**Designation: ~~E1975 – 21~~ E1975 – 22**

# Standard Specification for Shelter, Electrical, Equipment S-280/G[1]

This standard is issued under the fixed designation E1975; 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 one type of lightweight field and mobile shelter designed for transport by cargo truck, fixed or rotary winged aircraft, by rail, and ship, as Shelter, Electrical Equipment S-280/G (see 15.5).

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 refers only to the test methods described in this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*



## 2. Referenced Documents



2.1 *ASTM Standards:*[2]

C273/C273M Test Method for Shear Properties of Sandwich Core Materials
D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
D1622/D1622M Test Method for Apparent Density of Rigid Cellular Plastics
D2842 Test Method for Water Absorption of Rigid Cellular Plastics
E631 Terminology of Building Constructions
E864 Practice for Surface Preparation of Aluminum Alloys to Be Adhesively Bonded in Honeycomb Shelter Panels
E1730 Specification for Rigid Foam for Use in Structural Sandwich Panel Cores
E1749 Terminology Relating to Rigid Wall Relocatable Shelters
E1773 Practice for Sealing Rigid Wall Tactical Shelters with Polysulfide Based Sealants
E1794 Specification for Adhesive for Bonding Foam Cored Sandwich Panels (200 °F Elevated Humidity Service), Type II Panels
E1801 Practice for Adhesive Bonding of Aluminum Facings in Foam and Beam Type Shelters
E1851 Test Method for Electromagnetic Shielding Effectiveness of Durable Rigid Wall Relocatable Structures
E1925 Specification for Engineering and Design Criteria for Rigid Wall Relocatable Structures

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

Current edition approved ~~April 1, 2021~~May 1, 2022. Published ~~April 2021~~May 2022. Originally approved in 1998. Last previous edition approved in ~~2018~~2021 as E1975~~–18.~~–21. DOI: ~~10.1520/E1975-21.~~10.1520/E1975-22.

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

2.2 *AWS Standards:*[3]
AWS D17.1/D17.1M Specification for Fusion Welding of Aerospace Applications
AWS D17.2/D17.2M Specification for Resistance Welding for Aerospace Applications
2.3 *Federal Air Regulation (FAR):*[4]
FAR 25.853 Compartment Interior
2.4 *Military Standards:*
MIL-DTL-14072 Finishes for Ground Electronic Equipment[5]
MIL-DTL-53039 Coating, Aliphatic Polyurethane, Single Component, Chemical Agent Resistant[5]
MIL-DTL-55507 Shelter, Electrical Equipment, (With or Without Equipment), Packaging of[5]
MIL-STD-202 Electronic and Electrical Component Parts[5]
MIL-STD-252 Wired Equipment, Classification of Visual and Mechanical Defects for Equipment, Electronic, Wired, and Other Devices[5]
MIL-STD-810G Environmental Engineering Considerations and Laboratory Tests[5]
MIL-STD-1916 DOD Preferred Methods for Acceptance of Product[6]
MIL-STD-13231 Marking of Electronic Items[5]
2.5 *Drawings:*[6]
SC-D-36423 Hold Down Assembly
SC-D-36424 Cable Assembly
SC-C-200154 Keeper
SM-D-450462 Panel Assembly, Emergency Exit
SM-C-450466 Air Filter
SM-C-555515 Shock Mount
SM-B-563756 Sealer
SC-D-595509 Cover, Emergency Exit
SC-B-595564 Core Material-Urethane, Light
SC-B-595565 Core Material-Urethane, Heavy
SM-D-615264 Intake Louver Assembly
DL-SC-A-621051 Modification Kit, Radio Frequency Interference, MK-1079/G
SM-D-781242 Door Fixture (S-280) Construction Tightness Test
SM-D-781243 Drain Fixture (S-280) Construction Tightness Test
SM-D-781244 S-280 Construction Tightness Test
DL-SM-B-947080 Shelter, Electrical Equipment S-280C/G
SM-D-947080 Shelter, Electrical Equipment S-280C/G
SM-D-947081 Panel Assembly, Front
SM-D-947082 Panel Assembly, Rear
SM-D-947083 Panel Assembly, Roof
SM-D-947084 Panel Assembly, Floor
SM-D-947085 Panel Assembly, Side
SM-D-947141 Corner, Lifting Eye (Machining)
SM-D-947142 Corner, Towing Eye (Machining)
SM-D-947143 Casting, Lifting and Towing Eye
SM-D-947160 Door Jamb Assembly
SM-D-947166 Door Assembly
SM-B-947179 Bonding Procedure
SM-B-947180 Cleaning Procedure
SM-D-947181 Flatness and Squareness Measurements
SM-B-947184 Adhesive
SM-D-947186 Test Weight Installation
SM-C-947230 Shock Mount
SM-D-947235 Mounting Bracket, Skid
SM-C-947237 Shock Mount
SM-D-947238 Skid Assembly
17-1-3274 Shelter, Electrical Equipment, S-280C/G (Shielded)



[3] Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, http://www.aws.org.
[4] Available from Flight Standards Service, Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, http://www.faa.gov.
[5] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.
[6] Available from U.S. Army Natick Soldier Research, Development, and Engineering Center, ATTN: RDNS-SEE-T, 15 General Greene Avenue, Natick, MA 01760-5018, https://www.army.mil/info/organization/natick.

## 3. Terminology

3.1 *Definitions:*

3.1.1 *delaminations*—for the purpose of this specification, a delamination is defined as the condition that exists within a shelter section or panel when two surfaces that once were bonded together are no longer bonded together. Delaminations may occur between any two bonded surfaces, examples include: separations between thermal barriers and members, between thermal barriers and skins, between members and core, or between skins and core. They may be the result of a poor quality bond or they could occur due to misuse or severe handling of the panels or the shelter after bonding. Test requirements of this specification shall not be construed as misuse or severe handling as these terms apply to the definition of delaminations (see 5.4).

3.1.2 *examination*—examination consists of simple, generally nondestructive determinations of compliance, without the use of special testing equipment.

3.1.3 *inspection*—inspection is the examination or testing, or both, of supplies to determine compliance with the applicable requirements. Sampling is an element of inspection.

3.1.4 *testing*—testing consists of determinations of compliance, using technical means.

3.1.5 *voids*—for the purpose of this specification, a void is defined as any unauthorized separation or space within a shelter panel or section, that is, any separation or space that is in conflict with the drawings or other contractual requirements. Voids range from gaps as wide as the space created by a missing piece of core material to as thin as a break in the continuity of material. Voids may be located solely within one type of material, such as a core material separation; they may exist between adjacent materials, such as unbonded core material; or they may be located between other parts within a panel, such as where a piece of material is missing, damaged, or undersized. Voids may have been created at the time of construction, such as where a part was omitted; or may be created at a later time, such as a core separation or delaminated skin (see 5.4).



NOTE 1—All other terminology related to this specification is defined in Terminologies E631 and E1749.

## 4. Material Requirements

4.1 *General*—Materials used in the construction of this item shall be in accordance with the following requirements:



4.2 *Core Material*—Core material density, compressive strength, shear strength, flammability, and water absorption properties shall be in accordance with Specification E1730 and Drawings SC-B-595564 and SC-B-595565, as applicable (see 12.2.1, 10.1, Table 1, and Table 2).

4.3 *Adhesive*—The shear strength of the cured adhesive and its bond to aluminum shall be in accordance with requirements of Specification E1794 and the Drawing SM-B-947184. This requirement shall apply to the low temperature, room temperature, and

**TABLE 1 First Article Specimens**

| Inspection | Quantity | Requirements Subsection | Test Subsection |
|---|---|---|---|
| Core material: | | 4.2 | 10.1 |
| Density | 5 for every grade or type | 4.2 | 10.1.1 |
| Compressive strength | 5 for every grade or type | 4.2 | 10.1.2 |
| Shear strength | 5 for every grade or type | 4.2 | 10.1.3 |
| Flammability | 5 for every grade or type | 4.2 | 10.1.4 |
| Water absorption | 3 for every grade or type of urethane | 4.2 | 10.1.5 |
| Adhesive | 50 coupons | 4.3 | 10.2 |
| Sealer | 50 coupons | 4.4 | 10.2 |
| Shock mounts | SM-C-555515: 3 per –3<br>SM-C-947237: 3 each<br>SM-C-947230: 3 each | 4.5 | 10.3.1 |
| Impact panel | 1 from wall, 1 from floor | 5.4.1 | 10.7 |
| Hold down assembly | 1 complete | 9.2 | 10.32 |
| Eye casting hardness | 1 casting in accordance with SM-D-947143 | 7.5.2 | 10.24.2 |

**TABLE 2 In-Process Inspection**

| Inspection | Requirements Subsection | Sampling Subsection | Test Subsection |
|---|---|---|---|
| Core material: | 4.2 | . . . | 10.1 |
| Density | 4.2 | 12.2.1 | 10.1.1 |
| Compressive strength | 4.2 | 12.2.1 | 10.1.2 |
| Shear strength | 4.2 | 12.2.1 | 10.1.3 |
| Adhesive: | 4.3 | . . . | 10.2 |
| Low temperature | 4.3 | 12.2.2 | 10.2 |
| Room temperature | 4.3 | 12.2.3 | 10.2 |
| High temperature | 4.3 | 12.2.2 | 10.2 |
| Sealer: | 4.4 | . . . | 10.2 |
| Low temperature | 4.4.1 | 12.2.2 | 10.2 |
| Room temperature | 4.4.2 | 12.2.3 | 10.2 |
| High temperature | 4.4.3 | 12.2.2 | 10.2 |
| Shock mounts | 4.5 | 12.2.4 | 10.3.2 |
| Cleaning | 5.2 | 12.2.5 | 10.4 |
| Welding | 5.3 | 12.2.6 | 10.5 |
| Lamination | 5.4 | 12.2.7 | 10.6 |
| Interchangeability | 5.6 | 12.2.8 | 10.8 |
| Riveting | 5.7 | 12.2.9 | 10.9 |
| Eye casting hardness | 7.5.2 | 12.2.10 | 10.24.2 |
| Construction tightness, shelter | 8.2 | 12.2.11 | 10.10.1 |

high temperature conditions and after the humidity exposure and salt spray exposure conditions required by SM-B-947184 (see 12.2.2, 12.2.3, 10.2, 10.2.2, Table 1, and Table 2).

4.4 *Sealer*—The shear strength of the cured sealer and its bond to aluminum shall be in accordance with the following (see 10.2, 10.2.2, Table 1, and Table 2):

4.4.1 *Low Temperature*—200 psi (1.4 MPa) when tested at –65 °F ± 5 °F (–54 °C ± 3 °C) (see 12.2.2 and Table 2~~),~~).

4.4.2 *Room Temperature*—200 psi (1.4 MPa) when tested at 80 °F ± 10 °F (27 °C ± 6 °C) (see 12.2.3 and Table 2~~),~~).

4.4.3 *High Temperature*—75 psi (75 kPa) when tested at 200 °F + 0 °F – 5 °F (93 °C + 0 °C –3 °C) (see 12.2.2 and Table 2~~),~~).

4.4.4 *Sealer Shear, Humidity Exposure*—The sealer and its bond to the aluminum shall withstand exposure to 95 % relative humidity ±5 % at 160 °F ± 5 °F (71 °C ± 3 °C) for fourteen days. After exposure the sealer shall have a minimum average shear strength of 75 psi (520 kPa) when tested at 160 °F ± 5 °F (71 °C ± 3 °C).

4.4.5 *Sealer Shear, Salt Spray Exposure*—The sealer and its bond to the aluminum shall withstand exposure to the salt spray test. Method 509.6 of MIL-STD-810G using a 20 % NaCl solution at 95 °F ± 5 °F (35 °C ± 3 °C) for fourteen days. After exposure the sealer shall have a minimum average shear strength of 200 psi (1.4 MPa) when tested at 180 °F ± 10 °F (27 °C ± 6 °C).

4.5 *Shock Mounts*—Shelter skid shock mounts shall be in accordance with Drawing SM-C-555515, SM-C-947237, and SM-C-947230 (see 12.2.4, 10.3, 10.3.1, 10.3.2, Table 1, and Table 3).

## 5. Construction Requirements

5.1 *General*—The electromagnetic protected shelter shall be constructed in accordance with Drawing 17–1–3274 and all subsidiary drawings and parts lists pertaining thereto and as specified herein.

5.2 *Cleaning*—See 12.2.5, 10.4, Table 2, and Table 3.

5.2.1 *Welding and Bonding*—All aluminum parts to be welded or bonded shall be cleaned in accordance with Practice E864 and Drawing SM-B-947180. The inspection and records maintenance requirements of Practice E864 and SM-B-947180 shall be met. Arc 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.

5.2.2 *Other*—All aluminum parts to be sealed at a sub-assembly or at final assembly shall be cleaned in accordance with Practice E864 and SM-B-947180. Part drawings which cite a specific finish in accordance with MIL-DTL-14072 shall be cleaned as

**TABLE 3 Sequence of First Article Inspection**

| Inspection | Requirements Subsection | Test Subsection |
|---|---|---|
| Cleaning | 5.2 | 10.4 |
| Welding | 5.3 | 10.5 |
| Lamination | 5.4 | 10.6 |
| Interchangeability | 5.6 | 10.8 |
| Riveting | 5.7 | 10.9 |
| Construction tightness | 8.2 | 10.10 |
| Finish | 5.8 | 10.11 |
| Marking | 5.9 | 10.12 |
| Dimensional | 5.1 | 10.13 |
| Visual and mechanical | 9.3 | 10.14 |
| Shelter weight | 5.10 | 10.15 |
| Door latch torque | 8.3 | 10.16 |
| Moisture resistance[A] | 6.2 | 10.17 |
| Temperature | 6.3 | 10.18 |
| Thermal differential | 6.4 | 10.19 |
| Rail transport | 7.2.1 | 10.21 |
| Drops | 7.3 | 10.22 |
| Construction tightness[B, C] | 8.2 | 10.10.1 |
| Towing, simulated | 7.4 | 10.23 |
| Eye pulls | 7.5.1 | 10.24.1 |
| Air transport, simulated | 7.2.2 | 10.25 |
| Static door load | 7.6 | 10.26 |
| Roof access steps | 7.7 | 10.27 |
| Light tightness | 8.4 | 10.28 |
| Electromagnetic interference suppression | 8.5 | 10.29 |
| Watertightness | 8.6 | 10.30 |
| Fording | 8.7 | 10.31 |
| Door latch torque (second time) | 8.3 | 10.16 |

[A] First article specimen testing shall be completed no later than the end of this test (see 11.1.1).
[B] For correlation data purposes only. CTT test results are not to be used as accept/reject criteria for the drop test.
[C] Door portion and gasket portion only.



required therein. After assembly the shelter shall be free from particles or scale, flux, excess adhesive, excess sealer, and other foreign material. The shelter shall be cleaned prior to application of finish.



5.3 *Welding*—All welds shall have thorough penetration and good fusion and shall be free from splatter, scabs, blisters, abnormal pock marks, cracks, voids, slag inclusions, and other defects. Welders shall be certified in accordance with AWS D17.1/D17.1M. Inert gas shielded arc welding shall be used for welding of aluminum in accordance with the drawings, except where resistance welding is specified (see 12.2.6, 10.5, Table 2, and Table 3).

5.3.1 *Arc Welding*—Except where required on the shelter drawings, welded joints shall not require grinding of the finished weld and shall not be ground. Welding to repair castings shall not be permitted.

5.3.2 *Resistance Welding*—Resistance welding shall be in accordance with Class B AWS D17.2/D17.2M. Qualification of welding machines and certification of welding schedules in accordance with AWS D17.2/D17.2M is required prior to first article and production welding. Failure of any production specimen or any production part to meet the requirements of AWS D17.2/D17.2M shall be cause for rejection of the production quantity represented by that specimen or part.

5.4 *Lamination*—The roof, floor, door, and each wall of the shelter shall be bonded without voids or delaminations (see 3.1.1 and 3.1.5) to the inner and outer skins and other adjacent surfaces. No voids shall exist between the inner and outer surfaces of the panels due to foam breaks, misfits, or lack of adhesive. Bonding shall be in accordance with Practice E1801 and SM-B-947179 (see 12.2.7, 10.6, Table 2, and Table 3).

5.4.1 *Impact Resistance*—The floor, door, and each wall of the shelter shall be capable of withstanding impact by a foreign object. To determine compliance with this requirement, specimens shall be fabricated and tested in accordance with 10.7. Each specimen shall not suffer rupture or fracture of either of the skins and shall not result in denting of the lower skin (see Table 1 and Table 4).

5.5 *Vapor Seal*—Except for the breather holes required for the construction tightness test, and in accordance with the shelter

**TABLE 4 Group C Inspection**

| Inspection | Requirements Subsection | Sampling Subsection | Test Subsection |
|---|---|---|---|
| Drops | 7.3 | 12.3.3.1 | 10.22 |
| Construction tightness[A, B] | 8.2 | . . . | 10.10 |
| Watertightness[C] | 8.6 | . . . | 10.30 |
| Fording[C] | 8.7 | . . . | 10.31 |
| Door latch torque[C] | 8.3 | . . . | 10.16 |
| EMI suppression | 8.5 | 12.3.3.2 | 10.29 |
| Watertightness[D, E, F] | 8.6 | . . . | 10.30 |
| Fording[D, E] | 8.7 | . . . | 10.31 |
| Door latch torque[D, E] | 8.3 | . . . | 10.16 |
| Hold down assembly | 9.2 | 12.3.3.3 | 10.32 |
| Core material: | . . . | . . . | . . . |
| Flammability | 4.2 | 12.3.3.4 | 10.1.4 |
| Water absorption | 4.2 | 12.3.3.4 | 10.1.5 |
| Adhesive | . . . | . . . | . . . |
| Humidity exposure | 4.3 | 12.3.3.4 | 10.2 |
| Salt spray exposure | 4.3 | 12.3.3.4 | 10.2 |
| Sealer | . . . | . . . | . . . |
| Humidity exposure | 4.4.4 | 12.3.3.4 | 10.2 |
| Salt spray exposure | 4.4.5 | 12.3.3.4 | 10.2 |
| Shock mounts, complete | 4.5 | 12.3.3.4 | 10.3.1 |
| Impact panel | 5.4.1 | 12.3.3.4 | 10.7 |
| Environmentals:[A] | . . . | 12.3.3.4 | . . . |
| Moisture resistance[E] | 6.2 | . . . | 10.17 |
| Temperature[E] | 6.3 | . . . | 10.18 |
| Thermal differential[E] | 6.4 | . . . | 10.19 |
| EMI suppression[G, H] | 8.5 | . . . | 10.29 |
| Watertightness[E, G] | 8.6 | . . . | 10.30 |
| Fording[E, G] | 8.7 | . . . | 10.31 |
| Door latch torque[E, G] | 8.3 | . . . | 10.16 |
| Rail transport[E] | 7.2.1 | . . . | 10.21 |
| Drops[E, I] | 7.3 | . . . | 10.22 |
| Construction tightness[D, E, J] | 8.2 | . . . | 10.10 |
| EMI suppression[E, J] | 8.5 | . . . | 10.29 |
| Watertightness[E] | 8.6 | . . . | 10.30 |
| Fording[E] | 8.7 | . . . | 10.31 |
| Door latch torque[E] | 8.3 | . . . | 10.16 |
| Towing, simulated | 7.4 | 12.3.3.4 | 10.23 |
| Air transport, simulated | 7.2.2 | 12.3.3.4 | 10.25 |

[A] These inspections shall be performed on the same (serial number) shelter.
[B] Door portion and gasket portion only.
[C] If the EMI suppression test is to follow the drop test on the same shelter, these tests shall be done after EMI.
[D] To be performed only if EMI test followed drop test on the same shelter or if adjustment to gasket compression was necessary to satisfy EMI suppression requirements.
[E] Modification Kit MK-1079/G to remain installed during these tests.
[F] If shelter was not drop tested prior to EMI testing, this watertightness test shall use only the nine nozzles located at the door end of the shelter.
[G] If the transport test is to follow the environmental tests on the same shelter these tests shall be done after the drop test.
[H] This inspection may also satisfy sampling for EMI suppression in accordance with 12.3.3.2.
[I] This inspection may also satisfy sampling for drop test in accordance with 12.3.3.1.
[J] For correlation data purposes only. CTT test results are not to be used as accept/reject criteria for the drop test.



drawings, the inner and outer skins and all joints shall be sealed to provide a vapor barrier against the entrance of moisture to the core material and to the interior of the shelter (see 5.11, 10.30, and 10.31). (See Practice E1773).

5.6 *Interchangeability*—Like units, subassemblies, assemblies, and replaceable parts shall be physically and functionally interchangeable without modification of the items or the shelter. Individual items shall not be hand-picked for fit or performance. Reliance shall not be placed on any dimension, rating, characteristic, etc. not specified on the drawings. To determine compliance with this requirement, the items listed in 10.8 shall be measured and shall be in accordance with the dimensions and tolerances specified on the applicable drawing (see 12.2.8, Table 2, and Table 3).

5.7 *Riveting*—No more than one rivet or rivnut in ten and no more than two adjacent rivets or rivnuts shall exhibit any of the defects specified below (see 12.2.9, 10.9, Table 2, and Table 3).

5.7.1 *Looseness*—There shall be no evidence of looseness parallel to the plane of the mating surfaces due to oversized holes or looseness perpendicular to the plane of the mating surfaces due to rivets or rivnuts not being tightly sealed.

5.7.2 *Heads*—Rivet and rivnut heads shall not be cut, marred, chipped, eccentric, distorted, or otherwise mutilated. Countersunk rivets and rivnuts shall not project above or below the mating surface more than 15 % of the mating material thickness (see 10.9).

5.7.3 *Mating Surface and Materials*—The mating surface shall not be marred or indented due to rivet or rivnut installation, nor shall there be any distortion or warpage of the mating materials. There shall be no foreign material between riveted surfaces. The term foreign material does not include material required by and allied in accordance wit the shelter drawings.

5.8 *Finish*—The shelter shall be finished in accordance with the drawings and the paint finishes requirements of MIL-DTL-14072 (see 10.11, 10.14, and Table 3). The Government shall have the option of painting the S-280C Shelters the following colors using Chemical Agent Resistant Coating (CARC) in accordance with MIL-DTL-53039:

Option 1: CARC TAN 686 A (33446),

Option 2: CARC GREEN 383 (34094),

Option 3: Three Color Camouflage per Drawing 13228E1360: CARC GREEN 383 (34094), CARC BROWN 383 (30051), and CARC BLACK (37030).

5.9 *Marking*—Marking shall be in accordance with the drawings and MIL-STD-13231. Classification of defects in MIL-STD-13231 is applicable. Serial numbers shall be marked in accordance with the drawings on the shelter and on the nameplate in the space provided (see 10.12, 10.14, and Table 3).

5.9.1 *Facsimiles*—When specified (see 15.1.4), the contractor shall provide facsimiles of the nameplate and all data and instruction plates required by DL-SM-B-947080 (see 15.1.3). Each facsimile shall be in accordance with its drawing and shall include any and all information required to be inserted, except shelter serial number. Artwork shall be of a quality at least comparable to the drawing (see 10.14).



5.10 *Shelter Weight*—The gross weight of the shelter, excluding the hold down assembly, SC-D-36423, shall be as follows (see 10.15, Table 3, and Table 5):

5.10.1 1400 lb ± 30 lb (636 kg ± 14 kg) without MK-1079( )/G installed, and

5.10.2 1410 lb ± 30 lb (640 kg ± 14 kg) with MK-1079( )/G installed.



5.11 *Service Integrity*—Unless otherwise specified, all inspections required herein shall not result in any of the defects listed below. This service integrity requirement shall apply to the shelter both with and without Modification Kit, RFI, MK-1079( )/G installed, as required by the individual inspections specified herein, (see 6.1, 7.1, 8.1, 10.0, 10.17, 10.18, 10.19.1, 10.21, 10.22.2, 10.23, 10.24.1, 10.25, 10.26, and 10.27).

5.11.1 There shall be no delamination, buckling, splitting, or other deformation or structural weakening of the shelter.

5.11.2 The vapor seal of 5.5 shall remain intact at all cross-sectional openings of the shelter and at all fillets and fasteners.

**TABLE 5 Group A Inspection**

| Inspection | Requirements Subsection | Test Subsection | AQL % | |
|---|---|---|---|---|
| | | | Major | Minor |
| Construction tightness | 8.2 | 10.10 | . . . | . . . |
| Shelter portion (audit only) | 8.2 | 10.10.1 | 1.00 | . . . |
| Door portion | 8.2 | 10.10.2 | 1.00 | . . . |
| Gasket portion | 8.2 | 10.10.3 | 1.00 | . . . |
| Visual and mechanical | 9.3 | 10.14 | 1.00 | 4.00 |
| Dimensional | 5.1 | 10.13 | 1.00 | . . . |
| Door latch torque[A] | 8.3 | 10.16 | 1.00 | . . . |
| Shelter weight | 5.10 | 10.15 | 1.00 | . . . |

[A] Door latch torque to be repeated during the final cursory visual mechanical inspection.

5.11.3 Brackets, lugs, flanges, inserts, bolts and any other mounting arrangement shall securely retain test loads, the door, and all hardware.

5.11.4 There shall be no corrosion of any parts.

5.11.5 There shall be no growth of the core material.

5.11.6 Unless otherwise specified, all shelter dimensions shall remain in accordance with the drawings.

5.11.7 Any deformation of any mounting arrangement shall be within drawing tolerances and shall not cause degradation of its retaining ability or of specified shelter performance.

5.11.8 The door and the emergency exit cover shall open and close to their full extent without binding in the hinge(s) or interfering against any portion of the door or cover jamb or gasket bearing areas.

5.11.9 There shall be no malfunction of the door latch mechanism.

5.11.10 There shall be no binding in the door brace pivot points or interference between brace components.

5.11.11 When a tiedown is required, it shall not be damaged as a result of the test.

5.12 *Construction Tightness Preconditioning*—Prior to submission for the specified qualification inspection, each shelter shall show no evidence of air leakage through sealed seams, joints, rivets, mounting bolts, etc., when tested and corrected in accordance with 10.10.1.



## 6. Environmental Requirements

6.1 *General*—The shelter shall meet the following environmental service conditions. Where a test is referenced, meeting the test shall be considered as compliance with the requirement (see 5.11).

6.2 *Moisture Resistance*—Daily exposure up to 97 % relative humidity for 20 h and exposure at 100 % relative humidity with condensation for 4 h (see 10.17 and Table 3).



6.3 *Temperature*—The shelter shall withstand rapid temperature changes and exposure to the following (see 10.18 and Table 3):

6.3.1 *Operating*—Ambient temperature in the range of –65 °F to ± 125 °F (–54 °C to 52 °C) plus a solar load such that the outside skin reaches a minimum temperature of 200 °F (93 °C). Exposure at the high extreme is not to exceed 4 h and at the low temperature extreme is not to exceed 72 h at any one time.

6.3.2 *Nonoperating*—Exposure in the range of –80 °F to +160 °F (–62 °C to +71 °C). Exposure at the high temperature extreme is not to exceed 4 h and at the low temperature extreme is not to exceed 24 h at any one time.

6.4 *Thermal Differential*—See 10.19 and Table 3.

6.4.1 *Thermal Deformation*—The shelter shall withstand exposure to a temperature differential of 100 °F between the inside and outside of the shelter (see 10.19.1).

6.4.2 *Heat Transfer*—When specified (see 15.1.5), the overall coefficient of heat transfer of the shelter shall not exceed 0.28 British Thermal Units (BTUs) per hour per square foot per degree Fahrenheit (1.6 Watts per square metre per degree Kelvin). This overall coefficient shall apply to the shelter with the door and the emergency exit cover closed and with no additional thermal sealing (see 10.19.2).

## 7. Structural Integrity Requirements

7.1 *General*—The shelter shall be capable of complying with the following requirements. Unless otherwise specified when a payload is required, the shelter shall be loaded with 7100 lb (3227 kg). The contractor shall fashion an appropriate simulated

payload design to be used for all testing. This payload design shall be a modification of drawing SM-D-947186 and shall be approved by the procuring agency prior to its use in any test. Where a test is referenced, meeting the test shall be considered as compliance with the requirement (see 5.11, 10.21, 10.22, and 10.23).

7.2 *Transportability*—The shelter, with payload, shall be capable of being picked up by a crane using the hold down assembly, SC-D-36423, transported while suspended from the crane, and lowered to any predetermined point on the ground. The shelter shall also be capable of being transported as follows:

7.2.1 *Rail Transport*—The shelter, with payload, shall be capable of being loaded and braced on a flatcar for shipment by rail (see 10.21, Table 3, and Table 4).

7.2.2 *Air Transport*—The shelter shall have adequate strength to secure 7100 lb (3227 kg) of equipment mounted in the shelter when exposed to 3.0 G's acceleration with the shelter suspended by its lifting eyes (see 10.25, Table 3, and Table 4).

7.3 *Drops, Flat and Rotational*—The shelter, with a 7100 lb (3227 kg) payload, shall be capable of withstanding drops of 18 in. (460 mm) onto concrete during handling. After all drops of 10.22, the inside dimensions of the shelter shall remain in accordance with Drawing SM-D-947080. There shall be no permanent deformation, buckling, delamination (see 3.1.5), sealer separation, or structural weakness to any part of the shelter, except that deformation in the skids and skid mounting brackets shall not exceed ¼ in. (6 mm), and a quarter moon shaped (3 in. by 13 in. (75 mm by 330 mm)) delamination (bulge) that appears on the interior front panel along the floor between the two center members shall not be considered cause for failure. The door and cover shall open and close to the full extent specified on the applicable drawing on DL-SM-D-947080 without binding in the hinge(s) or interfering against any portion of the jamb or bearing areas, or both, (see 12.3.3.1, 10.22.1, 10.22.2, Table 4, and Table 6).

7.4 *Towing, Simulated*—The shelter shall be capable of withstanding a 4200 lb shear force applied to the plane of the skid attachment without damage to any part of the shelter, skid assemblies or skid mounting brackets (see 10.23, Table 3, and Table 4).



7.5 *Lifting and Towing Eyes*—See 10.24.

7.5.1 *Eye Pulls*—Each lifting and towing eye assembly, installed on the shelter, shall be capable of withstanding loads in accordance with 10.24.1 with no damage to the eye assemblies, or shelter (see Table 3 and Table 6).



7.5.2 *Eye Casting Hardness*—Each lifting and towing eye casting in accordance with SM-D-947143 shall be properly aged and hardened to a hardness of 75 Brinell Standard Type (10 mm ball, 500 kg load) prior to machining (see 12.2.10, 10.24.2, Table 1, and Table 2).

7.6 *Static Door Load*—The door, door frame, and door hardware shall be capable of supporting a vertical load of 200 lb (90 kg) applied in accordance with 10.26. There shall be no damage and the door shall seal properly, as determined by inspecting in accordance with 10.10.3 (see Table 3 and Table 6).

7.7 *Roof Access Steps*—Each roof access step installed on the shelter shall be capable of supporting a vertical load of 400 lb (180 kg) applied in accordance with 10.27. There shall be no damage and the step shall open and close without binding (see Table 3 and Table 6).

**TABLE 6 Group B Inspection**

| Inspection | Requirements Subsection | Test Subsection | AQL % |
|---|---|---|---|
| Finish | 5.8 | 10.11 | 6.5 |
| Eye pulls | 7.5.1 | 10.24.1 | 6.5 |
| Static door load | 7.6 | 10.26 | 6.5 |
| Roof access steps | 7.7 | 10.27 | 6.5 |
| Construction tightness[A] | 8.2 | 10.10 | 1.0 |
| Light tightness | 8.4 | 10.28 | 6.5 |

[A] Door portion and gasket portion only.

## 8. Tightness Requirements

8.1 *General*—The shelter shall be capable of meeting the following tightness requirements. Except for 8.5, these requirements apply both with and without MK-1079/G installed (see 5.11).

8.2 *Construction Tightness*—The shelter shall be airtight to the extent that it shall be capable of achieving and maintaining a pressurized state without leakage when tested in accordance with 10.10 (see 12.2.11, Table 2, Table 3, Table 4, and Table 5).

8.3 *Door Latch Torque*—When tested in accordance with 10.16, the door latch torque shall not exceed the following (see Table 3, Table 4, and Table 6):

8.3.1 15 ft-lbf maximum when MK-1079/G is not installed, and

8.3.2 30 ft-lbf maximum when MK-1079/G is installed.

8.4 *Light Tightness*—No direct rays of light shall be visible through the intake louver assembly when tested in accordance with 10.28 and viewed by an observer from the darkened shelter interior (see Table 3 and Table 6).

8.5 *Electromagnetic Interference (EMI) Suppression)*—The shelter shall be capable of being shielded from electromagnetic interference by the installation of Modification Kit, Radio Frequency Interference, MK-1079/G in accordance with DL-SC-A-621051 and with no other modification. Shielding shall provide a minimum attenuation of radiated and induced EMI fields as specified in Specification E1925 within the frequency range of 100 kHz to 10 Ghz when tested in accordance with 10.29. Should a shelter subjected to the EMI test fail to pass, another shelter from the same lot shall be subjected to the EMI test (see 12.3.3.2, 10.29, Table 3, and Table 4).

8.6 *Water Tightness*—The shelter shall be watertight when tested and inspected in accordance with 10.30. This requirement shall be met without the use of any external or internal sealing, caulking, taping, etc., not specified on the drawings (see Table 3 and Table 4).

8.7 *Fording*—The shelter shall be capable of being immersed in water to a depth of 21 in. (530 mm) measured from the bottom of the shelter skids. There shall be no leakage or damage to the structure or finish when tested and inspected in accordance with 10.31. This requirement shall be met without the use of any external or internal sealing, caulking, taping, etc. not specified on the drawings and without the use of a special fording kit (see Table 3 and Table 4).

## 9. Other Requirements

9.1 *First Article*—When specified (see 15.1.2), the contractor shall furnish sample items for first article inspection and approval (see 11.1).

9.2 *Hold Down Assembly*—A combination lift and tiedown device shall be provided as part of each shelter. This device will be used for lifting the shelter and for tying down the shelter in military trucks. The device shall be in accordance with Drawing SC-D-36423, Hold Down Assembly. Each cable assembly in accordance with Drawing SC-D-36424 shall be capable of withstanding a tensile load of 14 000 lb (6350 kg) as specified on SC-D-36424 (see 12.3.3.3, 10.25, 10.32, Table 1, and Table 4).

9.3 *Workmanship*—The shelter shall be manufactured with the degree of workmanship normally considered appropriate for each of the areas listed under Section 5 (see 10.14, Table 3, and Table 5).

## 10. Tests Required

10.1 *Core Material*—Subject core material specimens to the following tests. For each test a set of five specimens is required for each type or grade of core material used in the shelter. Fabricate specimens from actual shelter core material pieces randomly selected from production core material parts. Specimen dimensions shall be within ±0.015 in. (±0.4 mm). Except for flammability, the requirements of 4.2 shall be met by the average of the specimen results, with the lowest result no less than 90 % of the required value (see 12.2.1, Table 1, and Table 2).

10.1.1 *Density*—Test five specimens, each 2 in. by 3 in. by 3 in. (50 mm by 75 mm by 75 mm), in accordance with Test Method D1622/D1622M (see Table 1 and Table 2).

10.1.2 *Compressive Strength*—Test five specimens, each 2 in. by 3 in. by 3 in. (50 mm by 75 mm by 75 mm), in accordance with Test Method D1621, Procedure A (see Table 1 and Table 2).

10.1.3 *Shear Strength*—Test five specimens, each ½ in. by 1½ in. by 6 in. (13 mm by 38 mm by 150 mm), in accordance with Test Method C273/C273M, except apply the load at a constant rate such that the maximum load will occur in 1 min or more (see Table 1 and Table 2).

10.1.4 *Flammability*—Determine flame resistance of the five specimens, each ½ in. by 1½ in. by 7 in. (13 mm by 38 mm by 178 mm), (see Table 1) in accordance with FAR 25.853, Appendix F. The average extinguish time shall not exceed 15 s, and the average burn distance shall not exceed 6 in. (150 mm).

10.1.5 *Water Absorption*—Test three specimens, each 6 in. by 6 in. by 3 in. (150 mm by 150 mm by 75 mm), in accordance with Test Method D2842 with the following changes: weigh each specimen as it is first submerged; ~~also weigh~~ the weighing jig shall also be weighed at this time; for the final weight, weigh the specimens and remove from the water in reverse order; calculate the water absorption as follows:

$$lb\ water/ft^2 = (((W_{2a} - W_{1a}) - (W_2 - W_3))/A) \times (2.048\ \ lb/ft^2/g/cm^2) \quad (1)$$

where:

$W_{1a}$ = initial submerged weight of jig and samples (g),
$W_{2a}$ = initial submerged weight of jig (g),
$W_2$ = final submerged weight of jig (g),
$W_3$ = final submerged weight of jig and samples (g), and
$A$ = specimen surface area ($cm^2$).



10.2 *Coupon Specimens*—Coupon specimens for both adhesive and sealer tests shall be lap joints fabricated in accordance with SM-B-947184. Five coupons are required for each of the five test conditions. For first article inspection, ten coupons are required for each of the five test conditions (see 4.3, 4.4, 12.2.2, 12.2.3, Table 1, Table 2, and Table 4).



10.2.1 *Compatibility of Fabrication and Cure*—Verify two or more part mixes of adhesive as being in accordance with SM-B-947184 before coupons are fabricated. Verify two or more part mixes of sealer as being in accordance with SM-B-947184 before coupons are fabricated. Calibrate automatic dispensing machines, when used to mix and deliver two or more part adhesive or sealer, at least once every 4 h. Fabricate coupon specimens and cure using materials, processes, and conditioners compatible with those used on panels and shelters, including:

10.2.1.1 Same batch and type of material,

10.2.1.2 Surface conditions of and method of preparing materials to be bonded or sealed,

10.2.1.3 Time elapsed between application of adhesive to the first panel in a lot of panels and application of temperature and pressure to the lot of panels,

10.2.1.4 Time, temperature, and pressure of cure. Cure sealer coupons at a pressure of 5 psi ± ½ psi (34 kPa ± 3 kPa), and

10.2.1.5 Minimum cure time before handling.

10.2.2 *Shear Tests*—Test coupons at the specified temperature after being subjected to the specified exposure, if applicable. Stabilize the temperature of the coupons at the specified level and measure by a thermocouple attached to the coupon over the lap joint. The thermocouple shall not be attached on that side of the lap joint closest to the heat or cold source nor shall the method of attachment impair the application or measurement of the shear force in any way. Apply the shear force to destruction. Set rate of application of force under no-load conditions and be constant at 1 in./min ± 2 s (25 mm/min ± 2 s). Meet the requirements of 4.3 for adhesive and 4.4, with subparagraphs, for sealer by the average of the coupon results, with the lowest result no less than