INCH-POUND
MIL-PRF-26611E
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SUPERSEDING
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PERFORMANCE SPECIFICATION

GENERATOR, TACHOMETER GEU-7/A, MINIATURE

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 defines a miniature, electric, two-pole, ac tachometer generator for use in generating electrical signals for transmission to aircraft indicating instruments.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are cited in sections 3 and 4 of this specification. These lists do 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 these lists, 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.

2.2.1 Specifications. The following specifications form a part of this specification 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.

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-L-7808	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engines, Synthetic

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

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.

AMSC N/A FSC 6620

2.3 Order of precedence. 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 (see 6.2), the generator shall be subjected to first article inspection in accordance with 4.2.

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 materials meet or exceed the operational and maintenance requirements, and promote economically advantageous life cycle cost.

3.3 Materials. Unless otherwise specified, materials shall be non-magnetic and nonferrous. Materials shall not produce deleterious fumes and shall be treated to resist corrosion due to electrolytic decomposition, fungus, fuels, salt spray, or any other conditions that may be encountered during operation, use, or storage.

3.4 Interface.

3.4.1 Dimensions. The generator shall conform to the dimensions in Figures 1 and 2.

3.4.2 Electrical connector and mounting. The 2-pin connector for the generator shall conform to MS33678-125-3P. The threaded portion of the connector shall be located within 0.375 inch from the rear of the generator. The mounting shall withstand a force of 17 foot-pounds bending moment applied in any direction perpendicular to the longitudinal axis of the connector without damage.

3.4.2.1 Connections. The generator winding leads shall be designated B, A, and C (conforming to phases 1, 2, and 3). The B and A leads shall be connected to the B and A pins of the connector and the C lead shall be grounded to the generator frame. Voltage phase rotation is B, A, and C when rotating the generator drive shaft counterclockwise.

3.4.2.2 Connector shell. The shell shall be electrically grounded to the generator case. In addition, the shell shall be permanently marked FOR USE WITH PERCENT RPM INDICATORS ONLY. The letters shall be at least 0.093 inch high and clearly visible and easily readable on opposite sides of the shell.

3.4.3 Lubrication resistance. The generator shall be resistant to oil conforming to MIL-L-7808 or MIL-L-23699.

3.5 Environmental conditions. The generator shall be capable of operation under the following conditions:

(a) Temperatures ranging from -85° to 450°F.

(b) Vibration up to 20g at frequencies from 5 to 2,000 Hz.

(c) Relative humidity up to 100 percent.

(d) Oil temperatures from -50° to 350°F.

(e) Altitude to 80,000 feet.

(f) An explosive atmosphere without igniting a fuel vapor-laden environment.

3.6 Performance.

3.6.1 Overspeed and reverse operation. The generator shall operate at any speed up to 5,500 rpm in either direction of rotation and in any mounting position. The generator output voltage shall be three phase and have a frequency of one cycle per revolution of the generator drive shaft.

3.6.2 Dielectric strength. There shall be no insulation breakdown when a potential of 500 V root mean square (rms) is applied between any electrical pin contact and any metal part of the generator case without the C lead grounded.

3.6.3 Voltage output. The output voltages shall be 21 ± 0.5 when operated at a drive shaft speed of 4,200 rpm and connected to a load consisting of three 40-ohm, Y-connected resistances. None of the output voltages shall be less than 3.5 when operated at a drive shaft speed of 1,000 rpm and connected to a load consisting of three 20-ohm, Y-connected resistances.

3.6.4 Case.

3.6.4.1 Leakage. The generator case shall withstand oil leakage from the engine into the generator mounting flange at maximum rate of 0.3 in^3 per hour.

3.6.4.2 Drainage. Oil and combustible fumes shall not accumulate in the case.

3.6.5 Shaft.

3.6.5.1 Hardness. Hardness of the drive end of the shaft shall be Rockwell C-30 to C-40.

3.6.5.2 Strength. The shear section of the drive shaft shall withstand 40 ± 5 inch-pounds of torque, and twist through a minimum of 270 degrees before yielding.

3.6.5.3 Flexibility. The shaft face shall be capable of moving 0.016 inch in any direction about the generator centerline without rotating or bending the shaft. The shaft rotational backlash about its longitudinal axis shall not exceed 6 angular degrees. Free axial play shall not exceed 0.021 inch. Shaft deflection from the generator centerline shall not exceed 10 degrees.

3.6.6 Weight. The generator shall not exceed 1.2 pounds.

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

3.6.8 Reliability. When specified (see 6.2), the generator shall have a minimum mean time between failures (MTBF) of 3,000 hours.

3.6.9 Maintainability. No special tools shall be required for the installation, removal, adjustment, or repair of the generator.

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 be performed on eight generators. Four generators shall be subjected to all tests in 4.6, one shall be used for the fungus test (see 4.6.15), and three shall receive the shaft failure test (see 4.6.20).

4.3 Conformance inspection. Conformance inspection shall consist of tests indicated in 4.3.1 and 4.3.2.

4.3.1 Individual tests. Each generator shall be subjected to tests indicated in 4.6.1 through 4.6.5.

4.3.2 Sampling tests. For the first 100 generators, 10 shall be selected randomly, and for each additional 100 units, 5 generators shall be selected randomly and subjected to the tests in 4.6.1 through 4.6.7 and 4.6.10

4.4 Inspection conditions.

4.4.1 Atmospheric conditions. Unless otherwise specified, all tests shall be performed at room temperature and atmospheric pressure.

4.4.2 Voltages. All voltages are rms values. The voltmeter shall have an accuracy of 1% or better, and meter errors shall not be included in errors attributable to the generator.

4.4.3 Test indicator. Unless otherwise specified, a percent rpm indicator shall be used.

4.4.4 Standard load. The standard load shall consist of three 40-ohm, Y-connected resistances.

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

Table I. Requirements cross-reference matrix

Requirement	Verification
3.1	4.2
3.3	4.6.1, 4.6.15, 4.6.16
3.4.1	4.6.1
3.4.2	4.6.1, 4.6.20
3.4.2.1	4.6.2, 4.6.3
3.4.2.2	4.6.1
3.4.3	4.6.9
3.5	4.6.6, 4.6.7, 4.6.10, 4.6.11, 4.6.14, 4.6.17
3.6.1	4.6.12
3.6.2	4.6.5
3.6.3	4.6.4, 4.6.8, 4.6.13, 4.6.18
3.6.4.1	4.6.9
3.6.4.2	4.6.9
3.6.5.1	4.6.1
3.6.5.2	4.6.19
3.6.5.3	4.6.1
3.6.6	4.6.1
3.6.8	4.6.21
3.6.9	4.6.1

4.6 Tests.

4.6.1 Examination. The generator shall be examined for compliance with dimensions, weight, shaft hardness, connectors, mountings, markings, flexibility, and maintainability.

4.6.2 Continuity and resistance. The generator stator windings shall be checked for continuity between electrical connector pins A and B, and between pins A and B and the generator case. The resistance between the pins or between a pin and the case shall be less than 50 ohms. These three measurements shall be within 2 ohms of each other.

4.6.3 Phase rotation. The generator terminals marked A and B shall be connected to the test indicator terminals marked A and B, respectively, while the indicator C terminal shall be grounded to the electrical connector shell. The test indicator shall indicate positive when the generator drive shaft is rotated in a counterclockwise direction.

4.6.4 Voltage. The generator shall be brought to a temperature of 75° ± 10°F and the output connected to a standard load. The drive shaft then shall be rotated at 4,200 ± 5 rpm. The three voltages, measured across the generator terminals, shall be 21 ± 0.5.

4.6.5 Dielectric strength. The generator C lead shall be ungrounded and 500 V rms and 60 Hz applied between pins A, B, and C, in turn, and the metal parts of the generator case (including the receptacle shell) for 5 seconds. There shall be no insulation breakdown as indicated by leakage current in excess of 0.002 amp.

4.6.6 Low temperature operation. The generator shall be placed in a temperature chamber set to -85° ± 10°F for a minimum of 44 hours without rotating the drive shaft. After 44 hours, still at -85° ± 10°F, the shaft shall be rotated at 25 ± 5 rpm for 15 ± 1 minutes. The chamber temperature then shall be raised to -50° ± 10°F and maintained for a minimum of 20 hours without rotating the drive shaft. After 20 hours at -50° ± 10°F, the drive shaft shall be rotated at 25 ± 5 rpm. The breakaway torque shall not exceed 8 inch-pounds and the torque required to turn the shaft within the first minute of rotation shall not exceed 1.5 inch-pounds.

4.6.7 Vibration. Prior to vibration, the output voltage shall be measured in accordance with 4.6.4. The generator shall be mounted without vibration isolators directly to the vibration exciter. Tests shall be conducted under both resonance and cycling conditions as specified in paragraphs 4.6.7.1 and 4.6.7.2. Time consumed performing 4.6.7.1 plus time consumed cycling in 4.6.7.2 shall equal 3 hours. Vibration displacement, velocity, and acceleration shall be measured at the specific instantaneous test frequency applied. Loose components that impact each other resulting in a high “noise” content of the applied vibration shall be considered as vibration input. If such “noise” is encountered, a low pass frequency filter that cuts off at approximately twice the test frequency shall be employed to reject the “noise.”

4.6.7.1 Resonance test. Resonant nodes of the generator shall be determined by varying the frequency of applied vibration slowly through the specified range at vibrator accelerations shown in Table II. Individual resonant nodes surveys shall be conducted with vibration applied along each set of three mutually perpendicular axes of the generator. The generator shall be vibrated at the indicated resonant conditions for the times shown in Table III and the applied double amplitudes of vibrator accelerations in Table II. Vibration shall be applied along each of the three mutually perpendicular axes. If more than one resonance is encountered when vibration is applied along any one axis, each resonance shall be sustained for the time shown in the applicable portion of the vibration test schedule. If more than four resonances are encountered with vibration applied along one axis, the four most severe resonances shall be chosen for test.

TABLE II. Vibration data

Frequency (Hz)	Displacement in double amplitude (inch) and Acceleration (g), if applicable
5 - 14	0.1
14 - 23	0.1 to 0.036 at 20g
23 - 104	0.036
104 - 2,000	0.036 to 0.001 at 20g

4.6.7.2 Cycling test. The generator shall be connected to the standard load and the drive shaft rotated at 4,450 ± 250 rpm. While operating, the generator shall be vibrated in accordance with the vibration schedule in Table III. The frequency shall be varied logarithmically from 5 to 2,000 Hz and returned to 5 Hz in 20-minute intervals at an applied acceleration of ±20g. After completion of testing in three axes, the output voltage shall be measured in accordance with 4.6.4. The generator, not operating, shall be subjected to 350°F for a minimum of 1 hour. The generator shall be removed from the oven and immediately vibrated (while operating) for 15 minutes. During the 15 minutes, the vibration frequency shall be cycled between 5 and 2,000 Hz one or two times, and the output voltage measured at this higher temperature in accordance with 4.6.4. The generator, not operating, then shall be subjected to 350°F for a minimum of 1 hour and the test repeated. No output voltage measurement shall be less than 20.0. The generator shall be subjected to the dielectric strength test in 4.6.5.

TABLE III. Vibration schedule

Number of resonances	0	1	2	3	4
Total vibration time at resonance (min)(see note)	--	30	60	90	120
Cycling time (hr)	3	2.5	2	1.5	1
Note: 30 minutes at each resonance.					

4.6.8 Operation. The generator output shall be connected to a non-standard load consisting of three 20-ohm, Y-connected resistances. The generator temperature shall be 250° ± 10°F and the drive shaft rotated between 4,200 and 4,300 rpm for 500 to 520 hours. The generator temperature then shall be lowered to 75° ± 10°F and the drive shaft rotated at 4,200 ± 100 rpm for 500 to 520 hours. After the generator has cooled, the output voltages shall be checked as specified in 4.6.4. The three voltages shall be 21 ± 1.

4.6.9 Oil soak. The generator shall be immersed in oil conforming to MIL-L-7808 or MIL-L-23699 at 350° ± 10°F and operated for 24 hours at 4,200 ±100 rpm. The oil temperature then shall be lowered to -50° ± 10°F and the generator operated for a minimum of 30 minutes. No damage or malfunction of the generator shall result from this test.

4.6.10 High temperature operation, The generator shall be subjected to 350° ± 10°F for a minimum of 3 hours. At this higher temperature, the voltage test specified in 4.6.4 shall be conducted and no output voltage shall be less than 17. The generator temperature then shall be raised to 455° ± 10°F and maintained for 4 hours while rotating the drive shaft at 4,200 ± 100 rpm with no electrical load on the generator. After the generator has cooled to 75° ± 10°F, the output voltages shall be checked according to 4.6.4, and the 3 voltages shall be 21 ± 2. The generator shall then be subjected to the dielectric strength test in 4.6.5.

4.6.11 Altitude - high temperature. The generator shall be placed in a chamber maintained at 300° ± 10°F at an absolute pressure of 0.82 inch Hg (80,000 ft). The output shall be connected to the standard load and the drive shaft rotated at 4,200 ± 100 rpm for 20 hours. There shall be no damage to the generator as a result of this test.

4.6.12 Overspeed and reverse operation. The generator shall be connected to the standard load and the drive shaft rotated at 4,200 ± 10 rpm. The output voltages then shall be measured. With the standard load still connected, the generator first shall be rotated at 5,000 rpm for 5 minutes, then the direction of rotation reversed and the generator rotated at 4,200 ± 10 rpm for 1 minute. The generator shall be cooled to 75° ± 10°F, keeping the standard load connected, the drive shaft shall be rotated at 4,200 ± 10 rpm in the normal direction and the output voltages measured in accordance with 4.6.4. The voltages shall be 21 ± 2.

4.6.13 Short circuit. The generator shall be connected to the standard load and the drive shaft rotated at 4,200 ± 5 rpm and the terminal voltages again measured. With the generator still operating, all three generator terminals shall be short circuited five times at 1 second each time. The generator shall be cooled to 75° ± 10°F, keeping the standard load connected, and the drive shaft rotated at 4,200 ± 5 rpm. The output voltages shall again be measured and shall be between 19 and 21.5.

4.6.14 Humidity. At ambient temperature and humidity, the generator shall be mounted in the test chamber with the shaft in a horizontal position with external connections simulating installed conditions. The chamber temperature shall gradually be raised to 150°F and the humidity to 95% over a 2 hour period. This temperature and humidity shall be maintained for 6 hours. After 6 hours, the humidity shall be maintained at a minimum of 85% and the test chamber temperature shall be reduced from 150° to 85°F over a 16 hour period. The above temperature and humidity cycle shall be repeated 10 times (240 hour test). Within 2 hours after removal from the test chamber, the generator shall be subjected to the dielectric strength test in 4.6.5.

4.6.15 Fungus. The components of one generator, including any required lubricants, shall be subjected to a fungus resistance test for a minimum of 28 days and a maximum of 84 days depending on the degree of certainty required in determining the existence or effect of fungal growth. The generator shall be configured as it would be during shipping, storage, and service. The test temperature shall be between 75° and 90°F with 95% ± 5% relative humidity. At least five different species of fungus shall be used. Additional fungi may be used based on prior knowledge of specific material deterioration characteristics. Any trace of fungus, degradation, corrosion, or mechanical failure constitutes a cause for rejection.

4.6.16 Salt fog. The generator shall be subjected to a 50 hour salt fog test. The test shall be conducted using steam or distilled, demineralized, or deionized water. The salt solution concentration shall be 5 ± 1% at 95°F with a pH between 6.5 and 7.2. The salt solution shall consist of sodium chloride (NaC1) containing by weight not more than 0.1% sodium iodide (NaI) and not more than 0.5% total impurities. The test item shall be configured as it would be during service. Any evidence of corrosion or corrosion-caused damage shall constitute a cause for rejection. After the 50 hour test, the generator shall be subjected to the tests in 4.6.1, 4.6.2 and 4.6.5.

4.6.17 Explosive atmosphere. An explosive atmosphere test shall be conducted after vibration and temperature testing. Ignition of test fuel vapor and air environment constitutes a cause for rejection.

4.6.18 Cumulative voltage error. After completion of all the preceding tests, the voltage test in 4.6.4 shall be performed on all units undergoing first article inspection. Any voltage less than 19 shall be cause for rejection of the items.

4.6.19 Shaft failure. The shafts of two tested generators and three untested first article generators shall be made to fail. The torque required to cause failure shall be 35 to 45 inch-pounds. The shear sections shall twist through a minimum of 270 degrees before yielding.

4.6.20 Connector strength. A force of 17 foot-pounds shall be applied perpendicular to the longitudinal axis of the connector. There shall be no damage to the connector as a result of this test.

4.6.21 Reliability. A minimum MTBF of 3,000 hours shall be demonstrated by satisfactory completion of an industrially accepted reliability test indicating the MTBF shall be realized with a confidence level of 90 percent.

5. PACKAGING

5.1 General. 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 that may be helpful, but is not mandatory.)

6.1 Intended use. The GEU-7/A miniature tachometer generator covered by this specification is intended for use on turboprop and turbojet engines to generate electrical signals for transmission to magnetic-drag type indicators conforming to MIL-I-22596 and MIL-I-25623.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of the specification.

b. Item identification.

c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

d. When first article inspection is required (see 3.1).

e. When reliability testing is required (3.6.8).

f. Data required (see section 4).

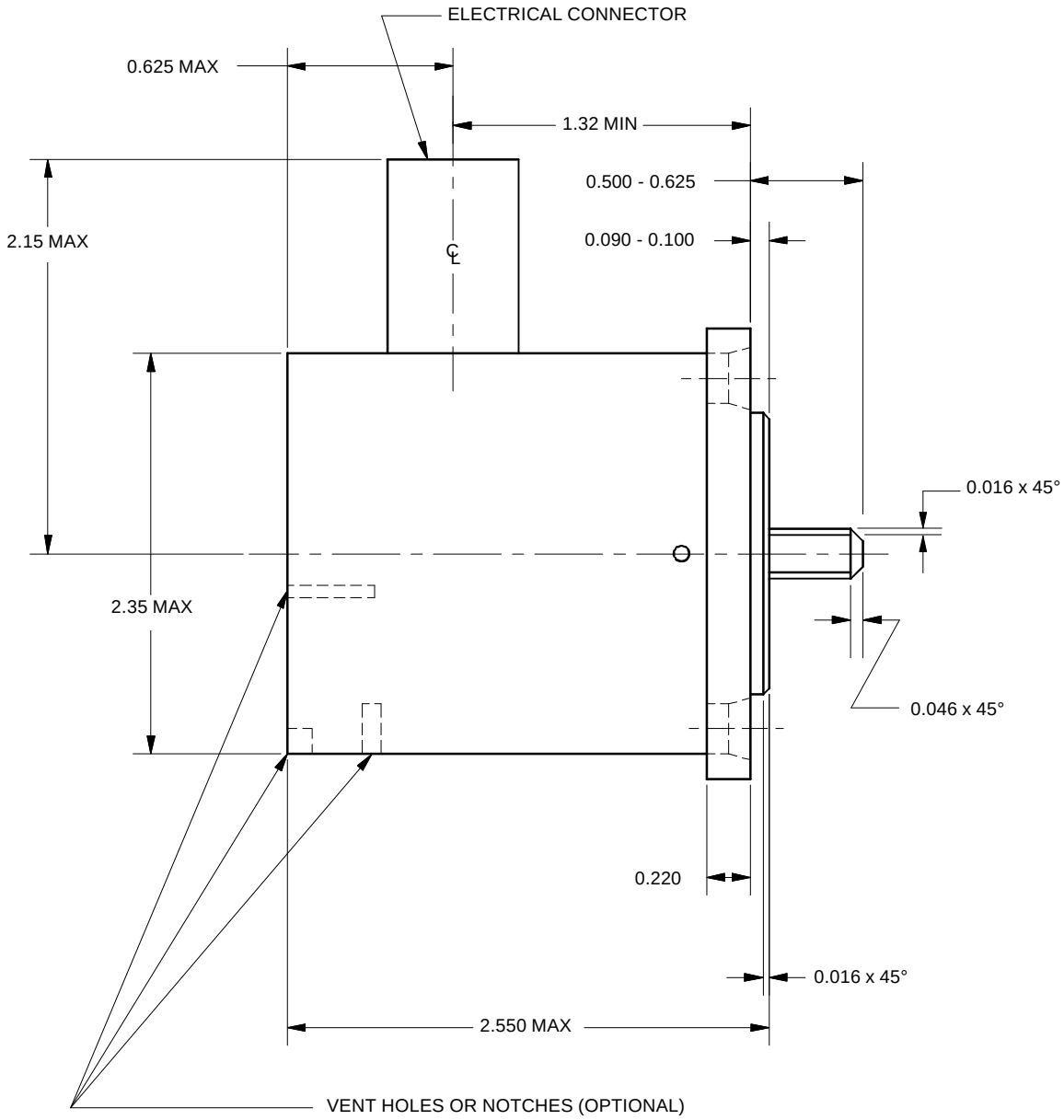
g. Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.
Generator
Miniature
Tachometer
Turboprop and turbojet engines
3,000 hr. reliability
5,500 rpm (100% = 4,200 rpm)

6.4 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
Navy - AS
Army - AV

Preparing Activity:
AIR FORCE -71

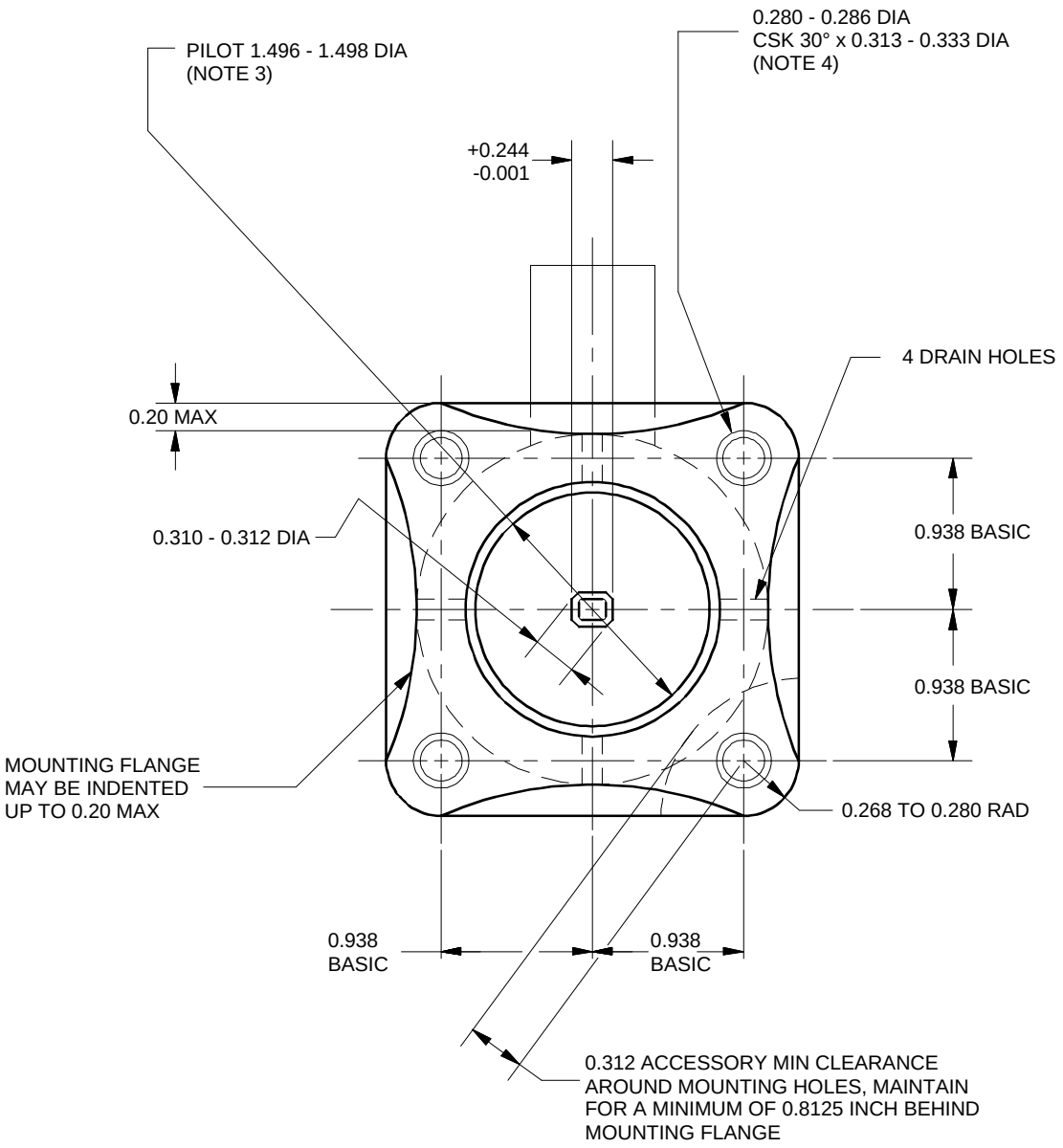


NOTES: 1. DIMENSIONS IN INCHES.

2. TOLERANCES: DECIMALS 2 PL 0.01, 3 PL 0.005.
ANGLES ±1°.

3. SHAPE OF GENERATOR OPTIONAL PROVIDED
ALL DIMENSIONS ARE MET.

FIGURE 1. Generator side view



NOTES:
1. DIMENSIONS IN INCHES.
2. TOLERANCES: DECIMALS 2 PL 0.01, 3 PL 0.005.
3. CONCENTRIC WITH AXIS OF ROTATION WITHIN 0.005 TOTAL INDICATOR READOUT.
4. FOUR HOLES LOCATED WITHIN 0.005 OF BASIC POSITION.
5. SHAPE OF GENERATOR OPTIONAL PROVIDED ALL DIMENSIONS ARE MET.

FIGURE 2. Generator end view

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER**	**2. DOCUMENT DATE (YYMMDD)**
	MIL-PRF-26611E	**960515**

3. DOCUMENT TITLE

GENERATOR, TACHOMETER GEU-7/A, MINIATURE

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. Organization	
c. ADDRESS *(Include zip code)*	**d. TELEPHONE** *(Include Area Code)* (1) Commercial (2) DSN *(if applicable)*	**7. DATE SUBMITTED** **(YYMMDD)**

8. PREPARING ACTIVITY

a. NAME **OC-ALC/TICLA**	**b. TELEPHONE** *(Include Area Code)* (1) Commercial: **(405) 736-5960** (2) DSN: **366-5960**
c. ADDRESS ***(Include Zip Code)*** ***OC-ALC/TICLA*** ***3001 Staff Drive Suite 1AE1-101A*** ***Tinker AFB, OK 73145-3096***	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** **Defense Quality and Standardization Office** **5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466** **Telephone (703) 756-2340/2343 DSN 289-2340/2343**