



Standard Practice for Spacecraft Hardware Thermal Vacuum Bakeout¹

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1. Scope

1.1 This practice establishes methods for thermal vacuum bakeout of spacecraft and spacecraft components.

1.2 This practice defines the equipment, environment, and certification criteria for each type of bakeout.

1.3 The methods defined in this practice are intended to reduce component outgassing rates to levels necessary to meet mission performance requirements of the contamination sensitive hardware. Times, temperatures, and configurations contained in this document have been found to provide satisfactory results. Experienced operators may find that other, similar times, temperatures and configurations have provided satisfactory results. If deviations from these criteria are deemed appropriate, they should be detailed in the bakeout report.

1.4 This practice describes three bakeout methods: Method A, using prescribed time and pressure criteria; Method B, using prescribed QCM stabilization rate criteria; and Method C, which measures the QCM deposition rate.

1.5 Determination of the acceptable molecular outgassing, selection of the bakeout method, and determination of the specific test completion criteria are the responsibility of the user organization.

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

2. Referenced Documents

2.1 ASTM Standards:²

E1546 Guide for Development of Fire-Hazard-Assessment Standards

E296 Practice for Ionization Gage Application to Space Simulators

E834 Practice for Determining Vacuum Chamber Gaseous Environment Using a Cold Finger

E1234 Practice for Handling, Transporting, and Installing Nonvolatile Residue (NVR) Sample Plates Used in Environmentally Controlled Areas for Spacecraft

E1235 Test Method for Gravimetric Determination of Nonvolatile Residue (NVR) in Environmentally Controlled Areas for Spacecraft

E1549 Specification for ESD Controlled Garments Required in Cleanrooms and Controlled Environments for Spacecraft for Non-Hazardous and Hazardous Operations

E1559 Test Method for Contamination Outgassing Characteristics of Spacecraft Materials

E1560 Test Method for Gravimetric Determination of Nonvolatile Residue From Cleanroom Wipers

E1731 Test Method for Gravimetric Determination of Nonvolatile Residue from Cleanroom Gloves

E2311 Practice for QCM Measurement of Spacecraft Molecular Contamination in Space

2.2 Other Standards:

IEST-STD-CC1246 Product Cleanliness Levels and Contamination Control Program³

MIL-STD-1246 Product Cleanliness Levels and Contamination Control Program^{4,5}

MIL-P-27401 Propellant Pressurizing Agent, Nitrogen⁵

ISO-14644 Cleanrooms and associated clean environments³

FED-STD-209 Federal Standard, Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones^{5,6}

3. Terminology

3.1 Definitions:

3.1.1 *ambient conditions*, *n*—room temperature and pressure.

3.1.2 *pre-bakeout*, *n*—to clean or condition, or both, a vacuum chamber prior to its use for flight hardware.

¹ This test method is under the jurisdiction of ASTM Committee E21 on Space Simulation and Applications of Space Technology and is the direct responsibility of Subcommittee E21.05 on Contamination.

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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.

³ Available from Institute of Environmental Sciences and Technology (IEST), Arlington Place One, 2340 S. Arlington Heights Rd., Suite 100, Arlington Heights, IL 60005-4516, <http://www.iest.org>.

⁴ MIL-STD-1246 may be used in lieu of IEST-STD-CC1246 by mutual agreement of the parties in the contract.

⁵ Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <https://assist.daps.dla.mil/quicksearch/>

⁶ FED-STD-209 may be used in lieu of ISO-14644 by mutual agreement of the parties in the contract.