APPLICATION PROFILE

THERMAL OXIDATION SYSTEMS

TYPICAL INDUSTRIES SERVED

- Chemical
- Pharmaceutical
- Petrochemical
- Composite Wood Panel
- Textile
- Paint/Coatings

INTRODUCTION

To bring VOC emissions and air toxins into compliance with the Clean Air Act Amendments of 1990 many facilities are utilizing thermal oxidation systems. A thermal oxidizer is a refractory-lined vessel equipped with a burner, which thermally decomposes volatile organics in a gas stream. These systems include direct-fired oxidizers, recuperative and regenerative thermal oxidizers, and catalytic oxidizers.

These thermal oxidation systems help safeguard the environment, but can also create a dangerous potential for fire flashbacks and explosions (see figure 1).

The purpose of this application guide is to provide an understanding of the possible hazards and protection solutions utilizing a Fike Explosion Isolation Valve System. This document is intended to be used as a guideline and is not applicable to all situations. If you have any questions, please contact the Fike Explosion Protection group or our sales representative in your area.

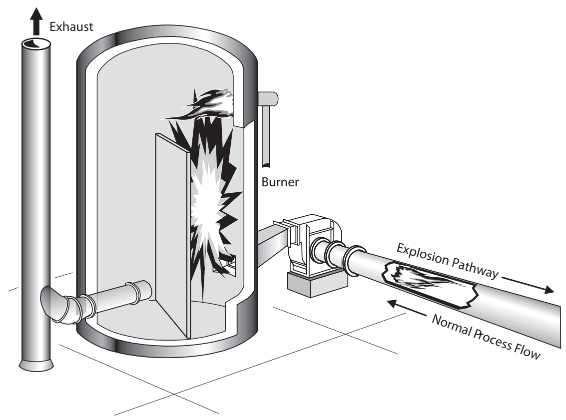

Figure 1: Unprotected Vapor Collection System

THE PROBLEM: FLAME PROPAGATION

The initial collection point of the volatile organic gases/vapors may be anywhere from a process vessel emergency relief system to tank farm venting. Vent exhausts now require manifolds running to the thermal oxidizer, creating a number of safety hazards that were not encountered with stand alone processes of the past.

It is important to understand how flames propagate through closed piping. Upon ignition, the flame generates a pressure wave. Initially the pressure wave is traveling much faster than the flame front. This is known as deflagration phenomena. The flame front propagates into the unburned fuel mixture, even against the normal process flow, at less than the speed of sound. At the same time, the pressure wave travels ahead of the flame at the speed of sound. Factors such as turbulence and increased flame surface area caused the rapid acceleration of the flame front until the pressure wave and flame front become closed coupled, which is known as a detonation (see figure 2).

In addition to the hazard of detonations, if flame is allowed to propagate to interconnected vessels, it can lead to “pressure piling,” where the pressure is built up in the adjoining vessel prior to the flame arriving. The ensuing deflagration in this connected vessel now starts at an increased pressure with correspondingly more serious consequences both in terms of rate of pressure rise and final pressure.

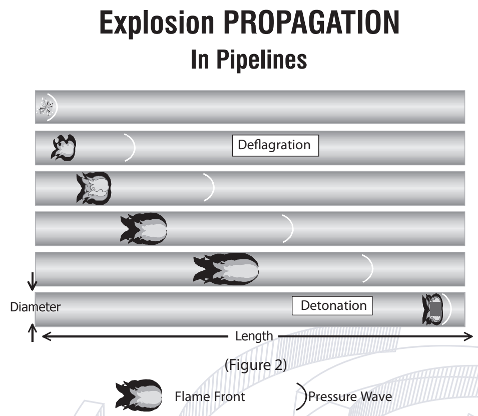

Figure 2

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THE SOLUTION: EXPLOSION ISOLATION

NFPA 68, 1998 Edition, Section 3-6.7 states that deflagration isolation devices should be considered when separate pieces of equipment are interconnected, to prevent the flame propagation, detonations, and pressure piling effects.

The Fike Explosion Isolation Valve compared to other possible isolation devices are:

- Minimal distance required from the ignition point, usually less than 5 feet, allowing the valve to be located close to the process equipment.
- Bi directional can stop flame originating from either side of the valve, eliminating the need for two isolation devices.
- Full port valve opening provides no pressure drop across the valve.
- Hazards include flammable dusts, vapors, gasses and hybrid mixtures.
- The valve can be mounted on both horizontal and vertical piping allowing more installation flexibility.
- New conduit valve design provides a clean valve seat to prevent plugging and product collection areas.
- Isolation valve can be serviced without removal from the process line, minimizing production downtime.
- Gas Cartridge Actuators (GCA) eliminates the need for explosive initiators and nitrogen storage containers.

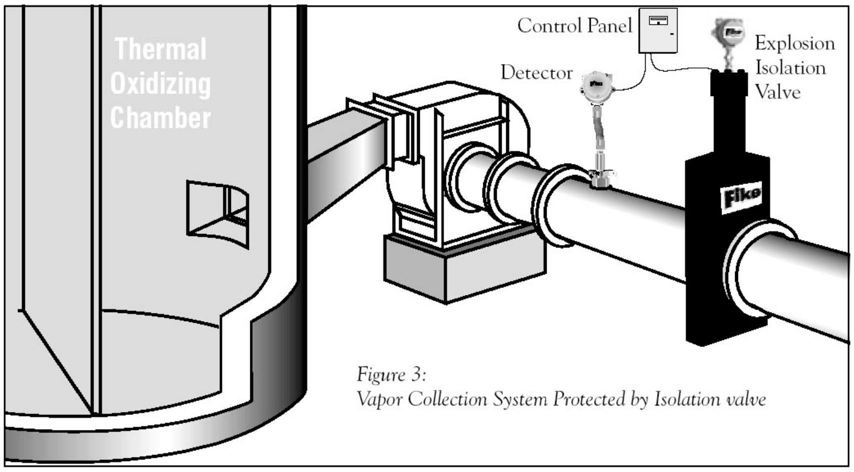

Figure 3: Vapor Collection System Protected by Isolation Valve

Form No. EAP 1007, November 1998. Specifications are subject to change without notice.