INCH-POUND
MIL-DTL-32022(OS)
5 November 1998

DETAIL SPECIFICATION

GENERATOR, GAS, FIRE EXTINGUISHER, GGU-16/A, GGU-17/A, GGU-18/A, GGU-19/A, GGU-20/A

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Department and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for the manufacture and acceptance of the GGU-16/A, GGU-17/A, GGU-18/A, GGU-19/A and GGU-20/A Generator, Gas, Fire Extinguishers, referred to herein as "gas generators".

1.2 Application. These gas generators were developed to fit specific bay volumes of the V-22 Aircraft and its variants

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents specified in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to the Commander, Indian Head Division, Naval Surface Warfare Center, Technical Information Division (Code 840), 101 Strauss Avenue, Indian Head, MD 20640-5035, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by sending a letter.

AMSC N/A FSC 1377

SPECIFICATIONS

FEDERAL

FED-STD-595	Colors used in Government Procurement

DEPARTMENT OF DEFENSE

MIL-D-21625G	Design and Evaluation of Cartridges for Cartridge Actuated Devices
MIL-I-23659G	Initiators, Electrical, General Design Specification for

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-331	Fuze and Fuze Components, Environmental and Performance Tests for
MIL-STD-810D	Environmental Test Methods and Engineering Guidelines
MIL-STD-1168	Ammunition Lot Numbering

(Unless otherwise indicated, copies of Federal and Military specifications and standards are available from: Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation (see 6.2).

DRAWINGS

NAVAL AIR SYSTEMS COMMAND (CAGE Code 30003)

3205AS156	Generator, Gas Fire Extinguisher GGU-19/A
3205AS157	Generator, Gas Fire Extinguisher GGU-18/A
3205AS158	Generator, Gas Fire Extinguisher GGU-16/A
3205AS159	Generator, Gas Fire Extinguisher GGU-17/A
3205AS160	Generator, Gas Fire Extinguisher GGU-20/A

3205AS191	100 Liter Gas Generator Test Assembly
3205AS195	Holding Fixture, Gas Generator

(Application for copies should be addressed to the Commanding Officer, Naval Inventory Control Point, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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

BELL-BOEING DOCUMENTS

901-947-034	V-22 Vibration Test Report
901-947-222	V-22 Wing Fire Detection/Suppression System, Prime Item Development Specification

(Application for copies of Bell-Boeing documents should be sent to Bell Helicopter Textron Inc., 600 E Huyrst Blvd, Fort Worth, TX 76101.)

PRIMEX AEROSPACE DRAWINGS

32706	Interface Control Drawing - Fire Extinguisher, Gas Generator
32705-302	Fire Extinguisher, Gas Generator (Tip Rib Bay)
32710-302	Fire Extinguisher, Gas Generator (Loss of Lube)
32715-302	Fire Extinguisher, Gas Generator (Midwing)
32720-302	Fire Extinguisher, Gas Generator (Aft Cove)
32725-302	Fire Extinguisher, Gas Generator (Dry Bay)
32721-501	Ignition Pellet (FS01-00)
32735-501	Propellant Pellet (FS01-40)

(Application for copies of Primex Aerospace drawings should be sent to Primex Aerospace Co., 11411 Willows Rd NE, Redmond, WA 98073-9709.)

SPECIAL DEVICES INCORPORATED

103377-324 Initiator

(Application for copies of Special Devices Incorporated drawings should be sent to Special Devices Inc., 16830 W Placerita Canyon Rd, Newhall, CA 91321-3227.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 1742 Standard Practice for Radiographic Inspection

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

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, superseded applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to the first article inspection as specified in sections 4.2 and 6.3. A first article inspection shall be required if :

a. Two years or more have passed since the gas generators or a similar item were manufactured,
b. There has been a major turn over in personnel,
c. There have been major changes to the production facility or
d. There has been a transfer of production to a new facility or site.

3.2 Flight critical part. These gas generators are flight critical items and the technical data package shall be identified and procured as such.

3.3 Design and construction. The following applies to the qualification status and configuration control of the gas generators over the entire life of the item.

3.3.1 Identical configuration. The gas generator's design and construction shall be identical to that subjected to qualification testing and approved for service use by the Navy. The qualified configurations are listed below:

Model No.	NAVAIR P/N	Primex P/N	Bell-Boeing P/N
GGU-16/A	3205AS158	32720-302	901-369-009-105
GGU-17/A	3205AS159	32715-302	901-369-009-103
GGU-18/A	3205AS157	32710-302	901-369-009-109
GGU-19/A	3209AS156	32705-302	901-369-009-101
GGU-20/A	3205AS160	32725-302	901-369-001-107

3.3.2 Configuration control. Only the gas generators procured from the vendor(s) listed on drawings 3205AS156 through 3205AS160 are approved for the application specified. A substitute gas generator shall not be used or procured without prior approval and testing by the Indian Head Division, Naval Surface Warfare Center, the Naval Air Systems Command Headquarters (AIR-4.3.5 and PMA-275), and the Bell-Boeing Joint Program Office.

3.4 Primary components. The electro-explosive device (EED), SDI P/N 103377-324, and propellants, Primex Aerospace P/Ns 32721-501 and 32735-501 are primary components. Only one lot of each primary component shall be used in a gas generator lot. One primary lot may be used in more than one gas generator lot.

3.4.1 Electro-explosive devices (EED). The zirconium potassium perchlorate ignition charge and the titanium hydride/potassium perchlorate main charge are the EED's, P/N 103377-324, primary components. Only one lot of each primary component shall be used in an EED lot. One primary lot may be used in more than one EED lot.

3.4.1.1 P/N 103377-324 compliance. As a minimum, the P/N 103377-324 EED lot for each gas generator shall demonstrate compliance to the inspection and test requirements in accordance with SDI ATP-103377-324. Any changes to this document are subject to approval by Indian head Division, Naval Surface Warfare Center, Indian Head, Maryland 20640-5035. In addition the EED shall comply with the requirements in MIL-I-23659C.

3.4.2 Propellants. Only propellant manufactured within the last 24 months or recertified within the last 12 months shall be used in the gas generators.

3.5 Gas Generator production. The gas generators shall be manufactured in accordance with the Primex drawings 32705, 32710, 32715, 32720 and 32725 and the drawings listed thereon. Each production gas generator shall meet the requirements of 3.4 and 3.5.1 through 3.5.7 as outlined in Table I. Failure of any gas generator to meet the requirements of 3.4 and Table I shall result in rejection of the lot of gas generators. Any acceptance of the failed lot by deviation or wavier shall have the written approval of the Naval Air Systems Command Headquarters, AIR-4.3.5 and Bell-Boeing if purchased as production installs.

3.5.1 Visual inspection. The gas generators shall be free of the following defects: illegible, missing or inaccurate markings, damage, burrs, dents, sharp edges, bent or missing electrical contact pins, damaged mounting studs or cushions, chipped or incomplete protective finish, or other defects which may prevent the installation of the gas generators. The electrical initiator shall have a shorting spring installed which shorts all pins to case, and protective caps shall be installed on the electrical connector and mounting studs. The gas generators shall be painted

white (FS-17925) per MIL-STD-595. Each gas generator shall meet the requirements of 3.4, 3.7 and the drawings 3205AS156 through 3205AS160.

3.5.2 Radiographic examination. When radiographically examined in accordance with 4.5.2, the gas generator shall show proper assembly, presence of parts, uniformity of propellant pellets, sealing and proper assembly of the electrical initiator. The radiographic inspection shall show no foreign materials present.

3.5.3 Leakage. The leak rate of each gas generator shall not exceed 1.0 $x10^{-5}$ cc/sec of air or 2.7 $x10^{-5}$ cc/sec of Helium when tested in accordance with 4.5.3.

3.5.4 Bridgewire resistance. The bridgewire resistance shall be 1.0 $\pm$ 0.1 ohms at 70°F between pins "A" and "C" when tested in accordance with 4.5.4.

3.5.5 Insulation resistance. The insulation resistance shall be greater than 2.0 megaohms when measured between shunted pins "A" & "C" and the gas generator electrical bonding surface, the mounting stud closest to the electrical initiator when tested in accordance with 4.5.5. The electrical bonding surface for the GGU-19/A (3205AS156) which does not have mounting studs shall be the electric initiator body.

Table I. Production inspections.

Test Sequence	Test Paragraph	Requirement Paragraph
1. Visual	4.5.1	3.5.1, 3.5, 3.7
2. Radiographic Inspection	4.5.2	3.5.2
3. Leakage	4.5.3	3.5.3
4. Bridgewire Resistance	4.5.4	3.5.4
5. Insulation Resistance	4.5.5	3.5.5

3.6 Gas generator performance. Gas generators shall meet all requirements of 3.6.1 through 3.6.8.5 and the acceptance criteria of 4.6.

3.6.1 Vibration. The gas generator shall not initiate or incur any internal/external damage or degradation when vibration cycles are applied in accordance with 4.5.6. A change in gas generator resonant properties following exposure to the source dwell shall constitute a test failure even if the gas generator performance is unaffected.

3.6.2 Shock. The gas generator shall not initiate or incur any internal/external damage or degradation when saw tooth shocks are applied in accordance with 4.5.7.

3.6.3 Temperature-shock/humidity/altitude (TSHA) cycling. The gas generator shall not initiate or incur any internal/external damage or degradation when subjected to TSHA cycling in accordance with 4.5.8.

3.6.4 Salt fog. The gas generator shall not initiate or incur any internal/external damage or degradation when subjected to salt fog testing in accordance with 4.5.9.

3.6.5 Six-foot drop. The gas generator shall not initiate or incur any major internal/external damage or degradation as a result of the six-foot drop test in accordance with 4.5.10.

3.6.6 Thermal-shock cycling and vibration. The gas generator shall not initiate or incur any internal/external damage or degradation when subjected to the combined thermal-shock cycling and vibration in accordance with 4.5.12.

3.6.7 Functioning. The gas generator shall meet the requirements of 3.6.8.1 and 3.6.8.2 when fired in accordance with 4.5.14.

3.6.7.1 Generator discharge time. The gas generators shall be completely discharged within 250 milliseconds maximum from the time of initiator actuation.

3.6.7.2 Time to 95% of maximum pressure. The limit for time to 95% of the maximum pressure shall not exceed 200 milliseconds.

3.6.7.3 Ignition delay time. The ignition delay shall not exceed 25 milliseconds.

3.6.7.4 Pressure limits. The upper and lower pressure limits for maximum pressure (psia) when function at the three specified temperatures shall be as follows:

	Pmax @ -65°F (psia)	Pmax @ +160°F (psia)
GGU-16/A	23	45
GGU-17/A	58	105
GGU-18/A	11	21
GGU-19/A	20	40
GGU-20/A	48	80

3.6.7.5 Delta weight. The minimum delta weight of the gas generators following functioning shall be as follows:

	Delta Wt. –65 °F (grams)	Delta Wt. +70°F (grams)	Delta Wt. +160°F (grams)
GGU-16/A	120	124	126
GGU-17/A	236	244	254
GGU-18/A	60	62	64
GGU-19/A	110	112	114
GGU-20/A	198	200	206

3.6.7.6 Initiator all-fire current. The electrical initiator shall function the gas generator when provided with a direct current of 3.5 amps for 10 milliseconds.

3.6.7.7 Case temperature. The case temperature shall be measured and shall not exceed +700°F over the functional temperature range.

3.7 Workmanship. The gas generator shall be constructed and finished in a manner to assure compliance with all requirements of this specification.

4. VERIFICATION

4.1 Classification of inspections.

a. First article inspection (see 4.2)
b. Production inspection (see 4.3)
c. Lot acceptance inspection (see 4.4)

4.2 First article inspection. Unless otherwise specified in the contract or purchase order (see 6.3), a first article inspection sample of 36 gas generators conforming to each drawing 3205AS156 through 3205AS160 shall be subjected to first article testing. Thirty-three of these gas generators shall be expended in the tests listed in Table II, any remaining units shall be retained by the government for investigative purposes. Any damage inflicted by the environmental exposures which would adversely affect the performance of the item in service application shall be cause for rejection of the first article sample. Any production prior to notification by the contracting agency of the first article sample acceptability shall be at the contractor's risk. Failure of any gas generator to comply with the requirements of section 3 shall be cause for rejection of the first article represented.

4.3 Production inspection. All production gas generators manufactured under the contract shall be inspected and screened for defects. Gas generators failing to meet the requirements listed in Table I shall be rejected and removed from the lot.

4.4 Lot acceptance inspection. Lot acceptance inspection shall consist of the examinations and tests specified in Table III. Failure of any sample gas generator to comply with the requirements listed in Table III shall be cause for rejection of the lot represented. Packaging defects shall be corrected before acceptance.

4.4.1 Sample size. A random sample of gas generators from each production lot, including the samples retained for investigative purposes, shall be selected in accordance with Table IV for lot acceptance inspection. Test sample gas generators and samples retained for investigative purposes shall not be applied as part of the quantity specified for delivery by the contract or purchase order.

4.5 Inspections and tests.

4.5.1 Visual inspections.

4.5.1.1 Gas generator inspection. The external condition and appearance of the gas generators shall be determined by comparison to drawings 3205AS156 through 3205AS160. Specific inspections of the electrical connector, shunting clip, mounting studs, aluminum case, labels shall be conducted at a minimum. Each gas generator shall meet the requirements of 3.5.1 and 3.7.

TABLE II. First article test plan.

Test Sequence	Test Para.	Req. Para.	Sample Groups								
			I	II	III	IV	V	VI	VII	VIII	IX
1. Visual	4.5.1.1	3.5.1	6	3	3	3	3	3	3	3	3
2. Radiographic	4.5.2	3.5.2	6	3	3	3	3	3	3	3	3
3. Leakage	4.5.3	3.5.3	6	3	3	3	3	3	3	3	3
4. Resistance	4.5.4	3.5.4	6	3	3	3	3	3	3	3	3
5. Vibration	4.5.6	3.6.1	6								
6. Shock	4.5.7	3.6.2		3							
7. TSHA	4.5.8	3.6.3			3						
8. Salt Fog	4.5.9	3.6.4				3					
9. 6 Foot Drop	4.5.10	3.6.5					3				
10. TSC/Vibration	4.5.11	3.6.6						3			
11. Function test:	4.5.12	3.6.7									
-65°F ± 5°F			2	1	1	1	1	1	3		
70 ± 5°F			2	1	1	1	1	1		3	
160 ± 5°F			2	1	1	1	1	1			3

Table III. Lot acceptance inspection and tests.

Inspection/Test	Test Paragraph	Requirement Paragraph	Quantity
1. Visual Inspection	4.5.1	3.5.1, 3.4, 3.7	Test and retain sample
2. Radiographic Inspection	4.5.2	3.5.2	Test and retain sample
3. Leakage	4.5.3	3.5.3	Test and retain sample
4. Bridgewire Resistance	4.5.4	3.5.4	Test and retain sample
5. Insulation Resistance	4.5.5	3.5.5	Test and retain sample
6. Function test:	4.5.13	3.5, 3.6.7	
-65 ± 5°F			1/3 sample
70 ± 5°F			1/3 sample
160 ± 5°F			1/3 sample

Table IV. Lot acceptance sampling.

Lot Size	Test Sample Size	Retained Sample Size
2-50	5	1
51-90	6	1
91-150	10	2
151-250	15	2
251-500	21	2

4.5.1.2 Packaging inspection. The condition of the packaging (inner container), packing (outer container), and markings shall be determined by comparison to the requirements of section 5.

4.5.2 Radiographic examination. Radiographic examination shall be conducted in accordance with ASTM E 1742. All gas generators shall be identified with serial numbers beginning with 001 prior to examination. The gas generators shall be arranged on boards or trays in consecutive order with any missing serial numbers identified on the radiographic plate. Each radiograph shall carry a permanent identification of the items displayed thereon in a 4 x 6 inch region maximum. The radiographic identification shall include the drawing number, the complete lot number in

accordance with MIL-STD-1168, the contract number, and the span of serial numbers displayed. Radiographs of the entire production lot shall accompany the ballistic sample to the activity conducting the lot acceptance tests. Any observable imperfections as outlined in 3.5.2 shall be cause for rejection of the gas generator. Defective gas generators found during radiographic review are to be marked on the radiographic plate and removed from the production lot. Setting on the radiographic equipment shall be noted on the radiographic review sheets. Radiographs of the SDI P/N 103377-324 shall be supplied along with those of fully assembled gas generators.

4.5.3 Leakage test. Production units shall be leak tested by flushing the loaded gas generator with Helium at a pressure of 1+0.1/-0.0 atmospheres absolute, sealing it with the installation of the electric initiator. The Helium filled gas generator shall then be washed with dry Nitrogen and placed in a vacuum chamber and checked for leakage at one atmosphere differential. Certification of the test results shall be supplied and Government witnessing will be as specified in the contract or purchase order. The gas generators shall meet the requirements of 3.5.3.

4.5.4 Bridgewire resistance. Measure the initiator bridgewire resistance across pins "A" and "C". The test current shall not exceed 50 milliamps. The bridgewire resistance shall meet the requirements of 3.5.4.

4.5.5 Insulation resistance. Install shunt between pins "A" and "C". Using a megaohm meter, apply 500 $\pm$ 10 VDC between the shorted initiator pins and the gas generator electrical bonding surface as defined in 3.5.5 for a minimum of 2 minutes. The insulation resistance shall meet the requirements of 3.5.5.

4.5.6 Vibration. The gas generators shall be subjected to the vibration requirements of Bell-Boeing report 901-947-034 as follows: 2 units at -65°F, 2 units at 70°F, and 2 units at 160°F. Each gas generator shall be subjected to the combined source dwell and random excitation environments or individual source dwell and random excitation environments as applicable at -65, +70 and +160°F in each axis for 20 minutes.

a. Conduct a resonance survey for each gas generator configuration in each of the three mutually perpendicular axes both prior to and following exposure to the source dwell environment. Conduct a low level (0.5 g peak), 5-500 Hz sweep at a frequency rate of 1/2 octave per minute (15 minutes duration) with a tolerance equal to $\pm$ 10% on the vibration amplitude and $\pm$ 2% or 1 Hz, for determination of the gas generator configuration's resonant frequency and transmissibility. The same gas generator serial number of each configuration and same mounting location on the vibration fixture will be utilized for both the pre- and post-source dwell frequency survey. The resonant frequency shall be considered to be any natural frequency with an amplification factor of 2.0 or greater output response relative to the input level. The gas generator response shall be measured on the housing at the least supported location or a location shown to have significant amplification. All resonance surveys will be conducted at ambient temperature. Following the completion of the source dwell vibration testing at -65°F and 160°F, the gas generators must be returned to ambient temperature prior to completion of the post-source dwell resonance survey.

b. Predicated upon the outcome of the resonance survey, source dwell vibration and random vibration excitation are to be conducted simultaneously. If based upon the resonance survey, the four (4) Government desired test frequencies exceed the permitted test frequencies and the source dwell vibration and random excitation cannot be applied simultaneously, the source dwell vibration levels shall be increased by 0.5 g.

Source dwell vibration shall be performed at each of the four (4) amplitudes and frequencies established by the Government based upon the resonance survey along each of the three (3) mutually perpendicular axes. Source dwell input levels are shown in figure 1 and shall include the superimposed broad band random background levels of the random excitation as described in 4.3.6.c.

c. Random excitation shall be conducted in accordance with MIL-STD-810D, Method 514.3, Paragraph I-4.2.2, Technique 3. Random excitation shall be a flat spectrum at 0.02 g^2/Hz over the bandwidth from 10-2000 Hz as shown in figure 2.

d. The following tolerances apply to all vibration testing:

(1) Instantaneous random vibration acceleration peaks shall be limited to three (3) times the RMS acceleration (3 sigma clipping).

(2) The random vibration spectrum shall be within the tolerance range of $\pm$3 dB between 10 and 2000 Hz except that deviations of $\pm$ 6 dB are permissible over a cumulative bandwidth of 200 Hz maximum between 500 and 2000 Hz.

(3) Overall RMS acceleration levels must be within $\pm$ 1.5 dB of the nominal input level.

(4) Sine tones must be within $\pm$ 10% of the nominal value.

e. Failure of any gas generator to comply with the requirements of 3.6.1 shall be cause for rejection of the first article.

4.5.7 Shock. The gas generators with protective caps and shunts installed on the electric initiators, shall be submitted to the shock test outlined in MIL-STD-810D, Method 516.3 Procedure I to the levels in Figure 4, three (3) shocks in each direction along each of the three (3) axis for a total of eighteen (18) shocks. All shocks will be conducted at ambient temperature. Failure of any gas generator to comply with the requirements of 3.6.2 shall be cause for rejection of the first article.

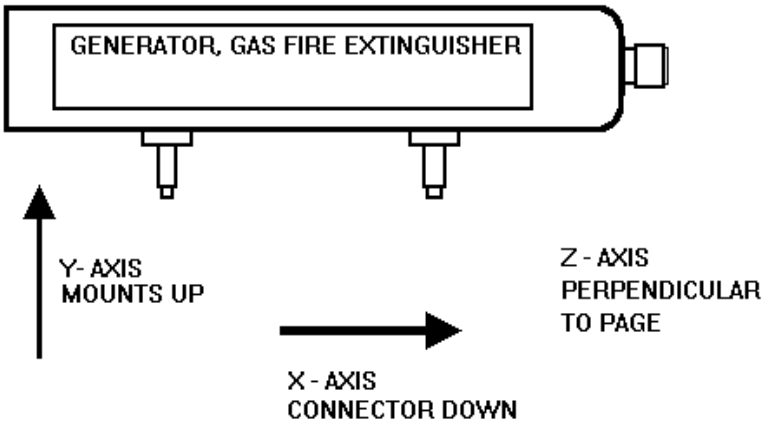

Figure 1. Shock / Vibration and Drop Axis

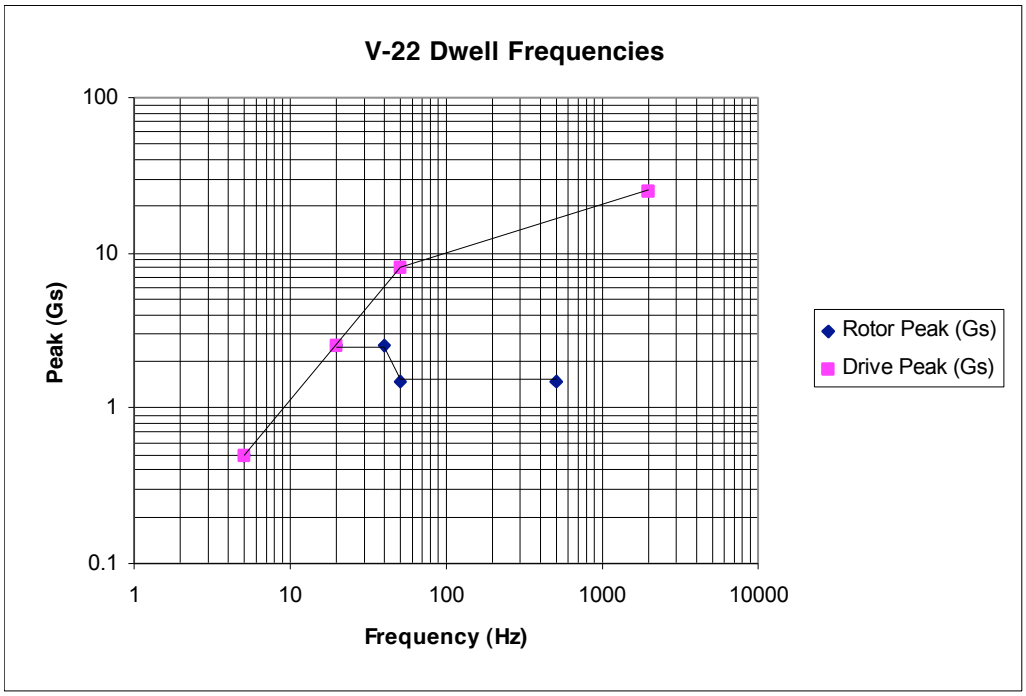

Figure 2. Source Dwell Input Levels

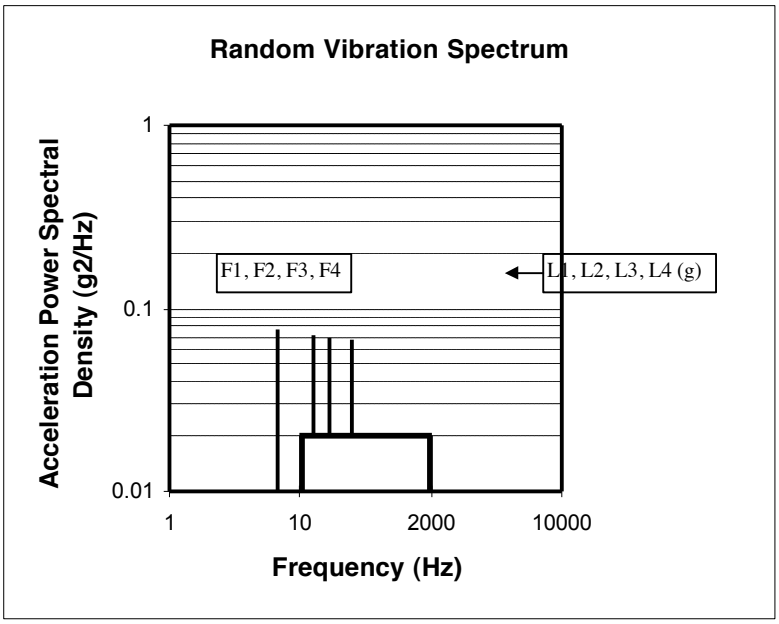

Figure 3. Random Vibration Spectrum

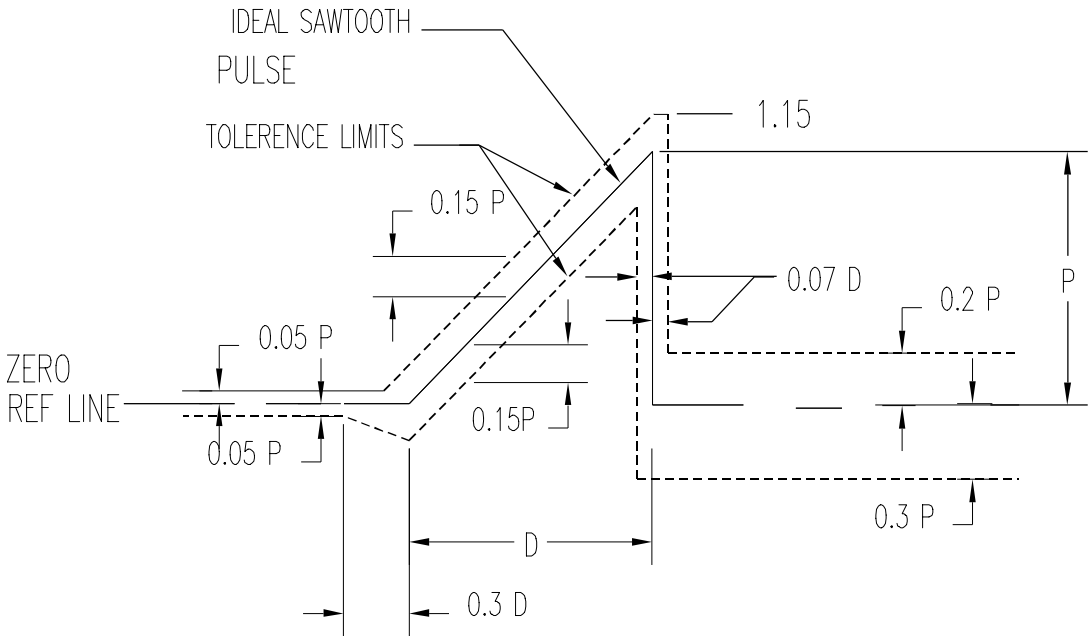

Figure 4. Terminal peak saw tooth shock pulse

4.5.8 Temperature-shock/humidity/altitude (TS/H/A) cycling. The gas generators with protective caps installed on the electrical connector shall be submitted to the TS/H/A cycling test outlined in MIL-D-21625G, paragraph 4.8.4 with the following requirements:

a. The gas generators shall be supported in such a way that all areas are exposed to the prescribed atmospheric conditions at all times throughout the test. No gas generator shall be in contact with another gas generator during the cycling schedule shown in Table V.

b. Failure of any gas generator to comply with the requirements of 3.6.3 shall be cause for rejection of the first article.

c. Thirty thousand (30,000) feet shall be used in lieu of 70,000 feet for the altitude test.

d. There shall be no interim withdraw of units.

Table V. Temperature shock/humidity/altitude cycling schedule

Monday	0800	Place gas generators (GGs) in chamber at 70°F at 50% relative humidity (RH).
	1200	Raise chamber temperature to 160°F and a RH of 95%. The chamber shall reach 160°F no later than 1300.
	1600	Remove the GGs from above chamber and immediately place in a chamber maintained at -65°F at a pressure altitude of 30,000 feet (4.36 psi)
Tuesday	0800	Remove GGs from chamber and immediately place in chamber maintained at 70°F at 50% RH.
	1200	Remove the GGs from above chamber and immediately place in a chamber maintained at -65°F at a pressure altitude of 30,000 feet (4.36 psi)
	1600	Remove GGs from above chamber and immediately place in a chamber maintained at 160°F at 95% RH.
Wednesday	0800	Reduce chamber temperature to 70°F and RH to 50%. The chamber temperature shall reach 70°F at 50% RH no later than 0900.
	1200	Raise chamber temperature to 160°F and a RH of 95%. The chamber shall reach 160°F no later than 1300.
	1600	Remove the GGs from above chamber and immediately place in a chamber maintained at -65°F at a pressure altitude of 30,000 feet (4.36 psi)
Thursday	0800	Remove GGs from chamber and immediately place in chamber maintained at 70°F at 50% RH
	1200	Remove the GGs from above chamber and immediately place in a chamber maintained at -65°F at a pressure altitude of 30,000 feet (4.36 psi)
	1600	Remove GGs from above chamber and immediately place in a chamber maintained at 160°F at 95% RH.
Friday	0800	Reduce chamber temperature to 70°F and RH to 50%. The chamber temperature shall reach 70°F at 50% RH no later than 0900.
	1200	Raise chamber temperature to 160°F and a RH of 95%. The chamber shall reach 160°F no later than 1300.
	1600	Remove the GGs from above chamber and immediately place in a chamber maintained at -65°F at standard ambient pressure.

This schedule shall be followed for a total of four (4) weeks (28 days) except that on the second and fourth weekend the soak time shall be from 1200 on Friday until 0800 on Monday at a temperature of 160°F at 95% RH.

4.5.9 Salt Fog. The gas generators, with protective caps installed over the electrical connectors, shall be submitted to the salt fog test with the following requirements:

a. Waxed string shall be used to support the gas generators in the chamber. The gas generator shall be oriented in the connector up position. No change in orientation is required during the test. The gas generators shall be exposed to a concentration of 5% salt corrosive agent for a constant wetting duration of 168 hours at 35°C (95°F).

Condensed fog shall be collected at two (2) points every twelve (12) hours and the specific gravity, concentration and pH of the solution measured.

b. After completing the 168 hours of testing, the salt deposits, if any, shall be removed, if necessary, by a gentle washing with water not warmer than 100°F.

c. After completing the washing, the units shall be stored for a 48 hour drying period at 70°F. After 48 hours a visual inspection shall be conducted. Any signs of damage or degradation shall be noted.

d. The failure of any gas generator to comply with the requirements of 3.6.4 shall be cause for rejection of the first article.

4.5.10 Six-foot drop. The gas generators, with protective shipping caps removed, shall be submitted to the drop test outlined in paragraph 4.8.2 of MIL-D-21625G with the following requirements:

a. The gas generators shall be dropped from a height of 6 feet onto a 2 inch thick steel plate supported by reinforced concrete. One gas generator shall be used for each drop orientation. All impact orientations are given in figure 1.

b. After each gas generator is dropped, a visual inspection shall occur to document any external damage that occurred and to verify non-initiation of the gas generator.

c. If it is determined that the damage sustained by any unit caused it to be unsafe for handling all testing shall be stopped.

d. Failure of any a gas generator to comply with the requirements of 3.6.5 shall be cause for rejection of the first article.

4.5.11 Thermal-shock cycling and vibration. The gas generator shall be submitted to the thermal shock cycling and vibration test outlined in Bell-Boeing Report 901-947-222, Revision B, paragraph 4.2.5.9 and MIL-STD-810D, Method 503.2, Procedure I with the following requirements:

a. An option to testing assembled gas generators is to load the propellant tablets into glass vials for the thermal shock cycling, then load the cycled propellant into the gas generators for vibration at the completion of the thermal cycling. The glass vials reduces the thermal soak time due to reduced mass from elimination of generator housing.

b. Stabilize vials at the specified low temperature for the specified range. (-65°F to +10°F, +65°F to + 160°F, and +95°F to +190°F)

c. Increase the ambient temperature to the specified upper limit of the specific range over a 2 minute period.

d. Stabilize at the specified upper limit for 1 minute past thermal stabilization for a gas generator to stabilize.

e. Decrease the temperature to the specified lower limit over a 2 minute period.

f. Repeat this cycle for 168 cycles from -65°F to 10 °F, 1344 cycles from 65°F to 160°F and, 168 cycles from 95°F to 190°F.

g. At the completion of the thermal cycling test the gas generators shall be subjected to vibration testing per 3.6.1.

h. At the completion of thermal shock cycling and vibration testing the gas generators shall be x-ray inspected to the requirements of 3.5.2. Indications of broken pellets shall be cause for halting the test. Gas generators with indications of fractured, broken or granular pellets shall not be functioned because of the risk of detonation.

4.5.12 Functional performance. Sample gas generators for the functional performance test firings shall be conditioned for not less than 4 hours and no more than 24 hours at the specified temperature. The gas generators shall be removed from the conditioning chamber and fired in the test fixture 3205AS191 within 5 minutes. If any gas generator is not fired within the 5 minute time period after removal, it shall be reconditioned at the specified temperature for an additional 4 hours and then tested. The gas generator shall meet the performance requirements of 3.6.8. The GGU-19/A shall be fired in the simulated tip rib bay sleeve identified in 3205AS195 when installed in test fixture 3205AS191. The gas generators shall be initiated by a 5 amp $\pm$ 0.5 amp pulse of 100 msec duration. The gas generators shall meet the requirements of 3.6.8.1, 3.6.8.2 and 3.6.8.3.

4.5.12.1 Discharge Time. The gas generator discharge time shall be identified as the time between initiator actuation and the time at 95% of maximum pressure. The discharge time shall be less than 250 msec.

4.5.12.2 Ignition delay. Ignition delay shall be measured from the application of power until first indication of pressure in the 100 liter test fixture.

4.5.12.3 Maximum pressure. The maximum pressure shall not vary outside the pressure range specified for the designated temperature as specified in 3.6.8.4.

4.5.12.4 Delta weight. The pre-function weight of each unit shall be recorded on the test data sheet. The post-functional weight shall also be recorded on the data sheet and the delta weight for each unit obtained. This shall be compared to the requirements specified in 3.6.8.5

4.5.12.5 Case Temperature. The case temperature measured over the time interval between initiator actuation and 2 minutes shall be as specified in 3.6.8.6.

4.5.12.6 Test Failure. If a test failure is attributable to an assigned cause, excluding the gas generator, the test shall be declared a no-test and repeated.

4.6 Acceptance criteria. The gas generators shall meet the requirements of 3.6 when tested as specified in 4.5.3 through 4.5.12. The acceptable number of defects is 0 and the rejection number is 1.

5. PACKAGING

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

6. NOTES

(This section contains information of a general or explanatory nature that maybe helpful but is not mandatory.)

6.1 Intended Use. These gas generators are intended to be part of the Wing Fire Protection System installed in the MV-22, CV-22 and HV-22 variant aircraft. They are part of an automatic fire detection/suppression system designed to extinguish a fuel fire in the V-22 wing area composed of the midwing area, aft coves, tip rib bays and areas in-board of the wing feed tanks. Upon detection of a fire by any of the optical detector the generators can be singly discharged or discharged as part of an inter-connected system. The Wing Fire Protection Systems are only used in military aircraft, therefore the cartridge has no commercial application.

6.1.1 Thermal-Shock Cycling and Vibration Testing. In the event of a major change to facilities (new facility, transfer to new location, etc) or large turn-over in staff, the government may require the performance of the thermal-shock cycling and vibration test on the propellant to ensure it meets the requirements and performance of the propellant as qualified.

6.1.2 Changes to configuration. These gas generators were developed to function in specific V-22 midwing area bays. The requirements addresses air flow into and out of these bays. Of major importance is the over pressure limits of each bay. Changes to the gas generators resulting in increased performance, faster burn times or greater pressure out put could result in the structural failure of wing components with the potential for catastrophic loss of the aircraft. Any changes effecting the ballistic functions of these gas generators require the approval of Naval Air Systems Command, AIR-4.3.5 and PM-275, and the Bell-Boeing Joint Program Office.

6.2 Acquisition Requirements. Acquisition documents must specify the following:

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

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1, 2.2.2 and 2.3).

c. Whether a first article inspection is required and. if so, specify the test activity (see 3.1 and 4.2.1).

d. Markings if other than as specified in 5.1.

e. If bar coding is not required on outer container.

f. Inspection conditions if other than specified in 4.2.

g. Production lot size (quantity) and test facility (see 4.2.3.1).

h. Configuration of DCA required (see 2.2.2).

i. That the safety precaution requirements of the "Contractors' Safety Manual for Ammunition, Explosives and Related Dangerous Material," DOD 4145.26M are applicable. NOTE: When this specification is used as a part of the description of work to be accomplished by a Government activity the safety precautions requirements of " Ammunition and Explosives," OP 5, are applicable.

6.3 First Article. When a first article inspection is required, the contracting officer should provide specific guidance to offeror(s) whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, standard production item from the contractor's current inventory (see 3.1) and the number of items to be tested as specified in 4.2.1. The contracting officer should also include specific instructions in acquisition documents of the first articles. Invitation(s) for bid(s) should provide that the U.S. Government reserves the right to waive the requirements for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the U. S. Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior U.S. Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Definitions.

6.4.1 Primary component. Primary components are all components in which a functional failure would result in a misfire or malfunction of the gas generator.

6.4.2 Flight critical part. A part, the single failure of which, during any operating condition, could cause the loss of aircraft or one of its major components, loss of control, or which may cause significant personnel injury, including during flight.

6.4.3 Caps. Plastic shipping caps should be installed on the end of the mounting studs and over the EED.

6.4.4 Level A packaging. The degree of preservation and packaging which will afford adequate protection against corrosion, deterioration and physical handling, shipment, indeterminate storage and world wide redistribution.

6.4.5 Level C packaging. The degree of preservation and packaging which will afford adequate protection against corrosion, deterioration and physical damage during shipment from the supply source to the first receiving activity for immediate use. This level may conform to the supplier's commercial practice when such meets the requirements of this level and MIL-STD-129-1.

6.4.6 Level A packing. The degree of packing which will afford adequate protection during shipment, handling, indeterminate storage and world-wide distribution.

6.4.7 Level C packing. The degree of packing which will afford protection against damage during direct domestic shipment from the supply source to the first activity for immediate use. This level in general will conform to the applicable carrier rules and regulations and may be the supplier's commercial practice when such meets the requirement of this level.

6.5 Contract packaging and markings. The following marking requirements should be specified in the contract.

6.5.1 Markings.

6.5.1.1 Special markings. Marking of interior, intermediate and exterior containers should be in accordance with 49 CFR 171-178 and MIL-STD-129-1.

6.5.1.2 Normal marking. Unless otherwise specified in the contract or purchase order (see 6.2), the marking on the container should be as specified below. The specified markings should be applied to the containers in accordance with the applicable provisions of MIL-STD-129-1.

Inner Container Marking

(a) National Stock Number and DODIC
(b) Nomenclature: Generator, Gas Fire Extinguisher GGU-xx/A
(c) Drawing and dash number
(d) Quantity: one
(e) Lot number in accordance with MIL-STD-1168
(f) Warning: Cartridge Powered Device UN0276

Outer Container Marking

(a) National Stock Number and DODIC
(b) Nomenclature: Generator, Gas Fire Extinguisher GGU-xx/A
(c) Drawing Number
(d) Dash Number
(e) Quantity
(f) Lot Number in accordance with MIL-STD-1168
(g) Gross weight and Cube
(h) Contract or Purchase Order
(i) Warning: Cartridge Powered Device UN0276

6.5.1.3 Bar Coding. Unless otherwise specified in the contract or purchase order (see 6.2), the outer container should be bar coded in accordance with MIL-STD-129-1, Part 2. Additionally, the above specified marking information should be applied to the containers in accordance with the provisions of MIL-STD-129.

6.5.1.4 Explanation of terms. For the purpose of this specification, NAVSUPINST 4030.28B should be used to clarify terms.

6.6 Subject term (key word) listing.

Gas generator
Propellant
Initiator
Fire extinguisher

Preparing Activity:
Navy - OS
(Project 1377-0081)