INCH POUND
MIL-DTL-32127A (OS)
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SUPERCEDING
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DETAIL SPECIFICATION

CATAPULT, AIRCRAFT EJECTION SEAT, CKU-5C/A ASSEMBLY

This specification is approved for use by the Naval Sea 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 requirements for the Rocket Catapult CKU-5C/A loaded assembly.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4 or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents specified in sections 3, 4 or 5 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-P-46994	Pellet, Boron Potassium Nitrate
MIL-DTL-32124	Propellant, NSWC/IH-BC-15, NSWC/IH-BC-16, NSWC/IH-BC-17, and NSWC/IH-BC-20

Comments, suggestions, or questions on this document should be addressed to Commander, Indian Head Division, Naval Surface Warfare Center, Technical Information Branch (Code 4230), 101 Strauss Avenue, Indian Head, Maryland 20640-5035, or emailed to amanda.penn@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil/

AMSC *N/A* **FSC 1377**

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-413	Visual Inspection Guide for Elastomeric O-rings
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-1168	Ammunition Lot Numbering and Ammunition Data Card
MIL-STD-1907	Inspection, Liquid Penetrant and Magnetic Particle, Soundness Requirements for Materials, Parts, and Weldments
MIL-STD-2102	Aircrew Escape Propulsion Systems; Vibration and Shock Tests for
DOD-STD-2101	Classification of Characteristics

(Copies of these documents are available online at http://assist.daps.dla.mil/ or from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia PA 19111- 5094.)

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

DRAWINGS

Naval Surface Warfare Center, Indian Head Division (CAGE Code 14083)

DL512-174-0068	Catapult, Aircraft Ejection Seat, CKU-5C/A Assembly

(Application for copies should be addressed to: Commander, Indian Head Division, Naval Surface Warfare Center. Attn: Technical Information Branch (Code 4230). Indian Head. MD 20640-5035.)

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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

E 1742	Standard Practice for Radiographic Examination
B 165	Liquid Penetrant Inspection Method
E 1444	Standard Practice for Magnetic Particle Examination

(Copies of this document are available online at http://www.astm.org or from the American Society for Testing and Materials Customer Service, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

AMERICAN SOCIETY FOR QUALITY

ANSI/ASQ Zl.4	Sampling Procedures and Tables for Inspection by Attributes

ANSI/ASQ Z1.9 Sampling Procedures for Inspection by Variables

(Application for copies should be addressed to the American Society for Quality, PO Box 3005, 611 E. Wisconsin Ave., Milwaukee, WI 53201-4606.)

SOCIETY OF AUTOMOTIVE ENGINEERS

SAE AS17983 Compass, Magnetic, Pilots Standby

(Copies of this document are available online at http://www.sae.org/ or from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pennsylvania, United States, 15096-001.)

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 (see 6.5) in accordance with 4.3.

3.2 Materials. All materials, parts, and assemblies shall be in accordance with DL512-174-0068 and this specification.

3.2.1 Primary components. Only primary components from a single primary component lot shall be used in a production lot of loaded rocket catapults or CCU-22B/A impulse cartridges.

3.2.1.1 CCU-22B/A Impulse Cartridge. The primary components for the CCU-22B/A cartridge are the percussion primer (Drawing 11820864), the $BKNO_3$ pellets (MIL-P-46994, type II-A), the propellant ribbon (MIL-DTL-32124, Type II) and the cartridge grain lot.

3.2.1.2 CKU-5C/A Rocket Catapult. The primary components for the CKU-5C/A catapult are the rocket motor grain lot and the rocket motor igniter ($BKNO_3$ pellets per MIL-P-46994, type II-A and propellant chips per MIL-DTL-32124, Type IV). More than one lot of CCU-22B/A cartridges may be used in a CKU-5C/A Rocket Catapult lot, provided each lot of cartridges complies with 3.2.1.1.

3.2.2 Propellant. The rocket motor propellant shall be in accordance with MIL-DTL-32124, Type IV. The catapult propellant shall be in accordance with MIL-DTL-32124, Type II.

3.2.3 Material Definitions.

3.2.3.1 Propellant batch. A propellant batch is a mix of ingredients, each ingredient composed of one homogeneous lot, that is mixed at one time in one vessel, resulting in a homogeneous mixture.

3.2.3.2 Propellant grain batch. A propellant grain batch is a group of grains (rocket motor or cartridge) cast from one propellant batch.

3.2.3.3 Propellant grain lot. A propellant grain lot is a group of grains (rocket motor or cartridge) composed of one or more propellant grain batches all having the same ingredient lots.

3.2.3.4 CCU-22B/A Impulse Cartridge lot. A cartridge lot is a group of units composed of one lot of each of the following; percussion primers, $BKNO_3$ pellets, propellant ribbon and cartridge propellant grains, that are assembled at one time.

3.2.3.5 Rocket catapult lot. A rocket catapult lot is a group of units composed of one lot of each of the following; rocket motor grains, $BKNO_3$ pellets, and propellant chips, that are assembled at one time.

3.3 Age and moisture control of explosive components. The following paragraphs give the requirements for controlling the age and moisture of explosive components.

3.3.1 Propellant grains. The propellant grains are defined as the rocket motor grain (motor tube and grain assembly per Drawing 512-174-0071) and the cartridge grain (cartridge propellant grain per Drawing 512-174-0108-2). For purposes of this section, loaded is defined as when the rocket catapult lot is released for lot acceptance test.

3.3.1.1 Rocket motor grain. The rocket motor grain shall be loaded within 180 days of the oldest rocket motor propellant mix.

3.3.1.2 Cartridge grain. The cartridge grain shall be loaded (when the cartridge case is crimped) within 60 days of the oldest cartridge propellant mix. The crimped cartridge must be loaded into the rocket catapult within 180 days of oldest cartridge propellant mix.

3.3.2 Other explosive components. The other explosive components are the percussion primer (Drawing 11820864), the $BKNO_3$ pellets (MIL-P-46994, Type II-A), and the propellant ribbon and chips (MIL-DTL-32124, Types II and IV).

3.3.2.1 Percussion primers. The percussion primers shall be loaded within 24 months of manufacture and certification or within 12 months of recertification. Loaded is defined as when the cartridge case is crimped.

3.3.2.2 $BKNO_3$ pellets, propellant ribbons and chips. The $BKNO_3$ pellets and propellant chips for the rocket motor igniter shall be loaded into the rocket catapult within 12 months of the certification date. Loaded is defined as when the rocket catapult lot is released for lot acceptance testing. The $BKNO_3$ pellets and propellant ribbon for the CCU-22B/A cartridge shall be loaded into the housing assembly and sleeve assembly within 12 months of the certification date. Loaded is defined as when the cartridge case is crimped.

3.3.3 Moisture control of explosive components. As a general practice, the propellant grains and other explosive components shall be dried as a part of or immediately after the completion of manufacture, and then stored dry until ready for final loading. As a final precaution, the explosive components shall be dried (conditioned) again immediately before they are loaded. Specific drying requirements for each explosive component are provided in the subassembly and assembly drawings of DL512-174-0068.

3.4 Performance and product characteristics. The rocket catapults shall meet the following performance and product characteristics when test fired at -65° F, 77° F and 165° F using an ejected weight of 375 pounds.

3.4.1 Ballistics. The rocket catapults shall meet the ballistic requirements specified in table I.

3.4.1.1 Ballistic Definitions. See figure 1 for a graphical representation of some of the definitions given below**.**

3.4.1.1.1 Mechanical failure. A mechanical failure is defined as any deformation or breakage of a part, the occurrence of which is other than a design function

3.4.1.1.2 Catapult ignition delay time. Catapult ignition delay time is the elapsed time from the first indication of shearing of the firing pin shear pins to first indication of catapult thrust.

3.4.1.1.3 Catapult separation velocity. Catapult separation velocity is defined as the average velocity of the simulated ejected weight propelled horizontally at catapult separation measured over the interval from separation to 12 inches after separation.

3.4.1.1.4 Catapult axial thrust. Catapult axial thrust is the maximum thrust from the thrust-time curve that occurs during the catapult phase.

3.4.1.1.5 Catapult dynamic response index (DRI). The DRI is representative of the maximum dynamic compression of the vertebral column of the human body. In physical terms, the DRI is calculated by mathematically describing the human body in terms of an analogous, lumped parameter mechanical model consisting of a mass, spring, and damper. The DRI is determined from the equations (1) and (2).

$$\frac{d^2\delta}{dt^2} + 2\zeta\omega_n \frac{d\delta}{dt} + \omega_n^2 \delta = \frac{d^2 z}{dt^2} \qquad (1)$$

$$DRI = \frac{\omega_n^2 \delta_{max}}{g} \qquad (2)$$

where:

δ = compression of spring
ζ = 0.224 (damping ration of the model)
ω_n = 52.9 radians/sec (undamped natural frequency of the model)
$\frac{d^2 z}{dt^2}$ = catapult acceleration

Substituting given numerical values, these equations become:

$$\frac{d^2\delta}{dt^2} + 23.7 \frac{d\delta}{dt} + 2798\delta = \frac{d^2 z}{dt^2}$$

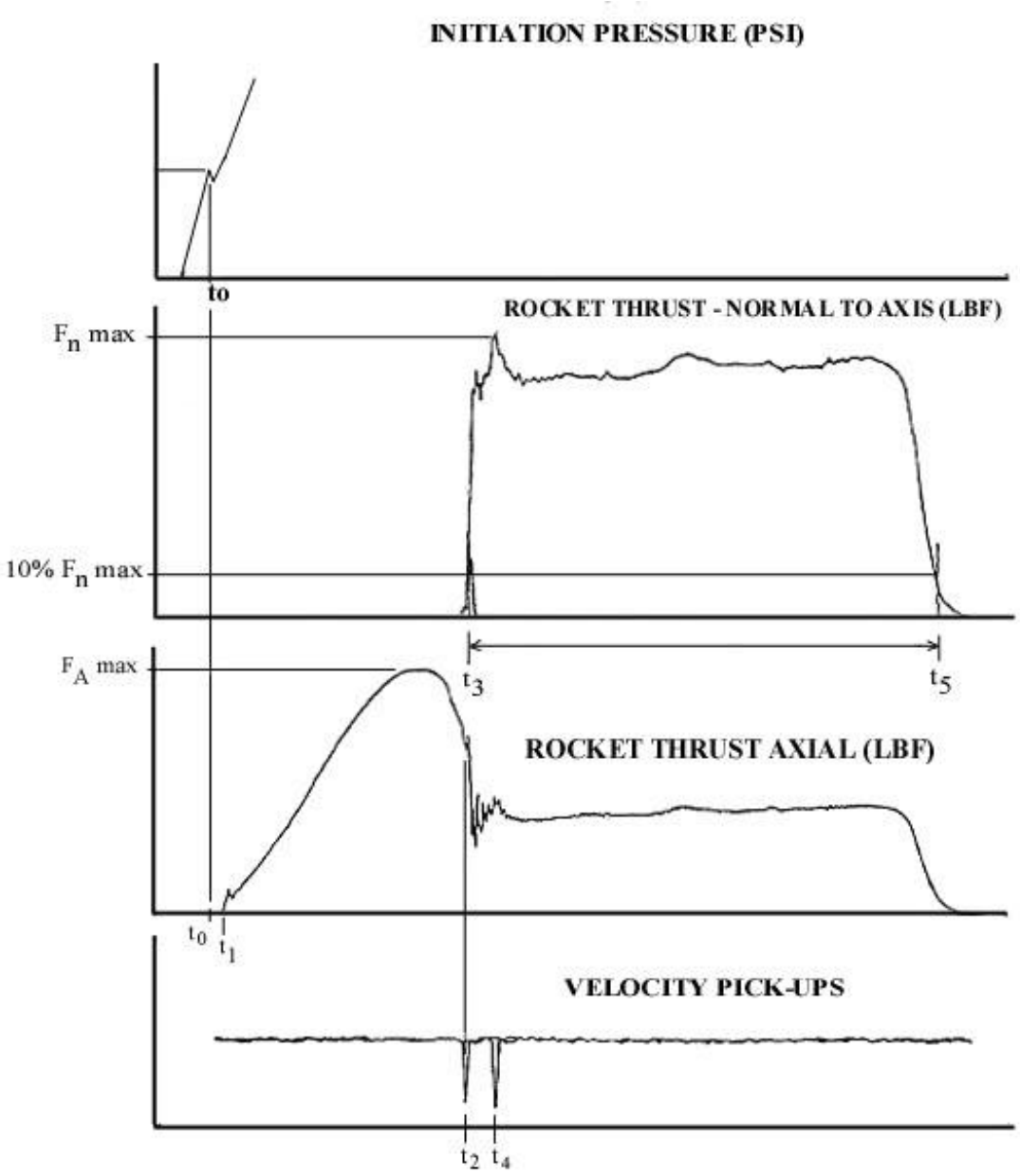
$$DRI = 86.9\, \delta_{max}$$

3.4.1.1.6 Rocket motor ignition delay. Rocket motor ignition time is the elapsed time from separation (the point where the booster tube exits the nozzle) to 10 percent of maximum thrust as measured on the rising portion of the normal component rocket thrust trace.

3.4.1.1.7 Rocket motor action time. Action time is determined from the normal thrust-time curve, and shall be defined as the time interval from the 10 percent of maximum thrust on the initial rise of the curve to the corresponding 10 percent of thrust on the declining portion of the curve.

3.4.1.1.8 Rocket motor resultant thrust. The rocket motor resultant thrust is obtained by vectorially adding the axial and normal components of rocket thrust.

3.4.1.1.9 Rocket motor resultant impulse. The rocket motor resultant impulse is obtained by integrating the resultant thrust of the rocket motor over the action time.



t_1 - t_0 = Catapult Ignition Delay Time

$$\frac{1\,foot}{t_4 - t_2} = \textbf{Catapult Separation Velocity}$$

$F_A$max = Catapult Axial Thrust - maximum

$F_n$max = Rocket Motor Normal (vertical) Thrust - maximum

t_3 - t_2 = Rocket Motor Ignition Delay

t_5 - t_3 = Rocket Motor Action Time

Figure 1. Performance Curves.

3.4.2 Other requirements. In addition to meeting the ballistic requirements, none of the following shall occur during test firing of rocket catapults:

a. No unit component, including but not limited to cartridge components, O-rings, springs, or pieces of propellant shall be ejected.
b. No component subject to loading shall fail.
c. No excessive nozzle erosion, hot spots, or burn through shall occur.
d. No leakage of ballistic gas past a sealing surface shall occur.
e. The thrust-time curve shall exhibit a shape that compares well with the established (or representative) curve for the unit.

3.4.3 Initiation. Maximum allowed initiation pressure is 10,000 psi. The rate of pressurization input shall be 10,000 to 50,000 psi/sec.

TABLE I. Ballistic performance requirements for a 375 pound ejected weight.

Parameter	-65 ± 5° F		77 ± 5° F		165 ± 5° F		AQL
	Min	Max	Min	Max	Min	Max	
Catapult							
Initiation Pressure (psi)	400	600	400	600	400	600	-
Ignition delay (ms)	-	10	-	10	-	10	.65
Dynamic response index (DRI)	-	18	-	18	-	22	.65
Separation velocity[1/] (ft/s)	35	-	35	-	35	-	.65
Axial thrust (lb_f)	-	7000	-	7000	-	7000	1.0
Pressure (psi)	1200	-	1200	-	1200	-	1.0
Rocket Motor							
Resultant Impulse (lb_f/sec)	950	-	950	-	950	-	1.0
Ignition delay (ms)	-	15	-	15	-	15	1.0
Action time (ms)[2/]	-	500	-	500	-	500	1.0
Resultant thrust (lb_f)	-	5000	-	5000	-	5000	.65
Thrust angle (Degrees) (reference)[3/]	52		52		52		

1/ Nominal separation velocities are: 38.0 ft/s at -65° F and 45.0 ft/s at 165° F.
2/ Nominal rocket motor action time is: 440 ms at -65° F and 340 ms at 165° F.
3/ Record for information only.

3.5 Hydrostatic pressure. The components listed in table II shall withstand the internal hydrostatic pressure specified for 15 seconds minimum when tested in accordance with 4.4.6.2.

TABLE II. Hydrostatic Pressure requirements.

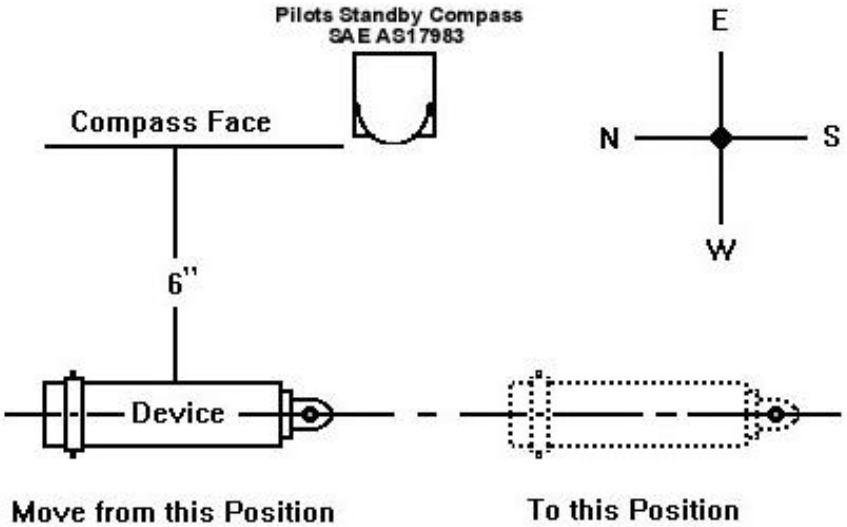
Component	Drawing	Hydrostatic pressure (psi)
Motor Tube	11726650	6,000
Launcher Tube	11726655	12,000
Booster Tube	11726656	12,000

3.6 Radiographic. Each loaded rocket catapult shall be examined radiographically to ascertain the presence, condition, and correct placement of internal components.

3.7 Torque. The booster tube and breech assembly, when seated with a torque of 35 foot-pounds, shall not be loosened or deformed when subjected to a breakaway torque of 17 foot-pounds.

3.8 Protective finish. Protective finish shall be in accordance with the applicable specifications and drawings and shall apply to all surfaces of the component regardless of configuration.

3.9 Residual magnetism. The rocket catapult assembly, when passed in front of an SAE AS17983 compass along the entire length of the catapult (see figure 2) shall not cause the compass indicator to deflect more than 5 degrees in either direction. The test shall be performed in an area free from local magnetic effects.



Note: Device and compass shall lie in a common horizontal plane.

FIGURE 2. Layout for determination of residual magnetism in device.

3.10 Environmental. The rocket catapult assemblies shall withstand the environmental conditioning of 3.10.1 through 3.10.4. Rocket catapult assemblies subjected to this conditioning shall show no evidence of deterioration of propellant or disarrangement of components when examined in accordance with 4.4.6.1 and shall meet the ballistic performance requirements of 3.4 when test fired in accordance with 4.3.2.

3.10.1 High temperature. The rocket catapult shall withstand the high temperature test of 4.3.1.1.

3.10.2 Vibration. The rocket catapult shall withstand the vibration test of 4.3.1.2.

3.10.3 Temperature shock. The rocket catapult shall withstand the temperature shock test of 4.3.1.3.

3.10.4 Thirty-day storage test. The rocket catapult shall withstand the 30-day storage test of 4.3.1.4.

3.11 Identification markings. Each rocket catapult shall be marked in accordance with Drawing 512-174-0068 with an identification label, a warning label, and an installation label.

3.11.1 Production lot designation. The production lot number shall follow MIL-STD-1168. The construction of the lot number shall be as follows:

XXX	03	D	002	-007
a	b	c	d	e

Where:

a = Manufacturer's identification code.
b = The year of manufacture of the oldest batch of propellant (cartridge or rocket motor) in the lot.
c = The month of manufacture of the oldest batch of propellant (cartridge or rocket motor) in the lot expressed as an alpha code in accordance with 4.1.3 of MIL-STD-1168.
d = Lot interfix number (controlled by Indian Head Division, Naval Surface Warfare Center, Code 5120, Indian Head, MD 20640-5035 or contracting activity).
e = Lot sequence number - lot number (manufacturer is responsible for the assignment of lot numbers.

3.12 Workmanship. The workmanship shall be that required by the applicable drawings, referenced specifications, and the best industrial practices governing the quality production of interchangeable parts for maintaining the dimensions, finishes, tolerances, and quality specified herein. All components and assemblies shall be free from burrs, contamination, corrosion, sharp edges, or foreign material, which could result in malfunction of the unit or components, or be a safety hazard in handling.

Specific practices deemed preferable for production of the CKU-5C/A Catapult Assembly are:

a. Propellant grains (both rocket motor grain and cartridge grain) are serialized with consecutive non-recurring serial numbers when manufactured. Serial numbers continue consecutively from batch to batch, and do not restart with a new batch, contract, or drawing revision.
b. The CKU-5C/A Catapult and the CCU-22B/A Cartridge use the serial number of the rocket motor grain and cartridge grain, respectively.
c. CCU-22B/A Cartridges are loaded consecutively into CKU-5C/A Catapults. Refer to section 4.4.1.5 for assembly records requirement.

d. When using two or more populations of serialized components, the populations would be loaded consecutively and not intermingled throughout the catapult population. Refer to section 4.4.1.5 for assembly records requirement.

4. VERIFICATION

4.1 Classification of inspections.

a. First article inspection (see 4.3)
b. Conformance inspection (see 4.4)

4.2 Inspection conditions. Unless otherwise specified in the contract or purchase order (see 6.2), inspection conditions shall be as follows:

a. Temperature: Room ambient 65 to 95° F
b. Altitude: Normal ground
c. Vibration: None
d. Humidity: Room ambient to 95 percent relative, maximum

4.3 First article inspection. Unless otherwise specified in the contract or order (see 6.2), a first article sample shall consist of three blocks of rocket motor propellant, three blocks of catapult propellant, two motor tube and grain assemblies, two cartridge propellant grains, and eighteen loaded rocket catapult assemblies. The rocket catapult assemblies shall be adapted for pressure transducers (see 6.6); and all first article samples shall be manufactured using the method and procedures proposed for production. The first article samples shall be subjected to the tests of 4.4, with the exception of the test firing of 4.4.5, followed by environmental testing, radiographic examination, and static firing in the sequence specified in table III. Acceptance of the first article sample shall be based on no defects in the sample. Any production of the rocket catapult assemblies by the contractor prior to approval of the first article samples shall be at the contractor's risk. First article samples shall not be included as part of the quantity specified for delivery in the contract (see 6.2).

4.3.1 Environmental tests.

4.3.1.1 High temperature. The rocket catapult assembly shall be subjected to the high-temperature storage test in accordance with Method 501 of MIL-STD-810. The test items shall be maintained at 165° F for 50 hours minimum. Operation of the rocket catapult shall be only as specified in table III.

4.3.1.2 Vibration. The rocket catapult assembly shall be subjected to random vibration for jet aircraft in accordance with MlL-STD-2102 with the exception that the duration shall be for 6 hours, with 2 hours on each axis. Before vibration units shall be temperature conditioned in accordance with table III for a minimum of 8 hours. The input vibratory acceleration must have a W_o factor of 0.1 g^2/Hz and the reduction factor must be 0 g^2/Hz-dB. If the rocket catapult must be removed from the environmental conditioning chamber or if the temperature falls outside the specified temperature limits for more than *5* minutes, the testing shall be stopped and the unit reconditioned. A reconditioning time of 2 minutes for every minute outside the specified temperature envelope shall be required. A continuous temperature history of the unit will be kept for all conditioning and testing time. Unless otherwise noted, the rocket catapult shall be mounted on a test fixture in a manner that will simulate actual seat/aircraft installation and excited through the attachment fittings. In addition to compliance with the random vibration test, the rocket catapult shall comply with the gunfire vibration test of Method 519 of MIL-STD-810 for those applications whereby the guns are installed on the aircraft (see 6.2). However, if the maximum test spectrum level of the gunfire configuration is determined to be equal to or less than the MIL-STD-2102 test level, the gunfire vibration test shall not be required.

4.3.1.3 Temperature shock. The rocket catapult assembly shall be subjected to the temperature shock test in accordance with Method 503 of MIL-STD-810. The test temperature extremes shall be -65° F and 165° F and the duration of exposure at each temperature shall be 8 hours. Operation of the rocket catapult shall be only as specified in table III.

4.3.1.4 Thirty-day storage. Three rocket catapults shall be placed in storage at -65° F and three at 165° F for 30 days each. Ensure that the proper temperature is maintained throughout storage. Operation of the rocket catapult shall be only as specified in table III.

TABLE III. First article evaluation test program. 1/

Test Para.	Test	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4.4.6.1	Radiographic inspection	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
4.3.1.1	High temperature	b	b	b	b	b	b												
4.3.1.2	Vibration -65° F							b	b	b									
4.3.1.2	Vibration 165° F										b	b	b						
4.3.1.4	30-day storage -65° F													b	b	b			
4.3.1.4	30-day storage 165° F																b	b	b
4.4.6.1	Radiographic inspection	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
4.3.1.3	Temperature shock	d	d	d	d	d	d	d	d	d	d	d	d						
4.4.6.1	Radiographic inspection	e	e	e	e	e	e	e	e	e	e	e	e						
4.3.2	Ballistic test -65° F	f	f					f			f			d			d		
4.3.2	Ballistic test 77° F			f	f				f			f			d			d	
4.3.2	Ballistic test 165° F					f	f			f			f			d			d

1/ Letters denote sequence of testing

4.3.2 Static firing test. Within 30 days after completion of environmental exposure the rocket catapults must be static fired at the Indian Head Division, Naval Surface Warfare Center, Indian Head, MD 20640-5035. The sample shall be temperature conditioned per Table III for a minimum of 8 hours and test fired within 10 minutes after removal from the conditioning chamber to verify conformance to the requirements of 3.4.

4.3.3 Propellant Aging. Three blocks of cured rocket motor propellant and three blocks of cured cartridge propellant from each batch of propellant used in the first article sample shall be submitted for aging testing to the Indian Head Division, Naval Surface Warfare Center, Indian Head, MD 20640-5035, Attn: Code 5120. High- temperature aging shall be conducted for 84 days 165 ± 5° F. The aging samples shall be placed in desiccators prepared in room ambient conditions of 15 to 50 percent relative humidity and 65 to 95° F. At zero time and at the end of the 28-, 56-, and 84-day aging, physical properties shall conform to MIL-DTL-32124, Type IV for the rocket motor propellant sample and to MIL-DTL-32124, Type II for the cartridge propellant sample. The rate for stress/strain determination shall be 2.0 inches/minute. The sample shall be cast into rectangular cardboard containers approximately 1.5 inches high by 8 inches wide by 11 inches long. All samples submitted shall be bare propellant, individually wrapped in moisture proof packaging and properly identified as to propellant lot and batch number. Failure of the propellant to meet the requirements of MIL-DTL-32124, Type II (cartridge propellant) or Type IV (rocket motor propellant) shall be cause for rejection of the propellant batch.

4.3.4 Propellant morphology. Two motor tube and grain assemblies and two cartridge propellant grains from each batch of propellant used in the first article sample are to be submitted for morphological examination to the Indian Head Division, Naval Surface Warfare Center, Indian Head, MD 20640-5035, Attn: Code 5120. All samples shall be individually wrapped in moisture proof packaging and properly identified as to propellant lot, batch number, and grain serial number. These tests shall be used as the baseline information.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests of 4.4.4 through 4.4.6, conducted on samples selected as specified in 4.4.2. The contractor is responsible for assuring that all rocket catapults offered for acceptance meet all requirements of the applicable drawings and specifications. Items of inspection shall be serialized and inspection data traceable to a specific serial number.

4.4.1 Test reports. When specified in the contract or order (see 6.2), the contractor shall furnish test reports to the contracting activity. Test reports should include the following information as described in 4.4.1.1 through 4.4.1.6:

a. Propellant description (see 3.2.2)
b. Static firing performance test results (see 4.4.5.1)
c. Summary sheet
d. Ammunition data cards
e. Propellant/assembly production records
f. Certification of age of explosive components and propellant (see 3.3)

4.4.1.1 Propellant description. The following propellant information shall be submitted with each production lot. The materials and components of each propellant batch should be listed with the manufacturer, lot number, and date of manufacture. The burning rates at 2000, 4000, 6000, and 8000 psi performed at - 65, 77, and 165° F for each pressure (three samples at each temperature and pressure per batch) for the cartridge propellant and at 1500, 2500, 3000, and 4000 psi performed at -65, 77, and 165° F for each pressure (three samples at each temperature and pressure per batch) for the rocket motor propellant shall also be included. In addition, include the results of tensile strength and elongation tests at -65° F, 77° F, and 165° F with a pull rate of 2 inches/minute (five samples at each temperature per batch), heat of explosion (three samples per batch), and verification that ingredients were properly weighed and added to each batch (mix sheet).

4.4.1.2 Static firing performance tests. All computations and data required for ballistic evaluation generated during quality conformance inspection static firing per 4.4.5 (Government) and 4.4.5.1 (contractor) shall be reported, including firing traces. The following information shall also be listed:

a. Grain designation, manufacturer, lot number, and date of manufacture
b. Type of test equipment
c. Deviations from standard testing procedures
d. Additional comments (malfunctions, unusual occurrences)
e. Disassembly findings report (see 4.4.5.2)

4.4.1.3 Summary sheet. A summary of the results of the inspections required by 3.5 through 3.12 shall be submitted to the designated government activity for each inspection lot. The summary shall include the sample size, number and nature of any defects, and the disposition (accepted or rejected).

4.4.1.4 Data cards. Data cards (DD Form 1650) shall be completed for each loaded rocket catapult lot. Copies shall be provided in accordance with contract requirements and one copy shall be forwarded to the Commander, Indian Head Division, Naval Surface Warfare Center, Indian Head, MD 20640-5035 (Code 5120).

4.4.1.5 Propellant/assembly production records. The contractor shall prepare and retain for the service life of the unit propellant production records including all propellant batch numbers and designations, rocket motor lot number, rocket motor serial number, cartridge lot number, and cartridge serial number. The records shall be cross referenced to the assembled rocket catapult lot number and to specific rocket catapult serial numbers.

This record shall also include the serial number of all serialized components (motor tube, booster tube, launcher tube assembly, nozzle, tang, breech, and head). The serial number of these components shall be traceable to the certification record of the component, and the certification record shall be retained for the service life of the unit or provided to the Commander, Indian Head Division, Naval Surface Warfare Center, Indian Head, MD 20640-5035 (Code 5120) as specified in the contract.

4.4.1.6 Age certification. A certification of the age of explosive components and propellants shall be furnished by the contractor to show compliance with 3.3.

4.4.2 Sampling for quality conformance inspection.

4.4.2.1 Lot. For the purpose of identification, inspection, and shipment, a lot of loaded assemblies shall consist of a maximum of 420 assemblies, including test samples. The homogeneity of inspection lots shall be retained as follows:

a. Components were produced by homogenous process.
b. Units loaded with same lot of rocket motors (see 3.2.3.3).
c. Each lot of cartridges used comply with section 3.2.3.4

4.4.2.2 Sampling for examination. Designation of defects (critical, major, or minor) shall be in accordance with DOD-STD-2101.

a. Critical and major defects: Each rocket catapult assembly (drawing 512-174-0068) shall be examined for all critical and major defects (see 4.4.4.1 for accept and reject criteria).

b. Minor defects: Unless a specific contractor-generated inspection plan has been approved by the contracting activity, sample rocket catapult assemblies (Drawing 512-174-0068) shall be selected for examination in accordance with general inspection level II of ANSI/ASQC ZI.4, AQL 1.0 for major characteristics and AQL 2.5 for minor characteristics (see 4.4.4.2 for accept and reject criteria).

c. Components: Unless a specific contractor-generated inspection plan for all subcontracted components has been approved by the contracting activity (see 4.4.4.3), the following sampling for components shall apply. All rocket catapult components shall be examined for all critical defects. Sampling for other defects shall be in accordance with general inspection level II of ASQC Zl.4, AQL 1.0 for major defects and AQL 2.5 for minor defects (see 4.4.4.3 for accept and reject criteria).

4.4.2.3 Sampling for firing test. A sample of loaded rocket catapult assemblies shall be submitted to the Indian Head Division, Naval Surface Warfare Center, Indian Head, MD 20640-5035, for static firing in

accordance with 4.4.5. The sample size shall be in accordance with table IV. Samples shall be chosen by Indian Head Division, Naval Surface Warfare Center personnel or by a designated Government representative upon completion of the production lot assembly. Loaded rocket catapult samples shall not be preselected during production. Rocket catapults selected for samples shall not be included as part of the quantity specified for delivery in the contract or order. The ballistic sample size shall be divided as equally as possible among rocket motor batches and cartridge batches. From each rocket motor batch not represented in the sample rocket catapult assemblies, one sample rocket motor shall be selected for static firing by the contractor (see 4.4.5.1) so that at least one rocket motor from each rocket motor batch has been static fired.

4.4.2.4 Sampling for nondestructive test. Each rocket catapult assembly shall be subjected to the tests specified in 4.4.6.

TABLE IV. Static firing sample size and temperature conditioning plan

Lot size	Sample size -65° F	Sample size 165° F	Total firing sample
Up to 100	5	5	10
111 to 180	7	7	14
181 to 300	10	10	20
301 to 340	11	11	22
341 to 380	12	12	24
381 to 420	13	13	26

4.4.3 Resubmission of rejected lot. A sample of rocket catapult assemblies shall be selected in accordance with 4.4.2.3 and submitted when, with prior approval of the contracting activity, the contractor requests that the rejected lot be test fired under different conditions or the contractor believes a rejected lot may be reworked to meet the requirements of this specification.

4.4.4 Examination.

4.4.4.1 Critical and major defects. Each rocket catapult assembly shall be visually and radiographically examined for critical and major defects in accordance with the applicable drawings, 3.5, 3.6, 3.7, 3.8, and 3.9, and the sampling plan of 4.4.2.2 a. Any rocket catapult assembly found to contain a critical or major defect shall be rejected.

4.4.4.2 Minor defects. Unless an alternative method is approved, the sample rocket catapult assemblies shall be examined for minor defects in accordance with the applicable drawings, 3.7, 3.11, 3.12, and the sampling plan of 4.4.2.2 b. If any rocket catapult assembly is found to contain a minor defect, the rocket catapult lot shall be rejected. The lot may be resubmitted for examination of minor defects when all of the defective units are removed from the lot or all of the defects are corrected.

4.4.4.3 Component examination. Unless an alternative method is proposed, the rocket catapult components shall be examined in accordance with the applicable drawings and the sampling plan of 4.4.2.2 c. Any component found to contain a critical defect shall be rejected. If any component is found to contain a major or minor defect, the component lot shall be rejected. The component lot may be

resubmitted for examination of major or minor defects when all of the defective units are removed from the lot or all of the defects are corrected. Alternative methods may be proposed and used with the approval of the contracting activity. The method shall be depicted in the contractor's product assurance quality program plan (see 6.2) and shall ensure that all fabricating and processing (of any type) are accomplished under the controlled conditions, which are monitored and accepted by the contracting activity. Systematic control is required for all facets of work to assure all dimensions and requirements are met. This control can be accomplished through direct or indirect inspection, process monitoring, or statistical process control, or a combination of all four. Inspection for rubber o-rings shall be in accordance with Mll.-STD-413.

4.4.5 Production lot acceptance firing. Rocket catapults selected in accordance with 4.4.2.3 shall be static fired at the Indian Head Division, Naval Surface Warfare Center, Indian Head, MD within 30 days after submission for acceptance of the rocket catapult lot. The sample catapults shall be divided into two equal groups with one group conditioned at -65 ± 5° F and the other group conditioned at 165 ± 5° F. Each group shall be conditioned for a minimum of 8 hours. The catapults shall be fired within 10 minutes after removal from the conditioning chamber. Minimum equipment accuracies shall be as shown in Table V. Data specified in table I shall be analyzed in accordance with ANSI/ASQC Z1.9, Section B, Part I, using the procedures of B-5 through B-7. Nonconformance with table I or any requirement of 3.4 shall be cause for rejection of the lot.

4.4.5.1 Contractor batch acceptance test firing. Rocket motors selected by the contractor to meet the requirements of 4.4.2.3 shall be static fired by the contractor as rocket motor batch acceptance tests. The sample rocket motors shall be divided into two equal groups with one group conditioned at –65 ± 5° F and one group at 165 ± 5° F. Each group shall be conditioned for a minimum of 8 hours. The rocket motors shall be fired within 10 minutes after removal from the conditioning chamber. Minimum equipment accuracies shall be as shown in table V. Failure of any rocket motor to meet the requirements of 3.4 shall be cause for rejection of the specific batch of rocket motors.

TABLE V. Test equipment accuracies

Measured characteristic	Equipment accuracy
Maximum thrust	± 2.0 percent
Time	± 0.001 second
Maximum acceleration	± 5.0 percent
Pressure	± 2.0 percent
Temperature	± 2.0° F
Minimum thrust frequency response for test stand	60 Hz

4.4.5.2 Post static-firing disassembly. A post firing disassembly and inspection shall be conducted on all first article, lot acceptance, and batch acceptance test units. Detailed observations on conditions, including marginal conditions of individual components, shall be noted. All findings shall be evaluated against the requirements of 3.4.2. When specified in the contract or order (see 6.2), a disassembly findings report shall be submitted to the contracting activity.

4.4.6 Nondestructive tests. Each rocket catapult assembly shall be subjected to the following tests. When specified in the contract (see 6.2), the contractor shall furnish test reports detailing the results of all nondestructive tests for each lot of rocket catapults.

4.4.6.1 Radiographic inspection. Rocket catapults shall be radiographically inspected in accordance with ASTM E 1472, radiographic quality level 2-1T. Any deficiency shall be cause for rejection of the unit. Radiographs shall be capable of detecting defects and rocket catapult components 0.03 inch in length or width. When specified in the contract (see 6.2), all radiographs taken of the rocket catapult assembly or components thereof shall be forwarded to the activity designated by the contracting activity. Otherwise, all radiographs shall be inspected on-site by a designated Government representative. Acceptance of the loaded rocket catapult lot shall be subject to approval of the radiographs by the designated Government activity.

4.4.6.2 Hydrostatic pressure. Each component listed shall be subjected to the respective internal hydrostatic pressure specified in table V for a minimum of 15 seconds without application of an external load. Any leakage, permanent deformation outside drawing tolerances, or mechanical failure shall result in rejection of that component. Each hydrostatically tested component shall then be subjected to the magnetic particle inspection of 4.4.6.3.

4.4.6.3 Magnetic particle inspection. Each motor tube, booster tube, and launcher tube shall be 100 percent magnetic particle inspected in accordance with ASTM E 1444. Discontinuities exceeding one-half the maximum size permitted by MIL-STD-I907, Grade A, Table 1, are unacceptable.

4.4.6.4 Radiographic inspection. Each breech assembly shall be 100 percent radiographically inspected in accordance with ASTM E 1472, radiographic quality level 2-1T. Any deficiency shall be cause for rejection of the assembly.

4.4.6.5 Penetrant inspection. Each breech, prior to anodizing, shall be 100 percent penetrant inspected in accordance with ASTM E 165. Linear indications are unacceptable. Rounded penetrant indications limited to 1/64-inch diameter are permissible, provided no more than 15 such indications per square inch are present.

4.4.6.6 Torque. After ascertaining that each booster tube (Drawing 11726656) and breech assembly (Drawing 11743980) has been seated with 35 ± 2 foot-pounds of torque, a breakaway torque of 17 ± 2 foot-pounds shall be applied. Any evidence of loosening or deformation of the booster tube and breech assembly shall result in rejection of the part.

4.4.6.7 Residual magnetism. Each Rocket Catapult assembly shall be passed 6 inches in front of an SAE AS17983 compass along the entire length of the catapult in accordance with figure 1. If the compass indicator deflects more than 5 degrees in either direction the rocket catapult assembly shall be rejected. The test shall be performed in an area free from local magnetic effects.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DOD or in-house contractor 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 Service or Defense Agency, or within the military service's system command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The CKU-5C/A Aircraft Ejection Seat Catapult Assembly is intended to be used to propel an aircraft ejection seat and its occupant safely out and away from a jet aircraft. The CKU-5C/A Aircraft Ejection Seat Catapult Assembly was designed for use in a military aircraft and has no commercial application.

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 2.1.1,2.2.2, and 2.3).

c. Whether a first article sample is required (see 3.1, 4.3 and 6.3).

d. Instructions for adaptation of first article samples for pressure transducers (see 4.3 and 6.3).

e. Assigned activity for first article inspection and static firing tests (see 4.3, 4.3.2, 4.4.2.3, 4.4.5, and 6.7).

f. Whether the gunfire vibration test is required (see 4.3.1.2).

g. Whether test reports are required (see 4.4.1,4.4.5.2, and 4.4.6).

h. When radiographs are to be furnished to the Government (see 4.4.6.1).

i. Packaging requirements (see 5.l).

j. Disposition of hardware, scrap propellant, and metal parts (see 6.8).

k. Inspection conditions, if other than as specified (see 4.2).

l. Whether any of the following are required and, if so the appropriate DID: test reports, ammunition data cards, certification data, product assurance quality program plan, and component certification records.

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

6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the items should be a first article sample or a sample selected from the first production items (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examination, approval of first article test results, and disposition of first articles. Invitations for bids

should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

For reference, the environmental testing of 4.3.1 performed for service release testing was done in accordance with MIL-STD-2102A and MIL-STD-810C.

6.4 Hazard notice. The rocket catapult described herein and certain of its components are flammable or explosive and present hazards in manufacture, handling, storage, and shipment. The contractor should recognize these properties and take appropriate measures to guard and protect against fire, explosion, adverse environment, corrosive atmosphere, rough handling, and electrically induced incidents.

6.5 Explosive hazard classification. The explosive hazard classification for this rocket catapult has been designated as:

Explosive Hazard Classification - Class 1, Division 3
Storage Compatibility Group - Group C
Department of Transportation (DOT) Hazard Class - Class B
DOT Marking - Rocket Motor

6.6 Pressure transducers. Instructions for adapting the first article catapult assemblies for pressure transducers should be compatible with instruments having a response not less than 600 Hz and that are capable of detecting ignition peak pressures and unstable burning.

6.7 Test facility. The Indian Head Division, Naval Surface Warfare Center, Indian Head, MD is the design agent for the product covered by this specification. As such, they are equipped to perform the first article inspection and static firing tests specified herein. Except when special conditions warrant otherwise, the Indian Head Division, Naval Surface Warfare Center, Indian Head, MD should be designated as the test facility for the first article inspection. Except when specified otherwise in the contract, the Indian Head Division, Naval Surface Warfare Center, Indian Head, MD should be designated as the test facility for the production acceptance test firings.

6.8 Disposition of hardware, scrap propellant, and metal parts. The contract should specify that:

a. all items purchased become the property of the U.S. Government
b. no hardware, propellant, or metal parts shall be disposed of without authorization of the contracting activity
c. all items be made available to the contracting activity upon request
d. the disposition of any tested hardware, propellant, or metal parts without authorization by the contracting activity will result in the test being declared invalid, and a retest will be required.

6.9 Retention of radiographs. All radiographs of accepted lots of rocket catapults are to be retained on file by the contractor for 9 years or 1 year past the service life of the unit, whichever is longer.

6.10 Service life. The rocket catapult has a design life of 7 years and an installed service life of 7 years from the date of propellant manufacture.

6.11 Subject term (keyword) listing.

Rocket catapult
Rocket motor

6.12 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue. The changes in this revision were authorized by ECP 05026-5120G.

Custodian:
Navy-OS

Preparing activity
Navy - OS
(Project 1377-2005-019)

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