

**MIL-C-172C****8 DECEMBER 1968****SUPERSEDING****MIL-C-172B****15 DECEMBER 1963****MILITARY SPECIFICATION****CASES; BASES, MOUNTING; AND MOUNTS, VIBRATION  
(FOR USE WITH ELECTRONIC EQUIPMENT  
IN AIRCRAFT)**

*This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.*

**1. SCOPE**

**1.1 Scope.** This specification covers cases, mounting bases, and vibration mounts used to enclose and isolate electronic equipment in aircraft from external vibrations. This specification establishes the general requirements and dimensions thereof, defines the space limitations in aircraft therefor, and sets forth the performance and dimensional requirements thereof, in order to insure interchangeability.

**1.2 Classification.** Items covered by this specification are standard cases identified by MS part numbers, nonstandard cases, and mounting bases and vibration mounts of the following classes, as specified (see 3.1 and 6.2):

**Class A.**

**Mounting bases —** Mounting bases conforming to the performance, dimensional, and two-to-one load-carrying requirements of this specification, and identified by MS part numbers.

**Vibration mounts —** Vibration mounts conforming to the performance, dimensional, and two-to-one load-carrying requirements of this specification, and identified by MS part numbers.

**Class B.**

**Mounting bases —** Mounting bases conforming to the performance and dimensional requirements of this specification. Load-carrying capability can be two-to-one, or  $\pm 15$  percent with non-geometric center of gravity. Unless otherwise specified (see 6.2), the mounting bases are identified by individual nomenclature in accordance with the Joint Communication-Electronic Nomenclature System (AN) (see 6.8).

**Vibration mounts —** Vibration mounts conforming to the performance, dimensional, and  $\pm 15$  percent load-carrying requirements of this specification, and identified by MS part numbers.

**Class C.**

**Mounting bases —** Mounting bases conforming to the performance requirements of this specification. They can have individual electrical connectors and, unless otherwise specified (see 6.2), are identified by individual AN nomenclature (see 6.8).

**1.2.1 Identification.**

FSC 8975, 5340

**MIL-C-172C**

**1.2.1.1 Cases.** The MS part number for standard cases shall be as specified (see 3.1). Nonstandard cases shall be identified as specified (see 6.2).

**1.2.1.2 Mounting bases.** The MS part number for class A mounting bases shall be as specified (see 3.1). Unless otherwise specified (see 6.2), the nomenclature for classes B and C mounting bases will be established in accordance with the AN system (see 6.8).

**1.2.1.3 Vibration mounts.** The MS part number for vibration mounts shall be as specified (see 3.1).

**2. APPLICABLE DOCUMENTS**

2.1 The following specifications, standards, and publications, of the issue in effect on date of invitation for bids, form a part of this specification:

**SPECIFICATIONS****FEDERAL**

- PPP-B-566 — Boxes, Folding, Paperboard.
- PPP-B-575 — Box, Paper - Overlaid Veneer (Straparound Type).
- PPP-B-585 — Boxes; Wood, Wirebound.
- PPP-B-591 — Boxes, Fiberboard, Wood-Cleated.
- PPP-B-601 — Boxes, Wood, Cleated-Plywood.
- PPP-B-621 — Boxes, Wood, Nailed and Lock-Corner.
- PPP-B-636 — Boxes, Fiber.
- PPP-B-676 — Boxes, Set-Up, Paperboard.

**MILITARY**

- MIL-P-116 — Preservation, Methods of.
- MIL-B-4229 — Boxes; Paperboard Metal-Stayed.

MIL-S-4456 — Shock, Variable Duration, Method and Apparatus for.

MIL-C-5541 — Chemical Films for Aluminum and Aluminum Alloys.

MIL-W-6860 — Welding; Aluminum and Magnesium Alloys, Spot and Seam.

MIL-A-8625 — Anodic Coatings, for Aluminum and Aluminum Alloys.

MIL-B-10377 — Box, Wood, Cleated, Veneer, Paper Overlaid.

MIL-L-10547 — Liners, Case, Waterproof.

**STANDARDS****MILITARY**

MIL-STD-105 — Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129 — Marking for Shipment and Storage.

MIL-STD-130 — Identification Marking of U. S. Military Property.

MIL-STD-202 — Test Methods for Electronic and Electrical Component Parts.

(For MS military standards for cases, mounting bases, and vibration mounts covered by this specification, see Supplement-1 to this specification.)

**PUBLICATIONS****AIR FORCE-NAVY AERONAUTICAL**

Bulletin No. 148 — Specification and Standards; Use of.

(Copies of specifications, standards, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

**2.2 Other publications.** The following documents form a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

**CONSOLIDATED CLASSIFICATION COMMITTEE**  
Consolidated Freight Classification Rules.

(Application for copies should be addressed to the Consolidated Classification Committee, 202 Chicago Union Station, Chicago 6, Ill.)

### 3. REQUIREMENTS

**3.1 Military standards for individual cases, mounting bases, and vibration mounts.** All requirements specified herein apply to all cases, mounting bases, and vibration mounts covered by applicable MS military standards. Details or exceptions applicable to individual classes, sizes, and types are specified on the MS military standards listed in Supplement-1 to this specification. In the event of any conflict between this specification and the individual MS military standards, the latter shall govern (see 6.2).

**3.2 Qualification (applicable only to class A mounting bases and classes A and B vibration mounts).** Class A mounting bases and classes A and B vibration mounts furnished under this specification shall be a product which has passed the qualification inspection specified in 4.4 (see 6.3 and 6.3.1).

**3.3 Definitions.** For the purpose of this specification, the following definitions shall apply:

**3.3.1 Case.** A case is an enclosure for a removable electronic unit (chassis).

**3.3.2 Equipment.** An equipment is a case with a removable electronic unit (chassis) installed therein.

**3.3.3 Mounting base.** A mounting base is the base upon which the equipment is placed for vibration isolation. It consists of a supporting system which provides a mounting structure complete with integral vibration-isolating elements, or with detachable vibration mounts.

**3.3.4 Vibration mount.** A vibration mount is an individual unit-mounting device used in multiples to isolate equipment from vibrations.

**3.3.4.1 Cup-type.** A cup-type vibration

mount is a mount which exerts its support at a single point.

**3.3.4.2 Beam-type.** A beam-type vibration mount is a mount which exerts its support along a line. It is usually equivalent to two cup-type mounts.

**3.3.5 Mounted unit.** A mounted unit consists of an equipment (or mockup) mounted on a standard mounting base.

**3.3.6 Mockup.** A mockup is a dummy or simulated equipment which has the same weight, center of gravity, and geometry as an actual or possible equipment.

**3.4 Material.** Unless otherwise specified herein, material will be specified in the applicable equipment specification. Specifications and standards for all materials and parts, and Government certification and approval of processes and equipment which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with Publication 143. Acceptance or approval of any constituent material or part shall not be construed as a guaranty of the acceptance of the finished product. In the event of any conflict between this specification and the equipment specification, the latter shall govern.

**3.4.1 Protective treatment.** Material used in the construction of cases, mounting bases, and vibration mounts shall be resistant to, or protected against, environmental and climatic conditions, corrosion resulting from salt air, high humidity, and moisture, in a manner that will assure compliance with the performance requirements of this specification. The use of any protective coating that will crack, chip, or scale with age or extremes of atmospheric conditions is prohibited. The protective coating applied to the interior of the case shall be compatible with the cooling techniques utilized.

**MIL-C-172C****3.4.1.1 Protective coating for aluminum.**

Aluminum structural parts which do not need to be grounded or bonded shall be anodized in accordance with Specification MIL-A-8625 or shall receive an approved chemical film in accordance with Specification MIL-C-5541. A 2- to 5-minute immersion in a solution containing 5 to 10 percent chromic acid in water, and maintained at 49° to 60° C, may be used in lieu of anodizing; or a chemical film in accordance with Specification MIL-C-5541 may be used on parts fabricated from aluminum 1100, aluminum alloys 3003, 5052, 6053, 6061, 6063, 7072, or equally corrosion-resistant alloys. For aluminum structural parts which need to be electrically bonded or grounded, aluminum 1100, alloys 3003, 5052, 6053, 6061, 6063, 7072, or equally corrosion-resistant alloys, shall be used and shall not be anodized. A caustic dip with or without water-lacquer finish is satisfactory for the above-specified aluminum alloys.

**3.4.2 Dissimilar metals.** Dissimilar metals shall not be used in intimate contact unless suitably protected against electrolytic corrosion (see 3.6.3). When it is necessary that any combination of dissimilar metals be assembled, an interposing material compatible to each shall be used.

**3.4.2.1 Grouping of metals.** The grouping below is intended to serve as a guide in selecting materials to be used in electronic equipment and shall not be construed to waive requirements herein or in the individual equipment specification as to corrosion resistance of components and assemblies.

| I                              | II   | III  | IV  |
|--------------------------------|--|--|---|
| Magnesium alloys (most anodic) | Aluminum alloys<br>Zinc<br>Cadmium<br>Tin<br>Stainless steel | Zinc<br>Cadmium<br>Steel<br>Lead<br>Tin<br>Stainless steel | Copper and its alloys<br>Nickel and its alloys<br>Chromium<br>Stainless steel<br>Gold<br>Silver (most cathodic) |

**3.4.2.2 Application.** Unless specifically approved by the procuring, or qualifying (see 6.3 and 6.3.1) activity, all metals not listed in 3.4.2.1 shall be considered dissimilar with respect to one another and with respect to any of the materials listed. Except for zinc and cadmium, as listed in the second and third groups, contact between a member of one group and a member of any other group shall be considered dissimilar. Such contact shall not be made unless necessary, in which case it shall be demonstrated that the contact is not detrimental (see 3.6.3), or an interposing material shall be used which will be compatible to each metal. When reference is made to a metal in a particular group, the reference applies to the metal on the surface of the part; i.e., zinc means zinc castings as well as zinc electroplate, zinc hot-dip, or zinc metal-spray. Different metals in contact, even though similar, shall be employed in assemblies in such a manner that the smaller part is cathodic (or protected) and the larger part is anodic (or corroded) if any corrosion takes place. Care shall be exercised in using different aluminum alloys against each other or against differing materials.

**3.4.3 Bearing surfaces.** The mating bearing surfaces at the holding devices between case and mounting base shall be free of any protective coating that will result in a higher impedance path than that afforded by bare metal-to-metal contact.

**3.5 Design and construction.**

**3.5.1 Cases.** The sizes and mating dimensions of standard cases shall be as specified (see 3.1). The sizes and mating dimensions of nonstandard cases shall be determined by the specific application. Cases shall be so constructed that they cannot come free of the mounting base as a result of weaknesses in the construction of the cases, when tested as specified in 4.6.5.

**3.5.1.1 Case form.** Outline dimensions for cases, as specified (see 3.1), do not prevent the outline from including irregular forms.

such as rotating machinery, filters, junction boxes, louvers up to  $\frac{1}{4}$  inch on each side, or similar elements located outside the case proper. No part of such forms, however, shall project outside the case dimensions specified (see 3.1 and 6.7). Rounded corners of the case will be permitted.

**3.5.1.2 Handles.** Handles or other suitable means shall be provided for handling the equipment, particularly during mounting and removal.

**3.5.1.3 Panel protection.** Means shall be provided for protecting any operating controls, meters, etc., when the unit is placed face downward for service. Handles located on the front of the equipment may be used for this purpose.

**3.5.1.4 Shielding.** The number of mechanical discontinuities in the case, such as covers, inspection plates, front plates, joints, etc. shall be kept to the minimum. All necessary mechanical discontinuities in the case shall be made electrically continuous across the interface of the discontinuity so as to provide a low-impedance current path, not only to lower but also to very-high frequencies and higher.<sup>1</sup> When ventilation openings are necessary, expanded mesh perforations or bonded screening of suitable conducting materials shall be used to cover all louvers and other apertures. Mesh used shall have low-impedance electrical continuity with the case around the entire periphery of the mesh.

**3.5.1.5 Electrical connections.** Electric plugs and receptacles may be placed either on the front or on the rear of the case, or in both locations, and on the mounting base. If electric receptacles are on the front of the case, the plugs shall be separate units. If electric plugs and receptacles are placed at the rear of the case, at least one unit shall be securely attached to the case or chassis, the other may be separate or may be securely attached to the

mounting base. Plugs shall not project beyond the specified limiting dimensions for the mounting bases (see fig. 1). That portion of the electric plug and receptacle group which is part of the mounting base shall be removable to provide interchangeability of mounting bases. The case shall be designed to accommodate that portion of the electric plug and receptacle group which is part of the removable chassis, and shall be recessed to avoid projections which may be subject to damage when the equipment is placed on its rear face. When the chassis is withdrawn, live contacts shall not be exposed in a manner that would be dangerous. When electrical connections are made at the rear of an equipment, the arrangement for attaching the interconnecting cables shall be such that the space required for installation shall not exceed that shown on figure 1. Electrical connections between resiliently mounted equipment and mounting bases shall not significantly reduce the isolation efficiency of the unit (see 3.6.6).

**3.5.2 Mounting bases.** Except for class C, mounting bases shall conform to the details and dimensions specified (see 3.1). All mounting bases shall comply with the performance requirements of this specification.

**3.5.2.1 Safety wiring.** Safety wiring, passing through holes provided for that purpose in the thumb nuts or wing nuts of the fastener assembly and in the mounting base, shall be used to prevent loosening thereof under vibration.

**3.5.3 Bonding jumpers.** Bonding jumpers shall be provided for conducting a path around vibration mounts or other mating parts.<sup>2</sup> The bonding jumpers shall be flat, unbraided, beryllium copper, or phosphor-bronze silver-plated, or cadmium-plated metal strip having a width-to-length ratio of not less than 1 to 5. When required for class C installations, bonding jumpers may be braided (see 6.2). Unless otherwise specified (see 3.1), a minimum of four bonding jumpers, preferably located at the four corners of the mounting base, shall be provided.

<sup>1</sup> A multiple-point, spring-loaded, contact interface is suggested as a desirable method for obtaining electrical continuity.

MIL-C-172C

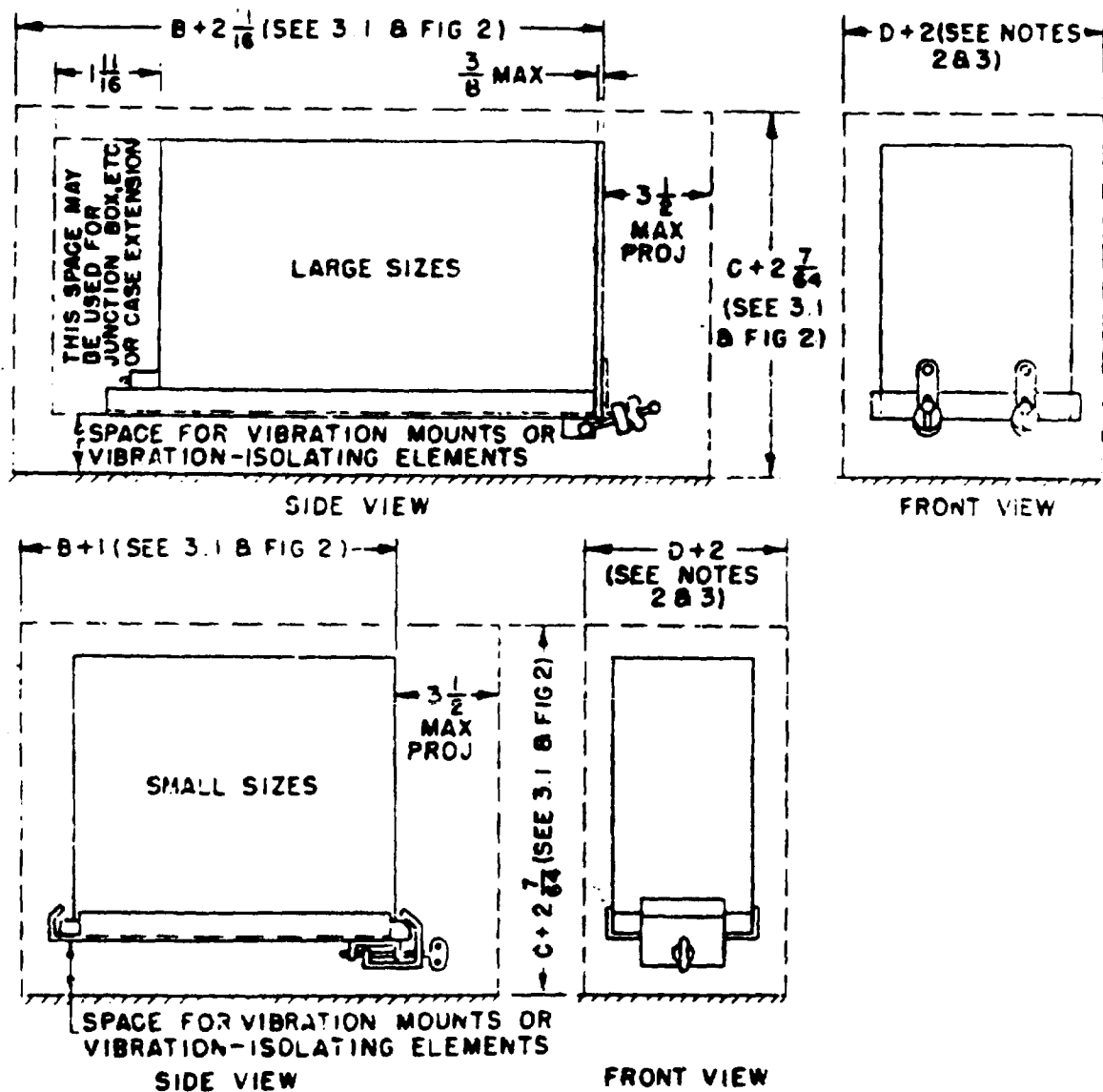


FIGURE 1. Assembly and installation space (large and small cases and mounting bases).

1. All dimensions in inches.
2. Dotted lines indicate maximum envelope, which includes case size, clearance for sway, and space for cable radius. (See 3.1 and fig. 2.)
3. If the horizontal envelope in the "D" dimension cannot be maintained for the tall, narrow cases, other methods of remaining within the envelope shall be employed. (See 3.1 & FIG 2.)



**3.5.4 Vibration mounts.** Class A vibration mounts shall be so designed as to comply with the applicable MS military standard (see 3.1), and the performance requirements of this specification. Class B vibration mounts shall be so designed as to comply with the applicable MS military standard (see 3.1), and the performance requirements of this specification when isolating any specific equipment mounted on a standard mounting base complying with this specification.

### 3.6 Performance.

**3.6.1 Loaded height.** The loaded height of mounting bases and vibration mounts at minimum rated load shall be as specified (see 3.1). The deflection of mounting bases and vibration mounts from minimum rated load to maximum rated load shall be the manufacturer's rated deflection  $\pm 0.30$  inch (see 4.6.3.1).

#### 3.6.2 Bonding.

**3.6.2.1 Case with mounting base.** When measured as specified in 4.6.3.2.1, the direct-current (dc) resistance shall not exceed 11 milliohms.

**3.6.2.2 Mounting base.** When measured as specified in 4.6.3.2.2, the dc resistance shall not exceed 6 milliohms.

**3.6.3 Salt spray (corrosion).** When cases, mounting bases, and vibration mounts are tested as specified in 4.6.3.3, there shall be no looseness, warping, cracking, excessive corrosion, or other damage. Excessive corrosion shall be construed as being any type of corrosion which in any way interferes with the mechanical performance of cases, mounting bases, or vibration mounts, or increases the electrical impedance between the mating parts.

**3.6.4 Stry space and snubbing.** When tested as specified in 4.6.3.4, the mounted unit shall meet the following requirements:

- (a) No part of the equipment or mock-up shall move from its normal position by more than the amount shown on figure 2.
- (b) The cushioned stop or safety device shall become operative.
- (c) There shall be no contact other than between snubber cushions.
- (d) There shall be no failure of, or damage to, the mounting bases or vibration mounts.

### 3.6.5 Fatigue (see 4.6.4.1).

**3.6.5.1 Cycling.** When the mounted unit is tested as specified in 4.6.4.1.1, there shall be no evidence of damage to vibration mounts, nor shall there be repetitive bouncing between snubber cushions. Transmissibility in each direction shall be not more than that shown on figure 3.

**3.6.5.2 Resonance.** When the mounted unit is tested as specified in 4.6.4.1.2, there shall be no evidence of damage to vibration mounts, nor shall there be repetitive bouncing between snubber cushions. Transmissibility at resonance shall not exceed five.

### 3.6.6 Isolation efficiency (see 4.6.4.2).

**3.6.6.1 At room temperature after  $85^{\circ} \pm 2^{\circ}$  C storage.** When the mounted unit is tested as specified in 4.6.4.2.1, the transmissibility in each direction shall be not more than that shown on figure 3.

**3.6.6.2 At  $-55^{\circ} \pm 2^{\circ}$  C.** When the mounted unit is tested as specified in 4.6.4.2.2, the transmissibility in each direction shall be not more than that shown on figure 3.

**3.6.6.3 At  $-65^{\circ} \pm 2^{\circ}$  C.** When the mounted unit is tested as specified in 4.6.4.2.3, there shall be no evidence of damage to the mounting base or vibration mounts.

**3.6.6.4 At room temperature.** When the mounted unit is tested as specified in 4.6.4.2.4,

MIL-C-172C

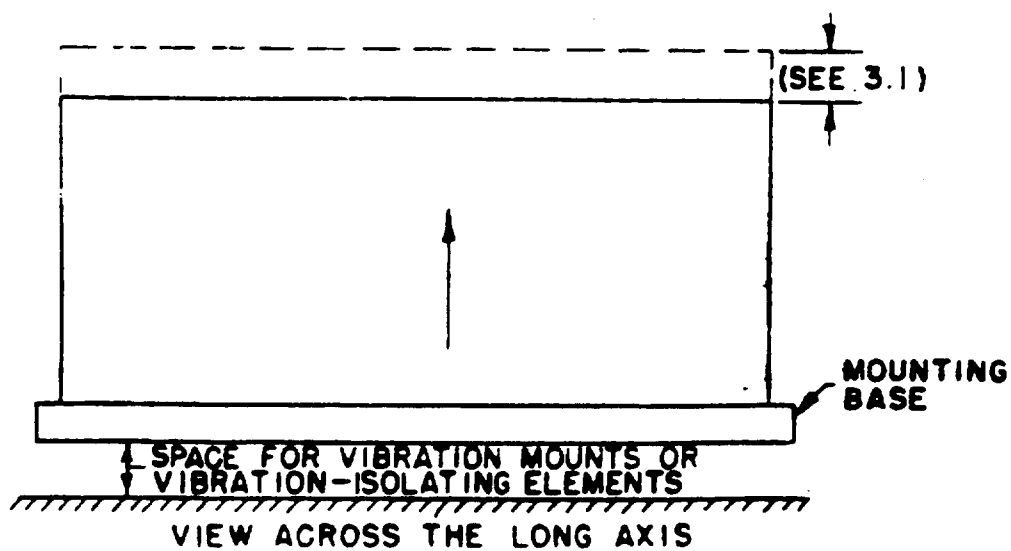
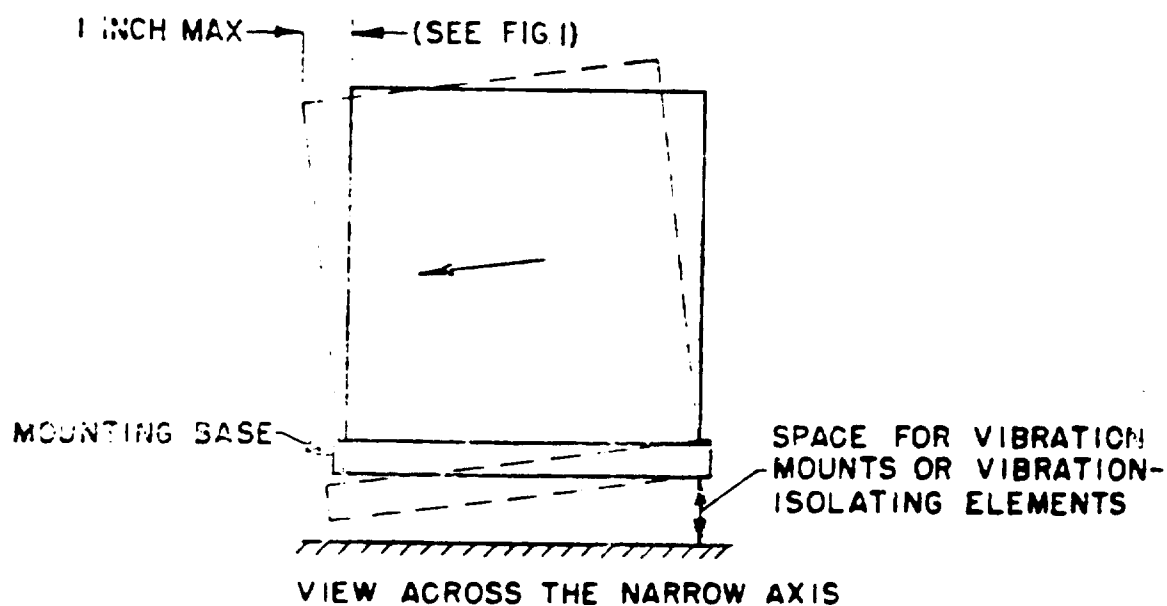


FIGURE 2. Sway space for mounting bases.



the transmissibility in each direction shall be not more than that shown on figure 3.

**3.6.6.5 At high frequencies.** When the mounted unit is tested as specified in 4.6.4.2.5, the transmissibility in each direction shall be not more than that shown on figure 3.

**3.6.7 Shock (see 4.6.5).**

**3.6.7.1 Step 1.** When the mounted unit is tested as specified in 4.6.5.1, there shall be no mechanical failure of the mounting base, vibration mounts, or any of the holding devices.

**3.6.7.2 Step 2.** When the mounted unit is tested as specified in 4.6.5.2, the isolation efficiency at room temperature shall be as specified in 3.6.6.4.

**3.6.7.3 Step 3.** When the mounted unit is tested as specified in 4.6.5.3, there shall be no separation of the unit from the supporting structure due to failure of the resilient medium, or due to weakness in design or construction of the mounting base or vibration mounts, nor shall the case come free of the mounting base. Bending or distortion of the mounting base or vibration mount is permitted.

**3.7 Identification marking.** Cases, mounting bases, and vibration mounts shall be marked in accordance with Standard MIL-STD-130 and as specified in 3.7.1 to 3.7.3, inclusive, as applicable. The marking shall be formed in the metal of the item or formed on an attached metal nameplate.

**3.7.1 Cases.** The MS part number shall be marked on the top of standard cases, centered approximately 1 inch from the front. For nonstandard cases, the marking shall be as specified (see 6.2).

**3.7.2 Mounting bases.** The MS part number and load range for class A mounting bases shall be marked as specified (see 3.1). For

classes B and C mounting bases, the assigned AN nomenclature (see 6.8) shall be marked as specified (see 6.2).

**3.7.3 Vibration mounts.** The MS part number, and load range or specific load as applicable, shall be marked as specified (see 3.1).

**3.8 Workmanship.** Cases, mounting bases, and vibration mounts shall be manufactured and processed in a careful and workmanlike manner, in accordance with good design and sound practice. Where welding is required it shall be done in accordance with Specification MIL-W-8860.

#### 4. QUALITY ASSURANCE PROVISIONS

**4.1 Classification of inspection.** The examination and testing of cases, mounting bases, and vibration mounts shall be classified as follows:

- (a) For cases:
  - 1. Acceptance inspection (see 4.5.1).
- (b) For mounting bases and vibration mounts:
  - 1. Qualification inspection. (see 4.4).
  - 2. Acceptance inspection. (see 4.5.2).

**4.2 Inspection conditions.** Unless otherwise specified herein, all inspection shall be made at room ambient temperature, pressure, and humidity. In case of dispute, the referee condition shall be  $23 \pm 1.1^\circ \text{C}$  and  $50 \pm 4$  percent relative humidity.

**4.3 Test equipment and inspection facilities.** Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required acceptance inspection. The manufacturer shall establish adequate calibration of test equipment to the satisfaction of the Government.

MIL-C-172C

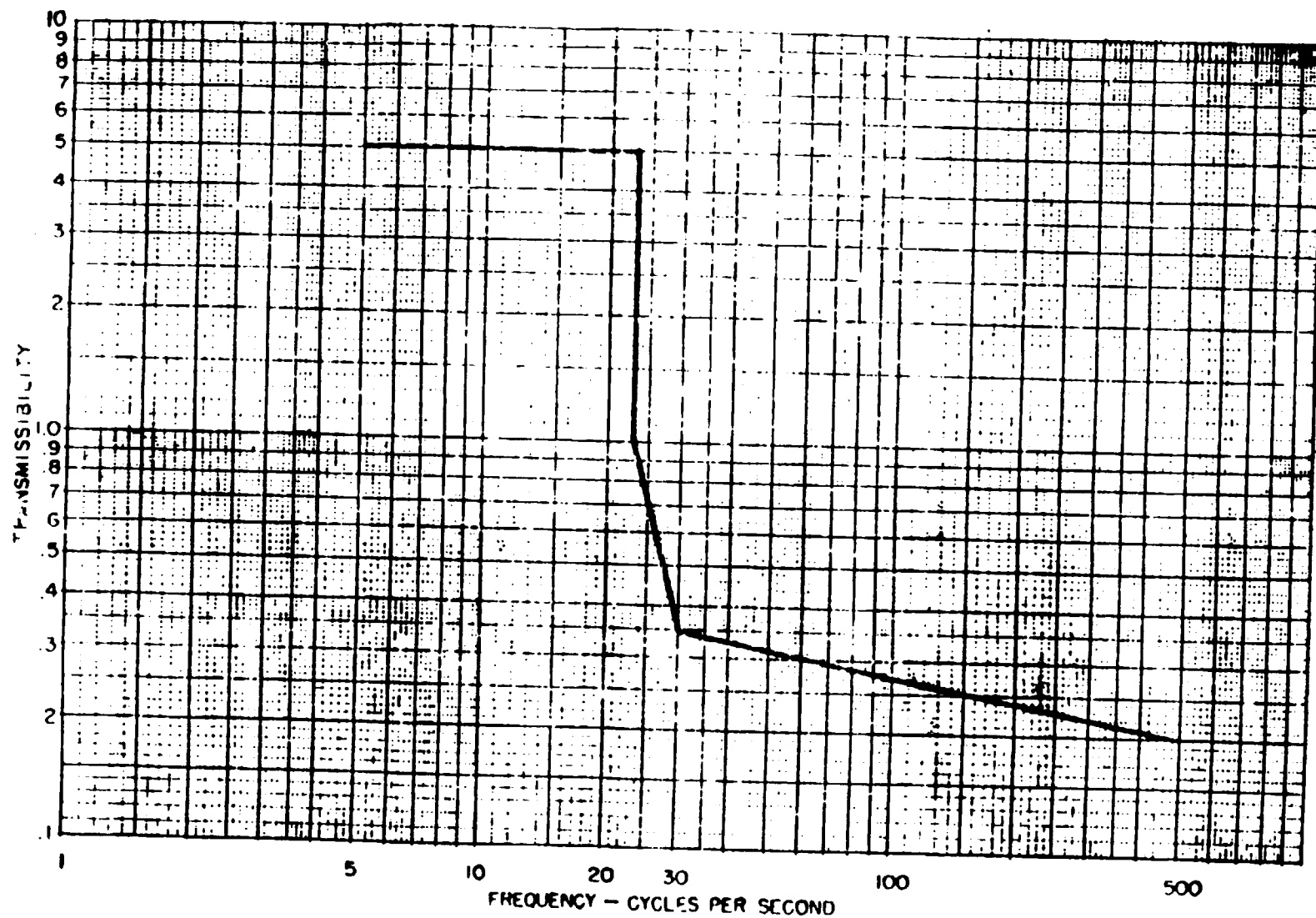


FIGURE 3. Isolation efficiency.

MIL-C-172C

4.4 Qualification inspection (applicable only to class A mounting bases and classes A and B vibration mounts).

4.4.1 *Sample.* The number of specimens comprising a sample of mounting bases and vibration mounts to be submitted for qualification inspection shall be as specified in the appendix to this specification.

4.4.2 *Inspection routine.* The specimens will be subjected to the examinations and tests specified in table I, in the order shown. All

TABLE I. Qualification inspection (applicable only to class A mounting bases and classes A and B vibration mounts).

| Examination or test                           | Requirement paragraph  | Method paragraph            |
|---|--|-----------------------------|
| <b>Group I</b>                                |  |                             |
| Visual and dimensional examination.           | 3.1, 3.4 to 3.4.3, incl,<br>3.5 to 3.5.4, incl, and 3.7 to 3.8, incl | 4.6.2                       |
| <b>Group II</b>                               |  |                             |
| Loaded height                                 | 3.6.1  | 4.6.3.1                     |
| <b>Group III</b>                              |  |                             |
| Bonding                                       | 3.6.2.2  | 4.6.3.2<br>and<br>4.6.3.2.2 |
| Salt spray (corrosion).                       | 3.6.3  | 4.6.3.3                     |
| Sway space and snubbing.                      | 3.6.4  | 4.6.3.4                     |
| <b>Group IV</b>                               |  |                             |
| Fatigue:                                      | 3.6.5  | 4.6.4.1                     |
| Cycling                                       | 3.6.5.1  | 4.6.4.1.1                   |
| Resonance                                     | 3.6.5.2  | 4.6.4.1.2                   |
| Isolation efficiency:                         | 3.6.6  | 4.6.4.2                     |
| At room temperature after 35° ± 2° C storage. | 3.6.6.1  | 4.6.4.2.1                   |
| At -55° ± 2° C                                | 3.6.6.2  | 4.6.4.2.2                   |
| At -65° ± 2° C                                | 3.6.6.3  | 4.6.4.2.3                   |
| At room temperature                           | 3.6.6.4  | 4.6.4.2.4                   |
| At high frequencies                           | 3.6.6.5  | 4.6.4.2.5                   |
| <b>Group V</b>                                |  |                             |
| Shock   | 3.6.7  | 4.6.5                       |

specimens, as furnished, either individual mounting bases or vibration mounts, will be subjected to the examinations and test of groups I and II. When individual vibration mounts are furnished, they shall then be mounted in three mounting bases conforming to the applicable MS military standard. One mounting base, either as furnished or as assembled, will be subjected to the tests of group III, the second to the tests of group IV, and the third to the group V test.

4.4.3 *Failure.* Any failure will be cause for refusal to grant qualification.

#### 4.5 Acceptance inspection.

4.5.1 *Cases.* Cases shall be inspected as an integral part of the system of which they form a part. The inspection shall include visual and dimensional examination, bonding, sway space and snubbing, as specified in 4.6.2, 4.6.3.2 and 4.6.3.2.1, and 4.6.3.4, respectively; and salt spray (corrosion) (see 4.6.3.3) and construction for which inspection may be made as part of the applicable portion of the equipment specification. The inspection shall be considered minimum and does not preclude additional inspection when such inspection is included in the applicable equipment specification of which this specification forms a part.

4.5.2 *Mounting bases and vibration mounts.* Acceptance inspection for mounting bases and vibration mounts shall consist of groups A and B.

4.5.2.1 *Inspection lot.* An inspection lot shall be as specified in Standard MIL-STD-105.

4.5.2.2 *Resubmitted lots.* If an inspection lot is rejected, the manufacturer may rework the lot or screen out defectives and resubmit it for acceptance inspection. Resubmitted lots shall be kept separate from new lots. The resubmitted lot shall be inspected, using tightened inspection.

## MIL-C-172C

**4.5.2.3 Group A inspection.** Group A inspection shall consist of visual and dimensional examination (see 4.6.2). Statistical sampling and inspection shall be in accordance with Standard MIL-STD-105. The acceptable quality levels (AQL) shall be 1.0 and 4.0 (percent defective) for major and minor defects, respectively. Major and minor defects shall be as defined in Standard MIL-STD-105.

**4.5.2.4 Group B inspection.** Group B inspection shall be the loaded-height test (see 4.6.3.1).

**4.5.2.4.1 Sampling procedure.** The sampling procedure shall be in accordance with the appendix to Standard MIL-STD-105. Unless otherwise specified herein, normal inspection shall be used at the start of the contract. The reduced inspection procedure shall be R-1. The AQL shall be 6.5 (percent defective) and the inspection level shall be L7 for normal inspection and L5 for reduced inspection.

**4.5.2.4.2 Disposition of sample units.** Sample units which have passed all the group B inspection shall be delivered on the contract or order, if the lot is accepted.

### 4.6 Methods of examination and test.

#### 4.6.1 Preparation for test.

**4.6.1.1 Test units.** The tests specified herein shall be performed on mounted units consisting of equipments (or mockups) mounted directly upon standard mounting bases conforming to the applicable MS military standards. All bonding means provided in the bases shall be in normal operating positions during test. Equipments (or mockups) are used as part of the test unit only for the purpose of applying the load or measuring the result; they are not items subject to test in themselves.

**4.6.1.1.1 Mockups.** A mockup, having the same weight, center of gravity, and geometry as an actual or possible equipment, shall be placed upon the applicable mounting base and,

thus mounted, shall be used in tests of the vibration mounts as a substitute for the actual equipment. The dimensions of the mockup shall be such as to enable it to fit into the applicable mounting base. Figure 4 delineates mockups that fill these requirements, and may be used as such to determine compliance with this specification. Where no specific equipment is referenced, the mass shall be approximately uniformly distributed about the center of gravity.

**4.6.1.1.1.1 For class A mounting bases and vibration mounts.** The dynamic tests (see 4.6.4) shall be made with a total mockup weight equal to the minimum load in the specified range, or with a total mockup weight equal to the maximum load in the specified range, or both, as specified in the individual test method. For these tests, the center of gravity shall be located in the geometric center of the mockup.

**4.6.1.1.1.2 For class B vibration mounts.** The dynamic tests (see 4.6.4) shall be made with a total mockup weight equal to the weight of the equipment or with the equipment itself (see 4.6.1.1.1), and with the total weight equal to the specified load minus 15 percent, or with the total weight equal to the specified load plus 15 percent, or both, as specified in the individual test method. For these tests, the center of gravity shall be approximately located horizontally equidistant from the mounts and vertically in the center of the mockup.

**4.6.2 Visual and dimensional examination.** Cases, mounting bases, and vibration mounts shall be inspected to verify that the materials, design, construction, physical dimensions, identification marking, and workmanship are in accordance with the applicable requirements. (See 3.1, 3.4 to 3.4.3, incl, 3.5 to 3.5.4 incl, and 3.7 to 3.8 incl).

#### 4.6.3 Static tests.

**4.6.3.1 Loaded height.** The specified load (see 3.1) shall be applied in accordance with the manufacturer's recommended procedure.

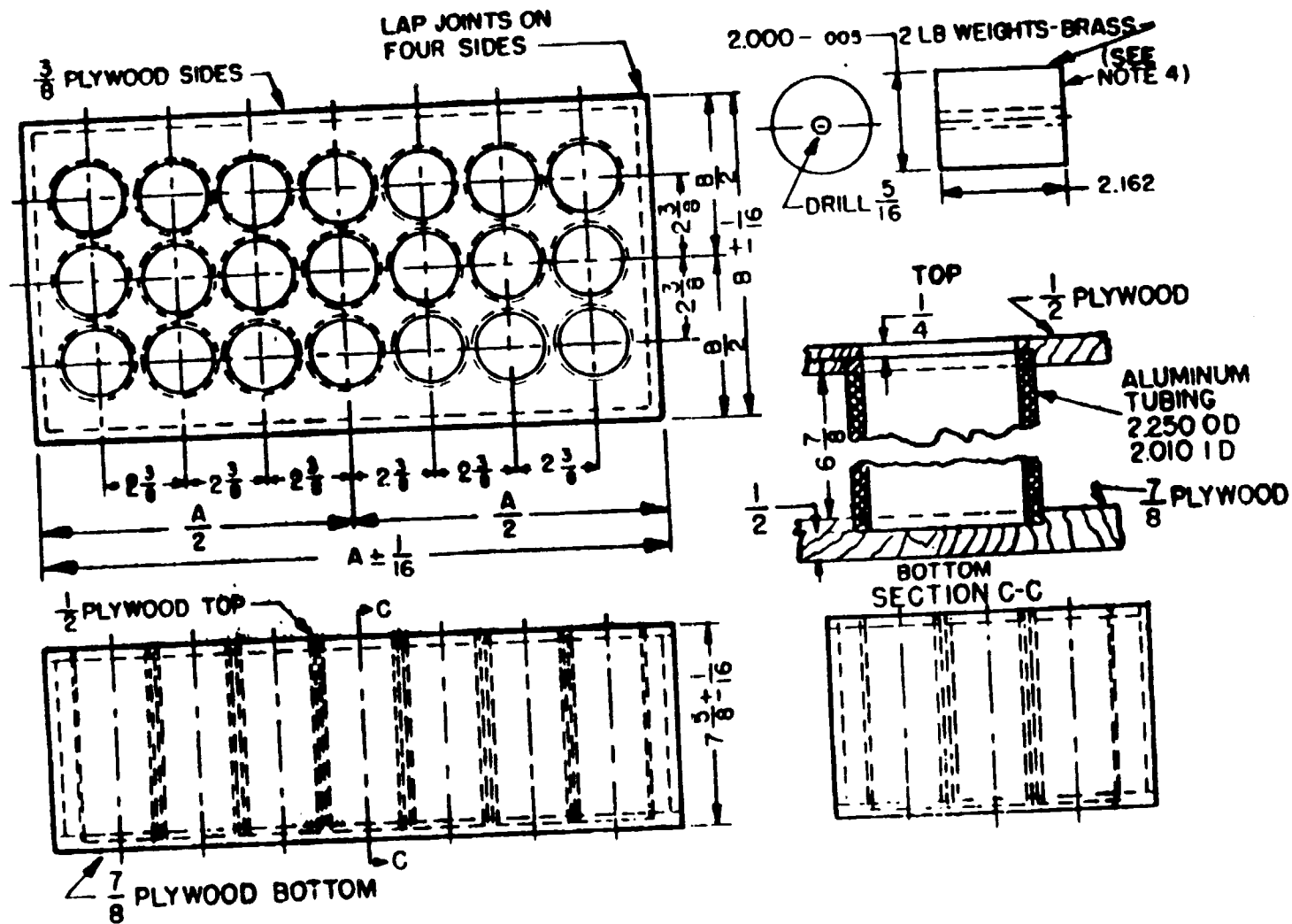


FIGURE 4. Test mockup.

MIL-C-172C

| Applicable<br>Mounting base | Mockup      |             |                  |                                 |                 |
|-----------------------------|-------------|-------------|------------------|---------------------------------|-----------------|
|                             | Dimensions  |             | Holes<br>per row | Number of<br>rows<br>lengthwise | Weight<br>range |
| MS part number              | A<br>Inches | B<br>Inches |                  |                                 | Pounds          |
| 'MS91404-S1                 | 9%          | 5%          | 3                | 1                               | 6-12            |
| 'MS91404-S2                 | 13%         | 4%          | 6                | 1                               | 10-22           |
| MS91406-A1R                 | 12%         | 4%          | 5                | 1                               | 8-18            |
| MS91406-B1B                 | 12%         | 10%         | 3                | 3                               | 18-40           |
| 'MS91406-A1D                | 19%         | 4%          | 7                | 1                               | 18-40           |
| 'MS91406-B1D1               | 19%         | 10%         | 5                | 3                               | 25-50           |
| MS91406-B1D2                |             |             |                  |                                 | 40-80           |
| MS91406-C1D                 | 19%         | 15%         | 5                | 3                               | 40-80           |

\* Add attachment flanges for cradles

1. All dimensions in inches.
2. Unless otherwise specified, tolerances are  $\pm 1/16$  on fractions and  $\pm .005$  on decimals.
3. Frame material shall be of Douglas-fir plywood; joints shall be secured by glue and brass flathead wood screws, properly countersunk.
4. To vary center of gravity in height, wood spacers of same dimensions as brass weights shall be used.

FIGURE 4. Test mockup (continued)

## MIL-C-172C

and the loaded height and deflection of the mounting bases or vibration mounts shall be noted and recorded (see 3.6.1).

**4.6.3.2 Bonding.** DC resistance shall be measured with an instrument having an accuracy of  $\pm 1.0$  percent. This test is applicable only when cases and mounting bases, or individual mounting bases, are submitted (see 3.6.2).

**4.6.3.2.1 Case with mounting base.** The case shall be mounted on the mounting base with the holding devices and bonding straps in place. The entire mounted unit shall then be mounted on a flat, bare-metal plate in a manner comparable to actual aircraft installation. The resistance shall be measured between the case and the metal plate (see 3.6.2.1).

**4.6.3.2.2 Mounting base.** The mounting base with the bonding straps in place shall be mounted on a flat, bare-metal plate in a manner comparable to actual aircraft installation. The resistance shall be measured between the holding devices and the metal plate (see 3.6.2.2).

**4.6.3.3 Salt spray (corrosion).** Cases, mounting bases, and vibration mounts shall be tested in accordance with method 101, test condition B, of Standard MIL-STD-202. After this test, they shall be visually examined for evidence of damage (see 3.6.3).

**4.6.3.4 Sway space and snubbing (see 3.6.4).** The mounted unit, with minimum rated load applied, shall be subjected to a force extending through the center of gravity of the equipment or mockup, along each of its three principal axes, in turn. This force shall be seven and one-half times the maximum weight of the equipment or mockup. At the conclusion of each application of force the following shall be noted and recorded:

- (a) The greatest distance the equipment or mockup moves from its normal position.

- (b) If the cushioned stop or safety device operates.

- (c) If there is contact other than between snubber cushions.

- (d) The amount of damage or failure sustained by the mounting base or vibration mounts.

#### 4.6.4 Dynamic tests.

**4.6.4.1 Fatigue.** Fatigue tests shall be performed at maximum rated load only.

**4.6.4.1.1 Cycling.** The mounted unit shall be rigidly mounted by normal mounting means on a vibration platform. A simple harmonic motion having a double amplitude of 0.06 inch shall be applied along the three principal axes of the mounting base. The frequency shall be varied uniformly between the approximate limits of 5 and 55 cycles per second (cps). The entire range of frequencies from 5 to 55 cps and return to 5 cps shall be traversed. All resonant frequencies shall be recorded. The transmissibility shall then be determined (see 3.6.5.1).

**4.6.4.1.2 Resonance.** This test should be performed with a mockup (not an actual equipment) mounted on the mounting base. The mounted unit shall be vibrated for 2 hours in each of the directions specified in 4.6.4.1.1 at a double amplitude of 0.06 inch and at the predominant resonant frequency for each direction determined by this test. The transmissibility shall then be determined (see 3.6.5.2).

**4.6.4.2 Isolation efficiency.** The mounted unit shall be rigidly mounted on a vibration platform by its normal mounting means and in its normal attitude. An input of simple harmonic motion shall be applied along each of the three mutually perpendicular principal axes of the mounting base, in turn. The frequency shall be varied uniformly between the approximate limits of 5 and 55 cps. The entire range of frequencies from 5 to 55 cps and return to 5 cps shall be traversed. The vibration amplitude and the rated load shall



## MIL-C-172C

be as specified in 4.6.4.2.1 to 4.6.4.2.5, inclusive, as applicable. The output shall be measured along each of the three mutually perpendicular axes of the mounted unit, for each of the three directions of input. The transmissibility shall then be determined. Where pickups are used, the sensitive elements shall be located within  $\frac{3}{4}$  inch of the upper corners of the mounted unit.

**4.6.4.2.1 At room temperature after  $85^{\circ} \pm 2^{\circ} \text{C}$  storage.** The mounted unit shall be exposed to air at a temperature of  $85^{\circ} \pm 2^{\circ} \text{C}$  for 240 hours continuously. Then the temperature shall be reduced to room temperature and after the mounted unit has reached thermal stability, it shall be tested as specified in 4.6.4.2, at maximum and minimum rated loads and at double amplitudes of 0.02 and 0.06 inch (see 3.6.6.1).

**4.6.4.2.2 At  $-55^{\circ} \pm 2^{\circ} \text{C}$ .** The mounted unit shall be exposed to air at a temperature of  $-55^{\circ} \pm 2^{\circ} \text{C}$ , for 3 hours continuously,

after reaching thermal stability. It shall then be tested, at  $-55^{\circ} \pm 2^{\circ} \text{C}$ , as specified in 4.6.4.2, at minimum rated load and at a double amplitude of 0.02 inch (see 3.6.6.2).

**4.6.4.2.3 At  $-65^{\circ} \pm 2^{\circ} \text{C}$ .** The mounted unit shall be exposed to air at a temperature of  $-65^{\circ} \pm 2^{\circ} \text{C}$  for 3 hours continuously, after reaching thermal stability. It shall then be tested, at  $-65^{\circ} \pm 2^{\circ} \text{C}$ , as specified in 4.6.4.2, for 15 minutes along each axis, at maximum rated load and at a double amplitude of 0.02 inch. The output need not be measured during this test. After this test, the mounting base and vibration mounts shall be examined for evidence of damage (see 3.6.6.3).

**4.6.4.2.4 At room temperature.** The mounted unit shall be exposed to room temperature until thermal stability is reached, then tested as specified in 4.6.4.2 at maximum rated load and at a double amplitude of 0.02 inch (see 3.6.6.4).

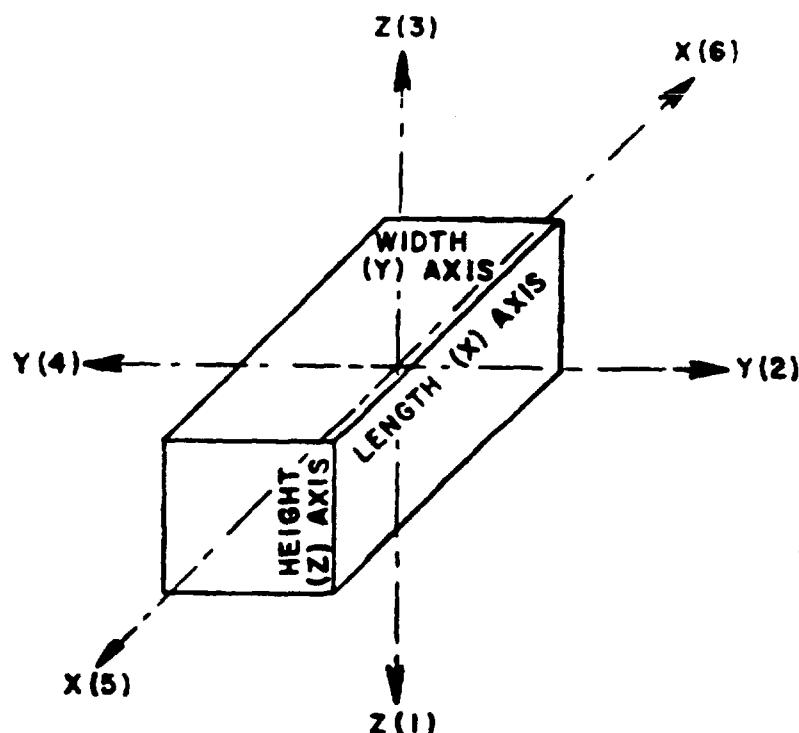


FIGURE 5. Numerical order and orientation of shock.

## MIL-C-172C

4.6.4.2.5 *At high frequencies.* The mounted unit shall be tested, at room temperature and at minimum rated load, as specified in 4.6.4.2, except that the frequency shall be varied at the rate of not more than 0.5 cycle per second per second between the approximate limits of 55 and 500 cps. The input shall be applied in the vertical axis (relative to the mounting base) only. The amplitude of vibration shall be equivalent to  $10 \pm 1$  gravity units (G) (see 3.6.6.5).

4.6.5 *Shock.* The mounted unit, at maximum rated load, shall be secured by its normal mounting means to the apparatus as specified in Specification MIL-S-4456, and tested as specified in 4.6.5.1 to 4.6.5.2, inclusive.

4.6.5.1 *Step 1.* Two groups of three impact shocks shall be applied along each of the three principal axes in the numerical order shown on figure 5 (a total of 18 shocks). Direction of shocks of each group applied to the unit shall be so oriented that both senses along each of the axes are represented. For each shock the mounted unit shall be accelerated in such a manner that during the first 11 milliseconds the peak acceleration shall be 15 G. The mounted unit shall then be examined for mechanical failure (see 3.6.7.1).

4.6.5.2 *Step 2.* The mounted unit shall then be removed from the apparatus and subjected to the test specified in 4.6.4.2.4 (see 3.6.7.2).

4.6.5.3 *Step 3.* Step 1 shall be repeated with the following exceptions:

- (a) Only two groups of two impact shocks (a total of 12 shocks) shall be applied.
- (b) During the first 11 milliseconds, the peak acceleration shall be 30 G.
- (c) The front clamps may be tightened after each shock.

The mounted unit shall then be examined for damage (see 3.6.7.3).

## 5. PREPARATION FOR DELIVERY

## 5.1 Preservation and packaging (see 6.2).

5.1.1 *Level A.* Cases, mounting bases, and beam-type vibration mounts shall be individually cartoned in accordance with method III of Specification MIL-P-116. Cartons or boxes shall conform to Specification PPP-B-566, PPP-B-676, or MIL-B-4229. Cup-type vibration mounts shall be unit-packaged in accordance with method III of Specification MIL-P-116, in the quantities specified (see 6.2).

5.1.2 *Level C.* Cases, mounting bases, and vibration mounts shall be afforded preservation and packaging in accordance with the manufacturer's normal commercial practice.

## 5.2 Packing (see 6.2).

5.2.1 *Level A.* Cases, mounting bases, and vibration mounts packaged as specified (see 6.2) shall be packed in type II straparound, wirebound wood (for class 3 use), wood-crested fiberboard, wood-crested plywood (overseas type), nailed wood, corrugated or solid fiberboard (class 2, grade 3 or better), or wood-crested paper-overlaid (overseas type) boxes conforming to Specification PPP-B-575, PPP-B-585, PPP-B-591, PPP-B-601, PPP-B-621, PPP-B-636, and MIL-B-10377, respectively. Shipping containers shall have case liners conforming to Specification MIL-I-10547 and appendix thereto. Case liners for boxes conforming to Specification PPP-B-636 may be omitted provided all joints of the boxes are sealed with tape as specified in the box specification. Box closures shall be as specified in the appendix of the applicable box specification. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

5.2.2 *Level B.* Cases, mounting bases, and vibration mounts packaged as specified (see 6.2) shall be packed in domestic-type wirebound wood, wood-crested fiberboard, wood-crested plywood, nailed wood, corrugated or

**MIL-C-172C**

solid fiberboard, or wood-clear paper-overlaid boxes conforming to Specifications PPP-B-585, PPP-B-591, PPP-B-601, PPP-B-621, PPP-B-636, and MIL-B-10377, respectively. Box closures shall be as specified in the applicable box specification or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

**5.2.3 Level C. Cases, mounting bases, and vibration mounts packaged as specified (see 6.2) shall be packed in containers of the type, size, and kind commonly used for the purpose, in a manner that will insure acceptance by common carrier and safe delivery at destination. Shipping containers shall comply with the Consolidated Freight Classification Rules, or regulations of other carriers as applicable to the mode of transportation.**

**5.2.4 General.** Insofar as possible and practical, exterior containers shall be uniform in shape and size, and shall be of minimum cube and tare consistent with the protection required.

**5.3 Marking.** In addition to any special marking required by the contract or order, interior packages and exterior shipping containers shall be marked in accordance with Standard MIL-STD-129 (see 6.2).

**6. NOTES**

**6.1 Intended use.** Long-stud vibration mounts (for flat mounting) are intended for use in instrument panels, center-of-gravity systems, etc. Vibration mounts covered by this specification are not intended for use in electronic equipment in helicopters.

**6.2 Ordering data.** Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) For standard cases, the title, number, and date of the applicable MS

military standard, and the complete MS part number (see 1.2, 1.2.1.1, and 3.1). Identification and marking for nonstandard cases (see 1.2.1.1 and 3.7.1).

- (c) For class A mounting bases, the title, number, and date of the applicable MS military standard, and the complete MS part number (see 1.2, 1.2.1.2, and 3.1).

- (d) For vibration mounts, the title, number, and date of the applicable MS military standard, the class, and the complete MS part number (see 1.2, 1.2.1.2, and 3.1).

- (e) When necessary, instructions for obtaining AN nomenclature for classes B and C mounting bases (see 1.2, 1.2.1.2, and 6.8).

1. Method of marking (see 3.7.2).

- (f) When necessary, designation other than AN nomenclature for classes B and C mounting bases (see 1.2 and 1.2.1.2).

- (g) When required, provision for other than flat-metal bonding jumpers (see 3.5.3).

- (h) That the manufacturer shall not substitute for a specified or a previously approved material or fabricated part unless he obtains approval for such substitution from the procuring activity. Evidence to substantiate his claim that such a substitute is suitable shall be submitted with his request. Similar notification and substantiating evidence shall be submitted at any later time if substitution becomes necessary or desirable. At the discretion of the procuring activity, a test sample may be required to prove the suitability of the proposed substitute.

- (i) That, when equipment is shipped mounted on mounting bases, the vibration mounts therein shall be

MIL-C-172C

blocked out to protect them against damage in transit.

- (j) Quantity of cup-type vibration mounts to be included in a unit package (see 5.1.1).
- (k) Levels of preservation and packaging and packing, and applicable marking (see sect 5).

**6.2.1 For items not requiring qualification inspection.** The contract or order should specify that samples of cases, and mounting bases not requiring qualification inspection, be required; and that these samples will be in quantity the same as the quantity of qualification samples, and be subjected to the examinations and applicable tests of the qualification-inspection procedure to determine compliance with this specification. The invitation for bids and the contract or order should specify the location for this inspection.

**6.2.2 Indirect shipments.** The packaging, packing and marking specified in section 5 apply only to direct purchases by or direct shipments to the Government and are not intended to apply to contracts or orders between the manufacturer and prime contractor.

**6.3 Qualification.** With respect to products requiring qualification, awards will be made only for such products as have, prior to the bid opening date, been inspected and qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date.

**6.3.1** The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, inspected for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products covered by this specification may be obtained from the Armed Services Electro-Standards Agency (ASESA), Fort Monmouth, N. J.

**6.4 Construction.** This specification is not intended to be restrictive with respect to the details of construction, except where such details are specified, but is intended to establish mating dimensions, case sizes, and space requirements for electronic equipment in aircraft. Alternate forms of construction will be considered, provided the bid clearly describes the specific points in which the proposed construction differs from that described herein, and provided that all other requirements of this specification are met. When exceptions are not clearly described and indicated as such, it will be assumed that bidders are offering units that are in strict conformance with the requirements of this specification.

**6.5 Pressurized and sealed units.** This specification does not limit the form of cases or mounting bases of pressurized or hermetically sealed units.

**6.6 Installation space.** Figure 1 indicates the space available for installation in aircraft. Standard cases, mounting bases, and vibration mounts fitting into the space allotted thereon are specified on the applicable MS military standards (see 3.1).

**6.7 Space utilization.** It is preferred that maximum utilization of the space provided by a standard case size be made before increasing outline dimensions. This caution should be exercised particularly in application of the odd configurations permitted under 3.5.1.1:

**6.7.1 Depths.** In selecting case sizes, an increase in the depth up to the maximum listed depth is preferred to an increase to a larger listed width or height.

**6.7.2 Widths.** In selecting cases larger than those provided by the maximum depths for a standard width, an increase to the next larger listed width is preferred to an increase to the next larger listed height.

**6.7.3 Heights.** In all instances, preference should be given to the lower listed height. To remain within the configurations shown on

**MIL-C-172C**

figure 1 when tall narrow cases are used, it is suggested that two cases and racks be placed on a single plate or that a stabilizer be used.

**6.8 AN nomenclature.** In most instances, the contract or order, equipment specification, or other document referencing this specification will include instructions for obtaining AN nomenclature to identify classes B and C mounting bases; in any other event, the procuring activity should be requested for these instructions (see 1.2 and 6.2).

**Notes.** When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government

procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

**Custodians:**

Army—Signal Corps  
Navy—Bureau of Aeronautics  
Air Force

**Preparing activity:**

Navy—Bureau of Aeronautics

MIL-C-172C

## APPENDIX

### PROCEDURE FOR QUALIFICATION INSPECTION

#### 10. SCOPE

10.1 This appendix details the procedure for submission of samples, with related data, for qualification inspection of items covered by this specification. The procedure for extending qualification of the required sample to other items covered by this specification is also outlined herein.

10.1.1 *Limitation.* MS part numbers or other military designations shall not be applied to the product, except for qualification-inspection samples, nor referred to in correspondence until notice of qualification has been received from the qualifying agency.

#### 20. SUBMISSION

##### 20.1 Sample.

##### 20.1.1 Class A.

20.1.1.1 *Individual vibration mounts.* A sufficient number of vibration mounts shall be provided for installation in three mounting bases conforming to the applicable MS military standard, for the largest load range in each size for which qualification is desired. In addition, a sufficient number of vibration mounts of similar design and construction shall be provided for installation in one base for each of the other load ranges for which qualification is being sought in the size submitted. Submission of short-stud mounts (for dimpled mounting) shall normally be required. However, when specifically permitted by the qualifying agency, long-stud mounts (for flat mounting) may be submitted for qualification inspection.

20.1.1.1.1 *For class B extension of qualification.* Where it is desired that qualification be extended to cover class B vibration mounts within the load range submitted, a sufficient number of vibration mounts modified as necessary to meet the loaded-height requirement shall be provided for the loaded-height

test for each of the specific loads for which extension of qualification is being sought.

20.1.1.2 *Mounting bases.* Three mounting bases shall be provided for the largest load range in each size (large or small) for which qualification is desired. In addition, one mounting base of similar design and construction shall be provided for each of the other load ranges for which qualification is being sought in the size submitted. Either dimpled or flat mounting bases may be submitted. If qualification of a mounting base is established by a test of samples using previously qualified vibration mounts, then the qualification will be contingent upon continued use of these previously qualified vibration mounts. If separate approval is desired for those vibration mounts submitted as part of a mounting base submission, then a sufficient number of vibration mounts shall be submitted for the loaded height and deflection tests.

##### 20.1.2 Class B.

20.1.2.1 *Individual vibration mounts.* A sufficient number of vibration mounts shall be provided for installation in three mounting bases conforming to the applicable MS military standard, for the largest specific load in each size for which qualification is desired. In addition, a sufficient number of vibration mounts of similar design and construction shall be provided for installation in one base for each of the other specific loads for which qualification is being sought, in the size submitted.

20.2 *Submission data.* Each sample submitted shall be accompanied by the following data:

- (a) Name of manufacturer, and the MS part number, size, class, and load range or specific load.
- (b) Date and place of manufacture.
- (c) For vibration mounts, descriptive



**MIL-C-172C**

drawings covering the installation of the mounts in standard mounting bases conforming to the applicable MS military standard.

- (d) Test data for all nondestructive tests on each vibration mount or mounting base submitted for qualification. Test data for all other qualification inspection for each type and size vibration mount or mounting base covered by the submission. These data shall be suitably keyed by cross reference to the individual vibration mount or to the mounting base to which they apply.
- (e) Manufacturer's ratings and tolerances for deflection and loaded height at minimum rated load for each vibration mount or mounting base. Manufacturer's procedure for measuring deflection and loaded height at minimum rated load.

**30. EXTENT OF QUALIFICATION**

**30.1 Individual vibration mounts.** When individual vibration mounts are furnished, the qualification will extend only to the vibration mounts in the type, class, size, and load range or specific load actually submitted. However, qualification of a vibration mount as class A for a particular size and load range will qualify that mount as class B for that size for each specific load within that range, without further testing, provided the loaded-height requirements are met. Qualification of either a long-stud or a short-stud mount will cover qualification of both.

**30.2 Mounting bases.** When vibration mounts are furnished already installed in mounting bases conforming to the applicable MS military standard, qualification will extend as follows:

- (a) The mounting bases will be qualified in the size and the specific load range actually submitted, with the following exceptions:

1. Qualification of either dimpled or flat mounting bases will cover qualification of both.
2. Qualification of mounting base MS91405-C2D will cover qualification of mounting base MS91405-C1D as well, but qualification of mounting base MS91405-C1D will not cover qualification of mounting base MS91405-C2D.
3. If the mounts used in the bases submitted conform to the applicable MS military standard, they will be qualified as individual cup-type or beam-type vibration mounts as specified in 30.1.
4. If the submission includes class A vibration mounts which have already been qualified as a result of a previous submission under the provisions of 30.1, qualification inspection of the base will consist only of visual and dimensional examination, loaded height, bonding, salt spray (corrosion), sway space and snubbing, and shock. Qualification will extend only to the mounting base in the size and the load range actually submitted, and will be contingent upon continued use of these previously qualified vibration mounts.

**30.3 Smaller load ranges.** In the case of individual vibration mounts and single assembled bases in the smaller load ranges or specific loads for which qualification is being sought, at the discretion of the qualifying activity, only the examinations and test of groups I and II of table I, and the isolation-efficiency test at room temperature, need be made if the design and construction are equivalent to others previously fully inspected and qualified.



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