FUEL GAS LEAKAGE POTENTIAL FROM COMMON THREADED PIPE CONNECTIONS - CONSIDERATIONS FOR FIRE/EXPLOSION INVESTIGATIONS

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ABSTRACT

Fire Explosion Investigations involving fuel gas explosions and flash fires in buildings often involve the examination of the complete indoor gas piping system, per NFPA 921[i] guidance. This often includes the examination of threaded piping connections for integrity. Unfortunately, many connections may degrade during exposure to the heat of fire or may be mechanically damaged from physical forces encountered during structural collapse and explosions. Some connections may appear to be loose, corroded; some may be broke at threads or at other portions of piping. Where portions of the piping system are intact, it is often desired to test them for leakage.

This paper summarizes efforts to estimate maximum potential fuel gas leak rates from threaded pipe connections without subjecting the piping components to a pressure test. It has been shown that in some limited cases, piping connections and segments can be eliminated from consideration, where supporting data (from experimental leak tests at typical service pressures) indicate potential leakage is very small. Only common American residential threaded pipe sizes are considered in this paper (e.g. 3/8", ½", ¾", 1"), which do not correlate well with standard SI pipe sizes. Also, different considerations should be utilized for other common mechanical connections found in gas piping installations, e.g. flare, compression, etc.

This paper is intended to generally apply to building gas systems downstream from gas service connections. However, it may have some application to utility distribution piping where installed above ground.

BACKGROUND

Pipe and tubing connection joints found in fuel gas systems can be of various types, welded, threaded, flange, flare fitting, compression fittings, soldered, etc., as allowed by the relevant code in force, e.g. NFPA[ii], ICC[iii]. Each type of connection has unique features and applications. One very common connection found in buildings throughout the U.S. is that of metallic threaded pipe.

American Codes for fuel gas piping using threaded connections specify compliance with *ANSI/ASME B1.20.1, Standard for Pipe threads, General Purpose*[iv]. This standard provides specifications for various types of pipe threads, including NPT (General Purpose Taper), NPSC (Internal Straight Threads in Pipe Coupling), NPTR (Railing Joint Taper Pipe Threads), etc.

The most common thread type found in fuel gas piping is the General Purpose Taper. The ANSI standard designates the thread type as, e.g. 3/8-18, indicating 3/8 inch (9.52 mm) pipe with 18 threads per inch (0.708 threads per mm), National Pipe thread (NPT). The standard taper is 1 in 16 or 0.75 inch per foot (62.5 mm per m). The root-to-root thread angle is 60 degrees. Note that this is not to be confused with the ISO standard, *ISO 7-1, Pipe Threads Where Pressure-Tight Joints are Made on the Threads*[v], as in that case the standard thread angle is 55 degrees and the thread root, crest and pitch are somewhat different as well. Thus, there is no direct comparison of American and ISO pipe specification and they are not to be mixed. *Do to this difference, English units will dominate this paper's format to avoid confusion regarding any equivalence (i.e. SI units will be parenthesis).*