Light Bulb Analysis at Impact

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Whenever light bulbs are found either with the glass intact or broken it is often possible to make determinations as to whether they were illuminated or not at the time of impact. This is important since it may gives clues as to condition of electrical systems and whether emergency or warning lights were on.

All light bulbs should be retrieved and cataloged when possible. They should be inventoried as to the as found condition.

All bulbs should be examined for illumination. This gives clues as to electrical availability to all busses and all systems. The warning annunciator bulbs give clues to particular system status and malfunction.

Most bulb filaments consist of hard, brittle metal (usually a tungsten alloy) filament. In a glass enclosed vacuum the filament is electrically excited and heated to give off light.

If the bulb is cold at ground impact (and the glass survives impact), the filament is brittle and will generally shatter in overload failure. If the bulb is hot at impact (and the bulb survives impact), it is usually ductile and malleable. Thus instead of a brittle break the filament will stretch and deform before breaking.

If the glass bulb breaks at impact and the bulb was illuminated the filament will instantly burn up. This will leave Tungsten Oxide as a residue of combustion. If the bulb breaks and was not illuminated there will be no Tungsten Oxide. Since the Tungsten requires such a hot temperature to burn, the formation of Tungsten Oxide will not occur due to the expected temperatures of a ground fire or an airborne fire. Thus even after a fire a broken bulb may be examined as to its pre impact - pre fire condition.

All N.T.S.B. investigators know the basics of filament analysis with the bulb intact. Most are familiar with the Tungsten Oxide concept of broken bulb analysis. This methodology is standard in aircraft accidents investigations. Most highway accident investigators don't have a clue, but the principle is just as true for automobiles, trains, trucks, busses and ships.