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Evaluation of the 90MM MK8 HESH Ammunition filled with IM P16945 explosive composition

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- Introduction
- Composition P16945
- Loading in 90 mm HESH-T M691A2
- Performances :
 - Dynamic test
 - IM tests
- Conclusions

Introduction

- This project is a collaboration between MECAR SA and Eurenco,
- Leader in energetic materials, Eurenco developed a pressed IM composition, called the P16945, based on NTO, RDX and a specific binder to replace composition A3. The development and qualification process of the composition has been presented during IMEMTS 2015 in Roma.
- MECAR SA, a subsidiary of NEXTER SYSTEMS, develops and produces medium and large caliber ammunition for land forces, such as 90 mm and 105 mm HESH ammunition.
- In the aim to upgrade the whole range of ammunitions, MECAR selected the composition P16945 for its application of 90 mm as the replacement of the composition A3.
- The objectives are :
 - To evaluate the processability of this composition with the current equipment in production - at ambient temperature and without using a vacuum process.
 - To evaluate dynamic performances compared to composition A3
 - To evaluate IM properties according to STANAG 4439.

Composition P16945

- EURENCO developed and produces the composition P16945, which is NTO/RDX based.
- This composition P16945 has been developed to replace composition A3; EURENCO has demonstrated that composition P16945 is less sensitive towards shock and friction while the performances are similar to composition A3 (Detonation pressure = 28,5 GPa).
- Composition P16945 is stable until high temperature (209°C).
- Composition P16945 keeps its properties and its integrity after ageing.
- The composition is pressable at room temperature and pressure and the density is 1,84.
- EURENCO has qualified this composition according to the STANAG 4170.



Evaluation of P16945 in 90 mm HESH-T ammunition

- The 90 MK8 HESH-T M691A2 ammunition has been selected by Mecar for the evaluation of the composition P16945 as a replacement for the composition A3.
- The objectives are :
 - Compression with the current equipment.
 - Performances equivalent to composition A3 :
 - *“The 90mm MK8 HESH-T M691A2 shall create an opening in a double reinforced, 20cm thick, concrete wall at 60 meters minimum from the muzzle. The opening shall be 60cm wide by 120cm high (threshold) and 75cm wide by 125cm high (objective). The opening shall have all reinforced bars severed or effectively moved out of the opening. The opening shall be achieved with 5 rounds (threshold); 4 rounds (objective).”*
 - The 90mm shall defeat the standard infantry bunker, LAV and infantry squad.
 - IM performances : in line with the requirement of STANAG 4439.



Loading P16945 in 90 mm HESH-T ammunition

- Processability with 350 ton computer controlled press
 - Density higher than 1.8 g/cm^3 obtained during the different compression tests.
 - Repeatability of the process within the standard conditions of compression – at room temperature and without vacuum.



- The processability of the explosive P16945 has been proven and shells have been loaded to perform the first dynamic and vulnerability tests.

Performances – Dynamic test

Target compliant with ITOP 5-2-503
Double reinforced concrete wall



Shot 1 : 50 cm



Shot 2 : 76 cm (H); 100 cm (V)



Shot 3 : 87 cm (H); 120 cm (V)



Shot 4 : 135 cm (H); 125 cm (V)



 **OBJECTIVE ACHIEVED**

Performances – Vulnerability test

- Fast Cook-Off test with LPG as fuel.



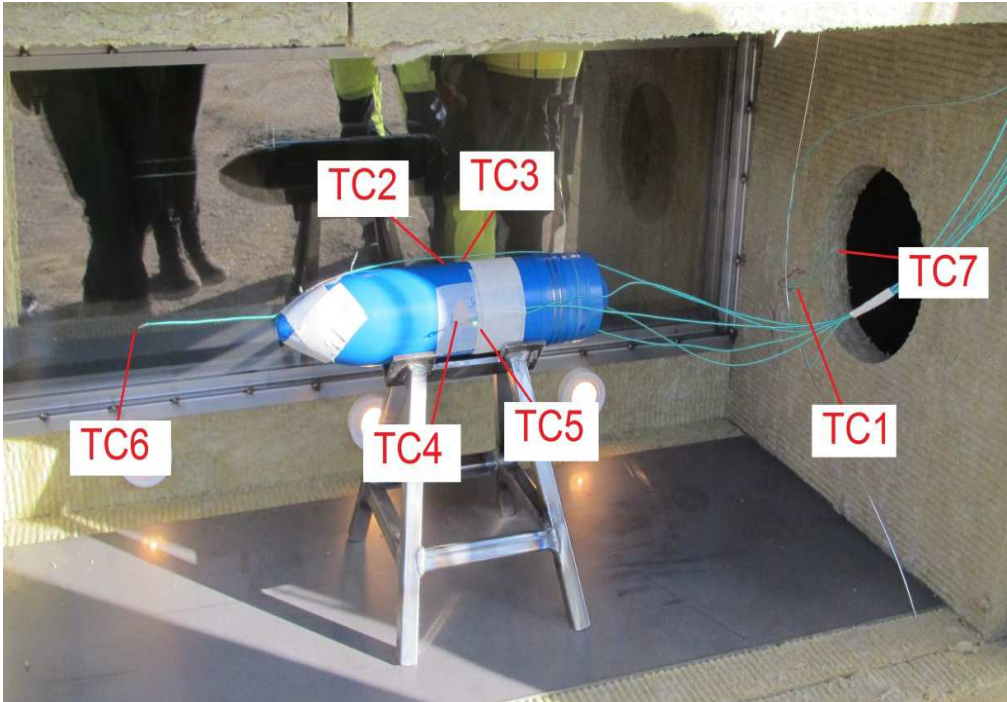
TYPE V REACTION

Results/Observations :

The object has been opened by a pneumatic explosion mechanism and the explosive contained in the projectile has been completely consumed by burning.

Performances – Vulnerability test

- Slow Cook-Off test (STANAG 4382)



TYPE V REACTION



Results/Observations :

Object opened by a pneumatic explosion mechanism, explosive contained in the projectile completely consumed by burning. Temperature of reaction : 178°C.

Projectile recovered at a distance lower than 15 m.

Performances – Vulnerability test

- Bullet Impact test (STANAG 4241)



TYPE V REACTION



Results/Observations :

Burning of some explosive during a few milliseconds.

The projectile body opened due to the reaction.

Two-thirds of unreacted explosive recovered inside the body.

Performances – Vulnerability test

- Fragment Impact test (STANAG 4496)

Fragment impact velocity : 1818 m/s



TYPE V REACTION



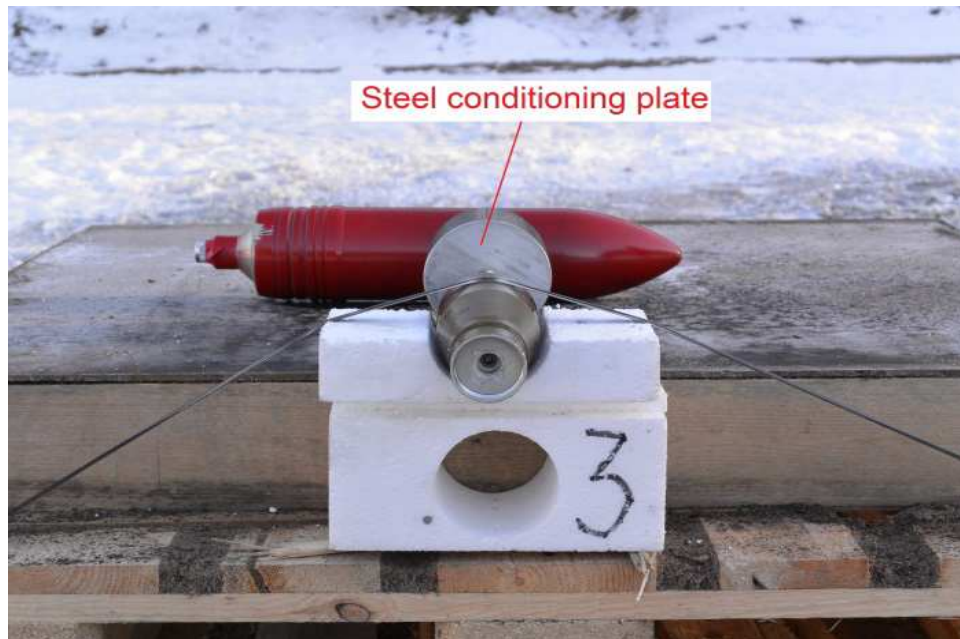
Results/Observations :

The projectile body opened due to the reaction.

Projectile recovered filled with unreacted explosive at a distance lower than 15 m.

Performances – Vulnerability test

- Shaped charge jet Impact (STANAG 4526)
RPG 7 used as shaped charge.



Results/Observations :

Blast pressure gages recorded an explosion.

Dent in the witness plate.

Recovery of big fragments.



TYPE III REACTION

Performances – Vulnerability test

- Sympathetic reaction (STANAG 4396)

Vehicule configuration



TYPE III REACTION



Results/Observations :

Recovery of big fragments and unreacted explosive

Blast pressure gages measure an explosion event

Assesement of the reaction with recovery test and open range test

Conclusions and Way Forward

- The processability of the compression has been demonstrated on current pressing equipment at room temperature and pressure.
- The evaluation of the composition P16945, explosive qualified according STANAG 4170, loaded in 90 MK8 HESH-T M691A2 is successful regarding the tests performed :
 - Compliant with the requirements for dynamic functioning.
 - Compliant with STANAG 4439 for all the tests

90 MK8 HESH-T M691B2						
IM signature						
	FCO	SCO	BI	FI	SR	SCJI
STANAG 4439 requirement	V	V	V	V	III	III
M691B2 assessment results	V	V	V	V	III	III
Compliance with STANAG 4439	OK	OK	OK	OK	OK	OK

- Mecar has started the process for transport classification as 1.2.

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EURENCO

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Thank you for your attention

Questions ?