



MINIMAX FIRE PRODUCTS WHITE PAPER

THE COST-BENEFIT ADVANTAGES OF REPLACING HALON WITH 725 PSI MX 1230 CLEAN AGENT FIRE SUPPRESSION SYSTEMS

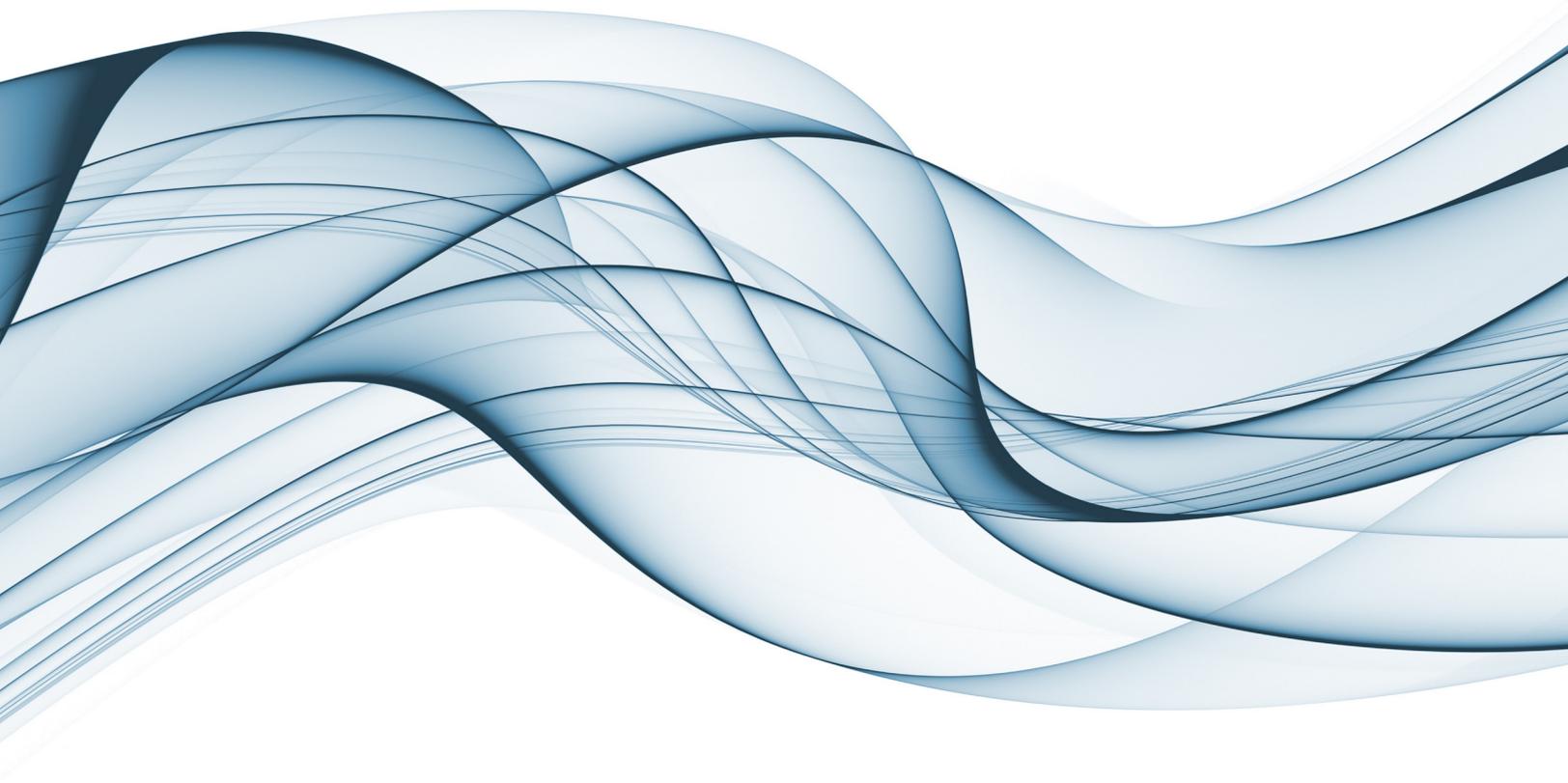




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725 psi MX 1230 Clean Agent Fire Suppression Systems have Changed the Halon Cost-Benefit Equation

This white paper will address the reasons why advancements in clean agent fire suppression technology are leading to renewed interest in replacing outdated 1301 Halon systems. Optimized high-pressure 725 psi MX 1230 systems with Novec™ 1230 clean agent deliver benefits not previously available:

- Much of the existing Halon piping network may be used in a new Minimax Novec™ 1230 system, significantly reducing direct replacement costs
- Multiple areas can be protected from a single cylinder bank utilizing the multi-zone option
- Suppression agent storage tanks can be located away from protected assets, freeing up space for asset utilization and improving security by lessening the need for personnel access
- High pressure 725 psi systems reduce storage tank size for space and cost savings
- Novec™ 1230 has zero impact on the ozone layer, with very low global warming potential compared to Halon and other agents

The History behind Halon

Developed in the 1960's, Halon 1301 became the extinguishing agent of choice for protecting areas from fire where potential water damage was a concern. Typical applications included electronic equipment, computer rooms, telecommunications equipment, record storage, and cultural artifacts. Halon provided a way to protect these valuable and irreplaceable properties without using water-based sprinkler systems that would control the fire but could damage assets in the process.

It is estimated that in the peak year of 1992 nearly 110,000 systems, with approximately 44 million pounds of Halon, were installed in North America ⁽¹⁾.

In the early 1980s, society became more aware of damage to the Earth's ozone layer and the resulting increase in harmful radiation from the sun. Certain products were identified for contributing to the degradation of the ozone layer. Specific solvents, refrigerants, and propellants (i.e. aerosol cans) were all well-publicized culprits. However, there was another destructive agent that received less media attention – Halon.

First manufactured in 1930 under the trademark Freon®, Halon gases and liquids are man-made chemicals that are not naturally occurring. Halon is not destroyed in the lower atmosphere, but wafts slowly upward toward the stratosphere where it finally breaks down. The chlorine or bromine atoms released in that breakdown are capable of destroying tens of thousands of ozone (O₃) molecules, thus contributing to the thinning of the protective layer. Halon has an atmospheric lifespan of 60 to 110 years, which contributes to its extremely high global warming potential. Even though Halon emissions are being stopped today, the destruction of the ozone layer will continue as already-released Halon will move slowly up to the stratosphere for many years.

Unfortunately, there is no cost-effective means of safely and effectively disposing of Halon. In 1986 the U.S. Environmental Protection Agency formally identified Halon as contributing to ozone depletion. In 1987 the Montreal Protocol effectively banned the manufacture of Halon and its use in new fire protection systems. Existing systems were excluded from the ban, and thousands of Halon systems are still in service today. In some respects these systems are ticking time bombs. Should they activate, Halon will be released into the atmosphere causing further environmental damage.

The Transition Away from Halon

The Standard on Clean Agent Fire Extinguishing Systems is NFPA 2001, which was created in 1991 to address various clean agents being developed to replace Halon, the most popular of which were hydrofluorocarbons, or HFCs. HFC-227, which is marketed today under brand names such as FM-200® (DuPont) and Solkaflam® 227 (Solvay Fluor), is effective at fire suppression and, like Halon, does not damage electronics or other protected assets. Although HFCs cause minimal damage to the ozone, they unfortunately have a large global warming potential and an atmospheric lifetime of over 30 years. While not banned from use in fire protection, HFCs were identified by the 1997 Kyoto Protocol for their negative environmental impact.

(1) Status of industry efforts to replace Halon fire extinguishing agents, Robert T. Wickham 2002.



Addressing the Risks of Existing Halon Systems

In the 1990s and into the 2000s, many environmentally conscious companies with Halon systems converted to a more environmentally friendly agent that did not impact the ozone layer. Others considered the hard costs of a full retrofit as outweighing the positive impacts of switching their systems. Consequently, thousands of Halon systems are still in operation.

When evaluating the impact of maintaining a Halon system, the owner's corporate image must be considered. Today's consumers are increasingly concerned with their impact on the environment, and prefer brands that reflect their concerns. A 2013 study conducted by Cone Communications found that 93% of consumers want to see more of the products and services they use support Corporate Social Responsibility, and more than eight-in-10 consider CSR when deciding where to work (81%), what to buy or where to shop (87%), and which products and services to recommend to others (85%).⁽²⁾ Maintaining a Halon system is in conflict with any serious environmental policy, and the potential for negative public perception of the company or its brands should be weighed.

There are several other business risks associated with Halon. Although not banned from sale, Halon is no longer manufactured and is becoming difficult to obtain. Recharging systems to maintain the correct agent level is becoming more expensive. Additionally, lead times for Halon are growing, which can lead to extended downtime for critical assets.

Downtime per Minute for Various Businesses	
Business Application Per Minute	Estimated Outage Cost
Supply Chain Management	\$11,000
Electronic Commerce	\$10,000
Customer Service Center	\$3,700
ATM	\$3,500
Financial Management	\$1,500
Messaging	\$1,000
Infrastructure	\$700

Source: Alinenan ROI Report, January 2004

Finally, replacement parts for Halon systems are increasingly difficult to source, and there are fewer people capable of servicing older units. These factors all contribute to significant direct business costs that can't be ignored.

To address and clarify some important points...

Must Halon fire suppression systems be dismantled?

No. There is no current legal obligation to remove Halon systems from service. Also, there is no federal legal requirement to remove systems from service by any specific date. In order to minimize Halon emissions, the EPA strongly encourages Halon users to explore non-ozone depleting alternatives.

Can you recharge after a Halon system discharges?

You can legally recharge your system using recycled Halon or Halon produced before the ban on manufacturing. Recycled Halon is still available, although somewhat costly. Again, the EPA strongly encourages switching to a non-ozone-depleting agent. Keep in mind that there are no "drop-in" replacements for Halon.

Why not wait to change until after my Halon system discharges?

Many companies are evaluating high-efficiency power and cooling technologies that provide cost reductions. An existing Halon system cannot be modified to meet requirements for which it has not been designed. Consequently, facilities managers cannot make use of energy saving or other state of the art technologies as long as the Halon system is in place.

As Halon is a regulated product, availability is limited. Even with other widely available halocarbon agents it is difficult to meet NFPA 2001 requirement to recharge, deliver and reinstall a system within 24 hours after discharge (NFPA 2001 A.4.1.1.2). With Halon it is even more difficult.

Halon still exists in so called "essential uses" for aviation and military applications, and efforts are ongoing to develop replacements. These applications absorb the majority of recycled Halon, and availability for commercial markets shrinks every year.

Halon system replacement costs can be offset with revenues from selling Halon to recycling organizations that supply the aviation industry and the military.

Have most Halon systems reached the end of their useful life?

While many Halon systems have not been updated since their installation, fire suppression knowledge and system advancements have changed the game over the past 20 years. To cite some examples, we now know that agent concentration must be increased to suppress energized equipment fires. Seals, O-rings or cylinder valve lubricants are chemically altered when in contact with halocarbons. Up-to-date valves utilize chemically stable materials and are subject to new approval standards. Halon system hardware generally does not incorporate these enhanced components and have not been approved in accordance to today's technical standards.



Introducing the Most Effective Replacement for Halon: The 725 psi High Pressure MX 1230 System

Minimax Fire Products, a pioneer in the development and application of clean agent fire suppression systems, has developed an effective alternative to Halon-based systems. By utilizing 725 psi and Novec™ 1230, Minimax delivers a number of performance and cost advantages.

Novec™ 1230 – effective, safe, and environmentally friendly

To address the need for a more environmentally friendly extinguishing agent, 3M pioneered the flourokeytone, and developed this new clean agent under the brand name Novec™ 1230. Highly effective at fire suppression, Novec™ 1230 has low toxicity, and an atmospheric lifetime of 5 days, zero ozone depletion and almost non-existent global warming potential.

Novec™ 1230 will not damage electronics and leaves no residue behind, which dramatically reduces clean-up and minimizes downtime of critical IT infrastructure. The agent works by absorbing heat prior to the generation of a flame, thus interfering with the combustion process in its earliest stages. A unique feature of Novec™ 1230 is that it is actually a fluid at ambient conditions but also rapidly changes to a gas when discharged from a nozzle. As a result, it can more be easily transported, filled, stored, and dispersed. It also has a higher safety margin than other clean agents, making it safer for people working in the protected area.

Why 725 psi is the Smart Solution for Halon Replacement

The Minimax high pressure system employs specially designed tanks able to be safely pressurized at 725 psi. This unique high pressure capability offers multiple advantages.

Higher pressure enables the use of smaller tanks, saving floor space and cost

An economically optimized design ensures that cylinder size enhances the ratio of agent to volume.

In a majority of cases, designing the system to use the smallest cylinder for the required quantity of agent is the most cost effective and best space-saving option.

The agent tank contains both suppression agent and Nitrogen propellant. When pressurized to 725 psi the Nitrogen requires less volume than when pressurized to 360 psi. This greatly increases the usable space for the agent and enables the use of smaller tanks (see Exhibit 1).



Tanks can be located almost anywhere in a building, saving valuable floor space in the protected area

A critical design factor is the difference between available pressure and nozzle minimum discharge pressure. Friction losses at valves, hoses, T's and pipes create a pressure drop that impacts the critical minimum nozzle discharge pressure. Longer pipe runs increase friction loss. A 725 psi system provides almost three times the available pressure over 360 psi systems, and ensures a homogeneous distribution of agent in the protected area, even when agent tanks are remote from the discharge area.

Pipes sizes can be reduced

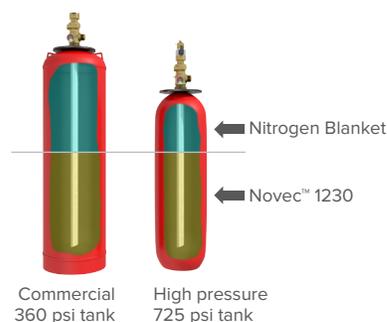
The Minimax advanced 725 psi system can move up to 75% more agent through the same size pipe size as a traditional 360 psi system in the maximum required 10 seconds agent discharge time. This allows the use of longer pipe runs or smaller pipe sizes, resulting in more efficient use of space and cost savings.

Multiple areas can be protected from the same cylinder bank

Advancements in higher pressure 725 psi systems also enable the use of multi-zone capabilities to protect several areas from one clean agent supply. A multi-zone system typically incorporates selector valves to automatically direct agent to the needed area. This can dramatically reduce the installed costs of a clean agent system, as a multi-zone system only requires enough agent to protect the largest area, as opposed to the combined volume of all areas. There are also ongoing benefits for service and maintenance of multi-zone clean agent systems compared to standard 360 psi stand-alone systems.

Environmental risk is eliminated

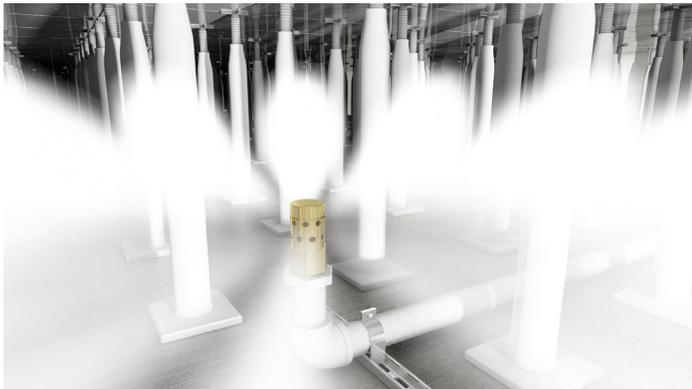
As previously stated, Novec™ 1230 has an atmospheric life of 5 days, compared to 60 to 110 years with Halon. The difference is so obvious that it needs no further elaboration. 3M Corporation is so confident in the environmental advantages for Novec™ 1230 that they have developed their "Blue Sky Warranty," which guarantees that the clean agent will never be limited or banned due to environmental reasons. 3M will reimburse the complete cost of the agent and replacement costs in the event of any regulatory limitation within 20 years of purchase.



Higher Pressure – the Key to an Optimized Delivery System

The flow characteristic of a liquid agent through a pipe depends on the following values:

- Density of the agent
- Average flow speed
- Pipe friction factor
- Pipe length
- Pipe diameter
- Pressure loss coefficient
- Altitude above sea level
- Gravity



Clean agent is discharged into raised floor with 360 degree upright nozzle

To build up a concentration in an enclosure to extinguish a fire, the suppression agent needs to flow from the agent cylinders through the pipe to the nozzles. Halon and also Novec™ 1230 need a minimum pressure at the nozzle to generate a high velocity spray pattern and to evaporate from liquid to gas. Minimum nozzle pressure is specific to each system and is dependent upon nozzle geometry; with Novec™ 1230 systems the average minimum nozzle pressure is typically between 80 psi and 120 psi.

Starting pressures and pipe run pressure drops have a significant impact on overall flow characteristics and the ability to make use of an installed Halon pipe network. When comparing Novec™ 1230 and Halon, the volume percentage of agent required to extinguish a fire in an enclosure is quite similar and the maximum discharge time of 10 seconds is the same. For a Class A hazard the design concentration is about 5.0 percent by volume for Halon and 4.7 percent by volume for Novec™ 1230. The difference in weight to achieve these concentrations is much different: 0.0437 ft/lb³ for Halon and 0.0206 ft/lb³ for Novec™ 1230. In addition the density of Novec™ 1230 is given with no option for modification.

When using Novec™ 1230 in an existing Halon piping network there are several factors at play: Gravity, altitude, tee splits and pipe lengths.

The ability to utilize 725 psi starting pressure is crucial. Due to the much higher density and weight of Novec™ 1230 compared to Halon, the pressure drop in a pipe network designed for Halon flow is higher and agent flow speed lower if Novec™ 1230 is used. The additional force provided from storage tanks pressurized at 725 psi overcomes this effect, and makes use of all the design advantages inherent in the Novec™ 1230 system.



Manifolded two cylinder 725 psi clean agent system protects raised floor and room space.

Another important consideration is the different vapor pressure between Halon and Novec™ 1230. Halon vapor pressure at room temperature is approximately 235 psi @ 77°F, and for Novec™ 1230 the vapor pressure is 5.8 psi. This means a cylinder filled with Halon would have at room temperature a pressure of approximately 235 psi, even without any nitrogen blanket to super-pressurize. The same cylinder filled with Novec™ 1230 would only have a pressure of 5.8 psi. In other words; Halon can be moved through a pipe without being super pressurized and Novec™ 1230 cannot. Novec™ 1230 needs a nitrogen blanket at super pressurization. The 725 psi high pressure system balances this effect.

To summarize, due to the countering effect of high pressure 725 psi systems it allows for minimum pipe modifications, hard cost reduction and minimized costly downtime and business interruption.



Clean agent is discharged into protected area.



Minimum nozzle pressures are specific to each system and dependent upon nozzle geometry.

Taking the Next Step

Technological advancements in clean agent delivery, specifically 725 psi high pressure systems, have changed the traditional view on the costs of Halon system retrofits. Lower costs, coupled with the increased business risks associated with Halon, are leading many to re-evaluate their strategies for protecting valuable assets and critical business infrastructure from fire.

The first step in evaluating a system replacement is to consult with a qualified fire suppression contractor who can provide technical guidance. Novec™ 1230 suppression and flow characteristics differ from Halon, and nozzle orifice size and minimum design pressures must be accurately specified to ensure homogeneous distribution of agent. To find a qualified fire suppression contractor in your area, please visit www.minimaxfp.com/distributors.

For additional information, contact:

MINIMAX FIRE PRODUCTS

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