NATO STANDARDIZATION AGENCY
AGENCE OTAN DE NORMALISATION

13 March 2007 NSA/0271(2007)-JAS/4599

See CNAD AC/326 STANAG distribution

STANAG 4599 JAS (EDITION 1) – WEAPON LAUNCHED GRENADE SYSTEMS, DESIGN SAFETY REQUIREMENTS AND SAFETY AND SUITABILITY FOR SERVICE EVALUATION

Reference: PFP(AC/326)D(2004)0017 dated 22 November 2004

1. The enclosed NATO Standardization Agreement, which has been ratified by nations as reflected in the **NATO Standardization Document Database (NSDD)**, is promulgated herewith.

2. The reference listed above is to be destroyed in accordance with local document destruction procedures.

ACTION BY NATIONAL STAFFS

3. National staffs are requested to examine **their ratification status of the STANAG** and, if they have not already done so, advise the Defence Investment Division through their national delegation as appropriate of their intention regarding its ratification and implementation.

for J. MAJ
Major General, POL(A)
Director, NSA

Enclosure:
STANAG 4599 (Edition 1)

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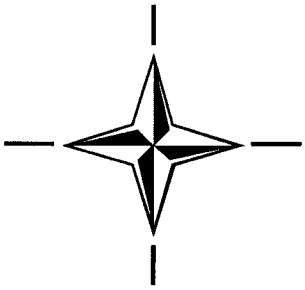
STANAG 4599
(Edition 1)

NORTH ATLANTIC TREATY ORGANIZATION (NATO)



NATO STANDARDIZATION AGENCY (NSA)

STANDARDIZATION AGREEMENT (STANAG)

SUBJECT: WEAPON LAUNCHED GRENADE SYSTEMS, DESIGN SAFETY REQUIREMENTS AND SAFETY AND SUITABILITY FOR SERVICE EVALUATION

Promulgated on 13 March 2007

J. MAJ
Major General, POL(A)
Director, NSA

RECORD OF AMENDMENTS

No.	Reference/date of Amendment	Date Entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Director NATO Standardization Agency under the authority vested in him by the NATO Standardization Organisation Charter.

2. No departure may be made from the agreement without informing the tasking authority in the form of a reservation. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

4. Ratification, implementation and reservation details are available on request or through the NSA websites (internet https://nsa.nato.int; NATO Secure WAN http://nsa.hq.nato.int).

FEEDBACK

5. Any comments concerning this publication should be directed to NATO/NSA – Bvd Leopold III - 1110 Brussels - Belgium.

STANAG 4599
(Edition 1)

NATO STANDARDIZATION AGREEMENT (STANAG)

WEAPON LAUNCHED GRENADE SYSTEMS, DESIGN SAFETY REQUIREMENTS AND SAFETY AND SUITABILITY FOR SERVICE EVALUATION

Annexes:

A. Design Safety Requirements, for Weapon Launched Grenade Systems.

B. Assessments in Support of Evaluation of Safety and Suitability for Service for Weapon Launched Grenades.

C. Tests in Support of Weapons Launched Grenades Safety and Suitability for Service Evaluation.

Related documents:

The following documents of the date of issue of this document form the basis for or have a relationship to this document. AC/326 Cadre Group STANAGs related to environments and test procedures must also be consulted in connection with this STANAG.

AECP-1	MECHANICAL ENVIRONMENTAL CONDITIONS
AECTP-100	ENVIRONMENTAL GUIDELINES FOR DEFENCE MATERIEL.
AECTP-200	ENVIRONMENTAL CONDITIONS
AECTP-300	CLIMATIC ENVIRONMENTAL TESTS
AECTP-400	MECHANICAL ENVIRONMENTAL TESTS.
AECTP-500	ELECTRICAL/ELECTROMAGNETIC ENVIRONMENTAL TESTS.
AEP-4	NUCLEAR SURVIVABILITY CRITERIA FOR ARMED FORCES MATERIAL AND INSTALLATIONS
AEP-22	A GUIDE TO TRANSIENT RADIATION EFFECTS ON ELECTRONICS AT THE TACTICAL LEVEL (LAND FORCES)
AOP-15	GUIDANCE ON THE ASSESSMENT OF THE SAFETY AND SUITABILITY FOR SERVICE OF NON-NUCLEAR MUNITIONS FOR NATO ARMED FORCES.
AOP-20	MANUAL OF TESTS FOR THE SAFETY QUALIFICATION OF FUZING SYSTEMS.
AOP-24	ELECTROSTATIC DISCHARGE, MUNITION ASSESSMENT AND TEST PROCEDURES
AOP-25	RATIONALE AND GUIDANCE CONCERNING STANAG 4327 - LIGHTNING, MUNITION ASSESSMENT AND TEST PROCEDURES
AOP-39	GUIDANCE ON THE DEVELOPMENT, ASSESSMENT AND TESTING OF INSENSITIVE MUNITIONS (MURAT)

STANAG 1307	MAXIMUM NATO NAVAL OPERATIONAL ELECTRO-MAGNETIC ENVIRONMENT PRODUCED BY RADIO AND RADARr.
STANAG 4110	DEFINITION OF PRESSURE TERMS AND THEIR INTERRELATIONSHIP FOR USE IN THE DESIGN AND PROOF OF CANNONS OR MORTARS AND AMMUNITION
STANAG 4147	CHEMICAL COMPATIBILITY OF AMMUNITION COMPONENTS WITH EXPLOSIVES (NON-NUCLEAR APPLICATIONS)
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 4234	ELECTROMAGNETIC RADIATION (RADIO FREQUENCY) 200 kHz TO 40 GHz ENVIRONMENT AFFECTING THE DESIGN OF MATERIEL FOR USE BY NATO FORCES.
STANAG 4235	ELECTROSTATIC DISCHARGE ENVIRONMENT
STANAG 4236	LIGHTNING ENVIRONMENTAL CONDITIONS AFFECTING THE DESIGN OF MATERIEL FOR USE BY NATO FORCES.
STANAG 4239	ELECTROSTATIC DISCHARGE, MUNITIONS TEST PROCEDURES - AOP-24
STANAG 4240	LIQUID FUEL/EXTERNAL FIRE, MUNITION TEST PROCEDURES
STANAG 4241	BULLET IMPACT, MUNITION TEST PROCEDURES
STANAG 4324	ELECTROMAGNETIC RADIATION (RADIO FREQUENCY) TEST INFORMATION TO DETERMINE THE SAFETY AND SUITABILITY FOR SERVICE OF ELECTRO-EXPLOSIVE DEVICES AND ASSOCIATED ELECTRONIC SYSTEMS IN MUNITIONS AND WEAPONS SYSTEMS
STANAG 4327	LIGHTNING, MUNITION ASSESSMENT AND TEST PROCEDURES
STANAG 4370	ENVIRONMENTAL TESTING
STANAG 4375	SAFETY DROP, MUNITION TEST PROCEDURES.
STANAG 4382	SLOW HEATING, MUNITIONS TEST PROCEDURES.
STANAG 4396	SYMPATHETIC REACTION, MUNITION TEST PROCEDURES.
STANAG 4416	NUCLEAR ELECTROMAGNETIC PULSE TESTING OF MUNITIONS CONTAINING ELECTRO-EXPLOSIVES DEVICES
STANAG 4439	POLICY FOR THE INTRODUCTION, ASSESSMENT AND TESTING FOR INSENSITIVE MUNITIONS (MURAT).

STANAG 4518	SAFE DISPOSAL OF MUNITIONS, DESIGN PRINCIPLES AND REQUIREMENTS AND SAFETY ASSESSMENT.
STANAG 4520	RIFLE LAUNCHED GRENADES SYSTEMS, DESIGN SAFETY REQUIREMENTS AND SAFETY AND SUITABILITY FOR SERVICE EVALUATION
STANAG 4560	ELECTRO-EXPLOSIVE DEVICES, ASSESSMENT AND TEST METHODS FOR CHARACTERIZATION

AIM

1. The aim of this agreement is to provide design safety requirements and to define standard tests required supporting the evaluation of the safety and suitability for service of weapon launched grenades.

AGREEMENT

2. Participating nations agree to comply with the design safety requirements and safety and suitability for service evaluation procedures outlined in this STANAG. The nation, or group of nations, carrying out the evaluation of design and safety and suitability for service on an ordnance weapon system agree to make their test parameters, safety analyses and trials reports available to other NATO nations considering purchasing or to take over that ordnance weapon system, on receipt of a valid request. The participating nations further agree that the results of the design assessment and the safety and suitability for service evaluation, performed for the weapon launched grenade/launcher combination in accordance with this document, will be provided by the developing nation to participating nations on a valid request.

DEFINITIONS

3. The following definitions are applicable to the requirements and guidelines included in this document.

Weapon Launched Grenade. A Weapon Launched Grenade is a fuzed munition designed to be projected from a launching device (other than a service rifle) using energy from an integral cartridge. Both Low Velocity and High Velocity grenade ammunition designs are included. The launching devices normally are hand held for Low Velocity ammunition whereas High Velocity grenades are fired by Automatic Grenade Launchers.

Rifle Launched Grenade. A rifle-launched grenade is a fuzed munition designed to be projected from a service rifle, using the energy from a rifle cartridge. STANAG 4520 addresses rifle launch grenades. Grenades launched from under a rifle barrel or from other launching devices, including launching devices attached to the rifle, are covered by this STANAG.

GENERAL

4. The purpose of the design safety assessment and safety and suitability for service evaluation of the weapon/munition combination is to establish that:

a. The weapon launched grenade and its components will remain safe and suitable for service and will function within acceptable performance limits after being exposed to environmental conditions equivalent to those that are likely to be found during the entire stated service life of the grenade.

b. The risk of a safety failure occurring at any point throughout the service life is acceptably low. Hazards that may arise during functioning of the grenade, or a credible accident, or an otherwise survivable enemy action, or the process of disposal following such an accident or at end of life, are to be either designed out or adequately controlled.

SAFETY OF OPERATION

5. The safety and suitability of the weapon launched grenade including components needs to be assessed in specific operational configurations. Where the developing nation(s) has conducted tests on a weapon launched grenade system, the configuration of the grenade and the system shall be included in the trial report.

DETAILS OF THE AGREEMENT

6. Procedures. Each nation will be responsible for the evaluation of design safety and safety and suitability for service of weapon launched grenades to be used by its own Services. Data developed in accordance with this STANAG shall be made available to other NATO nations participating in a collaborative weapon development or procurement programme upon receipt of a request submitted through appropriate national channels.

7. Variations on the Procedures.

a. Notwithstanding the intention to avoid duplication of testing, each nation reserves the right to carry out additional testing if considered appropriate and, when necessary, to bear the financial costs of so doing. Additional trials may be required when the grenade is to be launched from a launcher different from that used by the developing nation.

b. Any significant changes proposed to the agreed evaluation procedures will be provided to the user nation for comment and concurrence.

c. The service environment and usage profile to which the weapon launched grenade may be subjected will be specified by the user nation. The specific test programme need not be limited to tests described in this document. To ensure that any predicted failure modes are adequately investigated, the selection of tests, test parameters and test sequences shall be based on the following:

(1) A design safety assessment, including hazard analysis, of the weapon launched grenade.

(2) The measured or analytically forecast, environmental life cycle profile, including firing shocks, of the weapon launched grenade in accordance with AOP-15.

d. The final safety evaluation shall take account of development trials, as well as individual national safety appraisal procedures, to make a valid evaluation of the weapon launched grenade in the specific service environment.

SAFETY TESTING OF EXPLOSIVES

8. The safety characteristics of the explosives selected for use in weapon launched grenades shall be established in accordance with STANAG 4170. Nations may test to more severe levels to meet national requirements. The compatibility of all materials shall also be assessed in accordance with STANAG 4147.

LIFE CYCLE

9. During their life cycle, weapon launched grenades may encounter different ground, sea and air environmental conditions. Furthermore, within these environments the grenade, whether packaged or unpackaged, may be subjected to repair, testing, maintenance, loading and firing. The tests required to establish the safety and suitability for service characteristics of the grenade shall take account of the need to demonstrate the effects of the expected environment on the grenade during its expected life cycle in accordance with the operational requirement. The procedure for the assessment of the service life of the grenade shall be undertaken in accordance with AECTP-100, AECTP-200 and AOP-15. STANAG 4315, Whole Life Assessment of Munitions, is being drafted and should be used when promulgated.

ENVIRONMENTAL SPECIFICATION

10. To ensure that the environments used during tests are representative, the test environments shall be consistent with the operational requirement and the design specification for the weapon launched grenade. The appropriate operational requirements department of the developing nation’s Service or Services shall certify that the anticipated environments have been correctly defined. This process is defined in AOP-15.

11. Environments selected for testing should represent those extremes anticipated for the planned life cycle of weapon launched grenades and include climatic conditions specified in STANAG 2895. Environments which shall be considered for the assessment and testing of weapon launched grenades include, but are not limited to, the following:

a. Natural environments created regardless of human intervention, e.g. temperature, pressure, humidity, sand and dust, lightning or salt spray.

b. Induced environments associated with mechanical and thermal stresses of the transportation of the weapon launched grenade in a ship, vessel, aircraft, fighting vehicle, or other military installation.

c. Induced electromagnetic, electrostatic and nuclear environments resulting from human intervention.

d. Hazardous environments associated with enemy action and/or accidents, e.g. fire, strike by other ordnance or fragments, aircraft crash, loading and handling accidents.

DESIGN SAFETY ASSESSMENT

12. The weapon launched grenade shall be assessed against the design safety requirements specified in Annex A of this STANAG and as further amplified by the developing nation(s) if required. The grenade and its interface with the weapon should be analysed by hazard analysis in accordance with AOP-15. This safety assessment should identify the required safety tests and may highlight the need to examine in more detail some particular features or perceived weaknesses of the design. Detailed hazard analysis is required for a weapon launched grenade because of the potentially hazardous events associated with the short arming distance normally required, and possibility of failure to launch the grenade in the designed manner.

SAFETY AND SUITABILITY FOR SERVICE TESTS PROGRAMME

13. The safety and suitability for service tests programme shall be developed for the weapon launched grenade based on the design safety assessment, hazard analysis and the environmental profile as indicated in Paragraphs 7c, 9, 10, and 11 above. Such a programme shall include non-sequential functioning and safety tests and sequential environmental tests representing in-service usage patterns as described in paragraph 15 below. The selection of tests, test methods, parameters, duration and sequence, and the logic behind the choice of these in relation to the specified environment, shall be documented.

SAFETY AND SUITABILITY FOR SERVICE TESTS AND ASSESSMENT

14. The safety and suitability for service tests and assessments are those that shall be conducted to establish adequate safety during the complete life cycle of the weapon launched grenade including operational use and credible accident situations, and to determine suitability for service. These assessments are outlined in Annex B and the tests are in Annex C. The applicability of some of these tests is conditional upon the design of the particular grenade although all tests and assessments shall be considered when developing a safety and suitability test programme for weapon launched grenades. The tests are grouped in the following categories:

a. Environmental Functioning and Durability Tests. These tests are to ensure that:

(1) The weapon launched grenade is safe and functions satisfactorily in, or after exposure to, extreme limits of the environments specified in the operational requirement.

(2) The durability of the components is satisfactory.

b. Safety Tests and Analyses. The safety tests and analyses are to demonstrate that the weapon launched grenade will:

(1) Not create a hazard to the operator or other friendly forces when it is fired.

(2) Withstand the firing forces under extreme service conditions.

(3) Withstand potentially hazardous events that could occur and that the weapon design will not result in the unintentional firing of the grenade when subjected to environmental or accidental stimuli.

CHOICE OF TEST AND TEST SEQUENCE

15. Some or all of the safety and suitability for service tests within the programme are conducted sequentially to verify that the weapon launched grenade will be safe and suitable for service in its expected environments. Such sequences may end with destructive functioning, destructive safety tests or critical detailed examination. Grenades may be withdrawn at various points for detailed examination to ascertain the effects of specific environments. The detailed design of the weapon launched grenade should be critically examined so the sequence or sequences represent the best compromise between a realistic life cycle and those sequences which may cumulatively produce the most severe degradation of the grenades under test. The scope of the testing, content of test sequences and extent of the assessment will also be influenced by any similarities with previous designs or by technical innovation in the design. Where a weapon launched grenade or weapon and grenade system being assessed is a modification of a known and previously assessed design, some reduction of testing may be possible.

ADDITIONAL TESTS

16. Further tests, not included in Annex C, may be conducted if considered necessary by the developing authority. In particular, novel grenade designs may require further tests to be undertaken. They may be configured to examine any specific areas of concern highlighted during the design safety assessment. Any test intended to assess the response of the weapon launched grenade to a particular environment or hazard is to be conducted in a manner that simulates satisfactorily the effects of that environment or hazard.

INSENSITIVE MUNITIONS

17. The scope of the hazard analysis carried out on the weapon launched grenade shall be broad enough to support Insensitive Munition (MURAT) assessment in

accordance with STANAG 4439. The developing nation will provide the result of the hazard assessment and the outcome of tests to evaluate Insensitive Munitions (MURAT), performed in accordance with STANAG 4439 and AOP-39.

TEST PROCEDURES

18. The tests described in Annex C shall, where practicable, be conducted in accordance with ratified test STANAGs. In those instances where appropriate STANAGs have not yet been approved, national procedures will apply until superseded by ratified STANAGs. Items within the grenade may be substituted by non-functional items provided this does not detract from the purpose of the test or the test sequence. Such configurations shall be specified in the test plan and details shall be contained in the test report.

TEST PARAMETERS

19. Standard test details and procedures are given in Annex C. Test severities shall be no less than the minimum requirements presented, or referred to, in Annex C. If the results of analyses lead to more severe testing, or to the conduct of tests not mentioned in the Annex, the appropriate severities or tests shall be included in the test programme. Nothing in this STANAG should prevent a nation deciding on a higher or more severe criterion if it so wishes. However, the developing nation should be consulted in the event that a more severe test is specified, in case the test is outside the specified design parameters of the munition.

RESULTS OF TESTS AND ASSESSMENTS

20. Results of the tests and assessments shall be made available by the developing nation on a valid request. Where there is evidence of unacceptable or unsatisfactory results, the significance of these shall be explained by the developing nation. The environmental conditions against which the grenade has been assessed and tested shall be identified in order to enable the need for further testing in subsequent operational environments to be established.

RELATIONSHIP WITH DEVELOPMENT TESTING

21. Tests on weapon launched grenades shall be classified as “development” or “safety and suitability for service” tests. It is expected that development tests will also cover the spectrum of tests in Annex C. The essential differences between the two programmes is that the developmental tests may involve a non-representative build standard of grenade, whilst that selected for the safety and suitability test programme must be fully representative of the production procedures and build standard. Additionally, the grenade should successfully pass the environmental and safety test criteria. The results of development trials carried out with grenades or components which can be proven to be representative of the production build standard, may be taken into consideration in the evaluation of safety and suitability for service, providing test data are made available.

REPORTS ON SAFETY AND SUITABILITY FOR SERVICE TESTS AND ASSESSMENTS

22. It is essential that adequate data be made available to national/service safety evaluation organisations for the evaluation of weapon launched grenades safety and suitability for service. Therefore nations developing the grenades shall compile a data package that documents the test methods and rationale for the programme selection. Reports should be from accredited test houses/ranges/authorities and should carry a satisfactory assurance of quality. The package will also give the detailed results obtained during safety and suitability for service tests. Where results from development trials have been used to justify a reduction in the scope or duration of tests, the results of these development trials should also be included. This assumes that characteristics of the development munition under test have not been changed in the production version. This data package shall be supplemented by a technical design data package where available.

PROTECTION OF PROPRIETARY RIGHTS

23. Nations shall honour as applicable proprietary rights appropriately identified.

IMPLEMENTATION OF THE AGREEMENT

24. This STANAG is implemented by a nation when that nation has issued instructions to its services that all new weapon launched grenades procured for Service use will be designed, assessed and tested in accordance with the requirements and procedures detailed in this agreement.

DESIGN SAFETY REQUIREMENTS FOR WEAPON LAUNCHED GRENADES WHOLE SYSTEM

GENERAL

1. STRENGTH OF DESIGN

The design strength of the weapon launched grenade shall be sufficient to sustain the launch stresses.

2. SAFE OPERATION

a. The system shall remain safe to operate under all specified climatic, mechanical and electrical environment conditions. The specified conditions should include all those likely to be met during the defined life cycle of the grenade.

b. The design of the grenade and explosive materials used should meet the requirement of IM as stated in STANAG 4439 and AOP-39.

c. The technical specification for weapon launched grenades may include the nuclear environment in which they must be capable of operating. If so, the nation developing the weapon launched grenade is required to identify those design features that have been incorporated to meet this requirement, in terms of AEP-4:

Nuclear electromagnetic pulse.
Initial nuclear radiation (INR).
Blast.
Thermal radiation.

3. MATERIAL COMPATIBILITY

Materials used in the construction of the grenade shall perform as required by the design throughout the defined life cycle. Materials used in the construction of the grenade shall be compatible with the explosive materials contained within the grenade body.

4. SINGLE POINT FAILURE

No single fault or failure shall result in the unintentional functioning of the grenade, or in it becoming unsafe.

5. GRENADE STABILITY

The configuration of the grenade shall ensure that it remains safe and stable in flight over the operational range of the grenade.

6. ATTACHMENT TO THE LAUNCHER

Where applicable, any attachment to the launcher must withstand any pressure or force to which it may be subjected by the firing of the weapon launched grenade.

7. NOISE AND BLAST

The blast overpressure in the vicinity of the firer, or locations likely to be occupied by other adjacent personnel, is to be within national limits.

8. REARWARD PROJECTIONS

The rearward projections of any materiel associated with the weapon launched grenade during launch shall not hazard the firer or other personnel in an adjacent location likely to be occupied.

FEED/EXTRACTION MECHANISMS

9. FEED OPERATION

The firing of the weapon launched grenade shall not cause damage to the grenade in launcher or the grenade feed mechanism that will result in a hazard, or unsatisfactory functioning of either the launcher, or the next grenade.

10. UNLOADING

No hazard to the operator shall be created when unloading the grenade from the launcher.

GRENADE FIRING MECHANISM

11. VIBRATION AND SHOCKS

The firing mechanism, whether cocked or uncocked, shall not inadvertently function as a result of shock (including survivable underwater shock and shock from firing), vibration, or any single mode of failure. In a mechanically operated system, an interlock that would prevent the primer being struck should normally be provided.

12. ELECTRO EXPLOSIVE DEVICE (EED) SAFETY

a. When a grenade, which includes an EED initiated warhead, is exposed to the specified electromagnetic (EM) environment, there shall be no induction of electromagnetic energy into the firing circuit which would exceed the established No-Fire Threshold (NFT) energy level of the electro-explosive device (EED), lowered by a defined safety margin.

b. Where an EED is used in several natures of grenade, the NFT for each nature shall be established by the developing nation to be the level of energy corresponding to a 0.001 probability of functioning with a single

sided 95% level of confidence. The procedure in STANAG 4560 (draft) shall be used once ratified. The safe margin below the established NFT to which the firing circuit is designed shall be determined in accordance with the guidance provided in STANAG 4324 or by national safety approving authorities. If it is assessed that a significant probability exists of non-operation, the circuit shall be subjected to a safety test (see Annex C Para 20).

13. FUZE

a. The fuze used in the grenade shall meet the requirements of STANAG 4187.

b. The fuze system shall ensure that the grenade is safe throughout its life and, when fired, up to the safe separation distance.

c. For electrically operated fuzing systems, the requirement is for at least two(2) independent safety switches, connected in series between the EED and its source of firing power.

ASSESSMENTS IN SUPPORT OF THE EVALUATION OF SAFETY AND SUITABILITY FOR SERVICE FOR WEAPON LAUNCHED GRENADES

GENERAL

1. In paragraph 12 of this STANAG it calls for an analysis of the grenade system by formal hazard analysis methods. It is necessary to carry out this analysis to:

a. Determine the need for the conduct of the tests outlined in Annex C, and to identify additional national tests.

b. Determine the appropriate test conditions for the following tests:

(1) Logistic and Tactical Vibration (Annex C, Paragraph 1).
(2) Logistic Bounce (Annex C, Paragraph 2).
(3) Shock-Non Repetitive (Annex C, Paragraph 3).
(4) Underwater Shock (Annex C, Paragraph 7).
(5) Safety Drop (Annex C, Paragraph 12).
(6) Contamination by Fluids (Annex C, Paragraph 18).
(7) Electrical, Electromagnetic and Lightning Environments (Annex C Paragraph 20).

c. Assess compliance with particular design requirements where tests do not fully cover the design requirement(s) and/or are deemed to be inadequate:

(1) Single Point Failure (Annex A, paragraph 4).
(2) Grenade Stability (Annex A, paragraph 5).
(3) Feed Operation (Annex A, paragraph 9).
(4) Unloading (Annex A, paragraph 10).
(5) Safety Interlocks.
(6) Fuze requirements (Annex, paragraph 13).

2. In general the results of the tests conducted under Annex C should be assessed against the appropriate design requirement(s). Specific assessments in addition to the tests detailed in Annex C are outlined below.

SPECIFIC ASSESSMENTS

3. CRITICAL EXAMINATION

a. Reason For Assessment. Critical examinations are conducted to assess the effects of the environmental stressing, accelerated ageing and endurance firings on the weapon launched grenade components.

b. Information. The weapon launched grenade components are examined to determine if any physical or chemical changes have occurred in the components during the simulated life cycle. The need to examine other features may be identified during the environmental and firing tests. The examination may include:

(1) Repeat Sealing Test (See Annex C).
(2) Propellant weight, moisture content and stabiliser content.
(3) Condition of other explosive compositions (chemical stability, mechanical properties…).
(4) Condition of safety sensitive components (including radiographic examination where appropriate).
(5) Functioning of explosive train.

c. Assessment Procedures. The examinations shall be conducted in accordance with national procedures.

4. RANGE SAFETY

a. Reason For Assessment. A range safety assessment is conducted to identify the area susceptible to the hazards produced by firing the weapon launched grenade. The measurements will be applied to establish the Danger Area Template (DAT) and noise, blast over pressure and toxic hazard areas.

b. Information. The assessment is required to identify the dimensions of the DAT and hazard areas for land ranges, training areas and sea firings. Information on ballistic performance from range tables, together with the following additional information, will be required:

(1) Burst safety distance including fragment size, mass, velocity and drag (explosively filled projectiles).
(2) Ballistic characteristics of the greanade in flight including ricochet danger area (inert and explosive projectiles).
(3) Levels of toxic contaminants (for range installations).
(4) Noise and blast over pressure (where appropriate) for range installation configuration (Annex C, Paragraph 22).
(5) Minimum arming distance in accordance with STANAG 4157 - AOP-20, (for all types of fuze fitted ammunition in use).

c. Assessment Procedure. The assessment shall be conducted in accordance with national procedures. STANAGs covering these procedures are being prepared.

TESTS IN SUPPORT OF THE EVALUATION OF SAFETY AND SUITABILITY FOR SERVICE FOR WEAPON LAUNCHED GRENADES

1. LOGISTIC AND TACTICAL VIBRATION

a. Reason For Test. This test is conducted to demonstrate that weapon launched grenades will remain safe and suitable for service use following transportation by sea, road, rail and air, both packaged and unpackaged.

b. Information. The type of vibration testing selected must be chosen from the principal transportation modes in the Manufacture to Target or Disposal Sequence (MTDS). It may be necessary to carry out the selected vibration tests at appropriate high and/or low temperatures associated with transport modes.

c. Test Procedure. Test shall be conducted in accordance with AECTP-400 – Method 401.

2. LOGISTIC BOUNCE/SHOCK - REPETITIVE

a. Reason For Test. This test is conducted to demonstrate that weapon launched grenades will remain safe and suitable for service following repetitive shock loading expected during transportation and/or handling.

b. Information. Repetitive shocks may arise from road or rail transportation, or by handling in mechanical systems and roller conveyors. The severity, shape, direction, duration, frequency and number of shock test pulses will depend on the situation in the MTDS being simulated.

c. Test Procedure. Tests shall be conducted in accordance with AECTP-400 - Method 406.

3. SHOCK - NON REPETITIVE

a. Reason For Test. The test is conducted to demonstrate that weapon launched grenades will remain safe and suitable for service use following non repetitive shocks, multiple small drops or transient vibration expected during transport, handling and operation.

b. Information. Shock, multiple small drops, transient vibration or horizontal impact may occur during transportation by road, rail sea or air, in mechanical handling systems, or during crane operations. They may arise by design during launch from a weapon. The severity should be chosen to be representative of the worst case likely to be encountered during the MTDS.

c. Test Procedure. The test shall be conducted in accordance with AECTP-400 – Method 403.

4. HIGH TEMPERATURE CYCLING

a. Reason For Tests. This test is conducted to demonstrate that weapon launched grenades will remain safe and suitable for service after storage in temperate, hot humid or hot dry conditions.

b. Information. The test may also be used to represent accelerated ageing (to be described in STANAG 4315 - when available). The test cycles will normally be selected from those specified in STANAG 2895. Each cycle will represent a 24 hour period. The cycles may be conducted with low humidity conditions, with controlled high humidity conditions, or with the effects of high solar radiation superimposed. Such cycles may be used to represent accelerated ageing where an assessment of the store design indicates that high temperature cycling will cause appropriate deterioration. The selection of the cycles to be used, and the number of cycles to be applied, will depend upon assessment of the worst case in-service logistics of the store and the amount of accelerated ageing to be represented. Account should be taken of any environmental protection (e.g. by container design) provided for the store.

c. Test Procedure. The test shall be conducted in accordance with AECTP-300 – Method 302.

5. LOW TEMPERATURE CYCLING

a. Reason For Test. This test is conducted to demonstrate that weapon launched grenades will remain safe and suitable for service after storage in cold conditions.

b. Information. The test cycles will normally be selected from those specified in AECTP-200. Such cycle may be also used to represent ageing where an assessment of the store design indicates that low temperature cycling will cause significant deterioration. The selection of the cycles to be used, and the number of cycles to be applied, will depend upon assessment of the worst case in-service logistics of the store and the amount of ageing to be represented. Account should be taken of any environmental protection (e.g. by container design) provided for the store.

c. Test Procedure. The test shall be conducted in accordance with AECTP-300 – Method 303.

6. LOW FREE FALL DROP

a. Reason For Test. This test is conducted to demonstrate that unpackaged, and where considered appropriate, packaged weapon launched grenades will remain safe and suitable for service following a low free fall drop.

b. Information. A study of the MTDS for the ammunition should identify scenarios when the unpackaged or packaged grenade could be dropped and the maximum height from which the test should be conducted (e.g. railcar, truck, VERTREP). The test is normally conduced from a minimum of 1.5m (see also Safety Test No 3).

c. Test Procedure. The test shall be conducted in accordance with national procedures.

7. UNDERWATER SHOCK

a. Reason For Test. These tests are conducted to demonstrate that weapon launched grenades, when embarked in a naval or merchant vessel and subjected to the shock of underwater explosion, will not additionally hazard the vessel, and where appropriate will remain safe and suitable for service use.

b. Information. There are 2 levels of severity of test.

(1) For Vessel Survival Safety the test shock levels to be applied will be such that the vessel will safely survive. The grenades are required to remain safe for handling and disposal at this level.

(2) For the second level of severity the grenades must remain safe and suitable for service. This lower level test is to be conducted as part of the sequential trial. The shock level will vary according to the class of ship and the location of magazines or embarked forces assembly areas.

c. Test Procedure. The tests shall be conducted in accordance with national procedures.

8. PARACHUTE DELIVERY

a. Reason For Test. This test is conducted to demonstrate that packaged weapon launched grenades will remain safe and suitable for service following a parachute delivery of a unit load.

b. Information. If required by the MTDS, the packaged store shall be prepared for airdropping with other dummy weighted containers to represent a unit load on a shock absorbing base in accordance with national procedures. Further information is given in AECP-1 (STANAG 2914).

c. Test Procedure. The test shall be conducted in accordance with national procedures.

9. RAIN

a. Reason For Test. This test is conducted to demonstrate that unpackaged and, where considered appropriate, packaged weapon launched grenades will remain safe and suitable for service following exposure to driving rain.

b. Information. The parameters of the test are defined by rainfall intensity and duration.

c. Test Procedures. The test shall be conducted in accordance with AECTP-300 – Method 310.

10. SALT FOG

a. Reason For Test. This test is conducted to demonstrate that unpackaged and, where considered appropriate, packaged weapon launched grenades will remain safe and suitable for service following exposure to a salt atmosphere.

b. Information. The salt solution used in the test shall be representative of typical marine atmospheres. The severity of the test is determined by the spraying time and the subsequent storage conditions (temperature, humidity and duration).

c. Test Procedures. The test shall be conducted in accordance with AECTP-300 – Method 309.

11. DUST AND SAND

a. Reason For Test. This test is conducted to demonstrate that unpackaged and, where considered appropriate, packaged weapon launched grenades will remain safe and suitable for service following exposure to blowing dust and sand.

b. Information. The test severity is determined by the particle size and concentration, the air velocity and the test duration.

c. Test Procedures. The test shall be conducted in accordance with AECTP-300 – Method 313.

12. SAFETY DROP

a. Reason For Test. This test is conducted to determine the reaction of packaged weapon launched grenades to impact and whether it is safe to handle and for disposal of by qualified personnel following impact from high accidental drops.

b. Information. This test simulates an accidental drop of the grenade in its packaging during ship loading (or unloading) for transport or use. The minimum height for this test is to be 12m. The store will normally be dropped packaged onto an impacting surface of concrete, faced with a steel plate. As a minimum, one sample will be dropped so that the base of the packaged store impacts in the horizontal attitude. This test should be carried out with grenades in the packaging appropriate for logistic transportation. This is normally a pallet configuration or Unit Load Container. To avoid the expense of testing unnecessarily large quantities of grenades, this test may be carried out with live grenades in selected critical locations within the pallet configuration, and the remaining locations filled with ballasted containers. If it is assessed that palletised grenades will not be subjected to any unusual of additional strains over and above those experienced in individual containers, then the tests may be carried out on a single container. Under these circumstances, in the event of any form of failure affecting safety, the test is to be repeated with the full quantity of grenades in the palletised load.

c. Test Procedure. The test should be conducted in accordance with STANAG 4375. If study of the MTDS indicates that the height of drop may exceed 12m for any known class of ship or vessel, after full allowance for clear lifting height and safety margins, then the test should be carried out at the greatest height assessed.

13. LIQUID FUEL FIRE

a. Reason For Test. This test is conducted to determine the reaction of the weapon launched grenade to an intense fire (e.g. aircraft/helicopter/vehicle crash…).

b. Information. The quantity of fuel should be chosen to ensure that the duration of the fire is sufficient to cause reaction of the store. The severity of the reaction and the elapsed time before the reaction will be assessed. In most cases, the test criteria will require that neither the warhead nor the propulsive system function during the test, and/or react within a given time. Ammunition may be packaged and/or unpackaged depending on the MTDS sequence.

c. Test Procedure. The test shall be conducted in accordance with STANAG 4240.

14. SLOW HEATING

a. Reason For Test. This test is conducted to determine the reaction of the weapon launched grenade to increasing heat over a long period such as may result from a fire in an adjacent building or compartment.

b. Information. The temperature of the grenade is raised gradually until a reaction occurs (or 310^0C is reached). The reaction of the grenade may be more severe than that observed during the Liquid Fuel Fire Test because the structure of the grenade may provide containment for the explosives until a higher temperature is reached, or the explosive components may react differently to slow heating regimes.

c. Test Procedure. The test shall be conducted in accordance with STANAG 4382.

15. BULLET/FRAGMENT ATTACK

a. Reason For Test. This test is conducted to determine the reaction of the weapon launched grenade to bullet attack and fragment strike.

b. Information. The grenade should not detonate, explode or become propulsive when struck by the specified test bullet types. A variety of bullets types may be specified, both to assess reaction to direct impact as a result of enemy/terrorist attack and to simulate fragments produced by detonation of other warheads. Any residue should remain safe for handling and disposal. Prior to this test, the grenade may be subjected to any environmental conditioning sequence. Grenades may be packaged and/or unpackaged depending on the MTDS.

Separate tests should be conducted with the test strike impact on the grenade fuze, the warhead filling, or their interfaces, as appropriate.

c. Test Procedure. The test shall be conducted in accordance with STANAG 4241 and STANAG 4496 (when available). Additional fragment attack tests to national procedures may also be used.

16. SYMPATHETIC REACTION

a. Reason For Test. This test is conducted to determine the reaction of the weapon launched grenade to functioning of a grenade in close proximity.

b. Information. Sympathetic detonation between adjacent grenades in all MTDS configurations shall not occur. The test criteria may accept lesser reactions. Detonation propagation tests may be conducted and tests that may contribute information include Total Fragment Recovery Tests and Fragment Attack Tests.

c. Test Procedure. The test shall be conducted in accordance with STANAG 4396.

17. FUZE SAFETY

a. Reason For Tests. These tests are conducted to verify fuze safety in credible accident scenarios and in the environmental conditions to be encountered in the MTDS. Fuzes shall not function in such a way that the main charge is initiated in any credible accident situation nor under any climatic, physical or mechanical environmental condition identified in the MTDS. Additional tests may be required on separately packaged fuzes and grenades containing Pyrotechnically Initiated Explosives (PIEs).

b. Information. Evidence will be required that the fuze complies with the design safety requirements of STANAG 4187.

c. Test Procedure. The tests shall be conducted in accordance with STANAG 4157 – AOP-20. These include:

Arming

Distance Test (No Arm and All Arm).

Close

Obstruction Fail Safe.

Explosive Train Interrupt Test.

Firing

Through Brushwood Test.

18. CONTAMINATION BY FLUIDS

a. Reason For Test. This test is conducted to demonstrate that the unpackaged weapon launched grenades will remain safe and suitable for service following exposure to fluids typical of those which may cause contamination in service.

b. Information. The range of fluids to be considered includes fuels, oils, hydraulic fluids, solvents, cleaning fluids, battery electrolytes and nuclear fall-out decontamination fluids. The fluids to be used, and the severity parameters, should be determined from the MTDS. Consideration should be given to the need to pre-heat some fluids to appropriate temperatures.

c. Test Procedures. The test shall be conducted in accordance with AECTP-300 – Method 314 and national procedures.

19. SEALING

a. Reason For Test. This test is conducted to demonstrate that a weapon launched grenade is suitable for service after immersion.

b. Information. The test may be conducted by immersing unpackaged grenades in water and observing for the emergence of bubbles. The test criteria should indicate the proportion of rounds required to remain suitable for service.

c. Test Procedures. The test shall be conducted in accordance with AECTP-300 – Method 307.

20. ELECTRICAL, ELECTROMAGNETIC AND LIGHTNING ENVIRONMENTS

a. Reason For Test. These tests are conducted to assess the vulnerability of weapon launched grenades to electrical electromagnetic and lightning environments.

b. Information. These tests are applicable to weapon launched grenades containing electrical circuits, which influence safety and suitability for service. Tests which may be required are:

(1) External RADHAZ and EMC. This test identifies the effect of likely external RF sources on the ignition EED or fuze setting, if applicable.

(2) Electrostatic Test. This identifies the vulnerability of the ignition system EED to electrostatic discharges. The test will normally only be undertaken if the hazard assessment indicates potential vulnerability of the EED to electrostatic discharge.

(3) Lightning. This test identifies the vulnerability of the ignition system EED to lightning. The test procedure will normally be conducted only after a Lightning Hazard Design Assessment in accordance with STANAG 4327 and AOP-25. The requirement for safety and survivability against direct and nearby strikes in packaged or unpackaged states shall be defined as part of the risk assessment.

c. Test Procedures. Environments appropriate for use in tests are described in STANAGs 1307, 4234, 4235 and 4236. The following procedures are applicable:

(1) External RADHAZ and EMC. Using the instrumented device, likely combinations of external radio and radar transmitters are operated to a set plan, and the results recorded. Levels may be extrapolated to give the worst case, except for electronic circuits that may be non-linear. In such cases, a higher level can be simulated by use of current monitoring and injection techniques. The tests shall be conducted in accordance with STANAG 4324 Ed 2 (when ratified) or national procedures. Tests on fuze setting and control functions shall also be conducted, as applicable, using national procedures.

(2) Electrostatic Test. If required, the test shall be conducted in accordance with STANAG 4239 and AOP-24.

(3) Lightning. If required, the test(s) shall be conducted in accordance with STANAG 4327 and AOP-25.

21 NUCLEAR HARDENING

a. Reason For Test. This test or assessment is conducted to demonstrate that weapon launched grenades will remain safe, or safe and suitable for service, following exposure to the effects of a nuclear explosion.

b. Information. The potentially damaging effects of a nuclear explosion are electromagnetic pulse (EMP), initial nuclear radiation (INR), air blast and thermal radiation as defined in STANAG 4145 (AEP-4) and AEP-22. Consideration should be given to severity levels of these effects at which the grenade should remain safe, and severity levels at which the grenade should remain safe and suitable for service.

c. Test Procedure. The EMP Test or assessment for firing circuits shall be conducted in accordance with STANAG 4416 when promulgated, or national procedures. National procedures shall be used for INR, air-blast and thermal assessment.

22. NOISE BLAST OVERPRESSURE

a. Reason For Test. The test is conducted to establish the potential hazards from blast overpressure at launch and, where appropriate, on warhead function at minimum arming distance.

b. Information. Blast overpressure levels in the vicinity of the firer or locations likely to be occupied by other adjacent personnel shall be established. The test shall be carried out without any adjacent structure to identify the basic noise danger area. The test shall be repeated for each particular type of grenade.

c. Test Procedure. The test shall be conducted in accordance with national procedures.

23. ACCURACY AND CONSISTENCY

a. Reason For Test. The Accuracy and Consistency Test is conducted to assess the accuracy and consistency of the weapon launched grenade and its sighting system over the ranges and at targets laid down by the national requirement.

b. Information. The sighting system should be assessed for suitability, functionality and its ability to project the grenade at the correct target.

c. Test Procedures. This test shall be conducted in accordance with national procedures.

24. INITIAL FUNCTIONING

a. Reason For Test. This test is conducted to demonstrate that all grenades supplied for testing function as designed.

b. Information. The grenade is fired from the in-service weapon of the nation adopting the grenade using the specified in-service ammunition of that nation.

c. Test Procedure. Tests shall be conducted in accordance with national procedures.