Gear Lubricant Specifications

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Gear lubricants must meet a number of requirements which can be supplied only by specially formulated products. Most applications require gear oils that contain some degree of extreme pressure (EP) or antiwear additives to prevent wear, pitting, spalling, scoring, scuffing and other types of distress that can result in equipment failure and downtime. Depending on the application, protection against oxidation, thermal degradation, rust, copper corrosion and foaming must also be provided. In addition, the viscometrics of the finished lubricant must be tailored to both the high and low ambient temperatures in which the equipment will operate. A brief description of several of the specifications used to define the physical characteristics and performance attributes of many of today's automotive gear oil lubricants follows. SAE J306

Automotive gear lubricant viscosities are defined in SAE J306. This Standard was updated in July 1998 and incorporates several changes compared to previous versions. One change was the addition of two new viscosity grade designations, SAE 80 and SAE 85. These designations are frequently used in Europe, most commonly to specify the viscometrics for manual transmission lubricants.

A second addition was the requirement that the lubricant remain in its viscosity grade following a 20-hour shear stability test, the CEC L-45-T-93 Method. The need for the shear stability requirement is due to the increasing use of wide-span multigrades, which may contain significant amounts of polymers. If these polymers shear in service, a decrease in viscosity and subsequent decrease in fluid film protection may ultimately lead to equipment failure. The shear-stability requirement ensures that the lubricant will maintain sufficient oil film thickness during operation to protect equipment against premature wear and other types of distress.

The final addition was a set of standard viscosity identification and labeling guidelines. The benefit of these guidelines is that they provide a standard worldwide vocabulary to identify automotive gear lubricants. This should make it easier for consumers to select the proper lubricant viscosity grade without confusion.

Automotive Gear Lubricant Viscosity Classifications - SAE J306

SAE Viscosity Grade	Max Temperature for Viscosity of 150,000 cP (C)[1,2]	Kinematic Viscosity at 100C (cSt)[3]	
		min[4]	max
70W	-55[5]	4.1	...
75W	-40	4.1	...
80W	-26	7.0	11
85W	-12	11.0	...
80	...	7.0	<11.0
85	...	11.0	<13.5
90	...	13.5	<24.0
140	...	24.0	<41.0
250	...	41.0	...

1. Using ASTM D 2983.
2. Additional low-temperature viscosity requirements may be appropriate for fluids intended for use in light-duty synchronized manual transmissions.
3. Using ASTM D 445.
4. Limit must also be met after testing in CEC L-45-T-93, Method C (20 hours).
5. The precision of ASTM D 2983 has not been established for determinations made at temperatures below -40C. This fact should be taken into consideration in any producer-consumer relationship

API Category MT-1. Numerous performance specifications can be used to identify the level of protection that will be provided by an automotive gear lubricant. In the past, API Category GL-4 was commonly used to describe the type of lubricants that would provide acceptable performance in manual transmissions and lightly loaded final drive axles. API Category GL-5 described lubricants that were generally used in final drive axles operating in moderate to severe service. However, several new performance specifications are becoming the benchmark for describing lubricant quality.

API Category MT-1, which was issued in 1995, describes the performance requirements of lubricants intended for use in non-synchronized manual transmissions, such as those found in heavy-duty trucks and buses. Lubricants meeting the requirements of API Category MT-1 provide protection against the combination of thermal degradation, component wear, and oil seal deterioration, which is not provided by lubricants meeting only the requirements of API GL-1 through GL-5.

MIL-PRF-2105E. Another relatively new performance classification is MIL-PRF-2105E. This specification, which was also released in 1995, combines the performance requirements of its predecessor (MIL-L-2105D) and API MT-1. MIL-PRF-2105E maintains all existing chemical/physical requirements, stationary axle test requirements, field test requirements and data review by the Lubricant Review Institute that were required under MIL-L-2105D. It also adds the stringent oil seal compatibility and thermal durability test requirements outlined under API MT-1.

While MIL-PRF-2105E and its predecessors have been widely recognized and used in many areas of the world, this Specification has not been widely adopted globally. The primary reason is that it has not been possible for oil blenders and marketers in non-NATO countries to obtain a formal approval under this Specification. A recent event that will have a dramatic affect on this situation is the release of SAE J2360.

SAE J2360. In 1991, the U.S. Department of Defense published a directive to adopt non government standards in preference to federal and military specifications whenever practical. The objective was to relieve the government of the burden of maintaining these specifications. One outcome of this directive was that the SAE rewrote MIL-PRF-2105E in the form of SAE J2360. This Standard is identical to MIL-PRF-2105E with one exception. Under SAE J2360, an oil blender or marketer anywhere in the world can now obtain a formal approval and have their name and the name of their approved lubricant published on a Qualified Products List. This will enable them to demonstrate a measurable and recognized quality of performance for their lubricants and should lead to a greater return on their investment in the development of these lubricants. Equipment manufacturers will also benefit in that they now have a means by which to specify and identify high-quality lubricants for use in their equipment anywhere in the world. Perhaps most importantly, end-users benefit from gaining ready access to quality products that will reduce equipment downtime and maintenance