

INCH-POUND
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MIL-DTL-5099C  
30 March 2011  
SUPERSEDING  
MIL-I-5099B  
13 December 1968

## DETAIL SPECIFICATION

INDICATOR, CABIN AIR PRESSURE, 1-7/8 INCH DIAL, TYPE MA-1

Inactive for new design after 24 March 1999.
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This specification is approved for use by all Departments and Agencies of the Department of Defense.

### 1. SCOPE

1.1 Scope. This specification covers the design and performance requirements for one type of pressure altitude indicator having a range of 0 to 50,000 feet.

### 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

#### 2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to Defense Logistics Agency Aviation VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616, or e-mailed to <a href="mailto:STDZNMGT@dla.mil">STDZNMGT@dla.mil</a> . Since contact information can change, you may want to verify the currency of this address information using the ASSIST database at <a href="https://assist.daps.dla.mil/">https://assist.daps.dla.mil/</a> .
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## FEDERAL STANDARDS

- |                   |                                     |
|-------------------|-------------------------------------|
| FED-STD-595/37038 | - Miscellaneous, Flat or Lusterless |
| FED-STD-595/37875 | - Miscellaneous, Flat or Lusterless |

## DEPARTMENT OF DEFENSE SPECIFICATIONS

- |              |   |
|--------------|---|
| MIL-DTL-5541 | - Chemical Conversion Coatings on 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                            |
| MS28105      | - Cover Glass, Aircraft Instrument Dial                                       |
| MS33558      | - Numerals and Letters, Aircraft Instrument Dial, Standard Form of            |
| MS33638      | - Cases, Instrument, Flange Mounted, Aircraft                                 |

## DEPARTMENT OF DEFENSE STANDARDS

- |               |  |
|---------------|--|
| MIL-STD-130   | - Identification Marking of U.S. Military Property                         |
| MIL-STD-810   | - Environmental Engineering Considerations and Laboratory Tests            |
| MIL-STD-859   | - Standard Calibration Table for Aeronautical Pressure Measuring Equipment |
| MIL-STD-889   | - Dissimilar Metals  |
| MIL-STD-31000 | - Technical Data Packages  |

## DEPARTMENT OF DEFENSE HANDBOOKS

- |              |  |
|--------------|--|
| MIL-HDBK-454 | - General Guidelines for Electronic Equipment  |
| MIL-HDBK-781 | - Reliability Test Methods, Plans, and Environments for Engineering Development, Qualification, and Production |

(Copies of these documents are available online at <https://assist.daps.dla.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

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AEROSPACE INDUSTRIES ASSOCIATION

NASM33737 - Nut, Sheet Spring, Instrument Mounting

(Copies of this document are available online at [www.aia-aerospace.org/](http://www.aia-aerospace.org/) or from the Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928.)

ASTM INTERNATIONAL

ASTM C1036 - Standard Specification for Flat Glass

(Copies of this document are available online at <http://www.astm.org/> or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

SAE INTERNATIONAL

SAE AMS-QQ-P-416 - Plating, Cadmium (Electrodeposited)  
SAE AS5202 - Port or Fitting End, Internal Straight Thread,  
Design Standard

(Copies of these documents are available online at <http://www.sae.org> or from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 First article. When specified, the contractor shall furnish sample units for first article inspection and approval (see 4.2.1 and 6.2).

3.2 Materials. Materials shall conform to applicable specifications and shall be as specified herein. Materials for which there are no applicable specifications, or which are not specifically described herein, shall be of the best quality and of the lightest practicable weight suitable for the purpose intended.

3.2.1 Critical materials. Non-critical materials shall be used where practicable. Where the use of a critical material is essential to meet specification requirements, the material used shall be the least critical of those that are adequate for the purpose.

3.2.2 Nonmagnetic materials. Nonmagnetic materials shall be used for all parts of the indicator except where magnetic materials are essential.

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3.2.3 Metals. Metals shall be of the corrosion-resistant type, or shall be suitably protected as specified herein to resist corrosion due to fuels, salt spray, or atmospheric conditions to which the indicator may be subjected when in storage or during normal service life.

3.2.3.1 Dissimilar metals. Dissimilar metals, as defined in MIL-STD-889, shall not be used in intimate contact with each other, unless protection against electrolytic corrosion is provided.

3.2.3.2 Aluminum alloy parts. Unless otherwise specified, aluminum alloy parts shall be covered with a type IC, II, or IIB anodic film conforming to MIL-A-8625, or government-approved alternate methods. The dial, small holes, threads, and case inserts need not be anodized. Aluminum alloys that do not anodize satisfactorily shall be coated with a type II, class 3 chemical film in accordance with MIL-DTL-5541. Alternate chemical film methods may be substituted with government approval.

3.2.3.3 Steel parts. Steel parts shall be cadmium-plated where practicable in accordance with SAE AMS-QQ-P-416. Alternate methods of corrosion prevention may be used with government approval.

3.2.4 Protective treatment. When materials are used in the construction of the indicator that are subject to atmospheric or environmental conditions likely to cause corrosion in normal service life, they shall be protected against corrosion in a manner that will in no way prevent compliance with the performance requirements of this specification. Finishes and protective coatings which will crack, chip, or scale during normal service life, or are affected by extremes of atmospheric or environmental conditions, shall not be used.

3.2.5 Fungus-proof materials. Materials that are nutrients for fungi shall not be used where it is practicable to avoid them. Where used, they shall be treated with a fungicidal agent acceptable to the procuring activity. If the indicator case is of a hermetically sealed design, then fungicidal treatment of the materials or components installed within the case will not be necessary.

3.2.6 Fumes and vapors. Materials used in the construction of the indicator shall not produce corrosive, deleterious, or toxic fumes or vapors under the conditions specified herein.

3.3 Design and construction. The design of the indicator shall provide a pressure-actuated mechanism. The indicator shall be so constructed that no parts will work loose in service, and it will withstand the normal shocks, vibrations, and such other conditions as are incident to service, shipping, storage, and installation without a failure.

3.3.1 Maintenance. The design shall be such as to facilitate as much as possible disassembly, repair or overhaul, service maintenance, and reassembly using those tools and items of maintenance equipment that are normally available as commercial standards.

3.3.2 Case. The case shall consist of a body, a mounting flange, and a bezel ring conforming to MS33638 for the 2-inch nominal size, with an overall length of  $1.750 \pm 0.125$  inches. The case shall be made of nonferrous, low-density metal, uniform in texture, and shall

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be finished with lusterless black in accordance with FED-STD-595/37038. The finishing materials shall be of a durable type to withstand usage encountered in service.

3.3.2.1 Pressure boss. The case shall have a metal boss in accordance with SAE AS5202-04 located on the rear within 0.25 inch of the vertical and horizontal centerlines, and shall not protrude more than 0.25 inch from the rear of the case. A 150 × 150 wire mesh corrosion-resistant filter screen shall be firmly installed.

3.3.2.2 Reinforcement. The case around the pressure boss shall be of sufficient strength to prevent damage to the case when the connection is tightened during installation of the indicator.

3.3.2.3 Bezel ring. The bezel ring shall be held in place by means of screws properly secured with lock washers. Provision shall be made for the replacement of the cover glass by removal of the bezel ring.

3.3.3 Weight. The weight of the completely assembled indicator shall not exceed 0.5 pound.

3.3.4 Screw threads. Screw threads shall be in accordance with MIL-S-7742.

3.4 Dial and pointer.

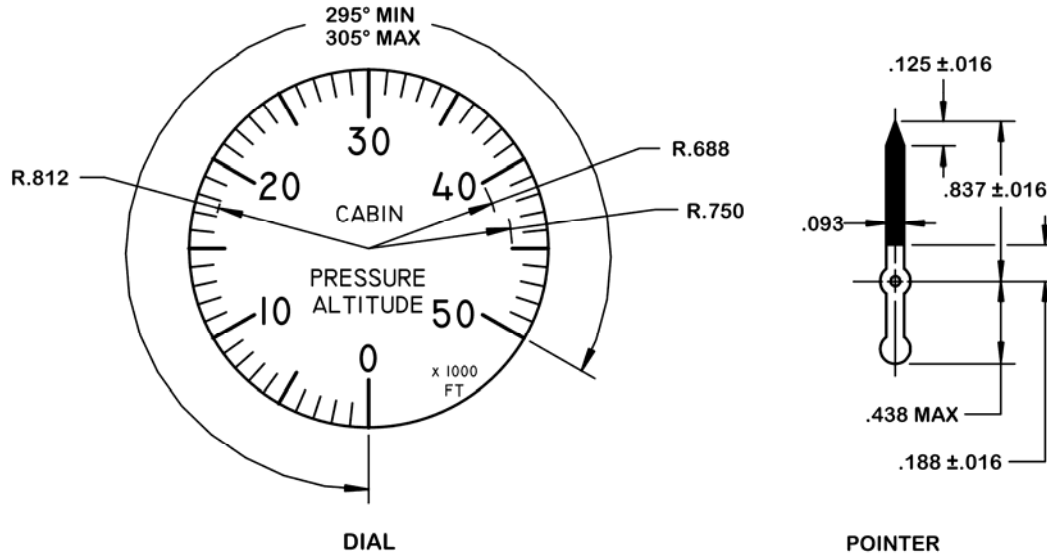
3.4.1 Dial. The dial shall be securely mounted in such a manner that it will not loosen or slip when the indicator is vibrated. If screws are used, they shall be so located that they will not interfere with the proper location of any dial marking.

3.4.1.1 Visibility of dial. The pointer, the numerals, at least 0.031 inch of the shortest graduations, and all other specified markings on the dial shall be visible from any point within the frustum of a cone whose side makes an angle of 30 degrees with a perpendicular to the dial, and whose small diameter is the aperture of the case.

3.4.1.2 Dial marking. The dial shall be marked and finished as shown in figure 1. The colors shall not change as a result of service use or subjecting the indicator to the inspections specified herein. The form of the numerals and letters shall be in accordance with MS33558. Numerals shall distinctly indicate the graduation to which each applies. If practicable, each numeral shall be placed so that the center of area of the numeral(s) is on the radial line joining the appropriate graduation and the center of the dial. Any confusion resulting in doubt as to the graduation to which the numeral applies shall be cause for rejection. When several numerals are used in one group, the space between the numerals shall be not less than 0.016 inch.

3.4.2 Pointer. The pointer of the indicator shall be firmly attached to the mechanism, but also shall be readily removable during servicing or overhaul. The pointer form, dimensions, and finish shall conform to the requirements shown in figure 1.

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## NOTES:

1. All dimensions are in inches.
2. Unless otherwise specified, dial tolerance  $\pm 0.016$ ; pointer tolerance  $\pm 0.010$ ; angles  $\pm 0.5^\circ$ .
3. All dial graduations are partial radial lines.
4. Numerals and letters shall be in accordance with MS33558.
5. Thickness of pointer shall be not less than 0.010.
6. Balance end and hub of pointer shall be designed to suit conditions.

Marking	Height or length ( $\pm 0.010$ )	Width of line or graduation ( $+0.005/-0.000$ )	Material or finish <sup>1</sup>
Numerals 0, 10, 20, 30, 40, 50	0.156	0.020	Lusterless white in accordance with FED-STD-595/37875
Lettering "CABIN PRESSURE ALTITUDE"	0.093	0.015	
"X 1000 FT"	0.062	0.010	
Major graduations at 0, 5, 10, 15, etc.	As shown	0.020	
Minor graduations	As shown	0.012	
Shaded portion of pointer	As shown	-	
Unshaded portion of pointer	As shown	-	Lusterless black in accordance with FED-STD-595/37038
Background of dial	-	-	

<sup>1</sup> Figure shown in negative view.

FIGURE 1. Dial markings.

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3.5 Cover glass. The quality of the cover glass shall be in accordance with ASTM C1036, quality Q1, for flat sheet glass. Any flaws permitted by ASTM C1036 shall not interfere with reading of the dial. The dimensions of the cover glass shall be in accordance with MS28105.

3.5.1 Cover glass mounting. The distance from the inner surface of the cover glass to the surface of the dial on which the marking is applied shall not exceed 0.125 inch.

3.6 Performance. The indicator shall perform satisfactorily when subjected to the tests shown in section 4 of this specification.

3.6.1 Mean-time between failures (MTBF). The indicator shall have a MTBF ( $\theta_1 - \theta_0/\theta_1$ ) of not less than 2,000 hours, based on a decision risk of 10 percent and a discrimination ratio ( $\theta_0/\theta_1$ ) of 1.5:1. In instances where the manufacturer does not have historical data for calculation of MTBF, the procuring activity may specify reliability assurance testing (see 4.2.2).

3.7 Nameplate. A nameplate shall be securely attached to the exterior of the case and shall be marked in accordance with the requirements of MIL-STD-130, except that the national stock number shall be omitted.

3.7.1 Manufacturer's part number. The manufacturer's part number on the nameplate shall be identical with the manufacturer's engineering production drawing number including applicable dash numbers if the drawing is tabulated and covers more than one part.

3.8 Interchangeability. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance. Changes in manufacturer's part numbers shall be governed by the drawing number requirements of MIL-STD-31000.

3.9 Mounting hardware. The mounting flange shall be capable of retaining clip-in lock nuts conforming to legacy part number MS33737-11 in accordance with NASM33737.

3.9.1 Mounting lugs. Mounting lugs of the complete assembled case shall each withstand for 1 minute, without fracture, a load of 175 pounds applied along the mounting hole axis and toward the front of the instrument.

3.10 Shipping plug. A suitable shipping plug shall be screwed in the pressure insert for shipping purposes. The plug shall incorporate a vent consisting of a hole  $0.062 \pm 0.016$  inch in diameter.

3.11 Mechanism adjustment. The mechanism shall be provided with means of adjusting or correcting the indications to conform to the performance requirements herein, in case this becomes necessary during the life of the indicator. The calibration adjustment shall not affect the temperature performance of the instrument. This means of adjustment shall be reasonably simple to manipulate and of such nature that adjustment can be accomplished by tools ordinarily possessed by an instrument repair technician.

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3.12 General requirements. Indicators manufactured under this specification should conform to the applicable general guidelines of MIL-HDBK-454.

3.13 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

## 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. First article inspection shall consist of all the inspections and tests of this specification, performed in the order specified in table I.

TABLE I. First article inspections and tests.

Inspections and tests	Reference paragraph
Examination of product	4.5.1
Case leakage	4.5.2
Scale error (room temp.)	4.5.3
Hysteresis	4.5.4
After effect	4.5.4.1
Position error	4.5.5
Friction	4.5.6
Scale error (-55 °C (-67 °F))	4.5.7
High temperature characteristics	4.5.8
Vibration error	4.5.9
Overpressure	4.5.10
Magnetic effect	4.5.11
Vibration endurance	4.5.12
High altitude (low temp.)	4.5.13
Humidity	4.5.14
Fungus resistance	4.5.15
Salt fog	4.5.16
Mounting lugs	4.5.17
Internal examination	4.5.18



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4.2.1 First article samples. Unless otherwise specified, as soon as practicable after award of a contract or order, the manufacturer shall submit three cabin air pressure indicators for first article testing. The sample units shall be representative of the construction, workmanship, components, and materials to be used during production. When a manufacturer is in continuous production of these cabin air pressure indicators from contract to contract, submission of further first article samples on the new contract may be waived at the discretion of the procuring activity (see 6.2). Approval of the first article samples or the waiving of the first article inspection does not preclude the requirements of submitting to the conformance inspection. The first article samples shall be furnished to the government as directed by the contracting officer (see 6.2). Each sample unit shall be plainly identified by a securely attached durable tag marked with the following information (less quotes/brackets):

"Sample for first article"

"Submitted by [name] [date] for tests in accordance with the requirements of specification

MIL-DTL-5099 under authorization [reference letter authorizing test]"

"Indicator, Cabin Air Pressure"

[Manufacturer's Part No.]

[MIL-DTL Part No.]

[Name of manufacturer]

4.2.1.1 Disposition of first article samples. Upon completion of the first article inspection, all the applicable inspection reports and, when applicable, recommendations and comments pertinent for use in monitoring production will be forwarded to the government contracting officer. The sample units may be consumed or destroyed in the first article inspection and shall not be considered as part of the quantity to be delivered under contract (see 6.2).

4.2.2 Reliability assurance testing. Reliability assurance testing, if required for the purposes of establishing MTBF, shall be as specified by the procurement contract (see 6.2). Reliability test documentation should conform to the guidelines of MIL-HDBK-781 and shall be maintained and readily available.

4.3 Conformance inspection. Conformance inspection of the cabin air pressure indicators shall consist of the individual inspections and tests; and the sampling plans of this specification as shown in table II.

TABLE II. Conformance inspection and test requirements.

Inspections and tests	Reference paragraph	Individual (See 4.3.1)	Sampling plan A (See 4.3.2.1)	Sampling plan B (See 4.3.2.2)
Examination of product	4.5.1	X	X	X
Case leakage	4.5.2	X	X	X
Scale error (room temp.)	4.5.3	X	X	X
Hysteresis	4.5.4	X	X	X

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TABLE II. Conformance inspection and test requirements - Continued.

Inspections and tests	Reference paragraph	Individual (See 4.3.1)	Sampling plan A (See 4.3.2.1)	Sampling plan B (See 4.3.2.2)
After effect	4.5.4.1	X	X	X
Position error	4.5.5	X	X	X
Friction	4.5.6	X	X	X
Scale error (-55 °C (-67 °F))	4.5.7	-	X	X
High temp. characteristics	4.5.8	-	X	X
Vibration error	4.5.9	-	X	X
Overpressure	4.5.10	-	X	X
Magnetic effect	4.5.11	-	X	X
Vibration endurance	4.5.12	-	-	X
High altitude (low temp.)	4.5.13	-	-	X
Humidity	4.5.14	-	-	X
Fungus resistance	4.5.15	-	-	X
Salt fog	4.5.16	-	-	X
Mounting lugs	4.5.17	-	-	X
Internal examination	4.5.18	-	-	X

4.3.1 Individual inspection. Each indicator submitted for acceptance shall be subjected to individual inspections and tests. These inspections and tests shall determine compliance with the requirements of material, workmanship, and operational accuracy. As a minimum, each indicator accepted shall have passed the individual inspections and tests shown in table II.

4.3.2 Sampling plans. The sampling plans shall consist of sampling plan A and sampling plan B inspections and tests shown in table II. The inspection samples selected for sampling tests shall first have passed the individual inspections. The inspection samples that have been subjected to sampling plan A inspection shall not be delivered on contract until they have been refurbished to good as new condition, resubmitted, and passed all the individual inspections. Inspection samples that have been subjected to the sampling plan B inspection shall not be delivered on the contract.

4.3.2.1 Sampling plan A sample selection. Sampling plan A samples shall be selected at random in accordance with the schedule shown in table III. When a defective indicator occurs, no items from those still on-hand or later produced shall be accepted until the extent and cause of the failure have been determined and appropriately corrected. In addition, when a failure occurs, shift to one sample out of fifteen (when sampling plan B is omitted) and proceed as indicated.

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TABLE III. Sampling plan A.

Quantity offered for acceptance	Quantity to be selected for inspection
First 15	See Note 1
Next 50	1
Next 75	1
Next 100	1
Each additional 200 or fraction thereof	1

<sup>1</sup> When sampling plan B is invoked, the quantity shall be zero.  
When sampling plan B is to be omitted, the quantity shall be one.

4.3.2.1.1 Sampling plan A inspection. Each sample selected for sampling plan A inspection shall be subjected to the tests as shown in table II, in the order listed.

4.3.2.2 Sampling plan B sample selection. When required by the procurement contract, 2 indicators shall be selected at random from the first 15 produced on contract (see 6.2).

4.3.2.2.1 Sampling plan B inspection. Each indicator selected for sampling plan B inspection shall be subjected to the tests as shown in table II, in the order listed.

#### 4.4 Inspection conditions.

4.4.1 Standard conditions. Unless otherwise specified, all inspections required by this specification shall be made under the following conditions:

Temperature	Room ambient: $25 \pm 5$ °C ( $77 \pm 9$ °F).
Pressure	Normal atmospheric: Approximately 29.92 inches mercury (Hg). When tests are made with atmospheric pressure substantially different from the above values, proper allowance for change in indicator reading shall be made for the difference from the specified conditions.
Humidity	Room ambient: 40 to 90 percent relative humidity.

4.4.2 Test readings. Unless otherwise specified, before a test reading is taken, the indicator shall be tapped using a vibrator set at 60 Hertz (Hz) with a maximum double amplitude of 0.002 inch.

4.4.3 Attitude. Unless otherwise specified, the indicator shall be tested in its normal operating position.

#### 4.5 Test methods.

4.5.1 Examination of product. Each indicator shall be examined externally to determine conformance with the applicable drawings and with all the requirements of this specification not covered by tests.

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4.5.2 Case leakage. A vacuum, sufficient to produce a change of reading of the pointer of approximately 18,000 feet, shall be slowly applied to the static pressure connection of the indicator, at which point the connection tubing shall be pinched off or otherwise sealed. After pinching or sealing, indicated pressure changes shall not exceed 100 feet in 1 minute.

4.5.3 Scale error (room temperature). The indicator shall be subjected successively to the pressures specified in table IV. The reduction in pressure, as indicated by a standard laboratory atmospheric barometer during the interval between test points, shall be made at a rate corresponding to an increase in altitude of approximately 3,000 feet per minute. The indicator shall remain at the pressure corresponding to each point for at least 1 minute, but not more than 10 minutes, before a test reading is taken. The scale errors shall be tabulated. Movement of the pointer shall be free from backlash and any irregular motion when the pressure is varied uniformly. The scale error at any point shall not exceed the tolerance listed in table IV. The tests shall be repeated while decreasing the altitude.

TABLE IV. Scale errors.

Standard altitudes (feet)	Equivalent atmospheric pressure (inches Hg) <sup>1</sup>	Room temperature (variation from standard altitude) (±feet)	-55 ±2 °C (-67 ±4 °F) (variation from room temperature reading) (±feet)
0	29.921	200	300
5,000	24.896	300	300
10,000	20.577	400	400
15,000	16.886	500	500
20,000	13.750	600	600
25,000	11.104	700	700
30,000	8.885	800	800
35,000	7.041	900	900
40,000	5.538	1,000	1,000
45,000	4.355	1,100	1,100
50,000	3.425	1,200	1,200

<sup>1</sup> Aeronautical pressure equivalents are listed from MIL-STD-859.

4.5.4 Hysteresis. Not more than 15 minutes after the indicator has been first subjected to the pressure corresponding to the upper limit of the scale in the scale error test, the pressure shall be increased at a rate corresponding to a decrease in altitude of approximately 3,000 feet per minute until the pressure corresponding to the first test point given in table V is reached. The indicator shall remain at this pressure for at least 5 minutes, but for not more than 15 minutes, before the test reading is taken. After the reading has been taken, the pressure shall be further increased at the above rate until the pressure corresponding to the second test point given in table V is reached. The indicator shall remain at this pressure for at least 1 minute, but for not more than 10 minutes, before the test reading is taken. After the reading has been taken, the pressure shall be further increased at the above rate until atmospheric pressure is reached. The reading of the indicator at either of the two test points shall not differ from the reading of the indicator for the corresponding altitude in the scale error test by more than the permissible variation given in table V.

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TABLE V. Hysteresis.

Test points	Standard altitude (feet)	Equivalent atmospheric pressure (inches Hg) <sup>1</sup>	Permissible Variation (±feet)
First point	25,000	11.104	300
Second point	20,000	13.750	300
Third point	-	Ground level	150

<sup>1</sup> Aeronautical pressure equivalents are listed from MIL-STD-859.

4.5.4.1 After effect. Not less than 1 minute and not more than 5 minutes after the completion of the hysteresis test, the pointer shall have returned to its original reading, corrected for any change in atmospheric pressure, within the tolerance given in table V at the third test point.

4.5.5 Position error. At normal atmospheric pressure, the indicator shall be held in the normal operating position, tapped in accordance with 4.4.2, and a reading taken. The procedure shall be repeated at 90-degree increments as the indicator is rotated 360 degrees about each horizontal axis. The maximum deviation of the latter readings from the original reading shall not exceed 200 feet.

4.5.6 Friction. The indicator shall be tested for friction at each of the test points listed in table VI. The pressure shall be decreased to bring the pointer in approximation to the desired reading, then held constant while two readings are taken: the first, before the indicator is tapped, and the second, after the indicator has been tapped. The difference of any two such readings shall be recorded as friction and shall not exceed the tolerances specified in table VI. This test may be combined with the test for scale error at room temperature. At the option of the government inspector, any other points may be tested for compliance with the above test.

TABLE VI. Friction.

Altitude (feet)	Tolerance (±feet)
1,000	200
2,000	200
3,000	200
5,000	200
10,000	200
15,000	200
20,000	300
25,000	300
30,000	300
35,000	400
40,000	500
50,000	700

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4.5.7 Scale error (-55 °C (-67 °F)). For a period of not less than 12 hours prior to this test, the indicator shall not have been subjected to any test involving operation at other than atmospheric pressures. The scale error (room temperature) test shall be repeated with the difference that the temperature of the indicator having been maintained for a 3-hour period prior to and during the test at -55 °C (-67 °F). The test points shall be those given in table V. The change in scale errors, of this test from corresponding scale errors in the room temperature test, shall not exceed the tolerance specified in table IV.

4.5.8 High temperature characteristics. The indicator shall be subjected to a temperature of  $70 \pm 2$  °C ( $158 \pm 4$  °F) for a period of 3 hours. It shall then be allowed to cool to ambient room temperature, after which it shall be subjected to, and meet the requirements specified for, case leakage and scale error (room temperature) tests (see 4.5.2 and 4.5.3).

4.5.9 Vibration error. The indicator shall be tested in accordance with vibration procedure I, method 514, of MIL-STD-810. While the indicator is being vibrated at frequencies from 10 to 40 Hz, the range of the pointer oscillation shall not exceed 250 feet and the pointer variation from its original position shall not exceed 250 feet. While the indicator is being vibrated at frequencies from 40 to 500 Hz, the range of pointer oscillation shall not exceed 400 feet and the pointer variation from its original position shall not exceed 400 feet.

4.5.10 Overpressure. The indicator shall be subjected to an absolute pressure of 50 inches Hg for a period of 1 hour, and then to ambient atmospheric pressure for the next 6 hours. Immediately following the 6 hours at atmospheric pressure, the scale error (room temperature) test (see 4.5.3) shall be performed. The scale errors shall not vary from the previously noted scale errors by more than the allowable variation listed in table VII.

TABLE VII. Allowable overpressure scale error.

Standard altitude (feet)	Variation (±feet)
0	200
5,000	200
10,000	200
20,000	200
25,000	200
30,000	200
35,000	300
40,000	300
45,000	400
50,000	400

4.5.11 Magnetic effect. The indicator shall be placed with its nearest part 6 inches from the center of an uncompensated short bar magnet compass in a horizontal magnetic field of 13.53 to 15.12 ampere-turns per meter. When the indicator is rotated 360 degrees about its two horizontal axes at each of the six 90 degree positions about the compass, the compass deflection shall not exceed 1 degree from its reference position.

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4.5.12 Vibration endurance. The scale error shall be noted at the existing atmospheric pressure. The instrument shall be subjected to a cyclic vibration endurance test in accordance with figure 2 and procedure I, method 514, of MIL-STD-810 for a 3-hour period. At the end of the vibration period, the scale error at atmospheric pressure shall again be noted. The difference between the reading determined before and that determined after vibration, after correction for any changes in atmospheric pressure, shall not exceed 100 feet.

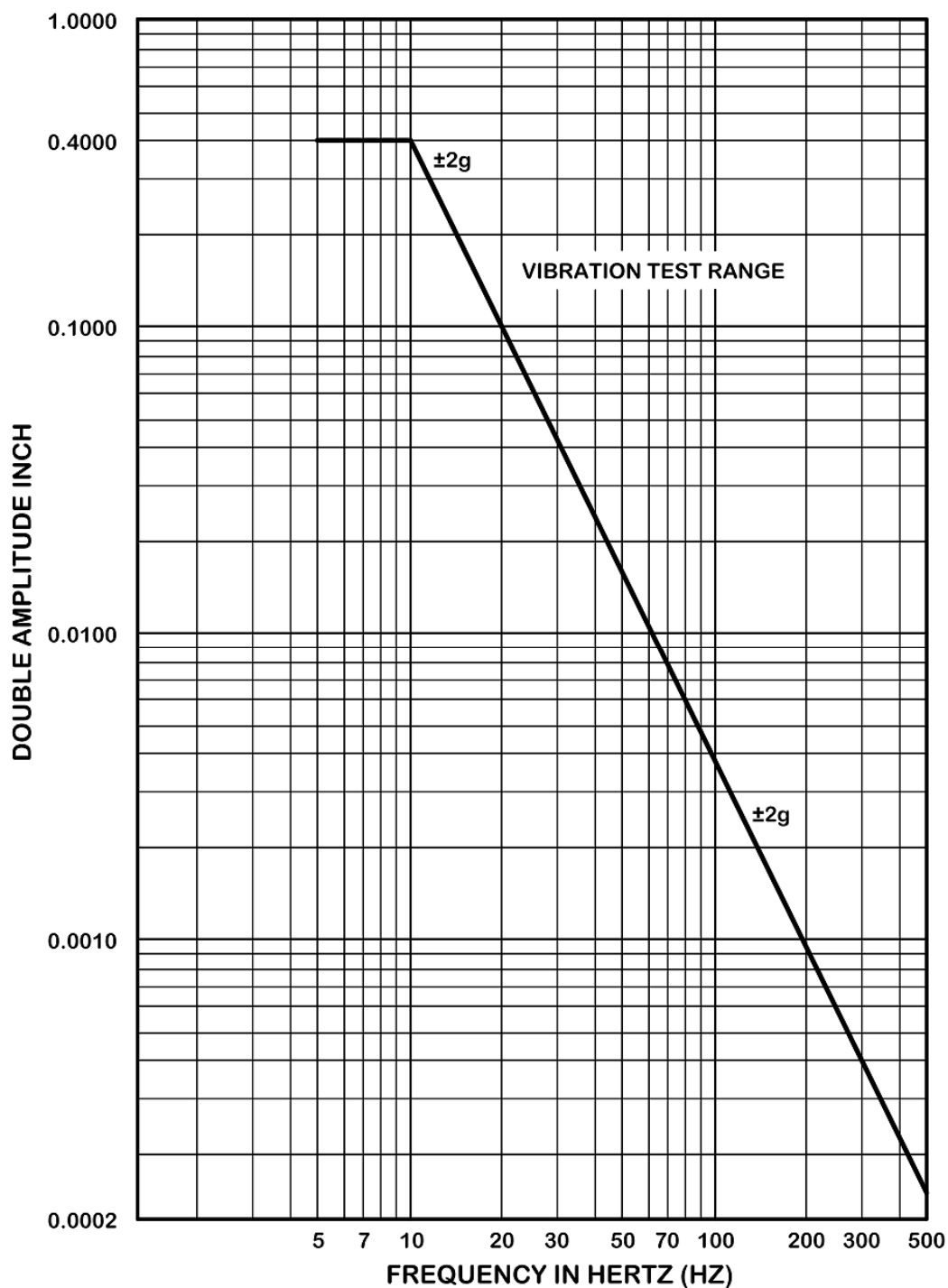


FIGURE 2. Vibration testing amplitude-frequency curve.

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4.5.13 High altitude (low temperature). The indicator shall be placed in a chamber and maintained at a temperature of approximately  $-65\text{ }^{\circ}\text{C}$  ( $-85\text{ }^{\circ}\text{F}$ ) and a pressure equivalent to 50,000 feet for 4 hours. The indicator shall then be returned to atmospheric pressure and maintained at a temperature of  $-65 \pm 2\text{ }^{\circ}\text{C}$  ( $-85 \pm 4\text{ }^{\circ}\text{F}$ ) for an additional period of 44 hours. There shall be no damage that would affect subsequent operation. Upon return to room temperature, the indicator shall be subjected to and shall meet the requirements of the individual inspection.

4.5.14 Humidity. The indicator mounted with the dial face up shall be tested in accordance with humidity testing procedure II, method 507, of MIL-STD-810. Within 24 hours after completion of the test, the indicator shall be subjected to and shall meet the requirements of the individual inspection.

4.5.15 Fungus resistance. The indicator shall be tested in accordance with fungus testing method 508 of MIL-STD-810 except that the test period shall be 14 days. Any evidence of fungi growth shall be cause for rejection.

4.5.16 Salt fog. The indicator shall be tested in accordance with salt fog testing method 509 of MIL-STD-810. Upon completion of the test, the indicator shall be subjected to and shall meet the requirements of the individual inspection.

4.5.17 Mounting lugs. The indicator case, with mechanism removed, shall be mounted face-downward on the movable head of a suitable testing machine with the face 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 the pull strap. A load of 175 pounds shall be applied along the mounting hole axis toward the front of the case for a period of 1 minute. Any evidence of fracture shall be cause for rejection.

4.5.18 Internal examination. The case of the indicator shall be opened and the internal mechanism examined. Any deterioration or damage that could in any manner prevent the indicator from meeting functional operation during its service life shall be cause for rejection.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.



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## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The indicator covered by this specification is intended for use in aircraft equipped with pressurized cabins to indicate the air pressure altitude in the cabins.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Quantity desired.
- c. First article inspection, if required (see 3.1 and 4.2.1).
- d. Reliability assurance test plan, if required (see 3.6).
- e. Waiver or delivery of first article samples (see 4.2.1).
- f. Disposition of first article samples (see 4.2.1.1).
- g. Reliability assurance testing, if required (see 4.2.2).
- h. Sampling plan B sample units, if required (see 4.3.2.2).
- i. Packaging requirements (see 5.1).

6.3 Definitions.

6.3.1 Amplitude. For the purposes of this specification, "amplitude" will be interpreted to mean the extent of motion as measured from the mean position to one extreme position (see 4.4.2).

6.3.2 Good as new. For the purposes of this specification, "good as new" will be interpreted to mean indicators that have been operated less than 10 percent of their specified MTBF operation (see 4.3.2).

6.3.3 Refurbished. For the purposes of this specification, "refurbished" will be interpreted to mean that the indicator has been completely overhauled with all component parts meeting current parts standards; and the indicator will have been subjected to, and met, all the requirements of a new indicator (see 4.3.2).

6.4 Subject term (key word) listing.

Aeronaut  
After effect  
Altimeter  
Altitude  
Atmospher  
Cadmium  
Gauge  
Hysteresis  
MTBF  
Scale error

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6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:

Air Force - 99

DLA - GS

Preparing Activity:

DLA - GS1

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Review Activity:

Air Force - 71

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST database at <https://assist.daps.dla.mil/>.