



# HFC-227ea APPLICATION PROFILE

## FLAMMABLE LIQUID STORAGE FACILITIES

Typical Industries Served	Automobile Manufacturing	Industrial Plants
	Process Plants	Refineries/Chemical Plants

### INTRODUCTION

Flammable liquid storage facilities are in many industrial and chemical plants as well as production facilities that use flammable liquids in various processes. These facilities store the flammable liquids used in processes such as painting, lubrication, fuel, and oil in areas called “Flammable Liquid Storage Areas”. These areas are segregated due to the special and careful handling required when using the flammable liquid.

### THE PROBLEM: RAPID FIRE GROWTH

Because of their critical nature, the potential fire problem in a flammable liquid storage facility gets special attention. Sprinkler systems provide good back-up protection, but if a fire should occur, it must be quickly suppressed before there is a major interruption in production or severe damage to the facility. The quantity of flammable liquid alone can contribute to fires that can destroy an entire facility. Flammable liquid fires grow very rapidly because they burn the vapors of the fuel on fire

creating a tremendous amount of heat. This promotes involvement of other flammable liquids stored in the hazard, which can happen instantaneously.



Fike HFC-227ea System Protecting a Flammable Liquid Storage Facility

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## THE SOLUTION: FIKE HFC-227ea CLEAN AGENT SYSTEM

If the desire for the facility is to minimize clean-up, ensure a safe fire suppressant agent for employees, and suppress the fire quickly, then a Fike HFC-227ea system provides all the necessary components of the fire suppression system. Because HFC-227ea discharges as a gas, it extinguishes a fire without spreading the liquid. It also does not require provision for drainage and containment of liquids. If the flammable liquid storage room is occupied, you do not have to worry that a system discharge could result in a fatality. At normal design concentrations, HFC-227ea is safe to use in occupied spaces. In a flammable liquid fire it is important to detect and suppress the fire quickly which makes HFC-227ea, along with the 10 second discharge time, a good choice for protection of flammable liquids.

In a fire suppression system, HFC-227ea is stored as a liquid in HFC-227ea storage containers. When called upon by an approved control panel, the HFC-227ea will flow through the length of piping required and will immediately change from a liquid to a vapor as it is released through the discharge nozzle.

To provide proper fire protection for a flammable liquid storage facility, it is imperative that a well-designed, fast response, and trouble free automatic fire detection system be installed. In many cases vapor or flame detection will be used. Advice should be sought when designing the detection system due to the amount of detectors available and the conditions in which they operate.

The example below walks through a flammable liquid storage facility designed with a Fike HFC-227ea system.

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## EXAMPLE SYSTEM

This example walks through the design for a fire detection and suppression system in a Flammable liquid storage facility. This room contains barrels of diesel fuel, gasoline, and has storage cabinets with various fuels and amounts of flammable liquid. The room being protected is 20' X 20' in dimension with a 10 foot ceiling.

The first step is to determine the quantity of HFC-227ea required to protect the hazard. The quantity of HFC-227ea required is dependent on the fuels being protected. In order to determine the HFC-227ea concentration required, an evaluation of the flammable liquids present must be performed. Once all of the fuels have been identified, the required HFC-227ea concentration is determined by choosing the fuel with the highest design concentration required. The design concentration for each fuel is determined by performing a cup burner test as described in NFPA 2001, Appendix B. A 30% safety factor is then added to the cup burner concentration, which is the design concentration for that fuel. Contact Fike for design concentrations of particular flammable liquids. For this example, gasoline requires the highest concentration of HFC-227ea at 7.5% design concentration at the minimum expected room temperature of 50 degrees F.

Using the formula:  $W = V/S (C/(100-C))$

Where: W = weight of HFC-227ea

V = volume of the hazard protected (4000 ft<sup>3</sup> for this example)

S = Specific vapor volume of HFC-227ea =  $1.885 + .0045(T)$  where T = temp in degrees F

S = 2.11 ft<sup>3</sup>/lb. when T = 50 degrees F

C = HFC-227ea concentration (7.5%)

Solving for W, this hazard requires 154 pounds of HFC-227ea.

This hazard will be protected using a pre-engineered HFC-227ea system approach with two 180 degree nozzles. I have used the pre-engineered approach because I am protecting a single hazard with a single cylinder and I wanted to save

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engineering time doing the system design. There are benefits of designing the system engineered over pre-engineered and they are described in the HFC-227ea Design Guide .

The next step in designing the system is to layout the system nozzles in the protected space. As mentioned before the room requires 154 pounds of HFC-227ea to protect the hazard. I have decided to use two 180 degree nozzles mounted on the same wall to protect this space. I have used 180 degree nozzles to minimize the amount of piping required and to keep the piping away from air-handling units and other equipment in the center of the room. A diagram of the container and piping isometric is shown for your reference.

The next step is to lay out the detection and control system for this facility. As mentioned before, Flame detectors will be used for detection in this facility. The reason for choosing Flame detectors is that they are good at picking up small, flaming fires that develop rapidly. I am not going to discuss detector spacing of the Flame detectors due to the wide range of products available and protection objectives of the system. Fike always recommends that UL Listed and/or FM Approved detectors be used. Consult the detector manufacturer and Fike for detector spacing limitations.

The Fike SHP (Single Hazard Panel) conventional control system will be used to provide reliable detection. A layout of the control panel with accessories is shown on the hazard layout.

An equipment list for this hazard is shown for your reference.



**Flammable Liquid Storage Facility Protected by  
a Fike HFC-227ea Clean Agent Suppression  
System**

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## EQUIPMENT LIST

Below is an equipment list for the HFC-227ea system installed in the flammable liquid storage room on the previous pages.

Part Number	Description	Quantity
<b>HFC-227ea SUPPRESSION EQUIPMENT</b>		
70-087-154-1431-04	215 pound HFC-227ea Container Assembly w/ 154 pounds HFC-227ea LLI, and Pressure Switch	1
80-1115	1-1/2"-180 Degree Pre-Engineered Nozzle	2
<b>SHP EQUIPMENT</b>		
10-051-R-1	SHP Control System	1
10-1643	Manual Release/System Abort Switch	1
20-098	Horn/Strobe	2
	Listed and/or Approved U.V. Flame Detectors	

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## Fike Corporation

In addition to Fike's HFC-227ea Clean Agent System, Fike has an extensive product offering for facility and process protection for commercial and industrial applications.

**Rupture Disc** – A pressure relief device, typically applied to a closed chemical process, will open at a predetermined pressure and temperature to prevent the bursting or explosion of the process.

**Explosion Venting/Isolation/Suppression** - Total Concept Explosion Protection, including explosion testing, explosion venting, explosion isolation, and explosion suppression systems to mitigate the effects of industrial explosions.

**Fire Detection Systems** – Fike offers a full line of detection products from single hazard to multi zone analog addressable systems. These controls are suited for fire alarm, agent suppression systems, or sprinkler/pre-action fire detection and control systems. The Cheetah analog addressable control panel can be configured to communicate directly with one or more VESDA<sup>®</sup> LaserPLUS detectors via a High Level Interface (HLI).

**Fire Suppression Systems** – Fike offers a full range of suppression systems to protect your equipment and/or process. Because Fike offers more than one choice of extinguishing agents you are certain to get the right agent for your hazard. Fike systems incorporate the following agents:

- HFC-227ea
- Carbon Dioxide
- Water Mist



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