

	Standard Operating Procedure	SOP Number D-702	Revision 5
	Density Determination of Liquids	Effective Date 09/25/23	Page Page 1 of 4
Written by/ Date K. Bunn 09/21/23	Reviewed by/ Date SAS 09/22/23	Approved by/ Date SAS 09/22/23	
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1.0 Purpose

This procedure describes the steps for determining the density of liquid samples.

2.0 Scope

This procedure is for determining the density of liquid samples, viscous liquid samples, and precious liquids that are small in volume.

3.0 Responsibility

- 3.1 It is the responsibility of QC Analysts to follow this procedure.
- 3.2 It is the responsibility of QC Laboratory Management to implement this procedure and to ensure that the procedure is being followed.
- 3.3 It is the responsibility of QC Laboratory Management to keep this procedure aligned with current practices.

4.0 Definitions

- 4.1 **Density** – The mass per unit volume of a substance, most commonly described as g/mL
- 4.2 **QS** – Quantity Sufficient; refers to bringing the bottom of the meniscus of a liquid to the measuring line of the volumetric glassware
- 4.3 **QC** – Quality Control

5.0 References

- 5.1 D-702-F1, Form, Liquid Density Determination Test Ticket
- 5.2 C-501, SOP, Document Control Procedure
- 5.3 C-502, SOP, Record Storage, Retention, and Destruction

6.0 Procedure

- 6.1 Density determination of normal and viscous liquids
 - 6.1.1 Depending on available quantity of liquid use a 10mL, 25mL, or a 50mL Class A volumetric flask. The greater the volume used, the greater the accuracy of the measurement.
 - 6.1.1.1 Determine the temperature of the liquid being measured. If the density needs to be performed at a specific temperature preequilibrate the liquid and volumetric flask to the specified temperature before measuring.
 - 6.1.1.2 Tare an appropriate volumetric flask on a calibrated analytical balance. QS the flask with the liquid sample and determine the weight.
 - 6.1.1.3 Take caution, especially when performing the density on viscous liquids to ensure no residue is on the walls of the volumetric flask above the volume line and this will add weight and provide an erroneous density value.
 - 6.1.1.4 Also be sure to remove any bubbles that may be present in test solution. This can be performed by:
 - 6.1.1.4.1 Putting the test liquid in a centrifuge before performing the test.

6.1.1.4.2 Putting the test liquid before or after it has been added to a volumetric flask, to degas by sonication. If this is performed, be sure to allow sufficient time for the temperature of the liquid to reach equilibrium to negate any expansion of the liquid that has occurred.

6.1.1.5 Calculate the density with the following equation:

$$\text{Density} = (\text{Total}_{\text{wt}} - \text{Flask}_{\text{wt}}) / \text{volume}$$

6.1.1.6 Weight should be expressed in grams and volume expressed in milliliters unless otherwise specified.

6.1.1.7 Record the raw data, calculations, determined density along with the temperature of the liquid on the form D-702-F1.

6.2 Density determination of precious liquids

6.2.1 Determine the temperature of the precious liquid being measured. If the density needs to be performed at a specific temperature preequilibrate the liquid and volumetric flask to the specified temperature before measuring.

6.2.2 Using a calibrated analytical balance tare a weigh boat.

6.2.3 Using a 1 milliliter Class A pipette draw and weigh exactly 1mL of the precious liquid.

6.2.3.1 This process can be performed at any volume using a Class A pipette.

6.2.4 Calculate the density with the following equation:

$$\text{Density} = \text{Liquid}_{\text{wt}} / \text{Liquid}_{\text{vol}}$$

6.2.5 Record the density along with the temperature of the liquid using Form D-702-F1 Liquid Density Determination Test Ticket.

6.3 Documentation Requirements

6.3.1 All completed test tickets will be maintained as outlined in SOP C-501 Document Control and SOP C-502 Record Storage, Retention, and Destruction.

7.0 Revision History

Revision	Date	Description of Changes	CCR #	By
0	05/06/10	New	-	-
1	02/25/13	Updated SOP format.	13-077	B. Johns
2	01/22/15	Updated SOP format. Changed title. Combined procedure for normal and viscous liquids. Corrected equation. Expanded information on pipette verification and use of tips. Updated test ticket. Biennial review	15-0091	B. Johns
3	04/10/17	Biennial review: Eliminated use of variable pipettes. Incorporated use of Class A, fixed volume pipettes. Changed responsibilities.	17-0388	B. Johns
4	04/15/20	Scheduled review: Added specific techniques for viscous liquids and removal of bubbles.	CC-20-0299	J. Maignan
5	09/21/23	Added documentation requirements. Added additional SOP references. Revised test ticket to include logbook number. Updated format. Updated responsibilities section.	CC-23-0486	K. Burris



Liquid Density Determination Test Ticket

Form: D-702-F1 CCR No. CC-23-0486 Revision: 6

Logbook Number: _____

Balance ID #:		Daily Calibration Verified:	
R#		Finished Product #	

Normal and Viscous Liquids	
Flask Weight (g):	
Flask + Sample Weight (g):	
Sample Volume (mL):	

Precious Liquids	
Sample Weight (g):	
Sample Volume (mL):	

Density Calculation: Liquid Mass(g)/ Liquid Volume(mL):					
Density Specification (g/mL):					
Temperature:		Ion # :		Cal Due:	

Determination (circle one): **Pass** **Fail**

Comments:

Performed By/Date: _____

Reviewed By/Date: _____