SOCIETY OF AUTOMOTIVE ENGINEERS, INC. • TWO PENNSYLVANIA PLAZA • NEW YORK, NEW YORK 10001

LAND SEA AIR SPACE

TECHNICAL REPORT J306a

AXLE AND MANUAL TRANSMISSION LUBRICANT VISCOSITY CLASSIFICATION—SAE J306a

SAE Recommended Practice

Report of Lubricants Division approved February 1924 and last revised by Fuels and Lubricants Committee November 1972.

This SAE Recommended Practice is intended for equipment manufacturers in defining and recommending gear and manual transmission lubricants, for oil marketers in labeling such lubricants with respect to viscosity, and for users in following their owner's manual recommendations. The SAE viscosity numbers shown in Table 1 constitute a classification for gear and transmission lubricant in terms of viscosity only; the change in viscosity with use, or other gear lubricant qualities, are not considered.

Gear and transmission lubricant SAE viscosity numbers should not be confused with engine oil SAE viscosity numbers. (Compare Table 1 in this report with Table 1 in SAE J300.) A gear lubricant and an engine oil having the same viscosity will have widely different SAE viscosity numbers as defined in the two viscosity classifications. For instance, an SAE 80W gear lubricant can have the same viscosity characteristics as an SAE 20W-20 engine oil; and an SAE 90 gear lubricant viscosity can be similar to that of an SAE 40 or SAE 50 engine oil.

This classification is based on the lubricant viscosity measured at both high and low temperatures. The high-temperature values are determined according to ASTM D 455, Method of Test for Viscosity of Transparent and Opaque Liquids, with the results reported in centistokes (cSt) or m^2/s. The low-temperature values are determined according to ASTM D 2983-71T, Method of Test for Apparent Viscosity at Low Temperature Using the Brookfield Viscometer, and these results are reported in centipoises (cP) or Pa·s. These two viscosity units are related as follows:

$$\frac{\text{cP}}{\text{Density, g/ml}} = \text{cSt}$$

Density is measured at the test temperature.

This relationship is valid for Newtonian fluids; it is an approximation for non-Newtonian fluids.

A multiviscosity numbered lubricant, such as SAE 80W-90, meets both the low- and high-temperature requirements shown in Table 1. That is, it conforms to the SAE 80W requirement at low temperature and is in the range provided for SAE 90 at high temperature.

The selection of a gear or transmission lubricant should be based on the lowest and highest service temperatures. The multiviscosity numbered lubricants may be satisfactory at both temperature extremes.

TABLE 1—AXLE AND MANUAL TRANSMISSION LUBRICANT VISCOSITY CLASSIFICATION

SAE Viscosity Number	Maximum Temperature for Viscosity of 150,000 cP (150 Pa·s)		Viscosity at 210°F (99°C)					
			Minimum			Maximum		
	°F	°C	cSt	SUS[a]	Mm^2/s	cSt	SUS[a]	Mm^2/s
75W	−40	−40	4.2	40	4.2	—	—	—
80W	−15	−26	7.0	49	7.0	—	—	—
85W	+10	−12	11.0	63	11.0	—	—	—
90	—	—	14.0	74	14.0	< 25	120	25
140	—	—	25.0	120	25.0	< 43	200	43
250	—	—	43.0	200	43.0	—	—	—

[a]Approximate.

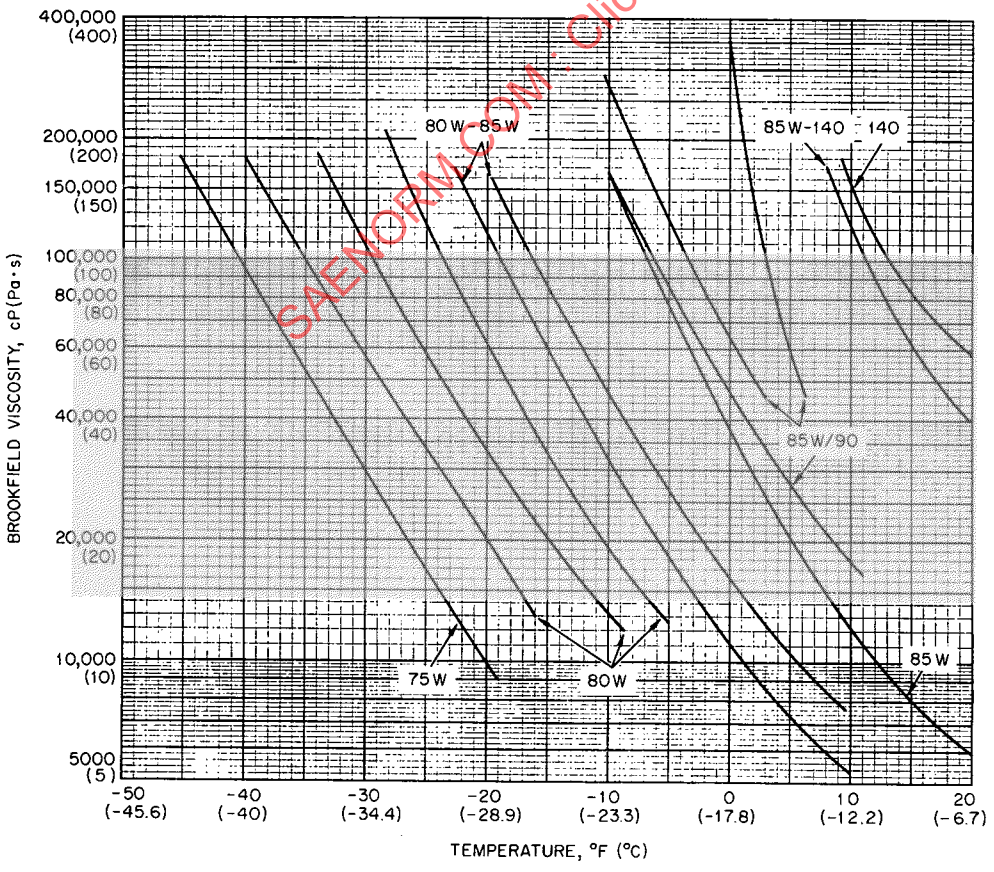

FIG. 1—BROOKFIELD VISCOSITY VERSUS TEMPERATURE FOR TYPICAL GEAR LUBRICANTS (SAE VISCOSITY NUMBERS INDICATED)