A. Scope

This method describes the procedure used to determine the volume change of soil caused by the absorption and loss of water.

B. Apparatus

The apparatus consists of the following:

1. Swell Mold—A cylindrical metal mold approximately four 4 ± .02 in (100 ± 0.51 mm) inside diameter and 1 ± .01 in (2.5 ± 0.13 mm) high. Each mold is fitted with a detachable perforated base plate and a removable extension approximately 2 in (50.8 mm) high. (See Figure 1) (WM-08).
2. Shrinkage Mold—The same mold as the swell mold except it requires close tolerances. The height at any point is 1 ± .005 in (25 + 0.13 mm) and diameter at any point is 4 ± .01 in (100 + 0.25mm). Paint the shrinkage mold a different color to distinguish it from the swell molds (WM-08).
3. Rammer—A metal rammer having a 2 in (50mm) diameter flat circular face and weighing 5.5 lbs (2.49 kg). Has a controlled height of free-fall of 12 1/8 in ± 0.06 (303 ± 1.5 mm) (WR-1). When using a mechanical rammer, observe the following:
   a. After use each day, oil the shaft with a thin lubricant.
   b. Before use each day, wipe clean the shaft and allow to drop 25 times to standardize the shaft friction.
   c. Check the mechanical rammer for tolerances semi-annually using the procedures in AASHTO T-99.
4. Water Vat—A pan at least 1½ in (38 mm) deep with a bottom flat enough that the water surface strikes the same point within 1/16 in (1.6 mm) on all mold assemblies in the vat. Place a screen wire or similar object in the vat to ensure that water can get under the molds.
5. Drying Rack—A flat perforated metal plate with five 3/8 in (10 mm) diameter holes located symmetrically under each specimen used to dry and cool shrinkage specimen.
6. Absorbent Papers—Absorbent paper used in the swell test. Two types of absorbent paper are used: a Number 1 qualitative 4 in (l00 mm) diameter paper placed in the bottom of the mold, and a double thickness paper towel measuring about 4½ in (114 mm) square is wet and placed on top of the specimen after the water level has been adjusted (WP-03-1).
7. Extruder—A cylindrical device 3.90 TO 3.97 in (99.1 to 100.8 mm) diameter used to remove thecompacted shrinkage specimen from the mold(WS-9).
8. Scales—A balance or scale having a capacity in excess of 2.2 lbs (1000 g), sensitive to 0.0022 lbs (1.0 g). (WB-ELC-1).
9. Drying Oven—An oven with the temperature thermostatically controlled to 230 ° ± 9 °F (110 ° ± 5 °C) used to dry the shrinkage specimen.
10. Knife—A stiff sharp blade approximately 12 in (300 mm) long with the cutting edge straight to within 1/32 in (0.8 mm) throughout its length. Used for slicing the compacted specimen flush with the top of the mold-(WS-13-1).
11. Swell Thickness Measuring Device—Device consisting of a one 1 in (25.4 mm) travel micrometer dial readable to and sensitive to one-thousandth 0.001 in (0.025 mm) and the stand shown in Figure 2. Measure the original and final thickness with this device by lowering the foot gently until contact is made with the surface of the specimen. Exercise caution to avoid penetration.
12. Shrinkage Thickness Measuring Device—A one 1 in (25.4 mm) travel micrometer dial readable to and sensitive to 0.001 in (0.025 mm). Use the stand shown in Figure 3 to measure the original and final thickness of the shrinkage specimen.
13. Shrinkage Final Diameter Measuring Device—A device consisting of a 1 in (25.4 mm) travel micrometer dial readable to and sensitive to 0.001 in (0.025 mm) and the stand shown in Figure 4. The original diameter is four 4 ± .005 in (101.6 + 0.13 mm) as given in step 2 above.
14. Calibration Tool—A calibration tool used to adjust each of the 3 measuring devices to read “zero” at a point that will allow gauge travel over the range of anticipated measurements. The constants, 6.35, 22.23, and 82.55, shown in

Figure 5 are added to the shrinkage thickness, swell thickness, and shrinkage diameter dial readings respectively to produce the measurements of the specimen. All swell base plates are preadjusted to give a dial reading of zero (WG-8).

15. Plastic Bags — Bags with a 2 qt (2 L) capacity (WB-01).
16. Graduated Cylinders—A 3.4 oz (100 ml) graduate cylinder (Bit-04-100).

C. Sample Size and Preparation

No sample preparation is needed.

D. Procedures

1. Take a 2.2 +0.0022 lbs (1000 + 1.0 g) sample of the minus No. 10 (2.00 mm) material from the material obtained according to
   GDT 4, "Method of Test for Determining Gradation of Soils."
2. Place the sample in a plastic bag and thoroughly mix it with enough water to bring the moisture content to optimum as determined by GDT 7, "Method of Test for Determining Maximum Density of Soils" or by GDT 67. After mixing, seal the sample in a plastic bag for a minimum of 1 hour.
3. Swell Testing—Place a 4 in (100 mm) diameter absorbent paper in the assembled swell mold with the extension intact and placed under the rammer. Put half of the wet material into the mold and lower the rammer to touch the soil. Compact the material with 25 freefalls with the rammer.

   Remove the extension and carefully slice the surface of the specimen flush with the top of the mold. Separate the mold full of soil from the base plate with a twisting motion and remove from the base plate, invert, and replace on the absorbent paper and perforated base plate. (Use two different base plates to avoid excessive wing nut adjusting.) Ensure that each base plate for the swell test has the dial plate support preadjusted so the micrometer dial reads zero on the 0.875 in (22.22 mm) constant of the calibration tool when arranged as shown in Figure 2 with the mold removed. Using the measuring device in Figure 2, determine and record the original swell thickness reading.

   Place the assembled mold, base plate, and sample into the empty vat. After all the swell samples are in the vat, slowly put water into the vat until the water level is at the top of the mold side pin, but not covering it. Wet and place an absorbent paper measuring about 4½ in (114 mm) square on top of each swell specimen so each corner will drop into the water. After the specimen has remained in the vat undisturbed for 20 1/2 hours, carefully remove the paper and make and record a final thickness measurement. Since the specimen diameter is constant, the only change is in thickness; therefore, the percent swell is calculated as follows:

$$\text{Swell, (\%)} = 100\left(\frac{\text{Final Dial Reading} - \text{Original Dial Reading}}{\text{Original Reading} + 0.875\text{in}}\right)$$

4. Shrinkage Testing—Place the other half of the wet material in step 2 into the assembled mold, base plate, and extension and put under the rammer. Lower the rammer to touch the soil and apply 25 tamps to compact the material. Remove the extension and carefully splice flush the surface of the specimen with the top of the mold. Separate the mold full of soil from the base plate with a twisting motion and remove from the base plate. Place the mold full of soil on the extruder and carefully push the mold from around the specimen. Carefully place the specimen on the measuring stand in Figure 3 and record the original thickness dial reading. Place the specimen on the drying rack and allow it to air dry for about 1 hour after compacting and measuring all specimens to be tested.

   Place the rack of specimen in the oven for 20 1/2 hours. Remove the rack of samples from the oven and allow to cool for about 30 minutes. Determine the final thickness dial reading and final diameter dial reading using the devices in Figure 3 and Figure 4, respectively. In determining the final diameter dial reading, the circular end of the specimen faces the same direction as the dial to ensure proper centering of the specimen. Record the thickness dial reading and the mean diameter dial reading. Calculate the percent of shrinkage as follows:

$$\text{Shrinkage, \%} = \frac{\text{Original Volume} - \text{Final Volume}}{\text{Original Volume}} * 100$$

$$\text{Original Volume, in}^3 = 0.7854 * (4)^2 * (.250\text{ in} + B)$$ 4 in formula represents 4 inch mold

$$\text{Final Volume, in}^3 = 0.7854 * (3.250\text{ in} + FD)^2 * (.250\text{ in} + FT)$$

Where:

B = beginning dial reading for thickness

FT = final dial reading for thickness

FD = final dial reading for diameter

If desired, the following simplified formula may be used:

$$\text{Shrinkage, \%} = 100 - \left[\frac{(3.250 + FD)^2 * (0.250 + FT)}{0.16 * (0.250 + B)} \right]$$

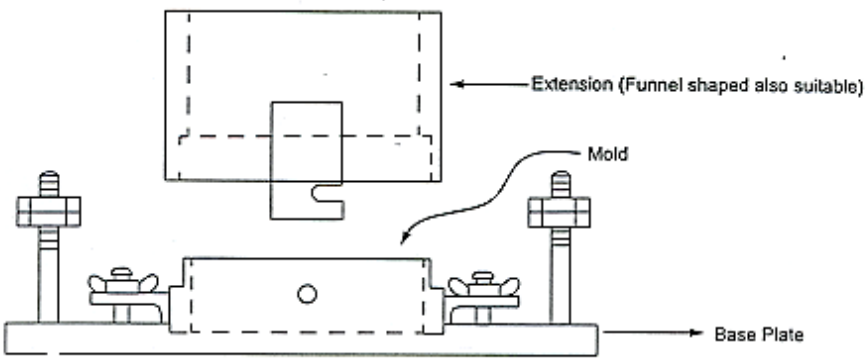
5. Correction for Plus No. 10 (2.00 mm) Material—Where the soil contains particles larger than the No. 10 (2.00 mm) sieve, the swell and shrinkage shall be corrected to reflect the percentage of Plus No. 10 (2.00 mm) material if the applicable specifications require volume change results on the total sample. Conversion factors for correcting the swell and shrinkage are given in the Volume Change Conversion Tables.
6. Total Volume Change—Calculate the total percentage points of volume change with the formula: Total Volume Change = Percent Swell + Percent Shrinkage

E. Calculations

No calculations are needed.

F. Report

Report swell, shrinkage, and volume change to the nearest 0.0022 lb (1.0 g) for minus No. 10 (2.00 mm) or total sample, whichever is appropriate.



Assembled Mold, Base Plate, and Collar

Figure 1

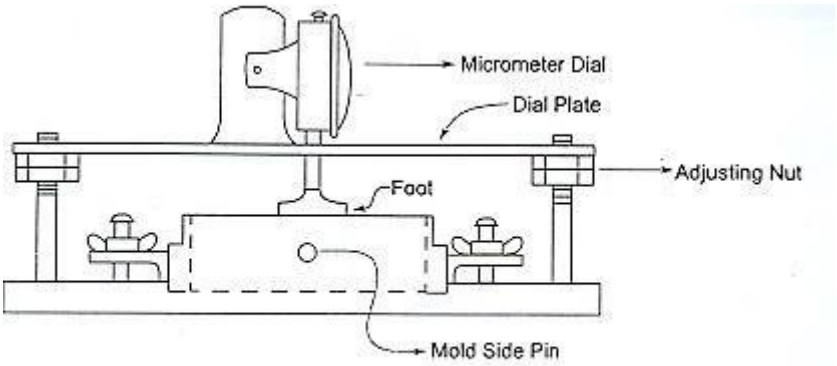


Figure 2
Swell Thickness

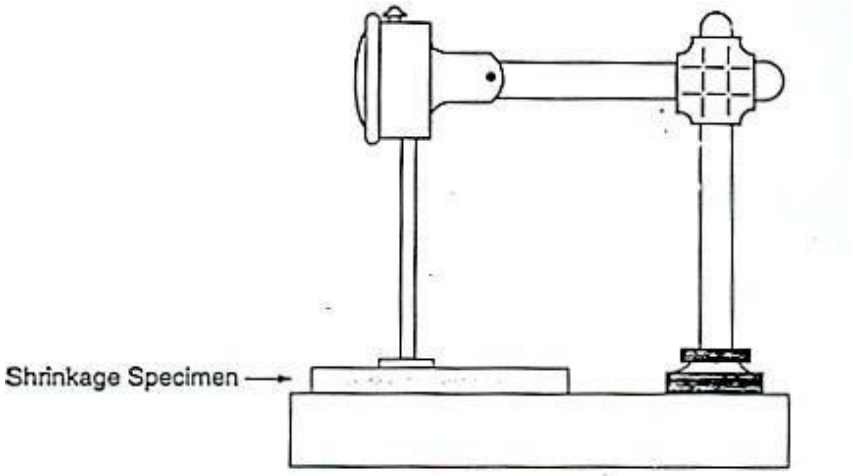


Figure 3
Shrinkage Thickness

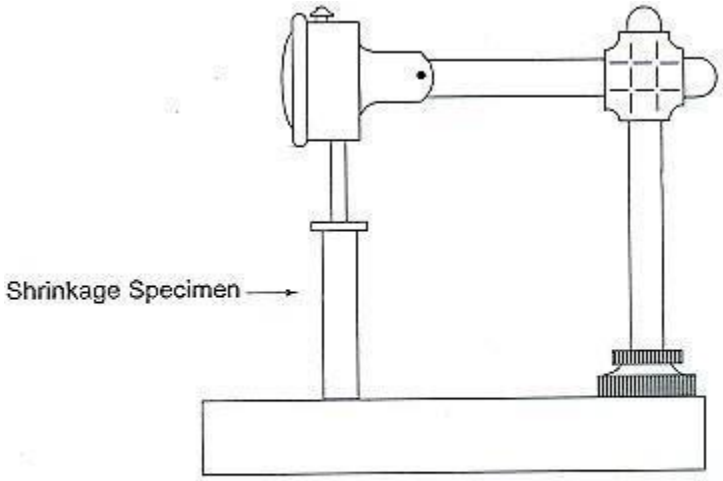
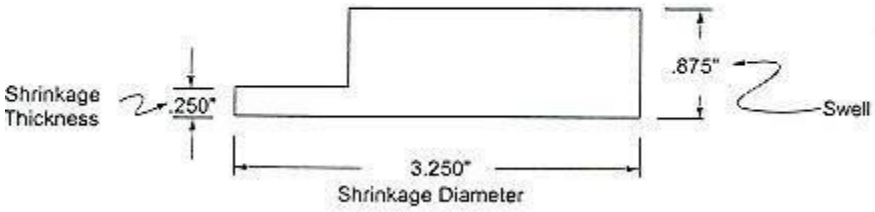


Figure 4
Shrinkage Final Diameter

Figure 5

Calibrating Tool



Volume Change Conversion Tables

This table on the next 12 pages gives a conversion factor for the related volume change of plus and minus No.10 materials combined to the minus No. 10 material volume change.

Example Of Application:

Suppose a soil sample has 25 percent plus No 10 material. The minus No. 10 material has a proctor density of 100 pounds per cubic foot and a shrinkage of 12 percent. To determine the composite soil (plus the minus No. 10 material) shrinkage, locate the 100 line in the left hand column, then follow this line right to the 25 percent column. The factor given is 0.804. Thus 12 x .804 = 9.6 percent shrinkage for the composite soil.

GDT-6: Volume Change Conversion Tables

	% Retained					
Density	**1-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**
80-105	6-1A	6-1C	6-1E	6-1G	6-1I	6-1K
106-130	6-1B	6-1D	6-1F	6-1H	6-1J	6-1L

GDT 6

6-1A	% Retained on No. 10 Sieve									
Density	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
80	.994	.989	.983	.978	.972	.965	.959	.953	.946	.939
81	.994	.989	.983	.978	.972	.965	.958	.952	.945	.938
82	.994	.988	.983	.977	.971	.964	.958	.952	.945	.938
83	.994	.988	.983	.977	.971	.964	.957	.951	.944	.937
84	.994	.988	.982	.976	.970	.963	.957	.951	.944	.937
85	.994	.988	.982	.976	.970	.963	.956	.950	.943	.936
86	.994	.988	.982	.976	.970	.963	.956	.949	.942	.935
87	.994	.988	.981	.975	.969	.962	.955	.948	.941	.935
88	.994	.988	.981	.975	.969	.962	.955	.948	.941	.934
89	.994	.987	.981	.974	.968	.961	.954	.947	.940	.933
90	.994	.987	.981	.974	.968	.961	.954	.946	.939	.932
91	.994	.987	.981	.974	.968	.960	.953	.945	.938	.931
92	.993	.987	.980	.974	.967	.960	.953	.945	.938	.930
93	.993	.987	.980	.974	.967	.959	.952	.944	.937	.930
94	.993	.986	.980	.973	.966	.959	.952	.944	.937	.929
95	.993	.986	.980	.973	.966	.958	.951	.943	.936	.928
96	.993	.986	.980	.973	.966	.958	.951	.942	.935	.927
97	.993	.986	.980	.973	.966	.958	.950	.942	.934	.926
98	.993	.986	.979	.972	.965	.957	.950	.941	.934	.926
99	.993	.986	.979	.972	.965	.957	.949	.941	.933	.925
100	.993	.986	.979	.972	.965	.957	.949	.940	.932	.924
101	.993	.986	.979	.972	.965	.956	.948	.940	.932	.923
102	.993	.986	.978	.971	.964	.956	.948	.939	.931	.923
103	.993	.986	.978	.971	.964	.955	.947	.939	.931	.922
104	.993	.985	.978	.970	.963	.955	.947	.938	.930	.922
105	.993	.985	.978	.970	.963	.954	.946	.938	.930	.921

GDT 6

6-1B	% Retained on No. 10 Sieve									
Density	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
106	.992	.985	.977	.970	.962	.954	.945	.937	.929	.920
107	.992	.985	.977	.970	.962	.953	.945	.937	.928	.920
108	.992	.984	.977	.969	.961	.953	.944	.936	.928	.919
109	.992	.984	.977	.969	.961	.952	.944	.936	.927	.919
110	.992	.984	.976	.968	.960	.952	.943	.935	.926	.918
111	.992	.984	.976	.968	.960	.952	.943	.934	.925	.917
112	.992	.984	.976	.968	.960	.951	.942	.933	.924	.916
113	.992	.984	.975	.967	.959	.951	.942	.933	.924	.915
114	.992	.984	.975	.967	.959	.950	.941	.932	.923	.914
115	.992	.984	.975	.967	.959	.950	.941	.931	.922	.913
116	.992	.984	.975	.967	.959	.950	.940	.931	.921	.912
117	.992	.983	.975	.966	.958	.949	.940	.930	.921	.912
118	.992	.983	.975	.966	.958	.949	.939	.930	.920	.911
119	.991	.983	.974	.966	.957	.948	.939	.939	.920	.911
120	.991	.983	.974	.966	.957	.948	.938	.929	.919	.910
121	.991	.983	.974	.966	.957	.947	.937	.928	.918	.909
122	.991	.982	.974	.965	.956	.947	.937	.928	.918	.908
123	.991	.982	.974	.965	.956	.946	.936	.927	.917	.908
124	.991	.982	.973	.964	.955	.946	.936	.927	.917	.907
125	.991	.982	.973	.964	.955	.945	.935	.926	.916	.906
126	.991	.982	.973	.964	.955	.945	.935	.925	.915	.905
127	.991	.982	.973	.964	.955	.944	.934	.925	.915	.905
128	.991	.982	.972	.963	.954	.944	.934	.924	.914	.904
129	.991	.982	.972	.963	.954	.943	.933	.924	.914	.904
130	.991	.982	.972	.963	.954	.943	.933	.923	.913	.903

GDT 6

61C	% Retained on No. 10 Sieve									
Density	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
80	.933	.926	.919	.912	.905	.898	.891	.885	.878	.871
81	.932	.925	.918	.911	.904	.897	.890	.884	.877	.870
82	.931	.924	.917	.910	.903	.896	.889	.882	.875	.868
83	.931	.923	.916	.908	.901	.894	.887	.881	.874	.867
84	.930	.922	.915	.907	.900	.893	.886	.879	.872	.865
85	.929	.921	.914	.906	.899	.892	.885	.878	.871	.864
86	.928	.920	.913	.905	.898	.891	.884	.877	.870	.863
87	.927	.919	.912	.904	.897	.890	.883	.876	.868	.861
88	.926	.919	.911	.904	.896	.889	.881	.874	.867	.860
89	.925	.918	.910	.903	.895	.888	.880	.873	.865	.858
90	.924	.917	.909	.902	.894	.887	.879	.872	.864	.857
91	.923	.916	.908	.901	.893	.886	.878	.871	.863	.856
92	.922	.915	.907	.900	.892	.885	.877	.870	.862	.855
93	.922	.914	.907	.899	.891	.883	.876	.868	.861	.853
94	.921	.913	.906	.898	.890	.882	.875	.867	.860	.852
95	.920	.912	.905	.897	.889	.881	.874	.866	.859	.851
96	.919	.911	.904	.896	.888	.880	.873	.865	.858	.850
97	.918	.910	.903	.895	.887	.879	.872	.864	.857	.849
98	.918	.910	.902	.894	.886	.878	.870	.863	.855	.847
99	.917	.909	.901	.893	.885	.877	.869	.862	.854	.846
100	.916	.908	.900	.892	.884	.876	.868	.861	.853	.845
101	.915	.907	.899	.891	.883	.875	.867	.860	.852	.844
102	.915	.906	.898	.890	.882	.874	.866	.859	.850	.842
103	.914	.906	.898	.888	.881	.873	.865	.857	.849	.841
104	.914	.905	.897	.887	.880	.872	.864	.856	.847	.839
105	.913	.904	.896	.886	.879	.871	.863	.855	.846	.838

GDT 6

6-1D	% Retained on No. 10 Sieve									
Density	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
106	.912	.903	.895	.885	.878	.870	.862	.854	.845	.837
107	.911	.902	.894	.885	.877	.869	.861	.853	.844	.836
108	.911	.902	.894	.884	.876	.868	.859	.851	.842	.834
109	.910	.901	.893	.884	.875	.867	.585	.850	.841	.833
110	.909	.900	.892	.883	.874	.866	.857	.849	.840	.832
111	.908	.899	.891	.882	.873	.865	.856	.848	.839	.831
112	.907	.898	.890	.881	.872	.864	.855	.847	.838	.830
113	.906	.897	.889	.880	.871	.862	.854	.845	.837	.828
114	.905	.896	.888	.879	.870	.861	.853	.844	.836	.827
115	.904	.895	.887	.878	.869	.860	.852	.843	.835	.826
116	.903	.894	.886	.877	.868	.859	.851	.842	.834	.825
117	.903	.894	.885	.876	.867	.858	.850	.841	.833	.824
118	.902	.893	.884	.875	.866	.857	.848	.840	.831	.822
119	.902	.893	.883	.874	.865	.856	.847	.839	.830	.821
120	.901	.892	.882	.873	.864	.855	.846	.838	.829	.820
121	.901	.891	.881	.872	.863	.854	.845	.837	.828	.819
122	.899	.890	.880	.871	.862	.853	.844	.836	.827	.818
123	.899	.890	.880	.871	.862	.853	.844	.834	.825	.816
124	.898	.889	.879	.870	.861	.852	.843	.833	.824	.815
125	.897	.888	.878	.869	.860	.851	.842	.832	.823	.814
126	.896	.887	.877	.868	.859	.850	.841	.831	.822	.813
127	.895	.886	.876	.867	.857	.848	.839	.830	.821	.812
128	.895	.885	.875	.865	.856	.847	.838	.828	.819	.810
129	.894	.884	.874	.864	.854	.845	.836	.827	.818	.809
130	.893	.883	.873	.863	.853	.844	.835	.826	.817	.808

GDT 6

6-1E	% Retained on No. 10 Sieve									
Density	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
80	.864	.857	.850	.843	.836	.829	.821	.814	.807	.799
81	.863	.856	.848	.841	.834	.827	.819	.812	.805	.797
82	.861	.854	.847	.840	.833	.825	.817	.810	.803	.795
83	.860	.853	.845	.838	.831	.824	.816	.809	.801	.793
84	.858	.851	.844	.837	.830	.822	.814	.807	.799	.791
85	.857	.850	.842	.835	.828	.820	.812	.805	.797	.789
86	.855	.848	.841	.833	.826	.818	.810	.803	.795	.787
87	.854	.847	.839	.832	.825	.817	.809	.801	.793	.785
88	.853	.845	.838	.830	.823	.815	.807	.799	.791	.783
89	.851	.844	.836	.829	.822	.814	.806	.797	.789	.781
90	.850	.842	.835	.827	.820	.812	.804	.795	.787	.779
91	.849	.841	.834	.826	.819	.810	.802	.793	.785	.777
92	.847	.840	.833	.825	.817	.809	.801	.792	.784	.775
93	.846	.838	.831	.823	.816	.807	.799	.790	.782	.774
94	.844	.837	.830	.822	.814	.806	.798	.789	.781	.772
95	.843	.836	.828	.821	.813	.804	.796	.787	.779	.770
96	.842	.835	.826	.819	.811	.802	.794	.785	.777	.768
97	.841	.833	.825	.817	.809	.800	.792	.783	.775	.766
98	.839	.832	.823	.816	.808	.799	.790	.782	.773	.764
99	.838	.830	.822	.814	.806	.797	.788	.780	.771	.762
100	.837	.829	.820	.812	.804	.795	.786	.778	.769	.760
101	.836	.827	.819	.810	.802	.793	784	.776	.767	.758
102	.834	.826	.817	.809	.801	.791	.783	.774	.765	.756
103	.833	.824	.816	.807	.799	.790	.781	.772	.763	.754
104	.831	.823	.814	.806	.798	.789	.780	.770	.761	.752
105	.830	.821	.813	.804	.796	.787	.778	.768	.759	.750

GDT 6

6-1F	% Retained on No. 10 Sieve									
Density	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
106	.829	.820	.812	.803	.794	.785	.776	.766	.757	.748
107	.827	.818	.810	.801	.793	.783	.774	.764	.755	.746
108	.826	.817	.809	.800	.791	.782	.773	.763	.754	.744
109	.824	.815	.807	.798	.790	.780	.771	.761	.752	.742
110	.823	.814	.806	.797	.788	.778	.769	.759	.750	.740
111	.822	.813	.804	.795	.786	.776	.767	.757	.748	.738
112	.821	.812	.803	.794	.785	.775	.765	.756	.746	.736
113	.819	.810	.801	.792	.783	.773	.764	.754	.745	.735
114	.818	.809	.800	.791	. 782	.772	.762	.753	.743	.733
115	.817	.808	.798	.789	.780	.770	.760	.751	.741	.731
116	.816	.807	.797	.788	.799	.769	.759	.749	.739	.729
117	.815	.805	.796	.786	.777	.767	.757	.747	.737	.727
118	.813	.804	.794	.785	.776	.766	.756	.746	.736	.726
119	.812	.802	.793	.783	.774	.764	.754	.744	.734	.724
120	.811	.801	.792	.782	.773	.763	.753	.742	.732	.722
121	.810	.800	.791	.781	.771	.761	.751	.740	.730	.720
122	.808	.798	.789	.779	.770	.759	.749	.738	.728	.718
123	.807	.797	.788	.778	.768	.758	.748	.737	.727	.716
124	.805	.795	.786	.776	.767	.756	.746	.735	.725	.714
125	.804	.794	.785	.775	.765	.754	.744	.733	.723	.712
126	.803	.793	.784	.774	.764	.753	.742	.731	.721	.710
127	.802	.792	.782	.772	.762	.751	.741	.730	.719	.708
128	.800	.790	.781	.771	.761	.750	.739	.728	.718	.707
129	.799	.789	.781	.769	.759	.748	.737	.727	.716	.705
130	.798	.788	.778	.768	.758	.747	.736	.725	.714	.703

GDT 6

6-1G	% Retained on No. 10 Sieve									
Density	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
80	.791	.783	.775	.767	.759	.750	.741	.732	.723	.713
81	.789	.781	.773	.765	.757	.748	.738	.729	.720	.710
82	.787	.779	.771	.762	.755	.745	.736	.727	.717	.708
83	.785	.776	.768	.760	.752	.743	.733	.724	.715	.705
84	.783	.774	.766	.757	.749	.740	.731	.722	.712	.703
85	.781	.772	.764	.755	.747	.738	.728	.719	.709	.700
86	.779	.770	.762	.753	.745	.735	.726	.716	.707	.687
87	.777	.768	.760	.751	.742	.733	.723	.714	.704	.695
88	.774	.765	.757	.748	.740	.730	.721	.711	.702	.692
89	.772	.763	.755	.746	.737	.728	.718	.709	.699	.690
90	.770	.761	.753	.744	.735	.725	.716	.706	.697	.687
91	.768	.759	.751	.742	.732	.723	.713	.704	.694	.685
92	.766	.757	.748	.739	.730	.721	.711	.701	.692	.682
93	.764	.755	.746	.737	.727	.718	.708	.699	.689	.680
94	.762	.753	.743	.734	.725	.716	.706	.696	.687	.677
95	.760	.751	.741	.732	.722	.713	.703	.694	.684	.675
96	.758	.749	.739	.730	.720	.711	.701	.692	.682	.673
97	.756	.747	.737	.728	.718	.708	.699	.689	.680	.670
98	.754	.744	.735	.725	.715	.706	.696	.687	.677	.668
99	.752	.742	.733	.723	.713	.703	.694	.684	.675	.665
100	.750	.740	.731	.721	.711	.701	.692	.682	.673	.663
101	.748	.738	.729	.719	.709	.699	.690	.680	.671	.661
102	.746	.736	.727	.717	.707	.697	.688	.678	.668	.658
103	.744	.734	.724	.714	.704	.695	.685	.675	.666	.656
104	.742	.732	.722	.712	.702	.693	.683	.673	.663	.653
105	.740	.730	.720	.710	.700	.691	.681	.671	.661	.651

GDT 6

6-1H	% Retained on No. 10 Sieve									
Density	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
106	.738	.728	.718	.708	.698	689	.679	.669	.659	.649
107	.736	.726	.716	.706	.696	.687	.688	.666	.656	.646
108	.734	.724	.714	.704	.694	.684	.674	.664	.654	.644
109	.732	.722	.712	.702	.692	.682	.672	.661	.651	.641
110	.730	.720	.710	.700	.690	.680	.670	.659	.649	.639
111	.728	.718	.708	.698	.688	.678	.668	.657	.647	.637
112	.726	.716	.706	.696	.686	.676	.666	.655	.645	.635
113	.725	.715	.704	.694	.684	.674	.664	.653	.643	.633
114	.723	.713	.702	.692	.682	.672	.662	.651	.641	.631
115	.721	.711	.700	.690	.680	.670	.660	.649	.639	.629
116	.719	.709	.698	.688	.678	.668	.658	.647	.637	.627
117	.717	.707	.696	.686	.676	.666	.656	.645	.635	.624
118	.716	.705	.695	.684	.674	.663	.653	.642	.632	.622
119	.714	.703	.693	.682	.672	.661	.651	.640	.630	.619
120	.712	.701	.691	.680	.670	.659	.649	.638	.628	.617
121	.710	.699	.689	.678	.668	.657	.647	.636	.626	.615
122	.708	.697	.687	.676	.666	.655	.645	.634	.624	.613
123	.706	.696	.685	.675	.665	.654	.643	.633	.622	.611
124	.704	.694	.683	.673	.663	.652	.641	.631	.620	.609
125	.702	.692	.681	.671	.661	.650	.639	.629	.618	.607
126	.700	.690	.679	.669	.659	.648	.637	.627	.616	.605
127	.698	.688	.677	.667	.657	.646	.635	.625	.614	.603
128	.697	.686	.676	.665	.655	.644	.633	.622	.611	.601
129	.695	.684	.674	.663	.653	.642	.631	.620	.609	.599
130	.693	.682	.672	.661	.651	.640	.629	.618	.607	.597

GDT 6

6-1I	% Retained on No. 10 Sieve									
Density	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**40**
80	.704	.695	.686	.676	.667	.657	.647	.638	.628	.618
81	.701	.692	.683	.673	.664	.654	.644	.635	.625	.615
82	.698	.689	.680	.670	.661	.651	.641	.632	.622	.612
83	.696	.687	.677	.668	.658	.648	.638	.628	.618	.608
84	.693	.684	.684	.665	.655	.645	.635	.625	.615	.605
85	.690	.681	.671	.662	.652	.642	.632	.622	.612	.602
86	.687	.678	.668	.659	.649	.639	.629	.619	.609	.599
87	.685	.676	.666	.657	.647	.637	.626	.616	.606	.596
88	.682	.673	.663	.654	.644	.634	.624	.614	.603	.593
89	.680	.671	.661	.652	.642	.632	.621	.611	.600	.590
90	.677	.668	.658	.649	.639	.629	.618	.608	.597	.587
91	.675	.665	.655	.646	.636	.626	.615	.606	.594	.584
92	.672	.663	.652	.643	.633	.623	.612	.602	.591	.581
93	.670	.660	.650	.640	.630	.620	.610	.599	.589	.579
94	.667	.658	.647	.637	.627	.617	.607	.596	.586	.576
95	.665	.655	.644	.634	.624	.614	.604	.593	.583	.573
96	.663	.652	.642	.632	.621	.611	.601	.590	.580	.570
97	.660	.650	.639	.629	.619	.609	.599	.588	.578	.568
98	.658	.647	.637	.626	.616	.606	.596	.585	.575	.565
99	.655	.645	.634	.624	.614	.604	.594	.583	.573	.563
100	.653	.642	.632	.621	.611	.601	.591	.580	.570	.560
101	.650	.640	.630	.619	.609	.599	.588	.578	.568	.557
102	.648	.637	.627	.617	.607	.597	.586	.575	.656	.555
103	.645	.635	.625	.614	.604	.594	.583	.573	.563	.552
104	.643	.632	.622	.612	.602	.592	.581	.570	.560	.550
105	.640	.630	.620	.610	.599	.589	.578	.568	.558	.547

GDT 6

6-1J	% Retained on No. 10 Sieve									
Density	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
106	.638	.628	.618	.607	.597	.587	.576	.566	.555	.545
107	.636	.625	.615	.605	.594	.584	.573	.563	.553	.542
108	.633	.623	.613	.602	.592	.582	.571	.561	.550	.540
109	.631	.620	.610	.600	.589	.579	.568	.558	.548	.537
110	.629	.618	.608	.597	.587	.577	.566	.556	.545	.535
111	.627	.616	.606	.595	.585	.575	.564	.554	.543	.533
112	.625	.614	.604	.593	.582	.572	.561	.552	.540	.531
113	.622	.611	.601	.590	.580	.570	.559	.549	.538	.528
114	.620	.609	.599	.588	.577	.567	.556	.546	.535	.525
115	.618	.607	.597	.586	.575	.565	.554	.544	.533	.523
116	.616	.605	.595	.584	.573	.563	.552	.542	.531	.521
117	.613	.603	.592	.582	.571	.560	.550	.540	.529	.519
118	.611	.600	.590	.579	.568	.558	.549	.537	.527	.517
119	.608	.598	.587	.577	.566	.555	.546	.535	.525	.515
120	.606	.596	.585	.575	.564	.553	.544	.533	.523	.513
121	.604	.594	.583	.573	.562	.551	.542	.531	.521	.511
122	.602	.592	.581	.571	.560	.549	.540	.529	.519	.508
123	.600	.590	.579	.569	.558	.547	.537	.526	.516	.506
124	.598	.588	.577	.567	.556	.545	.535	.524	.514	.503
125	.596	.586	.575	.565	.554	.543	.533	.522	.512	.501
126	.594	.584	.573	.563	.552	.541	.531	.520	.510	.500
127	.592	.582	.571	.561	.550	.539	.529	.518	.508	.498
128	.590	.580	.569	.558	.548	.537	.526	.515	.505	.497
129	.588	.578	.567	.556	.546	.535	.524	.513	.503	.495
130	.586	.576	.565	.554	.544	.533	.522	.511	.501	.494

GDT 6

6-1K	% Retained on No. 10 Sieve									
Density	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
80	.607	.597	.587	.576	.566	.555	.545	.534	.523	.513
81	.604	.594	.584	.573	.563	.552	.542	.530	.519	.509
82	.601	.591	.581	.570	.560	.549	.538	.527	.516	.505
83	.598	.587	.577	.566	.556	.545	.535	.523	.512	.502
84	.595	.584	.574	.563	.553	.542	.531	.520	.509	.498
85	.592	.581	.571	.560	.550	.539	.528	.516	.505	.494
86	.589	.578	.568	.557	.547	.536	.525	.513	.502	.491
87	.586	.575	.564	.554	.544	.533	.522	.510	.499	.488
88	.583	.572	.562	.551	.541	.530	.519	.507	.496	.485
89	.580	.568	.559	.548	.538	.527	.516	.504	.493	.482
90	.577	.566	.556	.545	.535	.524	.513	.501	.490	.479
91	.574	.563	.553	.542	.532	.521	.510	.498	.487	.476
92	.571	.560	.550	.539	.529	.518	.507	.495	.484	.473
93	.569	.558	.548	.537	.527	.515	.504	.492	.481	.469
94	.566	.555	.545	.534	.524	.512	.501	.489	.478	.466
95	.563	.552	.542	.531	.521	.509	.498	.486	.475	.463
96	.560	.549	.539	.528	.518	.506	.495	.483	.472	.460
97	.558	.547	.537	.526	.516	.504	.492	.480	.469	.457
98	.555	.544	.534	.523	.513	.501	.490	.478	.466	.454
99	.553	.542	.532	.521	.511	.499	.487	.475	.463	.451
100	.550	.539	.527	.518	.508	.496	.484	.472	.460	.448
101	.547	.536	.526	.515	.505	.493	.481	.469	.457	.445
102	.544	.534	.523	.512	.502	.490	.478	.466	.454	.443
103	.542	.531	.521	.510	.500	.488	.476	.464	.452	.440
104	.539	.529	.518	.507	.497	.485	.473	.461	.449	.438
105	.536	.526	.515	.504	.494	.482	.470	.458	.446	.435

GDT 6

6-1L	% Retained on No. 10 Sieve									
Density	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
106	.534	.523	.512	.501	.491	.479	.467	.455	.444	.432
107	.531	.521	.510	.499	.488	.476	.465	.453	.441	.430
108	.529	.518	.507	.496	.486	.474	.462	.450	.439	.427
109	.526	.516	.505	.494	.483	.471	.460	.448	.436	.425
110	.524	.513	.502	.491	.480	.468	.457	.445	.434	.422
111	.522	.511	.499	.488	.477	.466	.454	.443	.431	.420
112	.519	.508	.497	.486	.475	.463	.452	.440	.429	.417
113	.517	.506	.494	.483	.472	.461	.449	.438	.426	.415
114	.514	.503	.492	.481	.470	.458	.447	.435	.424	.412
115	.512	.501	.489	.478	.467	.456	.444	.433	.421	.410
116	.510	.499	.487	.476	.465	.454	.442	.431	.419	.408
117	.508	.497	.485	.474	.462	.451	.439	.428	.416	.405
118	.505	.494	.482	.471	.460	.449	.437	.426	.414	.403
119	.503	.592	.480	.469	.457	.446	.434	.423	.411	.400
120	.501	.490	.478	.467	.455	.444	.432	.421	.409	.398
121	.499	.488	.476	.465	.453	.442	.430	.419	.407	.396
122	.496	.485	.473	.462	.450	.439	.428	.417	.405	.394
123	.494	.483	.471	.460	.448	.437	.425	.414	.403	.392
124	.491	.480	.468	.457	.445	.434	.423	.412	.401	.390
125	.489	.478	.466	.455	.443	.432	.421	.410	.399	.388
126	.487	.476	.464	.453	.441	.430	.419	.408	.397	.386
127	.485	.474	.462	.451	.439	.428	.417	.406	.395	.384
128	.482	.471	.459	.448	.436	.425	.414	.403	.392	.381
129	.480	.469	.457	.446	.434	.423	.412	.401	.390	.379