



# Standard Test Procedures Manual

Section: SOILS

Subject: SPECIFIC GRAVITY

## 1. SCOPE

### 1.1. Description of Test

This method covers determination of the specific gravity of soils by means of a pycnometer. The specific gravity test is made on that portion of soil which passes the No. 2.00 mm sieve.

### 1.2. Units of Measure

The definition of specific gravity is the ratio of the weight in air of a given volume of a material at a stated temperature to the weight in air of an equal volume of distilled water at a stated temperature.

## 2. APPARATUS AND MATERIALS

### 2.1. Equipment Required

Pycnometer - glass bottle of 50 ml capacity with a fitted glass stopper.

Stopper - glass with small hole through centre to permit emission of air and water.

Balance - 0.001 g sensitivity.

Oven - capable of 110°C.

Thermometer - 25°C.

### 3. PROCEDURE

#### 3.1. Test Procedure

##### 3.1.1. Calibration of Pycnometer

Clean, dry, weigh pycnometer.

Fill pycnometer.

Fill pycnometer with distilled water.

Weigh pycnometer and water carefully to 3 decimals, =  $W_a$ .

Determine temperature of water to nearest degree =  $T_i$ .

From the weight  $W_a$  determined at temperature  $T_i$  prepare a table of value of weights  $W_a$  for a series of temperatures that are likely to prevail for later testing.

Calculate each value of  $W_a$  as follows:

$$W_a (@T_x) = (\text{dens. water @ } T_x / \text{dens. water @ } T_i) \times (W_a @ T_i - W_f) + W_f$$

Where:

$W_a$  = weight of pycnometer and water, g

$W_f$  = weight of pycnometer, g

$T_i$  = observed temperature of water, °C

$T_x$  = any other desired temperature, °C

Obtain densities of water from Table 205-12.

Repeat the calculation using a range of value of  $T_x$  and prepare a table showing  $W_a$  vs. temperature.

##### 3.1.2. Specific Gravity

Oven dry sample to constant weight at 110°C.

Crush sample to pass 2.00 mm sieve.

Weigh out about 10 g crushed soil, and weigh to 0.001 g =  $W_o$ .

Place in pycnometer, taking care not to lose any soil.

Fill pycnometer half full with distilled water.

Let sit overnight.

Remove entrapped air by boiling gently for 10 minutes occasionally rolling pycnometer to assist in removal of air.

Cool pycnometer and contents to room temperature.

Fill pycnometer with distilled water, then stopper.

Clean and dry outside of pycnometer.

Weigh pycnometer and contents accurate to 0.001 g.

## 4. RESULTS AND CALCULATIONS

### 4.1. Calculations

Obtain temperature of contents =  $T_x$

Calculate the specific gravity of the soil, based on water at a temperature  $T_x$ , as follows:

Specific gravity,  $T_x/T_x = W_o/[W_o + (W_a - W_b)]$

Where:

$W_o$  = weight of sample of over-dry soil, g

$W_a$  = weight of pycnometer filled with water at temperature  $T_x$ , g (from table previously prepared under calibration).

$W_b$  = weight of pycnometer filled with water and soil at temperature  $T_x$ , g.

$T_x$  = temperature of contents of pycnometer when weight  $W_b$  was determined, °C.

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Unless otherwise required, report specific gravity values at 20°C. The value based on water at 20°C is calculated from the value based on water at the observed temperature  $T_x$ , as follows:

$$\text{Specific Gravity } T_x/20^\circ\text{C} = K \times \text{Specific Gravity, } T_x/T_x$$

Where:

K = correction factor from Table 205-12

TABLE 205-12

Temperature Degrees C	Relative Density of Water	Correction Factor K
18	0.9986	1.0004
19	0.9984	1.0002
20	0.9982	1.0000
21	0.9980	0.9998
22	0.9978	0.9996
23	0.9975	0.9993
24	0.9973	0.9991
25	0.9970	0.9989
26	0.9968	0.9986
27	0.9965	0.9983
28	0.9963	0.9980
29	0.9960	0.9977
30	0.9957	0.9974

## 5. ADDED INFORMATION

### 5.1. References

ASTM D854

### 5.2. General

Since small amounts of soil are used in the test, extreme care must be taken with weighing, transferring of soil to flask and boiling so as not to lose any sample.

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## APPROVAL SHEET

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Description of Revision (Reason for Revision):  
Format of test procedure updated.

Review/Implementation Process:  
Reviewed by the Materials Section of the Technical Standards and Policies  
Branch.

Other Manuals/Policies Affected:  
Nil

Follow Up/Training Required:  
Nil

Comments/Concerns/Implications (Budget/Environment/Stakeholders):

Prepared and Recommended by D. MacLeod 93-11-30  
Materials Standards Engineer Date

Approval Recommended by R.A. Widger   -  -  
Senior Materials Engineer Date

Approval Recommended by A.R. Gerbrandt   -  -  
Dir., Technical Standards & Policies Br. Date

Approved by D.G. Metz   -  -  
Assistant Deputy Minister, Infrastructure Date

Electronic File Updated   -  -

Update Mailed   -  -