



Standard Practice for Determining Asphalt Volume Correction to a Base Temperature¹

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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 tables to convert asphalt volumes to 15°C [60°F] from volumes measured at any temperature from –25 to +275°C [0 to 500°F].

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

NOTE 1—Correction factors in Table 1 and Table 2 are for use in place of correction factors provided in Guide D1250, which do not address requirements for asphalt specifications.²

2. Referenced Documents

2.1 ASTM Standards:³

D70 Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)

D1250 Guide for Use of the Petroleum Measurement Tables

D3142 Test Method for Specific Gravity, API Gravity, or Density of Cutback Asphalts by Hydrometer Method

D3289 Test Method for Density of Semi-Solid and Solid Bituminous Materials (Nickel Crucible Method)

¹ This practice is under the jurisdiction of ASTM Committee D04 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 – 04.

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.

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 or [60°F] 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
2	0.00063	0.00072

4. Procedure

4.1 Volume correction factors are provided for volume adjustments to 15°C in Table 1 and [60°F] in Table 2. The tables are entered with asphalt temperature at which bulk volume is measured.

4.2 The tables provide 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, API gravity at [60°F], or by the specific gravity [60/60°F]. Column A factors apply to the majority of asphalts.

4.2.1 Values for density at 15°C, API gravity at [60°F], and specific gravity [60/60°F] may be obtained by Test Method D70, Test Method D3289, or Test Method D3142.

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

4.2.2.1 Table 1—A Factor Asphalts:

$$A = 1.00946841 - 6.33413411 \times 10^{-4} [T(^{\circ}\text{C})] + 1.45710416 \times 10^{-7} [T(^{\circ}\text{C})]^2 \quad (1)$$

where:

A = volume correction factor, and
 $T(^{\circ}\text{C})$ = temperature of asphalt in °C.

4.2.2.2 Table 1—B Factor Asphalts:

**D4311/D4311M – 15****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 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
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
51.5	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
51.0	0.9775	0.9745	76.0	0.9622	0.9571	101.0	0.9470	0.9400
52.5	0.9766	0.9734	77.5	0.9613	0.9561	102.5	0.9461	0.9390
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
53.0	0.9763	0.9731	78.0	0.9609	0.9557	103.0	0.9458	0.9386

**D4311/D4311M – 15****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 to 15°C	
	A	B		A	B		A	B
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
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

**D4311/D4311M – 15****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 to 15°C	
	A	B		A	B		A	B
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
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



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 to 15°C	
	A	B		A	B		A	B
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/m³ or higher.

^B Use column B factors for asphalts with density at 15°C of 850 to 965 kg/m³.

$$B = 1.01080200 - 7.23435153 \times 10^{-4} [T(^{\circ}\text{C})] + 2.19965983 \times 10^{-7} [T(^{\circ}\text{C})]^2 \quad (2)$$

where:

B = volume correction factor, and

$T(^{\circ}\text{C})$ = temperature of asphalt in °C.

4.2.2.3 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 D1250 for Group 0 and 1 Oils. Table 1 has been corrected to a base temperature of 15°C. See Appendix X1 for details.

4.2.3 Volume correction factors (see Note 3) for Table 2 were generated using the following formulas:

4.2.3.1 Table 2—A Factor Asphalts:

$$A = 1.02113262 - 3.54898812 \times 10^{-4} [T(^{\circ}\text{F})] + 4.49881 \times 10^{-8} [T(^{\circ}\text{F})]^2 \quad (3)$$

NOTE 3—The volume correction factors are designed to generate values similar to those found in the original published Guide D1250 for Group 0 and 1 Oils. Table 2 has been corrected to a base temperature of [60°F]. See Appendix X1 for details.

where:

A = volume correction factor, and

$T(^{\circ}\text{F})$ = temperature of asphalt in [°F].

4.2.3.2 Table 2—B Factor Asphalts:

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

where:

B = volume correction factor, and

$T(^{\circ}\text{F})$ = temperature of asphalt in [°F].

4.2.3.3 These formulas may be used in lieu of Table 2 to calculate volume correction factors.

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 or [60°F].

5. Example of Use

5.1 Example A—Volume of asphalt cement is measured to be 5000 m³ at a temperature of 135°C. Asphalt cement density at 15°C is 1015 kg/m³. 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/m³ 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 m³ by 0.9266 results in 4633 m³ of asphalt at 15°C.

5.2 Example B—Volume of asphalt cement is measured to be 347 m³ at a temperature of [307°F]. The asphalt cement specific gravity at [60°F] is 0.960. Determine the volume of the asphalt cement at a temperature of [60°F].

5.2.1 Column B factors from Table 2 are applicable since the specific gravity is between 0.850 and 0.966 at [60°F].

5.2.2 A volume correction factor of 0.9058 is read for an observed temperature of [307°F]. Multiplying the measured volume of 347 m³ by 0.9058 results in 314.3 m³ at [60°F].

6. Keywords

6.1 base temperature; volume correction



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TABLE 2 Volume Reduction to 60°F

Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]		Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]		Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]	
	A	B		A	B		A	B
0	1.0211	1.0241	50	1.0035	1.0040	100	0.9861	0.9842
1	1.0208	1.0237	51	1.0031	1.0036	101	0.9857	0.9838
2	1.0204	1.0233	52	1.0028	1.0032	102	0.9854	0.9834
3	1.0201	1.0229	53	1.0024	1.0028	103	0.9851	0.9830
4	1.0197	1.0225	54	1.0021	1.0024	104	0.9847	0.9826
5	1.0194	1.0221	55	1.0017	1.0020	105	0.9844	0.9822
6	1.0190	1.0217	56	1.0014	1.0016	106	0.9840	0.9818
7	1.0187	1.0213	57	1.0010	1.0012	107	0.9837	0.9814
8	1.0183	1.0209	58	1.0007	1.0008	108	0.9833	0.9810
9	1.0179	1.0205	59	1.0004	1.0004	109	0.9830	0.9806
10	1.0176	1.0201	60	1.0000	1.0000	110	0.9826	0.9803
11	1.0172	1.0197	61	0.9997	0.9996	111	0.9823	0.9799
12	1.0169	1.0193	62	0.9993	0.9992	112	0.9819	0.9795
13	1.0165	1.0189	63	0.9990	0.9988	113	0.9816	0.9791
14	1.0162	1.0185	64	0.9986	0.9984	114	0.9813	0.9787
15	1.0158	1.0181	65	0.9983	0.9980	115	0.9809	0.9783
16	1.0155	1.0177	66	0.9979	0.9976	116	0.9806	0.9779
17	1.0151	1.0172	67	0.9976	0.9972	117	0.9802	0.9775
18	1.0148	1.0168	68	0.9972	0.9968	118	0.9799	0.9771
19	1.0144	1.0164	69	0.9969	0.9964	119	0.9795	0.9767
20	1.0141	1.0160	70	0.9965	0.9960	120	0.9792	0.9763
21	1.0137	1.0156	71	0.9962	0.9956	121	0.9788	0.9760
22	1.0133	1.0152	72	0.9958	0.9952	122	0.9785	0.9756
23	1.0130	1.0148	73	0.9955	0.9948	123	0.9782	0.9752
24	1.0126	1.0144	74	0.9951	0.9944	124	0.9778	0.9748
25	1.0123	1.0140	75	0.9948	0.9940	125	0.9775	0.9744
26	1.0119	1.0136	76	0.9944	0.9936	126	0.9771	0.9740
27	1.0116	1.0132	77	0.9941	0.9932	127	0.9768	0.9736
28	1.0112	1.0128	78	0.9937	0.9929	128	0.9764	0.9732
29	1.0109	1.0124	79	0.9934	0.9925	129	0.9761	0.9728
30	1.0105	1.0120	80	0.9930	0.9921	130	0.9758	0.9725
31	1.0102	1.0116	81	0.9927	0.9917	131	0.9754	0.9721
32	1.0098	1.0112	82	0.9923	0.9913	132	0.9751	0.9717
33	1.0095	1.0108	83	0.9920	0.9909	133	0.9747	0.9713
34	1.0091	1.0104	84	0.9916	0.9905	134	0.9744	0.9709
35	1.0088	1.0100	85	0.9913	0.9901	135	0.9740	0.9705
36	1.0084	1.0096	86	0.9909	0.9897	136	0.9737	0.9701
37	1.0081	1.0092	87	0.9906	0.9893	137	0.9734	0.9697
38	1.0077	1.0088	88	0.9902	0.9889	138	0.9730	0.9693
39	1.0074	1.0084	89	0.9899	0.9885	139	0.9727	0.9690
40	1.0070	1.0080	90	0.9896	0.9881	140	0.9723	0.9686
41	1.0067	1.0076	91	0.9892	0.9877	141	0.9720	0.9682
42	1.0063	1.0072	92	0.9889	0.9873	142	0.9716	0.9678
43	1.0060	1.0068	93	0.9885	0.9869	143	0.9713	0.9674
44	1.0056	1.0064	94	0.9882	0.9865	144	0.9710	0.9670
45	1.0053	1.0060	95	0.9878	0.9861	145	0.9706	0.9666
46	1.0049	1.0056	96	0.9875	0.9857	146	0.9703	0.9662
47	1.0046	1.0052	97	0.9871	0.9854	147	0.9699	0.9659
48	1.0042	1.0048	98	0.9868	0.9850	148	0.9696	0.9655
49	1.0039	1.0044	99	0.9864	0.9846	149	0.9693	0.9651
150	0.9689	0.9647	200	0.9520	0.9456	250	0.9352	0.9268
151	0.9686	0.9643	201	0.9516	0.9452	251	0.9349	0.9264
152	0.9682	0.9639	202	0.9513	0.9448	252	0.9346	0.9260
153	0.9679	0.9635	203	0.9509	0.9444	253	0.9342	0.9257
154	0.9675	0.9632	204	0.9506	0.9441	254	0.9339	0.9253
155	0.9672	0.9628	205	0.9503	0.9437	255	0.9336	0.9249
156	0.9669	0.9624	206	0.9499	0.9433	256	0.9332	0.9245
157	0.9665	0.9620	207	0.9496	0.9429	257	0.9329	0.9242
158	0.9662	0.9616	208	0.9493	0.9425	258	0.9326	0.9238
159	0.9658	0.9612	209	0.9489	0.9422	259	0.9322	0.9234
160	0.9655	0.9609	210	0.9486	0.9418	260	0.9319	0.9231
161	0.9652	0.9605	211	0.9483	0.9414	261	0.9316	0.9227
162	0.9648	0.9601	212	0.9479	0.9410	262	0.9312	0.9223
163	0.9645	0.9597	213	0.9476	0.9407	263	0.9309	0.9219
164	0.9641	0.9593	214	0.9472	0.9403	264	0.9306	0.9216
165	0.9638	0.9589	215	0.9469	0.9399	265	0.9302	0.9212
166	0.9635	0.9585	216	0.9466	0.9395	266	0.9299	0.9208
167	0.9631	0.9582	217	0.9462	0.9391	267	0.9296	0.9205
168	0.9628	0.9578	218	0.9459	0.9388	268	0.9293	0.9201
169	0.9624	0.9574	219	0.9456	0.9384	269	0.9289	0.9197
170	0.9621	0.9570	220	0.9452	0.9380	270	0.9286	0.9194

**D4311/D4311M – 15****TABLE 2** *Continued*

Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]		Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]		Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]	
	A	B		A	B		A	B
171	0.9618	0.9566	221	0.9449	0.9376	271	0.9283	0.9190
172	0.9614	0.9562	222	0.9446	0.9373	272	0.9279	0.9186
173	0.9611	0.9559	223	0.9442	0.9369	273	0.9276	0.9182
174	0.9607	0.9555	224	0.9439	0.9365	274	0.9273	0.9179
175	0.9604	0.9551	225	0.9436	0.9361	275	0.9269	0.9175
176	0.9601	0.9547	226	0.9432	0.9358	276	0.9266	0.9171
177	0.9597	0.9543	227	0.9429	0.9354	277	0.9263	0.9168
178	0.9594	0.9539	228	0.9426	0.9350	278	0.9259	0.9164
179	0.9590	0.9536	229	0.9422	0.9346	279	0.9256	0.9160
180	0.9587	0.9532	230	0.9419	0.9343	280	0.9253	0.9157
181	0.9584	0.9528	231	0.9416	0.9339	281	0.9250	0.9153
182	0.9580	0.9524	232	0.9412	0.9335	282	0.9246	0.9149
183	0.9577	0.9520	233	0.9409	0.9331	283	0.9243	0.9146
184	0.9574	0.9517	234	0.9405	0.9328	284	0.9240	0.9142
185	0.9570	0.9513	235	0.9402	0.9324	285	0.9236	0.9138
186	0.9567	0.9509	236	0.9399	0.9320	286	0.9233	0.9135
187	0.9563	0.9505	237	0.9395	0.9316	287	0.9230	0.9131
188	0.9560	0.9501	238	0.9392	0.9313	288	0.9227	0.9127
189	0.9557	0.9498	239	0.9389	0.9309	289	0.9223	0.9124
190	0.9553	0.9494	240	0.9385	0.9305	290	0.9220	0.9120
191	0.9550	0.9490	241	0.9382	0.9301	291	0.9217	0.9116
192	0.9547	0.9486	242	0.9379	0.9298	292	0.9213	0.9113
193	0.9543	0.9482	243	0.9375	0.9294	293	0.9210	0.9109
194	0.9540	0.9478	244	0.9372	0.9290	294	0.9207	0.9105
195	0.9536	0.9475	245	0.9369	0.9286	295	0.9204	0.9102
196	0.9533	0.9471	246	0.9366	0.9283	296	0.9200	0.9098
197	0.9530	0.9467	247	0.9362	0.9279	297	0.9197	0.9094
198	0.9526	0.9463	248	0.9359	0.9275	298	0.9194	0.9091
199	0.9523	0.9460	249	0.9356	0.9272	299	0.9190	0.9087
300	0.9187	0.9083	350	0.9024	0.8902	400	0.8864	0.8724
301	0.9184	0.9080	351	0.9021	0.8899	401	0.8861	0.8721
302	0.9181	0.9076	352	0.9018	0.8895	402	0.8857	0.8717
303	0.9177	0.9072	353	0.9015	0.8891	403	0.8854	0.8714
304	0.9174	0.9069	354	0.9011	0.8888	404	0.8851	0.8710
305	0.9171	0.9065	355	0.9008	0.8884	405	0.8848	0.8707
306	0.9167	0.9061	356	0.9005	0.8881	406	0.8845	0.8703
307	0.9164	0.9058	357	0.9002	0.8877	407	0.8841	0.8700
308	0.9161	0.9054	358	0.8998	0.8873	408	0.8838	0.8696
309	0.9158	0.9050	359	0.8995	0.8870	409	0.8835	0.8693
310	0.9154	0.9047	360	0.8992	0.8866	410	0.8832	0.8689
311	0.9151	0.9043	361	0.8989	0.8863	411	0.8829	0.8686
312	0.9148	0.9039	362	0.8986	0.8859	412	0.8826	0.8682
313	0.9145	0.9036	363	0.8982	0.8856	413	0.8822	0.8679
314	0.9141	0.9032	364	0.8979	0.8852	414	0.8819	0.8675
315	0.9138	0.9029	365	0.8976	0.8848	415	0.8816	0.8672
316	0.9135	0.9025	366	0.8973	0.8845	416	0.8813	0.8668
317	0.9132	0.9021	367	0.8969	0.8841	417	0.8810	0.8665
318	0.9128	0.9018	368	0.8966	0.8838	418	0.8806	0.8661
319	0.9125	0.9014	369	0.8963	0.8834	419	0.8803	0.8658
320	0.9122	0.9010	370	0.8960	0.8831	420	0.8800	0.8654
321	0.9118	0.9007	371	0.8957	0.8827	421	0.8797	0.8651
322	0.9115	0.9003	372	0.8953	0.8823	422	0.8794	0.8647
323	0.9112	0.9000	373	0.8950	0.8820	423	0.8791	0.8644
324	0.9109	0.8996	374	0.8947	0.8816	424	0.8787	0.8640
325	0.9105	0.8992	375	0.8944	0.8813	425	0.8784	0.8637
326	0.9102	0.8989	376	0.8941	0.8809	426	0.8781	0.8636
327	0.9099	0.8985	377	0.8937	0.8806	427	0.8778	0.8630
328	0.9096	0.8981	378	0.8934	0.8802	428	0.8775	0.8626
329	0.9092	0.8978	379	0.8931	0.8799	429	0.8772	0.8623
330	0.9089	0.8974	380	0.8928	0.8795	430	0.8768	0.8619
331	0.9086	0.8971	381	0.8924	0.8792	431	0.8765	0.8616
332	0.9083	0.8967	382	0.8921	0.8788	432	0.8762	0.8612
333	0.9079	0.8963	383	0.8918	0.8784	433	0.8759	0.8609
334	0.9076	0.8960	384	0.8915	0.8781	434	0.8756	0.8605
335	0.9073	0.8956	385	0.8912	0.8777	435	0.8753	0.8602
336	0.9070	0.8953	386	0.8908	0.8774	436	0.8749	0.8599
337	0.9066	0.8949	387	0.8905	0.8770	437	0.8746	0.8595
338	0.9063	0.8945	388	0.8902	0.8767	438	0.8743	0.8592
339	0.9060	0.8942	389	0.8899	0.8763	439	0.8740	0.8588
340	0.9057	0.8938	390	0.8896	0.8760	440	0.8737	0.8585
341	0.9053	0.8934	391	0.8892	0.8756	441	0.8734	0.8581



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TABLE 2 *Continued*

Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]		Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]		Observed Temperature, [°F]	Volume Correction ^{A,B} Factor to [60°F]	
	A	B		A	B		A	B
342	0.9050	0.8931	392	0.8889	0.8753	442	0.8731	0.8578
343	0.9047	0.8927	393	0.8886	0.8749	443	0.8727	0.8574
344	0.9044	0.8924	394	0.8883	0.8746	444	0.8724	0.8571
345	0.9040	0.8920	395	0.8880	0.8742	445	0.8721	0.8567
346	0.9037	0.8916	396	0.8876	0.8738	446	0.8718	0.8564
347	0.9034	0.8913	397	0.8873	0.8735	447	0.8715	0.8560
348	0.9031	0.8909	398	0.8870	0.8731	448	0.8712	0.8557
349	0.9028	0.8906	399	0.8867	0.8728	449	0.8709	0.8553
450	0.8705	0.8550						
451	0.8702	0.8547						
452	0.8699	0.8543						
453	0.8696	0.8540						
454	0.8693	0.8536						
455	0.8690	0.8533						
456	0.8687	0.8529						
457	0.8683	0.8526						
458	0.8680	0.8522						
459	0.8677	0.8519						
460	0.8674	0.8516						
461	0.8671	0.8512						
462	0.8668	0.8509						
463	0.8665	0.8505						
464	0.8661	0.8502						
465	0.8658	0.8498						
466	0.8655	0.8495						
467	0.8652	0.8492						
468	0.8649	0.8488						
469	0.8646	0.8485						
470	0.8643	0.8481						
471	0.8640	0.8478						
472	0.8636	0.8474						
473	0.8633	0.8471						
474	0.8630	0.8468						
475	0.8627	0.8464						
476	0.8624	0.8461						
477	0.8621	0.8457						
478	0.8618	0.8454						
479	0.8615	0.8450						
480	0.8611	0.8447						
481	0.8608	0.8444						
482	0.8605	0.8440						
483	0.8602	0.8437						
484	0.8599	0.8433						
485	0.8596	0.8430						
486	0.8593	0.8427						
487	0.8590	0.8423						
488	0.8587	0.8420						
489	0.8583	0.8416						
490	0.8580	0.8413						
491	0.8577	0.8410						
492	0.8574	0.8406						
493	0.8571	0.8403						
494	0.8568	0.8399						
495	0.8565	0.8396						
496	0.8562	0.8393						
497	0.8559	0.8389						
498	0.8556	0.8386						
499	0.8552	0.8382						
500	0.8549	0.8379						

^A Use column A factors for asphalts with API gravity at [60°F] of 14.9° or less with a specific gravity [60/60°F] of 0.967 or higher.

^B Use column B factors for asphalts with API gravity at [60°F] from 15.0° to 34.9° or with a specific gravity [60/60°F] from 0.850 to 0.966.



APPENDIX

(Nonmandatory Information)

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

X1.1 *Volume Correction Formulas*—The formulas used in Tables 1 and 2 were derived from the original tables listed in Guide D1250 for Group 0 and 1 Oils in Tables 7.25. A linear regression analysis for the tables is listed below for each factor.

$$A = 1.02113262 - 3.54898812 \times 10^{-4} [T(^{\circ}\text{F})] \quad (\text{X1.1})$$

$$+ 4.49881000 \times 10^{-8} [T(^{\circ}\text{F})]^2$$

where:

A = volume correction factor, and

T($^{\circ}\text{F}$) = temperature of asphalt cement in [$^{\circ}\text{F}$].

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

$$+ 6.79176 \times 10^{-8} [T(^{\circ}\text{F})]^2$$

where:

B = volume correction factor, and

T($^{\circ}\text{F}$) = temperature of asphalt cement in [$^{\circ}\text{F}$].

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

Factor A		
Temperature, [$^{\circ}\text{F}$]	D1250 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, [$^{\circ}\text{F}$]	D1250 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 $^{\circ}\text{C}$* —Because the original tables were developed around correcting asphalt cement to a base temperature of [60 $^{\circ}\text{F}$] (15.6 $^{\circ}\text{C}$) it was determined to use

the formulas used to derive this table in converting to a new base temperature of 15 $^{\circ}\text{C}$. The first step is to convert the [60 $^{\circ}\text{F}$] formula to an equivalent 15.6 $^{\circ}\text{C}$ formula by replacing [$^{\circ}\text{F}$] = 32 + 1.8($^{\circ}\text{C}$). This results in new (A) and (B) factor formulas listed below:

$$A = 1.00982193 - 6.33635232 \times 10^{-4} [T(^{\circ}\text{C})] \quad (\text{X1.3})$$

$$+ 1.45761444 \times 10^{-7} [T(^{\circ}\text{C})]^2$$

$$B = 1.01120198 - 7.23721416 \times 10^{-4} [T(^{\circ}\text{C})] \quad (\text{X1.4})$$

$$+ 2.20053024 \times 10^{-7} [T(^{\circ}\text{C})]^2$$

X1.2.1 To convert to a base temperature of 15 $^{\circ}\text{C}$ rather than 15.6 $^{\circ}\text{C}$, a value of 15 $^{\circ}\text{C}$ 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 $^{\circ}\text{C}$ the following adjustment was made to A and B Factor Formulas:

$$A = (1.00982193 \div 1.0003502) - (6.33633523 \quad (\text{X1.7})$$

$$\times 10^{-4} \div 1.0003502) [T(^{\circ}\text{C})] \div (1.45761444$$

$$\times 10^{-7} \div 1.0003502) [T(^{\circ}\text{C})]$$

$$A = 1.00946841 - 6.33413411 \quad (\text{X1.8})$$

$$\times 10^{-4} [T(^{\circ}\text{C})] + 1.45710416 \times 10^{-7} [T(^{\circ}\text{C})]^2$$

$$B = (1.0112010198 \div 1.0003957) - (7.23721416 \quad (\text{X1.9})$$

$$\times 10^{-7} \div 1.0003957) [T(^{\circ}\text{C})]$$

$$+ (2.20053024 \times 10^{-7} \div 1.0003957) [T(^{\circ}\text{C})]$$

$$B = 1.01080200 - 7.23435153 \quad (\text{X1.10})$$

$$\times 10^{-4} [T(^{\circ}\text{C})] + 2.19965983 \times 10^{-7} [T(^{\circ}\text{C})]^2$$

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

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