



Designation: E2542 – 08 (Reapproved 2022)

Standard Specification for Portable Water Heaters Used at Personnel Decontamination Stations¹

This standard is issued under the fixed designation E2542; 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 specification is used to standardize the portable water heaters used on personnel decontamination lines to insure the heaters provide sufficient heated water for as long as they are needed during the emergency.

NOTE 1—These heaters are not intended to be used for the decontamination for any other surface or material. Also, these heaters are intended to be portable and easy to use by first responders during a chemical, biological, radiological, nuclear, and explosive (CBRNE) event.

1.2 This specification contains a specification section and a test methods section so users need to refer to the section applicable to their needs when using this standard specification.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

NOTE 2—The U.S. first responder personnel using the equipment manufactured under this standard are not likely to be familiar with SI units so English units need to be included as part of the system documentation and shown on control panels for any equipment sold to U.S. organizations.

1.4 *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.*

1.5 *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 This specification is under the jurisdiction of ASTM Committee E54 on Homeland Security Applications and is the direct responsibility of Subcommittee E54.01 on CBRNE Detection and CBRN Protection.

Current edition approved Dec. 1, 2022. Published January 2023. Originally approved in 2008. Last previous edition approved in 2014 as E2542 – 08 (2014). DOI: 10.1520/E2542-08R22.

2. Referenced Documents

- 2.1 *ASTM Standards*:²
 - D3195 Practice for Rotameter Calibration
 - E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves
- 2.2 *ASME Standards*:³
 - Boiler and Pressure Vessel Code
 - MFC-3M Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi
- 2.3 *NFPA Standard*:⁴
 - NFPA 70 National Electrical Code
- 2.4 *NIST Standard*:⁵
 - Recommended Practice Guide Special Publication 960-12 Stopwatch and Timer Calibrations

3. Terminology

- 3.1 *Definitions*:
 - 3.1.1 *decontamination, n*—process of reducing or eliminating the hazards associated with chemical, biological, or radiological contamination.
 - 3.1.1.1 *Discussion*—The means of decontaminating personnel, equipment, or areas include absorption, neutralization, weathering, and physical removal of the contaminant and hazards associated with nuclear, biological, or chemical (NBC) agents.

4. Classification

4.1 There will be no attempt to classify into categories the different types of portable water heaters that can fall under this

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 American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁴ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

⁵ Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, <http://www.nist.gov>.

specification since this specification will only address the minimum requirements these heaters must satisfy.

5. Ordering Information

5.1 Personnel ordering portable water heaters using this specification as a basis for their order should be aware that this specification is the minimum requirement for these types of devices and any needs beyond these minimum requirements shall be stated in the request for quote.

6. Materials and Manufacture

6.1 The hot water tanks of the portable water heaters purchased under this specification shall conform to the requirements of the current version of the ASME Boiler and Pressure Vessel Code.

7. Mechanical Properties

7.1 The heater materials of construction shall be easily cleaned of surface mud and grime with no degradation of the unit's ability to perform its function.

7.2 The preferred fuels for the heater section of the portable water heater are diesel fuel, gasoline, or bottled propane gas. If electricity is used, the circuit shall be no more than 120 V, 30 A, single phase, and shall conform to NFPA 70 for outdoor usage.

8. Performance Requirements

8.1 Using the input flows shown in **Table 1**, a continuous flow (25 L/min to 60 L/min [6.6 to 15.9 gal/min]) of warm water (between 13 °C and 27 °C [55 and 80 °F]) is provided at a pressure between 275 kPa and 620 kPa (40 and 90 lb/in.²) at each of the input conditions.

8.2 Be capable of providing a warm water flow within the temperature range specified in **8.1** within 2 min of being supplied 2 °C (36 °F) feed water.

8.2.1 Use 4 cm (1.5-in.) National Pipe Thread connectors (preferably female) to receive the input water and discharge the outlet water. The input lines shall be filtered using an ASTM 18 sieve. The sieve shall be certified under Specification **E11** to remove solid debris particles that might damage the equipment or injure the personnel undergoing the decontamination shower.

NOTE 3—As specified, the inlet filter is not intended to protect against chemical and biological warfare agents. The sole intended purpose of the inlet filter is to protect the water heater device from debris that may be attracted to it because of the suction of the inlet.

9. Other Requirements

9.1 Contain sufficient hoses as part of the unit packaging to connect to a water source up to 15.24 m (50 ft) distant and provide warm water to a shower up to 7.62 m (25 ft) from the unit.

TABLE 1 Range of Input Water Flows

Inlet Water Pressure, kPa (lb/in. ²)	Source Water Flow, L/min (gal/min)
345 (50)	95 (25)
552 (80)	95 (25)
690 (100)	95 (25)

10. Dimensions, Mass, and Permissible Variations

10.1 The unit shall be man-transportable by not more than four first responders carrying the assembled unit and not weigh more than 91 kg (200 lb) not including the fuel and hoses.

TEST METHODS

11. Scope

11.1 These test methods shall be used to insure portable water heaters comply with the requirements of this specification.

12. Significance and Use

12.1 The use of these acceptance tests will insure that organizations buying portable heaters will be assured the heaters meet certain performance requirements.

13. Hazards

13.1 Personnel using this portable water heater should take precautions against normal industrial hazards, such as fire and temperature hazards or accumulation of exhaust. They shall also comply with all other manufacturer's warnings when using the equipment.

14. Procedure

14.1 *Measurement of the Water Heater Unit's Water Flow*—The water heater unit's water flow shall be measured, and recorded, using one of the methods specified in the following:

14.1.1 Rotameter Test Method:

14.1.1.1 The testing facility shall obtain a water flow meter (certified to Practice **D3195**) with a current calibration in the 10 L/min to 70 L/min flow regime for the unit's warm water side outlet. Additionally, a water flow meter calibrated to 25 L/min to 100 L/min shall be obtained for the water heater's input line.

14.1.1.2 Install the flow meters as specified by the manufacturer's instructions on the cold water inlet side and the warm water outlet of the heater unit.

14.1.1.3 Begin operation of the water heater unit in accordance with the manufacturer's instructions.

14.1.1.4 Allow 2 min to pass as measured by a stopwatch calibrated following the NIST Recommended Practice Guide Special Publication 960-12 procedures.

14.1.1.5 Record the flow rate of the warm water as detected by the flow meters, perform follow-on recordings either using an automated continuous recording device (with physical checks of the device being performed hourly to insure continued operation of the water heater unit within the specified parameters), or manually recording the flow rate on an hourly basis.

14.1.1.6 Maintain operation of the water heater unit for a minimum of 12 h to insure the water heater unit can continuously supply warm water at this rate. Water used by the device may be recycled for use by the water heater unit as long as the water is the same temperature as the makeup feed water.

14.1.2 ASME Test Method:

14.1.2.1 Set up and operate the test apparatus using the procedures specified in ASME Standard MFC-3M.

14.1.2.2 Begin operation of the water heater unit in accordance with the manufacturer's instructions.

14.1.2.3 Allow 2 min to pass, as measured by a stopwatch calibrated following the NIST Recommended Practice Guide Special Publication 960-12 procedures.

14.1.2.4 Record the flow rate of the warm water as detected by the flow meter(s), perform follow-on recordings either using an automated continuous recording device (with physical checks of the device being performed hourly to insure continued operation of the water heater unit), or manually recording the flow rate on an hourly basis.

14.1.2.5 Maintain operation of the water heater unit for a minimum of 12 h to insure the unit can continuously supply warm water at this rate. Water used by the device may be recycled for use by the water heater unit as long as the water is the same temperature as the makeup feed water.

14.2 Measurement of the Water Heater Unit's Cold Water Inlet and Warm Water Output Temperatures:

14.2.1 The testing facility shall obtain water temperatures based on ASTM Manual MNL 12⁶ using a measurement device that has been calibrated to be accurate in the 0 °C to 35 °C range for the unit's warm water side outlet. Additionally, a measurement device that has been calibrated to be accurate in the 0 °C to 35 °C range shall be obtained to measure the inlet temperature.

14.2.2 Install the temperature meters as specified by the manufacturer's instructions on the water inlet and outlet of the water heater unit. The temperature meters on the outlet side of the water heater unit shall be placed at the end of the outlet hose, at least 7.62 m from the unit. At a minimum, the outlet hose shall be tested at ambient air temperatures of –20 °C and +35 °C.

14.2.3 Begin operation of the water heater unit in accordance with the manufacturer's instructions.

14.2.4 Allow 2 min to pass, as measured by a calibrated stopwatch calibrated following the NIST Recommended Practice Guide Special Publication 960-12 procedures. Record the temperature of the inlet water and the outlet water as detected by the temperature meters, perform follow-on recordings either using an automated continuous recording device (with physical checks of the device being performed hourly to insure continued operation of the water heater unit), or manually recording the temperatures on an hourly basis. At a minimum, the water heater shall be tested at an inlet water temperature of 2 °C.

14.2.5 Maintain operation of the water heater unit for a minimum of 12 h to insure the water heater unit can continu-

ously supply warm water at the required temperature. Water used by the device may be recycled for use by the water heater unit after the water has cooled to the same temperature as the initial feed water.

14.3 *Measurement of the Water Heater Unit's Water Supply and Outlet Pressures*—The water pressure supplied to and delivered from by the heater unit shall be measured according to the requirements of ASME PTC 19.2.⁷

15. Precision and Bias

15.1 The precision and bias from the referenced standards shall apply to the measurements required by this specification.

16. Rejection and Rehearing

16.1 Material that fails to conform to the requirements of this specification may be rejected.

17. Certification

17.1 At a minimum, the performance of the unit at the water flow conditions given in **Table 1** shall be permanently attached to the water heater unit using a metal plate. Additionally, when specified in the purchase order or contract, the purchaser shall be furnished certification stating that the device is in conformance with this specification. When specified in the purchase order or contract, a report of the test results shall be furnished. Test reports may be transmitted to the purchaser by electronic services. The content of the electronically transmitted document shall conform to any existing agreement between the purchaser and the seller.

18. Product Marking

18.1 The water heater units shall be marked in any fashion that adequately identifies the device, any applicable usage warnings, and adherence to the requirements of this specification. Additional markings may be required by the purchaser in the purchase order or contract.

19. Packaging and Package Marking

19.1 The packaging may be marked in any fashion that adequately identifies the package contents, any applicable usage warnings, and adherence to the requirements of this specification. Additional markings may be required by the purchaser in the purchase order or contract.

20. Keywords

20.1 decontamination; shower; warm water

⁶ *Manual on the use of Thermocouples in Temperature Measurement, Fourth Edition, MNL 12*, ASTM International, West Conshohocken, PA, 1993.

⁷ *ASME PTC-19.2, Pressure Measurement*, ASME International, New York, 1987, reaffirmed date: 2004.