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See CNAD AC/326 STANAG distribution

STANAG 4170 JAIS (EDITION 3)-PRINCIPLES AND METHODOLOGY FOR THE QUALIFICATION OF EXPLOSIVE MATERIALS FOR MILITARY USE

References: MAS/0190-PPS/4170, dated 16 February 2001

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. The CNAD Ammunition Safety Group (AC/326) considers this an editorial edition of the STANAG; previous ratifying references and implementation details are deemed to be valid.

A handwritten signature in black ink, appearing to read "Juan A. Moreno", is written over a horizontal line. The signature is stylized and cursive.

Juan A. MORENO
Vice Admiral, ESP(N)
Director, NATO Standardization Agency

Enclosure:
STANAG 4170 (Edition 3)

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**NORTH ATLANTIC TREATY ORGANIZATION
(NATO)**



**NATO STANDARDIZATION AGENCY
(NSA)**

**STANDARDIZATION AGREEMENT
(STANAG)**

SUBJECT: PRINCIPLES AND METHODOLOGY FOR THE QUALIFICATION OF
EXPLOSIVE MATERIALS FOR MILITARY USE

Promulgated on 4 February 2008

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Jua A MORENO,
Vice Admiral, ESP(N)
Director, NATO Standardization Agency

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 <http://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 - BE.

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT
(STANAG)

"PRINCIPLES AND METHODOLOGY FOR THE QUALIFICATION OF
EXPLOSIVE MATERIALS FOR MILITARY USE"

Annexes:

- A. Identification of National Authorities.
- B. Explosive Qualification Certificate.

Related documents:

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 NON-NUCLEAR MUNITIONS FOR NATO ARMED FORCES
AOP-26	NATO CATALOGUE OF EXPLOSIVES
AOP-48	EXPLOSIVES, NITROCELLULOSE BASED PROPELLANTS, STABILITY TEST PROCEDURES AND REQUIREMENTS USING STABILIZER DEPLETION
STANAG 4147	CHEMICAL COMPATIBILITY OF AMMUNITION COMPONENTS WITH EXPLOSIVES (NON NUCLEAR APPLICATIONS).
STANAG 4297	GUIDANCE ON THE ASSESSMENT OF THE SAFETY AND SUITABILITY FOR SERVICE OF MUNITIONS FOR NATO ARMED FORCES - IMPLEMENTS AOP-15.
STANAG 4397	EXPLOSIVES, NATO CATALOGUE – AOP-26
STANAG 4443	EXPLOSIVES, UNIAXIAL COMPRESSIVE TEST.
STANAG 4487	EXPLOSIVES, FRICTION SENSITIVITY TESTS.
STANAG 4488	EXPLOSIVES, SHOCK SENSITIVITY TEST(S).
STANAG 4489	EXPLOSIVES, IMPACT SENSITIVITY TESTS.
STANAG 4490	EXPLOSIVES, ELECTROSTATIC DISCHARGE SENSITIVITY TESTS.
STANAG 4491	EXPLOSIVES, THERMAL SENSITIVENESS AND EXPLOSIVENESS TESTS.
STANAG 4506	EXPLOSIVE MATERIALS, PHYSICAL/MECHANICAL PROPERTIES UNIAXIAL TENSILE TEST.
STANAG 4507	EXPLOSIVES MATERIALS, PHYSICAL/MECHANICAL PROPERTIES, STRESS RELAXATION TEST IN TENSION.
STANAG 4515	EXPLOSIVES, THERMAL CHARACTERISATION, BY DIFFERENTIAL SCANNING CALORIMETRY, DIFFERENTIAL THERMAL ANALYSIS AND THERMO-GRAVIMETRIC ANALYSIS.
STANAG 4525	EXPLOSIVES, PHYSICAL/MECHANICAL PROPERTIES, THERMO-MECHANICAL ANALYSIS FOR DETERMINING COEFFICIENT OF LINEAR THERMAL EXPANSION (TMA).

- STANAG 4540 EXPLOSIVES, PROCEDURES FOR DYNAMIC MECHANICAL ANALYSIS (DMA) AND DETERMINATION OF GLASS TRANSITION TEMPERATURE.
- STANAG 4556 EXPLOSIVES, VACUUM STABILITY TEST.
- STANAG 4581 EXPLOSIVES: ASSESSMENT OF AGEING CHARACTERISTICS OF COMPOSITE PROPELLANTS CONTAINING AN INERT BINDER
- STANAG 4582 EXPLOSIVES, NITROCELLULOSE BASED PROPELLANTS, STABILITY TEST PROCEDURE AND REQUIREMENTS USING HEAT FLOW CALORIMETRY
- STANAG 4620 EXPLOSIVES, NITROCELLULOSE BASED PROPELLANTS, STABILITY TEST PROCEDURES AND REQUIREMENTS USING STABILIZER DEPLETION – IMPLEMENTATION OF AOP-48

AIM

1. The aims of this agreement are:
 - (a) to establish the concept and requirement for Qualification of explosive materials by a National Authority for military use by NATO nations;
 - (b) to ensure that only explosive materials sufficiently characterised and assessed as possessing properties making them safe and suitable for consideration for military use are Qualified for an intended role. A change of role (e.g. the use of a Qualified booster as a main charge explosive) will require a separate assessment on a case-by-case basis, to determine whether that explosive can be used in a new particular application not covered under the intended (original) role;
 - (c) to provide for NATO nations an acceptable and uniform basis to achieve Qualification status of explosive materials by the adoption of the principles and methodology described in this STANAG and related document AOP-7.

DEFINITIONS

2. The following terms and definitions are used for the purpose of this agreement:
 - (a) Assessment. The evaluation of the properties of an explosive material, including the results of appropriate tests, to determine its relationship, with particular regard to safety, to other known explosive materials already in service use.
 - (b) Explosive Material. An explosive material is a substance (or mixture of substances) which is capable by chemical reaction of producing gas at such a temperature and pressure as to cause damage to the surroundings. Included are pyrotechnic substances even when they do not evolve gases. This document will refer only to those explosive materials whose application requires that they shall react reliably on demand. The term “explosive” thus includes all solid and liquid materials variously known as high explosives and propellants, together with igniter, primer, initiatory and pyrotechnic (e.g. illuminant, smoke, delay, decoy, flare and incendiary) compositions.
 - (c) Qualification. This is the assessment of the explosive material by the National Authority according to this STANAG and AOP-7 to determine whether it possesses properties which make it safe and suitable for consideration for use in its intended role.
 - (d) Qualified Explosive Material. An explosive material which has successfully completed the Qualification process of a National Authority. This is an intermediate risk reduction stage prior to Final (or Type) Qualification.
 - (e) Final (or Type) Qualification. Final (or Type) Qualification relates to the use of the

explosive material in a specific application or munition. Final Qualification is given when the explosive has been assessed as part of the design of the specific munition, and predicted to be safe and suitable for military operational or training use in that role. The database of results is a means of undertaking "Risk Assessment".

- (f) New Explosive Material. The term "New Explosive Material" encompasses:
- (1) an explosive material not previously Qualified;
 - (2) an explosive material for which the existing specification defining its composition, its material constituents, source of these constituents or the process by which the composition is prepared, has been modified;
 - (3) an explosive material resulting from a change in manufacturer or manufacturing location;
 - (4) an explosive material used in a role (See paragraph 2.h) for which it has not already been Qualified.
- (g) Comparison Explosive. An in-service explosive with proven safety characteristics whose properties are used to assess the relative safety and suitability of a new explosive intended for use in a similar role.
- (h) Intended Role. The main roles are listed as follows. Nations may define other roles or add to specific information for the intended application of a particular explosive material.
- (1) Primary Explosive. Substance, or mixture of substances, used to initiate a detonation or a burning reaction. In their intended role these materials are sensitive to a range of thermal, mechanical and electrical stimuli.
 - (2) Booster Explosive. Explosive material used to augment and transmit the reaction (initiated by the primary explosive) with sufficient energy to initiate a detonation reaction in the main charge.
 - (3) High Explosive. Material which is used as a detonating final charge.
 - (4) Solid Gun Propellant. Substance or mixture of substances which is required to burn in a controlled manner within a gun combustion chamber producing hot gases capable of propelling a projectile at high velocity. Combustible cases may also be included as they contribute to the overall energy of the propellant.
 - (5) Solid Rocket Propellant. Substance, or mixture of substances, which is required to burn in a controlled manner within a rocket motor producing hot gases which are vented through a nozzle to propel the munition.
 - (6) Liquid Propellant. Substance, or mixture of substances, which is required to react in a combustion chamber in a controllable manner in order to generate propulsive force. These may be mono-propellants, bi-propellants or hybrids comprised of liquids and solids.
 - (7) Pyrotechnic Compositions. Substances, or mixtures of substances, which when ignited undergo an energetic chemical reaction at a controlled rate intended to produce on demand and in various combinations, specific time delays or quantities of heat, noise, smoke, light or infrared radiation. Pyrotechnic compositions may be used to initiate burning reactions such as in igniters.

Note: Pyrotechnic compositions may be Qualified for specific role(s) such as time delay, illuminating flare etc. The Qualification status is not valid for other pyrotechnic roles for which the composition has not been assessed.

AGREEMENT

3. Participating nations agree that new explosive materials proposed for military use shall be assessed in accordance with the principles and methodology described in this STANAG and related document AOP-7. The degree of testing to achieve Qualification status may vary between the nations but it is agreed that the mandatory data requirements and assessment principles listed in this STANAG shall be the minimum requirement, supported by additional requirements described in AOP-7. Explosives already in service for which there is a well established history of safe and satisfactory use, providing the original material specifications remain the same, may be considered Qualified for use in the same role without further testing. National Authorities will assess whether changes to a specification, constituent or manufacturing process of an already Qualified explosive will necessitate further testing and assessment. The data used by the National Authority to Qualify an explosive material for military use in accordance with this STANAG shall be made available to the National Authority of nations participating in a collaborative weapon development or procurement programme upon a valid request. Each nation reserves the right to request additional data, explanation or clarification or to perform its own additional testing before nationally Qualifying the explosive material for its own military use. The use of Intellectual Property Right (IPR) data shall be respected at all times. In principle Qualification is granted by a National Authority, normally in the nation of origin of the explosive, otherwise in the nation developing the munition or munition component.

DETAILS OF AGREEMENT

4. (a) Each participating nation will identify its appropriate National Authority(ies) for the Qualification of explosive materials. The National Authority will maintain records and test data relating to each Qualification and the information used to grant, deny or restrict Qualification. The National Authorities responsible for performing the assessment and Qualification functions identified in this STANAG are listed at Annex A. This Annex will be reviewed as necessary, and updated, by AC/326, Sub-Group 1 (Energetic Materials), of the NATO Conference of National Armament Directors.
- (b) The assessment for Qualification should be completed before the decision is made to use the material in a munition. However, it is emphasised that the Qualification of a new explosive material on the basis of the provisions of this STANAG does not imply Final (or Type) Qualification for a specific munition. Final (or Type) Qualification has to be considered as a part of the assessment of Safety and Suitability for Service of this munition, according to STANAG 4297 and AOP-15. Final (or Type) Qualification is not subject to this agreement, but additional information on this topic is supplied in AOP-7.
- (c) The Qualification of an explosive material relates to a defined specification from a particular manufacturer and manufacturing location and using a particular manufacturing process. Where there is a change to:
- (1) the specifications;
 - (2) the source of raw materials;
 - (3) the manufacturing process;
 - (4) the manufacturer or manufacturing location;
- or there has been a loss of manufacturing know-how, it should not be assumed that the original judgement remains valid; requalification or partial requalification may be required.

- (d) Pass/fail criteria will not be applied to test results, except where noted in relevant test STANAGs and AOP-7. Judgement on overall safety and suitability for service will be made by comparison with the test results of explosive materials which have been used satisfactorily in the same role, together with relevant background information.
- (e) An explosive material may be Qualified in its own right without any immediate application being envisaged. It would then be available to weapon designers for use in a future munition in the role for which it was Qualified.
- (f) Any modification to an existing specification defining the composition of the explosive material, its material constituents, or the process for the preparation of a composition which has been Qualified, shall be notified to all National Authorities previously supplied with the original information by the originating National Authority.

METHODOLOGY FOR QUALIFICATION OF NEW EXPLOSIVE MATERIALS

5. For assessment of new explosive material leading to its Qualification, the following shall be identified:

- (a) the explosive composition and its intended role;
- (b) the characteristics of the explosive material which are relevant to its intended role and any specific application that is envisaged;
- (c) the characteristics of the explosive material in its original state, as-used condition and after possible degradation due to ageing and the service environment;
- (d) thermal and chemical stability, chemical compatibility with relevant ammunition components, explosive response when ignited (confined and unconfined), sensitiveness to external hazardous stimuli (heat, impact, friction, shock, electrostatic discharge), mechanical and rheological properties, performance characteristics (critical diameter, detonation velocity);
- (e) knowledge of the variation of the properties with temperature and age of the material, effects of confinement and charge size;
- (f) the toxicity and disposal data on the explosive material, its components, and its reaction products, in-so-far-as possible;
- (g) the appropriate National Authority shall identify the minimum data requirements which are needed to fulfil the conditions of this paragraph 5 and the test programme necessary. This shall include, but not be limited to, the mandatory data (properties) for the intended role given in Table 2;
- (h) tables 1 and 2 provide explosive material characteristics which need to be determined. Additional tests may also be further referenced in AOP-7. Procedures and equipment detailed in appropriate STANAGs shall be used to conduct the test methods. Table 3 provides guidance on the use of these test STANAGs for a range of applications. AOP-7 contains additional guidance on procedures where STANAGs for explosive material properties are not available;
- (i) after completion of the test programme the Qualification report shall be produced by the National Authority, or an organisation approved by a National Authority, identifying the explosive composition, developer/manufacturer, the organisation that conducted the tests, test results, intended role and Qualifying National Authority. The report shall include comparison of the test data with that of explosive material of known and proven satisfactory use in the same role;
- (j) if the composition characteristics are considered acceptable, the National Authority shall pronounce Qualification of the explosive material as safe and suitable for military use in a given role. Information collected in support of advice for safety and suitability for service should be recorded by the National Authority. In-service problems

experienced by explosive materials should be analysed and, where appropriate, Qualification of the material should be reconsidered. A formal Qualification certificate (for example as shown at Annex B) shall be issued;

- (k) information shall also be provided for inclusion in the NATO Catalogue of Explosives (AOP-26).

QUALIFICATION OF IN-SERVICE EXPLOSIVE MATERIAL

6. Providing there has been no change to the specification, explosive material already in service for which there is a history of satisfactory application may be considered Qualified by the National Authority for use in the same role (e.g. main charge filling, booster, primary, rocket motor propellant, gun propellant, pyrotechnic, etc.), without further testing. The National Authority will define the need for any restrictions of the role and for any further testing in specific cases.

IMPLEMENTATION OF THE AGREEMENT

7. This STANAG is implemented when a nation has issued the necessary national instructions/orders that new, modified, and in-service explosive materials shall be assessed in accordance with the principles and methodology contained herein.

TABLE 1 - COMPOSITION DETAILS, USE AND SAFETY - MANDATORY REQUIREMENTS

Composition and Safety - Mandatory Requirements	Type of Information
1. Details of the composition and its ingredients shall be given.	Composition and specification. Method of manufacture. Source of ingredients.
2. Details of its intended role and explosive type shall be specified.	Main warhead filling, booster charge, primary explosive, pyrotechnic, propellant, etc.
3. Details of its form as used in service shall be given.	Pressed, cast, extruded, machinability etc.
4. Chemical and physical properties shall be given.	Acidity, alkalinity, density (also as percentage of theoretical maximum density), melting/softening point, etc.
5. Comparisons to other similar compositions (if any) already in service shall be specified.	Service applications of closely related compositions and their status in regard to Qualification.
6. Information pertinent to material toxicity and disposal shall be specified.	Inherent toxicity data and information on the ability to be reused, recycled or destroyed with minimum effect on health and environment.
7. Information about any known incompatible materials shall be specified.	List of substances (e.g. polymers, plasticiser, lacquers, oxidising agents, etc. as appropriate).
8. Compliance with National Health and Safety requirements shall be given.	Material Hazard Data Sheet, etc.

TABLE 2 - MANDATORY QUALIFICATION DATA (PROPERTIES) DATA AND ASSOCIATED STANAGs^[4]

MANDATORY DATA (PROPERTIES)	PRIMARY EXPLOSIVE	BOOSTER EXPLOSIVE	HIGH EXPLOSIVE	SOLID GUN PROPELLANT	SOLID ROCKET PROPELLANT	LIQUID PROPELLANT	PYROTECHNIC COMPOSITION
1. Stability & Thermal characterisation ^[1]	4515	4515 & 4556	4515 & 4556	4515, 4556, 4582 AOP-48	4515, 4556, 4581 4582, AOP-48	4515	4515
2. Compatibility ^[2]	4147	4147	4147	4147	4147	4147	4147
3. Ignition Temperature	4515	4515, 4491	4515, 4491	4491	4491	4491	4515, 4491
4. Explosive response when ignited (confined and unconfined)	Not Applicable	4491	4491	4491	4491	4491	4491
5. Electrostatic Discharge	4490	4490	4490	4490	4490	Not Applicable	4490
6. Impact	AOP-7	4489	4489	4489	4489	AOP-7	4489
7. Friction	AOP-7	4487	4487	4487	4487	AOP-7	4487
8. Shock	Not Applicable	4488	4488	4488 ^[4]	4488	4488	4488 ^[4]
9. Critical Diameter ^[3]	Not Applicable	AOP-7	AOP-7	AOP-7	AOP-7	AOP-7	AOP-7 ^[4]
10. Detonation Velocity ^[6]	Not Applicable	AOP-7	AOP-7	Not Applicable	Not Applicable	Not Applicable	Not Applicable
11. Mechanical/ Rheological Properties ^[4,5]	Not Applicable	4506, 4507, 4525, 4540, 4443	4506, 4507, 4525, 4540, 4443	4525, 4540, 4443	4506, 4507, 4525, 4540, 4443	Not Applicable	4525, 4540, 4443
12. Variation of properties with age	AOP-7	AOP-7	AOP-7	AOP-7	AOP-7	AOP-7	AOP-7

- Table 2 Guidance Notes:
- (1) Stability & thermal characterisation, solid gun and rocket propellants, STANAGs 4515, 4556, 4581, 4582, AOP-48:
Table 3 provides further guidance on which STANAG applies. STANAGs for the measurement of specific stabiliser(s) are mandatory for relevant propellants. Where no STANAG exists for the measurement of a particular stabiliser, National Assessment applies. Mandatory STANAGs for composite propellants are STANAG 4515, 4556 and 4581.
 - (2) Chemical compatibility should be investigated on a case-by-case basis for combinations of the explosive and materials expected to come into contact with the explosive during processing, storage, or transportation. The requirement to determine compatibility with specific materials in a munition is part of Type Qualification.
 - (3) In the case of liquid propellants this would equate to the critical film thickness.
 - (4) These STANAGs may not be appropriate for all energetic materials, advice from the National Authority shall be sought.
 - (5) Mandatory for PBX and rocket propellants, others as per national requirements.
 - (6) Detonation velocity, is required to be representative of the composition density whilst in service use.

- Comments:
- 1. Additional tests may also be further referenced in AOP-7.
 - 2. Table 3 provides guidance on the use of test STANAGs and methods.

TABLE 3 - GUIDANCE ON THE USE OF TEST STANAGs AND ASSOCIATED METHODS.

STANAG/ SUBJECT	TEST PROCEDURE	PRIMARY EXPLOSIVE	BOOSTER EXPLOSIVE	HIGH EXPLOSIVE	SOLID GUN PROPELLANT	SOLID ROCKET PROPELLANT	LIQUID PROPELLANT	PYROTECHNIC COMPOSITION
AOP-48 Propellant Stability & life prediction	HPLC analysis for stabilizer; single or multiple temperature	Not applicable	Not applicable	Not applicable	Applicable (NC based)	Applicable (NC based)	Not Applicable	Not Applicable
4147 Compatibility	Vacuum stability	Not applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Not applicable
	HFC	Not applicable	Not applicable	Not applicable	Applicable	Applicable	Applicable	Applicable
	TGA	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	DSC	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	Chemical Analysis	Applicable (if with azide)	Not applicable	Not applicable	Applicable (if NC based)	Applicable (if NC based)	Not Applicable	Not Applicable
4443 Uniaxial Compressive test	Rheological Properties	Not applicable	Applicable (PBX)	Applicable (PBX)	Applicable	Applicable	Not applicable	Not applicable
4487 Friction	Friction	Not applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Applicable
4488 ^[1] Shock Sensitiveness	Small Scale	Not applicable	Applicable	Applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Intermediate Scale	Not applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Not applicable
	Expanded Large Scale	Not applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Not applicable
	Super large scale	Not applicable	Not applicable	Applicable	Applicable	Applicable	Applicable	Not applicable
4489 ^[2] Impact	Impact tests	Not applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Applicable

TABLE 3 (continued) - GUIDANCE ON THE USE OF TEST STANAGs AND ASSOCIATED METHODS.

STANAG/ SUBJECT	TEST PROCEDURE	PRIMARY EXPLOSIVE	BOOSTER EXPLOSIVE	HIGH EXPLOSIVE	SOLID GUN PROPELLANT	SOLID ROCKET PROPELLANT	LIQUID PROPELLANT	PYROTECHNIC COMPOSITION
4490 Electrostatic Discharge	Small Scale	Applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Applicable
	Large Scale	Not applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Not applicable
4491 ^[3] Thermal Sensitivity Tests	DTA	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	DSC	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	Temperature of Ignition	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	Woods Metal Bath	Not applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	Koenen Tube	Not applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	Variable confinement tube (FCO & SCO)	Not applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Not applicable
	Tube test (FCO & SCO)	Not applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Not applicable
4506 Uniaxial Tensile test	Rheological Properties	Not applicable	Applicable (PBX)	Applicable (PBX)	Not applicable	Applicable	Not applicable	Not Applicable
4507 Stress Relaxation	Rheological Properties	Not applicable	Applicable (PBX)	Applicable (PBX)	Not Applicable	Applicable	Not applicable	Not applicable

TABLE 3 (continued) - GUIDANCE ON THE USE OF TEST STANAGs AND ASSOCIATED METHODS.

STANAG/ SUBJECT	TEST PROCEDURE	PRIMARY EXPLOSIVE	BOOSTER EXPLOSIVE	HIGH EXPLOSIVE	SOLID GUN PROPELLANT	SOLID ROCKET PROPELLANT	LIQUID PROPELLANT	PYROTECHNIC COMPOSITION
4515 ^[4] Thermal Character- ization	DTA	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	DSC	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
	TGA	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Applicable
4525 TMA	Rheological Properties	Not applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Not applicable
4540 DMA	Rheological Properties	Not applicable	Applicable (PBX)	Applicable (PBX)	Applicable	Applicable	Not applicable	Not applicable
4556 ^[5] Vacuum stability	Manometer or transducer method	Applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Applicable
4581 Ageing of composite propellants	Several tests chemical and mechanical	Not applicable	Applicable (PBX)	Applicable (PBX)	Not applicable	Applicable (if composite)	Not applicable	Not applicable
4582 Stability of NC propellants	Heat Flow Calorimetry	Not applicable	Not applicable	Not applicable	Applicable (if NC based)	Applicable (if NC based)	Not applicable	Not applicable

Table 3 Guidance notes:

1. STANAG 4488, Explosives; Shock Sensitivity Test(s), use appropriate scaled test, not all tests are required.
2. STANAG 4489, Explosives; Impact Sensitivity Tests, tests include ERL/Bruceton Machine with Type 12 tools, Rotter Impact Machine, BAM Impact Machine, appropriate test method chosen to comply with National Authority requirements.
3. STANAG 4491, Explosives. Thermal Sensitiveness and Explosiveness Tests; not all tests are required, refer to STANAG.
4. STANAG 4515, Explosives; Thermal Characterisation, only one test should be sufficient to comply with the Qualification requirements.
5. STANAG 4556, Explosives; Vacuum Stability Test, consists of two equivalent methods, one uses a manometer and the other a transducer, there is no preference for either test method.

IDENTIFICATION OF NATIONAL AUTHORITIES

1. Each participating nation will identify its appropriate national authority(ies) for the Qualification of explosive materials for military use. The authority will maintain a code to identify the Qualified explosive materials and will maintain records and test data relating to each Qualification or to the information used to grant, deny or restrict Qualification.

2. The authorities nominated by the nations are listed below. This list will be reviewed as necessary and updated, by AC/326 Sub Group I (Energetic Materials) of the NATO Conference of National Armament Directors (CNAD) organisation.

3. LIST OF NATIONAL AUTHORITIES

- (a) Australia: Director Ordnance Safety
Department of Defence, CP4-3-164,
Canberra Act 2600,
Australia
- (b) Canada: Directorate of Ammunition and Explosives Regulation
(DAER), National Defence Headquarters,
M Gen George R Pearkes Building,
101 Colonel By Drive, Ottawa ON K1A 0K2
Canada
- (c) Czech Republic VOP-026 Sternberk. s.p.
Division VTUVM Slavcin
Dlouha 300, 763 21 Slavcin
Czech Republic
- (d) Denmark: Explosives Safety Commission,
Lautrupbjerg 1-5,
2750 Ballerup, Copenhagen,
Denmark
- (e) Finland: Munition Safety Manager
Defence Staff Headquarters,
B.O. 919, 00131 Helsinki
Finland
- (f) France: DGA IPE/SM
00303 Paris Armées,
France

- (g) Germany Defence Institute For Materials, Explosives, Fuels and Lubricants (WIWEB),
Großes Cent 53913 Swisttal-Heimerzheim,
Germany

- (h) Italy: Ministero della Difesa,
Direzione Generale,
Degli Armamenti Terrestri,
Via Marsala 104,
00100 Roma,
Italia

- (i) Netherlands: Matlogco/LBBKL/Munitiebedrijf
C-Munitiebedrijf, P.O.Box 90004
3509 AA, Utrecht
The Netherlands

- (j) Norway: NDLO/Systems Branch
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PO Box 24, Raufoss,
Norway

- (k) Slovak Republic: Military Technical and Testing Institute,
VTSÚ Záhorie,
90524 Senica, Slovak Republic

- (l) UK: Defence Procurement Agency
Defence Ordnance Safety Group,
Ash2b, # 3212, MOD Abbey Wood,
Bristol. BS34 8JH United Kingdom

- (m) US: Office of the Under Secretary of Defense,
OUSD (A&T)/S&TS,M (Room 3B1060),
3090 Defense - Pentagon,
Washington DC 20301-3090,
USA

- (n) Other countries: To be advised

**EXAMPLE: SUGGESTED FORMAT FOR AN EXPLOSIVE QUALIFICATION
CERTIFICATE.**

EXPLOSIVE QUALIFICATION CERTIFICATE	
Explosive Name:	Country of Origin:
Specification Number:	Manufacturer:
Composition Details: (With percentages)	Qualified Role:
Is it one of the following: ?	
a) Completely New Composition (yes or no)	Restrictions on use:
b) Modified Composition: (yes or no) (Name of reference composition)	Test Results/Assessment Ref:
or	
c) In Service Composition: (yes or no)	National Authority: