



COURSE HANDOUT

FIRE PREVENTION & FIRE FIGHTING



NAVIGATOR MARITIME ACADEMY

(Approved by DG Shipping, Ministry of Shipping, Govt. of India)

(MTI No. : 108025 & Approval No.: TR/A/58/2019)

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COURSE OUTLINE

Duration: 3 days

SUBJECT	HOURS		
	LECTURE	FILMS	DRILLS/ PRACTICALS
1. Introduction Safety & Principles	0.75		
2. Theory of fire 2.1 Conditions of fires 2.2 Properties of flammable materials 2.3 Fire hazard and spread on fire 2.4 Classification of fire and appropriate Extinguishing agents	1.00	0.5	
3. Fire prevention 3.1 Fire prevention principles 3.2 Ship construction arrangements 3.3 Safe practices	1.50		
4. Fire Detection System & Alarms 4.1 Fire & smoke detection system 4.2 Automatic fire alarms	0.75		
5. Fixed fire-extinguishing system 5.1 General 5.2 Smothering effect system: carbon dioxide (CO ₂) , foams 5.3 Inhibitor effect system: Powders 5.4 Cooling effect system: sprinklers, pressure Spray 5.5 Emergency fire pump (cargo ships) 5.6 Chemical powder applicants	1.75		
6. Fire-fighting equipment 6.1 Fire hoses and nozzles 6.2 Mobile apparatus 6.3 Portable fire extinguishers 6.4 Fireman's outfit 6.5 Breathing apparatus 6.6 Resuscitation apparatus 6.7 Fire blanket	1.00		1.50
7. Ship Fire-fighting Organization 7.1 General emergency alarm 7.2 Fire control plans and muster list 7.3 Communications 7.4 Personal safety procedures 7.5 Periodic shipboard drills 7.6 Patrol system	0.75		
8. Fire-fighting Methods 8.1 Knowledge of fire safety arrangements 8.2 Fire alarm and first action 8.3 Fire fighting	0.75	1.00	
9. Fire-fighting procedures	0.75		
10. Fire-fighting drills 10.1 Small fires 10.2 Extensive fires 10.3 Drills in smoke-filled spaces			4.50
Review and Assessment	1.50		
Subtotals	10.50	1.50	6.00
Total	18.00		

COURSE TIME TABLE

FIRE PREVENTION & FIRE FIGHTING

	Session 1 0930 ~ 1100	Session 2 1110 ~ 1240	LUNCH	Session 3 1330 ~ 1500	Session 4 1510 ~ 1640
Day 1	Subject: 1. Introduction Safety & Principles 2. Theory of fire 2.1 To 2.4 Theory	Subject: 2. Theory of fire (Contd.) 3. Fire prevention 3.1 To 3.2 Theory(1.0Hr)/Film(0.5Hr)		Subject: 3. Fire Prevention (Contd.) - 3.3 4. Shipboard fire Fighting organization 7.1 To 7.6 5. Fire Fighting Methods- 5.1 To 8.3 Theory	Subject: 6. Fire Fighting Equipment 6.1,6.3,6.5 9. Fire Fighting Procedure Theory
Day 2	Subject: 6. Fire Fighting Equipment 6.1 to 6.7 Practical	Subject: 10. Fire Fighting Drill 10.1 To 10.3 Practical		Subject: 10 Fire Fighting Drill (Contd.) 10.1 To 10.3 Practical	Subject: 10 Fire Fighting Drill (Contd.) 10.1 To 10.3 Practical
Day 3	Subject: 4. Fire Detection System & Alarms 4.1 To 4.2 5. Fixed Fire Extinguishing System 5.1 To 5.3 Theory	Subject: 5. Fixed Fire Extinguishing System 5.4 To 5.6 Theory		Subject: 8. Fire Fighting Methods 8.1 To 8.3 Theory/Film(1.0 Hr)	Review & Final Assessment ALL

OBJECTIVES

- 1. To prepare the seafarers to work on board in safe environment.**
- 2. Safety of life, which minimizes the loss of men, material and environment.**
- 3. To reduce the risk of fire on board.**
- 4. To maintain the state of readiness, thereby building confidence in responding to emergency situation with cool head.**
- 5. Familiarize to the use of various shipboard organizations to deal in case of fire.**
- 6. Familiarize to the use of various portable fire extinguishers and fixed installation for fire fighting.**
- 7. Familiarize to the use of various life supporting/ saving equipment on board.**
- 8. Finally to fight and extinguish fire with minimum damage to man and material.**

ABBREVIATIONS

FIRE	FIND, INFORM, RESTRICT, EXTINGUISH OR ESCAPE
LFL	LOWER FLAMMABLE LIMIT
UFL	UPPER FLAMMABLE LIMIT
PAS	PUBLIC ADDRESS SYSTEM
CO₂	CARBON DIOXIDE
O₂	OXYGEN
BA	BREATHING APPARATUS
CABA	COMPRESSED AIR BREATHING APPARATUS
SCBA	SELF CONTAINED BREATHING APPARATUS
ERP	EMERGENCY RESPONSE PLAN
ER	ENGINE ROOM
GRT	GROSS RATED TONNAGE
HALON	HALOGENATED HYDROCARBON
FM 200	FIRE MASTER 200 (HEPTA FLUORO PROPANE)
H_x FOAM	HIGH EXPANSION FOAM
L_x FOAM	LOW EXPANSION FOAM
M_x FOAM	MEDIUM EXPANSION FOAM
DCP	DRY CHEMICAL POWDER
IMO	INTERNATIONAL MARITIME ORGANISATION
FRP	FIRE RESPONSE PLAN
FFA	FIRE FIGHTING APPLIANCES
LSA	LIFE SAVING APPLIANCES

CHAPTER – 1

INTRODUCTION, SAFETY AND PRINCIPLES

THE BASIC FAMILIARISATION COURSE IN FIRE PREVENTION AND FIRE FIGHTING WAS PREPARED AS PER THE GUIDELINES OF THE DIRECTORATE GENERAL OF SHIPPING. THIS COURSE IS MANDATORY FOR ALL SEAFARERS BEFORE BEING EMPLOYED ON BOARD SEAGOING SHIP AND COVERS THE RECOMMENDED TRAINING AS PER REGULATION VI / I OF THE STANDARD OF TRAINING CERTIFICATION AND WATCH KEEPING FOR SEAFARERS (STCW) CONVENTION 1978 AS AMENDED IN 1995. THE REQUIREMENTS AS PER 2010 MANILA AMENDMENTS AND SUBSEQUENT DGS TRAINING CIRCULAR 03 OF 2012 HAVE ALSO BEEN INCORPORATED IN THIS COURSE.

PRINCIPLES OF SURVIVAL IN FIRE

- Knowledge of Theory of Fire
- Regular training
- Preparedness for fire emergency
- Knowledge of escape routes
- Knowledge of dangers
- Regular inspection and maintenance

CHAPTER -2.

THEORY OF FIRE

1. CONDITIONS OF FIRE

Fire is an external sign of chemical reaction between the combustible substance i.e. combination of carbon & hydrogen with oxygen in the presence of heat, resulting in the release of heat energy. To start a fire either a spark or a flame having a certain minimum energy is to be brought in contact with substance.

The three basic components of fire are:-

- (a) Fuel : Could be liquid, solid or gas.
- (b) Heat : Could be a flame, spark, produced by Friction or continued rise in temperature.
- (c) Oxygen : Air (21% Oxygen)

In order to avoid a fire these three components should not be allowed to come in contact with one another and to fight a fire any one of the three components is to be removed. The main aim in fire fighting should be either to reduce the temperature or stop the supply of air or cut off the fuel supply.

Most fire fighting techniques try to restrict any two of the three components, though any one will extinguish the fire.

To cause a fire, as stated previously three components are required which can be represented in the form of a triangle called the “TRIANGLE OF FIRE”



(Fig: 2.1 - Fire Triangle)

If any one of the sides is removed the fire will collapse or combustion will cease.

Once the fire starts, another phenomenon comes into operation. This is known as “CHAIN REACTION” and now the fire square is formed as is shown below:



(Fig: 2.2 - Fire Tetrahedron)

So the basic principle of fire fighting is to break the fire triangle by removing one of the sides before it converts itself into a fire square, which will be difficult afterwards to control.

IGNITION SOURCES

To start a fire heat / ignition source is required & to prevent a fire adequate attention should be paid towards not to allow spark / heat to come in contact with fuel. Heat is a form of energy & can be generated in the following ways: -

1. Chemically
2. Electrically
3. Physically / Mechanically
4. Biologically

1) **Chemically** : Chemical heat energy is the amount of heat released in the complete oxidation of a substance and is called the heat of combustion.

Spontaneous combustion : The chemical structure of some materials are more prone to oxidation. In these materials the absorption of oxygen is more because of this the liberation of heat is intensified and the ignition temperature (lowest temp to which a substances is heated to get ignited) powered. In some substances can start combustion even at normal temperatures.

2) **Electrically** :- Electrical heat energy is generated by resistance heating, induction heating and static electric heating. In static electric heating an electric

charge accumulates between 2 material surfaces when brought together & separated thereby charging one surface positive and the other negative. If they are not grounded they can produce sufficient electric charge to cause a spark and when in contact with flammable vapors can cause fire. Even fuel flowing through a pipe can accumulate sufficient static charge of electricity to ignite flammable vapors.

3) **Mechanical** :- Majority of fires onboard ship are caused by mechanical heat energy which can be generated by friction like working on grinder in presence of flammable gases or compression as in diesel engine.

4) **Biological** :- Biological heat energy is released as a result of chemical reaction of biological agents like bacteria e.g. fermentation of wheat dough, sugar of alcohol & the heat released can ignite flammable gases.

2. FLAMMABLE MATERIALS

Flammability :- It is defined as ability of a substance to burn. In the right proportion, vapors given off by a flammable material when mixed in air can burn in the presence of an ignition source.

Ignition Point :- It is defined as the lowest temp to which a flammable substance is heated to get ignited.

Burning Speed :- The rapid propagation of the flame front through a flammable vapor and air mixture is called burning speed. When flammable vapors and oxygen are present in the right quantity to oxidize it completely any ignition will produce the most rapid propagation of flame.

Thermal Values :- Thermal value is the amount of heat produced per unit weight of fuel during combustion.

Lower Flammable Limit :- Flammable vapors in air below which there is insufficient hydrocarbon to support and propagate combustion irrespective of the presence of ignition source is called LFL.

Upper Flammable Limit :- The density of hydrocarbon gas in air above which there is insufficient air to support & propagate combustion is called the upper flammable limit. (UFL)

Flammable Range :- It is defined as the range of concentration of hydrocarbon gas in air between lower & upper flammable limits within which it can cause combustion in presence of an ignition source.

Inerting:- It is the process by which the amount of oxygen is reduced to less than 8% in the tank by the injection of an inert gas.

Static Electricity:- The positive and negative electrical charge produced between two substances when united and then separated are said to be statically electrified.

Flash Point: - The lowest temperature at which a liquid gives off enough gas to form flammable vapours near the surface of liquid.

Auto Ignition :- It is the ignition of the material without the aid of an ignition source i.e. spark or flame, especially when its temperature has been raised, self sustaining combustion takes place e.g. coal, jute, cotton, paper etc.

3. FIRE HAZARDS AND SPREAD OF FIRE

FIRE HAZARDS FROM PETROLEUM CARGO

Potential For Fire and Explosion

Volatility is the ability of the liquid cargo to vapourise. Volatility increases with temperature and reaches a maximum at the boiling temperature of the liquid. Liquids with flashpoint below 60°C are considered volatile. (The flashpoint of oil indicates the lowest temperature at which the oil will give off sufficient hydrocarbon vapour to form a flammable gas mixture with air near the surface of the oil). At a given temperature there will be just sufficient liquid vapour lying on the surface of the liquid to produce a flammable mixture at that point.

The ability of petroleum to create vapour is a major factor. In order to eliminate the risk of fire and explosion on a tanker, it is necessary to avoid a source of ignition and a flammable atmosphere being present in the same place at the same time. It is not always possible to exclude both these factors and precautions are therefore directed towards excluding or controlling one of them.

When hydrocarbon vapour is mixed with oxygen (usually from the atmosphere) an explosive mixture is produced. A mixture of hydrocarbon vapour and air will only ignite and burn if its composition is within the 'flammable range'. The working flammable range of a mixture of petroleum vapour and air can be taken to be from 1% to 10% by volume. The use of inert gas in cargo tanks can reduce the oxygen content below that necessary to produce a flammable mixture. When an inert gas, typically flue gas, is added to a hydrocarbon gas/air mixture the result is to increase the lower flammable limit hydrocarbon concentration and to decrease the upper flammable limit.

FLAMMABILITY CLASSIFICATION

There are many classification systems for defining the flammability characteristics of petroleum liquids, most of which are based on Flashpoint and Reid Vapour Pressure data.

For the purpose of this guide, which deals primarily with the particular conditions associated with handling petroleum cargoes in tankers and terminals, the division of such liquids into the two broad categories of non-volatile and volatile, as defined below, is in general sufficient to ensure that proper precautions can be specified.

Non-Volatile

Flashpoint of 60°C or above, as determined by the closed cup method of testing.

Volatile

Flashpoint below 60°C, as determined by the closed cup method of testing.

**PROPERTIES AND HAZARDS OF LIQUEFIED GAS
TYPES OF GAS CARRIERS**

IMO divides liquefied gases into the following groups:

- LPG - Liquefied Petroleum Gas
- LNG - Liquefied Natural Gas
- LEG - Liquefied Ethylene Gas
- NH₃ - Ammonia
- Cl₂ - Chlorine
- Chemical gases

The IMO gas carrier code define liquefied gases as gases with vapour pressure higher than 2,8 bar with temperature of 37,8oC.

FIRE HAZARDS FROM LIQUEFIED GAS

These cargoes are normally carried as boiling liquids and, as a consequence, readily give off vapour.

Almost all cargo vapours are flammable. When ignition occurs, it is not the liquid which burns but the evolved vapour. Different cargoes evolve different quantities of vapour, depending on their composition and temperature.

Flammable vapour can be ignited and will burn when mixed with air in certain proportions. If the ratio of vapour to air is either below or above specific limits the mixture will not burn. The limits are known as the lower and upper flammable limits, and are different for each cargo.

Combustion of vapour/air mixture results in a very considerable expansion of gases which, if constricted in an enclosed space, can raise pressure rapidly to the point of explosive rupture.

HAZARDS IN ENGINE ROOM

COMBUSTIBLE LIQUIDS :- Diesel oil, heavy fuel oil, lub oil, grease, sludge and waste oil, Fuel / Oil leaks from pipe lines are prone to ignition.

HOT SURFACES : - Over heating of machine parts, e.g. oil accumulated on steam lines, exhaust pipes and around boilers can catch fire.

HOT WORK : - Welding, cutting and grinding in presence of fuel source can cause fire.

AUTO IGNITION : - Oil dripping on hot surfaces can cause combustion.

HAZARDS IN GALLEY

COMBUSTIBLE MATERIALS : - Cooking oil, hot fat.

HOT SURFACES : - Egg ovens, frying pans.

ELECTRICAL CONNECTION : - Poor electrical wiring, over heating of electrical equipment, hot plates, unattended heating pans, oils can also cause fires.

HAZARDS IN ACCOMMODATION

COMBUSTIBLE MATERIALS : - Clothing, furniture, personal effects, papers, etc. are highly combustible.

MATCHES & CIGARETTES SMOKING : - Avoid smoking in bed.

ELECTRICAL CONNECTION : - Short circuits in music systems, TV sets VCRs, washing machines, refrigerators, geysers etc.

HAZARDS IN CARGO HOLDS

SELF HEATING CARGO : - Like diesel oil, heavy oil, lube oil, dirty oil.

OXIDIZING CARGOES :- Organic peroxides.

COMPRESSED FLAMMABLE GAS :- LPG, butane etc.

EXPLOSIVES :- TNT, etc.

SPREAD OF FIRE

Fire spreads in three different ways, they are:-

a) **CONDUCTION**:- transfer of heat within a substance from high temperature to low temperature by direct contact between the particles of solid by means of elastic waves. Heat energy is passed from one molecule to another.

b) **RADIATION**:- Is a transfer of heat by temperature excited electromagnetic waves. Thermal energy is converted into radiant energy. Heat may also be transmitted in a straight line through empty space without the use of a medium. Radiant energy travels at the speed of 3×10 meters per second.

c) **CONVENTION CURRENTS:-** Transfer of heat is by actual physical movement of fluid particles. When a liquid or a gas is heated, it expands and becomes less dense and rises up and is displaced by colder liquid or gas. So a circulation is set up. Heat energy is carried throughout the liquid by actual movement of particles.

4. CLASSIFICATION OF FIRE AND EXTINGUISHING AGENTS

Fires are of four types namely class 'A', 'B', 'C' and 'D' fires according to the nature of combustible materials involved.

CLASS "A" FIRES

1. Fires involving solid materials, usually of an organic nature, in which combustion normally takes place with the formation of glowing ambers. Examples of such fires are bedding, clothing, cleaning rags, wood, canvas etc.
2. Cooling by large quantities of water or use of fire extinguishers containing water is very important to fight fires of such ordinary materials. Cooling the source of fire and surrounding areas should continue long enough to prevent any possibility of re-ignition.

CLASS "B" FIRES

1. Class 'B' fires or liquid fuel fires or liquid fuel fires. Foam is an efficient agent for fighting most liquid fuel fires. This method is also called smothering. Foam is directed in the form of a jet against any vertical surface adjacent to the fire to build up an unbroken smothering blanket. The principal is not to allow fresh air to the liquid/oil fire and if oxygen can be sufficiently reduced, the fire will extinguish. The foam forms a coating over liquid burning fuel, which besides limiting the supply of air also slows down, or stops forming of flammable fuel vapor.
2. Liquid fuel fire or "class 'B' fires" can also be fought by method called "Starvation" i.e. cutting of the fuel supply to the scene of fire by draining of fuel from burning fuel oil tank. By closing the concerned fuel supply valve or by stopping the fuel pump if the fuel lines is leaking from a flange joint or is holed.
3. Dry chemical powder type extinguishers can also be used on class B fires as it inhibits the combustion process by intercepting the chemical reaction.

CLASS "C" FIRES.

1. Class C fires or gas fires / liquid petroleum gas fires where possible, such fires are extinguished by stopping the gas flow. If the flow of gas cannot be

stopped, then the best way may be to cool and control the effect of radiant heat by water spray.

2. In order to reach and close the valve controlling the flow of gas, it may be necessary to extinguish flames from small leaks in its vicinity. In this case dry chemical powder extinguisher should be used.
3. Water jets should never be used directly into a liquefied petroleum gas fire. Foam is also not effective in controlling such fires.

CLASS “D” FIRES

1. Class ‘D’ fires or metallic fires are those fires which can be extinguished by powdered graphite, powdered talc, soda ash, lime stone and dry sand. The powder mixtures are directed on such fires under pressure (mostly CO-2 in portable extinguishers.)

ELECTRICAL EQUIPMENT FIRES

Such fires may be class A,B,C, or D. This may be caused by short circuit, over heating or the spreading of a fire from elsewhere. The immediate action should be to de- energize the equipment (i.e. switch off supply from the immediate switch or junction box or from main switchboard.) then a non – conducting agent, such as carbon dioxide, halon or dry chemical powder should be used to extinguish the fire.

FIRE FIGHTING AGENTS

FIRE FIGHTNG MEDIUM – WATER . On the basis of thermal capacity and latent heat of vaporization, water is a excellent fire fighting medium. This fact, combined with its availability in large quantities, make it by far the most useful fire extinguishing medium for general purposes. Water is fairly stable except at very high temperatures and is unlikely to decompose in most fire situations. It may be applied in a solid jet to class “A” fires involving solid materials such as wood, paper and fabrics achieving deep penetration to the seat of the fire. A fine spray of water is effective in extracting heat from the flames from burning liquids without seriously disturbing the surface of the liquid. Water spray curtains are also used to protect the front of superstructure facing the cargo tank deck and deck mounted cargo tanks from deck spillage fires on gas and chemical tankers. Water spray curtains generated at the nozzle of hand held hoses are also effective for the protection of the fire fighter.

The disadvantage with the use of water are :-

- (a) It conducts electricity
- (b) It cause damage to cargo and machinery
- (c) It can cause considerable loss of stability when used in large quantity.
- (d) It may aggravate the fire if used on cargoes, which emit flammable gases when wet.

FIRE FIGHTING MEDIUM – FOAM

Foam is the most suitable medium for extinguishing fires involving flammable liquids. Extinguishing is achieved by forming a layer of small bubbles on the surface of the liquid preventing fuel vaporizing and restricting the oxygen supply after extinguishing the flames, the foam blanket should be maintained to allow the surrounding structure to cool below the ignition temperature of the liquid.

FIRE FIGHTING MEDIUM – CARBON DIOXIDE

At normal temperatures, carbon dioxide is a gas 1.5 times as dense as air. It is easily liquefied and bottled. It is normally contained under a pressure in steel cylinders. As a fire extinguishing medium it acts as follows :-

When carbon dioxide is applied to a fire, the liquid CO₂ boils off rapidly as a gas extracting heat from the surrounding atmosphere. The gas, however, extinguishes by smothering, or reducing the oxygen content of the air. About 20 – 30 percent of the atmosphere should contain CO₂ to completely extinguish the fire. This varies accordingly to the nature of the burning material. In fact materials which supply their own oxygen will continue to burn, as will any material that tends to decompose the carbon dioxide, such as burning magnesium. Apart from this consideration, carbon dioxide is quick and clean, non conductor of electricity, non toxic and does not harm most fabrics.

For fire situations in cargo and machinery spaces, where complete flooding of the compartment is desirable. Fixed carbon dioxide installations may be provided.

The advantages of carbon dioxide are

- (a) It does not conduct electricity.
- (b) It is non corrosive.
- (c) It leaves no residue.
- (d) It is not subject to deterioration in quality with age.
- (e) It is easily available.

Its main disadvantages are :-

- (a) It is highly asphyxiating, a concentration of about 9 % could cause unconsciousness within a few minutes.
- (b) It has little or no cooling effect.
- (c) When discharged, particles of solid carbon dioxide are normally present and can generate sufficient static electricity to produce an incentive spark which could ignite flammable atmosphere such as may be found in ships. For this reason carbon dioxide is unsuitable as an inerting medium in cargo oil tanks and pump rooms.

FIRE FIGHTING MEDIUM – HALOGENATED HYDROCARBONS (HALONS)

Halons are extremely effective extinguishing agents which have been used for some time in land based installations and in the field of aviation but due to their toxic properties not been accepted for use in the marine environment. The halogenated hydrocarbons used for extinguishing fires have the property of vaporizing readily when heated and are, therefore generally known as vaporizing liquids. They form a dense, heavier than air cloud of non flammable vapor, which blankets a fire by the displacement of air flame propagation in the burning material. The advantages of halon are :-

- (a) It achieves incredibly rapid extinguishment of fires.
- (b) It leaves no residue.
- (c) Halon 1301 containers can be located inside or outside some protected spaces.
- (d) At the extinguishing concentration required, Halon 1301 and 1211 are slightly toxic but have no after effects for exposure of a few minutes.

The disadvantages are:-

- (a) It is not so effective against solid materials in which fire quickly becomes deep seated.
- (b) It has little cooling effect.
- (c) It is unsuitable for use against combustible chemicals that contain Oxygen, reactive metal and metal hydrides.
- (d) The medium is expensive in comparison with CO₂.

FIRE FIGHTING MEDIUM – DRY CHEMICAL POWDER

New problems have been produced for the fire fighter by the use in industry of an ever widening range of materials. Water can be often not be used on most fires involving burning metals, the result of applying water can be explosively disastrous and so new methods of extinction have been evolved. Chief among these is powdered chemicals which are stored in cylinders under pressure or which can be ejected by the release of the gas under pressure.

The basis of most chemical powders is Sodium bicarbonate. This with the addition of metallic stearate as a water proofing agent is widely used as an extinguishing agent, not only in portable extinguishers but also for general application in large quantities. Apart from stearates, other additives are sometimes used to decrease the bulk density and to reduce packing in the cylinder.

FIRE FIGHTING MEDIUM – SAND

Some burning materials, such as metals, which cannot be extinguished by the use of water, may be dealt with dry earth, dry sand, powdered graphite, powdered talc, soda ash or limestone, all of which act as a smothering agent. Dry Sand may also be used to prevent burning liquids, such as paint and oils.

CHAPTER – 3

FIRE PREVENTION

1. FIRE PREVENTION PRINCIPLES

The concept of preventing outbreak of fire or reducing the risk of spreading and avoiding the danger from fire to personnel and property is termed as fire prevention.

The ultimate aim is to prevent outbreak of fire. It must be however realized that perfectness is unlikely to be achieved due to engineering compromise or human error. For example, electrical faults, which could give risk of fire cannot be totally eliminated but can be minimized by good design, construction and installation.

2. SHIP CONSTRUCTION ARRANGEMENTS

Basic principles:

The following basic principles are embodied in the regulations as appropriate having regard to the type of ships and the potential fire hazard involved

1. Division of ship into main vertical zones by thermal and structural boundaries,
2. Separation of accommodation spaces from the remainder of the ships by thermal and structural boundaries.
3. Restricted use of combustible materials.
4. Detection of any fire in the zone of origin.
5. Containment and extinction of any fire in the spaces of origin.
6. Protection of means of escape or access for the firefighting.
7. Ready availability of fire extinguishing appliances.
8. Minimization of possibility of ignition of flammable cargo vapors.

CLASSIFICATION OF DIVISIONS: Divisions are of three types:

1. 'A' CLASS
2. 'B' CLASS.
3. 'C' CLASS

'A' CLASS: are those divisions formed by bulkheads and decks which comply with the following:-

1. They are constructed of steel or other similar materials.
2. They are suitably stiffened.
3. They are so constructed as to be capable of preventing the passage of smoke or flame to the end of one hour standard fire test. They are insulated with approved non combustible materials such that the average temperature of the exposed side will not rise more than 130 degree centigrade above the original

temperature nor will the temperature at any point including any joint rise more than 180 degree centigrade above the original temperature.

‘B’ CLASS: These divisions are formed by bulkheads, decks, ceiling or linings, which comply with the following:-

1. They are so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test.
2. They have an insulation value such that the average temperature of the exposed side will not rise more than 130 degree centigrade above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225 degree centigrade above the original temperature.
3. They are constructed of approved noncombustible materials and all materials entering into the constructions and erections of 'B' class divisions shall be noncombustible.

‘C’ CLASS: These are constructed of approved noncombustible materials for bulkheads, ceilings and linings (not requires to possess any resistance to either smoke or flame), however, use of combustible veneers are permitted within regulations.

MEANS OF ESCAPE: Stairways and ladders shall be so arranged as to provide. From all accommodation spaces and from spaces in which the crew is normally employed, other than machinery spaces, ready means of escape to the open deck and thence to the lifeboats and life rafts. In particulars the following general provisions shall be complied with.

1. At all levels of accommodation shall be provided at least two widely separated means of escape from each restricted space or group of spaces.
2. Below the lowest open deck the main means of escape shall be a stairways and the second escape may be a trunk or a stairway.
3. Above the lowest open deck the means of escape shall be stairways or doors to an open deck or a combination thereof.
4. Exceptionally the administration may dispense with one of the means of escape, due regard being paid to the nature and location of spaces and to the numbers of person who normally might be quartered or employed there.
5. No dead end corridors having a length of more than 7 m shall be accepted. A dead end. A dead end corridor is a corridor or part of a corridor from which there is only on escape route.

If a radiotelegraphs station has no direct access to the open deck, two means of access to or d egress from such station shall be provided. One of these may be a porthole or window of sufficient size or other means to the satisfaction of the administration, to provide an emergency escape except for ships of less than 1000 GRT two means of escape shall be provided from each machinery space of category a in particular one of the following provisions shall be complied with.

1. Two sets of steel ladders as widely separated as possible leading to doors in the upper part of the space similarly separated and from which access is provided to the open deck. In general, one of these ladders shall be provided

continuous fire shelter from the lower part of the space to a safe position outside the space.

2. One steel ladder to a door in the upper part of the space from which access is provided to the open deck. Additionally in the lower part of the space and in a position well separate from the ladder a steel door shall be provided capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the open deck.

From machinery spaces other than those of category a, Escape routes shall be provided to the satisfaction of the administration having regard to the nature and location of the space and whether persons are normally employed in that space.

3. SAFE PRACTICES

MAIN CAUSES OF FIRE ONBOARD SHIPS

Fire aboard a ship can be started by various sources, but as per the analysis of previous accidents in past following were found out as major causes.

OIL LEAKAGE IN ENGINE ROOM :- There are many types of oils present in any- engine room. Not only basic engine fuel, but various kinds of lubricants are also present. Oil leakage is an ever present fire hazard. This may result from :

- (a) Corroded pipelines, which should be replaced & accumulation of oil should be checked.
- (b) Old and worn out oil seals should be changed.
- (c) Malfunction of fuel separators should be checked and repaired.
- (d) Repairs on oil pipe lines to be done carefully taking all the precautionary measures.
- (d) Dirty oily rags should not be left lying around in the Engine Room and should be stored in proper designated covered containers.

SMOKING:- Smoking is a well known causes of fire any where. Onboard ships smoking is to be restricted to marked areas only. Smoking in bed must be prohibited & use of proper ash trays to be made while extinguishing cigarettes. It may be noted that on board certain ships such as oil tankers no smoking is permitted any where on the weather decks.

OVERHEATING OF BEARINGS :- A ship contains large number of running machinery. Poor lubrication may result in overheating of bearing leading to fire. It is mandatory to have a safety device or cut out for the machinery to stop in case of failure of lubrication system.

GALLEY APPLIANCES :- Almost all ships have hot plates for cooking food in the galley. In addition fat fryers and hot cases are also provided. Each of these galley appliances are a potential fire hazard if not carefully exploited. They must be switched off when not in use. Their electrical wiring must have insulation as per classification to prevent over heating and burning.

HOT WORK :- Any hot work such as welding, cutting or brazing is another potential fire hazard. No hot work may be carried out without completing the required checklist and clearance from Chief Engineer and Chief Officer. In port approval of the port authority is mandatory prior to commencement of hot work. When ever hot work is carried out, portable fire extinguishers and water bucket & sand bucket must be readily available, while cutting repairing plates & bulkheads be sure that no combustible material is present on the other side of the bulkhead.

ELECTRICAL APPARATUS :- All electrical apparatus must be used as per the operating instructions. Electrical equipment not in use must be kept off. In particular, light and fans in cabins, pantries, stores and saloons must be switched off when not in use. Most accommodation fires have begun due to short-circuiting or overheating of light and domestic electrical appliances. Proper servicing and maintenance record of each equipment must be kept.

REACTION SELF HEATING & AUTO IGNITION :- Certain cargoes are incompatible for stowage together. These must be stowed separately as laid down in the regulations. Some goods require to be protected from water, and that spontaneous combustion is prevented.

ARSON :- Though not a very common cause, a ship is susceptible to unscrupulous elements who may cause damage to the ship by arson. There should be strict security in terms of access to the ship. All visitors must be screened. Personnel who have not work on board should not be permitted on board.

STATIC ELECTRICITY :- Static electricity is a very serious and neglected hazard on board ships, particularly on oil tankers and gas carriers. All laid down checks and precaution must be strictly adhered to during various cargo operations and general ship work.

CARGO SPACE :- The cargo spaces should be properly cleaned, the stowed cargo should be properly ventilated in accordance with the rules, and no smoking during cargo operative must be strictly adhered to.

SPILL CONTAINMENT IN RELATION TO THE FIRE FIGHTING OPERATIONS

The spill containment equipment such as shovels, scoops, buckets etc must be of non-sparking type. The portable pump used for spill collection is generally air operated wildon pump. Electric motor driven pump should not be used for this purpose.

A permanently fitted spill tank, provided with suitable means of draining, is fitted under all ship's manifold, air pipe vent heads etc.

Care should be taken that the sawdust, for cleaning up small oil spills onboard ship, is stowed in a dry condition and, if possible in a cool location. Moist sawdust is liable to spontaneous combustion.

When sawdust has been used to clean up a minor oil spill, the contaminated sawdust should be stowed separately, in a sealed container and in a safe location, clear of the accommodation and hazardous areas.

Any oil impregnated absorbent granules or pads should be stowed in dedicated containers onboard, clear of the accommodation and hazardous areas.

Oil impregnated sawdust and absorbent granules should be disposed of as early as possible, either ashore or via the ship's waste incinerator

Material Safety Data Sheets are available giving the necessary data for the safe handling of the cargo.

Information on the product to be handled should be available on board the ship and should include:

- A full description of the physical and chemical properties, including reactivity, necessary for the safe containment and transfer of the cargo.
- Action to be taken in the event of spills or leaks.
- Counter measures against accidental personal contact.
- Fire-fighting procedures and fire-fighting media.

CHAPTER - 4

FIRE DETECTION SYSTEM & ALARMS

FIRE ALARMS :

An automatic fire alarm and detection system is fitted on board ships, gives fire alarm on bridge and in engine room/ control room on sensing fire. The object of fitting fire detector is to minimize the effects of unwanted fires by sounding alarm to alert ship's personnel before the fire has a chance to grow too large or spread too far. They are fitted in accommodation and machinery spaces. These automatic fire alarms are connected to the fire detectors & give an alarm as detectors are activated. The fire alarm can also be operated manually by breaking the glass of fire alarm switches.

The detectors operate in the presence of fire by reaching to one or more of the three characteristics of fire i.e. smoke, heat and flame. There are three types of detectors which are as follows:

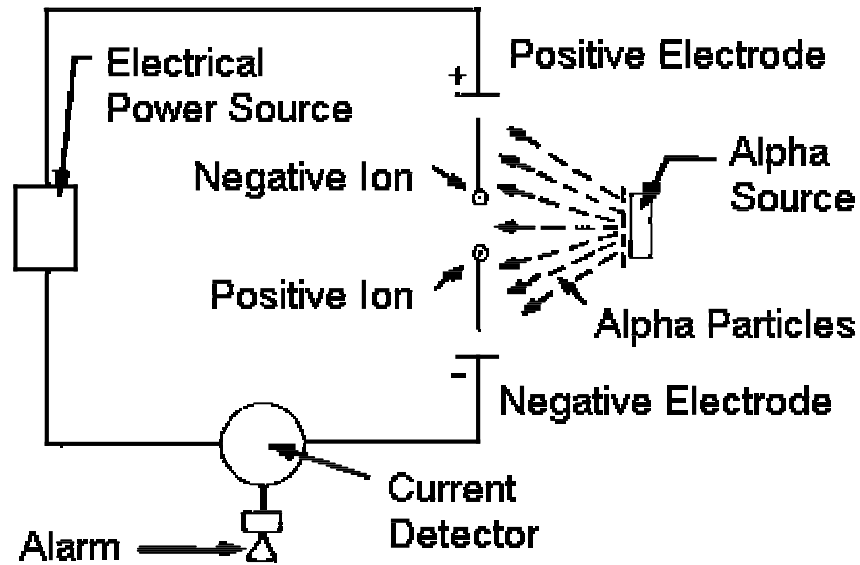
1. Smoke detector
2. Flame detector
3. Heat detector

Smoke detector-

There are two main types of smoke detectors: ionization detectors and photoelectric detectors:

a) Ionization Detectors

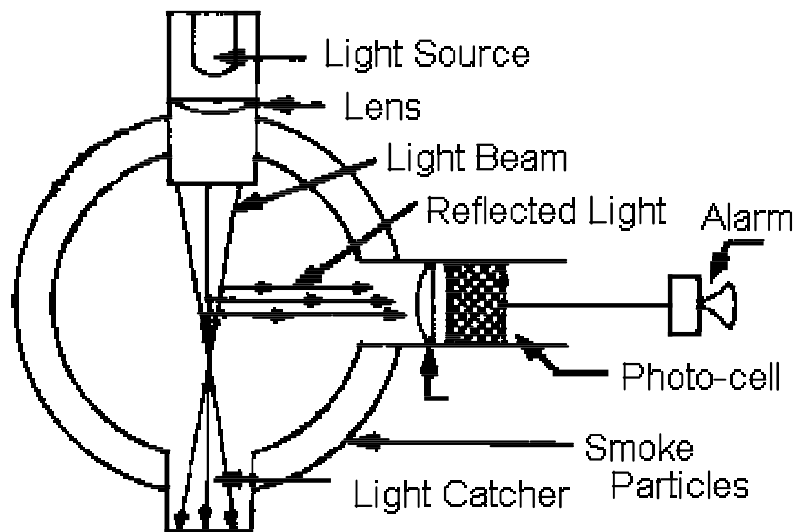
Ionization detectors have an ionization chamber and a source of ionizing radiation. The battery applies a voltage to the plates, charging one plate positive and the other plate negative. Alpha particles constantly released by the source knock electrons off of the atoms in the air, ionizing the oxygen and nitrogen atoms in the chamber. The positively-charged oxygen and nitrogen atoms are attracted to the negative plate and the electrons are attracted to the positive plate, generating a small, continuous electric current. When smoke enters the ionization chamber, the smoke particles attach to the ions and neutralize them, so they do not reach the plate. The drop in current between the plates triggers the alarm.



(Fig:4.1 - Schematic Diagram of the Ionization Type Heat detector)

b) Photoelectric Detectors

In one type of photoelectric device, smoke can block a light beam. In this case, the reduction in light reaching a photocell sets off the alarm. In the other LIGHT SCATTER TYPE of photoelectric unit, however, light is scattered by smoke particles onto a photocell, initiating an alarm.

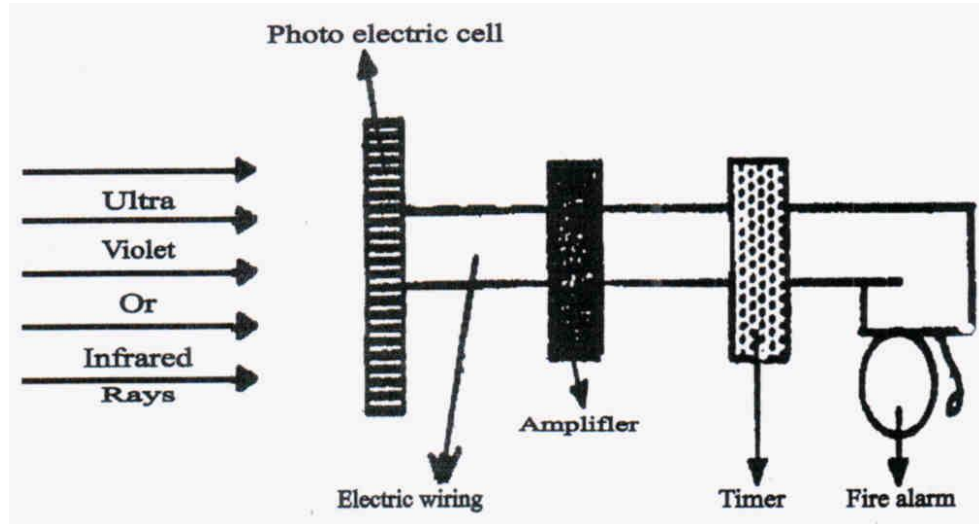


(Fig:4.2 - Schematic Diagram of the Photo-electric Type Smoke detector)

Flame Detector:

- a) Most common type is Infra red type; It is a special device sensitive to the radiation from flame and not to the radiation from other harmless sources such as sunlight, bulb and electric sparks.

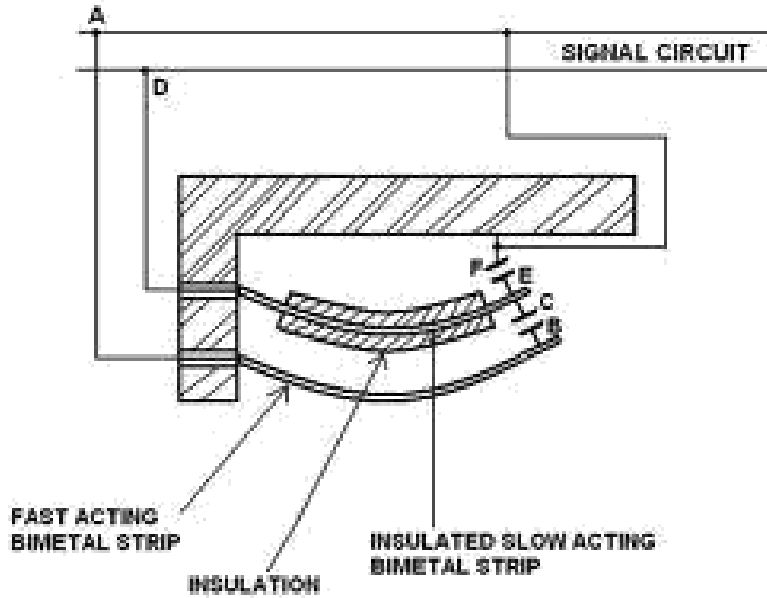
- b) Ultraviolet detector is used where the maximum reliability and rapid response of flame is required. Ultra violet detectors comprise of two electrodes across which a high voltage is applied. The electrodes are enclosed in a glass envelope. In case of fire, when ultra violet radiation is incident, the envelope is filled with an ionized gas that triggers a alarm.



(Fig:4.3 - Schematic Diagram of the IR or UV Type Flame detector)

Heat Detector:-

FIXED TEMPERATURE TYPE:- This type consists of either a bimetallic strip or a soldered joint, the bimetallic type is used to make or break an electrical circuit at a preset temperature. The contacts are encapsulated in a glass chamber to avoid accidental contacts. Soldered joint type consists of two electric contacts joined with low melting point solder thus when the temperature rises the solder melts and the circuit is completed by the action of spring. Bimetallic type detectors are useful in boiler rooms and where rapid change of temperature takes place.



(Fig:4.4 - Schematic Diagram of the Bi-Metallic Type Heat detector)

RATE OF RISE TYPE :- This detector works on the principle that the rate of increase in temperature of the surrounding air is above a given minimum.



(Fig: 4.5 - Smoke, Flame and Heat detectors)

CHAPTER - 5

FIXED FIRE FIGHTING EQUIPMENT

1. GENERAL

Fire fighting on board may be accomplished by single or combination of following methods:

- a) Combustible Material: Separating , covering or removing
- b) Oxygen: Smothering, covering or blanketing
- c) Heat: Cooling
- d) Chain Reaction: Inhibiting

2. SMOTHERING EFFECT SYSTEMS:

The following one or more smothering systems are installed on a ship:

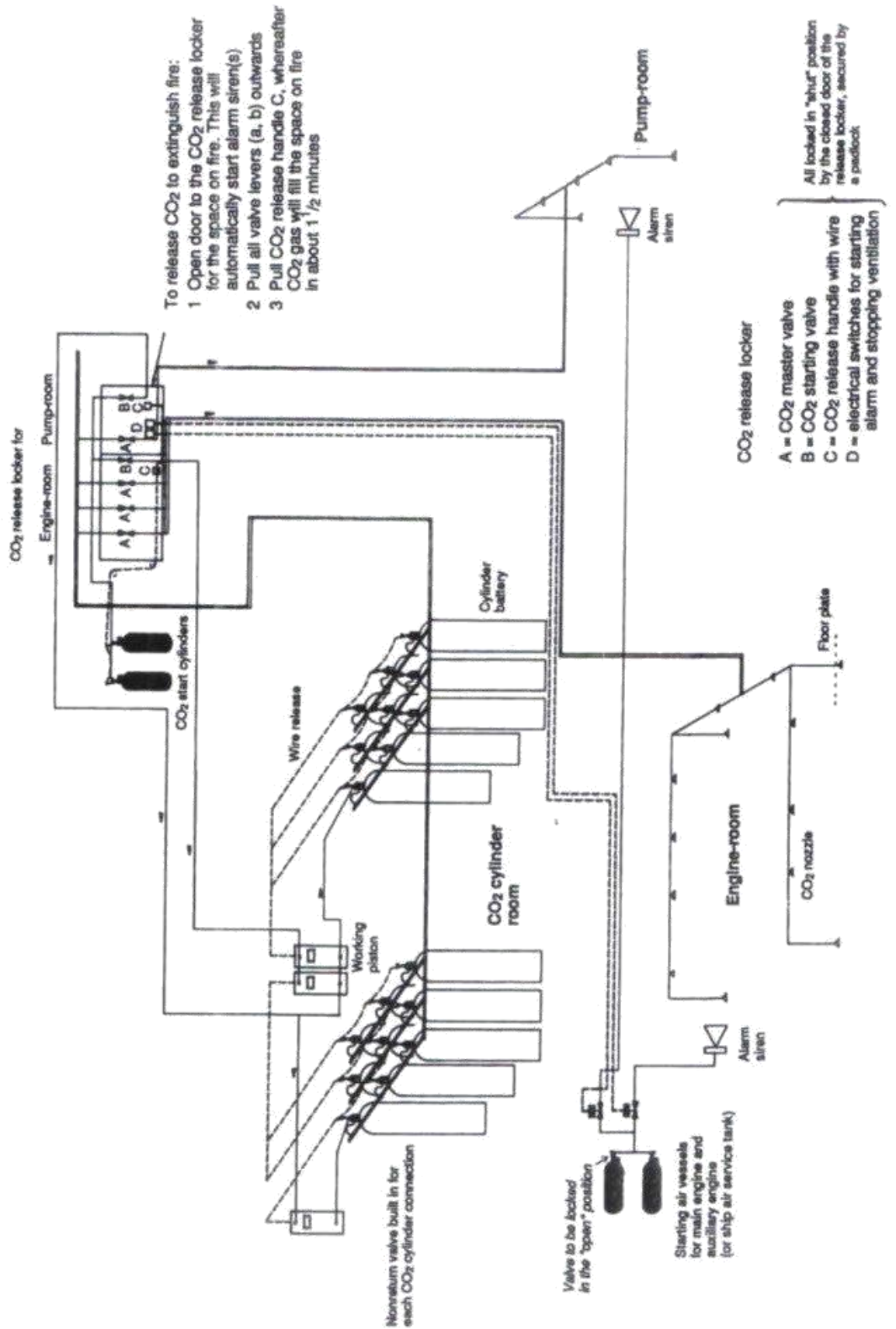
- A) CO-2 Fire extinguishing system.
- B) Foam (Low and High expansion system)
- C) Inert gas system
- D) Halon fire extinguishing system
- E) Dry chemical powder system.

CO₂ FIRE EXTINGUISHING SYSTEM

It is generally used to fight fires in the engine room, pump room, cargo holds, control rooms and paint stores.

The system consists of a number of CO-2 bottles called the battery and has a pipeline network for the above mentioned areas on the ship with diffusing nozzles on each end of the pipe. The capacity of the system is such as to give minimum volume of free gas to the largest machinery space. It can discharge 85 % of the gas in the machinery space in two minutes. Before the ejection of CO-2 in engine room, an audio visual alarm is incorporated in the system and it sounds for sufficiently long period so as to warn crew to evacuate before the release of CO-2 gas. Two separate controls are provided. One is used to discharge the gas from the bottles and the second to direct the gas in the required area. The ventilation of the location to which the gas is injected must be sealed before the injection of the gas.

A typical CO2 Flooding System is shown in the line diagram.



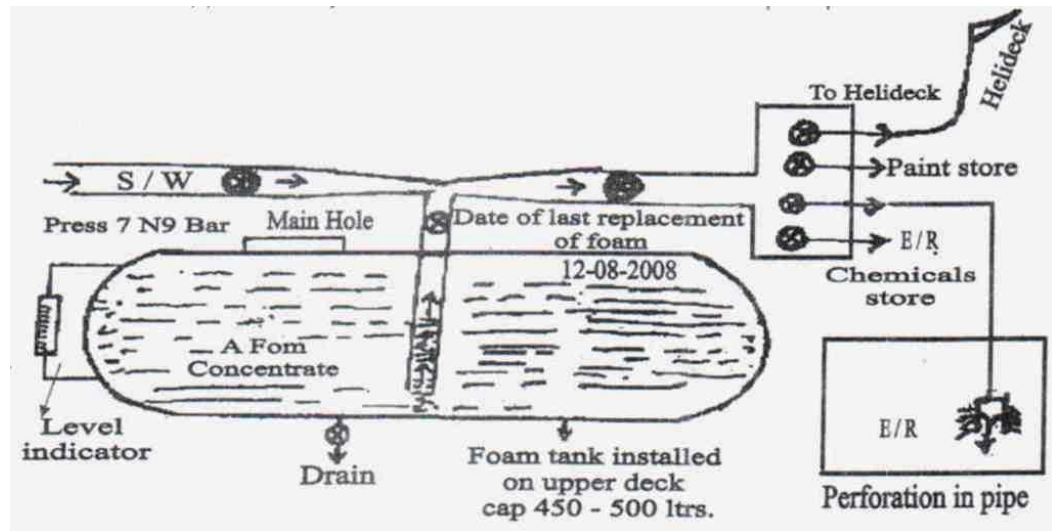
(Fig:5.1 - Schematic Diagram of Typical CO₂ Flooding System)

FOAM (LOW EXPANSION) FIRE EXTINGUISHING SYSTEM.

This system is used to fight fires in engine rooms, cargo spaces, cargo decks, pump room and paint stores.

It is capable of discharging foam through fixed outlets at the rate of 15mm height in 5 minutes to the required single area over which fuel is likely to spread and is suitable for extinguishing oil fires. Means are provided for equal distribution of foam. The expansion ratio should not exceed 12: 1.

The system consists of storage tanks containing foam making compound which are linked with the fire main line. Water flowing in the fire main picks up the compound in the right amount (based on siphoning principle) and is directed to the right part of the ship.



(Fig:5.2 - Schematic Diagram of a basic Fixed Foam Fire Fighting System)

DECK FOAM SYSTEMS FOR OIL, CHEMICAL AND LIQUEFIED GAS TANKERS

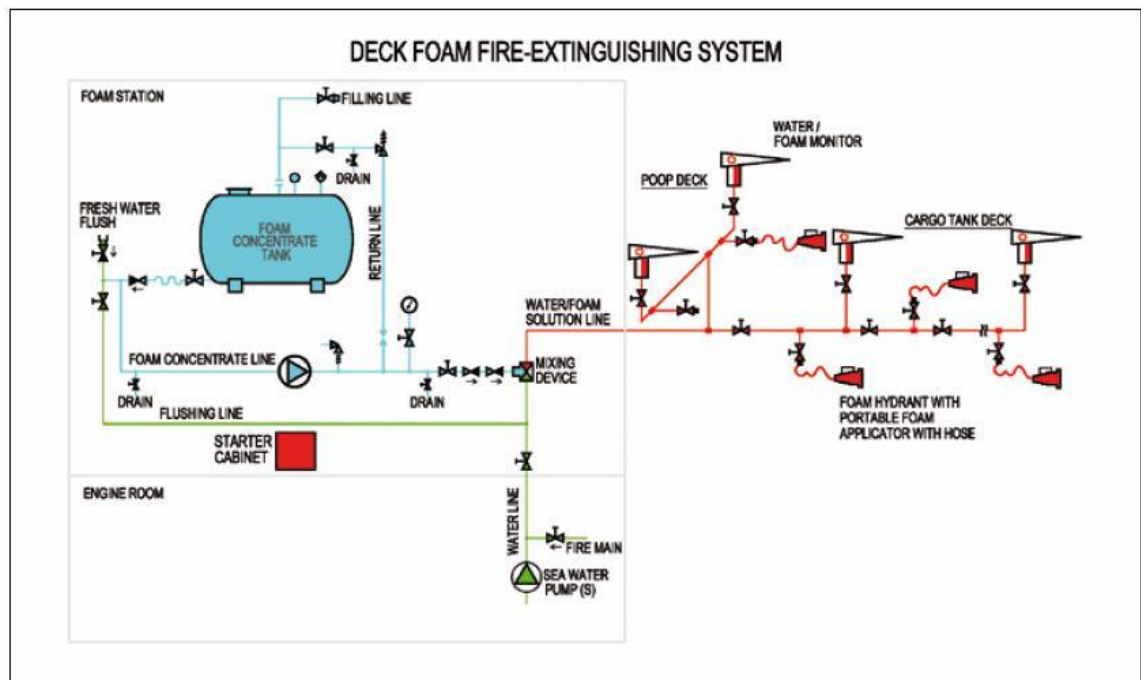
1. Capable of delivering foam to the entire cargo tank deck as well as into a cargo tank if it is ruptured.
2. Control station outside and away from cargo area and readily accessible, simple and rapid operation.
3. Rate of foam not less than 0.6 litres/ m² / minute.
4. Sufficient supply of foam concentrate to produce foam for at least 20 minutes. (IG system fitted).
5. Foam supplied through foam monitors and applicators. (1250 litre/min). Capacity of any monitors at least 3 liter/m² /minute.
6. Capacity of the applicator not less than 400 litres/minute and throw not less than 15 meter.

Description

The system is comprised of the following components:

- Foam tank
- Fire water pump
- Foam liquid pump
- Foam proportioner
- Distribution valves and piping
- Foam monitors / Hoses

Below is an example of a deck foam fire – extinguishing system



(Fig:5.3 - Schematic Diagram of a Typical Fixed Foam Fire Fighting Installation)

The concentrate is contained within a tank and usually introduced into the system by means of a foam pump and venturi proportioner. Water is pumped through the proportioner which contains a venturi restriction. The pressure drop caused by the venturi draws the correct amount of foam compound into the system. The water and foam compound is termed foam solution. At the discharge monitor or branch pipe or nozzles air is entrained to expand the solution into foam.

The cargo deck is normally provided with monitors situated along the centreline. Vessels with stern and bow loading / discharging arrangements are to have suitable foam protection in those areas. Each monitor will be provided with an isolating valve and in the foam main line immediately forward of each monitor there will be a valve to isolate damaged sections of the main.

Foam monitors are manually operated by a lever or geared hand wheel. Cross

winds significantly affect the effective range of a foam monitor. Some tests indicate that in a crosswind of 30 knots the effective range of a deck monitor was reduced to a third of that achieved in still conditions. Other tests show that cross winds of only 10 knots greatly affect the throw of a monitor.

FOAM (HIGH EXPANSION) FIRE EXTINGUISHING SYSTEM

The discharge capacity of this system is 1 meter in depth per minute. Quantity of foam forming liquid is sufficient to provide 5 times the volume of the largest space to be protected. The expansion rate does not exceed 1000: 1. The operation and construction of the system is the same as low expansion fire extinguishing system.

HALON FIRE EXTINGUISHING SYSTEM

The mechanism and construction of this system goes in accordance with the CO-2 system except for the gas used is either halogenated hydrocarbon gas 1211 or 1301.

3. INHIBITOR EFFECT SYSTEMS:

DRY CHEMICAL POWDER SYSTEM

This system is used to fight metallic, gasses, electrical and electronic equipment fires and are used for interrupting chemical reactions. On LPG carriers this is used as a fixed fire extinguishing system.

FIXED DRY POWER EXTINGUISHING SYSTEM FOR LIQUEFIED GAS TANKERS

Vessels carrying liquefied gases in bulk must be provided with a dry chemical powder system for fire protection of the cargo deck area and any bow and stern loading areas. It must be possible to deliver powder to any part of the cargo deck from at least two monitors. An inert gas usually nitrogen, stored in pressurized cylinders is used to pressurize the cylinders.

A monitor is required to protect the areas around the loading and discharge manifolds. It must be capable of being operated locally and remotely, although remote aiming is not required if the entire area is covered from its fixed position. At least one hand hose line and pistol or monitor should be situated at the after end of the cargo area. All hand held line and monitors should be capable of actuation at the hose storage reel or monitor.

The minimum permitted discharge rate for monitors is 10 kg/second and for hand hoses 3.5kg/second. The required capacity is increased with the distance each monitor is required to cover

Each container is to have sufficient powder to provide 45 seconds of discharge for all monitors and hand hoses fed by it.

SYSTEM OPERATION

Nitrogen passing through a reduction valve pressurizes the tank and nozzles fitted in the bottom atomize the contents.

When the current pressure has been achieved, a pilot valve opens the main discharge valve and the dry powder flows through the distribution manifold to the monitor or hand hose line in question.

The pressure during discharge is kept constant by means of a reduction valve placed upstream of the dry powder unit.

Release of the system may be remotely operated from the release boxes utilizing a nitrogen pilot cylinder or alternatively manually operated at the dry powder unit.

The propellant gas system is designed to contain sufficient nitrogen to maintain the pressure during release as well as to clean the pipes and hand hose lines after discharge.

The hand hose line cabinet are mounted in a GRP/FRP box suitable for installation on the weather deck and fitted with a release arrangement, trigger nozzle, and flange connection for the supply pipe.

Monitors are located to ensure coverage of the cargo manifolds on each side of the vessel.

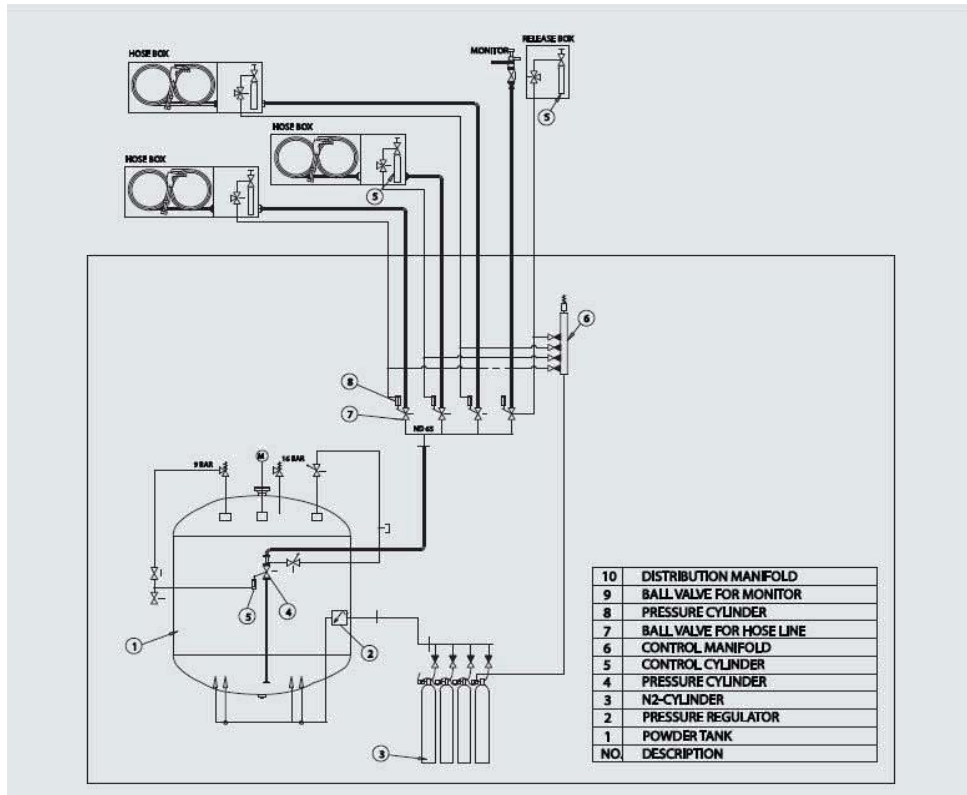
Before operating the system from a hose line cabinet, ensure that all of the hose has been pulled from the cabinet and the discharge pistol is held correctly.

The system can normally be activated from the following locations

Cargo Control Room
Fire Control Centre
Dry Powder Rooms
At the Hand line units

Ensure dry powder rooms are well ventilated prior to entry, particularly after activation of the system.

Below is a line diagram of how a dry powder system operates



(Fig:5.4 - Schematic Diagram of a Typical DCP Fire Fighting Installation)

MAINTENANCE

In general, all dry chemical powder systems should be thoroughly inspected and checked annually by a competent person.

The inspection and maintenance of hand hose line systems will vary with the location and climate conditions.

Dry chemical powder is available in various sized packages. Whatever the container, it should be kept tightly closed and stored in a dry location in order to prevent absorption of moisture. Once the powder has lost its free flowing characteristic, it shall be discharged.

Monitors should be free to move at all times.

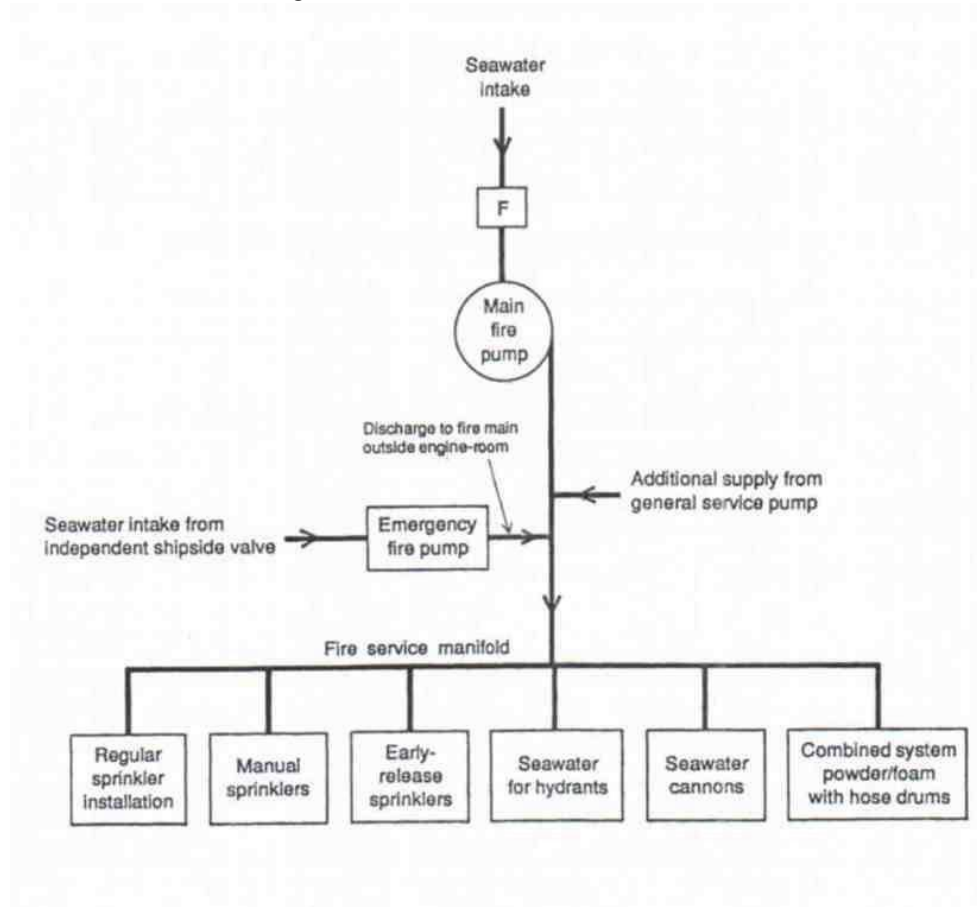


(Fig: 5.5 - A DCP Monitor)

4. COOLING EFFECT SYSTEMS :

SHIP'S MAIN AND EMERGENCY FIRE PUMPS:

Every ship is provided with fire pumps, fire mains, hydrants, hoses and nozzles. The pumps on cargo ships have a total discharge capacity of 180 cu m / hr of water. The arrangement of the hydrants is such that at any part of the ship 2 jets of water can reach. The pumps are centrifugal types and may be driven electrically, by steam or by diesel engine. Hydrant consists of screw down valves controlling an outlet which has a hose connection.

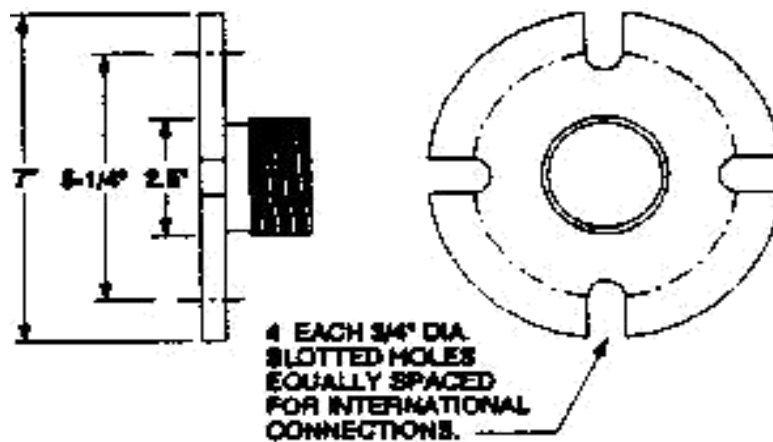


(Fig:5.6 - Fire Main System)

INTERNATI : It is generally located on the bridge and is used to take water supply from external sources i.e. from other ships or shore when own ship is disabled. It has a flange on one side of a particular dimension and the other side as per the hose coupling of the ship.

Standard Dimension of the Flange :

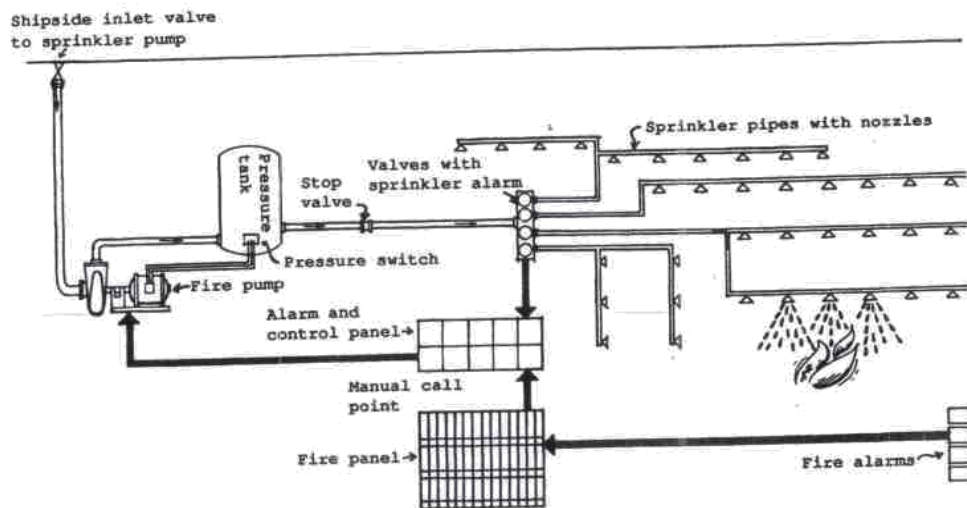
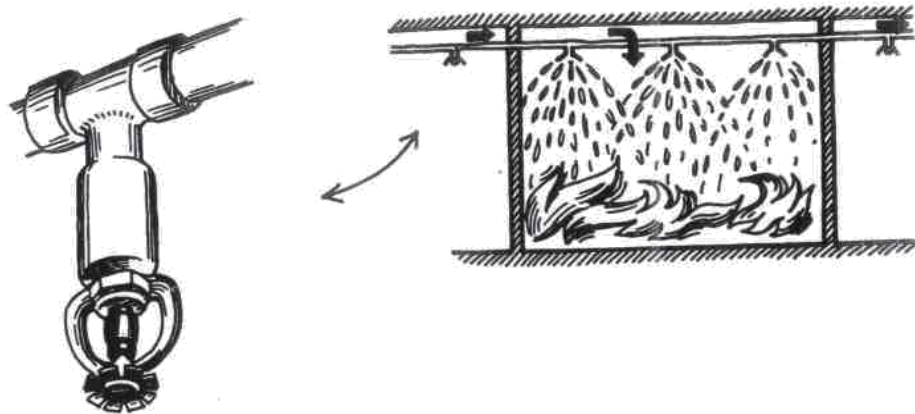
1. Outside Diameter : 178 mm.
2. Inside Diameter : 64 mm.
3. Bolt Circle diameter : 132 mm.
4. Slots in flange : 4 bolts of 19 mm. Diameter placed equidistantly in circle.
5. Flange thickness : 14.5 mm. (minimum)
6. Nuts and bolts : 4 each of 16 mm Diameter and 50 mm length.



(Fig:5.7 - International Shore Connection)

AUTOMATIC WATER SPRINKLER FIRE EXTINGUISHING SYSTEM

Automatic Sprinkler, fire detection and fire alarm system is capable of immediate operation and no action by the crew is required for its operation. Each section of sprinklers has means for giving a visual and audio alarm automatically at one or more indicating units whenever any sprinkler comes into operation. In cargo ships indication is centralized on the bridge. The sprinkler head is fitted with a bulb containing high expansion fluid which bursts due to heat and allows water in the pipes spray. This system is normally fitted in the accommodation.

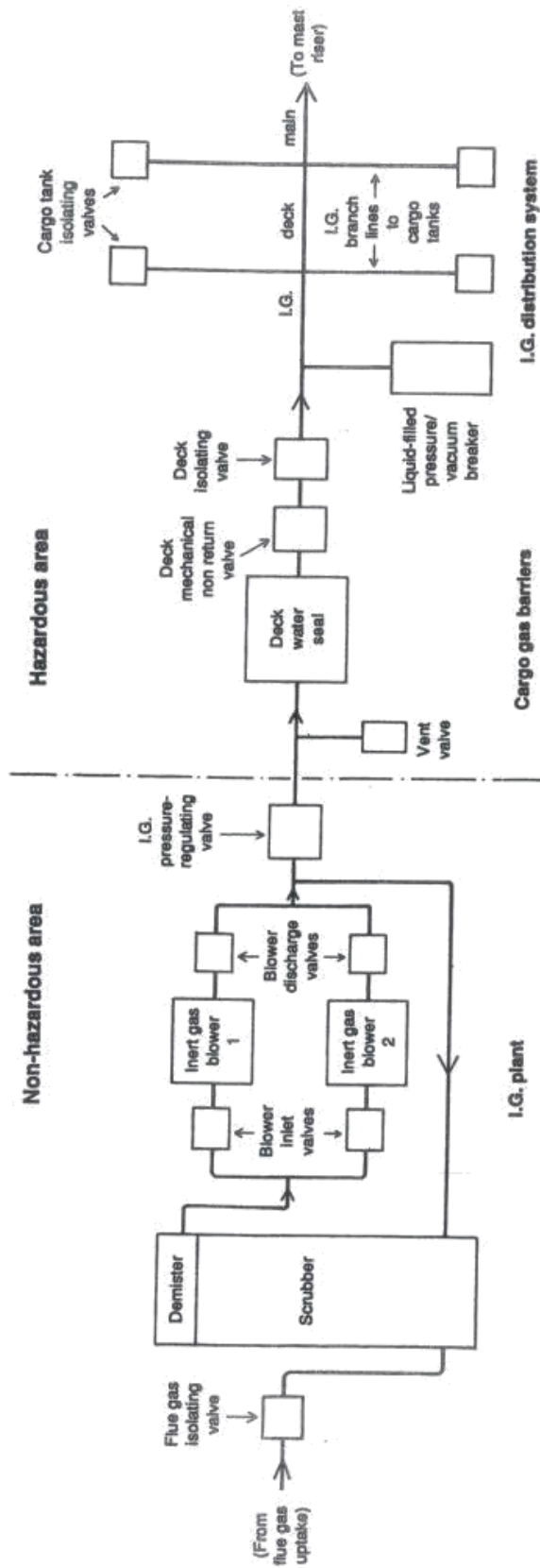


(Fig:5.8 - Schematic Diagram of a Water Sprinkler System)

INERT GAS SYSTEM

This system is so designed and operated so as to render and to maintain the atmosphere of the cargo tanks non-flammable at all times. The system is capable of :

1. Inerting empty cargo tanks by reducing the oxygen content of the atmosphere in tank to a level at which the combustion cannot be supported.
2. Maintaining the atmosphere in any part in the tank with oxygen contents under 8% by volume.
3. Purging empty cargo tank of a hydro carbon gas so that subsequent gas free operations will at no time create a flammable atmosphere in the tank. The system is capable of passing inert gas with oxygen content of under 5% by volume.



(Fig:5.9 - Schematic Diagram of Inert Gas System)

5. EMERGENCY FIRE PUMP

The emergency fire pump is located at a remote place away from the main machinery space so that if the engine room is threatened by fire and the main pump can not be used then power and water is supplied by the emergency fire pump which is connected to the fire main system and is driven by an independent marine engine or by an electric motor whose supply is from emergency switch board.

All the employees on board must know the operation and location of these units. In some ships they are kept in auto start in case fire main supply or electrical supply fails. In case auto start fails the starting handle is always kept near by the engine.

CHAPTER-6

FIRE FIGHTING EQUIPMENT

1. FIRE HOSES AND NOZZLES

Every hydrant is provided with a hose, wheel spanner (to close and open valves) coupling keys and a nozzle (jet, diffuser or spray) hose coupling are of two types:

1. **Standard boynet joint.**
2. **Instantaneous type.**

Nozzles are of three types:

1. **Jet type.**
2. **Spray type.**
3. **Diffuser type.**

Standard approved diameter of nozzles are 12mm, 16mm, and 19mm. 12mm nozzles are used in accommodation and 16 & 19mm nozzles are used in the engine room and machinery spaces and exterior locations. Nozzles are also of dual purpose type i.e. jet / spray type on twisting the rotating sleeve jet is converted into spray and vice versa. Spray gives a cooling effect and helps the fire fighter to approach the fire and jet helps him to extinguish the fire. Proper maintenance and stowing of hoses and nozzles must be done so as to insure their working during emergency. Hoses are made of non perishable materials and are of sufficient length to cover any area required by it . Generally the diameter of the hoses is of 3 configurations, 38mm, 51mm, and 65mm. Two hoses can be coupled together to increase their length if required.

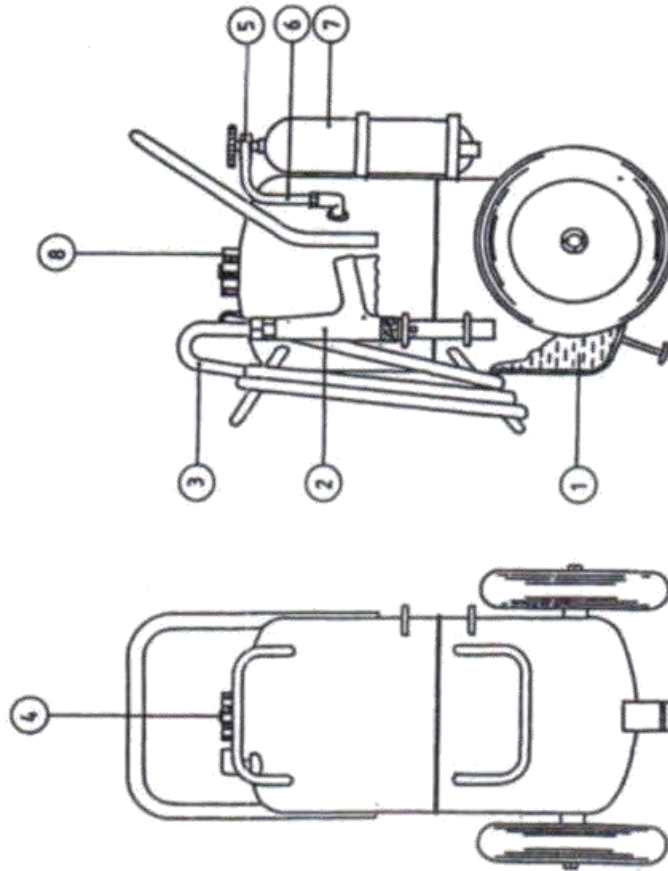
2 NON PORTABLE EXTINGUISHERS

Some of the extinguishers in particular the CO₂ type, foam type and dry chemical type powder type also come in large sizes and generally located in the engine room.

1. **FOAM TYPE** :- the range of this extinguishers is 14 meter and period of discharge is over 100 seconds and has a capacity of 30 gallons. A foam making hose reel unit is also available in the machinery and boiler spaces which can be taken in the same category of non portable fire extinguishers.
2. **CO₂ TYPE** :- In the CO₂ type non portable extinguishers it is usually mounted on wheels for easy movement and the rate of discharge is very high and is to be used with caution as it can cause injury.
3. **DRY CHEMICAL POWDER TYPE** :- These are generally fitted in the machinery spaces. These extinguishers are most suitable for use in open spaces on the decks of LPG and LNG ships. And at the loading manifold of a tanker.

TECHNICAL DESCRIPTION:

CLASS : AB
 CAPACITY : 45 LTR
 DISCHARGE TIME : 95 SEC.
 DISCHARGE RANGE (MINIMUM): 15 MTR
 TEST PRESSURE : 31 BAR
 CO2 CYLINDER SIZE : 1.0 KG
 HEIGHT : 1015 MM
 DIAMETER : 560 x 610 MM (W x D)
 WEIGHT EMPTY : 45 KG
 WEIGHT FULL : 91 KG
 COLOUR : PALE CREAM



	SYPHON TUBE	293-553016
	INSTRUCTION LABEL, USE	293-553461
8	HEADBLOCK O-RING	293-552927
7	CO2 CYLINDER, COMPLETE	294-553594
6	CO2 HIGH PRESSURE HOSE	293-553172
5	CO2 VALVE	293-553149
4	NUTRING & HEADBLOCK	293-553180
3	DISCHARGE HOSE	293-553446
2	FOAM LANCE & SWIVEL	293-553453
1	PROTEIN FOAM	294-553610
ITEM	DESCRIPTION	EDP .NO

(Fig:6.1 - Non Portable / Mobile Foam/DCP Fire Extinguisher)

3. PORTABLE FIRE EXTINGUISHERS

An extinguisher is an appliance containing an extinguishing medium which can be expelled by the action of internal pressure and be directed into a fire. This pressure may be store pressure or obtained by a chemical reaction or release of gas from a cartridge. A portable fire extinguisher is one which is designed to be carried and operated by hand in which in working order, has a total weight of not more than 23 KGs.

Portable fire extinguishers are for immediate use in the early stages of fire. For the limited duration of action they cannot deal with large fires. Portable extinguishers are divided into 5 categories:-

1. Water
2. Foam
3. Dry chemical
4. Carbon di oxide
5. Halon

The choice of the extinguisher used is to be decided as per the nature of the fire.

The location of the extinguisher is very conspicuous and readily seen. They are in the Alley ways, corridors, stair ways, galleys, engine rooms, paint stores etc. A portable extinguisher is marked by

- 1. Manufacturer**
- 2. Type of fire for which suitable**
- 3. Type and quantity of extinguishing medium**
- 4. Approval details**
- 5. Users instructions**
- 6. Charging instructions.**
- 7. Year of manufacture**
- 8. Hydraulic pressure test**
- 9. Temperature range of operation**

COMMON OPERATION OF WATER TYPE (SODA ACID & GAS WATER)

CHEMICAL (SODA ACID)

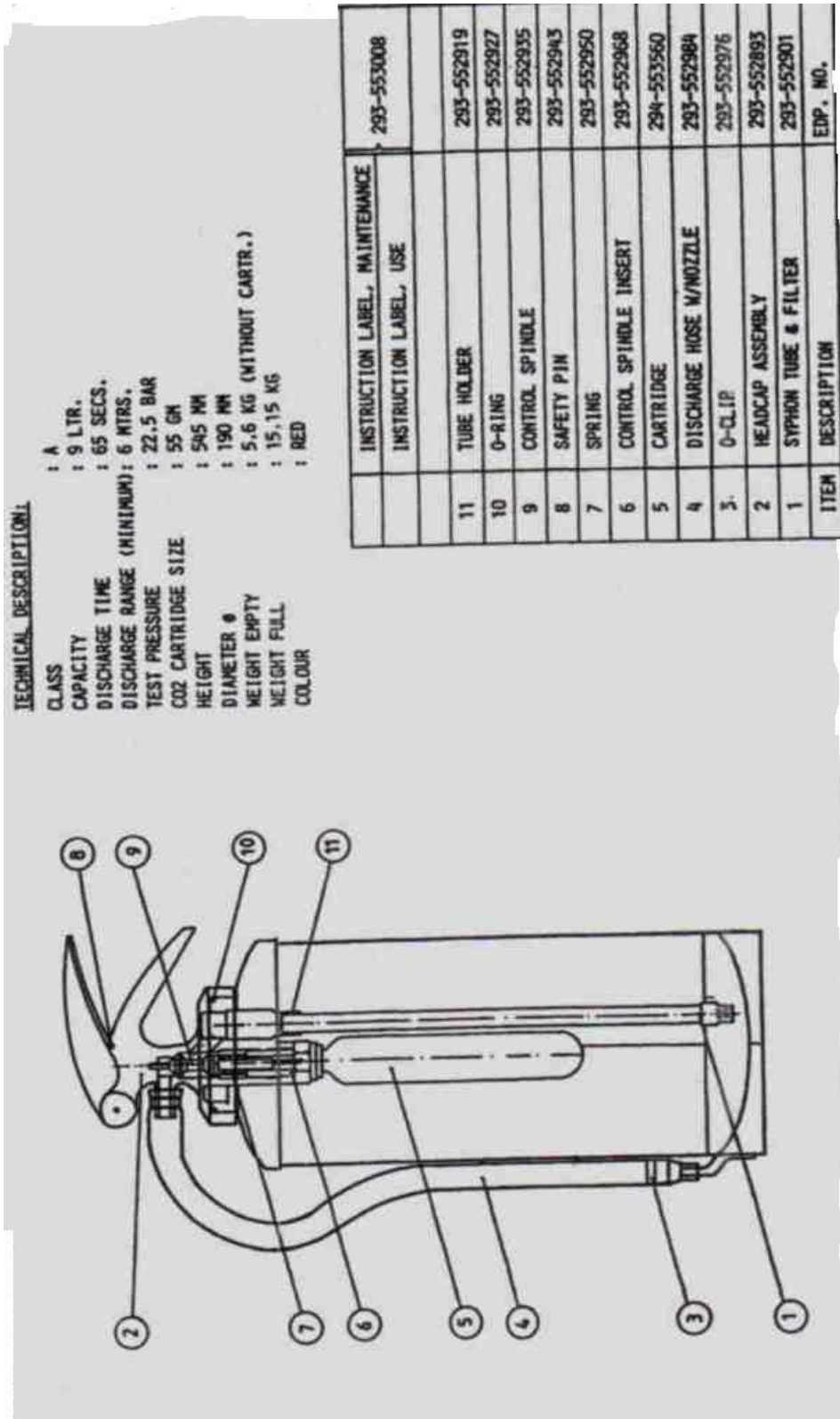
1. Remove the guard
2. Give plunger knob a blow
3. Direct the jet from the nozzle towards the base of fire

This has duration of 60 to 90 seconds & the range of water jet is 3 to 5 meters

The pressing of the plunger breaks an acid bottle, the acid falls into a solution of bicarbonate of soda. The chemical reaction generates CO₂ gas which propels the liquid from the Extinguisher.

MECHANICAL (GAS – WATER)

The gas pressure is contained in a small cartridge the seal of which is broken on pressing the plunger. The extinguisher is filled with fresh water as salt may cause corrosion.



(Fig:6.2 - Portable 9 Ltr Mechanical Water Fire Extinguisher)

**OPERATION OF FOAM
TYPE (CHEMICAL)**

1. Pull the plunger
2. Rest it on the knotch provided
3. Turn the extinguisher Upside down & shake well 3-4 times and ensure the mixing of the compounds
4. Block the nozzle while shaking. Then release the nozzle and foam spray is ejected with pressure

There is an inner and an outer container with different chemicals. When they are allowed to mix soap and gas are produced and the resultant foam is ejected by the excess pressure 6 mtr jet is maintained for 30 seconds and operates for 90 seconds.

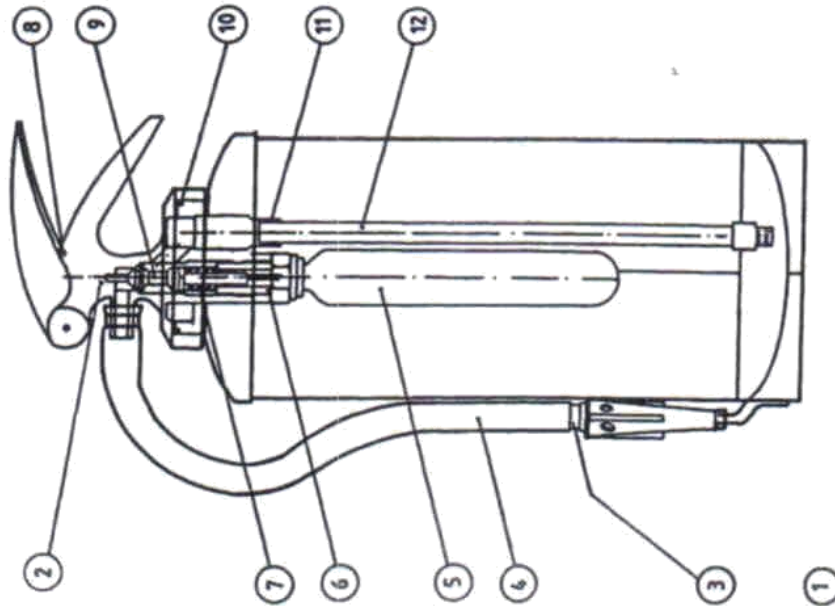
(MECHANICAL)

1. Remove protective cap
2. Strike the plunger
3. Jet of foam is obtained through the nozzle.

The extinguisher is filled with a mixture of water and foam compound. These are ejected by releasing the gas from a gas cartridge. The mixture is aerated into foam in the nozzle. The duration is 60-90 seconds and covers a distance of 3-5 mtrs.

TECHNICAL DESCRIPTION:

- CLASS : AB
- CAPACITY : 9 LTR.
- DISCHARGE TIME : 40 SECS.
- DISCHARGE RANGE (MINIMUM) : 4 MTRS.
- TEST PRESSURE : 22.5 BAR
- CO2 CARTRIDGE SIZE : 75 GM
- HEIGHT : 545 MM
- DIAMETER Ø : 190 MM
- WEIGHT EMPTY : 5.8 KG (WITHOUT CARTR.)
- WEIGHT FULL : 15.35 KG
- COLOUR : PALE CREAM



ITEM	DESCRIPTION	EDP. NO.
	INSTRUCTION LABEL, MAINTENANCE	293-553024
	INSTRUCTION LABEL, USE	
12	SYPHON TUBE W/FILTER	293-552901
11	TUBE HOLDER	293-552919
10	O-RING	293-552927
9	CONTROL SPINDLE	293-552935
8	SAFETY PIN	293-552943
7	SPRING	293-552950
6	CONTROL SPINDLE INSERT	293-552968
5	CARTRIDGE	294-553578
4	HOSE & FOAM NOZZLE	293-552992
3	O-CLIP	293-552976
2	HEADCAP ASSEMBLY	293-552893
1	AFFF FOAM	293-553586

(Fig:6.3 - Portable 9 Ltr AFFF Fire Extinguisher)

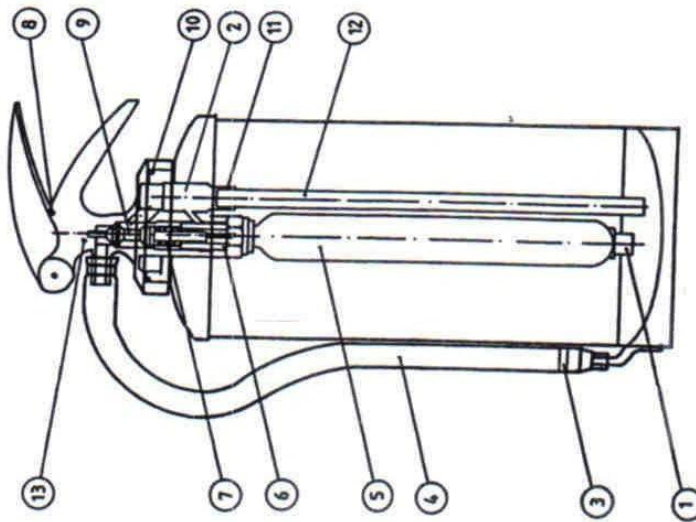
OPERATION OF DRY POWDER EXTINGUISHER

1. Remove the safety clip
2. Keep the extinguisher straight
3. Strike the knob
4. Powder is released with pressure

It may be pressurized from a cartridge or may have a stored gas pressure. Shake the extinguisher once a month to prevent compaction of powder

TECHNICAL DESCRIPTION:	
CLASS	: ABC
CAPACITY	: 10 KG
DISCHARGE TIME	: 13 SECS.
DISCHARGE RANGE (MINIMUM)	: 7 MTRS.
TEST PRESSURE	: 22.5 BAR
CO ₂ CARTRIDGE SIZE	: 150 GN
HEIGHT	: 545 MM
DIAMETER Ø	: 190 MM
WEIGHT EMPTY	: 5.6 KG (WITHOUT CARTR.)
WEIGHT FULL	: 16.4 KG
COLOUR	: BLUE

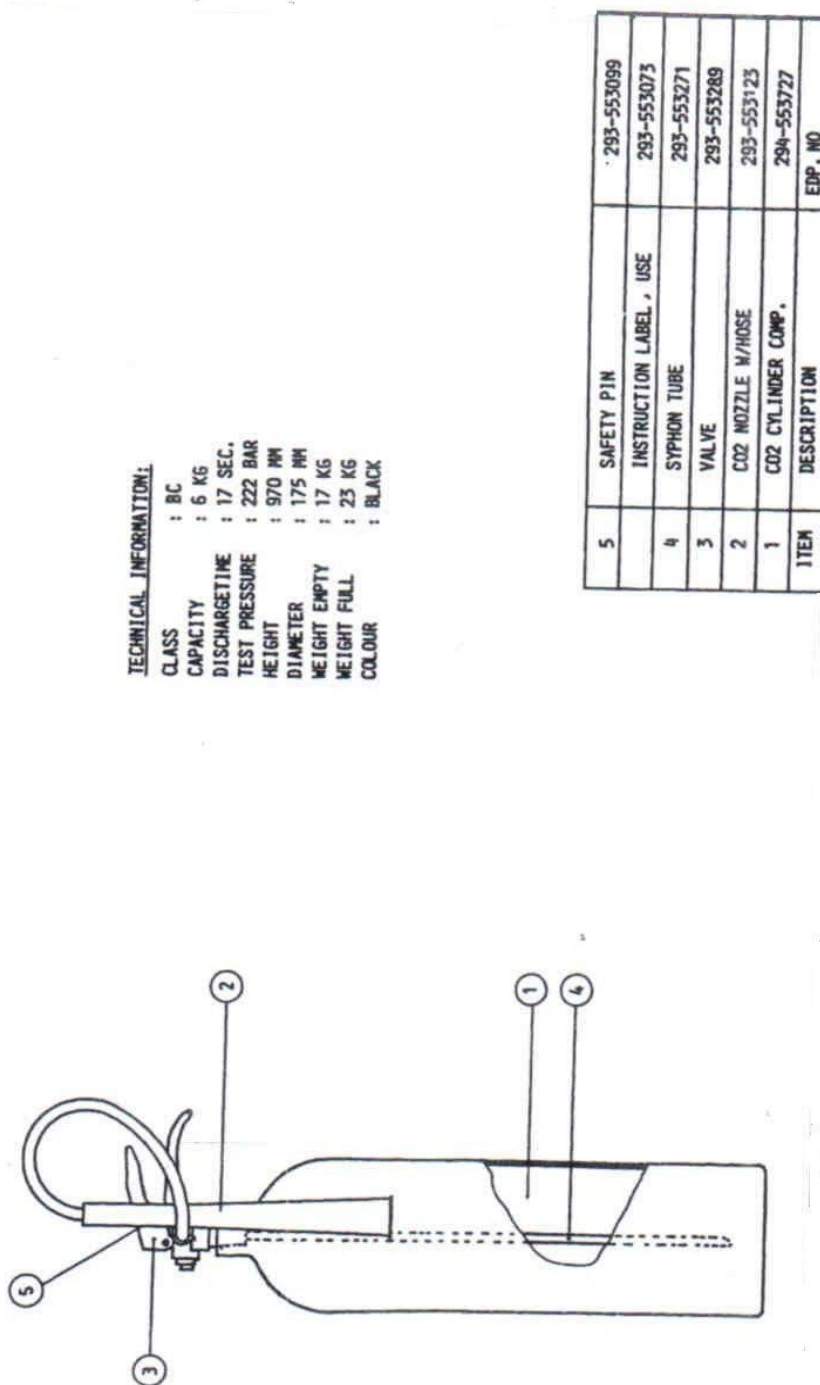
ITEM	DESCRIPTION	EDP. NO.
13	HEADCAP ASSEMBLY	293-553552
	INSTRUCTION LABEL, MAINT./ USE	293-553412
	10 kg ABC POWDER	293-553685
12	SYPHON TUBE	293-553404
11	TUBE HOLDER	293-552919
10	O-RING	293-552927
9	CONTROL SPINDLE	293-552935
8	SAFETY PIN	293-552943
7	SPRING	293-552950
6	CONTROL SPINDLE INSERT	293-552968
5	CARTRIDGE	294-553669
4	DISCHARGE HOSE W/NOZZLE	293-553362
3	O-CLIP	293-552978
2	BALANCE VALVE	293-553347
1	GAS TUBE	293-553354



(Fig:6.4 - Portable 6 KG DCP Fire Extinguisher)

OPERATION OF CARBON BIOXIDE (CO₂) TYPE EXTINGUISHER

1. Remove the safety pin
2. Un screw the valve
3. CO₂ is discharged with high pressure through discharge hose. The gas is liquefied under pressure. As the gas is discharged, both the evaporation & expansion are cooling processes & there is danger of a frost burn if the discharge horn is touched during discharge. Use the handle or grip provided.



(Fig:6.5 - Portable 6 KG CO₂ Fire Extinguisher)

OPERATION OF HALON TYPE EXTINGUISHERS

Operation and the construction is just the same as of CO₂ type. The difference is only of the nature of contents i.e. B.C.F. or B.T.M. gas.

4. FIREMAN'S OUTFIT

It consists of protective clothing of a material to protect the skin from the heat radiation from the fire and from burns and scalding from steam. The outer surface is water resistant, boots and gloves of rubber or other electrically non conducting material. A rigid helmet providing effective protection impact. It also has a safety lamp (hand lantern) with a minimum burning period of three hours and a fire axe. Breathing apparatus can be either of a smoke helmet with air pump or a self contained breathing apparatus which has an air supply of at least 30 minutes and a 36 meter long life line. It is mandatory for all ships to carry at least 2 fireman's outfits which are located in forward and main fire station on board ships.



(Fig:6.6 - Fireman's Outfit)

FIRE PROOF LINE AND HARNESS

This is a 36 meters long life line with snap book and is fire proof generally made of asbestos. It is located in the fire station fore and aft of the ship. It is accompanied by safety harness made of non flammable materials.

Self Contained Breathing Apparatus SCBA – Scott Pack



Self Contained Breathing Apparatus SCBA – Scott Pack

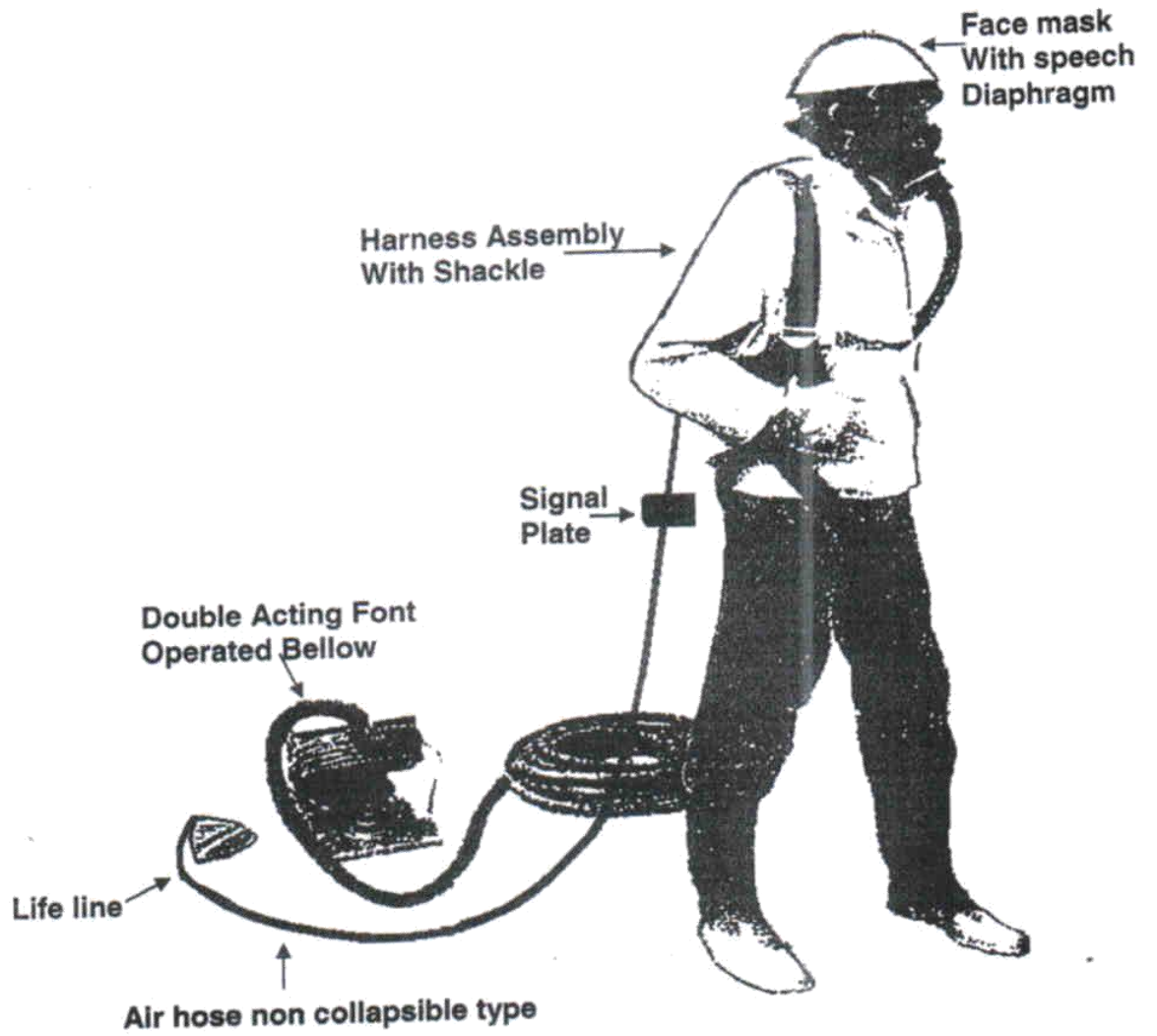


Self Contained Breathing Apparatus SCBA – Scott Pack



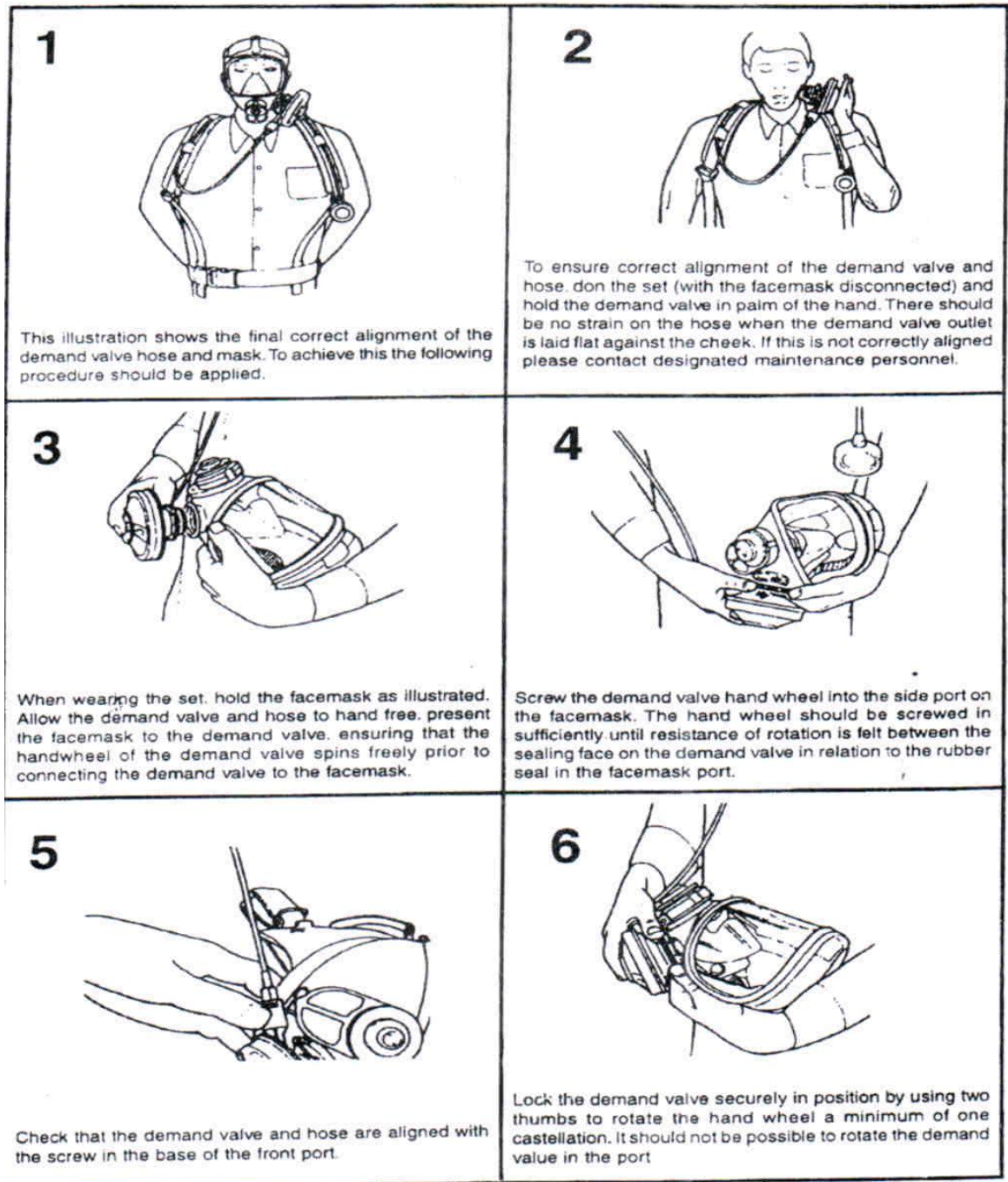
2

(Fig:6.7 - Self Contained Breathing Apparatus)



(Fig: 6.8 FORCED AIR BREATHING APPARATUS)

Procedure for Fitting Premier Demand Valve to Facemask



(Fig:6.9 - SCBA Donning Procedure)

PREPARATION FOR USE OF CABA SET

1. Fit cylinder buffer into rubber boot at base of the set, so that the valve lies horizontally. Tighten the connector into the cylinder (hand tight only). Place cylinder straps around cylinder and fit swing bolts into forks on cylinder straps and tighten adjusting shoulder straps and waist belt to full extent. Then adjust face mask harness straps to their full extent, leaving the Centre strap pre-adjusted.

2. Switch off demand valve positive pressure facility by pressing the red button. To prevent damage to the positive pressure mechanism, it is important that the lever is not depressed without the rubber shroud being in position.

CHECKING THE FUNCTION OF THE BREATHING SET

Open cylinder valve slowly but fully. Check functioning of the demand valve and exhalation valve by breathing deeply several times. Hold breath, the unit will get balanced i.e. no audible leak. Continue breathing. It must be possible for the expired air to flow easily out of the exhalation valve. Check the function of the supplementary supply by depressing fully the centre of the protective cap.

DRAW BACKS OF FORCED AIR BREATHING APPARATUS

1. Air supply is dependent of another person
2. Air hose lies behind the wearer which restricts his movement
3. The hose may be damaged during operation
4. Bulkiness of the apparatus causes discomfort

LIFE SIGNALS FOR FORCED AIR BREATHING APPARATUS:

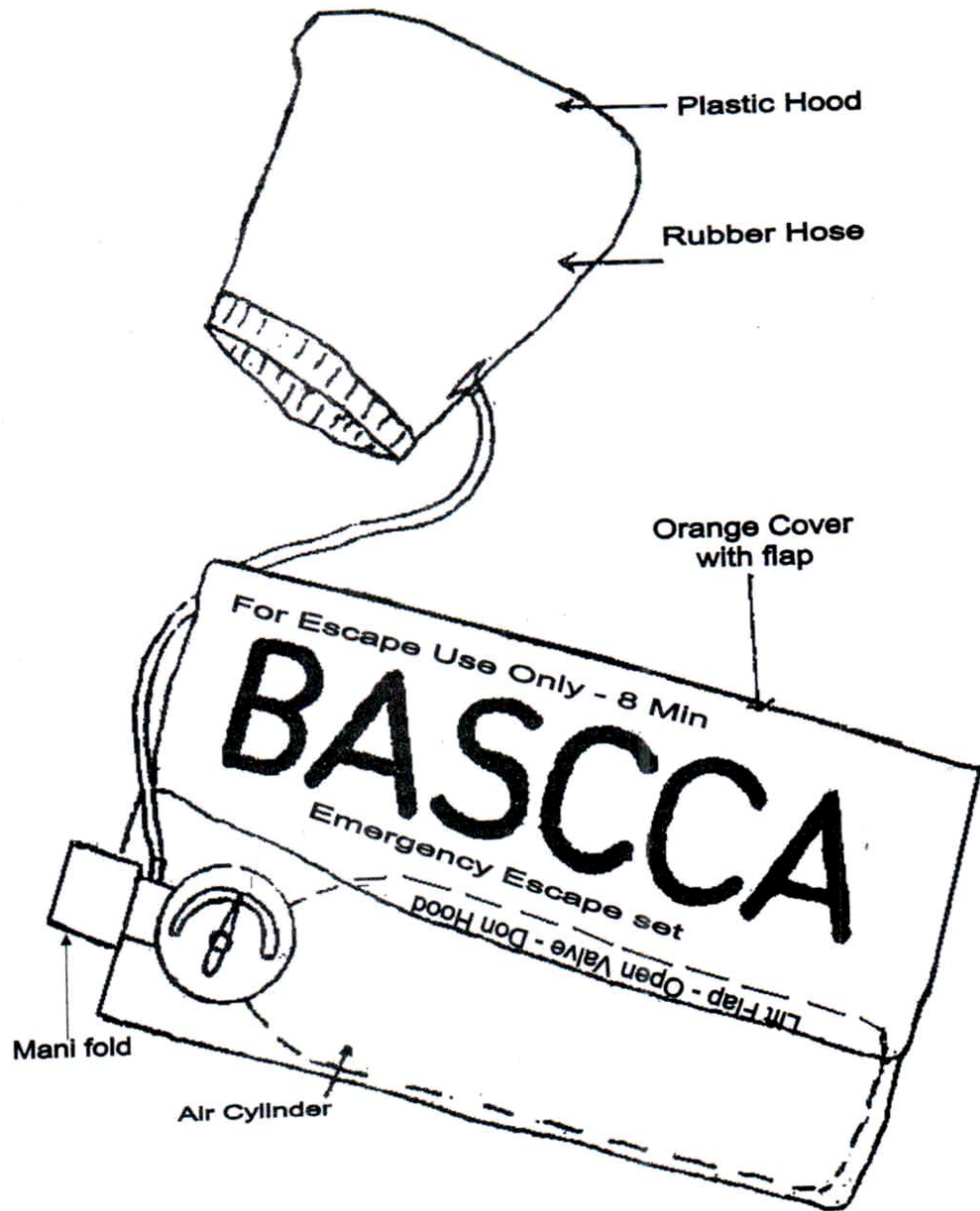
1. One pull: Fire attender asks fire fighter if he is OK. Fire fighter replies with one pull, means " I am OK
2. Two pulls: By fire fighter, "Pay out the line I want to proceed further." The fire attender acknowledge by 2 pulls & pays out more life line.
3. Three pulls: By fire fighter or fire attender, " I am in danger," I am coming out." There is danger to my life, you come out. The other person acknowledge the 3 pulls and takes appropriate action.
4. Four pulls or more : By fire fighter/ fire attender " there is impending danger I am coming out immediately, you must come out immediately due to impending danger." The person acknowledges and takes appropriate action.

EMERGENCY ESCAPE BREATHING DEVICE (EEBD)

This is a life saving equipment. This is to be used for escaping from the engine room in case of fire and not to be used for firefighting.

- a) Description:
 - Comprises of a cylinder having 200bar pressure
 - Pressure gauge
 - Main valve
 - Face mask / hood
 - Air supply hose (supplying positive pressure in the mask)
- b) Donning Procedures:
 - Take out set from the stand

- Hang it around neck
- Put on waist strap
- Open the flap
- Take out face mask
- Open valve for ventilation (it may have foul gases contaminated)
- Don the mask



(Fig:6.10 - Emergency Escape Breathing Device)

6. PRATICAL KNOWLEDGE OF RESUSCITATION METHODS

“Maintaining Airway, Breathing and Circulation” -the most important principle of first aid is ABC or resuscitation. This is a life-saving procedure that will enable you to decide whether a victim who has collapsed needs rescue breathing or CPR (cardiopulmonary resuscitation).The airway must be open, breathing must be checked and circulation must be assessed. .Always follow the ABC sequence before giving any other treatment if the victim is unconscious.

Resuscitation is the name given to the set of procedures that are applied when a person is not breathing and their heart has possibly stopped. The full set of procedures is known as cardiopulmonary resuscitation (CPR).Cardio relates to the heart and pulmonary to the lungs.

Early CPR:- the goal is to keep the person alive until emergency help arrives. Sometimes CPR alone will revive somebody whose heart has stopped but more often it is used to buy time until more advanced procedures are available.

Practically resuscitation consists of the following:

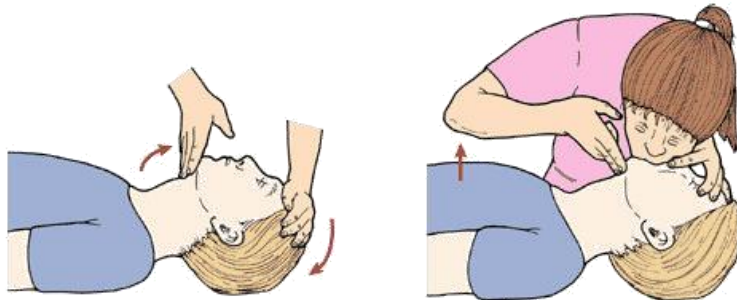
1. Mouth to mouth resuscitation.

Put finger in mouth to remove any obstruction, if any, seen in the neck and throat. Take a deep breath, close the nostrils of the casualty with one hand and seal your lips to the casualty mouth.

Blow into the casualty’s lungs looking along his chest rise to maximum expansion. If the chest does not rise beat him for chokings.

Remove your mouth well away from the casualty’s mouth and breath out any excess air while watching his chest fall. Take a deep breath. Repeat inflation.

CPR



1. Tilt the head back and lift the chin until the teeth almost touch. Look and listen for breathing.

2. If the person is not breathing, pinch the nose closed and cover the person's mouth with yours. Give 2 full breaths.



3. Put your hands in the center of the person's chest between the nipples. Place one hand on top of the other. Push down 30 times. Continue with 2 breaths then 30 pushes until medical help arrives or the person starts moving.

(Fig:6.11 – Resuscitation Methods)

7. FIRE FIGHTING BLANKETING

Another method by which fire may be extinguished, is by blanketing. For dealing with fire in small utensils such as those containing cooking fats the best method is to smother the fire with an asbestos blanket or similar material, such as a door mat which has been wetted first.

CHAPTER - 7

SHIPS FIREFIGHTING ORGANISATION

1. GENERAL EMERGENCY ALARM :

The general emergency alarm system is capable of sounding the general emergency alarm signal consisting of seven or more blasts followed by one long blast on the ships whistle or siren and additionally on an electrically operated bell or klaxon or other equivalent warning system which is powered from the ships main supply and the emergency source of electrical power. The system is capable of operation from the navigation bridge and, except for the ships whistle, also from other strategic points. The system is audible throughout the accommodation and normal working spaces and open decks. The alarm continues to function after it has been triggered and until it is manually turned off or is temporarily interrupted by message on the public address system. The fire alarm is a continuous ringing of bell which is both automatic and linked with the fixed installation and can also be operated manually by breaking the glass of fire alarm switches.

2. FIRE CONTROL PLANS AND MUSTER LIST :

In all ships the general arrangement plans are permanently exhibited for guidance of ships officers, showing clearly for each deck the control station with particulars of the fire detection and the fire alarm systems , the sprinkler installations, the fire extinguishing appliances (types and locations) means of access to different compartments including the emergency exits, decks etc.. Plans and booklets are kept up to date, any alterations being recorded thereon as soon as practicable. In all ships a duplicate set of fire control plans or booklets or a booklet containing such information or plans is permanently stored in a permanently marked weather tight enclosure outside the deck house for the assistance of shore side firefighting personal.

MUSTER LIST

The master prepares muster list showing in respect each member of the crew the special duties which are allotted to him and the station to which he shall go in the event of an emergency.

The muster list shows the duties assigned to the different members of the crew in connection with –

1. The closing of the watertight doors, fire doors, side scuttles, valves and closing mechanism of scuppers, ash-shoots, or other similar openings on the ship's side.
2. The equipping of the boats and other life-saving appliances.
3. The launching of the boats and life rafts attached to davits or to other launching appliance.
4. General preparations of any other boats and other life-saving appliances.
5. The muster of the passengers (if any)

The muster list is prepared after the agreement with the crew has been signed and before the ship proceeds to sea

3. COMMUNICATIONS

A good communication among all the parties and command team is of utmost importance. Following means of communication are provided on board:

- a) Telephones including sound power telephone.
- b) Loud hailers, public addresser system, talk back etc.
- c) Direct phone between bridge, ECR, EHQ, Steering room etc.
- d) Radio telephones including walkie-talkie.
- e) Messengers.

4. PERSONNEL SAFETY AND PRECEDURE

In tackling fire on board ships people must be cautious in their own safety first. The following safety procedures must be followed:-

1. Wear protective clothing to safeguard from fire/accident
2. Wear SCBA said while entering a smoke field space.
3. Keep stand by personnel at entrance while entering a smoke filled space enclosed space for rescue/assistance in case of emergency.
4. Thorough knowledge in the use of correct fire extinguishers.
5. Keep communication equipment in working order.
6. Knowledge of ships layout and escape routes is essential.
7. Knowledge of firefighting methods/procedures is necessary.
8. Safe practice must be followed while working.

5. PERIODIC SHIPBOARD DRILLS

On joining the ship every individual must know his fire station and boat station. He must familiarize himself with the general layout of the ship and with fire fighting appliances and life saving appliances on board.

A fire drill is held simultaneously with the first stage of the abandon ship drill. Fire fighting parties should be assembled in their designated stations. Engine room personnel should start the fire pumps in machinery spaces and see that full pressure is put on fire mains. Any emergency pump situated outside machinery spaces should also be started.

The fire parties should be sent from their designated stations to the selected side of the supposed fire, taking with them emergency equipment such as axes and lamps and breathing apparatus.

Hoses to deal with assumed fire should be realistically deployed.

Fixed fire extinguishing installations should be tested to the extent practicable.

At each drill one extinguisher or more should be operated by a member of the fire party, a different member on each occasion.

Breathing apparatus should be worn by members of the fire parties so each member in turn has experience of its use.

6. FIRE PATROL SYSTEMS

The ship should have an efficient uniformed fire patrol. The attention must be paid by both officers & crews on board. The proper selection of personnel is of great importance. Patrol men need a marked sense of duty to carry out, efficiently, a job which could easily become tedious to the type of a man who

was unable to appreciate the importance of the work. Careful selection of the officer in charge of a patrol is of the utmost importance. He must have had experience of handling men.

CONSTANT VIGILANCE

Fire at sea can be ugly and terrifying to those unfortunate enough to experience it. A ship would be a fire risk by any standard with its combination of living quarters, cargo spaces, fuel tanks and machinery designed in such a confined space, in addition, in the event of fire, it is neither possible to summon outside aid in the form of fire brigade, nor retreat from it without taking to the boats.

But it is also seen in the past that if constant vigilance is maintained and if following points are followed strictly, the danger of fire can be easily avoided.

- 1) Smoke in detailed places only and make use of self extinguishing ashtrays.
- 2) Keep clothing away from lighted electric lamps.
- 3) Disconnect electric supply while leaving cabins.
- 4) Keep machinery spaces always thoroughly clean and dry including bilges.
- 5) Do not keep rag pieces open in machinery spaces and do not leave fuel soaked rags in any place on board.
- 6) Switch off galley plates when not in use.
- 7) A suitable patrolling system is to be maintained.
- 8) Fill empty tanks with inert gas.

Every individual employed on board must possess a sense of responsibility, be careful and vigilant by remaining alert to the happenings around him. If there is a risk of fire he should take an immediate necessary action to avoid such a risk and notify the same to superior authorities so that in future safe practices are carried out.

CHAPTER – 8

FIRE FIGHTING METHODS

1. KNOWLEDGE OF FIRE SAFETY ARRANGEMENTS

- (a) Starvation : Removing or limiting fuel.
- (b) Smothering : Removing or limiting oxygen (air)
- (c) Cooling : Limiting or decreasing heat / Temperature.
- (d) Inhibition : Stopping/Breaking chemical reaction which is building up heat and rise in temperature (Exothermic reaction)

STARVATION

Extinction of fire by starvation is removing the fuel/combustible material from the place of fire. This can be done by draining of fuel from tank, stopping fuel pump, closing fuel tank valve etc.

SMOTHERING

By cutting off the air (which contains oxygen) to the place of fire. This can be done by stopping the blowers, closing the door/hatch/port/ hole and closing inlet and exhaust air trunking. A person clothing on fire can be smothered by a rug or blanket. A small metal fire can be fought by sand or earth. For liquid fuel fires, smothering is done by use of foam. Foam forms a coating on liquid fuel surface and cuts off air. It also does not allow the liquid fuel to form flammable vapour. It can also be done by forming a cloud of dry chemical powder (sodium bicarbonate) from a pressurized container. Powder also has cooling effect and can stop the heat being produced in a chemical reactions (exothermic i.e. more & more self producing heat in a chemical reaction). For fuel cargo tanks, inert gas is used as smothering agent.

COOLING

If heat can be taken away faster than the heat being produced due to fire, the fire will be extinguished. A jet or spray of water to a fire is normally the best way.

RE FLASH WATCH

A 24 Hours Reflash water must be maintained after the fire has been controlled in the compartment dully assigned to seamen in shifts. The following points to be taken care of:

- 1) Increase in temperature of the fire seat.
- 2) Any smoke detected.

- 3) Area of the seat is thoroughly cleaned and isolated.
- 4) Firefighting equipment are ready for immediate use.
- 5) Communication system is constantly maintained.
- 6) Reporting to bridge immediate in case of any danger.

SOUNDING THE ALARM

On detection of fire, the first main aim should be to draw the attention of the other crew by shouting “fire – fire”, and then sound the general fire alarm by breaking the glass of fire alarm switches located in the nearest vicinity. The bridge must be immediately informed, by the communication means available, of the nature, location and intensity of fire.

LOCATION AND ISOLATING

- 1) Closing the ventilators and doors of the compartment of fire.
- 2) Removing of combustible materials from the surrounding of the fire.
- 3) Prepare the equipment required to tackle the fire. If small, use extinguishers, if large rig hoses, nozzles and call the engine control room to start the main fire pump.

JETTISONING

When water is used to fight fires in the compartments which are above the sea water level it endangers the stability of the vessel with a risk of capsizing. Jettisoning is the process of dumping out cargo / fuel / water from the ships tanks / holds to keep it in equilibrium. The master and chief officer are responsible for the stability.

INHIBITION

- 1) Closing of doors and ventilators including trunking openings.
- 2) Boundary cooling of the compartment.
- 3) Use of fire extinguishing agents.
- 4) Use of inert gas.
- 5) Removal of the flammable materials in the vicinity.
- 6) In case of fire in the engine room, shut off the fuel and lube oil supply.

2. FIRE ALARM AND INITIAL RESPONSE

1. Irrespective of whether the vessel in at sea, anchor or in port, on hearing emergency alarm, all ships personnel muster at their emergency station with their life jacket and dressed in long sleeved boiler suit, safety shoes and safety helmet.
2. The teams are mustered by the team leader and report made to the master regarding any missing persons or absentees.
3. Depending on the emergency a master gives the order to tackle the emergency / fighting fire with the appropriate fire fighting appliances.

4. Prior to reaching the emergency fire station the chief engineer rushes to the engine control room for maximum information. On emergency chief officer secures cargo and ballast operations before going to muster station, the watch keepers on bridge and in the engine room continue on watch till relieved, bridge messenger distributes portable radio sets to all teams.
5. While the emergency / fire fighting is in progress, constant communication is maintained by the team leader with the bridge for effective control and safety of personnel on the vessel.

3. FIRE FIGHTING

GENERAL FIRE FIGHTING ORGANISATION ON BOARD SHIP

1. Bridge is always the controlling station and the master is the overall in-Charge.
2. Each team leader reports to the bridge and receives instructions.
3. The information to be given to the central control station is as follows :
 - (a) Time at which the fire alarm was initiated.
 - (b) The position and nature of fire.
 - (c) The fire parties are assembled and fireman outfits are available.
 - (d) One or more fire pumps are started and the fire main is pressurized.
 - (e) The report on initial use of portable fire extinguishers.
 - (f) The effect of fire on ships services like lighting, fresh water system, air conditioning, refrigeration systems, galley supplies and so on.
 - (g) Any person trapped in the compartment or unaccounted for.

TEAMS AND THEIR DUTIES

The teams are formed as per pattern given below depending upon the total number of personnel on board:

(a) COMMAND TEAM

Master overall incharge.

3 rd officer	:	Assistant
Radio officer	:	Communication record
Helmsman	:	Steering
ER Rating	:	Messenger

(b) MAIN FIRE PARTY

Chief officer	:	Leader
4 th Engineer	:	Assistant
Bosun	:	As directed.
Seaman	:	As directed.
Seaman	:	As directed
ER Rating	:	As directed.

(c) BACK UP PARTY

2 nd Officer	:	Leader.
2 ^{na} Engineer	:	Assistant.
Cadet	:	As directed.
Seaman	:	As directed.
Seaman	:	As directed.
ER Rating	:	As directed.

(d) ENGINE ROOM PARTY

Chief Engineer	:	Leader.
3 rd Engineer	:	Assistant.
Electrical Officer	:	As directed.
ER Rating	:	As directed.

(e) UTILITY AND FIRST AID PARTY

Chief Cook	:	Leader
Cadet	:	As directed.
Seaman	:	As directed.
Steward	:	As directed.

The command team is responsible for the command and control of the emergency situation. They initiate search for any person not accounted for and establish internal and external communication and maintain safe navigation and time event record.

Main fire party first musters and reports to the command team, then prepares equipment and reports of readiness to the command team. This team is the first to tackle the fire.

Back up party also musters and reports to the bridge, the main aim of this party is to provide resources to the main fire party like air bottles, extinguishers etc. it also provides a back up for personnel if required. They also prepare the life rafts and life boats in case the fire becomes out of control abandoning of the ship becomes quicker.

The utility and first aid party musters at a predetermined location and reports their readiness to the command party and main fire party on walkie talkie. They provide support to the emergency team in preparing survival craft, breathing apparatus, additional fire fighting, equipment, maintain security patrol, boundary cooling and shutting down of ventilators.

Engine room party reports their readiness to the command team and give status of machinery and other emergency systems and advice if any machinery has to be shut down for safety and attend to fixed fire fighting installations if necessary.

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CHAPTER - 9

FIRE FIGHTING PROCEDURES

Fire aboard is indeed capable of achieving almost infinite variety in the cause and manner of its outbreak, in the place where it starts, in the direction in which it spreads, and in the types of fuel on which it will feed.

FIRE FIGHTING IN PORT

The first and by far the most important thing about fire fighting in port is that to achieve maximum success, it must be a combined operation of ships fire fighting team and harbour authority including civil fire brigade and police. Only by personal acquaintance can really efficient liaison be maintained during the fire fighting operation for each officer already knows his counterpart. So it is really imperative that senior fire brigade officer should regularly meet and be on friendly terms with the harbour masters, with the senior police officer, the shore superintendents, the senior shore engineer officer representing all the shipping companies.

FIRE FIGHTING AT SEA

A bad fire in a ship at sea is an alarming experience for all aboard and a very heavy burden indeed is cast upon her master, who must continue to bear full responsibility for firefighting decisions made while ship is at sea.

It is in such circumstances that the irreplaceable value of crew training becomes so evident, it really matters little how magnificently a ship may be equipped with all the latest fire detecting and fire fighting devices, if her crew does not know how to use it properly, and if they are not quickly organized and effectively lead .

On the discovery of fire at sea, the first action of the ship's master should be to reduce speed at once and to order all mechanical ventilation to be closed down until the location and circumstance of the outbreak can be exactly determined, and a plan for counter attack made. The reason for closing down all mechanical ventilation is obvious for the reason that Fire lives on oxygen in the air.

The defense against this menace can be listed as follows –

1. Good fire prevention discipline
2. Efficient fixed fire fighting installation covering engine room and machinery spaces
3. A crew well trained in fire fighting action with well trained officer to lead them
4. Speed in counter attack.