

METRIC

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SUPERSEDING

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DETAIL SPECIFICATION

VALVE AND CYLINDER ASSEMBLIES, HALON 1301

This specification is approved for use within the US Army Tank-automotive and Armaments Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers three classes of fixed fire extinguishers, referred to herein as “extinguishers”, “valve and cylinder assemblies” and “assemblies”, and an electrically and manually actuated discharge valve, referred to herein as “discharge valve” and “valve”. These items are used with bromotrifluoromethane (Halon 1301) fire extinguishing systems in military vehicles (see 6.1 and 6.2).

1.2 Classification. The extinguishers will be of the following classes, as specified (see 6.2):

- Class 1 -A valve and cylinder assembly containing 2.27 kilograms (kg) [5 pounds (lb)] of Halon 1301 in a 2360 cubic centimeter (cm³) [144 cubic inch (in.³)] receiver cylinder.
- Class 2 -A valve and cylinder assembly containing 3.18 kg (7 lb) of Halon 1301 in a 3340 cm³ (204 in.³) receiver cylinder.
- Class 3 -A valve and cylinder assembly containing 4.54 kg (10 lb) of Halon 1301 in a 4720 cm³ (288 in.³) receiver cylinder.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-E/BLUE, Warren, MI 48397-5000, by using the Standardization Document Improvement Proposal (DD 1426) appearing at the end of this document or by letter.

ANSC N/A

FSC 4210

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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 requirement documents cited 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 supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

FEDERAL

BB-N-411 - Nitrogen, Technical.

DEPARTMENT OF DEFENSE

MIL-C-7905 - Cylinder, Steel, Compressed Gas, Non-Shatterable, Seamless, 1800 PSI and 2100 PSI.

STANDARDS

FEDERAL

FED-STD-595 - Colors Used in Government Procurement.

DEPARTMENT OF DEFENSE

MIL-STD-101 - Color Code for Pipelines and for Compressed Gas Cylinders.

MIL-STD-130 - Identification Marking of US Military Property.

MIL-STD-171 - Finishing of Metal and Wood Surfaces.

MIL-STD-810 - Environmental Test Methods and Engineering Guidelines.

MIL-STD-1246 - Product Cleanliness Levels and Contamination Control Program.

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- MS3112 - Connectors, Receptacle, Electric, Series 1, Box Mounting Flange, Bayonet Coupling, Solder Contact.
- MS3470 - Connectors, Receptacle, Electric, Series 2, Crimp Type, Narrow Flange Mount, Bayonet Coupling, Classes A, L, S and W.
- MS28889 - Valve, Air, High Pressure Charging, 5000 PSI.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia PA 1911-5094.)

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

DEPARTMENT OF TRANSPORTATION (DOT)

Code of Federal Regulations (CFR)

- Title 40 - Protection of Environment National Environmental Policy Act, Parts 1500-1508.
- Title 40 - Toxic Substances Control Act, Parts 702-775.
- Title 49 - Transportation, Shipping Container Specifications, Part 178.

(Copies of DOT regulations should be obtained from the Department of Transportation, Federal Highway Administration, Washington, DC 20591.)

DRAWINGS

ARMY

- 12273264 - Receiver Bottle.
- 12288691 - Plug, Anti-Recoil.
- 12288692 - Pin, Safety.
- 12295272 - Cylinder, Compressed Gas.
- 12314504 - Plate, Caution.
- 12314510 - Pressure Gauge, 0-1500 PSIG, Temperature Compensated/Coordinated.
- 12314511 - Receiver Bottle.
- 12343133 - Plug and Pin Assembly.
- 12343165 - Pin, Safety.
- 12370460 - Valve and Bottle Assembly.
- 12370477 - Valve Assembly.

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12376271	- Tag, Record.
2588282	- Tag, Marker.
5704998	- Repair Kit, Fire Extinguisher Valve Assembly.

(Copies of the above drawings are available from the U.S. Army Tank-automotive and Armaments Command, AMSTA-TR-E/BLUE, Warren, MI 48397-5000.)

2.3 Non-Government publications. 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 DoDISS cited in the solicitation. Unless otherwise specified, the issued of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D5632	- Standard Specification for Halon 1301, Monobromotrifluoromethane (CF ₃ Br).
ASTM G21	- Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

(Application for copies may be obtained from 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, supersedes 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 first article inspection in accordance with 4.1.1.

3.2 Materials. Materials shall be as specified herein and as specified in referenced specifications, standards and drawings. There shall be no adverse corrosion effects on materials or protective coatings from Halon 1301 and the minute quantities of water present in Halon 1301, nitrogen and ambient air. Materials, including elastomeric compounds, shall be suitable for use over an ambient temperature range of minus (-) 51 to 71 degrees Celsius (°C) [(-) 60 to 160 degrees Fahrenheit (°F)] without any temporary or permanent dimensional changes that could result in leakage at any temperature or over any thermal gradient within the temperature range specified. Static and dynamic seals, including gland design and mating sliding surfaces material selection, shall result in minimum dynamic seal(s) friction, negligible breakout frictional forces

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after short term or prolonged inoperation and zero stickslip characteristics of moving or sliding parts during the discharge valve opening process. Silicone seals shall not be used. Erosion of materials due to liquid and vapor flow shall be negligible and shall not wear through any protective or antifriction finish or coating. Elastomers which swell or contract when in contact with Halon 1301 shall not result in leakage or hinder operation at any ambient temperature or thermal gradient. Plastics that swell when in contact with Halon 1301, such as ethyl cellulose or cellulose acetate/butyrate, shall not be used. Materials that are soluble in Halon 1301 shall not be used (see 4.4.1).

3.2.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements and promotes economically advantageous life cycle costs.

3.2.2 Dissimilar metals. Contact between dissimilar metal parts within or anywhere on the extinguisher, which could encourage galvanic action, shall be avoided. Separation of dissimilar metals shall be accomplished by providing approved protective finishes, coatings or insulation between the mating materials and shall be in accordance with provision of MIL-STD-171, or equivalent, which address reduction of corrosion at intermetallic contact points. Corrosion-resistant materials shall be used whenever possible (see 4.4.1).

3.2.3 Environmental quality (see 4.4.1):

- a. The extinguisher shall have a Categorical Exclusion under Section 1508.4 of Title 40 CFR, Parts 1500-1508 by the Council of Environmental Quality.
- b. The extinguisher shall meet the requirements of Title 40 CFR, Subchapter R, Toxic Substance Control Act, Parts 702-775.

3.2.4 Extinguishing agent. The fire extinguishing agent, charged into the extinguisher, shall be bromotrifluoromethane (CBrF_3 , Halon 1301) conforming to ASTM D5632, or equivalent (see 4.4.1).

3.2.5 Nitrogen. The nitrogen used to superpressurize the extinguisher, after charging with Halon 1301, shall conform to BB-N-411, grade B, type 1, class 1, or equivalent (see 4.4.1).

3.3 Design and construction.

3.3.1 Discharge valve. The discharge valve shall be designed to safely contain and to electrically or manually discharge liquid and vaporous Halon 1301 which has been superpressurized with dry nitrogen to 5170 kilopascals (kPa) [750 pounds per square inch (psi)] at 21°C (70°F). It shall be designed for rapid opening and a high rate of expulsion (see 4.4.1).

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3.3.1.1 Configuration. The valve shall conform to the physical and dimensional requirements of Drawing 12370477. The discharge valve shall include a fill valve, an inlet and an outlet port, an inlet port vent, a safety relief device, a pressure gage, an extinguisher availability (charge and flow condition) signal device(s) and a standard electrical connector receptacle (see 4.4.1).

3.3.1.1.1 Fill valve. The fill valve for charging both Halon 1301 and nitrogen shall conform to MS28889-2, or equivalent (see 4.4.1).

3.3.1.1.2 Inlet port. The inlet port shall be externally threaded, and as specified on Drawing 12370477 (see 4.4.1).

3.3.1.1.2.1 Inlet port vent. The inlet port threaded connection shall incorporate a means to vent pressure within the extinguisher during valve removal. The vent shall be in accordance with Drawing 12370477. The venting shall occur while no less than four threads remain engaged (see 4.4.1).

3.3.1.1.3 Outlet port. The outlet port shall be internally threaded, and as specified on Drawing 12370477 (see 4.4.1).

3.3.1.1.4 Safety relief. The safety relief device shall be as specified on Drawing 12370477 (see 4.4.1).

3.3.1.1.5 Pressure gage. The pressure gage shall be a go-no-go temperature compensated/coordinated device conforming to Drawing 12314510 (see 3.4.1.4.2 and 4.4.1).

3.3.1.1.6 Availability signal. The availability signal device(s) shall inform the fire extinguishing system logic as to the availability of the extinguisher to be fired. The device(s) shall be wired in a circuit between connector receptacle pins (see 3.3.1.1.9.1) in accordance with table I and shall indicate whether extinguishant pressure is adequate and whether flow has been initiated (see 4.4.1).

3.3.1.1.7 Pressure signal. The pressure signal shall be provided by a pressure switch which, normally, shall be open at ambient pressure. The switch shall close during extinguisher charging and open when the extinguishant pressure has dropped as described in 3.4.1.4.3 (see 4.4.1).

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TABLE I. Availability signals and connector pin assignments.

Pin	Function	In/Out	Signal	Duration
A	<u>ACTIVATION SIGNAL AND CONTINUOUS CONTINUITY MONITOR.</u>	IN	16 V dc minimum 30 V dc maximum 10 A maximum for solenoid load impedance ≤ 0.9 ohms 1/ Quiescent condition: 5mA maximum	33 to 38 ms Continuous
B	<u>RETURN.</u>			
C	<u>PRESSURE/FLOW MONITOR.</u>	IN	High pressure and no flow-short to pin B Low pressure or flow-open circuit to pin B	Continuous
D	<u>UNUSED.</u>			
E	<u>UNUSED.</u>			

1/ Less than or equal to (<).

3.3.1.1.8 Flow signal. The flow signal shall be provided by a normally closed switch which shall open within 5 milliseconds (ms) from the time of valve opening or the start of Halon 1301 flow. The switch shall remain open until it is reset (manually, automatically, or by the extinguisher recharging). The switch shall remain open until the extinguishant pressure is below the pressure switch setting, when it may reset (see 4.4.1).

3.3.1.1.9 Electrical.

3.3.1.1.9.1 Connector receptacle. Electrical interface shall be through a MS3112 E14-5PN or MS3470 W14-5PN connector receptacle, or equivalents, as specified on Drawing 12370477. Pin assignments shall be as shown in table I (see 4.4.1).

3.3.1.1.9.2 Polarity. The valve shall operate with a negatively grounded two wire direct current electrical circuit (see 4.4.1).

3.3.1.1.9.3 Activation signal. The valve shall discharge upon receipt of a signal as specified in table I. The valve shall not be damaged by input currents up to 30 ampere (A) for a duration of 80 ± 20 ms (see 4.4.1).

3.3.2 Extinguisher. Each extinguisher shall consist of a valve (see 3.3.1), and a non-shatterable receiver bottle, filled with liquid and vaporous Halon 1301 and superpressurized to 5170 kPa (750 psi) at 21°C (70°F) with dry nitrogen. The extinguisher shall be designed for vehicle use mounted in a vertical position with the valve down (see 4.4.1).

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3.3.2.1 Configuration. The extinguisher shall conform to the physical and dimensional requirements of Drawing 12370460. The extinguisher shall be complete with an outlet port anti-recoil plug and a manual release lock. The receiver cylinder shall conform to the applicable drawing accordingly as follows:

Class 1	- 12295272
Class 2	- 12273264
Class 3	- 12314511

3.3.2.2 Dip or siphon tube. Unless otherwise specified (see 6.2), dip or siphon tubes shall not be used (see 4.4.1).

3.3.2.3 Receiver cylinder. The receiver cylinder shall meet the requirements of DOT 3A or 3AA of 49 CFR, Sections 178.36 or 178.37, and shall be tested according to the cited CFR and the non-shatterability requirements of MIL-C-7905, or equivalent. The receiver cylinder shall withstand a service pressure of 12 410 kPa (1800 psi) (see 4.4.1).

3.4 Operating requirements.

3.4.1 Discharge valve.

3.4.1.1 Manual discharge. The manual release mechanism shall open the valve and discharge the extinguishant in response to a force of 65 to 115 Newtons (N) [14.6 to 25.8 pound-force (lbf)] from a flexible cable or similar actuator. The mechanism shall function within the travel limits specified on Drawing 12370477. Clearance shall be provided within the valve envelope to allow both push and pull activation of the manual release lever. A means shall be provided whereby manual valve function may be locked by insertion of a safety pin release lock conforming to Drawing 12288692 or Drawing 12343165 (see 4.4.2.1.1).

3.4.1.2 Electrical release. The valve shall begin to discharge Halon 1301 within 10 ms after receiving the activation signal specified in 3.3.1.1.9.3 with 28 volt direct current (V dc) step input at room temperature, $25 \pm 8^{\circ}\text{C}$ ($77 \pm 14^{\circ}\text{F}$). The valve shall complete discharge of the liquid phase of Halon 1301 within the time limits of table II. After discharge, the residual agent content shall not exceed 1.5 percent (%) by weight of the initial charge. The residual pressure in the extinguisher shall not exceed 345 kPa (60 psi) at all temperatures between -51 and 71°C (-60 and 160°F). The valve shall operate at all voltages between 16 and 30 V dc (see 4.4.2.1.2 and 6.5.2).

TABLE III. Discharge time.

Extinguisher class	Maximum discharge time
1	135 ms
2	190 ms
3	270 ms

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3.4.1.3 Fragmentation. The valve shall not eject any solid metallic or nonmetallic fragments larger than 300 micrometers (μ m) (0.012 in.). The total number of ejected particles between 50 and 300 μ m (0.002 and 0.012 in.) shall not exceed the requirements of MIL-STD-1246, chart 1, level 300, or equivalent. Injury to personnel shall be of primary concern. Partial or complete blockage of discharge valve nozzles or distribution tubes shall not occur from ejected fragments (see 4.4.2.1.3).

3.4.1.4 Pressure.

3.4.1.4.1 Pressure relief device. The pressure relief device shall relieve extinguishant pressure at not less than 18 300 kPa (2660 psi) nor more than 20 700 kPa (3000 psi) (see 4.4.2.1.4.1).

3.4.1.4.2 Pressure indication device. When the extinguisher is initially filled with Halon 1301 and nitrogen as specified in 3.5.1.2, the pressure indicator device shall be in the green area within the ambient temperature range of -15°C (5°F) to 41°C (105°F) minimum, at pressures of 3680 kPa (520 psi) and 6240 kPa (705 psi), respectively. At ambient temperatures of -15°C (5°F), 21°C (70°F) and 41°C (105°F), the pressure indicator device shall be off and to the left of the green area at pressures of 3100 kPa (450 psi), 4830 kPa (700 psi) and 5760 kPa (835 psi), respectively. Where the indicator employs a pointer, the distance separating the pointer and the fixed or moving reference (green) shall not exceed 1 mm (0.04 in.). The pressure indicator shall not be damaged in any manner when tested to 20 700 kPa (3000 psi) (see 3.3.1.1.5 and 4.4.2.1.4.2).

3.4.1.4.3 Pressure switch. The pressure switch (see 3.3.1.1.7) shall automatically close during charging and shall open when the extinguishant pressure is reduced. The switch shall open as the pressure drops to between 2500 and 2200 kPa (363 and 319 psi) (see 4.4.2.1.4.3).

3.4.1.5 Flow indication device. The flow indication device shall indicate that a period of flow has occurred within 5 ms after the valve is open or extinguishant flow has been started. There shall be no flow indicator (see 3.3.1.1.8) prior to the beginning of extinguishant flow (see 4.4.2.1.5).

3.4.1.6 Quiescence. The discharge valve solenoid circuit and the pressure/flow circuit shall be capable of accepting continuity monitoring signals of 5 milliamperes (mA) continuously without valve activation. The resistance of both the solenoid and the pressure/flow circuits shall not exceed 8 ohms (see 4.4.2.1.6.1 and 4.4.2.1.6.2).

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3.4.2 Extinguisher.

3.4.2.1 Anti-recoil device. An anti-recoil device conforming to Drawing 12288691 shall be securely (wrench tight) installed in the outlet port of the extinguisher discharge valve. The +0.2-anti-recoil device shall be attached to the receiver cylinder neck with a ring and cable in accordance with Drawing 12343133. The anti-recoil device shall be removed from the outlet port of the valve after a safe and secure vehicle installation. No part of the extinguisher, when, discharged with the anti-recoil device installed, shall move more than 150 mm (6 in.) nor at a velocity that exceeds 40 millimeters per second (mm/s) [1.6 inches per second (in./s)] (see 4.4.2.2.1).

3.4.2.2 Manual release lock. The manual release lock, conforming to Drawing 1228692 or Drawing 12343165, shall be a permanent, non-active part of the extinguisher, stored on or in the valve assembly using a ring and cable in accordance with Drawing 12343133. The extinguisher shall be delivered with the manual release lock in the discharge-valve-closed position. With the manual release locked, there shall be no discharge of Halon 1301 from an extinguisher dropped from a height of 1 meter (m) (40 in.) (see 4.4.2.2.2).

3.4.2.3 Mechanical release. The extinguisher shall discharge the Halon 1301 extinguishing agent when a manual force between 65 and 115 N (14.6 and 25.8 lbf) is applied in-line and results in the maximum torque on the manual release shaft or arm. After discharge the residual Halon weight and pressure shall not exceed the limits specified in 3.4.1.2 (see 4.4.2.2.3 and 6.5.3).

3.4.2.4 Hydrostatic pressure. The extinguisher shall withstand hydrostatic pressure to 20 700 kPa (3000 psi) without damage or deformation. The extinguisher shall then meet the electrical release and mechanical release requirements after meeting the leakage requirements of 3.4.2.5 (see 4.4.2.2.4).

3.4.2.5 Leakage.

3.4.2.5.1 Filled extinguisher. An assembly, when charged with the proper weight of Halon 1301 and nitrogen as specified in table III, shall not have a leakage rate that exceeds 0.000145 standard cubic centimeters per second (cm^3/s) [0.000009 cubic inches per second ($\text{in.}^3/\text{s}$)] or 28 grams per year (1 ounce per year) (see 4.4.2.2.5.1).

3.4.2.5.2 Refilling extinguisher. Following a discharge of Halon 1301, the extinguisher shall be capable of being recharged with the proper weight of Halon 1301 and nitrogen specified in table III at any temperature between -40 and 43°C (-40 and 109°F). After charging at temperature extremes, the extinguisher pressure shall be 5170 ± 170 kPa (750 ± 25 psi) when returned to 19 to 21°C (66 to 70°F). The refilled extinguishers shall not leak in excess of that permitted in 3.4.2.5.1 (see 4.4.2.2.5.1 and 4.4.2.2.5.2).

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3.5 Interface requirements.3.5.1 Extinguisher.

3.5.1.1 Empty weight. The empty fire extinguisher shall have all components installed or placed on the weighing scale. This weight shall be the empty weight of the extinguisher and shall be placed, stamped or marked in a permanent manner on a caution plate conforming to Drawing 12314504 and in accordance with 3.6.2.2.3 (see 4.4.3.1.1).

3.5.1.2 Charged weight. The empty fire extinguisher of 3.5.1.1 shall be filled with the proper weight of Halon 1301 in accordance with table III and then supercharged with dry nitrogen to 5170 kPa (750 psi) at 21°C (70°F) (nitrogen weights are given for reference purposes only). The weights shall be marked in a permanent manner on the caution plate (see 4.4.3.1.2 and Drawing 12314504).

TABLE III. Extinguisher weight.

Class	Empty Weight (kg)	Weight of Halon 1301 (kg)		Weight of Nitrogen (kg)		Total charged weight (kg)	
1	W		+0.00		+0.025		+0.025
		2.27	-0.10	0.092	-0.000	W + 2.362	-0.100
2	X		+0.00		+0.032		+0.032
		3.18	-0.10	0.132	-0.000	X + 3.312	-0.100
3	Y		+0.00		+0.050		+0.050
		4.54	-0.10	0.184	-0.000	Y + 4.724	-0.100

3.6 Support and ownership requirements.3.6.1 Discharge valve.3.6.1.1 Repair parts and tools.

3.6.1.1.1 Repair parts kit. The valve shall be constructed to minimize repair parts and effort required to restore the valve to operational status following a discharge. If this effort requires installation of new parts, these parts shall be available in the form of a kit (see Drawing 5704998). Sealing materials shall not be silicone based or soluble in Halon 1301 (see 4.4.4.1.1).

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3.6.1.1.2 Special tools. The construction of the valve and components shall keep special tool requirements to a minimum. All special tools shall be identified as to use and also be available in kit form (see 4.4.4.1.1.1).

3.6.1.2 Maintainability. The mean time to repair (MTTR) the valve shall be not more than 0.5 hours when no rebuild kit is required or not more than 2 hours for a valve which requires a kit (see 4.4.4.1.2).

3.6.1.3 Nameplate. The discharge valve shall have a nameplate attached in a conspicuous location. The nameplate shall have the following minimum information:

- a. National Stock Number (NSN)
- b. Serial Number
- c. Manufacturer's Name or Identification Code
- d. Repair Kit NSN (if kit is required)

3.6.2 Extinguisher.

3.6.2.1 Reliability. The extinguisher shall be 90% reliable with 85% confidence to discharge as specified in 3.4.1.2 when activated electrically or mechanically (see 4.4.4.2.1).

3.6.2.2 Identification marking.

3.6.2.2.1 Receiver bottle. Required DOT markings, as shown on the applicable drawing, shall be plainly stamped as specified by DOT 3A or 3AA with the following:

- a. DOT-3AA1800 or DOT-3A1800, as applicable
- b. A serial number preceded by the letters "US"
- c. The code identification and Amy part numbers
- d. An identifying symbol (letter)

The symbol must be registered with the Bureau of Explosives.

Examples:

DOT-3AA1800		DOT-3A1800
US1234	or	US5678
19207-12273264		19207-12314511
X		Z

or

3AA1800-US1234-19207-12273264-X or DOT-3A1800-US5678-19207-12314511-Z
The inspector's official mark shall be placed near the serial number and date of inspection (as 9-83 for September 1983).

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3.6.2.2.2 Components. Components of the extinguisher shall be marked in accordance with MIL-STD-10 and DOT 3A or 3AA or equivalents, as applicable.

3.6.2.2.3 Caution plate. After marking, painting, and assembly with the valve, a caution plate shall be attached to the receiver bottle as shown on Drawing 12370460. The caution plate shall be in accordance with Drawing 12314504 and shall withstand the operating environmental conditions of 3.7. The empty weight of the extinguisher shall be marked as specified in 3.5.1.1. All other weights shall be within the limits of table II and marked as specified in 3.5.1.2

3.6.2.2.4 Tag. A fire extinguisher record tag (Drawing 2588282 or Drawing 12376271) shall be affixed (wired) to the bottle neck as shown on Drawing 12370460. The tag shall include actual filled weights as well as who filled the extinguisher, where the extinguisher was filled and when the extinguisher was filled.

3.6.2.3 Finish. Unless otherwise specified (see 6.2), all exterior surfaces, except connectors, ports, sliding and sealing surfaces and component interface shall be painted in accordance with manufacturers standard practice. The color of the topcoat shall conform to color chips 11136 or 11105 of FED-STD-595, or equivalent. If corrosion resistant steel is used, finish number 5.5.1 of MIL-STD-171, or equivalent, shall be substituted for the cleaning and pretreatment processes. The valve is excepted from this requirement if it is made of corrosion resistant steel or anodized aluminum. The receiver bottle shall be color coded and have exact agent identification in accordance with MIL-STD-101, or equivalent and Drawing 12370460 (see 4.4.4.2.3).

3.6.2.4 Interchangeability. The extinguisher shall be repairable, or functionally and physically interchangeable with respect to like assemblies, sub-assemblies and replaceable parts of the same type and design, regardless of the manufacturer (see 4.4.4.2.4).

3.7 Operating environment requirements. Each discharge valve and extinguisher shall operate under the following environmental conditions without degradation, damage, or loss of performance capabilities.

3.7.1 Discharge valve.

3.7.1.1 Fill temperature. The valve shall enable charging an extinguisher with the proper weight of Halon 1301 and nitrogen superpressure at any temperature between -40 and 43°C (-40 and 109°F) with subsequent external leakage limited to that specified in 3.4.2.5 (see 4.4.5.1.1).

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3.7.2 Extinguisher.3.7.2.1 Temperature.

3.7.2.1.1 High temperature. The extinguisher shall meet the requirements of 3.7 when soaked for a period of not less than 240 hours at temperatures up to 71°C (160°F) (see 4.4.5.2.1.1).

3.7.2.1.2 Low temperature. The extinguisher shall meet the requirements of 3.7 when soaked for a period not less than 240 hours at temperatures as low as -51°C (-60°F) (see 4.4.5.2.1.2).

3.7.2.1.3 Temperature shock. The extinguisher shall meet the requirements of 3.7 when exposed to rapid temperature changes between extremes of -51 and 71°C (-60 and 160°F) (see 4.4.5.2.1.3).

3.7.2.2 Vibration. The extinguisher shall meet the requirements of 3.7 when exposed to sinusoidal vibration applied along each of three really perpendicular axes in accordance with figure 1 (see 4.4.5.2.2).

3.7.2.3 Shock. The extinguisher shall meet the requirements of 3.7 when subjected to sawtooth shock pulses of 100 ± 10 g, with a duration of 11 ± 1.1 ms. The pulses shall be applied three times in both directions of three mutually perpendicular axes (see 4.4.5.2.3 and figure 2).

3.7.2.4 Water leakage.

3.7.2.4.1 Immersion. The extinguisher shall meet the requirements of 3.7 when immersed in water. There shall be no evidence of bubbles coming from within. The valve shall then meet the requirements of 3.4.1.2 without the benefit of drying after the immersion test (see 4.4.5.2.4.1).

3.7.2.4.2 Water jet. The extinguisher shall meet the requirements of 3.7 following exposure to a water jet cleaning spray condition (see 4.4.5.2.4.2).

3.7.2.5 Salt fog. The extinguisher shall meet the requirements of 3.7 and show no evidence of corrosion after prolonged exposure to a salt laden atmosphere (see 4.4.5.2.5).

3.7.2.6 Fungus. The extinguisher shall meet the requirements of 3.7 and shall show no evidence of microbiological growth that could adversely affect performance following prolonged exposure to an environment favorable to fungus growth for a period of 90 days (see 4.4.5.2.6).

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3.5.2.7 Sand and dust. The extinguisher shall withstand exposure to air driven sand and dust. It shall subsequently meet the requirements of 3.7 without any type of cleaning (see 4.4.5.2.7).

3.5.2.8 Humidity. The extinguisher shall meet the requirements of 3.7 when exposed to high humidity environments (see 4.4.5.2.8).

4. VERIFICATION

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

- a. First article inspection (see 4.1.1).
- b. Conformance inspections (CI) (see 4.1.2).
 1. Examination (see 4.2.2).
 2. Tests (see 4.2.3).

4.1.1 First article inspection. Unless otherwise specified, first article samples shall consist of four valves or four extinguishers, as specified (see 6.2), when a first article sample is required. Each extinguisher shall consist of a valve and a cylinder of the class specified (see 1.2 and 6.2). When valves only are specified they shall be subjected to testing with cylinders as complete extinguishers. Approval of the first article sample by the Government shall not relieve the contractor of his obligation to supply parts that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

4.2 Conformance inspection. Conformance inspection shall include the examinations of 4.2.2 and the tests of 4.2.3.

4.2.1 Sampling. Sampling shall be as specified in the contract or order (see 6.2).

4.2.2 Examination. Each valve and extinguisher selected in accordance with 4.2.1 shall be subjected to the examinations specified in table IV. Failure of any examination shall be cause for rejection.

4.2.3 Tests. Each valve and extinguisher shall be subjected to the tests specified in table IV. Failure of any test shall be cause for rejection.

4.3 Verification methods. Acceptable verification methods included in this section are visual inspection, measurement, sample tests, full-scale demonstration tests, simulation, modeling, engineering evaluation, component properties analysis, and similarity to previously-approved or previously-qualified designs.

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4.3.1 Verification alternatives. The manufacturer may propose alternative test methods, techniques, or equipment, including the application of statistical process control, tool control, or cost effective sampling procedures to verify performance. See the contract for alternatives that replace verification methods required by this specification.

4.3.2 Verification conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

- a. Air temperature: $23 \pm 10^{\circ}\text{C}$ ($73 \pm 18^{\circ}\text{F}$).
- b. Barometric pressure: 96.66 (+6.67, -10) kPa (28.5 (+2, -3) in. of mercury).
- c. Relative humidity: $50 \pm 30\%$.

4.3.2.1 Voltage setting. For all tests, the input voltage shall be supplied. By batteries (16 to 30 V dc), or a variable power supply of 30 A minimum current capacity, as specified herein or as appropriate.

Table IV. Classification of inspections.

Title	Require- ment	Inspect- ion	First article sample				CI	
			1	2	3	4	Examination	Tests
Materials	3.2 thru 3.2.5	4.4.1	X					
Design and construction	3.3 thru 3.3.2.3	4.4.1	X					
Operating requirements	3.4	4.4.2						
Manual discharge	3.4.1.1	4.4.2.1.1	X					
Electrical release	3.4.1.2	4.4.2.1.2	X	X	X	X		
Fragmentation	3.4.1.3	4.4.2.1.3						
Pressure	3.4.1.4	4.4.2.1.4						
Pressure relief device	3.4.1.4.1	4.4.2.1.4.1	X	X				
Pressure indication device	3.4.1.4.2	4.4.2.1.4.2	X	X				
Pressure switch	3.4.1.4.3	4.4.2.1.4.3	X	X	X	X		
Flow indication device	3.4.1.5	4.4.2.1.5	X	X	X	X		
Quiescence	3.4.1.6	4.4.2.1.6	X	X	X	X		X
Anti-recoil device	3.4.2.1	4.4.2.2.1	X	X	X	X	X	X
Manual release lock	3.4.2.2	4.4.2.2.2	X	X			X	X
Mechanical release	3.4.2.3	4.4.2.2.3	X	X	X	X		
Hydrostatic pressure	3.4.2.4	4.4.2.2.4	X	X				
Leakage	3.4.2.5	4.4.2.2.5						
Filled extinguisher	3.4.2.5.1	4.4.2.2.5.1	X	X	X	X		X
Refilling extinguisher	3.4.2.5.2	4.4.2.2.5.2						

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Table IV. Classification of inspections - Continued.

Title	Requirement	Inspection	First article sample				CI	
			1	2	3	4	Examination	Tests
Interface requirements	3.5	4.4.3						
Empty weight	3.5.1.1	4.4.3.1.1						
Charged weight	3.5.1.2	4.4.3.1.2						
Support and ownership requirements	3.6	4.4.4						
Repair parts kit	3.6.1.1.1	4.4.4.1.1.1						
Special tools	3.6.1.1.2	4.4.4.1.1.2						
Maintainability	3.6.1.2	4.4.4.1.2	X	X				
Nameplate	3.6.1.3	4.4.4.1.3						
Reliability	3.6.2.1	4.4.4.2.1			X	X		
Identification marking	3.6.2.2	4.4.4.2.2						
Receiver bottle	3.6.2.2.1	4.4.4.2.2						
Components	3.6.2.2.2	4.4.4.2.2						
Caution plate	3.6.2.2.3	4.4.4.2.2						
Tag	3.6.2.2.4	4.4.4.2.2						
Finish	3.6.2.3	4.4.4.2.3					X	
Interchangeability	3.6.2.4	4.4.4.2.4					X	
Operating environment requirements	3.7	4.4.5						
Fill temperature	3.7.1.1	4.4.5.1.1			X	X		
Temperature	3.7.2.1	4.4.5.2.1			X	X		
High temperature	3.7.2.1.1	4.4.5.2.1.1			X	X		
Low temperature	3.7.2.1.2	4.4.5.2.1.2			X	X		
Temperature shock	3.7.2.1.3	4.4.5.2.1.3			X	X		
Vibration	3.7.2.2	4.4.5.2.2			X	X		
Shock	3.7.2.3	4.4.5.2.3			X	X		
Water leakage	3.7.2.4	4.4.5.2.4						
Immersion	3.7.2.4.1	4.4.5.2.4.1			X	X		
Water jet	3.7.2.4.2	4.4.5.2.4.2			X	X		
Salt fog	3.7.2.5	4.4.5.2.5			X	X		
Fungus	3.7.2.6	4.4.5.2.6	X	X				
Sand and dust	3.7.2.7	4.4.5.2.7			X	X		
Humidity	3.7.2.8	4.4.5.2.8			X	X		

4.3.2.2 Test temperature stabilization. Tests shall be conducted after the test sample has been allowed sufficient time for temperature stabilization. Test temperature stabilization is the point at which the test sample has not varied in temperature more than 2°C (3.6°F) per hour.

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4.3.2.3 Mounting of the extinguisher during testing. During testing, except where otherwise specified herein, the extinguisher shall be mounted using metal straps, bolted clamps, or brackets to withstand an impulse load of 4500 N (1000 lbf) at 21°C (70°F) during discharge. No twisting, rotation or bending of the extinguisher or mounting hardware shall be allowed.

4.4 Methods of inspection.

4.4.1 Materials, design, and construction. Conformance to 3.2 through 3.3.2.3 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements specified herein. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certification, industry standards, test reports, and rating data.

4.4.2 Operating requirements verification.

4.4.2.1 Discharge valve.

4.4.2.1.1 Manual discharge. Using one or more of the methods outlined in 4.3 or 4.3.1, verify that the manual discharge is properly installed and present within the discharge valve. Visually inspect that the manual discharge provides clearance within the valve envelope to allow both push and pull activation of the manual release lever.

4.4.2.1.2 Electrical release. To determine conformance to 3.4.1.2, the extinguisher shall be set up in accordance with figure 4 at room temperature, $25 \pm 8^\circ\text{C}$ ($77 \pm 14^\circ\text{F}$). Upon being electrically actuated by a 28 V dc step input, the valve shall begin to discharge the Halon 1301 within 10 ms after receiving the activation signal specified in 3.3.1.1.9.3 across the terminals of the discharge valve. The valve shall complete the discharge of the liquid phase of Halon 1301 within the time limits specified in table II. Voltage and current draw shall be recorded. This test shall be repeated with inputs of 30 and 16 V dc. A check for residual Halon weight and pressure shall then be made.

4.4.2.1.3 Fragmentation. To determine conformance to 3.4.1.3, the extinguisher shall be electrically activated, as specified in 3.3.1.1.9.3, and all resulting fragments shall be collected. The fragments shall be sized and counted using a procedure capable of measuring and counting all fragments larger than 40 micrometers (0.0016 in.).

4.4.2.1.4 Pressure.

4.4.2.1.4.1 Pressure relief device. To determine conformance to 3.4.1.4.1, the modified extinguisher of 4.4.2.4 shall be used. The Pressure relief device shall be installed in the valve and the extinguisher filled with test liquid. Pressure shall be increased until the relief device opens

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[not less than 18 300 kPa (2650 psi) or, more than 20 700 kPa (3000 psi)]. The pressure shall be recorded.

4.4.2.1.4.2 Pressure indication device. To determine conformance to 3.4.1.4.2, the following tests shall be conducted. The procedures of 4.6.2.4 shall be followed except that the pressure indicator shall be installed and the pressure maintained at 20 700 kPa (3000 psi) for at least five seconds. The pressure indicator shall not be damaged, and the pointer, (if used) shall not be bent. Pressure shall then be returned to ambient. The extinguisher shall be drained and dried, without cooling, by use of clean filtered air or nitrogen to remove residual moisture. The extinguisher shall be rebuilt and instrumented with a master pressure gage. The extinguisher shall be pressurized with nitrogen and cold soaked at 16°C (5°F) until the temperature stabilizes as specified in 4.3.2.2. Nitrogen shall be released through the fill or vent valve until the pressure reaches 3580 kPa (620 psi). The process shall be repeated at all pressures and temperatures specified in 3.4.1.4.2.

4.4.2.1.4.3 Pressure switch. To determine conformance to 3.4.1.4.3, the valve shall be installed on an instrumented cylinder and a charge shall be applied. At ambient pressure the switch shall be in a normally open position and shall close during charging. Slowly release the charge through the fill or vent valve and monitor the extinguisher pressure. As the charge is released, the switch shall open between 2500 and 2200 kPa (363 and 319 psi). The pressure recession curve shall be as indicated in figure 3.

4.4.2.1.5 Flow indication. To determine conformance to 3.4.1.5, the extinguisher shall be set up as shown in figure 4. The extinguisher shall be activated by applying a 30 V dc stop input across the terminals of the discharge valve. Upon discharge, the flow indication device shall open a normally closed circuit. A steady state flow indication signal shall be provided within 5 ms after opening of the valve or the beginning of extinguishant flow. There shall be no flow indication prior to the beginning of extinguishant flow or opening of the valve. This test shall be repeated 16 V dc and may be conducted concurrently with the test of 4.4.2.1.2.

4.4.2.1.6 Quiescence.

4.4.2.1.6.1 Quiescent/continuity/resistance. To determine conformance to 3.4.1.6, the resistance in the valve solenoid circuit and in the pressure/flow circuit shall be measured using a current of less than 5 mA. The resistance shall not exceed 8 ohms.

4.4.2.1.6.2 Continuity/checkout current. To determine conformance to 3.4.1.6, the valve shall be set up according to figure 5. For qualification testing the discharge valve shall be set up to take a continuous current flow of 5 mA for not less than 240 hours without activation. This test may run concurrently with 4.4.5.2.1.1. For quality chance the duration of this test shall be 15 to 30 seconds.

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4.4.2.2 Extinguisher.

4.4.2.2.1 Anti-recoil device. To determine conformance to 3.4.2.1, the extinguisher, with the anti-recoil device securely installed in the valve and the manual release locked in the closed position, shall be electrically actuated while laying-unrestrained on a flat table or floor. No part of the extinguisher shall move more than 150 mm (6 in.) total nor at a velocity that exceeds 40 mm/s (1.6 in./s). The test shall be repeated at least 3 times, each test on a different extinguisher.

4.4.2.2.2 Manual release lock. To determine conformance to 3.4.2.2, the extinguisher, with the anti-recoil device installed and the manual release locked in the valve-closed position, shall be dropped on a 50 mm (2-in.) thick plywood floor (backed by steel) from a height of 1 m (40 in.) so that the manual release lever strikes the floor. There shall be no discharge of Halon 1301 as the result of this action.

4.4.2.2.3 Mechanical release. To determine conformance to 3.4.2.3, the extinguisher shall be mounted rigidly. Remove the anti-recoil device and disconnect the manual release lock from the extinguisher. Using a load cell or push-pull scale and applying a force slowly, record the force that is required to activate the valve. The manual force required to discharge the Halon 1301 shall be between 65 and 115 N (14.6 and 25.8 lbf) when applied in-line, resulting in maximum torque on the manual release shaft or arm. A check for residual Halon weight and pressure shall then be made.

4.4.2.2.4 Hydrostatic pressure. To determine conformance to 3.4.2.4, the manual release shall be locked in the valve-closed position. The pressure relief device, pressure indicator, main piston or poppet (if necessary), and internal parts that may be damaged by hydrostatic testing shall be removed and replaced with sealing plugs. An extinguisher shall be fitted with a hand pump and faster pressure gage and filled with alcohol or other test liquid which has the following properties: Low volatility, self-evaporating, noncorrosive, nontoxic, and not damaging to seals. The test liquid shall be pumped into the extinguisher so that both the inlet and outlet portions of the valve are subjected to 20 700 kPa (3000 psi). The pressure shall be maintained at 20 700 kPa (3000 psi) for at least 5 minutes and then released. The discharge valve shall be disassembled from the receiver bottle and thoroughly dried, without cooling, by use of clean filtered air or nitrogen to remove residual moisture. Inspect the valve and compare it to Drawing 12370477. Removed parts shall be replaced. The discharge valve shall be mounted to an instrumented receiver bottle, filled with extinguishant and nitrogen, and tested in accordance with 4.4.2.5.1 and 4.6.1.2.

4.4.2.2.5 Leakage.

4.4.2.2.5.1 Filled extinguisher. To determine conformance to 3.4.2.5.1, upon receipt of a shipment of extinguishers, the total weight of each extinguisher shall be compared to the total weight indicated on the tag attached to the receiver bottle neck. The date on the tag shall be used

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to establish that loss of weight does not exceed $0.000145 \text{ cm}^3/\text{s}$ ($0.000009 \text{ in.}^3/\text{s}$) or 28 grams per year (1 ounce per year). Units weighing less than permitted shall be returned to the manufacturer for correction of defect(s). If sufficient time has not passed to accurately determine the leakage rate, a commercial leak detector or precision weighing method shall be used to determine leakage rate.

4.4.2.2.5.2 Refilling extinguisher.

4.4.2.2.5.2.1 Low temperature refilling. To determine conformance to 3.4.2.5.2, an empty extinguisher and the refill kit being used to charge the extinguisher shall be allowed to soak at -51°C (-60°F) for 24 hours or until the temperature of the extinguisher and the refill kit stabilizes as specified in 4.3.2. Increase the temperature to -40°C (-40°F) and soak for 4 hours. Transfer the appropriate weights of Halon 1301 and nitrogen (compensating for weight of frost formation) as specified in table II into the empty extinguisher from the kit. Return the extinguisher to 19 to 21°C (66 to 70°F) and allow it to stabilize at which time the pressure shall be $5170 \pm 170 \text{ kPa}$ ($750 \pm 25 \text{ psi}$). The total weight and the leakage rate shall be measured and shall meet the requirements of 3.4.2.5.2 and table III.

4.4.2.2.5.2.2 High temperature refilling. To determine conformance to 3.4.2.5.2, an empty extinguisher and the refill kit being used to charge the extinguisher shall be allowed to soak at 51°C (124°F) for 24 hours or until the temperature of the extinguisher and the refill kit stabilizes as specified in 4.3.2. Decrease the temperature to 43°C (109°F) and soak for 4 hours. Transfer the appropriate weights of Halon 1301 and nitrogen (compensating for weight of condensation) as specified in table II into the empty extinguisher from the kit. Return the extinguisher to 19 to 21°C (66 to 70°F) and allow it to stabilize at which time the pressure shall be $5170 \pm 170 \text{ kPa}$ ($750 \pm 25 \text{ psi}$). The total weight and the leakage rate shall be measured and shall meet the requirements of 3.4.2.5.2 and table III.

4.4.3 Interface requirements verification.

4.4.3.1 Extinguisher.

4.4.3.1.1 Empty weight. The extinguisher shall be weighed using a scale when all of the components are properly installed within the extinguisher and prior to the filling of the proper weight of Halon 1301.

4.4.3.1.2 Charged weight. The extinguisher shall be weighed using a scale when all of the components are properly installed within the extinguisher and when the proper weight of Halon 1301 has been filled.

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4.4.4 Support and ownership requirements verification.4.4.4.1 Discharge valve.4.4.4.1.1 Repair parts and tools.

4.4.4.1.1.1 Repair parts kit. Verify the presence of the repair parts kit within the construction of the discharge valve through visual inspection.

4.4.4.1.1.2 Special tools. Verify that all special tools shall be identified as to use and be available in kit form as specified within 4.4.4.1.1.1.

4.4.4.1.2 Maintainability. To determine conformance to 3.6.1.2, the MTTR shall be demonstrated by 10 consecutive trial rebuilds (restored to a condition of complete operability without leakage exceeding the requirements of 3.4.2.5) of the extinguisher.

4.4.4.1.3 Nameplate. Verify the presence of the required nameplates as specified within (section 3) on the discharge valve. After performing all environmental tests in 4.9, re-inspect the valve nameplates for readability.

4.4.4.2 Extinguisher.

4.4.4.2.1 Reliability. To determine conformance to 3.6.2.1, the extinguisher shall be discharged 20 times without failure and without rebuild. The 20 discharges shall consist of not less than 12 electrical activations and not lose than 4 mechanical activations. The extinguisher shall then meet the leakage requirements of 3.4.2.5. Discharging the extinguisher before, during and after any of the tests specified in section 4 shall be counted toward the 20 discharges.

4.4.4.2.2 Identification marking. Verify the presence of the required markings on all of the components within the extinguisher and the extinguisher itself. After performing the environmental tests within 4.4.5, re-inspect the markings for readability.

4.4.4.2.2.3 Finish. Using one or more of the methods outlined in 4.3 or 4.3.1, verify that the extinguisher and its components shall be painted in accordance with the manufacturers standard practice, and the color of the topcoat shall conform to the specified standards.

4.4.4.2.4 Interchangeability. Use one or more of the methods outlined in 4.3 or 4.3.1 to verify the interchangeability of like parts.

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4.4.5 Operating environment requirements verification.4.4.5.1 Discharge valve.

4.4.5.1.1 Fill temperature. To determine conformance to 3.7.1.1, the extinguisher shall be filled at extreme temperatures in accordance with procedures of 4.4.2.2.5.2.1 for low temperature and 4.4.2.2.5.2.2 for high temperature refilling.

4.4.5.2 Extinguisher.4.4.5.2.1 Temperature.

4.4.5.2.1.1 High temperature. To determine conformance to 3.7.2.1.1 the extinguishers shall be subjected to the following tests. The extinguishers shall be placed in an oven and thermally stabilized for 24 hours at 71°C (160°F). The continuity circuit may be outside of the oven. The extinguisher shall be maintained at 71°C (160°F) for a period of not less than 240 hours. Voltage across each valve shall be recorded continuously for indication of any false alarm (see 6.5.5). The oven's internal temperature shall also be recorded. The pressure indicator reading of the extinguishers shall be checked and any change in position noted once each working day. At the conclusion of the 240 hour soak test the extinguisher shall meet the requirements for leakage as specified in 3.4.1. Following the leakage test one extinguisher shall be electrically actuated and one extinguisher shall be manually actuated while at 66 to 71°C (151 to 160°F).

4.4.5.2.1.2 Low temperature. To determine conformance to 3.7.2.1.2. the extinguishers shall be placed in a low temperature test chamber. All the test conditions of 4.4.5.2.1.1 apply to this test except the temperature shall be maintained at -51°C (-60°F). The extinguisher shall be allowed to thermally stabilize for 24 hours and soak for not less than 240 hours. At the conclusion of the soak the extinguishers shall meet the requirements for leakage as specified in 3.4.1. One extinguisher shall then be electrically actuated and the other extinguisher shall be manually actuated while at -46 to -61°C (-51 to -60°F).

4.4.5.2.1.3 Temperature shock. To determine conformance to 3.7.2.1.3, the extinguishers shall be put through three high temperature to low temperature cycles as described below. The instrumentation requirements shall be identical to the preceding paragraph as to type(s) and locations. The extinguishers shall be exposed to an ambient temperature of $26 \pm 8^\circ\text{C}$ ($77 \pm 14^\circ\text{F}$) for no more than 5 minutes during transfer between chambers. The procedures of 4.4.5.2.1.1 and 4.4.5.2.1.2 apply except:

- Step 1. The extinguishers and appropriate cables shall be placed in an oven preheated to 71°C (160°F) and maintained for 24 ± 2 hours.

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- Step 2. Immediately following step 1, the extinguishers shall be transferred to a precooled low temperature chamber and maintained at -51°C (-60°F) for a period of 24 ± 2 hours.
- Step 3. Repeat step 1.
- Step 4. Repeat step 2.
- Step 5. Repeat step 1.
- Step 6. Repeat step 2. At the conclusion of step 6 the extinguisher shall be returned to ambient temperature. The extinguishers shall be allowed to thermally stabilize and subsequently pass the test specified in 4.4.5.

4.4.5.2.2 Vibration. To determine conformance to 3.7.2.2, the extinguisher shall be mounted in its production installation configuration or equivalent. With the manual release unlocked, the extinguisher shall be connected to the instrumentation necessary for this test. The vibration acceleration level shall be in accordance with figure 1, applied in 15 minute sweep times in accordance with figure 7. Resonant search and dwell of 30 minutes at each of the four most severe resonant frequencies shall be part of the total cycle time of 3 hours. The discharge valve shall have a continuous 5 mA continuity check during vibration testing.

4.4.5.2.3 Shock. To determine conformance to 3.7.2.3, the extinguisher shall be mounted in its production installation configuration or equivalent and exposed to the shock pulse defined in 3.6.3, three times in each direction of three mutually perpendicular axes. A continuous electrical continuity check shall be conducted before, during and after the test.

4.4.5.2.4 Leakage.

4.4.5.2.4.1 Immersion. To determine conformance to 3.7.2.4.1, the extinguisher shall be tested in accordance with one of the following procedures. Bubbles coming from within the extinguisher shall be considered leakage; however, bubbles which result from trapped air on exterior surfaces shall not be considered leakage. The extinguisher shall subsequently pass the tests specified 4.4.5.

- a. The extinguisher shall be submerged in water so that the uppermost part of the extinguisher is 50 ± 25 mm (2 ± 1 in.) below the surface. The temperature of both the water and extinguisher shall be $23 \pm 10^{\circ}\text{C}$ ($73 \pm 18^{\circ}\text{F}$). The initial air pressure above the water shall be 250 mm Hg (9.8 in. Hg) absolute and maintained for 1 minute or until air bubbles substantially cease to be given off by the liquid which ever is the longer time. The air pressure above the liquid shall then be increased to 280 mm Hg (11 in. Hg) absolute and maintain for 60 minutes.
- b. The extinguisher shall be tested in accordance with the procedures of MIL-STD-810, method 512.2, procedure I. The extinguisher shall be heated 27°C above the water temperature of $23 \pm 10^{\circ}\text{C}$ ($73 \pm 16^{\circ}\text{F}$) and submerged to a depth of 1 m (39.4 in.).

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4.4.5.2.4.2 Water jet. To determine conformance 3.7.2.4.2, the extinguisher shall be exposed to a cleaning spray condition consisting of a water jet. The surface shall be cleaned at a rate of 3.3 square centimeters per second (cm^2/sec) (0.5 square inch per second) ($\text{in.}^2/\text{sec}$). The water jet shall be derived from a nozzle having a maximum orifice diameter of 6.4 mm (0.3 in.) and a minimum nozzle pressure of 350 kPa (50 psi). Following exposure the extinguisher shall pass the test of 4.4.2.1.6.

4.4.5.2.5 Salt fog. To determine conformance to 3.7.2.5, the extinguisher shall be subjected to the tests of MIL-STD-810, method 509.2, except the test duration shall be 200 hours. The extinguisher shall subsequently pass the tests specified in 4.4.5.

4.4.5.2.6 Fungus. To determine conformance to 3.7.2.6, the extinguisher shall be subjected to fungal incubation as specified in ASTM G21 for a period of 90 days. The extinguisher shall not demonstrate a susceptibility to fungal growth that could cause its operation to fall outside the performance limits specified herein. The extinguisher shall subsequently pass the tests specified in 4.4.5 without cleaning.

4.4.5.2.7 Sand and dust. To determine conformance to 3.7.2.7, an extinguisher with connector attached shall be tested in accordance with MIL-STD-810, method 510.2, procedure I. The extinguisher shall be rotated so that openings on the valve, such as vent ports, receive equal blast time with the connectors. The high temperature portion of testing shall be conducted at 71°C (160°F). The extinguisher shall subsequently pass the tests specified in 4.4.5 without cleaning.

4.4.5.2.8 Humidity. To determine conformance to 3.7.2.8, the extinguisher shall pass the tests of 4.4.2.1.6 during and after exposure to warm, high relative humidity in accordance with the applicable conditioning procedure for ground electronic equipment of MIL-STD-810, method 507.2. After conditioning, the extinguisher shall be exposed to five continuous 48 hour cycles in accordance with figure 8. Prior to post exposure operation the extinguisher shall be conditioned at $23 \pm 3^\circ\text{C}$ ($73 \pm 6^\circ\text{F}$) and $50 \pm 10\%$ relative humidity for 24 hours.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or 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 of Defense Agency or within the Military 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.

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6. NOTES

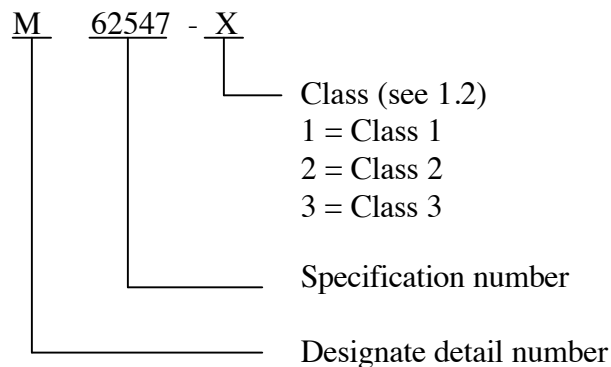
(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The extinguishers and valves covered by this specification are intended for use in military ground combat and tactical vehicles [such as the M992 Field Artillery Ammunition Support Vehicle (FAASV)]. Fire extinguishing protection will be afforded personnel areas, open areas and other compartments such as engine or ammunition storage spaces where there exists a potential danger of hydrocarbon fires. The dangers of detonation, deflagration and unobserved slow growth fires are due to the presence of highly combustible fuels, liquid hydrocarbons or flammable debris. The extinguisher will be operated manually or automatically in conjunction with an optimal or thermal fire sensing system. The extinguishers and valves are military unique because they have to operate in a temperature range between -51 to 71°C (-60 to +160°F).

6.2 Acquisition documents. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. If extinguisher or valves will be furnished (see 1.1).
- c. The class of extinguishers to be furnished (see 1.2).
- d. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2 and 2.3).
- e. When first article is required (see 3.1).
- f. If a dip or siphon tube will be permitted (see 3.3.2.2).
- g. Special finish requirements, if other than as specified (see 3.6.2.3).
- h. Sampling (see 4.2.1 and 6.5.4).
- i. Inspection conditions, if other than as specified (see 4.3.2).
- j. Packaging requirements (see 5.1).

6.3 Part identification number (PIN). The pin to be used for valves acquired to this specification are created as follows:



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6.4 Subject term (key word) listing.

Bromotrifluoromethane
CF₃Br
Extinguishing system
Fire extinguisher
Fire sensing system

6.5 Definitions.

6.5.1 Extinguisher. For testing purposes the term extinguisher as used in this specification includes the valve and cylinder assembly as shown on Drawing 12370460, or an equivalent.

6.5.2 Electrical. The extinguisher is actuated by an electrical signal as defined in table I.

6.5.3 Mechanical. The extinguisher is manually actuated by entirely mechanical means when there is an electrical malfunction or when electrical power is not available.

6.5.4 Sample. An extinguisher (one valve and a fully charged cylinder) in accordance with Drawing 12370460 or valve in accordance with Drawing 12370477, as specified (see 6.2).

6.5.5 False alarm. The extinguisher discharges its contents of Halon 1301 and nitrogen without receiving an electrical activation signal or being manually activated.

6.5.6 Pressures. All pressures cited in this specification are gage unless otherwise specified.

6.5.7 Solid waste. "Solid waste" means (a) any garbage, refuse, or sludge from waste treatment plant, water supply treatment plant, or air pollution control facility; and (b) other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Clean Water Act, (33 U.S.C. 1342 et seq.), or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) (Source: Federal Acquisition Regulations, section 23.402).

6.6 Laboratory safety precautions.

6.6.1 Halon 1301 exposure. Unnecessary exposure of personnel to either the natural agent, or to the decomposition products (due to heat) of Halon 1301 should be avoided. A ventilation blower should be turned on, and doors and windows open during testing.

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6.6.2 Noise. During testing, hearing protection should be worn at all times or the tests should be conducted in an unoccupied noise insulated test chamber, cell or room.

6.6.3 Cold temperature affects. Direct or indirect contact with Halon 1301 extinguishing agent being discharged can cause frostbite burns. Personnel should avoid positioning any part of the body in the agent discharge path.

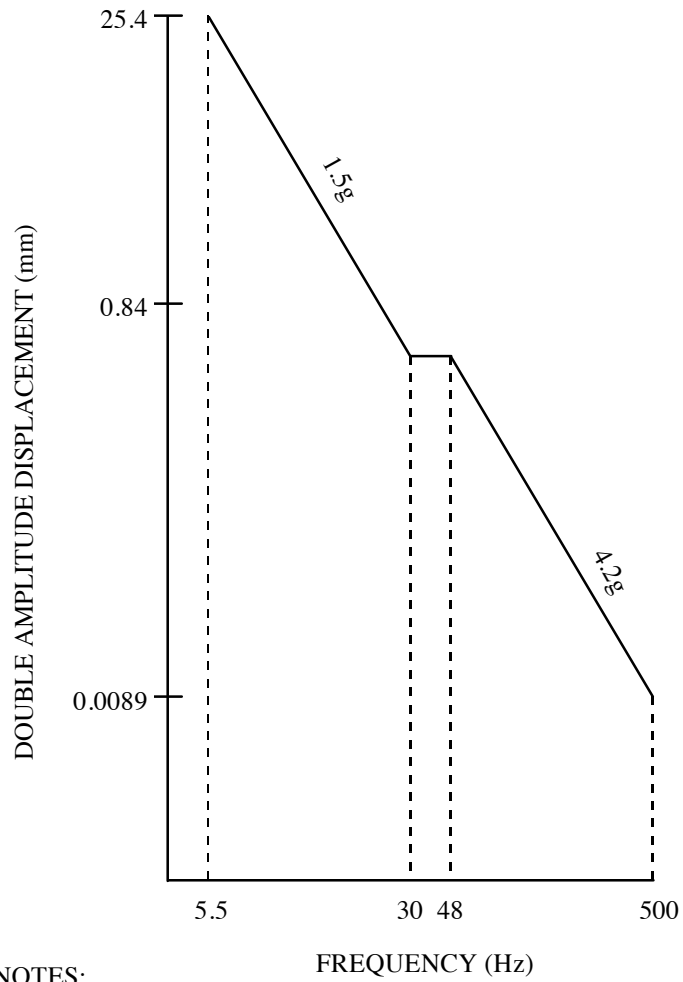
6.6.4 Receiver cylinder.

- a. Mounting (see 4.3.3).
- b. Removing. The extinguisher can be accidentally discharged if the anti-recoil plug is not installed and the manual release is not locked prior to loosening the extinguisher from its mounting. Such a discharge will turn the extinguisher into an uncontrolled projectile capable of serious personnel injury and property damage.

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

6.8 Supersession data. This specification supersedes MIL-V-62547B(AT), 11 November 1996. The original source document which formed the basis for this specification was ATPD 2071, Edition 6, revision A, dated 29 February 1984.

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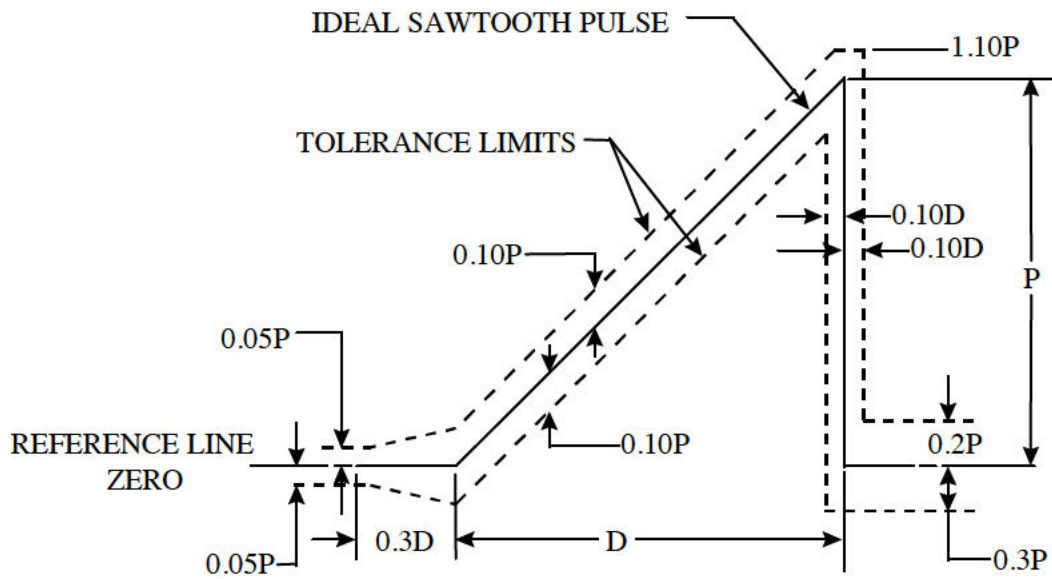


NOTES:

1. Hertz (Hz).
2. Gravity units (g).

FIGURE 1. Vibration test curve.

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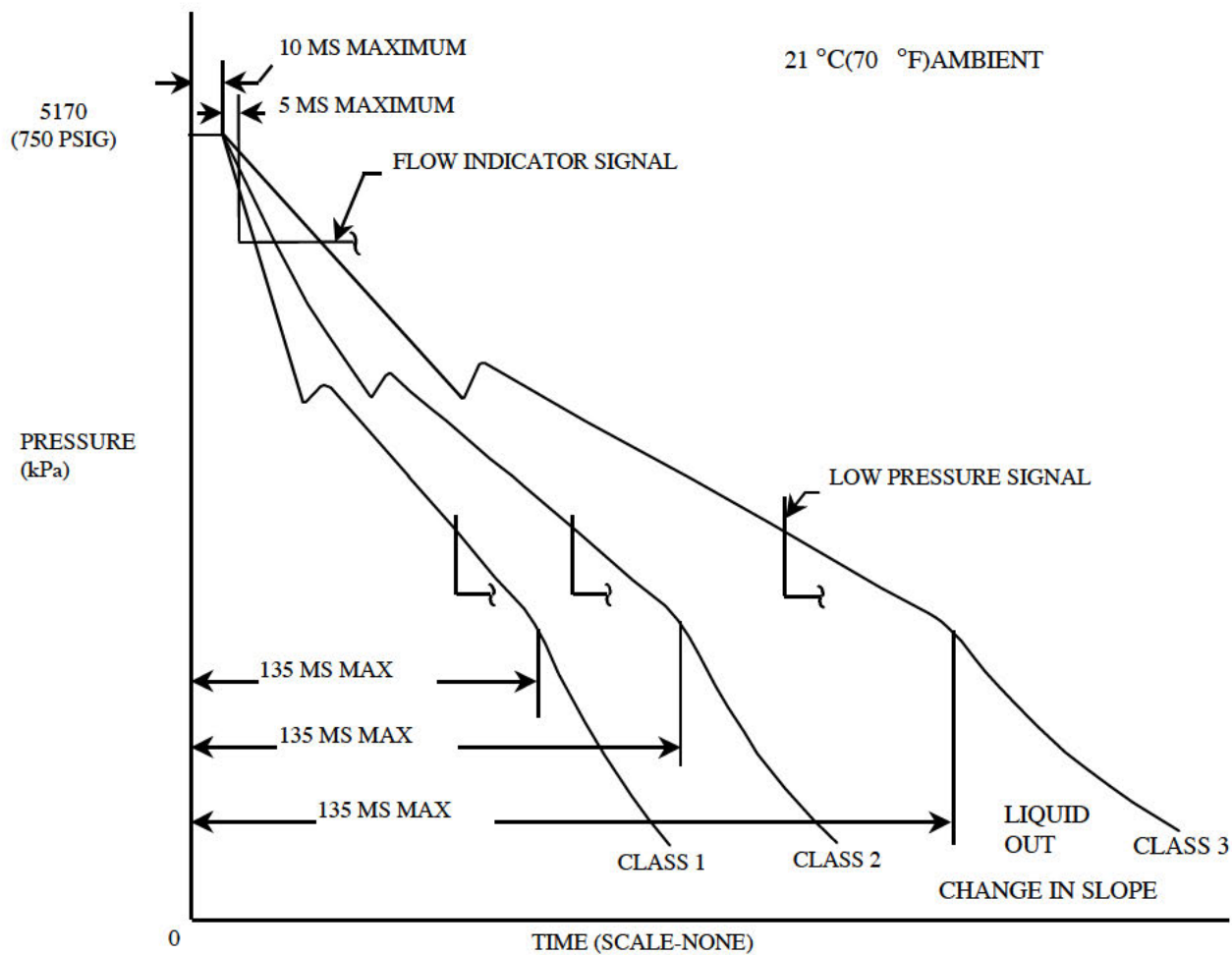


NOTE:

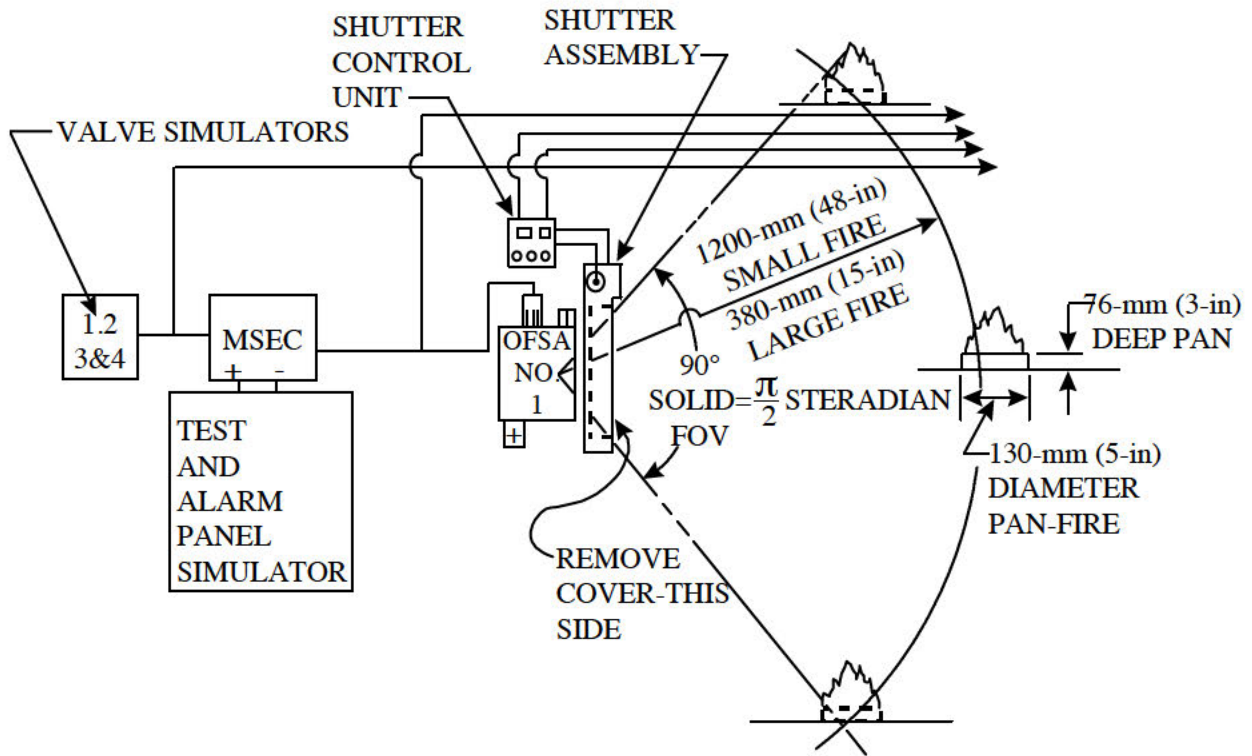
The oscillogram shall include a time about $3D$ long with a pulse located approximately in the center. The peak acceleration magnitude of the sawtooth pulse is P and its duration is D . The measured acceleration pulse shall be contained between the broken line boundaries and the measured velocity change (which may be obtained by integration of the acceleration pulse) shall be within the limits of $V_i + 0.1 V_i$. Where V_i is the velocity-change associated with the ideal pulse which equals $0.5 PD$. The integration to determine velocity change shall extend from $0.4 D$ before the pulse to $0.1 D$ after the pulse.

FIGURE 2. Terminal-peak sawtooth shock pulse configuration and tolerance limits.

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FIGURE 3. Pressure recession curves.

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NOTE: Use of shutter assembly and shutter control unit is optional.

FIGURE 4. Small fire and large fire threshold.

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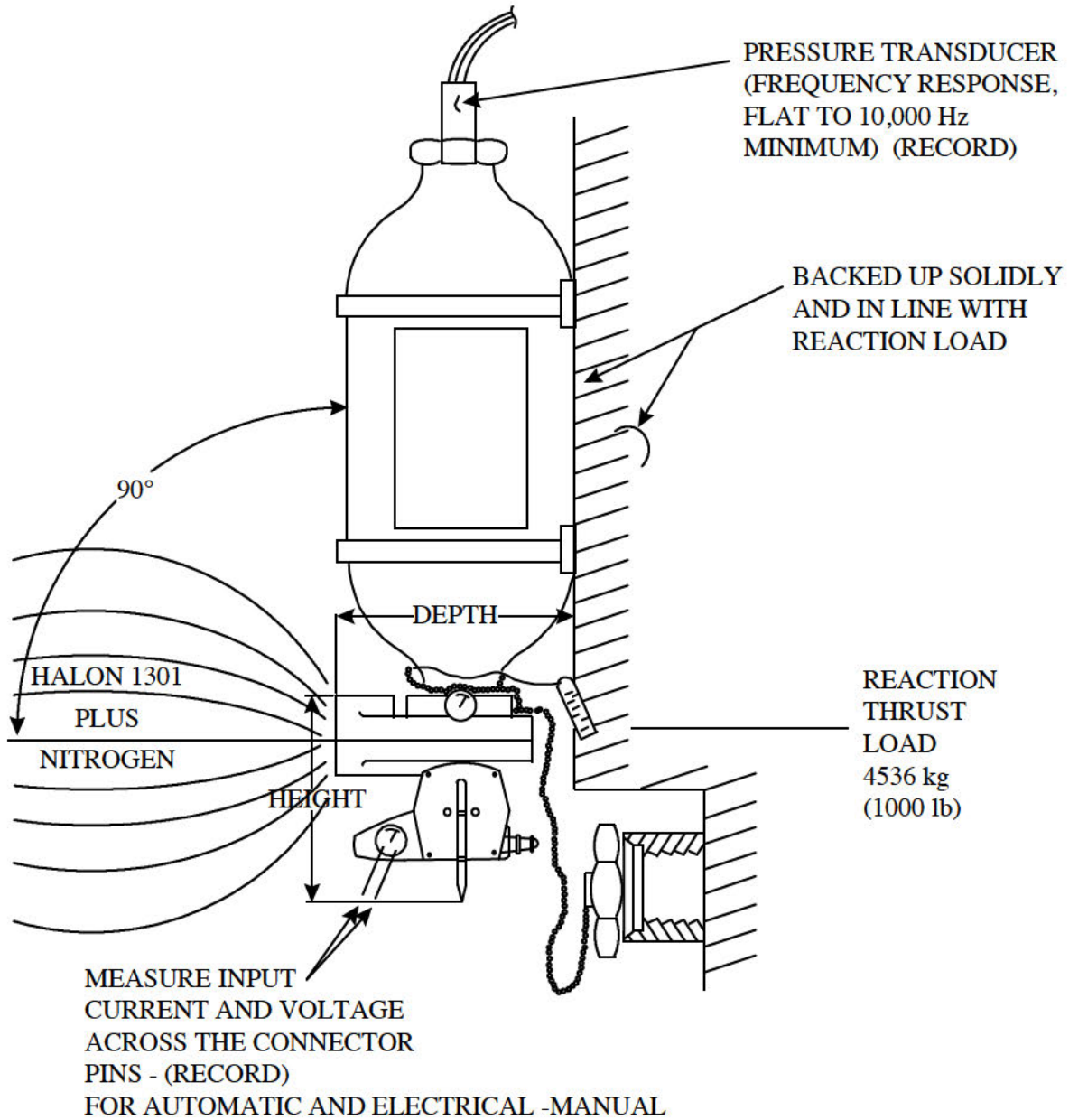


FIGURE 5. Response tests.

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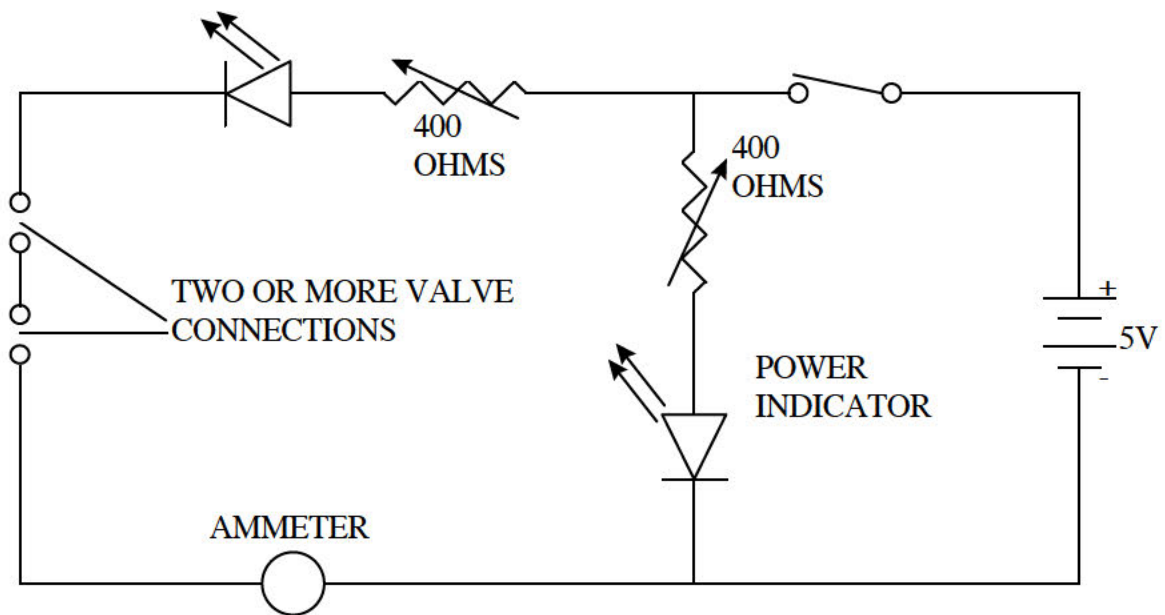


FIGURE 6. 5 mA current draw.

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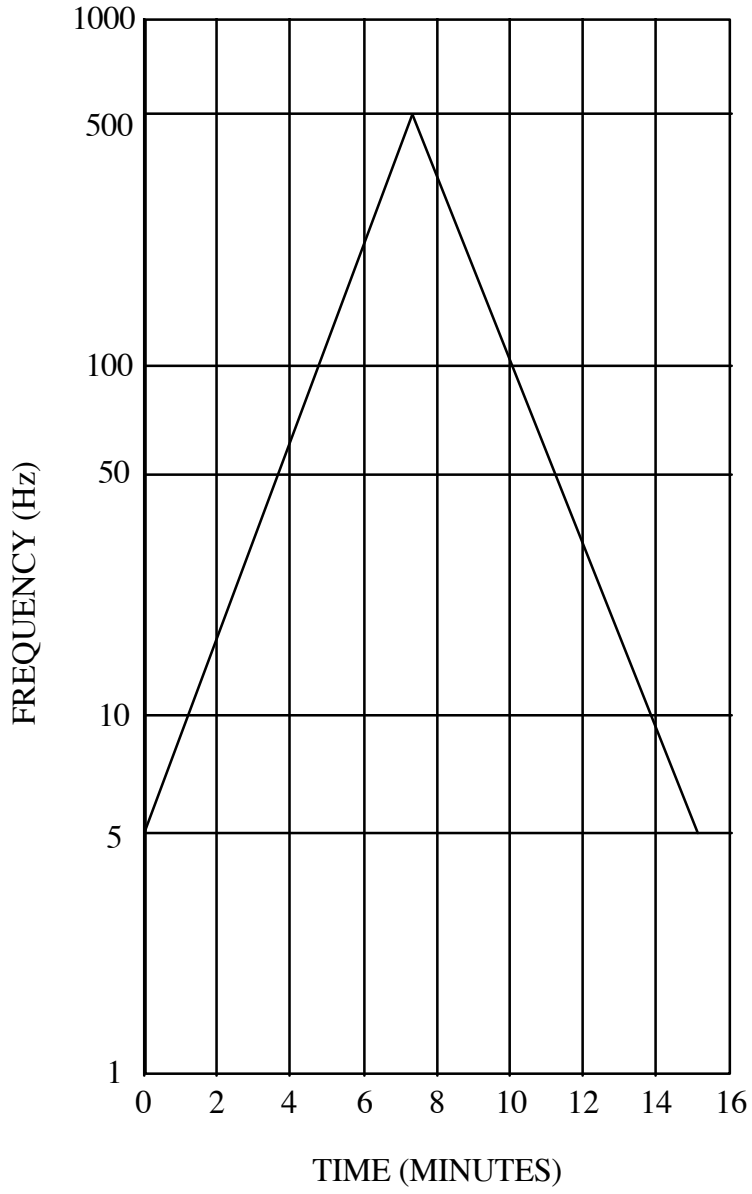
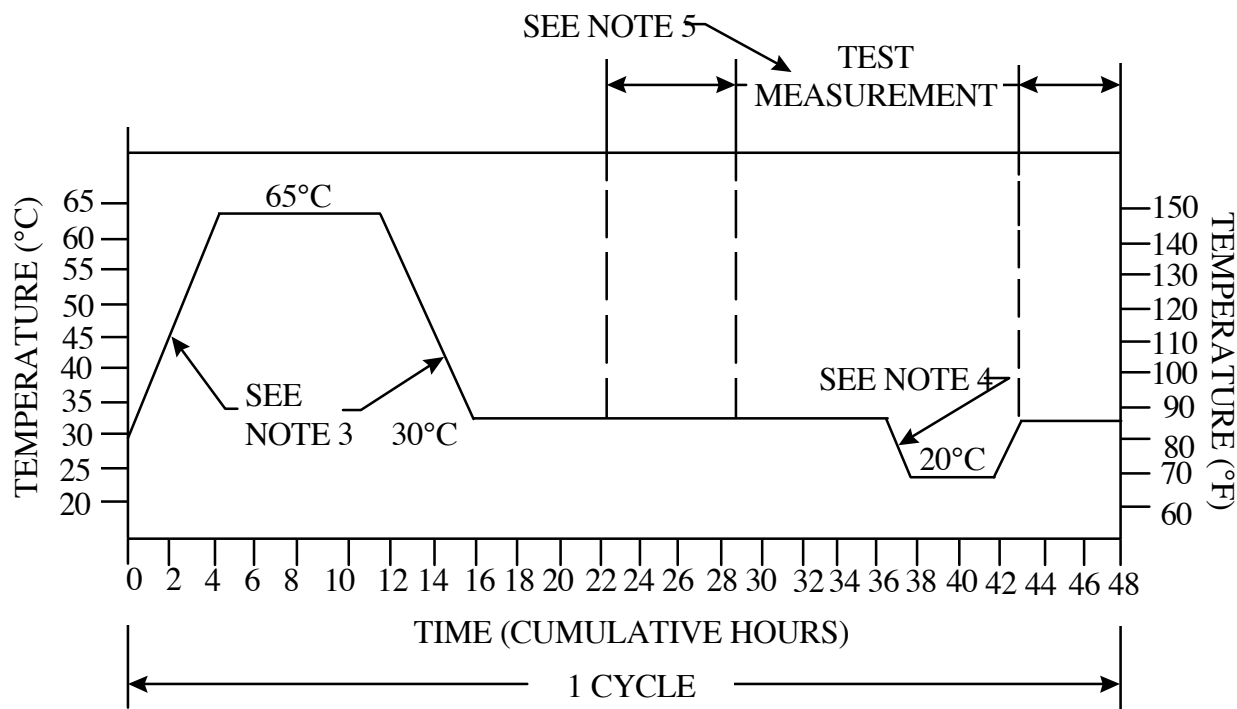


FIGURE 7. Logarithmic sweep.

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NOTES:

1. Tolerance during temperature change shall be not greater than 30°C (5°F).
2. Relative humidity shall be maintained at $94 \pm 4\%$ at all times, except that during the descending temperature period, the relative humidity may be permitted to drop as low as 85%.
3. Rate of temperature change between 30 and 65°C (86 and 149°F) shall be not less than 8°C (14.4°F) per hour.
4. The temperature increase in this portion of the curve shall be not less than 10°C (18°F).
5. Test measurements shall be taken only at the period specified in the applicable equipment or system specification.

FIGURE 8. Humidity cycle.

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(Project 4210-0611)

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2. The submitter of this form must complete blocks 4, 5, and 7.
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3. DOCUMENT TITLE VALVE AND CYLINDER ASSEMBLIES, HALON 1301		
4. NATURE OF CHANGE <i>(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)</i>		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
a. NAME <i>(Last, First, Middle Initial)</i>	b. ORGANIZATION	
c. ADDRESS <i>(Include Zip Code)</i>	d. TELEPHONE <i>(Include Area Code)</i> (1) Commercial (2) AUTOVON <i>(If applicable)</i>	7. DATE SUBMITTED <i>(YYMMDD)</i>
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