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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Practice for Determining Asphalt Volume Correction to a Base Temperature[1]

This standard is issued under the fixed designation D 4311; 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 practice provides tables of volume correction factors which may be used to convert volumes of asphalt measured at different temperatures to a volume at a standard base temperature. These tables are applicable to all types of asphalts except emulsified asphalts.

1.2 This practice provides a table to convert asphalt volumes to 15°C from volumes measured at any temperature from − 25 to + 275°C.

NOTE 1—Correction factors in Table 1 are for use in place of correction factors provided in Guide D 1250, which do not address requirements for asphalt specifications.[2]

2. Referenced Documents

2.1 *ASTM Standards:*

D 70 Test Method for Specific Gravity and Density of Semi-Solid Bituminous Materials[3]

D 1250 Guide for Petroleum Measurement Tables[4]

D 3142 Test Method for Specific Gravity or API Gravity of Liquid Asphalts by Hydrometer Method[3]

D 3289 Test Method for Specific Gravity or Density of Semi-Solid and Solid Bituminous Materials by Nickel Crucible[3]

3. Significance and Use

3.1 Asphalts change in volume with change in temperature. They are loaded or transferred at widely varying temperatures. Volume correction factors are used to adjust bulk volumes measured at those temperatures to corresponding volumes at a base temperature of 15°C for the purposes of custody transfer and accounting operations.

3.2 Correction factors as provided in this practice have proven to be sufficiently accurate for the intended purposes.

3.3 Coefficients of expansion used for development of data in this practice are as follows:

Table	Column A	Column B
1	0.00035	0.00040

4. Procedure

4.1 Volume correction factors are provided for volume adjustments to 15°C in Table 1. The table is entered with asphalt temperature at which bulk volume is measured.

4.2 The table provides two sets of factors in columns labeled A and B. The selection of the appropriate column, A or B, is defined by table footnotes. The selection is based on asphalt density at 15°C. Column A factors apply to the majority of asphalts.

4.2.1 Values for density at 15°C may be obtained by Test Method D 70 or Test Method D 3289.

4.2.2 Observed API gravity or specific gravity at test temperature obtained by Test Method D 3142 must be corrected to the base temperature of 15°C. Use of Guide D 1250 tables for crudes, designated as Table 5A, 23A, or 53A, is recommended to obtain corrected 15°C values for asphalts. In Guide D 1250, the term relative density has been substituted for specific gravity.

4.2.3 Volume correction factors (see Note 2) for Table 1 were generated using the following formulas:

4.2.3.1 Table 1—A Factor Asphalts

$$A = 1.0094684142 - 6.33413410744 \times 10^{-4}\,[T(°C)] + 1.45710416212 \times 10^{-7}\,[T(°C)]^2 \quad (1)$$

where:

A = volume correction factor, and
$T(°C)$ = temperature of asphalt in° C.

4.2.3.2 Table 1—B Factor Asphalts

$$B = 1.0108020095 - 7.2343515319 \times 10^{-4}\,[T(°C)] + 2.1996598346 \times 10^{-7}\,[T(°C)]^2 \quad (2)$$

where:

B = volume correction factor, and
$T(°C)$ = temperature of asphalt in° C.

4.2.4 These formulas may be used in lieu of Table 1 to calculate volume correction factors.

NOTE 2—The volume correction factors are designed to generate values similar to those found in the original published Guide D 1250 – 80 for Group 0 and 1 Oils. The table has been corrected to a base temperature of 15°C rather than 60°F as originally published. See Appendix for details.

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[1] This practice is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.40 on Asphalt Specifications.

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[2] Factors originally published for Groups 0 and 1 oils in Tables 7, 25, and 55 in D1250 – 52 T. Last previous edition D1250 – 80.

[3] *Annual Book of ASTM Standards*, Vol 04.03.

[4] *Annual Book of ASTM Standards*, Vol 05.01, description only; tables published separately in three volumes.

4.3 Enter the desired table with the asphalt temperature at which the volume measurement was made, and read the volume correction factor in a selected column A or B.

4.4 Multiply the volume measurement by the appropriate volume correction factor to obtain the adjusted volume of asphalt at 15°C.

5. Example of Use

5.1 *Example A*—Volume of asphalt cement is measured to be 5000 m^3 at a temperature of 135°C. Asphalt cement density at 15°C is 1015 kg/m^3. Determine the volume of asphalt cement at the standard base temperature of 15°C.

5.1.1 Column A factors from Table 1 are applicable since density at 15°C exceeds 966 kg/m^3 or higher.

5.1.2 A volume correction factor of 0.9266 is read for observed temperature of 135°C. Multiplying the measured volume of 5000 m^3 by 0.9266 results in 4633 m^3 of asphalt at 15°C.

5.2 *Example B*—Volume of asphalt cement is measured to be 347 m^3 at a temperature of 153°C. The asphalt cement density at 15°C is 960 kg/m^3. Determine the volume of the asphalt cement at a temperature of 15°C.

5.2.1 Column B factors from Table 1 are applicable since density is between 850 and 965 kg/m^3 at 15°C.

5.2.2 A volume correction factor of 0.9046 is read for an observed temperature of 154°C. Multiplying the measured volume of 347 kg/m by 0.9046 results in 313.9 m^3 at 15°C.

6. Keywords

6.1 base temperature; volume correction

TABLE 1 Volume Reduction to 15°C

Observed Temperature, °C	Volume Correction[A,B] Factor to 15°C		Observed Temperature, °C	Volume Correction[A,B] Factor to 15°C		Observed Temperature, °C	Volume Correction[A,B] Factor − 25 to + 50°C to 15°C	
	A	B		A	B		A	B
−25.0	1.0254	1.0290	**0**	1.0095	1.0108	**25.0**	0.9937	0.9929
−24.5	1.0251	1.0287	**0.5**	1.0092	1.0104	**25.5**	0.9934	0.9925
−24.0	1.0248	1.0283	**1.0**	1.0088	1.0101	**26.0**	0.9931	0.9921
−23.5	1.0244	1.0279	**1.5**	1.0085	1.0097	**26.5**	0.9928	0.9918
−23.0	1.0241	1.0276	**2.0**	1.0082	1.0094	**27.0**	0.9925	0.9914
−22.5	1.0238	1.0272	**2.5**	1.0079	1.0090	**27.5**	0.9922	0.9911
−22.0	1.0235	1.0268	**3.0**	1.0076	1.0086	**28.0**	0.9918	0.9907
−21.5	1.0232	1.0265	**3.5**	1.0073	1.0083	**28.5**	0.9915	0.9904
−21.0	1.0228	1.0261	**4.0**	1.0069	1.0079	**29.0**	0.9912	0.9900
−20.5	1.0225	1.0257	**4.5**	1.0066	1.0076	**29.5**	0.9909	0.9897
−20.0	1.0222	1.0254	**5.0**	1.0063	1.0072	**30.0**	0.9906	0.9893
−19.5	1.0219	1.0250	**5.5**	1.0060	1.0068	**30.5**	0.9903	0.9889
−19.0	1.0216	1.0246	**6.0**	1.0057	1.0065	**31.0**	0.9900	0.9886
−18.5	1.0212	1.0243	**6.5**	1.0054	1.0061	**31.5**	0.9897	0.9882
−18.0	1.0209	1.0239	**7.0**	1.0050	1.0057	**32.0**	0.9893	0.9879
−17.5	1.0206	1.0235	**7.5**	1.0047	1.0054	**32.5**	0.9890	0.9875
−17.0	1.0203	1.0232	**8.0**	1.0044	1.0050	**33.0**	0.9887	0.9872
−16.5	1.0200	1.0228	**8.5**	1.0041	1.0047	**33.5**	0.9884	0.9868
−16.0	1.0196	1.0224	**9.0**	1.0038	1.0043	**34.0**	0.9881	0.9865
−15.5	1.0193	1.0221	**9.5**	1.0035	1.0039	**34.5**	0.9878	0.9861
−15.0	1.0190	1.0217	**10.0**	1.0031	1.0036	**35.0**	0.9875	0.9858
−14.5	1.0187	1.0213	**10.5**	1.0028	1.0032	**35.5**	0.9872	0.9854
−14.0	1.0184	1.0210	**11.0**	1.0025	1.0029	**36.0**	0.9869	0.9850
−13.5	1.0180	1.0206	**11.5**	1.0022	1.0025	**36.5**	0.9865	0.9847
−13.0	1.0177	1.0202	**12.0**	1.0019	1.0022	**37.0**	0.9862	0.9843
−12.5	1.0174	1.0199	**12.5**	1.0016	1.0018	**37.5**	0.9859	0.9840
−12.0	1.0171	1.0195	**13.0**	1.0013	1.0014	**38.0**	0.9856	0.9836
−11.5	1.0168	1.0192	**13.5**	1.0009	1.0011	**38.5**	0.9853	0.9833
−11.0	1.0165	1.0188	**14.0**	1.0006	1.0007	**39.0**	0.9850	0.9829
−10.5	1.0161	1.0184	**14.5**	1.0003	1.0004	**39.5**	0.9847	0.9826
−10.0	1.0158	1.0181	**15.0**	1.0000	1.0000	**40.0**	0.9844	0.9822
−9.5	1.0155	1.0177	**15.5**	0.9997	0.9996	**40.5**	0.9841	0.9819
−9.0	1.0152	1.0173	**16.0**	0.9994	0.9993	**41.0**	0.9837	0.9815
−8.5	1.0149	1.0170	**16.5**	0.9991	0.9989	**41.5**	0.9834	0.9812
−8.0	1.0145	1.0166	**17.0**	0.9987	0.9986	**42.0**	0.9831	0.9808
−7.5	1.0142	1.0162	**17.5**	0.9984	0.9982	**42.5**	0.9828	0.9805
−7.0	1.0139	1.0159	**18.0**	0.9981	0.9979	**43.0**	0.9825	0.9801
−6.5	1.0136	1.0155	**18.5**	0.9978	0.9975	**43.5**	0.9822	0.9797
−6.0	1.0133	1.0152	**19.0**	0.9975	0.9971	**44.0**	0.9819	0.9794
−5.5	1.0130	1.0148	**19.5**	0.9972	0.9968	**44.5**	0.9816	0.9790
−5.0	1.0126	1.0144	**20.0**	0.9969	0.9964	**45.0**	0.9813	1.9787
−4.5	1.0123	1.0141	**20.5**	0.9965	0.9961	**45.5**	0.9809	0.9783
−4.0	1.0120	1.0137	**21.0**	0.9962	0.9957	**46.0**	0.9806	0.9780
−3.5	1.0117	1.0133	**21.5**	0.9959	0.9953	**46.5**	0.9803	0.9776
−3.0	1.0114	1.0130	**22.0**	0.9956	0.9950	**47.0**	0.9800	0.9773
−2.5	1.0111	1.0126	**22.5**	0.9953	0.9946	**47.5**	0.9797	0.9769
−2.0	1.0107	1.0122	**23.0**	0.9950	0.9943	**48.0**	0.9794	0.9766
−1.5	1.0104	1.0119	**23.5**	0.9947	0.9939	**48.5**	0.9791	0.9762
−1.0	1.0101	1.0115	**24.0**	0.9944	0.9936	**49.0**	0.9788	0.9759
−0.5	1.0098	1.0112	**24.5**	0.9940	0.9932	**49.5**	0.9785	0.9755

[A]Use column A factors for asphalts with density at 15°C of 966 kg/m^3 or higher.

[B]Use column B factors for asphalts with density at 15°C of 850 to 965 kg/m^3.

TABLE 1 *Continued*

Observed Temperature, °C	Volume Correction[A,B] Factor to 15°C		Observed Temperature, ° C	Volume Correction[A,B] Factor to 15°C		Observed Temperature, °C	Volume Correction[A,B] Factor − 25 to + 50°C to 15°C	
	A	B		A	B		A	B
50.0	0.9782	0.9752	**75.0**	0.9628	0.9578	**100.0**	0.9476	0.9407
50.5	0.9779	0.9748	**75.5**	0.9625	0.9574	**100.5**	0.9473	0.9403
51.0	0.9775	0.9745	**76.0**	0.9622	0.9571	**101.0**	0.9470	0.9400
51.5	0.9772	0.9741	**76.5**	0.9619	0.9567	**101.5**	0.9467	0.9396
52.0	0.9769	0.9738	**77.0**	0.9616	0.9564	**102.0**	0.9464	0.9393
52.5	0.9766	0.9734	**77.5**	0.9613	0.9561	**102.5**	0.9461	0.9390
53.0	0.9763	0.9731	**78.0**	0.9609	0.9557	**103.0**	0.9458	0.9386
53.5	0.9760	0.9727	**78.5**	0.9606	0.9554	**103.5**	0.9455	0.9383
54.0	0.9757	0.9724	**79.0**	0.9603	0.9550	**104.0**	0.9452	0.9379
54.5	0.9754	0.9720	**79.5**	0.9600	0.9547	**104.5**	0.9449	0.9376
55.0	0.9751	0.9717	**80.0**	0.9597	0.9543	**105.0**	0.9446	0.9373
55.5	0.9748	0.9713	**80.5**	0.9594	0.9540	**105.5**	0.9443	0.9369
56.0	0.9745	0.9710	**81.0**	0.9591	0.9536	**106.0**	0.9440	0.9366
56.5	0.9741	0.9706	**81.5**	0.9588	0.9533	**106.5**	0.9437	0.9363
57.0	0.9738	0.9703	**82.0**	0.9585	0.9530	**107.0**	0.9434	0.9359
57.5	0.9735	0.9699	**82.5**	0.9582	0.9526	**107.5**	0.9431	0.9356
58.0	0.9732	0.9696	**83.0**	0.9579	0.9523	**108.0**	0.9428	0.9352
58.5	0.9729	0.9692	**83.5**	0.9576	0.9519	**108.5**	0.9425	0.9349
59.0	0.9726	0.9689	**84.0**	0.9573	0.9516	**109.0**	0.9422	0.9346
59.5	0.9723	0.9685	**84.5**	0.9570	0.9512	**109.5**	0.9419	0.9342
60.0	0.9720	0.9682	**85.0**	0.9567	0.9509	**110.0**	0.9416	0.9339
60.5	0.9717	0.9678	**85.5**	0.9564	0.9506	**110.5**	0.9413	0.9335
61.0	0.9714	0.9675	**86.0**	0.9561	0.9502	**111.0**	0.9410	0.9332
61.5	0.9711	0.9671	**86.5**	0.9558	0.9499	**111.5**	0.9407	0.9329
62.0	0.9708	0.9668	**87.0**	0.9555	0.9495	**112.0**	0.9404	0.9325
62.5	0.9704	0.9664	**87.5**	0.9552	0.9492	**112.5**	0.9401	0.9322
63.0	0.9701	0.9661	**88.0**	0.9549	0.9488	**113.0**	0.9398	0.9319
63.5	0.9698	0.9658	**88.5**	0.9546	0.9485	**113.5**	0.9395	0.9315
64.0	0.9695	0.9654	**89.0**	0.9542	0.9482	**114.0**	0.9392	0.9312
64.5	0.9692	0.9651	**89.5**	0.9539	0.9478	**114.5**	0.9389	0.9309
65.0	0.9689	0.9647	**90.0**	0.9536	0.9475	**115.0**	0.9386	0.9305
65.5	0.9686	0.9644	**90.5**	0.9533	0.9471	**115.5**	0.9383	0.9302
66.0	0.9683	0.9640	**91.0**	0.9530	0.9468	**116.0**	0.9380	0.9298
66.5	0.9680	0.9637	**91.5**	0.9527	0.9464	**116.5**	0.9377	0.9295
67.0	0.9677	0.9633	**92.0**	0.9524	0.9461	**117.0**	0.9374	0.9292
67.5	0.9674	0.9630	**92.5**	0.9521	0.9458	**117.5**	0.9371	0.9288
68.0	0.9671	0.9626	**93.0**	0.9518	0.9454	**118.0**	0.9368	0.9285
68.5	0.9668	0.9623	**93.5**	0.9515	0.9451	**118.5**	0.9365	0.9282
69.0	0.9665	0.9619	**94.0**	0.9512	0.9447	**119.0**	0.9362	0.9278
69.5	0.9661	0.9616	**94.5**	0.9509	0.9444	**119.5**	0.9359	0.9275
70.0	0.9658	0.9612	**95.0**	0.9506	0.9441	**120.0**	0.9356	0.9272
70.5	0.9655	0.9609	**95.5**	0.9503	0.9437	**120.5**	0.9353	0.9268
71.0	0.9652	0.9605	**96.0**	0.9500	0.9434	**121.0**	0.9350	0.9265
71.5	0.9649	0.9602	**96.5**	0.9597	0.9430	**121.5**	0.9347	0.9262
72.0	0.9646	0.9599	**97.0**	0.9494	0.9427	**122.0**	0.9344	0.9258
72.5	0.9643	0.9595	**97.5**	0.9491	0.9424	**122.5**	0.9341	0.9255
73.0	0.9640	0.9592	**98.0**	0.9488	0.9420	**123.0**	0.9338	0.9251
73.5	0.9637	0.9588	**98.5**	0.9485	0.9417	**123.5**	0.9335	0.9248
74.0	0.9634	0.9585	**99.0**	0.9482	0.9413	**124.0**	0.9332	0.9245
74.5	0.9631	0.9581	**99.5**	0.9479	0.9410	**124.5**	0.9329	0.9241

[A]Use column A factors for asphalts with density at 15°C of 966 kg/m^3 or higher.
[B]Use column B factors for asphalts with density at 15°C of 850 to 965 kg/m^3.

TABLE 1 *Continued*

Observed Temperature, °C	Volume Correction[A,B] Factor to 15°C		Observed Temperature, ° C	Volume Correction[A,B] Factor to 15°C		Observed Temperature, °C	Volume Correction[A,B] Factor − 25 to + 50°C to 15°C	
	A	B		A	B		A	B
125.0	0.9326	0.9238	**150.0**	0.9177	0.9072	**175.0**	0.9031	0.8909
125.5	0.9323	0.9235	**150.5**	0.9174	0.9069	**175.5**	0.9028	0.8906
126.0	0.9320	0.9231	**151.0**	0.9171	0.9066	**176.0**	0.9025	0.8903
126.5	0.9317	0.9228	**151.5**	0.9169	0.9063	**176.5**	0.9022	0.8900
127.0	0.9314	0.9225	**152.0**	0.9166	0.9059	**177.0**	0.9019	0.8896
127.5	0.9311	0.9221	**152.5**	0.9163	0.9056	**177.5**	0.9016	0.8893
128.0	0.9308	0.9218	**153.0**	0.9160	0.9053	**178.0**	0.9013	0.8890
128.5	0.9305	0.9215	**153.5**	0.9157	0.9049	**178.5**	0.9010	0.8887
129.0	0.9302	0.9211	**154.0**	0.9154	0.9046	**179.0**	0.9008	0.8884
129.5	0.9299	0.9208	**154.5**	0.9151	0.9043	**179.5**	0.9005	0.8880
130.0	0.9296	0.9205	**155.0**	0.9148	0.9040	**180.0**	0.9002	0.8877
130.5	0.9293	0.9201	**155.5**	0.9145	0.9036	**180.5**	0.8999	0.8874
131.0	0.9290	0.9198	**156.0**	0.9142	0.9033	**181.0**	0.8996	0.8871
131.5	0.9287	0.9195	**156.5**	0.9139	0.9030	**181.5**	0.8993	0.8867
132.0	0.9284	0.9191	**157.0**	0.9136	0.9026	**182.0**	0.8990	0.8864
132.5	0.9281	0.9188	**157.5**	0.9133	0.9023	**182.5**	0.8987	0.8861
133.0	0.9278	0.9185	**158.0**	0.9130	0.9020	**183.0**	0.8984	0.8858
133.5	0.9275	0.9181	**158.5**	0.9127	0.9017	**183.5**	0.8981	0.8855
134.0	0.9272	0.9178	**159.0**	0.9124	0.9013	**184.0**	0.8979	0.8851
134.5	0.9269	0.9175	**159.5**	0.9121	0.9010	**184.5**	0.8976	0.8848
135.0	0.9266	0.9171	**160.0**	0.9119	0.9007	**185.0**	0.8973	0.8845
135.5	0.9263	0.9168	**160.5**	0.9116	0.9004	**185.5**	0.8970	0.8842
136.0	0.9260	0.9165	**161.0**	0.9113	0.9000	**186.0**	0.8967	0.8839
136.5	0.9257	0.9162	**161.5**	0.9110	0.8997	**186.5**	0.8964	0.8835
137.0	0.9254	0.9158	**162.0**	0.9107	0.8994	**187.0**	0.8961	0.8832
137.5	0.9251	0.9155	**162.5**	0.9104	0.8991	**187.5**	0.8958	0.8829
138.0	0.9248	0.9152	**163.0**	0.9101	0.8987	**188.0**	0.8955	0.8826
138.5	0.9245	0.9148	**163.5**	0.9098	0.8984	**188.5**	0.8952	0.8823
139.0	0.9242	0.9145	**164.0**	0.9095	0.8981	**189.0**	0.8950	0.8819
139.5	0.9239	0.9142	**164.5**	0.9092	0.8977	**189.5**	0.8947	0.8816
140.0	0.9236	0.9138	**165.0**	0.9089	0.8974	**190.0**	0.8944	0.8813
140.5	0.9234	0.9135	**165.5**	0.9086	0.8971	**190.5**	0.8941	0.8810
141.0	0.9231	0.9132	**166.0**	0.9083	0.8968	**191.0**	0.8938	0.8807
141.5	0.9228	0.9128	**166.5**	0.9080	0.8964	**191.5**	0.8935	0.8803
142.0	0.9225	0.9125	**167.0**	0.9078	0.8961	**192.0**	0.8932	0.8800
142.5	0.9222	0.9122	**167.5**	0.9075	0.8958	**192.5**	0.8929	0.8797
143.0	0.9219	0.9118	**168.0**	0.9072	0.8955	**193.0**	0.8926	0.8794
143.5	0.9216	0.9115	**168.5**	0.9069	0.8951	**193.5**	0.8924	0.8791
144.0	0.9213	0.9112	**169.0**	0.9066	0.8948	**194.0**	0.8921	0.8787
144.5	0.9210	0.9109	**169.5**	0.9063	0.8945	**194.5**	0.8918	0.8784
145.0	0.9207	0.9105	**170.0**	0.9060	0.8942	**195.0**	0.8915	0.8781
145.5	0.9204	0.9102	**170.5**	0.9057	0.8939	**195.5**	0.8912	0.8778
146.0	0.9201	0.9099	**171.0**	0.9054	0.8935	**196.0**	0.8909	0.8775
146.5	0.9198	0.9095	**171.5**	0.9051	0.8932	**196.5**	0.8906	0.8771
147.0	0.9195	0.9092	**172.0**	0.9048	0.8929	**197.0**	0.8903	0.8768
147.5	0.9192	0.9089	**172.5**	0.9045	0.8926	**197.5**	0.8901	0.8765
148.0	0.9189	0.9086	**173.0**	0.9042	0.8922	**198.0**	0.8898	0.8762
148.5	0.9186	0.9082	**173.5**	0.9040	0.8919	**198.5**	0.8895	0.8759
149.0	0.9183	0.9079	**174.0**	0.9037	0.8916	**199.0**	0.8892	0.8755
149.5	0.9180	0.9076	**174.5**	0.9034	0.8913	**199.5**	0.8889	0.8752

[A]Use column A factors for asphalts with density at 15°C of 966 kg/m^3 or higher.
[B]Use column B factors for asphalts with density at 15°C of 850 to 965 kg/m^3.

TABLE 1 *Continued*

Observed Temperature, °C	Volume Correction[A,B] Factor to 15°C		Observed Temperature, ° C	Volume Correction[A,B] Factor to 15°C		Observed Temperature, °C	Volume Correction[A,B] Factor − 25 to + 50°C to 15°C	
	A	B		A	B		A	B
200.0	0.8886	0.8749	**225.0**	0.8743	0.8592	**250.0**	0.8602	0.8437
200.5	0.8883	0.8746	**225.5**	0.8740	0.8589	**250.5**	0.8599	0.8434
201.0	0.8880	0.8743	**226.0**	0.8738	0.8585	**251.0**	0.8597	0.8431
201.5	0.8878	0.8740	**226.5**	0.8735	0.8582	**251.5**	0.8594	0.8438
202.0	0.8875	0.8736	**227.0**	0.8732	0.8579	**252.0**	0.8591	0.8425
202.5	0.8872	0.8733	**227.5**	0.8729	0.8576	**252.5**	0.8588	0.8422
203.0	0.8869	0.8730	**228.0**	0.8726	0.8573	**253.0**	0.8585	0.8419
203.5	0.8866	0.8727	**228.5**	0.8723	0.8570	**253.5**	0.8583	0.8415
204.0	0.8863	0.8724	**229.0**	0.8721	0.8567	**254.0**	0.8580	0.8412
204.5	0.8860	0.8721	**229.5**	0.8718	0.8564	**254.5**	0.8577	0.8409
205.0	0.8857	0.8717	**230.0**	0.8715	0.8560	**255.0**	0.8574	0.8406
205.5	0.8855	0.8714	**230.5**	0.8712	0.8557	**255.5**	0.8571	0.8403
206.0	0.8852	0.8711	**231.0**	0.8709	0.8554	**256.0**	0.8569	0.8400
206.5	0.8849	0.8708	**231.5**	0.8706	0.8551	**256.5**	0.8566	0.8397
207.0	0.8846	0.8705	**232.0**	0.8704	0.8548	**257.0**	0.8563	0.8394
207.5	0.8843	0.8702	**232.5**	0.8701	0.8545	**257.5**	0.8560	0.8391
208.0	0.8840	0.8698	**233.0**	0.8698	0.8542	**258.0**	0.8557	0.8388
208.5	0.8837	0.8695	**233.5**	0.8695	0.8539	**258.5**	0.8555	0.8385
209.0	0.8834	0.8692	**234.0**	0.8692	0.8536	**259.0**	0.8552	0.8382
209.5	0.8832	0.8689	**234.5**	0.8689	0.8533	**259.5**	0.8549	0.8379
210.0	0.8829	0.8686	**235.0**	0.8687	0.8529	**260.0**	0.8546	0.8376
210.5	0.8826	0.8683	**235.5**	0.8684	0.8526	**260.5**	0.8544	0.8373
211.0	0.8823	0.8680	**236.0**	0.8681	0.8523	**261.0**	0.8541	0.8370
211.5	0.8820	0.8676	**236.5**	0.8678	0.8520	**261.5**	0.8538	0.8367
212.0	0.8817	0.8673	**237.0**	0.8675	0.8517	**262.0**	0.8535	0.8364
212.5	0.8814	0.8670	**237.5**	0.8673	0.8514	**262.5**	0.8532	0.8361
213.0	0.8812	0.8667	**238.0**	0.8670	0.8511	**263.0**	0.8530	0.8358
213.5	0.8809	0.8664	**238.5**	0.8667	0.8508	**263.5**	0.8527	0.8354
214.0	0.8806	0.8661	**239.0**	0.8664	0.8505	**264.0**	0.8524	0.8351
214.5	0.8803	0.8657	**239.5**	0.8661	0.8502	**264.5**	0.8521	0.8348
215.0	0.8800	0.8654	**240.0**	0.8658	0.8498	**265.0**	0.8518	0.8345
215.5	0.8797	0.8651	**240.5**	0.8656	0.8495	**265.5**	0.8516	0.8342
216.0	0.8794	0.8648	**241.0**	0.8653	0.8492	**266.0**	0.8513	0.8339
216.5	0.8792	0.8645	**241.5**	0.8650	0.8489	**266.5**	0.8510	0.8336
217.0	0.8789	0.8642	**242.0**	0.8647	0.8486	**267.0**	0.8507	0.8333
217.5	0.8786	0.8639	**242.5**	0.8644	0.8483	**267.5**	0.8505	0.8330
218.0	0.8783	0.8635	**243.0**	0.8642	0.8480	**268.0**	0.8502	0.8327
218.5	0.8780	0.8632	**243.5**	0.8639	0.8477	**268.5**	0.8499	0.8324
219.0	0.8777	0.8629	**244.0**	0.8636	0.8474	**269.0**	0.8496	0.8321
219.5	0.8775	0.8626	**244.5**	0.8633	0.8471	**269.5**	0.8493	0.8318
220.0	0.8772	0.8623	**245.0**	0.8630	0.8468	**270.0**	0.8491	0.8315
220.5	0.8769	0.8620	**245.5**	0.8627	0.8465	**270.5**	0.8488	0.8312
221.0	0.8766	0.8617	**246.0**	0.8625	0.8461	**271.0**	0.8485	0.8309
221.5	0.8763	0.8614	**246.5**	0.8622	0.8458	**271.5**	0.8482	0.8306
222.0	0.8760	0.8610	**247.0**	0.8619	0.8455	**272.0**	0.8480	0.8303
222.5	0.8757	0.8607	**247.5**	0.8616	0.8452	**272.5**	0.8477	0.8300
223.0	0.8755	0.8604	**248.0**	0.8613	0.8449	**273.0**	0.8474	0.8297
223.5	0.8752	0.8601	**248.5**	0.8611	0.8446	**273.5**	0.8471	0.8294
224.0	0.8749	0.8598	**249.0**	0.8608	0.8443	**274.0**	0.8469	0.8291
224.5	0.8746	0.8595	**249.5**	0.8605	0.8440	**274.5**	0.8466	0.8288

[A]Use column A factors for asphalts with density at 15°C of 966 kg/m^3 or higher.
[B]Use column B factors for asphalts with density at 15°C of 850 to 965 kg/m^3.

APPENDIX

(Nonmandatory Information)

X1. FORMULAS USED IN DETERMINING VOLUME CORRECTIONS TO A BASE TEMPERATURE

X1.1 *Volume Correction Formulas*—The formulas used in Table 1 were derived from the original tables listed in Guide D 1250 – 80 for Group 0 and 1 Oils in Tables 7.25. A linear regression analysis for the tables is listed below for each factor.

$$A = 1.0211326242 - 3.548988118 \times 10^{-4}\,[T(°F)] + 4.49881 \times 10^{-8}\,[T(°F)]^2 \quad \text{(X1.1)}$$

where:

A = volume correction factor, and
T(°F) = temperature of asphalt cement in° F.

$$B = 1.02413769 - 4.0641418 \times 10^{-4}\,[T(°F)] + 6.79176 \times 10^{-8}\,[T(°F)]^2 \quad \text{(X1.2)}$$

where:

B = volume correction factor, and
T(°F) = temperature of asphalt cement in° F.

X1.1.1 These two formulas generate the same values as the original table at all temperatures except those listed below:

Factor A

Temperature,° F	D 1250 Table	Calculated Value
7	1.0186	1.0187
49	1.0038	1.0039
59	1.0003	1.0004
246	0.9365	0.9366

Factor B

Temperature, °F	D 1250 Table	Calculated Value
17	1.0174	1.0172
336	0.8952	0.8953
372	0.8823	0.8824
449	0.8554	0.8553
479	0.8451	0.8450
499	0.8383	0.8382

The differences are always in the 4th digit and the difference is never more than one. The 10 exceptions out of 1000 results indicates an exceptionally good fit to the original data.

X1.2 *Temperature Correction to 15°C*—Because the original tables were developed around correcting asphalt cement to a base temperature of 60°F (15.6°C) it was determined to use the formulas used to derive this table in converting to a new base temperature of 15°C. The first step is to convert the 60°F formula to an equivalent 15.6°C formula by replacing (°F) = 32 + 1.8(°C). This results in new (A) and (B) factor formulas listed below:

$$A = 1.00982193004 - 6.3363523212 \times 10^{-4}\,[T(°C)] + 1.45761444 \times 10^{-7}\,[T(°C)]^2 \quad \text{(X1.3)}$$

$$B = 1.01120198386 - 7.2372141648 \times 10^{-4}\,[T(°C)] + 2.20053024 \times 10^{-7}\,[T(°C)]^2 \quad \text{(X1.4)}$$

X1.2.1 To convert to a base temperature of 15°C rather than 15.6°C, a value of 15°C was substituted into the above equations. The result for each factor is listed below:

$$A = 1.0003502 \quad \text{(X1.5)}$$

$$B = 1.0003957 \quad \text{(X1.6)}$$

X1.2.2 To convert to a base temperature of 15°C the following adjustment was made to A and B Factor Formulas:

$$A = (1.00982193004 \div 1.0003502) - (6.3363523212 \times 10^{-4} \div 1.0003502)\,[T(°C)] \div (1.45761444 \times 10^{-7} \div 1.0003502)\,[T(°C)]^2 \quad \text{(X1.7)}$$

$$A = 1.0094684142 - 6.33413410744 \times 10^{-4}\,[T(°C)] + 1.45710416212 \times 10^{-7}\,T(°C)]^2 \quad \text{(X1.8)}$$

$$B = (1.01120198386 \div 1.0003957) - (7.2372141648 \times 10^{-4} \div 1.0003957)\,[T(°C)] + (2.20053024 \times 10^{-7} \div 1.0003957)\,[T(°C)] \quad \text{(X1.9)}$$

$$B = 1.0108020095 - 7.2343515319 \times 10^{-4}\,[T(°C)] + 2.1996598346 \times 10^{-7}\,[T(°C)]^2 \quad \text{(X1.10)}$$

These calculated formulas and the resulting table is listed in this practice.