

Designation: D2502 – 14 (Reapproved 2019) e1

Standard Test Method for Estimation of Mean Relative Molecular Mass of Petroleum Oils from Viscosity Measurements¹

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.

 ϵ^1 NOTE—Editorially updated Footnote 4 in May 2020.

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 °F and 210 °F (37.78 °C 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.4 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:³

- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
- 2.2 ASTM Adjuncts:

3. Summary of Test Method

3.1 The kinematic viscosity of the oil is determined at 100 °F and 210 °F (37.78 °C 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 °F and 210 °F (37.78 °C and 98.89 °C) as described in Test Method D445 or Test Method D7042.

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 $^{\circ}$ F (98.89 $^{\circ}$ C) viscosity. A simplified version of

¹This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, 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.

Mean Relative Molecular Mass of Petroleum Oils from Viscosity Measurements⁴

⁴ Available from ASTM International Headquarters. Order Adjunct No. ADJD2502-E-PDF.

∰ D2502 – 14 (2019)^{ε1}

TABLE 1 Tabulation of H Function

Kinematic Viscosity, cSt at 100 °F (37.78 °C)					Н						
	C)	0	.2	0.4	4	0.	6	0	.8	
2	-1			51	-12		-1			85	
3	-6			52	-3		-2			13	
4	-	1	ç	9	19	9	2	8	3	36	
5	4	4	5	52	59	9	6	6	7	73	
6	7	9	8	35	90)	9	6	10	01	
7	10		11		11		12			24	
8	12			32	13		14			44	
9	14	1 7	15	51	15	4	15	57	10	60	
10	16	33	16	66	16	9	17	2	1	75	
11	17			80	18		18			88	
12	19			92	19		19			99	
13	20			03	20		20			10	
14	21	11	21	13	21	5	21	7	2	19	
15	22	21	20	22	22	4	22	26	2	27	
16	22			31	23		23			35	
17	23			38	24		24			43	
18	24	14		45	24		24			49	
19	25	51	25	52	25	3	25	55	2	56	
20	25			58	25		26			62	
21	26			64	26		26			67	
22	26			70	27		27			73	
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		30	301		302		303	
30	304		304		305		306		306		
31	307		308		308		309			10	
	310										
32				11	312		312			13	
33	314		314		315		316			16	
34	317		317		31	8	31	9	3	319	
35	320		320		321		322		3	322	
36	323		323		324		325		325		
37	326		326		327		327		328		
38	32			29	32		33			31	
39	331		332		332		333		333		
	0	1		3	<u>Н</u>	5	6	7	8	9	
40	334	336	2 339	341	343	345	347	349	352	354	
50	355	357	359	361	363	364	366	368	369	371	
60				377	378	380		382			
70	372	374	375		0.0	000	381	OOL	384	385	
10	372 386	374 387	388	390	391	392	381	394		385 397	
80				390 401					384		
80	386 398	387 399	388 400	401	391 402	392 403	393 404	394 405	384 395 406	397 407	
80 90	386 398 408	387 399 409	388 400 410	401 410	391 402 411	392 403 412	393 404 413	394 405 414	384 395 406 415	397 407 415	
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