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A Study Of An Integration Of Electronics Devices With Fire Safety

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Abstract

In most sectors fire poses the biggest threat in terms of financial loss and of life and property loss. The factors that determine the risk of fire include the existence of materials, their physical arrangement, the possibility of ignition, and the required level of heat. With aid of technology advancements in detection and extinguishing, this project provides a better and more effective means to reduce losses of life and property due to fire in industrial environments. Selection of Fire & Gas Detection sensors according to Classification of Fire plays a vital role in Accident Prevention. Applicability of Smoke sensing and Flame detection based on different sensing methodologies enable rapid detection and corrective action against Fire. Different Fire Extinguishing agents and their efficacy are analyzed and the scope for better fire safety through its integration with Control Systems like Integrated Circuits or Programmable Logic Controllers is explored in this work. Few ways to prevent and warn the industry workers from fire threats, such as shut down the lift and power system of lifts and other electric equipment to be turn off, turn on water sprays, and monitoring smoke sensing devices are explained in this paper. The study investigate on preventing the fire accident to reduce the loss with an automatic sensing system.

Keywords: Alarm system, smoke detection, sensors**,** Water Mist, Fire Extinguishing agents

1. Introduction

Automatic fire control and detection are now crucial to lowering the risk of fires occurring within structures. The most crucial aspect of the industries is workplace fire safety; they must be equipped with safety measures. Real-time monitoring, alarming, and surveillance are all provided

by automatic fire alarm systems. With this strategy, finding new system that promote fire safety and preventative measures, which eases the struggle on management and staff members to maintain.

The components of fire protection are to quickly spot fire emergency and notify the emergency organisations and the function of fire detection and alarm systems. In general, fire detectors are made to react quickly to one or more of combustions. There is no one sort of detector that works for all types of buildings or fires. Smoke detectors only react to the smoke or gas produced by a fire, whereas heat detectors only react to the temperature rise brought on by a fire. The choice of sensor depends on the overall structure, design, and fire alarm control software of the autonomous fire alarm system.

2. LITERATURE REVIEW

Rupali S. Gajare, P.M. Mahajan 2018 [1] A fire and gas detection system was installed as part of this project for industrial and domestic safety. With the aid of an alarm system that notifies users of a fire or gas leak, this system uses a micro-controller together with sensing circuitry to detect gas leaks and fire. Installing a GSM modem will enable

Kausik Sen, Jeet Sarkar, Sutapa Saha, Anukrishna Roy, Dipsetu Dey, Sumit and Baitalik 2017 [2] This research essentially proposes a low-cost smoke and heat sensing-based fire detection and control system. It is made up of a variety of electrical and electronic tools that detect the fire and notify people through visual device.

2017 Maina Kironji [3] Due to its usefulness, complexity, and monetary value, a commercial high-rise structure poses a higher challenge to fire prevention than other types of occupancies. The purpose of this paper is to improve the fire safety. To access the physical fire protection system in Nairobi CBD.

2015 [4] research by T. Keerthivasan, S.P. Venkatesan, and M. Murugan The production of cars uses a variety of techniques and energy sources, including mechanical, electrical, hydraulic, chemical, pneumatic, and water.
2015 [5] R. Dinesh, S. Kumaraguru In order to prevent and avoid fires in industrial environments, this research offers a better method. This can be accomplished with the aid of technology advancements with ease.

2015 Tina Porwal [6] We like to paint our house, furniture, etc. every year for decoration, safety, identity, and sanitary reasons. But we fail to consider how paint affects the ecosystem. This can harm our bodies seriously and put us at risk for things like headaches, asthma attacks, allergic reactions, skin irritation, and eye irritation. It can also raise the strain on important organs like the heart.

Nezih Kamil Salihoglu and Guray Salihoglu 2016 [7] Several natural resources are consumed during the construction of an automobile, and numerous sorts of trash are also produced. The painting process is the main contributor to hazardous wastes in an automobile factory, and paint

sludge is the main hazardous waste produced. Every year, more paint sludge is produced than ever before.

2017 I.R. Thomas [8] The efficacy and dependability of a fire safety system are two key components that are introduced. The frequency of firefighter injuries and the loss recorded to the fire brigades that is depend on the intensity of flame propagation. Historically, USA data fire used in the performance of various fire protection strategies.

F. Karimipour, M. Argany, M. A. Mostafavi, and C. Gagme 2014 [9] Recent developments in sensor technology have led to the creation of more effective and affordable sensor networks for use in a variety of applications, that includes monitoring, surveillance, tracking and controlling etc.
[10] This study's objective was to determine the danger of Benzene, Toluene, Ethylbenzene, and Xylenes in the paint facilities of two automobile businesses in Iran by utilising the COSHH guidelines and determining the ambient concentration of these subset. This cross-sectional investigation was carried out in two phases. In phase one, three paint facilities' ambient BTEX concentrations were evaluated using a technique recommended by OSHA12.

Y. D. G. Lee, K. H. Ryu, J. Jung, Y. K. Lee, S. In 2012 Environment Observation and Forecasting System was introduced in 2012 to monitor air pollution what uses a context of model and flexible data monitoring and analysis [11].

2016 Roger Bentley [12] In the industrial setting, paint spraying is done on a variety of objects, from small, individual items to vehicle bodies on an ongoing production line. This article discusses both good and bad practises and focuses primarily on small-scale and irregular processes. Few factors such as Toxicology and flammability considered as risk factor and solvents, while regarding to the size of the operation.

Hamid Khabazi Oliaei and Aliasghar Farshad (2015) [13] This study's objective was to determine the danger in the paint facilities (Benzene, Toluene, Xylenes). The automobile businesses in Iran by utilising the COSHH guidelines and determining the ambient concentration of these substances.

3. Proposed Approach:

3.1. SYSTEM FOR FIRE DETECTION IN PLANT

There are primarily two types of heat detectors:
1. fixed or predetermined temperature
2. By increasing the speed in temperature

3.1.1. Pre-determined type or fixed temperature

The mode of operation, is incredibly straightforward. The bi-metallic strip in the first type creates and destroy the current at a predetermined temperature. The bi-metallic strip in the first type is used to create or destroy the current at a predetermined temperature. However, the contacts are being enclosed, while they are ready to form a circuit. On the other side it keeps away them from the impact by the environment. Because, corrosion could block the flow of current while they

form circuit. The second kind may include two electric contacts connected by low melting point solder using light springs. Thus, the joints begin to separate as soon as the air temperature reaches the solder's melting point.

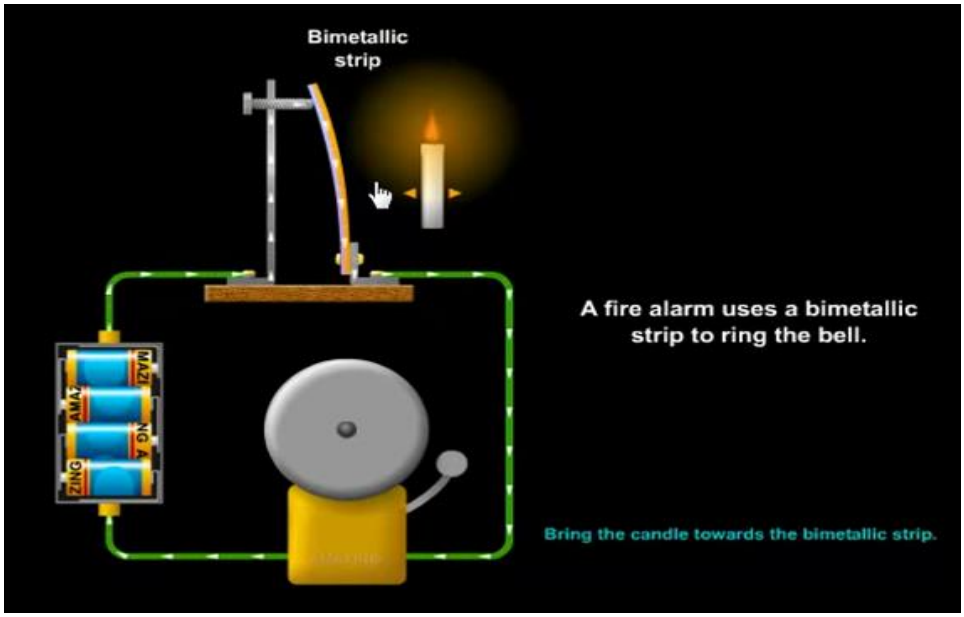
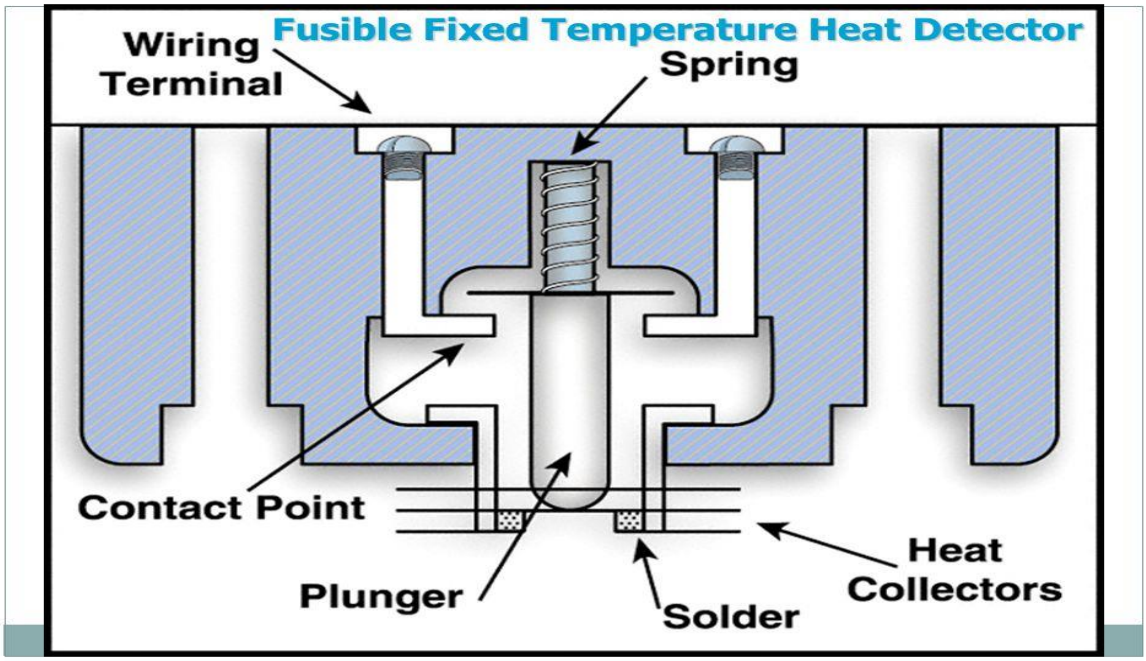


Figure 1 By-metal Strip Type of detection system



Figure, 2 Fusible Link Type of Fire detection system

3.1.2 Temperature rate

- This detector operates between specified limitations, the latter of which depends on the rate of temperature increase, so long as the rate of growth in the surrounding air's temperature is above a certain minimum.
- There are two different kinds of detectors: bimetallic strip and pneumatic. In the pneumatic kind, by expanding to a flexible diaphragm, and producing an electrical contact, it makes the sound (alarm) after completing the circuit.
- An aperture installed on the chamber, that will permit a specific ratio of air to escape in order to prevent alert from being sounded in the typical rise ambient temperature.

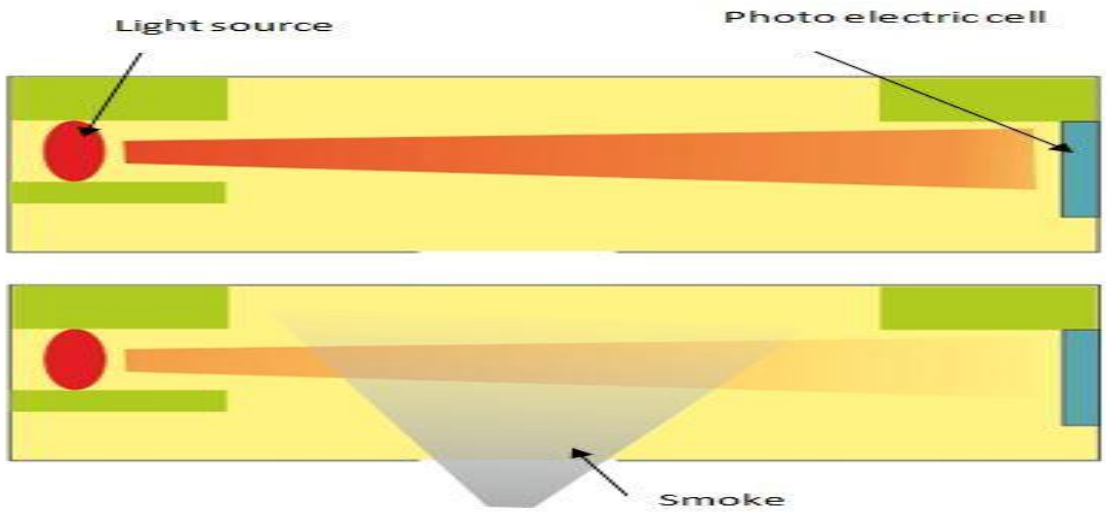
3.2 FIRE DETECTION-SMOKE DETECTORS

- ✓ photoelectric and ionisation.
- ✓ There are two varieties of photoelectric smoke and doctors: type with light obscuration and light scatter.

3.2.1 Light obscuration type

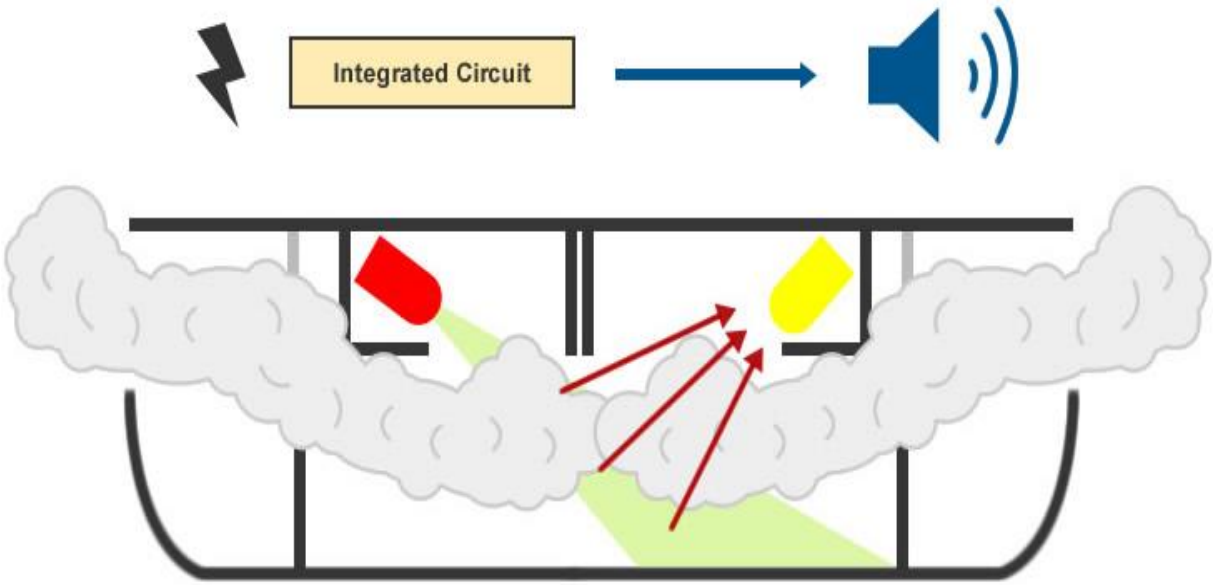
Light source and the cell are crystal clear on their way, a beam of light is not connected with a photoelectric cell, and the balance electric circuit maintain the same. However, as smoke passes through the detector by convection, the amount of light that strikes the photoelectric cell is diminished, causing the output bang to oscillate at a predetermined level.

Figure 3 Light Obstruction Type of Detection System



3.2.2 Light scatter type

A light beam's intensity is decreased when it passes through a transparent medium, like air, partially due to absorption and partially due to dispersion. The latter develops as a result of suspended particles, such as liquid or dust. A light barrier stops the light beam from shining on the photoelectric cell. By virtue of the regular air currents, the ambient atmosphere passes through the detector head. Detecting circuit is not affected, if no dust or smoke particles present. However, when smoke enters the detector, light rays are reflected off of the light barrier and pass through to the photoelectric cell, where a change in current triggers the alarm.



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4. EXTINGUISHING MECHANISM

4.1 FIRE EXTINGUISHING METHODS

- In general, there are three techniques to put out a fire: Starvation: cutting off fuel or combustibles; Smothering: removing oxygen; Cooling: removing heat.

4.1.1 STARVATION

Means denying the fire more fuel, so that when the fire runs out of fuel, it will extinguish on its own.
Remove fire form the combustible and put away the combustible form the vicinity of the fire.
By separating the burning material

4.1.2 SMOTHERING

In a high-power water mist system, the small droplets can absorb so much energy that cause the water to evaporate and it may change into steam . This implies that each droplet will swell by more than 1700 times as it approaches the combustible material, displacing oxygen and

combustible gases from the fire and making the combusting process increasingly oxygen-deficient.

4.2 APPLICATION TECHNIQUES FOR EXTINGUISHING AGENTS

Two ways are frequently used to apply fire extinguisher agents:

4.2.1 Flooding

Systems based on the entire flooding concept spray an extinguishing chemical into a contained area to build up an extinguishing agent concentration sufficient to put out the fire. These systems can be run either automatically or manually through the use of a system detector. Regardless of the agent's method of extinguishment, this is true for all gaseous complete flooding agents. Halons are most frequently used in total flooding systems, which have been used to protect areas housing critical electronics, ship machinery spaces, aircraft engines, cargo bays, enclosed process modules in the oil and gas industry, as well as the crew and engine compartments of military armoured vehicles.

4.2.2 Local Application:

In this type, the chemical sprayed directly near a fire. While some systems use this manner, manual wheeled or portable fire extinguishers are the most popular choice for local application. This approach is also known as a "streaming" application in those circumstances. The safeguarding of wet benches in the semiconductor production sector is an illustration of a local application system.

Those who had come to depend on halon-based fire suppression products were shocked to learn that they had a negative impact on the stratospheric ozone layer. In 1987 halons and ozone-depleting compounds were brought under international control.

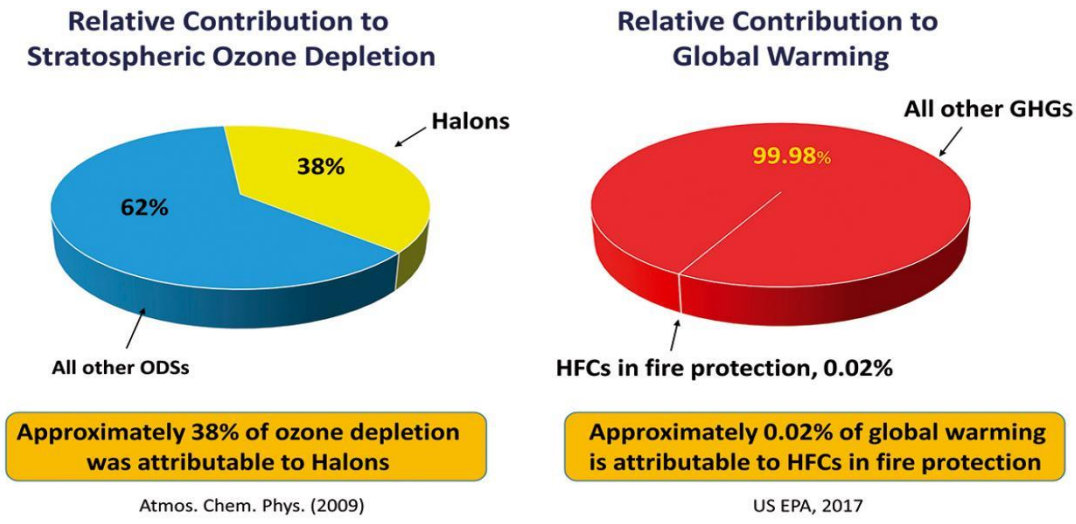

Figure 5 Halon Global Usage

4.4 CO2 BASED EXTINGUISHING AGENTS

Comparatively speaking, halons and dry chemicals are much better than carbon dioxide. However, possess two advantages, one over each of its rivals. Carbon dioxide is cleaner than dry chemicals. Carbon dioxide is less expensive than halon and the newest halocarbon substitutes.

For use in fire extinguishing applications, carbon dioxide (CO2) possesses a lot of the beneficial qualities of a clean fire extinguishing agent. Because of this, CO2 has been and is still being employed in a variety of hazard conditions for fire protection. However, utilising carbon dioxide has the disadvantage of suppressing fires through oxygen dilution rather than, as with halon, chemically disabling the catalytic combustion chain.

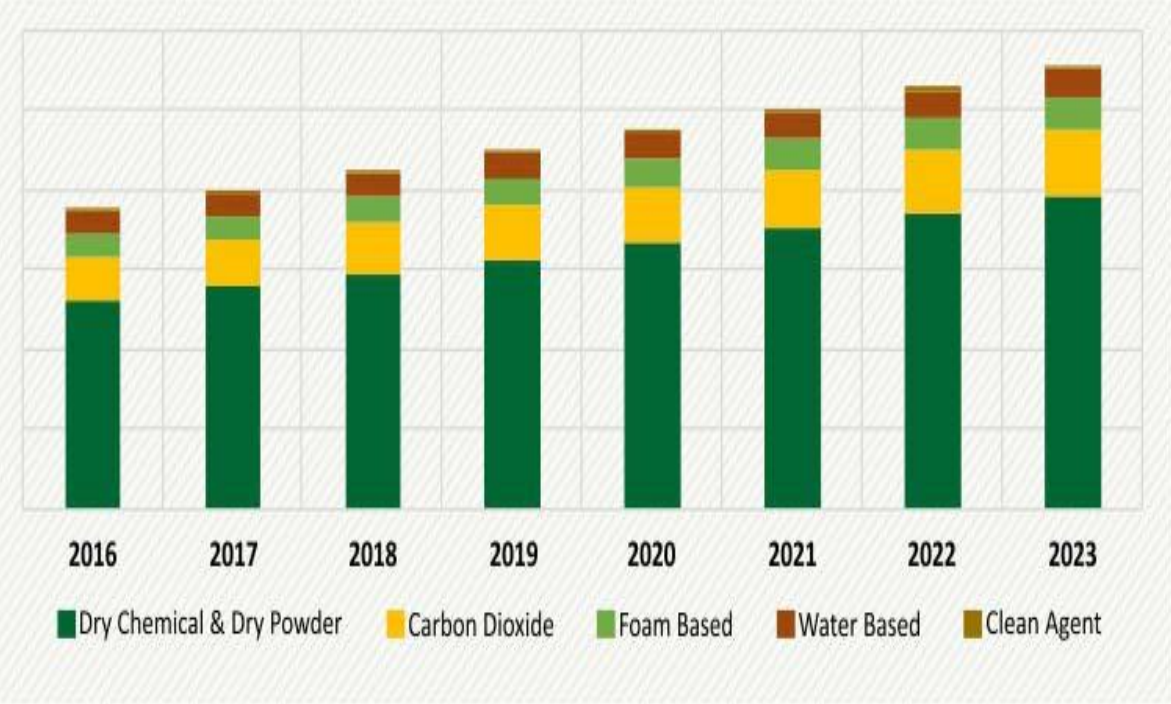

Figure 6 Extinguishing Agents Global Dissertation

4.5 CO2 BASED EXTINGUISHING AGENTS' RISKS

Exposures to 2530% v/v carbon dioxide concentrations will cause unconsciousness, convulsions, and death in a matter of seconds. Because the oxygen concentrations that result in atmospheres with 25–30% v/v CO2 are higher than those necessary to support life, the presence of CO2 confers the mechanism of lethality (i.e., severe CNS depression effects resulting in death).

There is a very small safety margin for these systems because the standard design concentration of CO2 is higher than the level of practically immediate acute mortality.

Table 1 Accidents involving CO_2 Extinguishing Agents

Use Category		Number of Incidents	Deaths	Injuries
United States and Canada				
1975-Present	Military	9	10	15
	Nonmilitary	20	19	73
Before 1975	Military	3	11	0
	Nonmilitary	5	3	3
Total		37	43	91
International				
1975-Present	Military	1	4	5
	Nonmilitary	21	39	52
Before 1975	Military	0	0	0
	Nonmilitary[a]	3	33	4
Total		25	76	61
Total		**62**	**119**	**152**

6.CONCLUSION

Industrial automation's integrated fire safety system that uses water mist extinguishing is a marvellous protection system because it controls the fire without actively fighting against fire. Many may contend that Sprinkler systems, an active firefighting system already in place, are more efficient. The benefit of employing Manual in the event of an Automatic System Failure is the justification for using both Manual and Automatic. By lowering the temperature below the point at which the material automatically ignites, the Hyper Mist may automatically put out fires in their early stages and significantly reduce the spread of fire. It can be put in any building or installation with the proper modifications if certain standards and specifications are met.

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