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KDI Precision Products, Inc.

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Miniature Electric Initiator

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Miniature Electric Initiator

- *Background*
- *Requirements*
- *Design*
- *Manufacturing*
- *Test Results*
- *Applications*
- *Status*

Miniature Electric Initiator Background

- KDI Requires Small Initiator for Self Destruct Fuze
  - Greatly simplifies fuze loading
    - Current detonator loaded in three layers into fuze
    - Bottom layer conductive explosive mix
  - Packaged initiator allows simplification of printed wiring board
  - Allows LAT at component level
- Navy Requires Small Initiator for M80 PIP Program
  - Requires high order initiation of M55 with low energy initiator
  - Hermetic seal

Miniature Electric Initiator Background

- KDI wrote Performance Specification and created TDP
  - Tailored to M234 Self Destruct Fuze
- KDI teamed with Technical Ordnance for development
- Navy provided input to specification for M80 PIP requirements
- Qualification performed under Navy M80 PIP program

Miniature Electric Initiator Requirements

- Design must meet MIL-I-23659
  - General Design Specification for Electrical Initiators
- Bridge wire resistance of 3 - 7 O
- All fire energy similar to M100 Electric Detonator
  - 1.6 V discharged from 100 µF capacitor
- No fire current similar to M100
  - 10 mA for not less than 10 seconds
- No soldering required for connection
- Must side initiate M55 high order
  - Dent depth of > .007 in from -50° F to +145° F

Miniature Electric Initiator Requirements

- Hermetically sealed
  - Leak rate less than 2.0 X 10^{-6} STD cc/sec He at 1 atmosphere
- Must withstand axial shock of 23,000 g's
  - M915 setback
- Must withstand lateral shock of 23,000 g's
  - ERMLRS cargo eject
- Small size
  - Must reside in Self Destruct Slide
    - Length < .09 in.
    - Diameter ~ .125 in.

Miniature Electric Initiator Design

- Two pin header
  - One pin is brazed to Header to provide a case ground
  - One pin is glass to metal sealed into the Header
- Pins are asymmetrically located about the center of the header
- Bridgewire connected between GTM pin and case
- Detonator cup is drawn from Stainless Steel

Miniature Electric Initiator Manufacturing

- Bridgewire is spot welded between the GTM pin and the header body.
- Match head is applied in a slurry using an automated dispenser and allowed to dry completely
- Explosive dispensed into cup and consolidated

Miniature Electric Initiator Manufacturing

- Matched header is inserted into the loaded cup to meet the 0.090 maximum overall length
- Header is laser welded 360° around interface between header and cup.
  - Laser welding provides hermetic seal.

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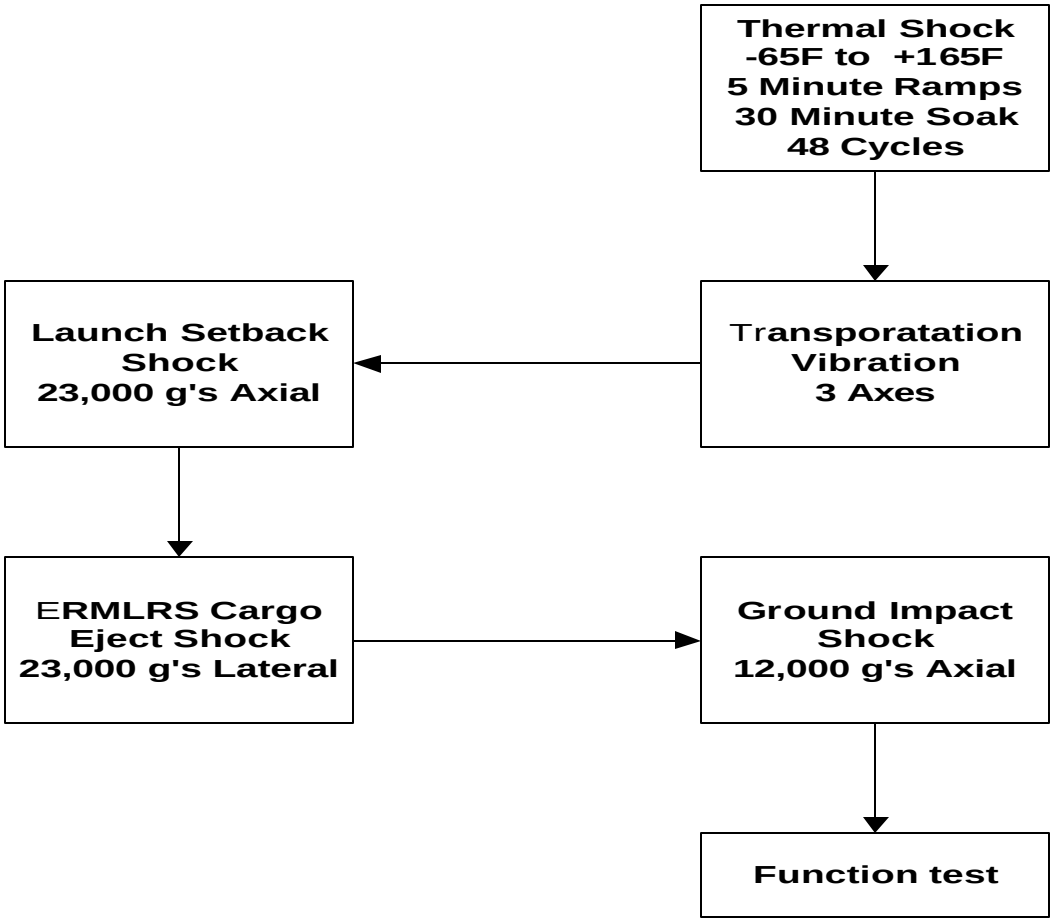
Miniature Electric Initiator Qualification Test Matrix

TEST	Reference	NUMBER OF INITIATORS (GROUPS)															TOTAL
		10	10	50	6	6	20	20	20	20	20	20	6	6	6	176	396
Radiographic	MIL-I-23659C 4.1.2.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	396
Leakage *	MIL-I-23659C 4.1.2.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	396
Resistance	MIL-I-23659C 4.4.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	396
Sensitivity – No-fire / all-fire				x													50
40 Foot Drop	MIL-I-23659C 4.6.1				x												6
6 Foot Drop	MIL-I-23659C 4.6.2					x											6
Shock	MIL-I-23659C 4.6.3						x						x	x	x		38
Vibration ***	Mil-Std-331B Test B1							x					x	x	x		38
Temperature-Shock/Humidity/Altitude	MIL-I-23659C 4.6.5								x								20
High Temperature Exposure	Mil-Std-331B, Test C6, 5.5.3									x							20
Axial Shock	3.3.2 of spec. 23910351	x															10
Lateral Shock	3.3.3.of spec 23910351		x														10
Radiographic	MIL-I-23659C 4.1.2.2	x	x			x	x	x	x				x	x	x		104
Resistance	MIL-I-23659C 4.4.2	x	x			x	x	x	x	x			x	x	x		124
Leakage *	MIL-I-23659C 4.1.2.3					x	x	x	x				x	x	x		84
Operational Function 70 F	3.1.1 of spec. 23910351	x	x			x	x	x					x			x	248
Operational Function -65 F	3.1.1 of spec. 23910351								x			x		x			46
Operational Function +160 F	3.1.1 of spec. 23910351									x	x				x		46
Function Time	3.1.3 of spec. 23910351	x	x		x	x	x	x	x	x	x	x	x	x	x	x	340
Output Verification	3.1.4 of spec. 23910351	x	x		x	x	x	x	x	x	x	x	x	x	x	x	340

Miniature Electric Initiator
Fuze Verification Test
M234, XM235



Miniature Electric Initiator Test Results

- Qualification successfully completed
- Fuze Verification Test
  - N=150 with no anomalies
- Ballistic test in Guided MLRS 3/12/03
  - N=101
  - No anomalies

Miniature Electric Initiator Current Applications

- KDI Self Destruct Fuzes
  - M234, XM235, XM236
- Navy M80 PIP Program
  - Adds proximity capability to M234 Self Destruct Fuze
- KDI Electromechanical Hand Grenade Fuze
  - Small output of initiator enhances out of line safety

Miniature Electric Initiator Status

- Qualification successfully completed
- Final test report in process
- KDI SOW for automated fuze loading equipment complete
- Design will be rolled into M234 Self-Destruct fuze design in Q1 2004
- XM235 and XM236 (MLRS and M864) Self-Destruct fuze design will incorporate miniature initiator from start