

FIRE AND TECHNOLOGY

THE HIGH PRESSURE WATER MIST SYSTEM AS A MEANS OF IMMEDIATE RESPONSE TO A FIRE EMERGENCY

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INTRODUCTION

For the 'Homo sapiens' very survival, fire has been one of the most important discoveries – the most revered and at the same time most feared! It is one of man's oldest friends. It is hard to imagine what life would be without fire and at the same time fire is one of man's deadliest enemies. *It can kill us, mutilate us, and literally destroy in a few minutes what may have taken a lifetime to build.*

Although the first organized attempts at fire fighting began at the time of the Roman Empire, it really started to develop in the 17th century. Manually operated fire engines were initially pulled by men, and then drawn by horses. This again changed with the coming in of the steam engine; and it was the internal-combustion engine, which truly heralded the development of both the fire engine as well as the fire fighting methods.

As nations have become industrialized and populations of cities have grown, so has the risk of fire in the grossly overcrowded urban multi-storied residential & office complexes and 'kuchhi abadeez' where even access for a conventional fire vehicle is impossible!

Fire fighting has developed into one of the world's major rescue organisations in advanced countries, incorporating the rapidly changing needs and the advent of newer fire response technologies. Though the colossal devastation an out-of-control fire can cause has finally starting to be register in Pakistan, the knowledge of the mechanics of a fire 'after a fire has established itself' is yet generally unknown. Once the fire has established itself, all the fire-tenders that can be mustered can only 'prevent the fire from spreading to adjoining areas/buildings, and no more - it is too late!

PRIMARY CAUSES OF FIRE

Whether or not the safety fire rules and regulations exist, fires will always be waiting to occur. Besides faulty or misused electrical equipment, the careless disposal of cigarettes, lack of care in using cooking stoves (unsafe cooking stoves included!), and children playing with matches are major causes. Compared to man-made fires, natural ones are relatively rare.

Another major cause of fire and one that we are particularly exposed to is arson, caused by whatever incentives!

THE NATURE OF FIRE

The way a fire behaves and spreads is what makes it so dangerous. We all know that for a fire to occur, it needs fuel (that will burn), heat (the source of ignition) and oxygen. Heat generated from a fire can travel laterally through the air (radiation) and be sufficient to ignite material remote from the original outbreak; as also heat travelling along solid materials (conduction), such as metal beams and joints. And when heat and objects travel upwards from a fire (convection), it will carry the fire with it or cause the combustible material to ignite. **Once a fire has established itself, it will most likely burn itself out when it runs out of one of these three main ingredients.** *To prevent a fire from establishing itself it is imperative to have a reliable and effective first response system "in-house".*

When the many fire engines gather together to tackle an established fire, all they can do is to try to keep the fire from propagating to nearby areas. I.e. Keep the surroundings

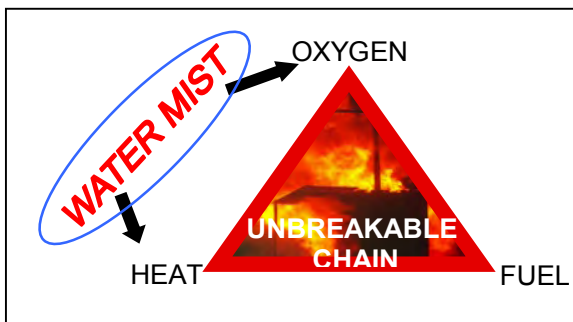
"cool" so that the fire does not 'travel next-doors'. They will probably never have the huge quantum of water that could possibly 'drown' an established fire, and in turn 'drowning everything else'!

Through history, from the 'human chains' literally 'passing the water buckets' to the most sophisticated 'Fire Engines' and 'automated response systems' of today, the most critical factor in dealing with an unintended fire is '**time**' - time in which to react to a fire emergency. Time has never been forgiving in any fire-fighting situation. Almost as a rule, **'If a fire has not been extinguished or brought under control within the first five minutes, it will continue till it burns itself out!'**

Therefore, 'fire engineers' face the challenges to develop effective systems, that must be able to respond to a fire emergency **within the first five minutes** of the fire occurring. And, if possible, use minimum amounts of water.

THE WATER-MIST

Unlike the gallons of water thrown into the flames by conventional fire engines in trying 'drown' the fire; or the 'droplets' of water used through water sprinkles, **WATER MIST** is used. It is 'minute' atomised droplets of water which, when 'thrown' into the flames, 'convert' rapidly into steam; the water mist covers 1760 times larger surface area. The Water Mist therefore tackles both Heat & Oxygen. The result of this very rapid conversion is as follows:



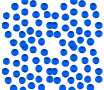


come in contact with the flames.

1. Extremely rapid heat absorption from the fire (Cooling & Radiant Heat Blocking)
2. Removal of oxygen by suffocation by the ensuing steam (Local Inerting)
3. *No residual water damage because the atomised droplets of water get converted into steam as soon as they*

THE PRINCIPLE:

Atomizing water creates the high-pressure process. The minute water droplets generated (water-mist) covers a much-increased surface area. The cooling effect of water is very efficient in energy extraction from the fire as the expansion of steam starves the fire of oxygen.

THE DROPLET SIZE				
	No. of drops	Droplet size (ave)	Surface area	Vaporisation
 Sprinkler	1	>1000 μ m	1	1 sec
 Class 2/3 Mist	40	300 μ m	10	0.1 sec
 Water Mist	8000	20-50 μ m	400	0.003 sec

Very large total surface area ↘

THIS DIAGRAM (COURTESY AFT WEBSITE) DEPICTS THE RELATIONSHIP OF DROPLET SIZE WITH SURFACE AREA AND THE RATE OF VAPORIZATION.

IMPORTANCE OF DROPLET SIZE:

Lower the average droplet size, more the surface area; and therefore greater the cooling for the fire as the heat is taken in as latent heat of vaporization.

WATER MIST COULD BE GENERATED BY TWO METHODS:

1. Compressed air when forced through a specially designed 'venturi' where it speeds up. As the air accelerates, negative pressure is created in the venturi and water is 'sucked' in through special nozzles opening in the venturi. This water mist is then carried along by the compressed air straight into the fire:
 - a. **HP Water Pump & Special Nozzles.** Special high-pressure water pumps force water through special nozzles to form water mist or fog. This pressure is also utilized to propel the atomized water droplets into the flames.

b. Pros & Cons. Both methods create water mist. Compressed air has to depend on compressed air bottles that will deplete in about five minutes and would need to be replenished. HP pumps on the other hand depend on an integral source of power to drive the pump. Both systems being immediate response systems, they are usually configured to last for about five to 10 minutes.

THE HDL-250 is a water-mist system. Normal tap water is used as the normal extinguishing agent. It utilizes high-pressure in-line ceramic pumps to pressurize the water to 250 bar (3600 psi) ensuring that the water emerges from the atomizing nozzles at very high velocity. The **20 to 50 microns** mist even reaches difficult areas of the fire, such as behind false ceilings, inside sofa foam, etc. The fire rapidly loses great amounts of energy by evaporation and suffocation that reduces the oxygen levels below critical limits, resulting in extinguishing of the already weakened fire. The synergetic effect of these two processes creates an incredibly effective extinguishing action.

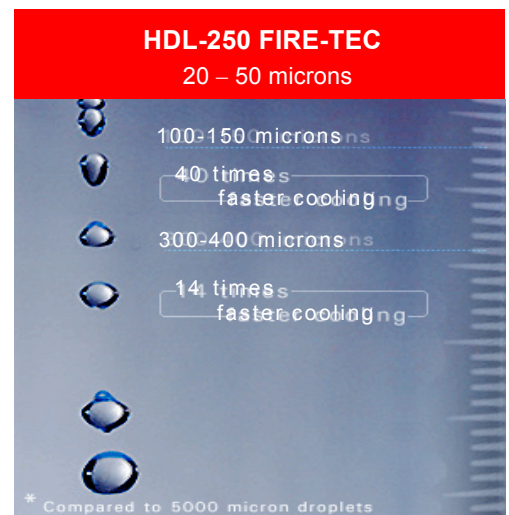
The HDL is ideal for use against both Class 'A' and 'B' fires having a built-in foam-dispensing unit. It provides from 5 to 20 minutes of fire fighting by the flick of a switch. The built-in 'triple-action' special nozzles allow usage on electrical fires of up to 1000 volts as well. *And there is no water damage or spillage of contaminated water.* The HDL comes in the 'Hazard Area' configuration as well.

The extinguishing qualities of the HDL are most impressive in its minimal use of water. The HDL cools the fire down and starves it of oxygen, rather than drowning it by water. Extensive trials on realistic as well as real-life fires have achieved the following economies of water consumption:

TRAINING AND RE-TRAINING is imperative for the efficient use of any emergency equipment. The HDL-250 FIRE-TEC affords the most economical and practical training to 'everyone', without the hassle of refilling and maintenance expenses. Extensive usage practice can be given to a select team from each work shift along with the fire and security personnel. Refresher training in its practical use can be carried most economically and efficiently.

Cars: fully ignited including tyres	60 sec - 13-30 litre
Cars: early stages of burning	09 litre
Tyres: burning upto 50 tyres (/ tyre)	60 sec -1/2 to 1 litre
10 stacked pallets (fully burning)	45-60 sec 20 litre
Room: burning	30-45 sec/10 to 50 l

ONE OF THE BEST WAYS TO FIGHT FIRES IS TO HAVE AN EFFECTIVE, EASY-TO MAINTAIN, AND RELIABLE FIRST-RESPONSE SYSTEM – 'IN-HOUSE'!



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