

INCH-POUND

MIL-PRF-27197D(USAF)

24 November 1997

SUPERSEDING

MIL-I-27197C(USAF)

31 December 1985

## PERFORMANCE SPECIFICATION

## INDICATOR, AIRSPEED, MACH NUMBER AND MAXIMUM ALLOWABLE SPEED

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

## 1. SCOPE

1.1 Scope. This specification covers nonlighted and integrally lighted combination indicated airspeed (IAS) and mach number indicators.

1.2 Classification. Indicators will be of the following classifications as specified (see 6.2):

AVU-8B/A	Improved Dial, and Cover Glass Coated with Multilayer Anti-reflection Coating of High Efficiency
AVU-8C/A	Cover Glass Coated with Multilayer Anti-reflection Coating of High Efficiency and with 3/8 Inch Static and 1.4 Inch Pitot Tubing Connectors
ME-4	Nonlighted, Dial Fluorescent, Luminescent Material Conforming to MIL-L-25142

## 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 documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to: Oklahoma City Air Logistics Center/TICLA, 3001 Staff Drive, Suite 1AE1-101A, Tinker AFB, OK 73145-3036 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2.2.1 Specification and standards. The following specification and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

## SPECIFICATION

## DEPARTMENT OF DEFENSE

MIL-C-14806 - Coating, Reflection Reducing, for Instrument Cover Glasses and Lighting Wedges

## STANDARDS

## FEDERAL

FED-STD-595 - Colors Used in Government Procurement

## DEPARTMENT OF DEFENSE

MS28105 - Cover Glass, Aircraft Instrument Dial  
 MS33558 - Numerals and Letters, Aircraft Instrument Dial, Standard Form of  
 MS33649 - Boss, Fluid Connection - Internal Straight Thread

(Unless otherwise indicated, copies of the above specification and standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia, PA 19111-5094.)

2.3 Other Government document. The following other Government document forms a part of this document to the extent specified herein. Unless otherwise specified, the applicable issues are cited in the solicitation.

## NASA Technical Note

D822 - Tables of Airspeed, Altitude, and Mach Number Based On Latest International Values For Atmospheric Properties And Physical Constants

(Copies of the NASA document may be obtained from the National Aeronautics and Space Administration, Washington DC 20546).

2.4 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

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AMERICAN NATIONAL STANDARDS INSTITUTE/AMERICAN SOCIETY FOR QUALITY (ANSI/ASQ)

ANSI/ASQ Z1.4 - Sampling Procedures And Tables For Inspection By Attributes (DoD-adopted)

(Application for copies should be addressed to American Society for Quality, P.O. Box 3066, Milwaukee, WI 53201-3066, or to the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus (DoD-adopted)

(Application for copies should be addressed to American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

RADIO TECHNICAL COMMISSION FOR AERONAUTICS (RTCA)

RTCA/DO-160 - Environmental Conditions and Test Procedures for Airborne Equipment

(Application for copies should be addressed to RTCA, Inc., Suite 1020, 1140 Connecticut Avenue, NW, Washington, DC 20036-4001.)

2.5 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), 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 Qualification. The indicators furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) before contract award (see 4.2 and 6.3).

3.2 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 cost.

3.3 Materials. All materials shall be suitably treated to resist corrosion due to electrolytic decomposition, fungus, salt fog, and any other condition that may be encountered during operational use or storage. Nonmagnetic materials shall be used for all parts of the indicator

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where possible. The use of toxic chemicals, hazardous substances, or ODCs shall be avoided, whenever feasible.

### 3.4 Interface. (See 6.4.4)

3.4.1 Dimensions. The indicator and case shall conform to Figures 1, and 3 through 5.

3.4.2 System interface. The indicator shall incorporate the following features:

- a. A pitot-static pressure-operated IAS mechanism that drives a pointer to IAS on a fixed dial as shown on Figures 2 and 3, as applicable.
- b. A static pressure-operated altitude mechanism that drives a moving scale to indicate the mach number through the window on the moving mask as shown on Figures 2, 4, and 5.
- c. The mach number shall be indicated by the IAS pointer on the moving scale at any combination of airspeed and altitude within the range of the indicator.

3.4.3 Maximum allowable equivalent airspeed (MAEAS) pointer. The MAEAS pointer shall conform to Figure 5. The pointer shall be positioned as a function of equivalent airspeed (EAS) and shall indicate, in terms of IAS, the EAS which has been set into the instrument by means of the adjustment on the rear of the indicator. The pointer shall be adjustable from 600 to 800 knots EAS in 10 knot increments. An MAEAS adjustment conforming to Figure 1 shall be provided on the rear of the indicator. The scale of adjustment shall conform to Figure 1. The mechanism shall allow the values of EAS between the numerals to be set by linear interpolation between the numbers of the scale.

3.4.4 IAS index set knob and index pointer. An IAS index pointer shall be provided as shown on Figures 2 and 5. The setting of the IAS index pointer shall be controlled by the IAS index set knob shown in Figure 2. The IAS index pointer shall be adjustable from 100 to 700 knots (minimum) IAS within  $\pm 1$  knot. The IAS index pointer shall conform to Figure 5.

3.4.5 Case. The case shall conform to Figure 1. The case shall be entirely covered with a durable, lusterless black finish conforming to color number 37038 of FED-STD-595.

3.4.6 Bezel. The bezel shall have a lusterless black finish conforming to color number 37038 of FED-STD-595. The bezel shall be securely attached to the case.

3.4.7 Pointers. The IAS and MAEAS pointers shall conform to Figure 5.

3.4.8 Cover glass. The cover glass shall conform to MS28105 and shall be replaceable. If the cover glass is used as part of the lighting system, its size and shape may deviate from the dimensions specified on MS28105 to the extent required for proper lighting design.

3.4.9 Reflection-reducing coating. All reflecting surfaces shall be reflection-reduced according to MIL-C-14806.

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3.4.10 Integral lighting (AVU-8B/A and AVU-8C/A only). The indicator shall incorporate parallel lighting circuitry as shown in Figure 1. Other lighting requirements shall be specified in the acquisition document (see 6.2), and shall operate on 5Vac or 5Vdc.

3.4.11 Dial. The indicator dial shall conform to Figures 2 and 3. The style and proportions of the numerals and letters shall conform to MS33558. Each numeral shall distinctly indicate the graduation to which it applies. The graduations shall be located on the dial as shown on Figures 2, 3, and 4.

3.4.12 White markings (AVU-8B/A and AVU-8C/A only). The markings in Table I shall be finished in lusterless white, color number 37875, or semi-gloss gray, color number 36595, of FED-STD-595 (see 6.4.1). The dimensions of the markings shall conform to Table I.

3.4.13 Fluorescent luminescent material (ME-4 only). The markings in Table I shall be finished in fluorescent luminescent material (see 6.4.2). The dimensions of the markings shall conform to Table I.

TABLE I. Marking dimensions

Marking	Height or length ( $\pm 0.016$ )	Width of line or graduation ( $\pm 0.005$ )
Numerals on IAS dial	0.250	
Numerals on mach scale		
0.5 through 1.6	0.156	
1.8 through 2.2	0.125	
Graduations corresponding to 100 knot increments	As shown on Figure 3	
Graduations corresponding to 50 knot increments		
below 400 knots (except 150)	0.219	0.030
above 400 knots	0.156	0.030
Graduations corresponding to 150 knot increments	0.125	0.030
Graduations corresponding to 10 knot increments	0.156	0.020
Graduations corresponding to 0.10 mach increments	0.125	0.030
Graduations corresponding to 0.05 mach increments	0.094	0.020
Lettering MACH NO.	0.094	0.020
Lettering KNOTS X 100	0.094	0.020
Zero graduation	0.125	0.020
Lettering SET INDEX	0.078	0.020
Shaded portion of IAS pointer	As shown of Figure 5	
Settable index pointer	As shown of Figure 5	
Note: All dimensions are in inches		

3.4.14 Black markings. USAF, classification, and MACH NO. & IAS shall be permanently and legibly marked as specified in Figure 5. These markings, all backgrounds, and all other markings shall be finished in lusterless black, color number 37038 of FED-STD-595.

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3.4.15 Dial visibility. The pointer, numerals, at least 0.063 inch of the shortest graduations, and other specified markings on the dial shall be visible from any point within the frustum of a cone, the side of which makes an angle of 30° from a perpendicular to the dial, where the small diameter is the aperture of the indicator case.

3.4.16 Pressure fittings. Pitot-static pressure and static pressure fittings shall be as shown on Figure 1.

### 3.5 Performance.

3.5.1 Airspeed and mach number equations. Airspeed equations, mach number equations, and the relationship between pressure and altitude shall be in accordance with NASA Technical Note D822.

3.5.2 MAEAS pointer adjustment. The MAEAS shall be adjustable by an adjustment on the back of the indicator (see Figure 1). The MAEAS pointer adjustment shall be protected by a cover. The cover shall be removable without the use of special tools.

3.5.3 Concentricity of pointers. The MAEAS pointer and the IAS pointer shall be concentric within 0.010 inch total indicator reading (TIR). The MAEAS pointer shall be nearest the dial.

3.5.4 Indicator Range. The indicator shall operate over an IAS range of 80 to 850 knots and at mach number ranges of 0.50 to 2.2 at altitudes of -1,000 to 80,000 feet.

3.5.5 System safety. The indicator shall present no danger of minor injury to operating and service personnel or minor damage to the weapon system.

3.5.6 IAS range of indication. The IAS pointer movement shall be limited by stops. The pointer shall rotate no more than 355° clockwise from 0° when the indicator is subjected to overpressure.

3.5.7 Magnetic effect. The indicator shall not cause a free compass to deflect more than 1° when revolved about a short bar magnetic compass with a field intensity of 0.17 to 0.19 oersted.

### 3.5.8 Seal.

3.5.8.1 Case leakage. Case leakage shall be no more than 0.01 inch Hg per minute when mounted in an instrument panel or mock-up panel.

3.5.8.2 Low temperature case leakage. The case leakage shall be no more than 0.025 inch Hg per minute at -31°F.

3.5.8.3 Static pressure. The static pressure of the case shall change no more than 0.15 inch of Hg.

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3.5.9 Weight. The weight of the indicator shall be 2.5 pounds or less.

3.5.10 Damping. The time for the indicator to change indication from full scale to 90 knots shall be greater than 0.8 seconds and less than 2.0 seconds.

3.5.11 Seasoning. The AVU-8B/A and ME-4 shall withstand 250 hours of pressure cycling at a rate of 4 cycles per hour. The AVU-8C/A shall withstand 1,000 hours of pressure cycling at a rate of 4 cycles per hour.

3.5.12 Scale error. The IAS, mach number, and MAEAS scale errors shall be within the tolerances in Tables II, III, and IV.

3.5.13 Friction error.

3.5.13.1 IAS friction error. The IAS friction error shall be less than 3 knots for airspeeds less than 200 knots and less than 5 knots for airspeeds greater than 200 knots.

3.5.13.2 MAEAS friction error. The MAEAS friction error shall be less than 10 knots.

3.5.13.3 Mach number scale friction error. The mach number scale friction error shall be less than 5 knots.

3.5.14 Position error.

3.5.14.1 IAS position error. The IAS position error shall be less than 3 knots for airspeeds less than 200 knots and shall be less than 5 knots for airspeeds greater than 200 knots.

3.5.14.2 MAEAS position error. The MAEAS position error shall be less than 10 knots.

3.5.14.3 Mach number scale position error. The mach number scale position error shall be less than 5 knots.

3.6 Item identification. The indicator shall be permanently and legibly marked with the following information:

- a. Manufacturer's name.
- b. Manufacturer's CAGE code.
- c. Manufacturer's part number.
- d. Manufacturer's lot number.
- e. National Stock Number (NSN)
- f. Date of manufacture

3.7 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable.

3.8 Environmental conditions.

3.8.1 Temperature.

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3.8.1.1 Operating temperature. The indicator shall operate in temperatures ranging from -65° to 160°F.

TABLE II. Scale error tolerance

IAS (knots)	Differential pressure (inches Hg)	Tolerance ( $\pm$ knots)
80*	0.308	4.0
90	0.390	4.0
100*	0.481	3.0
110	0.583	3.0
120*	0.695	3.0
130	0.817	3.0
140*	0.949	3.0
150*	1.091	3.0
160*	1.244	3.0
170	1.406	5.0
180*	1.580	5.0
190	1.764	5.0
200*	1.959	5.0
220*	2.382	5.0
250*	3.104	5.0
280	3.924	5.0
300*	4.534	5.0
320	5.195	5.0
350*	6.286	5.0
380	7.502	5.0
400*	8.385	8.0
420	9.330	8.0
450	10.867	8.0
480	12.558	8.0
500*	13.776	8.0
520	15.069	8.0
550*	17.159	8.0
580	19.441	8.0
600*	21.075	10.0
650	25.589	10.0
700*	30.764	10.0
750	36.566	10.0
800*	42.938	10.0
850*	49.842	10.0



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TABLE III. Mach number scale error tolerance

Pressure altitude (1000s of feet)	Inches Hg	Mach setting	IAS (knots)	Tolerance (± knots)
0	29.9213	0.5	331	5
0	29.9213	0.6*	397	5
0	29.9213	0.9*	595	5
0	29.9213	1.0	661	5
10	20.5770	0.5*	277	5
10	20.5770	0.7*	391	5
10	20.5770	1.1*	625	5
20	13.7500	0.7*	324	5
20	13.7500	1.2	579	5
20	13.7500	1.4*	675	5
30	8.8854	0.6*	223	5
30	8.8854	1.0	390	5
30	8.8854	1.6*	643	5
40	5.5380	0.7	209	5
40	5.5380	1.0*	313	3
40	5.5380	1.5*	493	5
50	3.4246	0.9*	219	5
50	3.4346	1.6*	425	5
60	2.1178	1.2	245	3
60	2.1178	1.7*	363	3
80	0.8099	1.8*	245	5
80	0.8099	2.0	274	5

TABLE IV. MAEAS scale error tolerance

Pressure altitude (1000s of feet)	Ve = 600 knots		Ve = 700 knots		Ve = 800 knots		Tolerance (± knots)
	IAS	Mach number	IAS	Mach number	IAS	Mach number	
0	600	0.9077	700	1.0590	800*	1.2102	10
5	610	0.9951	713	1.1609	813	1.3268	10
10	622*	1.0945	726*	1.2770	826	1.4594	10
15	635*	1.2083	738*	1.4096	837*	1.6100	10
20	647	1.3390	749	1.5621	847	1.7853	10
25	658*	1.4900	758*	1.7384	---	---	10
30	667	1.6656	767*	1.9432	---	---	10
35	675*	1.8712	774*	2.1830	---	---	10
40	682*	2.1098	---	---	---	---	10

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3.8.1.2 Exposure temperature. The indicator shall withstand exposure to temperatures ranging from -85° to 160°F.

3.8.2 Vibration.

3.8.2.1 Vibration tolerance. The indicator shall operate while vibrated at a double amplitude of 0.10 inch from 5 to 20 Hz and while vibrated at 2g from 20 to 500 Hz.

3.8.2.2 Vibration error. The indicator shall function with a tolerance of  $\pm 10$  knots while vibrated at a double amplitude between 0.003 and 0.005 inch at frequencies from 5 to 50 Hz.

3.8.3 Humidity. The indicator shall operate at 95% relative humidity.

3.8.4 Acceleration. The indicator shall operate while subjected to an acceleration of 20g.

3.8.5 Sand and Dust. Exposure to sand and dust particles shall have no affect on the operation of the indicator.

4. VERIFICATION

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

- a. Qualification inspection (see 4.2)
- b. Conformance inspection (see 4.3)

4.2 Qualification inspection.

4.2.1 Test samples. The qualification test shall require five indicators. The qualification inspection shall consist of all the tests described in 4.6. Three of the indicators shall be subjected to all of the tests. The remaining two indicators shall be subjected to the individual tests.

4.3 Conformance inspection. Conformance inspection shall consist of:

- a. Individual tests.
- b. Sampling tests.

4.3.1 Individual tests. Each indicator shall be subjected to the following tests in 4.6:

- a. Examination.
- b. Seal.
- c. Scale error.
- d. Friction error.
- e. Position error.
- f. High temperature.
- g. Low temperature.
- h. Lighting.

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4.3.2 Sampling tests. Indicators shall be sampled according to ANSI/ASQ Z1.4 at the inspection level (normal, tightened, or reduced) specified in the acquisition document (see 6.2). The sampling tests be comprised of the following:

- a. Scale error.
- b. Dial visibility.
- c. Damping.
- d. Vibration error.
- e. Low temperature exposure.
- f. High temperature exposure.
- g. Vibration tolerance.
- h. Magnetic effect.
- i. Acceleration.
- j. Humidity.
- k. Salt fog.
- l. Fungus.
- m. Overpressure.
- n. Seasoning.
- o. Pressure altitude.

4.4 Test conditions. Unless otherwise specified in the acquisition document (see 6.2), all inspections shall be performed in accordance with the test conditions specified in this specification.

4.4.1 Standard atmospheric conditions. Unless otherwise specified in the test description, tests are to be made at ambient atmospheric pressure and temperature.

4.4.2 Tapping. Unless otherwise specified in the test description, the indicator shall be tapped before a test reading is taken.

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

4.5 Requirements cross-reference matrix. Table V provides a cross-reference matrix of the section 3 requirements tested or verified in the paragraphs below.

4.6 Tests.

4.6.1 Examination. Prior to sealing, the indicator shall be examined to determine compliance with the materials requirement. After sealing, the indicator shall be examined for compliance with interface and performance requirements as indicated in Table V.

4.6.2 Seal.

4.6.2.1 Case leakage. The indicator shall be mounted in an instrument panel or mock-up panel. The pitot and static pressure connections of the indicator shall be connected to a mercury

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manometer, or equivalent. A vacuum equal to 25 inches Hg (equivalent to a pressure altitude of approximately 40,000 feet altitude) shall be applied to the pitot and static connections of the indicator. With the connecting tubing sealed for a period of one minute, the mercury level shall change no more than 0.01 inch.

TABLE V. Requirements cross-reference matrix

Requirement	Verification	Requirement	Verification
3.1	4.2	3.5.6	4.6.1, 4.6.6, 4.6.12
3.3	4.6.1, 4.6.21, 4.6.22	3.5.7	4.6.18
3.4.1	4.6.1	3.5.8.1	4.6.2.1
3.4.2a	4.6.3.1	3.5.8.2	4.6.2.2
3.4.2b	4.6.3.1	3.5.8.3	4.6.2.3
3.4.2c	4.6.4, 4.6.5	3.5.9	4.6.1
3.4.3	4.6.1, 4.6.4, 4.6.5	3.5.10	4.6.11
3.4.4	4.6.1	3.5.11	4.6.23 or 4.6.24
3.4.5	4.6.1	3.5.12	4.6.3
3.4.6	4.6.1	3.5.13.1	4.6.4.1
3.4.7	4.6.1	3.5.13.2	4.6.4.2
3.4.8	4.6.1	3.5.13.3	4.6.4.3
3.4.9	4.6.14	3.5.14.1	4.6.5.1
3.4.10	4.6.9	3.5.14.2	4.6.5.2
3.4.11	4.6.1	3.5.14.3	4.6.5.3
3.4.12	4.6.1	3.6	4.6.1
3.4.13	4.6.1	3.7	4.6.1
3.4.14	4.6.1	3.8.1.1	4.6.7, 4.6.8
3.4.15	4.6.10	3.8.1.2	4.6.15, 4.6.16
3.4.16	4.6.1	3.8.2.1	4.6.17
3.5.1	4.6.4, 4.6.5	3.8.2.2	4.6.13
3.5.2	4.6.1	3.8.3	4.6.20
3.5.3	4.6.1	3.8.4	4.6.19
3.5.4	4.6.27	3.8.5	4.6.26
3.5.5	4.6.25		

4.6.2.2 Low temperature case leakage. The indicator shall be held at a temperature of -31°F for 3 hours. While at this temperature, the case leakage test shall be conducted. The mercury level shall change no more than 0.025 inch.

4.6.2.3 Static pressure test. The static pressure connection shall be open to the atmosphere, and the pitot connection shall be connected to a mercury manometer, or equivalent. A pitot-static pressure equivalent to a reading of 800 knots shall be applied to the indicator. The connecting tubing shall be sealed. During a period of 1 minute, the level of Hg shall change no more than 0.15 inch.

4.6.3 Scale error.

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4.6.3.1 IAS pointer scale error. For qualification or sampling tests, the indicator shall be tested for scale error at all test points in Table II. For individual tests, the indicator shall be tested for scale error at only those test points marked with an asterisk in Table II. The indicator shall be subjected to the pressure needed to produce the IAS reading, first with increasing pressure, then with decreasing pressure. The error at each test point shall be within the tolerance in Table II.

4.6.3.2 Mach number scale error. For qualification and sampling tests, the indicator shall be tested at each of the mach number settings in Table III. For individual tests, the indicator shall be tested at only those test points marked with an asterisk. The specified altitude shall be established and the IAS pointer set on the mach number graduation at each of the specified test points. The error shall be determined by reading the airspeed value indicated by the airspeed pointer.

4.6.3.3 MAEAS pointer scale error. For the qualification and sampling tests, the MAEAS pointer shall be tested at each test point in Table IV. For the individual tests, the MAEAS pointer shall be tested at only those test points marked with an asterisk. At each test point, the error shall be within the tolerance specified in Table IV.

#### 4.6.4 Friction error.

4.6.4.1 IAS pointer friction error. The IAS pointer shall be tested for friction error at the first and then every other asterisked test point in Table II. The pressure shall be increased to bring the pointer to the approximate desired reading and held constant while two readings are taken, the first before the indicator is tapped, the second after the indicator is tapped. The difference between any two readings shall be within 3 knots for an IAS of 80 to 200 knots, and within 5 knots for an IAS greater than 200 knots.

4.6.4.2 MAEAS pointer friction error. The MAEAS pointer shall be tested for friction error at the first and then every other asterisked test point in Table IV. The pressure shall be held constant while the two readings are taken, the first before the indicator is tapped and the second after the indicator is tapped. The difference between any two readings shall be less than 10 knots.

4.6.4.3 Friction error mach number scale. The mach number scale shall be tested for friction error at the first and then every other asterisked test point in Table III. Pressure shall be decreased to bring the mach number position to the desired test point and the position held constant while two readings are taken, the first before the indicator is tapped and the second after the indicator is tapped. The difference between any two readings shall be within 5 knots.

#### 4.6.5 Position error.

4.6.5.1 IAS pointer position error. The difference between the IAS scale reading taken while the indicator is held in any position and is being tapped and when the indicator is held in the normal position shall be within 3 knots for airspeeds between 80 and 200 knots, and 5 knots for airspeeds greater than 200 knots. This test shall be conducted at 80, 200, and 850 knots.

4.6.5.2 Mach number scale position error. The difference between the mach number reading taken while the indicator is held in any position and is being tapped and when the indicator is held

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in the normal position shall be within 5 knots. This test shall be conducted at the first test point in Table III, and any other three points

4.6.5.3 MAEAS pointer position error. The MAEAS pointer shall be set to 700 knots. The difference between the MAEAS pointer readings while the indicator is held in the normal position and in any other position shall be within 10 knots.

4.6.6 Pointer zero position error. The IAS pointer shall be within 0.0625 inch of the zero position and the MAEAS pointer shall be within 10 knots of the set position when differential pressure applied to the indicator is reduced to zero.

4.6.7 Low temperature. The indicator shall be exposed to -65°F for three hours and maintained at -65°F during the test. The MAEAS scale error test shall be conducted at the test points in Tables II and III and the  $V_e = 700$  knots test points in Table IV. Allowable scale error shall not exceed that specified in Tables II and III by more than 2 knots and in Table IV by more than 5 knots. During this test, the IAS set adjustment index shall retain its original setting within 10 knots and shall operate satisfactorily throughout its range at all points.

4.6.8 High temperature operation. The indicator shall be exposed to 160°F for three hours and maintained at 160°F during the test. The indicator shall be subjected to the MAEAS scale error test. The test shall be conducted at the test points specified in Tables III and IV and the  $V_e = 700$  knots test points in Table V. The scale errors shall not exceed those specified in Tables III and IV by more than 2 knots and in Table V by more than 5 knots. During the test, the IAS set adjustment index shall retain its original setting within 10 knots and shall operate satisfactorily throughout its range at all points.

4.6.9 Lighting. If additional lighting requirements were specified in the acquisition document, the indicator shall be subjected to the lighting tests also specified in the acquisition document for these additional requirements (see 6.2), and shall operate on 5Vac or 5 Vdc.

4.6.10 Dial visibility. The indicator shall be viewed from a point on and within a circle, formed by the intersection of a plane parallel to and 24 inches from the front surface of the instrument cover glass, and frustum of a cone the side of which makes an angle of 30° with a perpendicular to the dial and of which the small diameter is the aperture of the indicator case. The pointer numerals, and at least 0.0625 inch of the shortest graduation shall be visible from any point on and within the above defined circle.

4.6.11 Damping. Sufficient pressure shall be applied to the pitot connection to produce full-scale deflection of the IAS pointer. The pressure shall be released. The time required for the IAS pointer to reach the 90 knot graduation shall be between 0.8 and 2.0 seconds.

4.6.12 Overpressure. A pressure of 32.0 inches Hg shall be applied to the static port and a pressure of 29.92 inches Hg shall be applied to the pitot port for 10 minutes. Five minutes following the application of these pressures, the indicator shall be subjected to the scale error test at all test points. At each test point, the error shall be within the tolerance in Table II, III, and IV. A pitot pressure of 55 inches of Hg and a static pressure of 6 inches of water shall be applied to

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the indicator for a period of 10 minutes. Not less than 5 minutes following the applications of this overpressure, the indicator shall again be subjected to the scale error test at all test points. At each test point, the mach number scale, IAS pointer, and MAEAS pointer error shall be within 3 knots of the values specified in Tables II, III and IV. During this test the adjustment index shall be within 10 knots of its original setting and shall operate throughout its range at all test points.

4.6.13 Vibration error. The indicator shall be mounted on a vibration stand in its normal operating position on an aircraft panel. While being operated at an altitude of 35,000 feet and an airspeed of 350 knots, the indicator shall be vibrated with circular motion in a plane inclined 45° to the horizontal plane with a diameter of circular motion at a double amplitude between 0.003 and 0.005 inches. The frequency of applied vibration shall be varied from 5 to 50 Hz, and the natural frequency of the indicator shall not occur in this range. While being vibrated, the indicator shall be tested at test points specified in Table II, the maximum total spread of pointer vibration and the pointer vibration from its original position shall be no more than 10 knots.

4.6.14 Reflection-reducing coating. The reflection-reducing coating requirement shall be verified according to MIL-C-14806.

4.6.15 Low temperature exposure. The indicator shall be to  $-85^{\circ} \pm 3^{\circ}\text{F}$  for 48 hours. At the end of the 48-hour period, the temperature shall be raised to  $-65^{\circ} \pm 3^{\circ}\text{F}$  and shall be maintained at this temperature for 4 hours. While at this temperature, the scale error test shall be conducted at the asterisked test points in Tables II, III and all test points in the  $V_e = 700$  knot column of Table IV. The scale error at each test point shall not exceed that specified in Tables II and III by more than 2 knots and shall not exceed that specified in Table IV by more than 5 knots. After the indicator has returned to room temperature, it shall be subjected to the individual tests.

4.6.16 High temperature exposure. The indicator shall be exposed to  $160^{\circ} \pm 3^{\circ}\text{F}$  for 48 hours. While at this temperature, the scale error test shall be conducted at the asterisked test points in Tables II, III, and the asterisked test points in the  $V_e = 700$  knot column of Table IV. The scale error at each test point shall not exceed that specified in Tables II and III by more than 2 knots and shall not exceed that specified in Table IV by more than 5 knots. After the indicator has returned to room temperature, it shall be subjected to the individual tests.

4.6.17 Vibration tolerance. The indicator shall subjected to the vibration test in RTCA/DO-160 at the levels defined in Table VI. The indicator shall then be subjected to the individual tests.

TABLE VI. Vibration data

Frequency (Hz)	Displacement in double amplitude (inch) and acceleration (g), if applicable
5-20	0.10
20-500	0.10 to 0.036 at 2g

4.6.18 Magnetic effect. The indicator shall be held in various positions with its nearest part 5 inches from the center of a short-bar magnetic compass with compensator magnets removed and

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which is set up in a uniform magnetic field having a horizontal intensity between 0.17 and 0.19 oersted. The maximum deflection of the compass shall 1° or less.

4.6.19 Acceleration. The indicator shall be subjected to an acceleration of 20g and then be subjected to the individual tests.

4.6.20 Humidity. The indicator shall be subjected to the humidity test in RTCA/DO-160, Category B. The indicator shall then be subjected to the individual tests.

4.6.21 Salt-fog. The indicator shall be subjected to the salt fog test in ASTM B117 for 48 hours. There shall be no damage to any part of the indicator. The indicator shall then be subjected to the individual tests.

4.6.22 Fungus. The indicator, including applicable external connectors, shall be subjected to a fungus test in accordance with RTCA/DO-160, category F. At the end of the test period, the indicator shall be examined to ascertain that no fungus growth has occurred. The indicator shall then be subjected to the individual tests.

4.6.23 Seasoning (AVU-8B/A, ME-4). The indicator shall be subjected to 250 hours of pressure cycling at a rate of 4 cycles per hour. Each cycle shall consist of an application of a differential pressure sufficient to produce approximately full scale deflection of the IAS pointer and then removal of the differential pressure so that the IAS pointer returns to a zero IAS indication. During this testing the indicator shall be subjected to temperature and vibration cycling. After 250 hours of cycling, the individual tests shall be performed. The tolerances shall be increased by 100% or 5 knots, whichever is less, for scale error, friction error, and position error tests.

4.6.24 Seasoning (AVU-8C/A). The indicator shall be subjected to 1,000 hours of pressure cycling at a rate of 4 cycles per hour. Each cycle shall consist of an application of a differential pressure sufficient to produce approximately full scale deflection of the IAS pointer and then removal of the differential pressure so that the indicator returns to a zero IAS indication. During this testing the indicator shall be subjected to temperature and vibration cycling. After each 250 hours of cycling, the individual tests shall be performed. The tolerance shall be increased by 100% or 5 knots, whichever is less, for scale error, friction error and position error after the first 250-hour period. An additional 100% or 5 knots, whichever is less, increase of the tolerance shall be allowed after 750 hours of testing.

4.6.25 System safety. A hazard analysis shall be performed to verify the safety of the indicator (see 6.4.3). Hazards associated with the indicator shall be identified, tracked, evaluated, and eliminated and the associated risk reduced to a level acceptable to the procuring activity.

4.6.26 Sand and dust. The indicator shall be tested according to the sand and dust test in RTCA/DO-160. The indicator shall then be subjected to the individual tests.

4.6.27 Altitude. The indicator shall be subjected to an altitude of 80,000 feet. The scale error, friction error, and position error tests shall be conducted. Then the altitude shall be lowered to -1,000 feet. The scale error, friction error and the position error tests shall again be conducted.



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## 5. PACKAGING

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

## 6. NOTES

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

6.1 Intended use. The indicator covered by this specification is intended for use on high speed aircraft to indicate airspeed and mach number on a single dial, with an MAEAS pointer. The IAS range is from 80 to 850 knots at altitude from -1,000 to 80,000 feet.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Classification (see 1.2).
- c. Issue of the DoDISS to be cited in the solicitation, and if required, the specific issue individual documents referenced (see 2.2).
- d. If there are additional lighting requirements for the AVU-8 B/A or C/A indicators, and their description (see 3.4.10).
- e. If there are verification requirements for any additional lighting requirements, and their description (see 4.6.9).
- f. Inspection level (normal, tightened, or reduced) for conformance (sampling) tests (see 4.3.2).
- g. If the test conditions are different than specified (see 4.4).
- h. Packaging requirements (see 5.1).
- i. Data required.
- j. Item identification.

6.3 Qualification. The attention of the contractors is called to the requirements with respect to products requiring qualification. Awards will be made only for products which are, at the time of award of contract, qualified for inclusion in the Qualified Products List (QPL No. 27197) whether or not such products have actually been listed by that date. In order that the manufacturers may be eligible to be awarded contracts or purchase orders for the products covered by this specification, they are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification. Information pertaining to qualification of products may be obtained from Oklahoma City Air Logistics Center/TICLA, 3001 Staff Drive, Suite 1AE1-101A, Tinker AFB, OK 73145-3036.

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6.4 Notes.

6.4.1 Color and brightness tolerances. Previously, the color and brightness tolerances, as specified in MIL-L-27160 for white markings and pointers applied.

6.4.2 Fluorescent-luminescent material. Previously, fluorescent-luminescent material requirements were done in accordance with MIL-L-25142, type I or III, as applicable. A copy of MIL-L-25142 may be obtained from Oklahoma City Air Logistics Center/TICLA, 3001 Staff Drive, Suite 1AE1-101A, Tinker AFB, OK 73145-3036.

6.4.3 Hazard analysis. Previously, the safety hazard analysis was performed to determine, from a safety consideration, the functional relationships of components and equipment interfacing with the indicator. The safety analysis identified all components, equipment, and materials whose performance degradation or functional failure could result in category III and IV hazards as defined in MIL-STD-882, paragraph entitled Hazard Level. This analysis included a determination of the failure modes and the effects on safety should failures occur. Areas considered were the appropriate sections of MIL-STD-882, as listed under paragraph entitled System Hazard Analyses, and the effects of storage, shelf life, transportation, and packaging. Where practicable, design changes were made to eliminate or minimize the hazards. If the hazards could not be eliminated, alternative controls such as recommended changes to interfacing equipment were presented to the procuring activity for resolution.

6.4.4 Interface. Extensive interface is included to ensure that indicators procured to this specification provide identical appearance and performance to indicators currently in use. Close attention to human interface provides an indicator that aircrews were trained to use and will not cause distractions during flight.

6.5 Subject term (key word) listing.

AVU-8B/A  
AVU-8C/A  
ME-4

6.6 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.

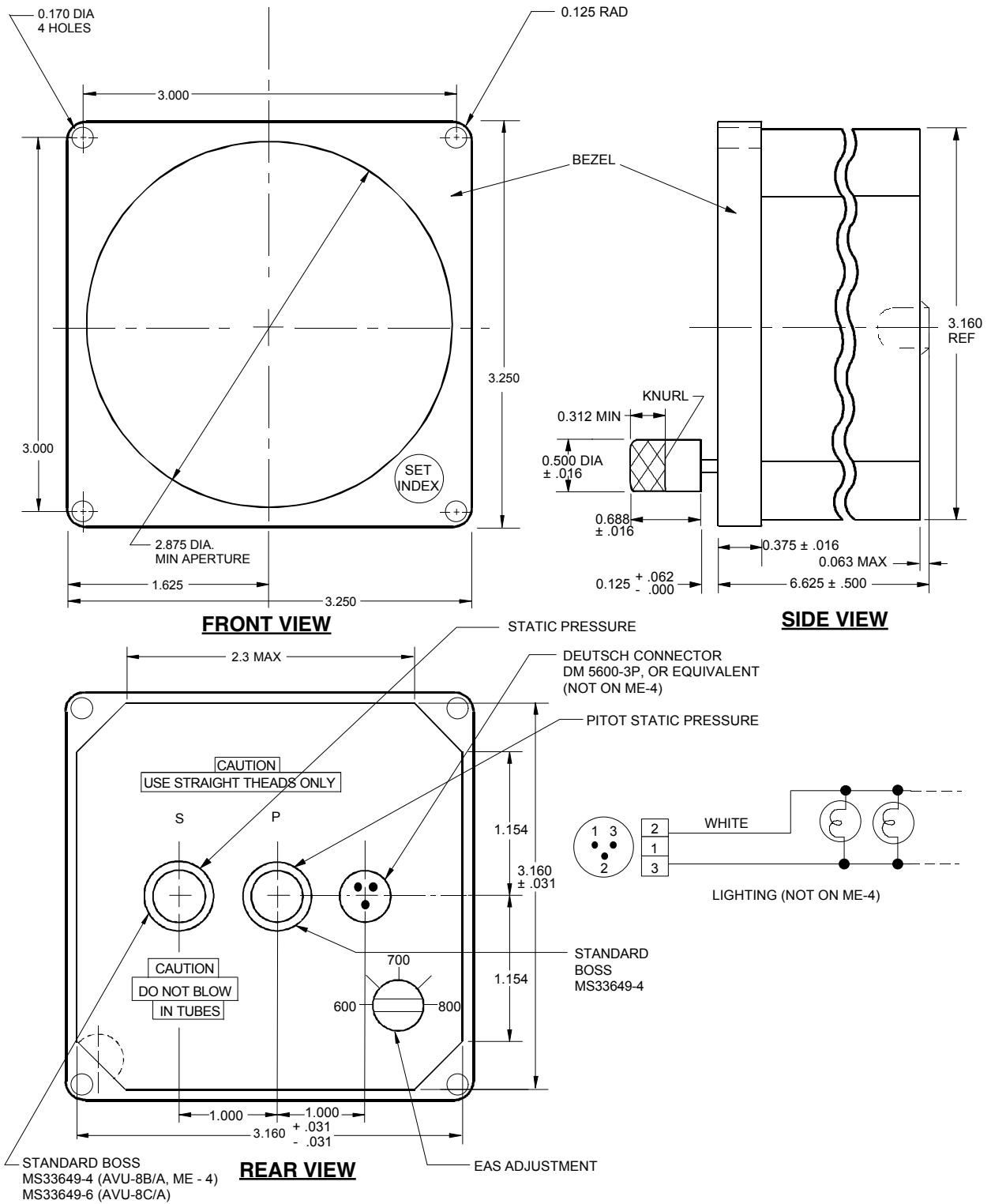
Custodian:  
Air Force - 99

Preparing Activity:  
Air Force - 71

Agent Activity:  
Air Force - 99

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NOTE: DIMENSIONS IN INCHES,  
TOLERANCE ±0.01 UNLESS  
OTHERWISE SPECIFIED

FIGURE 1. Case

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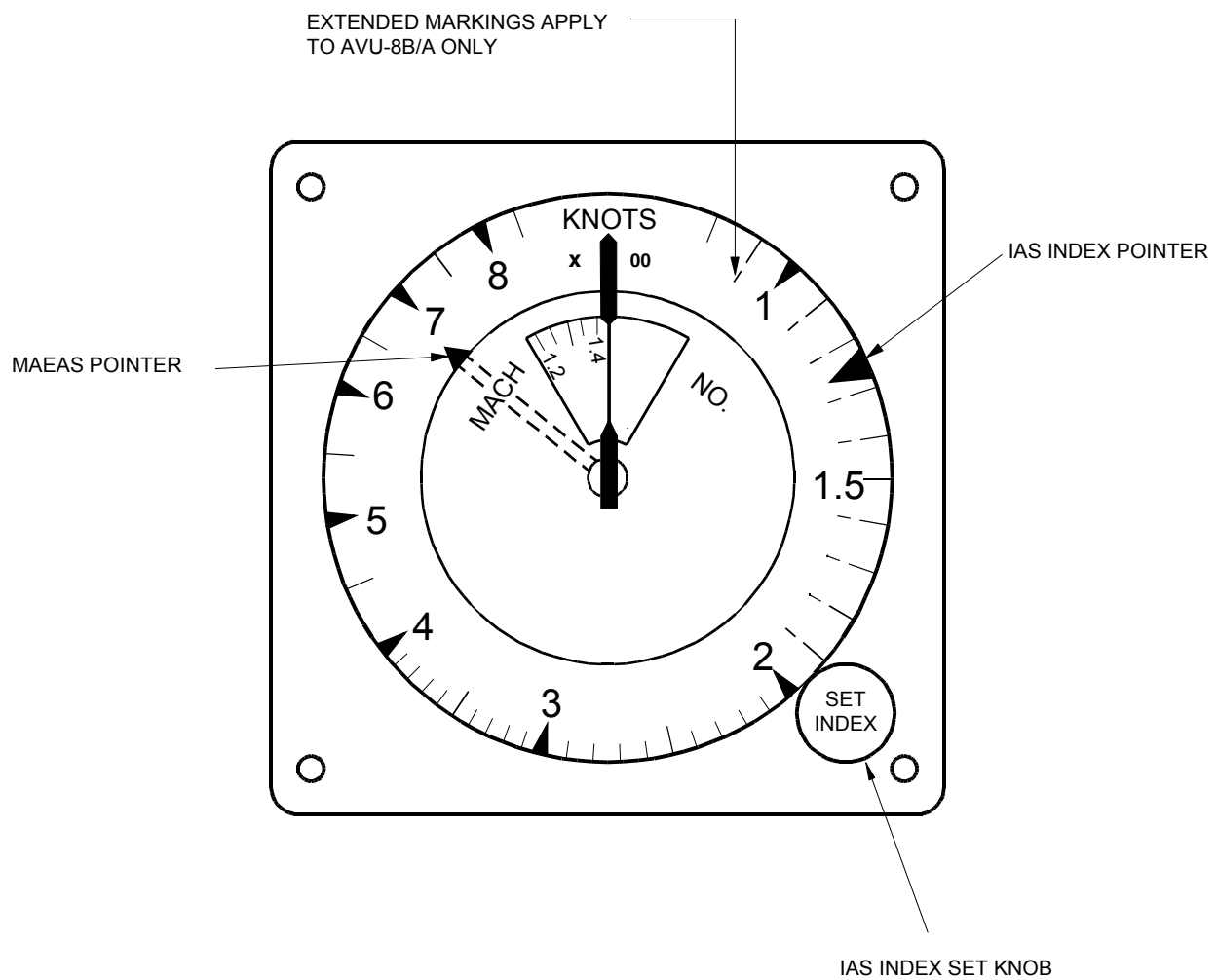
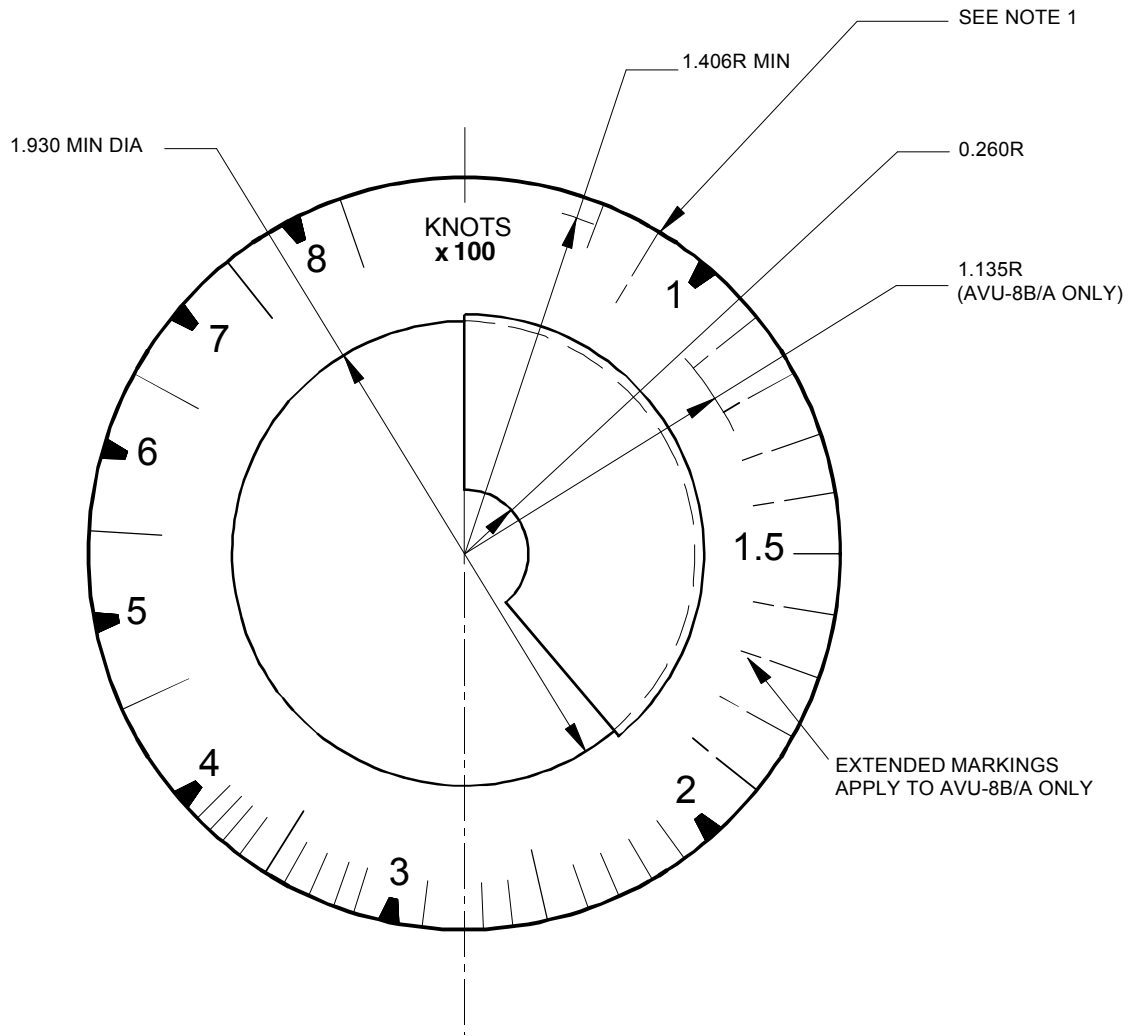


FIGURE 2. Dial arrangement

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NOTE:

1. THE 80 KNOT GRADUATION SHALL BE LOCATED AS SHOWN IN THIS FIGURE  $20^\circ \pm 5^\circ$  CLOCKWISE FROM THE VERTICAL CENTERLINE OF THE DIAL.
2. LINEARITY OF SCALE DISTRIBUTION BELOW 190 KNOTS TO BE MAINTAINED WITHIN  $1.25^\circ$  BETWEEN 10-KNOT INCREMENTS
3. DIMENSIONS IN INCHES
4. TOLERANCE:  $\pm 0.010$ ,  $\pm 0.05^\circ$  UNLESS OTHERWISE SPECIFIED

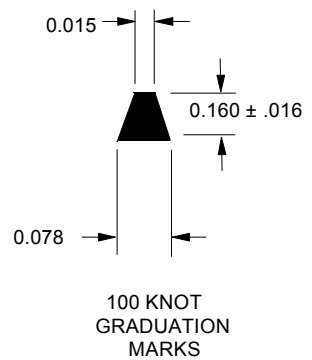
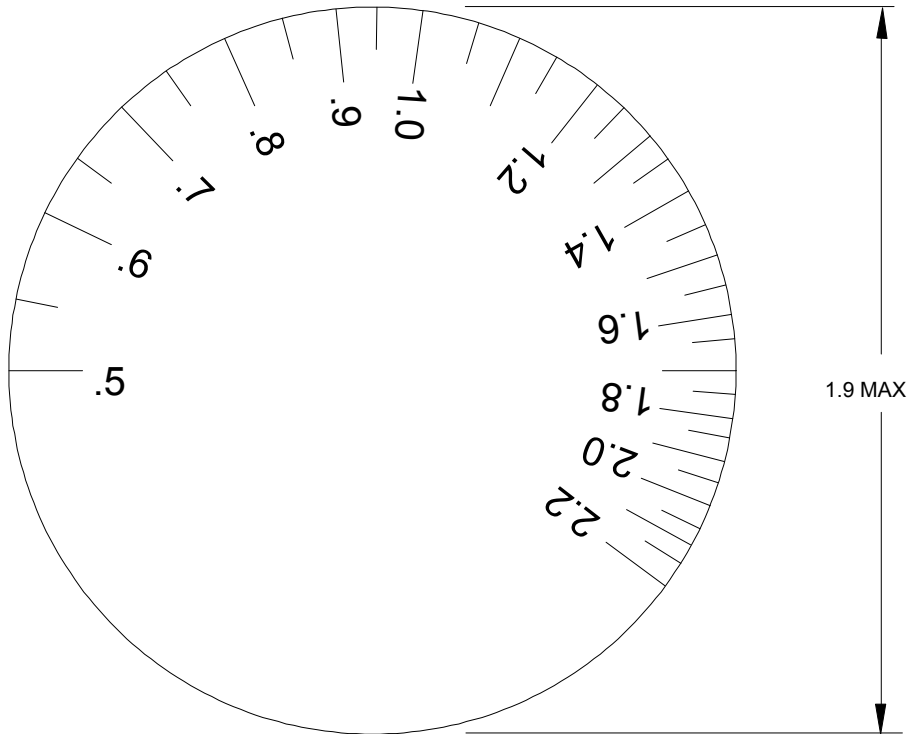


FIGURE 3. IAS dial

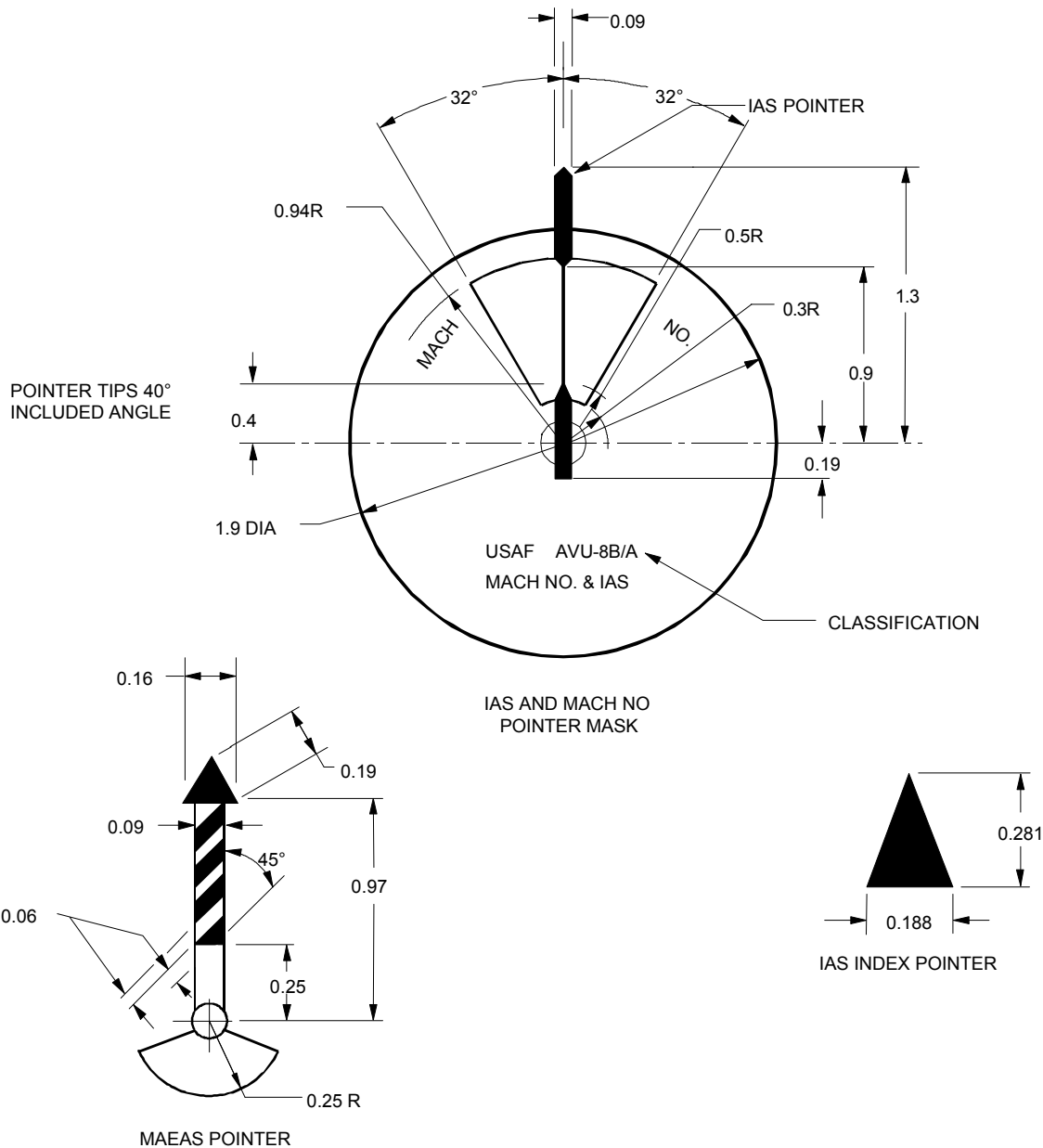
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NOTE: DIMENSION IN INCHES

FIGURE 4. Mach number dial

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## NOTE:

1. FOR THE AVU-8B/A AND AVU-8C/A, THE IAS AND MACH NUMBER POINTER SHALL BE LUSTERLESS WHITE, COLOR NO. 37875 OF FED-STD-595. FOR THE ME-4, THE IAS POINTER AND MACH NUMBER SCALE SHALL BE FLUORESCENT LUMINESCENT.
2. SHADED PORTIONS OF THE MAEAS POINTER SHALL BE LUSTERLESS RED, COLOR NO. 31136 OF FED-STD-595.
3. UNSHADED AREAS OF THE POINTER MASK AND MAEAS POINTER SHALL BE LUSTERLESS BLACK, COLOR NO. 37038 OF FED-STD-595.
4. FOR THE AVU-8B/A, THE IAS INDEX SHALL BE LUSTERLESS WHITE, COLOR NO. 37875 OF FED-STD-595. FOR THE AVU-8C/A, THE IAS INDEX SHALL BE LUSTERLESS FLUORESCENT GREEN, COLOR NO. 36901 OF FED-STD-595.
5. DIMENSIONS IN INCHES AND DEGREES. TOLERANCES: LINEAR  $\pm 0.01$ , ANGULAR  $\pm 0.5$ .

FIGURE 5. Pointer mask, MAEAS pointer, IAS pointer, and IAS index pointer

