120 mm IM HE–MP–T - M339
Multi-Purpose Tank Cartridge

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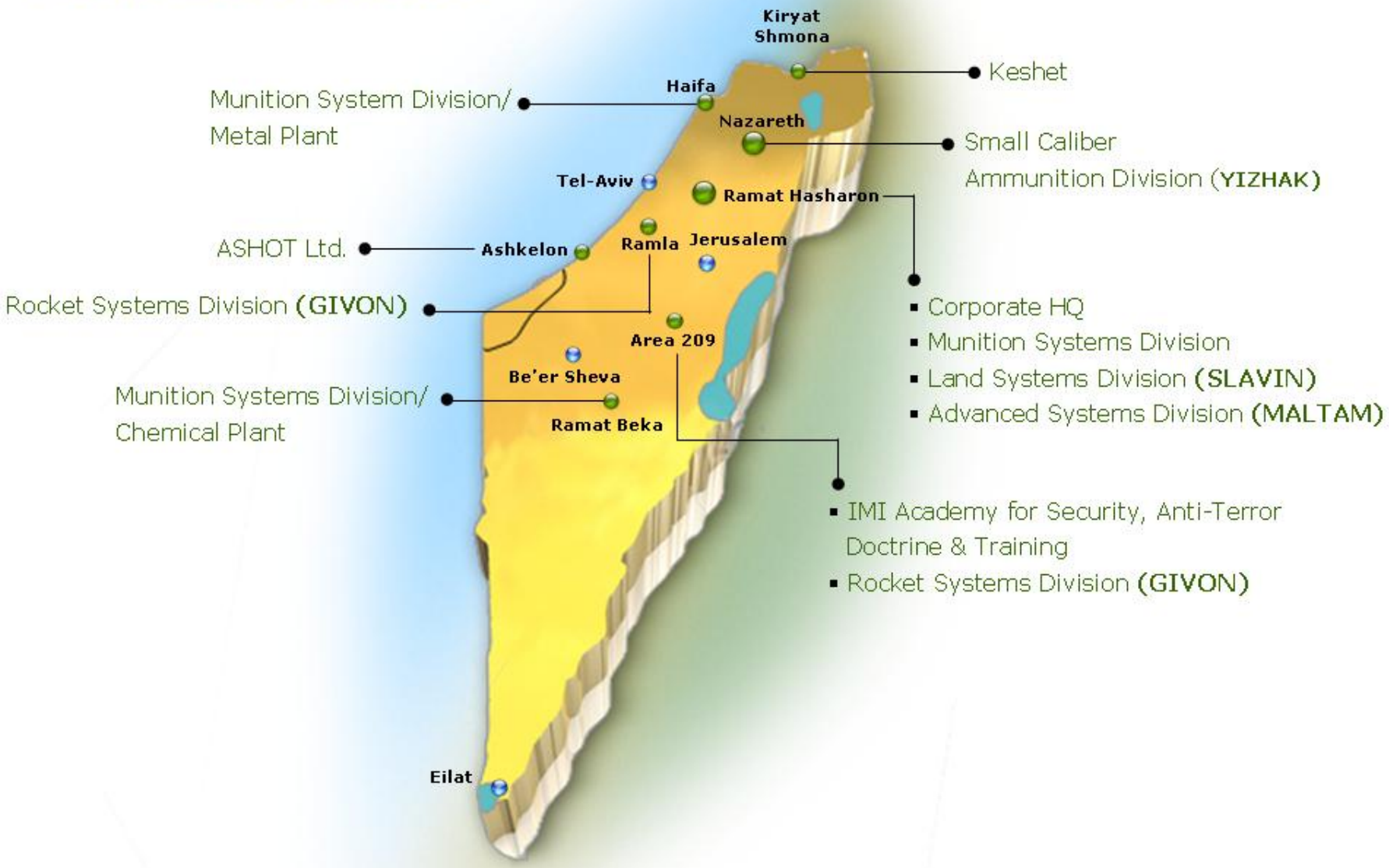
Israel Military Industries Ltd.
Munition Systems Division (MSD)

IMI Locations



Munition Systems Division

- Tank & Artillery Ammunition
- Infantry and Medium Cal. Ammo
- Air-to-Ground Munitions
- Smart Munitions
- Warheads
- Ammunition Handling - Storage Management, Reutilization, Demilitarization & Disposal

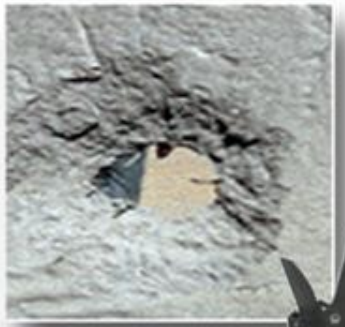
Outline of the presentation :

- Introduction & Background.
- Goals & Mission
- Insensitive Substances
- IM tests.
- Summary.

The goals of the development program :

- Develop a Multi-Purpose Tank Cartridge
- Can be fired with 120mm smooth bore guns L44/L55
- Developed and qualified according NATO STANAG 4385 and IDF requirements
- Complies with:
  - STANAG 4493
  - STANAG 4369 & AOP 22
  - STANAG 4157
  - MIL-STD-810, ITOP and others
- IM – MIL – STD – 2105 / STANAG 4439
  - HE (CLX663) – Qualified by the IDF
  - LOVA propellant (optionally) – Qualified by the IDF

HE-MP-T 120 - A Multi-Purpose Round



Concrete Wall

Earth & Timber Bunkers

Light Armour

Wall Breaching &

Infantry & AT Squads

The IM goals concept

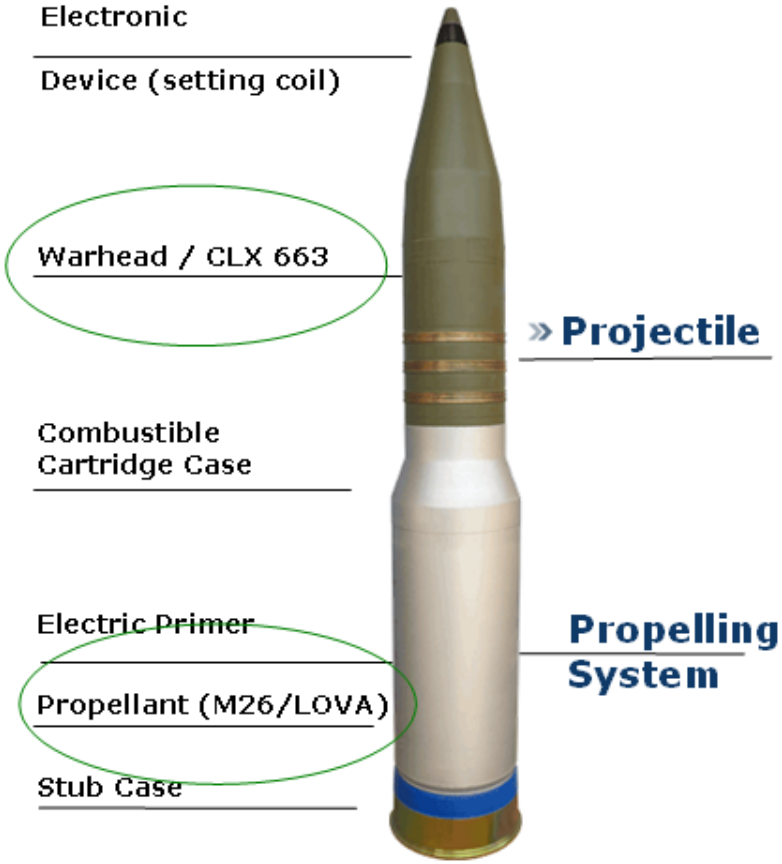
Energetic materials:

- Explosive classified as 1.5 UN
- Propellant less sensitive as LOVA nitramine .

Ammunition:

- Design to IM.
- Mitigation (if necessary).
- Packaging.
- Pass major tests according 2105/4439.

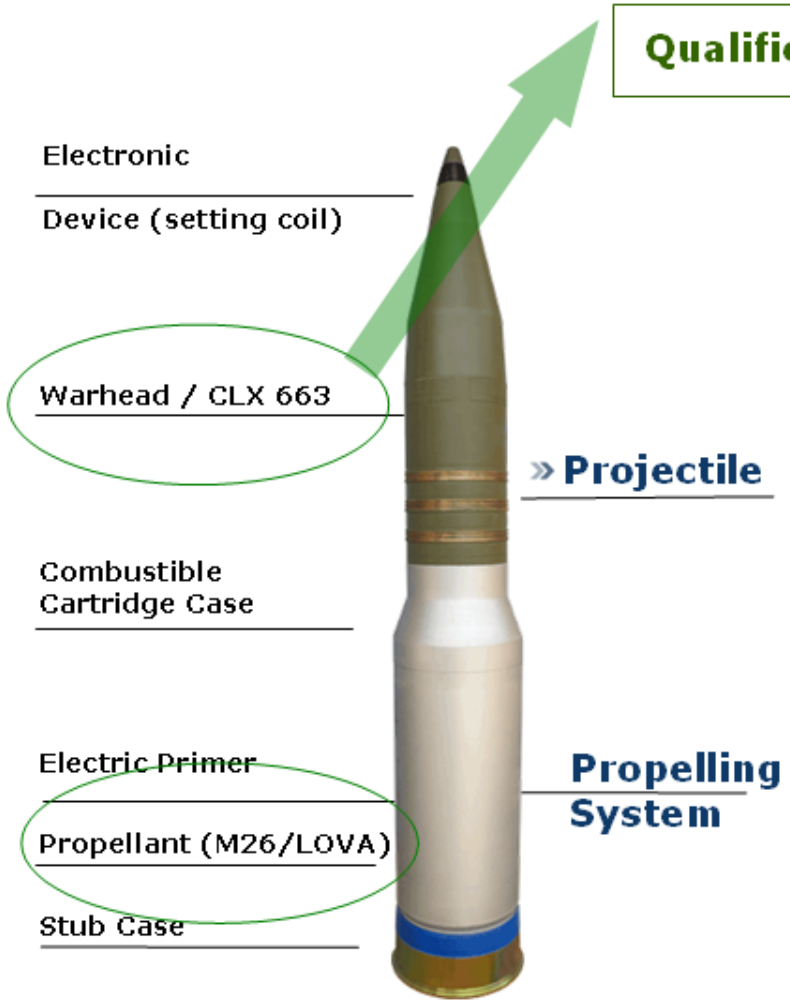
HE-MP-T 120 - A Multi-Purpose Round
Insensitive energetic compounds



Cartridge length	**984 mm**
Cartridge weight	**27 Kg**
Projectile weight	**17 Kg**
HE weight (IM-CLX663)	**2.3/2.5 Kg**
Muzzle velocity	**900 m/sec**
Chamber pressure	**3,300 bar**
Accuracy (SD)	**0.3 mil**

HE-MP-T 120 - A Multi-Purpose Round
Insensitive energetic compounds

Qualified as 1. 5 UN Hazard



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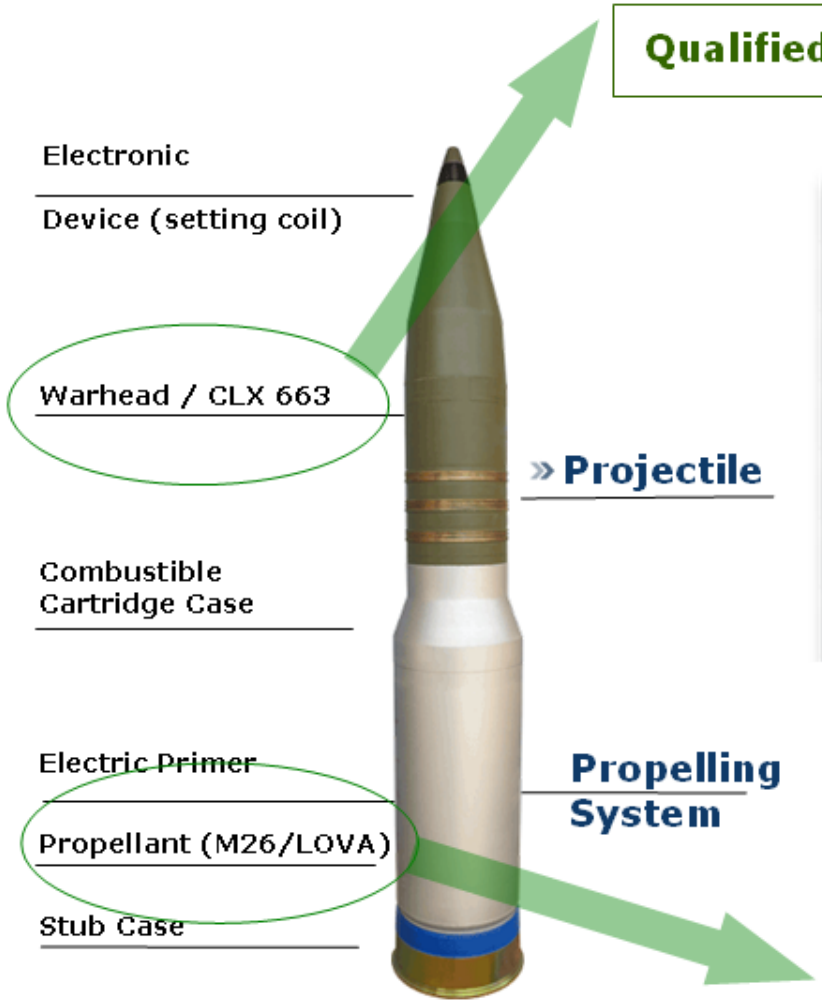

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CLP 15/26 Nitramine propellant

IMI 120 mm IM HE–MP–T- M339
IM Testing Protocol

- Explosive Qualification
- Propellant testing and qualification
- SCO test
- FCO (Liquid Fire Test).
- FI (Packaged as well)
- BI (Packaged as well)
- Shape charge attack test
- Sympathetic Reaction

CLX 663 - A NEW INSENSITIVE HIGH EXPLOSIVE (IHE)

- QUALIFIED by the IDF
- ENERGY NEAR PBXN 109
- IMPROVED CASTING
- RESISTANCE TO THERMAL TREATS
- WITHSTANDS FCO SCO TESTS.

Qualified as 1.5 UN

BULLET ATTACK TEST

IM TESTING

Method: TB 700-2 Chapter 5-8

SCO –	PASS TEST
FCO –	PASS TEST
BI -	PASS TEST
FI -	PASS TEST
LSGT -	PASS TEST
GAP/CAP TEST	PASS TESTS

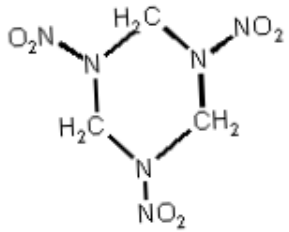
IMI LOVA PROPELLANT

To maximize the Force

$$F = R\,\frac{Tv}{MW}\ (j/gr)$$

High Energetic materials + **Novel Energetic Plasticizer**
High Nitrogen Content

Nitramine (RS-RDX)



No Nitroglycerine

IMI LOVA PROPELLANT

Thermo-chemical computations

Formulation	Force [j/g]	T [K]	Mw [g/mol]
Form. 1	1169	3517	25.0
Form. 2	1218	3442	23.5
CLP-26	1204	3259	22.5
M-26	1076	3125	24.1

$$F = R\frac{Tv}{MW}$$

High force – high performance

IMI LOVA PROPELLANT

IMI has introduced novel high energetic propellants for new 120 mm KE/MP round – CLP 15 / CLP 26 .

- **Improved Ballistic performances**
  - Higher muzzle velocity
  - Low flame temperature (<3500 K)
  - High Impetus (>1200 j/g)
- **Stability Shelf life**
  - Low weight loss during aging
  - Low stabilizer degradation
  - Extended shelf life
- **Enhanced safety properties**
  - Low vulnerability in IM test
  - Nitroglycerin free

IM Tests according STANAG 4439
Insensitive signature

SCO Test according stanag 4382

Slow Cook-off STANAG 4382

Results : Pass test
Reaction level IV -V

Liquid Fuel Fire (Fast Cook-off) STANAG 4240.

No explosion occurred – parts of the round found at 20 meters.

Results : Pass test
Reaction level IV-V

Fragment Impact acc. STANAG 4496

Fragment Impact According STANAG 4496

Requirement: No explosion or detonation.

Response: type V reaction

Fragment Impact acc. STANAG 4496 (packaged)

Results : Pass test
Reaction level V

Bullet Impact - STANAG 4241

Results : Pass test
Reaction level V

Bullet Impact - with Package STANAG 4241

Results : Pass test
Reaction level V

Shaped Charge Jet Impact Test STANAG 4526.

Pressure Gauges

Hollow charge : M-85

T- ambient 21 C

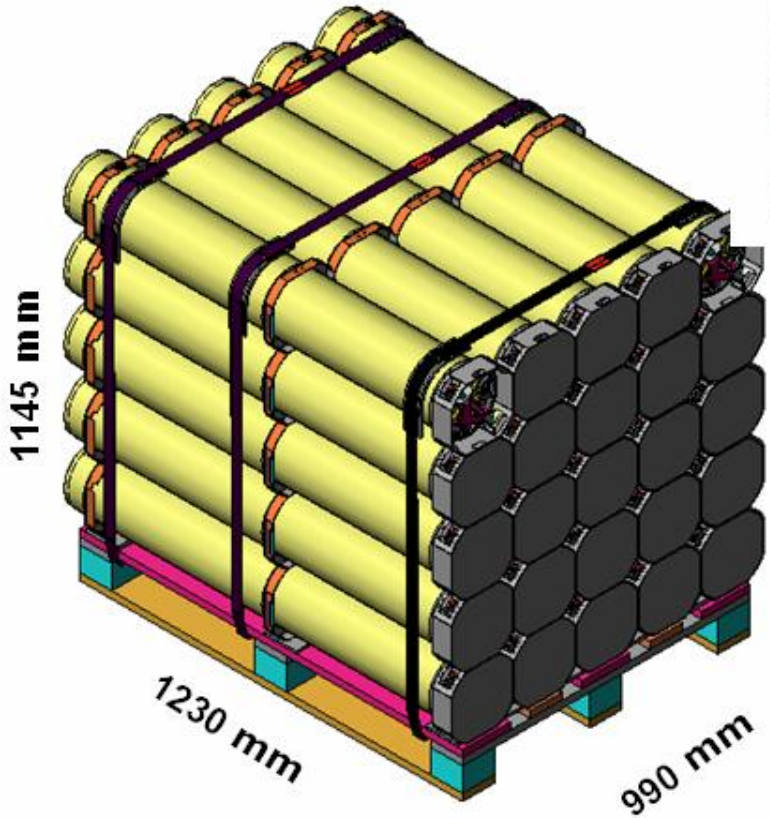
Charge Acceptor : M 339

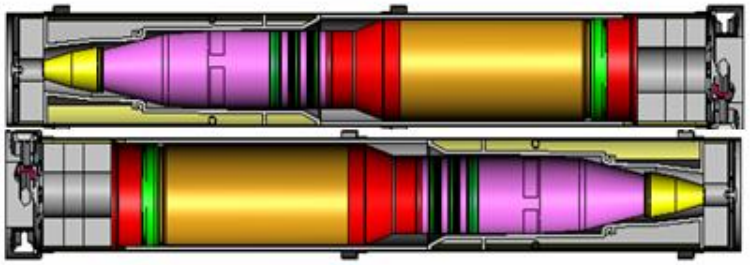
Shaped Charge Jet Impact Test STANAG 4526.

Results : Failed ! Reaction level I-II

Sympathetic Reaction test STANAG 4396.

HE-MP-T 120 – Packaging & Logistical Configuration





Weight	- 36 kg
Overall dimensions	-
	1230 X 196 X 196 mm

Shipping and storage

UN Serial number	0321
Hazard Classification	1.2E

Total weight = 950 kg

Sympathetic Reaction test STANAG 4396 (Preliminary)

Results : Pass test Reaction level IV

Summary of IM Reaction Levels (with CLX663)

IM Stimulus	Reaction Level	Results
Fast Heating (Fast Cook-Off)	IV-V	
Slow Heating (Slow Cook-Off)	IV-V	
Bullet Impact	V	X3 In Fuze 
With Package	V	X3 In Primer 

Summary of IM Reaction Levels (with CLX663)

IM Stimulus	Reaction Level	Results
Fragment Impact	V	By Targeting the Fuze & Primer 
With Package	V	
Sympathetic Reaction Preliminary. (Test will be repeated)	(IV)	One donor & One acceptor 
Shaped Charge Jet Impact <u>without barrier</u>	I-II	

IMI 120 mm IM HE–MP–T - Summary

- IMI has introduced its new 120 mm HE-MP-T tank round. The round is consisted from an insensitive explosive substance and as well a LOVA propellant as an option.
- The round passes major IM tests and failed to pass the shape charge test attack.
- The ammunition meets all ballistics and lethally requirements with high tank crew survivability.
- Further work will be done to improve reaction level for some of the tests .
- A derivative of this type ammunition will be operational for the IDF at Q4 2012.