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MILITARY SPECIFICATION

ACCELEROMETER, AIRCRAFT

This specification is approved for use by all Department and Agencies of the Departments of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for a 1-7/8-inch dial, 3-pointer, -5 to +10g unit (see 6.3.3) range aircraft accelerometer.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issues of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

Federal

PPP-B-601	Boxes, Wood, Cleated Plywood
PPP-B-636	Box, Shipping, Fiberboard

Military

MIL-P-116	Preservation, Methods Of
MIL-C-5541	Chemical Films And Chemical Film Materials For Aluminum And Aluminum Alloys
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series: General Specification For
MIL-A-8625	Anodic Coatings, For Aluminum And Aluminum Alloys
MIL-C-83488	Coating Aluminum, Ion Vapor Deposited

STANDARDS

Federal

FED-STD-595	Colors

Beneficial comments (recommendation, additions, deletions) and any pertinent data, which may be of use in improving this documents should be addressed to: Oklahoma City Air Logistics Center/MMEDO, Tinker AFB OK 73145-5990 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6610

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Military

DOD-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking Of U.S. Military Property
MIL-STD-143	Specifications And Standards Order Of Precedence For The Selection Of
MIL-STD-454	Standard General Requirements For Electronic Equipment
MIL-STD-781	Reliability Tests Exponential Distribution
MIL-STD-785	Requirements For Reliability Program (For Systems And Equipments)
MIL-STD-794	Parts And Equipment, Procedures For Packaging And Packing Of
MIL-STD-810C	Environmental Test Methods And Engineering Guidelines
MIL-STD-889	Dissimilar Metals
MS28025	Accelerometer, Aircraft
MS28105	Window, Dial-Aircraft Instrument Dial, Standard Form Of
MS33558	Numerals And Letters, Aircraft Instrument Dial, Standard Form Of
MS33585	Pointer, Dial, Standard Design Of Aircraft Instrument

(Copies of documents required by suppliers in connection with specific procurement functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.1.2 Other government documents, drawings, and publications. The following other government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

AIR FORCE DRAWING 8346561 - ASSY OF ROTOR, CENTRIFUGE

(Copies of specifications, standards, handbooks, drawings, publications, and other government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation . Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

ASTM D3951 Packaging, Commercial

(Application for copies should be addressed to: ASTM, 1916 Race St, Philadelphia PA 19103.)

(Nongovernment standards and other publications are normally available from the organization which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

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3. REQUIREMENTS

3.1 First article. When specified, in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.4 and 6.4).

3.2 Selection of specification and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected according to MIL-STD-143.

3.3 Materials.

3.3.1 Fungus-proof materials. Materials that are nutrients for fungi shall not be used where it is practical to avoid them. Where used and not hermetically sealed, they shall be treated with a fungicidal agent acceptable to the contracting activity. However, if they will be used in a hermetically sealed inclosure, fungicidal treatment will not be necessary.

3.3.2 Nonmagnetic materials. Nonmagnetic materials shall be used for all parts except where magnetic materials are essential.

3.3.3 Nonferrous materials. Nonferrous materials shall be used for all parts of the accelerometer except where ferrous materials are essential.

3.3.4 Metals. Metals shall be of the corrosion-resistant type or suitably treated to resist corrosion due to fuels, salt spray, or atmospheric conditions likely to be met in storage or normal service.

3.3.5 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. Dissimilar metals are defined in MIL-STD-889.

3.3.6 Corrosive fumes. The materials, as installed in the accelerometer, and under the service conditions specified herein shall not liberate deleterious fumes.

3.3.7 Protective treatment. When materials are used in the construction of the accelerometer that are subject to deterioration when exposed to climatic and environmental conditions likely to occur during service usage, they shall be protected against such deterioration in a manner that will in no way prevent 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 climatic and environmental conditions shall be avoided.

3.3.8 Recovered materials. Recovered materials shall be used to the maximum extent possible without jeopardizing the end use of the item.

3.4 Design and construction.

3.4.1 Design. The accelerometer shall be designed to indicate aircraft accelerations in maneuvers and rough air, and shall conform to MS28025 and figure 1. The accelerometer shall be designed to meet the response characteristics specified herein.

3.4.2 Construction. The construction shall be reasonably simple to permit overhaul or repair without the use of special tools and fixtures. The accelerometer

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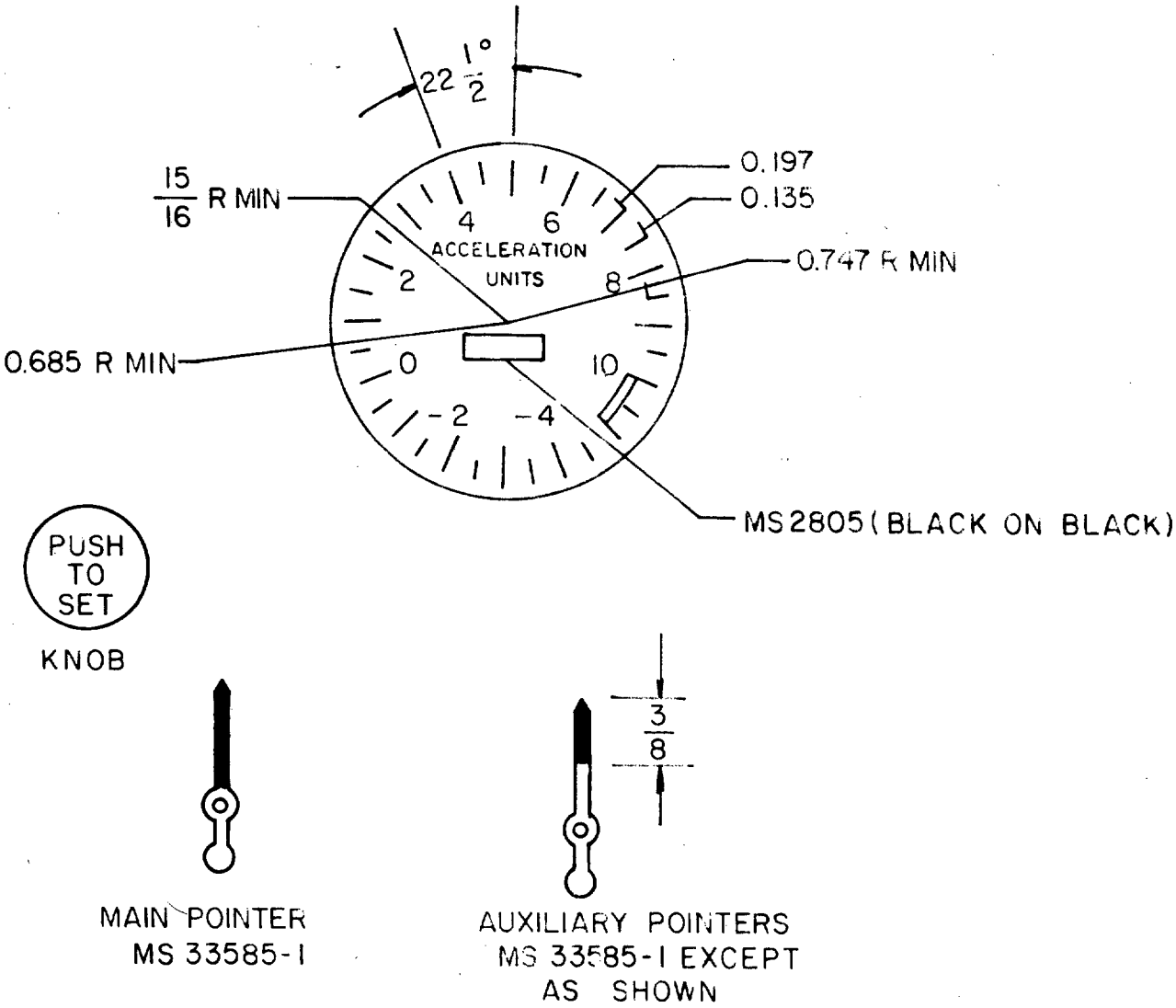

DIMENSIONS IN INCHES
UNLUNLESS OTHERWISE
TOLERANCES: FRACTIONS ± 1/64
DECIMALS ± .010
ANGLES ± 1/2°

FIGURE 1. Dial and pointers.

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shall be so constructed as to withstand the normal strains, jars, vibrations, and such other conditions are incident to shipping, storage, installation, and service, without failure.

3.4.3 Pivots, bearings, and gears. Pivots, bearings, and gears shall not bind nor shake and shall be as nearly frictionless as practicable.

3.4.4 Reliability program. The contractor shall establish a reliability program in accordance with MIL-STD-785.

3.4.4.1 Reliability. The accelerometer shall have a minimum acceptable mean-time-between-failures (MTBF) of 2,500 hours at a confidence level of 90 percent.

3.4.5 Longevity. The accelerometer shall have an operating life (equipment longevity as defined in MIL-STD-781) of 5,000 hours before wearout failures occur or the equipment consistently fails to meet the specified MTBF.

3.5 Performance. The accelerometer shall meet the requirements specified herein under the following conditions:

a. Temperatures-operating temperatures ranging from -54° to $+71^{\circ}$C and nonoperating temperatures ranging from -62° to $+71^{\circ}$C.

b. Vibration-vibration at an amplitude of 0.018 to 0.020 inch at a frequency of 5 to 50 Hz.

c. Low pressure-absolute pressure of 2.1 $\pm$0.2 inches Hg.

d. Shock-shock force of 15g for 11 $\pm$1 msec

e. Rain-simulated rainfall of 4 $\pm$1 inches per hour for a period of 2 hours (exposure for 30 minutes on each of the four sides of the accelerometer)

f. Humidity-relative humidity of 95 percent.

g. Fungus-fungus as encountered in tropical climate.

h. Salt fog-salt fog for a period of 50 hours.

3.5.1 Magnetic effect. When the accelerometer is held in various positions not more than 5 inches from a short bar magnetic compass in a field intensity of 0.17 to 0.19 oersted, deflection of the compass shall not exceed 1°.

3.5.2 Response characteristics. Response characteristics shall be in accordance with figure 2.

3.6 Part numbering of interchangeable parts. All parts having the same manufacturer's part number shall be functionally and dimensional interchangeable. The item identification and part number requirements of DOD-STD-100 shall govern the manufacturer's part numbers and changes thereto.

3.7 Case. The case shall consist of a body and bezel ring and shall conform to MS28025. The case shall be moistureproof.

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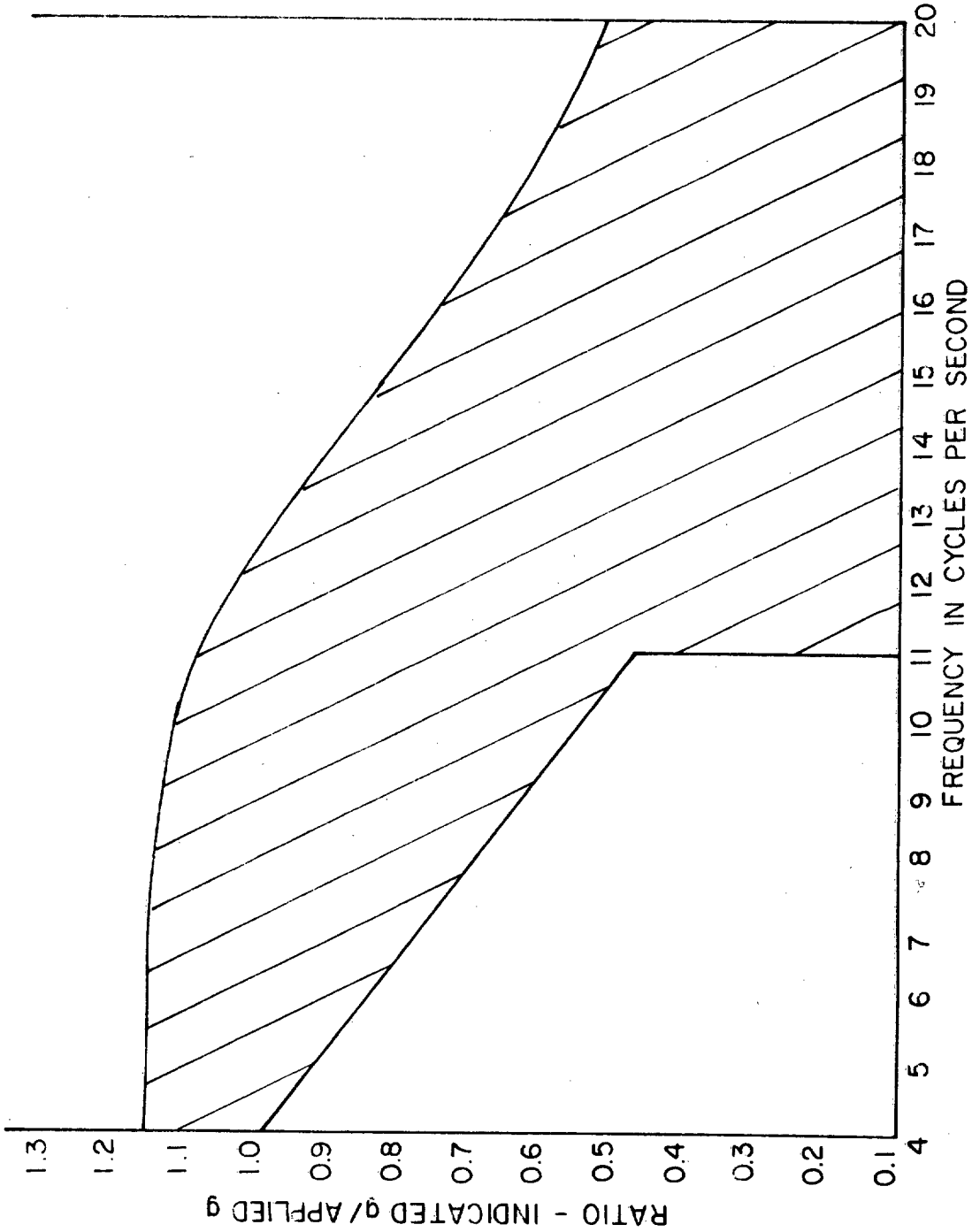

FIGURE 2. Dynamic response characteristics.

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3.7.1 Body. The body shall be made of nonferrous low-density metal, uniform in texture and shall have a smooth surface with durable, dull, black finish, color NO. 37038 of FED-STD-595.

3.7.2 Benzel ring. The bezel ring shall be made of nonferrous low-density metal and shall have a durable, dull, black finish. The bezel ring shall be held in place by means of screws. Provisions shall be made for replacement of the cover glass by removal of the bezel ring.

3.8 Cover glass. The cover glass shall conform to MS28105.

3.9 Dial. The dial shall conform to figure 1 and shall be fastened securely to the case or upon the frame of the mechanism by not less than two screws in such a manner that it will not loosen or turn when the accelerometer is vibrated.

3.9.1 Distance from dial to cover glass. The distance between dial and cover glass shall be no greater than 0.250 inch.

3.10 Pointers. The accelerometer shall have three pointers; one main pointer for indicating instantaneous acceleration and two auxiliary pointers - one for indicating maximum positive acceleration, and one for indicating maximum negative acceleration. The pointers shall conform to figure 1. They shall be light and sufficiently rigid to prevent oscillation under vibration. They shall be firmly attached to the mechanism, yet shall be readily adjustable.

3.10.1 Ratchet mechanism. Each auxiliary pointer shall be provided with a ratchet device in order that indication of the maximum plus and minus deflections of the main pointer will be maintained until the auxiliary pointers are reset to obtain a new reading.

3.10.2 Auxiliary pointer return mechanism. A mechanism shall be provided for resetting the auxiliary pointers into juxaposition with the main pointer. The PUSH-TO-SET knob, located as shown on MS28025, shall be spring loaded to 3 $\pm$1 pounds for operating the return mechanism. The shaft of this knob shall be capable of withstanding a load 15 pounds applied perpendicular to the shaft at the extreme outward end of the know without permanent deformation. Stops shall be provided so that the auxiliary pointers, when reset, will not indicate a lower or higher reading than that indicated by the main pointer. The stops shall be a part of the mechanism connecting the pointers and shall not directly engage them.

3,10,3 Main pointer mechanism. The main pointer mechanism shall not engage the mechanism of the auxiliary pointers when the imposed acceleration is less than the acceleration indicated by the auxiliary pointers.

3.11 Stops for acceleration-responsive element. Mechanical stops shall be provided for arresting the motion of the acceleration-responsive element when the accelerometer is subjected to accelerations beyond the limits specified. One stop shall engage the element at an acceleration of not less than -5.1g and not more than -5.5g, and the other at an acceleration of not less than +10.1g and not more than +10.5g.

3.12 Locking device. A device for manually locking the position of the acceleration-responsive element shall be provided to protect the accelerometer mechanism during shipment. This device shall be controlled by means of a suitable

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knurled knob located in the back of the case and marked as shown on MS28025. The force required to lock and unlock the unit shall be 4.5 ±1 pounds.

3.13 Adjustment. The mechanism shall be provided with means to adjust or correct the indications. This means of adjustment shall be reasonably simple to manipulate and of such a nature that adjustment can be accomplished with tools ordinarily possessed by and instrument repairman.

3.14 Indication and range. The accelerometer shall indicate vertical accelerations when the plane of the mounting lugs is vertical and the +5.0 graduation is at top center. When in this position, normal gravity shall be indicated at +1g. The accelerometer shall be designed to indicate accelerations ranging from -5 to +10g's.

3.15 Markings. All markings shall be durable to withstand the usage encountered in service. The style and proportions of numerals and letters, except the letter g, placed on the dial shall conform to MS33558. Each numeral shall distinctly indicate the graduation to which it applies.

3.15.1 Dial. The following markings shall be finished in white, color No. 37875 of FED-STD-595. The markings shall be located as shown on figure 1.

	Height or Length Inch ±1/64	Width of Line or Graduation Inch ±0.005
Numerals	3/16	MS33558
Lettering g UNITS and ACCELERATIONS	1/16	MS33558
Major graduations (except +1g)	Figure 1	0.031
+1g graduation	Figure 1	0.062
Minor graduation	Figure 1	0.015
Arc-section dial	--------	0.015
Shaded portion of pointers	--------	-------
Knob markings	1/16	MS33558

3.15.2 Dull black finish. The MS part number, background of the dial, and the color of all other markings not specified shall be durable dull black, color No. 37038 of FED-STD-595. The height of such markings shall be 1/16 ±1/64 inch.

3.15.3 Dial visibility. The pointers, numerals, at least 1/16 inch of the shortest graduations, and other markings on the dial shall be visible from any point within the frustum of a cone the side of which makes an angle of 20° with a perpendicular to the dial and of which the small diameter is the aperature of the instrument case.

3.16 Weight. The weight of the accelerometer shall not exceed 1.50 pounds.

3.17 Screw threads. Unless otherwise specified, the threads of all machine screws shall conform to MIL-S-7742.

3.18 Finishes and protective coatings.

a. Aluminum alloy parts shall be covered with an anodic film conforming to MIL-A-8625, except as follows:

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b. Dials, small holes, and case inserts need not be anodized.

c. Aluminum alloys which do not anodize satisfactorily shall be coated with a chemical film in accordance with MIL-C-5541.

d. Where the primary purpose of the treatment is to afford a suitable paint base, chemical treatments in accordance with MIL-C-5541 may be used in lieu of anodizing.

e. Castings containing nonaluminum alloy integral inserts may be treated with a chemical film in accordance with MIL-C-5541 in lieu of anodizing.

f. When abrasion resistance is a factor, chemical films in accordance with MIL-C-5541 shall not be used in lieu of anodizing.

3.18.1 Steel parts. Steel parts shall be coated with ion vapor deposited aluminum, where practical, in accordance with MIL-C-83488, type I or II as applicable and of a class that is adequate to achieve the degree of protection required. Other protective coating, in lieu of MIL-C-83488, may be used if demonstrated to be satisfactory and approved by the contracting activity. Cadmium plating must be avoided when satisfactory alternative processes can be used.

3.19 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.20 Envelope. An envelope, containing the mounting screws, shall be furnished with each accelerometer. The following information shall be printed on the face of the envelope:

IMPORTANT
THIS ENVELOPE CONTAINS
MOUNTING SCREWS

3.21 Workmanship. The accelerometer, including all parts and accessories, shall be fabricated and finished in a thoroughly workmanlike manner in accordance with MIL-STD-454, requirement 9. Particular attention shall be given to freedom from blemishes, defects, burns, and sharp edges; accuracy of dimensions, radii of fillets, and marking of parts and assemblies; thoroughness of soldering, welding, brazing, painting, wiring, and riveting; alignment of parts and tightness of assembly screws and bolts, et cetera.

3.21.1 Screw assemblies. Assembly screws and bolts shall be tight. The word "tight" means the screw or bolt cannot be appreciably tightened further without damage or injury to the screw or bolt threads.

3.21.2 Gears. Gear assemblies shall be properly aligned and meshed and shall operate without interference, tight spots, loose spots or other irregularities. Where required, for accuracy adjustment, gear assemblies shall be free from back lash.

3.21.3 Cleaning. The accelerometer shall be thoroughly cleaned of loose, spattered or excess solder, metal chips or other foreign material after assembly. Burrs and sharp edges as well as resin flash which might crumble shall be removed.

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3.21.4 Dimensions and tolerances. Dimensions and tolerances not specified shall be as close as is consistent with the best shop practices. Where dimensions and tolerances may affect the interchangeability, operation, or performance of the accelerometer, they shall be held or limited accordingly.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the government. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and service conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the government to acceptance of defective material.

4.2 Classification of tests. The inspection and testing requirements specified herein are classified as follows:

a. First article inspection (see 4.4).

b. Quality conformance tests (see 4.5).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.3.1 of this specification.

4.3.1 Standard atmospheric conditions. Whenever the pressure and temperature existing at the test are not specified definitely, it is understood that the test is to be made at atmospheric pressure (approximately 29.92 inches Hg) and at room temperature (approximately +25°C). Unless otherwise specified, all tests shall be performed without correction for temperature or atmospheric pressure variations.

4.3.2 Instruments vibration. Unless otherwise specified, the accelerometer shall be vibrated before a test reading is taken. This vibration shall be accomplished utilizing an electric motor and an attached counterweight as defined by Air Force Drawing 8346561.

4.3.3 Vibration stand. A vibration stand shall be used which will vibrate at any desired frequency between 5 and 50 Hz, and shall subject the accelerometer to vibration such that a point on the case will describe in a plane inclined 45° to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein. (See 6.3.2).

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4.3.3.1 Allowable centrifuge vibration. The centrifuge utilized for accomplishing the tests herein shall not have an inherent vibration of more than 0.04g between 2 and 200 Hz where "g" is defined as $g=0.0511\ f^2D$ with "D" being displacement in inches (double amplitude) and "f" is the frequency in cycles per second. Inherent vibration shall be defined as the vibration sensed by the accelerometer which is induced by the centrifuge when testing in accordance with this document. Installed on the centrifuge shall be centrifuge rotor per Air Force Drawing 8346561 for mounting the accelerometer.

4.3.4 Calibration procedure. The contractor shall furnish a drawing of the mechanism and case showing clearly the vertical distance of the center of mass of the actuating mechanism from the center of the instrument dial for each of the required tests points. This drawing shall also include a table of the rpm required for each test point computed on the basis of a rotating arm whose radius to the center of the instrument dial is 20 inches. The rpm required for each test shall be computed by the formula:

$$N = 9.5493\sqrt{\frac{32.2g}{r}}$$

Where N = rpm of rotation arm
g = test point
r = radius of arm in feet, corrected for mass position.

4.3.4.1 Test points. "N" shall be computed for all points from -5 to +10g in increments of 1g.

4.3.5 Pointer reset. The maximum plus and minus auxiliary pointers shall be reset after each reading.

4.4 First article testing.

4.4.1 Test samples. The test samples consist of nine accelerometers representative of the production equipment. Three samples shall be subjected to all the tests except reliability and other six samples shall be subjected to the reliability test only. The samples shall be identified with the manufacturer's part number and such other information as required by the contracting activity.

4.5 Quality conformance tests. Quality conformance tests shall consist of:

a. Individual tests

b. Sampling tests.

4.5.1 Individual tests. Each accelerometer shall be subjected to the following tests as described under 4.6.

a. Examination of product

b. Static scale error and friction

c. Dynamic scale error

d. Return mechanism operation

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e. Locking mechanism operation.

4.5.2 Sampling tests.

4.5.2.1 Sampling plan A. One accelerometer shall be selected at random from each 100 or less produced on the contract or order and subjected to the following tests as described under 4.6:

a. Individual tests

b. Vibration error

c. Magnetic effect

d. High temperature

e. Low temperature

f. Low pressure

g. Response characteristics.

4.5.2.2 Sampling plan B. Unless otherwise specified, 3 accelerometers selected at random from the first 15 items of the contract or order shall be subjected to the following tests as described under 4.6:

a. Sampling plan A tests

b. Vibration endurance

c. Shock

d. Mounting-lugs

e. High temperature exposure

f. Low temperature exposure

g. Rain

h. Humidity

i. Fungus resistance

j. Salt fog.

4.5.2.3 Rejection and retest. When one item selected from a production run fails to meet the specification, no items still on hand or later produced shall be accepted until the extent and cause of failure are determined. After corrections have been made, all necessary tests shall be repeated.

4.5.2.3.1 Individual tests may continue. For operational and production reasons, individual tests may be continued pending the investigation of a sampling test failure. But final acceptance of items on hand or later produced shall not be

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made until it is determined that items meet all the requirements of the specification.

4.5.3 Defects in items already accepted. The investigation of a test failure could indicate that defects may exist in items already accepted. If so, the contractor shall fully advise the contracting activity of all defects likely to be found and methods of correcting them.

4.6 Test methods.

4.6.1 Examination of product. The accelerometer shall be examined to determined compliance with this specification with respect to material, workmanship, marking, and dimensions.

4.6.2 Static scale error and friction. The static scale error shall be observed with the accelerometer held in each of the following positions:

a. Plane of dial vertical with +5g graduation at top (scale reading shall be -1g)

b. Plane of dial horizontal (scale reading shall be zero)

c. Plane of dial vertical with +5g graduation at bottom (scale reading shall be -1g).

In each position, the main-pointer reading obtained shall be due entirely to gravity and not to motion in change of position of the accelerometer. The static scale error shall not exceed ±0.25g unit in any of the three positions tested. The accelerometer shall also be tested for friction at the three positions specified. The amount of tapping or vibration applied shall be sufficient to remove all friction from the instrument. In going from one position to the next, one of the memory pointers shall be engaged. After the desired test position is reached, two readings shall be taken, the first before vibration and the second after vibration. The difference in the two readings shall be recorded as friction and shall not exceed 0.3g.

4.6.3 Dynamic scale error and friction. The accelerometer shall be mounted on a suitable centrifuge and centrifuge rotor per Air Force Drawing 8346561 and tested for dynamic scale error and friction for accelerations of -4, -3, -2, +2, +3, +4, +5, +6, +7, +8, +9, and +10 at 1g increments for a total of 13 test points. For the first test point and without instrument vibration, the centrifuge shall be brought up to; bun not exceeding, the rotation rate equivalent to the "g" level being tested. The centrifuge rate shall be reduce to zero and the accelerometer reading taken from the memory pointer. After re-zeroing the memory pointer, the procedure shall be repeated except that instrument vibration shall be applied per paragraph 4.3.2. The centrifuge rate shall be reduced to zero and the accelerometer reading taken from the memory pointer. The memory pointer shall then be zeroed. The reading with and without vibration shall not differ from the centrifuge input "g" reading by more than ±0.25g. This procedure shall be repeated for the remaining 12 test points. The centrifuge rate need not be returned to zero and the memory pointer reset; if capability exists to read the instruments without reducing the centrifuge's rotational rate.

4.6.4 Return mechanism operation. The accelerometer shall be placed in

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operating position with the pointers deflected to their maximum indication. The reset knob shall then be operated to return the pointers to juxtaposition with the main pointer. The force applied to the reset knob shall be 3 ±1 pounds.

4.6.4.1 Shaft and knob torque test. A force of 15 ±1 pounds shall be applied perpendicular to the shaft at the extreme outward end of the setting knob. When the force is removed, the shaft and knob shall return to the original position. There shall be no permanent deformation of the shaft or knob.

4.6.5 Locking mechanism operation. The pulling force required to lock or unlock the locking mechanism shall measure between 3.5 and 5.5 pounds.

4.6.6 Vibration error. The accelerometer shall be mounted on a suitable vibration stand with the dial in a vertical plane and with the graduation +5 at the top. The auxiliary pointers shall be displaced approximately 2g from the main pointer and the readings noted. The reset mechanism shall not be operated until the completion of the test. For a total of 3 hours the accelerometer shall be vibrated at the specified frequencies at a circular motion amplitude between 0.018 and 0.020 inch, and the pointer oscillation shall be noted. The frequency shall be varied from 5 to 50Hz in a period of not more than 60 minutes. The natural frequency of the seismic system shall be noted during the frequency variation between 5 and 50. For the remainder of the 3-hour test period, the accelerometer shall be vibrated at a frequency of 30 Hz. At the end of the test period, the indications of the auxiliary pointer shall be read before operating the resetting mechanism. At frequencies below 20 Hz, the oscillation of the main pointer shall not exceed 0.4g and the frequencies over 20 Hz, the oscillation shall not exceed 0.6g. After vibration, the indications of the auxiliary pointers shall not be changed by more than 0.2g. The accelerometer shall suffer no damage as a result of this test.

4.6.7 Magnetic effect. The accelerometer shall be held in various positions with the nearest part 5 inches from and magnetically east or west of the center of a short bar magnet compass. The horizontal magnetic field intensity shall be 0.17 to 0.19 oersted. The compass deflection for any position of the accelerometer shall not exceed 1°.

4.6.8 High temperature. The accelerometer shall be placed in a chamber and maintained at a temperature $71^{\circ} \pm 2^{\circ}$C for a period of 4 hours. While still at this temperature, the accelerometer shall be subjected to and shall meet the static scale error test. The static error shall not exceed 0.25g. There shall be no damage to the accelerometer as a result of this test.

4.6.9 Low temperature. The accelerometer shall be placed in a chamber and maintained at a temperature of $71^{\circ} \pm 2^{\circ}$C for a period of 4 hours. While still at this temperature, it shall be subjected to the scale error test. The scale error shall not exceed ±0.3g at any test point.

4.6.10 Low pressure. This test is applicable only to accelerometers equipped with devices that may be sensitive to pressure changes. The complete accelerometer shall be subjected to the static scale error test while at an absolute pressure of 2.1 ±0.2 inches Hg. The static scale error shall not vary by more than 0.25g from those at standard atmospheric pressure.

4.6.11 Response characteristics. The accelerometer shall be subjected to vibration applied along the axis passing through the +5 and -3 dial graduations.

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The test apparatus used shall be as specified in 4.6.11.1. The accelerometer shall be tested at frequencies between 4 and 20 Hz at 1-Hz intervals. The amplitude of vibration at each point shall be such that the maximum g-forces practicable for the test point will be obtained. The indicated g shall be recorded and a plot made for each test point of indicated g/applied g versus frequency. The points so plotted shall fall within the shaded area shown on figure 2.

4.6.11.1 Test apparatus. The test apparatus shall impose linear sinusodial motion to the accelerometer and shall produce the frequency and amplitude required for each test point. The acceleration vector of any harmonic measured on the test table shall not exceed 10 percent of the fundamental acceleration vector.

4.6.12 Vibration failure. The accelerometer shall be mounted on a suitable vibration stand with the dial in a vertical plane and with the graduation +5 at the top. The auxiliary pointers shall be displaced approximately 2g from the main pointer and the readings noted. The reset mechanism shall not be operated until the completion of the test. The accelerometer shall be subjected to vibration at a double amplitude between 0.018 and 0.020 inch in the frequency range of 5 to 50 Hz, for a period of 50 hours. Oscillation of the main pointer shall not exceed 0.8g during or after the test. At the completion of the test, the indications of the auxiliary pointers shall not be changed by more than 0.4g from their setting at the start of the test. The accelerometer shall then be subjected to the individual tests. The static scale error shall not exceed 0.25g.

4.6.13 Shock. The accelerometer shall be subjected to the shock test in accordance with MIL-STD-810C, Method 516.2, procedure I. The shock pulse shape shall be in accordance with Figure 516.2-2, amplitude and time duration C. The accelerometer shall be installed in the normal operating position during the shock test. The instrument mechanism shall be locked. The accelerometer shall be allowed to fall from a height 8 inches, examined for damage, and then subjected to the individual tests. There shall be no damage to the accelerometer and the static scale error shall not exceed 0.25g.

4.6.14 Mounting lugs. The instrument case, with mechanism and cover glass removed, shall be mounted face downward on the movable head of a suitable testing machine with the diameter of the case in a horizontal plane so that the mounting lugs receive no added support. A suitable pin shall be inserted through the hole in the mounting lug and attached to a pull strap in the stationary head of the machine. A load of 175 pounds shall be applied along the axis of the mounting hole and toward the front case for a period of 1 minute. There shall be no fracture.

4.6.15 Environmental. The following tests shall be conducted in accordance with the specified procedures of MIL-STD-810C and as specified herein.

4.6.15.1 High temperature exposure. The accelerometer shall be subjected to a temperature of $71^{\circ} \pm 2^{\circ}$C for a period of 24 hours. After return to normal temperature, the accelerometer shall be subject to the individual tests. There shall be no damage to the accelerometer and the static scale error shall not exceed 0.25g.

4.6.15.2 Low temperature exposure. The accelerometer shall be maintained at a temperature -65°C $\pm$ Z$^{\circ}$C for a period for 48 hours. The temperature shall then be changed to 54°C $\pm$ C and maintained for an additional 24-hour period. After returning to normal temperature, the accelerometer shall be subjected to the

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individual tests. There shall be no damage to the accelerometer and the static scale error shall not exceed 0.25g.

4.6.15.3 Rain. The accelerometer shall be subjected to the test in accordance with MIL-STD-810C, Method 506.1, procedure II, except at a constant rate of 4 ± 1 inches per hour. At the completion of this test, the accelerometer shall be subjected to the individual tests. The accelerometer shall be examined and there shall be no evidence of water penetration nor damage.

4.6.15.4 Humidity. The accelerometer shall be subjected to the humidity test Method 507.1, procedure I. At the end of this test period, the individual tests shall be repeated. No damage shall result from this test and the tolerances specified for the individual tests shall apply.

4.6.15.5 Fungus. The accelerometer shall be subjected to the fungus test in accordance with Method 508.1, procedure I, except for a period of 14 days. At the end of the test period, the accelerometer shall be carefully examined to ascertain that no fungus growth has occurred that would affect subsequent operation.

4.6.15.6 Salt fog. The accelerometer shall be subjected to the salt fog test in accordance with Method 509.1, procedure I, except for a period of 50 hours. At the end of this test period, the individual tests shall be repeated. No damage shall result from this test and the tolerances specified for the individual tests shall apply.

4.6.16 Reliability. The six test samples shall be subjected to a reliability test in accordance with MIL-STD-781, test level F, test plan I. After each 250-hour period of temperature and vibration cycling, the accelerometer shall be subjected to 500 impacts so that it reads at least -3g and +5g. The auxiliary pointers shall be reset by the PUSH-TO-SET knob after each impact. The accelerometer shall then be subjected to and shall meet the individual tests. Failure to meet any individual test shall be cause for rejection.

4.16.7 Longevity. Unless otherwise specified, testing on two of the samples that have been subjected to the reliability test (see 4.6.16) shall be continued through a longevity test for a total of 10,000 hours (5,000 hours each) in accordance with MIL-STD-781, test plan XXVIII, including the 250-hour reliability test periods.

4.6.18 Internal examination. The case of the accelerometer shall be opened and the mechanism examined. Any deterioration or damage that would be prevent the accelerometer from meeting the performance requirements specified herein during its service life shall be cause for rejection.

4.7 Inspection of packaging. The inspection of the preservation packaging and interior package marking shall be in accordance with Group A and B quality conformance inspection requirements, Section 4 of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of applicable container specification and the marking requirements of MIL-STD-129.

5. PACKAGING

5.1 Preservation-packaging. Preservation-packaging shall be level A, C, or Industrial, as specified (see 6.2).

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5.1.1 Level A.

5.1.1.1 Cleaning. Accelerometer shall be cleaned in accordance with process C-1 or MIL-P-116.

5.1.1.2 Drying. Accelerometer shall be dried in accordance with D-4 of MIL-P-116.

5.1.1.3 Preservation application. Not applicable.

5.1.1.4 Unit packaging. Unless otherwise specified by the contracting activity, each accelerometer shall be packaged in quantity unit packs of one each in accordance with Method ICI of MIL-P-116. Overbox completed pack in PPP-B-636 container. Apply sufficient cushioning material between bag and unit container of a type, density, and thickness to insure shock transmission does not exceed peak values in G's established for the accelerometer when completed packs are subjected to the rough handling drop tests of MIL-P-116.

5.1.2 Level C. Each accelerometer shall be clean, dry, and individually packaged in a manner that will afford adequate protection against corrosion, deterioration, and physical damage during shipment from supply source to the first receiving activity.

5.1.3 Industrial. The Industrial preservation of accelerometer shall be in accordance with ASTM D3951.

5.2 Packing. Packing shall be level A, B, C, or Industrial as specified (see 6.2).

5.2.1 Level A. Accelerometer packaged as specified in 5.1.1 shall be packed in shipping containers conforming to PPP-B-601, Styles A or B, Class overseas, unless otherwise specified by the contracting activity. Insofar as practical, exterior shipping container shall be of uniform shape, size, minimum tare and cube consistent with the protection required.

5.2.2 Level B. Accelerometer packages as specified in 5.1.1 shall be packed in shipping containers conforming to PPP-B-636, class, weather-resistant, unless otherwise specified by the contracting activity. Other requirements as specified in 5.2.1 apply.

5.2.3 Level C. Packing shall be applied which affords adequate protection during domestic shipment from the supply source to the first receiving activity for immediate use. This level shall conform to applicable carrier rules and regulations.

5.2.4 Industrial. The packaged accelerometer shall be packed in accordance with ASTM D3951.

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

6. NOTES

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6.1 Intended use. The accelerometer covered by this specification is intended for use in the cockpit of aircraft to indicate vertical acceleration loadings.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification

b. When sampling plan B tests will not be conducted

c. Levels of packaging and packing required.

6.3 Definitions.

6.3.1 Scale error. Scale error is the difference between the indication of the accelerometer and the corresponding calibrated standard.

6.3.2 Amplitude. Amplitude is the extent of motion as measured from the mean position to the extreme position.

6.3.3 G unit. The g unit is defined as an acceleration of 32.2 feet per second per second.

6.4 First article. A first article is required for inspection and approval (see 3.1 and 4.4)."

6.5 International standardization agreement. Certain provisions of 3.4.1, 3.7, figure 1, and 3.10.2 of this specification are the subject of international standardization agreement ASCC 10/4 and STANAG 3330. When amendment, revision, or cancellation of this specification is proposed, the departmental custodians will inform their respective Departmental Standardization Offices so that appropriate action may be taken respecting the international agreement concerned.

6.6 Subject term (key word) listing.

Accelerometer
Aircraft
Indicating
Indicating Range -5g to =10g
Type B-6
Unlighted

6.7 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
AIR FORCE - 99
ARMY - AV
NAVY - AS

Preparing Activity:
AIR FORCE - 71

Project Number:
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AIR FORCE - 11

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5. PROBLEM AREAS

a. Paragraph Number and Wording:

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