

MIL-I-5356A(USAF)

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Superseding

MIL-I-5356(USAF)

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MILITARY SPECIFICATION

INDICATOR, AIRSPEED, PITOT STATIC, TYPE L-7A

1. SCOPE

1.1 This specification covers one type of pitot static air-speed indicator, designated Type L-7A.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-E-5272	Environmental Testing, Aeronautical and Associated Equipment, General Specification for
MIL-I-5415	Indicators, Airspeed, Pitot and Static Pressure, General Specification for
MIL-L-25142	Luminescent Material, Fluorescent

STANDARDS

Federal

FED-STD-595	Colors
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Military

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-794	Parts and Equipment, Procedures for Packaging and Packing of
MS33585	Pointer, Dial, Standard Design of Aircraft Instrument
MS33638	Cases, Instrument, Flange-Mounted Aircraft

FSC 6610

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

3. REQUIREMENTS

3.1 Qualification. The airspeed indicator covered by this specification shall be a product which has been tested, and passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 General specification. The requirements of MIL-I-5415 apply as requirements of this specification. Where the two specifications conflict, this specification shall govern.

3.3 Design and construction.

3.3.1 General design. The airspeed indicator shall conform to Figures 1 and 2.

3.3.2 Pointers. An indicated airspeed pointer conforming to MS33585-3 shall be provided, except that the shaded portion of the pointer shall be finished in luminescent material conforming to MIL-L-25142. A maximum airspeed pointer shall be provided and shall conform to MS33585-3, except that the shaded portion of the pointer shall be finished as shown in Figure 3, and the pointer width shall be 0.150 instead of 0.093. The nonindicating ends of the pointers shall not obscure the drum.

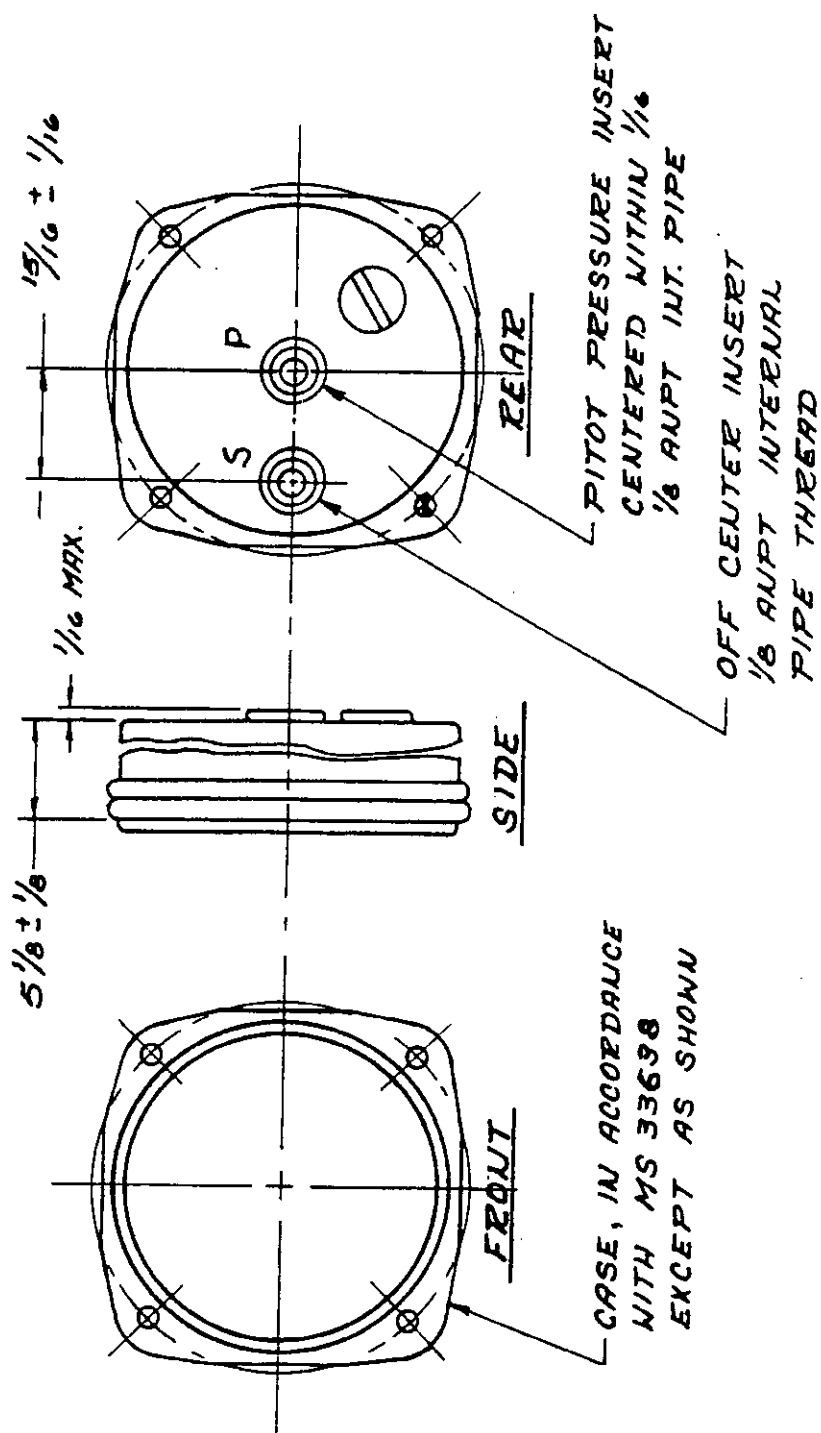
3.3.2.1 The two pointers shall be concentric, with the maximum speed pointer nearest to the dial, and the indicated airspeed pointer nearest to the cover glass.

3.3.3 Dials. The dial and drum shall conform to Figure 2. The drum shall make one revolution for each 100-knot change in airspeed and shall be geared to the indicated airspeed pointer so that proper relationship is maintained at all speeds.

3.3.3.1 A triangular index conforming to Figure 2 shall be provided to show the Mach number to which the index is adjusted. The Mach numbers shall be placed on the dial as shown in Figure 2 and the mechanism shall be arranged so that the values of the Mach number between the numerals may be set by linear interpolation between the numerals.

3.3.4 Limitation of pointer movement.

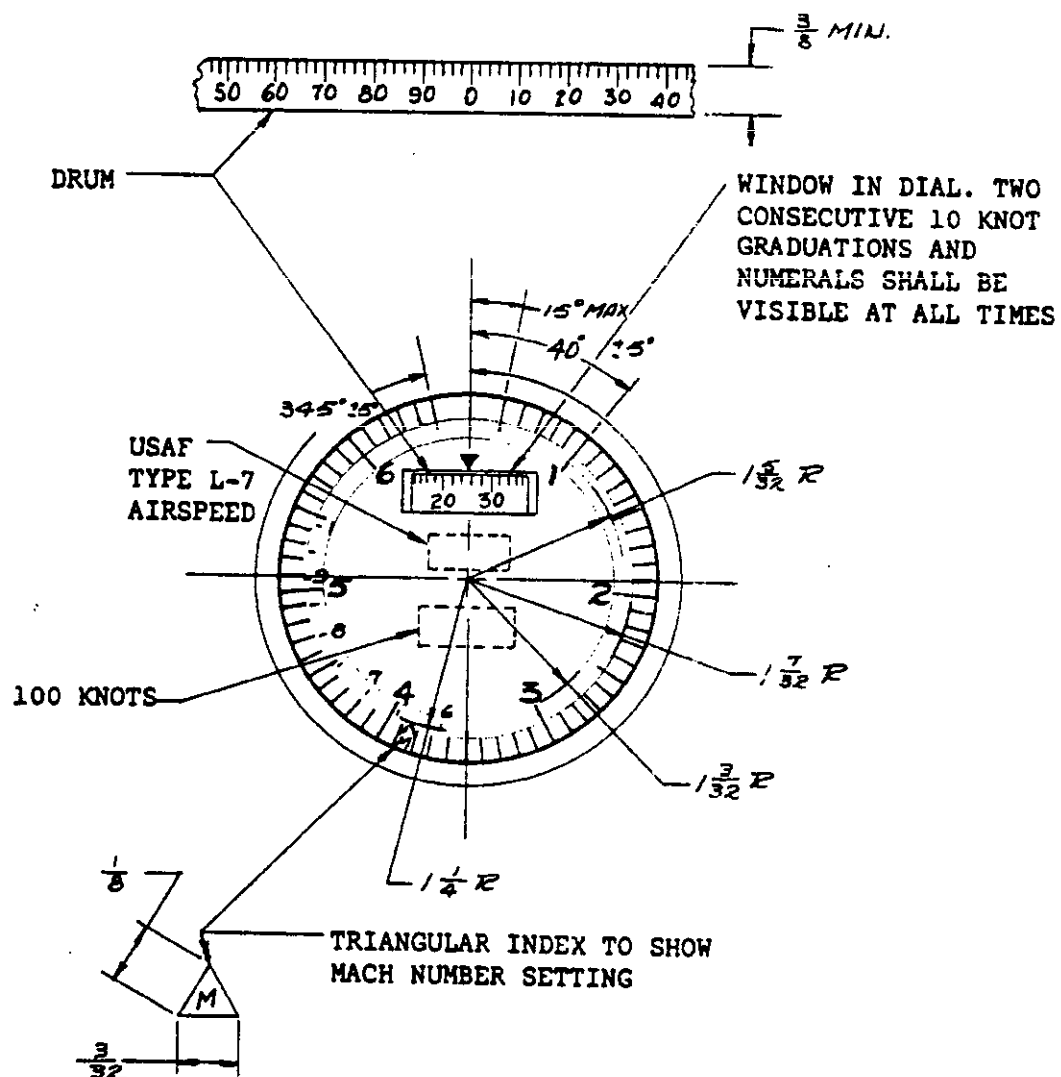
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DIMENSIONS IN INCHES

FIGURE 1

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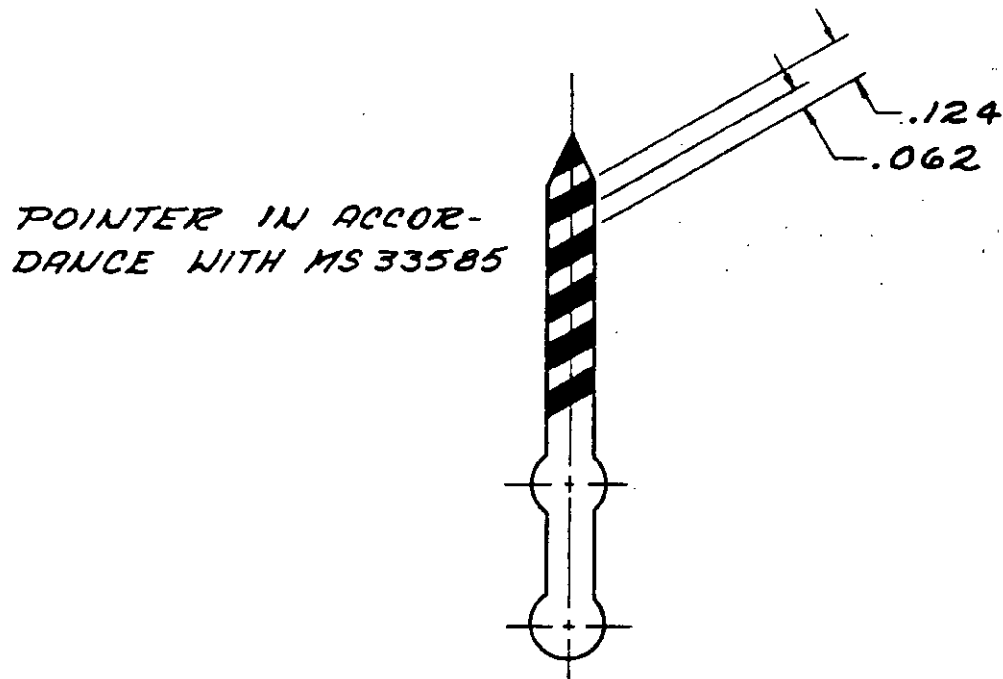


DIMENSIONS IN INCHES.
UNLESS OTHERWISE SPECIFIED,
TOLERANCES: FRACTIONS $\pm 1/64$

ALL GRADUATIONS ARE
PARTIAL RADIAL LINES

FIGURE 2

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SHADED AREA TO BE FLUORESCENT-LUMINESCENT MATERIAL IN ACCORDANCE WITH MIL-L-25142. UNSHADED AREA TO BE FINISHED IN DURABLE DULL BLACK.

FIGURE 3

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3.3.4.1 Airspeed pointer. The airspeed pointer movement shall be limited by suitable stops in the mechanism in such a way that the pointer shall not be permitted to rotate more than 350 degrees of arc clockwise from the "no pressure" position when the indicator is subjected to overpressure tests. The design of the stops shall be subject to approval of the procuring activity.

3.3.4.2 Maximum speed pointer. The maximum speed pointer shall be limited by a stop which is adjustable from the front of the indicator by a screwdriver slot in the lower left mounting lug as shown in Figure 1. The range of the stop shall be from 300 knots, or less, to 650 knots. The design of this adjustable stop shall be such that it will in no way affect the indication of the pointer when the altitude and Mach number setting are such that the limiting speed will be lower than that set by the adjustable stop.

3.3.5 Mach number adjustment. The method of adjustment of the Mach number shall be such that it may be made by removing a plug from the rear of the case and adjusted by the use of standard tools. The design of this adjustment shall be subject to the approval of the procuring activity.

3.4 Weight. The weight of the indicator shall not exceed 1.8 pounds.

3.5 Operational markings.

3.5.1 Luminescent material. The following markings shall be finished in luminescent material conforming to MIL-L-25142:

Marking	Height or Length Inch \pm 1/64	Width of Line or Graduation Inch \pm 0.005
10-Knot graduations	As shown in Figure 2	0.016
Triangular index to show drum indication	3/32 on each edge	
Graduations corresponding to numerals and to 50, 150, 250, 350, 450, 550 and 650 knots	As shown in Figure 2	0.031
Numerals 1, 2, 3, 4, 5, and 6	5/16 min.	0.031
Graduations on drum corresponding to numerals	1/8	0.031
2-Knot graduations on drum	3/32	0.016
Numerals on drum	3/16	0.016
Lettering "100 knots"	1/8	0.016

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3.5.2 Durable Dull Black. The lettering "USAF", "Type L-7A", and "Airspeed" shall be permanently and legibly marked on the dial. These markings and all other markings not otherwise specified shall be finished in durable dull black. The height of the markings shall be $3/64 \pm 1/64$ inch.

3.5.3 Glossy black enamel. The following markings shall be finished in glossy black, Color No. 17038 of FED-STD-595. The dimensions of these markings shall be as follows:

Marking	Height or Length Inch \pm 0.010	Width of Line or Graduation Inch \pm 0.005
Triangular index for Mach No. setting	As shown in Figure 2	As shown in Fig 2
Graduations cor- responding to mach numerals	0.062	0.016
Numerals representing Mach number settings	0.093	0.016

3.5.4 Visibility of dial markings. All graduations, numerals, pointers and other markings on the dial shall be readable from any point within the frustum of a cone the side of which makes an angle of not less than 30 degrees with the perpendicular to the dial and the small diameter of which is the aperture of the dial.

3.5.5 The back of the case, adjacent to the connections, shall be marked as follows:

"P" Pressure connection

"S" Static connection

"MACH NUMBER ADJUSTMENT" Mach number adjustment cover

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

3.7 Mounting. No insert nuts or spring nuts shall be furnished.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 services conform to the prescribed requirements.

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4.2 Classification of tests. The inspection and testing of indicators shall be classified as follows:

- a. Qualification tests
- b. Acceptance tests

4.3 Qualification tests. Qualification tests shall consist of sampling plan B of MIL-I-5415, except the Vibration test should be Vibration failure as specified herein (4.6.14). Individual and sampling plan A tests used as qualification tests shall be as specified herein.

4.3.1 Qualification test samples. Qualification test samples shall consist of three type L-7A airspeed indicators. They will be identified as qualification test samples and forwarded to the activity designated in the letter of authorization.

4.4 Acceptance tests. Acceptance tests shall consist of the following test:

- a. Individual tests
- b. Sampling tests

4.4.1 Individual tests. Each indicator submitted for acceptance shall be subjected to the individual tests listed in MIL-I-5415 plus the following tests as specified herein:

- a. Hysteresis
- b. After effect

4.4.1.1 The individual tests shall be conducted in the following order:

- a. Examination of product
- b. Leakage (Case leak and diaphragm capsule leak)
- c. Scale error at room temperature
- d. Hysteresis
- e. After effect
- f. Friction error
- g. Position error

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4.4.2 Sampling tests. Sampling tests shall consist of Sampling plan A of MIL-I-5415 plus the following tests specified herein:

- a. Drum pointer relationship
- b. Maximum pointer stop
- c. Vibration error

4.4.2.1 The sampling tests shall be conducted in the following order:

- a. Individual tests
- b. Damping
- c. Weight
- d. Magnetic effect
- e. Pointer zero position error
- f. Drum pointer relationship
- g. Maximum pointer stop
- h. Low temperature exposure
- i. High temperature exposure
- j. Vibration error
- k. Examination of the end item for delivery

4.5 Test conditions. In addition to the test conditions specified in MIL-I-5415, the test conditions as specified below shall apply as test conditions for the inspection and testing of indicators.

4.5.1 The maximum speed pointer stop shall be adjusted so that the maximum speed pointer will not stop until 650 knots is reached.

4.5.2 Whenever tests are specified on the airspeed pointer, the test shall include the airspeed drum.

4.6 Test methods. Test methods shall be as specified in MIL-I-5415, except as specified herein.

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4.6.1. Leakage

4.6.1.1 Case leak. The indicator shall be subjected to the case leak test as specified in MIL-I-5415, except that it shall not be subjected to the pressure of ten inches of mercury.

4.6.1.2 Diaphragm capsule leak. The diaphragm capsule leak test shall be accomplished only on the airspeed pointer.

4.6.2 Scale error at room temperature. The indicator shall be tested for scale errors at the points of the scale indicated by asterisks in Table III. The test shall be accomplished by adjusting the Mach number adjustment to the setting listed at the top of Table III. During this test, the pitot and static connection shall be connected together to a standard mercury barometer and to sources of vacuum and pressure. The reduction in pressure, as indicated by the barometer, shall be made at a rate corresponding to an increase in altitude of approximately 6000 feet per minute. The scale errors shall not exceed the tolerances specified in Table III. This test shall be combined with the hysteresis test at each Mach number setting.

4.6.3 Hysteresis. Not more than 15 minutes after the indicator has been subjected to the pressure corresponding to the highest altitude specified in Table III, the pressure shall be increased at a rate corresponding to a decrease in altitude of approximately 3000 feet per minute until the pressure corresponding to 30,000 feet is reached. The indicator shall remain at this pressure for at least five minutes, but no 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 a pressure corresponding to 10,000 feet is reached. The indicator shall remain at this pressure for at least one minute, but not more than ten minutes before a test reading is taken. After the reading has been taken, the pressure shall be further increased at the same rate until atmospheric pressure is reached. The reading of the maximum speed pointer at either of the two test points shall not differ from the corresponding reading, with decreasing pressure, by more than two knots.

4.6.4 After effect. Not less than one minute and not more than five minutes after the completion of the scale error at room temperature and hysteresis tests, the maximum speed pointer shall be checked to determine that it has returned to its original reading, corrected for any change in atmospheric pressure, within four knots.

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4.6.5 Friction error. The indicator shall be tested for friction at every other point marked with an asterisk in Table III, beginning at the first asterisk. The difference between any two readings shall not exceed the tolerance specified in Table I.

4.6.6 Position error. The pointer reading taken while the indicator is held in any desired position, and while it is being tapped, shall not differ from its reading, when held in normal operating position, by more than the amount specified in Table I. At least one of these positions shall be at approximately 45° with the horizontal simulating a 45° climb or dive or both. This test shall be conducted at the test points marked with a double asterisk in Tables II and III. This test may be combined with the Friction error test.

4.6.7 Damping. Tolerances and values for damping test are contained in Table I.

4.6.8 Pointer zero position error. Tolerance for position error are contained in Table I.

4.6.9 Drum pointer relationship. The indicator airspeed pointer shall be set on the graduation and the drum indication shall be noted. The difference between the respective readings of the drum and pointer shall not differ by more than two knots. This test shall be conducted at the points marked with a double asterisk in Table II.

4.6.10 Maximum pointer stop. The indicator shall be disconnected from external sources of vacuum and pressure, adjusted to 1.0 Mach number, and the stop mechanism tested for range by turning the screw in the lower left mounting lug to determine the limits of adjustment. The adjustment shall operate smoothly throughout range of 650 to at least 300 knots on the airspeed scale. No damage or loosening in the mechanism shall result from this test.

4.6.11 Low temperature exposure. The indicator shall be subjected to the low temperature exposure test as specified in MIL-I-5415 except that when the indicator is tested for scale error, the test points shall be every other point in Tables II and III marked with an asterisk beginning with the first asterisk. The scale errors in this test shall not exceed the tolerance specified in Tables II and III by more than two knots, but in no case shall the total allowable scale error exceed ten knots. During and after this test the maximum airspeed pointer stop adjustment shall operate satisfactorily. The hysteresis and after effect tests shall not be repeated at low temperature.

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4.6.12 High temperature exposure. The indicator shall be subjected to the high temperature exposure test as specified in MIL-I-5415, except the exposure period shall be 24 hours. At the conclusion of the exposure period and while still at the high temperature, the indicator shall be tested for scale errors as specified in the scale error at room temperature test. The test points shall be every other point in Tables II and III marked with an asterisk, beginning with the first asterisk. The scale errors in this test shall not exceed the tolerance specified in Tables II and III by more than two knots, but in no case shall the total allowable scale error exceed ten knots. During and after this test, the maximum airspeed pointer stop adjustment shall operate satisfactorily. The hysteresis and after effect test shall not be repeated at high temperatures.

4.6.13 Vibration error. The vibration error test shall be conducted using the test conditions specified in Table I. The indicator shall be subjected to vibration in accordance with procedure IV of MIL-E-5272. The diameter of circular motion shall be 0.009 inch. While the indicator is being vibrated, the maximum total spread of pointer vibration and the pointer variation from its original position shall not exceed the tolerances specified for Maximum Vibration in Table I.

4.6.14 Vibration failure. The vibration failure test shall be conducted using the test conditions specified in Table I. The instrument indication at the test differential pressure specified shall be determined with pressures increasing. The indicator shall be subjected to vibration in accordance with procedure V of MIL-E-5272. At the completion of this vibration, the indicator shall be subjected to the pressure specified to produce the test point reading (with pressure increasing). The difference between this indication and that determined prior to vibration for the same differential shall not exceed two knots. No looseness in the mechanism or damage to any part of the indicator shall result from this test.

4.6.15 Overpressure. The pressures to be applied to the pitot and static connections and allowable tolerance are specified in Table I.

4.6.16 Seasoning. Allowable tolerance is specified in Table I.

4.6.17 Ageing. Allowable tolerance is specified in Table I.

4.6.18 Examination of the end item for delivery. An examination shall be made to determine compliance with preservation, packaging and packing requirements of Section 5 of this specification.

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TABLE I

<u>Tests and test points</u>	<u>Tolerances</u>
Position error	
Airspeed pointer	3 knots
Maximum speed pointer	3 knots
Friction	
Maximum speed pointer	3 knots
Airspeed pointer	3 knots
Vibration error	
(Mach number setting at 0.8)	
(Test altitudes of 0 and 20,000 feet)	
(Differential pressures equal to 100 and 400 knots)	
Maximum Vibration (either pointer)	2 knots
Variation from original position	
(either pointer)	2 knots
Vibration failure	2 knots
(Test altitude of 20,000 feet)	
(Differential pressure equal to 400 knots)	
(Mach number setting at 0.8)	
Overpressure	2 knots
(Static connection - 6 in. Water)	
(Pitot connection - 30 in. Hg)	
(Test altitude of 0 and 20,000 feet)	
(Differential pressure equal to 100 and 400 knots)	
Seasoning	2 knots
Aging	3 knots
Zero position of drum	30 \pm 10 knots
Damping	
Time required for pointer to travel from	
full scale deflection to the 60 knots	
graduation	1 \pm 1.0 - 0.2 second

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TABLE II

Speed Knots	Tolerance Knots	Speed Knots	Tolerance Knots
50	4.0	360	4.0
60	4.0 *	370	4.0
70	2.0	380	4.0 *
80	2.0 **	390	4.0
90	2.0	400	5.0 **
100	2.0 **	410	5.0
110	2.0	420	5.0 **
120	2.0 *	430	5.0
130	2.0	440	5.0
140	2.0	450	5.0
150	2.5 *	460	5.0 *
160	2.5	470	5.0
170	2.5	480	5.0
180	2.5 *	490	5.0
190	2.5	500	6.0 *
200	3.0 **	510	6.0
210	3.0	520	6.0
220	3.0 *	530	6.0
230	3.0	540	6.0 *
240	3.0	550	6.0
250	3.0	560	6.0
260	3.0 **	570	6.0
270	3.0	580	6.0 **
280	3.0	590	8.0
290	3.0	600	8.0 **
300	4.0 *	610	8.0
310	4.0	620	8.0 *
320	4.0	630	8.0
330	4.0	640	8.0
340	4.0 *	650	8.0 *
350	4.0		

TABLE III

Altitude 1000 feet	MACH NUMBER											
	0.6			0.7			0.8			0.9		
	Airspeed Knots	Tolerance	Airspeed Knots	Tolerance	Airspeed Knots	Tolerance	Airspeed Knots	Tolerance	Airspeed Knots	Tolerance	Airspeed Knots	Tolerance
0	397**	4	463*	6	529*	8	595*	10	-	-	-	-
5	364	4	426	5	488	6	550	8	613	10		
10	333*	4	390*	4	448*	6	507*	6	566**	8		
15	303	4	356	4	410	5	464	6	520	8		
20	275**	4	323*	4	373*	4	423*	5	475*	6		
25	248	4	292	4	337	4	384	4	431	5		
30	223*	4	262*	4	303*	4	346*	4	390**	4		
35	199	4	235	4	272	4	310	4	350	4		
40	177**	4	209*	4	242*	4	277*	4	312*	4		
45	157	4	186	4	216	4	247	4	279	4		
50	140*	4	165*	4	192*	4	220	4	248**	4		

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5. PREPARATION FOR DELIVERY

5.1 Packaging and packing. The indicator shall be preserved and packaged in accordance with Level A of MIL-STD-794, unless otherwise specified by the procuring activity.

5.1.1 Packing for shipment shall be in accordance with Level B of MIL-STD-794 unless otherwise specified by the procuring activity.

5.2 Marking. In addition to any special marking required by the contract or order, unit packages, intermediate packages and shipping containers shall be marked in accordance with the requirements of MIL-STD-129.

6. NOTES

6.1 Intended use. The Type L-7A airspeed indicator covered by this specification is intended to indicate the airplane's speed and the maximum allowable speed as set by the Mach number adjustment at the rear of the case. This is accomplished by the use of two pointers.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification
- b. Level of packaging and packing required

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is Oklahoma City Air Materiel Area (OCNE), Tinker AFB Oklahoma, and information pertaining to qualification of products may be obtained from that activity.

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