

## **FIRE, FIREFIGHTING & FIREFIGHTING EQUIPMENT**

### 1. Elements of Fire:

The process combustion of fire may be regarded as a chemical triangle in its three side consisting of fuel, heat and oxygen.

The control and extinguishing of fires in general are brought by eliminating any one side of this triangle. If oxygen (air) can be diluted or smothered out, the flame will go out. Its heat can be removed by cooling the fuel to temperature below that at which it will take fire, then the fire will no longer exist. For the purpose of this manual, it is assumed in ships that except in rare cases, it will be impossible to remove the fuel from heat and oxygen in order to put out the fire.

Oxygen comes from the air that we breath. Air consists of 21% oxygen and 79% nitrogen. If oxygen can be diluted below 15% fire will be extinguished.

### **HEAT**

There are three stages of temperature relative to ignition of a material namely: Flash Point, fire point and ignition temperature.

1. Flash Point – is the temperature of the substance at which it will give a vapor sufficient to form an ignitable mixture.
2. Fire Point – is the lowest temperature at which vapors being given off-by a material can be ignited and will continue to burn.
3. Ignition Temperature – is the temperature at which the vapor being given off-by a substance will ignite spontaneously in the air.

### **FUEL**

Any combustible substance which will burn when heated to its ignition temperature.

The importance of the spread of fire to all fire fighting operations cannot be over emphasized. Fire grows as fast as they can develop a fire temperature in the surrounding material.

Before a fire can be successfully extinguished, its class must be identified so that the proper extinguisher will be used.

The following chart is a sample of classification and corresponding extinguishing agent:

CLASS	CHARACTERISTICS	MATERIAL	EXTINGUISHING AGENT
"A"	Solid materials	Wood, Paper, Deep-sated leaves, cloth, films	Water, High-low-velocity, fog, solid streams co2, (in ash or embers small space w/c can be Flooded)
"B"	Flammable liquids, Fuel oil, Surface Burning, May leave Carbon	Diesel Oil, gasoline, Kerosene	Mechanical Foam, Water Fog, High & low-velocity, CO2 (in small spaces, W/c can be flooded, & light water).
"C"	Electrical equipment	Transmitters, Switch Board, electro nic, equipment, electrical, motors	CO2, Note: as a last resort, water may be used.

## FIRE FIGHTING: FIRE FIGHTING EQUIPMENT:

Fire main - A system of piping that receives water pumped from the sea and delivers it to fire plugs, sprinkling system. It also supplies water to flushing system and cooling water to auxiliary machineries.

### 1. Fire hose

#### a) Nomenclature

#### 1) 1 ½" and below

1a) Standard Navy Hose Thread

1b) Length 50' and 25'

### 2. Fittings

All Purpose Nozzle

- a) 1 ½" and 2 ½ size
- b) To put the nozzle in operation pull the lever:
  - 1) Rear-back Position-solid stream of water
  - 2) Vertical Position
    - 2a) High velocity for nozzle tip.
    - 2b) Low velocity for nozzle with applicator.
  - 3) Applicator Forward Position – Shut Off.

### 3. FOAM Production Equipment

- a) Continue type Generator
  - 1) Designed to produce chemical foam.
  - 2) Uses foam powder-stored on a 50 pounds (lbs) container.
  - 3) Has 2 ½" inlet and outlet.
  - 4) Rate of consumption is approximately 100 pounds per minute.
  - 5) Each pound of foam process 800 gals.
- b) Duplex Pressure Proportioner
  - 1) Has two (2) chambers-lower and upper.
  - 2) Each chamber or compartment contains 10 gals of liquid foam and will last for about 3 minutes.
  - 3) Uses liquid foam-mechanical.
- c) Straight Type Proportioner
  - 1) Foam discharge is mixture of water, liquid foam solution and air.
  - 2) One gal of liquid foam solution will produce about 233 gal.
  - 3) One can of liquid foam will last approximately 1 ½ minutes.
- d) S-Type Proportioner - Consist of suction chamber of the suction size of handy billy pump and pick-up tube.
- e) Water Motor Proportioner
  - 1) Has 2 ½" at both the inlet and outlet side.
  - 2) Two (2) inch foam pick-up tube.
  - 3) Three (3) position foam valves.

- 3a) Two for each pick-up tube.
- 3b) One for off position.
  
- 4) Foam will be produced at inlet pressure of 75-175 PSI.
- 5) Thoroughly flush and drain motor after use.
  
- f) Mechanical foam nozzle and pick-up tube
  - 1) One size only 1 ½”.
  - 2) 21” (in diameter) Flexible discharge tube.
  - 3) 2’ in diameter.
  - 4) Can be necked, chain attached for this purpose.
  - 5) As-----ator Gage – for entering
  - 6) Pick-up tube with cross foot and strainer.
  - 7) Operating pressure – 75-100 PSI.
  - 8) Used with all 1 ½” foam equipment.
  
- g) Application of Foam In Fire:
  - 1) DEFLECTION – off obstruction foam flows gently over fire makes a complete blanket.
  - 2) DEREFLCTION – Direct stream at 30 degrees angle to deck foam rolls gently over fire.
  - 3) LOBBING – direct stream into the air. Gives snow strong effect. Disadvantage: Wind makes control difficult.

#### 4. Extinguishing agents

##### CO2 (Carbon Dioxide):

- a) Liquid from while stored in 15, 35 and 50 pounds cylinders under pressure of 850 psi at 70 degrees F.
- b) When released from cylinder, 1 cubic inch of liquid CO2 expands to 450 cubic inches of gas.
  
- c) 2 ½ times heavier than air.
- d) Colorless, odorless and tasteless.
- e) Non-toxic but will not support life.
- f) Smothers the fire by displacing the oxygen.
- g) Ideal for fighting electrical fire.
- h) Non-conductor of electricity and non-corrosive.

- i) When released, the rapid expansion creates extremely low temperature and forms carbonic or carbon dioxide snow which will blister the skin on contact similar to frostbite.
- j) Primarily used to fight class "C" fires but may be used to fight class "A" fires.
- k) 35 to 50 lbs CO<sub>2</sub> cylinders are used in fixed flooding system which includes installed hose and reel system.
- l) Hose and reel system as installed in machinery spaces.
- m) Fixed flooding systems is usually found in places that are manned by personnel.

## 5. Portable Pump 250

Uses: Emergency firefighting, De-watering and Fire main booster.

## 6. Explosimeter-Navy type "E"

## 7. Flame Safety Lamp

NOTE: Never use alcohol. Alcohol will burn less oxygen that man can live in 18% - 11%.

- a) Light lamp and let it burn for five minutes, then adjust flame to 3/8 inch. Lamp is ready to enter compartment being tested.
- b) When checking compartment:
  - 1) Hold lamp vertically at all times.
  - 2) Move slowly.
  - 3) Introduce lamp.
  - 4) Observe lamp at all times.

Flame Indicator:

- a) Flame dies out-deficiency in oxygen, less than 16%.
- b) Flames goes out with a pop-explosive concentration of gases or vapors.
- c) Flame flares un-brightly-lean concentration of explosion gases or vapors.

CAUSES: Operator of the explosimeter or flame safety lamp should always wear OBA or line-mask.

## 10.OBA (Oxygen Breathing Apparatus)

- a) General: Designed to protect respiratory system in any harmful atmosphere.
- b) Entirely self-contained
  - 1) Independent of outer air.
  - 2) Fire fighting purpose – gives protection from hazardous and toxic gases, hot gas heat from fire and vapors while testing compartment.
  - 3) Canister (quick starting)
    - 3a) Green in color.
    - 3b) Instructions labeled in front.
    - 3c) Life of single canister is 45-60 minutes.
    - 3d) Light breathing 60 minutes.
    - 3e) Hard work 45 minutes.

**WARNING:** Do not allow canister to come in contact with oil or grease as it can produce violent explosive reaction.

- a) Strengthen all strap – Pre-adjusted length.
- b) Support OBA by main valve assembly. No stain on tubes or bag.
- c) Slip-V shaped 100% over head. Insure leather thing positioned between.
- d) Fit face mask. Button to top in this order:
  - 1) Neck
  - 2) Side
  - 3) Front
- e) Test face mask for fitness
- f) Snap waist strap in place.

Procedures in inserting a canister:

- 1) Remove protective cap. Insure copper foil seal is not broken.
- 2) Remove chlorate cover, do not pull lanyard until canister is seated.
- 3) Insert Canister
  - 3a) Neck up
  - 3b) Concave side in
- 4) Swing bail out away from body
- 5) Swing bail in – turn hard wheel up to standby position.
- 6) Lanyard must be in front of bail.