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How JUNGHANS Feinwerktechnik has Adressed the Needs of IM Requirements in its Design of Fuzing Systems

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Prepared & Presented by:
J. Fitzgerald-Smith
M. Kopf
contact at JUNGHANS: markus.kopf@junghans-fwt.de

IM Requirements in Design of Fuzing Systems

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Markus Kopf
JUNGHANS Feinwerktechnik GmbH&Co.KG
Unterbergenweg 10, D-78655 Dunningen

IM Requirements in Design of Fuzing Systems

Introduction :

As NATO nations have demanded that IM Requirements become a fundamental issue in all new munitions systems, it is essential that fuzing systems must also meet these demands.

This is particularly the case with out of line safety and arming systems where such items as leads and boosters have to be as insensitive as the main filling, but as well ensure that satisfactory take over is performed.

Over a number for years JUNGHANS Feinwerktechnik has been addressing these issues and is developing its fuzes to incorporate the very latest qualified improved IM lead and booster materials such as UK ROWANEX 3601 and German DXP 1340.

This paper demonstrates how by evaluating different parameter permutations of lead and booster materials satisfactory take over can be achieved on these IM main charge fillings.

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Range of Suitable of IM Booster Candidates in Relation to Tetryl :

Material	Formulation	Impact Sensitiveness	Temperature Ignition	Shock Sensitivity	Water Gap Test	Detonation Velocity
		F of I	[°C]	SSGT [mm]	GPT [mm]	[km/s]
Tetryl	Tetryl	105	176	2.81	21	7.26
Debrix 11	RDX 99%, Wax 1%	100	216	2.72	28	8.72
CH 6	RDX 97.5%, Polyisobutalene 0.5%, Graphite 0.5%, Calciumstearite 1.5%	110	220	2.6	26	8.55
DXP 1340	HMX 96%, Binder 4%	-	282	-	17	8.62
DXP 1340-2	HMX 96%, Binder 4%	-	282	-	12	8.62
PBXN 5	HMX 95%, Viton A 5%	60	273	2.3	28	8.21
ROWANEX 3601 / PBXN 7	RDX 35%, TATB 60%, Viton A 5%	90	225	1.42	16 to 19	8.05

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Selecting Best Candidate for IM Fuze Train :

Debrix 11 and CH 6 which were developed as replacements for Tetryl for Booster compositions are similar in impact sensitiveness, have better thermal stability and show slightly reduced shock sensitivity.

PBXN 5 has very high impact sensitiveness and its water gap tests value is much more shock sensitive than Tetryl.

ROWANEX 3601 and DXP 1340 have similar impact sensitiveness to Tetryl much improved thermal stability and are very much less shock sensitive than Tetryl.

Hence these two materials would seen to demonstrate the best IM Characteristics for Lead and Booster components !

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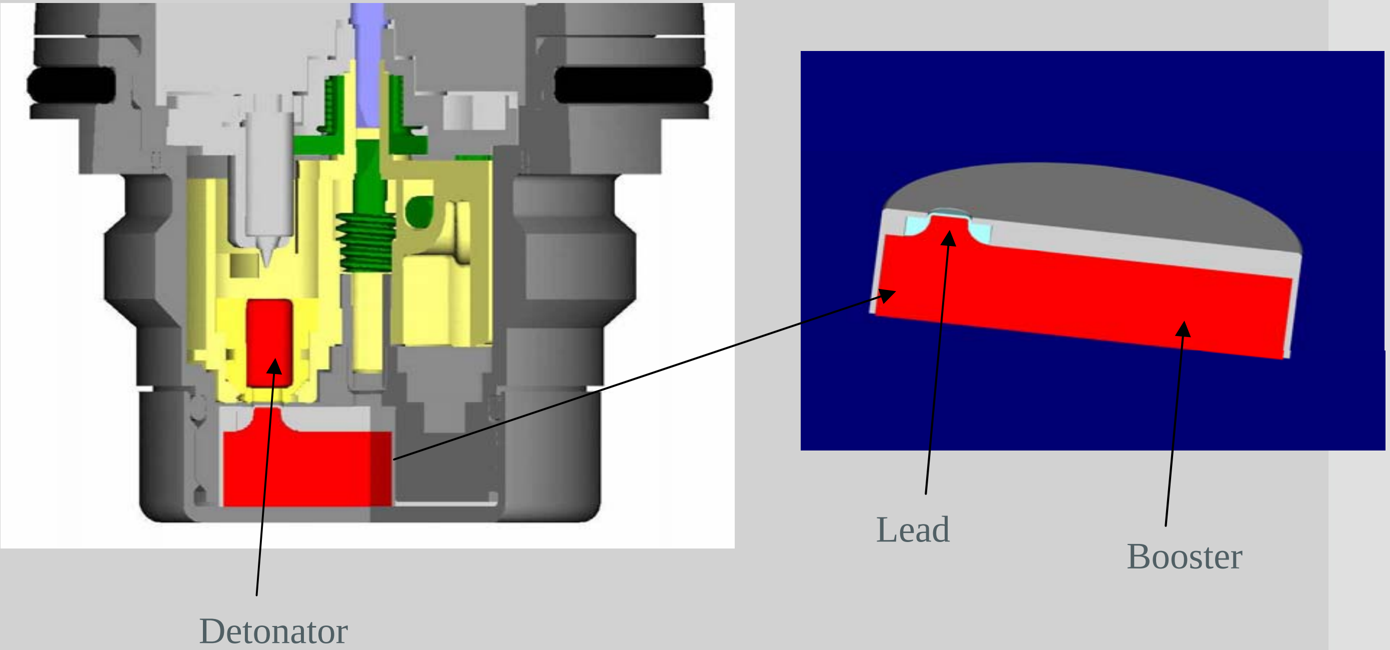
General Lead and Booster Design for out of Line Fuzing Systems :



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Take Over Trials conducted on various Parameter Permutations of the selected Candidate Material that covered the following :

1. 3 different densities of lead charge material of Debrix 11 and ROWANEX 3601
2. 2 different material metal housings A and B
3. 2 different base thicknesses of housing
4. either no booster or a booster of ROWANEX 3601
5. nominal air gap between detonator housing and lead charge or increased air gap dimensions

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Results of best Take Over Performance :

From conducting over 300 firing permutations, the results demonstrated very satisfactory take over performance with the following criteria:

-Using housing material A, a lead charge of Debrix 11 at its middle density on to a ROWANEX 3601 booster at up 3x maximum design nominal distance of air gap with confirmation at temperatures down to -46°C.

-Further confidence was provided after conducting take over tests using the above criteria following the temperature humidity test of STANAG 4157 / AOP 20 Test C1.

-Similar take over test results were also achieved using lead material HNS4+DXP1340 and DXP1340 booster charge when incorporated into the material A housing.

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Satisfactory Take Over Trials on to IM Main Filling :

Using the established IM design criteria for a Debrix 11 lead and a ROWANEX 3601 booster configuration as an IM explosive train.

Take over trails haven been satisfactory demonstrated on to IM main fillings of ROWANEX 1100 at the temperature range -46°C to +63°C when incorporated in the DM84 artillery fuze and in the DM111 (L127) mortar fuze, but only at -46°C !

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Conclusion :

Introducing new booster energetic materials with better IM characteristics has proven to be more difficult for old fuze designs than with new specific IM / system fuze designs, such as JUNGHANS IM fuze for case telescopic 40mm ammunition.

However using suitable IM lead and booster compositions with the right confinement and density has demonstrated that both improved IM-ness can be achieved and satisfactory take over on IM main charge fillings ensured .

It is recommended for the future that the fuze design for IM purposes can not be designed in isolation from the complete munitions system.