MILITARY SPECIFICATION

VALVES, PRESSURE, ANTI-G SUIT, MXU-804/A and MXU-805/A

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

1. SCOPE

1.1 Scope. This specification covers two types of high-flow, pressure regulating valves for inflating anti-G suits. These valves differ in dimensional configuration only and are designated MXU-804/A and MXU-805/A.

1.2 Part number. The part numbering system shall be as follows: Valves designated MXU-804/A (for use in the F-15 aircraft) shall be identified as M87223-1 and valves designated MXU-805/A (for use in the F-16 and A-10 aircraft) shall be identified as M87223-2 (see 3.9).

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

BB-N-411	Nitrogen, Technical
PPP-B-636	Boxes, Shipping, Fiberboard

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASD/ENES, Wright-Patterson AFB OH 45433-6503, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 1660

MILITARY

MIL-P-116	Preservation, Methods Of
MIL-T-27730	Tape, Antiseize, Polytetrafluoroethylene, With Dispenser

STANDARDS

FEDERAL

FED-STD-209	Clean Room and Work Station Requirements, Controlled Environment

MILITARY

DOD-STD-100	Engineering Drawing Practices
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-889	Dissimilar Metals
MIL-STD-2073-1	DoD Materiel Procedures for Development and Application of Packaging Requirements
MS33656	Fitting End, Standard Dimensions for Flared Tube Connections and Gasket Seal
MS33658	Fitting End, Hose Connection, Standard Dimensions For

(Copies of specifications and standards required by contractors in connection with specific acquisition functions shall be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.4 and 6.2).

3.2 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.3 Materials (see 6.3). Materials shall conform to applicable specifications and standards as specified herein and on applicable drawings. Materials which are not covered by specifications and standards, or specifically described herein, shall be reported to the contracting

activity and will require contracting officer approval prior to use. Materials shall be of the best quality, of the lightest practical weight, and suitable for the purpose intended.

3.3.1 Metal parts. All metal parts shall be of a corrosion-resistant material or treated in a manner to render them adequately resistant to corrosion.

3.3.1.1 Dissimilar metals. Unless protected against electrolytic corrosion, dissimilar metals as defined in MIL-STD-889 shall not be used in intimate contact with each other.

3.3.2 Nonmetallic materials. Any nonmetallic material that is adversely affected by continued use with air shall not be used.

3.3.2.1 Elastomer components. Elastomer components, except silicone, shall be not more than 12 months old from the date of manufacture to the date of delivery to any government service or to any airframe or accessory manufacturer.

3.3.3 Protective treatment. Materials shall be protected from deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification. The valve shall resist corrosion and deterioration due to fuels, salt fog, microorganisms, moisture, hydraulic fluids, lubricating oils, grease, ozone, or atmospheric conditions likely to be encountered in storage or normal service. Protective coatings which might crack, chip, or scale during normal service or storage life or under extremes of environmental conditions shall not be used.

3.4 Standard parts. Military standard parts shall be used when they suit the purpose. Use of non-standard parts requires contracting officer approval prior to use.

3.5 Design and construction. The valve shall be designed to pass air at a regulated pressure to aircrewmember's anti-G suit and shall contain provisions for suit exhaust. The valve shall include inlet and outlet fittings that incorporate swivel features. The fittings shall have a diameter and finish compatible with the aircraft inlet hose and the G-suit delivery hose. The outlet pressure shall be a function of the acceleration force applied to the valve in the $+G_z$ (see 6.4) direction. The design shall enable manual operation (push-to-test) of the valve and shall provide means to simulate acceleration forces. The valve shall be designed to perform as specified in 3.6. Moisture in the air source to the valve shall not adversely affect operation of the valve.

3.5.1 Installation. The valve shall be designed such that it can be properly installed in the applicable aircraft. This includes proper alignment with the mounting brackets and connections with the inlet and outlet hoses. The existing control panels shall also be accommodated. There shall be no interferance with aircraft structure. Minimum requirements for installation are given on figures 1 and 2. Proper installation shall be demonstrated as specified in 4.6.1.1.1. Should there be a conflict between

the installation demonstration specified in this document and figures 1 and 2, the installation demonstration shall take precedence.

3.5.2 Relief valve. The valve design shall include a pressure relief valve that the contractor will calibrate such that when tested on the centrifuge, the outlet pressure shall be within the range specified on figure 3. The valve shall not allow the outlet pressure to exceed 12 psig.

3.5.3 Lubrication. The valve shall be designed and constructed in such a manner that no maintenance lubrication is required.

3.5.4 Inlet screen. The valve shall contain a corrosion-resistant steel, 30 by 30 maximum mesh, 0.010 inch minimum wire diameter inlet screen. All inlet air shall pass through the screen.

3.6 Performance. All specified performance requirements are based on the use of air.

3.6.1 Minimum operating acceleration force. When tested, the minimum acceleration force required to open the valve to permit flow of 0.01 liter per minute shall be between 1.25 and 1.50 G_z (see 4.6.2).

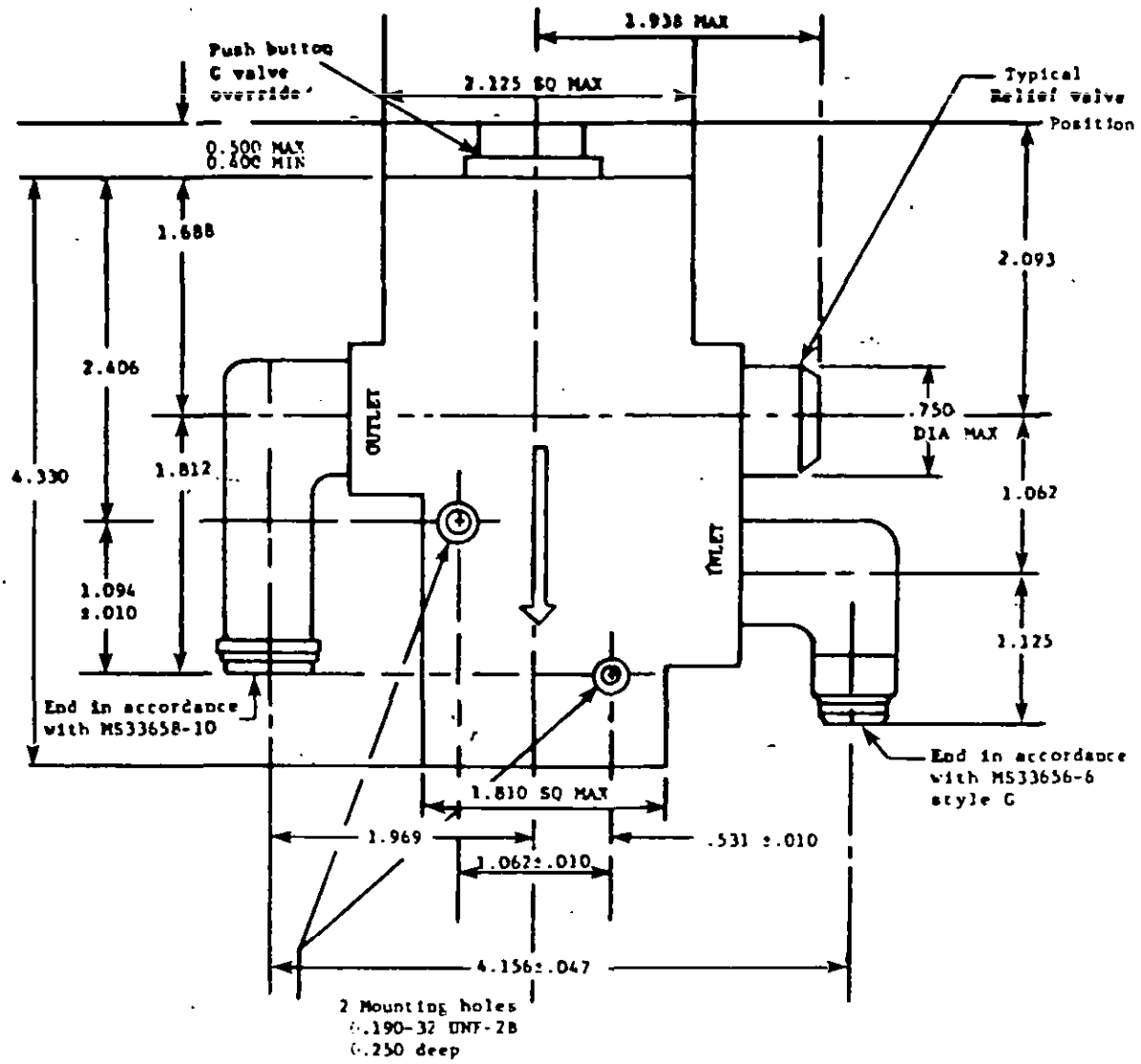
3.6.2 Outlet pressure regulation. The outlet pressure schedule shall be within the range specified on figure 3 for the acceleration force being applied when tested (see 4.6.3). The outlet pressure shall not fluctuate more than ±0.1 psi at any test point.

3.6.3 Leakage. The leakage to the ambient shall not exceed 0.10 liter per minute. There shall be no leakage to the outlet (see 4.6.4).

3.6.4 Anti-chatter. The valve shall not chatter (see 4.6.5 and 6.4.2).

3.6.5 Response time. When the force is being increased, the outlet pressure shall reach the specified range within two seconds after application of the force. When the force is being decreased, the outlet pressure shall reach the specified range within five seconds after decreasing the force. During testing, the tank pressure shall reach the following specified values within the indicated response time (see 4.6.6).

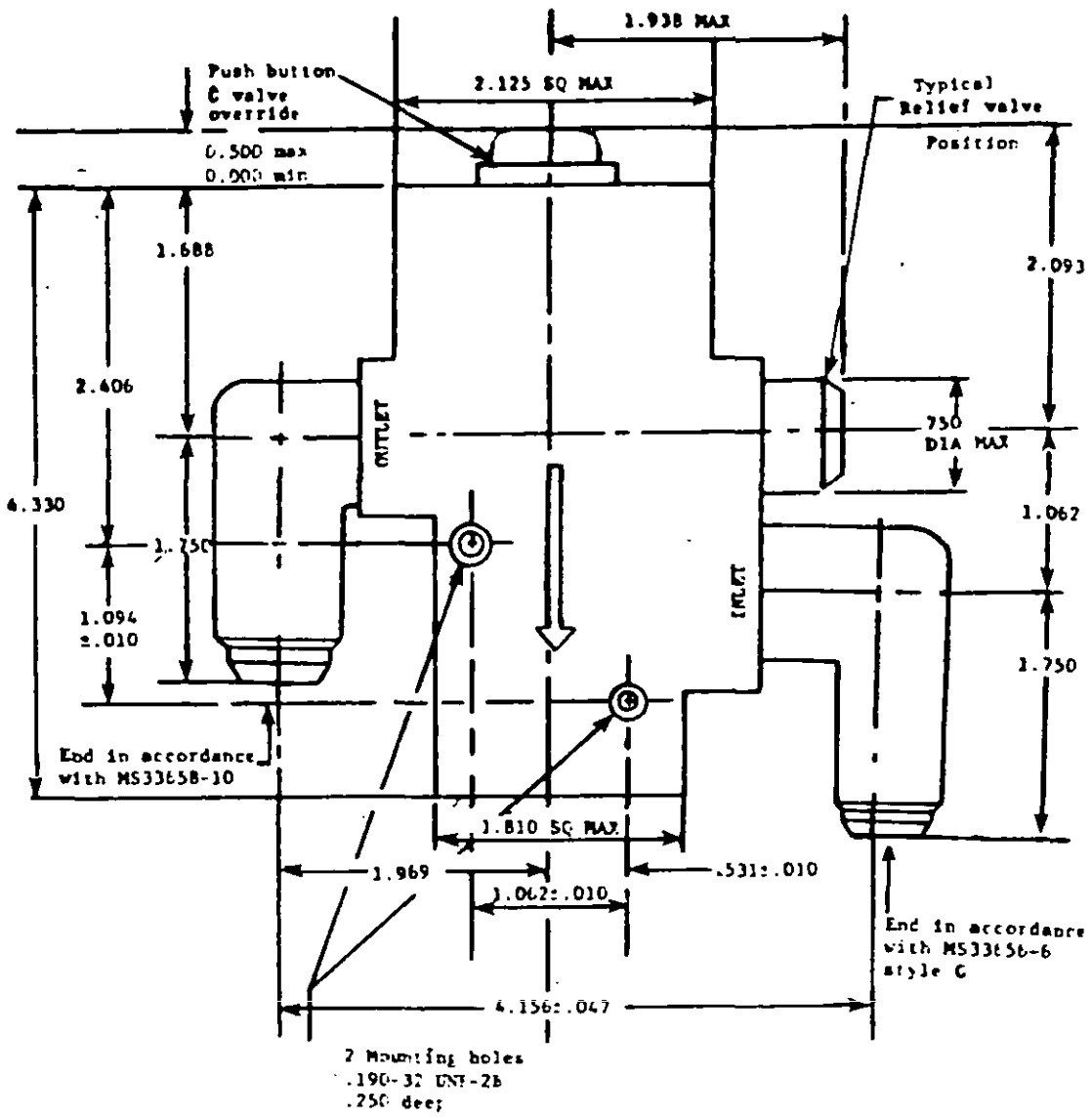
Force applied from	Tank pressure	Response time (maximum)
1 to 10 G_z	As specified on fig 3 for 10 G_z	1.0 sec
10 to 1 G_z	0	2.7 sec
1 to 6 G_z	As specified on fig 3 for 6 G_z	1.6 sec
6 to 1 G_z	0	2.2 sec



NOTES:

1. Dimensions are in inches.
2. Inlet and outlet shoulder, connectors, etc. shall not exceed the 2.125 and 1.810 sq max body dimensions and are located on the centerline of the body.

FIGURE 1. Anti-G suit, high-flow, pressure regulating valve, MXU-804/A, for use in the F-15 aircraft - M87223-1.



NOTES:

1. Dimensions are in inches.
2. Inlet and outlet shoulder, connectors, etc. shall not exceed the 2.125 and 1.810 sq max body dimensions and are located on the centerline of the body.

FIGURE 2. Anti-G suit, high-flow, pressure regulating valve, MXU-805/A. for use in the F-16 and A-10 aircraft - M87223-2.

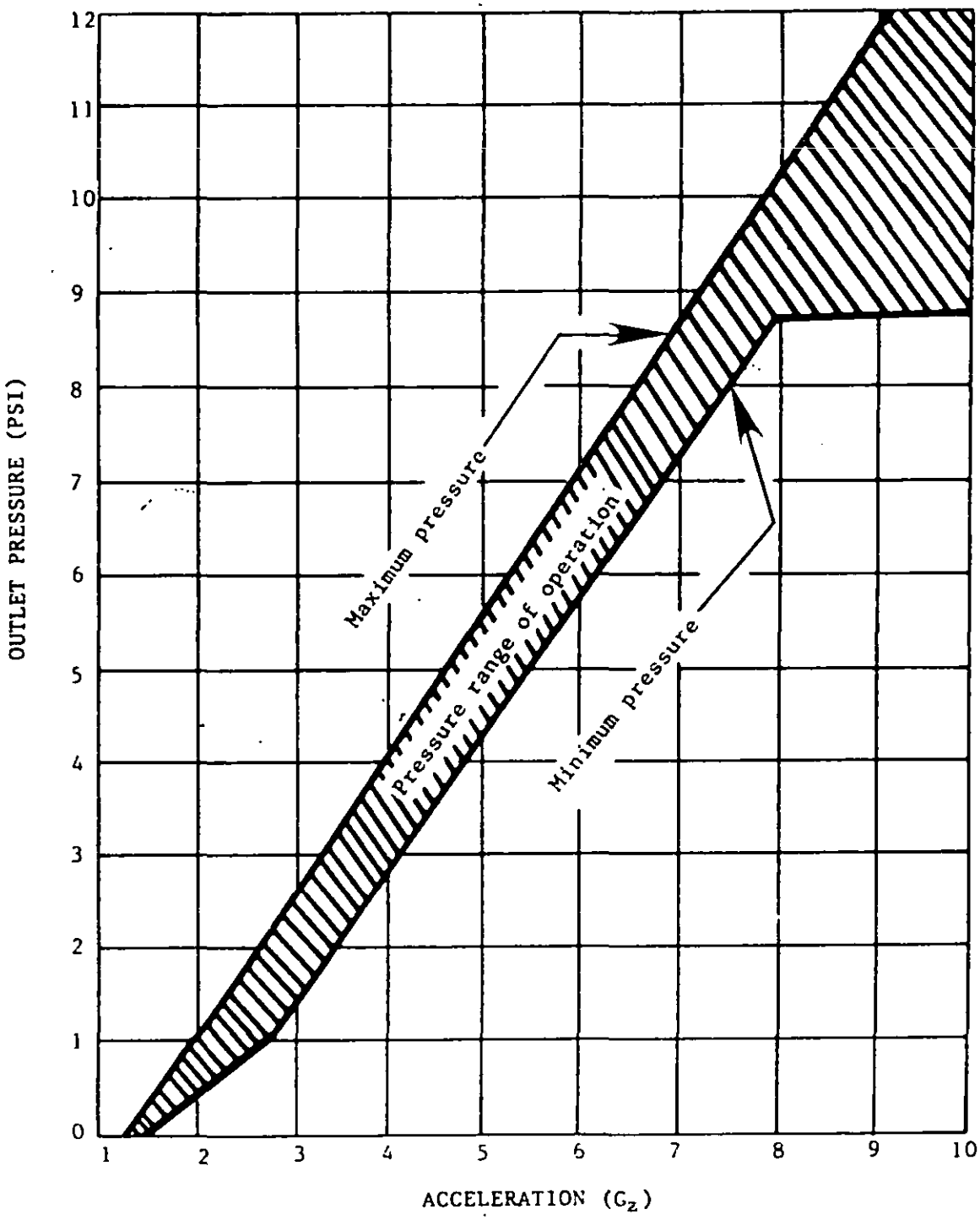


FIGURE 3. Outlet pressure vs acceleration.

3.6.6 High temperature exposure. The valve shall operate satisfactorily after completion of the high temperature test at 400 °F ±5 °F (see 4.6.7).

3.6.7 Low temperature exposure. The valve shall operate satisfactorily after completion of the low temperature test at -65 °F ±5 °F (see 4.6.8).

3.6.8 Vibration. The valve shall operate satisfactorily and shall show no evidence of mechanical or material failure after completion of the vibration tests (see 4.6.9).

3.6.9 Salt fog. The valve shall show no evidence of corrosion or mechanical failure after completion of the salt fog test (see 4.6.10).

3.6.10 Internal corrosion. The valve shall show no sign of internal corrosion after completion of testing (see 4.6.11).

3.6.11 Centrifuge testing. When specified (see 6.2), centrifuge tests will be conducted by the contracting activity with equipment and support as determined by the contracting activity to be provided by the contractor. When tested (see 4.6.12), the valve shall be the same design as that valve which passed all performance tests in 3.6.

3.6.12 Endurance. The valve shall have a mean-cycle-between-failure of 15,030 cycles (see 6.4.3) and shall pass the endurance test (see 4.6.13).

3.6.13 Disassembly and examination. The valve shall not show excessive evidence of deterioration or wear due to testing which might affect the valve performance (see 4.6.14).

3.7 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable with each other with respect to installation and performance. The item identification and part number requirements of DOD-STD-100 shall apply.

3.8 Weight. The total weight of the valve shall not exceed 3 pounds.

3.9 Identification of product. The valve shall be marked for identification in accordance with MIL-STD-130 and shall include at least the following information:

Valve, Pressure, Anti-G Suit, MXU-804/A or MXU-805/A (as applicable)
Manufacturer's Part No.
Manufacturer's Identification
US
M87223-X (see 1.2)
Date of Manufacture: MFD (Month)(Year) 1/

1/ The manufactured date may be stamped on the valve rather than marked on the nameplate and shall be as permanent as the normal life expectancy of the valve.

3.9.1 Ports. All inlet and outlet ports shall be clearly identified by permanent markings.

3.9.2 Push-to-test button. The valve shall have a permanent marking on the push-to-test button to identify them and shall be visible when installed in the applicable aircraft.

3.9.3 Direction of acceleration force. The valve shall be marked with an arrow in accordance with figures 1 or 2, as applicable, denoting the direction the influencing acceleration force is to be applied.

3.10 Workmanship. The valves shall be uniform in quality and shall be free from irregularities, defects, or foreign matter which could adversely affect safety, performance, reliability, or durability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facility suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the document where such inspections are necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

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

a. First article inspection (see 4.4).

b. Quality conformance inspection (see 4.5).

4.3 Test conditions

4.3.1 Environmental conditions. Unless otherwise specified, all tests shall be conducted at local ambient temperature and barometric pressure. Test instruments shall be calibrated or adjusted according to their required usage in conducting individual tests. The temperature and barometric pressure shall be recorded at the time of inspection. This information shall be available for computation of test data, where

required, to normal temperature and pressure (NTP) conditions. NTP conditions are 29.92 inches of mercury and 70 ^{o}F.

4.3.2 Acceleration force. When conducting the tests specified herein, the acceleration force (see 6.4) shall be applied to the valve in the direction specified on figures 1 or 2, as applicable. Weights or any other means may be used to simulate the acceleration force provided the weight of the sensing mass of the valve is controlled and verified by 100 percent inspection. In this case the total G force shall be 1 G_z plus the amount simulated by the test weights. The contracting activity reserves the option to verify the performance of the valve on a centrifuge as specified in 4.6.12.

4.3.3 Test medium. Unless otherwise specified, the test medium used in testing the valves shall be air or nitrogen. The moisture content of the air shall not exceed 0.02 milligram per liter. The nitrogen shall conform to type I, class 1, grade B of BB-N-411. When nitrogen is used as a test medium the appropriate density corrections shall be made in determining that the test requirements are met.

4.3.4 Test equipment

4.3.4.1 Tank. When specified, a tank having a volume of approximately 10 liters shall be used. The tank shall be connected to the outlet port of the valve as specified in 4.3.4.2 and shall provide a connection for the measurement of pressure in the tank.

4.3.4.2 Tank piping. The tank specified in 4.3.4.1 shall be connected to the valve by piping which simulates the resistance characteristics of the anti-G suit hose and applicable aircraft quick disconnect fittings.

4.4 First article inspection. First article inspection shall be as specified by the contracting activity. Table I consists of all the examinations and tests of this specification.

4.4.1 First article samples. The samples shall be of identical construction, workmanship, components, and materials to be used during production. When a contractor is in continuous production of these valves, from contract to contract, first article inspection on the new contract may be waived at the discretion of the contracting activity (see 6.2). Approval of the first article inspection samples or the waiving of the first article inspection does not preclude the requirements for performing the quality conformance inspection.

4.4.1.1 Disposition of sample units. Upom completion of the first article inspection, all the applicable inspection reports, sample valves, and when applicable, recommendations and comments pertinent for use in monitoring production will be forwarded to the cognizant Government activity. One of the approved first article inspection samples of the valves will be returned to the contractor for use in monitoring production. The other valves will be consumed or destroyed in the first article inspection and shall not be considered as part of the quantity to be delivered under the contract or purchase order.

TABLE I. First article inspection.

Inspection	Requirement paragraph	Examination or test method
Visual examination		4.6.1
Minimum operating acceleration force	3.6.1	4.6.2
Outlet pressure regulation	3.6.2	4.6.3
Leakage	3.6.3	4.6.4
Anti-chatter	3.6.4	4.6.5
Response time	3.6.5	4.6.6
High temperature exposure	3.6.6	4.6.7
Low temperature exposure	3.6.7	4.6.8
Vibration	3.6.8	4.6.9
Salt fog 1/	3.6.9	4.6.10
Internal corrosion	3.6.10	4.6.11
Centrifuge testing	3.6.11	4.6.12
Endurance 1/	3.6.12	4.6.13
Disassembly and examination	3.6.13	4.6.14

1/ This test is considered destructive. Valves subjected to this test shall not be considered or shipped as part of the contract or purchase order.

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests specified in table II. The sampling and inspection levels and acceptance criteria shall conform to MIL-STD-105. The lot from which the valve samples were selected shall be rejected if any sample fails to comply with any requirement specified. A rejected lot shall not be resubmitted except with the approval of the contracting officer.

4.5.1 Endurance acceptance criteria. The endurance requirements of 3.6.12 shall be verified by lot sampling tests to be conducted at the contractor's facility in accordance with the criteria specified in 4.6.13. The acceptance criteria for the first sampling test is 30,060 cycles with zero failures. The 30,060 cycles shall be accumulated on two units, 15,030 cycles on each unit, selected from the first 10 units produced under this specification. One unit out of every subsequent production lot of 500 shall be subjected to 15,030 cycles to the criteria stated above with zero failures as the acceptance criteria. Corrective actions for all failures shall be determined and recommended to the procuring activity. In the event of non-compliance (reject decision), or when a pattern failure occurs, the contractor shall immediately notify the procuring activity. Changes of specified performance or required endurance characteristics of the valves are not corrective action.

4.5.2 Sampling

4.5.2.1 Inspection lot

4.5.2.1.1 Valve. An inspection lot size shall be expressed in units of valves, manufactured essentially under the same conditions and from the same materials and components. The sample unit shall be one valve.

4.5.2.1.2 Packaging. An inspection lot size shall be expressed in units of one fully prepared shipping container, containing valves fully prepared for delivery and made from essentially the same materials and components. The sample unit shall be one shipping container, containing valves fully prepared for delivery with the exception that it need not be sealed.

4.5.2.2 Sampling for tests and inspections of valves and packaging. The sample size, acceptance criteria, tests, and inspections required for the valves and for the packaging shall be as specified in table II.

4.6 Inspection methods

4.6.1 Visual examination

4.6.1.1 Valve. Each valve selected as a sample unit from the lot shall be thoroughly examined visually and checked dimensionally for defects to determine conformance to this specification with respect to materials, design, construction, marking, and workmanship. Defects shall be classified in accordance with table III.

4.6.1.1.1 Dimensions and configuration. The valves shall be examined for defects in dimensions and configuration. Any dimensions or configuration not conforming to the requirements of the applicable assembly number of figures 1 or 2, as applicable, shall be classified as a defect. Information shall be submitted that demonstrates compatibility with proper installation in the applicable aircraft.

TABLE II. Quality conformance inspection.

Test or inspection	Test method	Sample size	Classification of characteristics	Acceptance criteria
Visual examination	4.6.1	Every valve for critical defects.	Critical	Reject all valves with any critical defects.
		Inspection level II for minor defects.	Minor	An acceptable quality level of 2.5 defects per hundred units for minor defects.
Dimensions and configuration	4.6.1.1.1	Inspection level S-2	Major	Acceptance number of 0, rejection number of 1.
Minimum operating acceleration force	4.6.2	Every valve	Major	Acceptance number of 0, rejection number of 1.
Outlet pressure regulation	4.6.3	Every valve	Critical	Acceptance number of 0, rejection number of 1.
Leakage	4.6.4	Every valve	Major	Reject all defective units.
Anti-chatter	4.6.5	Inspection level I	Major	Acceptance number of 0, rejection number of 1.
Response time	4.6.6	Every valve	Critical	Reject all defective units.

TABLE II. Quality conformance inspection. - Continued

Test or inspection	Test method	Sample size	Classification of characteristics	Acceptance criteria
Endurance 1/	4.6.13	See 4.5.1	Major	See 4.5.1
Packaging	4.6.1.2	Inspection level S-2	Minor	Total acceptable quality level of 4.0 percent defective.

1/ This test is considered destructive. Valves subjected to this test shall not be considered or shipped as part of the contract or purchase order.

4.6.1.2 Packaging. An examination shall be made to determine that the preservation, packing, and marking comply with the section 5 requirements. Defects shall be scored in accordance with the list below. The sample unit shall be one shipping container fully packaged. The lot size shall be the number of containers in the inspection lot. The inspection level shall be S-2 and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 2.5

Examine	Defect
Marking (exterior and interior)	Missing, incorrect, incomplete, illegible; of improper size, location, sequence, or method of application; markings not the same on the interior and exterior containers.
Packaging and packing materials	Any nonconforming component; any component missing, damaged, or otherwise defective.
Workmanship	Inadequate application of the components, such as: incomplete closure of the unit package, intermediate package, container flaps, loose strappings, etc. Bulging or distortion of the containers.
Exterior and interior content or weight	Number per container is more or less than required; gross or net weight exceeds the requirements.

TABLE III. Classification of defects for visual examination of the valve.

Critical	Minor
1. Material imperfections - foreign matter embedded. 2. Surface - unclean, rough, misaligned, or containing cracks, nicks, or other flaws. 3. Any component missing, malformed, fractured, or otherwise damaged. 4. Any component loose or otherwise not securely retained. 5. Incorrect assembling or improper positioning of components. 6. Any functioning part that works with difficulty. 7. Faulty workmanship or other irregularities. 8. Linkage interference or component binding.	201. Marking - missing, insufficient, incorrect, permanent.

4.6.2 Minimum operating acceleration force. The valve shall be subjected to inlet pressures of 30, 100, 200, and 300 psig. The acceleration force required to open the valve at each inlet pressure shall be as specified in 3.6.1.

4.6.3. Outlet pressure regulation. A tank shall be connected as specified in 4.3.4.1 during this test. A source of pressurized gas shall be connected to the valve inlet port. The inlet gas pressure shall be increased and maintained at 30 psig while acceleration forces of 2, 4, 6, 8, 10, 8, 6, 4, 2, and 1 G_z are applied in this order to the valve. Each force shall be maintained for at least 10 seconds before the next force is applied. The inlet pressure shall be increased to 100, 200, and 300 psig, and the test repeated at each of these inlet pressures. The outlet pressure shall be as specified in 3.6.2.

4.6.4 Leakage. With a force of 1 G_z applied to the valve, the inlet flow to the valve at an inlet pressure of 30, 100, 200, and 300 psig shall not exceed that specified in 3.6.3.

4.6.5 Anti-chatter. A tank shall be connected as specified in 4.3.4.1 during this test. A source of pressurized gas shall be connected to the valve inlet connection. The inlet pressure shall be increased and maintained at 30, 100, 200, and 300 psig. At each pressure level the valve shall be fully opened manually, by pressing the push-to-test button, and held open a sufficient length of time to determine that there is no evidence of chatter when there is air flow through the relief valve.

4.6.6 Response time. A tank shall be connected as specified in 4.3.4.1 during this test. A source of pressurized gas shall be connected to the valve inlet connection and the pressure increased to and maintained at 100 psig. A pressure transducer shall be connected to the tank to allow tank pressure to be recorded as a function of time. Acceleration forces of 6, 1, 10 and 1 G_z shall be applied in this order to the valve. Each force shall be maintained for at least 10 seconds before the next force is applied. Tank pressure shall be recorded as a function of time for at least 5 seconds following the application of each force level. The time interval from the time of application of each force level to the time at which the tank pressure reaches the value specified in 3.6.5 shall not exceed the response time specified in 3.6.5.

4.6.7 High temperature exposure. The pressure regulating valve shall be conditioned at a temperature of 400 ^{o}F ±5 ^{o}F for eight hours. After this period, the valve shall be immediately subjected to and pass the tests specified in 4.6.2, 4.6.3, 4.6.4, 4.6.5, and 4.6.6.

4.6.8 Low temperature exposure. The pressure regulating valve shall be stabilized at a temperature of -65 ±5 ^{o}F. After this period, the valve shall be warmed to -40 ±5 ^{o}F and immediately subjected to and pass the tests specified in 4.6.2, 4.6.3, 4.6.4, 4.6.5 and 4.6.6.

4.6.9 Vibration. The anti-G valve shall be subjected to the following vibration tests while the valve is subjected to an inlet pressure of 300 psig:

a. Vibrate the anti-G valve for one hour in each of three mutually orthogonal axes to the following random vibration envelope:

0.04 G^2/Hz from 15 to 225 Hz

±4 dB/Octave slope from 225 to 300 Hz

0.06 G^2/Hz from 300 to 1000 Hz

-6 dB/Octave decay from 1000 to 2000 Hz

Resonance search between 10 and 2000 Hz shall also be done with sinusoidal vibration at 0.02 inches double amplitude or ±2 G_z, whichever is less, to identify resonant frequencies in the valve assembly.

There shall be no damage to the valve and the valve shall not fail to function as a result of the test. Upon completion of this test, the valve shall be subjected to and pass the tests specified in 4.6.2, 4.6.3, 4.6.4, 4.6.5, and 4.6.6.

b. The anti-G valve shall be subjected to random vibration in accordance with figure 4.

c. The anti-G valve shall be subjected to sine dwells in accordance with table IV. There shall be no damage to the valve and the valve shall not fail to function as a result of the test. Upon completion of this test, the valve shall be subjected to and pass the tests specified in 4.6.2, 4.6.3, 4.6.4, 4.6.5, and 4.6.6.

d. The anti-G valve shall be subjected to vibration along each mutually perpendicular axis. The excitation shall consist of four, phase uncorrelated sinusoids superimposed over a random vibration background. The sinusoids shall be at frequencies representing the basic gunfire rate f_1 (100 Hz), and the second f_2 (200 Hz), third f_3 (300 Hz), and fourth f_4 (400 Hz) orders. Synchronously, the frequencies shall be swept logarithmically over a bandwidth equal to $\pm 0.2\ f_1$, $\pm 0.2\ f_2$, $\pm 0.2\ f_3$, and $\pm 0.2\ f_4$ beginning at the low frequency end and ending at the high frequency limit. The sweep time for the combination sine sweep and random vibration shall be 60 minutes per axis. The instantaneous peaks of the random vibration may be limited to 2.5 times the rms spectral acceleration level. Spectrum frequencies, frequency-function levels, and location-function levels for the combined random and sinusoidal vibration tests are contained on figure 5. Upon completion of this test the valve shall be subjected to and pass the tests specified in 4.6.2, 4.6.3, 4.6.4, 4.6.5, and 4.6.6.

e. The anti-G valve shall be subjected to vibration along each mutually perpendicular axis. The excitation shall consist of six resonance dwells of five minutes each per axis as follows:

(1) One in each of the frequency bands corresponding to ±10 percent of the first four harmonics of the gunfiring frequency. If no resonance is found in a frequency band, the dwell shall be at the center frequency of the band.

(2) Dwells in the frequency range from 100 to 1000 Hz at the four most significant resonant frequencies.

The excitation level at the dwell frequencies shall be given by the sinusoidal range curve of figure 5. The background random excitation is not required for the dwells. Upon completion of this test the valve shall be subjected to and pass the tests specified in 4.6.2, 4.6.3, 4.6.4, 4.6.5, and 4.6.6.

TABLE IV. Sine dwell. 1/

Frequency (Hz)	Cockpit acceleration (g)
33	2.50
67	5.00
100	5.00
133	5.00
167	5.00
200	5.00
233	5.00
267	5.00

1/ 7-1/2 mins sine dwell/ frequency/axis

4.6.10 Salt fog. The valve shall be subjected to a salt fog test in accordance with method 509.2 of MIL-STD-810. The valve shall be examined for evidence of corrosion to all exposed surfaces. If the valve exhibits any corrosion indicative of dissimilar metals or corrosion that could preclude normal operation or create any unsafe condition, the valve shall be rejected. The valves shall be subjected to and pass the tests described in 4.6.2, 4.6.3, 4.6.4, 4.6.5, and 4.6.6.

4.6.11 Internal corrosion. With the valve maintained at a temperature of 135 ±5 °F, a salt fog in accordance with the salinity requirements of MIL-STD-810, method 509.2, at a temperature of 135 ±5 °F, shall be passed through the valve in the normal direction of flow at approximately three flow cycles per minute for a duration of at least 15 minutes. The rate of flow of salt fog shall be no less than 30 liters per minute. This procedure shall be performed at least 10 times with the valve dried after each 15 minute period. After completion of the above tests, the valve shall be subjected to and pass the tests specified in 4.6.2, 4.6.3, 4.6.4, 4.6.5, and 4.6.6.

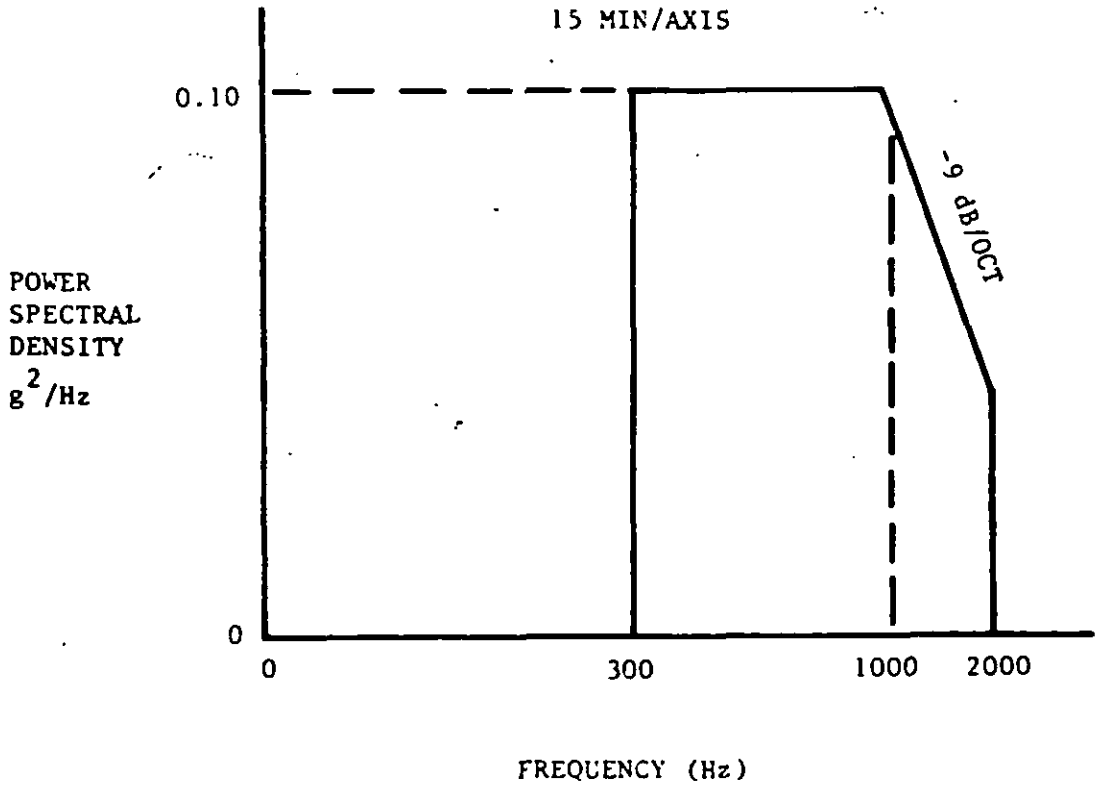


FIGURE 4. Random vibration vs frequency.

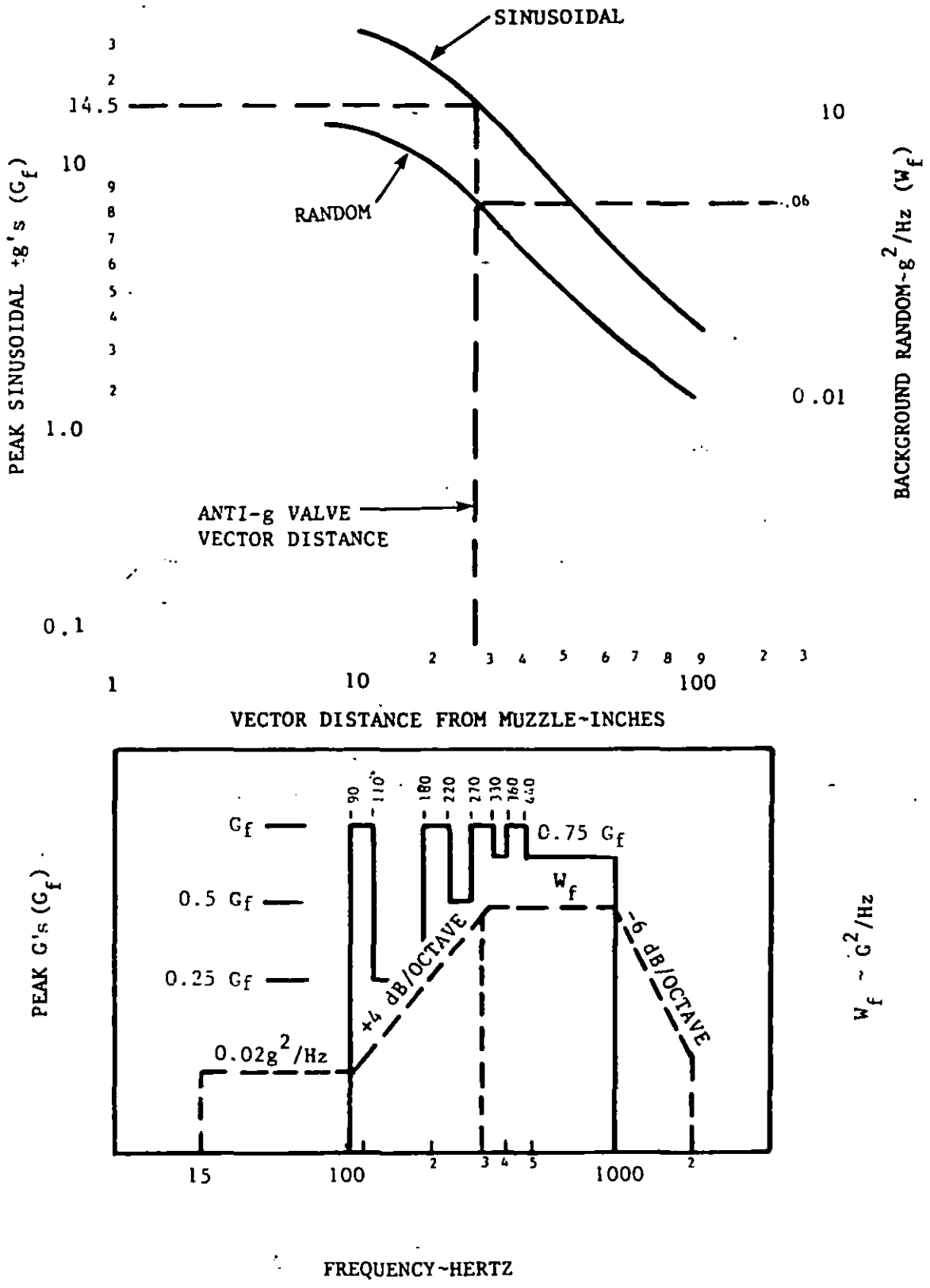


FIGURE 5. Combined random and sinusoidal vibration test for gunfiring environment.

4.6.12 Centrifuge testing. Centrifuge testing, when specified (see 6.2), shall be conducted at a facility approved by the Government. Instrumentation is required for the following:

a. G_z: 1 to 10

b. G_y: 1 to 3

c. G suit pressure: 0 to 11 psig

d. G suit pressure (expanded): 0 to 0.5 psig

e. Source pressure: 0 to 300 psig

An analog strip chart of these parameters shall be sufficient. The sampling rates and calibrations shall be specified by the procuring activity and shall be as accurate as possible. Both pre and post calibrations are required. The following test set-up is required: The valve shall be mounted in the gondola in radial line with the accelerometer. For unmanned testing the outlet of the valve shall be connected through the standard hose and connector to a flexible volume of approximately 9 liters. The test medium shall be as specified in 4.3.3. The following test procedures are required:

a. Phase I (Unmanned)

(1) The valve inlet pressure shall be maintained at 30 psig while the centrifuge shall be accelerated from 1 to 10 G_z at 6 G_z per second onset rate. The G_z level at pressure initiation, the slope of the G_z versus pressure, and the relief valve opening point shall be in accordance with 3.5 and 3.6. The inlet pressure shall be increased to 70 and 300 psig and the test shall be repeated at each of these inlet pressures.

(2) The valve inlet pressure shall be maintained at 30 psig while the centrifuge is accelerated to 4, 6, and 8 G_z for 60 seconds at each G_z level. The inlet pressure shall be increased to 70 and 300 psig and the test shall be repeated at each of these inlet pressures. The outlet valve pressure shall be as specified on figure 3.

b. Phase II (Unmanned) transverse G_z test

The valve shall be mounted 22° from the normal axis of the gondola floor to simulate Gy. The inlet pressure shall be maintained at 30 psig while the centrifuge is accelerated from 1 to 5 G_z at 6 G_z per second onset rate, with respect to the normal axis of the gondola floor and held at this level for 60 seconds. The outlet valve pressure shall be as specified on figure 3. The inlet pressure shall be increased to 70 and 300 psig and the test shall be repeated at each of these pressures.

c. Phase III (Manned) subjective performance

(1) The test subject shall be fitted with a standard CSU-13B/P or CSU-15/P anti-G suit. Source pressure shall be 70 psig. The subject shall be prepared for the run. The centrifuge shall then be accelerated through a simulated air combat maneuver in accordance with figure 6. The outlet valve pressures shall be in accordance with figure 3. This test shall be repeated three times each for at least three test subjects.

(2) At the conclusion of these tests the subjects shall be interviewed for their subjective opinion or any noted characteristics (e.g., chatter, pulsing, comfort, etc.) of the valve. At least two valves shall be subjected to this entire test series. The information obtained from these interviews is additional criteria the procuring activity needs to evaluate valve performance.

4.6.13 Endurance. A tank shall be connected as specified in 4.3.4.1 during this test. A source of pressurized gas shall be connected to the inlet and the valve shall be subjected to the cyclic operations for the number of cycles (see 6.4.2), under the conditions, and in the order specified in table V. The rate of cycling shall be approximately 6 cycles per minute. The outlet pressure at the extreme forces of each cycle shall be as specified on figure 3 for the applied force. After completing all phases of the cyclic operation, the valve shall be subjected to and pass the inspections specified in 4.6.2, 4.6.3, 4.6.4, 4.6.5, and 4.6.6.

TABLE V. Conditions of cyclic operation.

Inlet pressure (psig)	Inlet air temperature (^{o}F)	Applied force (G_z)	Number of cycles
100	70	1 to 6 to 1	5,000
100	70	1 to 9 to 1	15
300	400	1 to 6 to 1	1,000
300	400	1 to 9 to 1	15
100	400	1 to 6 to 1	4,000
100	70	1 to 6 to 1	5,000

4.6.14 Disassembly and examination. At the conclusion of each inspection specified herein, the valve shall be disassembled and examined. The valve shall not show evidence of excessive deterioration or wear due to testing which might affect the valve performance. The valve shall be disassembled and examined after any test in which valve failure indicates faulty construction.

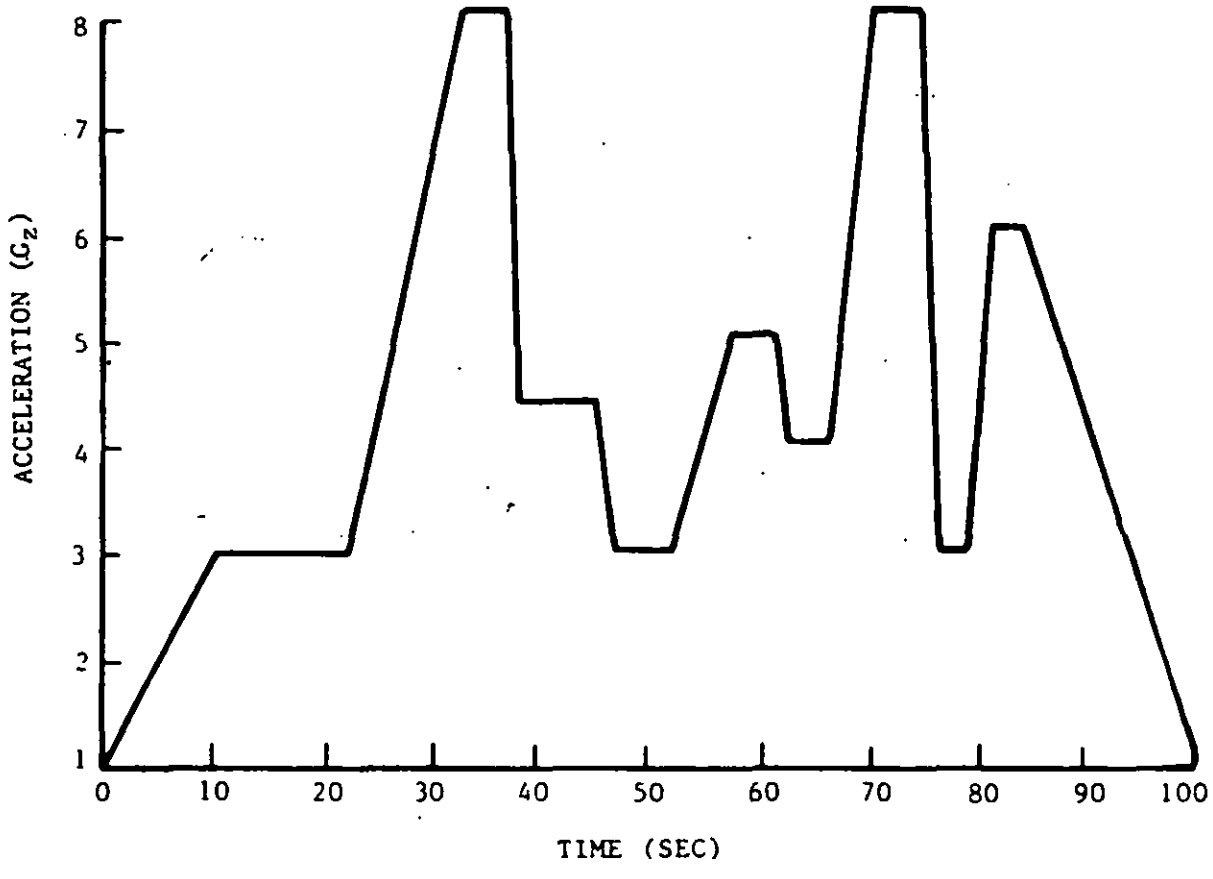


FIGURE 6. The G_z profile of a simulated aerial combat maneuver (SACM).

5. PACKAGING

5.1 Preservation. Preservation shall be level A of MIL-STD-2073-1. Preservation and packaging shall be accomplished in accordance with the requirements of FED-STD-209.

5.1.1 Level A. Unless otherwise specified, valves shall be preserved in accordance with method IC1 of MIL-P-116.

5.1.1.1 Cleaning and drying. Each valve shall be cleaned and dried for oxygen service in accordance with industry practice according to the applicable processes of MIL-P-116. Petroleum and other flammable solvents shall not be used.

5.1.1.2 Preservation application. No preservatives shall be applied.

5.1.1.3 Unit packaging. Unless otherwise specified by the contracting activity, valves shall be individually packaged in accordance with method IC1 of MIL-P-116, insuring compliance with the applicable requirements of that specification.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A. Unless otherwise specified by the contracting activity, valves preserved as specified in 5.1, shall be packed in shipping containers applicable to level A requirements of MIL-STD-2073-1. Insofar as practical, exterior shipping containers shall be of uniform shape, size, minimum tare and cube consistent with the protection required.

5.2.2 Level B. Unless otherwise specified by the contracting activity, valves preserved as specified in 5.1, shall be packed in shipping containers conforming to PPP-B-636, style RSC, type CF, class weather resistant, grade V3c. Additional requirements as specified in 5.2.1 are applicable.

5.2.3 Level C. Unless otherwise specified by the contracting activity, valves preserved as specified in 5.1, shall be packed in shipping containers conforming to PPP-B-636, style RSC, type CF, class domestic, grade 275. Additional requirements as specified in 5.2.1 are applicable.

5.3 Marking. In addition to any other markings required by the contract or purchase order (see 6.2), interior and exterior containers shall be marked in accordance with MIL-STD-129.

5.3.1 Precautionary marking. The following precautionary marking shall appear on each package:

LIFE SUPPORT ITEM
All oil, grease, shop residue
or other contaminants
have been removed.
DO NOT OPEN UNTIL READY FOR USE

5.3.2 Bar code markings. Bar code markings, when specified (see 6.2), shall be in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The pressure-regulating valves are intended for use in high performance aircraft. Valves designated MXU-804/A are to be used in the F-15 aircraft and valves designated MXU-805/A are to be used in the F-16 and A-10 aircraft. The valves sense change in acceleration force and provide pressure for the operation of aircrewmembers' anti-G suits in accordance with these changes.

6.2 Ordering data

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

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

b. Part number required (see 1.2).

c. Requirements for first article samples (including shipping instructions) or waiver of requirements for first article samples (see 3.2, 4.4, and 6.2.2).

d. Whether centrifuge testing is required (see 4.6.12).

e. Selection of applicable levels of preservation and packing required (see 5.1 and 5.2).

f. When bar code markings are required (see 5.3).

6.2.2 First article. When a first article inspection is required, the item should be a first article sample or it may be a standard production item from the contractor's current inventory as specified in 4.4.1. The first article should consist of three valves. If centrifuge testing is specified (see 6.2.1), a valve that is the same design as has passed first article should be submitted. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.3 Recycled, virgin, and reclaimed materials. Provided that all other requirements of this specification are met, reclaimed materials should be considered for use whenever feasible with no exclusions to the use of recovered materials and no requirements that an item be manufactured from virgin materials.

6.4 Definitions

6.4.1 Acceleration force. A force resulting from acceleration that acts upon an aircraft or person in the aircraft.

6.4.2 Chatter. A rattling or vibration resulting in either excessive pressure irregularities or audible noise.

6.4.3 Cycle. A cycle shall consist of varying the force on the valve from 1 G_z to the maximum specified for the specific cycle and back to 1 G_z.

6.4.4 G-force. A force on an object resulting from an applied acceleration due to gravity or reaction to a change of direction in unit of gravitational acceleration.

a. $+G_z$. A positive acceleration acting along the z-axis of a body. Examples are aircraft recovery from a dive and turning maneuvers.

b. $-G_z$. A negative acceleration acting along the negative z-axis of a body axis. Examples are flying on outside loop and a nose-over.

c. $+G_y$. Acceleration acting across a body perpendicular to its long axis in a side to side direction. Examples are a pilot in a high performance aircraft executing an uncoordinated turn and exposure to lateral buffeting.

6.5 Subject term (key word) listing.

Suit, Anti-G
Valve, anti-G
Valve, high flow
Valve, relief
Valve, pressure regulators

Custodian:
Air Force - 11

Preparing activity:
Air Force - 11

Review activities:
Air Force - 71, 99

(Project No. 1660-F527)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-V-87223(USAF)	Valves, Pressure, Anti-G Suit, MXU-804/A and MXU-805/A

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*:

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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