## C45 Virtual Loosening of Fittings From Elevated Temperatures

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After attending this presentation, attendees will have a basic understanding of why threaded fittings may be loose after being subjected to elevated temperatures, such as from exposure to a fire.

This presentation will impact the forensic community and/or humanity by demonstrating the importance of applying engineering sciences in fire investigations to correctly analyze and interpret the evidence.

A fire occurs at a property supplied by natural or LP gas. Following the fire, investigators test the gas system, find leaks, and ultimately implicate the gas company or pipe installer for faulty workmanship. Was the connection indeed loose prior to the fire? Barring unforeseen circumstances (tampering), the fitting was likely leak-free at the time the fire started, particularly if proper leak tests were performed at the time of installation. The naïve investigator reasons that the only way for a fitting to be loose is for it to have been loose prior to the fire, but it is not the torque that should be of sole interest after the fire, rather the number of threads engaged. The number of threads engaged becomes the only reliable method of estimating the pre-fire engagement torque.

Looseness in pipe and tubing fittings post-fire must be carefully scrutinized before an assumption of pre-existing leaks can be made. Investigators must understand that sufficient heating of threaded metal fittings, as in basic heat treatment processes, relieves stress in the metal. Stress in the metal is what allows a fitting to become tight and "leak free." Heat from a fire, if not sufficient to completely melt the fitting, can allow the metal to re-crystallize, thus softening and relieving stress in the fitting. This results in a virtual loosening of the fitting, although no rotation or unscrewing of the parts has occurred.

Experiments conducted with various flare and pipe fittings of different materials showed that brass flare fittings, a form of compression fitting, "loosened" to the greatest degree with the lowest temperature exposures. Steel pipe fittings required the greatest heat exposure and resulted in the least effective "loosening." "Leak free" fittings with known, standardized initial torques were subjected to elevated temperatures for various times. After removal from the elevated temperatures, the fittings were tested for leaks and post heating torque values. These results demonstrate how stress-relieving processes can, and do, occur in environments like house fires. The simple engineering process of stress relief and how it relates to threaded fitting tightness must be understood by investigators involved with testing gas systems following fires in order to properly interpret the fitting conditions, and how they relate to pre-fire conditions.

**Loose, Fittings, Fire**

 ** Presenting Author*