

## CAUTION: Very Fast “Black Match”

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There is a new style of black match used to make the quick match leader fuse on some Chinese products. The fuse has recently been found on some Flower Basket aerial shells and Lidu display fireworks boxes and may also be used on other items as well. While this new black match seems to function well in quick match, it has one characteristic that is important to note for safety reasons. Where normal black match tends to burn rather slowly at about an inch per second, this new black match burns very much faster, perhaps as fast as quick match (roughly 10–20 feet per second). Because of this much faster burn rate, it is possible for someone to have a serious problem. For example, if the end of a shell leader fuse were damaged, someone might attempt a repair by cutting off some of the damaged shell leader and then exposing a few inches of this new black match. In this case, the person may have the expectation that lighting the tip of the newly exposed fuse would provide a few seconds before the item would function. However, instead, the fireworks could begin to function essentially immediately upon ignition of the tip of the leader fuse.

Before further discussion of the burning of this new black match, it is appropriate to first consider the manner of its construction. (For a discussion of typical black match and quick match construction and their manner of burning, see reference 1.) Figure 1 is a photograph of the end of a shell leader of this new type, with the safety cap removed. Figures 2A and 2B are the same piece of shell leader that has been progressively dissected to reveal the manner of its construction.

The end of the shell leader is composed of three lengths of thin visco fuse (each a little larger than 1/16 inch in diameter and about four inches long). In Figure 2B, the end of one of the pieces of visco fuse has been cut open for a short distance to expose the fuse powder con-



*Figure 1. Photo of a shell leader containing the new fast burning black match. (Note that the three exposed fuses have been separated slightly for clarity.)*

tained in it. Further, these three fuses have been surface coated with a slurry of powder. These fuses are attached to the length of shell leader with a thin wrap of tissue paper (not shown) over a string tie. Upon initial inspection, the shell leader appears similar to conventional quick match, with an outer wrap of Kraft paper (match pipe) over an internal fuse which is black in appearance. However, most importantly, this is not conventional black match. It is made using a wrap of approximately two and a half turns of a thin tissue paper around two cords of string heavily coated with a slurry of powder. Also in the tissue paper wrap is a substantial additional amount of a fine loose powder, some of which tightly adheres to the tissue paper (suggesting that the tissue paper was probably somewhat wet when wrapped up). Figure 3 is an attempt at a cross-sectional illustration of the construction of this central fuse.

Because the tissue paper of the central fuse is only loosely wrapped, abundant fire paths remain within it. Accordingly, when it is burned, even when not enclosed within the Kraft paper match pipe, it burns very quickly, much like it does when made into quick match. Thus for this fuse, the purpose of the Kraft paper match pipe

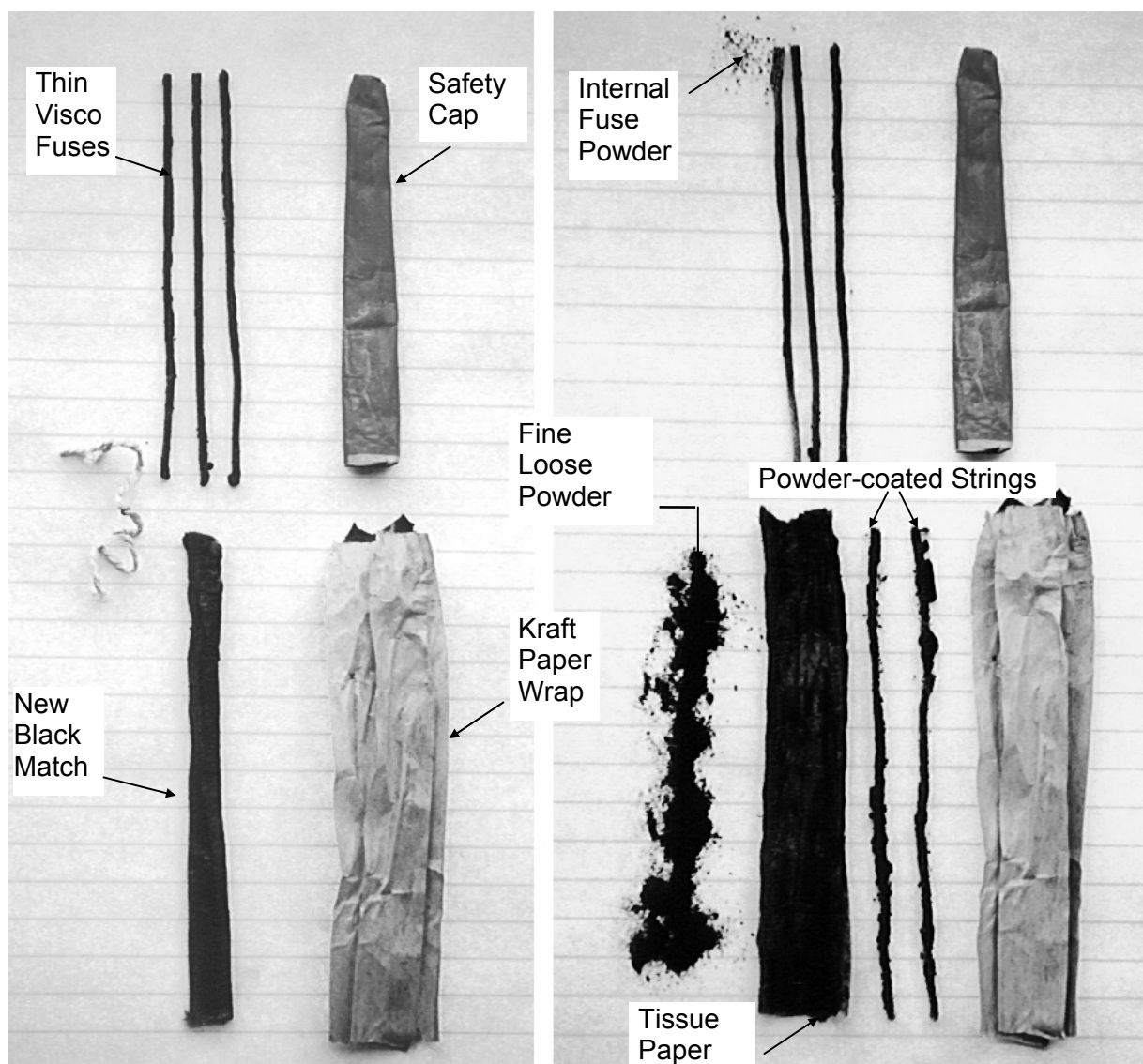


Figure 2. Photos of a dissected shell leader illustrating its construction.

seems to be mostly for additional strength and the protection of the central tissue wrapped fuse.

There is nothing intrinsically wrong with having a central fuse that burns essentially as fast as completed quick match. In fact, although it has not been extensively tested by the authors, it seems to perform quite well. Further, the abundant amount and distribution of the fuse powder probably makes this fuse less likely to fail as either a hangfire or misfire.<sup>[1]</sup> However, it can be important for users to know this new style fuse exists. For example, as suggested above, if a shell leader or the delay element is seriously damaged, or the delay elements are missing, one would normally make a repair in

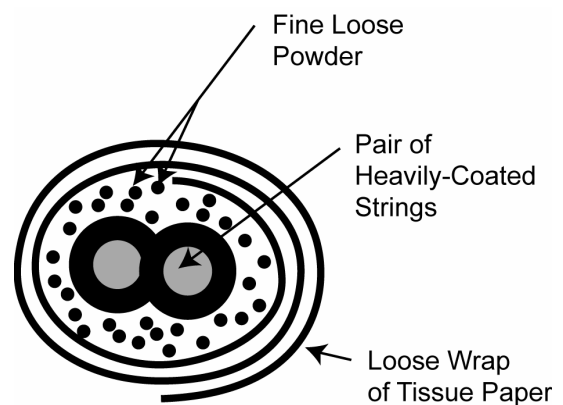


Figure 3. Cross sectional illustration of the new fast burning black match.

the field. This might be done by simply removing the damaged portion of the fuse and stripping back some of the Kraft paper match pipe to expose more of the central fuse. With a typical quick match shell leader this works well and is an appropriate repair. However, if this procedure is done using this new style of tissue fuse quick match, when it is ignited, instead of the expected few seconds delay, there would be essentially no delay at all. In most cases, that would merely startle the lighter. However, if the device being ignited seriously malfunctioned, or if the lighter was not properly positioned at the time, an injury could result. (Note: There has been at least one minor, but very nearly serious, accident caused by the unexpectedly fast burning of this fuse.)

It is not known how widely this new style of quick match is being used. The authors first saw

it several years ago and have more recently seen it on Flower Basket aerial shells and on Lidu finale boxes. If you encounter it, there should be no problem, providing any delay elements are left in place or where no delay is intended when it is ignited. To reiterate, there seems to be nothing intrinsically wrong with this new style of tissue fuse core quick match. However, it is just important to be able to recognize it and to know what to expect when using it.

## References

- 1) K. L. and B. J. Kosanke, "Quick Match: A Review and Study", *Proc. 4<sup>th</sup> Int'l. Symp. Fireworks* (1998). Also in *Selected Publications of K. L. and B. J. Kosanke, Part 5 (1998 through 2000)*, Journal of Pyrotechnics, 2002.