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Fixed Water Fog Fire Fighting System

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Abstract:
As Fire Fighting plays a vital role in maintaining the safe working condition of the vessel without any fire hazard, it has to be adopted with advanced technologies to ensure maximum safety for the ship and the crew. Even though Plenty systems and Techniques are available for fighting the fire onboard, fire accidents are inevitable. Many researches are been carrying out by shipping industries to minimize fire accidents. This project report deals with the "Fixed Water Fog Fire Fighting System". The progress on the research and application of water mist systems in fire suppression has been substantial over the last decade. To bring this work into focus, a model is made on Total Flooding System with the application of water mist. This report also discusses the properties of water mist, extinguishing mechanisms and the effectiveness of water fog in fire suppression.

1. INTRODUCTION

Seafarers will be familiar with the fire triangle, with sides representing fuel, heat and oxygen. Removal of any side results in the collapse of the triangle and the extinguishing of the fire. Without contradicting this, it is more appropriate to use a fire tetrahedron (see figure below) to illustrate the nature of fire and, in particular, extinguishing action of modern extinguishing media such as halogenated hydrocarbons (halons) and certain dry chemicals. (NB: Halons are to be phased out due to their ozone layer depletion effects).

1.1 WATER FOG FIRE EXTINGUISHING SYSTEM

Water has favorable physical properties for fire suppression. Its high heat capacity(4.2 J/.Kg) and high latent heat of vaporization (2442 J/g) can absorb a significant quantity of heat from flames and fuels. Water also expands 1700 times when it evaporates to steam, which results in the dilution of the surrounding oxygen and fuel vapor. With the formation of fine droplets, the effectiveness of water in fire suppression is increased, due to the significant increase in the surface area of water that is available for heat absorption and evaporation. Water mist refers to fine water droplets in which 99% of the volume of the spray is in drops with diameters less than 1000 microns. Advantages of water mist over gaseous agents are that water is non-toxic, readily available, and lower in cost than most chemicals or patented mixtures. Water mist provides effective cooling for fuel and for the compartment that cannot be provided by the gaseous agents, potentially preventing re-ignition that may occur if a gaseous agent concentration cannot be maintained for a sufficient period of time. With effective cooling and less clean-up time, water mist allows the space to be reoccupied and operational in a short time following a fire. Advantages of water mist over conventional sprinklers include reduced water flow rates and therefore less water damage to sensitive equipment or occupancies. Low water flow rates also provide a clear advantage in terms of space and weight requirement for the water supply. In addition, water mist is able to control flammable liquid fires that conventional sprinklers cannot control due to splashing and spillage of the fuel. The use of water mist in fire suppression, compared to the use of gaseous agents and conventional sprinkler systems, has demonstrated advantages including the following:

(1) No toxic and asphyxiation problems;
(2) No environmental problems;
(3) Low system cost;
(4) Limited or no water damage; and
(5) High efficiency in suppressing certain fires.

One of the most effective ways of fighting fire is to provide quick and effective cooling at the source of the fire. To achieve cooling, suppression and extinguishing of a fire using water in a conventional way via a hose or standard sprinkler often requires many thousands of liters of water. The primary reason for this is that the vast majority of the water used is wasted; this can be seen by the amount of pools of water left on the floor, known as 'run off. This is because only the surface area of the water drop or stream comes into contact with the energy from the fire (the heat) the rest is wasted.

2. THEORITICAL DEVELOPEMENT

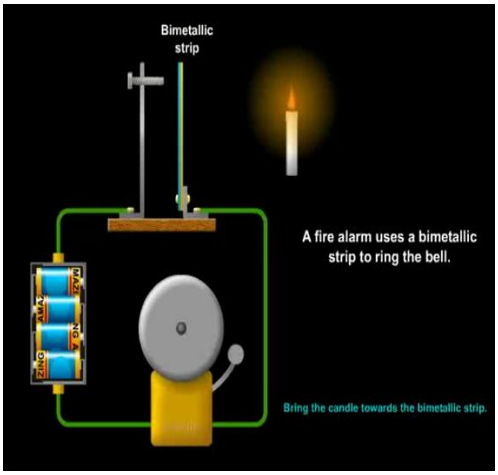
2.1 Fire Detection System Used In Plant

The heat detectors are mainly of two types namely,

✓ Fixed temperature or pre-determined temperature type
✓ Rate of temperature type.

2.1.1. Fixed Temperature or Pre- Determined Type

The means of operation is extremely simple, usually being either a bi-metallic strip or a soldered joint. In the first type, the bi-metallic strip is used to make or break an electric current at a pre-set temperature.



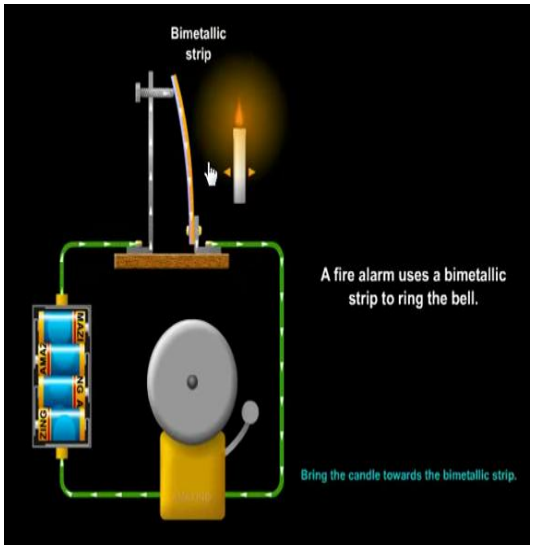


Figure. 2.1 Fire Detection System-Heat Detectors

Bi- Metal Strip Type

When it is arranged to make a circuit, the contacts are usually encapsulated in a glass cover to avoid the contact becoming affected by the atmosphere, since any corrosion may prevent the passage of current when the contacts are required to make a circuit. The second type may consist of two electric contacts joined through light springs by low melting point solder. Thus, when the air temperature reaches the melting point of the solder, the joints pulls apart under the action of the spring and the alarm is sounded

2.1.2 Rate of Temperature Type

- This type of detectors works on the principle that providing the rate of increase in the temperature of the surrounding air is above a given minimum, the detector will operate between given limits, the latter depending on the rate of increase of temperature.
- They are two types of detectors, namely pneumatic and bimetallic strip. o In the pneumatic type, a sealed chamber when subjected to heat expands and pushes up a flexible diaphragm and makes an electrical contact and completes the circuit for the alarm.
- To avoid alarm being raised in the normal rise ambient temperature, a bleed orifice fitted on the sealed chamber will allow a certain amount of air to escape.

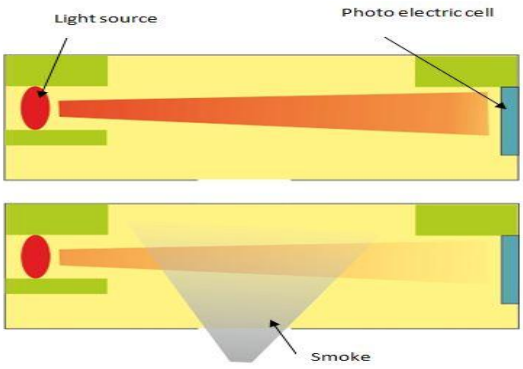


Figure.2.2.FireDetection System-Smoke-Light Obstruction Type

2.2 FIRE DETFCI ION SVSITNI-SMOKE DFIECTORS

The smoke detectors are mainly of two types namely,

- ✓ photo Electric Type
- ✓ Ionization Type

There are two types of photo electric type smoke &doctors namely,

- ✓ Light obscuration type
- ✓ Light scatter type

2.2.1 Light scatter type

When a beam of light transverse a transparent medium, e.g. air, its intensity is reduced by absorption and partially by scattering. The latter arises due to suspended partials suds as dust or liquid particles. The beam of light is prevented from illuminating the photo electric cell by a light barrier. The surrounding atmosphere circulates through the detector head by virtue of the normal air currents and providing no dust Or smoke particles, present in it, the electrical bola Mt of the detector circuitry remains undisturbed On smoke entering the detector however, the light rays are or scattered around the light barrier and reach the photo electrical cell, the change in current being used to signal the alarm.

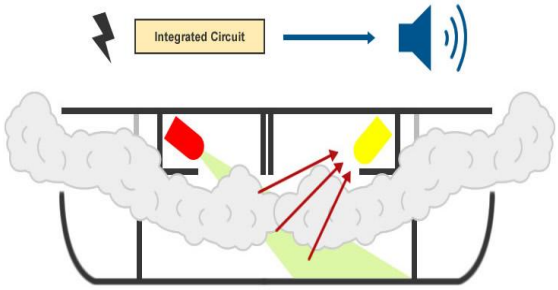


Figure.2.3 Fire Detection System-Smoke Detectors-Light Scattering Type

2.3 FIRE DETECTION SYSTEM-FLAME DETECTORS

Detectors of this type can be of Infra-Red [IR] (or) Ultra-Violet [UV] type, but only infra-red type is used extensively. These detectors are intended to respond to radiated heat and light, and to avoid false alarms being given by natural or artificial light, they have been designed to respond only to that particular part of the spectrum which is characteristics of flame.

Functioning of IR type:

✓Unique property for a flame 14 Hz-15 Hz.

✓ The time is 12 sec-15 sec.

✓ The filter, timer, PE cell, amp, and alarm are all place in a quartz bulb.

✓ During flame expose from the fire, the IR rays will fall on the quartz bulb.

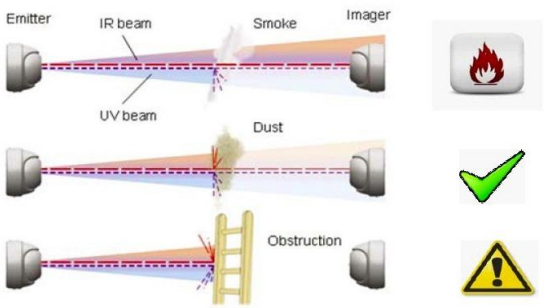


Figure .2.4 Fire Detection System-Flame Detectors-Irtype

✓ The filter will allow the IR rays having different frequency of 14Hz-15Hz per second.

✓ The filter will not allow any rays having different frequency below 14Hz.

✓The different frequency of IR rays come from gas welding sunlight, lighting, and tungsten lamp.
✓ The timer will check the IR rays stays 12sec-15sec.
✓ The IR rays will fall the photo electric cell.

3. FIRE AND CLASSIFICATION

Fire is the release of heat and light from rapid combination of oxygen and other materials, It is a chemical reaction. It is involving rapid oxidation and burning of a material. For fire to exist, a combustible substance must be present, the temperature must be high enough to cause combustion, and enough oxygen must be present to sustain rapid combustion.

3.1 MECHANISM OF FIRE

The fire is sustained through a process called chain reaction.
Fuel + oxygen +Energy --> FIRE (Light +Heat+ Products of combustion)
Fire comes from a chemical reaction between oxygen in the atmosphere and sort of fuel (wood or petrol, for example). The fuel does not spontaneously catch on fire just because they are surrounded by oxygen. For the combustion reaction to happen, you have to heat the fuel to its ignition temperature. The most flammable compounds contain carbon and hydrogen, which recombine with oxygen relatively easily to form carbon dioxide, water and other gases. The chemical equations for the oxidation of carbon and hydrogen are:

C +0, ---> CO_2 (This reaction occurs when there is enough oxygen for the formation of carbon dioxide.)

2C +0, ---> 2C0 (This reaction occurs when there is only enough oxygen for the formation of carbon monoxide.)

2H2 + 0_2 ---> $2H_20$ (These reactions release the energy you feel as heat and light.)

3.2 STAGES OF FIRE

Fire may be categorized into four stages:
1. Incipient stage – invisible products of combustion giving off no visible smoke, flame or heat.
2. Smoldering stage — combustion products visible as smoke. Flame or heat still not present.
3. Flame stage — flame is present; heat not present in appreciable amount but follows almost simultaneously. Actual fire now exists.
4. Heat stage —Uncontrolled heat and rapidly expanding tire in space.

3.3 REQUIREMENTS FOR FIRE

Three things are needed to occur a fire:
A fuel —some sort of combustible solid, liquid or gas
Oxygen — to react with the fuel
Heat — there must be enough heat to get the fuel above its flash point

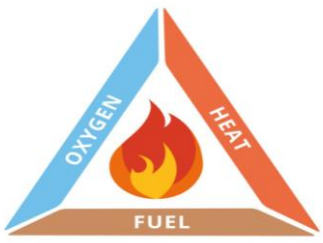


Figure 3.1 Fire Triangle

Nowadays when the fire is actually taking place there are four components. They are fuel, oxygen, temperature or heat source of ignition and chemical and chain reaction. These four components can be own diagrammatically by a tetrahedron each side representing one of the components.

3.4 SOURCE OF IGNITION

The Potential sources of ignition are:
1. Electrical
2. Open flames
3. Friction
4. Sparks
5. Self-oxidation or spontaneous ignition

Causes of fire:
For the fire to start, it needs a source of ignition. The sources are:

Table 3.1 Source of Ignition

SL. NO	TYPE	SOURCE
1	Electrical	Sparkorarc,Electrostatic discharge,short Circuit
2	Open flame	Matches and lighters, pilot lights, welding and cutting torches, lighted cigarettes
3	Friction	Drivebelts and pulleys
4	Sparks	Engine exhausts and electrical systems , tools, shoe nails, striking other materials
5	Self oxidation/spontaneous ignition	Oxidation of combustible materials

3.5 CLASSIFICATION OF FIRE (as per is-2190:1922)

- All fire is not identical to each other different techniques and media should be used to fight different fires.
- Depending upon the material involved in the fire. This classification was said by (NFPA) national fire protection agency.

❖ Class A
❖ Class B
❖ Class C
❖ Class D
❖ Class E
❖ Class F (or) class k

3.6 CLASSES OF FIRE

Table 3.2 Classes of Fire

CLASS	COMBUSTIBLE MATERIALS	DESCRIPTION	SUITABLE FIRE-EXTINGUISHER	FACTORS
A	Carbonaceous (or) Ordinary Combustible Materials	Wood, Paper, furniture, etc.,	Water[Soda acid type Banned,Gas/ expelled type], Foam Dry Chemical Powder CO2 [Enclosed Space only]._	Extinguishing by cooling. It leaves ash content after combustion.

B	Flammable Liquids	Petroleum products(Petrol, Diesel, Kerosene,etc.),Chemicals,paints,etc.	Foam[Appropriate], Dry chemical powder[extinguish deep seat of fire], CO2[enclose spaces only]Halon [now banned]	Extinguish by Smothering (or) Blanketing. Never use water at any circumstances.
C	Flammable Gases	Petroleum Gases(Propane,Butane, etc.) Chemicals (Vinyl Chloro Methane), etc.	Dry chemical powderCO2[Enclosed spaces only]Halon[now banned]	Extinguishing By Smothering (or) Blanketing
D	Metals	Potassium,Sodium, Cesium, Lithium, etc	Special ChemicalPowder such as Ternary Eutectic Chloride[TEC]	Massive Drenching
E	Electrical	Circuits, Switch boards, Control panels, etc.	Dry Chemical Power Powder CO2[Enclosed Spaces only] Halon[Bromo to Chloro Fluorine now banned]	Isolate Supply. Use suitable extinguisher with respect fire it cause.
F or k	Cooking media (or) Kitchen fire	Edible cooking oil and facts used in cooking	Dry chemical powder CO2 [enclosed spaces only] fire blanket insitu wetted towels]	Existing by smothering using water is highly dangers

3.7 VARIOUS CHEMICAL AND THEIR REACTIVENESS

Table. 3.3 Various Chemical And Their Reactiveness

S.no.	Name	Flash Point °C	Auto Ignition Temperatre °C	Lower Explosive limit %	Upper explosive limit °A
1	Acetaldeh-yde	-38	175	4.1	60
2	Acetone	43	516	5.4	16
3	Ammonia	-18	651	2.6	12.8
4	n-Butane	-60	405	1.8	8.4
5	Kerosene	-38	220	0.7	6.0
6	Diesel	-62	210	1.3	6.0
7	petrol	-40	246	1.3	7.6

4. FIRE FIGHTING AND CLASSIFICATION

4.1 ACTIVE AND PASSIVE FIRE PROTECTIVE SYSTEM

✓ Fire protection prevention and detection of hazards associated with fire.

✓ The fire department is two basic fire related functions.

➢ Prevention.

➢ Suppression.

✓ Fire prevention activities aim to keep fires from starting.

✓ Fire suppression activities seek to put out fire once has started to rescue individual.

✓ To protect properties from the fire.

✓ The fire production system can be classified into two groups

➢ Active fire protection.

➢ Passive fire protection

4.1.1 Active Fire Protection

✓ It means the system activated mechanically (or) electronically.

✓ Active fire protection system are those which help in extinguishing the firedirectly.

✓ Active fire protection system are classified into two types:

➢ Fixed system.

➢ Portable systems

4.1.2. Passive Fire Protection

✓ Passive fire protection system are those which do not fight the fire actively preventing the spared of fire.

✓ Conations the fire in a particular area and allow for fire fighting.

✓ Passive fire fighting system can be provide under the following:

➢ Fireproof doors

➢ Fire proof walls

➢ Wired glass windows

➢ Fire proof cables

➢ Fire proof materials

➢ Dampers

➢ Fire proof paints

4.2 WATER

✓ The most commonly available and effective fire-fighting medium is Water

✓ Water readily absorbs heat and therefore reduces the temperature of the fuel to below its ignition point.

4.3 FOAM

➢ Foam used for fire fighting consists of tiny air (or) gas bubbles, which can form a compact fluid layer (or) blanket on the surface of flammable liquids and thus preventing combustion of the liquid surfaces.

➢ Foam flows freely over a burning liquid surface and forms a tough, air-excluding, continuous blanket that seals volatile vapours from access to air.

➢ It resists disruption from wind and draft (or) heat and flame attack and is capable of resealing in case of mechanical rupture.

➢ Fire-fighting foam retains these properties for relatively long periods of time.

4.4 TYPES OF FOAM COMPOUND

There are two types of foam compounds in general use. They are,

✓ Chemical foam
✓ Mechanical foam

4.4.1 Chemical Foam Compound

✓ When two (or) more chemicals are added, foam is generated due to chemical reaction.
✓ The most common ingredients used for chemical foam are sodium bicarbonate and alumiiumsulphate with added stabilizers.
✓ These type types so foam compounds can be used in portable extinguishers, where sometimes mechanical formation of foam is not possible.

4.4.2 Mechanical foams compounds

✓ These foams are produced due to air entraption by mechanical means such as aspiration (or) air blowing.

4.5 FOAM AND COMPOSITION

✓ Protein-based foam
✓ synthetic foam

4.5.1 Protein Based Foam

✓ Hydrolyzed proteins with added stabilizers and preservatives.
✓ Form a thick foam blanket and is suitable for hydrocarbon liquid fires, but cannot be used on water miscible liquids.
✓ Their effectiveness is limited on low flash point fuels which have a lengthy pre-burn time.

4.5.2 Synthetic Foam

✓ It is based on foaming agent other than hydrolyzed proteins and includes AFFF [Aqueous Film Forming Foam] concentrates, medium and high-expansion foam
✓ Concentrates and other synthetic foam concentrates.
✓ Synthetic foam concentrates contains hydrocarbon surface active agents and acts

4.6 TYPES OF FIRE EXTINGUISHER AND EXTINGUISHING MEDIUM

According to the mobility of the extinguisher, they are classified into three types namely,

- Fixed Fire Extinguishing System
- Portable Fire Extinguishing System
- Semi-Portable Fire Extinguishing System

Table.4.1. Extinguishing Agents

EXTINGUISHING MEDIUM	RECOMMENDED FOR USE ON FIRES
Water	Wood,Paper,Textile,And Similar Materials
Foam	Wood,Paper,Textil And Flammable Liquid
Dry Chemical	Flammable Liquid, Electrical Equipment And Flammable Gases
Dry Powder	Combustible Materials
Carbondioxide	Flammable Liquid, Electrical Equipment

Extinguishing Media Used in Extinguishing System

- Water
- Foam
- Powder agent
- Gaseous agent
- Vaporizing agent

5. EXTINGUISHING MECHANISM

5.1 FIRE CAN BE EXTINGUISHED IN THREE WAYS

➢ Starvation: cutting off combustibles
➢ smothering : removal of oxygen
➢ Cooling: removal of heat

5.2 STARVATION

✓ Means to deprive the burning fuel of more fuel, whereby once the fuel is exhausted, the fire will automatically die-out.
✓ By removing the combustible materials from the neighborhood of the fire.
✓ By removing the fire from the neighborhood of the combustible materials.
✓ By sub-dividing the burning material.

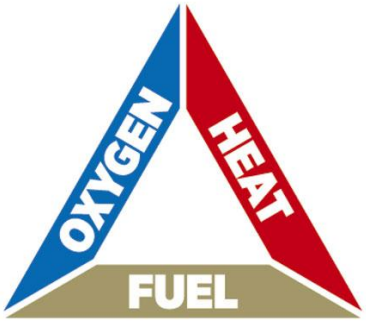


Figure 5.1 Starvation Concepts

5.3 SMOTHERING

The very small droplets in a high-pressure water mist system quickly absorb so much energy that the droplets evaporate and transform from water to steam, because of the high surface area relative to the small mass of water. This means that each droplet will expand more than 1700 times, when getting close to the combustible material, whereby oxygen and combustible gasses will be displaced from the fire, meaning that the combusting process will increasingly lack oxygen.

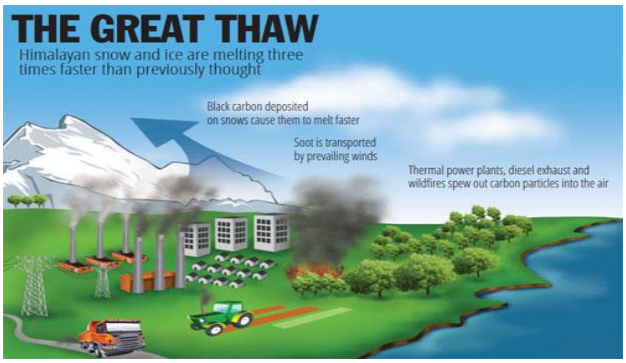


Figure 5.2 Smothering

5.4 REMOVAL OF HEAT

To fight a fire, a traditional sprinkler system spreads water droplets over a given area, which absorbs heat **to** the cool the room. Due to their large size relatively small surface, the main part of the droplets will not absorb enough energy to evaporate and they quickly fall to the floor as water. The result is **a limited** cooling effect.

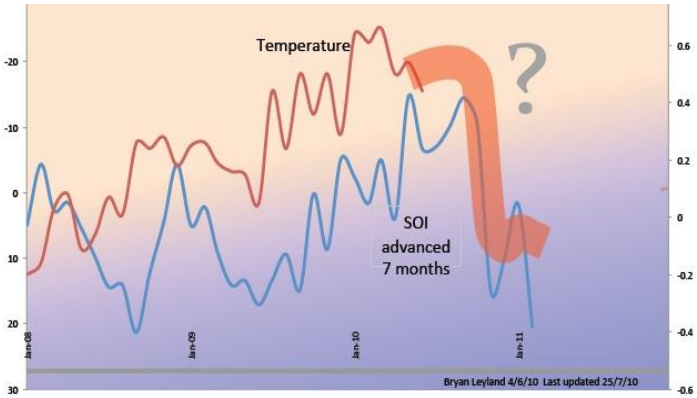


Figure 5.3 Cooling Effect Graph

By contrast high pressure water mist consists of very small droplets, which falls more slowly. Water **mist** droplets have a large surface area relatively to their mass and during their slow descent towards the floor, they absorb mucl˙: more energy.Water mist in fire suppression, however, does not behave like a "true" gaseous agent. When water is injected into a compartment, not all the sprays that are formed are directly involved in fire suppression. They are partitioned into a number of fractions as follows:

1. Droplets that are blown away before reaching the fire;
2. Droplets that penetrate the fire plume, or otherwise reach the burning surfaces under the fire plume, to inhibit pyrolysis by cooling, and the resultant steam that dilutes the available oxygen;
3. Droplets that impact on the walls, floor and ceiling of the compartment and coolthem, if they are hot or otherwise run-off to waste;
4. Droplets that vaporize to steam while traversing the compartment and contribute to the cooling of the fire plume, hot gases, compartment and other surfaces; Droplets that pre-wet adjacent combustibles to prevent fire spread.

5.5 WATER MIST EXTINGUISHING MECHANISM

There are two types of extinguishment was done by water mist, that as follows

5.5.1 Primary Mechanisms

1. HEAT EXTRACTION
   - Cooling **of** fire plume
   - Wetting/cooling of the fuel surface

2. DISPLACEMENT
   - Displacement of oxygen
   - Dilution of fuel vapor

5.5.2Secondary mechanism

- **1.** Radiation attenuation

5.6 HEAT EXTRACTION (Cooling)

The cooling mechanism of water mist for fire Suppression can be divided broadly into cooling of the fire plume and wetting of fuel surface. Flames cooling by water mist is attributed primarily to the conversion of water to steam that occurs when a high percentage of small water droplets enter a fire plume rapidly evaporate .A fire will be extinguished when the adiabatic flame temperature is reduced to the lower temperature limit , resulting in the termination of the combustion reaction of the fuel air mixture. ForMost hydrocarbon and organic vapors, this lower temperature limit is approximately 1600k.The rate of vaporization of a droplet depends on surrounding temperature.

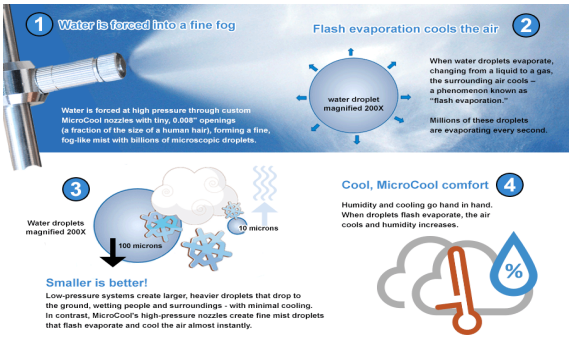


Figure .5.4 Fog Operation Model

Transferred from the flame to the fuel by convection and radiation, while fuel cooling by water mist is primarily due to the conversion of water to steam. For fuels whose low flash points are above normal ambient temperature, wore water sprays are needed to cool the fuel surface, because less heat is required to produce fuel vapor. Also, more water sprays are needed to prevent re-ignition of a hot, deep-seated fire. This is because higher water flow rates extinguish the fire faster, but the fuel remains hot and continues to pyrolysis if the water is switched off immediately after extinction.

5.6.1 Oxygen Displacement

Oxygen displacement can occur on either a compartmental or localized scale. On a compartmental scale, the oxygen concentration in the compartment can be substantially reduced by the rapid evaporation and expansion of fine water droplets to steam, when water mist is injected into a hot compartment and absorbs heat from the fire, hot gases and surfaces. The reduction of the oxygen concentration in a compartment by water mist is a function of the fire size, the length of pre-bum period, the volume of the compartment and the ventilation conditions in the compartment. As the fire size or the length of the pre-burn period of the fire increases, both the oxygen depletion due to the fire and the oxygen displacement due to the formation of more water vapor caused by high Compartment temperatures are increased. This combined effect significantly reduces the oxygen concentration in the compartment and enhances the effectiveness of water mist for fire suppression.

5.6.2 Radiant Heat Attenuation

When water mist envelops' or reaches the surface of the fuel, water can act as a thermal barrier to prevent further heating by radiation of the burning fuel surface as well as non-burning surfaces. Also, water vapor in the air above the fuel surface acts as a gray body radiator that absorbs radiant energy, and re-radiates it to the fuel surface at a reduced intensity. Blocking radiant heat by water mist stops the fire from spreading to un-ignited fuel surfaces and reduces the vaporization or pyrolysis rate at the fuel surface. It has been shown that the attenuation of radiation depends very much on drop diameter and mass density of the droplets. A given volume of water will provide a more efficient barrier against radiation if it is made up of very small droplets in a dense spray, than a dilute spray with larger droplets.

6. EXPERIMENTAL COMPUTATION

6.1 VISUAL INSPECTION

Visual inspection of the spray by characteristic droplets To provide a better overview of the data obtained in the PDA

measurements a methodology has been developed for drawing the spray pattern of a water mist spray. Here characteristic droplets are illustrated as circles, with diameters to scale. Furthermore, velocities are illustrated with arrows that are also drawn to scale; there are many different representative diameters that can be used to characterize a spray. They help to describe different phenomena, for example, for surface area cooling the surface mean diameter issued. In the case where the amount of water determines the extinguishing capabilities, volume-weighted. Diameters are relevant. One problem in using a single value is that it doesn't describe the droplet distribution. A spray with a very wide distribution in droplet size may give the same volume weighted diameter as a spray where all droplets are of the same size. 56 Droplet size distribution has therefore been characterized by using the three representative diameters.

D0.1: is the drop diameter where 10% of the liquid volume is in drops of smaller diameter

D0.5: is the drop diameter where 50% of the liquid volume is in drops Of smaller diameter, the mass median diameter (hereafter referred to as the mean droplet)

D0.9: is the drop diameter where 90% of the liquid volume is in drops of smaller diameter By using these diameters, both distribution as well as volume of drops, 100 which for this application is the most important factor, are described. Two other droplets are illustrated, the maximum measured droplet that varies in size from 33 to 70pm and the minimum droplet size from 3 to 8 pm. Droplet size of the largest droplet is illustrated whereas all the minimum droplets are all drawn with size 10 pm for practical purposes. l he velocities are illustrated for the minimum, maximum and mean droplet. In most cases, they will describe the relevant velocity range. 57 The same, but the distribution is very different. The scan of the whole spray shows that there is a large spread in droplet size, whereas in the point measurement the majority of droplets have the same size.

6.2 INTERNATIONAL STANDARDS

Current British, European, International and other standards The following summarizes the current British, European, International and NFPA (USA) Standards relevant to water mist systems. There are other standards which partly relate to water mist systems. These are not detailed here.

7. EXPERIMENTAL SET-UP

7.1 FOG MODEL

To demonstrate the fixed water fog system, a model is made with the use of following components.

1. A model compartment
2. Water misting Nozzles
3. Pipelines
4. Hand operated hydraulic line testing pump
5. Fire source

7.2 COMPARTMENT MODEL

➢ MI sheet of l mm thickness is used to prepare a model compartment

➢ MI Sheet is made into a compartment of 1200mm X 600 mm X 600mm

➢A frame is made for both ends of the compartment for strengthening purpose by using L-angle of size 600mm X 600mm

➢By using Metal Arc welding, the frame is fixed to the compartment.

➢Both longitudinal ends of the compartment is kept unclosed for demonstration and observing purpose.

7.3 WATER MISTING NOZZLES

➢ Single fluid, flat orifice nozzle

➢Four misting nozzles were used. The nozzle specification is given below

➢ Nozzle tip diameter 0.01mm

➢ Nozzle bore diameter : 0.8 mm

➢ Operating pressure : 12 bar

➢Operation: spring tensioned

➢Nozzle tip material: ceramic

➢ Number of tip : one

7.4 PIPELINES

➢ Stainless steel pipe of22.4mm for 5 ft were used.

➢ Material specification: S-202

➢One end of the pipe is blocked, hence the water pressure will be developed inside the pipeline.

➢Four nipples were TIG welded at unique interval for fixing the nozzle

7.5 HAND OPERATED HYDRAULIC LINE TESTING PUMP

➢ Maximum operating pressure: 70 bar

➢Accessories : a pressure gauge; a drain valve; high pressure pipe of lm

7.6 FOR HUGE INSTALLATION ONBOARD HYDRAULIC PUMP

- The selection of pump is fully dependent on the requirement whether it is low load application or High load application
- For low load application 20-30 bar of hydraulic pressure is required
- For heavy load applications 70-80 bar of hydraulic pressure required
- The pump should have the capacity to supply sufficient quantity of water to the misting nozzles

8. OPERATION

This system can be activated either by manual or auto. The hyper mist system manually started by using local control panel located at the location of the floor or the compartment. But the system can be operated automatically by incorporating the fire detectors along with fire alarm system.

8.1. DESCRIPTION

The fire detectors detect the fire at the place of vicinity and the fire detectors electrical signal fed to the main control panel through the fire alarm panel, Once the main control panel gets the signal, it send operating signal to the motor control panel to start the pump and also send signal to the solenoid valve located at the place of vicinity. So, the solenoid valve opens and allows the water pumped by the hyper mist pump to the piping installation at the place where the fire exists.

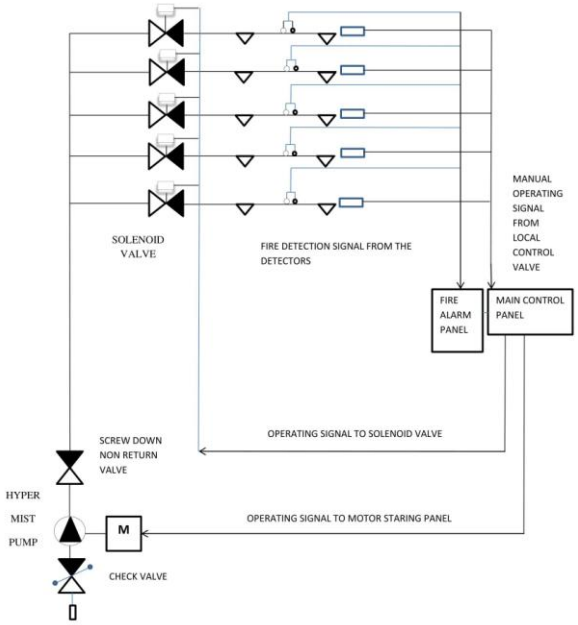


Figure 8.1 Line Diagram for Fog Model Set Up

8.2 COMPONENTS AND THEIR FUNCTIONS

➢Hyper mist pump [Capacity: 3501itres/min @10 bar.]
➢Hyper mist nozzle [Capacity: 16 liters/min @ 8 bar.]
➢ Solenoid valve
➢ Fire detectors [Flame & Smoke]
➢ Check valve
➢ Screw down non-return valve Strainer

8.2.1 Hyper Mist Pump

it is multistage centrifugal pumps which have the capacity of pumping out the water 350 liters/min at 10 bars. The starting and stopping can be done by activating starting or stop switch at local control panel, or otherwise by the main control panel through motor control panel.

8.2.2. Hyper Mist Nozzle

It is a convergent type nozzle which spraying out the water in the form of mist by converging the water stream. It can discharge 16 liters/min @ 8 bar. 9.2.3. Solenoid Valve It is an electrical driven valve and it is control by the opening and closing signal from main control panel with respect to the fire detection system.

8.2.3. Fire Detectors

There are two types of fire detectors are incorporated in this installation.

- Flame detector
- Smoke detector

Working of these detectors has already been discussed in the previous chapters. For more accuracy and avoid false activation, two detectors are fixed together.

8.2.4 Check Valve

It is fitted at the suction side of the pump to check the flow of water.

8.2.5. Screw Down Non-Return Valve

It is unidirectional non-return valve fitted on the discharge side of the pump which is used to avoid the back flow of water into the pump.

8.2.6. Strainer

Strainer is a filtering material used to remove any impurities comes along the flow of water which may clog the nozzle.

8.2.7. Main Control Panel

It gets alarm fed from alarm panel or it can also be activated by using Local control panel [LCP] manually. It indicates the region or section of building in fire.

8.2.8. Fire Alarm Panel

It gets the fire detection signal from the fire detectors situated at the location of vicinity; it sends signals to Main control panel & to the alarm system. NOTE: The Main control panel consists of Auto/Manual switch. We can change the settings to our convenience and also for Maintenance purpose.

7 9. CONCLUSION

As stated by the scholars, Hydro Fog is a passive fire protection system. Since it do not fight the fire actively and prevents the spread of fire. Most may argue that the preexisting active firefighting system, the Sprinklers. But being innovatively used in high rise building, it topples the sprinklers in many ways

- Water Mist uses less than $1/4^{th}$ of water used in sprinklers
- Like sprinkler heads. Mist nozzle doesn't need any replacement after operation, It is a conventional type.
- The main advantage of Mist over any other Fire protection system is that it does not affect the appliance exposed to it.
- It won't cause any electrocution in case of any. And By absorbing the heat from the fire the water mist itself evaporate into stream hence easy to clean while other mediums take minimum of seven to nine days for cleaning.
- As stated above it reduces the wastage of water comparatively to that of sprinklers and water fall system.

The reason for using both Manual and automatic, gives the benefit of using Manual in case of any failure in automatic system. By automatic installation, the Hyper mist can extinguish fire in its initial stage. And prevents fire spread to greater degree by reducing the temperature bellow auto ignition of the material. By the usage of Solenoid valve, a particular section of the entire building alone subjected to fire activate the mist system and not the entire building. With Specific requirements and specification, it can be installed in any of the buildings.

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