



Designation: D1429 – 13

Standard Test Methods for Specific Gravity of Water and Brine¹

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 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

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. 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 Flowing Process Streams

D5847 Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis

E2251 Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids

3. Terminology

3.1 *Definitions*—For definitions of terms used in these test methods, refer to Terminology D1129.

3.2 Definitions of Terms Specific to This Standard:

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

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.

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.

*A Summary of Changes section appears at the end of this standard

TABLE 1 Determination of Precision and Bias, Pycnometer Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	S_T	S_O	% Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0262	0.00145	0.00023	-0.049	yes
1.0648	1.0665	0.0012	0.00019	+ 0.16	yes
1.1100	1.1119	0.0010	0.00034	+ 0.17	yes
1.2299	1.2235	0.0012	0.00037	-0.52	yes

TABLE 2 Determination of Precision and Bias, Balance Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	S_T	S_O	% Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0264	0.0013	0.00022	-0.166	yes
1.0648	1.0657	0.0008	0.00026	+ 0.084	yes
1.1100	1.1126	0.0017	0.00053	+ 0.234	yes
1.2299	1.2233	0.0017	0.00501	-0.539	yes

TABLE 3 Determination of Precision and Bias, Erlenmeyer Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	S_T	S_O	% Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.026	0.0024	0.00104	+ 0.126	yes
1.0648	1.066	0.0025	0.00164	+ 0.169	yes
1.1100	1.1121	0.0026	0.00119	+ 0.74	no
1.2299	1.2225	0.0018	0.00082	-0.60	yes

TABLE 4 Determination of Precision and Bias, Hydrometer Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	S_T	S_O	% Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0256	0.0023	0.00041	+ 0.088	no
1.0648	1.0647	0.0022	0.00060	-0.099	no
1.1100	1.1106	0.0025	0.00078	+ 0.054	no
1.2299	1.2207	0.0064	0.00052	-0.74	yes

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

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 $15.6 \pm 1^\circ\text{C}$ ($60 \pm 1.8^\circ\text{F}$). 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.

8.3 *Thermometer*—An ASTM Gravity Thermometer having a range from -20 to $+102^\circ\text{C}$ (or -5 to $+215^\circ\text{F}$), as specified, and conforming to the requirements for Thermometer 12C (or 12F), respectively, as prescribed in Specification E2251.

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 $15.6 \pm 1^\circ\text{C}$ ($60 \pm 1.8^\circ\text{F}$). 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

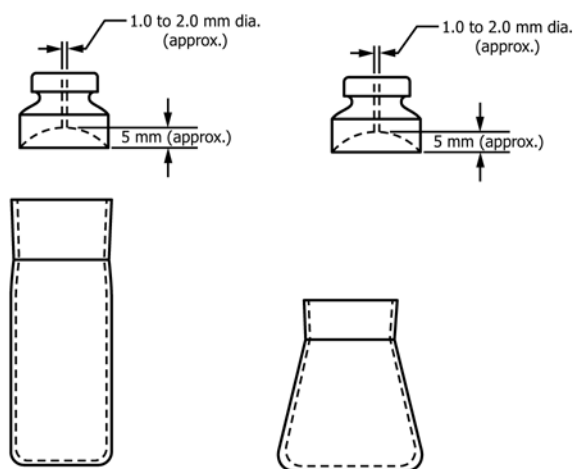


FIG. 1 Suitable Pycnometers