MIL-E-005272B(USAF)
5 June 1957
Used in Lieu of
MIL-E-5272A
16 September 1952

MILITARY SPECIFICATION

ENVIRONMENTAL TESTING, AERONAUTICAL AND ASSOCIATED EQUIPMENT, GENERAL SPECIFICATION FOR

This limited coordination military specification has been prepared by the Air Force based upon currently available technical information, but it has not been approved for promulgation as a revision of military specification MIL-E-5272A. It is subject to modification. However, pending its promulgation as a coordinated military specification, it may be used in procurement.

CONTENTS

1. SCOPE

1.1 GENERAL.- This specification establishes uniform procedures for testing aeronautical and associated equipment under simulated and accelerated climatic and environmental conditions. On any particular equipment, test procedures are to be followed to the extent specified in the detail specification.

2. APPLICABLE SPECIFICATIONS

2.1 The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification:

2.1.1 SPECIFICATIONS.-

Military

JAN-S-44	Shock-Testing-Mechanism for Electrical-Indicating Instruments (2-1/2 and 3-1/2 Inch, Round, Flush-Mounting, Panel-Type)
MIL-S-901	Shockproof Equipment, Class HI (High-Impact), Shipboard Application, Tests For
MIL-S-4456	Shock, Variable Duration, Method and Apparatus For
MIL-F-5572	Gasoline, Aviation: Grades 80/87, 91/96, 100/130, 115/145
MIL-C-9435	Chamber, Explosion-Proof Testing

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

3. REQUIREMENTS

3.1 ENVIRONMENTAL CONDITIONS.- Test procedures for the following climatic and environmental conditions are described herein. (See 5.3.)

3.1.1 TEMPERATURE.-

3.1.1.1 EQUIPMENT OPERATING.- Temperatures ranging from -54° to +71°C (-65° to +160°F), remaining constant or varying at a rate as high as 1°C (1.8°F) persecond.

3.1.1.2 EQUIPMENT NONOPERATING.- Temperatures ranging from -62° to +71°C(-80° to +160°F), the temperature may remain constant or vary at a rate as high as 1°C (1.8°F) per second.

3.1.2 HUMIDITY.- Relative humidity up to 100 percent including conditions wherein condensation takes place in the form of both water and frost.

3.1.3 ALTITUDE.-

3.1.3.1 AIRBORNE AERONAUTICAL EQUIPMENT.- Pressures ranging from 30 inches of mercury down to 1.32 inches of mercury (approximating an altitude of 70,000 feet), the pressure may remain constant or vary at a rate as high as 0.5 inches of mercury per second.

3.1.3.2 GROUND BASED EQUIPMENT.- Pressures ranging from 30 inches of mercury down to 23.98 inches of mercury (approximating an altitude of 6,000 feet).

3.1.4 SALT SPRAY.- Exposure to salt sea atmosphere.

3.1.5 VIBRATION.- Vibration incident to service use.

3.1.6 FUNGUS.- Fungus growth as encountered in tropical climates.

3.1.7 SUNSHINE.- Radiant energy as found under natural conditions.

3.1.8 RAIN.- Rainfall as encountered in any locale.

3.1.9 SAND AND DUST.- Sand and dust particles as will be encountered in desert areas.

3.1.10 EXPLOSIVE ATMOSPHERE.- Operation in an explosive vapor within or surrounding the equipment.

3.1.11 ACCELERATION AND SHOCK.- Acceleration and shock forces as anticipated.

3.2 MODIFICATION OF TEST LIMITS.- The limits for the test conditions specified herein may be modified to meet the requirements of the particular equipment. The requirements of the detail specification shall govern in case of conflict between this specification and the detail specification.

3.3 TEST FACILITIES.-

3.3.1 GENERAL.- The apparatus used in conducting tests shall be capable of meeting the conditions required.

3.3.2 VOLUME.- The test facilities shall be such that the equipment under test shall not exceed 50 percent of the internal volume of the test chamber.

3.3.3 HEAT SOURCE.- The heat source of the test facilities shall be so located that radiant heat shall not fall directly on the equipment under test.

3.3.4 STANDARD CONDITIONS.- Room conditions for conducting the equipment operational check shall be as follows:

a. Temperature: 25 plus or minus 10°C.
b. Relative Humidity: 90 percent or less.
c. Barometric Pressure: 28 to 32 inches of mercury.

3.4 MEASUREMENTS.- All measurements shall be made with instruments whose accuracy has been verified. If tests are conducted at the contractor's plant the accuracy of the instruments and test equipment shall be verified periodically by the contractor to the satisfaction of the procuring activity.

3.4.1 TOLERANCES.- The maximum allowable tolerances on test condition measurements shall be as follows:

a. Temperature: Plus or minus 2°C.
b. Altitude: Plus or minus 5 percent in feet.
c. Humidity: Plus or minus 5 percent relative.
d. Vibration Amplitude: Plus or minus 5 percent. This tolerance is applicable only to the amplitude measuring instruments.
e. Vibration Frequency: Plus or minus 2 percent. This tolerance is applicable only to the frequency measuring instruments.
f. Additional tolerances shall be as specified.

3.5 TEST SEQUENCE.- The tests shall be performed in sequence or combination as specified in the detail specification.

3.6 PERFORMANCE RECORD.- Prior to conducting any of the tests specified herein, the equipment shall be operated under room conditions and a record made of all data necessary to determine compliance with the detail equipment specification. These data shall provide the criteria for checking satisfactory performance of the equipment undergoing environmental tests. Variation from room condition performance shall be within limits acceptable to the procuring activity. Where the detail equipment specification establishes the level of acceptable performance for the test procedure, a comparison with room condition performance shall not be made.

3.7 DETERIORATION.- Deterioration or corrosion of any internal or external components which could in any manner prevent the equipment from meeting operational maintenance and servicing requirements during service life shall provide reason to consider the equipment as having failed to meet the test to which it was subjected.

4. TEST PROCEDURES

4.1 HIGH TEMPERATURE TESTS.-

4.1.1 PROCEDURE I.- The equipment shall be placed within the chamber and the internal temperature of the chamber raised to 71°C (160°F) with an internal relative humidity of not more than 5 percent. The item of equipment shall be maintained at 71°C (160°F) for a period of 50 hours or as specified in the detail specification. While still at this temperature, the equipment shall be operated and the results compared with the data obtained in 3.6. The temperature shall then be reduced to prevailing room conditions and a visual examination conducted in accordance with 3.7.

4.2 LOW TEMPERATURE TESTS.-

4.2.1 PROCEDURE I.- The item of equipment shall be placed within the test chamber and the chamber cooled to and maintained at a temperature of -54°C (-65°F) until stabilization of the equipment is reached. (See 5.3.4.) While at this temperature, the equipment shall be operated and the results compared with the data obtained in 3.6.

4.2.2 PROCEDURE II.- The equipment shall be placed within the chamber and the chamber cooled to and maintained at a temperature of -62°C (-80°F) for a period of 48 hours, at which time the equipment shall be examined in accordance with the requirements of 3.7. The temperature of the chamber shall then be raised to -54°C (-65°F) and maintained for an additional 24-hour period or until stabilization is reached (see 5.3.4), whichever is the longer. At the conclusion of this exposure period and while at this temperature, the equipment shall be operated and the results compared with the data obtained in 3.6 and visually examined in accordance with 3.7.

4.3 TEMPERATURE SHOCK TESTS.-

4.3.1 PROCEDURE I.- The equipment to be tested shall first be placed within a test chamber wherein a temperature of 85°C (185°F) is maintained. The equipment shall be subjected to this temperature for a period of 4 hours, at the conclusion of which, and within 5 minutes the equipment shall be transferred to a chamber having an internal temperature of -40°C (-40°F). The equipment shall be subjected to this temperature for a period of 4 hours. This completes one cycle. The number of complete cycles shall be three. At the conclusion of the third cycle the equipment shall be removed from the test chamber and, within a period of 1 hour, operated and the results compared with the data obtained in 3.6. A visual examination shall then be completed in accordance with 3.7.

4.3.2 PROCEDURE II.- The equipment shall be placed within the chamber and maintained for a period of at least 1 hour or until the equipment performance stabilizes at a temperature of 25° ±15°C (77° ±27°F). The chamber temperature shall then be reduced to -55°C (67°F) and maintained at this condition for at least 1 hour or until the equipment performance stabilizes. The internal temperature of the chamber shall then be increased to 71°C (160°F) and maintained at this condition for at least 1 hour or until the equipment performance stabilizes. The internal temperature shall then be returned to 25° ±15°C (77° ±27°F) and the performance of the equipment compared with data obtained in 3.6. Tests shall be made at any other ambient temperature between the limits specified, at the option of the qualifying agency or as stated in the detail specification.

4.4 HUMIDITY TESTS.-

4.4.1 PROCEDURE I.- The equipment shall be placed in the test chamber and set up to simulate installed conditions. The chamber temperature shall be between 20° and 38°C (68° to 100°F) with uncontrolled humidity. During the first 2-hour period, the temperature shall be gradually raised to 71°C (160°F). The temperature of 71°C (160°F) shall be maintained during the next 6-hour period. During the following 16-hour period, the temperature in the chamber shall be gradually reduced to 20° to 38°C (68° to 100°F) which constitutes one cycle. The relative humidity throughout the cycle shall be 95 percent. The cycle shall be repeated a sufficient number of times to extend the total time of the test to 240 hours (10 cycles). At the conclusion of the 240-hour period, the equipment shall be operated and the data compared to that obtained in 3.6, and a visual examination made in accordance with 3.7. Distilled or demineralized water having a pH value of between 6.5 and 7.5 at 25°C (77°F) shall be used to obtain the desired humidity. The velocity of the air throughout the test area shall not exceed 150 feet per minute.

4.4.2 PROCEDURE III.- The equipment shall be placed in the test chamber and set up to simulate installed conditions; the temperature and relative humidity in the chamber shall be 49°C (120°F) and 95 percent, respectively. The test conditions shall be maintained for 360 hours. At the conclusion of this period, the equipment shall be operated and the results compared with those obtained in 3.6. An examination in accordance with 3.7 shall then be made.

4.5 ALTITUDE TESTS.-

4.5.1 PROCEDURE I.- The equipment shall be placed within the test chamber and the internal absolute pressure reduced to 23.98

inches of mercury (corresponding to an altitude of 6,000 feet above sea level) and the ambient temperature reduced to -55°C (-67°F). The duration of the test period shall be in accordance with the detail specification. At the conclusion of this period and while the altitude and temperature conditions are maintained, the equipment shall be operated and the result compared with those obtained in 3.6.

4.5.2 PROCEDURE II.- The equipment shall be placed within the test chamber and the absolute internal pressure of the chamber reduced to 3.44 inches of mercury (corresponding to an altitude of 50,000 feet above sea level) and an ambient temperature of -54°C (-65°F). The equipment shall be maintained under these conditions for the period specified in the detail specification. At the conclusion of this period and while the altitude and temperature conditions are maintained, the equipment shall be operated and the results compared with those obtained in 3.6.

4.5.3 PROCEDURE III.- The equipment shall be placed within the test chamber and the pressure altitude shall be varied from approximately sea level to conditions approximating the maximum altitude given by the applicable equipment specification. Tests shall be made at intermediate altitudes at the option of the qualifying activity. Each altitude shall be held until the equipment performance stabilizes. The ambient temperature shall be within 5° of the maximum shown on the temperature-altitude curve of the equipment specification.

4.5.4 PROCEDURE IV.- The equipment shall be operated under the following conditions. Different altitude conditions may be specified by the applicable equipment specification in which case the test altitude may be changed accordingly.

a. 100 hours at sea level conditions.

b. Four continuous cycles consisting of the following:

(1) 24 hours at altitude conditions approximating 35,000 feet and -50° ±5°C.

(2) At least 1 hour at standard test conditions and no more than 2 hours between each 24-hour run at altitude. The rate of change in altitude need not be controlled; however, temperature must remain within 5° of the maximum shown on the temperature-altitude curve of the equipment specification.

c. Two continuous cycles consisting of the following:

(1) 9 hours at maximum altitude conditions as specified by the applicable equipment specification.

(2) At least 1 hour at continuous operating speed at standard test conditions, and no more than 2 hours prior to each 9-hour run at altitude. The rate of change in altitude need not be controlled; however, the temperature must remain within 5° of the values shown on the temperature-altitude curve of the equipment specification.

4.5.5 PROCEDURE V.- The equipment shall be placed within the test chamber and the absolute internal pressure of the chamber reduced to 1.32 inches of mercury (corresponding to an altitude of 70,000 feet above sea level) and an ambient temperature of -54°C (-65°F). The equipment shall be maintained under these conditions for the period specified in the detail specification. At the conclusion of this period and while the altitude and temperature conditions are maintained, the equipment shall be operated and the results compared with those obtained in 3.6.

4.6 SALT SPRAY TESTS.-

4.6.1 PROCEDURE I.-

4.6.1.1 APPARATUS.- Apparatus used in the Salt Spray test shall include the following:

a. Exposure chamber with racks for supporting specimens.
b. Salt solution reservoir.
c. Means for atomizing salt solution, including suitable nozzles and compressed air supply.
d. Chamber heating means and control.
e. Means for humidifying the compressed air at a temperature above the chamber temperature.

4.6.1.1.1 CHAMBER.- The chamber and all accessories shall be made of material which will not affect the corrosiveness of the fog, such as glass, hard rubber, plastic, or wood other than plywood. In addition, all parts which come in contact with test items shall be of materials that will not cause electrolytic corrosion. The chamber and accessories shall be so constructed and arranged that there is no direct impinging of the spray or dripping of the condensate on the test items, that the spray circulates freely about all items to the same degree and that no liquid which has come in contact with the test specimens returns to the salt solution reservoir. The chamber shall be properly vented.

4.6.1.1.2 ATOMIZERS.- The atomizers used shall be of such design and construction as to produce a finely divided, wet, dense fog.

4.6.1.1.3 AIR SUPPLY.- The compressed air entering the atomizers shall be free from all impurities such as oil and dirt. Means shall be provided to humidify and warm the compressed air as required to meet the operating conditions. The air pressure shall be suitable to produce a finely divided dense fog with the atomizer or atomizers used. To insure against clogging the atomizers by salt deposition, the air should have a relative humidity of at least 85 percent at the point of release from the nozzle. A satisfactory method is to pass the air in very fine bubbles through a tower containing heated water. The temperature of the water should be 35°C (95°F) and often higher. The permissible temperature increases with increasing volume of air and with decreasing heat insulation of the chamber and temperature of its surroundings. It should not exceed a value above which an excess of moisture is introduced into the chamber (for example, 43°C (109°F) at an air pressure of 12 psi) or a value which makes it impossible to meet the requirement for operating temperature.

4.6.1.1.4 SALT SOLUTION.- The salt used shall be sodium chloride containing on the dry basis not more than 0.1 percent of sodium iodide and not more than 0.2 percent of total impurities. The solution shall be prepared by dissolving 20 ±2 parts by weight of salt in 80 parts by weight of distilled or other water containing not more than 200 parts per million of total solids. The solution shall be kept free from solids by filtration or decantation. The solution shall be adjusted to and maintained at a specific gravity of from 1.126 to 1.157 and at a pH of between 6.5 to 7.2 when measured at a temperature between 33° and 36°C (92° and 97°F). Only C.P. hydrochloric acid or C.P. sodium hydroxide shall be used to adjust the pH. The pH measurement shall be made electrometrically using a glass electrode with a saturated potassium chloride bridge or by a colorimetric method such as bromothynol blue provided the results are equivalent to those obtained with the electrometric method.

4.6.1.2 OPERATING CONDITIONS.-

4.6.1.2.1 TEMPERATURE.- The test shall be conducted with a temperature in the exposure zone maintained at 35°C. Satisfactory methods for controlling the temperature accurately are by housing the apparatus in a properly controlled constant-temperature room, by thoroughly insulating the apparatus and preheating the air to the proper temperature prior to atomization, and by jacketing the apparatus and controlling the temperature of the water or of the air used. The use of immersion heaters for the purpose of maintaining the temperature within the chamber is prohibited.

4.6.1.2.2 ATOMIZATION.- The conditions maintained in all parts of the exposure zone shall be such that a suitable receptacle placed at any point in the exposure zone will collect from 0.5 to 3 ml of solution per hour for each 80 sq cm of horizontal collecting area (10 cm diameter) based on an average of at least 16 hours. The solution thus collected shall have a sodium chloride content of from 18 to 22 percent (sp gr of from 1.126 to 1.157 when measured at a temperature between 33° and 36°C). At least two clean fog collecting receptacles shall be used, one placed nearest to any nozzle and one farthest from all nozzles. Receptacles shall be fastened so that they are not shielded by specimens and so that no drops of solution from specimens or other sources will be collected. When using nozzles made of material nonreactive to the salt solution, suitable atomization has been obtained in boxes having a volume of less than 12 cubic feet with the following conditions:

a. Nozzle pressure between 12 and 18 pounds per square inch.

b. Orifices between 0.02 and 0.03 inch in diameter.

c. Atomization of approximately 3 quarts of the salt solution per 10 cubic feet of box volume per 24 hours.

When using large size boxes having a volume considerably in excess of 12 cubic feet, the specified conditions may have to be modified in order to meet the requirements for operating conditions.

4.6.1.2.3 PREPARATION OF EQUIPMENT.- The equipment shall be mounted in the chamber and electrical and mechanical connections completed where operation is required during the test period. Access covers and inspection plates shall be in place except when such covers would normally be removed for service use. When operation is not required, external connections may be plugged to simulate actual service conditions.

4.6.1.3 CONCLUSION.- The length of the Salt Spray test shall be not less than 50 hours. At the end of the test period, the equipment shall be operated and the results compared with the data obtained in 3.6. Salt deposits resulting from the test conditions may be removed prior to operation. A visual examination shall be conducted in accordance with 3.7.

4.7 VIBRATION TESTS.-

4.7.1 PROCEDURE I.- This procedure applies to items of equipment (including vibration isolating assemblies) which mount directly on the structure of aircraft powered by reciprocating, turbojet, or turbo-propeller engines. It also applies to equipment mounted directly on gas-turbine engines. The test specimen shall be mounted on the apparatus dynamically similar to the most severe condition likely to be encountered in service. The test specimen shall be functioning in accordance with the provisions of the detail specification during the entire test period, whenever practicable. At the end of the test period, the test specimen shall be inspected thoroughly for damage or defects resulting from the vibration tests. The amplitude or acceleration for the frequency cycling test shall be within ±10 percent of the specified values. Vibration tests shall be conducted under both resonant and cycling conditions according to the following Vibration Test Schedule (table I) (see 5.3.7):

TABLE I

VIBRATION TEST SCHEDULE (Times shown refer to one axis of vibration)			
Type	Vibration at Room Temp	Vibration at 160°F (71°C)	Vibration at -65°F (-54°C)
Resonance	60 minutes	15 minutes	15 minutes
Cycling	60 minutes	15 minutes	15 minutes

4.7.1.1 RESONANCE.- Resonant frequencies of the test specimen shall be determined by varying the frequency of applied vibration slowly through the specified range of frequencies at vibratory accelerations not exceeding those shown in figure 1. Individual resonant frequency surveys shall be conducted with vibration applied along each of any set of three mutually perpendicular axes of the test specimen. Whenever practicable, functioning of the test specimen shall be checked concurrently with the operation of scanning the frequency range for resonant frequencies. The test specimen shall be vibrated at the indicated resonant conditions for the periods shown in the Vibration Test Schedule and with the applied double amplitude or vibratory acceleration specified in figure 1. These periods of vibration shall be accomplished with vibration applied along each of three mutually perpendicular axes of vibration. When more than one resonant frequency is encountered with vibration applied along any one axis, the test period may be accomplished at the most severe resonance or the period may be divided among the resonant frequencies, whichever is considered most likely to produce failure. When resonant frequencies are not apparent within the specified frequency range, the specimen shall be vibrated for periods twice as long as those shown for resonance in the Vibration Test Schedule at a frequency of 55 cps and an applied double amplitude of 0.060 inch. However, in no instance shall the specimen be vibrated at any resonant mode for periods less than half as long as those shown for resonance in the Vibration Test Schedule.

4.7.1.2 CYCLING.- For test specimens mounted on vibration isolators, a vibration test shall be conducted with a constant applied double amplitude of 0.060 inch and the frequency cycling between 10 and 55 cps in 1-minute cycles. Vibration shall be applied along each of three mutually perpendicular axes according to the Vibration Test Schedule. For specimens which are to be installed in

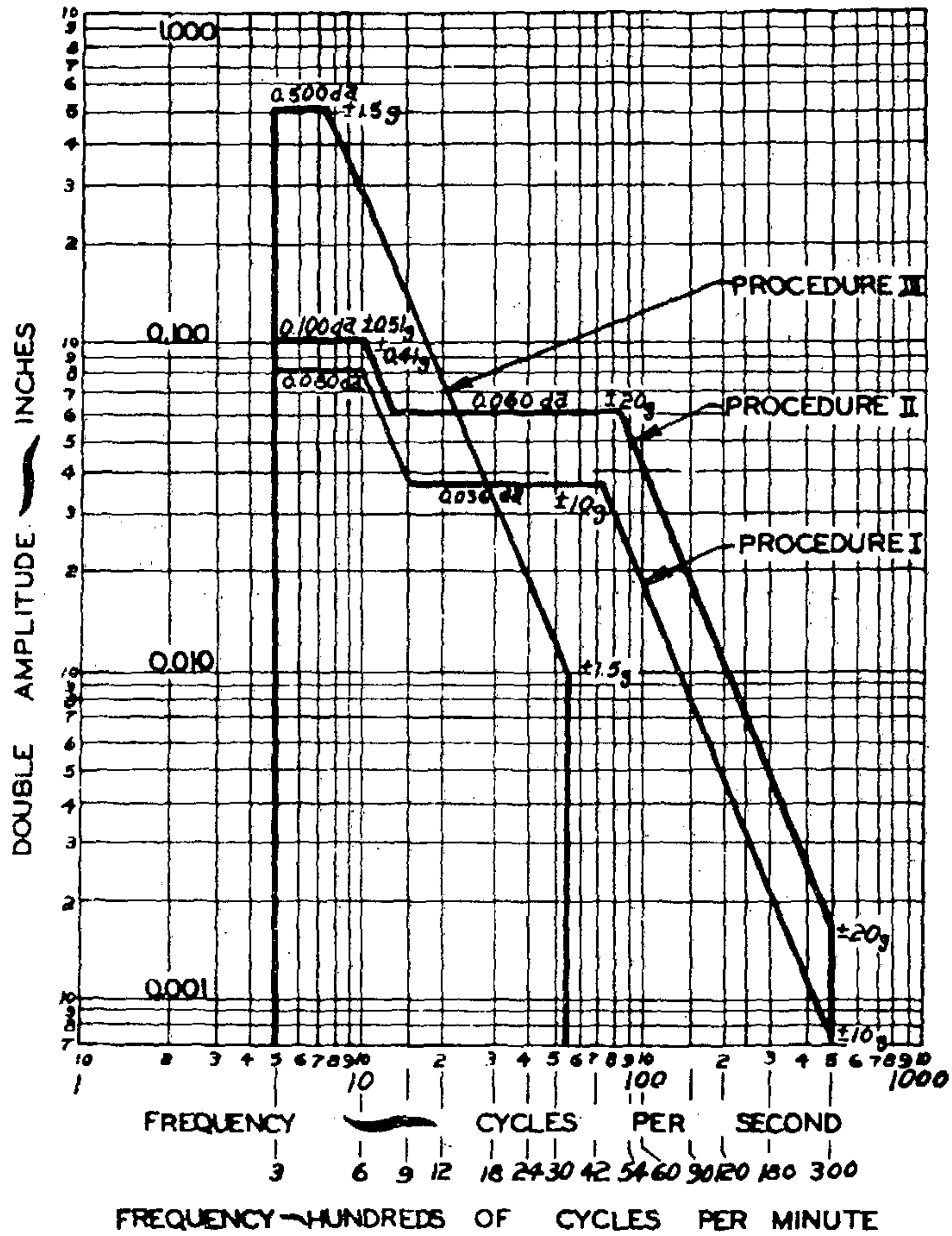

FIGURE 1 RANGE CURVE FOR VIBRATION TESTS

aircraft without vibration isolators, a vibration test shall be conducted with the frequency cycling between 10 and 500 cps in 15-minute cycles at an applied double amplitude of 0.036 inch or an applied acceleration of ±10g, whichever is the limiting value. Vibration shall be applied along each of three mutually perpendicular axes according to the Vibration Test Schedule (table I).

4.7.2 PROCEDURE II.- This procedure applies to items of equipment which mount directly to reciprocating engines. The test specimen shall be mounted on the apparatus in a position dynamically similar to the most severe mounting likely to be used in service. Resonant frequencies of the test specimen shall be determined by varying the frequency of applied vibration slowly through the specified frequency range at vibratory accelerations not exceeding those shown in figure 1. Individual resonant frequency surveys shall be conducted with vibration applied along each of any set of three mutually perpendicular axes of the test specimen. Whenever practicable, the functioning of the test specimen shall be checked concurrently with the operation of scanning the frequency range for resonant frequencies. If resonant frequencies are encountered, the test specimen shall be vibrated successively along each of three mutually perpendicular axes for 4 hours at the resonant conditions with the applied double amplitude or vibratory acceleration shown in figure 1. When more than one resonant frequency is encountered with vibration applied along any one axis, the test period may be carried out at the most severe resonance, or the period may be divided uniformly among the resonant frequencies, whichever procedure is considered most likely to produce failure. When clearly defined resonant frequencies are not encountered within the specified frequency range, the test specimen shall be vibrated for 12 hours along each of its mutually perpendicular axes at an applied double amplitude of 0.018 inch and a frequency of 150 cycles per second. The test specimen shall be functioning in accordance with the provisions of the detail specification during the entire test period whenever practicable. At the end of the test period, the test specimen shall be inspected thoroughly for damage or defects resulting from the vibration tests.

4.7.3 PROCEDURE III.- This procedure applies to an item of equipment destined to be used as a part of such vibration isolated assemblies as instrument panels, equipment racks, etc, when the main vibration isolator assembly is not available for the Vibration test. The test specimen shall be mounted on the apparatus in a position dynamically similar to the most severe mounting likely to be used in service. Resonant frequencies of the test specimen shall be determined by varying the frequency of applied vibration slowly through the specified frequency range at vibratory accelerations or double amplitudes not exceeding those shown in figure 1. When the applied vibration is linear, individual resonant frequency surveys shall be conducted with vibration applied along each of any set of three mutually perpendicular axes of the test specimen. Whenever practicable, functioning of the test specimen shall be checked concurrently with the operation of scanning the frequency range for resonant frequencies. If resonant frequencies are encountered, the test specimen shall be vibrated for 4 hours at the resonant conditions determined by applying linear vibration along each of three mutually perpendicular axes; or for 6 hours at the resonant conditions determined by applying circular motion in a plane inclined 45 degrees to the horizontal plane with the applied acceleration, double amplitude, or diameter of circular motion shown in figure 1. When more than one resonant frequency is encountered with vibration applied along any one axis or with circular motion in a plane tilted 45 degrees to the horizontal plane, the test period may be carried out at the most severe resonance, or the period may be divided uniformly among the resonant frequencies, whichever procedure is considered most likely to produce failure. When clearly defined resonant frequencies are not encountered within the specified frequency range, the test specimen shall be vibrated for 12 hours along each of its mutually perpendicular axes, or for 18 hours with circular motion in a plane inclined 45 degrees to the horizontal plane, at an applied double amplitude, or diameter of circular motion amounting to 0.010 inch with a frequency of 50 cycles per second. The test specimen shall be functioning in accordance with the provisions of the detail specification during the entire test period whenever practicable. At the end of the test period, the equipment shall be inspected thoroughly for damage or defects resulting from the vibration tests.

4.7.4 PROCEDURE IV.- This procedure applies to the determination of vibration errors in panel-mounted aircraft instruments. The instrument shall be mounted on the apparatus in its normal operating position. While being operated in accordance with the detail specification the item shall be vibrated with circular motion in a plane inclined 45 degrees to the horizontal plane with one of the following diameters of circular motion as specified in the detail specification: 0.003 to 0.005, 0.009 to 0.011, or 0.018 to 0.020 inch. The frequency of applied vibration shall be varied slowly from 5 to 50 cycles per second. No condition of applied vibration shall cause vibration errors involving pointer oscillation or variation in excess of the tolerance outlined in the detail specification.

4.7.5 PROCEDURE V.- This procedure constitutes a vibration failure test to detect faulty constructional details in panel-mounted aircraft instruments. The instrument shall be mounted on the apparatus in its normal operating position. While being operated in accordance with the detail specification, the instrument shall be vibrated with circular motion of 0.018 to 0.020 inch diameter in a plane inclined 45 degrees to the horizontal plane, and the frequency of vibration shall be varied uniformly from 5 to 50 cycles per second and return once each hour for a 3-hour period. At the completion of this test, the instrument shall be operated and the results compared with the data obtained in 3.6. A visual inspection shall be made in accordance with 3.7.

4.7.6 PROCEDURE VI.- This procedure is used to determine the torsional vibration characteristics of rotary equipment. The test specimen shall be mounted on the apparatus in a position dynamically similar to the most severe mounting used in service. The equipment shall be vibrated with torsional motion through a total travel of 3 degrees at rates varying from 10 to 40 cycles per second. Frequency and method of test shall be as described in the detail specification.

4.7.7 PROCEDURE VII.- This procedure applies to the determination of the resonant frequency in the fundamental bending mode of generators and alternators mounted directly on aircraft engines. The alternator or generator shall be mounted on the test apparatus in such a manner that sufficient rigidity is obtained so that the fundamental bending resonance of the alternator or generator does not induce appreciable flexure in the mounting. A frequency survey through the frequency range of 100 to 500 cycles per second shall be made to determine the resonant frequency in the fundamental bending mode. The applied vibratory accelerations at the base of the alternator or generator shall not exceed ±10g. The resonant frequency shall be above the minimum frequency specified in the detail specification.

4.7.8 PROCEDURE VIII.- This procedure constitutes a vibration endurance test to detect mechanical and functional weaknesses of alternators or generators which are mounted directly on aircraft engines. Vibration pickups shall be mounted at the following stations: On the base of the alternator or generator, at a point approximately 10 inches from the base of the alternator or generator, and at a point on the opposite side of the engine. Two pickups shall be located at each station with their sensitive axes mutually perpendicular and normal to the armature axes of the generator or alternator. The alternator or generator shall be mounted on apparatus which will accommodate an engine accessory section and which will produce circular vibration at the mounting pad of the generator or alternator through the frequency range of 90 to 200 cycles per second with a vibratory acceleration up to ±15g. In addition, appropriate means shall be provided to vibrate the accessory section with conical motion which simulates engine "whirling modes." The mode or apex of the conical motion shall be approximately 18 inches forward from the mounting surface of the accessory section. Resonance of the installed generator or alternator shall be so adjusted that the flexural double amplitude of the generator or alternator at the station 10 inches from the base shall be 0.030 inch with respect to an imaginary rigid body motion at the same point determined by the pickups at the other two stations. A vibration endurance test shall be conducted maintaining this condition for 24 hours. During the vibration endurance test, functional tests shall be conducted according to the requirements of the detail specification. There shall be no mechanical failure due to vibration.

4.7.9 PROCEDURE IX.- This procedure shall be used to determine the efficiency of vibration isolation systems when vibrated at room temperature (approximately 25°C (77°F). At ambient temperature, the equipment mounted on vibration isolators shall be vibrated in each of three mutually perpendicular directions over a frequency range of 5 to 55 cycles per second at an amplitude of 0.018 inch (0.036 inch total excursion). The amplitude of the mounted unit shall be measured at the point of maximum amplitude in each direction while the frequency is changed in one-cycle increments until resonance has occurred, and five-cycle increments thereafter. The resonant points shall be 15 cycles per second or less, and efficiency of the isolator system shall be at least 65 percent above 26 cycles per second.

4.7.10 PROCEDURE X.- This procedure constitutes a vibration failure test to detect faulty constructional details in items of electrical equipment and shall be used as a production sampling test only.

4.7.10.1 DURABILITY.- The equipment shall be subjected to harmonic or circular motion applied to the mounting base. The amplitude shall be 0.015 inch (maximum total excursion of 0.03 inch). The frequency of the vibration shall be established by cyclic operation from approximately 10 cps to 55 cps and back to 10 cps. The duration of one such cyclic operation shall be between 1 and 5 minutes. The equipment shall be vibrated continuously for 2 hours in the direction of each of the three major axes. At the end of the test period, the specimen shall be inspected thoroughly for damage or other defects resulting from the Vibration test.

4.7.10.2 PERFORMANCE.- The equipment shall be subjected to simple harmonic or circular motion applied to the mounting base. The amplitude shall be 0.015 inch (maximum total excursion of 0.03 inch), up to 60 cps; above 60 cps the acceleration shall be limited to 10g. The equipment shall be vibrated over the frequency range of 20 to 200 cycles per second along each of its major axes. The equipment(s) shall show no signs of instability or harmful arcing.

4.7.11 PROCEDURE XI.- This procedure applies to vibration-isolated equipment (including electronic) which is to be transported frequently without the benefit of isolators and for which a minimum structural resistance to vibration is necessary.

4.7.11.1 EQUIPMENT NORMALLY MOUNTED.- Mount the equipment on the vibration table. The mounting should simulate service installation including all vibration mounts and other holding devices if any. Then follow the procedures listed below:

Step 1.- With the equipment operating, vibrate it in a horizontal direction with the frequency varying between 10 and 55 cps at an amplitude of 0.03 inch (0.06 inch total excursion). The frequency shall change uniformly from 10 to 55 cycles and return to 10 cycles in from 1 to 3 minutes. This test shall continue for at least 90 minutes and during this time the frequency of any and all resonant points (natural periods) shall be noted.

Step 2.- Vibrate the equipment for 15 minutes at each of the resonant frequencies noted in Step 1 at 0.06 inch total excursion.

Step 3.- Repeat steps 1 and 2 changing the direction of vibration 90 degrees horizontally.

Step 4.- Repeat steps 1 and 2 changing the direction of vibration to vertical.

Step 5.- Remove the equipment from the table and visually inspect for any mechanical failures.

4.7.11.2 EQUIPMENT WITH VIBRATION ISOLATORS REMOVED.- Mount the equipment directly to the vibration table with vibration isolators removed but including any other required holding device. Then follow the procedures listed below:

Step 1.- With the equipment non-operating, vibrate it in a horizontal direction with the frequency varying between 5 and 500 cps. The total amplitude shall be 0.01 inch or an applied vibratory acceleration of ±2g, whichever is the limiting value. The frequency cycle may be continuous from 5 to 500 or may be in steps. However, the rate of change shall be such that a complete cycle will consume approximately 30 minutes. The test shall continue for at least 2 hours and, during this time, the frequency of any and all resonant points (natural points) shall be noted.

Step 2.- Vibrate the equipment for 10 minutes at each of the resonant frequencies noted in step 1.

Step 3.- Repeat steps 1 and 2 changing the direction of vibration 90 degrees horizontally.

Step 4.- Repeat steps 1 and 2 changing the direction of vibration to vertical.

Step 5.- Remove the equipment and visually inspect for any mechanical failures. The equipment shall be required to operate satisfactorily at the conclusion of this test.

4.8 FUNGUS RESISTANCE TESTS.-

4.8.1 PROCEDURE I. Five groups of fungi are listed below, and one species of fungus from each group shall be used. In the preparation of the spore suspension, distilled water having a pH value between 5.8 and 7.2 at temperatures between 72°F and 89°F shall be utilized. Approximately 10 ml of distilled water shall then be introduced directly into a tube culture of the fungus and the spores brought into suspension by vigorous shaking or by gentle rubbing of the spore layer with an inoculating loop without disturbing the agar surface. This process is repeated for each species of fungus. The separate spore suspensions from the five species of fungi shall be mixed together to provide a composite suspension. Actively sporulating cultures between 7 to 21 days old after initial inoculation shall be used for the preparation of the spore suspension. After preparation the spore suspension will not be kept for more than a 24-hour period at temperatures between 72°F and 89°F and not more than 48 hours at refrigerator temperatures of 35°F to 45°F. The equipment, including applicable external connections, shall be placed in a chamber maintaining an internal temperature of 30° ±2°C (86° ±3.6°F) and a relative humidity of 95 ±5 percent, and sprayed with the suspension of mixed spores. The test period shall be 28 days. At the end of the test period, the test item shall be examined visually in accordance with 3.7.

4.8.1.1 ORGANISMS.-

Group I Chaetomium globosum USDA 1042.4 or Myrothecium verrucaria USDA 1334.2

Group II Rhizopus nigricans S.N. 32 or Aspergillus niger USDA Tc215-4247

Group III Aspergillus flavus WADC No. 26 or Aspergillus terreus PQMD 82J

Group IV Penicillium luteum USDA 1336.1, Penicillium sp. USDA 1336.2 or Penicillium citrinum ATCC 9849

Group V Memnoniella echinata WADC No. 37 or Fusarium moniliforme USDA 1004.1

4.8.1.2 STOCK CULTURE DESIGNATION AND SOURCE.-

Symbols	Source
ATCC	American Type Culture Collection 2029 M Street, N. W. Washington 6, D. C.
PQMD	Philadelphia Q. M. Depot 2800 South 20 Street Philadelphia, Pennsylvania
WADC	Wright Air Development Center Materials Laboratory Wright-Patterson Air Force Base, Ohio

4.9 SUNSHINE TEST.-

4.9.1 PROCEDURE I.- The equipment shall be mounted within the test chamber in the manner prescribed by the detail specification and subjected to radiant energy at the rate of 100 to 120 watts per square foot. Of the total energy 50 to 60 percent shall be in wave lengths above 7,800 angstrom units and 4 to 6 percent in wave lengths below 3,800 angstrom units. The test chamber temperature shall be maintained at 45°C (113°F) during the course of the test. Upon completion of the test period specified by the detail specification, the equipment shall be examined in accordance with 3.7.

4.10 RAIN TESTS.-

4.10.1 PROCEDURE I.- The equipment shall be mounted in the test chamber to simulate installation conditions. The rain test chamber temperature shall be maintained between 20° to 30°C (68° to 86°F) throughout the test period. A simulated rainfall of 4 ±1 inch per hour shall be produced by means of a water spray nozzle of such design that the water is emitted in the form of small droplets rather than a fine mist. The temperature of the water shall be maintained between 11° to 20°C (51.8° to 68°F). The rainfall shall be dispersed uniformly over the test area within the limits as specified above. Duration of the test shall be 2 hours at the completion of which the equipment shall be examined for evidence of water penetration or damage.

4.11 SAND AND DUST TESTS.-

4.11.1 PROCEDURE I.- The equipment shall be placed within the test chamber and the sand and dust density raised and maintained at 0.1 to 0.5 grams per cubic foot within the test space. The relative humidity shall not exceed 30 percent at any time during the test. Sand and dust used in the test shall be of angular structure and shall have characteristics as follows:

a. 100 percent of the sand and dust shall pass through a 100-mesh screen, U S Standard Sieve Series.

b. 98 ±2 percent of the sand and dust shall pass through a 140-mesh screen, U S Standard Sieve Series.

c. 90 ±2 percent of the sand and dust shall pass through a 200-mesh screen U S Standard Sieve Series.

d. 75 ±2 percent of the sand and dust shall pass through a 325-mesh screen, U S Standard Sieve Series.

e. Chemical analysis of the dust shall be as follows:

Substance	Percent by Weight
SiO_2	97 to 99
Fe_2O_3	0 to 2
Al_2O_3	0 to 1
TiO_2	0 to 2
MgO	0 to 1
Ign Losses	0 to 2

The internal temperature of the test chamber shall be maintained at 25°C (77°F) for a period of 6 hours with sand and dust velocity through the test chamber between 100 to 500 feet per minute (2,300 ±500 feet per minute if specified by the detail specification). After 6 hours at above conditions, the temperature shall be raised to and maintained at 71°C (160°F). These conditions shall be maintained for 6 hours. At the end of this test period, the equipment shall be removed and allowed to cool to room temperature and shall be operated and the results compared to those obtained in 3.6 and examined in accordance with 3.7.

4.11.2 PROCEDURE II.- This test shall be the same as Procedure I except that the test at 25°C shall be of 8 hours duration, and the test at 71°C shall be deleted.

4.12 IMMERSION TESTS.-

4.12.1 PROCEDURE I.- The equipment shall be immersed in a suitable liquid, such as water. The absolute pressure of the air above the liquid shall then be reduced to approximately 1 inch of mercury and maintained for 1 minute, or until air bubbles substantially cease to be given off by the liquid, whichever is the longer. The absolute pressure shall then be increased to 2-1/2 inches of mercury. Any bubbles coming from within the equipment case shall be considered as leakage. Bubbles which are the result of entrapped air on the various exterior parts of the case shall not be considered as a leak. A helium leak detector or other means of test, equal or superior in sensitivity to the immersion test method described above, may be used upon approval by the procuring activity.

4.13 EXPLOSION-PROOF (AERONAUTICAL) TESTS.-

4.13.1 PROCEDURE I.-

4.13.1.1 APPARATUS.- An explosion chamber equal to the chamber specified in Specification MIL-C-9435 shall be utilized for conducting explosion proof tests.

4.13.1.2 OPERATING CONDITIONS.-

a. The following test shall be used to determine the explosion producing characteristics of items of equipment not equipped with cases designed to prevent flame or explosion propagation. The equipment shall be operated to determine that it is functioning properly and to observe the location of any sparking which shall be considered as potential explosion hazards.

b. The entire equipment, assemblies, or components thereof shall be installed in the chamber in such a manner that normal electrical operation is possible and mechanical controls may be operated through the pressure seals from the exterior of the chamber. Large equipment may be tested one or more units at a time by extending electrical connections through the cable port to the balance of the equipment located externally.

c. Mechanical loads on drive assemblies and servomechanical and electrical loads on switches and relays may be simulated when necessary if proper precaution is given to duplicating the normal load in respect to torque, voltage, current, inductive reactance, etc. In all cases it shall be considered preferable to operate the equipment as it normally functions in the system.

d. The ambient temperature within the chamber during the test shall be maintained between 52°C and 71°C (125°F and 160°F), at the highest temperature which the equipment will tolerate. The temperature of the test item and the chamber walls shall be permitted to rise to within 11°C (20°F) of that of the chamber ambient air prior to introduction of the explosive mixture.

e. A single test shall be conducted as follows:

(1) The chamber shall be sealed and the internal pressure reduced to approximately 10,000 feet above the desired altitude, to compensate for leakage or reduction in pressure when fuel is introduced to insure entrance of explosive vapors into the test item. The predetermined quantity of fuel shall be introduced into the chamber. The amount of fuel used shall depend upon the size of the chamber, test altitude, and atmospheric conditions existing at the time of the test. The explosive mixture shall be in the "lean" sector of the explosive range and shall be capable of producing an instantaneous explosion when ignited by the chamber spark plug. If necessary, an additional quantity of air shall be bled into the chamber until the desired test pressure is obtained. Fuel used shall conform to Specification MIL-F-5572 grade 100/130.

(2) All making and breaking electrical contacts shall be operated at least 10 times while the equipment is operating in accordance with the requirements of the detail specification.

(3). If an explosion did not occur as a result of the operation of the equipment under test, the explosive mixture shall be ignited by the chamber spark plug, or its explosive characteristics determined by sampling methods acceptable to the procuring activity.

(4) If no explosion occurred as a result of equipment operation, the above described procedure shall be repeated utilizing explosive mixtures in the "intermediate" and "rich" sectors respectively of the explosive range.

f. A test shall be conducted using the test procedure of paragraph 4.13.1.2 e. at pressures simulating altitudes from sea level to 5,000 feet, 10,000, 20,000, 30,000, and 40,000 feet.

4.13.2 PROCEDURE II.- This procedure constitutes a method for determining the flame and explosion-arresting characteristics of cases designed for that purpose. Testing shall be accomplished without consideration of the operating characteristics of the equipment contained within the case. The equipment shall remain in position within the case but need not be operated during the test procedure. The following provisions for testing cases shall be accomplished (the test chamber shall be the same as that outlined for Procedure I):

a. Adequate circulation of explosive mixture through the case shall be provided by optional means. If it is necessary to drill the case for insertion of a hose from a blower, adequate precaution must be taken to prevent ignition of the ambient mixture by backfire or release of pressure through the supply hose.

b. A positive means of igniting the explosive mixture within the case shall be provided. The case may be drilled and tapped for the spark plug or the spark plug may be mounted internally.

c. The case shall be installed in the chamber and an explosive mixture obtained within both the case and chamber as outlined in 4.13.1.2 e.(1). Adequate time shall be allowed to insure complete circulation of explosive mixture through the case.

d. The spark plug shall be energized causing an explosion within the case. If ignition of the mixture within the case does not take place immediately, the test shall be considered void and repeated with a new explosive charge.

e. At least five explosions shall be accomplished simulating a sea level altitude of from 0 to 5,000 feet. If the case being tested is small (not exceeding one-fiftieth the volume of the chamber) and if the reaction within the case upon ignition is of an explosive nature without continued burning of the mixture as it circulates into the case, more than one test, but not more than five tests, may be conducted without recharging the entire chamber. Adequate time between tests must be allowed for replacement of burnt gases within the case with ambient explosive mixture. If there is any doubt concerning the explosive characteristics of the charge, the chamber spark plug shall be energized. The criteria of 4.13.1.2 e.(3) shall be used to determine if the previous tests should be repeated. A new charge shall be used for ensuing tests.

f. The occurrence of an internal case explosion may be detected by utilization of a thermocouple inserted in the case and connected to a sensitive galvanometer located outside the chamber.

4.14 TEMPERATURE-ALTITUDE TEST.-

4.14.1 PROCEDURE I.- The equipment shall be placed in the test chamber in a manner similar to that in which it would be used in service, and such electrical and mechanical connections and instrumentation as may be necessary shall be completed. The Temperature-Altitude Condition Schedule of figure 2 shall be followed in the manner outlined in the following steps. The rates of temperature and pressure change shall be as high as chamber construction permits, except that the rates need not exceed those specified in 3.1.1.1 and 3.1.3, respectively. Also, the change from room temperature to -62°C (-80°F) shall not require more than 4 hours.

Step 1.- The internal temperature of the test chamber shall be reduced to -62°C (-80°F) and the equipment stabilized and maintained for at least 1 hour at this temperature. The pressure within the chamber during this period shall be atmospheric. The equipment shall be nonoperative. Where it is possible without changing the temperature condition, a visual inspection of the equipment shall be made to

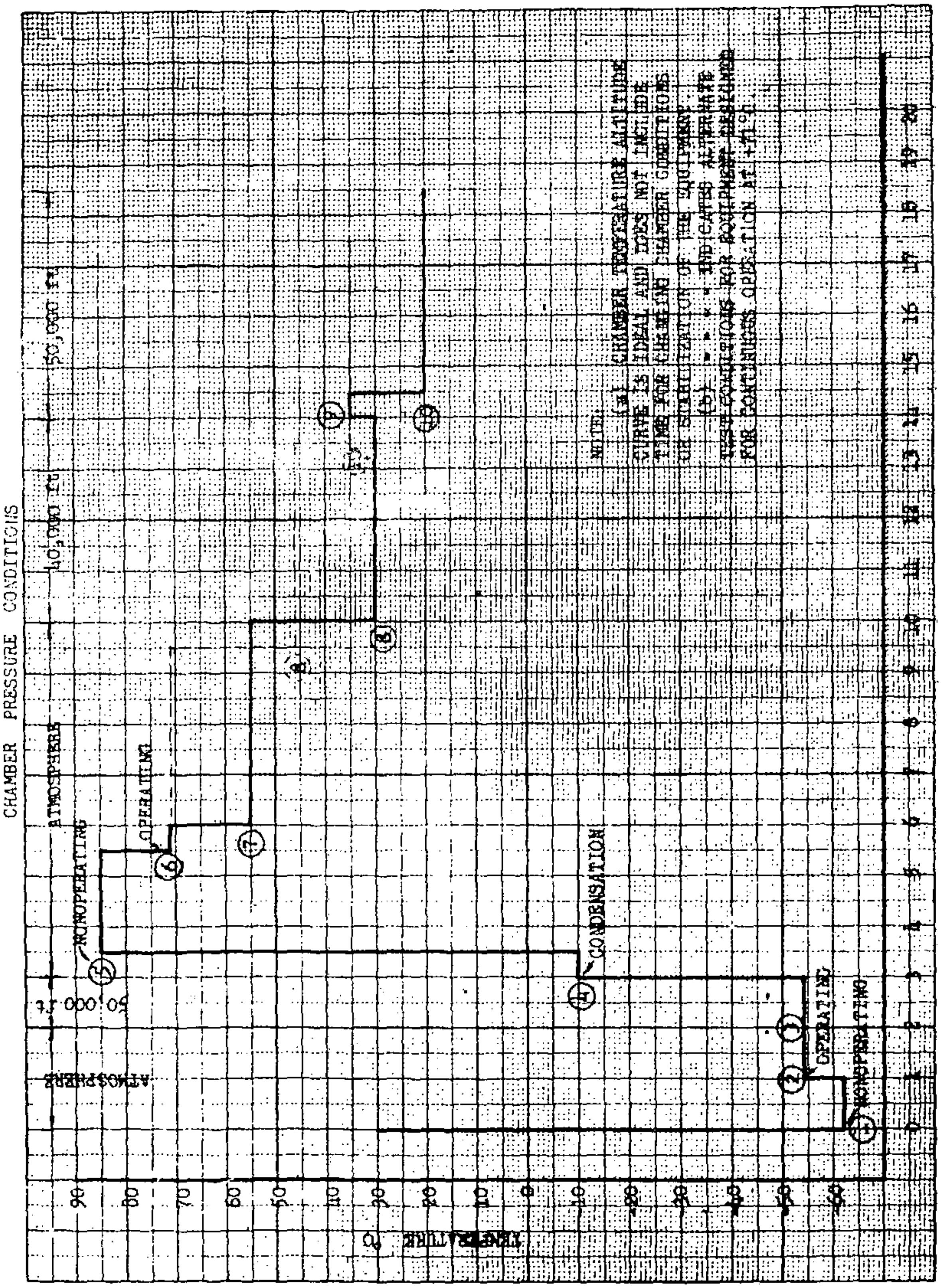

FIGURE 2. Temperature - Altitude Versus Time Curve

determine whether or not deterioration that would impair future operation has occurred (see 3.7).

Step 2.- The internal temperature of the test chamber shall then be raised to -54°C (-65°F) and maintained until the equipment has stabilized at -54°C. The pressure within chamber shall be atmospheric. The equipment shall then be operated and the results compared with those obtained under prevailing room conditions (see 3.6).

Step 3.- The equipment shall be turned off and the internal atmospheric pressure of the chamber reduced to 50,000 feet. The chamber temperature shall be maintained at -54°C. Upon reaching the specified altitude the equipment shall be turned on and operated, and the results compared with those obtained under prevailing room conditions (see 3.6).

NOTE: Step 3 shall be performed only if specified by the detail equipment specification.

Step 4.- The equipment shall then be turned off and the internal temperature of the chamber raised to -10°C (+14°F) and maintained until the equipment stabilizes at this temperature. The internal pressure of the chamber shall be adjusted to atmospheric pressure if step 3 has been performed, or held at atmospheric if not. The test chamber door shall then be opened to allow frost to form on the equipment. The door shall remain open until the frost has melted but not long enough to allow the moisture to evaporate. The door shall then be closed and the equipment operated and the results again compared with those obtained under prevailing room conditions (see 3.6)

Step 5.- With the equipment nonoperating, the chamber temperature shall be raised to +85°C (185°F). The chamber pressure shall be atmospheric. The equipment shall be stabilized at this temperature, and maintained in the stabilized condition for 2 hours. At the conclusion of the 2-hour period, the equipment may be visually inspected to determine the extent of deterioration, if any, which has taken place (see 3.7).

Step 6.- The chamber temperature shall then be reduced to +71°C (160°F) with the pressure remaining atmospheric. The equipment shall be stabilized at this temperature and then operated for a period of 30 minutes. During this period the equipment shall be checked for satisfactory operation (see 3.6).

Step 7.- The chamber temperature shall then be reduced to +55°C (130°F). The pressure within the chamber shall be atmospheric. The equipment shall be stabilized at this temperature. The equipment shall be operated for a minimum of 4 hours. The equipment shall be turned on and off at least three times during this period and the results of each cycle of operation shall be compared with those obtained under prevailing room conditions (see 3.6).

Step 8.- The internal temperature of the chamber shall then be reduced to +30°C (86°F) and the pressure to that of 40,000 feet altitude. When the chamber conditions have stabilized, the equipment shall be operated for a minimum of 4 hours. The equipment shall be turned on and off at least three times during this period and the results of each cycle of operation compared with those obtained under prevailing room conditions (see 3.6).

Step 9.- The internal conditions of the test chamber shall then be changed to +35°C (95°F) and 50,000 feet altitude. When the internal conditions of the chamber have stabilized, the equipment shall be turned on and operated for a period of 30 minutes. Operational results shall be compared to those obtained under prevailing room conditions (see 3.6).

Step 10.- The internal pressure of the chamber shall be maintained at 50,000 feet; however, the temperature shall be reduced to +20°C (68°F). When the internal conditions of the test chamber have stabilized at these conditions, the equipment shall be operated for a minimum of 4 hours. The equipment shall be turned on and off at least three times during this period and results of each cycle of operation compared to those obtained under prevailing room conditions (see 3.6).

NOTE: If the equipment is designed for continuous operation at 71°C, then steps 6 and 9 should be deleted and the following modifications made in steps 7, 8, and 10:

Step 7	Change +55°C to +71°C
Step 8	Change +30°C to +46°C
Step 10	Change +20°C to +35°C.

4.15 SHOCK TESTS.-

4.15.1 PROCEDURE I.- The shock testing machine, designed and fabricated according to Specification JAN-S-44, shall be set up to produce the magnitude and duration of shock specified in the detail specification. Figure 3 shall be used to determine the drop height and carriage weight for the specified conditions of shock. The number of shocks and position of the test specimen shall be as specified in the detail specification. Functional tests shall be conducted during shock applications according to the requirements of

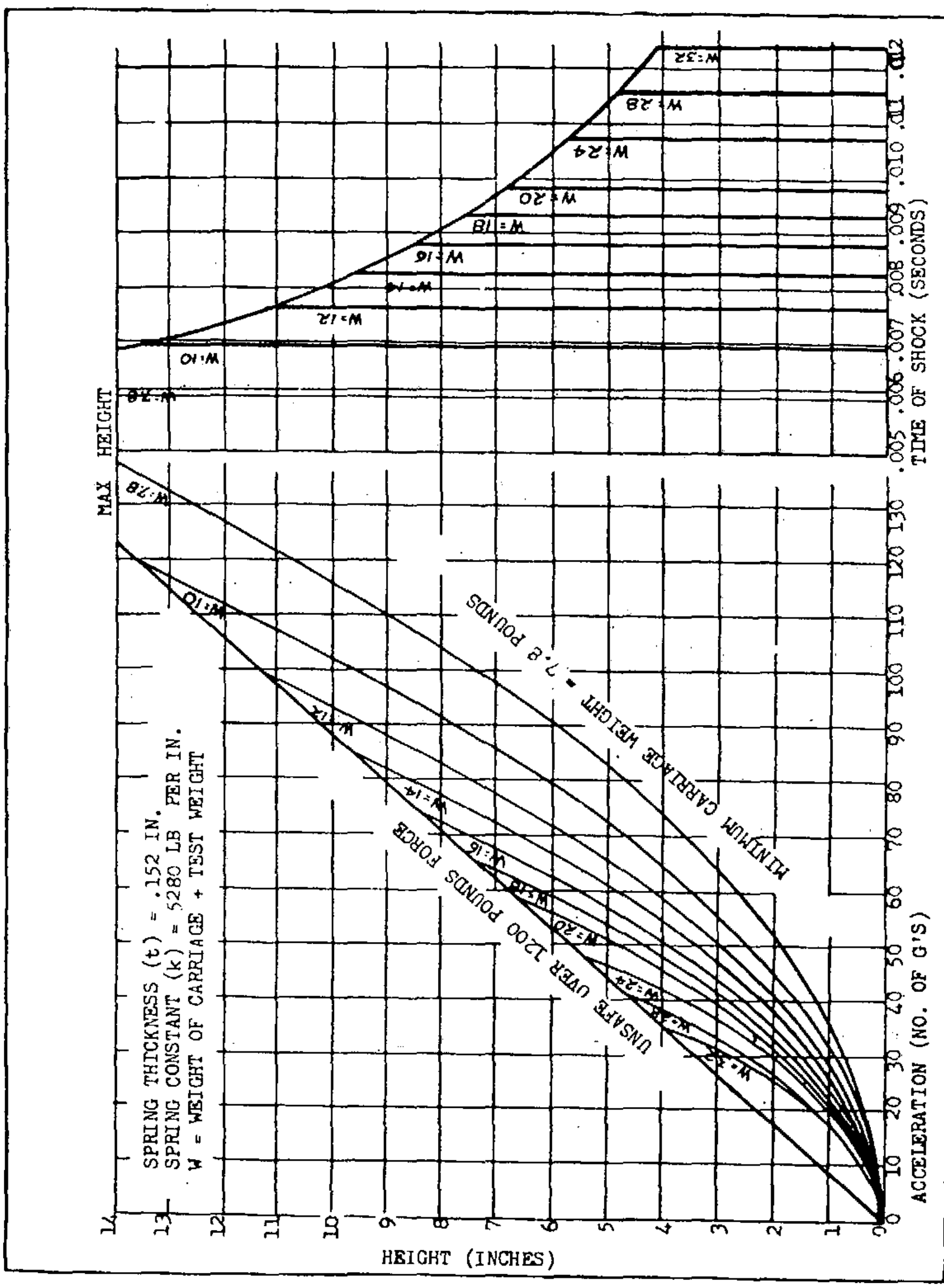

FIGURE 3

Range and Performance of
JAN-S-44 Shock Testing Machine

the detail specification. There shall be no mechanical failures due to the applied shocks.

4.15.2 PROCEDURE II.- This procedure shall be used to determine the equipment operating characteristics as well as its structural integrity under conditions of shock. The equipment shall be subjected to the shock conditions as normally used in service, including any shock mount assembly. The shock testing machine, designed and fabricated according to Specification MIL-S-4456, shall be used.

4.15.2.1 EQUIPMENT OPERATION.- The test specimen shall be subjected to 18 impact shocks of 15g, each shock impulse having a time duration of 11 ±1 milliseconds. The intensity shall be within ±10 percent when measured with a filter having a band width of 5 to 100 cycles per second. The maximum g shall be reached in approximately 5-1/2 milliseconds. The shock shall be applied in the following directions:

a. Vertically, 3 shocks in each direction.

b. Parallel to the major horizontal axis, 3 shocks in each direction.

c. Parallel to the minor horizontal axis, 3 shocks in each direction.

The test specimen shall not suffer damage or subsequently fail to provide the performance specified by the detail specification.

4.15.2.2 EQUIPMENT CRASH-SAFETY.- The structural integrity of the mounting base and isolators shall then be determined with either the equipment or dummy load in place, as specified by the detail specification. If mounting bases and isolators are not normally used in service, then the equipment attached by its normal points of attachment shall be tested. The test specimen shall be subjected to the procedure as described above, except that the intensity of shock shall be 30g in lieu of 15g and the number of shocks in each direction will be two. Bending and distortion shall be permitted. There shall be no failure of the attachment joints, and the equipment or dummy load shall remain in place.

4.15.3 PROCEDURE III.- A high impact, shock testing machine designed and fabricated according to Specification MIL-S-901 shall be set up to produce the magnitude and duration of shock specified in the detail specification. The number of shocks and position of the test specimen shall be as specified in the detail specification. Functional tests shall be conducted during shock applications according to the requirements of the detail specification. There shall be no mechanical failures due to the applied shocks.

4.16 ACCELERATION TESTS.-

4.16.1 PROCEDURE I.- The test specimen shall be mounted on the apparatus (centrifuge) in a position specified by the detail specification. The centrifuge shall be brought up to the rotational speed required to produce the radial acceleration specified in the detail specification and this acceleration shall be stabilized and maintained for a period of not less than 1 minute. The specimen shall then be rotated 90 degrees about a vertical axis while the radial acceleration is maintained. The test specimen in this new position shall be subjected to the same acceleration for a period of not less than 1 minute. Functional tests shall be conducted in accordance with requirements of the detail specification during application of the acceleration. There shall be no mechanical failures or malfunctions due to the applied acceleration.

4.16.2 PROCEDURE II.- The test specimen shall be mounted on the apparatus (centrifuge) successively in three positions so that each of the three major axes of the test specimen in turn extend in a radial direction with respect to the centrifuge center of rotation. The applied acceleration as specified by the detail specification, shall be attained, stabilized, and maintained for a period of not less than 1 minute for each position. Functional tests shall be conducted in accordance with the requirements of the detail specification during application of the acceleration. There shall be no mechanical failures or malfunctions due to the applied acceleration.

5. NOTES

5.1 INTENDED USE.- This specification is intended to prescribe procedures to be followed in subjecting equipment to simulated and accelerated environmental conditions in order to insure satisfactory operation and to reduce deterioration when the equipment is operated or stored in any global locality.

5.2 DEFINITIONS.-

5.2.1 EXPLOSION-PROOF AERONAUTICAL EQUIPMENT.- Explosion-proof aeronautical equipment is that which when operated at any design load will not ignite an explosive mixture in the equipment or, if an explosion does occur within the equipment, this explosion will not cause any explosion or fire outside of the equipment.

5.2.2 HERMETICALLY SEALED.- A hermetically sealed enclosure is one, the walls of which are glass, glazed ceramic, or metal, and the closure of which is a fused joint of the appropriate material which so seals the enclosure that it shall not breathe under any combination of environmental conditions.

5.2.3 TEMPERATURE STABILIZATION.- Temperature stabilization has been reached when the temperature of the largest internal mass centrally located of the equipment does not vary more than 1°C from the ambient temperature.

5.3 GENERAL APPLICATION.-

5.3.1 Prior to referencing test procedures in the detailed equipment specification, the listed climatic and environmental conditions of 3.1 should be carefully reviewed. It is intended that only those conditions that reflect actual service usage and that could adversely affect the item should be considered. When this review has been completed, suitable test procedures to reflect these conditions should be selected and referenced in the detail specification.

5.3.2 The sequence or combination in which the various climatic and environmental tests are performed is of considerable importance and should be carefully considered if maximum evaluation of equipment is to be realized. For example, the fungus test should precede the salt spray test to prevent salt deposits from reducing possible fungus growth.

5.3.3 HIGH TEMPERATURE.- Equipment, in general, must be capable of performing satisfactorily in an ambient temperature of 71°C (160°F). Modification of this requirement may be necessary for certain types of equipment, which, due to location or function, require higher operating temperatures, or certain equipments which may require operation at temperatures below 71°C.

5.3.4 TEMPERATURE STABILIZATION.- Temperature stabilization of equipment may be checked by a thermal measuring device in good thermal contact with the largest internal mass centrally located.

5.3.5 SAND AND DUST.- The sand and dust as outlined for use in Procedures I and II is commercially known as "140-mesh silica flour." Sand and Dust (140-mesh silica flour) produced by the Fenton Foundry Supply Company, Dayton, Ohio, and Ottawa Silica Company, Ottawa, Illinois, or equal, is satisfactory for use in the performance of these tests.

5.3.6 EXPLOSION-PROOF AERONAUTICAL EQUIPMENT.- Under this specification, hermetically sealed or pressurized equipment, connecting wire, and cables shall be considered explosion-proof and require no test.

5.3.6.1 When necessary, large items of electrical equipment, such as motors, large relays, etc, shall be prepared for explosion-proof testing by drilling and tapping openings in the case for inlet and outlet connections to the fuel-vapor-air mixture circulating system and for mounting a spark plug. This spark plug is used only for igniting the vapor-air mixture in the equipment to insure the presence of an explosive mixture inside the equipment on test. Small items of equipment such as switches, circuit breakers, etc, shall not be drilled and tapped for mounting a spark plug when it is not practicable.

5.3.6.2 When performing the explosion-proof test, dust or other auxiliary covers may be removed or loosened to facilitate penetration of the explosive mixture.

5.3.6.3 The equipment to vaporize the gasoline fuel when performing the explosion-proof test should be so designed that a small quantity of air and gasoline vapor will be heated together to a temperature such that the gasoline vapor will not condense as it is drawn from the vaporizer into the chamber.