40mm Infantry Grenade Fuzes

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Outline

- Company Presentation
- Program Background, Application
- Requirements for DM431A1
- Overview of JUNGHANS 40mm Products
- Overview of the Cartridges and Fuzes
- DM431A1 IG HV fuze family
- DM431A1 - Fuze Design
- Fuze Functioning Modes
- Arming Criteria
- Safety and Reliability
- Trial Results
- Conclusion
Company Presentation

- A global leader in the field of ammunition fuzes and S&A devices
- Full range of products
- Key competencies in
  - Fuzing technologies
  - Micro-technologies
  - Ammunition electronics
Program Background, Application

- Increasing intensive military action in urban terrain and a move to asymmetric combat situations triggered demand for other types of guns and ammunition for those situations
- German Army required a 40mm IG HV fuze with SD mode
- Selection of US M549 design as basis
- Improvement of the M549 PD fuze into DM431A1 PDSD fuze
- September 2002: First serial production contract
- Following the successful completion of the development phase the DM431A1 fuze was already presented at the Fuze Conference in 2003
The DM431A1 fuze is in serial production since 2003

Both DM441 and DM451 fuze are now entering the international markets

- DM441 Customer: Hellenic Defence – End users: GRE, FRA, QATAR
- DM451 Customer: Diehl BGT Defence – End user: GER
Program Background, Application

- AGL 40mm from Heckler & Koch

- H&K AGL mounted on German Vehicle FENNEK
Program Background, Application

- Maximum range with integrated SD mode is 1,800m
- The German Army requirement is between 100m and 1,500m combat distance
Requirements for DM431A1

- STANAG 4157; STANAG 4187
- MIL-STD-331B; MIL-STD-1316B; MIL-STD-810E
- Overall functional Reliability ≥ 97%
- Functioning Temperature: -46 C to +63 C
- Storage Temperature: -54 C to +71 C
Overview of JUNGHANS 40mm Products

- 40mm Low Velocity
  - DM411A1
  - DM361

- 40mm High Velocity
  - DM431A1
  - DM441
  - DM451 (IM)
Overview of Cartridges and Fuzes

- Low Velocity: DM411A1 and DM361
  - JUNGHANS has produced many thousands LV-fuzes

Technical Information:

- Muzzle safety distance ($v_0=78$m/s): 8m
- Arming distance: 15m
- Arming set back: 2.000g
- Arming rotation: 2.300rpm
- Functioning temperature: -35°C to +50°C
- SD time (in the temperature range): >8s
- Weight: ~50.5g
Overview of Cartridges and Fuzes

- High Velocity Cartridges in Service

**Fuze DM431A1**
DM111 HE-PFF (Diehl)
High Explosive Pre-Formed Fragments

**Fuze DM441 / DM451**
DM42 HEDP (e.g. Diehl)
High Explosive Dual Purpose
DM431A1 IG HV fuze family

- DM431A1 IG HV and Variations

Background:
- Mechanical point detonating fuzes equipped with a pyrotechnic self-destruct mechanism

Technical Information:
- Muzzle Safety Distance: $\geq 18m$
- Arming Distance: $\leq 40m$
- Arming set back: 22.500g
- Arming rotation: 6.500rpm
- Functioning Temperature: -46 C to +63 C
- Storage Temperature: -54 C to +71 C
- SD time (in the temperature range): $>14s$
DM431A1 IG HV fuze family

- DM431A1 IG HV
  - PDSD fuze on HE-PFF (high explosive pre-formed fragments) round
  - To date, JUNGHANS has produced some 1 million DM431A1 fuzes
  - Reliability rate 99.7% based on the results of the lot acceptance firings, in summary more than 7,400 rounds
DM431A1 IG HV fuze family

- **DM441 IG HV**
  - Used for HEDP ammunition on the DM32 round
  - For use against soft targets and light armored vehicles
  - Penetration performance of more than 70mm armor steel
  - More than hundred thousand fuzes DM441 have been produced
DM431A1 IG HV fuze family

- DM451 IG HV
  - Latest addition to JUNGHANS 40mm fuzes
  - Used for insensitive HEDP ammunition on the DM42 round
  - Pilot lot acceptance in approval by GER
  - Serial production in progress
  - With insensitive spit back booster DM1603 (IM) and black ogive
  - For use against soft targets and light armored vehicles
  - High penetration performance of more than 70mm armor steel, high effectivity and robustness
DM431A1 – Fuze Design

- Fuze Description in safe position

Firing pin
Percussion pin
Escapement
Safety spring
Booster DM1515
Stab detonator DM1518
Rotor
Delay detonator DM1519
Set-back device
DM431A1 – Fuze Design

- Fuze description - integration of the SD mode
Fuze Functioning Modes

- Fuze Functioning Modes are:
  - Impact mode (PD-mode)
  - Pyrotechnical self-destruct function

- Evaluation of Fuze Functioning Modes within Lot Acceptance Firings:
  - Muzzle safety: target plate at 18m
  - PD function: target plate at 40m
  - Impact sensitivity: target plate with 70°NATO angle at 100m
  - Impact sensitivity: firing on soft ground at 300m
  - SD firing with AGL (according to German standards)

- Lot acceptance firings are conducted according to high German standards
Arming Criteria

STANAG 4187 Compliance

- The fuze has two independent safety features.
  1. acceleration-dependent safety elements: two setback springs
  2. rotation-dependent safety element: safety spring
- A mechanical delay mechanism guarantees the muzzle safety distance
- No manual manipulation possible due to closed fuze housing
- No stored energy for rotor movement prior to launch
- No duds due to self-destruct mode
Safety and Reliability

Why SD-mode?

- Very high reliability rate (calculated with the results of the lot acceptance firings) of 99.7% with all firings conducted on the specified ground / targets.

- SD mode prevents (hazardous) duds in case of not specified target impact conditions:
  - High grass or bush
  - Snow
  - Water
  - Angle >70° NATO or ricochet
Trial Results

- DM431A1 – Firing against 3mm steel plate at 70°NATO
Trial Results

- DM431A1 – Firing against 2mm plate at arming distance 40m
Trial Results

- DM451 HEDP – Pilot lot acceptance trials in GER

- Disciplines performed for this acceptance:
  - Dispersion pattern
  - Weapon function
  - Penetration performance: Firing against 70mm armor steel plate (in addition towards HE-PFF round)
  - Muzzle safety: target plate at 18m
  - PD function: target plate at 40m
  - Impact sensitivity: target plate with 70°NATO angle at 100m
  - Impact sensitivity: firing on soft ground at 300m
  - SD firing with AGL (according to German standards)

- Strongly convincing performance of the DM42 round with the DM451 fuze from JUNGHANS
Trial Results

- DM451 HEDP – Firing against 70mm armor steel plate

  - Complete Penetration of the ammunition
Conclusion

- JUNGHANS is offering very safe and reliable IG fuzes which fully meet the latest safety requirements of major international customers and different IG solutions for asymmetric combat situations.
- JUNGHANS demonstrates an unmatched live firing reliability today on the IG market.
- JUNGHANS, thanks to its background and technology in fuzing solutions, is also considering new solutions for the future in the domain of IG fuzes.
- JUNGHANS focusses on Safety, Quality and Reliability to provide customers with flexible solutions for improved operational efficiency.
JUNGHANS Microtec GmbH

Thank you for your kind attention!

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