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Standard Practice for Calculating Viscosity Index from Kinematic Viscosity at 40 °C and 100 °C[1]

1. Scope

1.1 This practice[2] covers the procedures for calculating the viscosity index of petroleum products, such as lubricating oils, and related materials from their kinematic viscosities at 40 °C and 100 °C.

NOTE 1—The results obtained from the calculation of *VI* from kinematic viscosities determined at 40 °C and 100 °C are virtually the same as those obtained from the former *VI* system using kinematic viscosities determined at 37.78 °C and 98.89 °C.

1.2 This practice does not apply to petroleum products with kinematic viscosities less than 2.0 mm^2/s at 100 °C. Table 1 given in this practice applies to petroleum products with kinematic viscosities between 2 mm^2/s and 70 mm^2/s at 100 °C. Equations are provided for calculating viscosity index for petroleum products having kinematic viscosities above 70 mm^2/s at 100 °C.

1.2.1 In cases where kinematic viscosity data are not available at temperatures of 40 °C and 100 °C, an estimate may be made of the viscosity index by calculating the kinematic viscosity at temperatures of 40 °C and 100 °C from data obtained at other temperatures. Such viscosity index data may be considered as suitable for information only and not for specification purposes. See Test Method D341, Annex A1.

1.3 The kinematic viscosity values are determined with reference to a value of 1.0034 mm^2/s at 20.00 °C for distilled water. The determination of the kinematic viscosity of a petroleum product shall be carried out in accordance with Test Methods D445, D7042, IP 71, or ISO 3104.

1.3.1 If Viscosity Index calculated for a given sample using kinematic viscosity measurements from different test methods are in disagreement, the values calculated from Test Method D445 measurements shall be accepted.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4.1 The values stated in SI units are to be regarded as the standard. For user reference, 1 $mm^2/s = 10^{-6} m^2/s$ = 1 cSt.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D341 Practice for Viscosity-Temperature Charts for Liquid Petroleum Products

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D1695 Terminology of Cellulose and Cellulose Derivatives

D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *ISO Standards:*[4]

ISO 3104 Petroleum Products—Transparent and Opaque Liquids—Determination of Kinematic Viscosity and Calculation of Dynamic Viscosity

[1] This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.07 on Flow Properties.

In the IP, this practice is under the jurisdiction of the Standardization Committee and issued under the fixed designation IP 226. The final number indicates the year of last revision.

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[2] Supporting data (Metrication of Viscosity Index System Method D2270) have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-1009.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

2.3 *Energy Institute Standard:*[5]
IP 71 Determination of Kinematic Viscosity and Calculation of Dynamic Viscosity

3. Terminology

3.1 *Definitions:*

3.1.1 *viscosity index, n*—an arbitrary number used to characterize the variation of the kinematic viscosity of a petroleum product with temperature.

3.1.1.1 *Discussion*—For oils of similar kinematic viscosity, the higher the viscosity index the smaller the effect of temperature on its kinematic viscosity.

3.1.1.2 *Discussion*—Viscosity index is also used in Terminology D1695 in a definition unrelated to this one.

4. Significance and Use

4.1 The viscosity index is a widely used and accepted measure of the variation in kinematic viscosity due to changes in the temperature of a petroleum product between 40 °C and 100 °C.

4.2 A higher viscosity index indicates a smaller decrease in kinematic viscosity with increasing temperature of the lubricant.

4.3 The viscosity index is used in practice as a single number indicating temperature dependence of kinematic viscosity.

4.4 Viscosity Index is sometimes used to characterize base oils for purposes of establishing engine testing requirements for engine oil performance categories.[6]

5. Procedure

5.1 Determine the kinematic viscosity of the sample at 40 °C and 100 °C in accordance with Test Method D445, Test Method D7042, ISO 3104, or IP 71.

5.2 *Calculation:*

5.2.1 If the kinematic viscosity of the sample at 100 °C is less than or equal to 70 mm²/s, extract from Table 1 the corresponding values for *L* and *H*. Measured values that are not listed, but are within the range of Table 1, may be obtained by linear interpolation. The viscosity index is not defined and shall not be reported for oils with kinematic viscosity of less than 2.0 mm²/s at 100 °C.

5.2.2 If the kinematic viscosity is greater than 70 mm²/s at 100 °C, calculate the values of *L* and *H* as follows:

$$L = 0.8353\ Y^2 + 14.67\ Y - 216 \quad (1)$$

$$H = 0.1684\ Y^2 + 11.85\ Y - 97 \quad (2)$$

where:

L = kinematic viscosity at 40 °C of an oil of 0 viscosity index having the same kinematic viscosity at 100 °C as the oil whose viscosity index is to be calculated, mm²/s,
Y = kinematic viscosity at 100 °C of the oil whose viscosity index is to be calculated, mm²/s, and
H = kinematic viscosity at 40 °C of an oil of 100 viscosity index having the same kinematic viscosity at 100 °C as the oil whose viscosity index is to be calculated, mm²/s.

5.2.3 If $U > H$, calculate the viscosity index, *VI*, of the oil as follows:

$$VI = \left[(L - U)/(L - H)\right] \times 100 \quad (3)$$

where:

U = kinematic viscosity at 40 °C of the oil whose viscosity index is to be calculated, mm²/s.

5.2.3.1 *Calculation Example*—Measured kinematic viscosity at 40 °C of the oil whose viscosity index is to be calculated = 73.30 mm²/s; kinematic viscosity at 100 °C of the oil whose viscosity index is to be calculated = 8.86 mm²/s.

From Table 1 (by interpolation) L = 119.94

From Table 1 (by interpolation) H = 69.48

Substituting in Eq 3 and rounding to the nearest whole number:

$$VI = \left[(119.94 - 73.30)/(119.94 - 69.48)\right] \times 100 = 92.43 \quad (4)$$

$$VI = 92 \quad (5)$$

5.2.4 If $U < H$, calculate the viscosity index, *VI* , of the oil as follows:

$$VI = \left[\left((anti\log N) - 1\right)/0.00715\right] + 100 \quad (6)$$

where:

$$N = (\log H - \log U)/\log Y \quad (7)$$

or

$$Y^N = H/U \quad (8)$$

5.2.4.1 *Calculation Example*—Measured kinematic viscosity at 40 °C of the oil whose viscosity index is to be calculated = 22.83 mm²/s; kinematic viscosity at 100 °C of the oil whose viscosity index is to be calculated = 5.05 mm²/s:

From Table 1 (by interpolation) H = 28.975

Substituting by Eq 7 (by logarithms):

$$N = \left[\frac{\log(28.975) - \log(22.83)}{\log(5.05)}\right] = 0.14719 \quad (9)$$

Substituting in Eq 6 and rounding to the nearest whole number:

$$VI = \left[\frac{anti\log(0.14719) - 1}{0.00715}\right] + 100 = \left[\frac{1.40343 - 1}{0.00715}\right] + 100$$

$$= \left[\frac{0.40343}{0.00715}\right] + 100 = 156.4235 \quad (10)$$

$$VI = 156$$

5.2.4.2 *Calculation Example*—Measured kinematic viscosity at 40 °C of the oil whose viscosity index is to be calculated = 53.47 mm²/s; kinematic viscosity at 100 °C of the oil whose viscosity index is to be calculated = 7.80 mm²/s:

From Table 1, H = 57.31

Substituting in Eq 7 (by logarithms):

[5] Available from Energy Institute, 61 New Cavendish St., London, W1G 7AR, U.K., http://www.energyinst.org.

[6] API 1509, "*Engine Oil Licensing and Certification System*, " 16e, American Petroleum Institute, April 2007.

TABLE 1 Basic Values for *L* and *H* for Kinematic Viscosity in 40 °C to 100 °C System

Kinematic Viscosity at 100 °C, mm²/s	*L*	*H*
2.00	7.994	6.394
2.10	8.640	6.894
2.20	9.309	7.410
2.30	10.00	7.944
2.40	10.71	8.496
2.50	11.45	9.063
2.60	12.21	9.647
2.70	13.00	10.25
2.80	13.80	10.87
2.90	14.63	11.50
3.00	15.49	12.15
3.10	16.36	12.82
3.20	17.26	13.51
3.30	18.18	14.21
3.40	19.12	14.93
3.50	20.09	15.66
3.60	21.08	16.42
3.70	22.09	17.19
3.80	23.13	17.97
3.90	24.19	18.77
4.00	25.32	19.56
4.10	26.50	20.37
4.20	27.75	21.21
4.30	29.07	22.05
4.40	30.48	22.92
4.50	31.96	23.81
4.60	33.52	24.71
4.70	35.13	25.63
4.80	36.79	26.57
4.90	38.50	27.53
5.00	40.23	28.49
5.10	41.99	29.46
5.20	43.76	30.43
5.30	45.53	31.40
5.40	47.31	32.37
5.50	49.09	33.34
5.60	50.87	34.32
5.70	52.64	35.29
5.80	54.42	36.26
5.90	56.20	37.23
6.00	57.97	38.19
6.10	59.74	39.17
6.20	61.52	40.15
6.30	63.32	41.13
6.40	65.18	42.14
6.50	67.12	43.18
6.60	69.16	44.24
6.70	71.29	45.33
6.80	73.48	46.44
6.90	75.72	47.51

Kinematic Viscosity at 100 °C, mm²/s	*L*	*H*
7.00	78.00	48.57
7.10	80.25	49.61
7.20	82.39	50.69
7.30	84.53	51.78
7.40	86.66	52.88
7.50	88.85	53.98
7.60	91.04	55.09
7.70	93.20	56.20
7.80	95.43	57.31
7.90	97.72	58.45
8.00	100.0	59.60
8.10	102.3	60.74
8.20	104.6	61.89
8.30	106.9	63.05
8.40	109.2	64.18
8.50	111.5	65.32
8.60	113.9	66.48
8.70	116.2	67.64
8.80	118.5	68.79
8.90	120.9	69.94
9.00	123.3	71.10
9.10	125.7	72.27
9.20	128.0	73.42
9.30	130.4	74.57
9.40	132.8	75.73
9.50	135.3	76.91
9.60	137.7	78.08
9.70	140.1	79.27
9.80	142.7	80.46
9.90	145.2	81.67
10.0	147.7	82.87
10.1	150.3	84.08
10.2	152.9	85.30
10.3	155.4	86.51
10.4	158.0	87.72
10.5	160.6	88.95
10.6	163.2	90.19
10.7	165.8	91.40
10.8	168.5	92.65
10.9	171.2	93.92
11.0	173.9	95.19
11.1	176.6	96.45
11.2	179.4	97.71
11.3	182.1	98.97
11.4	184.9	100.2
11.5	187.6	101.5
11.6	190.4	102.8
11.7	193.3	104.1
11.8	196.2	105.4
11.9	199.0	106.7

Kinematic Viscosity at 100 °C, mm²/s	*L*	*H*
12.0	201.9	108.0
12.1	204.8	109.4
12.2	207.8	110.7
12.3	210.7	112.0
12.4	213.6	113.3
12.5	216.6	114.7
12.6	219.6	116.0
12.7	222.6	117.4
12.8	225.7	118.7
12.9	228.8	120.1
13.0	231.9	121.5
13.1	235.0	122.9
13.2	238.1	124.2
13.3	241.2	125.6
13.4	244.3	127.0
13.5	247.4	128.4
13.6	250.6	129.8
13.7	253.8	131.2
13.8	257.0	132.6
13.9	260.1	134.0
14.0	263.3	135.4
14.1	266.6	136.8
14.2	269.8	138.2
14.3	273.0	139.6
14.4	276.3	141.0
14.5	279.6	142.4
14.6	283.0	143.9
14.7	286.4	145.3
14.8	289.7	146.8
14.9	293.0	148.2
15.0	296.5	149.7
15.1	300.0	151.2
15.2	303.4	152.6
15.3	306.9	154.1
15.4	310.3	155.6
15.5	313.9	157.0
15.6	317.5	158.6
15.7	321.1	160.1
15.8	324.6	161.6
15.9	328.3	163.1
16.0	331.9	164.6
16.1	335.5	166.1
16.2	339.2	167.7
16.3	342.9	169.2
16.4	346.6	170.7
16.5	350.3	172.3
16.6	354.1	173.8
16.7	358.0	175.4
16.8	361.7	177.0
16.9	365.6	178.6

Kinematic Viscosity at 100 °C, mm²/s	*L*	*H*
17.0	369.4	180.2
17.1	373.3	181.7
17.2	377.1	183.3
17.3	381.0	184.9
17.4	384.9	186.5
17.5	388.9	188.1
17.6	392.7	189.7
17.7	396.7	191.3
17.8	400.7	192.9
17.9	404.6	194.6
18.0	408.6	196.2
18.1	412.6	197.8
18.2	416.7	199.4
18.3	420.7	201.0
18.4	424.9	202.6
18.5	429.0	204.3
18.6	433.2	205.9
18.7	437.3	207.6
18.8	441.5	209.3
18.9	445.7	211.0
19.0	449.9	212.7
19.1	454.2	214.4
19.2	458.4	216.1
19.3	462.7	217.7
19.4	467.0	219.4
19.5	471.3	221.1
19.6	475.7	222.8
19.7	479.7	224.5
19.8	483.9	226.2
19.9	488.6	227.7
20.0	493.2	229.5
20.2	501.5	233.0
20.4	510.8	236.4
20.6	519.9	240.1
20.8	528.8	243.5
21.0	538.4	247.1
21.2	547.5	250.7
21.4	556.7	254.2
21.6	566.4	257.8
21.8	575.6	261.5
22.0	585.2	264.9
22.2	595.0	268.6
22.4	604.3	272.3
22.6	614.2	275.8
22.8	624.1	279.6
23.0	633.6	283.3
23.2	643.4	286.8
23.4	653.8	290.5
23.6	663.3	294.4
23.8	673.7	297.9

Kinematic Viscosity at 100 °C, mm²/s	*L*	*H*
24.0	683.9	301.8
24.2	694.5	305.6
24.4	704.2	309.4
24.6	714.9	313.0
24.8	725.7	317.0
25.0	736.5	320.9
25.2	747.2	324.9
25.4	758.2	328.8
25.6	769.3	332.7
25.8	779.7	336.7
26.0	790.4	340.5
26.2	801.6	344.4
26.4	812.8	348.4
26.6	824.1	352.3
26.8	835.5	356.4
27.0	847.0	360.5
27.2	857.5	364.6
27.4	869.0	368.3
27.6	880.6	372.3
27.8	892.3	376.4
28.0	904.1	380.6
28.2	915.8	384.6
28.4	927.6	388.8
28.6	938.6	393.0
28.8	951.2	396.6
29.0	963.4	401.1
29.2	975.4	405.3
29.4	987.1	409.5
29.6	998.9	413.5
29.8	1011	417.6
30.0	1023	421.7
30.5	1055	432.4
31.0	1086	443.2
31.5	1119	454.0
32.0	1151	464.9
32.5	1184	475.9
33.0	1217	487.0
33.5	1251	498.1
34.0	1286	509.6
34.5	1321	521.1
35.0	1356	532.5
35.5	1391	544.0
36.0	1427	555.6
36.5	1464	567.1
37.0	1501	579.3
37.5	1538	591.3
38.0	1575	603.1
38.5	1613	615.0
39.0	1651	627.1
39.5	1691	639.2
40.0	1730	651.8
40.5	1770	664.2
41.0	1810	676.6
41.5	1851	689.1
42.0	1892	701.9

Kinematic Viscosity at 100 °C, mm²/s	*L*	*H*
42.5	1935	714.9
43.0	1978	728.2
43.5	2021	741.3
44.0	2064	754.4
44.5	2108	767.6
45.0	2152	780.9
45.5	2197	794.5
46.0	2243	808.2
46.5	2288	821.9
47.0	2333	835.5
47.5	2380	849.2
48.0	2426	863.0
48.5	2473	876.9
49.0	2521	890.9
49.5	2570	905.3
50.0	2618	919.6
50.5	2667	933.6
51.0	2717	948.2
51.5	2767	962.9
52.0	2817	977.5
52.5	2867	992.1
53.0	2918	1007
53.5	2969	1021
54.0	3020	1036
54.5	3073	1051
55.0	3126	1066
55.5	3180	1082
56.0	3233	1097
56.5	3286	1112
57.0	3340	1127
57.5	3396	1143
58.0	3452	1159
58.5	3507	1175
59.0	3563	1190
59.5	3619	1206
60.0	3676	1222
60.5	3734	1238
61.0	3792	1254
61.5	3850	1270
62.0	3908	1286
62.5	3966	1303
63.0	4026	1319
63.5	4087	1336
64.0	4147	1352
64.5	4207	1369
65.0	4268	1386
65.5	4329	1402
66.0	4392	1419
66.5	4455	1436
67.0	4517	1454
67.5	4580	1471
68.0	4645	1488
68.5	4709	1506
69.0	4773	1523
69.5	4839	1541
70.0	4905	1558

$$N = [(\log 57.31 - \log 53.47)/\log 7.80] = 0.03376 \quad (11)$$

Substituting in Eq 6 and rounding to the nearest whole number:

$$VI = [((\text{antilog } 0.03376) - 1)/0.00715] + 100 \quad (12)$$

$$= [(1.08084 - 1)/0.00715] + 100 = 111$$

5.2.5 If $U = H$, the viscosity index, VI, of the oil equals 100.

5.3 *ASTM DS 39b,*[7] is based on the above calculation and may be used instead of 5.2 through 5.2.5.

6. Report

6.1 Report the viscosity index to the nearest whole number, using the Rounding Method of E29. When the number is exactly halfway between the nearest two whole numbers, round to the nearest even number. For example, 116.5 shall be reported as 116.

6.2 The test report shall contain at least the following information:

6.2.1 A reference to this standard,

6.2.2 The type and complete identification of the product tested,

6.2.3 The result of the test,

6.2.4 The test method used for the kinematic vixcosity measurements,

6.2.5 Any deviation, by agreement or otherwise, from the procedure specified, and

6.2.6 The date of the test.

7. Keywords

7.1 kinematic viscosity; viscosity index

[7] ASTM DS 39b, *Viscosity Index Tables for Celsius Temperatures*, ASTM International.

APPENDIXES

(Nonmandatory Information)

X1. VISCOSITY INDEX CALCULATIONS FROM KINEMATIC VISCOSITIES AT NON-STANDARD TEMPERATURES

X1.1 In certain cases, it is of interest to obtain the *VI* of an oil when conditions prevent the use of the standard temperatures of 40 °C and 100 °C. An estimate may be made by calculating the kinematic viscosity at 40 °C and 100 °C from data obtained at other temperatures. Reference should be made to Test Method D341 for the suitable equations. The kinematic viscosity data used should preferably be taken from temperatures near the standard values and as widely separated as possible.

X1.2 Viscosity index values of an oil calculated from non-standard data as discussed above should be considered as suitable for information only and not desirable for specification purposes.

X2. ANOTHER COMPUTATIONAL METHOD

X2.1 The exact computational method for the calculation of viscosity index is defined in Section 5 of this practice. However, computation by computer or programmable calculator may be desired. This appendix describes one widely used method.

X2.1.1 In case of conflict between results using this method and the method in Section 5, the method in Section 5 shall be accepted.

X2.2 The calculation of viscosity index requires:

X2.2.1 Input of kinematic viscosity data at 40 °C and 100 °C.

X2.2.2 Calculation of L and H corresponding to the kinematic viscosity at 100 °C.

X2.2.3 Calculation of the viscosity index using equations in Section 5 of this practice.

X2.3 Values of L and H can be determined using computer software and the coefficients and equations stored in Table X2.1. In this set of sixteen equations, the errors in individual values of L and H so calculated are believed not to exceed 0.1 %. For a given value of Y, select the pair of equations whose range includes this value of Y and calculate directly the values of L and H.

X2.4 With the given values of Y and U and the calculated values of L and H corresponding to Y from Table X2.1, the viscosity index is calculated directly using:

X2.4.1 (Eq 3) where $U \geq H$ or

X2.4.2 (Eq 6) and (Eq 7) where $U \leq H$ as is described in Section 5 of this practice.

X2.5 An example of these methods is as follows:
given kinematic viscosity at 40 °C = 73.50 mm²/s,
and kinematic viscosity at 100 °C = 8.860 mm²/s.

X2.5.1 As described in X2.3, the equations stored in memory which include $Y = 8.860$ are:

$$L = 0.41858\ Y^2 + 16.1558\ Y - 56.040 \quad (X2.1)$$

$$H = 0.05794\ Y^2 + 10.5156\ Y - 28.240 \quad (X2.2)$$

X2.5.1.1 From the given value of $Y = 8.860\ mm^2/s$:

$$L = 119.9588 \quad (X2.3)$$

TABLE X2.1 Coefficients of Quadratic Equations

Y min	Y max	a	b	c	d	e	f
2.0	3.8	1.14673	1.7576	−0.109	0.84155	1.5521	−0.077
3.8	4.4	3.38095	−15.4952	33.196	0.78571	1.7929	−0.183
4.4	5.0	2.5000	−7.2143	13.812	0.82143	1.5679	0.119
5.0	6.4	0.10100	16.6350	−45.469	0.04985	9.1613	−18.557
6.4	7.0	3.35714	−23.5643	78.466	0.22619	7.7369	−16.656
7.0	7.7	0.01191	21.4750	−72.870	0.79762	−0.7321	14.610
7.7	9.0	0.41858	16.1558	−56.040	0.05794	10.5156	−28.240
9.0	12	0.88779	7.5527	−16.600	0.26665	6.7015	−10.810
12	15	0.76720	10.7972	−38.180	0.20073	8.4658	−22.490
15	18	0.97305	5.3135	−2.200	0.28889	5.9741	−4.930
18	22	0.97256	5.2500	−0.980	0.24504	7.4160	−16.730
22	28	0.91413	7.4759	−21.820	0.20323	9.1267	−34.230
28	40	0.87031	9.7157	−50.770	0.18411	10.1015	−46.750
40	55	0.84703	12.6752	−133.310	0.17029	11.4866	−80.620
55	70	0.85921	11.1009	−83.19	0.17130	11.3680	−76.940
70	Up	0.83531	14.6731	−216.246	0.16841	11.8493	−96.947

$L = a\,Y^2 + b\,Y + c$
$H = d\,Y^2 + e\,Y + f$

$$H = 69.4765 \quad (X2.4)$$

X2.5.2 Since $U \geq H$:

$$\text{Viscosity index} = \left[(L - U)/(L - H)\right] \times 100 \quad (X2.5)$$

X2.5.2.1 For the data in X2.5.1:

$$VI = \frac{119.9588 - 73.50}{119.9588 - 69.4765} \times 100 = 92.030 = 92 \quad (X2.6)$$

X3. PRECISION OF VISCOSITY INDEX

X3.1 Precision and Bias[8]

X3.1.1 The calculation of viscosity index from kinematic viscosities at 40 °C and 100 °C is exact, and no precision limits can be assigned to this calculation.

NOTE X3.1—This precision value was obtained by statistical examination of interlaboratory results from approximately 40 base oil samples (base oils without additive package) in the range from 79 VI to 164 VI and between 2.4 mm^2/s and 80 mm^2/s kinematic viscosity at 100 °C for D445 and 12 base oil samples (base oils with additive package) in the range from 93 Vi to 150 Vi and between 3.5 mm^2/s and 40 mm^2/s kinematic viscosity at 100 °C for Test Method D7042.

X3.1.2 The precision of a viscosity index value for an unknown sample depends on the precision of the two independent kinematic viscosity values from which it is derived. For petroleum base stocks within the limits of viscosity at 100 °C listed below and within the limits of viscosity index listed below, the precision of viscosity index has been determined by examination of multiple data sets.

X3.1.3 *Reproducibility (R)*—The difference between two single and independent results obtained by different operators working in different laboratories on nominally identical test material would, in the long run, in the normal and correct operation of this practice, exceed the values in Table X3.1 only in one case in twenty.

TABLE X3.1 Precision of Viscosity

Method to Measure Kinematic Viscosity	Range of Applicability		Reproducibility (R)
	Kinematic Viscosity at 100 °C	Viscosity Index	
D445	2.4 to 80	79 to 164	2
D7042	3.5 to 40	93 to 150	2
Other		Not determined	

[8] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-1707.