Coffee Break Training - Fire Protection Series

Hazardous Materials: Flame Arrestors

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Learning Objective: *The student will be able to explain the design and operation of a flame arrestor.*

Process or storage vessels and pipe systems that contain ignitable ranges of oxygen and flammable vapors are susceptible to catastrophic explosions. If the oxygen and vapor mixture is ignited by sparks, arcs, friction, compression or other heat sources, the expanding flame front may cause significant injuries and damage.

One method of lessening the likelihood of a flash fire is by the installation of a flame arrestor in the equipment or on the end of a vent or process line. Flame arrestors are used in many industries, including refining, oil exploration and production, pharmaceutical, chemical, petrochemical, pulp and paper, sewage treatment, landfills, mining, power generation, and bulk liquids transportation.

There are many manufacturers of simple to sophisticated flame arresting equipment. These arrestors are configured in a way that ensures that the aperture size is carefully controlled based on the flammability of the oxygen and vapor mixture.

This wire mesh end-of-line flame arrestor is part of a pressure relief assembly on a liquefied petroleum gas transfer apparatus.

The wire mesh or gauze flame arrestor shown in the illustration is based on a principle discovered in the 19th century to reduce coal mine explosions caused by open-flame lamps in methane environments. Flame is extinguished when it passes through a sufficiently small gap in the mesh because the wire mesh absorbs the heat from the flame. Mesh flame arrestors are also found in many gasoline safety cans.

Wire mesh or gauze flame arrestors should be selected only after careful engineering analysis. Mesh/Gauze coarser than 28 meshes to the linear inch (No. 28 mesh, 630 microns) is ineffective in quenching a flame, and mesh/gauze finer than 60 meshes to the linear inch (No. 60 mesh, 250 microns) is liable to become blocked by dirt, insects or other debris. The main advantages of gauzes are their low cost, ready availability, and the ease of fitting into the orifice. Their disadvantages include limited effectiveness at suppressing high-velocity flames and their propensity to damage.

End-of-line flame arrestors (like the one illustrated) prevent flames from entering the pipe but not from leaving the pipe. Process in-line deflagration or detonation arrestors are designed to prevent flame propagation in gas or vapor mixtures. By locating the arrestor in close proximity to the potential ignition source, any flame or explosion is confined to the immediate area.

Flame arrestors are made from a range of materials, such as carbon steel and stainless steel, aluminum and zinc alloys. Not all materials are available for every arrestor range, so always check the manufacturer's literature to match the flame arrestor to the product.

For more information, consider enrolling in the National Fire Academy course "Hazardous Materials Code Enforcement" (R0615). Information and applications can be obtained at http://apps.usfa.fema.gov/nfacourses/catalog/details/10504.