Shell Aviation Grease 7

MIL-G-21164
Aeroshell Grease 17, Braycote 664, Royco 64, Everlube 211-G Moly Grease, PQ Moly Grease 353

MIL-G-81322
Aeroshell Grease 22, Mobilgrease 28, Royco 22, Aeroshell Grease 22C, Convoy 322H, 322 Grease, Arpolube 81322, Braycote 622, Chevron W-T, GN-22

BMS 3-24
Aeroshell 16, Braycote 660

Categories

Several other grease types are used on Boeing airplanes and their types and applications are described in the applicable maintenance manual. However, since their use is limited, they will not be discussed here. Each of the above grease types are discussed in terms of the following categories:

1. General characteristics and properties
2. General applications
3. Examples of specific applications
4. Some advantages and disadvantages of each grease type

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

MIL-G-23827

GENERAL PROPERTIES AND CHARACTERISTICS

MIL-G-23827 is a synthetic diester oil base product. It is thickened by either clay, as in Aeroshell 7, or lithium soap as in Royco 27. The operating temperature range of this lubricant is -100 to +250 degrees F (-73 to +121 degrees C).

GENERAL APPLICATIONS

Due to the excellent low temperature characteristics of MIL-G-23827, it is used in a wide variety of applications covering all airplane models including instrument bearings and rolling elements (ball, roller, and needle bearings), highly loaded gears, splined couplings, actuator screws, sliding and rolling surfaces and general airframe lubrication.

EXAMPLES OF SPECIFIC APPLICATIONS

This grease has long been the lubricant favored for general use on Boeing airplanes. MIL-G-23827 is used extensively throughout all models. Some of the various locations this grease is used include leading and trailing edge flaps/slats systems, elevator control systems, horizontal stabilizer trim control systems, rudder systems, aileron control systems, doors, and landing gear systems.

This grease is used extensively in sealed and unsealed bearings and bushings throughout all models of Boeing airplanes. Most gearboxes and mechanical actuators that employ grease as a lubricant use MIL-G-23827. Torque tube couplings, stabilizer jackscrews, main and auxiliary flap and slat tracks, and landing gear drag struts and trunion bearings are a few of the many other areas of application for MIL-G-23827.

ADVANTAGES AND DISADVANTAGES

MIL-G-23827 grease has demonstrated excellent lubrication and corrosion protection qualities when used in sufficient quantity. It exhibits superior low temperature drag torque – an advantage that, when used in system components, can result in lower power requirements. Good load carrying capability is another advantage that contributes to the wide usage of this grease. Additionally, MIL-G-23827 has very low volatility.

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

MIL-G-23827 continued

ADVANTAGES AND DISADVANTAGES

Another advantage of this grease is that while it is hygroscopic (absorbs water), it retains the ability to resist corrosion even when the grease is nearly saturated with water. Tests have shown that MIL-G-23827 will absorb up to 50% of its volume in water without losing corrosion protection, providing that a sufficient quantity of grease is present to cover component surfaces. It is generally considered advantageous for grease to absorb rather than repel water in a gearbox or mechanical actuator because moisture that is not absorbed may become entrapped in discrete locations and form ice during long cold soak conditions when the gearbox is inactive. The ice may then impart severe resistance to gearbox start-up.

In some cases, MIL-G-23827 may tend to "dry out" and lose its lubricating and corrosion protection properties if not used in adequate quantities. The low oil viscosity may result in a higher rate of separation of oil or "bleeding" of the oil than is generally seen in high temperature greases. This oil separation or "bleeding" may also be accelerated if clay thickened and lithium soap thickened greases are mixed.

Some incompatibility may exist between MIL-G-23827 greases that are thickened with clay and those thickened with lithium soap. Therefore, intermixing of brand name greases that employ different thickening systems should be avoided.

This grease is incompatible with MIL-G-81322 grease and due to the diester base oil is incompatible with BMS 10-100 paint as well. Contact with this paint by MIL-G-23827 grease will cause the paint to deteriorate and eventually dissolve. The base oil is also known to attack and degrade phenolic compounds.

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

MIL-G-21164

GENERAL PROPERTIES AND CHARACTERISTICS

This grease is also a synthetic diester oil base product. It is thickened by either clay or lithium soap. MIL-G-21164 is virtually identical to MIL-G-23827 except that 5% molybdenum disulphide is added. In some applications, Boeing maintenance manuals allow interchanging the two. The added moly-disulphide increases the load carrying capability of the grease. The operating temperature range is also -100 to +250 degrees F (-73 to +121 degrees C).

GENERAL APPLICATIONS

Applications involving MIL-G-21164 include plain bushings, plain spherical bearings, sliding surface bearings (particularly on heavily loaded sliding surfaces), and gears and mechanical actuators where contact and sliding stresses are exceptionally high.

EXAMPLES OF SPECIFIC APPLICATIONS

MIL-G-21164 has been or is currently being used in several locations on Boeing airplanes including 707/727/737 landing gear components, 707 main gear lock mechanism, 767 TE flap offset and offset tee gearboxes, pressure stop pins and bearing plates on 767 overwing escape hatches and cargo doors, hook roller attach bolt on 767 standard forward and aft cargo doors, 757 TE flap torque tube couplings, 747 JT9D spare engine strut winch bearings and gears, and attach fittings of 767 wing nacelles.

ADVANTAGES AND DISADVANTAGES

The primary advantage of MIL-G-21164 is its excellent load carrying capability. It also exhibits low breakaway friction and is effective at extreme low temperatures as well as over a wide temperature range.

A disadvantage of MIL-G-21164 is that it tends to contribute to interior bearing corrosion which makes it unsuitable for use in rolling element and sealed bearings or bearings which have no relubrication provisions. It is believed that the "moly" may attract moisture and if not replaced periodically, the grease may develop degraded corrosion protection. Additionally, it may "dry out" and lose its lubricating and corrosion protection properties if not used in adequate quantities. This grease also is not acceptable for use on friction devices such as braking components.

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

MIL-G-21164 continued

ADVANTAGES AND DISADVANTAGES

MIL-G-21164 is incompatible with phenolic compounds, BMS 10-100 paint, and also with MIL-G-81322 grease. Furthermore, the molybdenum disulphide in MIL-G-21164 gives the grease a dark black color which will aggressively soil and stain fabrics.

Some incompatibility may exist between MIL-G-21164 greases that are thickened with clay and those thickened with lithium soap. Therefore, intermixing of brand name greases which use different thickening agents should be avoided.

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

MIL-G-81322

GENERAL PROPERTIES AND CHARACTERISTICS

This grease is a polyalphaolefin oil base product and is non-soap thickened. The operating temperature range is -65 to +350 degrees F (-54 to +177 degrees C). Some brand names are Aeroshell 22, Mobil 28, and Royco 22.

GENERAL APPLICATIONS

MIL-G-81322 grease is generally used in locations where film lubrication is the primary mode of resisting drag friction. It is used in aircraft wheel bearings, airframe lubrication, landing gear wheel assemblies, oscillating bearings, and some mechanical actuators.

EXAMPLES OF SPECIFIC APPLICATIONS

MIL-G-81322 is currently used in the 767 leading edge slat offset gearbox due to the presence of phenolic impregnated fiber friction discs which are adversely affected by MIL-G-23827 type greases. MIL-G-81322 is also used in Boeing airplane wheel bearings.

ADVANTAGES AND DISADVANTAGES

Some tests on grease films have shown that sliding resistance at extreme low temperatures (-65 degrees F) may be less for MIL-G-81322 than for MIL-G-23827. However, start-up and drag torque at these low temperatures increase dramatically when some quantity of grease must be moved or cycled. This limits the usability of the grease in gearboxes and mechanical actuators.

Because of its high operational temperature range, MIL-G-81322 is a good choice for high temperature applications such as high speed bearings. MIL-G-81322 is considered a hydrophobic lubricant (repels water). This may be a disadvantage in applications where irregular, rotating parts are stationary during long, cold soak conditions when moisture that has been repelled may collect and form ice. In other applications, a hydrophobic grease may be an advantage. Each application must be considered individually, understanding that with hydrophobic greases, water is repelled and water droplets can form at the grease/metal boundary and contribute to local rust. Hygroscopic greases will absorb water so that no droplets are formed but the overall corrosion resistance of the grease water mixture may become somewhat degraded.

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

MIL-G-81322 continued

ADVANTAGES AND DISADVANTAGES

MIL-G-81322 greases should not be used around butyl rubber (used in some seals) because they cause the material to swell severely. This grease also exhibits inferior resistance to varnish formation, bleed out, and evaporation and the corrosion prevention and lubrication capability is marginal at -100 deg F (-73 deg C).

In some cases (due to the variations in specific product formulations), MIL-G-81322 is incompatible with MIL-G-23827 grease and therefore the two greases should not be intermixed.

MIL-G-81322 replaces the following obsolete grease specifications: MIL-G-25760 (polyester oil based), MIL-G-7711 (mineral oil based), and MIL-G-3545 (mineral oil based).

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

BMS 3-24

GENERAL PROPERTIES AND CHARACTERISTICS

This grease is a synthetic polyolester plus mineral oil base product. It is a clay thickened product. The operating temperature range of BMS 3-24 is -65 to +350 degrees F (-54 to +177 degrees C). Trade names for BMS 3-24 are Aeroshell 16 and Braycote 660.

GENERAL APPLICATIONS

BMS 3-24 is generally used for applications such as lubricating balance panel hinges, piano type hinges, and some rolling element bearings (ball, roller and needle), and carbon steel control cables.

EXAMPLES OF SPECIFIC APPLICATIONS

BMS 3-24 is used on carbon steel control cables on all Boeing airplane models, the 767 entry service door sliding shaft and numerous carbon steel control cables, 727 main landing gear lock, 747 main entry doors secondary fixed pin, 737 rudder and elevator hinge fittings, 757 elevator hinge, power control actuator and input linkage, 757 rudder and aileron hinges, 737 flap track and linkage, 737 elevator control push rod, and the 767 number 2 window ball screw.

ADVANTAGES AND DISADVANTAGES

The combination of good high temperature performance and excellent corrosion preventative properties keep BMS 3-24 on the Boeing list of preferred greases for the above types of applications. It displays good resistance to leaching by airplane maintenance fluids and is compatible with BMS 3-11 resistant elastomers. It is ideal for excluding moisture and providing corrosion protection for some exposed surfaces such as carbon steel cables. It exhibits dramatic increases in start-up and drag torque characteristics at low temperatures and is therefore not recommended where grease must be moved or cycled after long exposure to freezing temperatures.

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SUMMARY OF GREASES MOST COMMONLY USED ON BOEING AIRPLANES

BMS 3-24 continued

ADVANTAGES AND DISADVANTAGES

The Boeing specification, BMS 3-24, was initially created to insure that the Aeroshell 16 formulation (originally qualified to MIL-G-25760) was retained when the three specifications, MIL-G-25760, MIL-G-7711, and MIL-G-3545, were made obsolete and combined into one spec, MIL-G-81322. This resulting specification was considered to be too broad for some existing applications and the products qualified to the new specification lacked some of the excellent corrosion protection experienced with Aeroshell 16. Therefore, as noted above, BMS 3-24 is still preferred for some applications at Boeing.

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