

AEROSPACE RECOMMENDED PRACTICE

SAE ARP4898

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STANDS, SHIPPING AND STORAGE, AIRCRAFT ENGINES, REUSABLE

1. SCOPE:

This SAE Aerospace Recommended Practice (ARP) recommends design and test criteria for reusable shipping and storage stands for aircraft engines. An optional hard cover (enclosure) is also specified.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of all SAE Technical Reports shall apply.

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

TT-E-527	Enamel, Alkyd, Lusterless
TT-E-529	Enamel, Alkyd, Semigloss
MIL-P-23377	Primer Coatings, Epoxy - Polyamide, Chemical and Solvent Resistant
MIL-T-31000	Technical Data Packages, General
MIL-C-46168	Specification for Coating, Aliphatic Polyurethane, Chemical
MIL-P-53022	Agent Resistant Primer, Epoxy Coating, Corrosion Inhibiting, Lead and Chromate Free
MIL-P-53030	Primer Coating, Epoxy, Water Reducible, Lead and Chromate Free
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-209	Slings and Tiedown Provisions for Lifting and Tiedown of Military Equipment
MIL-STD-648	Design Criteria for Specialized Shipping Containers
MIL-STD-808	Finishes, Materials and Processes for Corrosion Prevention and Control in Support Equipment
MIL-STD-889	Dissimilar Metals
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities

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2.1 (Continued):

A-A-208	Ink, Marking, Stencil, Opaque (Porous and Non-Porous Surfaces)
FED-STD-101	Test Procedures for Packaging Material
FED-STD-595	Federal Standard Colors

2.2 ANSI Publications:

Available from ANSI, 11 West 42nd St., New York, NY 10036-8002.

ANSI/AWS D1.1 Structural Welding Code, Steel
ANSI/AWS D1.2 Structural Welding Code, Aluminum

3. REQUIREMENTS:

3.1 First Article Sample:

Before starting production, a sample of the finished stand shall be submitted for approval. The 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 stand shall be identified on drawings and specifications. Materials which are not covered by specifications or which are not specifically described shall be of the lightest practical weight and entirely suitable to meet all performance requirements. Unless specific materials are identified in Section 6, any suitable material may be considered for the primary stand construction.

3.2.1 Metals: Metal components shall be corrosion resistant or suitably processed to resist corrosion. Dissimilar metals as defined in MIL-STD-889 shall not be used in intimate contact unless suitably protected against electrolytic corrosion. 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 shall not be in intimate contact with the contained item. Materials and processes shall be selected to prevent galling.

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

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3.2.3 Standard, Commercial, and Qualified Parts: Standard, commercial, and qualified parts shall 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 provided they can be replaced by the standard parts (MS and AN) without alteration; corresponding standard part numbers are referenced in the parts list on the contractor's drawings; and commercial parts have passed environmental tests to ensure quality throughout the life cycle of the container.

3.2.4 Data Package: The procuring activity shall specify conceptual, developmental, or product drawings/data IAW MIL-T-31000 (see Section 6).

3.3 Design and Construction:

3.3.1 Internal Component Parts:

3.3.1.1 Mounting Provisions: Each stand shall 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 stand. The fasteners shall 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 shall be of the self-locking type with nonmetallic inserts. Safety wire shall be used only if the configuration of the component precludes self-locking fasteners.

3.3.1.2 Accessibility: The stand shall be designed so as to provide ready accessibility to the interior supports and shall 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 stand shall be designed so as to prevent damage to the item resulting from the tests of Section 4. Maximum allowable transmissibility and "G" levels imposed on the items by the tests of Section 4 shall be as described in the contract or purchase order (see Section 6). If consistent with the shock requirements and other design considerations, the recommended resonant frequency of the loaded suspended system in the major translational modes of vibration should be between 7 Hz and 10 Hz.

3.3.1.4 Isolators: If elastomeric isolators are used, each isolator shall be marked with its date of manufacture. This date shall be visible when the mount is installed. Elastomeric materials used in isolation mounts shall be capable of meeting the ozone and air-heat aging test specified in MIL-STD-648.

3.3.3 Stand Assembly:

3.3.3.1 Permanent Joints: All permanent fittings, seams, and joints, affecting structural stability of the stand, shall be welded, brazed, or bonded.

3.3.3.2 Cover Installation: As required by procuring agency and subject to standard oversize load restrictions.

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- 3.3.3.2.1 Cover Fastenings: Cover fasteners shall be either hand operated or require the use of only common hand tools, excluding torque wrenches, to open and close the cover. The closure fasteners if captivated to the cover section of the container shall not sustain damage when the cover is removed and placed on the floor in its normal attitude. The type of fastener shall 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 overcenter, 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, but must be wrenched, and may not be readily replaceable if damaged.
 - c. Nuts and Bolts (Noncaptive): These can be readily replaced if damaged, but must be wrenched, and might be misplaced or lost.
- 3.3.3.2.2 If a cover is not specified, then cargo tie down nets may not be used.
- 3.3.3.2.3 Installation Time: The time required to remove and reinstall the item and prepare the stand for shipment shall be the minimum practical.
- 3.3.4 Handling Provisions: Features provided for lifting, tie down, and towing shall be combined wherever practical or as specified by the procuring activity (see Section 6).
- 3.3.4.1 Lifting Ring, Eyes, or Lugs: Lifting rings, eyes, or lugs capable of withstanding the tests prescribed herein without failure or visible permanent distortion shall be provided for lifting the stand or major sections thereof with chains, hooks, or by a single overhead hook. These rings, eyes, or lugs shall 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, shall not project beyond the envelope of the stand. Rings and eyes shall have a minimum opening in accordance with MIL-STD-209.
- 3.3.4.1.1 Stand Lifting: Provisions for four point suspension of loaded rectangular stands shall be located on the stand base for all stands that exceed 68 kg (150 lb) loaded gross weight.
- 3.3.4.1.2 Cover/Section Lifting: Provisions for cover lifting shall be provided. Manual lifting provisions shall be provided when the cover/section weight and lift height are in accordance with MIL-STD-1472 unless otherwise specified.
- 3.3.4.2 Tie Down/Towing Provisions: Tie down/towing provisions shall be provided on the base and shall have a minimum opening in accordance with MIL-STD-209. The load-carrying capacity shall be in accordance with a 5.8.4 of MIL-STD-648. There shall be a minimum of two tie down provisions on each of the longest sides and a minimum of one tie down provision in each end of containers wider than 1524 mm (60 in). Tie down/towing provisions, when not in use, shall not project beyond the envelope of the container.