IM Response for Army Engineering Charges filled with FPX V40

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IM Response for Army Engineering Charges filled with FPX V40

- Background
- Qualification of FPX V40 according to STANAG 4170
- IM testing
  - BI, SH, FH, SR, FI (mod)
- CBAM calculation for Forcit DFC 2010 System and comparison with conventional non-IM-system
Background

• Replacement of infantry mines and old army engineering equipment in FDF
• Forcit In-house development of IM products
• A new FPX development to replace e.g. hexotol in army engineering charges
• FPX V40 suitable for e.g. Directed Fragmentation Charges and Mine Clearance Charges
Background

- Forcit DFC 2010 is based on the FPX V40 main charge and FPX R1 booster charge
- For the best performance of the product a suitable combination of bubble- and shock energy was developed
- In-house development included field testing and 3 D-modelling of the charge
## General information FPX V40

<table>
<thead>
<tr>
<th>FPX V40</th>
<th>General purpose, army engineering charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type:</td>
<td>RS-RDX, AP, Al, binder</td>
</tr>
<tr>
<td>Density:</td>
<td>1,72</td>
</tr>
<tr>
<td>Velocity of detonation</td>
<td>6600 m/s</td>
</tr>
<tr>
<td>UN test series 7</td>
<td>Pass (except EIDS Gap)</td>
</tr>
<tr>
<td>STANAG qualified</td>
<td>Yes</td>
</tr>
<tr>
<td>IM-tested</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Qualification of FPX V40 according to STANAG 4170 and the effect of ageing (1/2)

<table>
<thead>
<tr>
<th>TEST</th>
<th>FRESH</th>
<th>3 MONTHS</th>
<th>6 MONTHS</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact sensitivity, BAM (cm) STANAG 4489</td>
<td>39</td>
<td>41</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Friction sensitivity (N) STANAG 4487</td>
<td>252</td>
<td>168</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>LSGT (NOL) (mm/kbar)</td>
<td>31 / 41</td>
<td>31 / 41</td>
<td>31 / 41</td>
<td></td>
</tr>
<tr>
<td>Deflagration point (° C) STANAG 4491 B1</td>
<td>211</td>
<td>213</td>
<td>213</td>
<td></td>
</tr>
<tr>
<td>DSC (° C) STANAG 4515</td>
<td>227,3</td>
<td>226,3</td>
<td>223,5</td>
<td></td>
</tr>
<tr>
<td>Thermal expansion coefficient α (1/° C) STANAG 4525</td>
<td>9,4E-05</td>
<td>10,3E-05</td>
<td>10,7E-05</td>
<td></td>
</tr>
<tr>
<td>Slow Cook Off (° C) STANAG 4491 Annex C-3</td>
<td>168/explosion</td>
<td>172/expl.</td>
<td>172/expl.</td>
<td>Acc. UN EIDS SCO pass</td>
</tr>
<tr>
<td>Fast Cook Off (° C) STANAG 4491 FCO-tube</td>
<td>Deflagration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Koenen test (mm)</td>
<td>No det./2 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Sensitivity properties and thermal stability as well as mechanical properties not significantly changed during ageing
Qualification of FPX V40 according to STANAG 4170 and the effect of ageing (2/2)

- Slow Cook Off –reaction
  - According to STANAG 4491 Annex C: explosion
  - According to UN EIDS Slow Cook Off: pass
IM testing:
Bullet Impact STANAG 4241 ed 2 (1/2)
IM testing:
Bullet Impact STANAG 4241 ed 2 (2/2)

- Impact on the front side of the charge and direct on the booster
- Reaction level: Type V, no reaction
IM testing:
Slow Heating STANAG 4382 ed 2

- Reaction level: Type V, burning
IM testing:
Fast Heating STANAG 4240 ed 2

- Reaction level: Type V, burning
IM testing:
Sympathetic Reaction STANAG 4396 ed 2

- Reaction level: Type V-IV, burning-deflagration
Sensitivity to Fragment Impact

- Another DFC was fired towards the acceptor charge with different distances between the charges (80 cm – 0 cm)
- Reaction level:
  Type V, burning
CBAM calculation

• Cost Benefit Analysis Model based on the IM testing of the Forcit DFC 2010

• Calculated for 25 years lifecycle and compared to a conventional DFC

• The cost for Forcit DFC 2010 was 15 % of the total lifecycle cost of the conventional DFC.
Summary

- The replacement of infantry mines and obsolete army engineering charges have given cause to a development of new army engineering charges with IM properties.
- FPX V40 and FPX R1 are suitable explosive fills e.g. army engineering charges and give excellent performance and IM properties.
- There is a huge potential of storing cost savings with Forcit DFC 2010 if the potential would be fully utilized (UN Test series 7 renewal).
Acknowledgements

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Forcit Defence team