

Latest Fire Fitting Technology

Halocarbon Clean Agent Extinguisher to replace Halon 1211 in Portable Extinguisher & modular system

By

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Introduction :

After Montreal Protocol treaty on ozone layer, protection Halon 1211 which is a high ozone depleter gas, is been stopped world over including India where production is stopped and import not allowed except for very small quantities for some essential uses

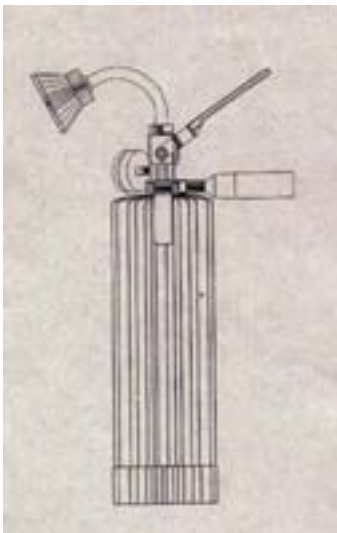
.What after this Indian halon phase out strategy spells out following substitutes:-

- ABC Powder
- CO₂ gas
- NASA Gas (HCFC-123) + NASA Proprietary Gas mixture.

Many of uses need replacement as streaming agent clean, non conductive, ability to permeate, multipurpose, low toxicity & environment friendly in addition fire extinguishing characteristic similar to Halon 1211. An alternative based on HCFC –123 main chemical & blend with other inerts etc. that has similar characteristics & comparable fire fighting efficiency well tested & tried on practical situations. HCFC blend new agent can be used in modular fixed fire protection systems under conditions such as where agrees can be accomplished within calculated time or where area is properly ventilated, similar to that Halon 1211, 2402. Similar to other substitutes for H-1301, like Fe-227ea, inert gases, Fe-13 etc, there is design change, size & shape of equipment & piping changes based on new agent quantity requirement based on its fire fighting efficiency. This paper attempt to describes design change of extinguisher & module for adoption of HFC-123 bare clean agent.

New Extinguisher is a combination of well designed portable and modular system discharge nozzle (suiting to new blend HCFC) & Pattern of discharge making it most effective on all classes A, B & C type fires.

Portable new extinguisher design



Following salient feature extinguisher suits new agent.

The container and the valve body assembly are of stainless steel for long life corrosion free to maintain the efficiency. To achieve the maximum efficiency both in vertical & horizontal position during the operation of the extinguisher, the siphon selects the position automatically, to maintain the required flow. After various real fire condition experiments the nozzle and valve connection DISCHARGE TUBE ANGLE be designed that untrained common man also can correctly target the fire seat & control the early stage small fire. The discharge ball deflector plays vital role for the uniform flow without AIR POCKETS in achieving highest efficiency to control the fire. Nozzle cap is designed to control the velocity, maintain the concentration reduces the pressure to avoid splashing off liquid or flying off a burning objects. The nozzle cap discharge angle designed to maintain the maximum floor area coverage with uniform concentration. The unique valve design gets closed automatically to avoid leakage & preserve expensive Extinguishent in the container. The valve design having double seal in top & bottom so that there is double safety to avoid leakage. In spite of repeated operation of the valve the Extinguishent doesn't leak. The valve assembly moving components & its assembly is so designed that even after long gap between two operations , there is no chance of bonding or leakage. The total weight is around 4 kg easy even for a child to operate. The extinguisher assembly appearance is self explanatory to operate. Doesn't required any training. Extinguisher is pressurized at 7-8 bar and the nozzle pressure is around 60 PSI. Altogether the total design is helping to increase agent efficiency with least agent.

The new clean agent substitute Halon 1211 has following characteristics.

The chemical composition & Properties :- 2,2-dichloro-1,1,1-trifluoroethane
C₂HCl₂F₃ HCFC-123 + NASA gas mixture.

Boiling Point :- 25.5⁰C.

Vapor Pressure at 25⁰C :- 2.5 bar

Extinguishing Concentration :- 6 to 7%

Filling pressure :- 7-8 bar

Pressurizing Agent :- Argon

Filling ratio :- 80 – 20 (80%)

Metal Compatibility :- compatible to aluminum , stainless steel, nickel, titanium, zinc , magnesium, cadmium plated steel, bare steel.

Electrical conductivity :- Non conductor.

Cleanliness :- does not leave residue.

ODP :- 0.03 – (No control till 2040)

No control under Kyoto Protocol

:- Suitable for portable fire extinguisher for A, B & C class of fire.

The portable fire extinguishers are also suitable for occupied area only with the above designed extinguisher container & valve body assembly mainly because it is designed in the combination of the of gases is with in limits of their toxicity.

Experiment & Practical Results using new clean agent:-

It was fifteen years back that we came across the problems that have plagued granite industry in India. But some Indian Industry found out that the life of diamond tool can be almost doubled by **replacing water with kerosene as coolant** which, in fact, is the truth. The resultant reduction in production cost is nearly half, enabled the industry to compete effectively in the world market.

But alas!!, **here starts** the long and unfortunate Saga of **explosions, fires, loss of lives and what not!** The brilliant minds who found this out easily overlooked the vast difference in basic properties of two coolants! It was forgotten that in addition to act as coolant, **kerosene could act as a fuel too.**

The cutting operation of granite stone process involve **high risk of fire & explosion .**

Well tried Fire Extinguishing System with New agent in granite cutting industry.

The sequence of cutting operation is as under: -

Operation –1

The kerosene pump of 2HP having delivery of around 350 liters per minute starts the delivery of kerosene as a coolant.

Operation – 2

The 7 ft . diameter diamond cutter with 15mm. Blade thickness & with 180 diamond segment in the blade circumference starts running with 750 RPM .

Operation – 3

The Granite stone of around 4 ft. x 4 ft. x 10 ft. having around 25 tones of weight starts moving horizontally on the trolley in the close chambers of around 22 ft. (height) x 8 ft.(width) x 40 ft. (length) of volume.

Once the cutter starts running together with the flow of the kerosene (coolant) it forms very fine particles of kerosene & gets mix with the air already present in the close chamber creates explosive mixture. The moment cutter comes in contact with the stone to cut, it produces spark.

Explosive mixture + Spark = Explosion & FIRE.

In above process there was a heavy loss in the range of around 8 to 10 lakhs by way of loss of expensive cutter, loss of production, loss of finished goods, loss of business, loss of profit & many more other hidden losses and the **loss of irrecoverable machine operator life.**

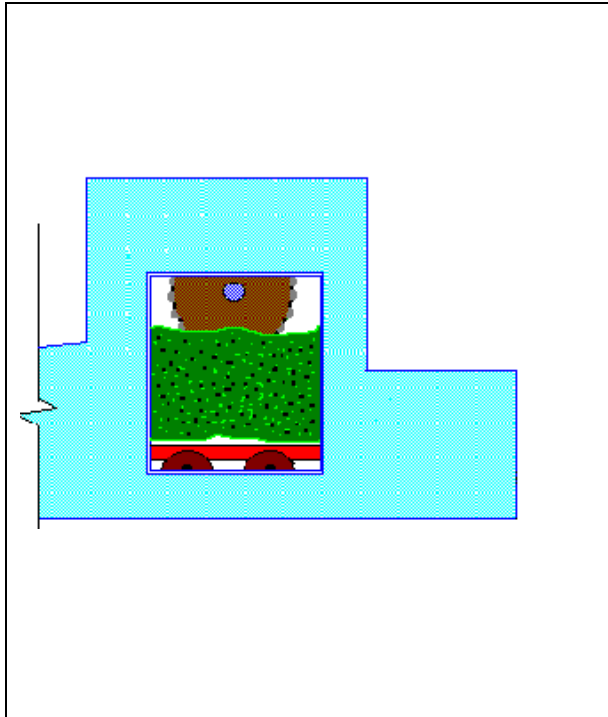
Altogether We found that many young and dynamic industrialists were hesitant to enter the granite industry thinking, though rightly so, it to be a highly hazardous undertaking.

To manage this fire in the beginning they used water to control the fire but when it has spread in the entire plant they understood their mistake and then they started using Halon & CO₂ extinguisher initially and then started adding 9 kg. Of additional cylinders up to 5 numbers connected altogether with the manifold having discharge pipe installed in the machine chamber. But still it was very difficult for them to control the machine chamber fire.

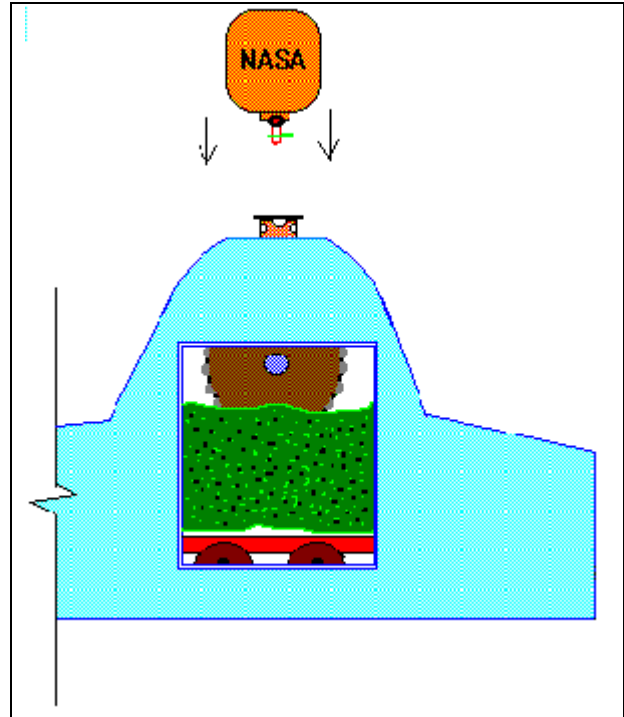
The reason for the failure of CO₂ Conventional extinguisher is mainly because of: -

- It is manual system. At the time of fire & explosion because of panic everybody are running out of the plant. Hence non-is present to operate the system.
- There is a gap between fire detection and extinction.
- Difficult to achieve required concentration of CO₂ to extinguish fire because of the gap of opening the cylinder valve one after the other.
- The required quantity of CO₂ Gas is not available at the time of fire.
- Out of seven cylinders operator fails to open minimum 2 to 3 cylinders because of either the valve is jam or suitable spanner is not available.
- Loss of gas because of leakage in manifold connection and discharge pipe fails to achieve the required concentration to extinguish the fire.
- Compare to the risk and volume of the fire CO₂ system is too slow to control the fire.

1st To avoid chamber explosion following development was made:-



(Drawing – A)



(Drawing – B)

- (A) The machine chamber was of rectangular type of design without any pressure release mechanism (refer drawing A).

NASA scientist help them to have curvature chamber design with pressure relief mechanism on the top of the machine, helps to avoid machine chamber damage (refer drawing B) because of sudden expansion of ignitable mixture.

- (B) The supporting structure of the chamber body was inside. Stone powder with kerosene slurry gets deposited on the inner surface **acting as an additional quantity of fuel available to burn for the longer duration.**

We have developed the technology to keep the supporting structure outside so that inner surface of the chamber is plane (smooth) helps to keep the Chamber Clean. So no fuel is available to burn any longer.

- (C) The flow of the kerosene (coolant) is so organized that it helps to minimize Atomization of the kerosene to avoid explosive mixture.

- (D) The 30^o slop angle has been recommended to drain out all the kerosene with stone powder out of the machine chamber to avoid stored fuel availability at the time of fire.

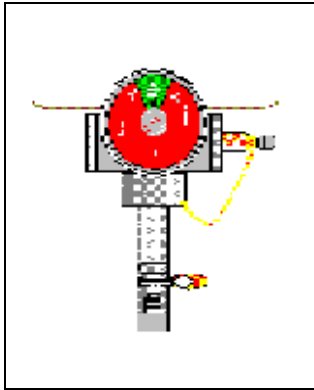
To control the fire of the chamber a specially designed suitable model of 150T which operates automatically and that too without any external source of energy. It has replaced all those seven Co₂ cylinders. The instrument is highly sensitive and is capable of detecting and extinguishing the fire in machine chamber in less than three seconds. The losses have

been reduced drastically so the moral and confidence of industrialists have greatly increased.

The automatic instrument can be divided in two major assembly; -

01. Automatic valve body assembly & the container.

(Automatic Assembly)



The automatic valve body assembly having positive nature of design gives more reliability. The best part of the design is that, it works independently without any external source of energy i.e. no man power, no storage battery, no main power source , no pipeline . All it needs is the temperature and the gravitational force to operate. At the time of fire both parameters are positive which increases the reliability. The automatic valve assembly contains SS main body, pressure gauge, nozzle cover as gravitational force, fusible link type temperature sensor, discharge nozzle, Extinguishent charging nozzle & other hardware.

The instrument is having in built detection and extinction device. There is a fusible link type temperature sensor operates at $66^{\circ}\text{C} (+ -) 2^{\circ}\text{C}$. The nozzle cover opens up because of gravitational force and the Extinguishent gets discharge in machine chamber through nozzle maintaining uniform concentration of around 6% v/v. The whole chamber gets flooded and almost as big as railway boggy size closed chamber fire gets controlled in 2 to 3 seconds.



02. Container

The stainless steel container act as a reservoir to store new Extinguishent at working pressure at 7/8 bar. The size of the container is 11" Diameter x 13" height .

Altogether at the time of fire automatic instrument is instantaneously & momentarily gets activated and flood the entire machine chamber by around 6% concentration v/v to control the fire.

In those days Halon 1211 was on its peak all over the world mainly because of its advantage of wonderful fire knocking down capability but there was a biggest disadvantage of Ozone Depletion.

Any safety instrument should be safe enough to provide safety in total. **Use of Halon cannot provide safety in total.** It can extinguish fire effectively but at the same time it also damages the ozone & **inviting further complications by environmental imbalance.**

Therefore new non ozone depleting agent system developed and worked without any environmental concern.

We never ever used any Halons, which can protect the entrepreneur today & kills his kids tomorrow by depleting the Ozone, and has designed a own combination of available gases before , which is much better & safe compare to Halon 1211 / 1301 & 2402 in terms of ODP & GWP & still maintaining the efficiency of FIRE knocking down capability.

It is extremely important to be noted that whenever there is a problem of fire it is not only the instruments & the type of the Extinguishent but the operational instrumental reliable design suitable to the type of the problem, safe building design, electrical design, machine design & training to the machine operators altogether only can provide the total safety which is infact to be considered as a part of the product or system

An Example - The fact that the repeated fire and explosion is not because of the KEROSNE but it is because of the SLURRY .

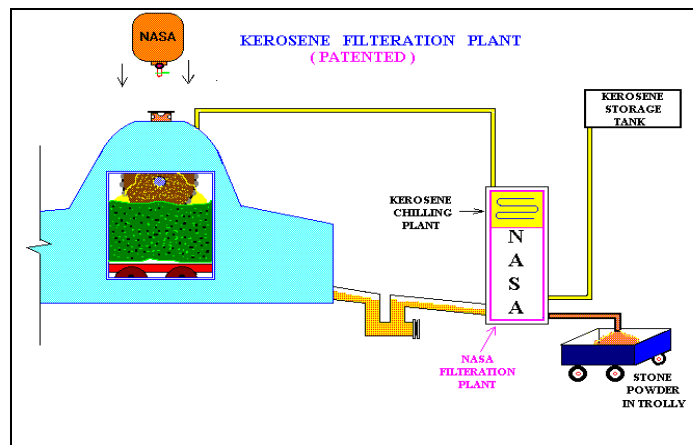
(Stone powder + kerosene = slurry)

Every day almost minimum one ton of slurry gets produced per machine and on enquiring all over the world no online slurry filtration systems are available which can filter one ton impurities everyday without chocking up. Scientists at the moment are engaged in the R & D of Kerosene/Slurry Filtration System. Their laboratory results are very encouraging and if everything goes well, in addition to achieve the goal of fire free cutting operation following will be the additional advantages as a by-product which are much more then getting the profit out of doing the business of stone cutting and they are as under.

- ✓ No slurry deposition in the chamber.
- ✓ No fire.
- ✓ Plant and workers are absolutely safe.
- ✓ No more a Hazardous Kerosene Plant.
- ✓ No much of the kerosene consumption.

- ✓ No additional space and kerosene storage tank.
- ✓ No pollution
- ✓ No heavy power consumption.
- ✓ No labour.
- ✓ No much of the maintenance.
- ✓ Insurance premium will go down.
- ✓ All export quality production.
- ✓ Blade life increases up to 2 to 3 times.
- ✓ Environment friendly meets ISO standards.
- ✓ Segment life increases up to 20 %.
- ✓ Compact clean system
- ✓ Maintenance of kerosene pumps is negligible
- ✓ Minimum 1000 crore of kerosene of the country will be saved.
- ✓ High demand of filtration system in the stone cutting market of the world .

Fire free Kerosene based stone cutting plant is as under with the additional benefit as mentioned above .



TOXICITY DATA & SUMMERY REPORT OF NEW HALOCARBO1N EXTINGUISHMENT

The toxicity is very important in terms of safety. No matter what Extinguishent is used to extinguish the FIRE. But toxicity definitely has to be taken in to consideration while designing the Extinguisher . Because in the process of Extinguishments further decomposition of Extinguishent may effect the health of the occupants and also the environment.

But the fact is there are much more toxic gases produces because of the various material involved in the FIRE in addition to the heat and heat radiation which are more dangerous then that of the toxicity level of Extinguishent.

Fire scientist are not only limited to bother for the toxicity of Extinguishent but are very much concern for the toxicity produced during the process of chemical reaction of FIRE .

It is the first time ever in the history of FIRE FIGHTING INDUSTRIES has got privilege to turn the Arrow in the SAFE direction of basic concept of controlling VERY EARLY STAGE of VERY SMALL FIRE instead of FIGHTING THE VERY BIG FIRE by INVENTING fully Automatic & Semi-Automatic First Aid Fire Extinguisher along with very powerful message of NIP THE FIRE AT THE SOURCE.

The extinguisher VALVE ASSEMBLY and the CONTAINER is so designed that it is playing the MOST VITAL INDIRECT ROLE for the reduction in generation of toxic gases both because of Extinguishent and because of various material involved in the FIRE produces very heavy TOXIC GASES during chemical reaction and incomplete combustion.

A VERY SMALL UNATTENDED FIRE is multiplying at the speed of 50 times in first 8 minutes in the beginning and ultimately it leads to VERY BIG FIRE responsible to produce very heavy HEAT and TOXIC GASES because of various material involves in the FIRE.

However the laboratories test of new Extinguishent components having fully examined according to all required toxicity evaluations. The manufactures of these chemical components also conducted extensive toxicological tests. Sixteen CFC products from around the world jointly sponsored toxicity evaluations of Halon replacement. HCFC-123 the basic compounds with two proprietary inert gas mixtures were extensively tested for: -

- Acute Toxicity.
- Sub chronic Toxicity.
- Chronic Toxicity.
- Skin & Eye Contact.
- Inhalation exposures.
- Typical Fire Fighter Exposures

And is concluded that it is THE SAFE and BEST ALTERNATIVE IN ALL RESPECT as compared to HALON 1211 having acute toxicity (1 % LOWEST OBSERVED ADVERSE EFFECTED LEVEL) and (NO OBSERVED ADVERSE EFFECT LEVEL IS 0.5%) which is almost half of HCFC based gas.

As an alternative of Halon 1211 government of India approves the use of HCFC based gas. Ministry of Home Affairs, DGCD (Fire Cell) & is specified an Indian Halon Phase out strategy of Min. of Env. The gas is also an approve agent by UNEP Halon Technical Option Committee.