LUBE TECHNI-GRAM

FROM: LEWIS FOX
DIRECTOR OF TECHNOLOGY

December 2005

ISO VS. SUS VISCOSITY

A customer recently asked what ISO meant and what was the viscosity of an ISO oil. Since it has become a universal practice for equipment manufacturers to describe the required viscosity of an oil in one or another of several viscosity "classification" or "grading" systems, this question reinforced the need to clarify two of the main systems.

ISO stands for the International Standards Organization. The American Petroleum Institute adopted the ISO standards for viscosity measurement in 1977.

Prior to the adoption of the ISO viscosity grades, viscosity was measured in Saybolt Universal Seconds (SUS) and was traditionally checked at either 100°F. or 210°F.

With the acceptance of the International Standards Organizations' standards for lubricants, the ISO Celsius viscosity reference temperatures were adopted. These required the determination of the Kinematic Viscosity in centistokes (cSt) at reference temperatures of 40°C and 100°C.

ASTM-D-2422, the standard recommendation practice for viscosity system for industrial fluid lubricants was revised to conform to the ISO metric viscosity and reference temperature units. All petroleum companies and manufacturers have adopted this system as a standard for viscosity measurement.

The ISO viscosity depends on the ISO grade. The ISO classification system has 18 viscosity grades covering a viscosity range from 2 to 1500 centistokes. Each viscosity grade is approximately 50% higher than the preceding lower viscosity grade. The permissible variance in viscosity for each grade is plus or minus 10% of the normal or midpoint viscosity.

As an example, if you have an ISO 220 grade, the midpoint of this viscosity range is 220 centistokes at 40°C. So the ISO viscosity grade is the midpoint of the viscosity range at 40°C. The heaviest or highest viscosity grade typically referred to in the lubricants industry would be the ISO 1500. This has a viscosity of 1500 centistokes at 40°C. At the other end of the scale, we have the ISO 2, which has a viscosity of 2.2 centistokes at 40°C.

So, we basically have two viscosity grading systems, the Saybolt System and the Kinematic. Generally, most automotive manufacturers still recommend the use of the SAE grades in Saybolt Universal Seconds and

covers industrial oils, transmission fluids, etc. under their SAE Grades Crankcase Oils Category. Gear Lubes and differentials oils are covered under their SAE Grades Gear Oils Category. However, most industrial applications recommend the ISO grading system or the Kinematic Viscosity Grading System. A SWEPCO Viscosity Equivalent Chart is available from SWEPCO's Field Service Representatives. This informative tool makes it easy to determine the "*grade*" or "*weight*" of an oil no matter what the temperatures or terms it is listed in. The chart also includes the ranges for American Gear Manufacturer Association (AGMA) listings.

VISCOSITY CLASSIFICATION OF INDUSTRIAL LUBRICATING FLUIDS

ISO Viscosity Grade	ISO Viscosity Range cSt at 40°C (104°F)	ISO Viscosity Range Approximate SUS at 100°F (37.8°C)	ISO Viscosity Range Approximate SUS at 210°F (98.7°C)
2	1.98 – 2.42	32.8 – 34.4	---
3	2.88 – 3.52	36.0 – 38.2	---
5	4.14 – 5.06	40.4 – 43.5	---
7	6.12 – 7.48	47.2 – 52.0	---
10	9.00 – 11.0	57.6 – 65.3	34.6 – 35.7
15	13.5 – 16.5	75.8 – 89.1	37.0 – 38.3
22	19.8 – 24.2	105 – 126	39.7 – 41.4
32	28.8 – 35.2	149 – 182	43.0 – 45.0
46	41.4 – 50.6	214 – 262	47.1 – 49.9
68	61.2 – 74.8	317 – 389	52.9 – 56.9
100	90.0 – 110	469 – 575	61.2 – 66.9
150	135 – 165	709 – 871	73.8 – 81.9
220	198 – 242	1047 – 1283	90.4 – 101
320	288 – 352	1533 – 1881	112 –126
460	414 – 506	2214 –2719	139 – 158
680	612 – 748	3298 – 4048	178 - 202
1000	900 – 1100	4864 – 5975	226 - 256
1500	1350 – 1650	7865 – 9079	291 - 331