ECARO-25™ APPLICATION GUIDE

HALON REPLACEMENT WITH ECARO-25™ FIRE EXTINGUISHING SYSTEM

Introduction

When Halon 1301 was introduced to the fire protection industry in the 1960's, it was rightly seen as the most effective gaseous fire fighting agent ever developed. It found widespread use in the protection of data processing rooms, telecommunication switches, art and historical collections, process control rooms, and many other like applications. However, by the late 1980's, a great deal of scientific evidence indicated that Halon 1301 was an ozone-depleting chemical, and the adoption of the Montreal Protocol of 1987 required a phaseout of new production.

Certain market segments still allow the use of Halon 1301, but some markets, such as the European Community (EC), have formulated a legislative position mandating the sale and removal of Halon 1301 systems in non-critical areas. This has initiated several Halon 1301 system owners to begin developing a decommissioning plan to properly replace and dispose of their Halon 1301 agent. The search for a Halon alternative has yielded several replacement agents; however, the physical properties of these agents have prevented them from becoming a true "drop-in" replacement for existing Halon systems.

Recognizing the need for a true Halon replacement, Fike Corporation developed the ECARO-25™ fire extinguishing system, which utilizes DuPont™ FE-25™ (HFC-125, Pentafluoroethane, or CHF_2-CF_3) as the extinguishing media. The flow characteristics and agent vapor pressure of FE-25™ are very similar to that of Halon, thus allowing the exiting distribution piping to be reused.

Due to its "drop-in" replacement feature, the ECARO-25 fire extinguishing system is the most similar and cost-effective alternative to Halon 1301. This document provides greater detail on the ECARO-25 system and direction on how to replace an existing Halon 1301 system with an ECARO-25 fire extinguishing system.

Applications

ECARO-25 is a total flood fire extinguishing system designed to protect Class A fires in normally occupied spaces. Class A fire assets represent greater than 90% of all commercial protection scenarios. Typical applications include computer rooms, data storage, telecommunication switch stations, semi-conductor manufacturing facilities, clean rooms, libraries, museums, and historical sites.

The extinguishing agent utilized in ECARO-25 is FE-25™, which is an environmentally acceptable replacement for Halon 1301 due to its zero ozone depletion potential, low global warming potential and short atmospheric lifetime. It is particularly useful where an environmentally acceptable agent is essential, where clean-up of other media presents a problem, where weight versus suppression potential is a factor, where an electrically non-conductive medium is needed, and where people compatibility is an overriding factor.

Halon 1301 to ECARO-25 – "The Transformation"

Upgrading your Halon 1301 system does not have to be a time consuming, labor intensive, expensive process. Certain components of your Halon 1301 system can be utilized during the system upgrade. The existing detection and control equipment can still be utilized to monitor and release the ECARO-25 system. A thorough survey by an authorized Fike Corporation distributor should be conducted to evaluate the complete fire extinguishing system to verify what equipment can and cannot be utilized. Replacing your Halon 1301 system will call for the following to be evaluated:

- The likelihood of utilizing the existing pipe network.
- Addition of agent to meet ECARO-25 design requirements.
- The possibility of utilizing a larger volume storage container with a reduced fill density.
- The replacement of discharge nozzle(s).

➨ ***Pipe Network***

The likelihood of utilizing the existing pipe network is much greater with an ECARO-25 system as compared to any other alternative fire extinguishing system. This is due to the ECARO-25 system performance and its physical characteristics such as vapor pressure and liquid density. The utilization of Fike's patented fast-acting rupture disc valve design also adds to the "drop -in" feature the ECARO-25 system offers.

ECARO-25 demonstrates the closest physical property match to Halon 1301 in terms of flow characteristics and vapor pressure. ECARO-25, like Halon 1301, is stored in liquid form and when discharged is converted to a gaseous state that rapidly penetrates enclosures reaching the source of the fire conquering areas that water or dry chemical agent cannot. When in liquid form, the pressure in the storage container is provided by the vapor in the space above the liquid. This is known as the vapor pressure. Some gases have a higher natural vapor pressure than others. Halon 1301 has a natural vapor pressure of 199 psi @ 70° F, as compared to ECARO-25, which has a vapor pressure of 195 psi @ 70° F.

By comparison, the natural vapor pressure of HFC-227ea (FE-227™, a trademark of the DuPont™ Company, or FM-200®, a trademark of GLCC) is 66 psi @ 70° F, which is much lower than that of Halon 1301 or ECARO-25. Having a low natural vapor pressure greatly restricts the ability to reuse complex pipe systems commonly used with Halon.

By applying the same working pressure as Halon 1301 systems (360 psi), the ECARO-25 system does not require its distribution piping to have a higher pressure rating than that of the existing piping. This means Halon systems using schedule 40 and 80 pipe can be converted to an ECARO-25 system without the need to replace the pipe network.

Authorized and trained designers utilize agent flow calculation programs to determine if the existing piping network can remain as is for the ECARO-25 system.

➨ ***Agent Quantity & Storage Containers***

The quantity of ECARO-25 agent is accurately calculated for each risk area. The ECARO-25 system utilizes storage containers connected to a common manifold and pipe network to deliver the agent to strategically placed nozzles. The rupture disc valve design, cylinder volume and pressure, together with the existing pipe network and new calculated discharge nozzles ensure that ECARO-25 is released and distributed evenly throughout the protected space.

The flooding factors for ECARO-25 systems are much different than Halon 1301. Halon 1301 systems were designed with a 5% to 6% design concentration by volume, with 5% generally used. The minimum design concentration for ECARO-25 systems is 8.0% meaning that more ECARO-25 will be required. As an example, the minimum amount of Halon required to protect a computer room with a volume of 25,000 ft^3 utilizing a 5% design concentration is 515 pounds. To protect the same volume with an ECARO-25 system at 8.0% design concentration, the minimum required amount of agent is 685 pounds. The increase in the required amount of agent is primarily due to the extinguishing mechanisms of the ECARO-25 system, which is more of a physical element (heat absorption) whereas Halon 1301 suppressed fires by more of a chemical means (chemical interruption).

While ECARO-25 relies primarily on heat absorption to cease the combustion reaction, Halon 1301 relied predominately on the ability to form free radicals, which interrupted the combustion reaction and required less agent. ECARO-25 uses unique mechanisms to prevent or extinguish a fire compared to conventional extinguishing agents such as water, dry chemical and carbon dioxide, which are unacceptable because they may cause collateral damage, significantly interrupt business productivity or present a safety risk. The unique mechanism ECARO-25 relies upon is its ability to absorb, at a molecular level, the heat energy from the combustion reaction. The ability of ECARO-25 to absorb heat faster than the amount of heat generated by the combustion reaction essentially ceases the combustion reaction since it cannot sustain itself. The ability of ECARO-25 to form free radicals, which chemically interfere with the chain reaction of the combustion process, also aids in the extinction of the fire.

Replacing Halon 1301 systems with an ECARO-25 system will require more agent per cubic foot, but the least amount as compared to other approved Halon 1301 alternatives. If the existing Halon 1301 container is near its maximum fill capacity it is likely that additional storage containers will be required to accommodate the increase in ECARO-25 agent. However, the ability exists to utilize the same quantity of storage containers as the Halon 1301 system. For the agent concentration comparison above, one (1) 1000 pound (423 litre) ECARO-25 storage container storing 685 lbs. ECARO-25 would be required to replace one (1) 650 pound (267 litre) Halon storage container storing 515 lbs. Halon 1301. The liquid density of ECARO-25 agent is higher than that of Halon 1301, which does not allow agent fill range equalization.

➨ ***Discharge Nozzles***

Halon 1301 discharge nozzles were specially designed to give a specific dispersal pattern, provide for uniform mixing of the Halon 1301, and flow the right amount of agent required at each nozzle. New nozzles will be required when replacing a Halon 1301 system. It is unlikely that the Halon 1301 nozzle design and orifice area specifications will match what are required for the ECARO-25 system nozzle specifications.

➨ ***Extended Discharge System***

In order to support the need to remove existing Halon 1301 systems from use and replace them with an environmentally conscious, economically feasible, alternative that minimizes business interruption and protects what matters most, Fike developed the ECARO-25 Maximized Piping System. Fike has designed the patent pending ECARO-25 Maximized Piping System for certain Halon 1301 replacement systems that won't permit the standard 10-second discharge system. Other uses for extended discharge systems include; when storage containers are remotely from the protected risk, utilization of smaller pipe diameters for protection of the risk are required, selector valve systems where using smaller pipe sizes saves money, and use of an existing complex pipe network installed in the protected risk.

An ECARO-25 Maximized Piping System isn't always required when replacing an existing Halon 1301 system. However, in certain cases it will secure the fact that the only changes that must be made to the existing fire protection system is the agent storage container and system nozzles. The ECARO-25 Maximized Piping System is designed to provide a maximum 20-second discharge with a minimum 8.5% design concentration. This unique and patented pending system has been extensively tested by Fike Corporation and its design is incorporated into the ECARO-25 Flow Calculation Program.

Selecting a long-term Halon 1301 replacement

It is important that you select a replacement agent that will present a long lifetime and not place you in a position like you are with your Halon. The ECARO-25 system has the lowest environmental impact of any of the HFC products, which have been commercialized in the fire protection industry. The ECARO-25 system supplies the best combination of benefits to the end-user from an environmental and commercial perspective for the replacement of Halon in existing systems. The ECARO-25 agent is also a significant component of many of the refrigeration blends being used today to replace CFCs. In total, the benefits of the ECARO-25 system and its utility in many applications make it a long-term solution in the fire protection industry.

The Fike ECARO-25 system has received system approval by Factory Mutual Research Corporation (FM) and is included within NFPA 2001. In addition, the Dupont™ FE-25™ fire extinguishing agent has been validated by independent agencies and received component approval from FM. FE-25™ is listed as an acceptable replacement for Halon 1301 in the United Sates Environment Protection Agency's Significant New Alternative Policy (SNAP) program for fixed fire extinguishing systems.

Summary

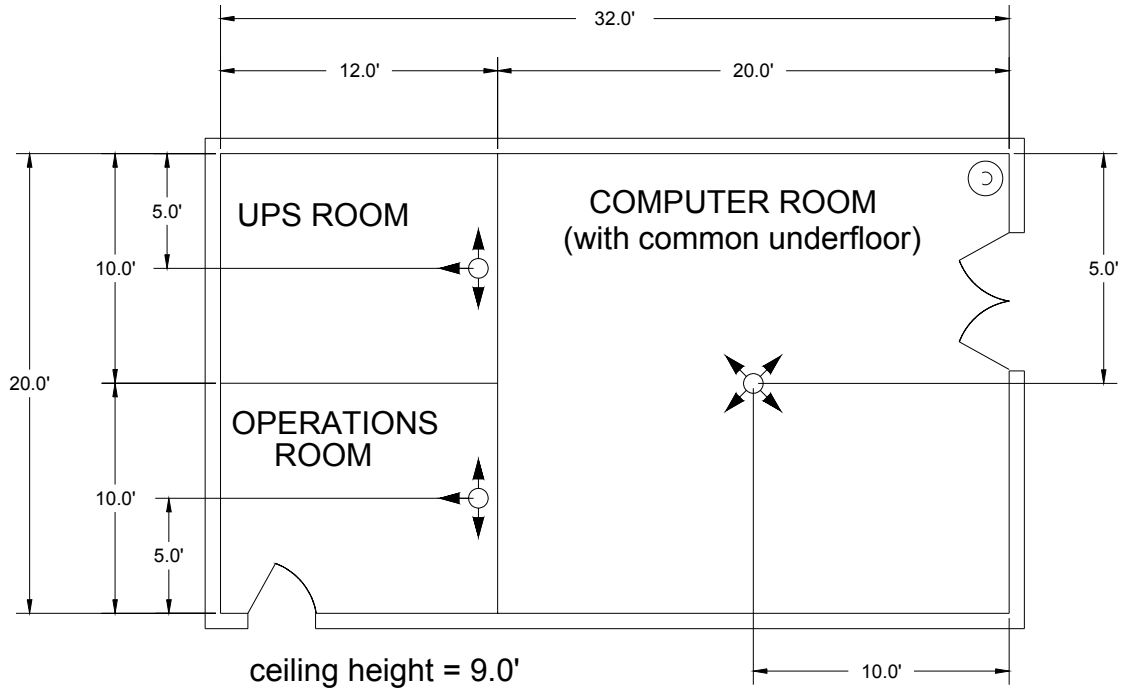
Historically, it was unusual for a facility to have to replace a fixed fire extinguishing system prior to system discharge or a fire event. However, for certain market areas, legislation is in place mandating the removal of Halon 1301 systems and requiring that they be decommissioned and legitimately disposed of.

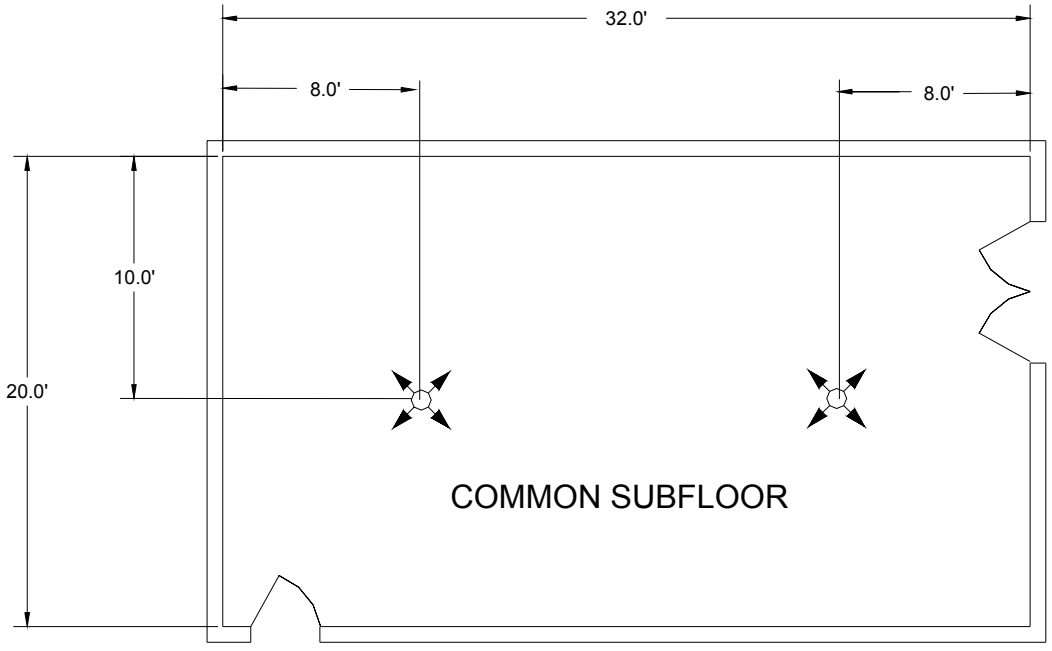
The Factory Mutual Approved ECARO-25 system is the most idealistic, cost-effective and preferred replacement for Halon 1301 fire protection systems. Compared to other Halon 1301 alternatives, the ECARO-25 system contains physical properties and economical aspects that make it the most desirable, long-term fire protection solution. Utilizing DuPont™ FE-25™ fire extinguishing agent, the ECARO-25

system meets the Halon 1301 replacement demand, minimizes business interruption, and provides maximum fire protection without requiring a complicated design and installation process.

Halon 1301 Retrofit Example

This example shows a walk through of a Fike ECARO-25 system retrofit process replacing an existing engineered Halon 1301 system that protects a computer room application. This application currently has three separate risks: sub-floor, main room, and false ceiling area. The total Halon agent protecting these risks is 154 pounds and the total volume of all three risks equals 7,360 ft^3. This example was chosen to show the flexibility of the ECARO-25 design procedure.





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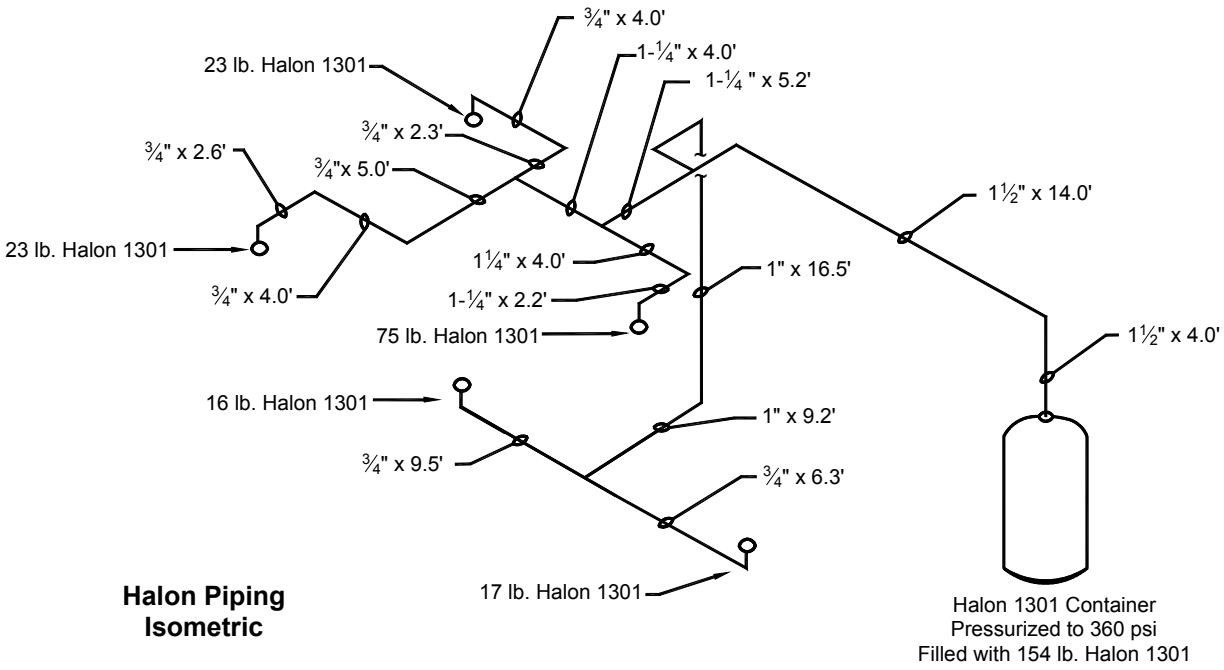


Halon Piping Isometric

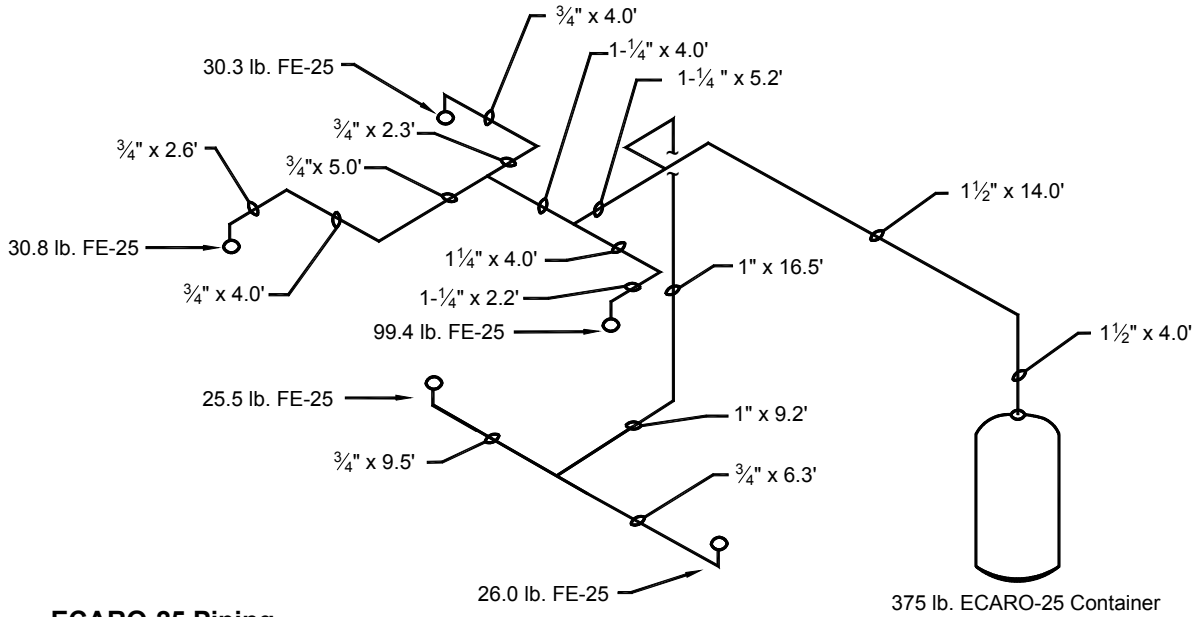
The first step in beginning the Halon retrofit is to determine the minimum quantity of ECARO-25 required to protect the risks. The sub-floor, main room, and false ceiling area will all be protected by ECARO-25. Providing protection in these three risks is because most fires start with an overheated wire or equipment in an equipment rack or sub-floor. Per NFPA 2001 standards and Fike's determined extinguishing concentration, the ECARO-25 minimum design concentration is 8.0% to protect these risks. Per Fike design manuals, a flooding factor of 0.0274 lb/ft^3 is multiplied by the room volume in cubic feet to calculate the minimum amount of agent required. The minimum quantity of ECARO-25 agent required to protect all three risks is 203 pounds.

The next step is to assess the existing Halon 1301 pipe network. During a retrofit design it is ideal to utilize the existing pipe network to reduce cost and operation downtime. To achieve this cost saving feature, an adjustment to the design concentrations may be required. The most efficient method of protecting this risk is to use an engineered system design and to perform the system calculations by utilizing the ECARO-25 Flow Calculation Program. The ECARO-25 Flow Calculation Program will verify if the existing pipe network can remain as is. If required, the design concentration can be increased to accommodate ECARO-25 flow rates and tee split ratio limits. Adjusting the design concentration will modify the agent quantity to provide correct agent flow enabling the existing pipe network to remain as is. This design adjustment may be necessary to comply with ECARO-25 design limitations and to remain in accordance with the ECARO-25 system design and its FM approval.

After collecting the existing pipe data and determining the minimum quantity of ECARO-25 agent needed, it is time to utilize the ECARO-25 Flow Calculation Program. This flow calculation program generates new nozzle specifications to replace the existing Halon 1301 nozzles. The selection of nozzles is generally determined by the amount of ECARO-25 agent required (flow rate) versus the flow rate capabilities of the nozzle(s). Additional factors such as area coverage, nozzle placement, discharge path obstructions, etc. will have an impact on this decision as well. Nozzle area coverage must also be considered when designing an ECARO-25 system. Each nozzle type (180^o or 360^o) has been FM approved for the maximum area coverage specified in the ECARO-25 Design, Installation, and Maintenance Manual, P/N 06-285. For this sample system, adding additional nozzles will not be required. Simply removing the Halon 1301 nozzles and replacing them with new ECARO-25 engineered discharge nozzles is acceptable.

A larger volume storage container will be required to compensate for the increase in ECARO-25 agent. The minimum agent quantity determination requested a total of 203 pounds for all four risks. After performing the system flow calculation, the quantity of ECARO-25 agent was adjusted to 212 pounds and is stored in one (1) 215 lb. (90 L) ECARO-25 container assembly. Due to the complexity of the existing Halon 1301 piping and the volumes ratios between the three risks, agent concentration levels have been adjusted to meet FM approved tee split ratios and an agent discharge time of less than 10 seconds.

Agent discharge time for this sample problem equals 8.51 seconds in accordance with NFPA Standards and Fike's ECARO-25 Factory Mutual Approval. The piping isometric below is the new ECARO-25 system. As you can tell, the only change from the previous Halon 1301 system is a new ECARO-25 container assembly and discharge nozzles.



ECARO-25 Piping Isometric

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