

Registration Form Access

Course Title:

- **USCG Basic Fire Fighter**



Safety & Comfort First

Important Facility Amenities

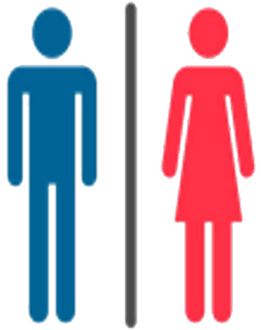
- Galley has coffee, water, ice and a snack machine.

Free Wifi:

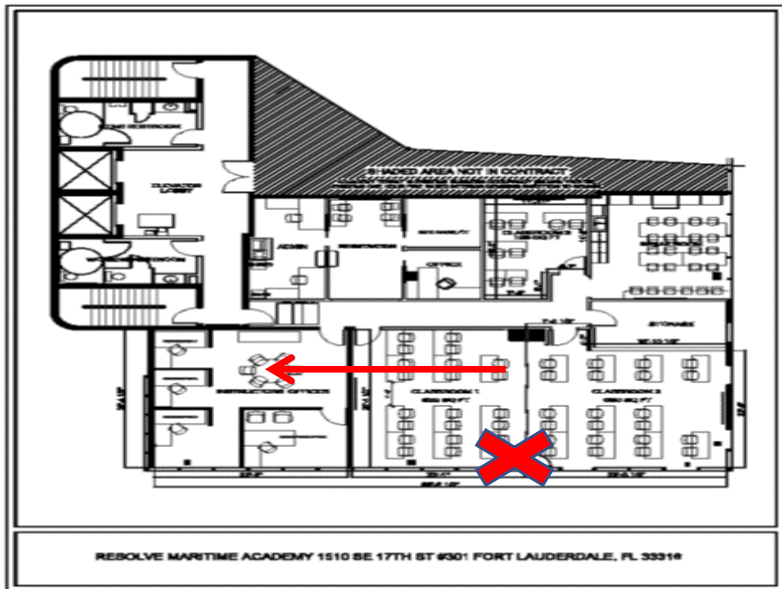
RMG-GUEST

@realasitgets247!

Please silence phones during class



Emergency Egress



Emergency Evacuation
X marks your class location

- For **ANY** Emergency
 - Seek closest stairwell for Emergency Egress
 - Activate Fire Alarm Pull Station at the door
 - Descend Stairs
 - Muster on Ground Floor, at the detached Parking area

Basic Fire Fighting Presented by Resolve Maritime Academy

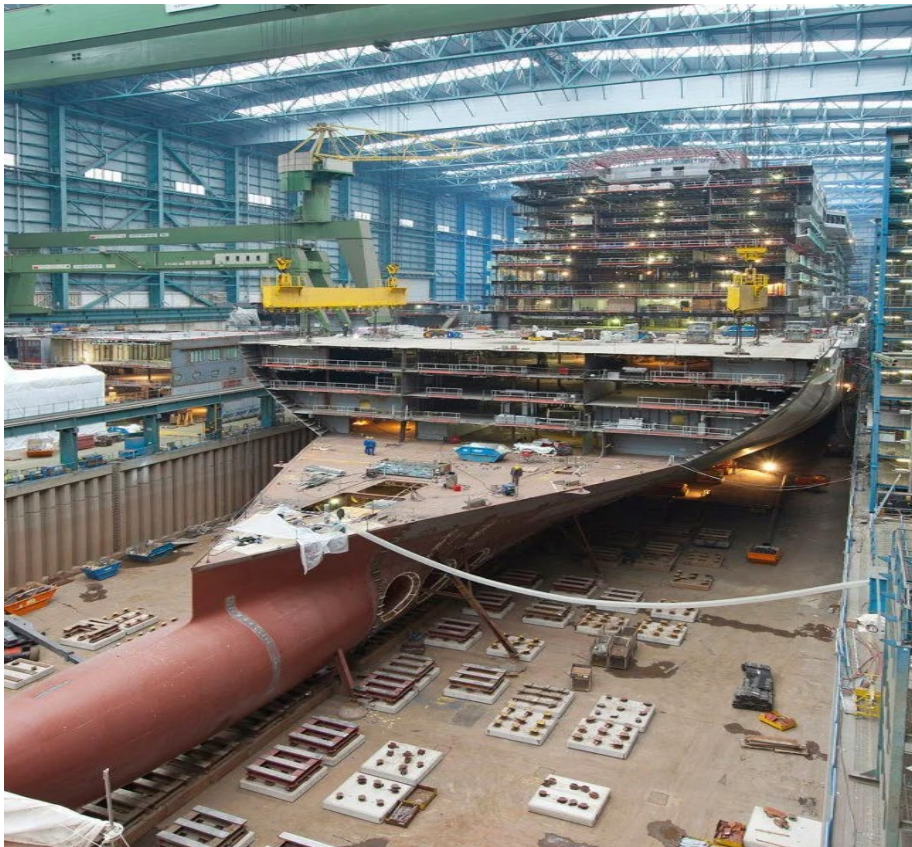


Out in the Bayou

-
- The fire on board this 140' (42.6m) motor yacht fire started at 12:40 PM.
 - The crew sent a distress call at 12:40pm some 2-2.5 miles (4-5km) out to sea.

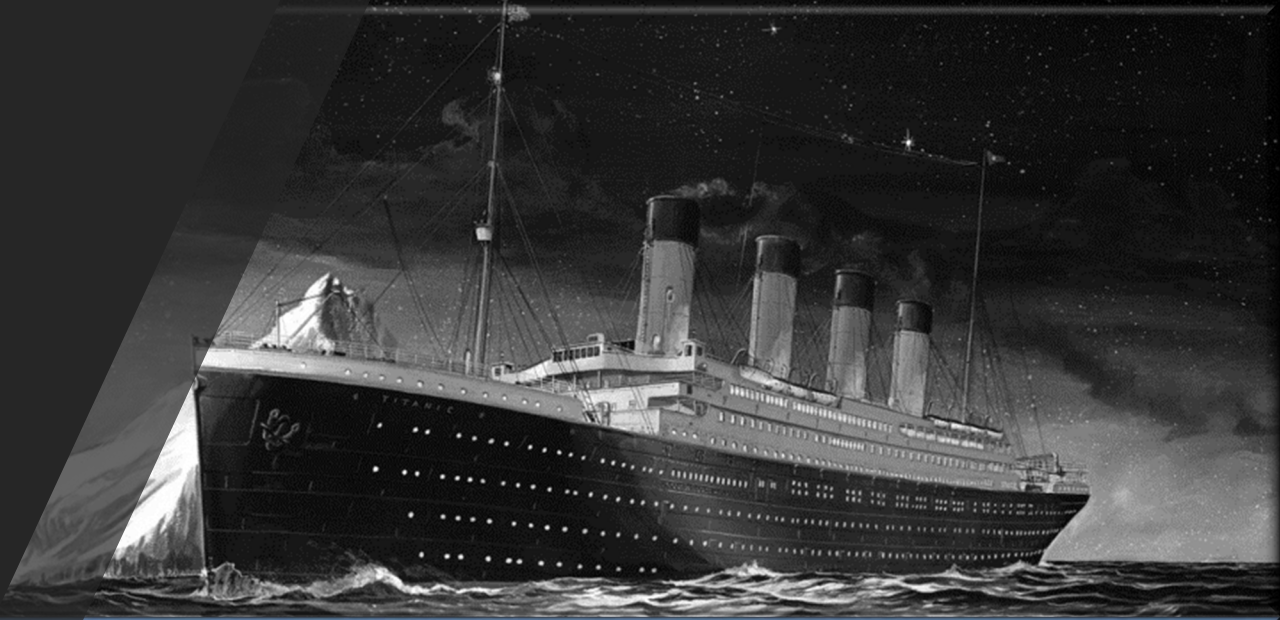


Ships Construction Standards



Minimum Standards

These minimum standards are largely based on past experiences and the availability of new technology.



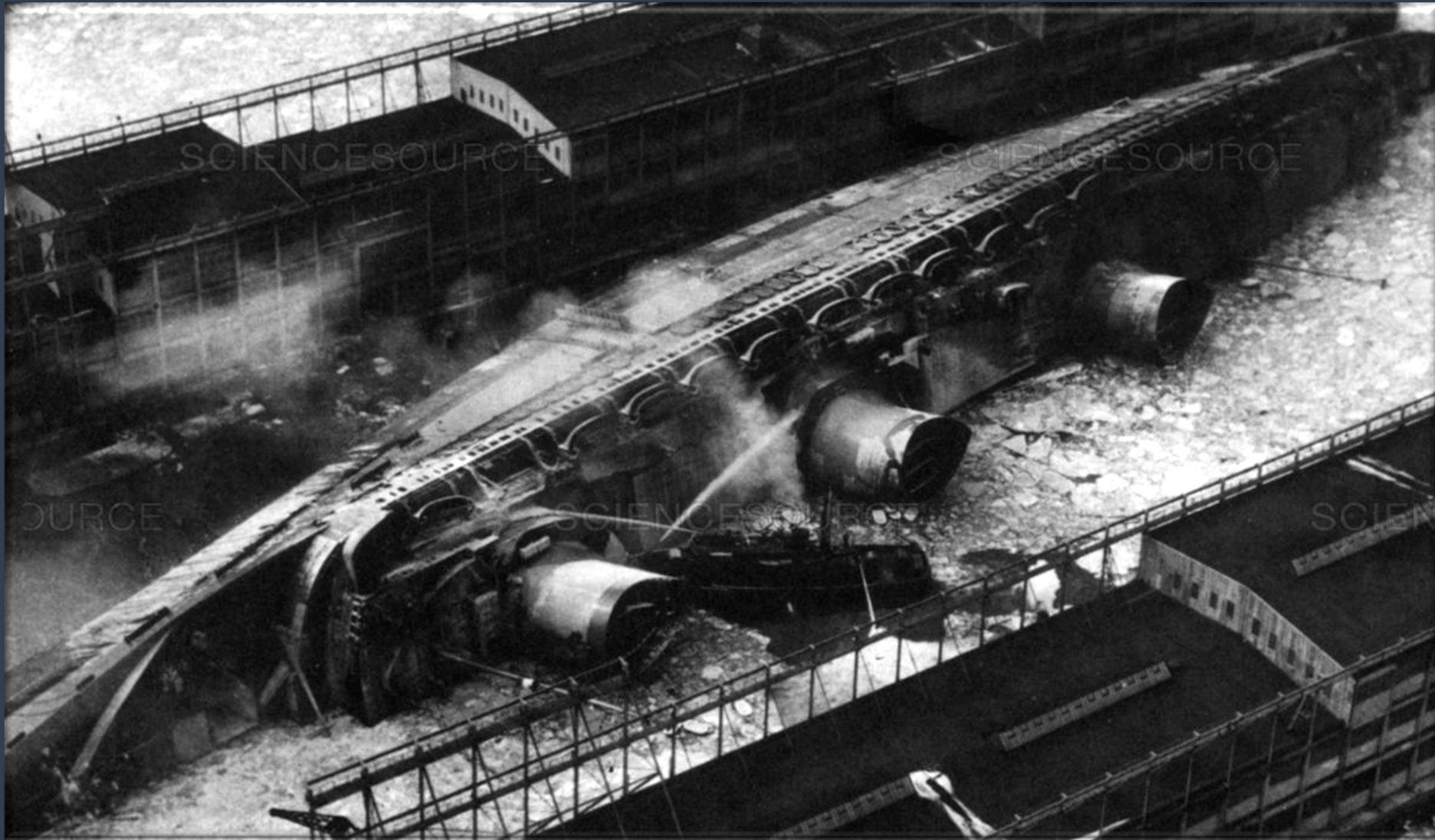
Who Develops the Standards?



The Classification Societies and the Flag State agencies set construction standards for vessels.



Flag State Agencies Include



SS Lafayette (NYC, 1942) capsized due to firefighting efforts!

Structural Fire Protection Ships Construction

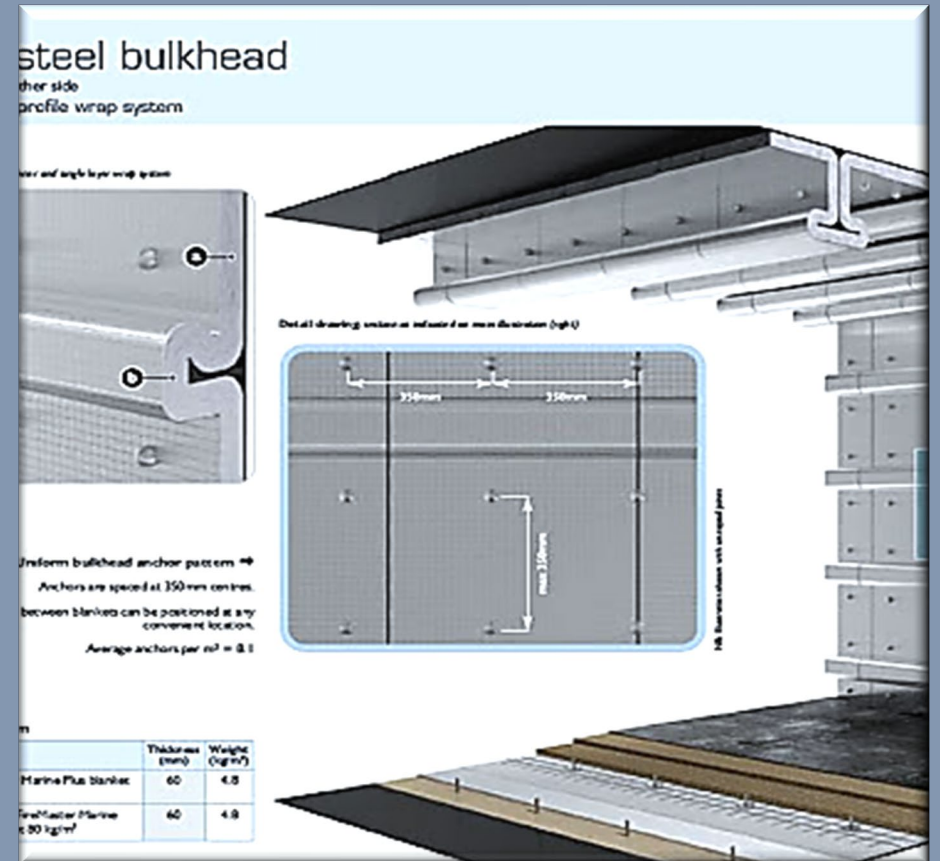
A fire is to be contained within the point of origin as follows:

- The ship shall be subdivided by thermal and structural boundaries
- Class A and B division are used to maintain thermal barriers depending on the associated risk. Fire dampers are also provided in ventilation ducting to limit the spread of heat and smoke.
- Class C division are limited combustible material but have limited thermal or smoke value.
- Thermal insulation of boundaries shall consider the fire risk of the space and adjacent spaces



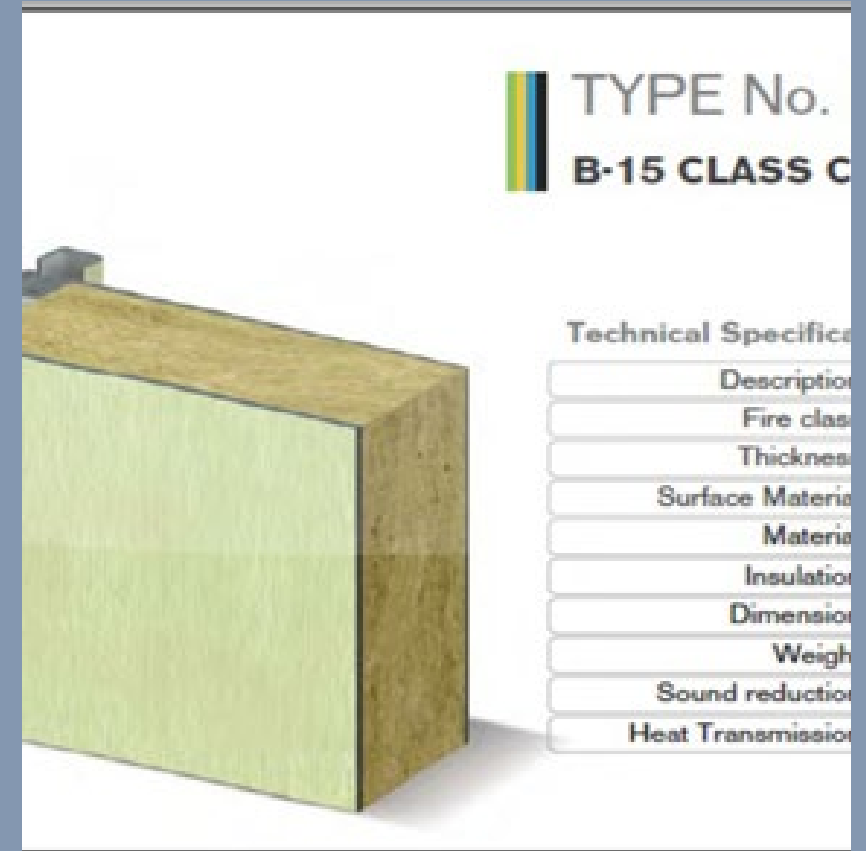
Class A Division

- A" class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:
- They are constructed of steel or equivalent material.
- They are constructed to be capable of preventing the passage of smoke and flame to the end of the **one-hour standard fire test**.
- A-60,A-30,A-15,A-0



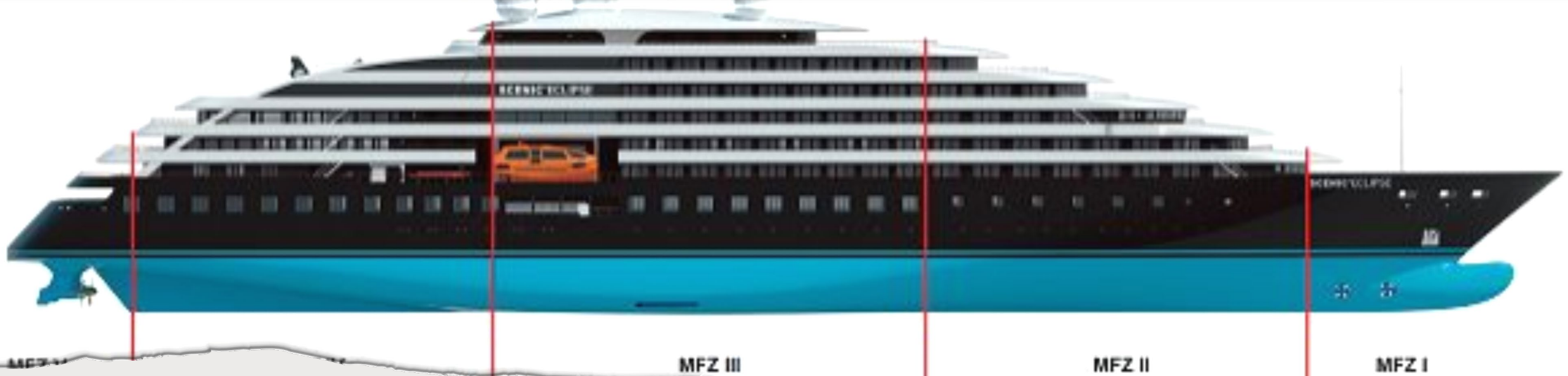
Class B Division

- B" class divisions are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:
- They are constructed of approved non-combustible materials and all materials used in the construction and erection of "B" class divisions are non-combustible.
- They are constructed as to be capable of preventing the passage of flame to the end of the ***first half hour of the standard fire test***
- Class "B-30, B-15



Class C Division

- C" class divisions are divisions constructed of approved non-combustible materials. They need to meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise.
- Normally used as room dividers within staterooms (i.e. washroom & closet)



Construction Divisions

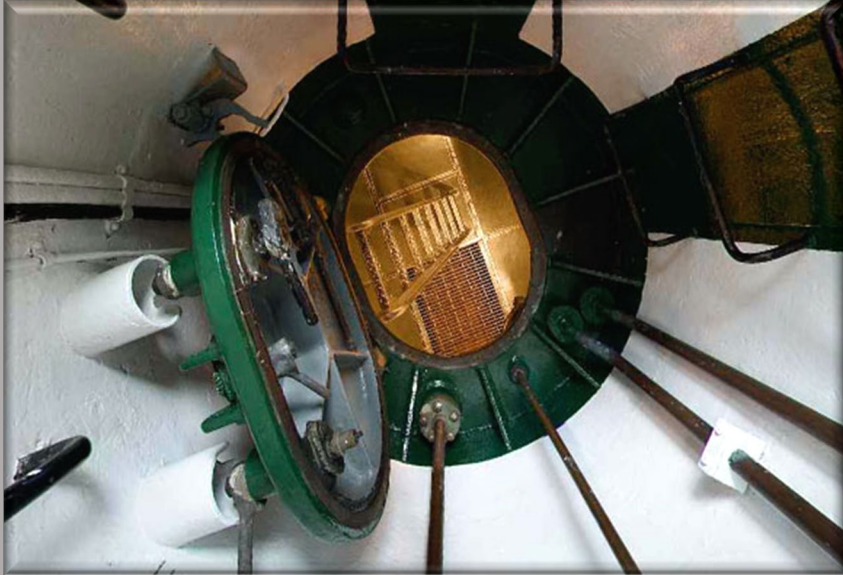
Main Vertical Fire Zones: **Normally Class A Division**

- Divide a ship into separated zones using thermal and structural boundaries including:
- bulkheads, decks, fire doors, watertight doors, fire dampers and ventilation ducting.

Vertical Fire Zones



Vertical zone



Emergency Escape Routes

- **Two means of escape must be provided for:**
 - All decks
 - Main Vertical Zones
 - Machinery spaces
 - Accommodation spaces
- **Escape Routes protected with:**
 - Thermal and smoke Boundaries (**Class A or B**)



Watertight / Weathertight

Fire Prevention

Fire prevention must be a proactive way of life, not reactive.

Proactive measures are:

- Good Housekeeping
- Preventative Maintenance & Repair
- Safety Inspections
- Education & Training



TO SAFETY

- **CLEANLINESS**
- **ORDER**
- **A PLACE FOR EVERYTHING**

Fire Prevention

What is fire prevention?

- Any action taken ahead of time to prevent fires from occurring or reducing their potential to spread.
- While no program can prevent all fires, fire prevention is the least expensive and safest approach to fire protection by far!
- Always maintain vigilance. It makes all the difference!
- **Good house keeping means:**
 - Keeping the areas clean and free of clutter.
 - Stowing and securing all gear properly.
 - General cleanliness

When/Where Does Fire Prevention Start?

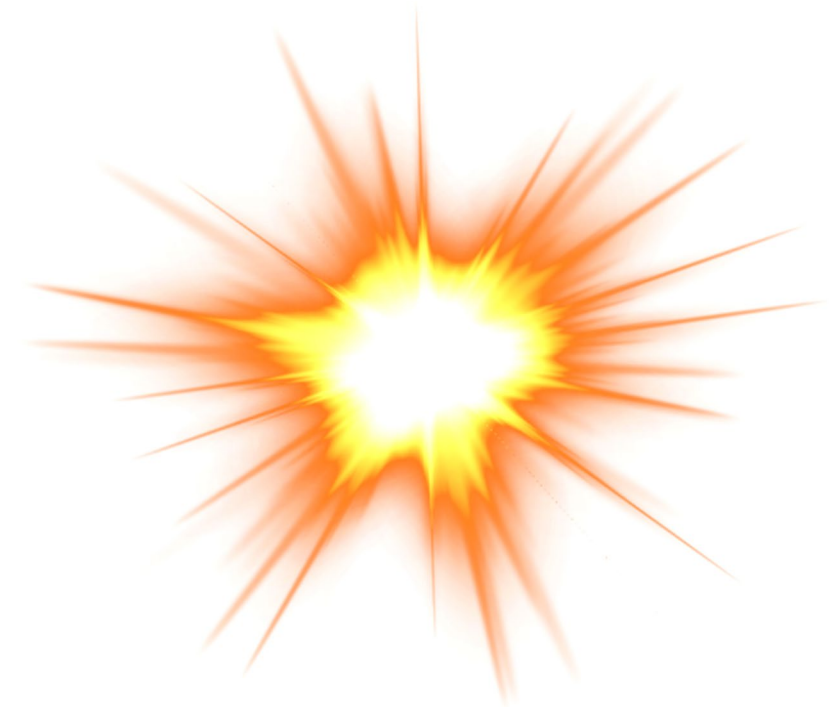
During the design phase!

Areas addressed include:

- Structure, Decks, Bulkheads
- Restriction of Combustible Materials
- Fire Detection, Fire Suppression Systems
- Fire Main Systems
- Portable Fire Extinguishers
- Means of Egress (Escape)

Factors Leading to Shipboard Fire

- Hot Work
- Smoking
- Spontaneous Combustion
- Galley Operations
- Engine Room Operations
- Fuel Transfer Operations
- Electrical Equipment Failure
- Makeshift Connections



Hot Work

Any operation that requires heat to do a job or produces sparks.

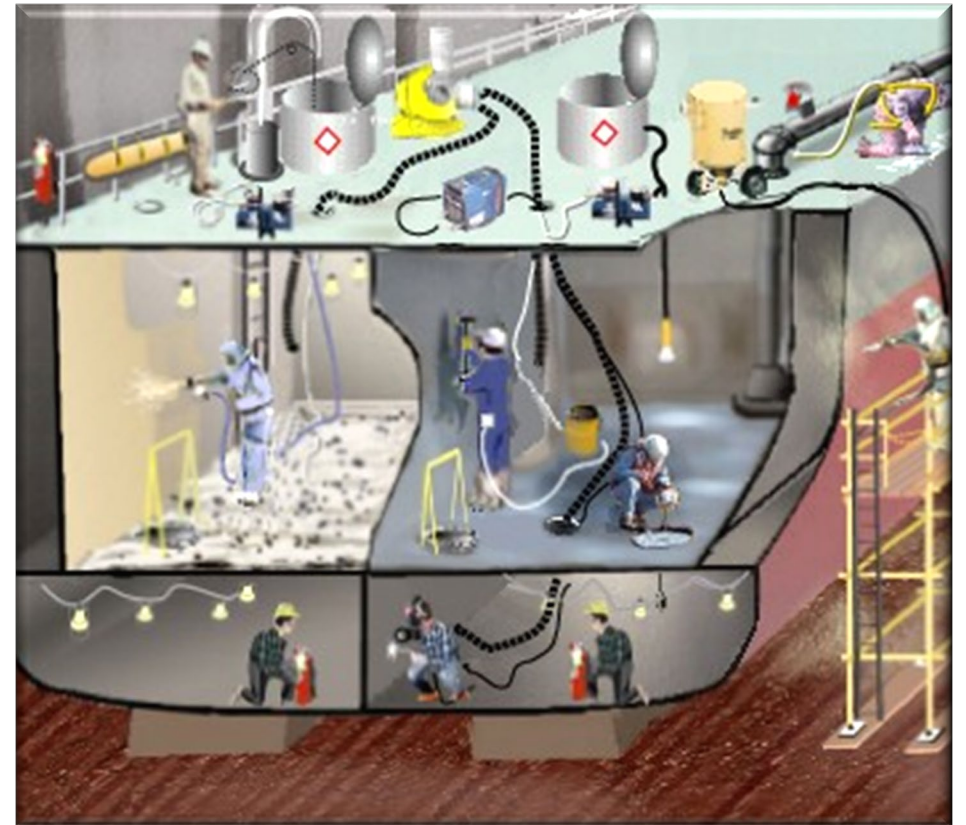
- Welding
- Cutting
- Brazing
- Grinding

The vessel's Hot Work Permit procedure must be followed.



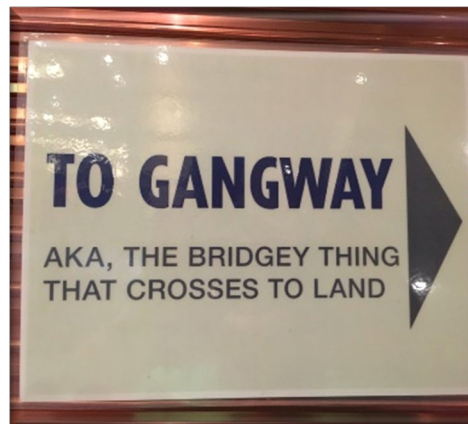
Hot Work Safety

- A fire extinguisher and associated fire protection equipment must be always on site.
- When performing Hot Work on bulkhead, deck or deck head a fire watch must also be posted in adjacent compartments.
- Fire watch to remain on site 30 minutes after work is completed.



Smoking Policy

- Never smoke in bed.
- Never smoke around open hatches, in machinery spaces or workspaces.
- Smoke only in designated areas.



Spontaneous Combustion

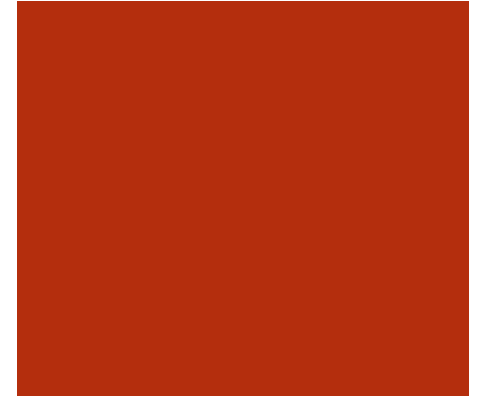
The bursting into flame of a mass of material because of chemical reactions within the substance, without the addition of heat from an external source.

- Oily rags and suntan oil covered pool towels, for **example**, are subject to **spontaneous combustion**.



Laundry Room/Spaces

- Laundry Rooms are one of the leading causes of fire on board vessels.
- Discarding of oily towels, heat sources such as irons, dryers help to increase the chances of a fire.



Laundry Room/Spaces

- Ensure dryer lint traps and ductwork are kept clean
- Ensure electrical equipment is well maintained
- Ensure cleaning chemicals are properly stored
- Ensure hot irons or automatic pressing equipment is not left unattended

One of the leading cause of fires in laundry rooms is lint traps not being properly cleaned.





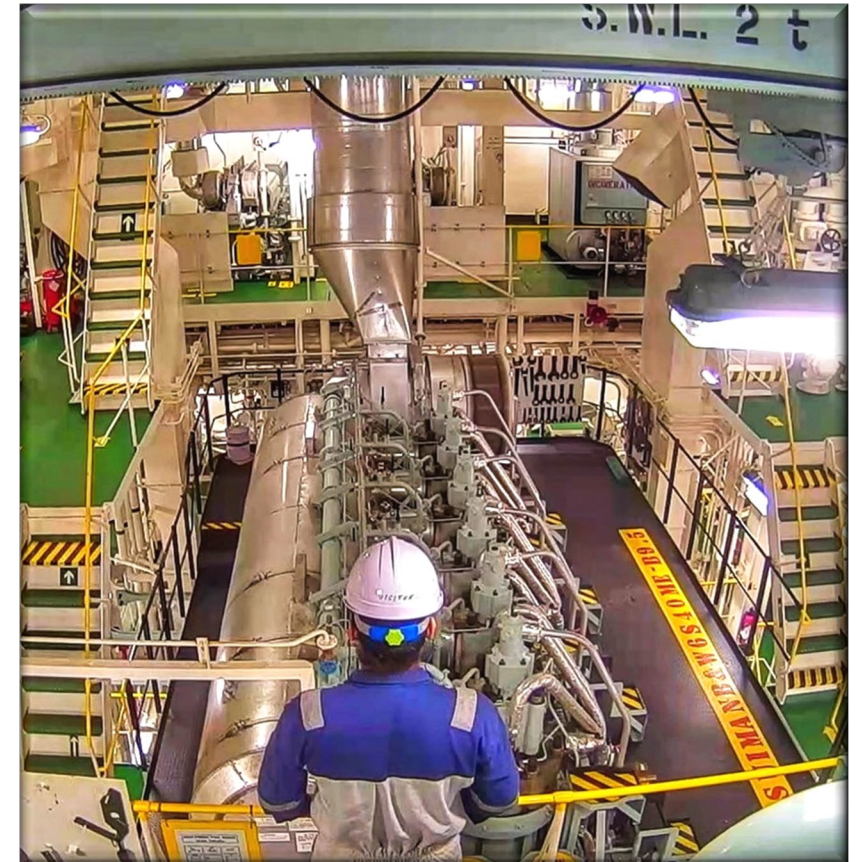
Galley Operations

Vent Hood Systems:

- Keeping exhaust fan ducts clean
- Ensuring cooking oils do not spill or overheat
- Ensure covers are available for deep fat fryers
- Keeping electrical installations well maintained
- Auto-ignition point of cooking oils to be between 750 to 815°F (400° to 435°C)
- **Most galley fires are caused by poor housekeeping.**

Engine Room Operations

- Oil leakage hitting hot spots on engines is the most common cause of engine room fires on board ships.
- Ensure insulation and exhaust lagging are kept in good condition
- Eliminating oil leaks
- Prevent accumulation of oil in bilges
- Proper storage of oil-soaked rags





Fuel Transfer Operations

Ensure that smoking, and Hot Work are not allowed during transfer operations.

- **BRAVO** flag is raised, and a fire watch is maintained during transfer





Electrical Equipment

- The vessel's generator includes a main switch board which is a metal enclosure taking power (440v) from the diesel generator and supplying it to various machinery.
- When power is delivered to the lighting system a step-down transformer is used in the distribution system.
- Power is supplied through circuit breakers to large auxiliary machinery at high voltage.



Electrical Fire

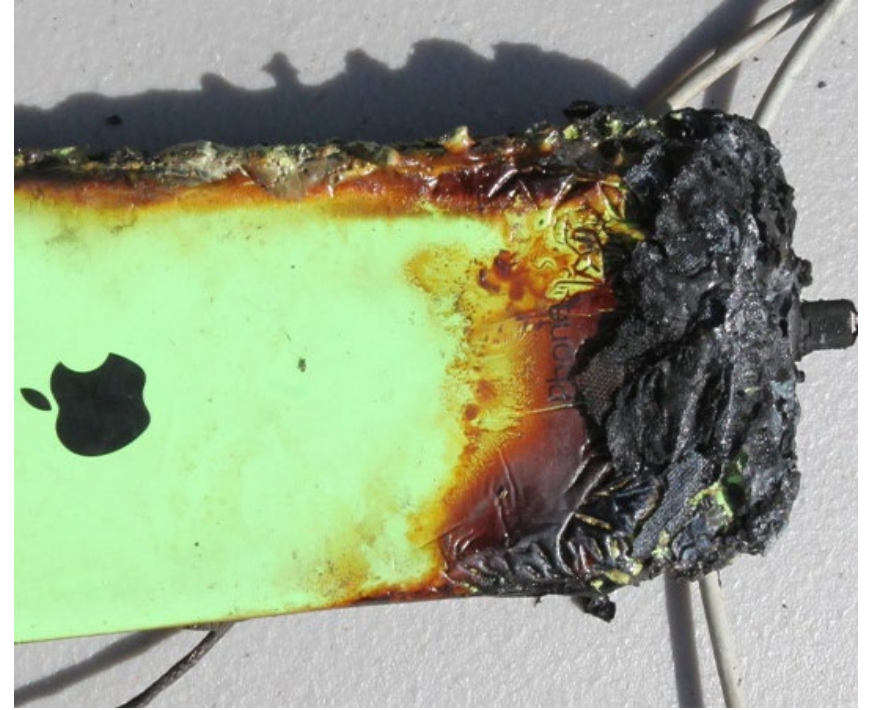
- A common practice in crew quarters and galley.
- Wiring is designed to carry a certain maximum load, when overloaded with too many appliances it can overheat and burn the insulation and ignite flammable material in the area.

Lithium-Ion Batteries

There are numerous factors that can cause thermal runaway:

- **Overcharging:** increases internal temperatures, leading to thermal runaway. A [faulty charger](#) or improper one can contribute to overcharging
- **External factors:** extreme temperatures will degrade battery components. Leaving batteries near a heat source will greatly increase the risk of a battery undergoing thermal runaway
- **At the onset of thermal runaway, the battery [heats in seconds](#) from room temperature to approximately 700°C.**

Leading cause of most fires, improper charging cords and after market batteries.



FIRE BEHAVIOR



Fire Triangle

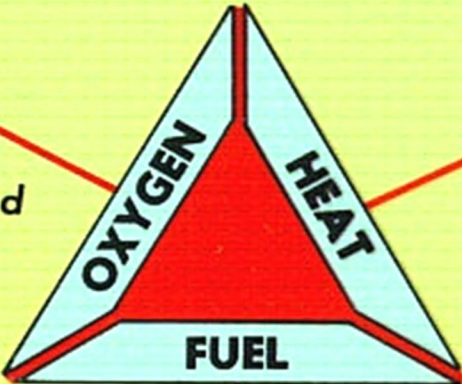
THE FIRE TRIANGLE

OXYGEN SOURCE

Approximately 16% Required
 Normal air contains 21% O₂.
 Some fuel materials contain sufficient oxygen within their make-up to support burning.

HEAT SOURCES

To Reach Ignition Temperature
 Open Flame – The Sun
 Hot Surfaces
 Sparks and Arcs
 Friction – Chemical Action
 Electrical Energy
 Compression of Gases



PHYSICAL STATE

GASES

- Natural Gas
- Propane
- Butane
- Hydrogen
- Acetylene
- Carbon Monoxide
- others*

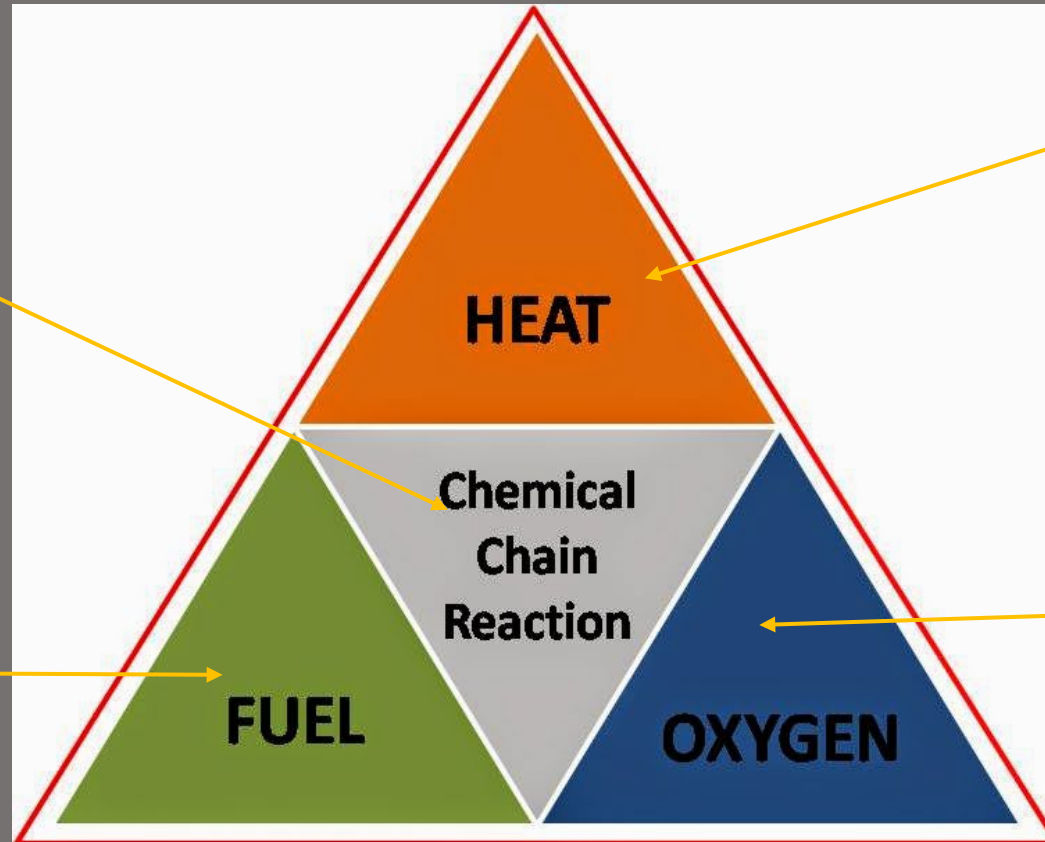
LIQUIDS

- Gasoline
- Kerosene
- Turpentine
- Alcohol
- Paint
- Varnish
- Lacquer
- Olive Oil
- Cod Liver Oil
- others*

SOLIDS

- Bulky – Finely Divided – Dust**
- Coal
 - Wood
 - Paper
 - Cloth
 - Wax
 - Leather
 - Plastic
 - Sugar
 - Grain
 - Hay

Fire Tetrahedron



The 4th side of the Fire Triangle

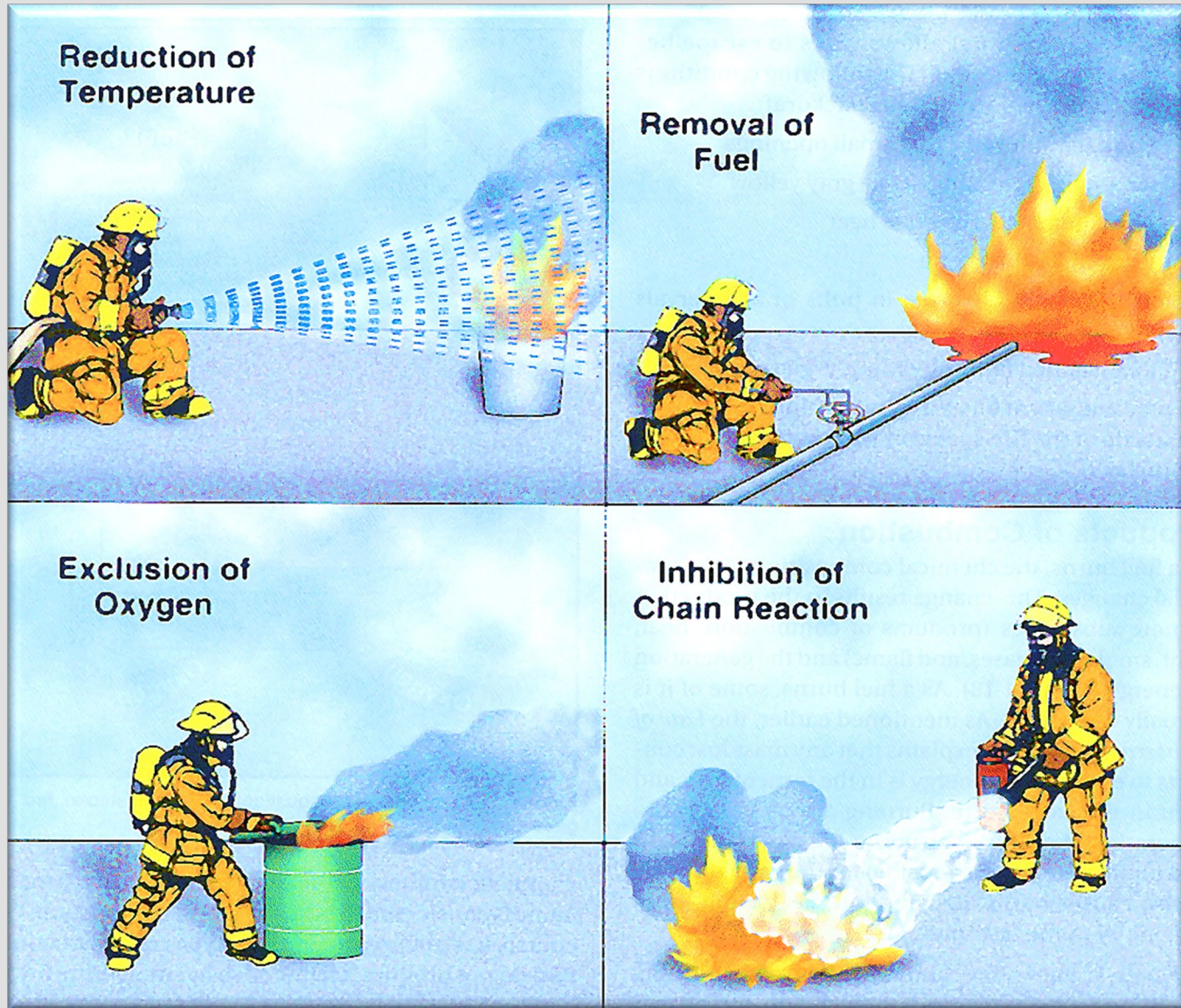
- Wood, Paper
- Plastics, Foam
- Flammable, Combustible Liquids
- Oil, Grease

Open Flame, Pilot Light
Energized electrical Source
omprEngines, Motors
Friction, Cession

Oxygen
Bleach, Pool Chemicals
Halogens, Nitric Acid
Inorganic Peroxides

Definition: The process of fuel, heat and oxygen combining in sufficient amounts to support combustion.

Methods of Extinguishment



Products of Combustion

Heat

Light

Smoke*

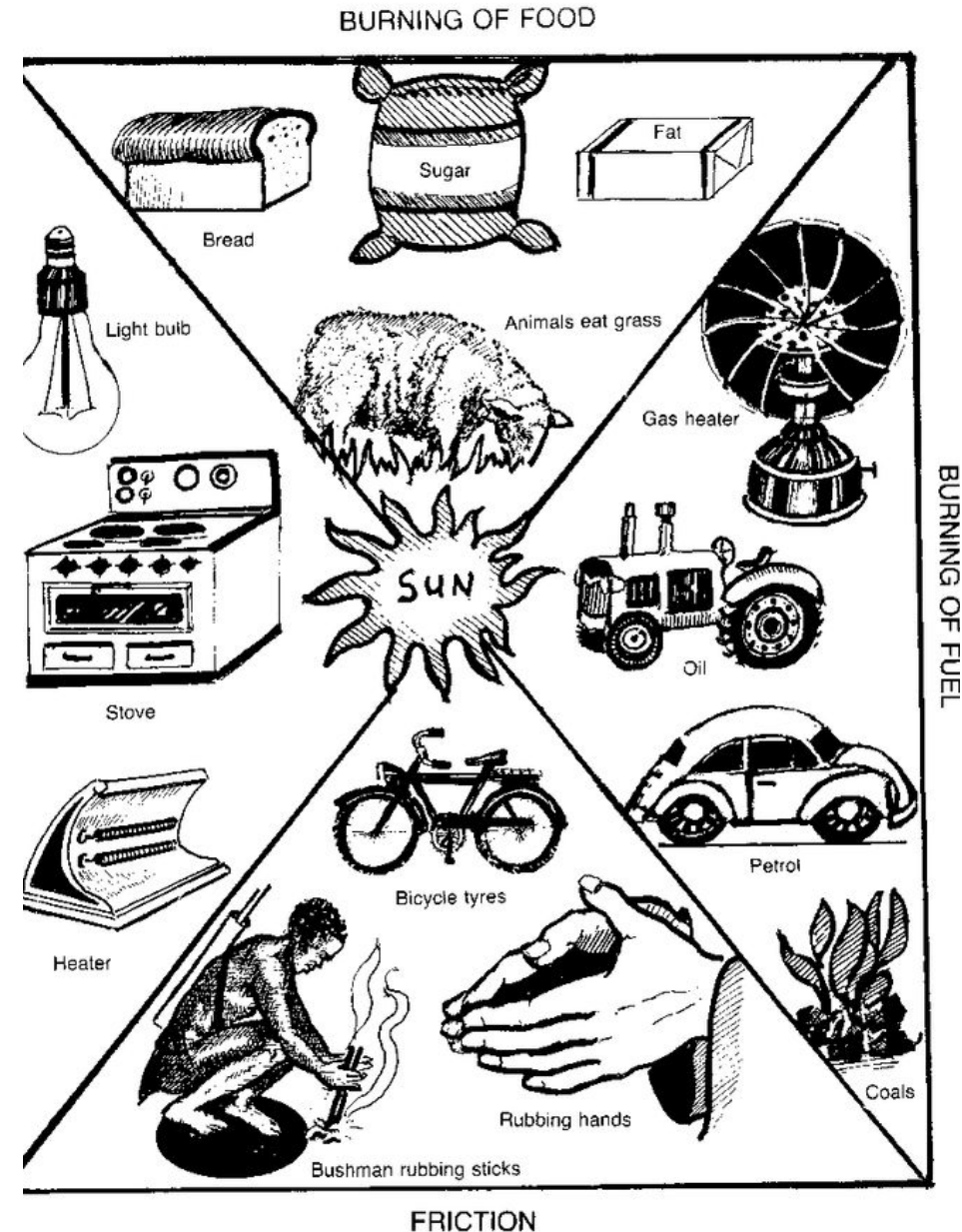
- Carbon Monoxide
- Carbon Dioxide
- Carbon Particles
- Sulfur Dioxide
- Hydrogen Cyanide
- Toxic & Explosive Gases

***Smoke is made up of unburned products of combustion that escaped consumption.**

SOURCES of HEAT ENERGY

Some of the most common sources of Heat Energy:

- Chemical
- Mechanical
- Electrical



Chemical Heat Energy

- Most common source of heat energy in combustion reactions.
- Self-heating (spontaneous heating) – Chemical energy that occurs when a material increases in temperature without the addition of external heat.
- Some chemicals can produce violent reactions when they are dissolved in water. Alkali metals such as sodium, potassium and lithium are a few.



Electrical Heat Energy

Resistance heating

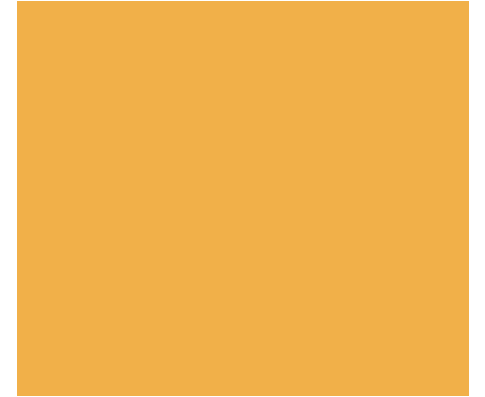
- When electric current flows through a conductor, such as incandescent lamps, ranges, ovens or portable heaters.

Overcurrent or Overload

- When current flowing through a conductor exceeds its limits.

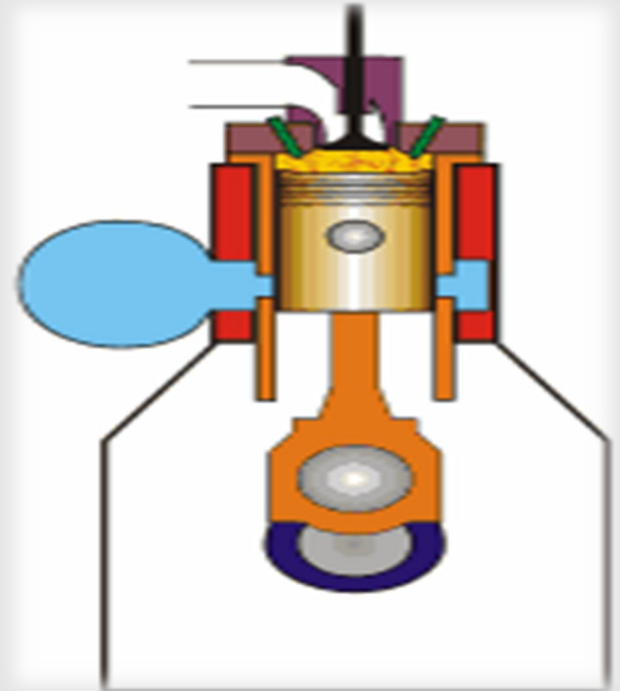
Arching

- An arc is a high-temperature luminous electric discharge across a gap or through medium such as charred insulation.



Mechanical Heat Energy

- Mechanical heat energy is generated by friction or compression. The movement of two surfaces against each other creates heat of friction.
- Heat of compression is generated when gas is compressed. Diesel engines use this principle to ignite fuel vapor without a spark plug.



Law of Heat Flow

Heat will travel from a warm object to a cooler object until both objects are at the same temperature.

5. Heat

a. The *flow* of thermal energy from one object to another.

b. Heat *always* flows from **warmer** to **cooler** objects.

Cup gets cooler while hand gets warmer



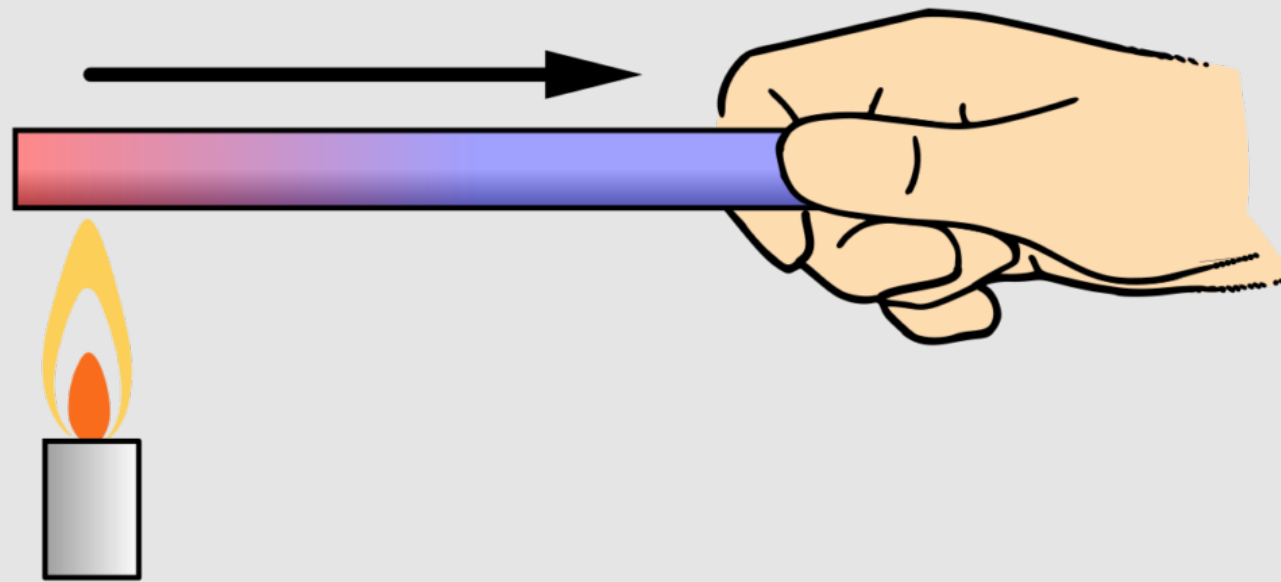
Ice gets warmer while hand gets cooler

Transmission of Heat (Methods of Heat Transfer)

Heat can be transferred from one body to another by three mechanisms:

- Conduction
- Convection
- Radiation

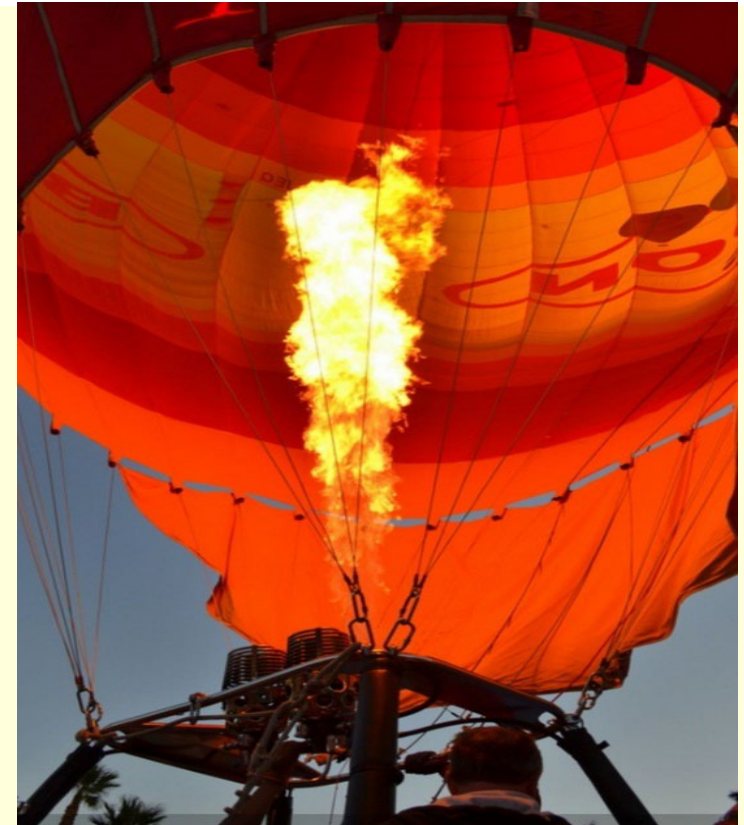
Conduction



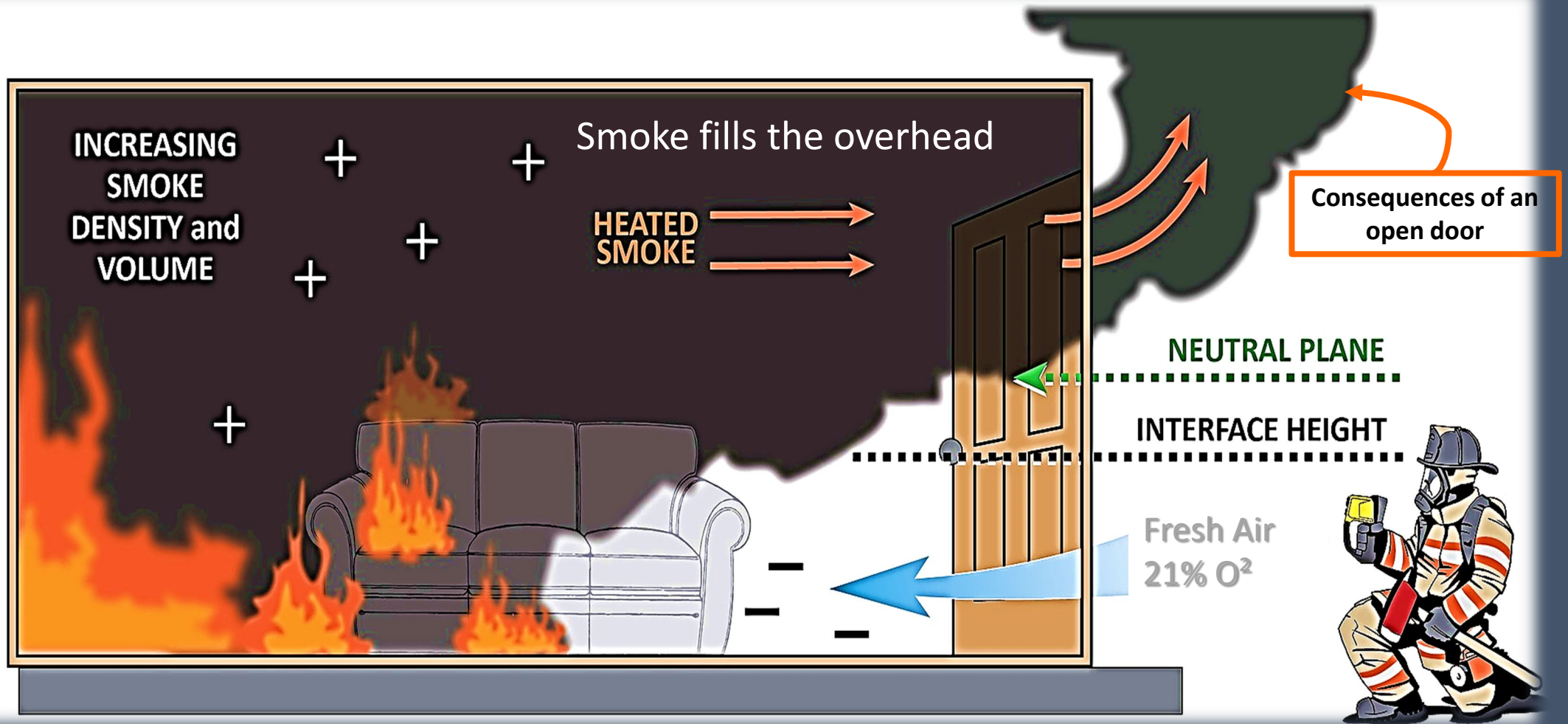
- Conduction is the transfer of heat by direct contact.
- Conduction rate depends on the material being heated.

Convection

Transfer of heat by the movement of heated fluids or gases, usually in an upward direction



Spread of Fire by Convection



Radiation

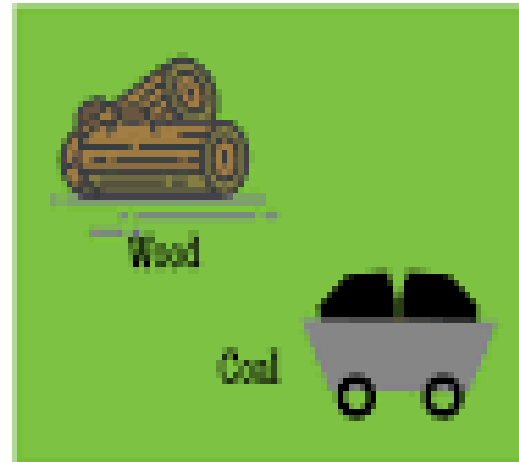
Heat waves that travel in all directions in air from a heat source.

- Felt when standing next to a fire
- Major source of fire spread due to exposures



Fuels can be solids, liquids or gases

Fuel Types



SOLIDS



Liquids



Gases

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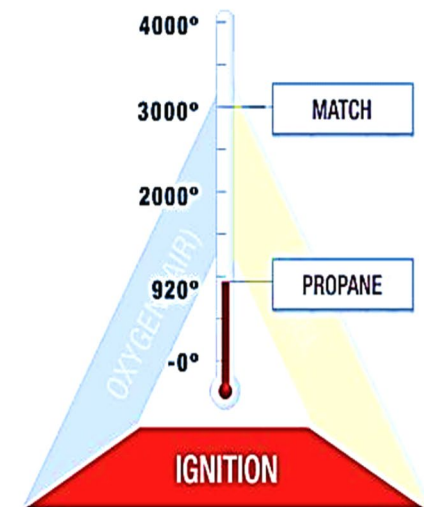
Ignition Temperature

The minimum temperature to which a fuel in air must be heated to start self sustained combustion without a separate ignition source.

Even with an ideal mixture of propane and air, there must still be an ignition source for combustion to take place. Ignition sources are usually expressed as the minimum temperature needed for a mixture of propane and air to ignite.

The minimum ignition temperature of propane is 920°F.

Although that temperature may seem very high, remember that the flame of a match can develop temperatures up to about 3,000°F. Does this seem extremely high? Well, consider this. The flame of a match burns at about 3,000°F. So propane can ignite at a much lower temperature than that.



Gaseous Fuel



- Methane
- Propane
- Carbon Monoxide
- Natural gas
- LNG

Vapor Density

Air has been assigned a vapor density of 1.

Gases with a vapor density of less (<) than 1 will rise while those having a vapor density greater than (>) 1 will sink.

- Methane (Natural gas)- Vapor Density of 0.55
- Propane (Liquefied Petroleum Gas)- Vapor Density of 1.55
- Carbon Monoxide- Vapor Density of 0.96

Liquid Fuels



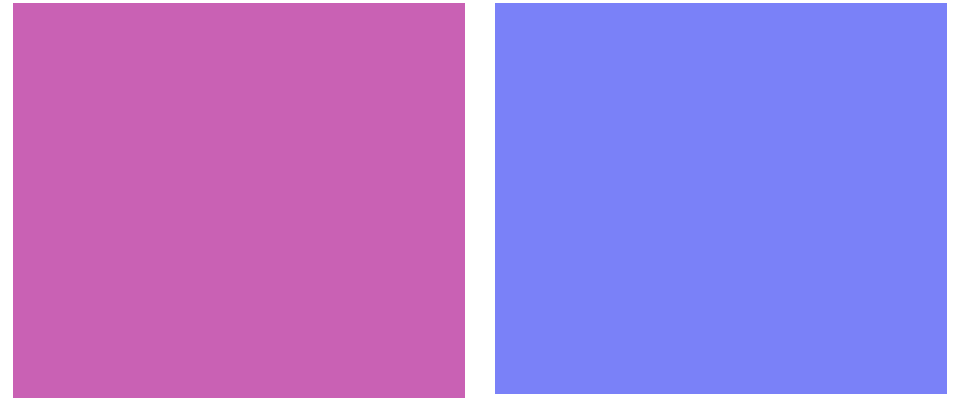
To burn, liquids must be vaporized.

- Gasoline
- Diesel
- Ethanol
- Methanol

Vaporization

Process of evolution that changes a liquid into a gaseous state. The rate of vaporization depends on the substance involved, heat and pressure.

- Vaporization occurs as fuel gases are generated from the action of heat
- Vapors then mix with air producing an ignitable mixture

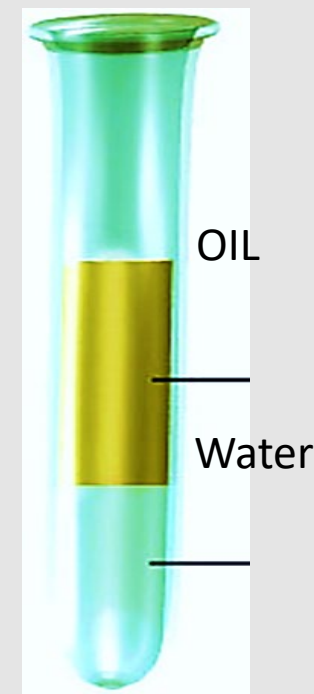


Specific Gravity

Weight of a substance compared to the weight of an equal volume of water at a given temperature.

Water is assigned a Specific Gravity of 1.

- A specific gravity less than <1 indicates a substance lighter than water.
- A specific gravity greater than >1 indicates substance heavier than water.



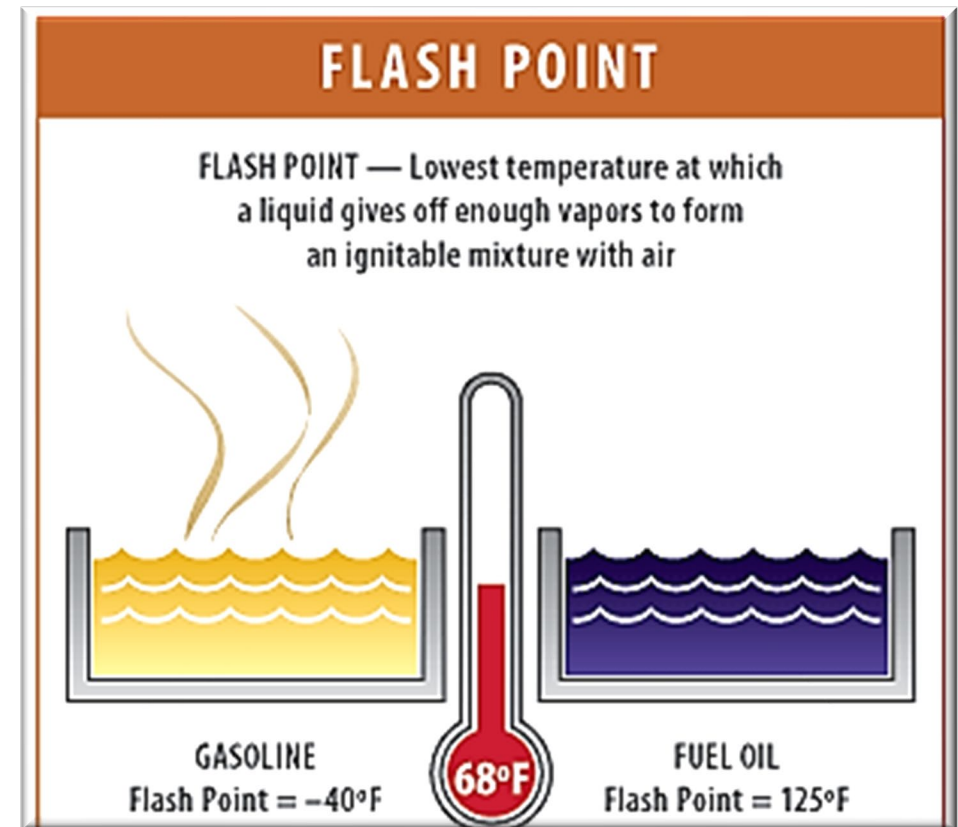
Flash Point/Fire Point

Flash Point

- The lowest temperature which a liquid fuel gives off sufficient vapors to form an ignitable mixture with the air but will not continue to burn.

Fire Point

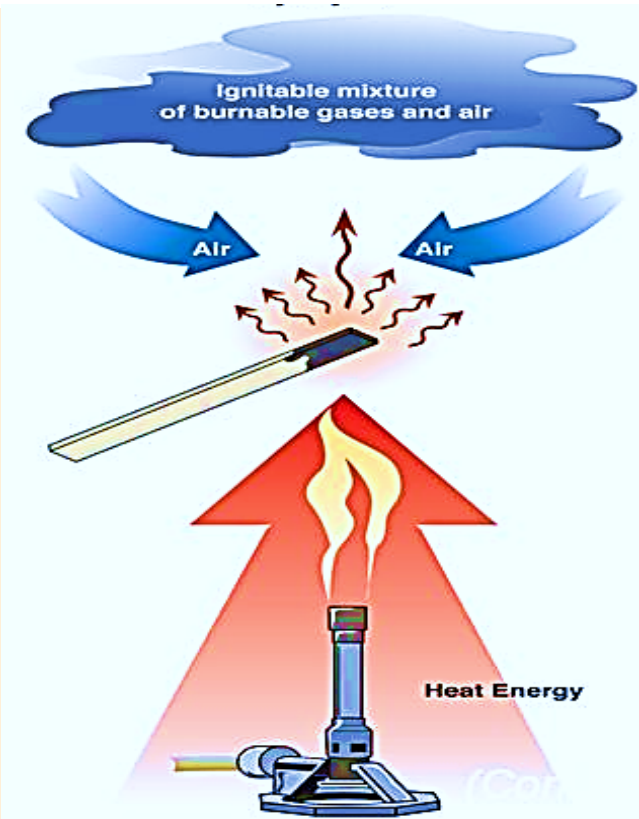
- The lowest temperature at which a liquid fuel will produce vapors sufficient to support continuous combustion once ignited.



Solid Fuel

Pyrolysis:

- Chemical decomposition of a substance through the action of heat evolves solid fuel into gases/vapors
- As the solid is heated, it begins to decompose below 400°F (204°C), giving off combustible vapors

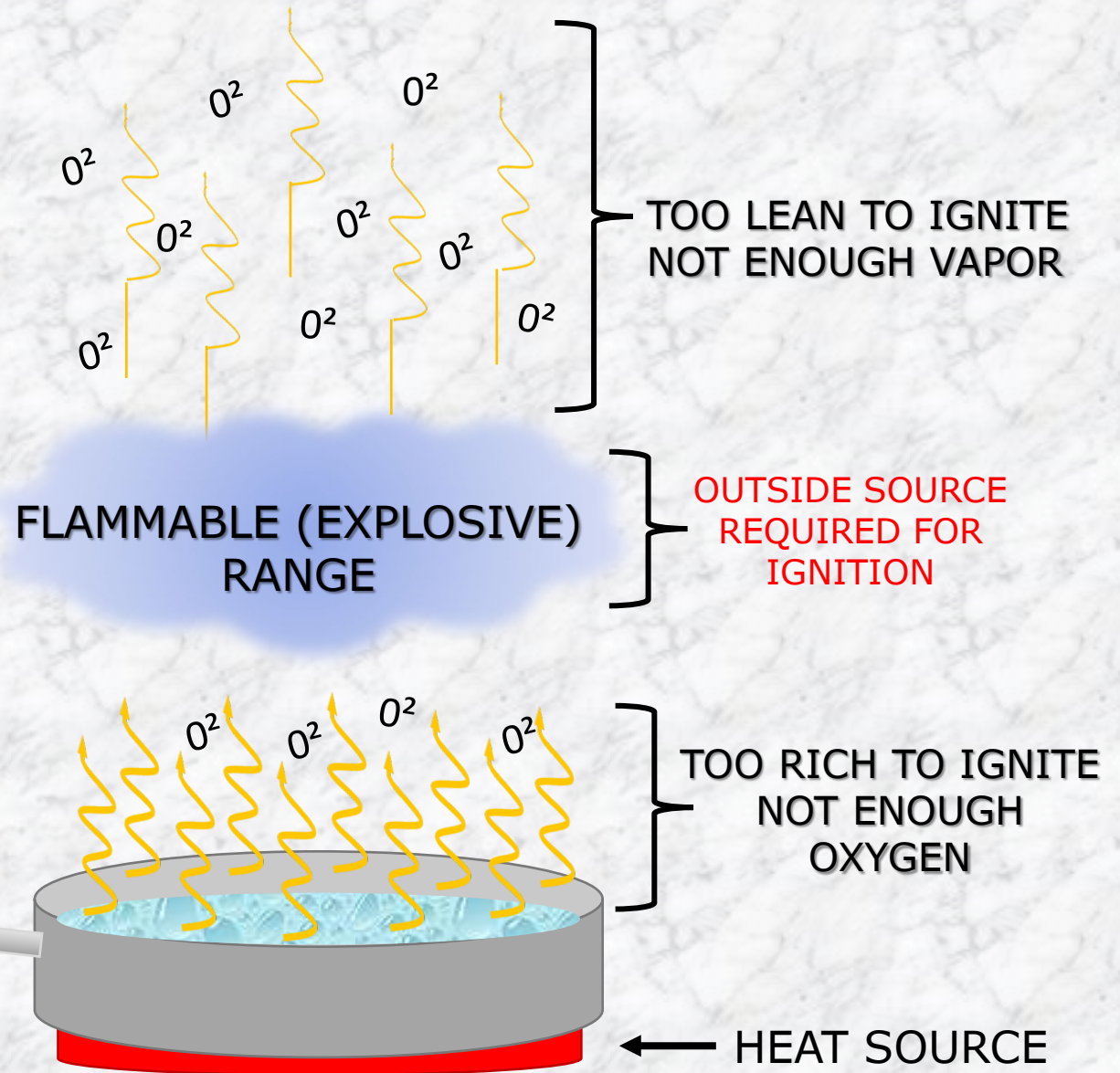
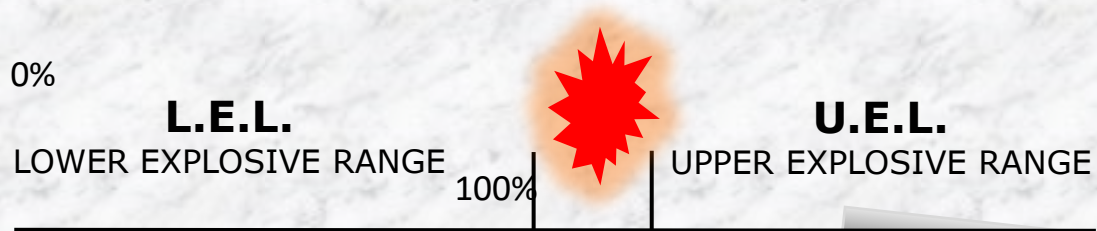


Flammable (Explosive) Range





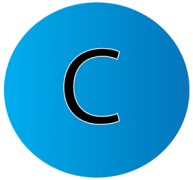





The use of a properly calibrated monitoring device can detect explosive vapors in the atmosphere.
Normal action level is 15% of the L.E.L (Lower Explosive Limit).

Example of Explosive Range:

Propane	2.1% - 9.5%
Diesel Fuel	1.3% - 6%
Gasoline	1.4% - 7.4%
Methane	5% - 15%



Classification of Fires

		Ordinary Combustibles	Wood, Paper, Cloth, Etc.
		Flammable Liquids	Grease, Oil, Paint, Solvents
		Live Electrical Equipment	Electrical Panel, Motor, Wiring, Etc.
		Combustible Metal	Magnesium, Aluminum, Etc.
		Commercial Cooking Equipment	Cooking Oils, Animal Fats, Vegetable Oils

Class A (ALPHA)

Anything that Leaves an **Ash**

- Wood, paper, textiles, rubber, etc.



Class A Fires

- Wood
- Paper
- Cloth
- Plastic
- Garbage



Class B (BRAVO)

Flammable and Combustible Liquids and Gases:

- Gasoline
- Diesel fuel
- Grease
- Alcohol

Gases

- Propane
- Hydrogen
- Butane
- Methane



Class C (CHARLIE)

Class- C fires involve energized electrical equipment.

Electrical equipment such as:

- Household appliances
- Computers
- Transformers
- Electric motors
- Overhead transmission lines



Class D (DELTA)



Combustible Metals

- Aluminum
- Magnesium
- Titanium
- Zirconium
- Sodium
- Potassium
- Lithium
- Calcium
- Zinc





Class K (KILO)

Kitchen

- Cooking oils and cooking fats
- Grease, Oil, lard

The Burning Process

Fire develops in phases sometimes referred to as stages.

- The growth and development of a fire is usually controlled by the availability of fuel and oxygen.
- Some fires can/will skip the stages of development and go straight to the Flashover Phase.

For example: Fresh cut green pine tree

NIST

National Institute of Standards
and Technology
Technology Administration
U.S. Department of Commerce

Incipient Stage



- Earliest stage of fire
- Fire limited to original materials of ignition
- Flame temperature above 1000° F (537° C)
- Room temperature only slightly increased
- Recognizing a fire in this stage provides the best chance for suppression or escape!
- Suppression is the correct choice!!!

Growth Stage

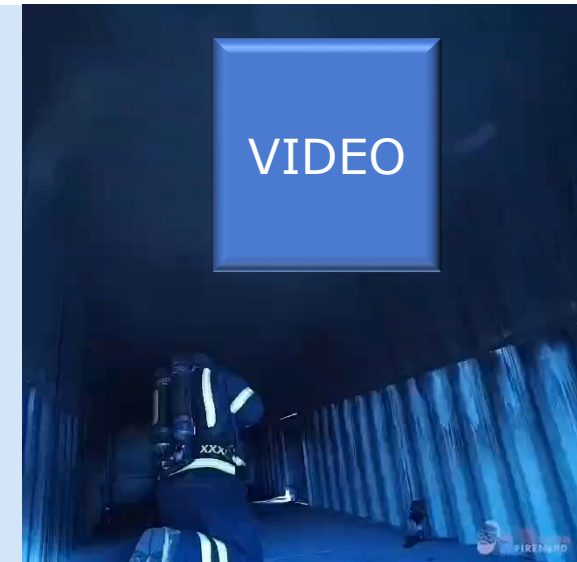


- Sufficient oxygen and fuel are available for fire growth
- Smoke and superheated gases collect at the overhead level
- Temperatures in upper regions may exceed 1150F (621° C)
- It is the shortest stage and may cause a deadly flashover condition

Thermal Layering



- Is the tendency of smoke & gases to form layers according to temperature.
- Hottest gases will rise via convection.



Rollover

- Occurs when flames move across unburned gases and smoke during a fire's progression.
- Occurs during the growth stage. Is distinguished from flashover in that only gases are burning, not the entire contents of a compartment.



Flash-over

Video

- Rapid transition between the growth and fully developed fire stages.
- The combustible material in the compartment and the gases produced by pyrolysis ignite almost simultaneously.
- Temperatures range from approximately 900° F to 1200° F (483° to 640° C)

Fully Developed Stage



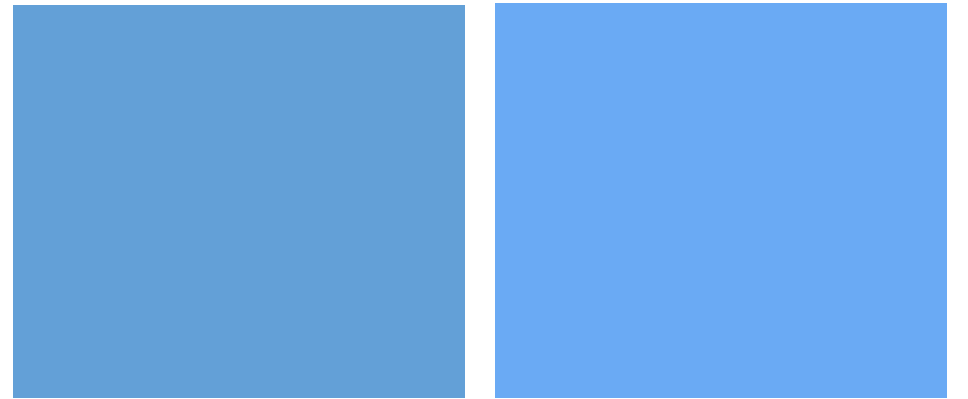
- When the growth stage has reached its maximum intensity, all combustible materials have been ignited.
- This is the hottest stage of a fire and the most dangerous for rescuers searching for a missing crew member.

Decay Stage

- Oxygen content below 15% (15%-3%)
- Temperature in excess of 537 ° C (1000° F)
- Carbon Monoxide, dense smoke & superheated gases remain
- New supply of oxygen may cause "Backdraft" or "Smoke Explosion"
- Most *Dangerous* Phase of Fire

Back Draft Explosion

- A backdraft is a rapid or explosive burning of superheated gasses in a fire, caused when oxygen rapidly enters an oxygen-depleted environment.
- For example, when a door to an enclosed space is opened during the decay phase of a fire
- Backdrafts present a serious threat to firefighters.





Extinguishing Agents

Extinguishing Agents

- As mariners we have available to us a wide selection of agents for use on fires.
- These agents are designed for use on specific classes of fires.
- The use of the incorrect agent on a fire may result in an ineffective suppression effort and/or injury to the firefighter.

Common Extinguishing Agents

- Water /Steam
- Carbon Dioxide
- Dry Chemical
- Dry Powder
- Foam
- Clean Agents

WATER

- Extinguishes a fire by cooling below ignition temperature
- Commonly utilized on Class **A**
- Application is normally done via portable extinguisher, hose or sprinkler system.
- Water affect the stability of a vessel when used in large quantities.
- Sea water weighs approximately 8.6 lbs. per gallon (3.9kg). 64 lbs. per cubic foot (29kg/cubic meter).
- The expansion ratio of water (liquid) @ 212°F (100°C) to steam (gas) is 1,700:1

Carbon Dioxide

- Extinguishes fire by displacing oxygen
- Commonly used on Class **B** & **C** fires
- Does not cool! Fire may re-flash once agent dissipates
- Does not leave a residue
- Does not conduct electricity
- Applied from Portable Extinguisher or Fixed Flooding System

Dry Chemical

- Multi-purpose used on Class **A-B-C** fires
- Extinguishes fire by interrupting the Chemical Chain Reaction
- Highly corrosive chemical

Dry Powder

- Utilized on class **D** fires
- Will not extinguish all metal fires
- Most dry powders are made up of a sodium chloride agents
- Flow enhancers and thermoplastic material are added to agents to enhance crusting



Fire Fighting Foam Concentrate

Aqueous Film Forming Foam (AFFF)

AFFF is use on Class **B** fires involving hydrocarbons

Provides an aqueous film designed to suppress fuel vapors and occlude O_2

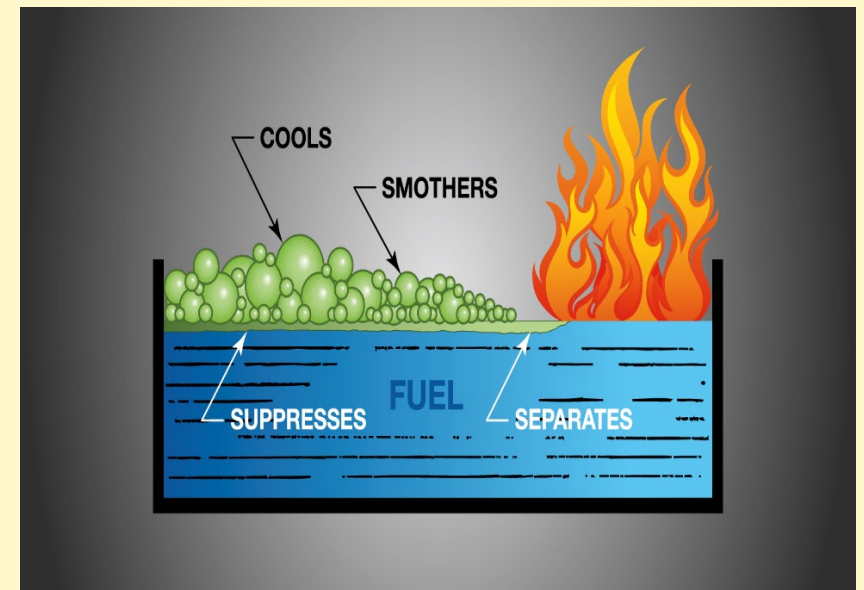
AFFF has self-healing capabilities.

Fire Fighting Foams

Foam is lighter than the burning liquid, so it floats across the fuels surface.

What are the 3 extinguishing actions of foam?

- Cooling
- Smothering
- Separating



Class A Foam Concentrate

Improves effectiveness by reducing the surface tension of water thereby allowing penetration through Class A materials.

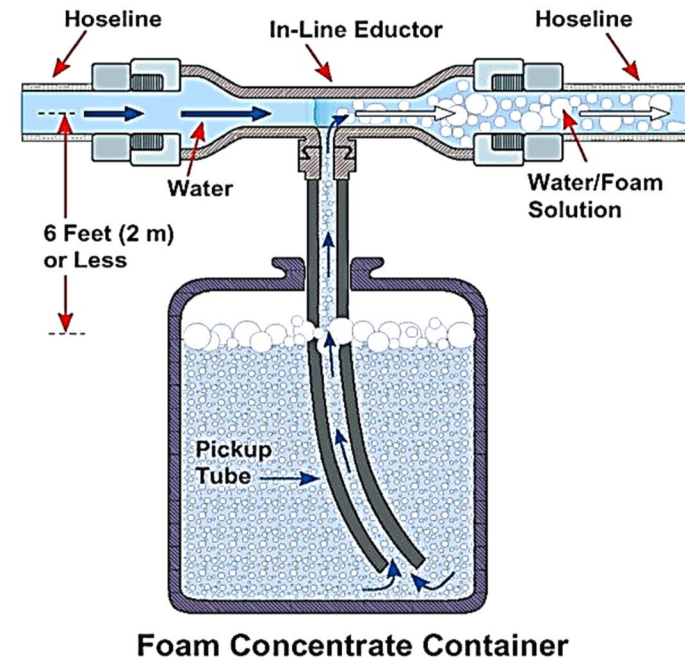


Proportioning

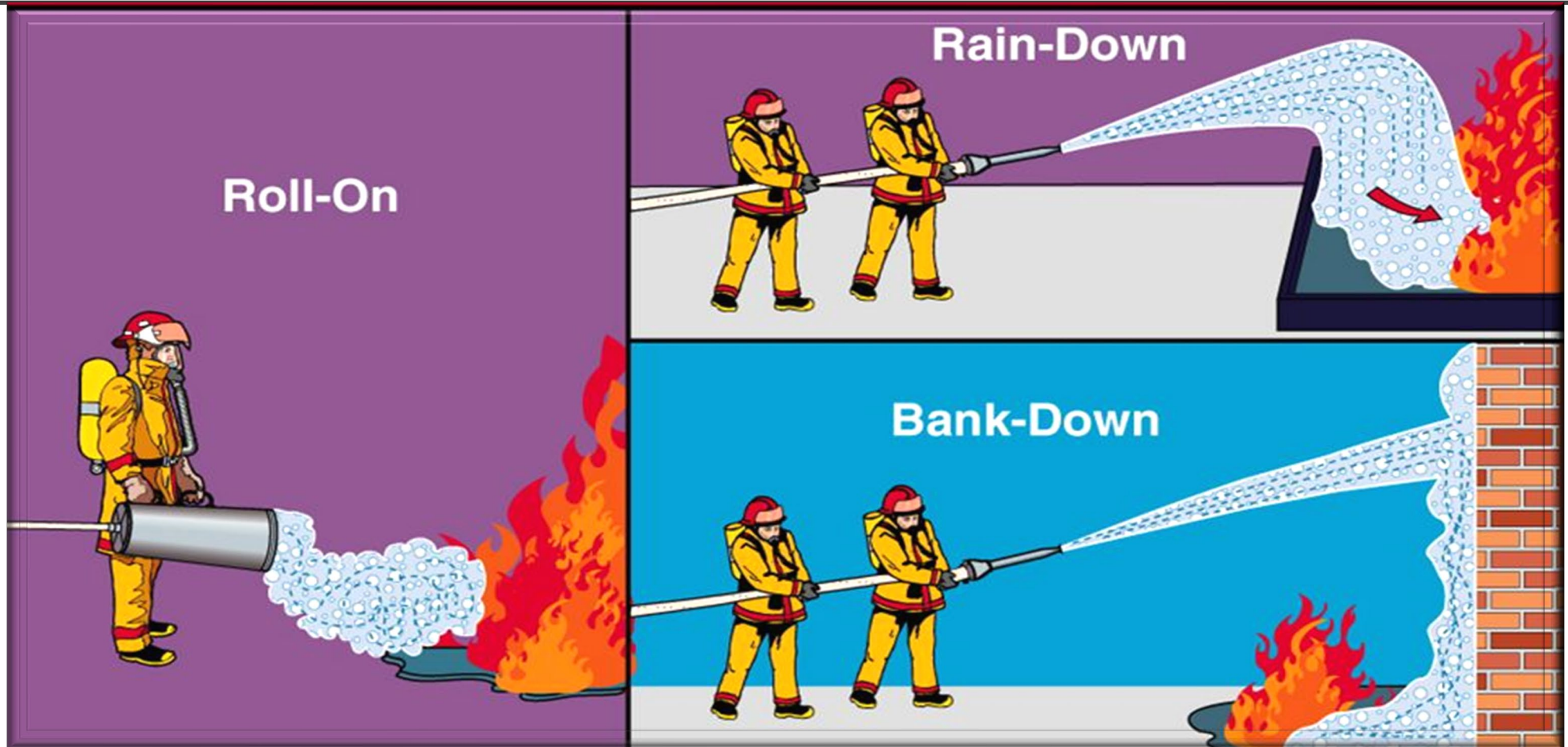
Foam Proportioner:

- The device that introduces foam concentrate into the water stream at a metered rate.

In-Line Eductor Mechanics



Application Method



Clean Agent FM-200 / NOVEC 1230

Clean Agent Gas Systems Advantages:

- Smaller amounts of agent required to suppress a fire. This means fewer cylinders, therefore less wasted space for.
- Reach extinguishing levels in 10 seconds or less, stopping ordinary combustible, electrical, and flammable liquid fires before they cause significant damage

Clean Agent FM-200/NOVEC-1230

- Advantages:
 - Extinguishes a fire in seconds, before it even starts and long before water-based systems discharge
 - Safe to use within occupied spaces
 - Environmentally friendly
- Disadvantages:
 - Forms minimal decomposition products
 - Higher agent cost













Portable Fire Extinguishers

Fire Extinguisher Labeling

FIRE CLASSIFICATIONS

BEFORE USING A FIRE EXTINGUISHER LOOK FOR ONE OF THE FOLLOWING SYMBOLS THESE SYMBOLS INDICATE WHAT TYPES OF FIRES AN EXTINGUISHER IS MEANT TO BE USED ON

LETTER SYMBOL:	PICTURE SYMBOL:	FOR USE ON:
		ORDINARY COMBUSTIBLES SUCH AS TRASH, PAPER, WOOD AND TEXTILES
		FLAMMABLE LIQUIDS
		ELECTRICAL EQUIPMENT
		COMBUSTIBLE METAL
		COMBUSTIBLE COOKING MEDIA

Reorder: NHE-50953 www.ComplianceSigns.com

Pressurized Water

- Class **A** fires
- Stream reaches up to 40 feet
- Discharge time 30 - 60 seconds
- Extinguishes a fire by cooling





Dry Chemical

- Multipurpose suitable on Class **A, B & C** fires
- Effective range is only 5-20 feet
- Discharge time 10 - 25 seconds
- **Cartridge Operated Dry Chemical**



Carbon Dioxide

- Suitable on Class **B & C** fires
- Effective range is only 3-5 feet
- Discharge time 8-30 seconds depending on unit size
- Discharge horn becomes extremely cold & may produce static electric

video →



Stored Pressure – AFFF/ AR-AFFF* (Aqueous Film Forming Foam)

- Suitable on Class **A** & **B** fires
 - Best used on smaller fires for vapor suppression involving liquid fuels.
 - Effective range up to 25 feet
 - Discharge time 55 seconds
-
- ***AR = Alcohol Resistant**



Stored Pressure Dry Powder

- Used to extinguish some Class **D** fires
- Extinguishes fires by smothering
- Effective range is 4-6 feet
- Discharge time is up to 30 seconds
- May not be suitable for all types of metals



Stored Pressure Wet Chemical

- Used on grease fires in the galley, Class "**B**" or also called Class "**K**"
- When mixed with the grease it forms a foam blanket like layer over the surface of the grease/oil.
- Effective range 6-8 feet
- Discharge time about up to 60 seconds.





*Safety kit that
doesn't work is
worse than useless
– it's dangerous*

Galley Fires



Mobile Apparatus

Mobile Apparatus

Semi-Portable Wheeled Type Extinguishers

Foam

- Size approximately 33 gallons (125 Liters)

Carbon Dioxide

- Sizes 50 - 100 pounds (22.6 - 45.3 kilograms)

Dry Chemical

- Sizes 75 - 350 pounds (34 -158.7 kilograms)

- **Typically found in large Engine Rooms, Machinery Spaces and Helicopter landing decks.**

OPERATING YOUR FIRE EXTINGUISHER



PULL THE PIN



AIM AT THE BASE



SQUEEZE TRIGGER



SWEEP

Remember:

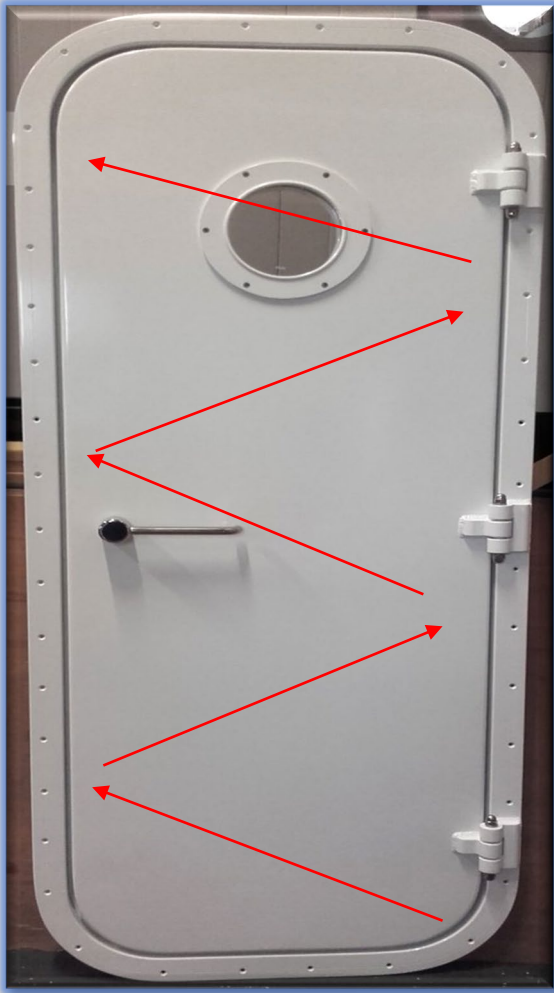
- Test extinguisher before approaching the fire
- Keep low & approach with the wind at your back
- Back away, watching for rekindle

Portable Fire Extinguisher Operation

Basic Inspection

- Fire extinguishers are inspected **Monthly**.
- Location & positions according to – Fire Control Plan
- Maintain repair log & inspection tag
- Verify extinguisher is visible & accessible
- Operating instructions & labels are in place
- We add a T for TEST.

Checking For Heat



- Use proper door opening techniques:
- Check the door for heat using the back of the hand in a "Z" pattern, going from **bottom** to **top**
- Stand opposite side of the hinges
- Out of the path of travel

Fire! What do I do?

Upon discovering a fire, the FIRST ACTION is to:

- Close the door and Sound the Alarm!
- Alert the Bridge!
- Simultaneously determine whether you are going to engage the fire.
- Incipient Phase: Grab an extinguisher or go for a fire hose & Attack!
- Free Burning Phase: Close the door and notify everyone in the area.

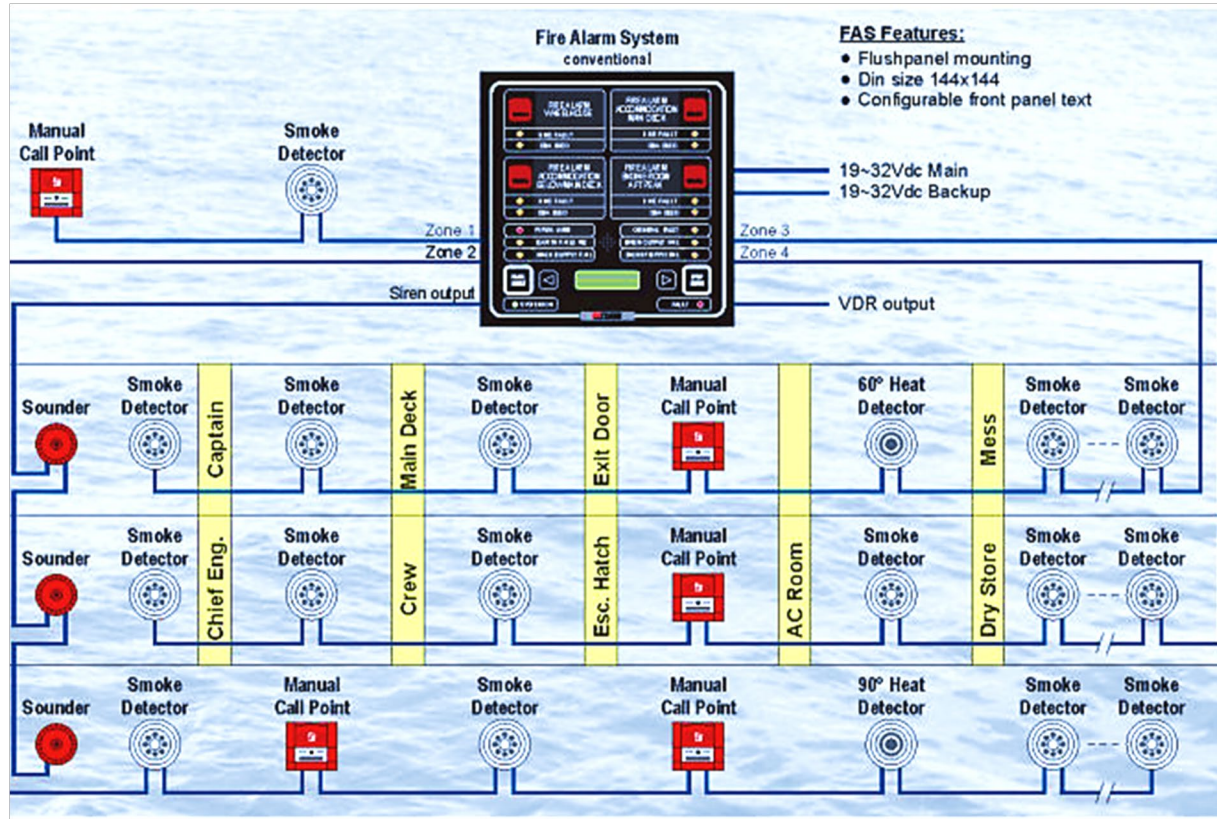


Portable Fire Extinguishers

Basic Inspection

- Location & positions according to – Fire Control Plan
- Maintain repair log & inspection tag
- Verify extinguisher is visible & accessible
- Operating instructions & labels are in place
- External inspection for damage or corrosion

Fire Alarm and Fixed Fire Suppression Systems



Fire Alarm Control Panel

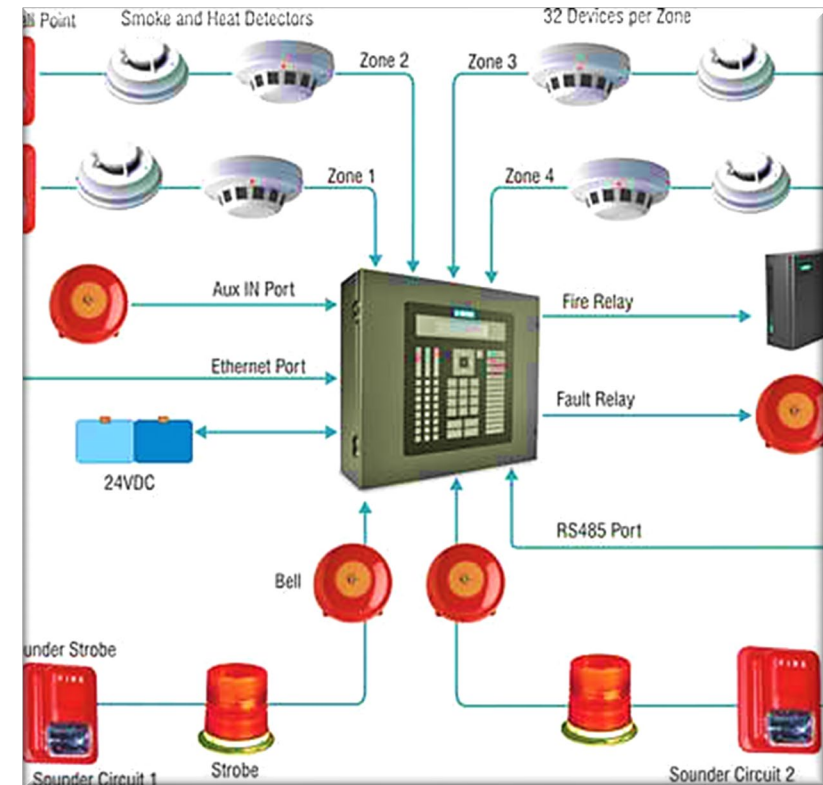
The Main Fire Alarm Panel is usually located on the bridge.

Secondary power supply must make the system operational within 30 seconds of main power failure



Fire Alarm Control Panel

- Receives signals from detectors
- Processes signal and takes the appropriate actions
- Activates lighting of alarm indicators on the Bridge, Engine Room.
- **The Watch Officer is responsible for investigating all alarms and sounding the general alarm when indicated**



Fire Alarm Initiating Devices

- Fire alarm push buttons
- Pull station
- Smoke/Heat detector
- Flow switches for sprinkler





FIRE

Audible & Visual Indicators

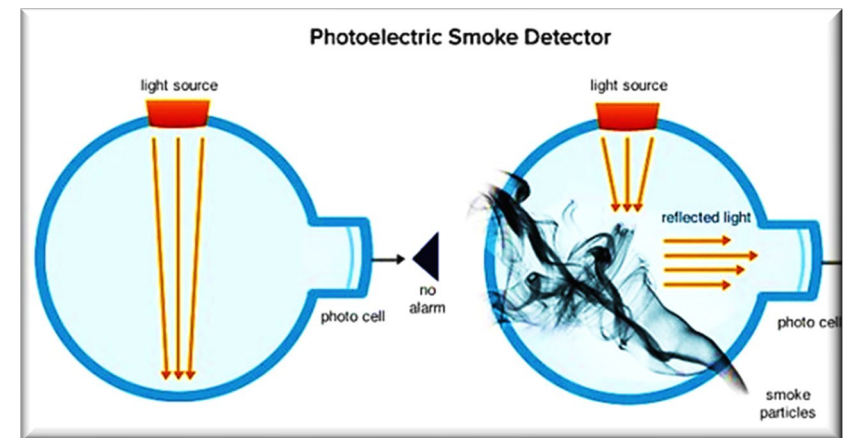
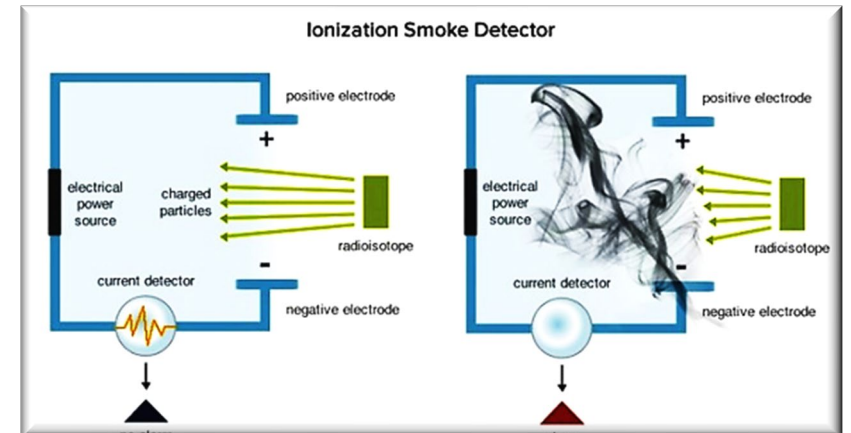
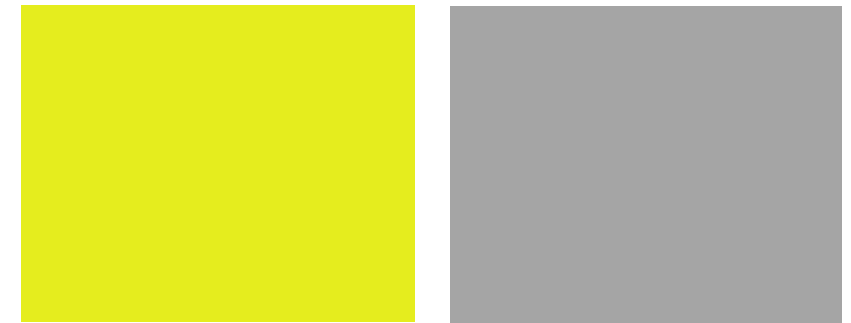
Audible Alarm and Visible Devices:

- Bells, buzzers, horns, and other warning lights.
- Visual alerts (strobe lights) are typically coupled along with audible alarm for high noise areas (i.e., Engine Rooms).



Smoke Detectors

- Smoke Detectors are considered most reliable.
- **Virtually all fires produce smoke!**



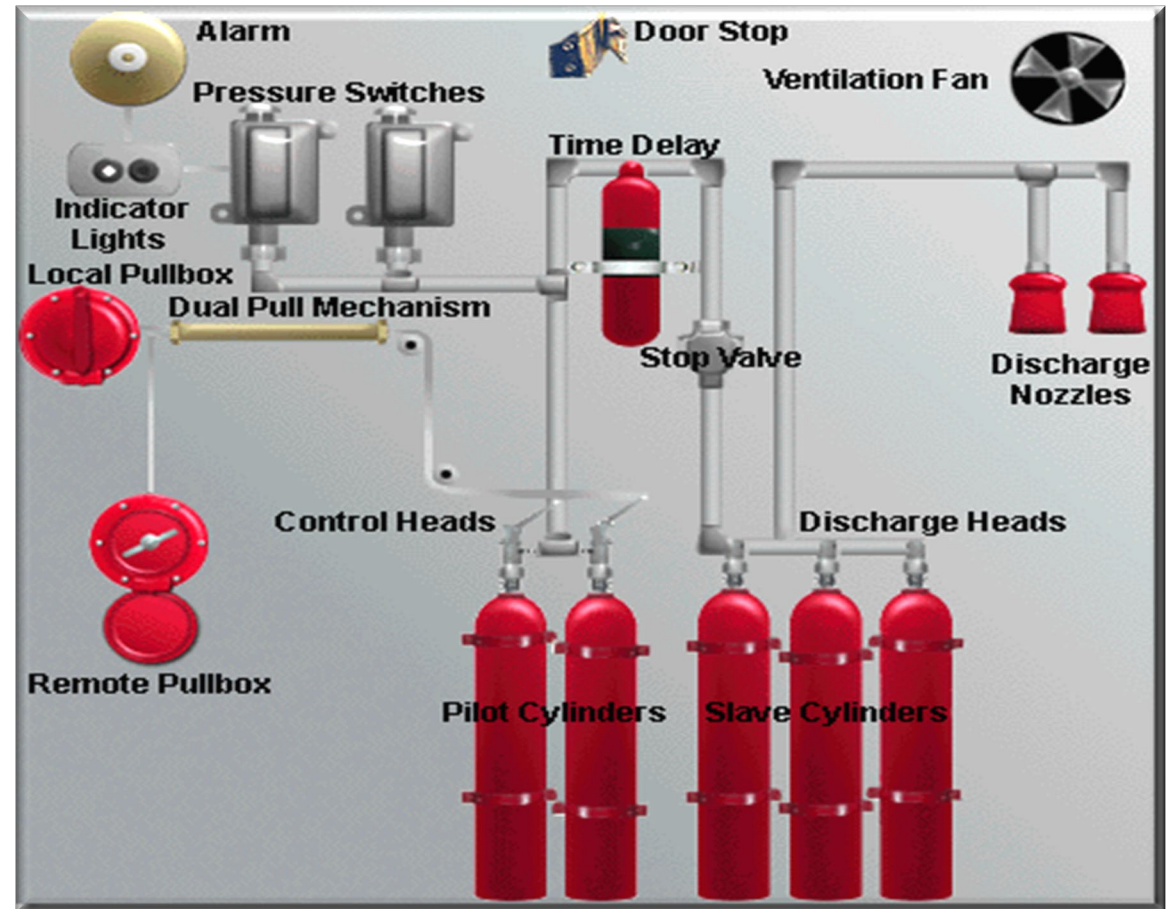
Different Types of Detectors



- Heat detectors
- Flame or light detectors
- Carbon Monoxide
- Rate of Rise

Common Fixed Fire Protection System

- Carbon Dioxide (CO₂)
- Water sprinkler systems/High Fog
- Clean Agent-FM-200 / Novec 1230
- Wet chemical (Class K)
- Fire Pumps



High Pressure CO2 System

Carbon Dioxide Systems

Advantages

- No damage to cargo or machinery
- Leaves no residue
- Non-conductive
- Provides own pressure for discharge
- Requires no ship power

Disadvantages

- Extremely dangerous to humans by displacing oxygen
- System is designed to introduce a minimum of 34% concentration in the protected space.
- Large bulky, heavy systems

Carbon Dioxide Systems (cont.)

Delayed Discharge

- Spaces accessible to persons with CO2 systems larger than 300 pounds must be fitted with an approved time delay.
- **Minimum delay of 20 seconds for CO2 system** (For the evacuation of personal and Ventilation shut down)
- Manual controls must be located outside protected space

Alarms

- Typically, siren type
- Requires no source of power other than CO2
- Must also be accompanied with warning sign

Carbon Dioxide Systems (cont.)

Operation

- Ensure space is evacuated
- Doors, dampers & openings must be closed before releasing CO2 system
- Remote fuel shutoffs should be closed
- Secure electrical power if possible

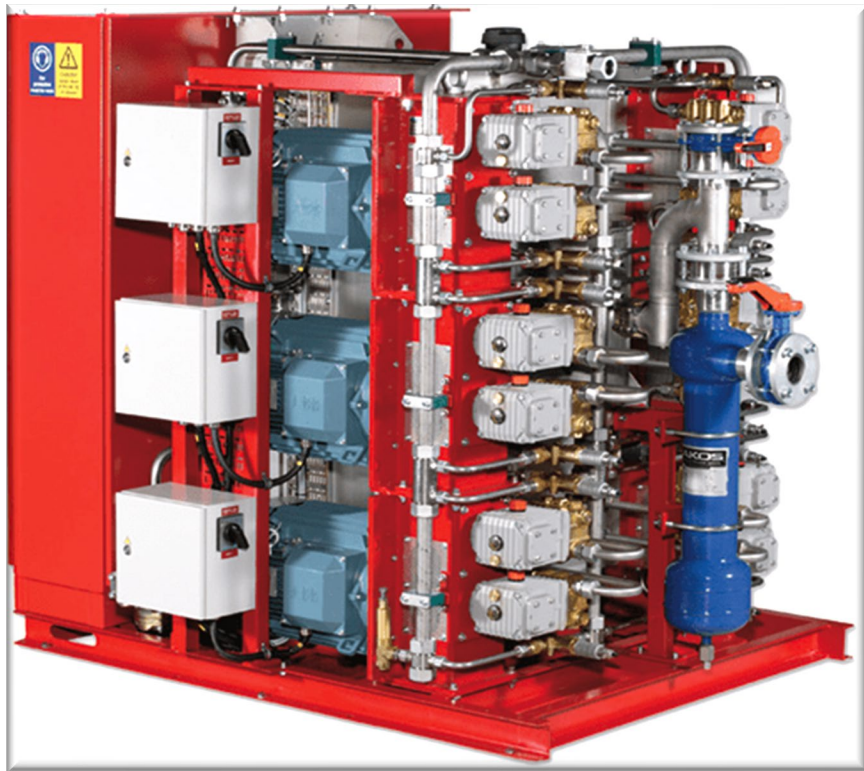


Fire Detection & Suppression Systems

Common mistakes / Fixed CO2 systems

- Not closing all openings, hatches, dampers & doors before releasing CO2
- Decision to activate system not made soon enough
 - If making progress with fire team attack - wait
 - If not, use CO2 system & begin boundary cooling
- Not maintaining fire boundaries on all boundaries
- Opening space prematurely (Recommended waiting period 24 hours)

Footprint Comparison CO2 System / High Pressure Water Fog



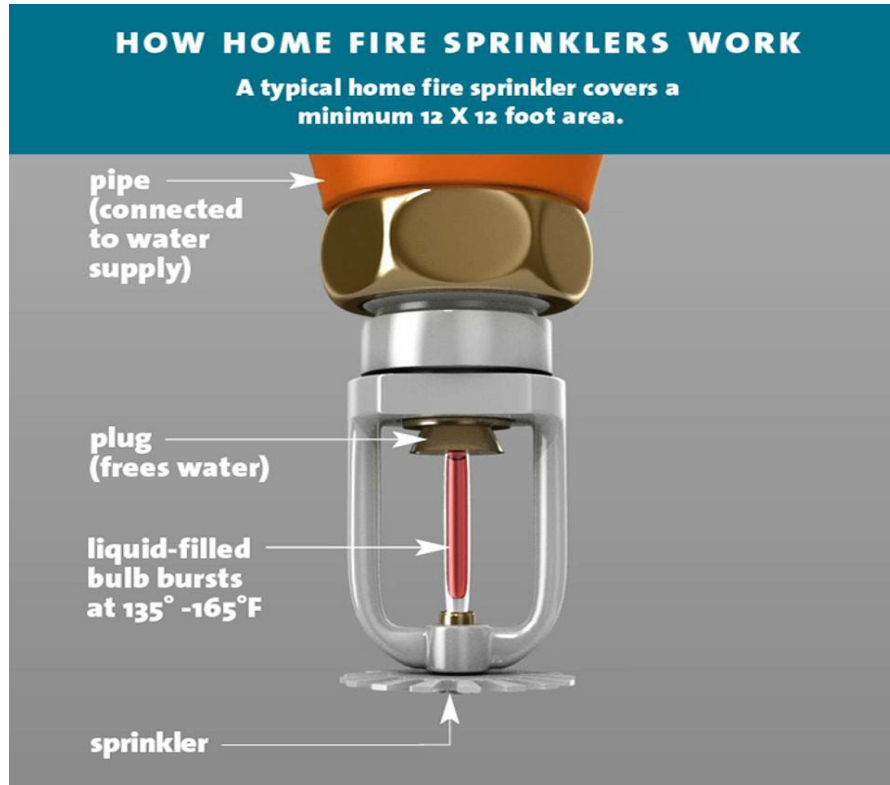
High Pressure Water Fog

Hi-Fog System
Video

- Uses 1/10 of the water used in conventional fire water sprinkler systems (90% less water)
- Protects accommodation, public, and service areas to include galley and engine room/machinery spaces



Glass Bulb



Fusible Device



Fire Sprinkler System

FM200 Gas Systems



- FM200 is a synthetic/chemical fire suppression gas and extinguishes a fire by removing the free radicals or heat elements from the fire triangle.
- The typical concentration of an FM200 system is normally between 7.9% to 8.5%

NOVEC 1230 Systems

A synthetic/chemical vaporizing liquid fire suppression gas and extinguishes a fire by removing the free radicals or heat elements from the fire triangle "Chemical Chain Reaction". (Oxygen, Heat and Fuel).

The concentration is typically between 5.3% to 5.6% of the room volume.



Wet Chemical Systems

- Newer galley systems utilize a wet chemical system
- Consists of an Aqueous solution of Potassium Carbonate
- Highly effective
- Produces less residue

Class K
Wet Chemical System
Video

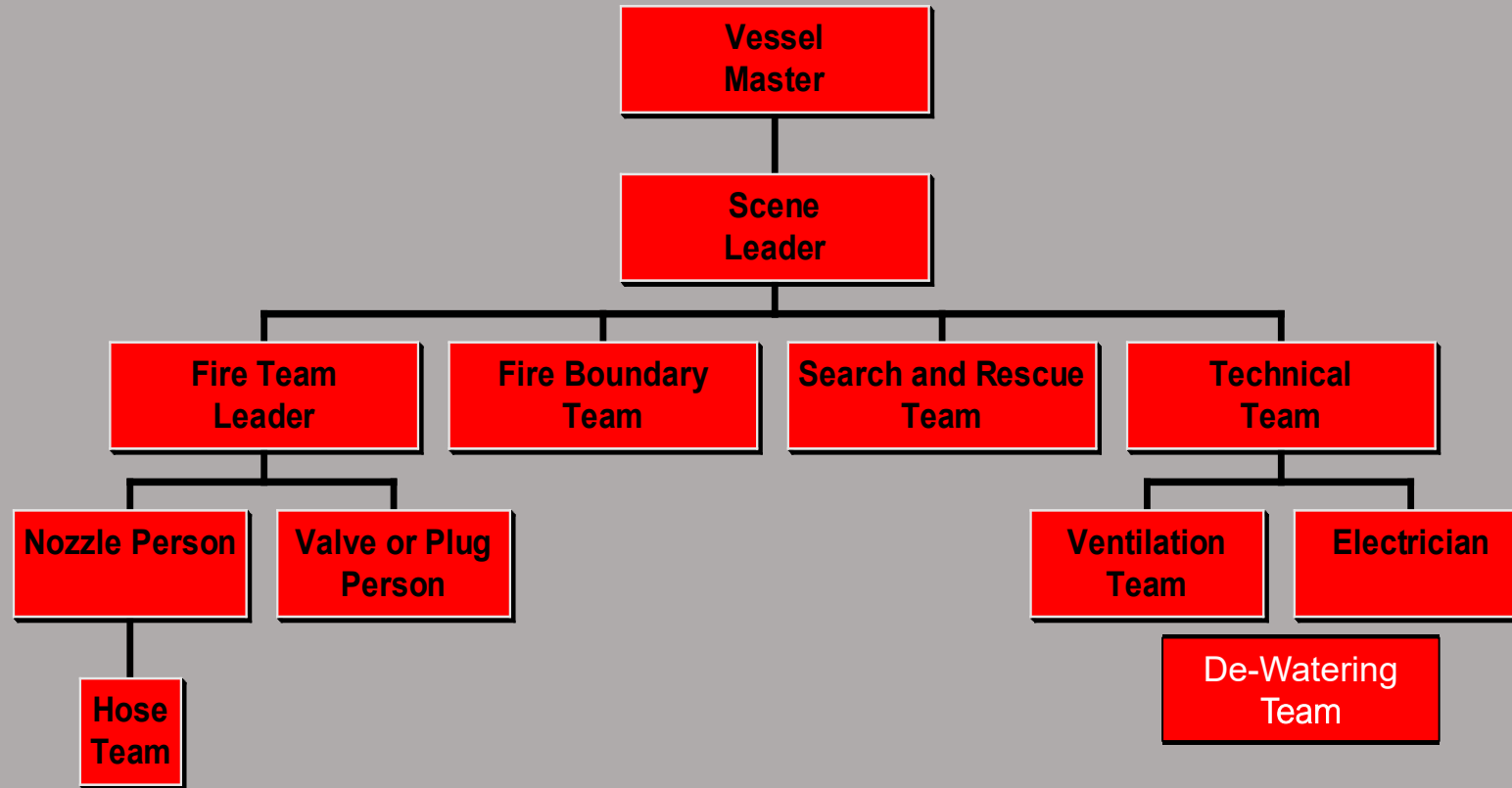


Fire Pumps



Shipboard Organization and Firefighting

Fire Team Composition



Fire Team Composition

Master/Captain of the Vessel

- Incident Commander during any Emergency
- Manages incident from bridge
- Coordinates efforts of shipboard fire fighting teams with the On-Scene Commander
- Oversees operation & use of all shipboard fixed fire fighting systems and dewatering procedures
- Decides if & when to abandon ship

Fire Team Composition

On Scene Leader (Officer in Charge on scene)

(Chief Mate, 1st Engineer or Chief Stewardess)

- Determines exact location of fire and preforms a “Size-Up”
(Size-up: Exact Location of the fire / Color of smoke /Class of Fire/
Search & Rescue needed)
- Oversees tactical operations at the scene
- Monitors comms between all tactical units
- Keeps master informed

Fire Team Composition

Fire Team Leader Responsibility (Engineer(s) & Deck Officers)

- Directs tactical activities of fire hose Team(s)
- Safety of fire team members under their command
- Reports status to Scene Leader

Nozzleman

- Directs the fire stream and chooses the pattern required
- Crew member(s) to back-up nozzle person and relieve nozzle reaction force.
- In charge of the hose team if no fire team leader is present.

Fire Team Composition (cont)

Hose Team

- Typically, crewmembers familiar with involved space
- Equipped with PPC & SCBA
- 2 people required for smaller hoses
- 3-4 people required for larger hoses

Search and Rescue Team

- Minimum two-person team
- Sweeps boundary areas for trapped personnel
- PPC & SCBA recommended if available

Fire Team Composition (cont)

Fire Boundary team

- Establishes & maintains primary & secondary fire & smoke boundaries

Technical Team

Ventilation Team

- Secures openings to effected area
 - Fire dampers
 - Fire doors
 - Hatches

Electrician

- De-energizes circuits in involved area

Dewatering

Emergency Internal Communications

Hand-held radios

- Primary choice due to mobility & non-reliance on ship's power*
- Ship's Telephones
- Public Address Systems
- Messengers



DECK DEPARTMENT

ENGINE DEPARTMENT

STEWARD DEPARTMENT

Captain

Chief Engineer

Chief Steward

1st Mate/Chief Mate

1st Asst. Engineer

Chief Cook

2nd Mate

2nd Asst. Engineer

2nd Cook

3rd Mate **

3rd Asst. Engineer **

Able Bodied Seaman

Oiler/QMED

Cook

Ships Organization

Ordinary Seaman

Wiper

Steward

General Emergency Alarm

- International Standard for General Emergency Alarm
- Seven or more short blasts followed by one long blast on ship's whistle and general alarm system
- Must have an emergency power source
- Must be operable from the bridge



**GENERAL ALARM
WHEN ALARM SOUNDS
GO TO YOUR STATION**

THE DISCHARGE OF PLASTIC OR GARBAGE MIXED WITH PLASTIC INTO ANY WATERS IS PROHIBITED. THE DISCHARGE OF ALL GARBAGE IS PROHIBITED IN THE NAVIGABLE WATERS OF THE UNITED STATES AND IN ALL OTHER WATERS WITHIN THREE NAUTICAL MILES OF THE NEAREST LAND.		
THE DISCHARGE OF DUMPS, LIME, AND ANCHORS WITHIN TEN MILES THAT FLOAT IS PROHIBITED WITHIN TEN NAUTICAL MILES FROM THE NEAREST LAND.	OTHER UNBROKEN GARBAGE MAY BE DISCHARGED BEYOND 12 NAUTICAL MILES FROM THE NEAREST LAND.	OTHER GARBAGE GRIND TO LESS THAN ONE INCH MAY BE DISCHARGED BEYOND THREE NAUTICAL MILES OF THE NEAREST LAND.
PERSON WHO VIOLATES THE ABOVE REQUIREMENTS IS LIABLE FOR A FINE UP TO \$5000, A FINE OF UP TO \$1000, AND IMPRISONMENT FOR UP TO 6 MONTHS FOR EACH VIOLATION. FEDERAL, STATE, AND LOCAL RESTRICTIONS OR LAWS ENFORCED ALSO MAY APPLY.		

Emergency Alarms (cont.)

Special Fire Alarm

- Required on Passenger Vessels
- Separate alarm that does not sound in passenger spaces
- Summons crew in case of fire
- Must be operable from bridge

Muster List

The muster list must contain details of the general emergency alarm and other emergency signals and the action to be taken by the crew and passengers.

Assignments must include:

- Abandon Ship
- Man Overboard
- Medical
- Fire
- General Emergency
- Lifesaving Appliances

Muster List

LIFE BOAT STATIONS ID:



= MAIN DECK PORT SIDE

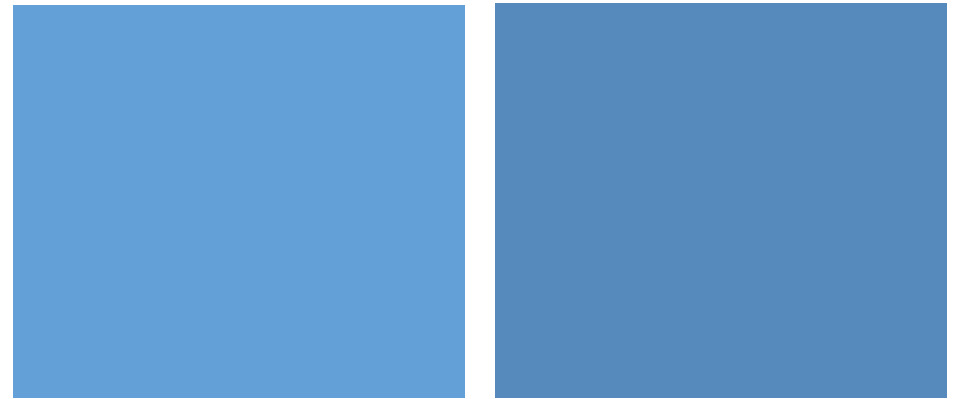


= MAIN DECK STARBOARD SIDE

RAFT		POSITION	FIRE	MOB WITNESSED	ABANDON SHIP	GENERAL EMERGENCY
	DECK	CAPTAIN	BRIDGE – Overall Command	BRIDGE – Overall Command	BRIDGE – Overall Command	BRIDGE – Overall Command
		CH. OFFICER	AT ZONE – First Response, On Scene Command	AT ZONE – First Response, On Scene Command	AT ZONE – First Response, On Scene Command	AT ZONE – First Response, On Scene Command
		FIRST OFFICER	BRIDGE – GMDSS	BRIDGE - Throw smoke ring - GMDSS	BRIDGE – GMDSS, Release Bridge Deck Life rafts	BRIDGE - GMDSS
		BOATSWAIN	MDFL - Fire Station Red - BA Team Leader	FOREDECK - Coxswain	FOREDECK – Coxswain	FOREDECK – Coxswain
		LEAD HAND	MDFL Fire Station Red - BA Team	FOREDECK - RB Crane Operator – Foredeck Communications	FOREDECK - RB Crane Operator - Release Bridge Deck Liferrafts,	FOREDECK - RB Crane Operator – Foredeck Communications
		DECKHAND	UDA -Unlock Crew Door, BC & Fire Equipment (Backup BA Team Red)	FOREDECK - Unlock Crew Door RB Crew	FOREDECK - RB Crew, Unlock Crew Door	FOREDECK - RB Crew, Unlock Crew Door
		DEAN	FOREPEAK - Fire Station Yellow BA Team Leader	FOREDECK - RB Painter/Boat Hook Assist/ Rig Mob device	MDA - RB Painter & Life rafts	FOREDECK - RB Painter/Boat Hook Assist

Crew Responsibilities

- Performs assigned tasks & work toward good housekeeping practices & Fire Prevention
- Actively engage in training & drills
- Mentally & physically prepared for emergencies
- React & perform up to their level of training



Fire & Emergency Drills

Designed to accurately portray various emergencies that may occur onboard.

- Realistic
- Challenging
- Safe



Fire Patrols

Fire Patrol Requirements:

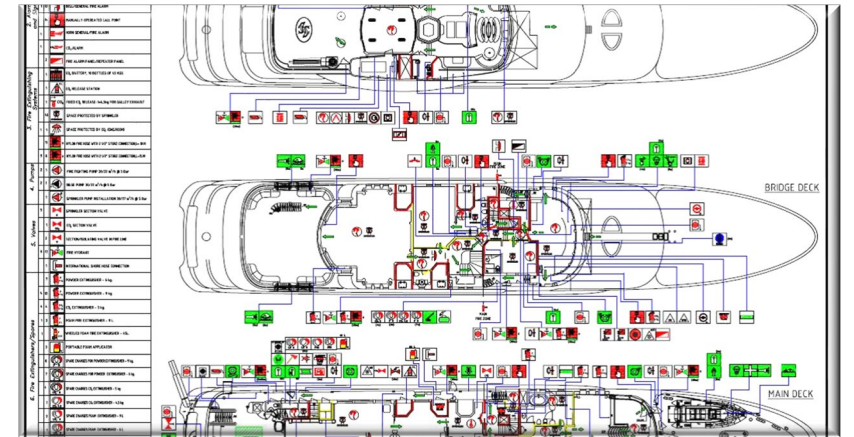
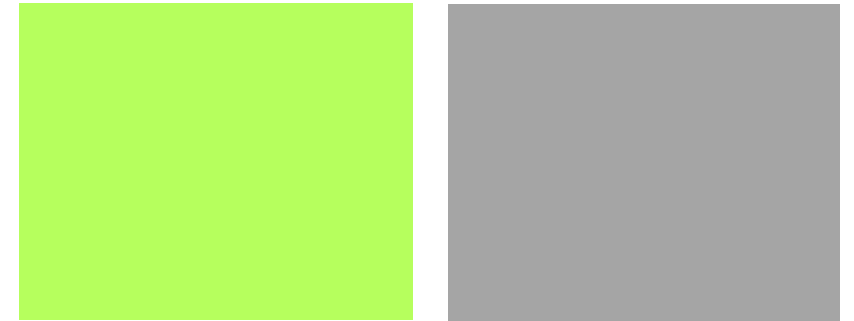
- Hourly rounds on all passenger vessels carrying 36 or more people, from 2200 to 0700.

Fire Patrol Members

- Familiar with vessel & containment methods
- Familiar with extinguishers & portable fire fighting equipment
- Provided with two-way radio and proper use

Vessel Fire Control Plans

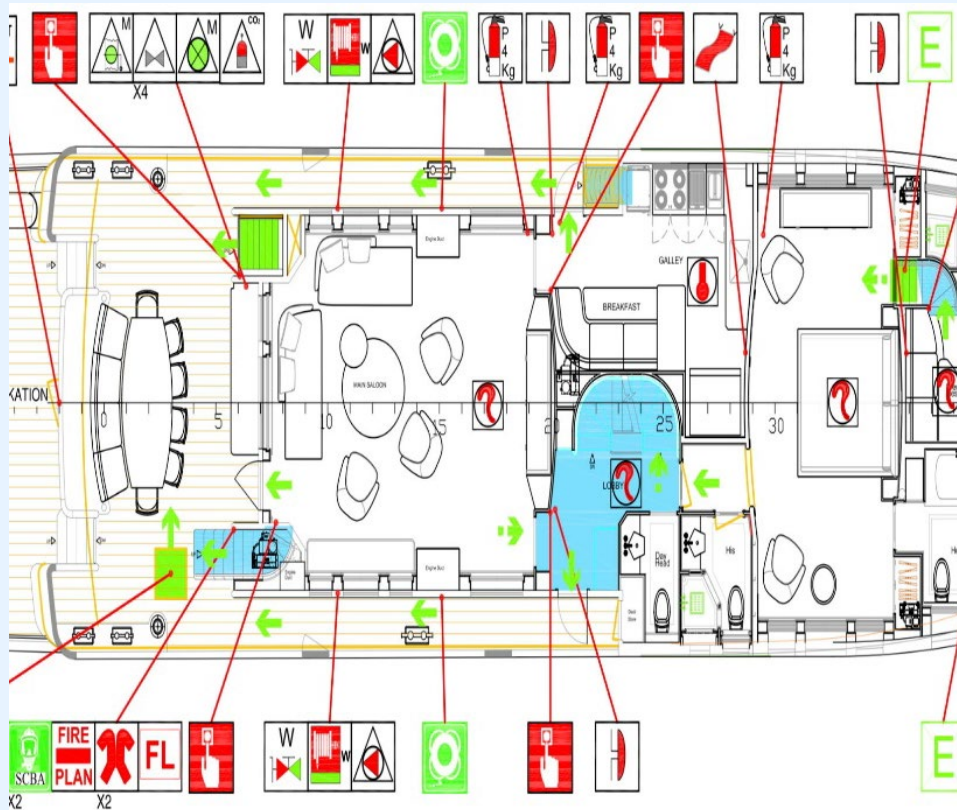
- Permanently exhibited on Bridge (SOLAS)
- Duplicates must be stored outside the deckhouse in waterproof containers at the gangway
- Must be kept up to date



Fire & Life Safety Plan Symbols



Fire Control Plans



- Main Vertical Zones
- Class A Divisions
- Class B Divisions
- Fire Detection Systems
- Fire Alarms
- Sprinkler Systems
- Fire Extinguishing Appliances



Firefighting Strategies / Tactics

Firefighting Tactics

Three types of Attack:

- Direct Attack
- In Direct Attack
- Combination



Direct Attack

Direct fire attack, is a strategy in which you make a direct attack on the fire.

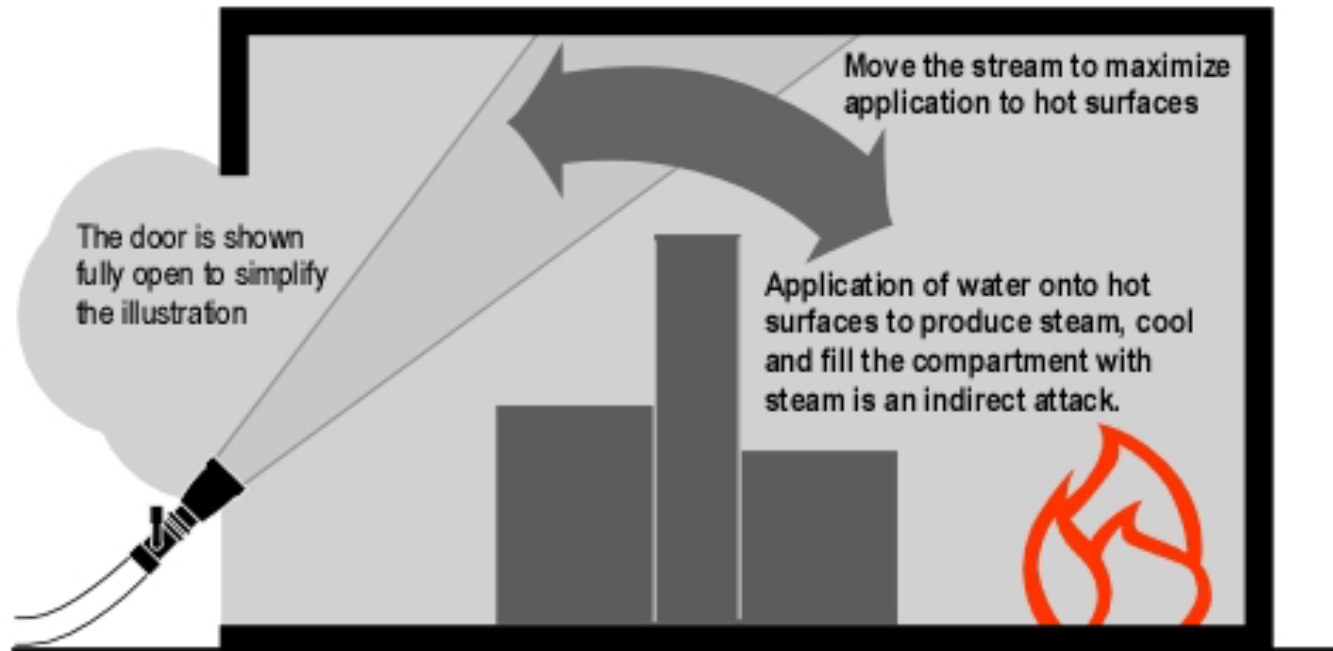
Nozzle Pattern:

- Power Cone (30° Fog Pattern) to attack base of fire
- Straight Stream to penetrate



Indirect Attack

This **IS** an Indirect Attack



IMPORTANT! Indirect attack is done with a limited opening to protect the people entering and keep them from getting steam

Use when unable to advance due to excessive heat or potential flashover conditions during fully developed or decay phase.

- Direct a 3-5 second burst of a 30° fog fire stream towards the center overhead of the compartment
- Water flashes to steam, displaces air & temporarily smothers fire.
- This action is generally followed by a direct attack to achieve extinguishment. Also referred to as a combination attack.

R.E.C.E.O. Model

Firefighting Team objectives:

- **Rescue**
- **Exposure**
- **Contain / Control**
- **Extinguishment**
- **Overhaul**

- **Ventilation**

Search and Rescue Techniques

Types of search patterns

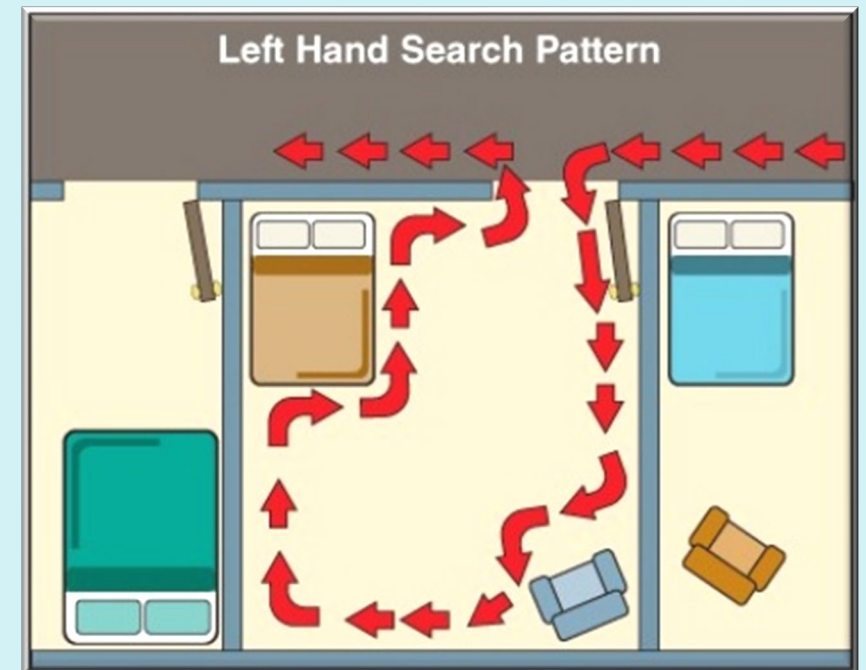
- Left Hand
- Right Hand

Search techniques

- Maintain contact with bulkhead
- Maintain contact with partner
- Use extension devices

Common mistakes

- Not maintaining contact with bulkhead (freelancing)



Minimize & Protecting Exposures

Exposures = Fire Spread

- On-board consider adjacent compartments above below and all around
- In port this may include vessels along side and even the dock itself.



Containing the Fire

- Shut all doors, hatches, portholes, ventilation dampers, and other bulkhead/deck penetrations
- Secure all fans and other ventilation equipment
- Secure all electricity and fuel
- Deploy Boundary Cooling

Boundary Cooling

- Consider all 6 sides of a compartment when accessible
- Use water only when the surface shows excessive heat
- Consider de-watering or getting the water down low in or off the vessel to minimize free-surface effect



Extinguishing the Fire

To be considered under control, the following condition must be met:

- The main body of the fire has been extinguished.
- Overhaul is the task of checking for extension and hot spots to prevent rekindle.
- Set a reflash watch.





Personal Protective Gear / SCBA

Personal Protective Clothing - PPE



Components of a Firefighter's Ensemble

Personal Protective Clothing

- Bunker Coat & Pants (Turn-Out Gear)
- Helmet
- Flash Hood
- Gloves
- Boots

Self Contained Breathing Apparatus

Fireproof Lifeline with Snap Hook and Harness

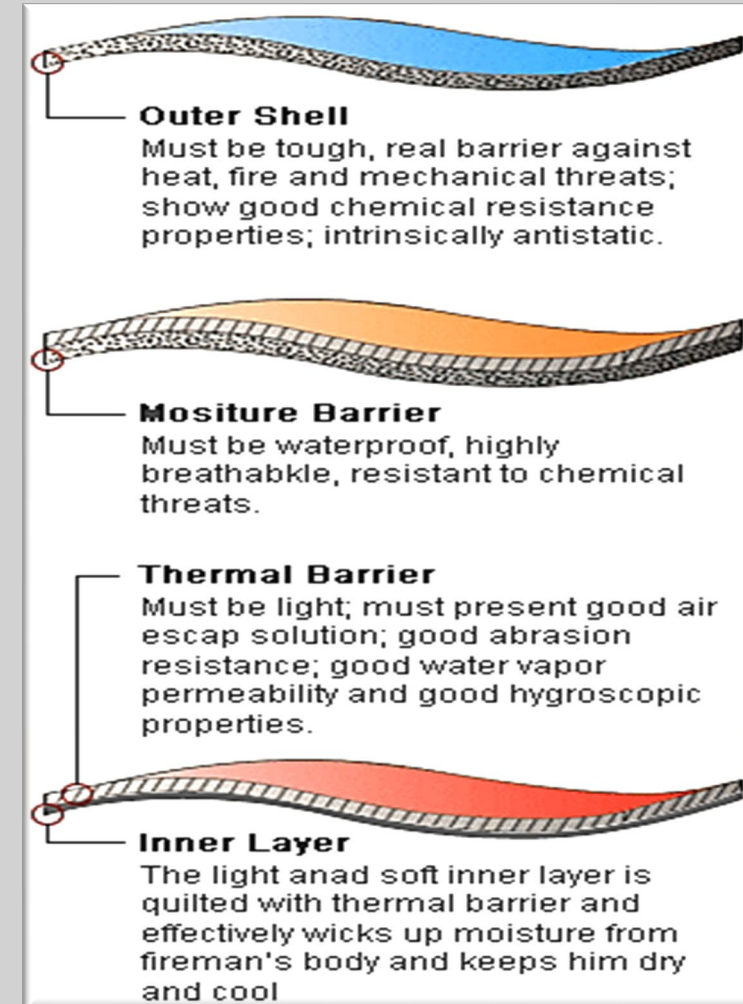
Personal Protective Equipment(PPE)

Bunker Gear / Turn-Out Gear

- Protective equipment designed to provide protection for those engaged in interior firefighting operations

Designed with 3 primary layers:

- Outer Shell
- Moisture Barrier
- Thermal Barrier with Inner liner



Self Contained Breathing Apparatus

There are 3 main components to a S.C.B.A:

- Backpack and Harness Assembly
- Air Cylinder (Bottle)
- Mask



S.C.B.A. Components

Backpack and harness assembly

- Includes straps, buckles and cylinder bracket
- Distributes weight of the cylinder & pack
- Includes high-pressure hose & low-pressure alarm
- Low pressure alarm sounds when the pressure reaches one third of the capacity of the cylinder



S.C.B.A. Components

Air cylinder (Bottle)

- Includes cylinder, valve & pressure gauge
- Stores high pressure air (2216p.s.i. - 4500p.s.i.)
- Available in 60, 45, 30 & 15 minute

A 30-minute rated cylinder provides approximately 15 minutes of work time





S.C.B.A. Components Mask / Face Piece

Firefighting / Flash Hood

The Firefighting hood is designed to wear over the mask / facepiece assembly for flash protection as well as a thermal barrier.



Self Contained Breathing Apparatus

Positive Pressure

- Offers greater protection with slightly increased pressure in facepiece to block contaminants from entering the mask.
- Inhaling super heated gases can cause death from asphyxiation and burning of the lungs lining
- Units should be inspected Weekly.

Pre-Donning Inspection

- Check cylinder gauge for full charge
- Check remote Pressure gauge to verify pressures are within 100p.s.i. of cylinder valve gauge
- Check the harness assembly and facepiece to ensure that all straps are fully extended.
- Operate all valves to ensure that they function properly and in the correct position
- Check PASS device.



S.C.B.A. (cont.)

Donning Procedures

- Over the head method
- Coat method
- Facepiece harness and seal



S.C.B.A. (cont.)

Breathing Techniques

- Slow shallow breaths
 - Breath in through the nose & out through the mouth
 - Conserve energy
 - Each minute uses approximately 150psi.(10.3bar)
-
- **If the low-pressure alarm sounds, notify your team leader and exit the space as a team**

Limitations of the S.C.B.A.

Factors affecting the individual's ability to use an S.C.B.A. effectively include:

- Physical condition
- Comfort level with mask
- Limited visibility
- Decreased communication capability
- Increased weight



Fire Hose

Hose sections come in lengths of 50' (15M) & 100' (30M)

Attack fire hose:

1 1/2" (38mm) Diameter

Supplies water to the nozzle.

Supply hose:

2 1/2" (64mm) Diameter

Delivers volumes of water to attack lines.

Hose Damage

Mechanical damage

abrasion, excess water pressure, water hammer

Thermal damage

Exposed to excessive heat, UV

Organic damage

Stored wet, mildew

Chemical damage

Concentrated chemicals liquid/vapor

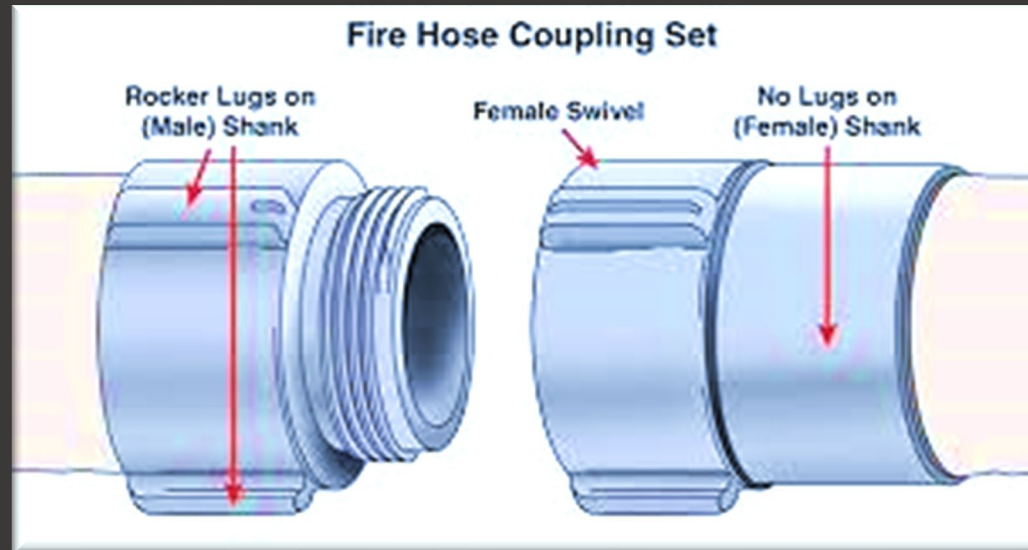
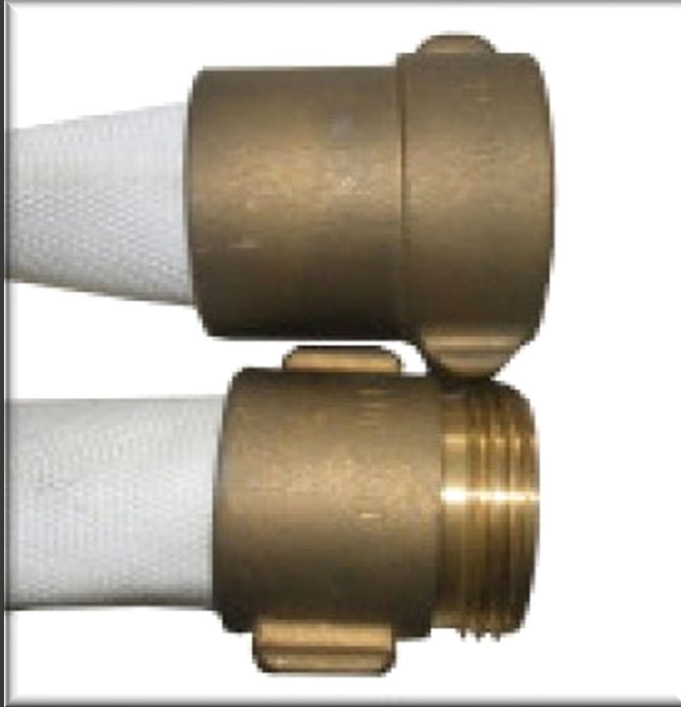
Inspect all hose for dirt in couplings, missing gaskets, damaged threads



Hose Connections

Hose couplings come in various types & sizes

Marine couplings are generally brass because it does not rust

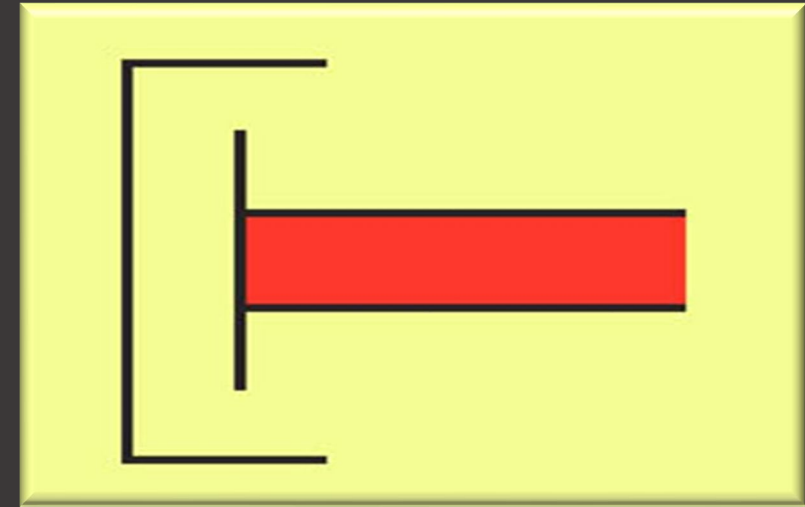


Hose Connections

- Couplings connect two lengths of the same size diameter hose together
- There are also fittings known as adapters and reducers which connect two hoses of different diameters



International Shore Connection



Fire Plan Symbol

This IMO/SOLAS standard flanged device allows the vessel to connect to another vessel's I.S.C. or a shore-side water supply.

Nozzles

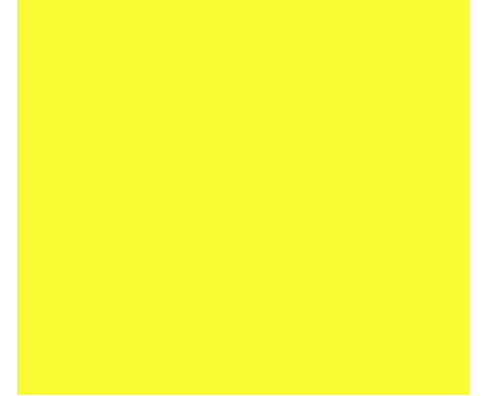


- Used to shape fire stream and direct water onto the fire.
- Can be bail operated or twist type

Nozzle Patterns

Straight Stream

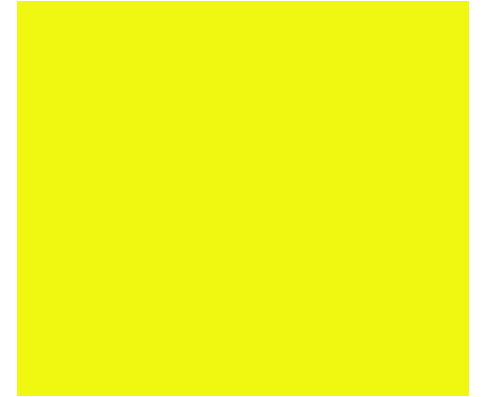
- Adjusting the nozzle to the right (Right to Fight)
- Very effective for reach and penetration



Nozzle Patterns

30% Power cone/Fog Nozzle Pattern

- This “broken” fire stream is composed of very fine droplets of water enhancing the ability to absorb BTU’s (British Thermal Units) effectively
- Preferred pattern for most firefighting applications



Nozzle Patterns

Wide Fog Nozzles Pattern

- Personnel Protection Pattern
- Provides Nozzle Team protection from intense heat
- (Left for Life)
- Not an effective firefighting stream!

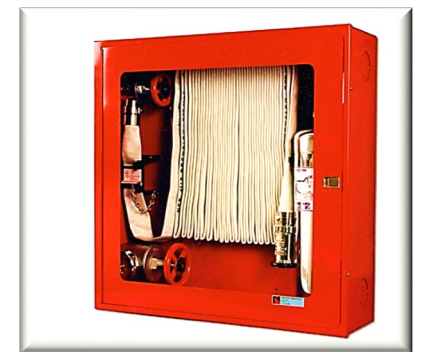


Fire Station & Contents

- Water Supply Valve
- Hose
- Nozzle
- Spanner Wrench

Some ships:

- Extinguisher
- Foam & In – Line Eductor



Fire Blanket



Field Day Preparations

Gray Manatee Shipboard Fire Fighting Facility
3305 S.E. 19th Avenue Ft. Lauderdale, FL 33316

Picture I.D. required to enter Port Everglades

Dress Code:

- Long pants, shirt w/sleeves, close toed shoes, socks

Hydrate prior to arrival. Cold water & Gatorade provided

- On Site (refrigerator & snack/soda machine)
- You will be given 1- hour and 30 minutes for lunch.

