



# Standard Specification for Shelter, Tactical, Expandable, Two-Side<sup>1</sup>

This standard is issued under the fixed designation E1978; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

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

## 1. Scope

1.1 This specification covers a rigid wall, two-side expandable shelter constructed of aluminum-faced, nonmetallic honeycomb sandwich panels and meeting the International Organization for Standardization (ISO) cargo container specification in the transport mode. Nominal dimensions when closed (container mode) are: height 8 ft, width 8 ft, and length 20 ft (2.4 by 2.4 by 6.1 m). Approximate dimensions when expanded (shelter mode) are: height 8 ft, width 22 ft, and length 20 ft (2.4 by 6.7 by 6.1 m).

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 *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:<sup>2</sup>

- E864 Practice for Surface Preparation of Aluminum Alloys to Be Adhesively Bonded in Honeycomb Shelter Panels
- E865 Specification for Structural Film Adhesives for Honeycomb Sandwich Panels
- E866 Specification for Corrosion-Inhibiting Adhesive Primer for Aluminum Alloys to Be Adhesively Bonded in Honeycomb Shelter Panels
- E874 Practice for Adhesive Bonding of Aluminum Facings to Nonmetallic Honeycomb Core for Shelter Panels
- E990 Specification for Core-Splice Adhesive for Honey-

### comb Sandwich Structural Panels

- E1091 Specification for Nonmetallic Honeycomb Core for Use in Shelter Panels
- E1749 Terminology Relating to Rigid Wall Relocatable Shelters
- E1773 Practice for Sealing Rigid Wall Tactical Shelters with Polysulfide Based Sealants
- E1826 Specification for Low Volatile Organic Compound (VOC) Corrosion-Inhibiting Adhesive Primer for Aluminum Alloys to Be Adhesively Bonded
- E1925 Specification for Engineering and Design Criteria for Rigid Wall Relocatable Structures

### 2.2 ISO Standards:<sup>3</sup>

- ISO 1161-1980 Series 1-Freight Containers-Corner Fittings, Specification
- ISO 1496/I Series 1-Freight Containers-Specification and Testing Part
- ISO 9001 Quality Systems—Model for Quality Assurance in Design, Development, Production, Installation, and Servicing

### 2.3 Military Standards:<sup>4</sup>

- MIL-STD-810 Environmental Engineering Considerations and Laboratory Tests

### 2.4 ANSI/ASQC Standards:<sup>5</sup>

- ANSI/ASQC Z1.4-1993 Sampling Procedures and Tables for Inspection by Attributes

### 2.5 Drawings:<sup>6</sup>

- 5-4-3118 Shelter, Assembly, Two-Side Expandable-60 amp
- 5-4-3201 Shelter, Assembly, Two-Side Expandable-100 amp

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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

<sup>5</sup> Available from American Society for Quality (ASQ), 600 N. Plankinton Ave., Milwaukee, WI 53203, <http://www.asq.org>.

<sup>6</sup> Copies of drawings are available from U.S. Army Natick Soldier Center, ATTN: AMSRD-NSC-CP-CS, Kansas Street, Natick, MA 01760-5018, <http://www.natick.army.mil>.

## 2.6 SAE Standards:<sup>7</sup>

**SAE-AMS-STD-1595 Qualification of Aircraft, Missiles, and Aerospace Fusion Welders**

**SAE-AMS-STD-2219 Fusion Welding for Aerospace Application**

### 3. General Requirements

**3.1 Alternate Components**—When this specification or the referenced drawings specify use of a specific component “or equal,” the contractor may substitute a component equal to the specified component provided that the contractor complies with the following requirements. Prior to manufacture of the first article or, if none is required, prior to commencing production, the contractor shall submit for the purchaser’s approval, a list identifying each proposed “or equal” component together with proof that each listed component is functionally equal to the specified component and is compatible with the end item covered by this specification. The purchaser, at his/her option, may require a physical sample of any “or equal” component. Approval of the submitted listing and supporting data authorizes the commencement of fabrication of the first article or of production, as applicable, but does not relieve the contractor of the responsibility that the “or equal” components perform in accordance with specified requirements when incorporated into the end item.

**3.2 Materials and Components**—Materials and components shall conform to the documents listed in Section 2 and as specified herein. Any change to the proposed materials or processes must be approved by the purchaser. It is encouraged that recycled material be used when practical as long as it meets the requirements of this specification.

**3.3 Workmanship**—The shelter, including all parts and accessories, shall be constructed and finished in a workmanlike manner with particular attention given to removal of burrs and sharp edges, accuracy of dimensions, thoroughness of soldering, welding, painting, alignment of parts and assemblies, and the tightness of screws, bolts, and so forth. Gaskets shall not be torn or split and shall be free of finish. Cloth components shall be clean and free of holes, cuts, or tears. All latches utilized for erection and closing of the shelter shall be properly adjusted before the shelter is prepared for delivery to the purchaser.

**3.4 Riveting**—Riveting joints shall be tight. The joined parts shall be undamaged, and the rivet heads shall be properly seated and tight against the bearing surfaces. All the rivets, except those used in panel bonding, shall be dipped in polysulfide sealant just prior to insertion; however, a dab of polysulfide sealant shall be applied to the head of each rivet.

**3.5 Cleaning**—After fabrication, parts shall be cleaned in accordance with the drawings.

**3.6 Welding**—Welded joints shall be such that grinding of the finished weld shall not be a requirement, except when specified on the drawing. Spot, stitch, and seam welds shall be

as indicated on the drawings. All surfaces to be welded shall be cleaned and free from scale, paint, grease, and other foreign materials. Welds shall have thorough penetration, good fusion, and shall be free from scabs, blisters, abnormal pock marks, cracks, voids, slag inclusions, and other harmful defects. Welded assemblies shall be cleaned to remove any scale, oxidation products, and excess flux. Any acid used in cleaning shall be completely neutralized and removed. Welders shall be certified in accordance with SAE-AMS-STD-1595. Welding equipment and procedures shall conform to SAE-AMS-STD-2219.

**3.7 Finish**—Coatings shall level out to an adherent, continuous, and uniform film without runs, wrinkles, streaks, or areas of no film. Any coating damaged during assembly or examination shall be touched up. There shall be no areas of rust. Finish shall be free from blistering, peeling, and chipping.

**3.7.1 Adhesion of Paint**—The shelter shall be capable of withstanding, without degradation to the finish, the tests as specified in 11.37.

NOTE 1—After top coat application, the shelter in the deployed mode shall be stored for a minimum of 168 h at a minimum of 70°F (21°C) prior to performing this test.

**3.7.2 Color**—The color of the paint film shall be compared with an appropriate color chip for the paint specified.

**3.7.3 Thickness**—Thickness of the paint film shall be checked as specified in 11.39.

**3.8 Finish and Color**—Surfaces shall be of the color, treatment, and finish as shown on the drawings. Top coat painting shall be performed on the fully assembled shelter so as to prevent mismatch of color shading, unless other control techniques are approved by the purchaser. After top-coat application, the shelter in the deployed mode (that is, expanded) shall be stored in a 70°F (21°C) minimum temperature indoor facility for a minimum of 36 h to ensure adequate coating(s) cure. During this storage period, the shelter doors and vents shall be opened to permit air circulation within the shelter.

**3.9 Manuals**—Unless otherwise specified (see 13.2), technical manuals shall be provided with each shelter. Stowage provision for the manuals shall be located as shown on the applicable drawings.

**3.10 Terminology** related to this specification is defined in Terminology E1749.

### 4. Design and Construction Requirements

**4.1 Design and Construction**—Design and construction of the expandable shelter shall conform to the requirements specified on the drawings, all subsidiary drawings and parts lists, and hereinafter. The shelter shall be free of panel delaminations and shall meet all physical and environmental requirements specified herein.

**4.2 Container Mode**—The shelter in the closed or transport mode shall be referred to as a container, hereinafter, for the purpose of definition. The shelter, in the container mode, shall be an article of transport equipment meeting ISO freight container requirements related to cargo containers. The shelter

<sup>7</sup> Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

**TABLE 1 Container Dimensions**

Type	Height				Width				Length			
	ft	in.	tol.	in.	ft	in.	tol.	in.	ft	in.	tol.	in.
IC	8	0	+0	-0.1875	8	0	+0	-0.1875	19	10.5	+0	-0.25
	(2.438 m)		+0	(-5 mm)	(2.438 m)		+0	(-5 mm)	(6.058 m)		+0	(-6 mm)

shall not show structural damage when tested as specified in 11.20, 11.22, 11.23, and 11.28-11.35, and shall not show leakage when tested as specified in 11.24 and 11.24.1-11.24.3. The contractor shall ensure that the shelter receives Coast Guard Certification for ISO containers. The container’s overall dimensions shall be in accordance with ISO freight container designated IC and are as shown in Table 1.

4.3 *Panels*—The panels used as structural members in the container configuration shall structurally meet all transportation and environmental requirements specified herein. Each panel shall be fabricated as a net panel with aluminum extrusions bonded about the panel perimeter during panel bonding. The inner and outer skins on all joints shall be sealed to provide a water barrier against the entrance of moisture to the core material and to the interior of the shelter. The water barrier is to be maintained intact at all panel cross-sectional openings. All joints and edges shall be assembled and sealed in a manner to prevent collection and retention of moisture. Particular emphasis shall be placed on the sealing of all mitered corners. All of the above sealing procedures shall be accomplished in accordance with Practice E1773. Rivet shafts shall be coated with sealing compound before insertion. The sealer shall be as indicated on the drawings. The contractor shall have the appropriate equipment and facilities, use the correct procedures in accordance with Practices E874 and E864, and use qualified panel components (that is, structural film and core splice adhesives, corrosion-inhibiting adhesive primer, structural nonmetallic honeycomb core, and as specified 5052-H34 or 6061-T6 aluminum skins, FRP barrier strips, 6061-T6 panel extrusions). Prior to use, all critical panel component materials must be qualified to Specifications E865, E866, E990, E1091, and E1826. There shall be no skin splices in the panels except where noted on the drawings. Unless otherwise specified (see 13.2), prior to award of contract, the contractors shall submit to the purchaser a certified copy of a laboratory test report and a copy of their process specification covering fabrication of the metallic-faced, nonmetallic honeycomb core sandwich panels they propose to use in the construction of the end item. Using their process specification, the contractors shall fabricate qualification test sandwich panels and structural film adhesive floating roller peel test specimens, and shall perform tests in accordance with Specification E865 and Practice E874 (see 13.2).

4.3.1 *Panel Processing*—The shelter panels shall be processed and inspected as specified in Practices E864 and E874 and Specifications E865, E866, or E1826 depending upon which primer is being used, Specifications E990, E1091, and Practice E1773. The shelter panels shall be inspected for dimensions and flatness in accordance with the Dimensional and Flatness Inspection of Panel paragraph of Practice E874 (see 10.2).

4.3.2 *Panel Watertightness*—Panel assemblies shall not permit the entry of water (see 10.3.1) when tested as specified in 11.18

4.3.3 *Resistance to Thermal Shock*—Panels shall be resistant to thermal shock, when tested as specified in 11.6.

4.3.4 *Panel Interchangeability*—All panels and panel assemblies bearing same part numbers shall be functionally and dimensionally interchangeable without modification or reworking. Individual assemblies shall not be hand picked for fit or performance, when tested as specified in 11.7.

4.3.5 *Delaminations*—Delaminations in shelter panels shall be tested as specified in 10.3.4.

4.3.6 *Panel Frame Airtightness*—Welded panel frames shall be airtight when tested as specified in 11.41.

4.4 *Inserts*—When tested as specified in 11.8, the following sized inserts, where used, shall withstand the torque and pullout loads as specified in Table 2, without failure of the inserts, panel, or potting compound.

4.5 *Payload*—The unit is designed to carry a maximum payload of 8050 lb (3650 kg) during transport.

4.6 *Corner Fittings*—The container shall be equipped with corner fittings at the top and bottom corners in accordance with the dimensional requirements for corner fittings for Series-1 freight containers as stipulated in ISO 1161-1980 requirements for commercial containers. The upper faces of the top corner fittings shall protrude above the top of the rest of the container by a minimum of ¼ in. (6 mm). The lower faces of bottom corner fittings shall protrude below the bottom of the container by a minimum of 7/16 in. (11 mm).

4.7 *Shelter Mode*—The shelter in the erected mode shall be referred to as a shelter herein for the purpose of definition. Hinged shelter panels shall be attached in a manner to ensure compliance with the environmental test requirements as specified in 11.6, 11.13-11.17, 11.24, and 11.26.

4.8 *Exterior Lighting*—One area lighting fixture, as shown on the drawings, shall be provided with each shelter.

4.9 *Shelter Electrical System:*

4.9.1 *General*—The system shall have all equipment, cabling, and other hardware necessary to receive three-phase 120/208 V, 60 Hz power from the base electrical distribution systems, and distribute it to lighting fixtures and receptacles as

**TABLE 2 Insert Strength (Proof Loads)**

Insert (diameter thread size)	Pull-Out, lb (kN)	Torque, ft-lb (N-m)
10-32	1000 (4.5)	10 (13.6)
¼-28	1000 (4.5)	20 (27.2)
5/16-24	2000 (9.0)	20 (27.2)
3/8-24	2000 (9.0)	40 (54.2)

indicated on the drawings. The 60 A shelters shall be in accordance with Drawing 5-4-3118 and all subsidiary drawings and parts lists. The 100 A shelters shall be in accordance with Drawing 5-4-3201 and all subsidiary drawings and parts lists. All parts of the electrical system shall operate when tested for electrical continuity as specified in 11.40.

4.9.2 *Operating Temperature*—The wiring system and all individual hardware items shall be capable of operating at their required capacity within an ambient temperature range from –60 to 125°F (–51 to 52°C), except that the fluorescent lights shall operate from 0 to 125°F (–18 to 52°C), when tested as specified in 11.14 and 11.15.

4.9.3 *Current Rating*—All conductors and appropriate hardware shall be rated for current carrying capacity in accordance with the applicable industry standards as specified on the drawings. Derating of components may be necessary for an operating ambient temperature of 125°F (52°C).

4.9.4 *Finish*—Panel boards and all other exposed metallic items shall have finishes as indicated on the drawings (see 3.7).

4.9.5 *Panel Board*—The panel board used will be as indicated on the drawings. It will be of dead front construction and have a solid neutral bus, a ground bus, and a 60 or 100 A three-phase main breaker as specified (see 13.2). The panel will have a NEMA-1 enclosure with conduit hubs as necessary and at least 18 breaker spaces excluding the main breaker. The panel board bus feed will be by rigid conduit and conductors; the conductors having a current carrying capacity of at least 100 A at 125°F (52°C) ambient temperature. The bus feed cables will terminate in a connector mounted on the exterior of the shelter. Conductors running from panel board circuits to fixtures or receptacles shall be enclosed in rigid conduit or shall be specified flexible cable for the expandable portion of the shelter. The current carrying capacity of the conductors shall be 20 A minimum, based upon an ambient temperature of 125°F (52°C) and NEC rating procedures. All circuit breakers used in the system shall be bolt-on type and have a minimum interrupting capacity of 10 000 A root mean square symmetrical.

4.9.6 *Cabling*—Flexible cables shall be used to feed all relocatable lighting fixtures and receptacles. These cables shall be as indicated on the drawings.

4.9.7 *Switches*—Switches used shall be as indicated on the drawings.

4.9.8 *Grounding*—All noncurrent carrying metal components shall be solidly grounded using the green ground wire within the wiring system, as indicated on the drawings.

4.9.9 *Receptacles:*

4.9.9.1 *Electrical Power Service Entrance*—The electrical power service entrance shall be as shown on the drawings.

4.9.9.2 *Convenience Outlets*—The shelter shall contain duplex convenience outlets as indicated on the drawings. All outlets shall be electrically grounded.

4.9.9.3 *Air Conditioning*—Power for heating and cooling equipment shall be provided from the distribution panel in the shelter to an electrical connector mounted in the service entrance recessed pan on the outside of the shelter as indicated on the drawings.

4.9.9.4 *External Outlets*—Power distribution shall be provided from the distribution panel box in the shelter to outlets

mounted in the service entrance recessed pan on the outside of the shelter as indicated in the drawings.

4.9.10 *Communications*—The shelter shall have four (two pairs) circuits through the wall telephone and intercom utility connections terminating in four protected terminals inside and outside the shelter, as indicated on the drawings.

4.9.11 *Tools*—Tools provided with the shelter shall be readily accessible to personnel when the shelter is in both the container and shelter configuration.

4.10 *Nameplates and Product Marking*—All markings shall conform to the drawings. Each shelter shall be serially numbered and provided with a nameplate in accordance with applicable drawings (see 13.2).

4.10.1 *Interior Markings*—Interior markings shall be as shown and in the locations shown on the applicable drawings.

4.10.2 *Exterior Markings*—The shelter shall be provided with specific exterior markings as shown on the applicable drawings.

## 5. Performance Requirements

5.1 *Floor Loads*—The shelter floor shall be capable of supporting a uniform load of 65 lb/ft<sup>2</sup> (320 kg/m<sup>2</sup>). The shelter floor shall be capable of supporting a concentrated load of 2000 lb (910 kg) over a 4 ft<sup>2</sup> (0.4 m<sup>2</sup>) area at the center of the floor. The floor shall also be capable of supporting a point load of 125 lb/in<sup>2</sup> (9 kg/cm<sup>2</sup>). Loads shall not cause any permanent deformation of the floors or cause any deflection that interferes with proper shelter operation, when tested as specified in 11.9.

5.2 *Roof Loads*—The roof assembly of the shelter shall withstand a snow load of 40 lb/ft<sup>2</sup> (200 kg/m<sup>2</sup>) and a personnel load of 660 lb (300 kg) static over 2 ft<sup>2</sup> (0.2 m<sup>2</sup>) when tested as specified in 11.10.

5.3 *Door Loads*—Container doors shall be tested to withstand the following loads without deformation or impairment of function:

5.3.1 *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 when tested as specified in 11.11.

5.3.2 *Wind Gust Door (Stop) Load*—The doors, 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 by its door stop device when tested as specified in 11.11.

5.4 *Step Assembly*—The completely mounted step assembly shall withstand a vertical load of 500 lb (225 kg) applied to the outer section without deformation of the assembly or supporting structure when tested as specified in 11.12.

5.5 *Airtightness*—The shelter shall not permit air leakage beyond specified limits in either container or shelter configuration when tested as specified in 11.13.

5.6 *Temperature Range:*

5.6.1 *Non-operating Temperature*—The container mode configuration shall withstand exposure to a temperature range of –60 to 160°F (–51 to 71°C).

5.6.2 *Operational Temperature*—The shelter shall be dependable and operable in an ambient temperature range of –60°F (except electrical (see 4.9.2)) to 125°F (–51 to 52°C) plus a solar load such that the outer skin reaches a temperature of 200°F (93°C), when tested as specified in 11.14, 11.15, and 11.26.

5.7 *Humidity and Temperature Aging (Components)*—The shelter components shall be capable of withstanding the conditions of a minimum 95 % relative humidity at 200°F (93°C). There shall be no evidence of delamination, cracking, corrosion, or deterioration when tested as specified in 11.16.

5.8 *Blackout*—There shall be no internal light visible from outside of the unit in the shelter mode when tested as specified in 11.17.

5.9 *Insert Strength*—When tested as specified in 11.19, the inserts indicated in Table 2 shall withstand loads equal to 80 % of the applicable strengths shown in Table 2 without failure and as indicated in Table 3.

**TABLE 3 Insert Strength (Working Loads)**

Insert (diameter thread size)	Pull-Out, lb (kg)	Torque, ft-lb (J)
10-32	800 (360)	8 (11)
¼-28	800 (360)	16 (22)
⅝-24	1600 (725)	16 (22)
¾-24	1600 (725)	32 (43)

5.10 *Rail Transportability*—The shelter when tested as specified (see 11.20) shall be capable of withstanding, without damage, the shocks normally induced by rail transport.

5.11 *Impact Resistance*—The shelter panel shall be impact resistant when tested as specified in 11.21.

5.12 *Drop Test*—The shelter when tested as specified in 11.22 shall show no evidence of damage as a result of the drop test.

5.13 *Towing*—The shelter shall show no evidence of damage when tested as specified in 11.23.

5.14 *Water Leakage*—The shelter shall show no evidence of leakage when tested as specified in 11.24

5.15 *Fluorescent Light Temperature*—Shelter fluorescent light assemblies shall show no failure when tested as specified in 11.25.

5.16 *Solar Load*—The shelter shall withstand a solar load test when tested as specified in 11.26.

5.17 *Operational Fitness*—The shelter shall prove functional when tested as specified in 11.27.

5.18 *Heat Transfer*—The overall coefficient of heat transfer of the shelter shall not exceed 0.35 Btu/h/ft<sup>2</sup>/F (2.0 W/(m<sup>2</sup> \* °K) (see 11.36).

## 6. Other Requirements

6.1 Requirements and testing for lifting, six high stacking, longitudinal restraint, racking, lashing, endwall strength, sidewall strength, and lifting from forklift pockets shall conform to ISO 1496-1 when tested as specified in 11.28-11.35.

6.2 *First Article*—When specified, a sample shall be subjected to first article inspection (see 8.1, 13.2, and 13.3).

6.3 *Inspection Comparison Testing Sample*—When specified (see 13.2), the contractor shall furnish a sample for comparison inspection and approval (see 8.1 and 13.4).

6.4 *Manuals*—Unless otherwise specified (see 13.2), technical manuals shall be provided with each shelter. Stowage provisions for the manuals shall be located as shown on the applicable drawings.

## 7. Quality Assurance

7.1 *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his/her own or any other facilities suitable for the performance of the inspection requirements specified herein unless disapproved by the purchaser. The purchaser reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

7.1.1 *Responsibility for Compliance*—All items must meet all requirements of Sections 3-5. The inspections set forth in this specification shall become a part of the contractor’s overall inspection system or quality program. The absence of any inspection requirement in this specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the purchaser for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the purchaser to acceptance of defective material.

7.1.2 *Responsibility for Dimensional Requirements*—Unless otherwise specified in the contract or purchase order, the contractor is responsible for assuring that all specified dimensions have been met. When dimensions cannot be examined on the end item, the inspection shall be made at any point or at all points in the manufacturing process necessary to assure compliance with all dimensional requirements.

7.2 *Classification of Inspection*—The inspection requirements specified herein are classified as follows:

7.2.1 *First Article Inspection*—See 8.1.

7.2.2 *Comparison Sample Inspection*—See 9.1.

7.2.3 *Quality Conformance Inspection*—See 10.1.

## 8. First Article Inspection

8.1 *First Article Inspection*—When a first article is required (see 13.3), it shall be examined for visual defects in Table 4, dimensions specified, and tested as specified and in the sequence specified in Table 5. All testing shall be performed on the same shelter. The presence of any visual defect, any dimension not within specified requirements, or failure of any test shall be cause for rejection of the first article.

8.1.1 *First Article Panel Specimen Inspection*—Prior to fabrication of any panels, a panel specimen shall be fabricated for torque and pullout testing to demonstrate strengths of potted inserts. The panel specimen shall be fabricated using the

**TABLE 4 End Item Visual Defects**

Examine	Defect	Classification	
		Major	Minor
Finish	not as specified, not finished where required	101	
	not adherent, for example, blistered, peeled		201
	runs, wrinkles, streaks, or areas of no film		202
	finish not dry, that is, wet or tacky to touch		203
	scratch, gouge, abrasion exposing prime coat or bare metal, in accordance with the drawings		204
	any area of rust		205
Design	any characteristic not in accordance with specified requirement	102	
Construction and Workmanship	component or part fractured, split, punctured, dented, or malformed	103	
	component missing, inoperative, or will not operate as intended	104	
	component not properly assembled or secured	105	
	any functioning component which requires abnormal force to operate		206
	burr, rough or sharp edges, or sliver which may be injurious to personnel or cargo	106	
	gaskets torn or split	107	
	gasket or seals painted		207
	visible gaps between aluminum faces and extruded edges or panel cutout edge members	108	
Welding and brazing (where required)	not type specified, missing where required	109	
	incomplete, burn through area, pits, crack or fracture, or otherwise not fused	110	
	slag inclusion, undercut, not smooth and uniform, scale or flux deposit not removed		208
Metal fasteners, bolts, nuts, screws, studs	missing, not type specified, broken, stripped, or loose	111	
	lockwasher missing where required		209
Rivets	missing	112	
	not type specified	113	
	not sufficiently peened, not drawn tight, excessively peened		210
	cloth cut or tear longer than 1/8 in.	114	
	hole larger than 1/8 in. diameter	115	
Marking	missing, incomplete, not legible, not specified type or size, misplaced		
Instruction plate, nameplate	missing, incomplete, not legible	116	
Instruction manual	missing, incomplete, not legible	117	

**TABLE 5 First Article Test Sequence**

Inspection	Requirement	Test
Panel frame airtightness	4.3.6	11.41
Panel watertightness	4.3.2	11.18
Panel delamination	4.3.5	11.38
Visual defects	8.1	10.4
Thickness	3.7.3	11.39
Adhesion of paint	3.7.1	11.37
Operational (first time)	5.17	11.27
Thermal shock	4.3.3	11.6
Panel interchange	4.3.4	11.7
Insert proof load	4.4	11.8
Electrical system	4.9	11.40
Floor load, static	5.1	11.9
Roof load	5.2	11.10
Door load	5.3	11.11
Step	5.4	11.12
Airtightness	5.5	11.13
Low temperature	5.6	11.14
High temperature	5.6	11.15
Humidity and temperature aging	5.7	11.16
Heat transfer	5.18	11.36
Insert working load	5.9	11.19
Rail transportability	5.10	11.20
Impact resistance	5.1	11.21
Drop	5.12	11.22
Towing test	5.13	11.23
Fluorescent light temperature	5.15	11.25
Lifting	6.1	11.28
Six-high stacking	6.1	11.29
Longitudinal restraint	6.1	11.30
Racking	6.1	11.31
Lashing	6.1	11.32
Endwall strength	6.1	11.33
Sidewall strength	6.1	11.34
Lifting from forklift pockets	6.1	11.35
Blackout	5.8	11.17
Water leakage	5.14	11.24
Solar load	5.16	11.26
Operational test (second time)	5.17	11.27

same techniques and materials used to fabricate production panels, except aluminum facing thickness shall be nominal 0.040 in. (1.0 mm) and overall thickness shall be nominal 2 in. (25 mm) thick. The edges of the specimen are not required to be sealed. The specimen shall be sized to accept 16 inserts (four each size specified in [Table 2](#)) located a minimum of 6 in. (150 mm) from panel edges and 6 in. (150 mm) on center from each other. The inserts shall be installed in accordance with the process to be used for production panels. Eight (two of each size) inserts shall be installed within the panel in a vertical plane and eight (two of each size) inserts shall be installed within the panel in a horizontal plane and so identified, that is, H or V. Failure of one or more inserts to pass the tests specified in [11.8.1](#) and [11.8.2](#) shall be cause for rejection of the installation process. This test shall be repeated until an insert installation process has been developed to pass the strength test.

## 9. Comparison Sample Inspection

*9.1 Comparison Sample Inspection*—When a comparison sample is required (see [13.4](#)), it shall be inspected and tested as specified in [8.1](#).

*9.2 Comparison Sample Panel Specimen Inspection*—Comparison sample panel specimen inspection shall be performed in accordance with [8.1.1](#).

## 10. Quality Conformance Inspection

*10.1 Quality Conformance Inspection*—Unless otherwise specified, sampling for inspection shall be performed in accordance with ANSI/ASQC Z1.4-1993. The contractor's quality control system shall conform to ISO 9001.

10.1.1 *Component and Material Inspection*—In accordance with 7.1, components and materials shall be inspected in accordance with all the requirements of the referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

10.2 *In-Process Examination*—Examination shall be made of the following fabrication operations to establish conformance with the specified requirements:

10.2.1 That panel materials are as specified,

10.2.2 That rivet heads are sealed and tight for conformance with 3.4,

10.2.3 That parts are cleaned and free of adhesive sealer and other foreign materials for conformance with applicable drawings.

10.2.4 Prior to assembling other components over any welded area or prior to priming for painting, that welding processes and welded assemblies conform to referenced documents when specified on the drawings and to the requirements of 3.6.

10.2.5 That electrical assemblies and wiring are fabricated in accordance with applicable drawings and industry standards.

10.2.6 That the primer thickness, topcoat thickness, and topcoat color are as specified in the applicable drawings (see 3.7.2 and 3.7.3), and

10.2.7 That the panels are processed, fabricated and inspected in accordance with the requirements of Practices E864 and E874 and Specifications E865, E866, E990, E1091, and E1773 (see 4.3.1).

10.2.8 Whenever nonconformance is noted, correction shall be made to the items affected and the process.

10.3 *In-Process Testing*:

10.3.1 *Panel Watertightness Testing*—Prior to assembly (that is, fabrication of cutouts, installation of inserts and hardware, and so forth) one panel from every lot of both welded frame panels and unwelded frame panels shall be tested for watertightness as specified in 11.18. The lot size shall not exceed 100 panels. The panels to be tested shall be 8 by 20 ft (2.4 by 6.1 m). Failure of the test shall be cause for rejection of the panel lot represented.

10.3.2 *Panel Insert Testing*—Each type of shelter panel (roof, end wall, and so forth) shall be tested for insert working load by first-piece inspection and by sample inspection of each lot of each type roof panel. The inspection lot shall consist of all of one type of panels processed at one time. At the start of each panel and insert assembly operation, the first panel (first-piece) shall have all inserts tested for working load in accordance with 11.19 and failure of any insert shall be cause for rejection of the panel and the process. Each start-up of insert fabrication, change in type or formation of adhesive or potting compound, or any change in the method of insert bonding shall be cause for necessary changes to the process and for repeat of the first-piece inspection. Inspection lots shall be evaluated using inspection Level II and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 10.0. Each sample panel shall have all inserts tested for insert working load in accordance with 11.19.

10.3.3 *Panel Delamination Testing*—All panels coming out of the press shall be tested as specified in 11.18. Failure to pass

this test shall be cause for rejection of that panel. The purchaser shall be notified within 72 h of any failures. In addition, a failure analysis report shall be prepared with corrective action defined for inserts tested.

10.3.4 *Panel Frame Airtightness Test*—After welding, all welded panel frames shall be tested as specified in 11.41 and reworked, if required, as specified in 11.41.1.

10.4 *End Item Visual Examination*—The end item shall be examined for the defects listed in Table 4. The lot size shall be expressed in units of one shelter. The sample unit shall be one shelter. The inspection level shall be II and the AQL, expressed in terms of defects per hundred units, shall be 4.0 for major defects and 6.5 for total (major and minor combined) defects.

10.5 *End Item Dimensional Examination*—The end item shall be examined for conformance to dimensions specified. Any dimension not within the specified tolerance shall be classified as a defect. The lot size shall be expressed in units of one shelter. The sample unit shall be one shelter. The inspection level shall be II and the AQL, expressed in terms of defects per hundred units, shall be 4.0.

## 11. Required Tests

11.1 *Electrical Continuity Testing*—Every end item shall be tested as specified in 11.40. Any test failure shall be cause for rejection of the end item.

11.2 *Water Leakage and Operational Testing*—The first ten production units shall be tested as specified in 11.24, 11.24.1, and 11.24.3. If no failures are experienced five of the next ten production units shall be tested. If no failures are experienced on the 50 % sample, one of each 25 production units shall be tested thereafter. Any failure on sampled units shall be cause for rejection of the lot and return to 1008 testing, and repeat the above procedure (starting with the units of that lot).

11.2.1 *Water Leakage (Fully Loaded)*—One out of every fifty production units shall be tested as specified in 11.24.2 and 11.24.3. The purchaser shall be notified of any test failure within 72 h. A failure analysis report shall be prepared with corrective action defined, and one out of the next ten production units shall be tested followed by one out of the next fifty if no failures occur.

11.3 *Performance Testing*—One end item from each inspection lot shall be tested as specified in 11.13 (shelter mode only) and 11.26. After successful completion of these tests, the end item sample shall be tested as specified in 11.17. The size of the inspection lot shall not exceed 25 shelters. Any test failure shall be cause for rejection of the lot.

11.4 *Paint Adhesion Testing*—One of every forty production units shall be tested as specified in 11.37. This unit in the deployed mode shall be tested only after storage in a 70°F (21°C) minimum temperature indoor environment for 168 h minimum after topcoat painting. The purchaser shall be notified of any test failure within 72 h. A failure analysis report shall be prepared with corrective action defined, and one out of the next ten production units shall be tested, followed by one out of the next forty if no failures occur.

11.5 *Packaging Examination*—An examination shall be made to determine that preservation and packing comply with

the requirements in Section 5. Defects shall be scored in accordance with Table 6. The sample unit shall be one shelter fully packaged except the mechanical seals on the doors may be omitted to facilitate inspection. When omitted for internal inspection, after acceptance of the lot for preservation, mechanical door seals shall be applied to the shelters and then the lot of shelters subsequently inspected for sealing. The lot shall be the number of shelters offered for inspection at one time. The inspection level shall be II and the AQL, expressed in terms of defects per hundred units, shall be 2.5.

11.6 *Thermal Shock Test*—Within 30 min after exposure cycling of 11.16 has been completed, the panel specimens shall then be subject to a  $-65^{\circ}\text{F}$  ( $-54^{\circ}\text{C}$ ) environment for 4 h to evaluate the effects of thermal shock. After thermal shock, the panel specimens shall be inspected for delamination (see 11.38), corrosion, and material degradation. Any delamination, corrosion, or material degradation shall constitute a failure of the test.

11.7 *Panel Interchange Test*—The folding walls with the same part number and two fixed walls with the same part number randomly selected from the first article or production lot of completed shelters, as applicable, shall be interchanged. The interchange shall be accomplished by removing the hinge pins or bolts, as applicable, interchanging walls, and reinstalling the hinge pins or bolts (see 4.3.4). Any wall that cannot be fully interchanged shall constitute a failure of the test.

**TABLE 6 Packing Defects**

Examine	Defect
Workmanship, exterior	doors are not closed, latched, and mechanically sealed. exterior electrical connections are not covered and covers are not secure (hand pressure). expandable wall corner post-cam latch handles are not in locked position with pin in retaining hole puncture in exterior skin. damage (such as bend, gouge, or dent) to frame ends or to forklift opening. steps are not folded closed. any other protruding or not stowed part. equipment container is not secured in place.
Workmanship, interior	parts in the equipment container are not in accordance with the list of the parts. the four lift jacks are not secured on the doors. the two leveling jacks are not secured on the cargo door. the support struts are not secured with lock pin in place. the removable light fixtures are not secured to the fixed ceiling by four captive studs with stowage bracket plunger locked. the movable utility outlets are not secured to the hinged endwalls by their captive screws. the area light and cable are not secured to the interior of the personnel end panel with the retaining wing nuts secured (hand pressure). the area light does contain a bulb (bulb should be packaged and packed in the equipment container). any circuit breaker not in the OFF position. the circuit breaker box keys are not inside the box. air vents are not secured closed. environmental control units (ECU) panels are not stowed securely on the fixed ceiling. any other loose or not stowed part.

11.8 *Insert Proof Load Test*—Test fixtures shall be fashioned by the contractor and approved by the purchaser prior to use, to evaluate the inserts using bolts of the applicable thread size. Loads shall be applied to the insert in a tightening and loosening direction and held at the specified torque for a minimum of 5 s. The test fixtures shall be fashioned to induce only a twisting load to the insert for the torque test and, primarily, only on axial tensile load through the centerline of the insert for the pull-out test. The reaction load from the in outside of a 3 in. (75 sert pull-out fixture onto the test specimen panel shall be applied to the panelmm) radius measured from the centerline of the insert.

11.8.1 *Insert Torque*—To determine compliance with the torque requirements of 4.4, two identical inserts of each size (1-H, 1-V), potted in the test specimen pared cited in 8.1.1 and 9.1. Torque load applied shall be equal to torque strength cited in Table 2 for applicable size. Inability of any insert to meet specification requirement shall constitute a failure of the test.

11.8.2 *Insert Pull-Out*—To determine compliance with the pull-out requirements of 4.4, a tensile pull load equal to the pull-out strength cited in Table 2 shall be applied to two identical inserts of each size (1-H, 1-V) potted into the test specimen cited in 8.1.1 and 9.1. Failure of the potting compound to hold the insert firmly in the panel shall constitute failure of the test.

11.9 *Floor Loads Test-Static Load*—The floor loads test-static load shall be as specified in Specification E1925.

11.10 *Roof Load Test*—The roof load test shall be as specified in Specification E1925.

11.11 *Door Load Test*—The door load test shall be as specified in Specification E1925.

11.12 *Step Test*—A 500 lb (225 kg) weight shall be suspended from the outer end of a step assembly for 5 min and the load removed. Any permanent deformation or local delamination (see 11.38) shall constitute failure of this test.

11.13 *Airtightness Test*—The shelter airtightness test shall be as specified in Specification E1925.

11.14 *Low Temperature Test*—The shelter in its container mode, with shelter components and maximum payload packaged within, shall be first cold soaked at  $-60^{\circ}\text{F}$  ( $-50^{\circ}\text{C}$ ) temperature for a minimum of 24 h in a mechanically refrigerated cold chamber. At the end of the 24 h period and while at  $-60^{\circ}\text{F}$  ( $-51^{\circ}\text{C}$ ), erect the shelter. Operate all hardware (for example, latches, doors, knockout panels, and so forth) and examine the shelter and its components for any damage. Do not move lights or electrical receptacles into position at this time. Return the shelter to closed/container mode and then raise the chamber temperature to  $-25^{\circ}\text{F}$  ( $-32^{\circ}\text{C}$ ). Allow the chamber to stabilize at  $-25^{\circ}\text{F}$  ( $-32^{\circ}\text{C}$ ) for 4 h. Next, erect the shelter and hook up the power source to the shelter. Position the ceiling fluorescent lights and electrical receptacles on the expanded shelter section. Operate circuit breakers, blackout emergency switch, and emergency incandescent lights. The fluorescent ceiling lights shall not be operated at  $-25^{\circ}\text{F}$  ( $-32^{\circ}\text{C}$ ) since they are rated for a minimum of  $0^{\circ}\text{F}$  ( $-18^{\circ}\text{C}$ ) operation. The shelter shall then be returned to normal operating conditions and all



doors, electrical components, and hardware cycled. After operation and inspection of all components, the shelter shall be closed for shipment and reexamined for component damage and material degradation. The finding of any material or panel degradation or the inability of any hardware to function properly during this test shall constitute failure of the low-temperature test.

**11.15 High Temperature Test**—The shelter, in its container mode, with shelter components and maximum payload packaged within, shall be subjected to a 160°F (71°C) storage test cycle and a 125°F (52°C) operational test cycle. The shelter shall be soaked in a chamber for at least 6 h at the storage test temperature and for 24 h at the operational test temperature prior to initiation of the operation phase of the operational test cycle. At 125°F (52°C), the shelter shall be erected and circuit breakers, blackout emergency switch, emergency incandescent light, and fluorescent lights operated. All doors, vent openings, panel closeouts, and operational hardware shall be functional. The shelter shall be returned to normal atmospheric conditions and all doors, electrical components, and hardware cycled. After operation and inspection of all components, the shelter shall be closed for shipment and then examined for component damage and material and panel degradation. The finding of any material or panel degradation or the inability of any hardware to function properly shall constitute failure of the high-temperature test.

**11.16 Humidity and Temperature Aging Test**—All hardware (latches, handles, hinges, jacks, tools, struts, light fixtures, and so forth) and a 4 by 8 ft (1.2 by 2.4 m) specimen of each thickness composite panel (without edge members) shall be subjected to fifteen continuous 48-h cycles of the moisture resistance test in accordance with Method 507 of MIL-STD-810. After cycling has been completed, any evidence of delamination, cracking, corrosion, or deterioration to any component, and any malfunction of any hardware or panel specimen shall constitute a failure of the test.

**11.17 Blackout Test**—The shelter shall be placed in a dark environment. A light source of two 100 W bulbs operation at rated voltage shall be suspended from the ceiling brackets at the shelter. With all covers in place and doors closed, observe the unit at a 25 ft (7.6 m) distance to ensure that no rays of lighting are visible to normal, unaided eyesight. Visibility of any light at the specified distance shall constitute failure of the test.

**11.18 Panel Watertightness Test**—The shelter panel shall be weighed and then floated horizontally, with the sealed side down, in a tank of water. Approximately  $\frac{3}{4}$  of the thickness of the floating panel shall be submerged in water, using hold-down devices if necessary. The panel shall be sealed on the surface that is located on the shelter exterior when the shelter is in its open configuration. Panel sealing for the test panel shall be equivalent to the sealing performed on all production panels, excess sealant on rivet heads, panel edges, or areas not normally sealed in production shall not be allowed. The panel shall be submerged for 6 h. At the end of this period, it shall be removed from the water, hand dried, and reweighed within 15 min. The panel shall not gain more than 0.1 % of its original

weight upon reweighing. If a failure occurs, the source of the leak shall be determined and fixed. The panel shall then be retested using the above procedure. Upon passing this test, all panels in the lot shall be checked for similar deficiencies and repaired in the same manner as the sample panel. The scale for determining panel weight shall be accurate to 0.1 lb (50 g).

**11.19 Insert Working Load Test**—A working torque load and pull-out load shall be applied to all inserts incorporated in the shelter panels. This test shall be performed using torque and pull-out loads as specified in **Table 3**. The same devices used to perform the test specified in **11.8** shall be used for this test. Failure of potting compound to hold any insert firmly in the panel shall constitute failure of this test.

**11.20 Rail Transportability Test**—The shelter at a gross weight of 15 000 lb (6875 kg) shall be tested for rail transport as specified in MIL-STD-810. The test payload shall be secured to prevent shelter damage due to the load shifting on impact.

**11.21 Impact Resistance Test**—Test as specified in **E1925**, except that the panel shall meet the following acceptance criteria: no rupture of the impacting or opposite skin, or both, is allowed; no delamination of the opposite skin to core is allowed. Outside a 3 in. (75 mm) radius (except  $3\frac{1}{2}$  in. (90 mm) radius for fixed floor panel) from the “center of impact” (which shall coincide with the approximate center of the test panel specimen); no delamination of impacting skin to core shall be allowed, and crushing or collapsing of the core shall not be allowed. Core shear failure shall not be allowed outside a 5 in. (125 mm) radius from the “center of impact” (that shall coincide with the approximate center of the test panel specimen).

**11.22 Drop Test**—The shelter, in the container mode, and with a uniformly distributed payload such that the gross weight equals 15 000 lb (6875 kg) shall withstand drops of 6 in. (150 mm) onto a level concrete-type surface. A quick release hook shall be utilized that ensures the shelter falls freely the full 6 in. (150 mm). Any evidence of splits or tears on the bottom, deformation, buckling, delamination (see **11.38**), or structural weakness to any part of the shelter, and doors and panels not operating properly during erection and striking shall constitute failure of the test.

**11.22.1 Flat Drop**—Lift the shelter 6 in. (150 mm) high using a four-cable sling and allow the shelter to fall freely so that the bottom impacts onto a hard concrete surface.

**11.22.2 Rotational Drop**—A 4 in. (100 mm) high (nominal) board shall be placed under the ISO fittings at one edge of the shelter. The opposite edge of the shelter shall be lifted  $6\frac{1}{4}$  in. (160 mm) from the ground. Measurements shall be taken from the outer edge of the ISO fittings at the two raised corners of the shelter. The range of the two measurements shall not exceed  $\frac{1}{4}$  in. (6 mm) The shelter shall be released and allowed to fall freely such that the ISO fittings impact onto a hard concrete surface. After all four rotational drops, the requirements of **5.12** shall be met.

**11.23 Towing Test**—The shelter, in its container mode, shall be loaded to a gross weight of 15 000 lb (6875 kg) and then towed from the leading edge lower ISO fittings for a minimum

of 200 ft (61 m) forward and 200 ft (61 m) backward over rough plowed ground at a speed of 3 to 5 mph (5 to 8 km/h). Two right angle turns shall be performed on soft dirt while the shelter is being towed. The initial position before each of the turns shall be such that the direction of travel of the towing vehicle is perpendicular to the longitudinal axis of the 20-ft (6.1 m) side and the towing eye of the vehicle is in line with the leading edge of the shelter. Any panel delamination or structural deformation, except superficial base frame dents and scratches, as a result of towing shall constitute a failure of the test.

**11.24 Water Leakage Test (Shelter Mode)**—The shelter in its expanded mode with jacks raised a minimum of 2 in. (50 mm) from ground level shall be exposed to a simulated rainfall of  $5 \pm 1$  in./h ( $125 \pm 25$  mm/h), as measured by a U.S. Weather Bureau-type gage. Direction of the rainfall shall be angled at 45 from the vertical and the nozzles so spaced to ensure even dispersion over the test area. The roof with each of the major sides of the shelter in succession shall be exposed to this angled rainfall for periods of 30 min. The rainfall shall be dispersed uniformly over the entire test area. This test shall be performed for 2 h with the shelter in the closed configuration and for 2 h with the shelter in the erected configuration. All openings and doors shall be closed and latched. Upon completion of the test, any evidence of penetration of water into the shelter shall constitute a failure of the test. Alternately, the whole shelter shall be exposed for 30 min to the above test instead of exposing each section separately.

**11.24.1 Water Leakage Test (Container Mode)**—The shelter shall be tested as specified in **11.24**, except that it shall be in the container mode.

**11.24.2 Water Leakage Test (Shelter Mode Fully Loaded)**—The shelter shall be tested as specified in **11.24.1**, except that the maximum payload for the shelter shall be distributed uniformly on the fixed floor.

**11.24.3 Water Leakage Test (Container Mode Fully Loaded)**—The shelter shall be tested as specified in **11.24**, except that the maximum payload for the shelter shall be uniformly distributed on the fixed floor.

**11.25 Fluorescent Light Temperature Test**—Three fluorescent light assemblies shall be randomly selected from all of the light assemblies of the sample shelters. These sample fluorescent light assemblies shall be tested for performance at 0 and 125°F (−18 and 52°C) temperature extremes. Note this light test may be performed as an extension of the high and low-temperature shelter tests of this specification. All of the sample lights shall be tested at one temperature extreme, normalized at ambient if acceptable, and then tested at the other extreme. The sample lights shall be soaked and performance tested in a chamber at no more than 0°F (−18°C) for the low-temperature phase and at no less than 125°F (52°C) for the high-temperature phase. Each soak period shall be no less than 24 h. While remaining in the chambers, at the completion of the soak period, the lights shall be turned on. If any light does not provide full, constant illumination within 1 min, it shall be shut off for at least 1 min and then turned on a second time. Inability of any light to provide full, constant illumination

within 1 min after no more than two attempts and remain at full, constant illumination for at least 10 min shall constitute failure of the test.

**11.26 Solar Load Test**—The solar load test shall be as specified in Specification **E1925**.

**11.27 Operational Test**—The shelter shall be placed on fairly level ground and a complete cycle of leveling, erecting, operating all components, and closing shall be conducted. Any difficulty in operation experienced during the test (such as tools that are required to operate latches, incomplete, mechanical interface, interconnecting parts that do not properly function, inability to erect the shelter using the tools stored within, and so forth), failure of any component to function as intended, breakage or deformation of any components, or any panel delamination shall constitute failure of this test.

**11.28 Lifting Test**—The shelter in its container mode, at a gross weight of 48 000 lb (22 000 kg) (3.2 g by 15 000 (6875 kg)), shall be subjected to lifting by first the top corner fittings followed by a second lift by the bottom corner fittings. The lifting shall be accomplished using appropriate slings such that minimal acceleration or deceleration forces are applied. The dummy load shall be evenly distributed over the entire floor area. The shelter shall be hoisted off the ground by means of a four-cable sling having cable lengths (about 15 ft (4.5 m)) such as to form a single apex over the G with the sling legs at 45 angles minimum to the roof plane when attached to the top corner fitting of the unit. The shelter shall also be hoisted off the ground by means of a four-cable sling with a spreader bar such as to form a 45 angle to the roof plane when attached to the lower corner fittings of the shelter. The container will be held suspended for 5 min for each lift. Any structural damage (cracks, deformation, delamination, and so forth, see **11.38**) incurred in the shelter as a result of this test shall constitute a failure of the test.

**11.29 Six-High Stacking Test**—The shelter, in its container mode, loaded to a total gross weight of 30 000 lb (13 600 kg), shall be placed on four level pads, one under each bottom corner fitting. The pads shall be centered under the fittings and be substantially of the same plan dimensions (that is, shelter fitting dimensions as taken in a plan view) as the fittings. A stacking load of 476 190 lb (2118.2 kN) shall be applied through four pads of the same plan area as the corner fittings, the load being equally divided among the four top corner fittings. Each pad shall be offset in the same direction, 1.5 in. (38 mm) in the longitudinal direction and 1.0 in. (25 mm) in the lateral direction. Four tests shall be conducted for offsets in each of the four longitudinal and lateral combinations. Alternatively, the corner structures on one end of the shelter may be tested simultaneously and then the corner structures on the opposite end. In all cases, the loads shall be applied for not less than 5 min and any structural damage incurred in the shelter and the container dimensional requirements (see **4.2**) not maintained as a result of this test shall constitute a failure of the test.

**11.30 Longitudinal Restraint Test**—The shelter, in its container mode, loaded to a gross weight of 15 000 lb (6875 kg) shall be restrained longitudinally by securing the bottom corner

fittings at one end to suitable anchor points through the bottom apertures. A force of 30 000 lb (133 447 N) shall be applied longitudinally to the shelter, equally divided through the bottom apertures of the bottom corner fittings at the opposite end of the shelters, first in compression and then in tension. Alternatively, a force of 15 000 lb (66 723 N) shall be applied to each side, consecutively, first in tension and then in compression. In either case, the loads shall be applied for not less than 5 min and any structural damage incurred in the shelter and the dimensional requirements (see 4.2) not maintained as a result of this test shall constitute a failure of the test.

11.31 *Racking Test*—The shelter, in its container mode, shall be supported at all four bottom corner fittings on rigid pads lying in the same horizontal plane. The two bottom corner fittings diagonally opposite to the applied load which lie in the same face, perpendicular to the applied load, shall be totally restrained. The remainder of the bottom corner fittings shall be allowed to move only in the horizontal direction. The loads shall be applied and removed gradually, and any structural damage incurred in the shelter and the dimensional requirements (see 4.2) not maintained as a result of this test shall constitute a failure of the test.

11.31.1 *Transverse Racking*—A compression and tension force of 33 600 lb (149 460 N) shall be applied to either of the two top corner fittings, on one side of the container, the line of action of the force being horizontal and parallel to the ends of the container. Both ends shall be tested consecutively.

11.31.2 *Longitudinal Racking*—A compression force of 16 800 lb (74 730 N) and a tension force of 16 800 lb (74 730 N) shall be applied to either of the two top corner fittings on one end of the container, the line of action of the force being horizontal and parallel to the sides of the container. Both sides shall be tested consecutively.

11.32 *Lashing Test*—The shelter, in its container mode, shall be secured by all four bottom corner fittings and subjected to an upper longitudinal tension load of 16 800 lb (74 730 N). The loading shall be applied to the two corner fittings that are in line with the side of the shelter under test and induced through that face of the corner fittings, that are perpendicular to the sidewall. Any structural damage incurred in the shelter and the dimensional requirements (see 4.2) not maintained as a result of this test shall constitute a failure of the test.

11.33 *End Wall Strength Test*—Each endwall of the shelter in its container mode shall be subjected to an internal, uniformly distributed load of 3880 lb (1760 kg) applied separately and arranged to allow free deflection of the wall. The loads shall be applied for not less than 5 min. Any structural damage incurred in the shelter as a result of this test and the container dimensional requirements of this specification not maintained following the test shall constitute a failure of the test.

11.34 *Sidewall Strength Test*—Each sidewall of the shelter in its container shall be subjected to an internal, uniformly distributed load of 5820 lb (2640 kg) applied separately and arranged to allow free deflection of the wall. The loads shall be applied for not less than 5 min. Any structural damage incurred in the shelter as a result of this test and the container

dimensional requirements of this specification not maintained following the test shall constitute a failure of the test.

11.35 *Lifting from Fork Lift Pockets Test*—The shelter in its container mode shall have a load, as specified below, uniformly distributed over the floor and then the shelter shall be supported on two horizontal bars, each 8 in. (200 mm) wide, projecting 72 $\frac{1}{8}$  in. (1.83 m) into the fork pockets, measured from the outside face of the side of the container. The bars shall be centered within the pockets. The container shall be supported for 5 min and then lowered to the ground. Any structural damage incurred in the shelter as a result of this test and the container dimensional requirements of this specification not maintained following the test shall constitute a failure of the test.

11.35.1 *Outer Forklift Pockets*—The gross weight of the container and payload shall equal 18 750 lb (85110 kg).

11.35.2 *Inner Forklift Pockets*—The gross weight of the container and payload shall equal 9375 lb (4260 kg).

11.36 *Heat Transfer Test*—The heat transfer test shall be as specified in Specification E1925.

11.37 *Adhesion of Paint Test*—A portion of the painted surface(s) of the shelter assembly in the deployed mode (that is, expanded) shall be tested. Areas to be tested shall be as follows:

- 11.37.1 Shelter wall exterior and interior surfaces,
- 11.37.2 Shelter floor interior surface,
- 11.37.3 Shelter base frame exterior surface,
- 11.37.4 Shelter corner post exterior surface,
- 11.37.5 Shelter fluorescent light fixture exterior surface,
- 11.37.6 Latch pan exterior surfaces,
- 11.37.7 Shelter ISO corner fitting exterior,
- 11.37.8 Shelter breaker box exterior surface,
- 11.37.9 Shelter internal panel latch surface, and
- 11.37.10 Shelter jack body exterior surface.

Only a small area from each of the above listed items shall be subjected to the following test:

11.37.11 Each painted surface shall be scraped with a sharp knife. The paint shall peel evenly from the surface rather than chip or flake. Lastly, the following test shall be performed. A piece of cloth shall be taped on the area under inspection and soaked for 2 h with tap or distilled water. Remove wet cloth and wipe dry with a soft dry cloth. Within 1 min of wet cloth removal, make two parallel scratches 1 in. (25.4 mm) apart through the coating to the metal with a stylus. Immediately thereafter, apply a 1 in. (25.4 mm) strip of flat-back paper tape having an average adhesion of 80 oz/in. (89.3 g/mm) to the painted surface, adhesive side down. Press the tape down, employing a 2.0 kg rubber covered roller, having a surface durometer of 70 to 80, 3.5 in. (88.9 mm) in diameter, and 1.7 in. (43.2 mm) wide. The tape shall be pressed against the surface by passing the roller across the tape eight times. Remove the tape in one quick motion and examine the tested area for any paint damage, such as removal of paint at one of the layers of the paint system or removal of the entire system from the metal. Acceptable units subjected to these tests may be delivered on contract after all visible damage to the painted

surface is repaired and the repair is approved by the government. Failure to pass any of these tests shall be counted as a major defect.

11.38 *Panel Delamination Test*—The panel shall be tap tested for delaminations in accordance with Practice E874. Any panel debonds or delaminations shall constitute failure of this test. The contracting officer shall be notified within 72 h of any failure. In addition a failure analysis report shall be prepared with corrective action defined.

11.39 *Thickness Test*—The dry paint film shall be measured for each panel of each shelter. The paint thickness shall be measured at several places on each painted surface. Thickness may be determined by any method acceptable to the government. Paint thicknesses shall be in accordance with the drawings.

11.40 *Electrical System Test*—To determine compliance with 4.9.1, the electrical system of the shelter shall be checked to verify continuity of all circuits of the electrical installation to ascertain electrical readiness of the shelter. All lights and electrically powered equipment shall be operated. Any evidence of incomplete circuits, non-operating switches, or damaged electrical components shall constitute failure of the test.

11.41 *Panel Frame Airtightness Test*—Each welded panel frame shall be air pressurized to 25 to 30 psig. Detergent/gas leak detector shall be applied to all welded joints. The presence of a bubble trail, indicating a weld defect, shall constitute failure of this test and shall require rework to the weld (see 11.41.1).

11.41.1 *Weld Rework*—Any welds that fail to pass the airtightness test specified in 11.41 shall be reworked as follows:

11.41.1.1 Prior to depressurizing, rinse and dry the panel frame.

11.41.1.2 Circle areas of weld failure and depressurize.

11.41.1.3 Reweld circled areas in accordance with 3.6.

11.41.1.4 Retest as specified in 11.41.

## 12. Packaging

12.1 *Preservation*—Preservation shall be Level A.

12.1.1 *Level A Preservation*—All hardware necessary for erection and operation of the shelter shall be secured within the shelter as specified on the drawings. The equipment container shall be securely fastened with tie-down straps to the fixed floor, and it shall contain all parts as specified on its parts list. The parts in the equipment container and in the shelter shall be secured and padded, as required, to ensure that no damage shall occur to the parts, the equipment container, or to the shelter during shipment. All exterior electrical connections shall be covered and all expandable mechanisms (steps, latches, and so forth) shall be secured.

12.2 *Packing*—Packing shall be Level A.

12.2.1 *Level A Packing*—The shelter shall be closed into its container mode and secured by means provided. Mechanical seals shall be placed on the doors to deter unauthorized entry to the shelter during initial transport to the user.

## 13. Notes

NOTE 2—This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.

13.1 *Intended Use*—The two-side expandable shelter is intended for use as a general purpose shelter (for example, administrative, maintenance shop set, hospital unit, kitchen, latrine).

13.2 *Acquisition Requirements*—Acquisition documents must specify the following:

13.2.1 Title, number, and date of this provisional specification.

13.2.2 When a first article is required (see 8.1 and 13.3).

13.2.3 When a comparison inspection sample is required (see 9.1 and 13.4).

13.2.4 When test report, process specification, and samples are not regarded (see 4.3).

13.2.5 Electrical service required, 60 or 100 A (see 4.9.5).

13.2.6 Serial numbers in accordance with 4.10 are as specified.

13.2.7 When technical manuals are not required (see 3.9 and 13.5).

13.3 *First Article*—The first article should be a preproduction sample or an initial production sample consisting of five complete shelters. The first article should include all hardware, a 4 by 8 ft (1.2 by 2.4 m) specimen of each size composite panel (without edge members), 24 in. (61 mm) square panel specimens in accordance with 11.21, and a composite panel specimen in accordance with 8.1.1. The contracting officer should include specific instructions in all acquisition documents regarding arrangements for inspection and approval of the first article.

13.4 *Inspection Comparison Test*—When a comparison test sample is required, the contracting officer should include specific instructions in all acquisition documents regarding arrangements for inspection and approval of the comparison test sample.

13.5 *Manuals*—Any requirements for equipment and instruction manuals for the expandable shelter covered by this specification should be included in DD Form 1423, Contract Data Requirements List, and cited in the contract. Unless otherwise specified, no end item shall be shipped minus operator manuals without approval of the contracting officer.

## 14. Keywords

14.1 adhesive bonded; aluminum; bonding; film adhesive; honeycomb sandwich panels; nonexpandable; relocatable structures; rigid wall

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