Designation: D2502 – 04(Reapproved 2009)

Standard Test Method for Estimation of Mean Relative Molecular Mass of Petroleum Oils from Viscosity Measurements[1]

This standard is issued under the fixed designation D2502; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the estimation of the mean relative molecular mass of petroleum oils from kinematic viscosity measurements at 100 and 210°F (37.78 and 98.89°C).[2] It is applicable to samples with mean relative molecular masses in the range from 250 to 700 and is intended for use with average petroleum fractions. It should not be applied indiscriminately to oils that represent extremes of composition or possess an exceptionally narrow mean relative molecular mass range.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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]

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

2.2 *ASTM Adjuncts:*

Mean Relative Molecular Mass of Petroleum Oils from Viscosity Measurements[4]

3. Summary of Test Method

3.1 The kinematic viscosity of the oil is determined at 100 and 210°F (37.78 and 98.89°C). A function "*H*" of the 100°F viscosity is established by reference to a tabulation of *H* function versus 100°F viscosity. The *H* value and the 210°F viscosity are then used to estimate the mean relative molecular mass from a correlation chart.

4. Significance and Use

4.1 This test method provides a means of calculating the mean relative molecular mass of petroleum oils from another physical measurement.

4.2 Mean relative molecular mass is a fundamental physical constant that can be used in conjunction with other physical properties to characterize hydrocarbon mixtures.

5. Procedure

5.1 Determine the kinematic viscosity of the oil at 100 and 210°F (37.78 and 98.89°C) as described in Test Method D445.

5.2 Look in Table 1 for 100°F (37.78°C) viscosity and read the value of *H* that corresponds to the measured viscosity. Linear interpolation between adjacent columns may be required.

5.3 Read the viscosity–mean relative molecular mass chart for *H* and 210°F (98.89°C) viscosity. A simplified version of this chart is shown in Fig. 1 for illustration purposes only (Note 1). Interpolate where necessary between adjacent lines of 210°F viscosity. After locating the point corresponding to the value of *H* (ordinate) and the 210°F viscosity (superimposed lines), read the mean relative molecular mass along the abscissa.

Example:
Measured viscosity, cSt:
100°F (37.78°C) = 179
210°F (98.89°C) = 9.72

Look in Table 1 for 179 and read the corresponding value *H* = 461.

Using *H* = 461 and 210°F viscosity = 9.72 in conjunction with chart gives mean relative molecular mass = 360 (see Fig. 1).

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.04.0K on Correlative Methods.

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[2] Hirschler, A. E., *Journal of the Institute of Petroleum*, JIPEA, Vol 32, 1946, p. 133.

[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 ASTM International Headquarters. Order Adjunct No. ADJD2502.

TABLE 1 Tabulation of *H* Function

Kinematic Viscosity, cSt at 100°F (37.78°C)	*H*				
	0	0.2	0.4	0.6	0.8
2	−178	−151	−126	−104	−85
3	−67	−52	−38	−25	−13
4	−1	9	19	28	36
5	44	52	59	66	73
6	79	85	90	96	101
7	106	111	116	120	124
8	128	132	136	140	144
9	147	151	154	157	160
10	163	166	169	172	175
11	178	180	183	185	188
12	190	192	195	197	199
13	201	203	206	208	210
14	211	213	215	217	219
15	221	222	224	226	227
16	229	231	232	234	235
17	237	238	240	241	243
18	244	245	247	248	249
19	251	252	253	255	256
20	257	258	259	261	262
21	263	264	265	266	267
22	269	270	271	272	273
23	274	275	276	277	278
24	279	280	281	281	282
25	283	284	285	286	287
26	288	289	289	290	291
27	292	293	294	294	295
28	296	297	298	298	299
29	300	301	301	302	303
30	304	304	305	306	306
31	307	308	308	309	310
32	310	311	312	312	313
33	314	314	315	316	316
34	317	317	318	319	319
35	320	320	321	322	322
36	323	323	324	325	325
37	326	326	327	327	328
38	328	329	329	330	331
39	331	332	332	333	333

	H								
	0	1	2	3	4	5	6	7	8	9
40	334	336	339	341	343	345	347	349	352	354
50	355	357	359	361	363	364	366	368	369	371
60	372	374	375	377	378	380	381	382	384	385
70	386	387	388	390	391	392	393	394	395	397
80	398	399	400	401	402	403	404	405	406	407
90	408	409	410	410	411	412	413	414	415	415
100	416	417	418	419	420	420	421	422	423	423
110	424	425	425	426	427	428	428	429	430	430
120	431	432	432	433	433	434	435	435	436	437
130	437	438	438	439	439	440	441	441	442	442
140	443	443	444	444	445	446	446	447	447	448
150	448	449	449	450	450	450	451	451	452	452
160	453	453	454	454	455	455	456	456	456	457
170	457	458	458	459	459	460	460	460	461	461
180	461	462	462	463	463	463	464	464	465	465
190	465	466	466	466	467	467	468	468	468	469

	H								
	0	10	20	30	40	50	60	70	80	90
200	469	473	476	479	482	485	487	490	492	495
300	497	499	501	503	505	507	509	511	512	514
400	515	517	518	520	521	523	524	525	527	528
500	529	530	531	533	534	535	536	537	538	539
600	540	541	542	543	544	545	546	547	547	548
700	549	550	551	551	552	553	554	554	555	556
800	557	557	558	559	559	560	561	562	562	563
900	563	564	565	565	566	566	567	567	568	569

	H									
	0	100	200	300	400	500	600	700	800	900
1 000	569	574	578	583	587	591	594	597	600	603
2 000	605	608	610	612	614	616	618	620	621	623
3 000	625	626	628	629	631	632	633	634	636	637