SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE J310 | REV. APR90

Issued 1951-09
Revised 1990-04

Superseding J310 AUG87

(R) AUTOMOTIVE LUBRICATING GREASES

1. SCOPE:

This SAE Recommended Practice was developed by (1) SAE, and the section "Standard Classification and Specification for Service Greases" cooperatively with (2) ASTM, and (3) NLGI. It is intended to assist those concerned with the design of automotive components, and with the selection and marketing of greases for the lubrication of certain of those components on passenger cars, trucks, and buses. The information contained herein will be helpful in understanding the terms related to properties, designations, and service applications of automotive greases.

2. REFERENCES:

1. Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2. ASTM, 1916 Race St., Philadelphia, PA 19103.

3. National Lubricating Grease Institute, 4635 Wyandotte St., Kansas City, MO 64112.

2.1 Applicable Documents:

SAE J1146	Automotive Lubricant Performance and Service Classification and Maintenance Procedure
ASTM D 128	Analysis of Lubricating Grease
ASTM D 217	Cone Penetration of Lubricating Grease
ASTM D 566	Dropping Point of Lubricating Grease
ASTM D 942	Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method

2.1 (Continued):

ASTM D 972	Evaporation Loss of Lubricating Oils and Greases
ASTM D 1092	Apparent Viscosity of Lubricating Greases
ASTM D 1263	Leakage Tendencies of Automotive Wheel-Bearing Greases
ASTM D 1264	Water Washout Characteristics of Lubricating Greases
ASTM D 1403	Cone Penetration of Lubricating Grease Using One-Quarter and One-Half Scale Cone Equipment
ASTM D 1478	Low Temperature Torque of Ball Bearing Greases
ASTM D 1741	Functional Life of Ball-Bearing Greases
ASTM D 1742	Oil Separation from Lubricating Grease During Storage
ASTM D 1743	Corrosion Preventive Properties of Lubricating Greases
ASTM D 1831	Roll Stability of Lubricating Grease
ASTM D 2265	Dropping Point of Lubricating Grease of Wide Temperature Range
ASTM D 2266	Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)
ASTM D 2509	Measurement of Extreme-Pressure Properties of Lubricating Grease (Timken Tester)
ASTM D 2595	Evaporation Loss of Lubricating Grease Over Wide-Temperature Range
ASTM D 2596	Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)
ASTM D 3232	Measurement of Flow Properties of Lubricating Greases of High Temperatures
ASTM D 3527	Life Performance of Automotive Wheel Bearing Grease
ASTM D 4170	Fretting Wear Protection by Lubricating Grease
ASTM D 4289	Compatibility of Lubricating Grease with Elastomers
ASTM D 4290	Leakage Tendencies of Automotive Wheel Bearing Grease Under Accelerated Conditions
ASTM D 4693	Low Temperature Torque of Greased-Lubricated Wheel Bearings
ASTM D 4950	Standard Classification and Specification for Automotive Service Greases

2.1 (Continued):

Ford Ball-Joint Grease Test

NLGI Method, Matching Lubricating Grease Flow Properties with Lubricating Grease Dispensing Pump Delivery Behavior at Low Temperatures

3. DEFINITIONS OF LUBRICATING GREASE:

A lubricating grease is a solid to semifluid mixture of a fluid lubricant and a thickening agent. Additives to impart special properties or performance characteristics may be incorporated. The fluid component may be a mineral (petroleum) oil or a synthetic fluid; the thickener may be a metallic soap or soaps or a nonsoap substance such as an organophilic modified clay, a urea compound, carbon black, or other material. The soaps commonly used are lithium, calcium, sodium, aluminum, and barium, or certain combinations of these with other materials, such as calcium-lead. The viscosity of the fluid, the thickener concentration, and the chemical nature of the thickener may vary widely. The properties of the finished grease are influenced by the manufacturing process as well as by the materials used.

4. BASIC PERFORMANCE REQUIREMENTS:

Greases are most often used instead of fluids where a lubricant is required to maintain its original position in a mechanism, especially where opportunities for frequent relubrication may be limited or economically unjustifiable. This requirement may be due to the physical configuration of the mechanism, the type of motion, the type of sealing, or to the need for the lubricant to perform all or part of any sealing function in the prevention of lubricant loss or the entrance of contaminants. Because of their essentially solid nature, greases do not perform the cooling and cleaning functions associated with the use of a fluid lubricant. With these exceptions, greases are expected to accomplish all other functions of fluid lubricants.

A satisfactory grease for a given application is expected to:

a. Provide adequate lubrication to reduce friction and to prevent harmful wear of bearing components.

b. Protect against corrosion.

c. Act as a seal to prevent entry of dirt and water.

d. Resist leakage, dripping, or undesirable throw off from the lubricated surfaces.

e. Resist objectionable change in structure or consistency with mechanical working (in the bearing) during prolonged service.

f. Not stiffen excessively to cause undue resistance to motion in cold weather.

g. Have suitable physical characteristics for the method of application.

4. (Continued):

h. Be compatible with elastomer seals and other materials of construction in the lubricated portion of the mechanism.

i. Tolerate some degree of contamination, such as moisture, without loss of significant characteristics.

j. Have suitable oxidation and thermal stability for the intended application.

5. PROPERTIES OF GREASES:

5.1 Consistency:

A measure of relative hardness. This property is commonly expressed in terms of the ASTM penetration or NLGI consistency number. The ASTM penetration is a numerical statement of the actual penetration of the grease sample, in tenths of a millimeter, by a standard test cone under stated conditions. The higher the penetration value, the softer the grease. The National Lubricating Grease Institute classifies greases according to their ASTM penetration as shown in Table 1.

The consistency of a grease is an important factor in its ability to lubricate, seal, and remain in place, and to the methods and ease by which it can be dispensed and applied. Most automotive greases are in the NLGI No. 1, 2, or 3 range, that is, ranging from soft to medium consistency.

TABLE 1 - NLGI Consistency Number

NLGI Consistency No.	ASTM Worked (60 Strokes) Penetration at 25°C (77°F) tenths of a millimeter[a]	NLGI Consistency No.	ASTM Worked (60 Strokes) Penetration at 25°C (77°F) tenths of a millimeter[a]
000	445 to 475	3	220 to 250
00	400 to 430	4	175 to 205
0	355 to 385	5	130 to 160
1	310 to 340	6	85 to 115
2	265 to 295		

[a]ASTM D 217 Cone Penetration of Lubricating Grease.

5.2 Texture and Structure:

The appearance and feel of greases. A grease may be described as smooth, buttery, fibrous, long- or short-fibered, stringy, tacky, etc. These characteristics are influenced by the viscosity of the fluid, type of thickener, proportion of each of these components, presence of certain additives, and process of manufacture. There are no standard test methods for quantitative definitions of these properties. Texture and structure are factors in the adhesiveness and ease of handling of a grease.

5.3 Structural Stability:

The ability of a grease to retain its as-manufactured consistency and texture despite age, temperature, mechanical working, and other influences, or its ability to return to its original state when a transient infuence is removed.

5.4 Mechanical Stability:

The resistance of a grease to permanent changes in consistency due to the continuous application of shearing forces.

The stability of a grease is important to its ability to provide adequate lubrication and sealing and to remain properly in place during use.

5.5 Apparent Viscosity:

The ratio of shear stress to rate of shear at a stated temperature and shear rate. Grease is by nature a plastic material. Therefore, the usual concept of viscosity valid for simple fluids (that is, internal resistance to flow) is not entirely applicable. The ratio of shear stress to shear rate varies as the shear rate changes. The apparent viscosity of most greases decreases with increase of either temperature or shear rate. Apparent viscosity greatly influences the ease of handling and dispensing a grease.

5.6 Dropping Point:

The temperature at which the grease generally passes from a plastic solid to a liquid state, and flows through an orifice under standard test conditions. The dropping point is incorrectly regarded by some as establishing the maximum temperature for acceptable use. Performance at high temperature also depends on other factors such as duration of exposure, evaporation resistance, and design of the lubricated mechanism.

5.7 Oxidation Resistance:

The resistance to chemical deterioration in storage and in service caused by exposure to air. It depends basically on the stability of the individual grease components, and can be improved by use of antioxidants. Oxidation resistance is important wherever long storage or service life is required or where high temperatures prevail even for short periods.

5.8 Protection Against Friction and Wear:

A protection greatly influenced by the viscosity and type of the fluid component and by grease structural and consistency characteristics. This performance characteristic can be altered by use of additives.

5.9 Protection Against Corrosion:

A protection of ferrous components achieved primarily by the inclusion of suitable additives in the grease. The effectiveness of the protection is influenced also by the chemical and physical properties, such as interactions with other additives, consistency and base oil viscosity (both of which will determine how effectively the grease will seal out corrosive and other undesirable material), and the interaction with water. The effect of water on the grease can be significant. Some greases are water resistant or waterproof, which means that they resist the washing effect of water and do not absorb it to any significant extent. Other greases can absorb varying amounts of water without appreciable damage to their structure or consistency, and may provide better rust protection than waterproof greases which can permit the accumulation of free water in bearings.

5.10 Bleeding or Oil Separation:

The separation of liquid lubricant from a grease. Slight bleeding is regarded as desirable by some as indicative of good lubricating ability in rolling element bearings.

5.11 Color:

A superficial grease property without performance significance.

Of the above properties, oxidation resistance, protection against friction and wear, protection against corrosion, and structural stability are probably of most importance in automotive service as far as actual performance in bearings is concerned.

There is, of course, the problem of getting grease to the bearings to be lubricated. Certain terms, by no means of strict, rigid interpretation, are used to describe the factors involved: feedability, pumpability, and dispensability.

5.12 Feedability, or Slumpability:

The ability to flow to the suction of the grease-dispensing equipment or mechanism to be lubricated.

5.13 Pumpability:

The ability to flow through the grease-dispensing lines at a satisfactory rate, without the necessity of using excessively high pressures.

5.14 Dispensability:

The ease with which a grease may be transferred from its container to the point of application. For practical purposes, it is a combination of feedability and pumpability.

6. GREASE TESTING:

Many of the above grease properties are determined by tests which have been standardized or otherwise accorded industry recognition. These, in conjunction with simulated performance tests, permit some approximate judgment for the proper selection of greases for a given application. They are, however, not considered to be replacements for, or equivalent to, longtime service tests.

Table 2 shows some of the more important tests, both standard and otherwise, identified as to sponsor, title, and purpose.

TABLE 2 – Grease Tests

Test Designation	Test Purpose
ASTM D 128, Analysis of Lubricating Grease	Determination of nominal chemical composition, such as soap, unsaponifiable matter (mineral oil), water, free alkalinity, free fatty acid, glycerine, and insolubles. NOTE: This procedure has a supplementary method useful for greases containing nonsoap thickeners or synthetic fluids.
ASTM D 217, Cone Penetration of Lubricating Grease	Measurement of relative hardness.
ASTM D 566, Dropping Point of Lubricating Grease	Establishment of temperature at which grease generally passes from plastic to liquid state; not regarded as indicative of service suitability; limited to dropping points up to 260°C (500°F). (In this test, some nonsoap-thickened greases may release oil before the grease flows which is defined as their dropping points.)
ASTM D 942, Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method	Determination of resistance to oxidation under static conditions in a sealed system at elevated temperatures, not indicative of the stability of greases under dynamic service conditions, nor the stability of greases stored in containers for long periods, nor the stability of films of grease on machine parts.
ASTM D 972, Evaporation Loss of Lubricating Oils and Greases	Evaluation of weight loss by evaporation at temperatures up to 149°C (300°F).
ASTM D 1092, Apparent Viscosity of Lubricating Greases	Determination of apparent viscosity in temperature range of -54 to 38°C (-65 to 100°F); results relatable to ease of handling and dispensing.

TABLE 2 (Continued)

Test Designation	Test Purpose
ASTM D 1263, Leakage Tendencies of Automotive Wheel-Bearing Greases	Evaluation of leakage tendencies from an unsealed wheel bearing assembly, run for 6 h at 104°C (220°F); permits screening candidate greases; not a replacement for longtime service tests. NOTE: It has been replaced by ASTM D 4290 in many updated specifications.
ASTM D 1264, Water Washout Characteristics of Lubricating Greases	Evaluation of resistance to water washout from rotating bearings at 38°C (100°F) and at 80°C (175°F) under prescribed conditions; not a replacement for actual service tests; not suitable for fibrous greases.
ASTM D 1403, Cone Penetration of Lubricating Grease Using One-Quarter and One-Half Scale Cone Equipment	Essentially same as ASTM D 217, using small grease samples, but reserved to greases of NLGI No. 0 to 4 consistency.
ASTM D 1478, Low Temperature Torque of Ball Bearing Greases	Determination of the extent to which a grease retards the rotation of a slow-speed ball bearing when subjected to temperatures below 0°F (-18°C). This method was developed using a test temperature of -65°F and greases with extremely low torque characteristics. Although higher test temperatures are commonly used, the precision statements may not apply to temperatures other than -65°F or to greases with torque characteristics different from those used to establish precision. NOTE: See also ASTM D 4693.
ASTM D 1741, Functional Life of Ball-Bearing Greases	Endurance life of grease lubricated 306 ball bearings at 3600 rpm; evaluation valid up to 125°C (257°F) operating temperature; is primarily a screening test and does not replace longtime service tests.
ASTM D 1742, Oil Separation from Lubricating Grease During Storage	Determination of tendency of oil constituent to separate from parent grease while in containers; suitable for NLGI No. 1 or harder greases; results are indicative of oil separation in containers, but not of oil separation under dynamic service conditions.

TABLE 2 (Continued)

Test Designation	Test Purpose
ASTM D 1743, Corrosion Preventive Properties of Lubricating Greases	Determination of surface damage due to corrosion, such as pitting, etching, rusting, or black stains on raceways and rollers of tapered roller bearings which have been run-in and stored for a prescribed period at a definite temperature and 100% relative humidity.
ASTM D 1831, Roll Stability of Lubricating Grease	Determination of changes in consistency after working in tester for 2 h at room temperature. Although test significance has not been determined, changes in worked penetration of a grease after rolling are believed to be an indication of its shear stability under conditions of this low shear test.
ASTM D 2265, Dropping Point of Lubricating Grease of Wide-Temperature Range	See remarks under ASTM D 566; test is also valid for high temperatures greases (up to 330°C (625°F)).
ASTM D 2266, Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)	Determination of wear preventive characteristics of grease when a rotating loaded steel ball slides against three similar stationary steel balls, measured by wear-scar diameters on stationary balls after completion of test; not indicative of results in actual service, and cannot distinguish between extreme-pressure (EP) and nonextreme-pressure (non-EP) greases.
ASTM D 2509, Measurement of Extreme-Pressure Properties of Lubricating Grease (Timken® Tester)	Determination of load carrying ability of lubricating greases by Timken® Lubricant and Wear Tester. In this device, a rectangular steel test block is forced against a rotating steel ring. Scar width and surface conditions are noted. Method differentiates between lubricants of various extreme-pressure levels; not a replacement for actual service tests.
ASTM D 2595, Evaporation Loss of Lubricating Grease Over Wide-Temperature Range	Evaluation of weight loss by evaporation at temperatures between 93 and 316°C (200 and 600°F).
ASTM D 2596, Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)	Load-carrying properties up to extremely high pressures: a. load-wear index (formerly mean-Hertz load) b. weld point by Four-Ball EP Tester

TABLE 2 (Continued)

Test Designation	Test Purpose
ASTM D 3232, Measurement of Flow Properties of Lubricating Greases at High Temperatures	Measurement of the flow properties of lubricating greases under high-temperature low-shear conditions.
ASTM D 3527, Life Performance of Automotive Wheel Bearing Grease	Evaluation of the high-temperature life performance of wheel bearing grease.
ASTM D 4170, Fretting Wear Protection by Lubricating Grease[a]	Evaluation of fretting wear protection characteristic by measuring mass loss of ball thrust bearings oscillated under load; correlates with fretting protection performance of greases in wheel bearings of passenger cars shipped long distances.
ASTM D 4289, Compatibility of Lubricating Grease with Elastomers	Determination of hardness and volume changes in elastomers caused by contact with lubricating grease.
ASTM D 4290, Leakage Tendencies of Automotive Wheel Bearing Grease Under Accelerated Conditions	Evaluation of leakage tendency of a grease from unsealed wheel bearings run 20 h at 1000 rpm and thrust loaded to 111 N (25 lb force). Unlike D1263, this method, which is conducted at a higher temperature, 160°C (320°F), differentiates among wheel bearing greases having distinctly different high temperature leakage characteristics.
ASTM D 4693, Low Temperature Torque of Greased-Lubricated Wheel Bearings	Determination of the viscous resistance of a grease in a wheel bearing assembly rotated at low speed in a low-temperature environment; used to evaluate both wheel bearing and chassis greases for performance in low-temperature service.
Ford Ball-Joint Grease Test	Evaluation of grease performance in tension and compression type automotive ball joints as determined by general surface condition, rust, joint and seal wear, and noise level under simulated service conditions.

TABLE 2 (Continued)

Test Designation	Test Purpose
NLGI Method, Matching Lubricating Grease Flow Properties with Lubricating Grease Dispensing Pump Delivery Behavior at Low Temperature[b]	Determination of ability of a pump to dispense a grease at a stated temperature, and therefore primarily a pump test; can supply comparative data on two or more greases using same pumping equipment and test temperatures.

[a]NLGI Spokesman, August 1983, page 156.
[b]NLGI Spokesman, May 1960, page 47.

7. DESIGNATION OF GREASES BY FIELDS OF USE:

Greases are commonly classified and designated according to chemical composition, such as lithium-soap grease; by broad type of usage, such as antifriction bearing grease or multipurpose grease; by specific properties such as high temperature grease; by special additives, such as extreme-pressure grease or graphite grease; and by specific applications, such as automotive-wheel-bearing grease. SAE recognizes the following designations for greases used in servicing passenger cars, trucks, and buses according to their specific applications.

7.1 Wheel-Bearing Grease:

Designates lubricating greases of such composition, structure, and consistency as to be suitable for longtime use in antifriction wheel bearings. The properties and composition of greases used in ball-type wheel bearings can be significantly different than those used in tapered roller-type wheel bearings. Generally, ball-type wheel bearings used in modern automotive vehicles are not serviceable.

NOTE: Generally, these greases have high resistance to the deteriorating effects of temperature and the separating effects of centrifugal action. They should have good antirust properties. They should not exhibit oil-soap separation or excessive softening which could result in leakage that could lead to braking failure.

7.2 Universal Joint Grease:

Designates lubricating greases of such composition, structure, and consistency as to be suitable for the lubrication of those types of automotive universal joints requiring grease lubrication.

NOTE: In many cases, the service relubrication of universal joints can be satisfied with NLGI categories LA or LB (Table 4). However, some designs, such as constant velocity joints, or some types of service, may require special greases. Manufacturers' recommendations or lubrication charts should be consulted.

7.3 Chassis Grease:

Designates lubricating greases of proper consistency to be applied periodically at intervals in accordance with equipment manufacturers' recommendations, with grease guns through grease fittings, into the various parts of automotive chassis requiring grease for lubricants.

NOTE: When no means are provided for periodic relubrication, the ability of a grease to retain its performance characteristics over long intervals of time and service becomes critical. This applies to seals as well since only seals in good condition can effectively bar the entrance of water, dirt, and other contaminents, and minimize loss of grease by leakage.

7.4 Multipurpose Grease:

Designates lubricating greases of such composition, structure, and consistency to meet the performance requirements for chassis grease (more than 3200 km (2000 mile) service life), wheel bearing grease, universal joint grease, and other automotive uses of a miscellaneous nature, such as fifth-wheel service.

NOTE: Some chassis lubricants are satisfactory as multipurpose greases. The grease manufacturer should be consulted as to the multipurpose qualities of his product.

7.5 Extreme-Pressure or EP:

Not a designation by usage, but is applied to greases with high load-carrying capacity, determined usually by the Timken® Tester or the Four-Ball EP Tester or equivalent. In some cases, the EP property results from a surface-active additive that imparts antiwear or antiseize properties beyond the capabilities of the usual fluid-thickener or other finely dispersed inert solids in the grease. Extreme-pressure or wear-reducing properties may be incorporated in any of the usage types, most frequently those designated as multipurpose.

7.6 Greases for Other Vehicle Needs:

Automotive equipment may require special greases not as yet designated by SAE. Examples of such applications are speedometer cables and brake adjustors.

8. GREASE APPLICATION:

Automotive greases are applied by hand packing, by hand and power operated pressure guns, and by hand and power operated central systems fitted to individual vehicles. In wheel bearing lubrication, a bearing packing device is often used, as more effective, faster, and less wasteful of grease than hand packing. Mixing of different types of greases in wheel bearings should be avoided since it might result in excessive thinning and leakage.

The prime consideration in using and applying greases is that of cleanliness: of containers and dispensing and pumping equipment and in the removal of surface grease and dirt accumulation from application points such as plugs and grease gun fittings.

Excessive dispensing pressures and pumping rates are to be avoided. They tend to cause seal deformation and rupture and are wasteful of lubricant.

Automotive servicing literature is voluminous on the subject of grease lubrication. Important sources are vehicle manufacturers' service bulletins, oil company bulletins and lubrication charts, and trade organization manuals. Among the latter are three publications issued by NLGI: "Recommended Practice for Lubricating Passenger Car Wheel Bearings," "Recommended Practice for Lubricating Passenger Car Ball Joint Front Suspensions," and "Recommended Practice for Grease Lubricated Truck Wheel Bearings."

9. GREASE PROPERTIES AS RELATED TO TYPES OF SERVICE:

Service requirements determine the relative importance of the above grease properties for each kind of application and set the level of performance needed. Table 3 is a rough summary of the grease properties of primary importance in the several fields of automotive use previously discussed. Certain properties as, for example, texture or structure, consistency, and apparent viscosity are not included in the summary, since it is assumed they will be appropriate to the purposes of the individual grease types.

TABLE 3 - Relative Importance of Lubricating Grease Properties for Automotive Uses Shown[a]

Property	Wheel Bearings	Universal Joints	Chassis	Multipurpose Applications
Structural Stability (inc. Mechanical Stability)	H	M	H	H
High Dropping Point (High-Temp. Service)	H	M	M	H
Oxidation Resistance	H	M	H	H
Protection Against Friction and Wear	M	H	H	H
Protection Against Corrosion	M	M	H	M
Protection Against Washout	M	M	H	M

[a]H = Highest, M = Moderate, L = Least.

10. STANDARD CLASSIFICATION AND SPECIFICATION FOR SERVICE GREASES:

After years of cooperative effort, SAE, NLGI, and ASTM developed a system for the designation, description, classification, and specification of greases for service relubrication. This system has been accepted by both the grease and automotive industries. It was first published in 1989, as ASTM D 4950. (D 4950 is a grease specification expressly intended for service applications. Specifications for factory-fill grease are generally more restrictive and often contain additional performance requirements described by nonstandard tests. However, there is nothing in D 4950 to preclude its use by equipment manufacturers to describe initial-fill greases.) The pert-requirements of this document are summarized in Table 4.

Automotive service greases are classified into two groups, those suitable for chassis relubrication (including universal joints), and those suitable for the relubrication of serviceable-type wheel bearings. These are further separated into performance categories: two Chassis Grease categories, LA and LB, and three Wheel Bearing Grease categories, GA, GB, and GC. Tables 5 and 6 list the requirements (Acceptability Limits) for the respective categories. (These two tables do not constitute all of the requirements of D 4950. D 4950 also includes specific descriptions of the service applications and performance requirements, which are included in the document to ensure the selection of greases suited to the intended application.) For quick comparisons a qualitative guide to the specified requirements is shown in Table 7.

TABLE 4 - Summary of NLGI & ASTM Designation, Description, and Performance Requirements for Automotive Service Greases

NLGI Letter Designation	NLGI Service Description	ASTM D 4950 Performance Description	ASTM D 4950 Performance Requirements
Chassis Service			
LA	Service typical of chassis components and universal joints in passenger cars, trucks, and other vehicles under mild duty only. Mild duty will be encountered in vehicles operated with frequent relubrication in non-critical applications.	The grease shall satisfactorily lubricate chassis components and universal joints where frequent relubrication is practiced (at intervals 3200 km or 2000 miles or less for passenger cars). During its service life, the grease shall resist oxidation and consistency degradation while protecting the chassis components and universal joints from corrosion and wear under lightly loaded conditions. NLGI 2 consistency greases are commonly recommended, but other grades may also be recommended.	Conform to requirements of Table 5.

TABLE 4 (Continued)

NLGI Letter Designation	NLGI Service Description	ASTM D 4950 Performance Description	ASTM D 4950 Performance Requirements
LB	Service typical of chassis components and universal joints in passenger cars, trucks, and other vehicles under mild to severe duty. Severe duty will be encountered in vehicles operated under conditions which may include prolonged relubrication intervals, or high loads, severe vibration, exposure to water or other contaminants, etc.	The grease shall satisfactorily lubricate chassis components and universal joints at temperatures as low as -40°C (-40°F) and at temperatures as high as 120°C (248°F) over prolonged relubrication intervals (more than 3200 km or 2000 miles for passenger cars). During its service life, the grease shall resist oxidation and consistency degradation while protecting the chassis components and universal joints from corrosion and wear even when aqueous contamination and heavily loaded conditions occur. NLGI 2 consistency greases are commonly recommended, but other grades may also be recommended.	Conform to requirements of Table 5.
Wheel Bearing Service			
GA	Service typical of wheel bearings operating in passenger cars, trucks, and other vehicles under mild duty. Mild duty will be encountered in vehicles operated with frequent relubrication in noncritical applications.	The grease shall satisfactorily lubricate wheel bearings over a limited temperature range. Many products of this type are limited to bearing temperatures of -20°C to 70°C (-4°F to 158°F). No additional performance requirements are specified for these greases.	Conform to requirements of Table 6.

TABLE 4 (Continued)

NLGI Letter Designation	NLGI Service Description	ASTM D 4950 Performance Description	ASTM D 4950 Performance Requirements
GB	Service typical of wheel bearings operating in passenger cars, trucks, and other vehicles under mild to moderate duty. Moderate duty will be encountered in most vehicles operated under normal urban, highway, and off-highway service.	The grease shall satisfactorily lubricate wheel bearings over a wide temperature range. The bearing temperatures may range down to 40°C (-40°F), with frequent excursions to 120°C (320°F). During its service life, the grease shall resist oxidation, evaporation, and consistency degradation while protecting the bearings from corrosion and wear. NLGI 2 consistency greases are commonly recommended, but NLGI 1 or 3 grades may also be recommended.	Conform to requirements of Table 6.
GC	Service typical of wheel bearings operating in passenger cars, trucks, and other vehicles under mild to severe duty. Severe duty will be encountered in certain vehicles operated under conditions resulting in high bearing temperatures. This includes vehicles operated under frequent stop-and-go service (buses, taxis, urban police cars, etc.), or under severe braking service (trailer towing, heavy loading, mountain driving, etc.).	The grease shall satisfactorily lubricate wheel bearings over a wide temperature range. The bearing temperatures may range down to -40°C (-40°F), with frequent excursions to 160°C (320°F) and occasional excursions to 200°C (392°F). During its service life, the grease shall resist oxidation, evaporation, and consistency degradation while protecting the bearings from corrosion and wear. NLGI 2 consistency greases are commonly recommended, but NLGI 1 or 3 grades may also be recommended.	Conform to requirements of Table 6.