TEMPERATURE-VOLUME CONVERSION FOR ASPHALTIC MATERIALS

DOTD Designation: TR 321M/321-98

I. Scope

A. This procedure provides tables of volume correction factors for the conversion of volumes of hot asphalt (cutback asphalt, asphalt cement, and emulsified asphalt) measured at different temperatures to a volume at a standard base temperature of 15.5°C (60°F).

B. This procedure provides six tables, 3 using metric conversion and 3 using english conversion. Table 1 *(Table 4 - english conversion)* covers conversions to 15.5°C (60°F) of cutback asphalt volumes measured at any temperature from 16 to 92°C (60 to 200°F). Table 2 *(Table 5 - english conversion)* covers conversions to 15.5°C (60°F) of asphalt cement volumes measured at any temperature from 60 to 230°C (140 to 450°F). Table 3 *(Table 6 - english conversion)* covers conversions to 15.5°C (60°F) of emulsified asphalt volumes measured at any temperature from 16 to 78°C (60 to 175°F).

II. Apparatus

A. **Thermometer** - accurate to within ±2°C (±5°F), capable of determining temperatures of hot asphalt in storage and working tanks.

B. **Working or storage tank** - calibrated to enable volume determination to within 1.0%.

III. Health Precautions

Extreme caution is to be excercised when recording the temperature of the asphalt due to the high temperatures which may be involved.

IV. Procedure

A. Determine the temperature (t) of the hot asphalt to the nearest 2°C (5°F).

B. Determine the volume of the hot asphalt to within 1.0%.

C. Enter the appropriate table at the observed asphalt temperature at which the original volume measurement was made, and read the corresponding volume correction factor (M).

D. Multiply the original volume by the appropriate volume correction factor to obtain the adjusted volume of asphalt at 15.5°C (60°F).

V. Calculations

Calculate the adjusted volume (V_a) to the nearest gallon using the following formula:

$$V_a = V_o \times M$$

where:

V_o = original volume measured at observed temperature

M = volume correction factor corresponding to the observed temperature obtained from Table 1, 2 or 3 for metric conversion *(Table 4, 5 or 6 for english conversion)*

example: (metric conversion)

For 22000 liters of asphalt cement measured at the observed temperature of 156°C,

t = 156°C
V_o = 22000 liters of asphalt cement at 156°C
M = 0.9145 (corresponding to 156°C in Table 2)

$$V_a = 22000 \times 0.9145$$

$$V_a = 20119 \text{ liters at } 156°C$$

example: (english conversion)

For 6000 gallons of asphalt cement measured at the observed temperature of 310°F,

t = 310°F
V_o = 6000 gallons of asphalt cementat 310°F
M = 0.9154 (corresponding to 310°F in Table 5)

$$V_a = 6000 \times 0.9154$$

$$V_a = 5492 \text{ gallons at } 60°F$$

VI. Report

The adjusted volume shall be reported to the nearest liter (gallon) at 15.5°C (60°F).

VII. Normal Test Reporting Time

Normal test reporting time is 15 minutes.

TABLE 1 (METRIC CONVERSION)
TEMPERATURE-VOLUME CONVERSION
CUTBACK ASPHALT

t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M
16	0.9997	30	0.9897	44	0.9798	58	0.9700	72	0.9603	86	0.9506
18	0.9982	32	0.9883	46	0.9784	60	0.9686	74	0.9588	88	0.9492
20	0.9968	34	0.9868	48	0.9769	62	0.9672	76	0.9575	90	0.9479
22	0.9954	36	0.9854	50	0.9755	64	0.9658	78	0.9561	82	0.9465
24	0.9939	38	0.9840	52	0.9742	66	0.9644	80	0.9547		
26	0.9926	40	0.9826	54	0.9728	68	0.9630	82	0.9534		
28	0.9911	42	0.9812	56	0.9714	70	0.9617	84	0.9520		

TABLE 2 (METRIC CONVERSION)
TEMPERATURE-VOLUME CONVERSION
ASPHALT CEMENT

t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M
60	0.9723	90	0.9539	120	0.9359	150	0.9181	180	0.9005	210	0.8832
62	0.9711	92	0.9528	122	0.9347	152	0.9169	182	0.8993	212	0.8820
64	0.9699	94	0.9516	124	0.9335	154	0.9157	184	0.8982	214	0.8809
66	0.9686	96	0.9504	126	0.9323	156	0.9145	186	0.8970	216	0.8797
68	0.9674	98	0.9491	128	0.9311	158	0.9134	188	0.8959	218	0.8786
70	0.9662	100	0.9479	130	0.9299	160	0.9122	190	0.8947	220	0.8774
72	0.9650	102	0.9467	132	0.9287	162	0.9110	192	0.8936	222	0.8763
74	0.9637	104	0.9455	134	0.9275	164	0.9098	194	0.8924	224	0.8752
76	0.9625	106	0.9443	136	0.9263	166	0.9086	196	0.8913	226	0.8741
78	0.9613	108	0.9431	138	0.9252	168	0.9075	198	0.8901	228	0.8729
80	0.9601	110	0.9419	140	0.9239	170	0.9063	200	0.8890	230	0.8718
82	0.9588	112	0.9407	142	0.9228	172	0.9052	202	0.8878		
84	0.9576	114	0.9395	144	0.9216	174	0.9039	204	0.8867		
86	0.9564	116	0.9382	146	0.9205	176	0.9028	206	0.8855		
88	0.9552	118	0.9371	148	0.9192	178	0.9016	208	0.8844		

TABLE 3 (METRIC CONVERSION)
TEMPERATURE-VOLUME CONVERSION
EMULSIFIED ASPHALT

t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M	t (°C)	M
16	0.99980	28	0.99440	40	0.98900	52	0.98360	64	0.97820	76	0.97280
18	0.99890	30	0.99350	42	0.98810	54	0.98270	66	0.97730	78	0.97190
20	0.99800	32	0.99260	44	0.98720	56	0.98180	68	0.97640		
22	0.99710	34	0.99170	46	0.98630	58	0.98090	70	0.97550		
24	0.99620	36	0.99080	48	0.98540	60	0.98000	72	0.97460		
26	0.99530	38	0.98990	50	0.98450	62	0.97910	74	0.97370		

TABLE 4 (ENGLISH CONVERSION)
TEMPERATURE-VOLUME CONVERSION
CUTBACK ASPHALT

t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M
60	1.0000	85	0.9901	110	0.9803	135	0.9705	160	0.9609	185	0.9513
65	0.9980	90	0.9881	115	0.9783	140	0.9686	165	0.9589	190	0.9494
70	0.9960	95	0.9861	120	0.9763	145	0.9666	170	0.9570	195	0.9475
75	0.9940	100	0.9842	125	0.9744	150	0.9647	175	0.9551	200	0.9456
80	0.9921	105	0.9822	130	0.9725	155	0.9628	180	0.9532		

TABLE 5 (ENGLISH CONVERSION)
TEMPERATURE-VOLUME CONVERSION
ASPHALT CEMENT

t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M
140	0.9723	195	0.9536	250	0.9352	305	0.9171	360	0.8992	415	0.8816
145	0.9706	200	0.9520	255	0.9336	310	0.9154	365	0.8976	420	0.8800
150	0.9689	205	0.9503	260	0.9319	315	0.9138	370	0.8960	425	0.8784
155	0.9672	210	0.9486	265	0.9302	320	0.9122	375	0.8944	430	0.8768
160	0.9655	215	0.9469	270	0.9286	325	0.9105	380	0.8928	435	0.8753
165	0.9638	220	0.9452	275	0.9269	330	0.9089	385	0.8912	440	0.8737
170	0.9621	225	0.9436	280	0.9253	335	0.9073	390	0.8896	445	0.8721
175	0.9604	230	0.9419	285	0.9236	340	0.9057	395	0.8880	450	0.8705
180	0.9587	235	0.9402	290	0.9220	345	0.9040	400	0.8864		
185	0.9570	240	0.9385	295	0.9204	350	0.9024	405	0.8848		
190	0.9553	245	0.9369	300	0.9187	355	0.9008	410	0.8832		

TABLE 6 (ENGLISH CONVERSION)
TEMPERATURE-VOLUME CONVERSION
EMULSIFIED ASPHALT

t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M	t(°F)	M
60	1.00000	80	0.99500	100	0.99000	120	0.98500	140	0.98000	160	0.97500
65	0.99875	85	0.99375	105	0.98875	125	0.98375	145	0.97875	165	0.97375
70	0.99750	90	0.99250	110	0.98750	130	0.98250	150	0.97750	170	0.97250
75	0.99625	95	0.99125	115	0.98625	135	0.98125	155	0.97625	175	0.97125