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MILITARY SPECIFICATION

DESIGN AND EVALUATION OF CARTRIDGE ACTUATED DEVICES

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

1. SCOPE

1.1 Scope. This specification covers the general requirements for design and establishes uniform methods for testing cartridge actuated devices, (CADs). Guns, rockets, rocket catapults, ballistic hose/tubing, and stores separation equipment are not covered by this specification. For purposes of this specification, the term cartridge actuated device includes any device which provides the means of releasing potential cartridge energy or harnessing this energy to accomplish work. Linear shaped charge, explosive energy transfer lines, and "sealed-in" cartridge actuated devices (see 6.4.1) fall within the scope of MIL-D-21625. However, devices of the "sealed-in" type are also required to meet the safety and structural design requirements of this specification as specified in 3.6.3. The purpose of the testing program is to determine performance, safety, soundness of mechanical design, and resistance to environments encountered during storage, handling, and service use. Cartridge actuated devices are safe for handling and do not deteriorate to a degree which would render their performance or safety doubtful after being subjected to the testing programs of this specification.

1.2 Classification of the types of cartridge actuated device release.

Type I

Safety of handling and installation. This type of release is required prior to handling and installation of CADs in naval equipment. For requirements, see 3.17.1.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Warfare Center Aircraft Division Lakehurst, Systems Requirements Department, Code SR3, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 1377

Type II

Interim service release. This release is required prior to any flights or use of CADs involving naval personnel and will be granted in accordance with the provisions of 3.17.2. The Naval Air Systems Command has the prerogative to authorize procurement of CADs for fleet use, subsequent to a Type II release.

Type III A

Final release to service (fully documented). This type of release is required for admission of CADs into the Naval supply system as a fully documented device (see 3.9). For requirements, see 3.17.2

Type III B

Special release to service (documented by a source control drawing). If the data required for a Type III A release are not available, such as proprietary rights and patents, then a Type III B release to service is required for admission of CADs into the Naval supply system. For requirements for a Type III B release, see 3.17.2. For documentation and data requirements for a Type III B release, see 3.9.

Type IV

Use of approved cartridge actuated device (using same ballistic energy source and associated equipment) in a new application. If a CAD has previously been granted a Type III A or Type III B release and is to be used in a new application, a Type IV release to service for the new application will be granted in accordance with the requirements of 3.17.3.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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).

SPECIFICATIONS

MILITARY

MIL-P-514	Plate, Identification, Instruction and Marking, Blank
MIL-S-5002	Surface Treatments and Inorganic Coatings for Metal Surfaces of Weapons Systems
MIL-C-5501	Caps and Plugs, Protective, Dust and Moisture Seal
MIL-C-5541	Chemical Conversion Coatings of Aluminum and Aluminum Alloys

MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-N-18307	Nomenclature and Identification for Electronic, Aeronautical, and Aeronautical Support
MIL-P-19834	Plates, Identification or Instruction, Metal Foil, Adhesive Backed, General Specification for
MIL-D-21625	Design and Evaluation of Cartridges for Cartridge Actuated Devices
MIL-P-23460	Pin, Quick-Release, Self-Retaining, Positive Locking
MIL-I-23659	Initiators, Electric, General Design Specification for
MIL-D-81980	Design and Evaluation of Signal Transmission Subsystems: General Specification for
MIL-C-83124	Cartridge Actuated/Propellant Actuated Devices, General Design Specification for

STANDARDS

FEDERAL

FED-STD-H28	Screw-Thread Standards for Federal Services

MILITARY

MIL-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-331	Fuze and Fuze Components, Environmental and Performance Tests for
MIL-STD-453	Inspection, Radiographic
MIL-STD-810	Environmental Test Methods
MIL-STD-875	Type Designation System for Aeronautical and Aeronautical Support Equipment
MIL-STD-889	Dissimilar Metals
MIL-STD-970	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-1168	Ammunition Lot Numbering
MIL-STD-1521	Technical Reviews and Audits for Systems, Equipments, and Computer Software
DOD-STD-2101	Classification of Characteristics

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from DODSSP - Customer Service, Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.1.2 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.

CODE OF FEDERAL REGULATIONS

49CFR Parts 100-199 Transportation

(Copies are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-0001.)

2.2 Non-Government publications. The following document(s) 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 the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA (AIA)

NAS 618 Fastener-Recommended Shank, Hole and Head-to-Shank Fillet Radius Limits for

NAS 1091 Streamer Assembly, Warning

(Application for copies should be addressed to the Aerospace Industries Association of America, Inc., 1250 Eye Street NW, Washington, DC 20005.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4919 Specification for Testing of Hazardous Materials, Packaging

(Application for copies should be addresed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

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

2.4 Streamlining. This document has been streamlined. Appendix A to MIL-D-23615 lists those documents required for MIL-D-23615 acquisition and is

a mandatory part of MIL-D-23615. Those documents listed in Appendix A have the same status as those referenced directly in MIL-D-23615 (first tier documents). All other documents, referenced through tiering, may be used as guidance and information to supplement MIL-D-23615. MIL-D-23615 is a streamlined document.

3. REQUIREMENTS

3.1 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-970.

3.2 Special requirements. Special requirements for specific applications shall take precedence over those listed herein, provided such special requirements are more stringent. Other conflicting requirements are subject to the approval of the cognizant design agency (see 6.4.3) for the specific application involved.

3.3 Materials. Materials for the CAD shall be compatible with the explosive, propellant, delay composition, pyrotechnic, combustion products, and buffering fluid (if used); and shall withstand environmental, functional, service, and storage conditions to which the CAD will be exposed. Acceptance or approval of materials for design or use during the course of manufacture shall in no case be construed as a guarantee of acceptance of the finished device. Pyrocellulose materials shall not be included as wads, spacers, or closure discs. Materials which are nutrients for fungi shall not be used.

3.3.1 Metals. Exposed metals shall be of the corrosion-resisting type or suitably treated to resist the corrosive effects of fuels, salt spray or atmospheric conditions to which the CAD may be subjected in storage or normal service use.

3.3.1.1 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless protected against electrolytic corrosion. Dissimilar metals are defined in MIL-STD-889.

3.3.2 Plastic parts. The use of plastic parts shall be subject to the approval of the cognizant design agency for the specific application involved.

3.4 Finishes. Protective coatings and finishes shall be used which will not crack, chip, or scale during normal service life or when subjected to environmental conditions specified herein. Surface treatments, coatings, and finishes shall conform to MIL-S-5002 except that aluminum and aluminum alloy parts shall be anodized in accordance with 3.4.1.

3.4.1 Anodizing. Aluminum and aluminum alloy parts subject to wear, abrasion, and erosion or exposed to corrosive environmental elements shall be anodized in accordance with MIL-A-8625, Types II or III. Chemical conversion coatings conforming to MIL-C-5541 may be used to repair mechanically damaged areas from which the anodic coating has been removed.

3.5 Color coding. Color coding of CADs as a primary means of identification is strictly forbidden.

3.6 Design and construction. The CAD shall be of the simplest and most efficient design consistent with the proposed use. Specific consideration shall be given to the factors of minimum size and weight, resistance to deleterious environments, reliability of performance, maintainability (see 3.6.2), and safety of operation. All CADs, including the ballistic energy source, such as cartridges and explosive energy transfer lines, submitted for or subjected to the requirements of 3.16 shall be of final design configuration, identical in design, manufactured by the same process and shall be from the same lot. Prior to manufacturing CADs for service release testing, a critical design review shall be conducted per MIL-STD-1521 (see 6.3).

3.6.1 Ballistic energy. Prior to service release, the cartridge(s) for the CAD shall have met the release requirements of MIL-D-21625.

3.6.2 Disassembly and reassembly. Unless otherwise approved by the cognizant design agency, the CAD shall be designed so that it can be disassembled for inspection or installation of the cartridge(s), O rings, and associated subassemblies and reassembled. Disassembly and reassembly of the device shall be accomplished by the use of standard tools.

3.6.3 "Sealed-in" type of cartridge actuated device. "Sealed-in" type of cartridge actuated devices (see 6.4.1) shall meet the design, environmental and functional requirements of MIL-D-21625 and the firing mechanism, shear pin, dust, submersion, iced condition and structural integrity requirements of this specification.

3.6.4 Service life. CADs, when packaged in hermetically sealed containers, shall have a service life of not less than 5 years from the date of manufacture, and shall be capable of being rendered serviceable after this period by replacement of cartridges, O rings, shear pins, and similar items. Service life assignments must be approved by the Naval Air Systems Command prior to application in service.

3.6.5 Structural integrity. CADs shall be designed with a minimum safety factor of 1.5 at the most critical temperature extreme based on the maximum calculated operating pressure limit in the most severe operating condition.

3.6.5.1 Locked shut firing. Each CAD shall be designed to withstand the internal ballistic gas pressure developed during a locked shut condition (see 6.4.4) over the temperature range -65°F to 200°F. There shall be no mechanical failure or rupture.

3.6.5.2 No load firing. For a stroking CAD which is designed to remain intact at the end of a power stroke, parts shall not separate when it is fired at any temperature between -65°F and 200°F with no restraining load applied to the CAD; e.g., the piston shall not separate from the CAD at the end of stroke nor shall fragmentation of components occur.

3.6.6 Locking of parts. All parts not required to have relative motion prior to or during cartridge/ballistic energy source initiation shall be securely locked by a method that will not damage components or interfere with ease of disassembly. Safety wiring is the preferred method. Lock nuts shall not be used except where it is impossible to use the preferred method. Floating or press fit washers shall not be used in the CAD.

3.6.7 Mechanical firing mechanism. The force required to actuate mechanical firing mechanisms shall be 15 pounds minimum and 35 pounds maximum. Precocked firing mechanisms shall not be used (see 6.4.2).

3.6.7.1 Safety pins. Mechanical firing mechanisms shall be restrained by single acting safety pins which meet the requirements of MIL-P-23460 (Type I, 1/4 inch minimum diameter) unless otherwise specifically approved by the cognizant design agency (see 6.4.3). The longitudinal axis of the installed safety pin shall be 90° to the direction of travel of the restrained member. The safety pin shall act in double shear. Interference between the safety pin and the restrained member shall be 0.062 inch minimum. Removal and reinsertion of the safety pin shall be accomplished after the mechanical firing mechanism is securely locked in place (see 3.6.6). The pin length selected will be dependent upon the size and configuration of the device and shall provide for positive locking of the pin. Safety pin hole diameters (in the device) shall be within the hole limits for clearance fits specified by Column C of NAS 618. Safety pins shall be accessible and visible when the device is installed and shall not interfere with the installation or removal of the device or any other maintenance operation.

3.6.7.2 Warning streamers. Warning streamers designed in accordance with NAS 1091 shall be securely attached to all safety pins. Streamer length shall be as specified by the cognizant design agency.

3.6.8 Gas actuated firing mechanisms. The firing mechanism shall not actuate upon application of 400 psig gas pressure on the firing pin. The firing pin retention mechanism; e.g., shear pin(s), shall actuate within 0.030 second upon application of 600 psig applied at a rate between 10,000 psig/sec and 50,000 psig/sec inclusive acting on the firing pin assembly. Time to actuate is only a design guide and shall be reviewed by the cognizant design agency for each specific application.

3.6.9 Shear pins. Shear pins employed within CADs shall be of material which demonstrates shear strength characteristics within the specified tolerance over the temperature range -65°F to 200°F.

3.6.10 Installation. Installation provisions; e.g., mounting holes, flanges, and brackets, for CADs shall be so arranged that the possibility of incorrect installation or connection of fittings is minimized. Utilization of male inlet/outlet ports is preferred. Use of inlet/outlet ports of different thread diameters is mandatory.

3.6.11 Screw threads. All screw threads shall be specified in accordance with FED-STD-H28.

3.6.12 Cycle life. CAD component(s) which experience relative motion prior to cartridge/ballistic energy source initiation shall have a service cycle life. As a minimum, the number of cycles a CAD component(s) shall withstand would be comparable to its normal service cycles plus a 50 percent cycle safety factor. Service cycle life shall be subject to the approval of the cognizant design agency. A cycle shall consist of movement from the initial position through all positions and back to the initial position.

3.6.13 Cartridge actuated devices for signal transmission subsystems. CADs employed in signal transmission subsystems shall meet all additional requirements specified in MIL-D-81980.

3.7 CAD identification

3.7.1 Nomenclature. The contractor shall follow the procedure outlined in MIL-N-18307 and MIL-STD-875 when submitting the DD Form 61 for CAD nomenclature. The information on the DD Form 61 shall be concurred by the cognizant design agency prior to submittal.

3.7.2 National stock number. The cognizant design agency shall obtain a *national stock number and Department of Defense Identification Code (DODIC)* prior to final release to service use.

3.7.3 Explosive hazard classification. There shall be data for each CAD for explosive hazard classification (see 6.3). An interim explosive hazard classification is required prior to granting a Type I release per 3.16.2. The cognizant CAD design agency shall obtain a final explosive hazard classification prior to final release to service.

3.8 Marking. Identification marking for each CAD shall be clearly and permanently (nondefaceable through normal storage and service handling) marked in accordance with MIL-STD-130 with the CAD nomenclature (see 3.7.1), identifying number, contract number, national stock number, lot number in accordance with MIL-STD-1168, and serial number. Name plates shall conform to MIL-P-514 requirements for composition A, Class 2 or composition C identification plates, or MIL-P-19834. No other markings shall be placed on the CAD except those required by 3.8.1 and 3.8.2.

3.8.1 Inlet/outlet ports. CAD ports shall be labeled "inlet" or "outlet", as applicable, and the direction of flow indicated with permanent red arrows. In addition, ports shall be covered with effective shipping caps or plugs in accordance with MIL-C-5501, type as applicable, when the CAD is not installed.

3.8.2 Warnings. Red tags or labels in accordance with MIL-P-19834 with "WARNING - CARTRIDGE ACTUATED DEVICE (INCLUDING SAFETY INSTRUCTIONS)" lettered in white shall be provided for and affixed to all CADs.

3.9 Drawings. Drawings, including special tooling required, packaging, and detail and assembly drawings of test sets, shall be in accordance with MIL-STD-100 (see 6.3). A full disclosure of detail and assembly drawings of test sets is mandatory. If full disclosure cannot be obtained, then a source control drawing, as defined in MIL-STD-100, including packaging, shall be available. If source control drawings are obtained, complete drawings containing restrictive use notation shall facilitate in-service support/malfunction investigation.

3.10 Performance. The CADs shall satisfy all design, environmental, and functional requirements specified herein and reliability and performance requirements outlined in the detailed CAD design specification.

3.10.1 Radiographic examination. Each CAD shall be subjected to radiographic examination such as x-ray, neutron bombardment, and gamma ray, as specified in 4.7.2. Use of radiographic techniques not covered by military specifications shall be submitted to the cognizant design agency for approval. Radiographic plates shall be identified by date, contract number, part number, CAD lot number, and serial number. Radiographic plates shall be retained until acceptance of the qualification test report (see 6.3).

3.10.2 Dimensions. Unless otherwise specified, dimensions shall apply after all machining, process treatments (plating, anodizing, and heat treating), and nondestructive testing have been completed. No part of the assembly shall deviate from the drawing configuration, dimensions, and tolerances.

3.11 Environmental conditions.

3.11.1 Forty-foot drop. To ensure safety of handling, the CAD shall not fire when dropped from a height of 40 feet as specified in 4.8.1 and shall be safe for handling and disposal.

3.11.2 Six-foot drop. The CAD shall not fire when dropped from a height of six feet as specified in 4.8.2 to ensure safety of handling and installation. After being subjected to the six-foot drop test, the CADs shall meet the nondestructive test requirements and the design performance requirements when test fired.

3.11.3 Shock. The CADs shall withstand shock conditions as specified in 4.8.3. After being subjected to the shock test, the CADs shall meet the nondestructive test requirements and the design performance requirements when test fired.

3.11.4 Temperature/humidity/altitude cycling. The CADs shall withstand the temperature/humidity/altitude cycling conditions as specified in 4.8.4. After being subjected to the temperature/humidity/altitude cycling test, the CADs shall meet the nondestructive test requirements and the design performance requirements when test fired.

3.11.5 Vibration. The CADs shall withstand vibration conditions as specified in 4.8.5. After being subjected to the vibration test, the CADs shall meet the nondestructive test requirements and the design performance requirements when test fired.

3.11.6 Salt Fog. The CADs shall withstand exposure to salt fog as specified in 4.8.6. After being subjected to the salt fog test, the CADs shall meet the nondestructive test requirements and the design performance requirements when test fired.

3.11.7 Dust. The CADs shall withstand the dust conditions as specified in 4.8.7. After being subjected to the dust test, the CADs shall meet the nondestructive test requirements and the design performance requirements when test fired.

3.11.8 Cycling. The CADs shall withstand the cycling conditions as specified in 4.8.8. After being subjected to the cycling test, the CADs shall meet the nondestructive test requirements and the design performance requirements when test fired.

3.12 Functional tests.

3.12.1 Low temperature operation. Operation at -65°F (see 4.9.2 and 4.9.5).

3.12.2 Normal temperature operation. Operation at 70°F (see 4.9.3 and 4.9.5).

3.12.3 High temperature operation. Operation at 200°F (see 4.9.4 and 4.9.5).

3.12.4 Submerged operation. Submerged operation (see 4.9.6).

3.12.5 Iced condition. Operation under iced condition (see 4.9.7).

3.12.6 Underload. For information purposes, CADs containing cartridges with 80 percent of their output charges shall be tested at -65°F and 70°F as specified in 4.9.8 to assist in the evaluation of future production lots.

3.12.7 Overload. For information purposes, CADs containing cartridges with 120 percent of their output charge shall be tested at 200°F as specified in 4.9.9 to assist in the evaluation of future production lots. Cartridges which cannot be loaded with 120 percent of their output charge weight will be loaded with the maximum amount of output charge that will fit into the cartridge case. The cartridge hardware will have minimum and maximum material conditions that will allow the maximum free volume for the output charge. The weight of the maximum amount of output charge shall be recorded.

3.13 Structural integrity tests.

3.13.1 Locked shut operation. Locked shut operation at -65°F and 200°F (see 3.6.5.1 and 4.9.10.1).

3.13.2 No load operation. No load operation at -65°F and 200°F (see 3.6.5.2 and 4.9.10.2).

3.14 Post environmental and functional test analysis.

3.14.1 Damage and deterioration. Damage to or deterioration of any internal or external part of the CAD after environmental testing which could in any manner prevent it from meeting functional requirements shall be reason to consider the CAD as having failed to meet the test to which it was subjected.

3.14.2 Marginality of success evaluation. No failure, incipient failure, or marginal condition shall be permitted. A detailed post-test inspection of all CADs and test data shall be conducted to aid in the detection of failures or marginal conditions. The test data shall be recorded and treated in a manner aiding the detection of operating anomalies and examined for operating results. A marginality of success evaluation plan

shall be included in the design verification and service release test plans (see 6.3). All anomalies identified during design verification testing (see 4.5.2) or service release testing (see 4.6) shall be documented and evaluated to ascertain their potential for inducing failures in service, to ascertain the consequences of such failures, and to determine recommendations for appropriate remedial action (see 6.3).

3.15 Design freeze. Development tests (see 4.5) shall be conducted to establish a design freeze of the CAD.

3.16 Criteria of acceptance.

3.16.1 Minimum Type I requirements. After successful completion of the design verifcation tests (see 4.5.2), minimum requirements for a Type I release are satisfactory performance of the tests listed in Table I as performed by the Government, contractor, or an independent testing laboratory. If the tests of 4.5.2 are met without design change, the results may be accepted in fulfilling the requirements for a Type I release. If the tests are performed by a contractor or by an independent testing laboratory, there shall be an acceptable test plan, test facility, and test report (see 6.3). The tests shall be witnessed by personnel from the cognizant design agency or their appointed representative. A certified copy of the test data (see 6.3) shall be obtained prior to granting a Type I release.

3.16.2 Type II, Type III A, or Type III B release. A Type II, Type III A, or Type III B release to service can be given only after the CAD satisfies the environmental, functional, material, design and construction, and documentation and data requirements, and after successful performance in the complete testing program as set forth in Tables I and II. Unless otherwise specified in the contract, the tests listed in Table II shall be conducted by the cognizant design agency. If the tests are permitted by the contract to be conducted by the contractor or an independent testing laboratory, there shall be an acceptable test plan, test facility and test report (see 6.3). The tests shall be witnessed by personnel from the cognizant design agency or their appointed representative. A certified copy of the test data (see 6.3) shall be obtained prior to granting a Type II, Type III A, or Type III B release to service. Documentation for either a Type III A or Type III B release in accordance with the requirements of 3.9 shall be determined by contractual agreement. Distribution of CADs for the various environmental and functional tests shall be in accordance with Tables I and II. CADs which have met the requirements of MIL-C-83124 may be considered acceptable for a Type II, Type III A, or Type III B release provided all requirements of this specification have been met.

3.16.3 Acceptance of an approved CAD (using same ballistic energy source and associated equipment) in a new application. When it is desired to use a previously approved CAD (which has a Type III A or Type III B release) in a new application, Type I service release is automatically granted. A Type IV release for service use will be granted upon satisfactory performance in any special tests required by the new application (see 3.2) and the tests of Table II deemed acceptable for the new application. Test plans and test reports (see 6.3) shall be acceptable.

3.17 Workmanship. Workmanship shall be subjected to the inspection of all requirements as specified herein and as specified in 3.9.

TABLE I. Design verification test program.

Test	Test paragraph	Group 1/ and number of cartridges in group								Total
		A	B	C	D	E	F	G	H	
		6	3	4	4	9	3	2	2	33
Nondestructive										
Examination of product	4.7.1	6	3	4	4	9	3	2	2	33
Radiographic examination	4.7.2	6	3	4	4	9	3	2	2	33
Bridge circuit resistance 2/	4.7.3	6	3	4	4	9	3	2	2	33
Environmental										
40-foot drop 3/	4.8.1	6								6
6-foot drop	4.8.2		3							3
Shock	4.8.3			4						4
Vibration	4.8.5				4					4
Nondestructive										
Bridge circuit resistance 2/	4.7.3		3	4	4					11
Radiographic examination	4.7.2		3	4	4					11
Functional										
Firing mechanism	4.9.5.1/						3			3
Mechanical/gas actuated	4.9.5.2									
Locked shut	4.9.10.1							2		2
No load	4.9.10.2								2	2
Low temperature (-65°F)	4.9.2					3	1	1	1	6
Normal temperature (70°F)	4.9.3		3	4	4	3	1			15
High temperature (200°F)	4.9.4					3	1	1	1	6

1/ The tests shall be performed in the order listed for each group of cartridges.

2/ These tests are applicable only when the cartridge contains an electric initiator or a cartridge with an electric initiator that is an integral part of the cartridge design.

3/ Inert cartridges without explosive or propellants will not be subjected to this test. Cartridges subjected to the 40-foot drop test shall be disposed of in accordance with safety regulations.

TABLE II. Service release test program.

Test	Test paragraph	Group 1/ and number of cartridges in group																Total
		A 3	B 4	C 9	D 4	E 4	F 4	G 2	H 6	I 9	J 4	K 4	L 6	M 3	N 2	O 2	P 3/ 18	84
Nondestructive																		
Examination of product	4.7.1	3	4	9	4	4	4	2	6	9	4	4	6	3	2	2	18	84
Radiographic examination	4.7.2	3	4	9	4	4	4	2	6	9	4	4	6	3	2	2	18	84
Bridge circuit resistance 2/	4.7.3	3	4	9	4	4	4	2	6	9	4	4	6	3	2	2	18	84
Environmental																		
6-foot drop	4.8.2	3																3
Shock	4.8.3		4															4
Temperature/humidity/altitude	4.8.4			9														9
Vibration	4.8.5				4													4
Salt fog	4.8.6					4												4
Dust	4.8.7						4											4
Cycling	4.8.8							2										2
Nondestructive																		
Bridge circuit resistance 2/	4.7.3	3	4	9	4	4	4	2										30
Radiographic examination	4.7.2	3	4		4			2										13
Functional																		
Firing mechanism	4.9.5.1/																	
Mechanical/gas actuated	4.9.5.2								6									6
Submersion	4.9.6										4							4
Iced condition	4.9.7											4						4
Underload	4.9.8												6					6
Overload	4.9.9													3				3
Locked shut	4.9.10.1														2			2
No load	4.9.10.2															2		2
Low temperature (-65°F)	4.9.2			3					2	3		4	3		1	1		17
Normal temperature (70°F)	4.9.3	3	4	3	4	4	4	2	2	3			3					32
High temperature (200°F)	4.9.4			3					2	3				3	1	1		13

1/ The tests shall be performed in the order listed for each group of cartridges.
2/ These tests are applicable only when the CAD contains an electric initiator or a cartridge with an electric initiator that is an integral part of the cartridge design.
3/ If the tests of Table II are performed by a contractor as an independent testing laboratory, the 18 devices listed in group P that are not allocated to the destructive test of Table II are to be furnished to a Navy activity designated by the acquiring activity. These devices will be used to verify production lot acceptance procedures and test set functioning as being appropriate for acceptance and follow-on support for production lot procurements. If the tests of Table II are performed by a Government laboratory, the devices that were not allocated to the destructive tests of Table II shall be retained for investigative purposes.

4. QUALITY ASSURANCE PROVISIONS

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

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

4.2 Materials. Inspection and testing of component parts and assemblies shall be made to determine compliance with 3.3. Where defects or inferior quality are evident, and the Government deems material analysis necessary, the contractor will be requested to submit samples or specimens to the cognizant design agency for analysis and approval.

4.3 Measurement and records. All functional tests of CADs shall be performed with the equipment mounted and loaded to simulate service conditions. Performance parameters such as the following shall be recorded during functional tests (see 6.3):

(a) Pressure versus time for ballistic cycle time.

(b) Velocity (at end of power stroke).

(c) Displacement of load (or simulated) versus time.

(d) Thrust versus time for ballistic cycle time.

(e) Acceleration versus time.

(f) Resistive load versus time.

(g) Time interval between actuating firing mechanism and beginning of movement of load or start of pressure rise.

(h) Time interval between actuating firing mechanism and completion of operating cycle.

4.3.1 Instrumentation. Any state of the art type of instrumentation and recording equipment may be used, such as the oscillograph, oscilloscope, or magnetic tape. Transducers may be any state of the art; e.g., piezoelectric, strain gage, variable reluctance, capacitive, or potentiometer. However,

accuracy of all test apparatus shall conform to the requirements of MIL-STD-810. Documented calibration records shall be available for inspection.

4.4 Rejection. Failure of any CAD subjected to the environmental and functional test to conform to the applicable requirements of this specification or the predetermined critical design requirements may be cause for rejection of the entire lot (see 3.6). There shall be full particulars concerning the failure, recommended action to correct the defect(s) (see 6.3), and a plan for retest

4.5 Development testing. Development tests shall establish a design freeze of the CAD. Development tests may be used to determine operating characteristics. Stress to failure tests shall be conducted during development to provide failure mode characteristics for verification of analysis and determination of strength and operating margins of safety. It is required that development tests be run on the CAD under simulated thermal environments to ensure design compatibility with the requirements of this specification. Vibration amplification factors shall be substantiated during development testing. Development tests shall be categorized as follows:

(a) Design feasibility tests (4.5.1)

(b) Design verification tests (4.5.2)

4.5.1 Design feasibility tests (DFT). Prior to DFT, conceptual drawings and critical supporting calculations (see 6.3) shall be in compliance with the requirements specified herein. DFT shall include all tests conducted for the following purposes:

(a) Component and part selection.

(b) Investigation of development model performance shall include as a minimum, functional test performance to indicate rupture, operating margins, and structural integrity.

(c) Demonstration of safety and operating margins or other analytical assumptions (see 3.6.5).

(d) Establish system and performance requirements.

4.5.2 Design verification tests (DT-IA). Design verification tests are advanced stage development tests which are performed on the CADs for the purpose of substantiating the design for its intended mission. These tests shall include as a minimum, radiographic inspection, the tests listed in Table I, and certification of 4.5.1 (see 6.3). Successful completion of the design verification tests provides the assurance to permit a design freeze decision to be made.

4.6 Service release (DT-IIA) tests. Service release tests are conducted after design freeze to qualify the CAD for its intended application and service use by substantiating the performance, reliability, safety, soundness of mechanical design, and resistance to environments encountered during storage handling and service use. These tests shall include as a minimum, the successful completion of the design verification (DT-IA) tests and the tests listed in Table II (see 6.3).

4.7 Non-destructive tests. Individual tests shall be conducted on each CAD submitted for environmental and functional test. If any device fails a part of the non-destructive test, the entire lot may be rejected (see 3.6). The contractor shall correct all deficiencies (see 6.3) prior to non-destructive retest of the rejected articles. Non-destructive tests shall consist of those specified in 4.7.1, 4.7.2 and 4.7.3.

4.7.1 Examination of product. Each CAD shall be completely inspected for compliance with the requirements specified herein, workmanship (see 3.17), and its drawings and specification requirements (see 3.9) prior to environmental and functional testing.

4.7.2 Radiographic inspection. All CADs shall be inspected by radiographic means as specified in 3.10.1 and MIL-STD-453. The radiographic plates shall be examined for defects and misassembly.

4.7.3 Bridge circuit resistance. Any CAD which uses an electric initiator or a cartridge with an electrical initiator which is an integral part of the cartridge design shall be subjected to bridge circuit resistance per the test procedure of MIL-I-23659.

4.8 Environmental tests. All temperatures specified in 4.6.2 through 4.6.8 shall have a tolerance of not more than $\pm$ 5°F. If the CADs cannot be test fired within the temperature conditioning chamber, they shall be fired within 3 minutes after removal from the chamber. Whenever repeating low (-65°F) temperature conditioning of a cold device, all condensation shall be removed from the CAD before it is returned to the temperature conditioning chamber.

4.8.1 Forty-foot drop test. This test shall be conducted in accordance with test 103.2 of MIL-STD-331. Six CADs shall be dropped to impact in the following positions: (1) two nose up, (2) two nose down, and (3) two horizontal. A new CAD shall be used for each drop. The CADs shall meet the requirement of 3.11.1.

4.8.2 Six-foot drop test. Three CADs shall be dropped onto a 2-inch thick steel plate (minimum) embedded in concrete to impact as follows: (1) one nose up, (2) one nose down, and (3) one horizontal. A new CAD shall be used for each drop. No device shall fire during this test. After the drop test has been completed, the CADs shall be subjected to the nondestructive tests and fired per Table I or II, as applicable.

4.8.3 Shock. This test shall be conducted in accordance with Method 516.4, Procedure I of MIL-STD-810. The shock pulse wave form shall be terminal peak sawtooth. The peak amplitude shall be 20g and the duration shall be 11 msec. After the shock test has been completed, the CADs shall be subjected to the nondestructive tests and fired per Table I or II, as applicable.

4.8.4 Temperature/humidity/altitude cycling. The CADs shall be subjected to the temperature/humidity/altitude cycling test as outlined below. There shall be no interim withdrawals of CADs during this cycling test. The schedule has been arranged that operations are not required outside normal working hours except for such supervision to ensure proper operation of the test equipment. It is not mandatory that the day/clock time schedule given below be followed; however, it is mandatory that the time, environmental, and

sequence requirements be followed. A minimum of two chambers are needed to conduct the temperature shock portion of this test. If it is desired to use three chambers, it is permissible provided the time, environmental, and sequence requirements are met. The fluctuations from the specified temperatures shall not exceed 5°F. When the temperature chamber door is opened to place test items inside, the chamber pressure will be atmospheric. The time required to return the chamber pressure to 0.65 pounds per square inch (psia) shall not exceed one hour. CADs shall be supported on screen trays or racks so that all areas are exposed to the same prescribed atmospheric conditions at all times throughout the test. The schedule to be followed is:

Monday	0800	Place test items in a chamber maintained at 70°F at 50 percent relative humidity (RH).
	1200	Raise chamber temperature to 160°F and the RH to 95 percent. The chamber temperature shall reach 160°F at 95 percent RH not later than 1300.
	1600	Remove test items from above chamber and immediately place in a chamber maintained at -65°F at a pressure altitude of 70,000 feet (0.65 psi).
Tuesday	0800	Remove test items from above chamber and place test items in a chamber maintained at 70°F at 50 percent RH.
	1200	Remove test items from above chamber and immediately place in a chamber maintained at -65°F at a pressure altitude of 70,000 feet (0.65 psi).
	1600	Remove test items from above chamber and immediately place in a chamber maintained at 160°F at 95 percent RH.
Wednesday	0800	Reduce chamber temperature to 70°F at 50 percent RH. The chamber temperature shall reach 70°F at 50 percent RH not later than 0900.
	1200	Raise chamber temperature to 160°F and the RH to 95 percent. The chamber temperature shall reach 160°F at 95 percent RH not later than 1300.
	1600	Remove test items from above chamber and immediately place in a chamber maintained at -65°F at a pressure altitude of 70,000 feet (0.65 psi).
Thursday	0800	Place test items in a chamber maintained at 70°F at 50 percent RH.
	1200	Remove test items from above chamber and immediately place in a chamber maintained at -65°F at a pressure altitude of 70,000 feet (0.65 psi).
	1600	Remove test items from above chamber and immediately place in a chamber maintained at 160°F at 95 percent RH.

Friday	0800	Reduce chamber temperature to 70°F at 50 percent RH. The chamber temperature shall reach 70°F at 50 percent RH not later than 0900.
	1200	Raise chamber temperature to 160°F and the RH to 95 percent. The chamber temperature shall reach 160°F at 95 percent RH not later than 1300.
	1600	Remove test items 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 4 weeks (28 days) except that on the second and fourth weekends the soak time shall be from 1200 on Friday until 0800 on Monday at a temperature of 160°F at 95 percent RH. The completion of the test occurs on the 5th Monday after starting. After the temperature/humidity/altitude test has been completed, the CADs shall be subjected to the nondestructive tests and fired per Table II.

4.8.5 Vibration. This test shall be conducted per Method 514.4 of MIL-STD-810. The procedure shall be determined by the particular application. The CADs shall be vibrated as follows: (1) one at -65°F, (2) two at 70°F, and (1) one at 200°F. The minimum acceleration power spectral density (Wo) for CADs mounted in the cockpit of jet aircraft shall be 0.10 g^2/Hz over the frequency spectrum from 300 to 1000 Hz. Vibration at a power spectral density less than 0.10g^2/Hz shall be approved by the cognizant design agency. The vibration time per each axis shall be a minimum of three hours. After vibration testing has been completed, the CADs shall be subjected to the nondestructive tests and fired per Table I or II, as applicable.

4.8.6 Salt fog. This test shall be conducted in accordance with Method 509.3 of MIL-STD-810. This test shall be conducted for 168 hours continuous with a 5 percent salt concentration. After the salt fog test has been completed and without disassembling the devices, the external surfaces may be rinsed with tap water prior to being subjected to the nondestructive tests and fired per Table II.

4.8.7 Dust. This test shall be conducted in accordance with Method 510.3 of MIL-STD-810 except that the high temperature shall be 200°F. After the dust test has been completed, the CADs shall be subjected to the nondestructive tests and fired per Table II.

4.8.8 Cycling. Two CADs shall be subjected to the cycling test by moving the CAD component(s) from the initial position, through all positions, and back to the initial position. The cycling test shall be conducted at 70°F. The number of cycles (see 3.6.12) and cyclic rate shall be specified in the detailed CAD design specification. After the cycling test has been completed, the CADs shall be subjected to the nondestructive tests and fired per Table II.

4.9 Functional tests.

4.9.1 General. Operations at extreme temperatures and under high altitude conditions will be performed in a controlled condition room or chamber utilizing the energy source(s) and associated equipment that will be

used in service. CAD physical size and amount of travel will generally be the limiting factors. All temperatures specified in 4.9.2 through 4.9.10 shall have a tolerance of not more than ± 5°F. If the CAD cannot be fired in the temperature conditioning chamber, the CAD shall be removed from the temperature conditioning chamber, placed in the test device, and fired within 3 minutes after removal from the temperature conditioning chamber. Test data shall be recorded (see 4.3 and 6.3).

4.9.2 Low Temperature Operation (-65°F). Test devices and CADs shall be conditioned at a temperature of -65°F not less than 4 hours and not greater than 24 hours after the temperature conditioning chamber reaches thermal equilibrium and then fired.

4.9.3 Normal temperature operation (70°F). Test devices and CADs shall be conditioned at a temperature of 70°F not less than 4 hours after the temperature conditioning chamber reaches thermal equilibrium and then fired.

4.9.4 High temperature operation (200°F). Test devices and CADs shall be conditioned at a temperature of 200°F not less than 4 hours and not greater than 24 hours after the temperature conditioning chamber reaches thermal equilibrium and then fired.

4.9.5 Firing mechanism tests.

4.9.5.1 Mechanical firing mechanism. For CADs employing a mechanical firing mechanism, the rounds shall be fired as follows: (1) one-third at -65°F, (2) one-third at 70°F, and (3) one-third at 200°F. Conditioning time and method of firing shall be as specified in 4.9.2, 4.9.3 and 4.9.4. In addition to the requirements of 4.3, the firing mechanism pull force shall be recorded. Force values shall be as specified in 3.6.7. Direction of pull shall be "in line" with the axis of the firing mechanism.

4.9.5.2 Gas actuated firing mechanism. For CADs employing a gas actuated firing mechanism, the rounds shall be fired as follows: (1) one-third at -65°F, (2) one-third at 70°F, and (3) one-third at 200°F. Conditioning time and method of firing shall be as specified in 4.9.2, 4.9.3, and 4.9.4. To verify the requirement of 3.6.8, gradually apply 400 psig, and hold at 400 psig for 1 minute. Remove the 400 psig from the mechanism and apply 600 psig at the specified rate of application determined during the design verification tests (see 4.5.2). In addition to the requirements of 4.3, record time from pressure application to firing pin first motion (see 6.3).

4.9.6 Submerged operation. CADs shall be fired while submerged in water to a depth of 100 feet or, as an alternate method, CADs may be tested for submerged operation in a pressurized water chamber at a pressure corresponding to that experienced at a depth of 100 feet and functionally tested. The immersion time at 100 feet, prior to CAD operation, shall be subject to the approval of the cognizant design agency.

4.9.7 Iced conditions. The temperature of the CAD shall be reduced to -65°F and stabilized. The CAD shall be transferred to an atmosphere having a temperature of approximately 100°F and a relative humidity of approximately 90 percent until all evidence of frost has disappeared. Retaining all the condensation, the temperature of the CAD shall again be stabilized at -65°F and then fired. If firing is conducted outside the conditioning chamber, it shall be done within 3 minutes after removal from the chamber.

4.9.8 Underload operation. Test devices and CADs containing cartridges with 80 percent of their output charge shall be conditioned at a temperature of -65°F and 70°F per 4.9.2 and 4.9.3 and then fired.

4.9.9 Overload operation. Test devices and CADs containing cartridges with 120 percent of their output charge shall be conditioned at a temperature of 200°F per 4.9.4 and then fired.

4.9.10 Structural integrity tests.

4.9.10.1 Locked shut firings. Two CADs shall be conditioned, one at a temperature of -65°F and the other at a temperature of 200°F and fired under locked shut conditions to demonstrate conformance to 3.6.5.1. It is not required that the CAD be operable after test. Conditioning time and method of firing shall be as specified in 4.9.2 and 4.9.4.

4.9.10.2 No load firings. With the CADs subjected to the no load condition, the CAD firings shall be conducted at -65°F and 200°F. The devices shall meet the requirements of 3.6.5.2. Conditioning time and method shall be as specified in 4.9.2 and 4.9.4.

4.10 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with section 5.

4.11 Classification of characteristics. Classification of characteristics shall be in accordance with DOD-STD-2101.

5. PACKAGING

5.1 Testing. The contractor shall perform testing and acquire data to support compliance with Performance Oriented Packaging (POP) requirements of hazardous materials as defined in Title 49, Code of Federal Regulations (CFR) (see 6.8). Testing shall be performed in accordance with the American Society for Testing and Materials (ASTM) D 4919, Testing of Hazardous Materials Packaging.

5.1.1 Report, instructions and drawings. There shall be a POP test report, special packaging instructions, and packaging drawings (see 6.3).

5.1.1.1 Report number. The sequential and non-duplicative report number for each POP test report shall be provided by the cognizant design agency.

5.1.2 Certification. The contractor shall provide a signed certification that the packaging and marking conform to Title 49 of the CFR. The certification shall be incorporated on the DD 250 Form Material Inspection and Receiving Report or other acceptance document if the DD 250 Form is not used (see 6.3).

5.2 Inner pack. An inner pack shall be hermetically sealed, airtight and moisture proof.

5.3 Marking. Marking of inner packs and the shipping container shall be in accordance with Title 49 of the CFR and MIL-STD-129. Marking of inner packs and outer containers shall be as follows:

Inner pack

(a) Item nomenclature

(b) National/NATO stock number

(c) NALC/DODIC

(d) UN proper shipping name

(e) UN serial number

(f) Lot number in accordance with MIL-STD-1168 and serial number

(g) Quantity

(h) POP certification markings: (Example: UN 4C1/Y45S/92 USA/DOD/NAD)

Outer container

(a) Item nomenclature

(b) National/NATO stock number

(c) NALC/DODIC

(d) UN proper shipping name

(e) UN serial number

(f) Lot number in accordance with MIL-STD-1168

(g) Quantity

(h) Gross weight

(i) POP certification markings: (Example: UN 4C1/Y45S/92 USA/DOD/NAD)

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 CADs covered by this specification are intended to be used in conjunction with cartridges and ballistic energy sources.

6.2 Acquisition requirements. Acquisition documents should 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 2.1.1 and 2.2).

(c) Type of cartridge release.

(d) Type packaging (see 5).

(e) Quantity and marking of inner pack and shipping container (see 5.2 and 5.3).

(f) Applicable documentation for either a Type III A or III B release (see 3.17.2).

(g) Where data items (see 6.3) are to be forwarded.

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DIDs) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DIDs are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 227.405-70 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
3.6	DI-ADMIN-81250	Conference minutes	---
3.7.3	DI-L-3311B	Explosive hazard classification data	---
3.9, 5.1.1	DI-DRPR-81000	Product drawings and associated lists	---
3.9, 4.5.1	DI-DRPR-81001	Conceptual design drawings and associated lists	---
3.9	DI-DRPR-81002	Developmental design drawings and associated lists	---
3.10.1, 3.16.1,3.16.2, 3.16.3, 4.3, 4.6 4.9.1, 4.9.5.2	DI-NDTI-80809A	Test/inspection reports	---
4.1.1	DI-NDTI-80809A	Test/inspection reports	10.2.7, only
3.14.2, 4.4, 4.7	DI-R-5299C	Failure analysis and corrective action report	---
4.5.2, 3.16.1, 3.16.2, 5.1.2	DI-MISC-80678	Certification/data report	---
3.14.2, 3.16.1, 3.16.2, 3.16.3	DI-NDTI-80808	Test plans/procedures	---

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
5.1.1	DI-PACK-81059	Performance oriented packaging test report	---
5.1.1	DI-PACK-80121A	Special packaging instructions	---

The above DIDs were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD Form 1423.

6.4 Definitions.

6.4.1 "Sealed-in" type cartridge actuated device. Cartridge actuated devices in which the propellant, explosive, or pyrotechnic components become an integral part of the device and which by design are not to be disassembled and reassembled for inspection are termed "sealed-in" cartridge actuated devices.

6.4.2 "Precocked" type firing mechanism. A mechanical firing mechanism which contains sufficient stored energy in its safetied position for primer initiation is termed a "precocked" firing mechanism.

6.4.3 Cognizant design agency. Unless the contract specifically indicates otherwise, all reference herein to the "cognizant design agency" for cartridges and CADs are defined as referring to the Indian Head Division, Naval Surface Warfare Center, Indian Head, MD 20640-5035.

6.4.4 Locked-shut condition. A locked-shut firing is defined as a CAD firing simulating the most adverse conditions for the containment of ballistic gas pressure produced when the device fails to operate normally in the intended manner. The exact nature of this operational anomaly (failure of a piston move, mechanism to operate, and port to vent) is dependent upon the particular CAD design.

6.5 Subject term (key word) listing.

Feasibility tests
Verification tests
Service release tests
Functional tests
Types of CAD releases
Warning streamer

6.6 Streamlining. For MIL-D-23615 acquisitions, the required portions of all MIL-D-23615 tier reference documents shall be limited to the portions described in the "Applicability" column in Table III in Appendix A.

6.7 Tailoring. When MIL-D-23615 is tailored in an acquisition, Appendix A must be tailored accordingly. In particular, when Appendix A is tailored, specific attention must be given to the chain of referencing. For example, if a first tier reference document in MIL-D-23615 is tailored out, all of the reference documents which are tiered to that first tier reference document must be tailored out.

6.8 Outer container. Any containers that have been documented as being tested to the POP requirements are acceptable for use and additional testing is not required. Verification of whether the proposed container has met the POP requirements, can be obtained from the Naval Weapons Station Earle, Colts Neck, NJ 07722-5000, Attn Code 50C, Telephone Number (908) 577-3831/3832.

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

Preparing Activity:
Navy AS

(Project 1377-NE43)

APPENDIX A

STREAMLINING INFORMATION

10. SCOPE

10.1 Scope. This appendix is a list of documents referenced in MIL-D-23615 or tiered to documents referenced in MIL-D-23615. These documents have the same status as those referenced directly in MIL-D-23615 (first tier documents). This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

10.2 Application. This appendix identifies the applicability of the documents referenced in MIL-D-23615 or tiered to documents referenced in MIL-D-23615 through the third tier. Only that portion(s) of a document listed in Table III of this appendix and described in the "Applicability" column, is pertinent in the use of MIL-D-23615. If MIL-D-23615 is tailored in acquisition, this appendix must also be tailored.

20. DOCUMENTS

20.1 Documents. The documents listed herein and corresponding applicability data have been identified as required. All other documents referenced through tiering are not considered required and may be used for guidance and information.

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
First Tier (1 of 29 documents)			
MIL-C-5541	Chemical Conversion Coating on Aluminum and Aluminum Alloys	Classification, coatings, cleaning, application, chemical coatings, appearance	MIL-D-23615
Second Tier			
MIL-C-81706	Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys	Any QPL item	MIL-C-5541
The remaining second tier documents, tiered to MIL-C-5541, are for guidance and information.			
First Tier (2 of 29 documents)			
MIL-STD-889	Dissimilar Metals	Definitions, detailed requirements	MIL-D-23615
First Tier (3 of 29 documents)			
FED-STD-H28	Screw-Thread Standards for Federal Services	Entire document	MIL-D-23615
First Tier (4 of 29 documents)			
MIL-N-18307	Nomenclature and Identification for Aeronautical Systems Including Joint Electronics Type Designated Systems and Associated Support Systems	Nomenclature	MIL-D-23615
First Tier (5 of 29 documents)			
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys	Requirements and quality assurance for types II or III	MIL-D-23615

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
Second Tier			
MIL-C-5541	Chemical Conversion Coatings on Aluminum and Aluminum Alloys	Class IA, coatings, cleaning, application (brush), chemical coatings, appearance	MIL-A-8625
MIL-C-81706	Chemical Conversion Materials for Coating Aluminum and Alloys	Any QPL item using method B	MIL-A-8625
ASTM B 117 (Replaces FED-STD-151, Method 811.1)	Standard Method of Salt Spray (Fog) Testing	Entire document except see MIL-A-8625 for position of significant surface	MIL-A-8625
ASTM B 137 1/	Standard Method for Measurement of Weight of Coating on Anodically Coated Aluminum	Entire document	MIL-A-8625
FED-STD-141	Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing	Abrasion resistance (taber abraser) method 6192.1	MIL-A-8625

1/ The applicable portion of either ASTM B 137 or MIL-A-8625 may be used.

The remaining second tier documents, tiered to MIL-A-8625, are for guidance and information.

First Tier (6 of 29 documents)

MIL-D-21625	Design and Evaluation of Cartridges for Cartridge Actuated Devices	Classification, requirements, and quality assurance provisions	MIL-D-23615

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
First Tier (7 of 29 documents)			
DOD-STD-2101 (Replaces WR-43)	Classification of Characteristics	General requirements, detailed requirements	MIL-D-23615
First Tier (8 of 29 documents)			
MIL-STD-970 (Replaces MIL-STD-143)	Standards and Specifications, Order of Precedence for the Selection of	General requirements, detailed requirements	MIL-D-23615
First Tier (9 of 29 documents)			
MIL-P-23460	Pin, Quick-Release, Self-Retaining, Positive-Locking	Any QPL item that is a single acting pin (1/4 inch minimum diameter)	MIL-D-23615
First Tier (10 of 29 documents)			
MIL-S-5002	Surfaces Treatments and Inorganic Coatings for Metal Surfaces of Weapons Systems	Requirements and quality assurance provisions except omit for aluminum and aluminum alloys	MIL-D-23615
Second tier			
O-T-634 2/	Trichloroethylene, Technical	Requirements and quality assurance provisions	MIL-S-5002
O-T-236 2/	Tetracloroethylene (Perchloroethylene), Technical	Requirements and quality assurance provisions	MIL-S-5002
MIL-T-81533 2/ 3/	Trichloroethane 1.1.1 (Methyl Chloroform) Inhibited, Vapor Degreasing	Requirements and quality assurance provisions	MIL-S-5002

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
Second tier			
MIL-C-81302 3/	Cleaning, Compound, Solvent, Trichlorotri-Fluoroethane	Requirements and quality assurance provisions	MIL-S-5002
TT-N-95 3/	Naptha; Aliphatic		
O-A-51 3/	Acetone, Technical	Requirements and quality assurance provisions	MIL-S-5002
ASTM D 740 3/	Standard Specification for Methyl Ethyl Ketone	Properties, sampling, test methods	MIL-S-5002
QQ-P-35	Passivation Treatments for Corrosion-Resisting Steel	Classification, requirements and quality assurance provisions	MIL-S-5002
QQ-P-416	Plating, Cadmium (Electrodeposited)	Classification, requirements and quality assurance provisions	MIL-S-5002

2/ The applicable portions of O-T-236, O-T-634, or MIL-A-81533 may be used for vapor degreasing.

3/ The applicable portions of O-A-51, TT-N-95, MIL-C-81302, MIL-A-81533 or ASTM D 740 may be used for hand cleaning.

The remaining second tier references, tiered to MIL-S-5002, are for guidance and information.

Third tier			
MIL-S-5002	Surfaces Treatments and Inorganic Coatings for Metal Surfaces of Weapon Systems	Requirements for cleaning	QQ-P-416 QQ-P-35

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
Third tier			
MIL-STD-753	Corrosion-Resistant Steel Parts; Sampling, Inspection and Testing for Surface Passivation	Water immersion test method 100	QQ-P-35
O-N-350	Nitric Acid, Technical	Requirements	QQ-P-35
O-S-595	Sodium Dichromate, Dihydrate, Technical	Requirements	QQ-P-35
ASTM B 117	Standard Method of Salt Spray (Fog) Testing	Entire document	QQ-P-35
FED-STD-151 4/	Federal Test Method Standard Metals: Test Methods	Method 520.1 (electronic test)	QQ-P-416
ASTM B 499 4/	Standard Method for Measurement of Coating Thickness by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals	Measuring procedure, measuring accuracy	QQ-P-416
ASTM B 567 4/	Standard Method for Measurement of Coating Thickness by the Beta Backscatter Method	Summary of method, instrumentation factors affecting the measuring accuracy, procedure	QQ-P-416
ASTM B 568 4/	Standard Method for Measurement of Coating Thickness by X-Ray Spectrometry	Summary of method, factors affecting accuracy, procedure	QQ-P-416

4/ The applicable portions of FED-STD-151, ASTM B 499, ASTM B 567 or ASTM B 568 may be used for nondestructive measuring of plating thickness.

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
Third tier			
ASTM B 487 5/	Standard Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section	Summary of method, factors influencing the measurement result, preparation of cross sections, measurement	QQ-P-416
ASTM B 504 5/	Standard Method for Measurement of Thickness of Metallic Coatings by the Coulometric Method	Basic Principles, procedure for making measurements, accuracy	QQ-P-416
ASTM E 8	Standard Methods of Tension Testing of Metallic Materials	Figure 8 for rounded specimens	QQ-P-416

5/ The applicable portions of either ASTM B 487 or ASTM B 504 may be used for destructive measuring or plating thickness.

The remaining third tier references, tiered to MIL-S-5002, are for guidance and information.

First tier (11 of 29 documents)

MIL-STD-810	Environmental Test Methods and Engineering Guidelines	Salt fog method 509.3, sand and dust method 510.3, vibration method 514.4, shock method 516.4 procedure I, accuracy of test instrumentation calibration	MIL-D-23615
Second tier			
MIL-STD-45662	Calibration Systems Requirements	General requirements, detailed requirements	MIL-STD-810

The remaining second tier references, tiered to MIL-STD-810, are for guidance and information.

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
First tier (12 of 29 documents)			
MIL-STD-331	Fuze and Fuze Components, Environmental and Performance Tests for	Twelve meter drop method 103.2	MIL-D-23615
First tier (13 of 29 documents)			
MIL-C-5501	Caps and Plugs, Protective, Dust and Moisture Seal	Classification, requirements, and quality assurance provisions (see supplement)	MIL-D-23615
Second tier			
MS90376	Caps, Dust, Plastic, Electric Connector	Entire document	MIL-C-5501
The remaining second tier references, tiered to MIL-C-5501, are for guidance and information.			
First tier (14 of 29 documents)			
MIL-STD-875	Type Designation System for Aeronautical and Support Equipment	Detailed requirements	MIL-D-23615

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
First tier (15 of 29 documents)			
MIL-STD-100	Engineering Drawing Practices	Types of engineering drawings, qualification qualification provisions for source control drawings	MIL-D-23615
First tier (16 of 29 documents)			
MIL-P-19834	Plates, Identification or Instruction, Metal Foil, Adhesive Backed, General Specification for	1. Any QPL item for type I, size, colors, and WARNING information as stipulated. 2. Any QPL item 6/ for type I, size, colors and identification marking as stipulated.	MIL-D-23615
First tier (17 of 29 documents)			
MIL-P-514	Plates, Identification, Instruction and Marking Blank	Requirements and 6/ quality assurance for composition A, class 2 or composition C identification plates	MIL-D-23615

6/ The applicable portion of either MIL-P-19834 or MIL-P-514 may be used.

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
Second tier			
QQ-A-250/1 7/	Aluminum 1100, Plate and Sheet	Requirements for temper H12 or H14	MIL-P-514
QQ-A-250/2 7/	Aluminum Alloy 3003, Plate and Sheet	Requirements for temper H12 or H14	MIL-P-514
GG-P-455 7/	Plates and Foils, Photographic (Photosensitive Anodized Aluminum)	Classification, requirements, and quality assurance	MIL-P-514
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys	Requirements and quality assurance for type II, class 2	MIL-P-514

7/ The applicable portion of either QQ-A-250/1, QQ-A-250/2, or GG-P-455 may be used.

The remaining second tier documents, tiered to MIL-P-514, are for guidance and information.

Third tier			
QQ-A-250	Aluminum and Aluminum Alloy Plate and Sheet: General Specification for	Heat treatment, quality assurance provisions	QQ-A-250/1 QQ-A-250/2

The remaining third tier documents, tiered to MIL-P-514, are for guidance and information.

First tier (18 of 29 documents)			
NAS 618	Fastener-Recommended Shank, Hole and Head-to-Shank Fillet Radius Limits for	Hole limits for clearance fits specified by column C	MIL-D-23615
First tier (19 of 29 documents)			
NAS 1091	Streamer Assembly, Warning	Entire document (length to be specified)	MIL-D-23615

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
Second tier			
MS20230	Grommets, Metallic, Plain and Spur, with Washers, Type I and Type III	Use MS20230B2 grommet assembly	NAS 1091
MS51700	Streamer, Warning	Design standard	NAS 1091
MIL-C-20696	Cloth, Coated, Polyester or Nylon, Waterproof	Requirements and quality assurance provisions for type I nylon cloth, coated per class 3	NAS 1091
FED-STD-595	Colors	Red color number 11136 (full gloss), white color number 37875 (lusterless)	NAS 1091
MIL-W-83420	Wire, Rope, Flexible, for Aircraft Control	Any QPL item for .0625 diameter	NAS 1091
FED-STD-751	Stitches, Seams and Stitching	General information and requirements for stitch type 301	NAS 1091
MIL-F-46032	Fungus-Resistant Treatment for Sandbags; Copper Processes	Classification, requirements, quality assurance provisions for type III, method 1	NAS 1091
V-T-276	Thread, Cotton	Classification, requirements, quality assurance provisions for type 1B, red color, ticket no. 16, 4 ply	NAS 1091

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
Second tier			
MS51844	Sleeve, Swaging-Wire Rope	.0625 dia cable size, zinc coated for composition A wire rope, cres sleeve for composition B wire rope	NAS 1091
MIL-STD-130	Identification Marking of US Military Property	Methods of applying (stencilled letters), permanency and legibility, type of lettering	NAS 1091
Third tier			
FED-STD-141	Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing	Color of pigmented coatings, method 4250.1	FED-STD-595

The remaining third tier references, tiered to NAS 1091, are for guidance and information.

First tier (20 of 29 documents)

ASTM D 4919	Specification for Testing of Hazardous Materials, Packaging	Due to the extensive number of variables associated with packaging, applicable sections of packaging documents cannot be identified prior to acquisition. All packaging requirements of the zero tier document must be met, unless otherwise specified in the contract.	MIL-D-23615

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
First tier (21 of 29 documents)			
MIL-STD-129	Marking for Shipment and Storage	Due to the extensive number of variables associated with packaging, applicable sections of packaging documents cannot be identified prior to acquisition. All packaging requirements of the zero tier document must be met, unless otherwise specified in the contract.	MIL-D-23615
First tier (22 of 29 documents)			
49 CFR 100-199	Transportation, Explosives and Other Dangerous Articles	Due to the extensive number of variables associated with packaging, applicable sections of packaging documents cannot be identified prior to acquisition. All packaging requirements of the zero tier document must be met, unless otherwise specified in the contract.	MIL-D-23615

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
First tier (23 of 29 documents)			
MIL-STD-1168	Ammunition Lot Numbering	General requirements	MIL-D-23615
First tier (24 of 29 documents)			
MIL-C-83124	Cartridge Actuated Devices/ Propellant Actuated Devices General Design Specification for	Requirements and quality assurance provisions for CADs	MIL-D-23615
First tier (25 of 29 documents)			
MIL-STD-130	Identification Marking of US Military Property	General marking requirements and detail marking requirements	MIL-D-23615
First tier (26 of 29 documents)			
MIL-D-81980	Design and Evaluation of Signal Transmission Subsystems: General Specification for	Requirements and quality assurance provisions	MIL-D-23615
First tier (27 of 29 documents)			
MIL-STD-453	Inspection, Radiographic	General requirements	MIL-D-23615
First tier (28 of 29 documents)			
MIL-I-23659	Initiators, Electric, General Design Specification for	Quality assurance provisions	MIL-D-23615
First tier (29 of 29 documents)			
MIL-STD-1521	Technical Reviews and Audits for Systems, Equipments, and Computer Software	Definitions, critical design review, general requirements, appendix E	MIL-D-23615

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

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

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

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-D-23615C(AS)	93/11/30

3. DOCUMENT TITLE

DESIGN AND EVALUATION OF CARTRIDGE ACTUATED DEVICES

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

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code)	
COMMANDING OFFICER, NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION LAKEHURST SYSTEMS REQUIREMENTS DEPARTMENT	(1) Commercial (908) 323-7488	(2) AUTOVON 624-7488
c. ADDRESS (Include Zip Code) CODE SR3 LAKEHURST, NJ 08733-5100	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	