IMI SYSTEMS
MEETING YOUR TARGETS

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A New IMI Systems Less Sensitive Brisant Explosive Composition

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Outline of the presentation:

- IMI Systems Introduction.
- Objectives.
- Approach.
- Qualification Protocol.
- Test results of the qualification process.
- Summary.

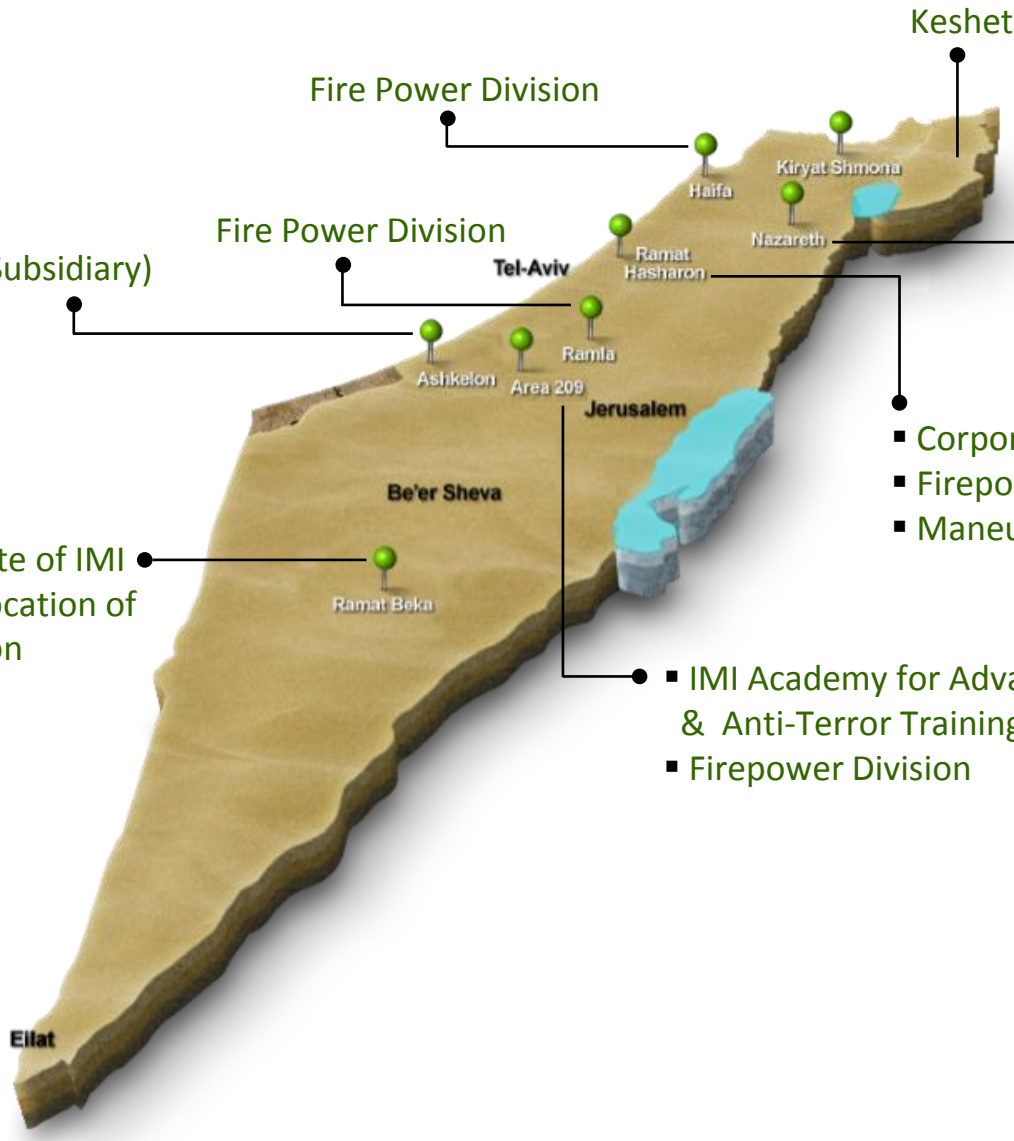
Vision

To be a world class leading defence company, providing cutting edge systems and solutions for Land, Air and Naval forces

In 1 Jan 2016, IMI transferred its core business activities, assets, obligations, rights and its employees, to IMI Systems Ltd.

- an Israeli company wholly owned by the State of Israel

IMI Systems Locations



Keshet

Fire Power Division

Fire Power Division

ASHOT Ltd. (Subsidiary)

Small Caliber Ammunition Division (YIZHAK)

- Corporate HQ
- Firepower Division
- Maneuverability Division

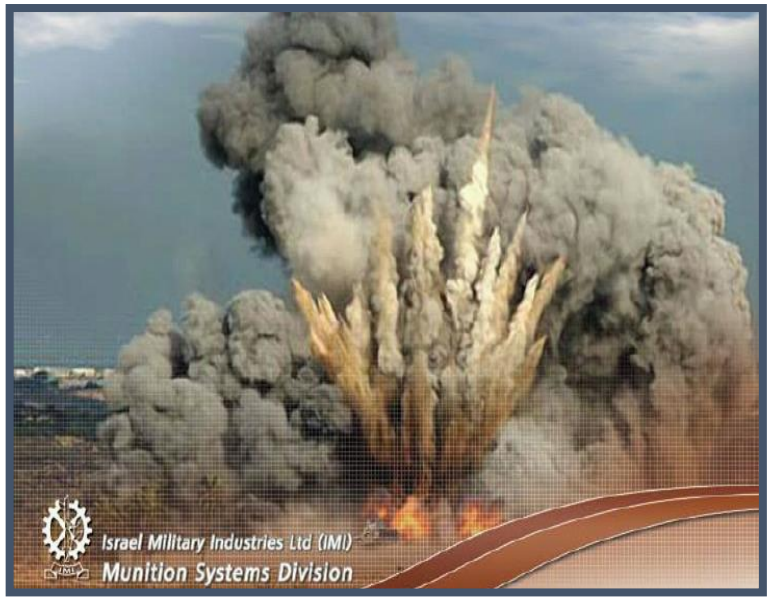
- ~52,000 km2 - Future main site of IMI Systems - Destination for relocation of facilities from Ramat Hasharon

- IMI Academy for Advanced Security & Anti-Terror Training (Subsidiary)
- Firepower Division

Objectives

- *The objective of this task was to introduce a new brisant HE composition with high fragmentation features and an output greater than that of PBXN-109.*

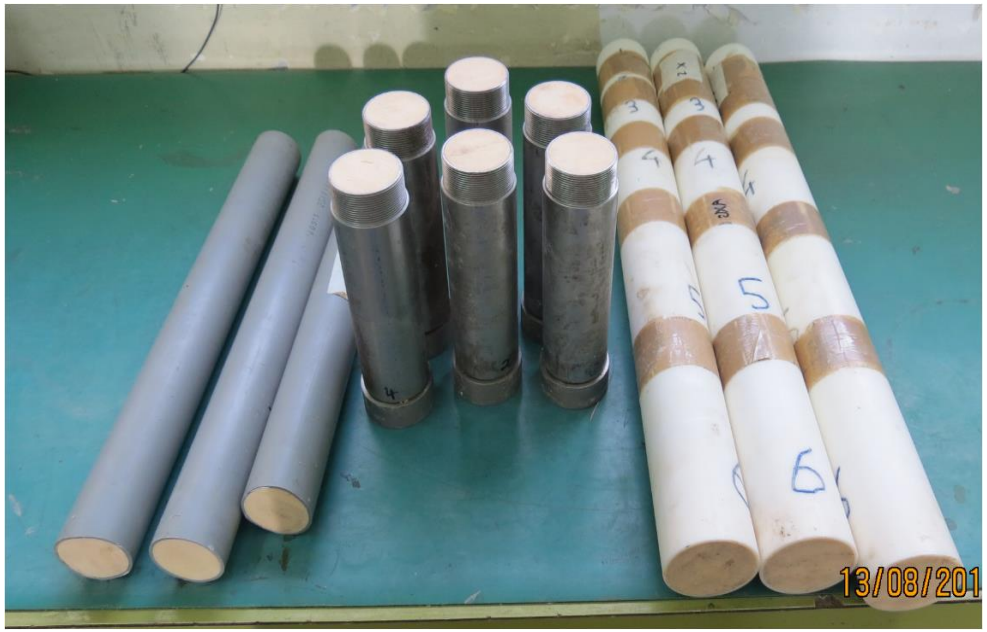
- *Qualify the new composition for the IDF using CLX-663s* as a reference.*



* CLX-663S – IMI Systems analog to PBXN-109

Approach

- *Identify PBXN-110 as the target composition.*
- *Develop an HMX based IMI systems' composition analogous to PBXN-110.*
- *Configuration of the production process for this composition.*
- *Characterization and Qualification of the composition according to IDF standard and protocol, based upon STANAG 4170.*



Qualification Protocol (Partial)

- *Hazard analysis – Friction, Impact, ESD*
- *Vacuum stability*
- *Thermal analysis*
- *Mechanical properties*
- *Accelerated aging*
- *Detonation velocity and critical diameter*
- *Additional tests : Bullet Impact*

  LSGT

  Cap test

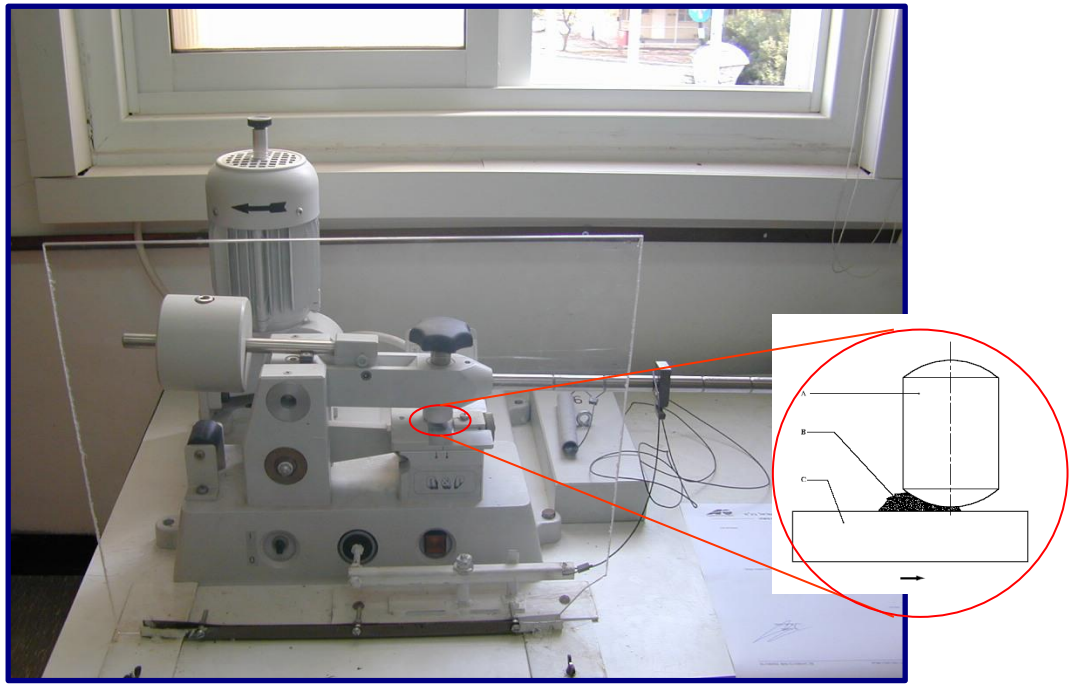
  Small external burning test

CLX-881 qualification protocol was dictated by IDF - based upon STANAG 4170

Hazard Characterization - Friction Sensitiveness

IDF Requirement: 6/6 consecutive negative tests.
Method: BAM Friction Machine, Stanag 4487 Annex A, MIL-STD-1751 Method 1024

Results : 6/6 consecutive negative tests - no reaction at 36 Kg F for both CLX 881 and CLX 663s



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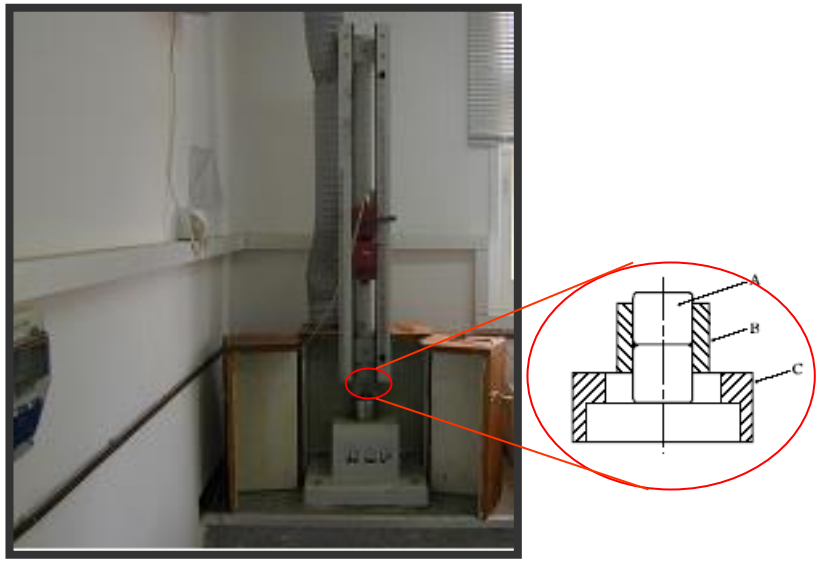
Hazard Characterization - Impact Sensitiveness

IDF Requirement: $E_{50\%} \geq 5$ joule for secondary explosive .
Method: Bam Impact Machine, Stanag 4489, Annex C

Results : $E_{50\%} \geq 5$ joule, less sensitive than CLX 663s

Explosive	Energy [Kg m]	$H_{50\%}$ [cm]
CLX-663s	2.92	58.4 (5 kg)
CLX-881	4.00	80.0 (5 kg)



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Hazard Characterization - ESD Sensitiveness

IDF Requirement: 20/20 No Fires at 0.25 J
Method: MIL-STD-1751 Method 1032

Results : 20/20 consecutive negative tests - no fires at 0.25 J for both CLX 881 and CLX 663s

Vacuum Stability

IDF Requirement: Less than 1 ml/gr.
Method: Stanag 4556, MIL-STD-1751 Method 1061

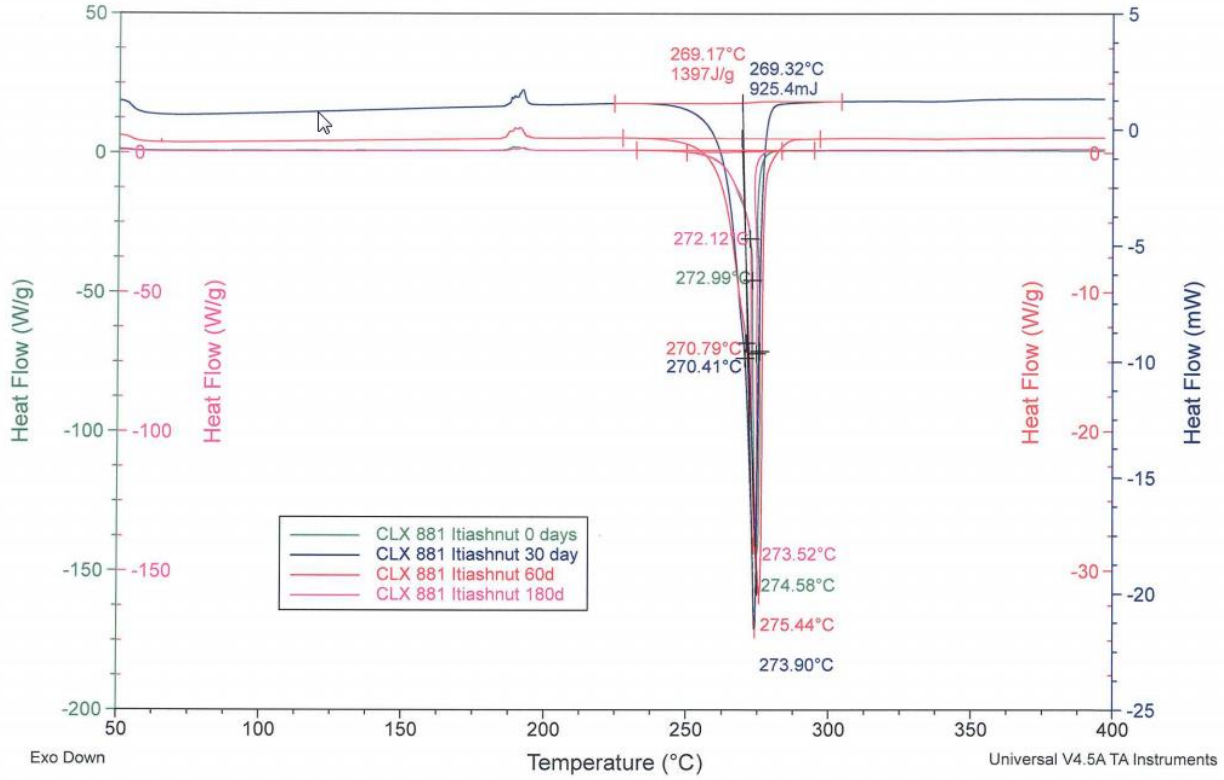
Results:

Explosive	Volume/gr (ml)	IDF Req.
CLX-663s	0.05	Less than 1 ml/gr
CLX-881	0.21	

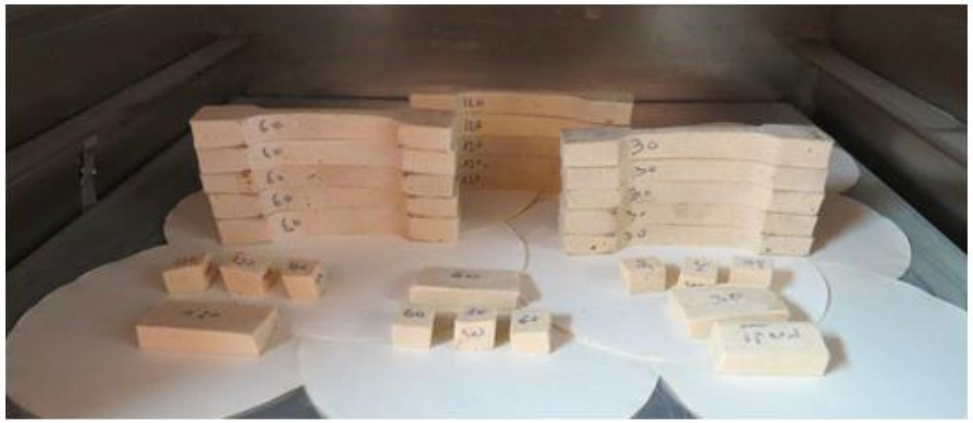
Thermal Analysis : Self Ignition Temp. and Thermal Stability

Method: Stanag 4515

Explosive	Self ignition temp. [◦C]
CLX-663s	220.2
CLX-881	273.0



Accelarated Aging - Mechanical properties



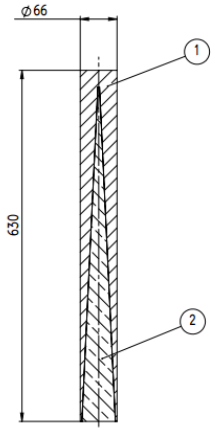
Aging (d)*	Hardness [Shore A]	Stress at Max. Load [kg/cm^2]
0	21	1.548
30	34	2.105
60	46	3.223
180	71	6.599

* According to IDF protocol

Detonation Velocity & Critical Diameter

Method: MIL-STD-1751 Method 1101

Method: MIL-STD-1751 Method 1091



Explosive	Detonation Velocity [m/sec]	Critical Diameter [mm]
CLX-881	8427	9.7
CLX-663s*	7600	10.3

* CLX-663S – IMI Systems analog to PBXN-109

Bullet Impact

Requirement: Up to moderate reaction – type V.
Method: TB 700-2 Chapter 5-8 (UN Test 7 (d))
Results : 2/6 Explosive scattered.
4/6 Explosive burned moderately inside the tube.

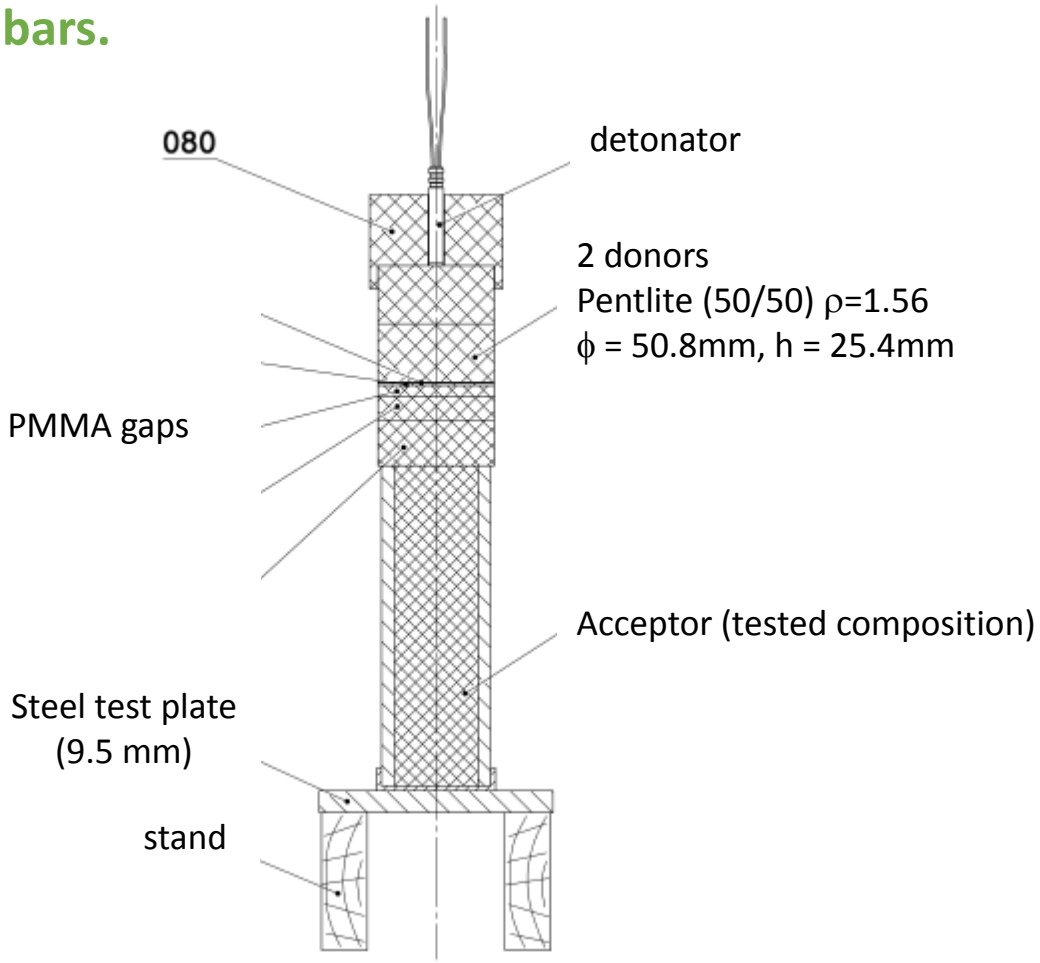
Test setup

Test Results

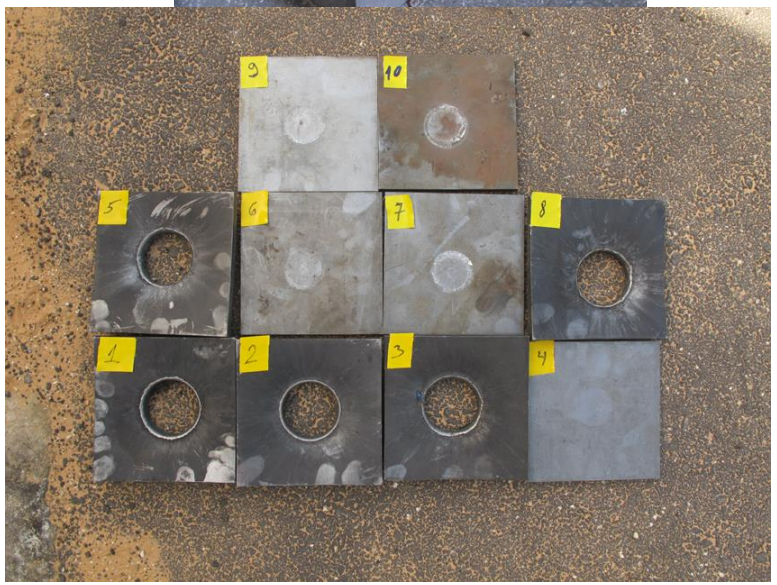
Type V reaction

NOL LSGT - Large Scale Gap Test

Method: MIL-STD-1751A Method 1041
Results : **34 Kilobars.**



Test setup



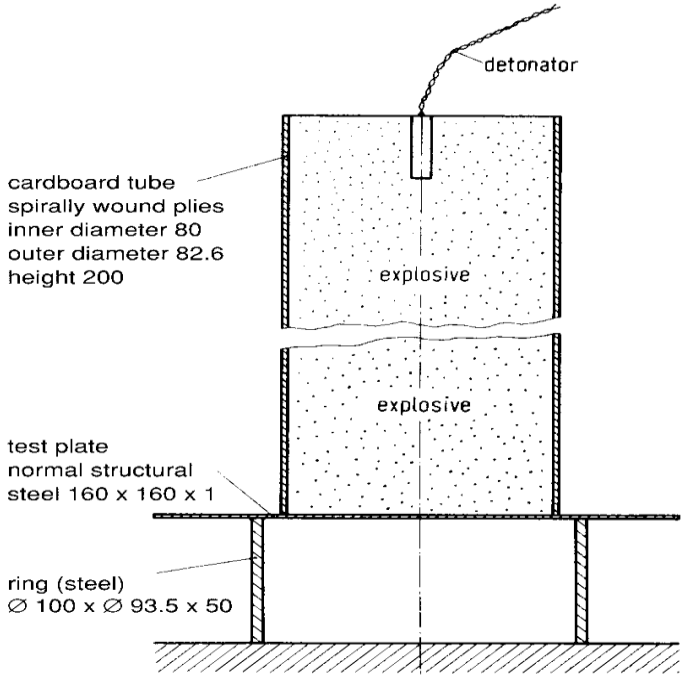
NOL LSGT Results – MIL-STD-1751A

Explosive	Cards	Kilobars
CH-6 (pressed)	267	11
Comp A3 (cast)	242	13.8
Comp B (cast)	201-220	16.9-20.5
Comp C-4	192	22.8
H-6 (cast)	197	21.5
LX-14	199	21
OCTOL 85/15	236	14.5
PBXN-7	217	17.4
PBXN-9	166-201	20.5-31.4
RDX	323	7.4
TATB	78	66.1
PBXN-110 (Cast)**	154-178	27.0-36.8
CLX-663S (cast) ***	178	27
CLX-881(cast) * **	**160**	**34**

** High Performance Polymer-Bonded Explosive Containing PolyNIMMO for Metal Accelerating Applications / R. Hollands, V. Fung and K. Burrows, IMEMTS 2014

*** Current study

Cap Sensitivity – CLX-533



Presented at IMEMTS 2009

CLX-881 'Cap Test'

Test setup

Test Results

CLX-881 cannot be classified as EIDS

CLX-881 - Tests results Summary

HMX based PBX explosive with an HTPB inert binder

Test	CLX-881	CLX-663s*
Vacuum Stability (ml)	0.21	0.05
Autoignition Temp. (°C)	273.0	220.2
ESD (5 KV up to 0.25 j)	No reaction	No reaction
Impact Sensitivity ($L_{50\%}$, Brucetone Method)	4.00 Kg•m	2.92 Kg•m
Friction Sensitivity	No reaction (max 36 kgf)	No reaction (max 36 kgf)
Detonation Velocity	8427 m/sec (ρ=1.66)	7600 m/sec (ρ=1.64)
Critical Diameter (mm)	9.7	10.3

CLX-881 qualification protocol was dictated by IDF - based upon STANAG 4170

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CLX-881 Tests results

Test	CLX-881	CLX-663s*
Small external burning test [UN Test Series 3(d)(i)]	Type V reaction (moderate burning)	Type V reaction (moderate burning)
Bullet impact (Stanag 4241)	Type V reaction	Type V reaction
NOL LSGT (MIL-STD-1751A Method 1041)	34 Kilobars	27 Kilobars
Cap Test	reaction	reaction

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Thank you for listening !