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GREEN INSIGHTS

NEWSLETTER ON
Eco-Labelling & Eco-Friendly Products

FIRE EXTINGUISHERS
EFFICIENT & ECO-FRIENDLY

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INDIA
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Foreword

Are you ready for emergencies, like a fire in your kitchen or at your workplace? Make fire prevention a top priority but also be armed with a fire extinguisher to deal with emergency situations.

Innovations in fire protection measures contributed to immense reduction in risk to human life, industry, government, national security and cultural heritage, especially during the second half of the 20th century. The development and adoption of effective, safe and affordable chemical fire protection agents like halons have significantly contributed to increase in fire safety worldwide. Unfortunately, what is good for fighting fires is not always good for the environment.

Halons are excellent suppressants but with high potential for ozone destruction. They damage the stratospheric ozone layer. This layer protects humans, animals and plants from the damaging effects of ultraviolet solar radiation. An international treaty - **Montreal Protocol on Substances that Deplete the Ozone Layer** - was designed to reduce the production and consumption of ozone depleting substances.

It was agreed upon on September 16, 1987 and came into force on January 1, 1989.

Now, there is a major thrust to find an appropriate fire suppression agent to replace halons. The present challenge is to discover halon substitutes with fire suppression ability for various applications without damaging the environment and human health.

Scientists are working on innovations and have developed an exciting new method of putting out fires - carbon dioxide hydrate crystals. The team of scientists of Keio University, Japan uses the hydrate crystals to extinguish burning methanol by sprinkling the crystals into the base of the flames. They have found it very effective in putting out fires. Their most attractive feature is that in extinguishing same sized fires they use much less water and release far less carbon dioxide into the atmosphere than traditional water-based or dry-ice/CO_2 extinguishers.

The current issue of the newsletter covers the history of the fire extinguisher from its invention to recent technologies replacing halons.

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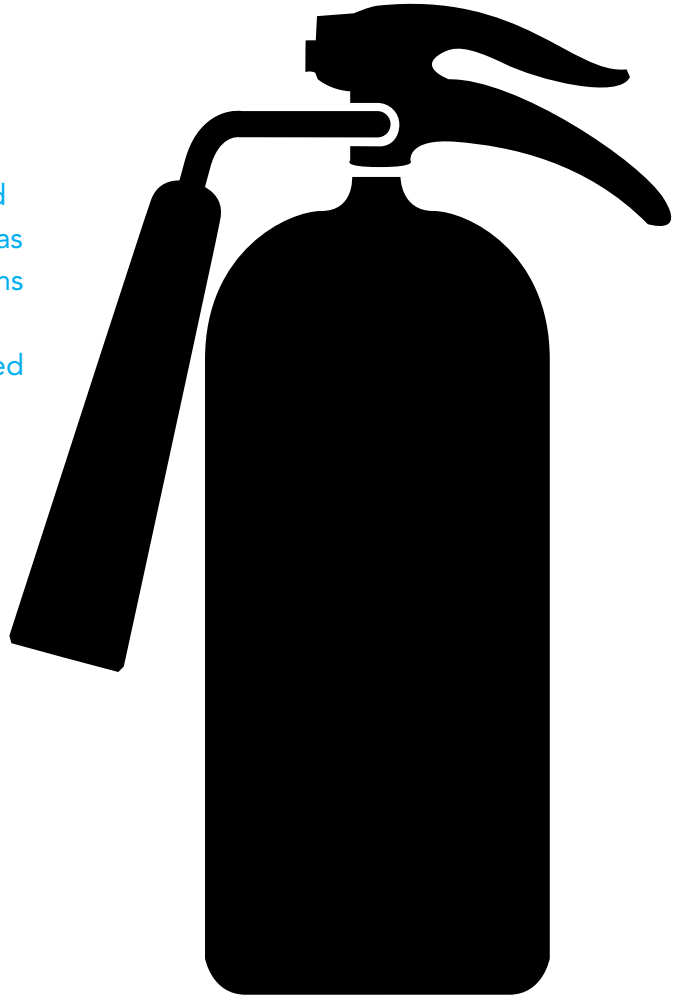
FIRE EXTINGUISHER

HISTORY

A fire extinguisher is an active fire protection tool used to extinguish or control small fires. The first fire extinguisher was patented in 1723 in England by a chemist, Ambrose Godfrey. It was made up of a cask of fire-extinguishing liquid containing a pewter chamber of gunpowder. This was linked with a system of fuses which were ignited, exploding the gunpowder and scattering the solution. Bradley's Weekly Messenger for November 7, 1729, refers to its efficiency in stopping a fire in London. Many other models using various chemical reactions to produce propellants of various types to extinguish fires were invented thereafter.

In 1818, British Captain George William Manby invented the modern fire extinguisher. It was portable and consisted of a copper vessel of 3 gallons (13.6 litres) of pearl ash (potassium carbonate) solution contained under compressed air. In late 19th century soda-acid extinguisher was invented where a cylinder contained 1 or 2 gallons of water with sodium bicarbonate mixed in it producing the propellant CO_2 gas. It was patented in the US in 1881 by Almon M. Granger.

In early 20th century, the chemical foam and carbon tetra chloride (CTC) fire extinguisher were invented. But because of the toxicity of CTC (it damages the nervous system and internal organs), the use of chemicals stopped in the 1950s. In 1924, the Walter Kidde Company of US invented the carbon dioxide fire extinguisher which is still used. It is an ozone-friendly, clean agent. The National Fire Protection Association defines, a 'clean agent' as "an electrically non-conducting, volatile, or gaseous fire extinguishant that does not leave a residue upon evaporation". In the 1950s, small dry chemical fire extinguishers were also developed for use in homes.



USE OF HALONS

In the 1970s, halogenated hydrocarbons (halons), liquefied compressed gases, were used in fire extinguishers. They stop the spread of fire by chemically disrupting combustion. Halons are 'clean agents'. Halon 1211 and 1301 are low-toxicity, chemically stable compounds that, as long as they remain contained in cylinders, are easily recyclable.

Halons are still in use today but have an environment impact. Halons are chlorofluorocarbons which cause depletion of the ozone layer and are being phased out and replaced by more environmentally-friendly alternatives.

In 1994, halon production ceased in developed countries. Under the Montreal Protocol Halon 1301, Halon 1211 and Halon 2402 are widely banned with some exceptions. Use of Halon 1211 is permitted in hand-held fire extinguishers and fixed extinguisher equipment for engines for use on board aircraft, in aircraft for the protection of crew compartments, engine nacelles, cargo bays and dry bays. It can also be used in fire extinguishers essential for personal safety used for initial extinguishing by fire brigades and in military and police fire extinguishers for use on persons.

Now alternatives to halon have become available. Other substances like CO_2, HFCs (hydrofluorocarbons), inert gases, water, foam and dry powder are extensively used now instead of halon in fire-fighting systems. Alternative approaches like good fire-preventive practices, use of fire-resistant materials and better-building design have considerably reduced the need for halon systems.

>>
www.activescg.com/fire-equipment/4384-history-of-the-fire-extinguisher
www.firesafetyplatform.org/wp-content/uploads/2014/01/T-McGuirk-Paper-Fires-dont-have-labels-promoting-new-extinguisher-systems.pdf, http://www.firesafe.org.uk/history-of-fire-extinguishers/, http://ec.europa.eu/clima/publications/docs/montreal_prot_en.pdf

WHAT ARE HALONS ?

fluorine, chlorine, hydrogen and carbon. Chlorine and hydrogen are present in some halons. Halons are used as fire extinguishing agents, both in built-in systems and in handheld portable fire extinguishers. They cause ozone depletion because they contain bromine. Bromine is many times more effective at destroying ozone than chlorine. Halon numbers directly show the number of C, F, Cl, and Br atoms.

Halon	1	2	1	1
	#C	#F	#Cl	#Br

For this molecule, there are 2 x 1 + 2 = 4 bonds, all of which are taken by Cl, F, and Br, leaving no room for any H atoms.

Thus:

Halon 1211 = CF_2ClBr

>>
www.epa.gov/spdpublc/defns.html#halon

PHASEOUT OF HALON PRODUCTION

The relationship between the depletion of the ozone layer and certain halogenated compounds came to a notice of scientists with the discovery of the Antarctic ozone hole in 1985. The need to cut the production and use of ozone-depleting substances (ODS) – chlorofluorocarbons (CFCs) and halons - was addressed at a conference in Montreal, Canada in 1987, which negotiated the United Nations Montreal Protocol on Substances that Deplete the Ozone Layer.

The parties to the Montreal Protocol have amended the protocol to enable, among other things, the control of new chemicals and the creation of a financial mechanism to enable developing countries to comply. The Protocol has been further strengthened through five amendments - London 1990, Copenhagen 1992, Vienna 1995, Montreal 1997 and Beijing 1999. These have brought forward phaseout schedules and added new ODS to the list of substances controlled under the protocol. Now, developed and developing countries phased out their production and consumption of halons in 1993 and 2010 respectively. Recovered, recycled and/or reclaimed halon is not controlled by the Montreal Protocol. Therefore, Parties are allowed to continue using, importing and exporting used halon.

USA

Halon production ended on December 31, 1993. The ban on production and import of halons took effect on January 1, 1994.
>>
www.epa.gov/ozone/defns.html

EUROPEAN UNION

EU member states have stopped the use of ODS in many industrial sectors. The EU legislation has spurred the development of innovative technologies like the creation of innovative fire fighting systems on board ships and airplanes which do not use halons. Italy has phased out most of its stocks and further reduced the list of critical uses of halon.

NORDIC MEMBER STATES

The Nordic countries of Denmark, Finland, Iceland, Norway and Sweden have led the way in controlling ODS. These countries have significantly reduced the amount of halons used in fire extinguishing systems. In Finland, under national regulations, halons were decommissioned from portable fire extinguishers and fixed systems in 1997 and 2000 respectively. Halons which were taken out of use were treated as hazardous waste.
>>
www.ec.europa.eu/clima/publications/docs/montreal_prot_en.pdf

CANADA

The federal Ozone-depleting Substances Regulations, 1998 (ODSR 1998) regulate the manufacture, import and export of ODS, including halons, in Canada. They allow for some exceptions authorised under a permit issued by Environment Canada. The fire-extinguishing systems are regulated under the Federal Halocarbon Regulations, 2003 (FHR 2003). Environment Canada is in the initial stages of revising the FHR 2003. The proposed revisions aim to continue minimising releases of halocarbons to the environment.
>>
www.ec.gc.ca/ozone/defaultasp?lang=En&n=D90FFDBB-1

CARIBBEAN COUNTRIES

The countries in the Caribbean are classified as Article 5 (developing) countries under the Protocol. The schedule for Article 5 countries included a freeze of halon consumption from 1995-1997, 50% reduction by 2005 and complete phaseout by 2010. These countries did not produce or export virgin halon therefore their commitments were to reduce and phaseout halon imports.
>>
www.sta.uwi.edu/fst/halonproject/halon_mgt.asp

INDIA

There is no halon production in the country and the phaseout activities of production and consumption of halons at all enterprises have been completed. The Ministry of Environment and Forest established a National Halon Banking Facility at Centre for Fire, Explosive and Environment Safety (CFEES), Defence Research and Development Organization (DRDO), Ministry of Defence, New Delhi with financial assistance from the multilateral fund of the Montreal Protocol. This facility has the capability to recover,

recycle and store the halons for future use in the existing equipment. It is worth mentioning that all the three defence forces have also established their own Halon Banking Facility to meet the future requirements.
>>
www.ozonecell.com/viewsection.jsp?lang=0&id=0,166,221

CHINA

China is the world's largest producer of chlorofluorocarbons (CFC) and halons. China completely phased out production (more than 100,000 tons) and consumption (110,000 tons) of ozone-harming gases and substances, ensuring fulfillment of its obligations under the Montreal Protocol ahead of schedule, and contributing greatly to climate change mitigation.
>>
www.worldbank.org/en/results/2014/04/11/world-bank-supports-china-in-phasing-out-ozone-depleting-substances

AEROSPACE INDUSTRY

The aerospace industry is working to find effective replacements for halon in airplane fire-extinguishing and suppression systems. Industry has conducted extensive research on halon alternatives, but fully replacing the chemical will require multiple regulatory approvals and the cooperation of all stakeholders.

While potential replacement chemicals have been proposed, none of them meet all the stringent performance requirements for aviation. As a result, the industry relies on recycled halon to meet current needs. The EU adopted halon replacement deadlines for airplanes in 2010 while the International Civil Aeronautic Organization (ICAO) established halon replacement deadlines in 2011. Underwriters Laboratories (UL) withdrew its standard for halon-based handheld fire extinguishers in October 2014.
>>
www.boeing.com/commercial/aeromagazine/articles/2011_q4/3/

ALTERNATIVES TO HALON

In response to the ban on halons, the fire suppression industry has responded with the development of alternative clean agents that pose less threat to the ozone layer. It is necessary to select the alternative which has lowest environmental impact and will perform in the specific application. There are both long established technologies and new concepts or agents. Traditional fire protection systems include water sprinkler, dry chemical, carbon dioxide and foam systems. Newly developed alternatives include water mist, compressed-air-foam and inert gas systems and gas and aerosol generators.

TRADITIONAL TECHNOLOGIES

DETECTION AND MANUAL INTERVENTION: With the help of high sensitivity smoke detection and aspirating systems, it is possible to plan a fire protection strategy on suitable detection coupled with arrangements for the fire to be tackled manually with fire extinguishers and hose reels or by the Fire Brigade. These detection systems themselves do nothing to suppress the fire.

WATER SPRINKLER SYSTEM: This is a well-established, common, reliable fixed fire protection technology. But it can't be used in the case of live electrical equipment, fires due to flammable liquids and anything that would react violently with water.

CARBON DIOXIDE: Carbon dioxide is the most commonly used inert gas extinguishing agent. It is a clean agent with good penetration and safe to use on live electrical equipment. It is most suitable for use on fires involving flammable liquids.

FOAM SYSTEMS: It is most suited for liquid pool fires. It extinguishes fire involving flammable or combustible liquids. It may not be safe to use where live electrical circuits are present.

DRY POWDER SYSTEMS: These are effective against fires of flammable liquids including spray fires. The can also be used safely where live electrical circuits are present. There are different powders available for different types of fires. These are unpleasant to breathe, reduce visibility and are not recommended for use in occupied space. However, they may be safely used where live electrical circuits are present.

NEWER SYSTEMS

These clean agents are electrically non-conductive, leave no residue, relatively non-toxic and have good penetration.

HALOCARBON GASES: Halocarbon agents are chemicals similar to halon with molecular structures modified to reduce or eliminate the chlorine and bromine atoms which are responsible for ozone depletion.

FINE WATER SPRAY/WATER MIST: The term 'water mist' refers to fine water sprays in which 99% of the volume of the spray is in drops with diameters less than 1000 microns. Depending on fluid systems-single and dual – it falls into two main categories. Single utilises water stored at 40-200 bar pressure and spray nozzles that deliver droplet sizes in the range of 10-100 microns diameter. Dual systems use air, nitrogen and other gas to atomise water at the nozzle.

INERT GAS GENERATORS: These generators utilise a solid material which oxidises rapidly, producing large quantities of CO_2 and/or nitrogen. This technology is a recent and continuing development. Its use has so far been limited to specialised applications such as engine nacelles and dry bays on a few new military aircraft where space and weight are major considerations.

FINE SOLID PARTICULATES: This relatively new technology is related to fine solid particulates and aerosols. It is used in conjunction with inert or halocarbon gases. Aerosol and inert gases are formed pyrotechnically - the solid aerosol acts directly on the flame, cooling it, the gases serve as a mechanism for delivering the aerosol to the fire.

>>
www.harc.org/images/TechnicalNote1.pdf
www.firesafe.org.uk/phase-out-of-halons/
www.iafss.org/publications/aofst/5/12/view

TYPES OF FIRE EXTINGUISHERS

CLASSIFICATION OF FIRES

Fires are classified depending on the materials or fuel being burned. Fire extinguishers are labelled based on which type of fire they are effective in controlling.

CLASS A
Fires involving solid combustible materials of organic nature such as wood, paper, rubber and plastics where the cooling effect of water is essential.

CLASS B
Fires involving flammable liquids or liquefiable solids or the like where a blanketing effect is essential.

CLASS C
Fires involving flammable gases under pressure including liquefied gases, where it is necessary to inhibit the burning gas at fast rate with an inert gas, powder or vaporising liquid.

CLASS D
Fires involving combustible metals like magnesium, aluminium, zinc, sodium, and potassium where the burning metals are reactive to water containing agents and in certain cases carbon dioxide, halogenated hydrocarbons and ordinary dry powders. These fires require special media and techniques to extinguish.

CLASS E
Fire risks involving electrical apparatus/equipment.

CLASS F/K
Fires involving cooking oils, trans-fats or fats in cooking appliances. These typically occur in restaurant and cafeteria kitchens

TYPES OF FIRE EXTINGUISHERS

Based on the classification of fires, there are different types of fire extinguishers. Each type has a code symbol/ shade that depict how it is useful in fighting fires with a particular group of fuel.

WATER FIRE EXTINGUISHERS: Used for Class A fire risks and most widely used. Not suitable for Class B (liquid) fires or where electricity is involved.

FOAM FIRE EXTINGUISHERS: Very versatile and used for Class A and B fires. These are not recommended for fires involving electricity, but are safer than water if inadvertently sprayed onto live electrical apparatus.

CO_2 FIRE EXTINGUISHERS: Used for Classes B and E fires. They do not work very well on Class A fires because they may not be able to displace enough oxygen to put the fire out, causing it to re-ignite. But they have an advantage over dry chemical extinguishers since they do not leave a harmful residue.

WET CHEMICAL FIRE EXTINGUISHERS: Used specifically for Class F fires.

POWDER FIRE EXTINGUISHERS :Also termed as multi-purpose extinguisher, they are used for Class A, B, C and E fires. They are also called fire blankets commonly used for chip pan fires and toasters (kitchen fire risks) but also used for waste bins and in laboratories.

HOSE REEL: Best for Class A fires involving organic solid materials such as wood, cloth, paper, plastics and coal. Used to provide a controlled supply of water to combat any potential fire risk.

FIRE BUCKETS: A simple bucket filled with water or sand and can be used for Class A fires. Fire buckets are painted bright red and have the word 'FIRE' stencilled on them.

>> www.law.resource.org/pub/in/bis/S03/is.15683.2006.html >> www.extinguishers.co.uk/types-of-extinguisher.html >> www.firesafe.org.uk/types-use-and-colours-of-portable-fire-extinguishers/

ECOMARK CRITERIA FOR FIRE EXTINGUISHERS

GENERAL REQUIREMENTS
Any fire extinguisher having Bureau of Indian Standards (BIS) standard mark qualifies for consideration for Ecomark. Following are the BIS Standards for portable and mobile fire extinguishers:

The EcoMark criteria is incorporated in the following BIS standards

Indian Standards	Incorporated Eco Mark criteria in the Year	Descriptions
IS 2171:1999	2001	Portable Fire Extinguishers Dry Powder Type (Cartridge)
IS 2878: 2004, Reaffirmed 2010	2005	Fire Extinguishers Carbon Dioxide Type (Portable and Trolley -Mounted)
IS 10658:1999	2002	Higher Capacity Dry Powder Fire Extinguishers (Trolley-Mounted)
IS 11833:1986	2002	Dry Powder Fire Extinguishers for Metal Fires
IS 13385:1992	2002	Specifications for Fire Extinguishers 50 litre Wheel-Mounted Water type (Gas Cartridge)
IS 13386:1992	2002	Specifications for Fire Extinguishers 50 litre Mechanical Foam Type
IS 13849:1993	2001	Portable Fire Extinguishers Dry Powder Type (Constant Pressure)

The incorporation of Eco-mark requirements, in the following BIS standards are under process

Indian Standards	Descriptions
IS 940:2003	Portable Fire Extinguishers Water Type (Gas Cartridge)
IS 6234:1986	Portable Fire Extinguishers Water Type (Stored Pressure) is inactive now
IS 10204:1982	Portable Fire Extinguishers Mechanical Foam Type is inactive now
IS 15397:2003	Portable Fire Extinguishers Mechanical Foam Type is inactive now

The product manufacturer must produce the consent clearance as per provision of the Water (Prevention & Control of Pollution) Act, 1974, Water (Prevention & Control of Pollution) Cess Act, 1977 and Air (Prevention & Control of Pollution) Act, 1981, respectively, along with authorisation if required under Environment (Protection) Act, 1986, and the rules made there to the BIS while applying for Ecomark. The product may display in brief the criteria based on which the product has been awarded Ecomark.

The product may be sold along with instructions for proper use so as to maximise product performance with statutory warning, if any, minimise waste and method of safe disposal. The material used for product packaging (excluding refills) shall be recyclable, reusable or biodegradable. The product must display a list of critical ingredients in descending order of quantity present in percent by weight. The list of such critical ingredients shall be identified by the BIS.

PRODUCT SPECIFIC REQUIREMENTS

The fire extinguishers shall not contain any ODS relevant to fire extinguishers industry as identified under the Montreal Protocol (Annexure A). Gas-based extinguishing media once discharged in the atmosphere should not have atmospheric life time of more than a year (Annexure B). Chemicals used should not have Global Warming Potential (Annexure C). The metallic body and other metal parts of the fire extinguishers shall be free of lead or lead alloys. The coatings used for the metallic part shall not be formulated with mercury and mercury compounds or be tinted with pigments of lead, cadmium, chromium VI and their oxides. Excluded are natural impurities or impurities entailed by the production process up to the amount of 0.1% by weight which are contained in the raw material.

Note: CO_2 extinguishers may be permitted till suitable substitutes are available.

ANNEXURE A

List of ODS
controlled by Montreal Protocol

Trade Name	Ozone Depleting Potential (ODP)
Halon 1211	3.0
Halon 1301	10.0
Halon 2402	6.0
CFC - 11	1.0
CFC - 12	1.0
CFC - 113	0.8
CFC - 114	1.0
CFC - 115	0.6
CC 14	1.1
C 2 H 3 C 13	0.1
CFC-13	1.0
CFC-111	1.0
CFC-112	1.0
CFC-211	1.0
CFC-212	1.0
CFC-213	1.0
CFC-214	1.0
CFC-215	1.0
CFC-216	1.0
CFC-217	1.0
Methyl Bromide	0.6

ANNEXURE B

1	4 - Aminodiphenyl
2	Benzidine
3	4 - Chloro-o-toluidine
4	2 - Naphthylamine
5	p - Chloraniline
6	2, 4 - Diaminoanisole
7	4, 4 - Diaminodiphenylmethane8; 3,3 - Dichlorobenzidine
8	3, 3 - Dichlorobenzidine
9	3, 3 - Dimethoxy-benzidine
10	3, 3 - Dimethylbenzidine
11	3, 3 - Dimethyl - 4, 4 - diaminodiphenylmethane
12	p-Cresidin (2 - Methoxy 5 - methylaniline)
13	4, 4 - Methylene-bis (2- chloraniline)
14	4, 4 - Oxydianiline
15	4, 4 - Thiodianiline
16	o - Toluidine
17	2, 4 - Toluendiamine
18	2, 4, 5 - Trimethylaniline

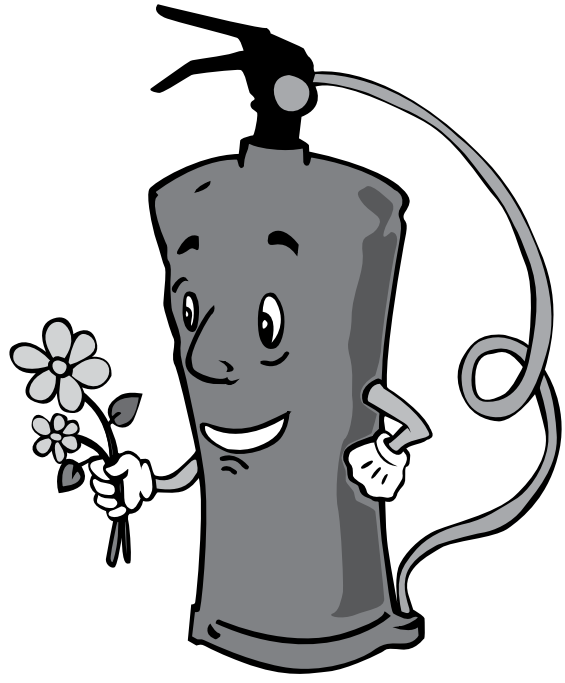
Note: ODP values are relative to CFC-11 which has been assigned arbitrary value of 1.0

ANNEXURE C

List of Substances
having Global Warming Potential (GWP)

>>
www.cpcb.nic.in/EnvironmetalPlanning/
Eco-label/fire.pdf

Trade Name	GWP (100 years) vs CO_2
Halon 1301	5600
Inergen	-
Argonite	-
Argon	-
CEA 410	5500
FM 200	3300
FE 13	12100
FE 36	8000
FE 241	480
FE 25	3200
NAFS III	1450
CF 31	5



LIST OF LICENSEES WHO GOT ECOMARK FOR FIRE EXTINGUISHER

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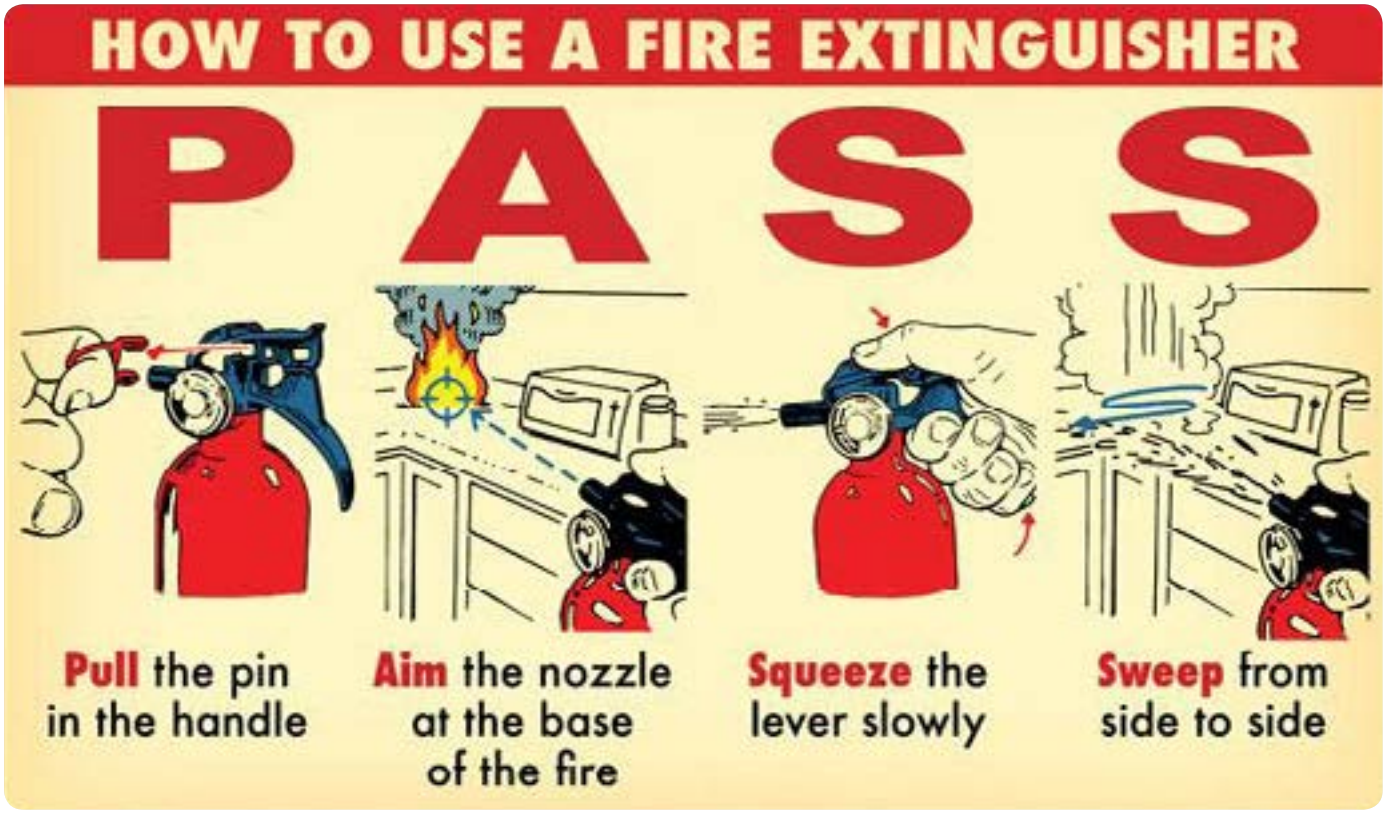
www.bis.org.in/other/ECOMarkLic.pdf

S. No.	License No.	Name of License and Addresses	Validity Date	IS No.	Operative Status	Product Covered	Variety/Board name
MDD-I	8637491	Cascade Counsel Tech Pvt. Ltd, 63/19, Rama Road, Indl. Area Najafgarh Road, New Delhi, 110015.	31/12/11	6234: 2003	Operative	Water type (Stored Pressure) Portable Fire Extinguisher Water Type (Stored) CASCADE Portable fire extinguisher	CASCADE Portable Fire extinguisher Water type (Stored Pressure) Portable Fire Extinguisher Water Type (Stored)
PRBO 1	9478809	Mahan Fire Protection Plot No.195, HPSIDC Baddi, Himachal Pradesh	07/08/11	6234	Operative	Portable fire extinguishers, water type (Stored pressure	MAHAN
2	9493094	Mahan Fire Protection Plot No.195, HPSIDC Baddi, Himachal Pradesh	03/11/12	11833	Operative	Dry powder fire extinguisher, for metal fires.	MAHAN



The Environment information System acronymed as ENVIS was implemented by the Ministry of Environment & Forest by end of the 6th Year Plan as a Plan Scheme for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders.

The Ministry of Environment and Forest has identified Consumer Education and Research Center (CERC), Ahmedabad, as one of the centers to collect and disseminate information on Eco-labelling and Promotion of Eco friendly Products. The main objective of the ENVIS Centre is to disseminate information on Eco products and International and Naitonal Eco Labeling Programmes.

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