Designation: D1429 – 08

StandardTest Methods for Specific Gravity of Water and Brine[1]

This standard is issued under the fixed designation D1429; 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 These test methods cover the determination of the specific gravity of water and brine free of separable oil, as follows:

	Sections
Test Method A—Pycnometer	7 to 11, 21
Test Method B—Balance	12 to 16, 21
Test Method C—Erlenmeyer Flask	17 to 21
Test Method D—Hydrometer	22 to 27

1.2 Test Methods A and B are applicable to clear waters or those containing only a moderate amount of particulate matter. Test Method B is preferred for samples of sea water or brines and is more sensitive than Test Method D which has the same general application. Test Method C is intended for samples of water containing mud or sludge.

1.3 It is the user's responsibility to ensure the validity of these test methods for waters of untested matrices.

1.4 The test method was tested at 22°C over a range, shown in Tables 1-4, of 1.0252 through 1.2299; all data were corrected to 15.6°C (60°F).

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1066 Practice for Sampling Steam
D1129 Terminology Relating to Water
D1193 Specification for Reagent Water
D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water
D3370 Practices for Sampling Water from Closed Conduits
D5847 Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis
E1 Specification for ASTM Liquid-in-Glass Thermometers

3. Terminology

3.1 *Definitions:*

3.1.1 *brine*—water that contains dissolved matter at an approximate concentration of more than 30 000 mg/L.

3.1.2 For definitions of terms used in these test methods, refer to Terminology D1129.

4. Significance and Use

4.1 Specific gravity is an important property of fluids being related to density and viscosity. Knowing the specific gravity will allow determination of a fluid's characteristics compared to a standard, usually water, at a specified temperature. This will allow the user to determine if the test fluid will be heavier or lighter than the standard fluid.

5. Reagents

5.1 *Purity of Water*— Unless otherwise indicated, reference to water shall be understood to mean reagent water conforming to Specification D1193, Type I. Other reagent water types may be used provided it is first ascertained that the water is of sufficiently high purity to permit its use without adversely affecting the precision and bias of the test method. Type III water was specified at the time of round robin testing of this test method.

6. Sampling

6.1 Collect the samples in accordance with Practices D3370 and Practice D1066.

6.2 In view of the lack of a standard test method for sampling mud or sludge, no instructions are given for sampling this type of material.

TEST METHOD A—PYCNOMETER

7. Summary of Test Method

7.1 The sample is introduced into a pycnometer, stabilized at the desired temperature, and weighed. The specific gravity is calculated from this weight and the previously determined

[1] These test methods are under the jurisdiction of ASTM Committee D19 on Water and are the direct responsibility of Subcommittee D19.05 on Inorganic Constituents in Water.

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[2] 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.

TABLE 1 Determination of Bias, Pycnometer Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	± %Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0262	−0.049	yes
1.0648	1.0665	+ 0.16	yes
1.1100	1.1119	+ 0.17	yes
1.2299	1.2235	−0.52	yes

TABLE 2 Determination of Bias, Balance Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	± %Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0264	−0.166	yes
1.0648	1.0657	+ 0.084	yes
1.1100	1.1126	+ 0.234	yes
1.2299	1.2233	−0.539	yes

TABLE 3 Determination of Bias, Erlenmeyer Flask Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	± %Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.026	+ 0.126	yes
1.0648	1.066	+ 0.169	yes
1.1100	1.1121	+ 0.74	no
1.2299	1.2225	−0.60	yes

TABLE 4 Determination of Bias, Hydrometer Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	± %Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0256	+ 0.088	no
1.0648	1.0647	−0.099	no
1.1100	1.1106	+ 0.054	no
1.2299	1.2207	−0.74	yes

weight of reagent water that is required to fill the pycnometer at the same temperature.

8. Apparatus

8.1 *Bath*—Constant-temperature bath designed to maintain a temperature of 15.6 ± 1°C (60 ± 1.8°F). If any other temperature must be used due to local conditions, appropriate corrections shall be made.

8.2 *Pycnometer*—Cylindrical or conical glass vessel carefully ground to receive an accurately fitting 24/12 standard taper glass stopper provided with a hole approximately 1.0 to 2.0 mm in diameter, centrally located in reference to the vertical axis. The top surface of the stopper shall be smooth and substantially plane, and the lower surface shall be concave in order to allow all air to escape through the bore. The height of the concave section shall be approximately 5 mm at the center. The stoppered pycnometer shall have a capacity of about 24 to 30 mL, and shall weigh not more than 40 g. Suitable pycnometers are shown in Fig. 1.

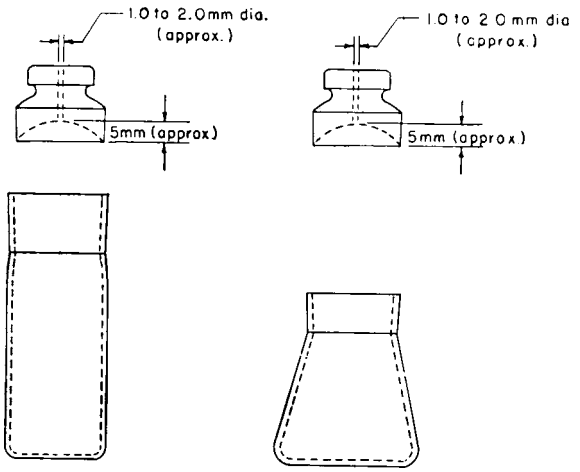

FIG. 1 Suitable Pycnometers

8.3 *Thermometer*— An ASTM Gravity Thermometer having a range from − 20 to + 102°C or − 5 to + 215°F, as specified, and conforming to the requirements for Thermometer 12C or 12F, respectively, as prescribed in Specification E1.

9. Procedure

9.1 Weigh a clean, dry, calibrated pycnometer, complete with stopper, on an analytical balance, and record this weight to the nearest 0.1 mg, as *P*.

9.2 Remove the stopper and fill the pycnometer with recently boiled reagent water that has been cooled to room temperature, to within several millimetres of the top. Remove the air bubbles. Immerse the unstoppered pycnometer up to the neck in a constant-temperature bath maintained at 15.6 ± 1°C (60 ± 1.8°F). Allow the pycnometer to remain in the bath for a period of time sufficient to establish temperature equilibrium. Twenty minutes is usually sufficient.

9.3 After temperature equilibrium has been established, and before removing from the bath, firmly insert the stopper and remove the excess water from the top of the stopper, taking care to leave the capillary filled. Remove the stoppered pycnometer from the bath and wipe it dry. Immediately weigh the pycnometer, and record this weight to the nearest 0.1 mg, as *W*.

9.4 Empty the reagent water from the pycnometer and dry, or rinse with the sample to be tested.

9.5 Using the sample to be tested, repeat the procedure in accordance with 9.2 and 9.3, recording the weight of the pycnometer containing the sample under test as *S*.

10. Calculation

10.1 Calculate the specific gravity of the sample as follows:

$$\text{Specific gravity} = (S - P)/(W - P)$$

where:

P = weight of the empty pycnometer,
S = weight of the pycnometer and contained sample, and