



CNAD AC/326 – SG/A(EMT)  
on Energetic Materials

**Energetic Materials Standards – Fundamental  
Data Supporting the Munition Life-Cycle Safety  
Assessment**

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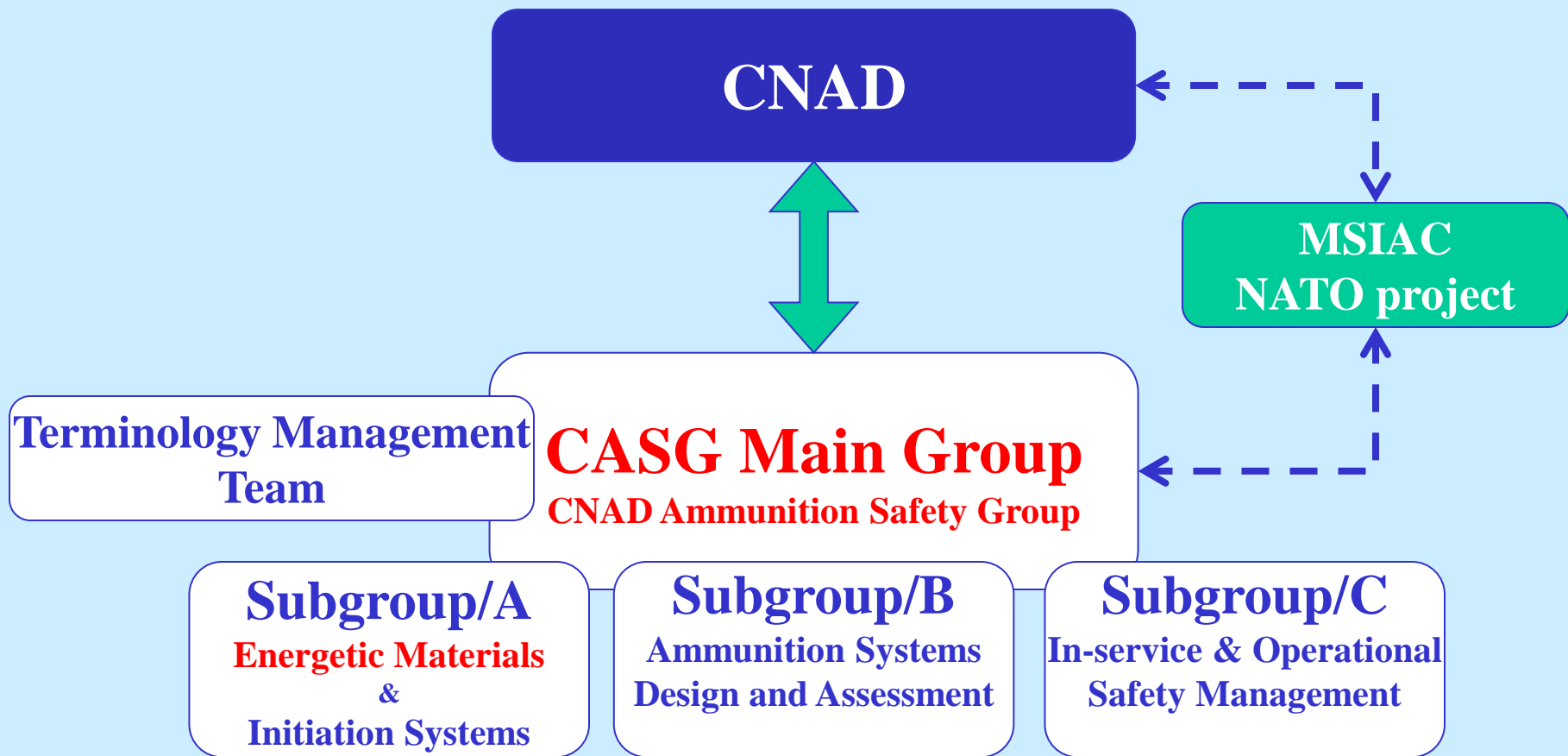


# CNAD AC/326 – SG/A(EMT) on Energetic Materials

## Outline

- **Introduction**
- **The Core Area of SG/A(EMT)**
- **Methods of Work**
- **Promotion of Common Language**
- **SG/A(EMT) Portfolio**
- **Ingredients**
- **Hazard and Sensitivity Testing**
- **Summary**

# CNAD AC/326 – SG/A(EMT) on Energetic Materials Introduction





# CNAD AC/326 – SG/A(EMT) on Energetic Materials Introduction (cont.)

## **AC/326 CASG Publications:**

- **STANdardization AGreements – STANAGs**
- **STANdard RECommendations – STANRECs**
- **Allied Publications - APs**



CNAD AC/326 – SG/A(EMT)  
on Energetic Materials  
**The Core Area of SG/A(EMT)**

**SG/A(EMT)**

- **develops and maintains standards that provide fundamental information and guidance for the design, assessment and qualification of energetic materials.**
- **provides internationally recognized standards.**
- **supports Nations to build their technical capability at each stage of the life cycle of energetic materials and components.**
- **provides fundamental understanding to specify requirements for energetic materials, which important to act as an Intelligent Customer or a Smart Buyer.**



# CNAD AC/326 – SG/A(EMT) on Energetic Materials Methods of Work

- **AC/326 CASG is the Tasking Authority to SG/A(EMT)**
- **SG/A(EMT) Programme of Work**
  - **Must be aware of tasks in relation to NATO/CNAD/National Priorities**
- **Custodian**
  - **A Nation responsible for managing the development of a standardization task**
  - **Providing support to SG/A(EMT) in the maintenance of the life cycle of the standard**
- **Temporary non-entitled Working Groups**
  - **Assisting the work of SG/A(EMT) on a specific document**
  - **SG/A(EMT) is the Tasking Authority**
  - **SG/A(EMT) monitors the progress of work**



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on Energetic Materials  
**Promotion of Common Language**

- **Defence Investment Portal DI-Portal**
- **Virtual Study Group – Working Group**
- **Document Management**
  - **Traceability and Transparency of changes proposed to document**
    - **Technical Note**
      - **Applies to the document in its development and update phase**
      - **Records technical information at appropriate level of details, provides any deviation from the standard procedure or parameters used in measurements**
      - **Supports the tracking of changes and proposed and background information related to the document**



# CNAD AC/326 – SG/A(EMT) on Energetic Materials SG/A(EMT) Portfolio

## **The SG/A(EMT) Portfolio covers the following areas:**

- **Qualification of Energetic Materials**
- **NATO Catalogue of Qualified Energetic Materials**
- **Chemical Compatibility**
- **In-Service Surveillance**
- **Ingredients**
- **Hazard Testing**
- **Stability/Reactivity Testing**
- **Mechanical Analysis**
- **Performance Testing**





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on Energetic Materials  
**SG/A(EMT) Portfolio (cont.)**

- **STANAG 4170 is the overarching document.**
- **There are a number of STANAGs directly supporting STANAG 4170 by defining test methods.**
- **The ingredient standards support interoperability by defining the energetic material formulations used in ammunition and ammunition components.**
- **The test methods break down further into hazard, stability/reactivity, mechanical and performance properties.**
- **Many methods appear in the category Qualification and In-Service Surveillance.**
- **Some of the stability/reactivity documents are also associated with In-Service Surveillance.**



# CNAD AC/326 – SG/A(EMT) on Energetic Materials The SG/A(EMT) Portfolio (cont.)

**STANAG 4170, AOP-7, Principles and Methodology for the of Qualification of Energetic Materials for Military Use**

**Chemical Compatibility**

**In-Service Surveillance of Energetic Materials**  
Part of SG/B ISS-Document Package

**NATO Catalogue  
of Qualified Explosives**

**Ingredients**  
TNT,  
RDX, HMX, Cl-20,  
AN, AP, NTO,  
NQ, NC, GUDN,  
HNS, TEGDN, Bu-NENA, ...

**Performance Testing**  
Solid Propellant Burn Rate

**Hazard Testing**  
Friction  
Shock  
Impact  
Electric Spark  
Thermal Tests

**Stability/Reactivity**  
NC Propellant Stability  
NC Stability by HFC  
Vacuum Stability  
Ageing of Composite Propellants  
Ageing of PBX  
Thermal Analysis

**Mechanical Analysis**  
Compression  
Tensile  
Stress Relaxation  
TMA  
DMA

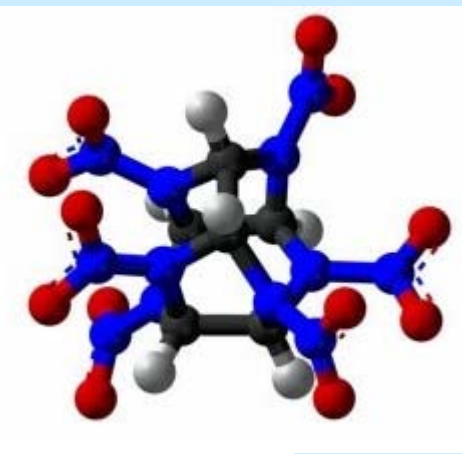
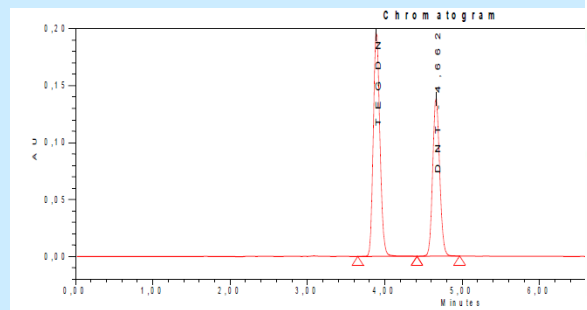
## Standards

- new ingredients that are important to many nations
- updates to incorporate improved characterization methods, overcome the variety of industry specs. and national standards, reduced sensitivity variants of energetic materials

## Requirements

Compendium of test methods

Precision of methods



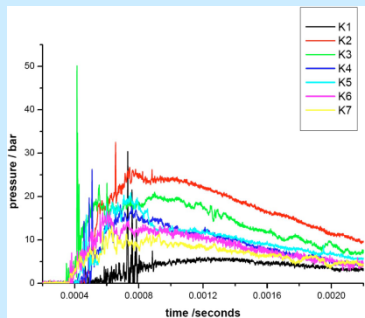
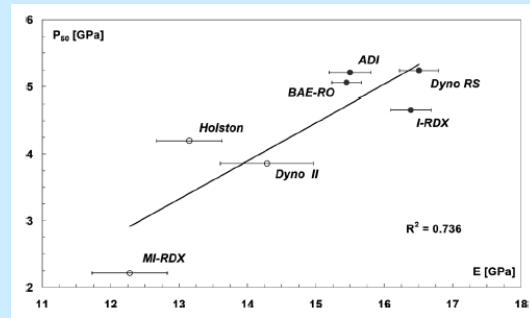
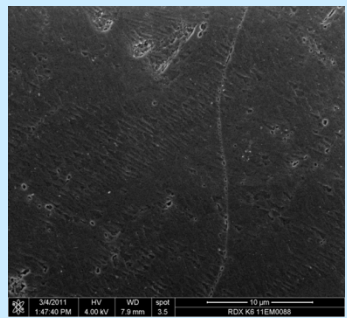
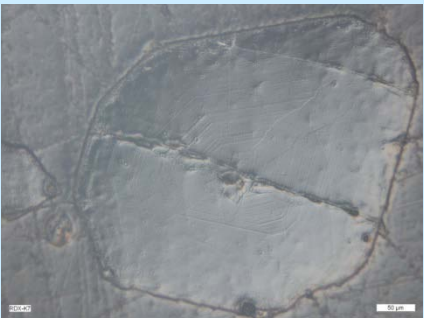
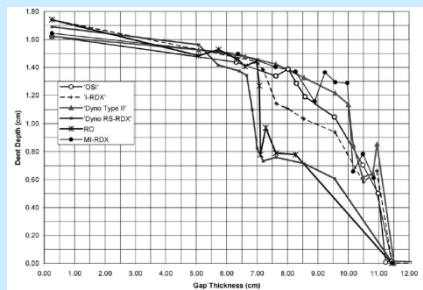
purity  
 melting point  
 granulation acidity  
 particle density  
 thermal stability  
 volatile content  
 inorganic matter  
 specific surface

# CNAD AC/326 – SG/A(EMT) on Energetic Materials Ingredients (cont.)

## Example of activities:

### Reduced Sensitivity RDX Round Robin

- STANAG with updated methods
- Aim to find characterization method at crystal level that is the indicator of shock sensitivity at PBX level
- Comparison of results inter-laboratory testing → required precision of methods
- Follow-ups in international R&D arena



## Typical activities / discussion topics

- UN Test series 7 – SG/A(EMT) analogues
- Pressure and energy fluence threshold in gap tests
- Improvement to VCCT
- Spreadsheets at DI portal
- Setback sensitivity
- Nano-sized particles in energetic formulations

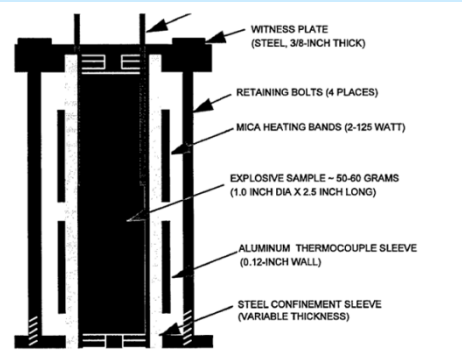
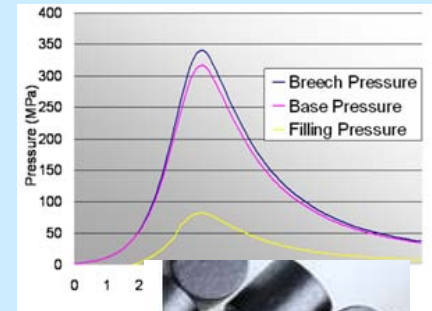
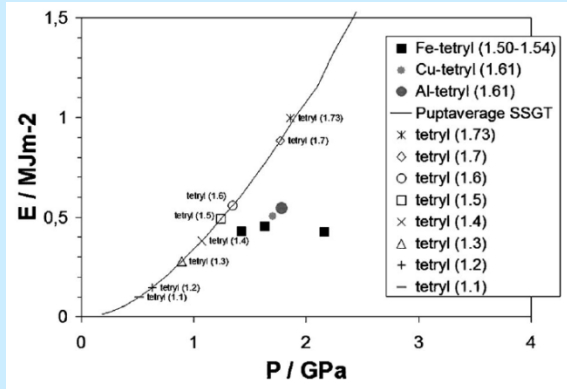


FIGURE 1. VARIABLE CONFINEMENT COOKOFF TEST ASSEMBLY



50% POINT (CM): 32.7  
 STANDARD DEVIATION (CM): 2.1  
 BRUCETON PROCEDURE VALID: yes  
 S/D: 0.55  
 IMPACT ENERGY (50%, J): 3  
 x=pos.reaction; 0=neg.reaction

height cm	trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
10.0																															
11.2																															
12.6																															
14.1																															
15.8																															
17.8																															
20.0																															
22.4																															
25.1	x																														
28.2		x	x	x	x	0																									
31.6		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
35.5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
20.0																															



# CNAD AC/326 – SG/A(EMT) on Energetic Materials **Summary**

**The SG/A(EMT) activities include**

- **Standardization efforts on energetic materials**
- **State of the Art**
  - **Developments on energetic materials**
  - **Latest information on the health and environmental aspects**

**Mature energetic materials for applications and test methods are accepted as standardization tasks.**

- **SG/A(EMT) does not conduct research or development of energetic materials or test methods.**

**The SG/A(EMT) Portfolio provides fundamental information on the properties and behaviour of energetic materials that is relevant/crucial for all the life cycle phases of ammunition/weapon systems.**

**The AC/326 CASG Portfolio supports**

- **The development of methodologies and tools for risk analysis, as well as, management on explosives/ammunition/weapon systems.**
- **The development and maintenance of national methodologies and instructions on explosive and ammunition safety.**
- **The expertise on the key factors connected to the management of material capabilities and explosives safety.**

**The AC/326 activities allow Nations to build a common language and safety culture in terms of interoperability and interchangeability.**