Designation: E1925 – 10

Specification for Engineering and Design Criteria for Rigid Wall Relocatable Structures[1]

This standard is issued under the fixed designation E1925; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers engineering and design criteria required for the development of rigid wall relocatable structures (RWRS) and shall be applied to the design of expandable and nonexpandable RWRSs. This specification applies to present engineering and design requirements for effective RWRSs that are operable in a variety of environments without degradation and are capable of all specified transport modes. This specification shall be applied to the design of expandable and nonexpandable RWRSs. This specification is a conversion of a military standard that was approved by all departments and agencies of the Department of Defense.

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

1.3 The following safety hazards caveat pertains only to the test required portion, Section 10, of this specification. *This specification 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 specification 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]

E1851 Test Method for Electromagnetic Shielding Effectiveness of Durable Rigid Wall Relocatable Structures

G21 Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

2.2 *ISO Standards:*[3]

ISO 668-1995 Series 1 Freight Containers - Classification, Dimensions and Ratings, 5th Edition

ISO 1161-1990 Series 1 Freight Containers - Corner Fittings

ISO 1496-1 Series 1 Freight Containers Specification and Testing Document - Part 1, 1993

ISO 1496-2 Series 1 Freight Containers Specification and Testing Document - Part 2, 1993

2.3 *Military Standards:*[4]

MIL-STD-1472D Notice 3, Human Engineering Design Criteria for Military Systems, Equipment and Facilities

MIL-F-14072D Finishes for Ground Electronic Equipment

MIL-C-22992E Amend 5, Connector, Plugs and Receptacles, Electrical, Waterproof, Quick Disconnect, Heavy Duty Type General Specification for

MIL-STD-810 Environmental Engineering Considerations and Laboratory Test

MIL-STD-1791 Notice 1, Designing for Internal Aerial Delivery in Fixed Wing Aircraft

2.4 *SAE Standards:*[5]

SAE-AS8090 Mobility, Towed Aerospace Ground Equipment, General Requirements for

3. Terminology

3.1 *Definitions:*

3.1.1 *degradation*—damage by the weakening or loss of some property, quality, or capability.

3.1.2 *delamination*—separation into constituent layers.

3.1.3 *galvanic corrosion*—the corrosion of metallic objects in the presence of moisture, caused by electrolytic action.

3.1.4 *special tools*—tools other than common hand tools or those designed specifically for use with a delivered product.

[1] This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is under the direct responsibility of Subcommittee E06.53 on Materials and Processes for Durable Rigidwall Relocatable Structures.

Current edition approved Oct. 1, 2010. Published October 2010. Originally approved in 1997. Last previous edition approved in 2004 as E1925 – 04. DOI: 10.1520/E1925-10.

[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 National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://dodssp.daps.dla.mil.

[5] Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

4. Materials and Manufacture

4.1 *Materials and Workmanship*—All materials and workmanship shall be in accordance with good commercial practice. All materials shall be recovered materials to the maximum extent possible consistent with quality and performance. All materials shall be free of defects that would affect the performance or maintainability of individual components or the overall assembly adversely.

4.2 *Dissimilar Materials*—The intimate contact of dissimilar materials, which can be expected to cause galvanic corrosion, shall be prevented. When such contact cannot be prevented, an insulating material shall be provided to minimize the corrosive effect.

4.3 *Corrosion*—All RWRS components shall be adequately protected from corrosion in accordance with MIL-F-14072D. The use of dissimilar metal combinations shall be avoided whenever possible. The selection of permissible couples shall be in accordance with the compatible couples table of MIL-F-14072D. If, due to special conditions of service or design, the contractor considers that finishes, processes, or materials other than those specified herein are necessary or more suitable, such finishes, processes, or materials may be used.

4.4 *Toxicity*—The materials (in their cured state) used shall cause no skin irritations or other injury to personnel handling the material during transportation, operation, or maintenance of the equipment. Exposure of personnel to toxic substances shall not be in excess of the threshold values contained in the American Conference of Government Industrial Hygienists Threshold Limit Values.

5. General Requirements

5.1 *Objectives*—The RWRS shall be designed and built to withstand a variety of environments while providing an effective and reliable facility for system equipment. The design shall also be directed toward minimizing the man-hours required to strike or erect RWRSs using common hand tools.

5.2 *Standardization*—The design and engineering requirements specified herein are designed to encourage standardization of RWRSs. Existing performance and test criteria have been used to the maximum extent possible.

5.3 *Simplicity of Design*—The RWRS shall represent the simplest design consistent with functional and performance requirements, expected service conditions, and structure life.

5.4 *RWRS Life, Reliability and Maintainability*—The design life for a typical structure shall be 15 years.

6. Physical Properties Requirements

6.1 *Interchangeability of Parts*—Like units, assemblies, sub-assemblies, and replaceable parts shall be physically and functionally interchangeable without modification of either such items or the unit. Demonstration of the interchangeability of selected panels and hardware shall be conducted.

6.2 *Special Tools*—There shall be no special tools or equipment required to erect or strike RWRSs. Standard hand tools may be provided as required.

6.3 *Physical Security*—A means shall be provided to secure all openings, folding panels, and removable components in order to prevent unauthorized entry.

6.4 *Lighting Provision*—If lighting is installed as part of the basic RWRS, all RWRS tests shall be conducted with such provisions installed.

6.5 *Electrical Grounding*—The RWRS electrical system shall be grounded through electrical input cable back to the power source ground.

6.6 *Input-Output Panels and Openings*—All RWRS tests shall be conducted with the panels and openings installed if input-output panels and openings are installed as part of the basic RWRS.

6.7 *Electrical Power Connector*—When an electrical power connector is provided as part of the basic design of a nonexpandable or expandable RWRS, that connector shall be a class L connector in accordance with MIL-C-22992E.

6.8 *Lightning Protection*—A separate grounding system for lightning protection shall be designed for the RWRS.

6.9 *Human Engineering and Safety*—The provisions of MIL-STD-1472D applicable to RWRSs shall be implemented.

7. Performance Requirements

7.1 *Air Transportability*—The air transportability of all RWRS shall comply with the guidelines of MIL-STD-1791. See 10.2 for verification test.

7.2 *Ground Mobility*—The RWRS shall be capable of withstanding the shocks and vibrations induced by ground transport equipment over the mobility courses described for Type V mobility in SAE-AS8090. See 10.3 for verification test.

7.3 *Rail Transportability*—The RWRS shall be capable of withstanding the shocks induced by rail transport without damage. See 10.4 for verification test.

7.4 *Forklift Handling*—The RWRS shall be capable of withstanding the stresses of forklift movements or shall be marked "DO NOT FORKLIFT." See 10.5 for verification test.

7.5 *Erecting and Striking*—Erecting and striking expandable and nonexpandable RWRS shall be accomplished within two man-hours per 150 square feet (ft^2) (14 m^2) of floor space. The RWRS shall be capable of being erected and struck on a surface that has up to a 24-in. (610-mm) differential in grade to the diagonal dimension of the RWRS floor. See 10.6 for verification test.

7.6 *Weather Seals*—Weather seals shall be designed to be an integral part of the RWRS and shall be designed to be readily replaceable by user in the field without the use of special tools. This requirement shall be verified by demonstration.

7.7 *Airtightness*—The RWRS shall not permit air leakage in either the shipping or operational configuration, as specified in 10.7 and 10.8 verification test.

7.8 *Blackout*—The RWRS shall not permit light emission with the doors closed, in an operational mode. See 10.9 for verification test.

7.9 *Ice*—The RWRS design shall not permit water accumulation in pockets, creases, fissures, and so forth, which could cause structural damage upon freezing. The operation of moveable RWRS components shall not be impaired unduly by the formation of ice anywhere on the RWRS structure. This requirement shall be validated by analysis.

7.10 *Wind Velocities (Load)*—When tied down, the RWRS shall withstand winds up to 100 mph (160 km/h) steady state, with gusts up to 120 mph (190 km/h). This requirement shall be validated by analysis.

7.11 *Altitude (Low Pressure)*—The RWRS shall use devices permitting air passage and allowing pressure equalization to preclude damage to the RWRS. At least a total of 12 $in.^2$ of vent area for each 10 ft length (2500 mm^2 of vent area for each metre length), or fraction thereof, or RWRS shall be provided. This requirement shall be verified by analysis.

7.12 *Humidity Resistance*—The RWRS shall withstand daily exposure of up to 97 % relative humidity for 20 h and exposure of 100 % relative humidity (with condensation) for 4 h. See 10.10 for verification test.

7.13 *Marine Corrosion Resistance*—The RWRS shall be fully serviceable when exposed to a salt environment as specified in 10.11. All hardware including fasteners, jacks, and seals shall show no evidence of corrosion or degradation following 96 h of exposure to this simulated environment. See 10.11 for verification test.

7.14 *Temperature Range*—In storage, the RWRSs shall be capable of withstanding exposure to temperatures of –70 to 160°F (–57 to 71°C). In transit, the RWRSs shall be capable of withstanding exposure to temperatures of –65 to 160°F (–54 to 71°C) with personnel access at low end of range. Operational temperature of RWRS shall be –40 to 120°F (–40 to 49°C). See 10.12 for verification test.

7.15 *Solar Loads Assembled RWRS*—The RWRS shall withstand a simulated solar load outer skin temperature of 205°F (96°C) while internal temperature is maintained at 85°F (29°C). See 10.13 for verification test.

7.16 *Temperature Shock*—RWRS panels, windows, and other components shall withstand a temperature shock from 160 to –70°F (71 to –57°C) without separation, delamination cracks, or degradation. See 10.14 for verification test.

7.17 *Heat Transfer*—The RWRS shall have an overall heat transfer coefficient less than or equal to 0.35 Btu/(h*ft^2*°F) (2.0W/(m^2*°K)), in the operational configuration. Heat transfer coefficient for nonexpandable shelters shall be less than or equal to 0.35 Btu/hr-ft^2*°F in the transport configuration. See 10.15 for verification test.

7.18 *Blowing Sand*—The external moving parts of the RWRS in transport or operational mode shall be designed to resist the effects of blowing sand. External moving parts shall be designed to operate and withstand particle concentrations of 1.32×10^{-4} lb/ft^3 (2.19 g/m^3) with a wind velocity of 1750 ± 250 ft/min (8.9 ± 1.3 m/sec) without degradation. Such particles shall range in size from 6×10^{-3} in. (150 µm) to 4×10^{-2} in. (1000 µm). Relative humidity shall be less than 23 %. See 10.16 for verification test.

7.19 *Sunshine (Ultraviolet Effects)*—Ultraviolet effects shall neither significantly degrade nor affect the serviceability of RWRS components or materials for the service life of the RWRS. See 10.17 for verification test.

7.20 *Flame Resistance*—The RWRS shall be designed to be flame resistant. See 10.18 for verification test.

7.21 *Fungus*—There shall be no degradation of RWRS components due to fungus growth. Materials shall be selected to minimize fungal growth. See 10.19 for verification test.

7.22 *RWRS Squareness*—The RWRS must be squared so that in any two intersecting fixed RWRS wall, floor, or roof panels, the inside panel surface in one panel shall be mutually perpendicular to the inside surface of the adjacent panel within 1/16 in. (2 mm) when measured with a 36-in. (900 mm) square whose two edges are perpendicular to each other within 0.005 in. (0.1 mm). This requirement does not apply to curved wall shelter designs. Outside and inside skin temperatures shall be within 5°F (3°C) of the same temperature when this is verified. See 10.20 for verification test.

7.23 *Panel Flatness*—Panel surfaces shall not be cupped or bowed in excess of 0.125 in. (3 mm) when measured with a 48-in. (1300-mm) long straight edge. Outside and inside skin temperatures shall be within 5°F (3°C) of the same temperature when this is verified. This requirement does not apply to curved wall shelter designs. See 10.21 for verification test.

7.24 *Roof Loads*—The roof assembly of the RWRS shall withstand a snow load of 40 lb/ft^2 (200 kg/m^2) and a personnel load of 660 lb (300 kg) static over 2 ft^2 (0.2 m^2). See 10.22 for verification test.

7.25 *Floor Loads*—The RWRS floor shall be capable of supporting a uniform load of 65 lb/ft^2 (320 kg/m^2). The RWRS floor shall be capable of supporting a concentrated load of 2000 lb (900 kg) over a 4-ft^2 (0.4-m^2) area at the center of the floor. The floor shall also be capable of supporting a point load of 125 lb over a 1 in. square area (57 kg over a 650-mm^2 area). The loads shall not cause any permanent deformation of the floors or cause any deflection that interferes with proper RWRS operation. See 10.23 for verification test.

7.26 *Door Loads*—Doors shall be tested to withstand the following loads without deformation or impairment of function. These requirements are for vertically hinged doors. See 10.24 for verification test.

7.26.1 *Static Door (Hinge) Load*—The doors, frames, and hardware shall be capable of supporting 200 lb (90 kg) applied to the door at the edge opposite the hinge pivot line with the door open to approximately 90 degrees. See 10.24.1 for verification test.

7.26.2 *Wind Gust Door (Stop) Load*—The door frames and hardware shall withstand a wind gust of 60 mph (100 km/h) in any direction when the door is secured in its open position(s) by its door stop device(s). See 10.24.2 for verification test.

7.27 *Panel Attachment Points*—Panel attachment points shall have a minimum torque of 100 in.-lb and a minimum pull-out resistance (tension) of 2000 lb (900 kg) for panel thickness equal to or greater than 2 in. (50 mm) and 1000 lb (450 kg) for panel thickness under 2 in. (50 mm). Panel

attachment points of less than ¼ in. (6 mm) thread size shall withstand a minimum torque of 100 in.-lb (11 Nm) and shall have a minimum pullout strength of 800 lb (360 kg). See 10.25 for verification test.

7.28 *Leveling Device*—All RWRSs shall have leveling capabilities of at least 24 in. (610 mm) over uneven terrain, without the use of shims. See 10.26 for verification test.

7.29 *Lifting and Towing Eye Strength*—All lifting and towing eyes shall withstand a tensile load of 2.26 times the gross weight of the RWRS. See 10.27 for verification test.

7.30 *Towing and Dragging (for RWRSs with Skids)*—The RWRS with attached skids shall be capable of withstanding a towing and dragging force applied to the plane of the skid attachment equal to one-half the RWRS gross weight without damage to any part of the RWRS, skid assemblies, or skid mounting brackets. See 10.28 for verification test.

7.31 *Drop Shock (All RWRS without skids)*—RWRSs without skids shall be capable of withstanding flat and rotational drops of 6 in. (150 mm) onto concrete. There shall be no permanent deformation, buckling, delamination, sealer separation, or structural failures of any part of the RWRS after each test, and the doors and covers shall open and close to their full extent without binding. See 10.29 for verification test.

7.32 *Drop Shock (RWRS with skids)*—RWRS with shock attenuating skids shall be capable of withstanding flat and rotational drops of 18 in. (460 mm) onto concrete. There shall be no permanent deformation, buckling, delamination, sealer separation, or structural failures of any part of the RWRS after each test, and the doors and covers shall open and close to their full extent without binding. See 10.30 for verification test.

7.33 *Panel Impact*—All floor and roof shelter panels shall withstand a blow from a 70 lb (30 kg) steel cylinder as specified in 10.31. See 10.31 for verification test.

7.34 *EMI Provisions*—RWRSs requiring electromagnetic interference (EMI) shielding shall provide a minimum attenuation of radiated and induced EMI fields as shown in Fig. 1 within the frequency range of 100 kHz to 10 GHz. See 10.32 for verification test.

7.35 *Watertightness*—The RWRS, including panels and louvers, shall be made watertight without the use of additional external sealing, caulking, taping, and so forth. See 10.33 for verification test.

7.36 *Lift Test*—The RWRS shall incur no structural damage when subjected to a 3.2-G lift test. See 10.34 for verification test.

7.37 *ISO RWRS Compatibility Requirements*— RWRS designated ISO shelters shall meet the requirements for the following: all modes of transport (marine, highway, rail, and fixed and rotary wing aircraft), stacking requirements of marine modes, and dimensional requirements. They shall be provided with four forklift pockets. ISO standard payload ratings shall not apply to RWRS. Performance shall conform to the following specifications: ISO 668-1995, ISO 1161-1990, ISO 1496-1, and ISO 1496-2. See 10.1 for verification test.

8. Dimensions

8.1 *Dimension*—The external dimensions of the RWRS in shipping configuration shall not exceed 8-ft high by 8-ft wide. ISO shelter dimensions shall comply with ISO 668-1995.

8.2 *Door Sizes*—Door sizes shall be as indicated in Table 1.

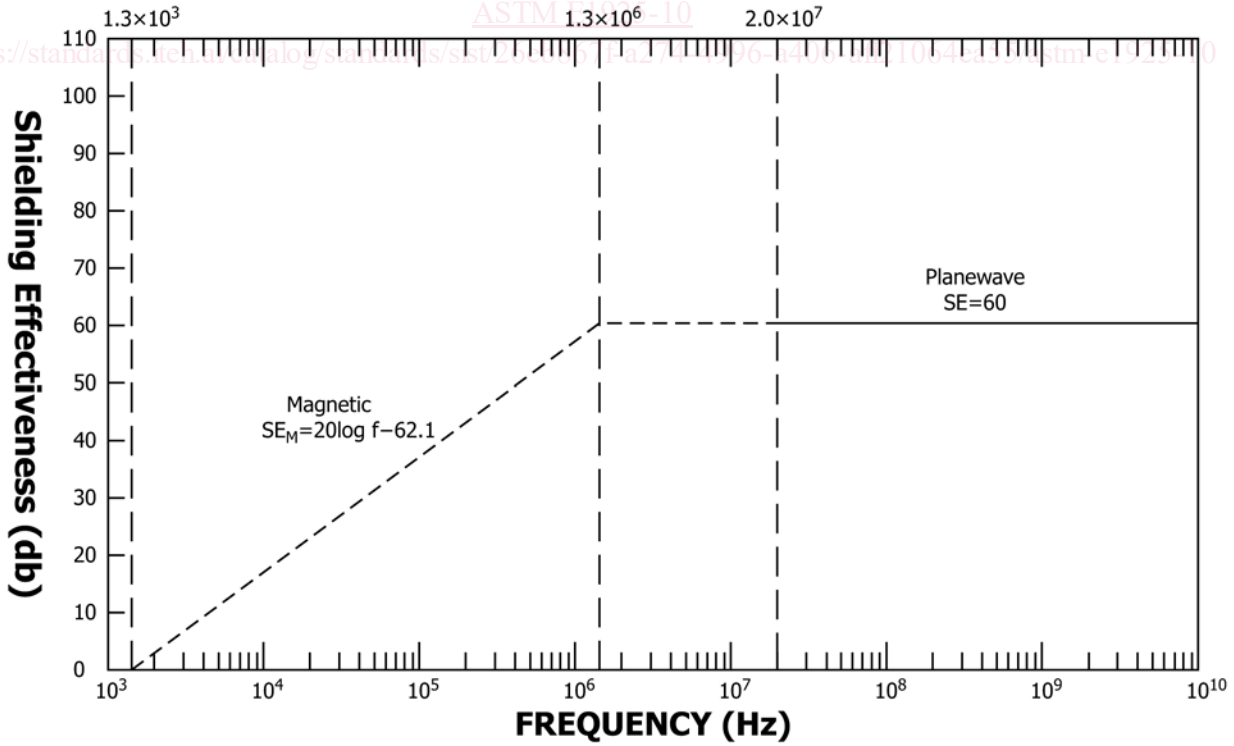

FIG. 1 Minimum Shielding Effectiveness Requirements

TABLE 1 Door Sizes

ISO	Dimension, in. (mm)	NON-ISO
	Fixed Walls	
76[A] × 36 (1930 × 910)		65 × 35 (1650 × 890)
76[A] × 48 (1930 × 1220)		55 × 30 (1400 × 760)
76[A] × 72 (1930 × 1830) (double doors)		
	Expandable Walls	
76[A] × 30 (1930 × 760)		65 × 35 (1650 × 890)

[A] This is a minimum value.

9. Sampling

9.1 *Samples*—Samples for testing shall be taken from the finished product whenever possible. When the thickness or shape of the finished product makes it impossible to obtain the type of samples specified in the various test methods, the manufacturer shall, upon request by the purchaser at the time of ordering, furnish a sufficient number of test articles, prepared in accordance with good testing practices for the proper performance of the required tests.

10. Tests Required

10.1 *ISO RWRS Compatibility Test*—The RWRS designated ISO shelters shall be examined according to ISO 668-1995 and ISO 1161-1990 and shall be tested in accordance with ISO 1496-1 and ISO 1496-2.

10.2 *Air Transportability Test*—The air transportability test for the RWRS of each size and type shall be tested in accordance with MIL-STD-1791. The RWRS developer may require the application of alternative equipment restraint test instead of an analytical equipment restraint test.

10.3 *Ground Mobility Test*—The ground mobility test for the RWRS using the appropriate mobilizer (dolly set) or vehicle as the transport means shall be tested as prescribed in SAE-AS8090, Type V Mobility.

10.4 *Rail Transportability Test*—The RWRS rail transportability shall be tested in accordance with MIL-STD-810. Payload will be distributed to simulate the weight, center of gravity, and mounting profile of mounted equipment. Rail Transportability Tests shall be performed for impacts at 4, 6, and 8 mph (6, 10, and 13 km/h) and 8 mph (13 km/h) reversed.

10.5 *Forklift Handling Test*—Loaded with payload distributed to simulate the weight, center of gravity, and mounting profile, the RWRS shall be picked up, transported over a paved surface for 500 yards (460 m) at 8 ± 1 mph (13 ± 1.6 km/h), complete two 90° right turns and two 90° left turns at a reduced safe speed (approximately 5 ± 1 mph (8 ± 1.6 km/h)), and then be lowered to the ground. Tiedown cables or chains shall be required to secure RWRSs without forklift pockets. The test shall be performed using a forklift capable of lifting a fully loaded RWRS and shall be performed once for each insertion point on the RWRS. The forklift tines shall be inserted completely under the RWRS and into the forklift pockets, if applicable, and the RWRS shall be raised off the ground upon contact with the tip of the forklift tines. There shall be no permanent deformation, delamination, or sealer separation within the RWRS structure except for minor abrasions from the forklift tines.

10.6 *Erecting and Striking Test*—The RWRS under test shall be placed on the surface that has a 24-in. (610-mm) differential in grade across the diagonal dimension of the floor of the erected RWRS (by using blocks, and so forth). If appropriate, the RWRS shall be leveled and expanded, and made ready for use within a period equal to two man-hours for each 150 ft^2 (14 m^2) of erected RWRS floor space. Striking shall be accomplished in a similar or shorter time period. Consideration must be given in RWRS design to allow for erection and striking in winds up to 30 mph (50 km/h).

10.7 *Airtightness Test for Expandable RWRSs*—Airtightness test, shipping, and operational configuration for expandable RWRSs are as follows:

10.7.1 *Shipping Configuration*—The maximum allowable internal air leakage is 200 standard cubic feet per minute (scfm) (0.10 m^2/s) at 0.3 in. of H_2O (75 Pa). Test: An air supply to the RWRS (with all openings closed) and an internal pressure of 0.3 in. of H_2O (water gauge) (75 Pa) shall be obtained and maintained. The air flow shall be stabilized. Any additional air supplied to maintain specified internal pressure shall be recorded to determine compliance with above.

10.7.2 *Operational Configuration*—The maximum allowable internal air leakage is 100 scfm (0.05 m^2/s) at 0.3 in. of H_2O (75 Pa). Test: same as 10.7.1

10.8 *Airtightness Test for Nonexpandable RWRSs*—The airtightness test, shipping and operational configuration for nonexpandable RWRSs is as follows:

10.8.1 *Shipping and Operational Configurations*—The maximum allowable air leakage is 200 scfm (0.10 m^2/s) at 1.2 in. of H_2O (300 Pa). For the test, an air supply to the RWRS (with all appropriate openings closed) and a internal pressure of 1.2 in. of H_2O (water gage) (300 Pa) shall be obtained and maintained in both the shipping and operational configurations. The air pressure and air flow shall be stabilized. Any additional air supplied to maintain specified internal pressure shall be recorded to determine compliance with the above.

10.9 *Blackout Test*—The RWRS shall be tested in the operational mode for light tightness with a bare 100 W incandescent lamp operating at rated voltage and held anywhere in a plane 1 ft (0.3 m) from the outside wall and roof surfaces. No direct rays of light shall be seen by an observer stationed inside the darkened closed RWRS as the lamp is moved outside.

10.10 *Humidity Resistance Test*—With the doors open, the RWRS shall be subjected to MIL-STD-810E, the moisture resistance test, Method 507.3, Procedure II, for hot-humid conditions. There shall be no evidence of delamination, cracking, corrosion, or deterioration of any part of the RWRS after cycling has been completed.

10.11 *Marine Atmosphere Test*—One representative sample of all fasteners, jacks, seals, and other hardware that will be

exposed to the atmosphere in the operational or storage mode and finished in accordance with MIL-STD-810E, Method 509.3, except that the salt solution shall have a concentration of 10 % and the exposure period shall be 96 h. The test items shall display no evidence of corrosion or degradation upon completion of the test.

10.12 *Temperature Test*—The RWRS shall be tested for both high temperature and low temperature storage and operating temperatures as described below. Upon completion of the temperature test, the RWRS shall sustain no delamination nor shall there be damage to seals or other components and all hardware shall operate during and after completion of temperature testing.

10.12.1 *High Temperature Test*—The RWRS shall be tested in accordance with MIL-STD-810E, Method 501.3. Storage temperature shall be maintained at a constant temperature of 160°F (71°C) for 4 h. Personnel shall be capable of erecting and striking the shelters and the doors shall be fully operable. Operational temperature shall be 120°F (49°C). The RWRS shall be fully operable. The solar load test is identified in 10.13.

10.12.2 *Low Temperature Test*—The RWRS shall be tested in accordance with MIL-STD-810E, Method 502.3. The storage temperature shall be maintained at a constant temperature of –70°F (–57°C) 4 h. Personnel shall be capable of erecting and striking the shelters and the doors shall be fully operable. Operational temperature shall be –40°F (–40°C). The RWRS shall be fully operable.

10.13 *Solar Load Test, Assembled RWRSs*—With the RWRS in operational mode, a simulated solar load sufficient to raise the outer skin temperature to 205°F (96°C) shall be applied uniformly to the fixed roof and one folding or expanded roof. A uniform solar load temperature should be attained gradually within 4 h and shall be maintained for an additional 4 h. As a minimum, one thermocouple per 10 ft^2 (1 m^2) of roof shall be uniformly distributed on the entire area of the roof. All of the thermocouples should read 205 ± 15°F (96 ± 8°C) throughout the 4-h period that the solar load shall be maintained. During this test, the ambient temperature within the RWRS will be maintained at a maximum of 85°F (29°C). The roof panels shall be examined upon completion of the solar load test, and any evidence of delamination or deformation will constitute failure of this test.

10.14 *Temperature Shock Test*—A representative RWRS panel specimen measuring 4 by 8 ft (1.2 by 2.4 m) shall be tested in accordance with MIL-STD-810E, Method 503.3. The high temperature chamber shall be at 160°F (71°C) and the low temperature shall be set at –70°F (–57°C). The sample will be checked for evidence of degradation of physical properties. Windows and other components shall also be tested.

10.15 *Heat Transfer Test*—The RWRS shall be erected inside a chamber with an automatic control system for maintaining a constant minimum temperature of –25°F (–32°C) when the temperature inside the RWRS is maintained at 75°F (23°C). The volume of the test chamber shall be such that the bulk of the RWRS will not interfere with the generation and maintenance of test conditions. The minimum distance from any RWRS panel to adjacent chamber wall shall be 24 in. (610 mm). The conditioned air flow shall be suitably baffled to provide free circulation between the RWRS and the chamber walls and ceiling and to provide uniform air flow around the RWRS with the maximum velocity on the RWRS surface of 5 mph (8 km/h). The chamber temperature shall be measured by placing one thermocouple 6 in. (150 mm) away from each corner fitting, and one thermocouple centrally located 6 in. (150 mm) away from each wall and ceiling panel. For ISO-type RWRS, internal temperature shall be measured with a total of 16 thermocouples, with each located 6 in. (150 mm) away from the panel surface, each shielded from the heat source and positioned as shown in Fig. 2. For non-ISO RWRS, internal temperature shall be measured with a minimum total of ten thermocouples. An electrical resistance heat source, with sufficient power to maintain a stabilized temperature of not less than 100°F (56°C) above the outside temperature, shall be used. A heater providing air discharge radially in a 360° pattern, with adjustable louvers around the circumference and discharge louvers in the top, is the preferred item for providing uniform heat. Additional fans may be used to ensure that the difference between any two thermocouples is a maximum of 5°F (3°C), thereby providing a uniform temperature within the RWRS. Also, the heater resistance elements shall be completely shielded from any interior RWRS surfaces. Temperature conditions shall be considered stable when, for 30 min, internal thermocouple readings remain within 5°F (3°C) of one another while the average external temperature remains at –25° ± 5°F (–32 ± 3°C) and the average internal temperature remains a minimum of 100°F (56°C) above the average external temperature. Thermocouple readings shall be recorded every 15 min. After the temperature conditions have stabilized and while maintaining stability, the electrical power to the internal apparatus shall also be recorded every 15 min during which time the power shall not be changed and all apparatus shall operate continuously. Four sets of power readings shall be recorded with an allowable variation of 5 %. The overall coefficient of heat transfer shall be calculated using the average internal and external temperatures, amount of electrical power consumed, and nominal internal surface area.

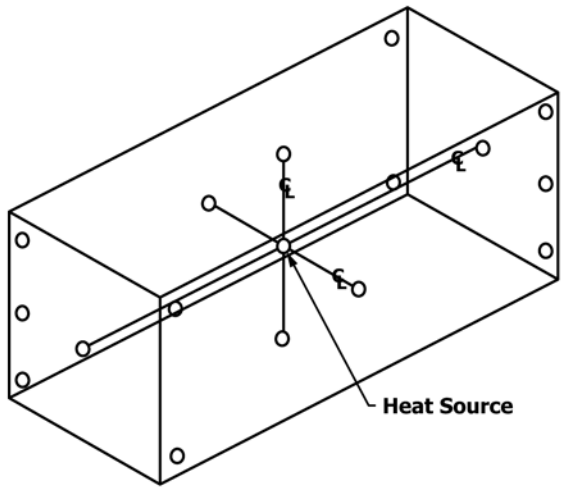

FIG. 2 Thermocouple Locations