



Designation: D8283 – 19

Standard Practice for Cleaning and Certification of Specially Prepared Canisters¹

This standard is issued under the fixed designation D8283; 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 This practice describes procedures to clean and verify the cleanliness of reusable sample containers used in air sampling and analysis applications, which includes but is not limited to passivated stainless steel canisters and rigid containers of other material specifically designed for whole-air sampling. This practice describes the steps used to clean volatile substance from canister interiors and document cleanliness prior to re-use.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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.*

1.4 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

D1193 Specification for Reagent Water

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

D5466 Test Method for Determination of Volatile Organic Compounds in Atmospheres (Canister Sampling Methodology)

¹ This practice is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.05 on Indoor Air.

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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.

2.2 EPA Documents:³

EPA TO-15 Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, second edition, January 1999

NATTs EPA Technical Assistance Document for the National Air Toxics Trends Stations Program, revision 3, October 2016

2.3 DoD Document:⁴

DoD Department of Defense Quality Systems Manual for Environmental Laboratories, version 5.1.1, 2018

3. Terminology

3.1 Definitions—

3.1.1 For definitions of terms used in this practice, refer to Terminology **D1356**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *cleaning batch, n*—a grouping of canisters cleaned concurrently on the same cleaning “system” (heated isothermal or unheated).

3.2.1.1 *Discussion*—Typical sizes range from 4 to 20 canisters/batch.

3.2.2 *cleaning cycle, n*—a standardized duration in which canisters are serially filled and evacuated.

3.2.2.1 *Discussion*—This process can be automated or manual depending on application.

3.2.3 *contaminated canister, n*—a canister pending cleaning and cleanliness verification/re-certification.

3.2.4 *other prepared containers or vessels, n*—other rigid containers designed for re-use, which may include but is not limited to inert-coated glass bottles used for collecting whole air samples.

³ Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, <http://www.epa.gov>.

⁴ Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.access.gpo.gov>.

3.2.5 *passivated canister, n*—a stainless steel air sampling canister whose inner surface is first electropolished to decrease surface roughness.

3.2.5.1 *Discussion*—The electropolishing may be followed by application of either a coating of nickel/chromium oxide (or similar) or a layer of fused silica (silicon dioxide) so as to increase the canister's inertness as compared to untreated stainless steel.

3.2.6 *quality control canister (QC canister), n*—canister that is selected and analyzed from a cleaning batch to verify canister cleanliness requirements have been satisfied.

3.2.7 *virgin canister, n*—a canister that is pending its initial cleaning, verification and certification.

3.2.8 *zero-grade air or nitrogen, n*—“hydrocarbon-free” air or nitrogen used as purge/fill gas, with typically <0.10 ppmv of total hydrocarbons.

4. Summary of Practice

4.1 This procedure describes *Best Practices* for cleaning and certifying reusable sample vessels designed for volatile organic compound collection. Contaminated and virgin canisters are first evacuated to remove the bulk contents from each canister. Once evacuated, the canisters are connected to a cleaning system, where they are serially evacuated and filled with humidified zero air or nitrogen. Depending on canister cleanliness and the system used, this process may take anywhere from a few hours to a few days to complete. Following the cleaning process, a minimum of one canister per batch or 5 % of the total batch, whichever is larger, is selected as the QC canister(s). The QC canister is analyzed for target compounds of concern using the same analytical test method as applied to the intended samples, or other accepted analytical method that has demonstrated equivalent performance. Following the cleaning procedure, the canisters are either pressurized or evacuated and stored for a minimum of 24 hours to verify that the canisters do not leak. The pressure of each canister is evaluated using a calibrated pressure/vacuum gauge and the results are recorded. All canister batches that pass both the batch QC and individual leak check are verified as ready for use.

5. Significance and Use

5.1 Whole-air sampling vessels are cited and utilized throughout a variety of internationally, nationally, and regionally applied documents and test methods, yet the methods generally fail to uniformly specify criteria used to qualify the use and re-use of sample containers. This practice describes a set of best practices for reusable containers and canister media cleaning, quality control (QC) objectives, and corrective actions necessary to ensure equipment that meets cleanliness needs of their intended use.

6. Reagents

6.1 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type I or II of Specification **D1193**.

7. Hazards

7.1 *Electrical Shock*—All electrical wiring should be periodically checked for insulation cuts and chafing as electrical shock can occur from exposed wires.

7.2 *Fires*—All flammable materials, especially solvents, shall be kept clear of the cleaning system and pumps since the canister heaters generate considerable heat.

7.3 *Pollution Prevention and Waste Management*—Air purged from canisters via vacuum pumps should be discharged under a fume hood or to the outside air.

8. Equipment and Supplies

8.1 *Initial Evacuation System*—A manifold system for evacuating the canister constituents prior to cleaning may be used. While initial evacuation is not necessary, it may assist expediting the cleaning process and may be used to prevent gross contamination of the canister cleaning system.

8.1.1 The vacuum manifold consists of a vacuum pump and may include a gas supply connected to a series of canister positions, which connect directly to the canister to be evacuated.

8.1.2 The purge cycles may be controlled automatically with a three-way solenoid valve; one position connects to the gas source, the second position connects to a pump, and the third position connects to the manifold. The canisters are then purged by serial evacuation and dilution.

8.1.3 Recommendations on the quantity and duration of cycles recommendation is not given within this practice, as the parameters are dependent on the container contents.

8.2 *Canister Cleaning System*—The canister cleaning system is comprised of cleaning manifolds, a gas source, high vacuum pump(s), vacuum/pressure gauges, humidification apparatus if necessary, and an oven capable of maintaining $100^{\circ}\text{C} \pm 10^{\circ}\text{C}$.

8.3 *Canister Manifolds*—Manifolds are, typically, constructed of tubing made of stainless steel. Canisters are attached to the oven manifold with a compression fitting. Each manifold has its own pump and vacuum gauge, but may share a common gas source.

8.3.1 *Vacuum Pumps*—Typical pumps that can be used include, but are not limited to: dual-stage direct driven rotary-vane type, two-stage oil-less pumping system comprised of a molecular drag pump backed by a diaphragm-type roughing pump with integrated vacuum controller, or other pump capable of allowing the cleaning and final evacuation process to meet the intended use cleanliness objectives.

8.3.1.1 A definition criteria table for various vacuum levels can be found in **Table 1**.

8.3.2 *Electric Ovens with Single or Multi-Connection Manifold*—Canisters are heated during the cleaning process. Degradation of the canister coating can occur if the canister exceeds manufacturers specified limits, and so a typical maximum heating temperature is $100^{\circ}\text{C} \pm 10^{\circ}\text{C}$, but may be as high as $110^{\circ}\text{C} \pm 10^{\circ}\text{C}$.

8.3.2.1 The maximum allowable oven temperature may be lower than $100^{\circ}\text{C} \pm 10^{\circ}\text{C}$ depending on canister manufacturer recommendations.