NATO STANDARD

AEP-90

NATO POWERED ACCESSORY RAIL

Edition A Version 1
JUNE 2016

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

1 June 2016

1. The enclosed Allied Engineering Publication AEP-90, Edition A, Version 1, NATO POWERED ACCESSORY RAIL, which has been approved by the nations in the NATO Army Armaments Group, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 4740.

2. AEP-90, Edition A, Version 1, is effective upon receipt.

4. This publication shall be handled in accordance with C-M(2002)60.

Edvardas MAŽEIKIS
Major General, LTUAF
Director, NATO Standardization Office

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RESERVED FOR NATIONAL LETTER OF PROMULGATION

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
CAN	Canada is not in agreement with constraining physical implementation as specified in Annex A-1 and Annex A-2.
ITA	Italian Air Force will not apply this STANAG because it's not considered of convenient application within the Air Service.
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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CHAPTER 1 INTRODUCTION

1. The aim of this document is the standardization of an accessory power and communications rail interface that:

   (a) Is an interface that permits interchangeability. It is compatible with the STANAG 4694 NATO Accessory Rail and backwards compatible with US MIL-STD-1913 accessories.
   (b) Provides power transfer through rail interface.
   (c) Permits device control through the rail interface.

2. The following terms and definitions are used for the purpose of this standard:

Dismounted Soldier Systems: Everything the soldier wears, carries and consumes to fulfill the soldiers' tasks as individuals, as members of fighting teams and as parts of higher-level operational units.

3. This standard deals with:

A standard interface between electrical accessories for small arms and the weapon that provide power from a centralized power source. The NATO Powered Accessory Rail according to this STANAG is compatible with the NATO Accessory Rail, STANAG 4694 and has full backwards compatibility with existing US MIL-STD-1913 accessories.
This standard is implemented when signatory countries, by means of appropriate national procedures, have:

   (a) Ensured that all persons responsible for the design and construction of Dismounted Soldier System and related equipment are informed of the existence of the NATO standard characteristics defined in this Agreement; and

   (b) Ensured that the introduction of new equipment designs does not hinder the interoperability of their respective new equipment with other Nations' Dismounted Soldier System. It is the implementing Nation's responsibility to provide interoperability at the level of their choices in accordance with this standard.

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CHAPTER 2 TECHNICAL SPECIFICATIONS

1. The NATO Powered Accessory Rail is defined by the drawings in Annex A.

2. Recommended method to attach accessories to the NATO powered Rail is found in Annex B.

3. Dimensioning and Tolerances

(a) Dimensioning and tolerances of the NATO Powered Accessory Rail interface shall be in accordance with ISO 2768, ASME Y 14.100, and ASME Y 14.5M-2009.

(b) Dimensioning and tolerances are expressed in Annex A.

4. Environmental Specifications

(a) Chemical Resistance

The Powered Accessory Rail shall survive a minimum 4 hour exposure to lubricants (including LSA and CLP), insect repellant (DEET) and cleaning solutions (including acetone and isopropyl alcohol) without damage to form or degradation of performance.

(b) Environmental Design

The Powered Accessory Rail shall meet the environmental exposure requirements “Test Evaluation Plan (TEP) for the North Atlantic Treaty Organization (NATO) Powered Rail.”; Annex C

5. Contacts and Switch Specifications

(a) Contact Switch Force

- Switches must activate (ON) when a compressive force of more than 12N is applied
- Switches must deactivate (OFF) when the force on them is less than 4 N
- Powered Accessory Rail must be able to indefinitely sustain a maximum 18 N force applied to switch with no mechanical or electrical performance degradation
- Switch force must be maintained constant (ON) in order to maintain current flow to positive electrical contact

(b) Contact layout, dimensions, and polarity are expressed in Annex A-1

(c) Switch and contact grouping is defined in Annex A-2

(d) Contact – non-corrosive

Electrical contacts shall be fabricated from materials that resist the effects of corrosion and oxidation

6. Electrical Specifications

(a) Voltage Range

The NATO Powered Accessory Rail shall provide an operational voltage between the values of 4 and 32 VDC with no evidence of shorts, sparking or overheating. Electrical accessories should be able to operate at any voltage between these two boundaries. It is assumed that every electrical accessory has an internal power conditioning unit (DC/DC conversion) to supply its internal working voltages.

(b) Current 1.5 A Per Contact Pair

The NATO Powered Accessory Rail shall provide at least 1.5 Amperes continuously with no evidence of shorts, sparking, or overheating and no degradation of performance.

(c) Total Current 3 A Per Rail

The NATO Powered Accessory Rail shall provide at least 3 Amperes continuously with no evidence of shorts, sparking, or overheating and no degradation of performance.

(d) Bi-Directional Power Flow Between Rail And Accessories

The NATO Powered Accessory Rail shall be designed such that it can be energized either from a remote power source (such as a remote battery pack) or from any attached accessory acting as a power source. Bi-directional power flow shall not be impeded by the Powered Accessory Rail.

7. Recommended Method for the Control of Attached Devices

It is envisioned that devices, Laser Aiming Devices, Tactical Flashlights etc., that are attached to the rail will also be controlled by a signal that is passed through the rail between the buttons and the devices.

It is preferred that the protocols used between the buttons (controllers) and the devices be an existing commercial standard protocol that can be implemented in hardware through a peripheral integrated circuit package or in software on a microcontroller by any manufacturer.

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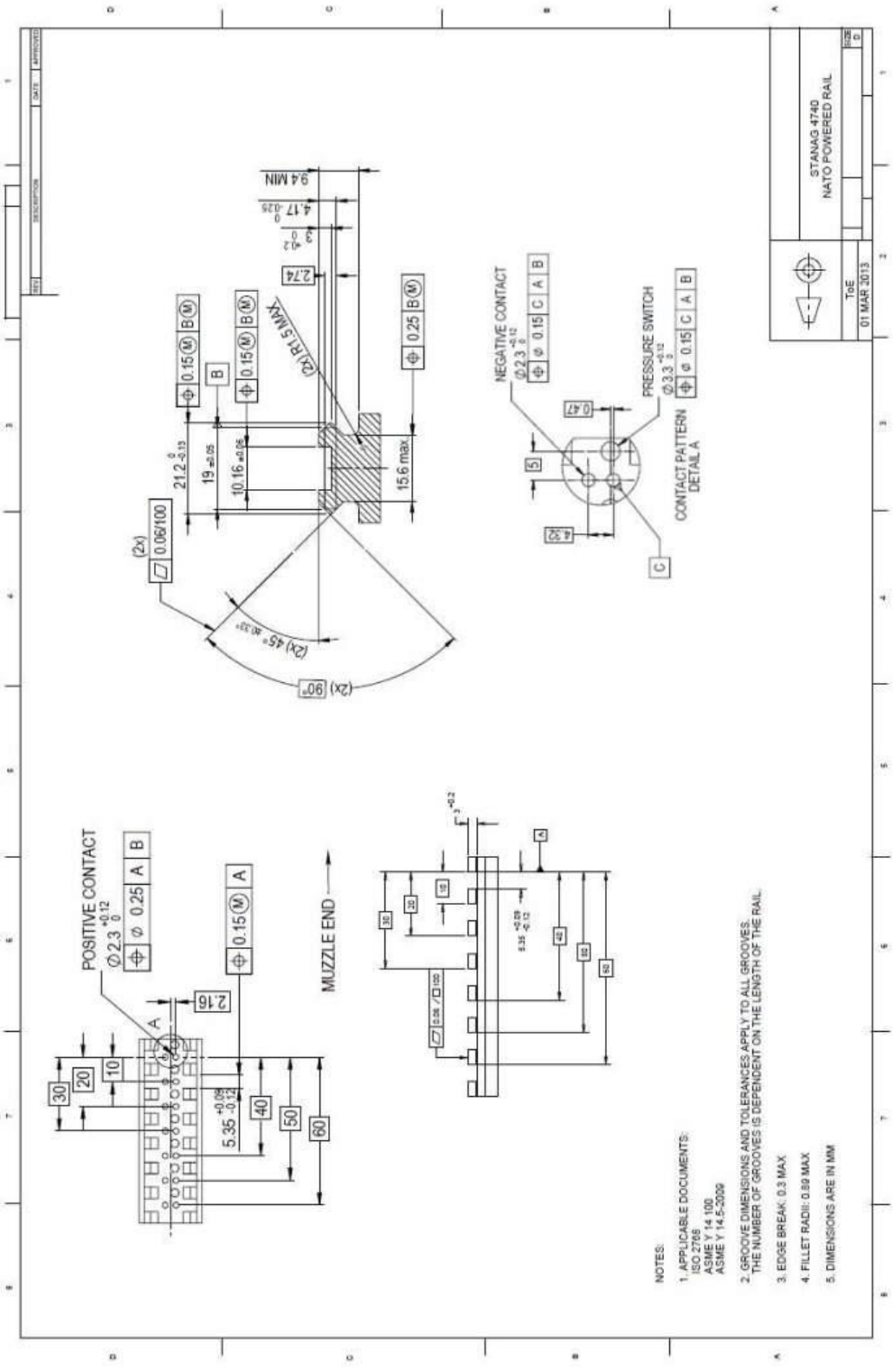
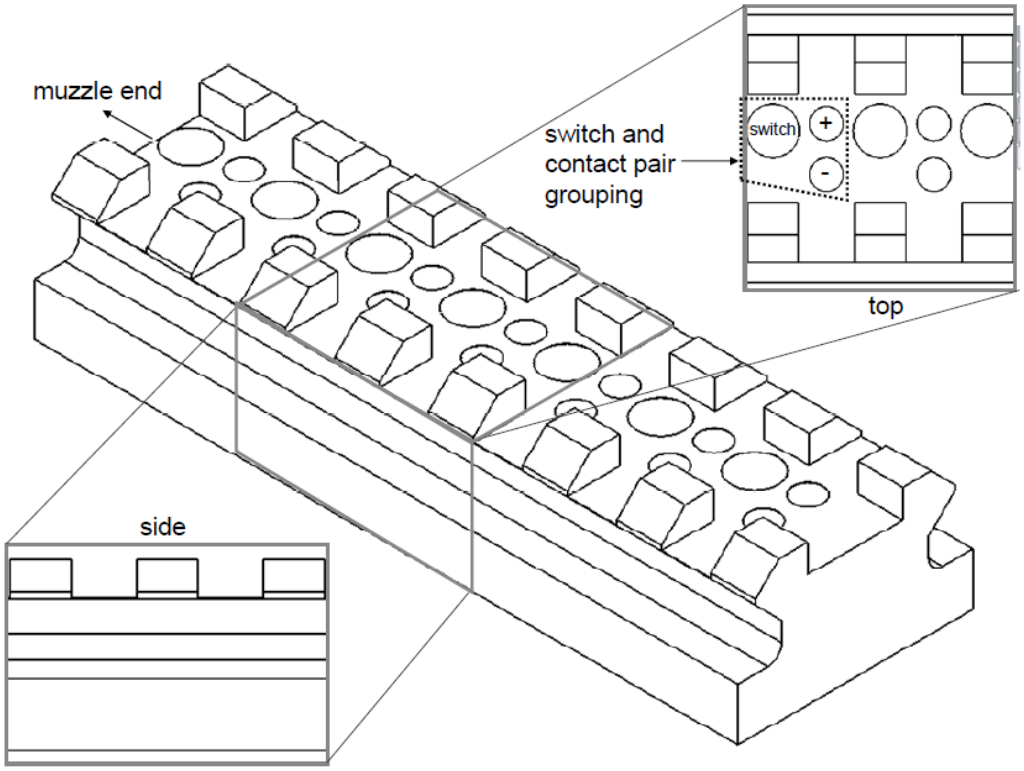
ANNEX A-1 DRAWING



Annex A-2 Switch and contact grouping diagram for the Powered Accessory Rail

Rail contacts for the Powered Accessory Rail are grouped in series of one “contact pair” per “switch”. When the switch is activated (ON), the contacts will respond actively to power and communication signals. When the switch is deactivated (OFF), the contacts are unresponsive and do not supply power. Switch and contact pair grouping is defined in the drawing below.



ANNEX B RECOMMENDED METHOD TO ATTACH ACCESSORIES TO THE NATO POWERED ACCESSORY RAIL

It is recommended that accessories (for example, sight mounts) are in contact with the rail on three sides only. These are the top surface of the rail, and the lower angled two surfaces as shown below.

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ANNEX C TO
AEP-90

TEST EVALUATION PLAN (TEP) FOR THE NORTH ATLANTIC TREATY ORGANIZATION (NATO) POWERED RAIL

13 AUGUST 2009

EXCERPT

ACRONYMS AND DEFINITIONS

Catalog Number	Manufacturer's Model or Part Number
CLP	Cleaning, Lubricating and Protective solution
Data Test Card	Standardized form to record test data (See Appendix A)
DoD	Department of Defense
DEET	N-Diethyl-meta-Toluamide, an insect repellent
LSA	Lubricant, Small Arms
NATO	North Atlantic Treaty Organization
NBC	Nuclear Biological and Chemical
NDA	Non-Disclosure Agreement
ONS	Optics and Non-Lethal Systems
OTF	Ordnance Test Facility
PPE	Personal Protective Equipment
STA	Standard Test Accessory (See Appendix B)
TEP	Test Evaluation Plan
UUT	Unit Under Test (the powered rail system)

ENVIRONMENTAL TESTING

This portion of the testing verifies that the UUT is capable of enduring extreme environments and strenuous usage. The test procedures are detailed below:

Chemical Resistance

The UUT, coatings, and accessories shall be subjected to lubricants (including LSA and CLP), insect repellant (DEET) and cleaning solutions (including acetone and isopropyl alcohol) without damage or degradation of performance.

The UUT shall resist damage by Nuclear, Biological and Chemical (NBC) decontamination treatments for individual weapons.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Visually examine the UUT and note condition on a Data Test Card.

b. Insert fresh batteries into the UUT.

c. Attach an STA and confirm proper UUT mechanical and electrical operation, noting results on the Data Test Card.

d. Remove the STA.

e. Sketch out a grid of the powered rail and its accessories and attach to the Data Test Card.

f. Mark on the sketch which chemical is going to be applied to which section.

g. Apply each chemical per the sketch, ensuring exposure to contacts, connections and wiring harnesses.

h. Let sit for four (4) hours at 20°C (+5°C/-0°C). If chemicals evaporate, run or smear, do not re-apply them.

i. Clean the exterior of the UUT with cloths or paper towels.

j. Visually examine the UUT and note condition for each chemical tested on the Data Test Card.

k. Attach an STA and confirm proper UUT mechanical and electrical operation.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

Temperature Range (Low Operating)

The UUT and STA shall be operable, between the temperature ranges of -32°C and +63°C without degradation of performance or damage. The UUT shall not exhibit damage or degradation in performance from non-operating storage temperatures without power, between the ranges of -51°C and +71°C.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Conduct a visual examination of the UUT paying special attention to stress areas, such as corners, contacts and wiring harnesses. Record the condition of the UUT on a Data Test Card.

b. Utilize a power supply to activate the UUT, then attach and power an STA.

c. Conduct an operational examination, noting results on the Data Test Card.

d. Place the UUT along with a power supply in a temperature chamber.

e. Soak the UUT at -32°C for 2 hours.

f. With the UUT at -32°C, repeat visual and operational examinations (steps a & c). Record results on the Data Test Card.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

Temperature Range (Low Storage)

The UUT and STA shall be operable, between the temperature ranges of -32°C and +63°C without degradation of performance or damage. The UUT shall not exhibit damage or degradation in performance from non-operating storage temperatures without power, between the ranges of -51°C and +71°C.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Conduct a visual examination of the UUT paying special attention to stress areas, such as corners, contacts and wiring harnesses. Record the condition of the UUT on a Data Test Card.

b. Connect external power into the UUT, then attach and power an STA.

c. Conduct an operational examination, noting results on the Data Test Card.

d. Place the UUT in a temperature chamber, removing the external power source and the STA.

e. Soak the UUT at -51°C for 2 hours.

f. With the UUT at -51°C, repeat visual and operational examinations (steps a & c). Record results on the Data Test Card.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

Temperature Range (High Operating)

The UUT and STA shall be operable, between the temperature ranges of -32°C and +63°C without degradation of performance or damage. The UUT shall not exhibit damage or degradation in performance from non-operating storage temperatures without power, between the ranges of -51°C and +71°C.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Conduct a visual examination of the UUT paying special attention to stress areas, such as contacts, connectors and wiring harnesses. Record the condition of the UUT on a Data Test Card.

b. Connect the UUT to an external power supply, then attach and power an STA.

c. Conduct an operational examination, noting results on the Data Test Card.

d. Place the UUT in a temperature chamber, leaving the external power supply installed and the STA operating.

e. Soak the UUT at 63°C for 2 hours.

f. With the UUT at 63°C repeat visual and operational examinations (steps a & c). Document results on the Data Test Card.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

Temperature Range (High Storage)

The UUT and STA shall be operable, between the temperature ranges of -32°C and +63°C without degradation of performance or damage. The UUT shall not exhibit damage or degradation in performance from non-operating storage temperatures without power, between the ranges of -51°C and +71°C.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Conduct a visual examination of the UUT with special attention to stress areas, such as corners of molded cases. Record the condition of the UUT on a Data Test Card.

b. Install a set of fresh batteries, attach and power the STA and conduct an operational examination, noting results on the Data Test Card.

c. Remove the STA, and the batteries from the UUT.

d. Place the UUT in a temperature chamber.

e. Soak the UUT at +71°C for 2 hours.

f. Repeat visual and operational examinations (steps a & b). Document results on the Data Test Card.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

Salt Fog (Combat Ready But Non-Operating)

The UUT shall not be damaged or exhibit degradation after exposure to a salt fog atmosphere consisting of 5% ± 1% by weight of non-iodized salt solution for a minimum of four (4) 24 hour periods (2 wet and 2 dry). Cosmetic changes that are a result of minor oxidation that do not require maintenance are not considered damage or degradation of performance.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Prepare a salt fog chamber – the salt fog should be generated from a 5 ± 1 percent saline (NaCl) solution produced by dissolving 5 parts of salt in 95 parts (by weight) of distilled water.

b. Precondition the chamber to +35°C (+5°C/-2°C) until collection rates of 1~2ml.hr are observed.

c. While conditioning the chamber, clean the UUT and accessories in accordance with the operator's manual. Do not use corrosive solvents, solvents which deposit either corrosive or protective films, or abrasives in any cleaning methods.

d. Install batteries into the UUT, attach an STA and conduct a complete visual and operational examination of UUT, documenting the results on a Data Test Card.

e. Power down the STA but leave it attached and the UUT batteries installed.

f. Position UUT and accessories at 15° (+5°/-5°) to the horizontal in the salt fog chamber.

g. Condition UUT test articles for four 24-hour periods – two wet and two dry.

Remove the UUT and conduct a complete visual and operation examination. Inspect the test items for evidence of deterioration such as flaking, peeling, cracking, or blistering. Document the results on the Data Test Card.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.
2. Results
3. Photographs (as applicable).

Scratch Resistance (Powered) Dust

The UUT shall be scratch resistant to the abrasive effects of sand and dust. The UUT shall not be damaged or exhibit degradation after exposure to blowing dust consisting of silica flour which contains 97-99 percent by weight of silicon dioxide for a minimum of two 6 hour periods (1 ambient temperature and 1 at high storage temperature) at a minimum flow rate of 1.5 m/s. The UUT shall be exposed. Cosmetic changes that result which can be remedied by brushing, wiping or shaking and that do not require maintenance are not considered damage or degradation of performance.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Insert a set of fresh batteries into the UUT, then mount and activate the STA.

b. Conduct a visual and operational evaluation of the UUT, recording findings on a Data Test Card.

c. With the test item in the chamber and stabilized at standard ambient temperature, adjust the air velocity to 8.9 + 1.3 m/s (1750 + 250 ft/min).

d. Adjust the dust feed control for a dust concentration of 10.6 ± 7 g/m3 (0.3 + 0.2 g/ft3)

e. Maintain the conditions of c and d for at least 6 hours.

f. Stop the dust feed. Reduce the test section air velocity to approximately 1.5 +1 m/s (300 + 200 ft/min) and adjust the temperature to the required high operational temperature).

g. Maintain the f. conditions for a minimum of 1 hour following test item temperature stabilization.

h. Adjust the air velocity to that used in c, and restart the dust feed to maintain the dust concentration as in d.

i. Continue the exposure for at least 6 hours. If required, operate the test item in accordance with the test plan.

j. Stop the dust feed and allow the test item to return to standard ambient conditions at a rate not to exceed 3°C/min (5°F/min). Stop any air flow and allow the dust to settle.

k. Remove accumulated dust from the test item by brushing, wiping, or shaking, taking care to avoid introduction of additional dust or disturbing any that may have already entered the test item. Do NOT remove dust by either air blast or vacuum cleaning unless these methods are likely to be used in service.

l. Perform an operational check in accordance with the approved test plan, and document the results for comparison with pretest data.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

Scratch Resistance Sand

The UUT shall not be damaged or exhibit degradation after exposure to blowing sand consisting of silica sand (at least 95% by weight SiO_2) for a minimum of one 6 hour period, re-orienting the test items at 90-minute intervals to expose all vulnerable faces to the blowing sand. The air velocity shall range between 18-29 m/s. The UUT shall be exposed. Cosmetic changes that result which can be remedied by brushing, wiping or shaking and that do not require maintenance are not considered damage or degradation of performance.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Insert a set of fresh batteries into the UUT, then mount and activate the STA.

b. Conduct a visual and operational evaluation of the UUT, recording findings on a Data Test Card.

c. Increase the chamber temperature (at a rate not to exceed 3°C/min (5°F/min)) and stabilize the test item at its high operating temperature.

d. Adjust the air velocity between the range of 18-29 m/s.

e. Adjust the sand feeder to obtain the sand mass flow rate determined from the pretest calibration.

f. Maintain the conditions of Steps c-e for the duration specified in the test plan. If required, re-orient the test item at 90-minute intervals to expose all vulnerable faces to blowing sand, and repeat Steps c-e.

g. If operation of the test item during the test is required, perform an operational test during the last hour of the test, and document the results.

h. Stop the sand feed. Allow the test item to return to standard ambient conditions at a rate not to exceed 3°C/min (5°F/min). Stop any air flow and allow the sand to settle. Remove accumulated sand from the test item by using the methods anticipated to be used in service such as brushing, wiping, shaking, etc., taking care to avoid introduction of additional sand into the test item.

i. Conduct an operational check of the test item in accordance with the approved test plan, and record results for comparison with pretest data.

j. Visually inspect the test item looking for abrasion and clogging effects, and any evidence of sand penetration. Document the results.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

Drop Test (Operating) Use a Simulated Device and Without

The UUT in its operational configuration shall not exhibit degradation of performance after sustaining one (1) meter drops on six faces with an STA mounted onto the rail and powered on.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Insert a set of fresh batteries into the UUT, then mount and activate the STA.

b. Conduct a visual and operational evaluation of the UUT, recording findings on a Data Test Card.

c. Drop the UUT in operational configuration on 6 sides from 1 meter, while attached to the weapon. These sides consist of left, right, muzzle down, muzzle up, underside of the weapon down with STA pointing up and on the top of the weapon with the STA pointing down. Perform drop onto hard-packed earth.

d. Document the impact point or surface for each drop and any obvious damage on the Data Test Card.

e. Perform a functional check of the UUT and document results on the Data Test Card.

f. Following completion of all required drops, visually examine the UUT test item(s).

g. Document the results on the Data Test Card.

h. Repeat steps a.-g. without an STA mounted.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.
2. Results
3. Photographs (as applicable).

Altitude (Operating)

The UUT along with a mounted device shall be capable of continuous operation without degradation from sea level to 15,000 feet.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Power the UUT with an external power source, then mount and activate the STA. Place the UUT along with the activated STA in a pressure/vacuum chamber and seal the chamber.

b. Evacuate the chamber to a pressure of 57 kPa, using an equivalent altitude rate of change of 100 feet per 3 seconds.

c. Hold the chamber at 57 kPa for three hours. Midway through the test cycle, confirm that the STA is still powered and record results on the Test Data Card.

d. Release the vacuum from the chamber at a rate of 100 feet per 3 seconds until the chamber returns to ambient sea level pressure.

e. Remove the UUT along with the mounted device from the chamber and inspect the body surfaces for evidence of deterioration such as flaking, peeling, cracking and blistering, documenting results on the Test Data Card.

f. Operate the UUT and record results on the Test Data Card.

g. Check for condensation inside the battery compartment and record results on the Test Data Card.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.
2. Results
3. Photographs (as applicable).

Immersion with Accessory Powered On (Operational)

The UUT shall withstand immersion in salt water to a depth of 10 meters for one hour without preparation or subsequent performance degradation.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Clean the test items in accordance with manufacturers' instructions, insert a set of fresh batteries into the UUT, then mount and activate the STA. Record results on a Data Test Card.

b. Place the UUT in a pressure chamber.

c. Cover the UUT with salt water consisting of 95% by weight, distilled water and 5% by weight of non-iodized salt.

d. Secure the lid to the chamber and pressurize to simulate a depth of 10 meters of seawater for one hour.

e. Return the chamber pressure to ambient and remove the UUT.

f. Inspect the UUT and record any moisture within the battery compartment, recording results on the Data Test Card.

g. Wait 24 hours, then activate the STA.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.
2. Results

3. Photographs (as applicable).

Immersion Stand Alone Rail

Evaluation Procedure

The following procedures will be conducted for this test:

a. Clean the test items in accordance with manufacturers' instructions, insert a set of fresh batteries into the UUT. Record results on a Data Test Card.

b. Power down and remove the STA but leave the UUT batteries in place.

c. Place the UUT in a pressure chamber.

d. Cover the UUT with salt water consisting of 95% by weight, distilled water and 5% by weight of non-iodized salt.

e. Secure the lid to the chamber and pressurize to simulate a depth of 10 meters of seawater for one hour.

f. Return the chamber pressure to ambient and remove the UUT.

g. Inspect the UUT and record any moisture within the battery compartment, recording results on the Data Test Card.

h. Mount and exercise the STA, recording results on the Data Test Card.

i. Wait 24 hours, then repeat Step h.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

PERFORMANCE LIVE-FIRE TESTING (OPERATIONAL)

The Live Fire Test shall be performed by range personnel to verify that the UUT along with its mounted STA will tolerate the shock, vibration and thermal heating of live weapon fire.

Live-Fire Testing

The UUT shall withstand a 5,000 round endurance firing with no physical damage or performance degradation.

Evaluation Procedure

The following procedures will be conducted for this test:

a. Insert a set of fresh batteries into the UUT, then mount and activate the STA, recording results on a Data Test Card.

b. Visually examine the UUT and STA and record the conditions on the Data Test Card.

c. Fire 200 rounds, using the following sequences:

d. Fire 20 series of 5-round bursts.

e. Fire 10 series of 10-round bursts.

f. Inspect the UUT by performing the following:

g. Using the Data Test Card, record in detail any physical damage sustained on the exterior of the UUT or the STA.

h. Using the Data Test Card, record in detail any physical damage to the interior of the UUT or the STA.

i. Repeat above steps until a total of 5,000 rounds are expended.

Required Data

The following data will be recorded:

1. Names of personnel conducting test.

2. Results

3. Photographs (as applicable).

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