



# AEROSPACE RECOMMENDED PRACTICE

**ARP1967****REV. B**

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Revised 2014-04

Superseding ARP1967A

(R) Containers, Shipping and Storage, Reusable

## RATIONALE

This revision updates applicable referenced documents throughout. A section on foam vibration and shock isolation systems for military applications was incorporated as well as a section on environmental health and safety. The document was also updated to reflect more precise terms used in identifying parts of containers throughout.

### 1. SCOPE

This SAE Aerospace Recommended Practice (ARP) recommends design and test criteria for reusable shipping and storage containers for aircraft engines and modules, weapon systems and components, etc. The containers are to provide water-vaporproof and physical protection.

### 2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications will apply. The applicable issue of other publications will be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

#### 2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

|           |                                                                    |
|-----------|--------------------------------------------------------------------|
| AS4863    | Plug, Pipe, External Thread                                        |
| AS5017    | Air Filling Valves                                                 |
| AS5135    | Desiccant Port and Desiccant Holder                                |
| AS26860   | Indicator, Humidity, Plug, Color Change                            |
| AS27166   | Valve, Pressure Equalizing, Gaseous Products                       |
| SAE J1173 | Size Classification and Characteristics of Glass Beads for Peening |

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Document Sharing Hub

## 2.2 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org).

ANSI/AWS D1.1 Structural Welding Code - Steel

ANSI/AWS D1.2 Structural Welding Code Aluminum

ANSI/AWS D1.6 Structural Welding Code - Stainless Steel

## 2.3 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, [www.asme.org](http://www.asme.org).

ASME Y14.100 Engineering Drawing Practices

ASME Y14.5M Dimensioning and Tolerancing

ASME Y14.24 Types and Applications of Engineering Drawings

## 2.4 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, [www.astm.org](http://www.astm.org).

ASTM D573 Standard Test Method for Rubber - Deterioration in an Air Oven

ASTM D642 Test Method for Determining Compressive Resistance of Shipping Containers, Components, and Unit Loads

ASTM D880 Standard Method for Impact Testing for Shipping Containers and Systems

ASTM D999 Test Methods for Vibration Testing of Shipping Containers

ASTM D1083 Test Methods for Mechanical Handling of Unitized Loads and Large Shipping Cases and Crates

ASTM D1149 Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber

ASTM D2000 Standard Classification System for Rubber Products in Automotive Applications

ASTM D4169 Standard Practice for Performance Testing of Shipping Containers and Systems

ASTM D4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing

ASTM D5276 Test Method for Drop Test of Loaded Containers by Free Fall

ASTM D6055 Mechanical Handling of Unitized Loads and Large Shipping Cases and Crates

ASTM D6179 Test Method for Rough Handling of Unitized Loads and Large Shipping Cases and Crates

## 2.5 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, <http://quicksearch.dla.mil/>.

|               |                                                                                                      |
|---------------|------------------------------------------------------------------------------------------------------|
| A-A-208       | Ink, Marking, Stencil, Opaque (Porous and Non-Porous Surfaces)                                       |
| A-A-56032     | Ink, Marking, Epoxy Base                                                                             |
| FED-STD-595   | Colors Used in Government Procurement                                                                |
| MIL-D-3464    | Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification                             |
| MIL-DTL-53072 | Chemical Agent Resistant Coating (CARC) System Application Procedures and Quality Control Inspection |
| MIL-PRF-81733 | Sealing and Coating Compound, Corrosion Inhibitive                                                   |
| MIL-STD-129   | Standard Practice for Military Marking                                                               |
| MIL-STD-130   | Identification Marking of U.S. Military Property                                                     |
| MIL-HDBK-808  | Finish, Protective and Codes for Finishing Schemes for Ground and Ground Support Equipment           |
| MIL-STD-1472  | Human Engineering                                                                                    |

## 3. REQUIREMENTS

### 3.1 Sample(s)

#### 3.1.1 Prototype

Unless otherwise specified (see Section 6) a prototype container will be built using production processes and tooling whenever practical and subjected to the inspections, demonstrations and tests identified herein. Recommend preliminary testing be conducted prior to priming and painting to validate design, prior to qualification testing. Approval of the prototype does not relieve the supplier from the responsibility of producing a first article sample. No prototype will be required for container purchased using a production set of drawings.

#### 3.1.2 First Article Sample

Unless otherwise specified (see Section 6) a first article sample will be built using production processes, tooling, and personnel and submitted for approval. The first article sample will be subjected to the test identified herein or as required by the purchasing activity. Approval of the first article sample does not relieve the supplier of responsibility for compliance with all applicable provisions of this document during subsequent production.

### 3.2 Materials

Materials to be used in containers will be identified on specifications and drawings. Materials which are not covered by specifications or which are not specifically described will be of the lightest practical weight and entirely suitable to meet all performance requirements. Unless specific materials are identified (see Section 6), any suitable material may be considered for the primary container construction.

### 3.2.1 Metals

Metal components will be corrosion resistant or suitably processed to resist corrosion. Dissimilar metals will not be used in intimate contact unless suitably protected against electrolytic and/or galvanic corrosion. When specified (see Section 6), plated or painted parts will not contact the end item (i.e., engines). When it is necessary that any combination of such dissimilar metals be assembled, an interposing material compatible with each should be used. Cadmium plated parts will not be used. Materials and processes will be selected to prevent galling.

### 3.2.2 Plastics and Composites

Plastics and composites that meet or exceed the performance and quality assurance provisions of this specification may be used. Special consideration will be given to assure the adequacy of the data package for purposes of reprourement. For example, the plastics or composite materials, reinforcements, and the location of the reinforcements will be completely defined. Essential process specifications will be included in the data package.

### 3.2.3 Standard, Commercial, and Qualified Parts

Standard, commercial, and qualified parts will be used to the maximum extent, consistent with reliability, maintainability, and performance. Commercial utility parts such as screws, bolts, nuts, and cotter pins with suitable properties may be used. Standard part numbers will be referenced in the parts list on the contractor's drawings. The cage code and manufacturers part number for commercial parts will be provided. Information related to the performance and requirements of the commercial part will be provided on the drawings. The nongovernmental or government standard should be identified along with manufacturer's cage code and part number whenever possible.

## 3.3 Design and Construction

### 3.3.1 Internal Component Parts

#### 3.3.1.1 Mounting Provisions

Each container will include all necessary interior supports, fixtures, and attachments to receive and secure the contained item(s), individual mounting provisions or supports for designated accessories, and provisions for storing detachable hardware during shipment of an empty container. The fasteners will be single action self-contained devices. A deviation to use threaded fasteners may be allowed provided that these threaded fasteners used in the primary support structure will be of the self-locking type with nonmetallic inserts. Unless otherwise specified (see Section 6), safety wire will be used only if the configuration of the component precludes self-locking fasteners.

#### 3.3.1.2 Accessibility

The container will be designed so as to provide ready accessibility to the interior supports and will permit the installation and removal of the item by means of overhead lifting devices through a sequence of simple operations.

#### 3.3.1.3 Vibration and Shock Isolation

The container will be designed so as to prevent damage to the item resulting from the tests of Section 4. Maximum allowable transmissibility, random vibration, critical acceleration levels (G's), or shock spectrum imposed on the item by the tests of Section 4 will be as described in the contract or purchase order (see Section 6). If consistent with the shock requirements and other design considerations, the resonant frequency of the loaded suspended system in the major translational modes of vibration will be above 7.0 Hz.

### 3.3.1.3.1 Elastomeric Isolators

If elastomeric isolators are used, each isolator will be marked with its date of manufacture. This date will be visible when the mount is installed. Elastomeric materials used in isolation mounts will be in accordance with ASTM D2000. The mount under 20% strain will have been tested and certified in accordance with ASTM D1149 for ozone resistance. The mount will be subjected to an ozone concentration of 50 parts per hundred million at  $40\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  ( $104\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ ) and the test duration will be 168 hours. The mount under 20% strain will be tested and certified in accordance with ASTM D573 for air-heat aging. This test will be done at an operating temperature of  $80\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  ( $176\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ ). Elastomeric isolators will not exceed 18 months old when first installed or as specified by the procuring agency (see Section 6).

### 3.3.1.3.2 Wire Rope Isolators

Wire rope isolators will be free of visible physical damage when first installed. The isolators will be replaced in accordance with the manufacturer's recommendations.

### 3.3.1.3.3 Foam

For military applications, foam cushioning material used in the container must meet or exceed the requirements of A-A-59136, Class IV, Grade A, for the stated Type. The material's dynamic cushioning curve will fall between the upper and lower curve limits for the stated Type (I – IV). In addition, the cushioning material's thermal stability (ASTM D4819, S) will not exceed 10%. The following information will be provided:

Grade & Type

Salient Characteristics, 3.3.2 & 5.4.2

Density, 3.7 & 5.4.2

Constant Compression Creep, 3.10 & 5.5

If the foam cushioning material does not meet the requirements of A-A-59136, dynamic cushioning curves for the material used will be provided, and complete characterization of the material will be provided and verified by the purchaser to insure item requirements are met.

#### ASTM D4819, Table 1 (Flexible Cellular Materials Made from Polyolefin Plastics)

Provide the foam classification (Type, Suffix Letter & Suffix Number) and indicate meet/exceed, of:

- A - Heat resistance
- B - Compression set under constant deflection
- C - Ozone or weather resistance
- D - Compression deflection
- E - Oil resistance
- F - Low temperature
- G - Tear resistance
- J - Abrasion resistance
- K - Adhesion capability
- L - Water absorption
- M - Flammability resistance
- O - Electrical properties
- S - Thermal stability (not to exceed 1% for thickness)
- V - Thermal conductivity
- W - Density
- BB - Compressive creep (not to exceed 10%)
- CC - Dynamic cushioning (stated cushion thickness and include dynamic set data per ASTM D1596)

### 3.3.2 Free Drainage

Provisions will be incorporated to ensure that any water collecting areas on the exterior of the container are provided with a means of drainage in the normal storage position of the container. Where necessary, holes will be drilled of sufficient size, 10-mm diameter (0.38-inch diameter) minimum that they may be adequately painted without danger of subsequent blockage. Where drainage holes are impractical, the affected area will be filled with a sealing compound conforming to MIL-PRF-81733, or equivalent, in such a manner as to prevent the collecting of water.

### 3.3.3 Container Assembly

#### 3.3.3.1 Permanent Joints

All permanent fittings, seams, and joints, affecting the airtightness of the container, will be welded, brazed or bonded. The container will be pressure tested prior to priming or painting when the addition of primer or paint could contribute to the sealing of joints or seams.

#### 3.3.3.2 Container Closure

##### 3.3.3.2.1 Closure Fasteners

Closure fasteners will be either hand operated or require the use of only common hand tools, excluding torque wrenches whenever practical, to open and close the container. The closure fasteners, if captivated to the cover section of the container, will not sustain damage when the cover is removed and placed on the floor, in its normal attitude. The type of fastener will be selected and specified (see Section 6) by the procuring agency, with consideration of the anticipated service environment. Some options are:

- a. **Hand Operated Self-Contained Latches:** These latches include over center, cam action, and/or spring loaded configurations. They are convenient to use and produce consistent clamping force, and cannot be misplaced or lost, but may not be readily replaceable if damaged. Physical protection by recessing or shielding is required to prevent damage during normal handling.
- b. **Self-Contained/Captive Threaded Fasteners:** These cannot be misplaced or lost. They must be wrenched or properly tightened as they may not be readily replaceable if damaged.
- c. **Nuts and Bolts (Noncaptive):** These can be readily replaced if damaged. They must be wrenched or properly tightened as they might be misplaced or lost.

NOTE: Leak testing is recommended after each closing to ensure environmental protection for the contents.

##### 3.3.3.2.2 Container Sealing

All sealing surfaces will be such to ensure sealing under the performance requirements of this specification at 10 kPa (1.5 psig) positive and 7 kPa (1.0 psig) negative pressure unless otherwise specified (see Section 6). When specified a structural integrity test will be conducted at 10 kPa (1.5 psig) above the pressure valve and 0.5 psig below the vacuum valve setting. All gasket joints should be processed so as to form a continuous gasket. The gasket will remain in place during normal installation and removal of the cover and will be mechanically secured. When pressurized, the container-stacking interface with a like container will remain engaged and not present an unsafe condition. When assembled, the sections of the container should apply no loads to the gasket(s) other than those required for sealing. Permanent set of the gasket that will adversely affect the seal of the container is not permitted. Secondary sealing compounds will not be used. The main closure flange, between the cover and the base, will be configured such that rainwater will not enter the container if the gasket is missing or fails. When the cover is removed and placed in its normal attitude on a rigid floor, the sealing surfaces will be a minimum of 6 mm (0.25 inch) off the floor.

### 3.3.3.2.3 Installation Time

The time required to open the container, to remove and reinstall the item, and to close the container for shipment will be the minimum practical, unless otherwise specified by the procuring activity (see Section 6).

### 3.3.3.2.4 Leakage

Leakage will not exceed that specified in 4.5.2.

## 3.3.4 Handling Provisions

### 3.3.4.1 Lifting Rings, Eyes, or Lugs

Lifting rings, eyes or lugs capable of withstanding the tests prescribed herein, without failure or visible permanent distortion, will be provided for lifting the container and cover and base individually with chains, hooks, or by a single overhead hook. These rings, eyes or lugs will be located so as to permit the container to be lifted without significant deviation from the normal storage attitude. Rings, eyes, or lugs, when not in use, will not project beyond the envelope of the container. Rings and eyes will have a minimum opening of 64 mm (2.5 inches) unless otherwise specified (see Section 6). When specified (see Section 6) the lifting provisions will be capable of handling unitized loading.

#### 3.3.4.1.1 Container Lifting

Provisions for four-point suspension of loaded rectangular containers will be located on the container base, unless otherwise specified (see Section 6), for all containers that exceed 68 kg (150 pounds) loaded gross weight. Vertical cylindrical containers will have a minimum of three lift points. Additional lift rings may be required for stable lift of empty containers.

#### 3.3.4.1.2 Cover/Section Lifting

Provisions for cover lifting will be provided. Manual lifting provisions will be provided when personnel can safely remove or install the cover or section. The cover or section will be capable of being lifted without injury to personnel or damage to the item.

### 3.3.4.2 Tiedown/Towing Provisions

Tiedown and towing provisions will be provided on the base and will have a minimum opening of 64 mm (2.5 inches) unless otherwise specified (see Section 6). The load-carrying capacity of the tiedown provisions will be 3 G's forward, 2 G's up, 1.5 G's aft and lateral, and 4.5 G's down unless otherwise specified (see Section 6). There will be a minimum of two tiedown provisions on each of the longest sides and a minimum of one tiedown provision on each end of containers wider than 1524 mm (60 inches). Tiedown and towing provisions, when not in use, will not project beyond the envelope of the container.

### 3.3.4.3 Vertical Alignment and Stacking

Each container will be provided with alignment provisions on top and bottom in order to allow rapid and orderly stacking operations for containers of the same part number. These provisions will provide lateral and longitudinal restraint and will not interfere with forklift access. The container will be capable of supporting the superimposed weight of two like containers including the contents, or a number of like containers with contents stacked to a height of 4877 mm (192 inches), whichever is greater. Stacking interface dimensions will be identified on the container drawings for the cover and base.

### 3.3.4.4 Lateral Alignment

The container side will be a flush surface that allows containers to be butted up against one another and that there are no protrusions that could create snagging hazards.