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Review and Update of STANAG 4496 Fragment Impact, Munitions Test Procedure

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BACKGROUND

- **MSIAC survey: O159 - Review of the Fragment Impact test - edition 2, January 2017**

- **2 Custodial Working Group meetings**

  - DGA Missiles Testing, Bordeaux, France (January 2017)
  - Kromhout Kazerne, Utrecht, Netherlands (April 2017)

- **STANAG 4496 ed.1** will be replaced by Allied Ordnance Publication (**AOP-4496 ed.A version 1**) to allow for more efficient updates


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AOP-4496, Ed. A

NATO STANDARD
AOP - 4496, Draft Edition A
FRAGMENT IMPACT TEST PROCEDURES FOR MUNITIONS
Edition A Version 1
DRAFT – April 2018

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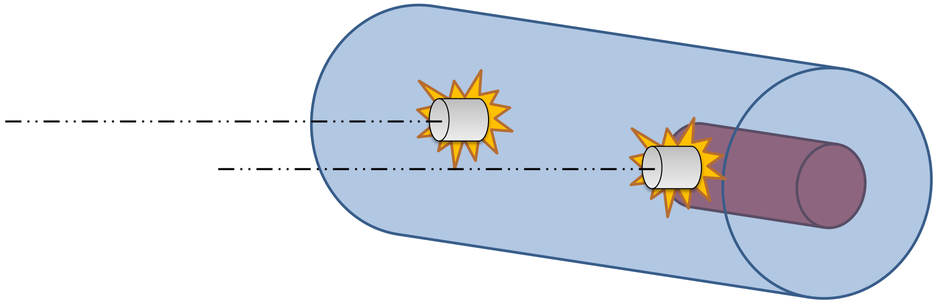
PROCEDURES AND NUMBER OF TESTS

- **Procedures**
  - Procedure 1: 2530 +/- 90 m/s
  - Procedure 2: 1830 +/- 60 m/s

UNCHANGED



- **Number of tests**
  - Shall be carried out twice by sub-component of the munition;
  - Once against the **main charge filling**
  - Once against the **most sensitive component/energetic material** (e.g. motor igniter, warhead booster)

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AIM POINT SELECTION

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- Shall be selected to create the most stressing condition on the target energetic

- Shall represent a credible exposure condition, based on the THA
  - First test **at the centre of the energetic component**
  - Second test **on the most vulnerable area**
  - Nota Bene:
    - Aim point and shotline for each test should be approved by national authorities prior to testing
    - Guidance for choosing aim point and shotline can be found in SRD AOP-39.1

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ACCURACY REQUIREMENT

NEW

- Shall be defined prior to testing and recorded after the test

Current STANAG 4496 ed.1	New AOP-4496 ed.1
	

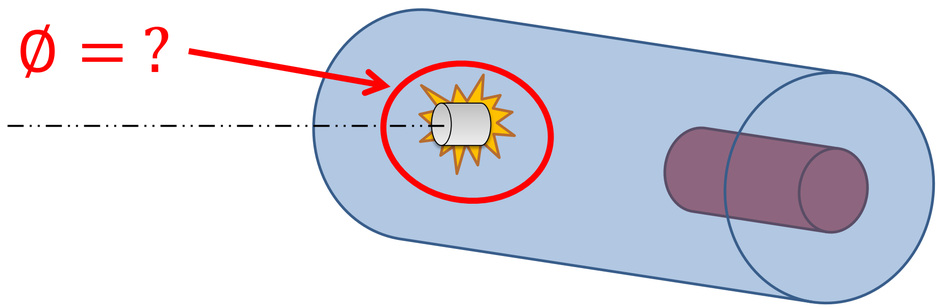
- Should be agreed by the National Authority

ACCURACY REQUIREMENT

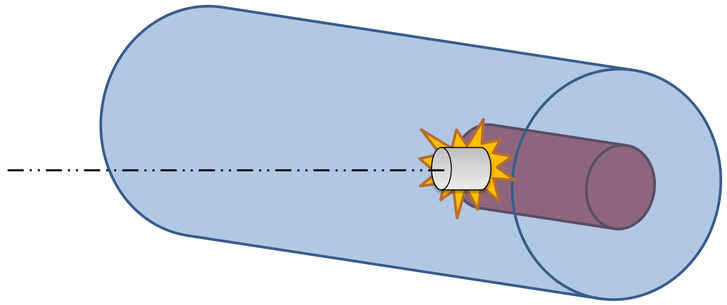
NEW

- Shall be dependent on the geometry of the item under test

Large area:
Hit the centre of the EM with an accuracy to define prior to testing

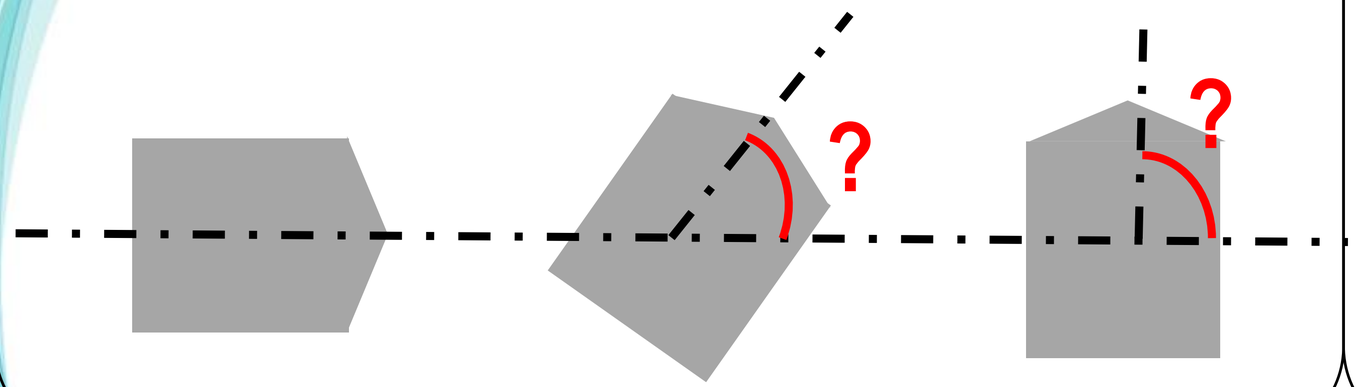


Small area (booster, small munition, …):
Hit the energetic component



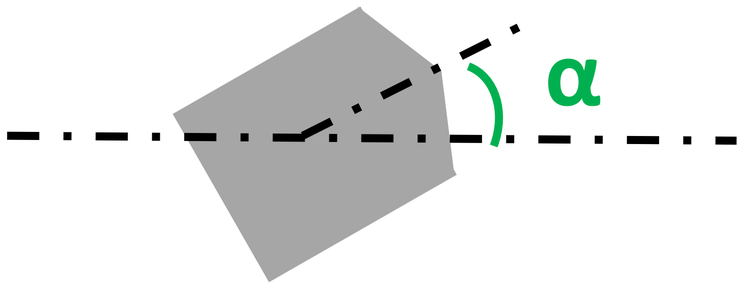
ORIENTATION OF THE FRAGMENT AT IMPACT

Current STANAG 4496 ed.1



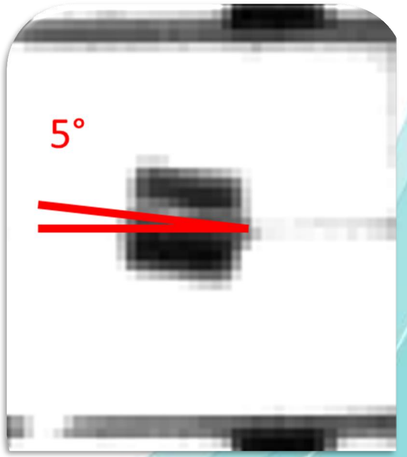
New AOP-4496 ed.1

NEW



- Angular deviation (e.g. vector sum of yaw and pitch) for the threat fragment at impact shall be measured and recorded
- Should be limited to ±10 °

➢ Collect data before imposing an acceptable limit value (next edition of the AOP)

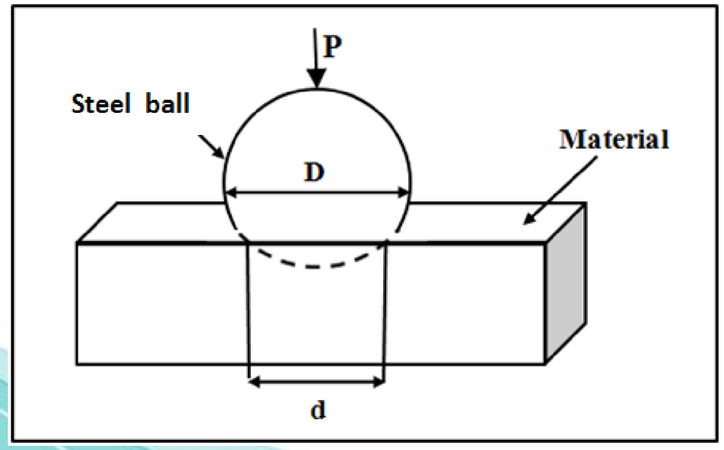


LOWER VALUE FOR THE BRINELL HARDNESS

- Addition of a lower value for the Brinell Hardness
- Measurement and record of the value

NEW

Current STANAG 4496 ed.1	New AOP-4496 ed.1
HB < 270	**190** < HB < 270



OTHER ISSUES DISCUSSED (1/2)

- No **sabot** design guidance

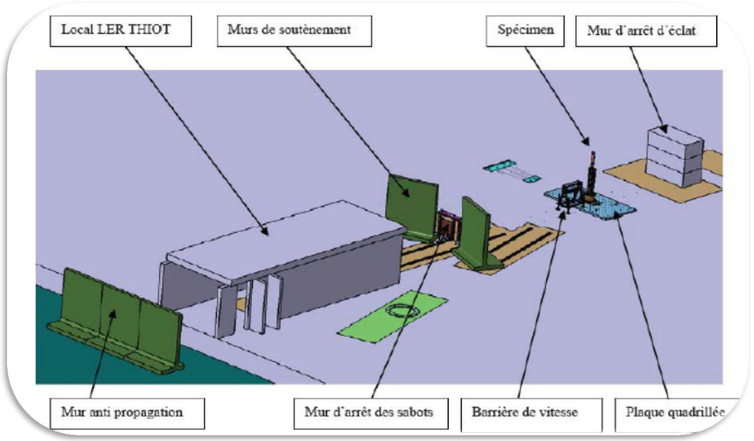
UNCHANGED

- No **launcher system** design guidance

UNCHANGED

- No example of the **test set-up** design

UNCHANGED



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OTHER ISSUES DISCUSSED (2/2)

- **No requirement for a standoff distance** between the launching system and the test item

UNCHANGED

- No **new** requirement on the measurement of the fragment velocity

UNCHANGED

  - Assess the measurement **uncertainties** of the impact velocity, the impact location, and the total angular deviation

NEW

NEW OBSERVATIONS AND RECORDS

NEW

- Aim point(s) selected, hit point(s) (if possible) and whether the fragment exited from the test item or remained within it (if possible)
- Impact velocity of the fragment and **method of determination**
- Suitable blast or pressure gauges **shall** be positioned around the test item. The location and height of the gauges have to be recorded
- Accuracy at impact
- Brinell hardness of the threat fragment
- Total angular deviation of the fragment at impact (e.g. vector sum of yaw and pitch)
- Estimated measurement uncertainties for: (a) the impact velocity, (b) impact location, and (c) total angular deviation

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OBSERVATIONS AND RECORDS

Unchanged / Rewording (1/2)

MODIFIED

- Test item identification and configuration; Type and weight of energetic material; Listing of environmental preconditioning test performed; Spatial orientation of the test item;

MODIFIED

- Test setup/configuration: Type of procedure, details of weapon(s) and munition used; Distance between weapon(s) and test item; Method of mounting and/or restraint; Distances from the test item to any protective wall or enclosure; Identification and location of any other instrumentation if used;

UNCHANGED

- Record of events versus time from the order to fire to the end of the trial;
- The nature of any reactions by the test item

UNCHANGED

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OBSERVATIONS AND RECORDS

Unchanged / Rewording (2/2)

MODIFIED

- Imagery of the item under test and the test setup shall be done before and after performing the test

MODIFIED

- The nature and distribution of residue and debris (included recovery and mapping)

MODIFIED

- Meteorological data (wind speed, direction) during the trial

UNCHANGED

- Indication of propulsion (video or other suitable means)
- Microphone or other suitable listening device to record audible events and enable correlation with visible events and indicated time

MODIFIED

- Witness screens as a measure of projection severity

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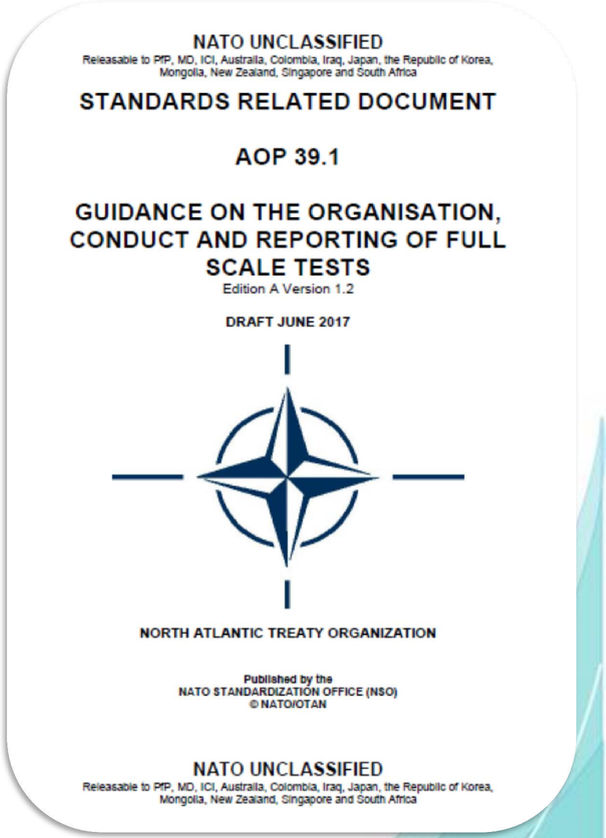
SOME MOVING SENTENCES TO SRD AOP-39.1

- **Sentences which are not specific to Fragment Impact test**
  - Tested Sample selection
  - Layout of the munition
  - Preliminary Shot
  - Safety
  - Orientation of impact normal to the surface of the munition
  - Calibration of blast gauges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STANDARDS RELATED DOCUMENT

AOP 39.1

GUIDANCE ON THE ORGANISATION, CONDUCT AND REPORTING OF FULL SCALE TESTS

Edition A Version 1.2

DRAFT JUNE 2017

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ANNEXES

- **Annex A: Standard fragment**
  - Conical ended cylinder
  - Tolerances: ± 0.05 mm and ± 0°30'
  - Fragment Mass: 18.6 g
  - Fragment material: mild, carbon steel with Brinell Hardness (HB) between **190** and 270

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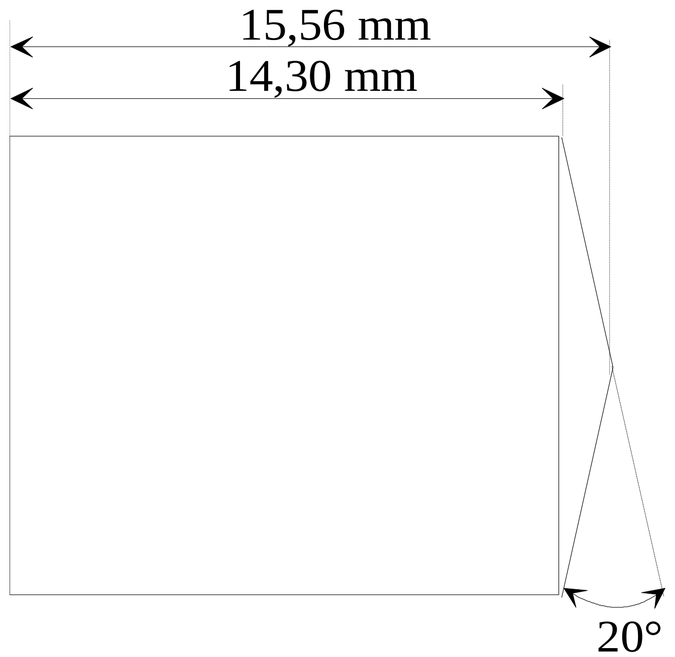

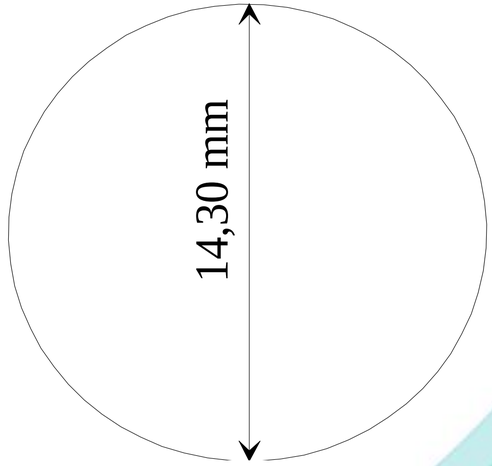

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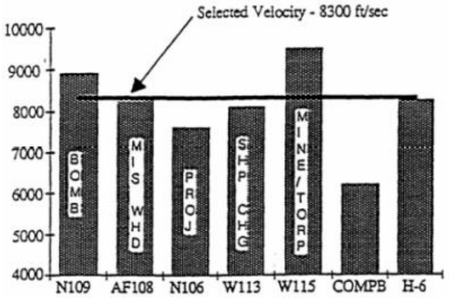
ANNEXES

NEW



Annex B: Historical overview

- Changes between STANAG 4496 ED 1 and AOP 4496 ed.A version 1
- Historical information on the shape, the material and velocities of the fragment from the first version to now

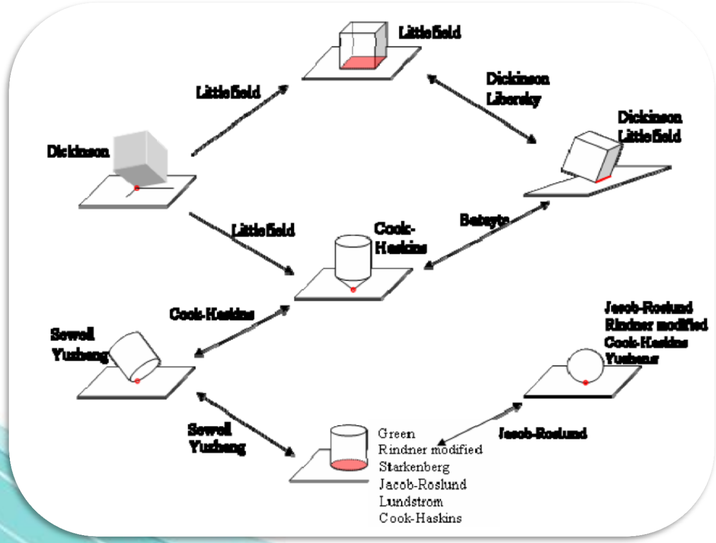


Table XXVIII: MSIAC Preferred Fragment Mass and Velocity

Munition	Worst Most Credible Mass Fragment (95±2% Confidence Level) (g)	Largest Initial Fragment Velocity (m/s)
Anti-Aircraft missile (current)	4 (tungsten, tantalum)	2000
Anti-Aircraft missile (next generation)	4 -16	2600*
Ø 80mm mortar Ø 80mm to 105 mm shell	16	1400
250lb bomb (Mk-81)	16	-
500lb bomb (Mk-82)	16	2000
Mk-48 torpedo	16 (aluminium)	2800
750lb bomb (M-117)	32	-
Ø 120 mm to 155 mm shell	64	1400
1000lb bomb (Mk-83)	64	2100
2000lb bomb (Mk-84)	64	2200
Exocet (natural fragmentation)	64	2000
Anti-ship missile (preformed fragments)	256	1800

* Using aimable/focused fragment warhead technology, fragment velocities are expected to increase by 20-35% within the next 5-10 years.

STATUS

- **Sent to AC/326 SG/B members for approval (March 2018) – silence procedure**

- **Next steps**
  - Approbation by AC/326 Main Group (June 2018)
  - Ratification process
  - Formal application of STANAG 4496 ed.2 and AOP-4496 ed.A version 1

PARTICIPANTS

Thanks to all!

Florian Péchoux (FRA - Lead)
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Thomas Reeves (UK)
Nathan White (UK)

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Brian Fuchs (US)
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Emmanuel Schultz (MSIAC)

Thank you for your attention!


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