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SAFETY AND SUITABILITY FOR SERVICE ASSESSMENT TESTING OF NON-NUCLEAR MUNITIONS

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NORTH ATLANTIC TREATY ORGANIZATION

ALLIED AMMUNITION S3 PUBLICATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

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NATO LETTER OF PROMULGATION

12 April 2019

1. The enclosed Allied Ammunition S3 Publication AAS3P-01, Edition B, Version 1, SAFETY AND SUITABILITY FOR SERVICE ASSESSMENT TESTING OF NON-NUCLEAR MUNITIONS, which has been approved by the nations in the CNAD AMMUNITION SAFETY GROUP (CASG – AC/326), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 4629.

2. AAS3P-01, Edition B, Version 1, is effective upon receipt and supersedes AAS3P-01, Edition 1, which shall be destroyed in accordance with the local procedure for the destruction of documents.

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS

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RECORD OF SPECIFIC RESERVATIONS

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ALLIED AMMUNITION SAFETY AND SUITABILITY FOR SERVICE ASSESSMENT TESTING PUBLICATION – GUIDANCE

CHAPTER 1 INTRODUCTION

This document is aimed at the 'Safety and Suitability for Service (S3) Assessment Testing of Non-Nuclear Munitions' as agreed under STANAG 4629. It is intended to act as an overarching document dealing with the common aspects of S3 assessment and testing for conventional (non-nuclear) munitions. It points to a family of documents which deal with the necessary testing and assessments for munitions to enter service within the NATO community.

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CHAPTER 2 SCOPE

2.1. PURPOSE

The purpose of this document is to guide personnel involved in the planning and implementation of S3 assessment and testing of munitions to enable appropriate evidence to be collected covering the entire life cycle. It gives an overview of the subject, indicates the benefits and rationale for the various elements of the programme and points to agreed munition specific test and assessment templates. It also indicates how acceptable tailoring of this process can be accomplished.

2.2. APPLICATION

The guidance provided in AAS3P-1 (Allied Ammunition Safety and Suitability for Service Assessment and Testing Publication) is applicable to munition projects used by NATO Nations; multi-national munition projects as well as for national munition projects.

2.3. LIMITATIONS

This document is only applicable to non-nuclear munitions. This document is not intended to be used to aid in the assessment of effectiveness, reliability or performance of a munition unless failure to be reliable or to perform effectively is deemed to represent a direct and immediate safety hazard to the user or other personnel.

2.4. WHOLE LIFE ASSESSMENT (WLA)

In assessing S3 it is necessary to assign some form of service life to the item. This is a prediction of the amount of environmental stress the item should be able to withstand without degrading to an unsafe condition based on a risk assessment. These predictions are less likely to be valid the longer an item stays outside of a controlled storage environment as the environment becomes more variable. In-Service Surveillance (ISS), as described in STANAG 4675, AOP-62, 63, and 64, provides the means by which initial service life estimations can be validated or revised to ensure safe and reliable use throughout the required service life. The use of a robust ISS program in conjunction with initial S3 testing of a munition provides a means to assess an item throughout its life. The through life implementation of S3 and ISS techniques is often referred to as Whole Life Assessment (WLA). The purpose of this AP is to guide personnel involved in the planning and implementation of S3 assessment testing of munitions to enable appropriate evidence to be collected covering the entire life cycle. The objective of the safety test program defined by this AP is to provide data to demonstrate that the munition will be “safe for use”, as defined in paragraph 13.6.4, throughout the potential deployment possibilities in NATO service.

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CHAPTER 3 DEFINITIONS

3.1. SAFE AND SUITABLE FOR SERVICE

For a munition to be regarded as Safe and Suitable for Service it must be demonstrably expected to remain safe (see paragraph 13.6) throughout its planned life cycle, remain acceptably free from hazard due to enemy attack or accident (e.g. Insensitive Munitions – IM and Electromagnetic Environmental Effects – E3) and the explosive materials should function within acceptable safe parameters. Safe and suitable for service does not imply that the item will meet all performance requirements.

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CHAPTER 4 REFERENCES/RELATED DOCUMENTS

References used within this document and related documents are contained within Annex A.

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CHAPTER 5 THE S3 FAMILY OF DOCUMENTS

5.1. GENERAL

The S3 family of documents is shown in Figure 1. The lead document is STANAG 4297, an agreement by participating nations regarding S3 policy and testing. As implemented by STANAG 4297, AOP-15 provides a uniform guide for the assessment of safety and suitability for service of non-nuclear munitions for NATO forces, including an environmental questionnaire to aid in the definition of a Life Cycle Environmental Profile (LCEP) and munition specific design assessment methodologies.

This overarching S3 AP complements AOP-15 by describing common aspects of S3 assessment testing including, sequential environmental testing, E3, IM vulnerability, munition testing, packaging, and life assessment. It also points to E3, IM vulnerability and software safety STANAGs and APs. This overarching S3 AP points to the munition type specific documents to deal with the practical aspects of type qualification including proof, sequential environmental testing and life assessment as required for munition types. It gives as an option using environmentally stressed munitions within E3/IM (vulnerability) test and assessment if this is required, for systems expected to have significant changes to its vulnerability with age/use.

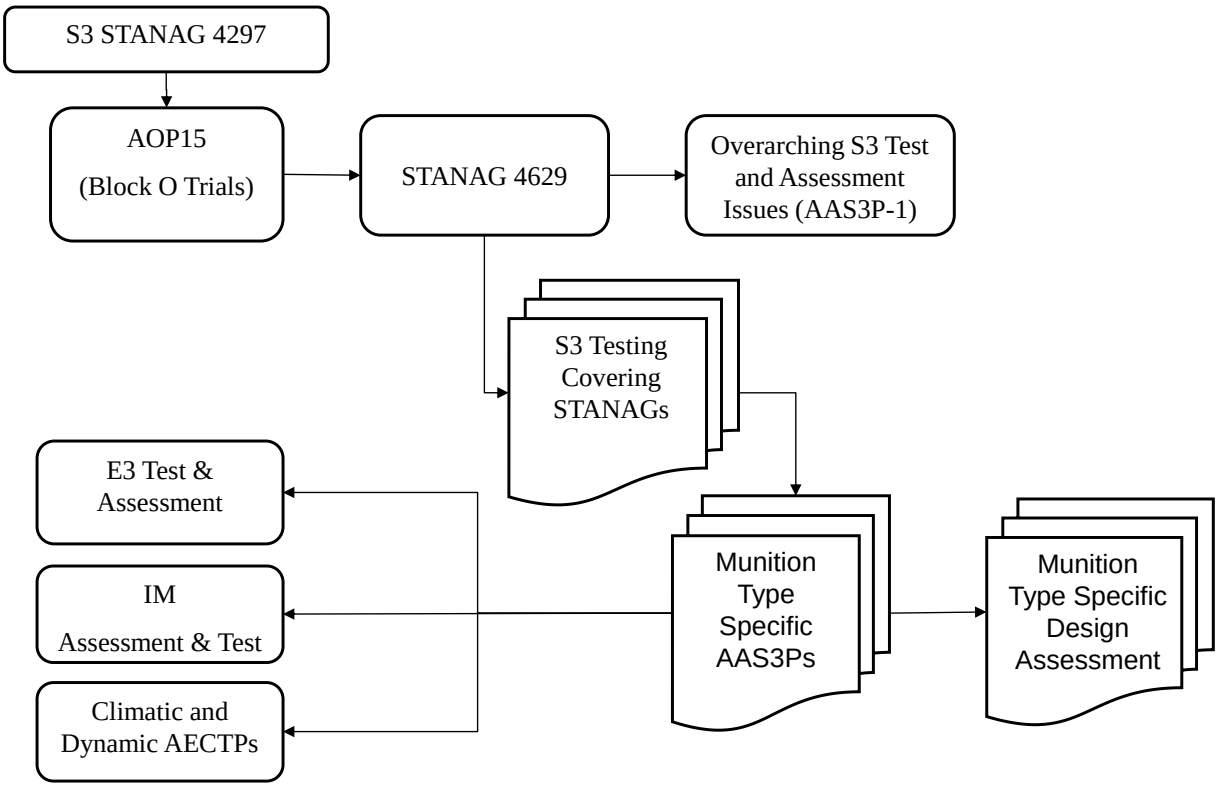

Figure 1 – The S3 Family of Documents

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CHAPTER 6 LIFE CYCLE ENVIRONMENTAL PROFILE

6.1 GENERAL

The development and conduct of a munition S3 program is a major undertaking in terms of cost, time and expertise. In order to minimize unnecessary effort due to test failures, it is recommended that adequate development testing has been carried out before such a program commences. To minimize risk to the program all tests intended for the live munition sequential test program should have been previously attempted during the developmental phase at least at the component level.

To avoid potentially duplicative testing and minimise the need for multiple Nation specific S3 test programmes, it is recommended that the Nation responsible for developing a munition, whether as a National or collaborative munition development programme, meet or exceed the standardised test requirements outlined in the munition type specific documents.

6.2 LIFE CYCLE ENVIRONMENTAL PROFILE (LCEP) AND TEST TAILORING

6.2.1 Sequential testing based upon the planned LCEP of a munition is a fundamental pillar of the evidence required to bring the munition in to service. The LCEP describes service-related events and environmental conditions that a munition will experience from its release from manufacturing to the end of its useful life. Furthermore, the LCEP serves as a tailored guide for developing the design and test parameters.

6.2.2 Nations shall include applicable testing, as outlined in section 5, as an integral part of the overall program to demonstrate and evaluate the characteristics of a munition under S3 assessment. There are generally inherent environmental and operational differences between various classes of munitions (e.g., air-launched, underwater-launched, artillery) that affect S3 testing programs. A munition test program should include all appropriate environments as required to meet the LCEP. Testing need not be limited to that described herein if the Nation believes that further evidence is required to support their S3 process. Decisions by Nations regarding applicable testing, test parameters, and test configurations may be based on agreed standardised regimes and procedures as defined within AECTP-100 through 500.

6.2.3. The AAS3P documents have been developed within the international community and are written with primarily references to NATO test procedures to provide a framework for international procurement and test programs. Each document contains a cross reference table of similar national and international test standards. Whilst each test standard often has unique requirements, the table does not imply the standards are the same or interchangeable. Tailoring of the test procedures and severities in this document is not encouraged. If tailoring is determined to be necessary, the tailoring may be carried out in accordance with the following general principles:

1. The tailored environment shall be at least as severe as the expected life cycle environment;

2. Any alternative test standards / methods that are utilized shall be technically equivalent or superior to the referenced standards / methods;

3. The tailored test procedures and severities, along with full justification / rationale shall be documented as part of the S3 assessment report;

4. Tailoring shall be approved by the relevant National Authority prior to test.

6.2.4 In some cases evidence may be provided to support an assessment that a particular environment is not in itself, or in combination with other elements of the LCEP, likely to result in the munition becoming unsafe to store, handle or use. In such cases the environment may be removed from the test sequence. However, it is essential that this additional evidence is substantial, relevant and focussed on the argument being presented. As such, some environments seen during the LCEP may be considered inconsequential compared to other more severe ones. In such cases these might be removed from the test sequence if an appropriate rationale can be generated. Guidance on test sequence generation dealing with these issues is given in AECTP-100.

6.3 TESTING & SHARING OF TRIALS & ASSESSMENT INFORMATION

6.3.1 To gain confidence in data from limited repetitions of munition testing, S3 assessments may consider the results of developmental tests, sub-scale trials, component or subassembly test programs, in-service surveillance and testing of analogous fielded munitions, and analyses, etc., to enhance the validity of the assessment of a munition in its expected service life environment. While an individual test from an S3 test program may seem pertinent to characterising a unique aspect of a munition, the whole body of evidence, (e.g., the results of all testing and analyses whether S3 specific or otherwise) must be available to a Nation's Authority(ies) for consideration in assessing safety and suitability for service use. NATO CASG AC326 handbook paragraph 5.2.2.2 provides guidance regarding approval Authorities.

6.3.2 As prescribed in STANAG 4297 and AOP-15, each Nation independently conducts their own S3 assessment during the munition acquisition process. Each Nation's S3 assessment is often specifically applicable to their Forces' intended use of that munition so it may be necessary for partnering Nations to conduct their own assessment and testing. To avoid potentially duplicative testing while addressing the need for multiple S3 assessments, the Nation responsible for developing a munition shall provide the testing methodology, data generated during testing, munition design characteristics (where appropriate) and safety analyses for assessing the S3 of that munition to other Nations participating with them in collaborative munition development and procurement programmes or as agreed in a foreign military sales agreement. Such information shall be provided upon receipt of a request through appropriate National channels.

6.3.3 When Nations are jointly participating in a collaborative munition development programme, the establishment of applicable testing, test parameters, test configurations, etc. should be mutually agreed by all Nations involved.

6.3.4 Each Nation reserves the right to carry out additional testing or analyses considered necessary.

CHAPTER 7 OUTLINE OF THE S3 ASSESSMENT TESTING PROGRAMME

7.1 GENERAL

Munition specific S3 assessment testing programs based on representative LCEPs have been developed and shall be executed to satisfy National S3 assessment Authority(ies) and other appropriate Authorities. Annex B contains a detailed list of munition type specific APs. The program shall also include appropriate additional tests deemed necessary by such Authorities. The construct of the testing program focuses on details such as the sequencing of tests, the types of trials and numbers of trials assets required. Although the test regime is intended to give sufficient information to conduct the testing it is inevitable that assumptions and decisions will have to be made throughout the program. The logic for any decisions made regarding applicable testing, test methodologies, test parameters, test configurations, the arrangement of test sequences, etc. shall be documented and consider the munitions LCEP where specific operational or environmental conditions may influence such decisions. The detail, content and extent of a munition S3 assessment test program may be influenced by the relationship between a component/subassembly and the overarching munition design. It may also be influenced by experience or confidence gained through test programs demonstrating and evaluating component/subassembly performance during design and development. However, this must not detract from the minimum sequential testing described in the munition specific S3 APs.

Deviations from the recommended S3 assessment testing program shall be approved by National S3 Authority(ies) and other appropriate Authorities prior to the start of testing. The rationale used in tailoring shall be documented and retained as part of the Munition Safety Data Package.

7.2 EXPLOSIVE MATERIALS QUALIFICATION TESTING

All explosive materials in a munition shall undergo appropriate testing and assessment per STANAG 4170 and AOP-7 to determine whether each possesses properties which make it safe for consideration for use in its intended role.

7.3 FINAL (OR TYPE) QUALIFICATION TESTING OF EXPLOSIVE MATERIALS

The specific use of each explosive material in a munition design role must be demonstrated to be safe and suitable for operational use or training throughout the LCEP. It is best practice to conduct those AOP-7 tests considered most appropriate on the test assets at the end of the sequential trials program to generate the necessary evidence to demonstrate S3 throughout all stages of the LCEP and to assess the residual margin of safety (e.g. for propellant stabiliser consumption). If it can be demonstrated that the cumulative effects of the LCEP cannot cause degradation that leads to an unsafe condition within any of the explosive materials, then it may be possible to waive these tests.

7.4 S3 ASSESSMENT TESTING OF MUNITION FUZING AND IGNITION SYSTEMS

Appropriate S3 assessment testing of munition fuzing and ignition systems designed per STANAGs 4187, 4368, and 4497 shall be conducted in accordance with STANAG 4157 and AOP-20. Additionally, appropriate testing and analysis to assess the effectiveness of mitigating

potential explosive remnants of war hazards, particularly from unexploded ordnance, should be conducted.

7.5 MUNITION SOFTWARE SYSTEM SAFETY ASSESSMENT TESTING

Munition software shall be designed, assessed and tested to assure its safety in accordance with AOP-52.

7.6 MUNITION HAZARD CLASSIFICATION TESTING

In accordance with STANAG 4123 and AASTP-3, appropriate munition hazard classification testing per STANAGs 4375, 4240, 4241, 4382, and 4396 shall be conducted and specifically, Procedure 1 of STANAGs 4375, 4241, and 4382 shall be utilised. The specific implementation of those procedures, however, in individual munition test plans must be coordinated to ensure all appropriate National Authorities' requirements will be satisfied by the testing.

7.7 INSENSITIVE MUNITIONS (IM) ASSESSMENT TESTING

The IM assessment testing shall be conducted in accordance with STANAG 4439 and AOP-39. For a system expected to have significant changes to its vulnerability with age/use, using environmentally stressed munitions within IM vulnerability test and assessment should be considered.

7.8 MUNITION ELECTROMAGNETIC ENVIRONMENTAL EFFECTS (E3) ASSESSMENT AND TESTING

Munition systems which contain electrically operated circuits and/or EID/EED (Electrically Initiated Device / Electro-Explosive Device) shall be assessed and tested for safety and suitability for service in accordance with AECTP-500. For a system expected to have significant changes to its vulnerability with age/use, using environmentally stressed munitions within E3 test and assessment should be considered.

7.9 MUNITION ELECTRICAL SAFETY ASSESSMENT

Munition systems containing electrical circuits which control ignition of EID/EED shall be assessed against the requirements of STANAG 4238 to ensure that no single credible event/fault or electrical/electromagnetic environment is capable of directly initiating an EID/EED, or causing a safety feature to become impaired or overridden. This assessment shall include a hazard analysis in accordance with AOP-15.

7.10 LIFECYCLE EVENTS AND SERVICE ENVIRONMENT ASSESSMENT TESTING

The testing necessary to establish munition safety and suitability throughout the LCEP per AOP-15 shall be conducted within the munition S3 assessment testing program. Environments that are applicable for the S3 assessment of a munition may be identified using the questionnaire in Annex A of AOP-15 and the general guidance found in STANAG 4370, AECTP-100. Detailed maps of the climatic zones and the respective climatic data can be found in AECTP-230. Data associated with the dynamic (shock and vibration) environment can be found in AECTP-240. Many environmental test procedures appropriate for use in assessing such environments are

provided in AECTP-300 and AECTP-400. Tailoring of these environments is fully encouraged, however any deviation from the AECTPs or the munition type specific S3 AP must be justified and approved by the appropriate Authority prior to the start of the S3 assessment program. The justification shall include necessary evidence, such as the life cycle environmental profile, required to support the deviation.

7.11 SERVICE LIFE EXTENSION AND ROLE CHANGE

The testing necessary to establish the safety and suitability of a munition for a specific period of time beyond its previously established or planned service life/environment shall be conducted in accordance with STANAG 4370, AECTP-600. Furthermore, NATO policy for In-Service-Surveillance is STANAG 4675, AOP-62, 63, and 64.

When the role of a munition is changed, or the platform by which it is transported or deployed is changed, then a review in accordance with STANAG 4370, AECTP-600 is necessary to determine if additional testing is required to demonstrate continued safety and suitability of that munition.

7.12 MUNITION DEMILITARISATION AND DISPOSAL ASSESSMENT TESTING

Appropriate safety testing and analysis to assess the demilitarisation and disposal qualities of a munition shall be required in accordance with STANAG 4518.

7.13 RENDER SAFE PROCEDURE TESTING

Appropriate testing and analysis shall be performed to develop Explosive Ordnance Disposal (EOD) render safe procedures for new munitions entering the inventory.

7.14 RANGE SAFETY AND SUSTAINABILITY

In accordance with AOP-15, appropriate testing and analysis shall be conducted to assess range safety and sustainability. The potential for individual and cumulative environmental effects of munitions use on operational ranges, e.g., the expected deposition of hazardous substances, pollutants and contaminants, or emerging contaminants should be assessed.

7.15. HEALTH HAZARD TESTING

Appropriate testing and analysis shall also be conducted to assess potential health hazards posed by the elements or combinations present in munitions and by munitions use. Such hazards may include:

a. Acoustic energy (steady-state noise, impulse noise and blast overpressure),
b. Biological species (mould, fungus and bacteria),
c. Toxic chemical substances (solids, liquids, gases, mists, vapours, fumes or dusts. Also includes combustion products),
d. Oxygen starvation (asphyxiants, confined space and altitude),
e. Radiation energy (ionising and non-ionising radiation, including lasers),
f. Shock (acceleration/deceleration including weapon recoil and blast),
g. Vibration (whole-body and multiple shocks),
h. Extreme temperature and humidity,
i. Impact trauma (blunt, sharp or musculoskeletal).

7.16. PLATFORM INTEGRATION/FIRING SAFETY

Appropriate testing and analysis shall be performed to assess platform integration and launch safety as applicable for new munitions entering the inventory. Live fire testing will be required to provide sufficient evidence of safe operation and separation, and to assess launch/blast effects, and human factors associated with weapon system operation. At a minimum, these tests should encompass the dynamic firing objectives and the operations and maintenance (O&M) objectives.

CHAPTER 8 TEST RESULT ASSESSMENT CRITERIA

The criteria for assessing certain S3 test results are provided in the relevant munition type specific AP (see Annex B).

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CHAPTER 9 TESTING PROCEDURES AND ENVIRONMENTAL CONDITIONS

For NATO interoperability interests and to avoid costs of potentially duplicative testing, any tests described in any of the S3 munition specific APs shall be conducted in accordance with the appropriate STANAGs wherever possible (see paragraph 6.2.3). The environment test conditions are defined in AECTP-230, AECTP-240 and AECTP-250. The environmental test methods are contained within AECTP-300, AECTP-400 and AECTP-500.

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CHAPTER 10 FACILITIES AND INSTRUMENTATION

10.1 TEST FACILITIES

Any test facility used in conducting S3 assessment testing should be approved by their appropriate National Authorities.

10.2 TEST INSTRUMENTATION

Any test chambers, instrumentation or test fixtures used in conducting S3 assessment testing shall not deleteriously interfere with the test stimulus being imposed on the test item or inadvertently influence the understanding of the response of the test item to the test stimulus.

10.3 TEST FIXTURES AND CHAMBERS

Further guidance on test fixtures and chambers used for environmental testing is provided in AECTP-100, AECTP-240, AECTP-300 and AECTP-400.

10.4 CALIBRATION

The accuracy and calibration of all equipment/instrumentation used shall be determined and verified against National standards for all testing.

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CHAPTER 11 SEQUENTIAL TESTING

11.1 SEQUENTIAL TESTING

Nations shall include applicable sequential testing as an integral part of the overall munition S3 assessment test program. Such sequences typically involve pertinent lifecycle environments and generally conclude with destructive performance functioning, destructive safety testing and destructive detailed examinations.

11.2 CUMULATIVE EFFECTS

Sequential testing of munitions is used for LCEP programmes in order that the cumulative effects of expected environments can be determined. In this way the effects of humidity for example may be more severe if the munition has previously been exposed to the vibration effects of road transport. It is therefore essential that the principal environments experienced by the munition are applied in a sequential manner, often emulating the likely order in which they are likely to be seen according to the LCEP.

11.3 OTHER CONSIDERATIONS

Decisions on sequential testing, including the number of munitions tested, shall consider the detailed design of the munition, its similarities with previous designs or conversely its technically innovative features, and the desired confidence level. Such decisions shall represent reasonable compromises that coincide with the LCEP and produce sequences approaching the expected maximum cumulative environmental effect on the munition. Detailed guidance can be found in the munitions type specific APs (a list of which can be found at Annex B).

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CHAPTER 12 TEST ASSETS

12.1 BUILD STANDARD (PRODUCTION REPRESENTATIVE)

Nations shall conduct S3 assessment testing using munition assets that are production representative of those that are expected to be acquired for its forces. Decisions to substitute munition subassemblies with simulated components that are physically, structurally, thermally, or dynamically (or any combination thereof) comparable in individual munition S3 testing must be coordinated to ensure all appropriate Authorities concur with such substitution(s) prior to testing. Such substitutions must not have a deleterious effect upon the trials results or other components in the system.

12.2 COMPONENT TESTING

The term component testing relates to the testing of sub-components of the munition, not necessarily in the configuration in which it is used operationally. Component testing is often a useful tool for the preparation for full scale testing, risk reduction and occasionally when a full scale test cannot completely simulate a particular environment. The value of component testing is significantly enhanced when the in-service interfaces with other components and the method of restraint is the same as that used in service. In this way parameters such as stress, temperature profile and vibration amplitudes can more closely match the real case, rather than being modified by fixtures/structural differences etc. Typically it is not possible to match the in service environment accurately during component testing or capture the synergistic effects of component interactions. Therefore, relying solely on the use of component testing to replace testing of the munition is not appropriate for S3 approval testing.

12.3 PACKAGE STATE

Throughout the S3 testing it is vital that the packaging and restraint of the item is appropriate for the mode of transport and stage of the LCEP concerned.

12.4 QUANTITIES

Quantities should be selected so as to provide statistically meaningful results (this will depend upon required confidence levels and the overall stockpile size and build quality variability) and should reflect the quantities used in previous assessments of similar munitions which subsequently entered into service. Where it is not possible to use statistically meaningful quantities, commonly for complex systems, the test severities used should reflect the maximum stimuli expected with an appropriate safety margin to deal with statistical uncertainty. In this way failure modes will become more likely to appear in the test programme. The overall objective should be to both meet National requirements and provide a convincing demonstration of safety and suitability for service to other participating Nations. Additional guidance is provided in the munition type specific APs. Deviations from the recommended quantities in the munition type specific APs is the responsibility of the appropriate National Authority(ies).

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CHAPTER 13 PRE- AND POST-TEST EXAMINATIONS AND TEST CRITERIA

13.1 GENERAL EXAMINATIONS

Below are the general requirements for pre and post-test examinations. Commodity specific AAS3P documents may contain additional unique requirements.

13.1.1 Prior to conducting and at the completion of the tests, the condition of each test item shall be established as follows:

Initial Baseline Inspection

An initial inspection should be conducted to verify conformance of the munition to the production representative build standard and to provide an assessment of the baseline condition for subsequent test inspections.

Level 1 – Basic

This consists of visual examination supported by photography as necessary (wide angle and close detail).

Level 2 – Intermediate

Encompasses Level 1 but also includes radiography and/or additional non-destructive techniques (e.g. tomography, ultrasonic).

Level 3 – Full (Breakdown Test and Critical Analysis (BTCA))

Encompasses Levels 1 and 2 but also includes disassembly for internal examination. This is typified by destructive examination assessing the chemical (composition, hazard properties, etc) and physical (tensile, hardness, etc) properties of not just the explosive materials, but also of other critical materials contained within the test item.

The following shall be recorded before test:

a. serial number or other identifier,
b. unique identifying characteristics,
c. missing or damaged components,
d. presence or absence of explosive components,
e. modifications to facilitate testing or instrumentation,
f. conformity of critical characteristics
g. record of facility and instrumentation utilised
h. record of calibration
i. digital photographs of the test setup, and
j. if required, the safety and suitability assessment shall be established using appropriate tests identified by the test directive and a record made of compliance with the requirements specifications.

The following shall be recorded during test:

a. significant observations of the test item or instrumentation
b. if operated during the test, a record shall be kept of the data for comparison with pre-test and post-test performance and
c. Appropriate data to confirm compliance with the test requirements (such as

temperature chamber profile, vibration spectra, etc). This shall include details of preconditioning as well as the actual test in question so that the thermal profile applied throughout the test programme can be determined.

The following shall be recorded following the completion of test:

a. results of applicable procedures such as visual inspection, radiographic, breakdown.
b. results of operational and performance testing if required.
c. any deviation from the test directive/test plan or unscheduled test interruptions.

13.1.2 Detailed inspection requirements are defined in the munition specific AP's.

13.2 VISUAL EXAMINATION

At the beginning and completion of any test, or when test exposure is considered to have affected the test item, a visual examination shall be made of the item and any damage observed shall be recorded in the test item record (using photographs as appropriate). The extent of the visual examination shall be governed by the nature of the test item and the damage suspected or incurred. The examination should be performed in a manner that does not interfere with subsequent performance or operational tests required to determine conformance with the criteria for passing the test.

13.3 RADIOGRAPHIC AND/OR OTHER NON-DESTRUCTIVE EXAMINATIONS

Before and after any non-destructive munition S3 test programme and when test exposure is considered to have affected the test item, it is typically appropriate to conduct radiographic and/or other non-destructive inspection of the test item to ascertain and document any external and internal conditions existing prior to or resulting from testing. Safety mechanisms and devices shall remain in their safe condition. Non-destructive techniques utilised shall have the capability to accurately assess condition of the safety critical characteristics.

13.4 BREAKDOWN, TEST AND CRITICAL ANALYSIS (BTCA)

Upon completion of the environmental test sequence it is best practice to disassemble one or more items in order to determine that it remains safe, and that the environments have not significantly degraded its materials, bonds, structures or other safety related requirements.

During breakdown, a detailed examination should be conducted to assess for obvious physical damage (cracking, delamination, wear, powdering etc.) caused by the test sequence.

Next, explosive material should be extracted to repeat appropriate material Qualification tests (STANAG 4170, AOP-7). Additional tests should be carried out to determine bond strength and physical properties of any materials, adhesives, liners, etc. used in the construction of the item.

Finally, all data gathered should be compared with 'baseline' items that have not been subjected to environmental stressing (i.e. stored in benign conditions). Any significant differences should then be raised and reported.

If it can be demonstrated that BTCA is not necessary, because sufficient evidence exists that degradation will not occur or that it is sufficiently well understood and tolerable, then elements of the BTCA can be removed from the test requirement.

13.5 STATIC & DYNAMIC FIRINGS

Following the test sequence, as well as the BTCA, it is necessary to conduct munition firings in order to determine that the munition still performs sufficiently within tolerance so that the appropriate safety margins are not critically affected. The nature of these firings depends upon the type of munition concerned and is dealt with in the munition type specific AP. In general, dynamic firings are performed at the service extreme temperatures/conditions. For missiles/rockets, in addition to dynamic firings, a series of static firings are required where the pressure and thrust are also measured so that the pressure vessel design margins can be determined and demonstrated not to have been adversely affected. These firings are carried out at the extreme service temperatures, although additional firings at other temperatures may also be used if the maximum/minimum pressures are not likely to occur at the extreme temperature values. Furthermore, it may be necessary to determine the flight characteristics such as muzzle/launch velocity, flight velocity (at a predetermined point), pitch/yaw, etc. depending upon the munition system.

13.6 CRITERIA FOR PASSING TESTS

The general criterion for passing any of the mandatory and recommended tests is that an unsafe condition shall not be observed during the test or upon examination of the munition after the test. Given the relatively small number of samples generally employed, one observed unsafe condition generally constitutes a failure. Depending upon the munition and the weapon system design requirement, a small decrease in performance may be acceptable, if safety is not affected. Large degradation in munition performance is likely to indicate that the item is not acceptable for service use. Munitions shall be evaluated by standards given in the test directive, design assessment, E3, IM/Vulnerability, software safety, and environmental life cycle testing/assessment munition specific documents. These criteria are determined by the purpose of each test. For performance tests, the criteria are established by the design or procuring agency and are stated in the appropriate test directive. For environmental safety and reliability tests, the criteria are generally characterised by the permissible deterioration or damage sustained during the environmental simulation. Basically, the test item shall remain safe during and following the test as described in the respective documents. Safe is further defined as safe for disposal, safe for use, or safe and operable. Additional criteria further defining or clarifying these standards are specified in individual APs where required.

13.6.1 Safe

In accordance with AOP-38, safe is defined as having an acceptable degree of freedom from risks to personnel and materiel at all times (see AOP-15 for additional guidance). Munitions usually contain explosive materials with the potential to adversely affect personnel and weapon system/platform within a specified proximity. Therefore, determination of the safety condition of a munition is vital in establishing its performance adequacy. Usable munitions shall remain safe to handle, transport, store, load, and fire or release/use. Unusable munitions shall be safe for disposal consistent with the hazard level of the situation and in accordance with established regulations and procedures.

13.6.2 Safe for disposal

If the munition is unusable, it shall maintain its safety features, including Explosive Ordnance Disposal (EOD) features, in a condition which will permit its disposal without injury to personnel using the applicable handling and disposal regulations and procedures. No unintended burning, detonation, or spread of propellant/pyrotechnic/ explosive or other materials that present a significant hazard shall occur as a result of the event or during the physical removal and disposal of a damaged munition. The munition shall remain sufficiently safe to allow minimal transport to a suitable location for disposal.

13.6.3 Safe for use

No unsafe conditions shall be observed during the test or upon examination of the munition after the test. The munition shall maintain its safety features in a condition which will not create a hazard or cause any subsequent action which will compromise the safety conditions required during handling, transportation, storage, load, and use. Munition use may include installation, loading, and firing or release from the weapon system where damage or irregularity does not prevent loading. Some degradation of performance may be acceptable if safety is not affected. For munitions that are used (e.g., loaded and attempted to be fired or released), failure to meet standard performance requirements does not, by itself, constitute a failure.

13.6.4 Safe and operable

In addition to being considered Safe for Use, the munition shall perform to completion of its function and sequence producing all required outputs within the operating period or at the specified time(s), and shall meet all performance requirements when provided its required inputs (firing command).

CHAPTER 14 S3 ASSESSMENT TEST AND ANALYSIS REPORT

The results of all S3 testing and related analyses conducted relevant to assessing the munition's safety and suitability for service shall be compiled into a documentation package, also known as a Munition Safety Data Package, for use by a Nation's S3 Authority(ies). The package must include the test plan and the rationales for any deviations from the munition type specific AP requirements. In addition, deviations in the execution of the original test plan, whether intended or not, and any concessions shall be presented. Failure to meet the original test requirement must be supported by the rational for acceptance of such deviations. The package must also provide data detailing the results of such testing (e.g., test videos, photographic, NDI/radiographic results) and any safety and vulnerability deductions derived from those results. Requests for the comprehensive documentation package shall be made through appropriate National channels. Reuse of existing applicable documentation amongst Nations participating in collaborative munition development or procurement programs is ultimately intended.

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ANNEX A REFERENCE/RELATED DOCUMENTS

AAP-6	NATO Glossary of Terms and Definitions.
AASTP-3	Manual of NATO Safety Principles for the Hazard Classification of Military Ammunition and Explosives
AECTP-100	Environmental Guidelines for Defence Materiel
AECTP-200	Environmental Conditions
AECTP-230	Climatic Conditions
AECTP-240	Mechanical Conditions
AECTP-250	Electrical & Electromagnetic Environmental Conditions
AECTP-300	Climatic Environmental Tests
AECTP-400	Mechanical Environmental Tests
AECTP-500	Electromagnetic Environmental Effects Tests and Verification
AECTP-600	The Ten Step Method For Evaluating The Ability Of Materiel To Meet Extended Life Requirements and Deployment Changes
AOP-7	Manual of Data Requirements and Tests for the Qualification of Explosive Materials for Military Use
AOP-15	Guidance on the Assessment of the Safety and Suitability for Service of Munitions for NATO Armed Forces.
AOP-20	Manual of Tests for the Safety Qualification of Fuzing Systems
AOP-38	Glossary of Terms and Definitions Concerning the Safety and Suitability for Service of Munitions, Explosives and Related Products.
AOP-39	Guidance on the Development, Assessment and Testing of Insensitive Munitions (MURAT)
AOP-62	In Service Surveillance of Munitions General Guidance
AOP-63	In Service Surveillance of Munitions Sampling and Test Procedures
AOP-64	In Service Surveillance of Munitions Condition Monitoring of Energetic Materials
STANAG 2818	Demolition Materiel: Design, Testing And Assessments
STANAG 3441	Design Of Aircraft Stores
STANAG 3786	Safety Design Requirements For Airborne Dispenser Weapons
STANAG 4110	Definition Of Pressure Terms And Their Interrelationship For Use In The Design And Proof Of Cannons Or Mortars And Ammunition
STANAG 4123	Determination of the Classification of Military Ammunition and Explosives
STANAG 4157	Fuzing Systems: Test Requirements for the Assessment of Safety and Suitability for Service.
STANAG 4170	Principles and Methodology for the Qualification of Explosive Materials for Military Use.
STANAG 4187	Fuzing Systems – Safety Design Requirements

STANAG 4225	The Safety and Evaluation of Mortar Bombs
STANAG 4238	Munition Design Principles, Electrical/Electromagnetic Environments
STANAG 4240	Liquid Fuel/External Fire, Munition Test Procedures.
STANAG 4241	Bullet Impact, Munitions Test Procedures.
STANAG 4297	Guidance on the Assessment of the Safety and Suitability for Service of Non-Nuclear Munitions for NATO Armed Forces (covering AOP-15)
STANAG 4340	NATO Standard Packaging Test Procedures (covering AEPP-3)
STANAG 4368	Electric and Laser Ignition Systems for Rockets and Guided Missile Motors – Safety Design Requirements
STANAG 4370	Environmental Testing (covering AECTPs 100-600)
STANAG 4375	Safety Drop, Munitions Test Procedure
STANAG 4382	Slow Heating, Munitions Test Procedures
STANAG 4396	Sympathetic Reaction - Munition Test Procedures
STANAG 4423	Cannon Ammunition (12.7 to 40 mm) Safety and Suitability for Service Evaluation
STANAG 4432	Air-Launched Guided Munitions, Principles For Safe Design
STANAG 4433	Field Mortar Munitions, Design Safety Requirement
STANAG 4439	Policy for the Introduction, Assessment and Testing of Insensitive Munitions
STANAG 4496	Fragment Impact, Munitions Test Procedure
STANAG 4497	Hand Emplaced Munitions (HEM), Principles for Safe Design
STANAG 4516	Cannon (Greater Than 12.7mm), Design Safety Requirements And Safety And Suitability For Service Evaluation Of The Weapon/Munition Combination
STANAG 4517	Large Calibre Ordnance/Munition Compatibility, Design Safety Requirements And Safety And Suitability For Service Evaluation
STANAG 4518	Safe Disposal Of Munitions, Design Principles And Requirements And Safety Assessment.
STANAG 4519	Gas Generators, Design Safety Principles And Safety And Suitability For Service Evaluation
STANAG 4520	Rifle Launched Grenades Systems, Design Safety Requirements And Safety And Suitability For Service Evaluation
STANAG 4526	Shaped Charge Jet, Munitions Test Procedure
STANAG 4599	Weapon Launched Grenade Systems – Design Safety Requirements And Safety And Suitability For Service Evaluation

STANAG 4608	Ammunition Below 12.7mm Calibre - Design Safety Requirements And Safety And Suitability For Service (S3) Evaluation
STANAG 4629	Safety And Suitability For Service Assessment Testing Of Non-Nuclear Munitions
STANAG 4675	In Service Surveillance (covering AOPs 62, 63, 64)
Def Stan 00-35	Environmental Handbook for Defence Materiel
MIL-STD-810	Test Method Standard for Environmental Engineering Considerations and Laboratory Tests
GAM-EG-13	Essais Généraux en Environnement des Matériels
CIN-EG-01	Guide pour la prise en compte de l'Environnement dans un Programme d'Armement

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ANNEX B MUNITION SPECIFIC AAS3Ps

The following table lists the munition specific Allied Publications associated with this overarching document:

Allied Pub #	Covering STANAG #	Title
AAS3P-01	4629	ALLIED AMMUNITION SAFETY AND SUITABILITY FOR SERVICE ASSESSMENT TESTING PUBLICATION – GUIDANCE
AAS3P-10	4757	SAFETY AND SUITABILITY FOR SERVICE ASSESSMENT TESTING FOR SHOULDER LAUNCHED MUNITIONS
AAS3P-11	4758	SAFETY AND SUITABILITY FOR SERVICE ASSESSMENT TESTING FOR SURFACE AND UNDERWATER LAUNCHED MUNITIONS
AAS3P-12	4759	SAFETY AND SUITABILITY FOR SERVICE ASSESSMENT TESTING FOR AIRCRAFT LAUNCHED MUNITIONS
AAS3P-20	4761	SAFETY AND SUITABILITY FOR SERVICE ASSESSMENT TESTING OF LARGE CALIBER AMMUNITION GREATER THAN 40MM

AAS3P-01(B)(1)