GAPS

There are many different kinds of explosive sensitivity tests but our all time favorite is the "LANL Small Scale Gap Test." We like it because it gives numbers which have some real meaning in our type of business (and because they use one of our detonators for the test). Tests like the "Drop Hammer," where a weight is dropped from various heights on a loose sample of the explosive until a 50% fire/fail height is determined, or the "Susan" where a high density sample of the test explosive is placed in the nose of a projectile and fired at armor plate until a velocity threshold is found, just don't seem to have that rnuch meaning in our detonator world.

The Los Alamos National Laboratory (LANL) Small Scale Gap Test uses an RP-1 Detonator (they call it an SE-1) as the donor and a 0.5 inch diameter pellet of the test explosive as the acceptor. The output of the RP-1 donor is a 0.300 inch diameter PBX-9407 pellet. Spacers consisting of 0.01 inch thick brass shims are inserted between the donor and acceptor for each test. Tests are performed with various numbers of spacers until a 50% fire/fail thickness is determined. The data is usually analyzed using the Bruceton method.

Some typical results lifted from the "LLNL Explosives Handbook" for this test are:

		Density	50% gap
Octol	Vacuum cast	1.638 g/cc	0.58mm
TNT	Hot Pressed	1.633 g/cc	0.33 mm
PBX-9407	Cold Pressed	1.598 g/cc	5.13 mm
A-3	Hot Pressed	1.635 g/cc	0.89 mm

In other words, if you put 0.58 millimeters of brass between the output end of an RP1 and a vacuum cast chunk of Octol, you can expect 50% of your experiments to fail.

This is very close to real life but not close enough. Unfortunately, in real life, what usually gets between the end of your detonator and the main charge is not brass but void or potting material. So when we do gap tests at RISI to check out a design, we usually use plastic shims to simulate the potting. How thick of a plastic shim should a detonator be able to fire through? Whatever makes you feel good (and more than can conceivably exist in your assembly).

Now suppose if instead of potting material getting between the end of the detonator and your main charge, you manage to get a void at the end of the detonator, something Please go to page 2

different comes into play. The RP-1 detonator used in the LANL Small Scale Gap Test, has a bare, exposed pellet as the donor while many of our other detonators have an aluminum or stainless can over the pellet.

If you have a bare pellet detonator, the most reliable firing is with no gap.

If you have a canned detonator and a void, the most reliable firing is with a gap.

Yes-with a gap. It turns out that if you have a void at the end of the detonator, the can bottom is sheared off, accelerates and initiates the next charge with its kinetic energy. The void gives the can bottom space to accelerate. If you have zero gap, the end of the can acts like one of the shims in the Small Scale Gap Test. Therefore it is more reliable to have a slight gap if you have a void but more reliable to have no gap if potting is in front of the detonator.

We have tested canned detonators that would fail to initiate a particular explosive 100% of the time with zero gap, but would initiate reliably with air gaps from 0.020 to 0.500 inch.

If you are worried about transferring a detonation across a gap (air, plastic, or potting), give us a call. We'll either dig it out of our files or give you a quote on doing the experiments.

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