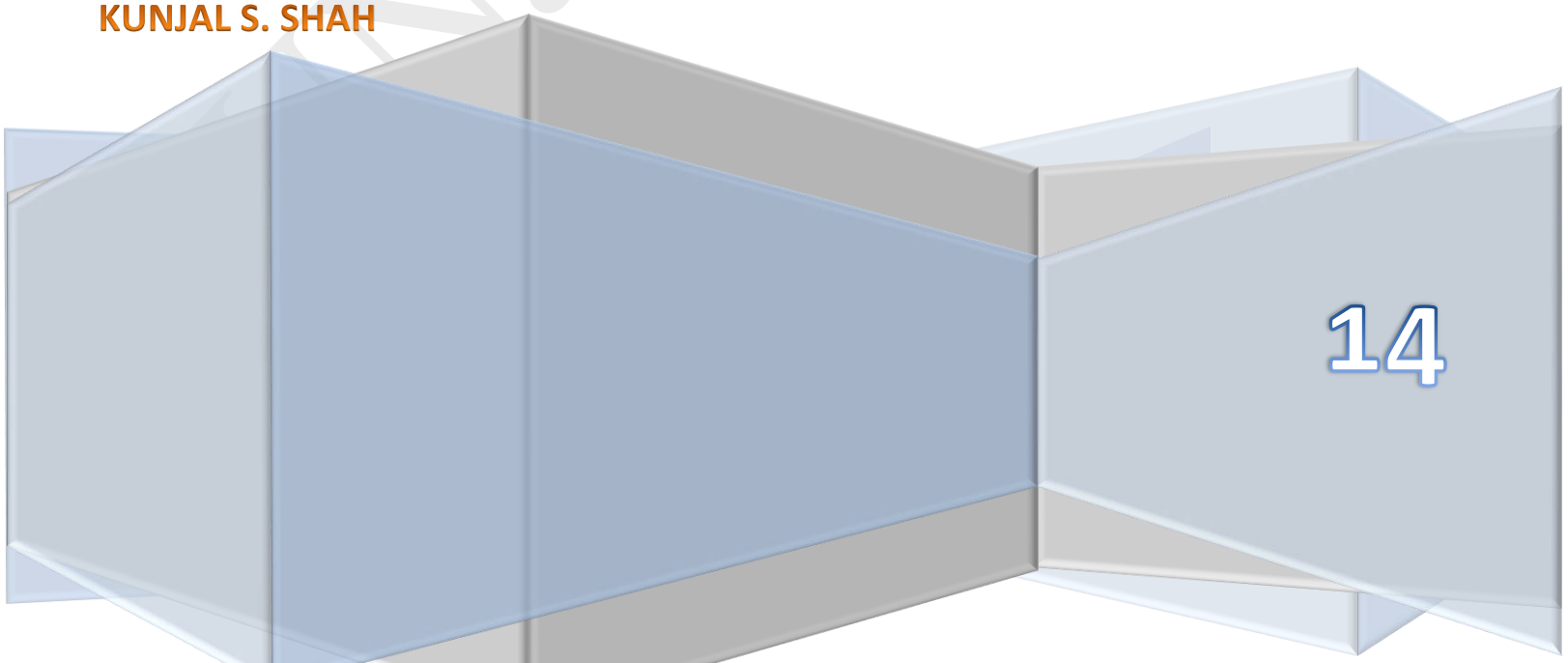
MEO CLASS 4 SAFETY(COSCPOOL) ORAL PREPARATION FILE PART 2

ORAL QUESTION WITH ANSWER

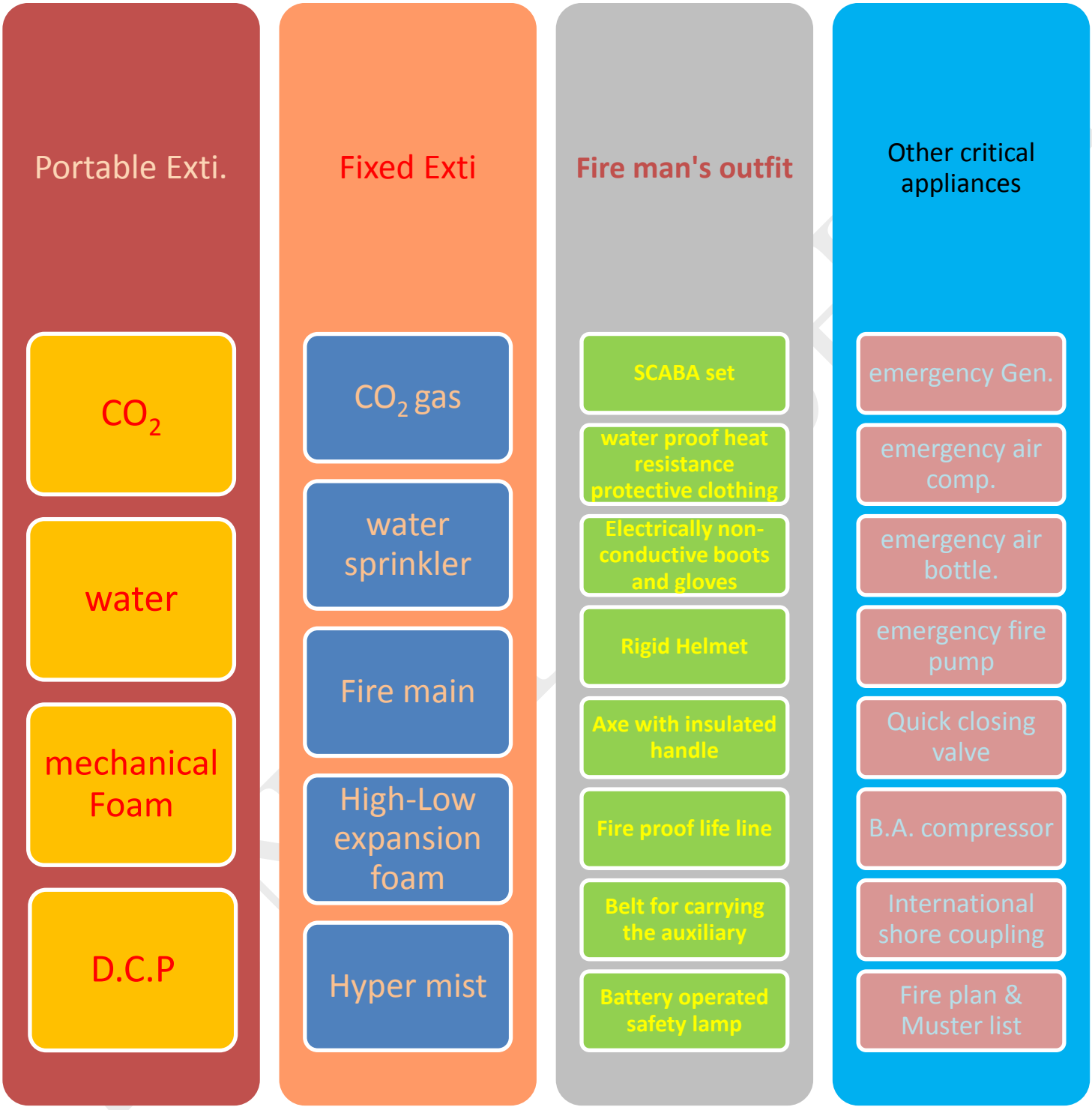
KUNJAL S. SHAH



SECTION : 2

Q 17: Explain FIRE FIGHTING APPLIANCE?

A 17:



Remote stops for F.O pumps

Semi Portable CO_2

Semi Portable DCP

Fire man's outfit

Fire Alarm

Quick closing valve

Q 18: Class of Fire explain?

A 18:

ON CLASS A (CARBONANCEOUS)= USE WATER MOSTLY

ON CLASS B (OIL FIRE) = USE FOAM, D.C.P., CO_2

ON CLASS C (GAS, CHEMICAL FIRE) = USE D.C.P

ON CLASS D (METAL FIRE) = USE D.C.P

ON ELECTRICAL FIRE = USE D.C.P AND CO_2

1. **STARVATION: Cutting of FUEL.**
2. **SMOTHERING: Separating the FUEL from the OXIDANT.**
3. **COOLING: Lower the TEMPERATURE, usually with water.**
4. **INHIBITION or RETARDATION OF THE COMBUSTION REACTION: Removal of MOLECULAR Chain Reaction.**

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PORTABLE FIRE EXTINGUISHER

Q 19: Explain in Detail about all Portable extinguisher (mostly surveyor asking about CO_2 and D.C.P)with cross section of it.?

Q 19 a: Solas Regulation regarding portable extinguisher?

Q 19 b: Weekly, monthly and Yearly maintenance on it?

Q 19 c: Weighting of extinguisher? How you will do it?

Q 19 d: Marking on portable extinguisher?

Q 19 e: How you will use foam exti, and if you don't found vertical surface how you will extinguish fire?

A 19, 19 a, 19 b, 19 c, 19 d, 19 e:

Solas Regulation:

- Accommodation, Service space, and Control station shall be provided with P.F.E (portable fire exit.) of appropriate type and in sufficient number to the satisfaction of the Administration.
- **Ship of 1000 GT and above have at least 5 P.F.E.**
- **Total weight shall not more than 23 Kg, and capacity of fluid not less 9 ltr and not more 13.5 ltr.**
- One of the P.F.E intended for use in any space shall be stowed near the entrance to that space.
- **CO_2 P.F.E shall not be use in Accommodation.**
- P.F.E shall be situated ready to use at easily visible.

- **P.F.E shall be provided with Device which indicate whether they been used .?**
- **Spare charge shall be provided for 100% of the first 10 exti. And 50% of the remaining P.F.E capable of being recharge on board. But not more than 60 total spare charge are required.**
- **Fore P.F.E which cant recharge on board additional P.F.E of the same quantity, type, capacity shall be provided lieu of spare carge.**

WATER TYPE (SODA ACID TYPE) P.F.E

- **Working principle on =COOLING effect**
- Use= Carbonaceous Type A fire
- **Safety= Relief hole and Safety pin**
- Body= Solid drawn steel and internally Zinc coated
- **Contain= CO_2 74 mg (*it will different as per weight and capacity of cylinder*) at 36 bar pressure**
  Water 9 ltr minimum
- **Duration of working = 6 meter jet length for 60 second**

Working:

- Carry exti. Nearby the fire.
- Keep exti. Towards the fire.
- Remove safety pin and strike plunger to pierce the CO_2 cartridge.
- When it will pierce the pressure created on the upper part of the container and water from the dip tube will pass and thrown as a Jet spray.

Maintenance:

Weekly	Monthly	Yearly
• Check exterior, clean exterior. • Check nozzle outlet and clean • Check relief hole and clean it.	• Check internal • Check gas cartridge • Check plunger • Check spring • Weighting of the cylinder	• Pressure tested at 35 bar before recharging.

MECHANICAL FOAM TYPE

- **Working principle on =SMOOTHERING effect**
- Use= Volatile petroleum, paint, oil Type A, B fire
- **Safety= Relief hole and Safety pin**
- Body= Solid drawn steel and internally Zinc coated
- **Contain= CO_2 74 mg (*it will different as per weight and capacity of cylinder*) at 36 bar pressure**

  A.F.F.F = 97 % and WATER= 3%
- **Duration of working = 6 meter jet length for 60 second**

Working:

- Carry exti. Nearby the fire.
- Keep exti. Towards the fire.
- Remove safety pin and strike plunger to pierce the CO_2 cartridge.
- When it will pierce the pressure created on the upper part of the container and water from the dip tube will pass and thrown as a Jet spray.

NOTE:

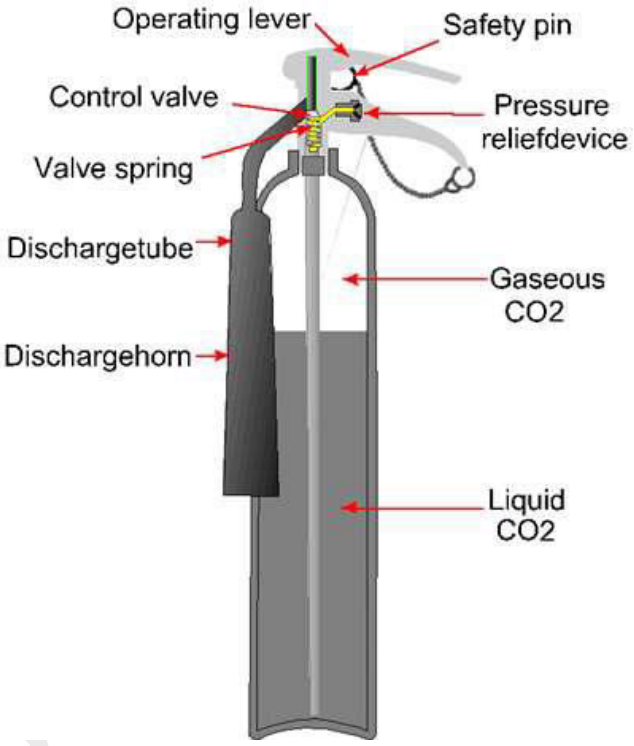
- ***do not allow foam to strike on the surface of burning liquid.***
- ***Direct the foam to some nearly vertical surface so that the foam runs down the side and blanket the liquid.***
- ***If you don't found any vertical surface than it advisable to keep the distance such that the discharge from the extinguisher will fall gently on the liquid surface.***
- ***Use same manufacture for refills and if you using pre-mix type fluid than DON'T INCREASE or DECREASE the proportion of the fluid bcoz it will affect the efficiency of the extinguisher.***

Maintenance:

Weekly	Monthly	Yearly
• Check exterior, clean exterior. • Check nozzle outlet and clean • Check relief hole and clean it.	• Check internal • Check gas cartridge • Check plunger • Check spring • Weighting of the cylinder	• Pressure tested at 35 bar before recharging.

CO_2 TYPE

- **Working principle on =SMOOTHERING effect**
- Use= oil, electrical, petroleum product, gaseous substance under enclosed space, Type B
- **Safety= control valve or safety valve, pressure relief device and Safety pin**
- **Discharge hose= NON-conductive material**
- Body= Solid drawn steel and internally Zinc coated
- **Contain= CO_2 4.5 kg (*it will different as per weight and capacity of cylinder*) at 53 bar pressure**
- **Duration of working = 3 to 4 meter length for 20 second**
- **Pressure tested= 210 kg/cm^2 prior recharge**
- **Recharge= only at shore and when weight reduced 10% and more.**
- **Storage= should be at least 750 mm above the floor level, it should not placed where it likely to gain heat from surrounding equipment or process.**



Working:

- Carry the extinguisher near the place of fire.
- Remove the safety pin.
- Direct the hose at the base of fire, starting one edge and sweeping across the surface on burning material.
- When use in open air the operator should stand up the UP-WIND side of the fire.
- ***Fire on electrical equipment , first SWITCH-OFF the current supply.***

Maintenance:

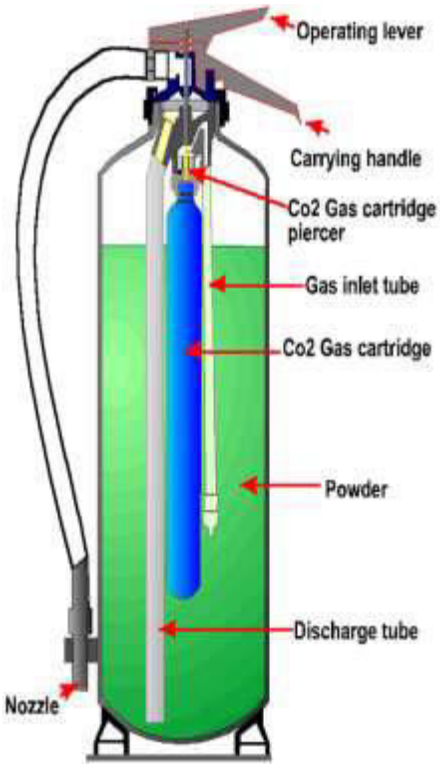
Weekly	Monthly	Yearly
• Check exterior, clean exterior. • Check hose outlet and clean	• Weighting of the cylinder, if 10 % less than send to shore	• Pressure tested at bar 210 kg/cm2 before recharging.

Friend this picture will show you how to do weighting of extinguisher. Which I did on my vessel.



DRY-CHEMICAL POWDER TYPE

- **Working principle on =SMOOTHERING effect**
- Use= oil, electrical, petroleum product, gaseous substance under enclosed space, Type A,B,C,D and electrical also.
- **Safety= Safety pin, Relief hole,**
  (in picture it will not show the inner container but there will be inner container for CO_2 cartridge bcoz Sodium Bicarbonate will get freeze when it will come in direct contact with CO_2 bcoz CO_2 is cool gas)
- Body= Solid drawn steel and internally Zinc coated
- **Contain= inner shell:CO_2 60 mg (*it will different as per weight and capacity of cylinder*)**
  Outer shell: 4.5 kg of D.C.P powder
  DCP powder contain mixture of
  SODIUM BICARBONATE + MAGNESIUM STEARATE
  $NaHCO_3 + Mg (C_{18} H_{35} O_2)_2$
- **Duration of working = 3 to 4 meter length for 20 second**
- **Pressure tested=35 kg/cm^2 prior recharge once in 3 year**



WORKING:

- carry the extinguisher to the place of fire and keep it upright.
- Remove the safety pin and strike plunger.
- CO_2 will escape to main shell and push out powder in the foam of FOG.
- When using outdoor the extinguisher operate upwind side of the fire for better range.

Maintenance:

Weekly	Monthly	Yearly	3 Yearly
• Check exterior, clean exterior. • Check pressure indicating needle it should be in green zone. • Check nozzle outlet and clean • Check relief hole and clean it.	• Check internal, check powder for any choking effect. • Check gas cartridge • Check plunger • Check spring • Extinguisher must be inverted once in month to avoid choking of powder • Weighting of the cylinder	• 1/3rd of the total number of extinguisher should be put into operation for evaluating their satisfactory performance	• As per IMO Pressure tested at 35 bar before recharging.

NOTE: MAGNESIUM STEARATE use for the purpose that it will not allowed to choking effect in powder. But if choking will be there remove and replace with fresh charge.

MARKING ON EXTINGUISHER: (as per FSS code)

- Name of manufacture
- Type of fire for which the extinguisher suitable.
- Quantity and Type of extinguishing medium.
- Approval detail
- Instruction for use and recharge
- Year of manufacture
- Temperature range over which the extinguisher will operate
- Test pressure

SEMI-PORTABLE TYPE

SEMI PORTABLE EXTINGUISHERS :

- **Types: CO2, Dry Chemical Powder & Mechanical Foam**
- **Propellant: Externally fitted CO2 cartridge**.
- Capacity: 55 liters / kg (will be different)
- **Discharge Mechanism: 15 meters Hose-reel type**
- Period of discharge duration: Maximum 3 minutes
- Head Assembly: Brass with tell - tale hole relief system.
- CO_2 cartridge operating lever equipped with safety pin.
- Maintenance: Weekly physical inspection & Annual complete servicing.
- **Location: CO2 adjacent to MSBD**
  DCP & Foam Boiler & Purifier Rooms

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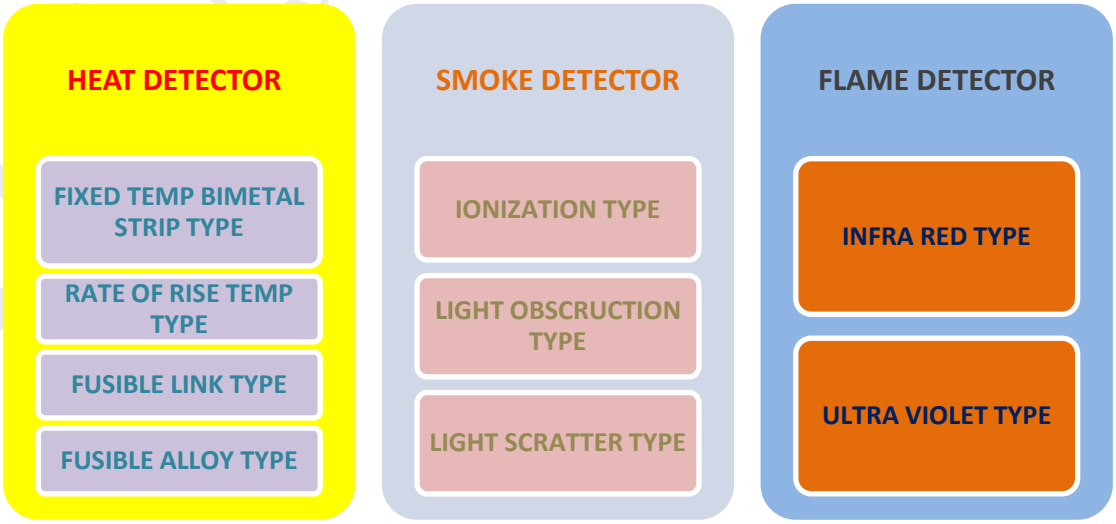
Q 20: Explain Detector type? Working of it?

Q 20 a: Regulation regarding detector?

Q 20 b: location of it?

A 20, 20 a, 20 b:



HEAT DETECTOR:

Location: Mainly in purifier room, near boiler platform, around M/E, A/E, near incinerator etc…

Position: located on the overhead shall be minimum distance of 0.5 m away from bulkhead, except in corridor, lockers and stairways.

Operate: operate before the temp exceeds 78^0 c but not until temp rise 54^0 c when the temp rise the those limit at a rate less than 1^0 c per minute.

Regulation required:

- Max floor area per detector: **37 m^2**
- Max distance a part between centre: **9 m**
- Max distance away from bulkhead: **4.5 m**

Power supply: from MSB, ESB and TRANSITIONAL BATTERY.

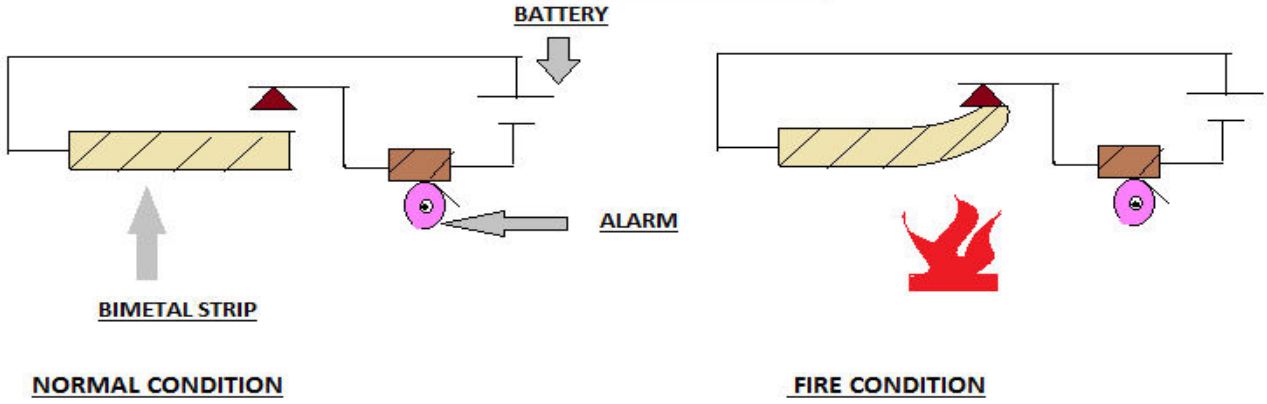
Friend, surveyor asking to draw detector so u can draw this simple and easy detector. I found this theory in SCI booklet when I went for AFF course so the diagram and theory is simple and easy to understand. If u want to read more just go through SCI AFF course manual.

(1) Bimetal type: in this type there will be a bimetal strip, alarm and power supply connection are there as in picture. In normal condition strip will not be band but in case of fire occurs the strip will start to band and it will touch the point and circuit will close , so current will flow through it and it will rise the alarm. It will take some time to come in natural position becoz of the property of bimetal.
Working range is from 55^0 c to 160^0c .

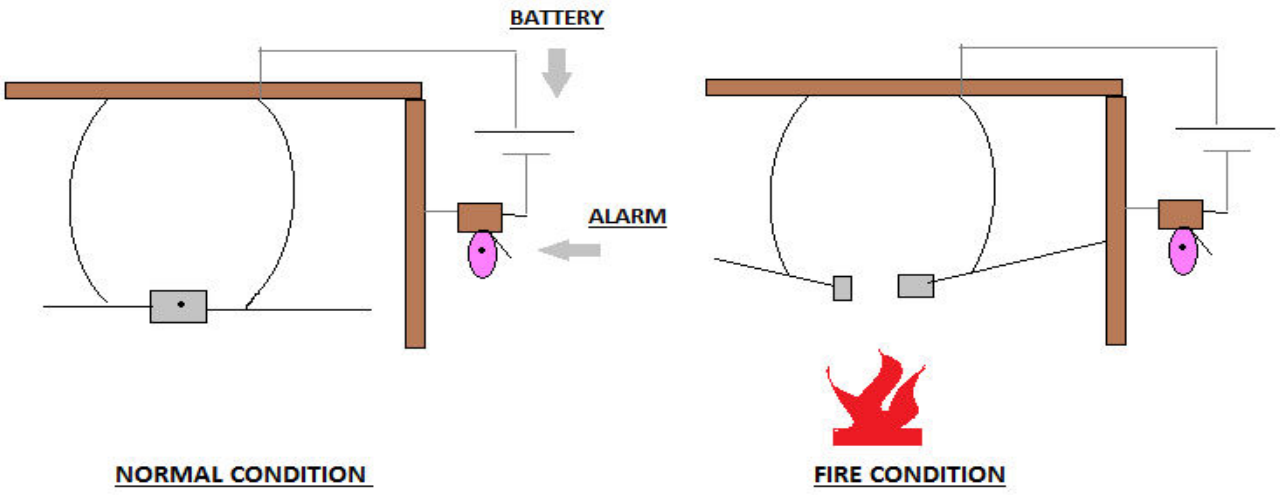
(2) Fusible link type: the principle is the same once it will close the circuit it will rise the alarm. In this type there is fusible link connection together, when fire occurs it will disconnect and one of the connection will touch the plate and the circuit will close and alarm will sound.
Working range is from 55^0 c to 180^0 c.

(3) Rate of rise temp pneumatic type: in this type inside the casing of detector atmospheric air is there, when fire occurs the air will get expand due to heat and the upper part of detector have diaphragm will get expand also and it will touch the plate and circuit will close and rise the alarm.
Working range is from 57^0 c to 82^0 c.

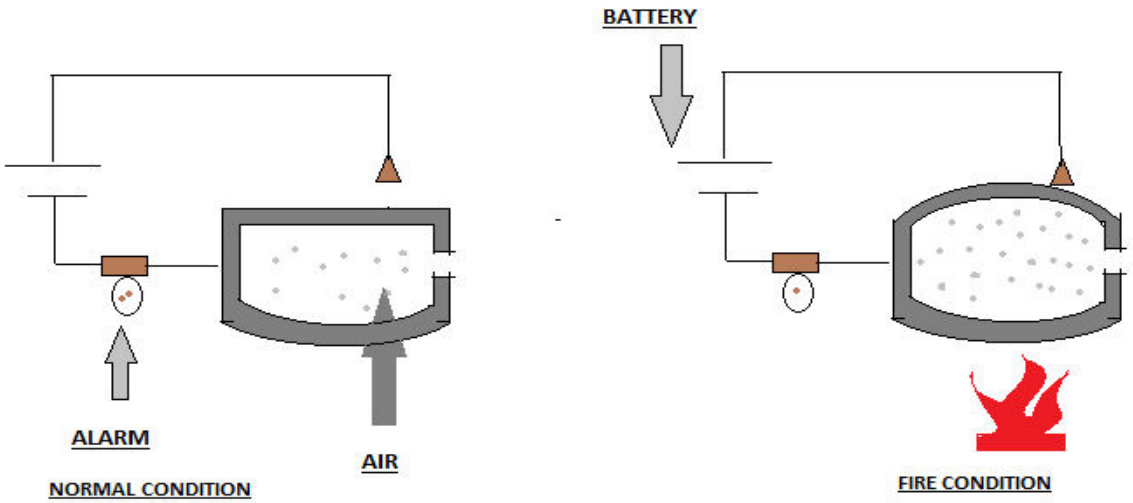
BIMETAL STRIP TYPE



FUSIBLE LINK TYPE



RATE OF RISE TEMP PNEUMATIC TYPE



SMOKE DETECTOR

Location: many places like accommodation stairways, ECR, bridge, cargo space, around machinery etc…..

Position: located on the overhead shall be minimum distance of 0.5 m away from bulkhead, except in corridor, lockers and stairways.

Operate: operate before smoke density exceed 12.5% obscuration per minute, but not until 2%.

Regulation required:

- Max floor area per detector: **74 m^2**
- Max distance a part between centre: **11 m**
- Max distance away from bulkhead: **5.5 m**

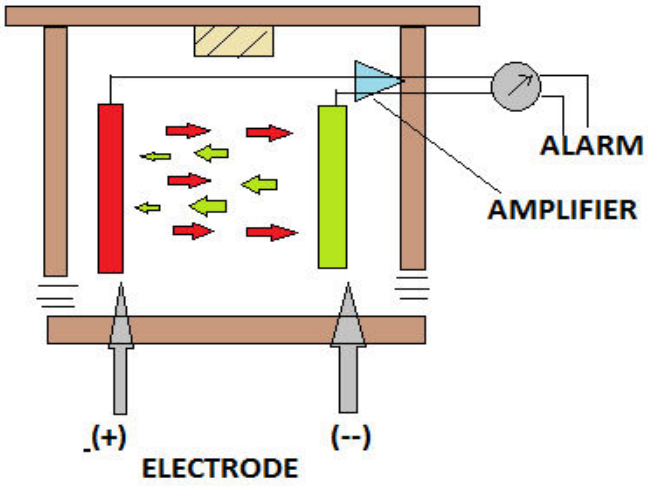
Power supply: from MSB, ESB and TRANSITIONAL BATTERY.

(1) Ionization type: in this type detector have positive and negative charge plate in container. A positive ions attracted to negative plate and vice versa. The movement of ions between the plates reduce resistance of the air , so small current flow in the circuit. The small current is amplified so it can be readily monitored. In fire, smoke particle entering in chamber become attached and reduction of ions flow will increase resistance and current falls down. Amplifier senses and monitored when it will below value it will give alarm.

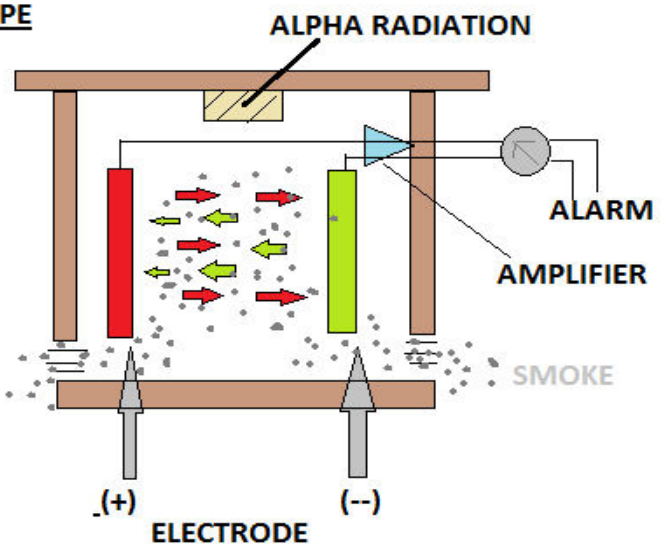
(2) Light obscuration type: it work on photo electric cell principle, in normal condition light source will focus on P.E.C but when fire occurs and smoke will enter in container the reduction of light source on to the P.E.C will rise the alarm.

(3) Light scatter type: it work on the opposite to obstruction type, when light source will focus on the P.E.C it will give alarm.

IONIZATION TYPE

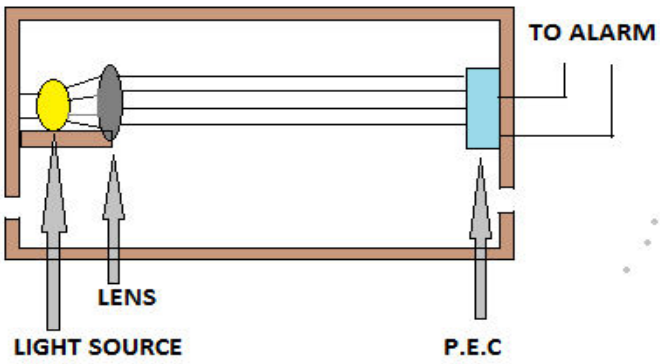


NORMAL CONDITION

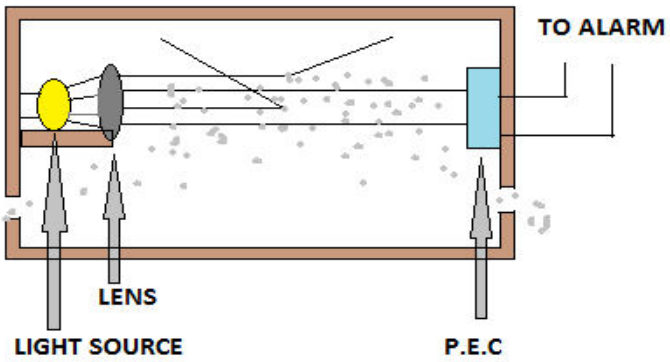


FIRE CONDITION

LIGHT OBSCURATION TYPE

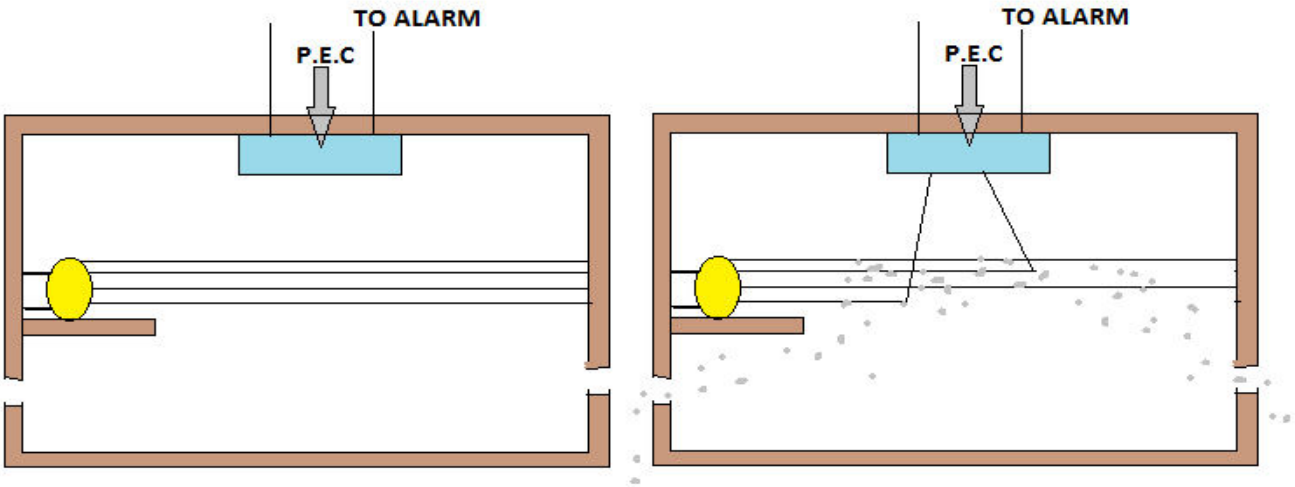


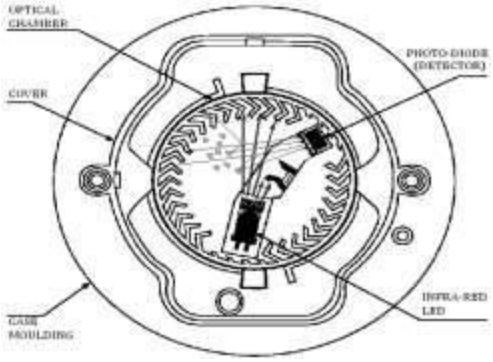
NORMAL CONDITION



FIRE CONDITION

LIGHT SCRATTER TYPE




OPTICAL CHAMBER
COVER
PHOTO-DIODE (DETECTOR)
INFRA-RED LED
CASE MOULDING

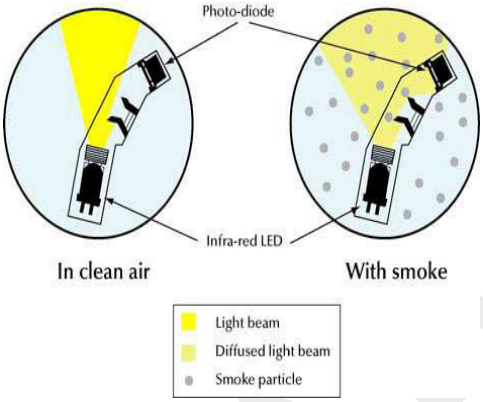
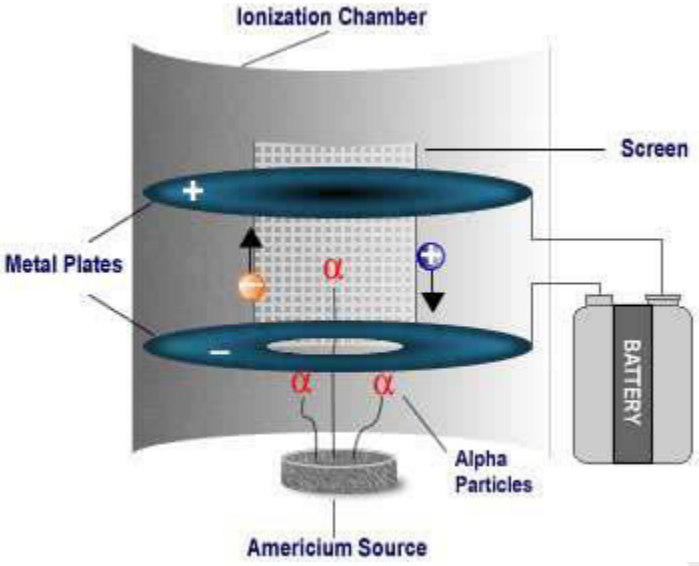
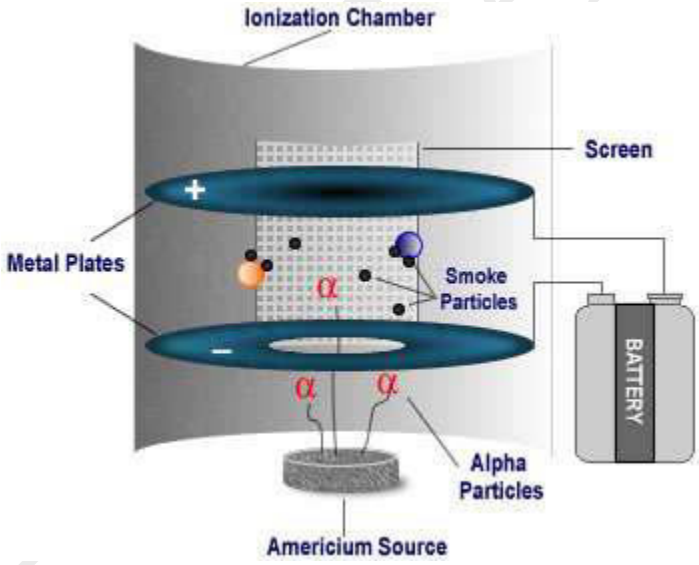


Photo-diode
Infra-red LED
In clean air
With smoke
Light beam
Diffused light beam
Smoke particle


Ionization Chamber
Screen
Metal Plates
+
−
α
Alpha Particles
BATTERY
Americium Source


Ionization Chamber
Screen
Metal Plates
+
−
α
Smoke Particles
Alpha Particles
BATTERY
Americium Source

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FIXED FIRE FIGHTING SYSTEM

Friend this is the most important section in SAFETY oral, All of the surveyor asking you at least ONE main question from this section and if you will not give proper answer, most of the surveyor will fail you surely.

The most favourite question from surveyor is CO_2 fixed system for all student and those who sail on tanker he will ask you Foam system also. He can ask you any thing from this.

So let start with main important topic of all surveyor:

CO_2 FIXED FIRE FIGHTING SYSTEM

Q 21: Draw CO_2 fixed system? Explain it?

Q 21 a: Regulation of this system?

Q 21 b: Safety on this System? Explain about fire into E/R and P/R, what is your action?

Q 21 c: Regulation Regarding CO_2 Room? Safety in CO_2 Room?

Q 21 d: Function of Master Valve?

Q 21 e: Calculation Of CO_2 bottle? What you mean by 0.56 in calculation?

Q 21 f: Weighting of CO_2 bottle?

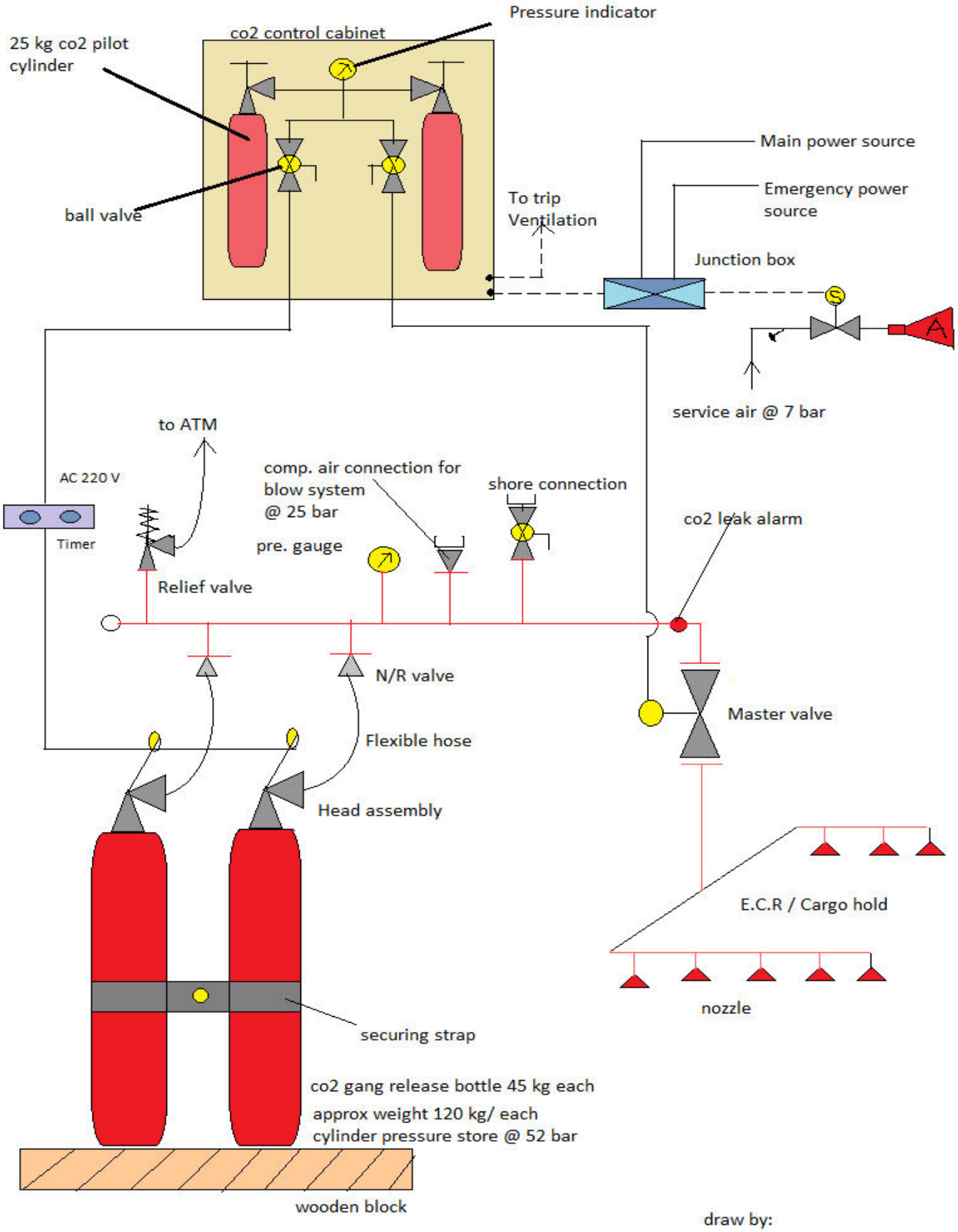
Q 21 g: Maintenance on CO_2 system?

A 21, 21 a, 21 b, 21 c, 21 d, 21 e, 21 f, 21 g:

Principle of this system : SMOOTHERING and COOLING, reduce O_2 %

Regulation:

- First of all Solas regulation says that the ship which has **MACHINARY SPACE of category A class 500 m^3 and above volume required additional fixed fire fighting system.**
- **Requirement that 85 % of the CO_2 gas is released into the space within 2 min of the actuating the system release.**
- CO_2 bottle are SOLID DRAWN steel, **hydraulically tested @ 228 bar**.
- **CO_2 bottle should not stored where the temp exceed 55^0 c.**
- CO_2 bottle pressure normally about 52 bar and it will varies with temp.
- CO_2 bottle content are **checked by RADIO ACTIVE ISOTOPE GUN level indicator or WEIGHTING**.
- **In CO_2 bottle head assembly the Bursting Disc are designed to rupture @ 177 bar pre produced by a temp pf about 63^0 c**.
- **syphon tube in bottle ensure that liquid is discharged from the bottles.**
- **Without syphon tube the CO_2 would evaporate from the surface giving a very slow discharge rate and taking latent heat, would cause the remaining CO_2 in bottle to freeze.**
- **Once you relese CO_2, it will reduce the O_2 in the space to less than 15 % to extinguish fire.**



FIXED co2 SYSTEM (AS FAR AS I KNOW)

draw by:
Kunjal S.Shah

CO_2 ROOM REGULATION:

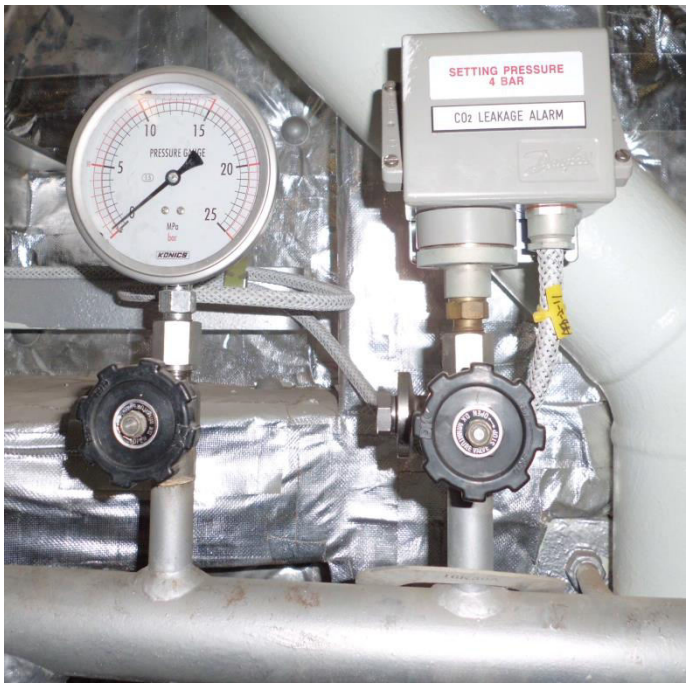
- The storage room should be used for no other purposes.
- **If the storage space is located below deck, it should be located no more than one deck below the open deck and should be directly accessible by a stairway or ladder from the open deck.**
- Spaces which are located below deck or spaces where access from the open deck is not provided, should be fitted with a mechanical ventilation system designed to take exhaust air from the bottom of the space and should be sized to provide at least 6 air changes per hour.
- Access doors should open outwards, and bulkheads and decks including doors and other means of closing any opening therein, which form the boundaries between such rooms and adjacent enclosed spaces, should be gas tight.
- **Room temp should maintain below 55^0 c.**
- **Room should have a minimum clear height of 2.4 m to provide the mounting of manifold and weighting the cylinder.**

CO_2 bottle assembly

250 bar pressure gauge

Blow through valve

Master valve



CO_2 leak alarm

Exhaust or ventilation fan at bottom floor

- if fixed extinguishing medium stored outside a protected space, it shall be stored in a room which is behind FWD collision bulkhead.

Safety on CO_2 system:

- **Trip switch:** control cabinet have special trip switch for ventilation trip and sound CO_2 alarm.
  - As soon as you open cabinet it will trip ventilation and sound alarm.

- **Master valve**: on main manifold line which is going to M/C space or Cargo space will have this valve.
  - It will not allowed to release CO_2 in ant of the space in case accidentally release.

- **Relief valve**: it will located on at the end of manifold.
  - if manifold pressure will exceed the relief valve will lift up into ATM,

- **Safety pin** : it will be provided into bottle head assembly, u can see into picture what I put just above .
  - It will function like to don't allowed to accidentally lever to operate, and for manually operation u have to take it out and operate the lever.

- **Bursting disc**: it will also into bottle head assembly.

- It will burst when the pressure into bottle exceed @ 177 bar along with the temp around the bottle reach 63^0 c.

- **Non-return check valve**: as I mentioned into my CO_2line diagram, it will located between bottle and Manifold.
  - Function of it is act as a non return and when you blow the system along with manifold it want allow to service air will pass through it, and if u have fire in Cargo hold or any one place where u need only few bottle to extinguish the fire, so once u operate system the manifold will fully pressurized but it want allow to open the another bottle after operating pilot cylinder.

- **CO_2 leak alarm** : the most of the surveyor want to hear this safety from you. As I saw you in my picture
  - It will located on the manifold.
  - It will work @ 4 bar pressure, it like a pressure switch, if any of the CO_2 bottle will leak so pressure into the manifold will be increase and as you know CO_2 is stored @ 52 bar pressure so a small leak will also create a high pressure in to manifold once the manifold pressure will reach @ 4 bar it will sound alarm, and by this safety switch you will come to know that there is a leak into any og the bottle, but u don't know which one it is?

So now you have to found the leak bottle? Now the question is how?

- Simple once u got alarm at least 2 person will go to outside the CO_2 room.
- Start the ventilation and stay outside for some time.
- Carry proper communication equipment with you.
- Now after some time the space will be properly ventilated, go inside the room.
- Now the main thing how u can identify?
- So start from the first bottle by physical touch by your hand, if any of the bottle leak the bottle is much cooler than the other.
- Mark on the bottle and check another.
- After u finished all of them, u can come to know how many of them is leak.

- **Pipe work solid drawn mild steel & galvanized to protect against corrosion.**

<u>Safety in CO_2 room</u>:

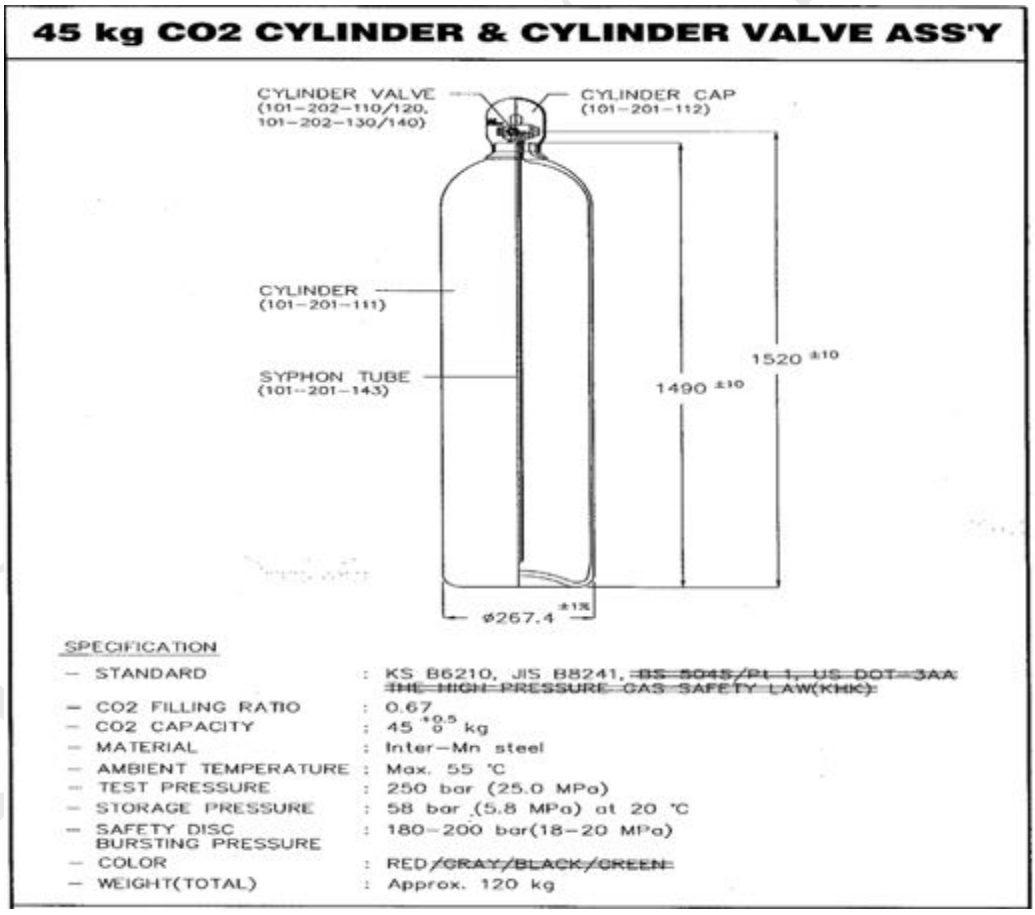
- Room is fully insulated
- Proper ventilation provided
- Room access door open outward

- It should not be use for any other purpose.
- All near by compartment should be gas tight.

Required CO_2 cylinder calculation:

On my vessel I have

- ***For E/R = 201 cylinder***
- ***For Purifier room = 7 cylinder***
- ***In Spare = 4 cylinder***
- ***Total = 212 cylinder***
- ***Cylinder pressure store = 58 bar***
- ***Approx weight = 120 kg /each cylinder and cylinder tare weight is approx= 72-80 kg***
- ***Design discharge time = 120 second***
- ***Actual discharge time = 107 second***



Solas regulation for calculate cylinder:

- **If the CO2 system is installed in the cargo spaces, the quantity of CO2 available should be sufficient enough to give at least a minimum of 30% of the total volume of the largest space that is protected by the CO2 system.**
- **40% of the total volume of the largest machinery spaces that is protected by the CO2 system. (The volume should exclude that part of the casing where the horizontal area of the casing is 40% or less then the horizontal area of the space taken into consideration and measured midway, between tank top and lowest part of casing).**
- **35% of the total volume of the largest machinery spaces that are protected by the CO2 system including the area covered by the casing.**
- **It is also a requirement that 85% of the required quantity of gas should be released into the spaces within two minutes of evacuating the fire-affected space.**

Formula:

For E/R (exclude casing): $$\frac{\text{Engine room gross volume} \times 0.40}{0.56} \Big/ \text{CO}_2 \text{ capacity per cylinder}$$

For E/R (including casing): $$\frac{\text{Engine room gross volume} \times 0.35}{0.56} \Big/ \text{CO}_2 \text{ capacity per cylinder}$$

For cargo hold**:** $$\frac{\text{largest cargo hold volume} \times 0.30}{0.56} \Big/ \text{CO}_2 \text{ capacity per cylinder}$$

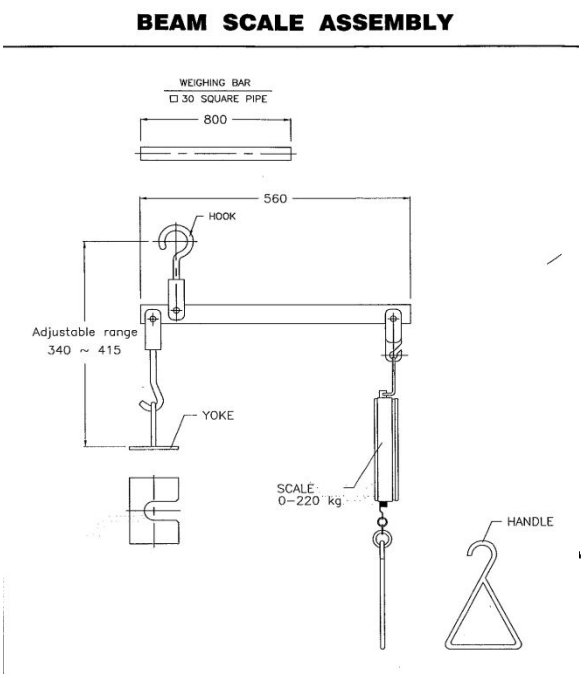
Where, 0.56 = volume of free carbon dioxide

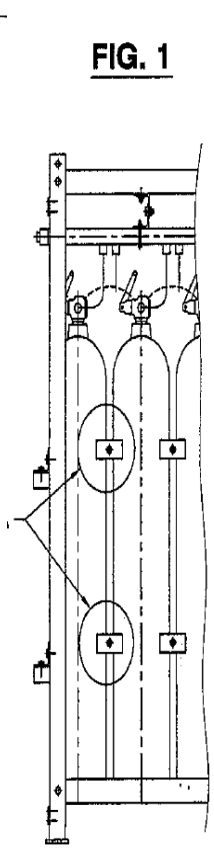
= also specific volume of CO_2 @ 21.1^0 c and 1 bar in m^3/kg.

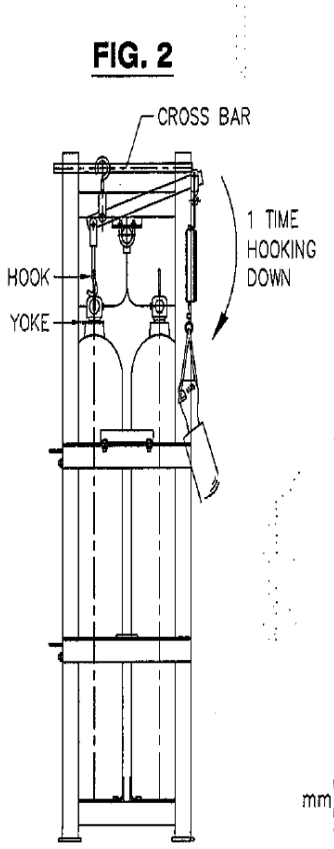
CO_2 capacity per cylinder = 45.4 kg

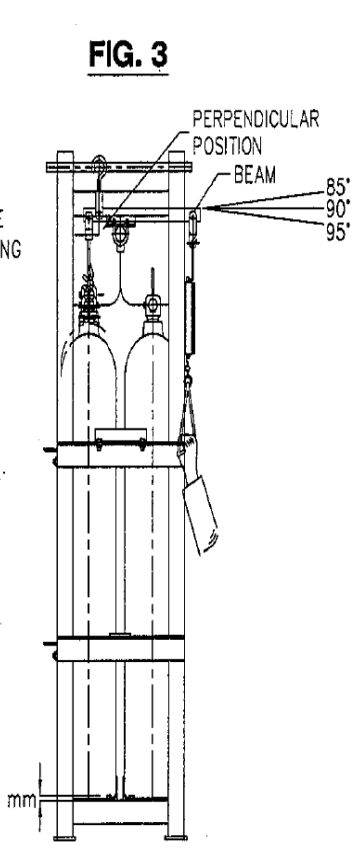
Weighting of CO_2 cylinder:

- As I shown in figure below there is beam scale assemblt tool, it is a special tool for weighting.
- It contain adjustable hook, yoke, scale from 0 – 220 kg and handle.
- And in second figure the way to take weighting of cylinder is mention.
- First you loosen the securing strap from the cylinder as shown in fig 1.
- Fit the yoke in the CO_2 head assembly and also fit the adjustable hook on the crossbar as shown in fig 2.









- Now pull down the scale with the help of handle and lift the cylinder upto it will free from the bottom contact.
- Now slowly pull down the beam to 90^0 against hook and now you can take reading from the scale.

Note: ± 5 degree of beam angle is allowed for measuring the bottle.
Recharge is must necessary if there is 10% reduction in weight.

Maintenance or check on CO_2 system:

Weekly:

- inform bridge before going inside the CO_2 room.
- Start ventilation blowers first and room should be ventilated for some time.
- Go with a person with proper communication equipment.
- Check all cylinder are properly secured.
- Check all the operating lever and there accessories are properly tight.
- check clamping.
- Check valve actuator.
- Flexible hose visually check and do leak test if required.

Monthly:

- All of the above.
- Open cabinet door and check alarm and ventilation cut off working.

Yearly:

- all above
- Blow the system with service air @ 25 bar pressure.

2 yearly:

- all above
- Weighting of CO_2 bottles.

5 yearly:

- All above
- Spring loaded relief valve pressure test @ 180 bar.

10 yearly:

- Cylinder pressure test @ 250 bar ***(after first 10 year cylinder to be tested every 5 year.)***

15 yearly:

- Pressure testing of line by suitable liquid
  - **Cylinder to master valve: @ 170 bar**
  - **Master valve to E/R or Cargo hold valve: @ 80 bar**
  - **E/R or Cargo hold to nozzle: @ 6-7 bar**

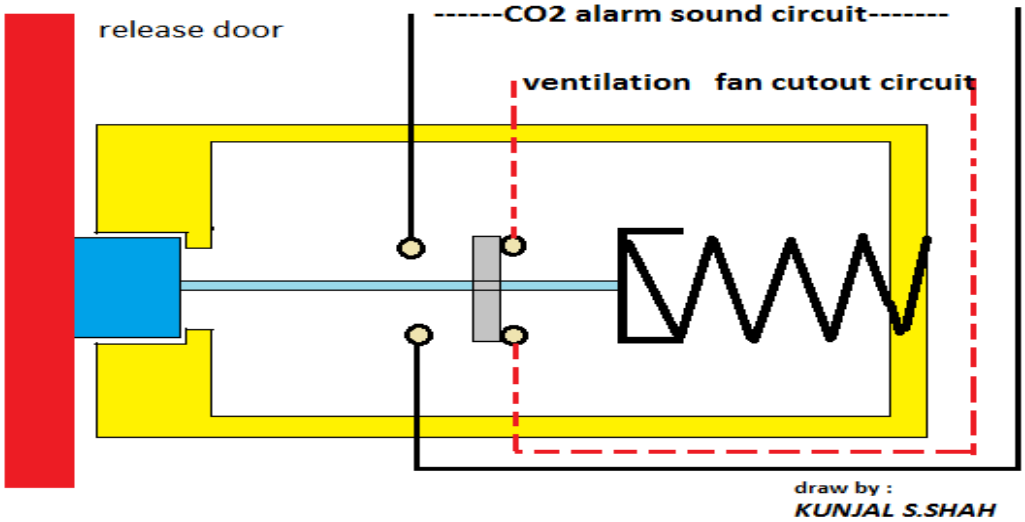
Working of CO_2 system:

- In E/R you also have hyper mist system so if you sure that it will help full to extinguish fire you can operate it also, for that you no need to shut any system. But if surveyor ask to explain about CO_2 than and then only you must have to explain CO_2
- as you all know that this system we can use only inside the enclosed space, in open space it will not work any more.
- So mainly it will be use in Machinery space or Engine room and Purifier room and Cargo hold.
- This system must be operated by Chief engineer or 2nd Engineer, these two person are responsible of all operation for this system.
- Surveyor asking in two way that fire in E/R what is your action? And fire in Purifier Room what is your action? I never heard that he asked fire in Cargo hold? But I will try to explain all thing , but in

my way. Might be I am wrong so just go through and try to understand and make correction if I will wrong at any point.

Fire in E/R what is your action?

- As you seen fire in any place in E/R, immediately rise the Fire Alarm from nearby place by breaking the glass with the use of hammer but incase if you don't found hammer what u will do? In that case remove your safety shoes and hit on the glass bcoz shoes have steel plate at fwd part so by using that u can easily break the glass.
- Now if you can able to recognized that which type of fire is there than use proper type of portable fire extinguisher (if fire is not too big).
- Now if you can't able to extinguish that fire than immediately run to inform the C/E and Deck Officer or on Bridge. Inform about location and type of fire.
- Now if M/E is running than immediately slow down and stop the M/E.
- After the instruction given by C/E or Master to release CO_2 system so before you leave the E/R make sure that all access from the E/R must be closed properly.
- Stop your running A/E and start E.G. and take on load. As you stop A/E all ventilation will also stop. Just need to close flaps.
- Now all crew member except the one bridge watch keeper or any officer or master. All have to gether at muster station for head counting.
- After head counting done as per the muster list follow the duty.
- Regarding closing vents, doors, flaps, damper, quick closing valve for fuel line.
- Now start the Emergency Fire Pump to make boundary cooling for the E/R bulkhead continue.
- Now from the fire control station you can operate the CO_2 system.
- Make sure that all crew member are present, no one is missing.
- Open the cabinet with the help of key, as soon as you open it will cut the power supply for ventilation fans and sound the CO_2 release alarm in E/R.
- Now operate the pilot cylinder valve and master valve to release the CO_2 gas.
- Keep continue boundary cooling and time to time check the temp of B/H.



CO2 CABINET ALARM CIRCUIT

ABOVE PICTURE WILL TELL YOU WHEN U OPEN CABINET THAN HOW THE VENTILATION SHUT AND ALARM SOUND.

Fire in PURIFIER ROOM what is your action?

- *In P/R you also have hyper mist system so if you sure that it will help full to extinguish fire you can operate it also, for that you no need to shut any system. But if surveyor ask to explain about CO_2 than and then only you must have to explain CO_2*
- In this case as you found fire in P/R. immediately rise the Fire Alarm from nearby place by breaking the glass with the use of hammer but incase if you don't found hammer what u will do? In that case remove your safety shoes and hit on the glass bcoz shoes have steel plate at fwd part so by using that u can easily break the glass.
- Stop the purifier from outside of the room by using EMERGENCY STOP.
- Now if you can able to recognized that which type of fire is there than use proper type of portable fire extinguisher (if fire is not too big).
- Close the P/R door. Don't forget to close it.
- Now if you can't able to extinguish that fire than immediately run to inform the C/E and Deck Officer or on Bridge. Inform about location and type of fire.
- Shut the ventilation of the P/R from the MSB. And shut the flaps.
- Shut the quick closing valve for fuel line only for the Purifier.
- Make boundary cooling for purifier room.

- C/E will be responsible to operate the CO_2 system from the outside of the P/R or from Fire control station.
- Release the CO_2 as per I mentioned above.
- Keep continue boundary cooling.

Prevention of Purifier Fire:

- ***All the pipes leading to the separator are to be double sheathed; the reason for this is that if inner pipe leaks, then it will not spray all over the place but instead it will leak into outer pipe.***
- ***Drip trays should be provided below the purifier or separator, so that in case of oil spill the oil will not flow and spread in the purifier room and contact with any hot material and catch fire.***
- ***All the pipes with flanges or connections are to be covered with anti spill tapes which can prevent spill from the flanges in case of a leakage.***
- *Fire fighting system such as water mist and CO2 system should be installed.*
- *Quick closing valves and remote stopping of pumps and purifier should be provided.*
- *Fire detection and alarm system are to be provided so that quick action can be taken.*

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SPRINKLER FIXED FIRE FIGHTING SYSTEM

Q 22: Expalin sprinkler fixed fire fighting system?

Q 22a:Regulation about it?

Q 22b: Can we use fire pump?

Q 22c: Draw sprinkler head and working range of it, and which liquid inside bulb?

A 22, 22a, 22b, 22c:

Working principle : Cooling

SOLAS REGULATION:

- Every cargo ship 2000 GT and above have fitted.
- M/C space 500 m^3 in volume and above required additional fixed fire fighting system.
- **It must have at least TWO source of power for the S/W pump, Alarm & Detection system and F.W. pump.**
- In Accomodation and service space the sprinkler shall come into operation within temp range from 69^0 c to 79^0 c except where high temp might be expected the operation temp may be increase by not more than 30^0 c above maximum deck head temp.
- **Sprinkler shall be resistant to corrosion by marine atmosphere**.
- **Sprinkler system is divided into section, each section is permitted to contain not more than 200 head.**
- **Each sprinkler head is sufficient to cover the areas of 16 m about.**
- **Sprinkler head are spaced not more than 4 m apart and 2 m from the vertical wall.**
- **Each sprinkler head capable of 100 litre/min discharge.**
- **At highest sprinkler head in the system is not less than 4.8 bar pressure.**
- Each section of sprinkler shall be capable of being isolated by ONE STOP valve.
- Location of STOP valve outside of the associated section or in cabinet and clearly and permanently indicated.
- A test valve shall be provided for testing the automatic alarm for each section of sprinklers by a discharge of water equivalent to the operation of one sprinkler. The test valve for each section shall be situated near the stop valve for that section
- **A gauge indicating the pressure in the system shall be provided at each section stop valve and at a central station**
- This system is nit to be fitted where NO risk of FIRE, such as Void Space, CO_2 room, Public Toilet, etc.
- **Paint locker room shall have sprinkler with designed 5 litre/m^2 min connected to FIRE MAIN pump of the ship.**
- A list or plan shall be displayed at each indicating unit showing the spaces covered and the location of the zone in respect of each section. Suitable instructions for testing and maintenance shall be available.

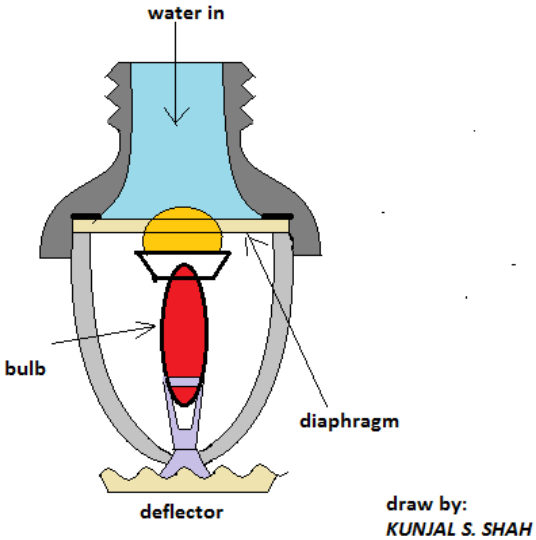
- **The sprinkler system shall have a connection from the ship's fire main by way of a lockable screw-down non-return valve at the connection which will prevent a backflow from the sprinkler system to the fire main**

BULB OPERATING RATING:

- **Orange : 57^0 c**
- **Red : 68^0 c**
- **Yellow: 79^0 c**
- **Green : 93^0 c**
- **Blue: 141^0 c**

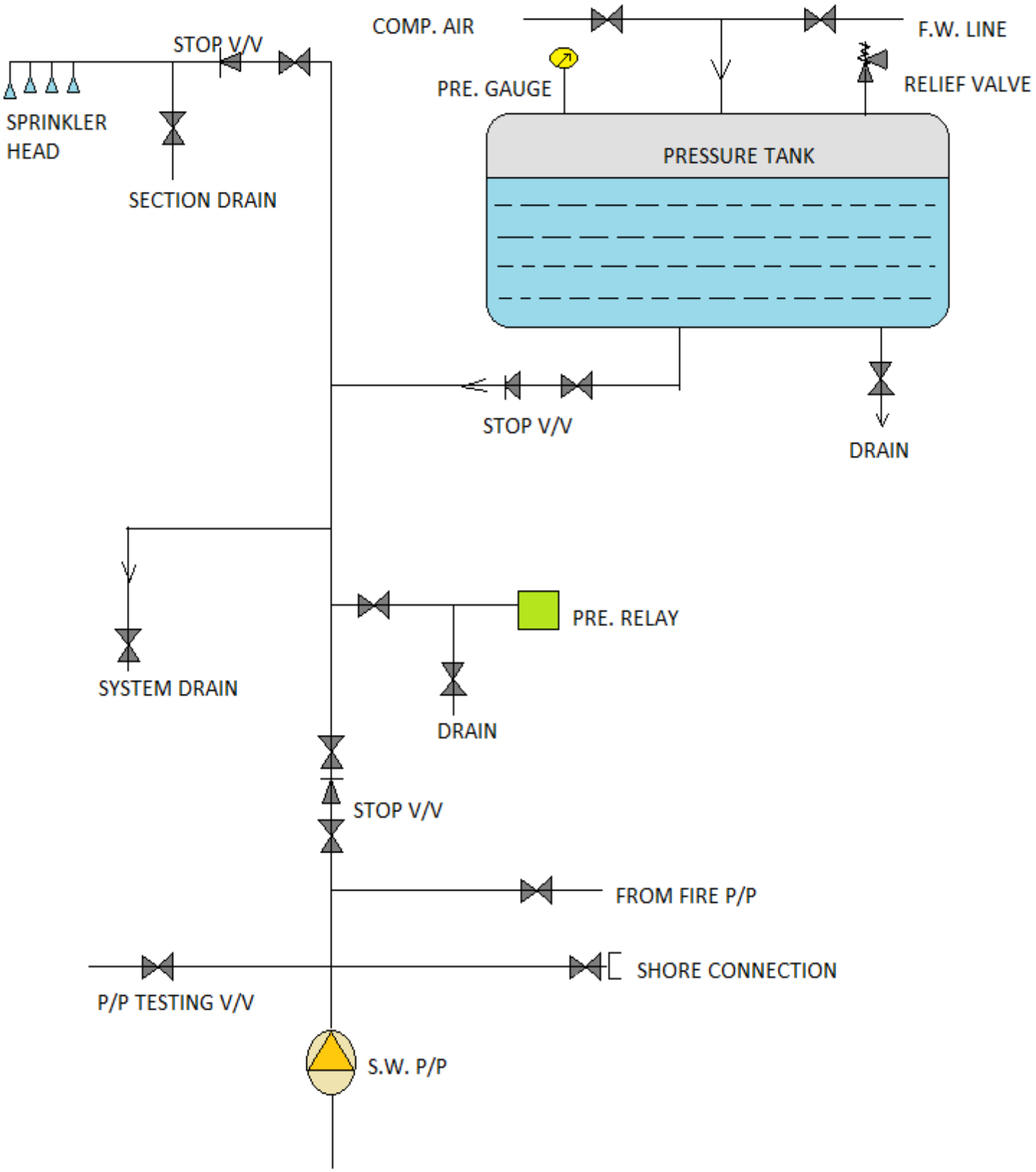
MAINTENANCE OF THIS SYSTEM:

- Pressure tank level check and recharge.
- Greasing of various valve.
- Check alarm system.
- S/W pump testing by closing isolating valve.
- Drain pressure switch circuit.
- Drain whole system yearly or every 6 month.



SPRINKLER QUARTZOID BULB

SPRINKLER FIXED FIRE FIGHTING SYSTEM



draw by:
Kunjal S. Shah

Testing procedure: -

- Close the section isolating valve, this will raise an alarm indicating zone isolation.
- Now, open the test valve, if no water comes out, then it means the NR valve placed after the section-isolating valve is not leaking.
- Since, the section after the NR valve remains pressurized, opening of the drain valve will cause the water pressure in the section line to decrease.
- A pressure switch sensor senses the decreased pressure & raises an alarm.
- Now, close the drain valve, open the section isolating stop valve.
- To check the flow switch, open the flow test switch to activate an alarm.
- All the above alarms will be indicated on the navigation bridge, E/R as well as in the Fire Control Room. The alarm will also indicate the particular zone from where it has risen.
- If all the alarm conditions are satisfied, close all the testing valves, open the section-isolating valve, purge the sprinkler line by air and again keep the line pressurized.
- Check from the pressure gauge, that proper pressure has been maintained or not.

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HYPERMIST (LOCAL APPLICATION) FIXED FIRE FIGHTING SYSTEM

Q 23: Explain about your ship another fixed fire fighting system into E/R?

Q 23 a: Regulation regarding Local fire fighting?

Q 23 b: Safety on Hypermist system?

Q 23 c: How it will activate?

A 23, 23 a, 23 b, 23 c:

Working principle: COOLING

SOLAS REGULATION:

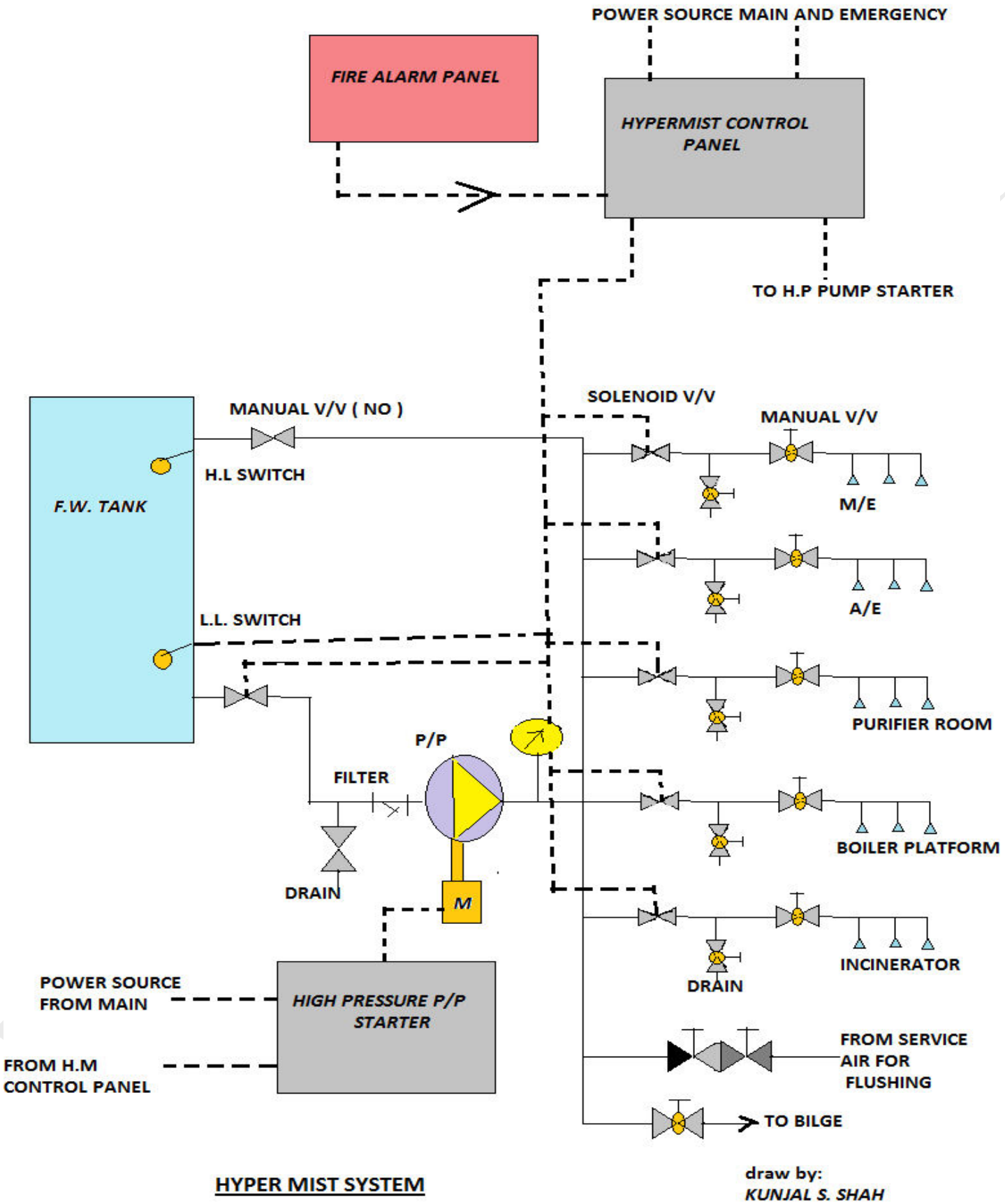
- **Cargo ship 2000 GT and above have this system.**
- **M/C space 500 m^3 in volume and above required additional fixed fire fighting system.**
- in periodically unattended M/C space have Manual and Auto release.
- In continue manned it have only manual release.
- It will protect are without the engine shutdown, personnel evacuation or sealing of space.
  - **Around M/E,A/E**
  - **Boiler platform**
  - **Purifier room**
  - **Incinerator area**
- Activation shall give a visual and audiable alarm in the protected space**.**

Working:

- It will get activate only when TWO detector will get activate, than and than only.
- Once it will activate it will send a signal to fire alarm panel.
- From fire alarm panel sense the ZONE of fire and it will send signal to Hypermist control panel.
- H.M. control panel send signal to High pressure pump ***(Plunger type reciprocating pump)*** starter and also solenoid operating valve according to Zone of fire.
- **Capacity of pump: 200 litre/min @ 70 bar pressure discharge.**
- **At nozzle 12-20 litre/min @ 50 bar pressure discharge.**
- It is very high water mist system which create a water fog which effectively puts out the fire while also providing a cooling effect.
- **Specialty of H.M Nozzle:** its diffuser action in Nozzle drop in pressure at Nozzle throat will breaking the liquid particle into fine mist.

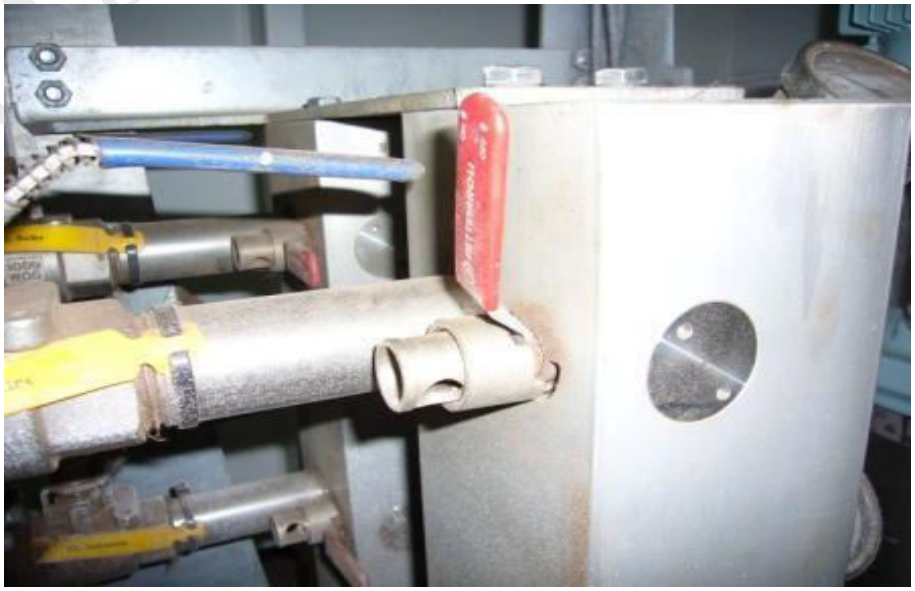
SAFETY:

- High and low water alarm switch.
- Detector sensor. (TWO)


POWER SOURCE MAIN AND EMERGENCY
FIRE ALARM PANEL
HYPERMIST CONTROL PANEL
TO H.P PUMP STARTER
F.W. TANK
MANUAL V/V (NO)
H.L SWITCH
L.L. SWITCH
SOLENOID V/V
MANUAL V/V
M/E
A/E
PURIFIER ROOM
BOILER PLATFORM
INCINERATOR
P/P
FILTER
DRAIN
M
DRAIN
POWER SOURCE FROM MAIN
FROM H.M CONTROL PANEL
HIGH PRESSURE P/P STARTER
FROM SERVICE AIR FOR FLUSHING
TO BILGE
HYPER MIST SYSTEM
draw by:
KUNJAL S. SHAH


Manual Release Panel


FIRE ALARM
CONTROL PANEL
ALARM
DELTA COMPACT



Q 24 : Draw Fire main system from your ship ?

Q 24 a : What is function of Isolation valve ?

Q 24 b: Regulation of Emergency fire pump and main fire pump ?

Q 24 c: Regulation of Fire hose and nozzle ?

Q 24 d: What is the Diameter of fire main line ?

Q 24 e: Is there any Relief valve on line ? if yes so location of it, and if no than why ?

A 24, 24 a, 24 b, 24 c, 24 d, 24 e :

FIRE MAIN LINE

General Principles

- The fire main is a system consisting of sea water inlet(s), suction piping, fire pumps and a distributed piping system supplying fire hydrants, hoses and nozzles located throughout the vessel.
- Its purpose is to provide a readily available source of water to any point throughout the vessel which can be used to combat a fire and is considered the backbone of the fire fighting systems onboard a vessel.
- Through the fire main system, the firefighter is provided with a reliable and versatile system capable of providing a number of different methods with which to engage a fire.
- Water can be supplied as a straight stream for combating deep seated fires, as a spray for combating combustible liquid fires where cooling and minimum agitation is desired or as a means to protect personnel where cooling is the primary effect desired.

Extinguishing Capabilities of Water

- Water primarily extinguishes a fire by the removal of heat. It absorbs heat more effectively than any other commonly used extinguishing agent due to its good thermal conductivity and its high latent heat of vaporization.
- It is most effective when it absorbs enough heat to raise its temperature to 100°C (212°F).
- At that temperature, water absorbs additional heat as it goes through the transition from a liquid to a vapor (i.e., steam).
- In the process of heating the water from normal temperatures, up through its conversion into steam, water absorbs approximately 2.6 kilo-joules of heat per gram (1117 BTU/lb) of water, which is a much higher heat absorption value than any other agent.
- This absorption of heat reduces the temperature of the burning vapors and also reduces the amount of vapor being generated by the cooling of the fuel surface.

- With adequate cooling, there is insufficient heat to maintain the self-supporting combustion process and the fire goes out.
- Water also has an important secondary effect. When it turns to steam, it expands about 1600 times in volume at atmospheric pressure. As a result, one cubic meter (cubic foot) of water can generate up to 1600 cubic meters (cubic feet) of steam vapor.
- This great cloud of steam surrounds the fire, displacing the air that supplies oxygen for the combustion process.
- Thus, water provides a smothering action as well as cooling.

Special tool

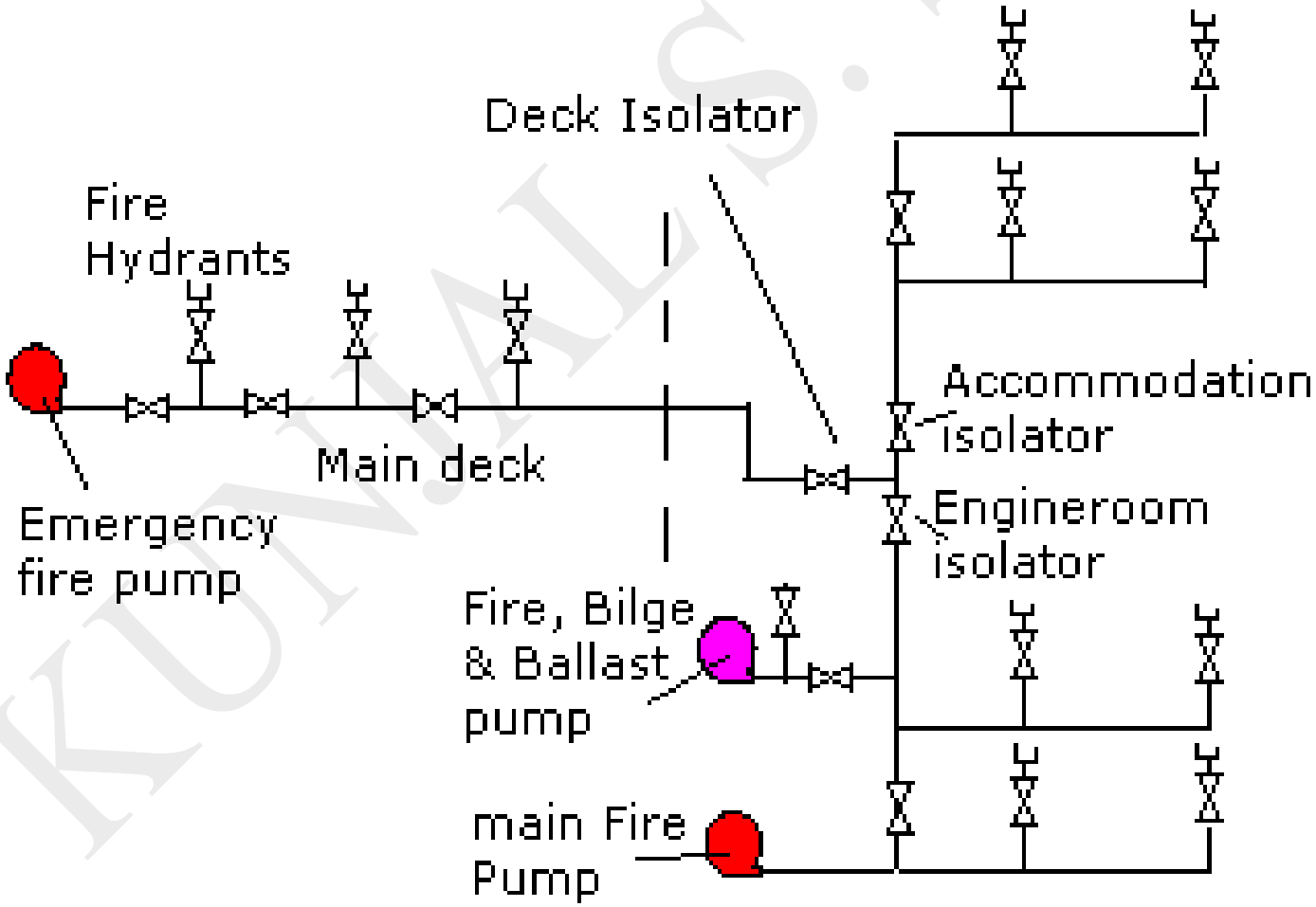
nozzle

coupling

International shore coupling

Fire hydrant

Hoses



Description

- A ship‟s main emergency fire system consists of a specific number of fire hydrants located at strategic positions across the ship. A series of dedicated pumps (2 Nos), called Fire Main pumps are provided to supply to these fire hydrants.
- The number and capacity of pumps required for a particular type of ship is decided as per FSS code book.
- **All these pumps are supplied power from the main power system. Apart from that, an emergency fire pump is also provided (25m^3 /hr or 40% capacity of Main Fire Pumps), which is located outside the machinery space.**
- The emergency fire pump has its own independent means of power source, which can be used to take over in case of main power failure.
- All the hydrant outlets are provided with an isolating valve so as to isolate those valves which are not in use.
- The fire hydrants are also provided with standard size flanges in order to attach hoses which have nozzles attached to them. All hoses are provided with snap in connectors for easy and quick engaging and disengaging operation.
- **The nozzles attached to the hoses can be operated in two modes – jet and spray, depending on the type of discharge required for extinguishing the fire.**
- The nozzles can be adjusted according to the type of spray and flow required, which could be used over the fire to cool it without spreading.
- The pumps are connected with the main sea water connection, having appropriate head to prevent any type of suction problem.
- The emergency fire pump is fitted with a priming unit & should be capable of overcoming the suction head even under the lightest draft the vessel may encounter and in any condition of list & trim.
- **The valves supplying water to these pumps are always kept open to provide a constant supply of sea water to fight fire at any point of time**.
- The pumps can be started from remote locations also.
- Though sea water is the best mode of fighting fire, the main emergency fire fighting system can only be used on fires of Type A. However, in case of class B fires, if all modes for extinguishing fire fails, sea water from main emergency system can be used.
- **Fire main system is also be used for boundary cooling.**
- **Performance criteria = 12 meter jets from 2 hydrants located farthest from each other.**

Regulation for the Emergency Fire Pump

- Apart from Main Fire Pump, an Emergency Fire Pump is also provided on board a ship, that can be used in case of an emergency like CO_2 flooding or when Main fire pumps are dysfunctional.
- They shall be capable of supplying two jets (12 meters each) and
- **Capacity being 40% of the total capacity of the Main Fire pumps, but in any case not less than 25m^3/h for passenger ships of less than 1,000 gross tonnage and for cargo ships of 2,000 gross tonnage and upwards;**
- **15m^3 /h for cargo ships of less than 2,000 gross tonnages.**
- It should be located outside the engine room, preferable on the same level of embarkation deck.
- It is generally driven by a diesel engine (started by battery and a hand cranking as an alternate starting mechanism).
- It should take suction without any external support in the lightest seagoing conditions.
- It should also be attached to a priming unit.
- The suction piping if passing through the space to be protected must be additionally reinforced with fire retardant material so that no damages takes place and supply of water ensured at all times.
- The power supply to the pump should be from the Emergency Generator in case the prime mover of the pump is an electric motor.
- **"The regulations require an independently driven power operated emergency fire pump to be fitted, this can be met by a self-contained compression ignition engine driven unit or an electrically or hydraulically driven unit.**
- Such units, their sea suctions, means of priming, sources of power supply, switchboards, electric cables and hydraulic piping as appropriate, must not be in the compartment containing the main fire pumps, but in a position not likely to be cut off by fire or smoke in that compartment and be such that the supply of water is ensured at all times".
- Venting of Emergency fire pump room should be as far as possible from M/C space to avoid any smoke from M/C space fire entering into that space.

Fire Hoses and Nozzles.

Fire Hoses:

- These are made from synthetic woven textiles, lined with rubber and PVC coated.
- They are strong and are not affected by oils, chemicals, extreme climates and mildew.
- These are generally 18 meter long and 64mm diameter and provided with couplings and Nozzle.
- They are conspicuously kept at designated positions near the hydrants, either rolled or flaked, in a Fire Hose Box.
    - **15 m for M/C space**
    - **20 m other space and open deck**
    - **25 m open deck with a max breadth in excess of 30 m**

- Testing annually @ 50% above working pressure, damaged and suspect hose must be removed.
- **Working pressure 17 bar and testing pressure 24 bar**.

Nozzles:

- They should be of approved dual purpose type, i.e. spray and jet, also incorporating a shut-off. They are kept with hoses in the Fire Hose Box.
- Nozzles shall be fitted above the bilges, tank tops and other areas over which oil fuel is liable to spread and also above other specific fire hazards in the machinery spaces.
- Precautions shall be taken to prevent the nozzles from becoming clogged by impurities in the water or corrosion.
- The number and arrangement of the nozzles shall be to the satisfaction of the Administrator and shall be such as to ensure an effective average distribution of water at least 5 litre/m^2 /min in the spaces to be protected.
- Where increased application rates are considered necessary, these shall be to the satisfaction of the Administrator.
    - **Size are 12 mm, 16 mm, 19 mm**
    - **For accommodation only 12 mm used**

Fire mains and Fire Hydrants.

- A Fire Main System must have at least two independently driven fire pumps that can each deliver water at a continuous pitot tube pressure of at least 3.5 kilograms per square centimeter (approximately 50 pounds per square inch) at least two fire hose nozzles that are connected to the highest two fire hydrants on the unit.
- Alternative designs that meet the pressure requirement of this paragraph will be considered for column stabilized and self-elevating units.
- Pressure @ hydrant:
  for passenger ships:
    - **4,000 gross tonnage and upwards 0.40 N/mm^2**
    - **less than 4,000 gross tonnage 0.30 N/mm^2**

  for cargo ships,
    - **6,000 gross tonnage and upwards 0.27 N/mm^2**
    - **less than 6,000 gross tonnage 0.25 N/mm^2**
- the maximum pressure at any hydrant shall not exceed that at which the effective control of a fire hose can be demonstrated.

Fire Hydrants:

- Number and position of hydrants shall be such that at least two jets of water, not emanating from same hydrant, one of which shall be from a single length of hose, may reach any part of ship normally accessible to passenger or crew.
- They should be positioned in such a way that the fire hose may be easily coupled to them.
- They should be fitted with a valve for controlling the discharge. Hydrant valves fitted in fire mains should be designed to open with an anti-clockwise rotation of the hand wheel.

Relief valve:

- Relief valves shall be provided in conjunction with fire pumps if the pumps are capable of developing a pressure exceeding the design pressure of the water service pipes, hydrants and hoses.
- These valves shall be so placed and adjusted as to prevent excessive pressure in any part of the fire main system.
- **Relief valve is provided if pumps are capable of developing the pressure exceeding the design pressure of water service pipes, hydrants & hoses.**
- It assists to avoid any overpressure to develop in any part of the fire main.
- **The fire line is fitted with relief valve to prevent the damage to pipe in case, the V/L is fighting fire with the help of shore while in dry-dock.**

Drain Valve:

- Drain valve is fitted to drain the fire line when not in use & also prevent the damage to pipe due to icing, while V/L is operating in Sub-zero temperature area.

Isolating valve:

- Isolating valves to separate the section of the fire main within the machinery space containing the main fire pump or pumps from the rest of the fire main shall be fitted in an easily accessible and tenable position outside the machinery spaces.
- The fire main shall be so arranged that when the isolating valves are shut all the hydrants on the ship, except those in the machinery space referred to above, can be supplied with water by another fire pump or an emergency fire pump.
- The emergency fire pump, its seawater inlet, and suction and delivery pipes and isolating valves shall be located outside the machinery space.
- If this arrangement cannot be made, the sea-chest may be fitted in the machinery space if the valve is remotely controlled from a position in the same compartment as the emergency fire pump and the suction pipe is as short as practicable. Short lengths of suction or discharge piping may penetrate the machinery space, provided they are enclosed in a substantial steel casing, or are insulated to A-60 class standards.

- The pipes shall have substantial wall thickness, but in no case less than 11 mm, and shall be welded except for the flanged connection to the sea inlet valve.
- A valve shall be fitted to serve each fire hydrant so that any fire hose may be removed while the fire pumps are in operation.
- **In tankers, isolation valves shall be fitted in the fire main at poop front in a protected position and on the tank deck at intervals of not more than 40 m to preserve the integrity of the fire main system in case of fire or explosion.**
- It is screw down isolation valve.

Diameter of fire mains:

- The diameter of the fire main and water service pipes shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously, except that in **the case of cargo ships the diameter need only be sufficient for the discharge of 140 m^3/h.**

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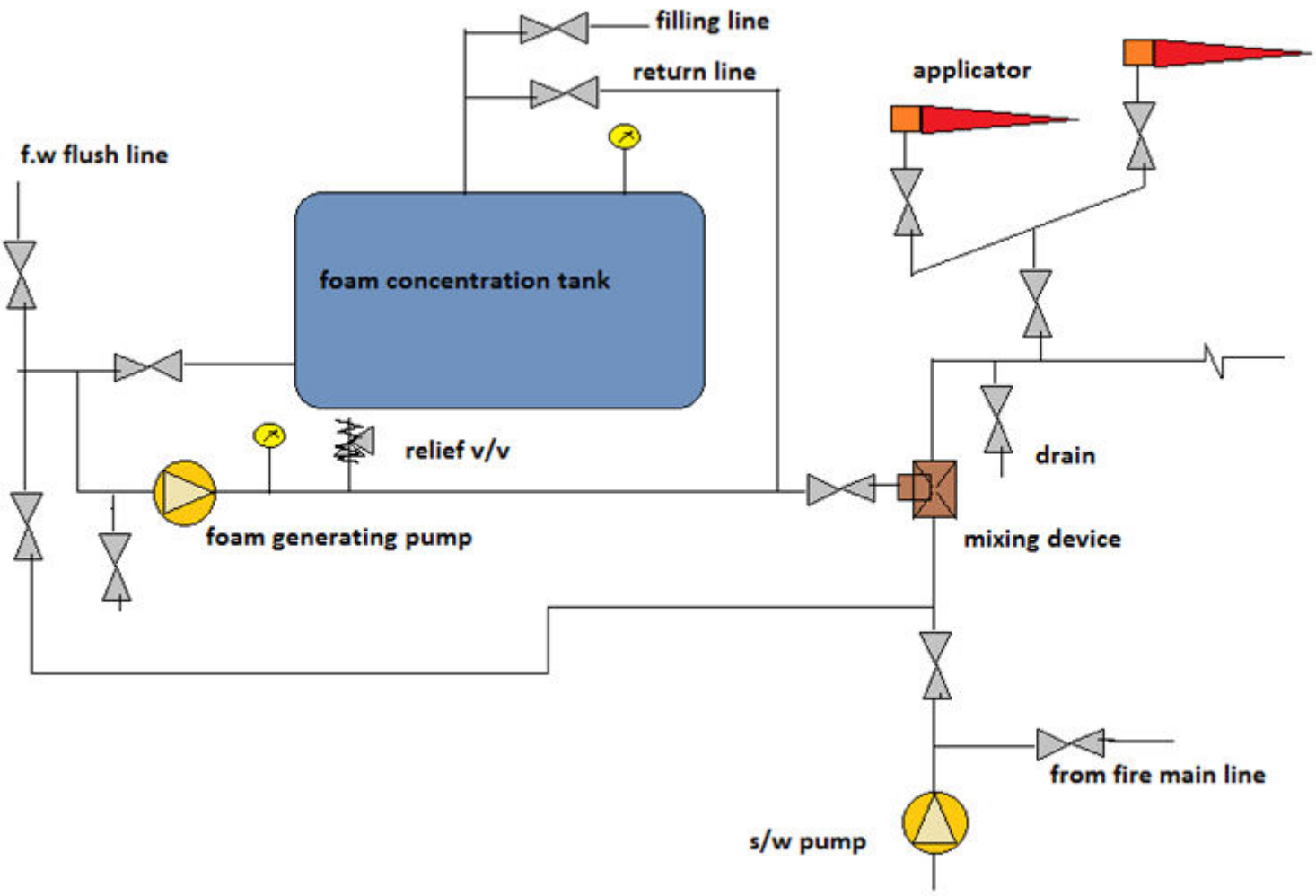
Q 25 : EXPLAIN DECK FOAM FOR FIRE FIGHTING SYSTEM?

A 25:

Deck foam for fire extinguishing:

- Foam for fire protection purposes is an aggregate of air-filled bubbles formed from aqueous solutions, and is lower in density than the lightest flammable liquids.
- It is mainly used to form a coherent floating blanket on flammable and combustible liquids to prevent or to extinguish fires by excluding air and cooling the fuel.
- It also pre-vents re-ignition by suppressing formation of flammable vapors.
- It has the property of adhering to surfaces, providing a degree of exposure protection from adjacent fires.
- Foam is used as a fire prevention, control, or extinguishing agent for flammable liquid in tanks or processing areas.
- Foam solution for these hazards may be supplied by fixed systems or portable foam generating systems.



Foam Types:

- The principal use of foam is to extinguish burning flammable or combustible liquid spills or tank fires by developing a coherent coolant blanket.
- Foam is the only permanent extinguishing agent used for fires of this type. Its application allows fire fighters to extinguish fires progressively.
- A foam blanket covering a liquid surface is capable of preventing vapor transmission for some time, depending on its stability and thickness.
- Fuel spills may be rendered safe by foam blanketing.
- The blanket may be removed after a suitable period of time.
- Foam is used to diminish or halt the generation of flammable vapors from non-burning liquids or solids, and to cut off access to air for combustion.
- The water content of foam cools and diminishes oxygen by steam displacement.

- Foam is also used to fill cavities or enclosures where toxic or flammable gases may collect.
- Foam solutions are conductive and therefore not recommended to be used for electrical fires.

Foam Concentrate Types:

- **Protein foam concentrate**. It is diluted with water to form 3% to 6% solutions depending on the type and, in general, it is only used for crude oil fires.
- **Fluor protein foam concentrate** is very similar to protein foam concentrates. It may also deposit a vaporization preventing film on the surface of a liquid fuel. It is diluted with water to form 3% to 6% solutions depending on the type, and is used for crude oil or refined oil products where a higher degree of protection is preferred.
- **Special 'alcohol type' foam concentrate** forms a foam that has an insoluble barrier in the bubble structure which resists breakdown at the interface of the fuel and foam blanket. It is used for fighting fires in water solution and certain flammable or combustible liquids and solvents that are destructive to regular foam. Mainly used for protection onboard chemical tankers.
- **Synthetic foam concentrate includes:** AFFF and medium and high expansion foam concentrates are used to produce foam or foam-to-solution volume ratios from 20:1 to approx. 1000:1 and are used for local protection and engine room hi-ex systems.

SOLAS REGULATION :

- For ships carrying chemicals or oils in bulk, SOLAS/IMO require a fixed deck foam system for extinguishing fires on deck or in tanks.
- In principle, the systems required are identical; however, for chemical tankers, IMO type 2 and 3, the foam system is considerably larger than for crude oil tankers, due to the higher risk of fire in chemicals.

Design Figures

- **Oil Tankers:** - The foam system capacity shall be a minimum of the largest of the entire cargo tank deck covered with 0.6 litre/m^2/min. or 6.0 litre/m^2/min. for the largest cargo tank.

- **Chemical Tankers:** - The foam system capacity shall be a minimum of the largest of the entire cargo tank deck covered with 2.0 litre/m^2/min. or 20 litre/m^2/min. for the largest cargo tank.

System Description:

- All foam systems, consist of a water supply, foam liquid storage, a proportioning device and a distribution system.
- The water supply pump(s) provide(s) a certain capacity of seawater to the deck foam system, and is/are supplied by the ship's fire pumps.

- The foam liquid is stored in a tank. The tank must be complete with vent, contents gauge, and access manhole.
- The foam is delivered via a high-pressure foam liquid pump to the automatic foam liquid proportionate, which will accurately proportionate foam liquid at 3% to 6% to the seawater flow, irrespective of flow rate or pressure.
- For satisfactory operation of the proportionate, foam liquid must be supplied with a minimum pressure of at least 10 meters head higher than the inlet water pressure under all load conditions.
- The electrically driven foam liquid pump is provided for this purpose.
- Foam solution is supplied to the deck monitors and hand lines by the deck main fitted with isolating valves.
- Each monitor is isolated from the main supply pipe by means of butterfly valves, which are normally closed.
- Four portable foam-making branch pipes are provided. Each branch pipe has a solution rate of 400 litre/min.

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Q 26: Explain I.G system?

A 26:

INERT GAS SYSTEM

Flammable Limits.

- Flammability Limits or Flammable Limits give the proportion of combustible gases in a mixture, between which, limits the mixture is flammable.
- Gas mixtures consisting of combustible, oxidizing, and inert gases are only flammable under certain conditions.
- The Flammable limit of a gas or a vapor is the limiting concentration (in air) that is needed for the gas to ignite and explode.
- The Lower Flammable Limit (LFL) describes the leanest mixture that is still flammable, i.e. the mixture with the smallest fraction of combustible gas. It is the lowest concentration (percentage) of a gas or a vapor in air, capable of producing a flash of fire in presence of an ignition source (arch, flame, heat).
- At concentration in air below the LFL there is no fuel to continue an explosion.
- Concentrations lower than LFL are "too lean" to burn.
- The Upper Limit (UFL) gives the richest flammable mixture, i.e. the mixture with the highest fraction of combustible gas. It is the highest concentration (percentage) of a gas or a vapor in air capable of producing a flash of fire in presence of an ignition source (arch, flame, heat).

- At concentration in air above the UFL are "too rich" to burn. Temperature and Pressure also influences flammability limits.
- Higher temperature results in lower LFL and higher UFL, while greater pressure increases both values.

Pyrophoric Reaction

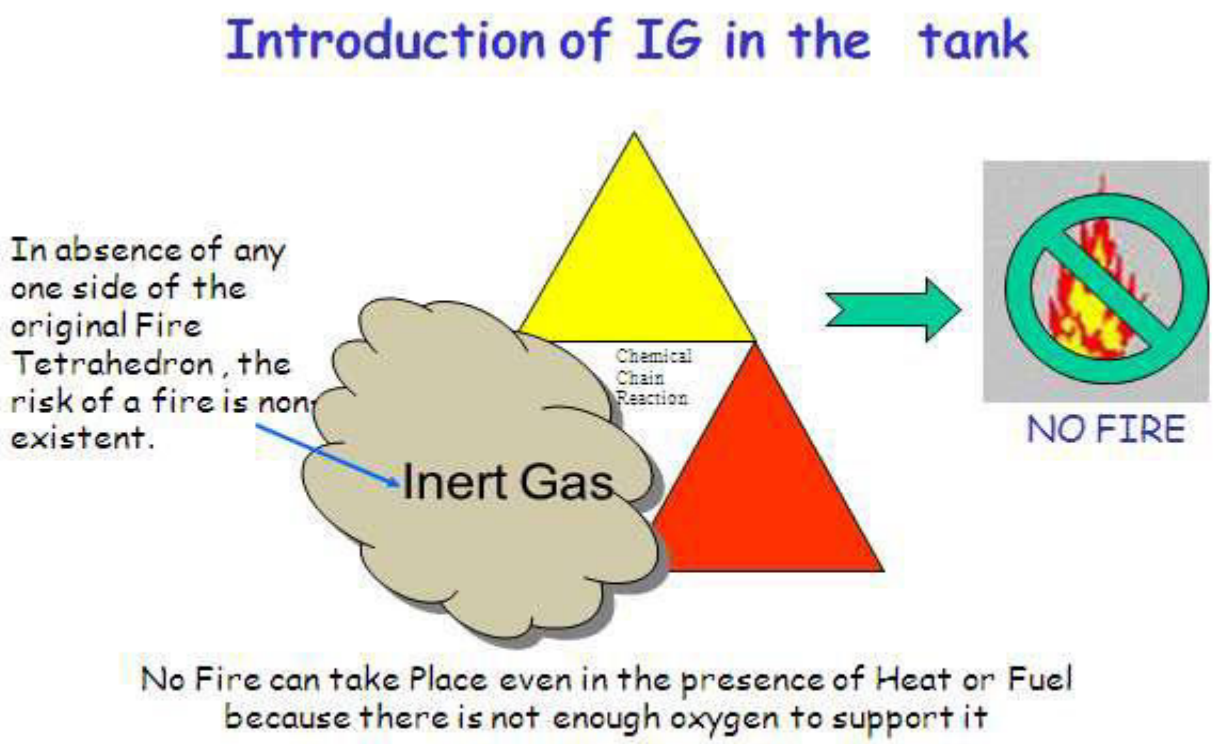
Or simply said

A potential source of ignition hazard on oil tankers

What is this ? → It is a rapid exothermic oxidation with Incandescence.

How it is formed ? →
- In an inerted atmosphere, the Hydrogen Sulphide reacts with Iron Oxide (rust) and forms Iron Sulphide.
- When a tank is exposed to air, the Iron Sulphide is oxidized back to Iron Oxide This oxidation is accompanied by generation of considerable heat so that individual particles may be incandescent.

Prevention ? → All cargo operation is carried in controlled inerted condition.



- The IMO and other international marine safety regulations stipulate that tankers transporting crude oil and other flammable and hazardous cargo use inert gas to prevent explosions from occurring in their cargo tanks.
- Inert gas systems produce inert gas by cooling the flue gasses from boilers and removing all traces of dust and sulfur, and then inert gas fans supply it to cargo tanks for preventing explosion via back flow preventing devices.
- These systems are generally used on crude oil tanker ships where a higher quality inert gas is not required for the unrefined cargo product.
- Typically a range between 4% to 5% O2 content with some soot content dependent upon flue gas quality

Various terms those are used in reference to IG System:

Inert gas: Gases with a low content of oxygen that are used to fill void spaces in and around tanks for explosion protection or gas which contains insufficient oxygen to support combustion of hydrocarbons.

Inert conditions:

- This is where a space has had its oxygen content reduced to 8% or less

Inert gas plant:

- This is a system specially designed to supply cool, clean, pressurised, monitored and controlled inert gas.

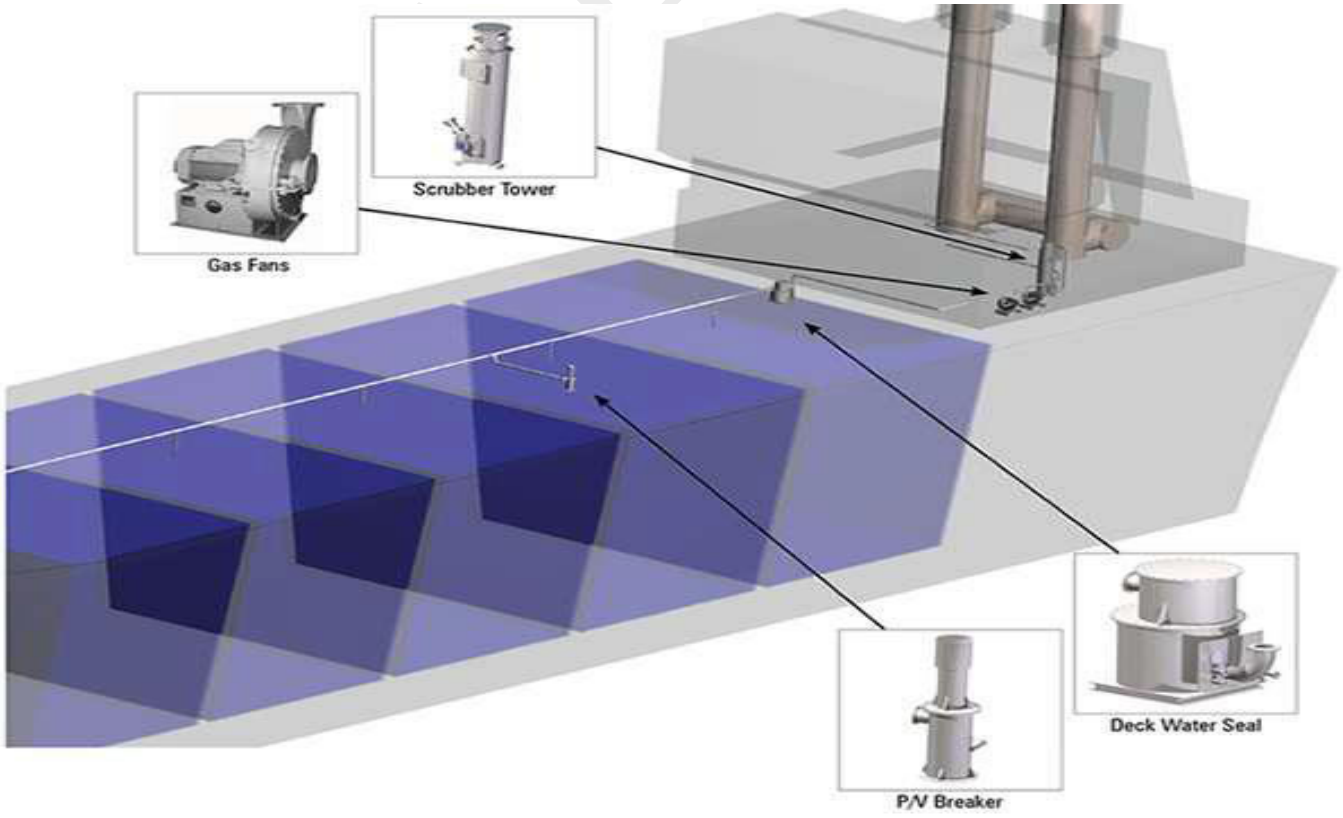
Gas freeing:

- Opposite to Inerting and is the replacement of an inert atmosphere with one of fresh air.

Purging-

- This is the introduction of inert gas into an Inerted space to:
  - Further reduce O2 content
  - Reduce hydrocarbon level in the inert gas so that air may be introduced without the mix entering the flammable range.

The various construction parts of an Inert Gas system are explained below:



Boiler Uptake Valve:

- It controls the flow of exhaust gas from the boiler to IG System. Boiler uptake valves are of butterfly type and of heat resistance material.
- Air sealing of this valve is provided to avoid the exhaust gases from entering the system when it is not in use.
- Soot blowing device is also provided to prevent the accumulation of carbon deposits.

Scrubber Unit:

- The Scrubber unit is used to cool and clean exhaust gases.
- It combines three scrubbing principles; a venturi scrubber, a wet filter and a spray section for high efficiency cooling and cleaning of boiler flue gases.
- Concentric arrangement with demister section and mesh type wet filter gives independence of ship‟s pitching and rolling without loss of efficiency.
- The scrubber unit is internally GRP coated and venturi tube in corrosion and heat resistant steel.

Blower Units:

- The blower units are of a single stage centrifugal type with motors and each unit is arranged on a rigid steel base frame equipped with resilient mountings.
- The blower house is of mild steel and internally GRP coated.
- The impeller is manufactured from corrosion resistant steel.
- Their total capacity is 25% more than the discharge rate of IG system.

Pressure/Vacuum Breaker:

- The Pressure/Vacuum Breaker is another device of importance for the ship‟s safety, releasing excessive pressure or vacuum from the cargo tanks, thus avoiding exploding or collapsing of cargo tanks.
- The unit is internally coated with epoxy.

Control System:

- The control system is based on a Programmable Logical Control (PLC).
- The control panel is of the touch screen type. Several mimic flow diagrams are implemented as well as the controls required for safe and easy operation with a minimum of operator supervision.

- Additional functions like user manuals and condition monitoring can also be included.
- The capacity is remotely controlled from a panel in the cargo control room.

O2 Analyzer:

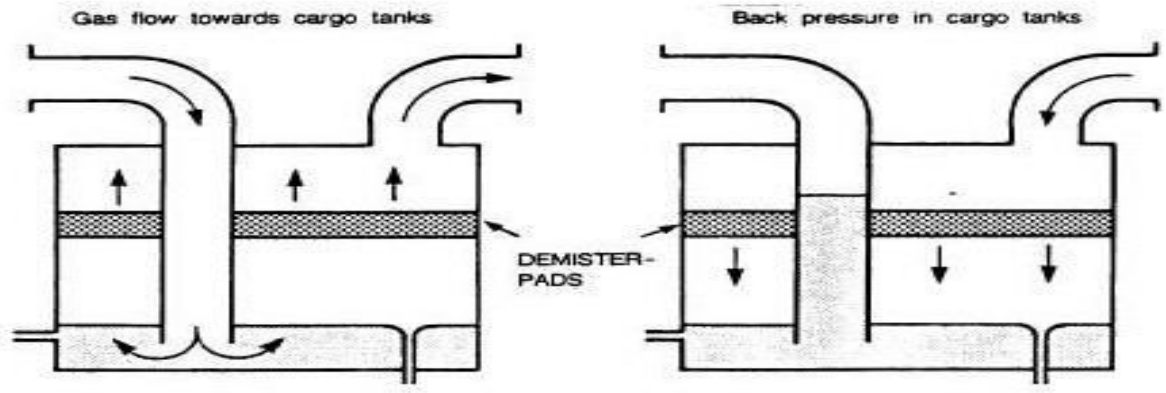
- It measures the Oxygen content in Inert Gas and if it is more than specified, it opens the vent to atmosphere and closes the supply of gas to IG main line.

Deck Water Seal:

- The Deck water seal acts as a non-return safety valve to avoid the hazardous cargo vapors from entering back the IG system.
- It is of displacement semi-dry type internally GRP coated.
- Upon loss of positive flow, the water immediately closes the seal.
- The mesh demister effectively prevents the carry-over of water droplets under all flow conditions.

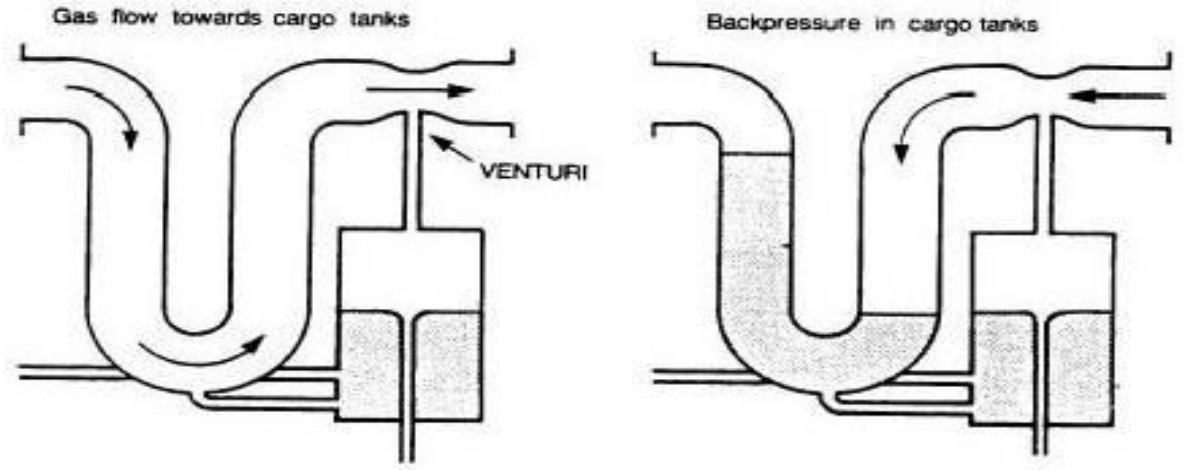
Wet Type Deck Water Seal

- The picture below shows the construction of a wet type deck water seal and its functioning.
- Basically it consists of a chamber semi-filled with water and two pipes for inlet and outlet of flue gases while another two small pipes denote inlet and outlet for sealing water.
- There is a demister pad to remove water droplets from gas.
- The operation of this device is pretty simple and the two diagrams shows conditions where the inert gas is flowing from the plant to the distribution area and the right hand side showing a condition where back pressure tends to push cargo gases into the IG system and is prevented by the water seal.



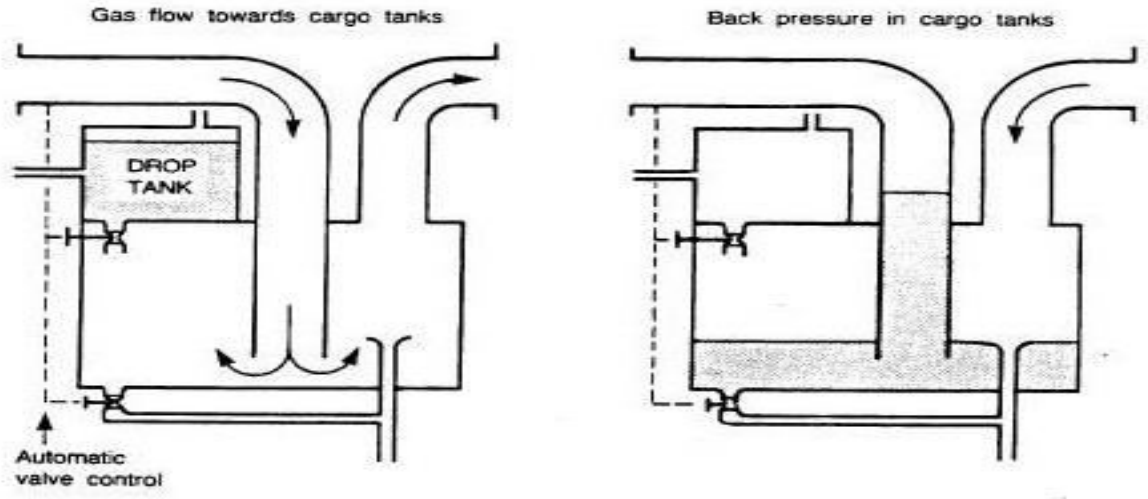
Semi Dry Type Deck Water Seal

- The construction of this type of seal as well as the functioning under both conditions is shown in the diagram below.
- The main difference with the previous type of seal is that it uses venture action to draw water when there are chances of backflow of the gases thus reducing if not completely eliminating water carry over to the cargo tanks.

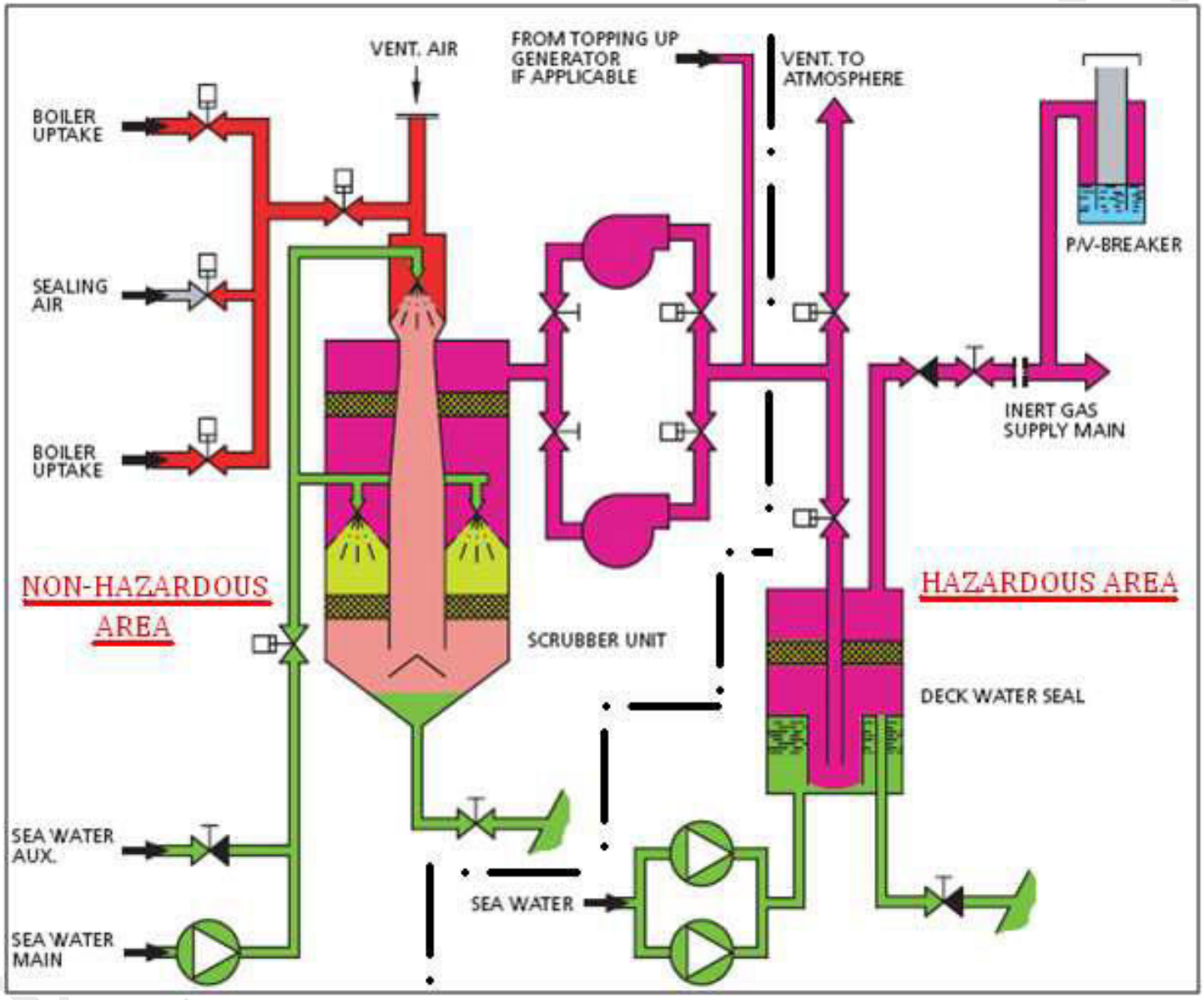


Dry Type Deck Water Seal

- This seal totally eliminates any water carry over and uses automated valve control to deliver water to the seal in case there is any back flow but the only disadvantage is that if automation system fails then there is a danger of blow back of cargo gases.
- The only alarm is Deck water seal low level alarm.

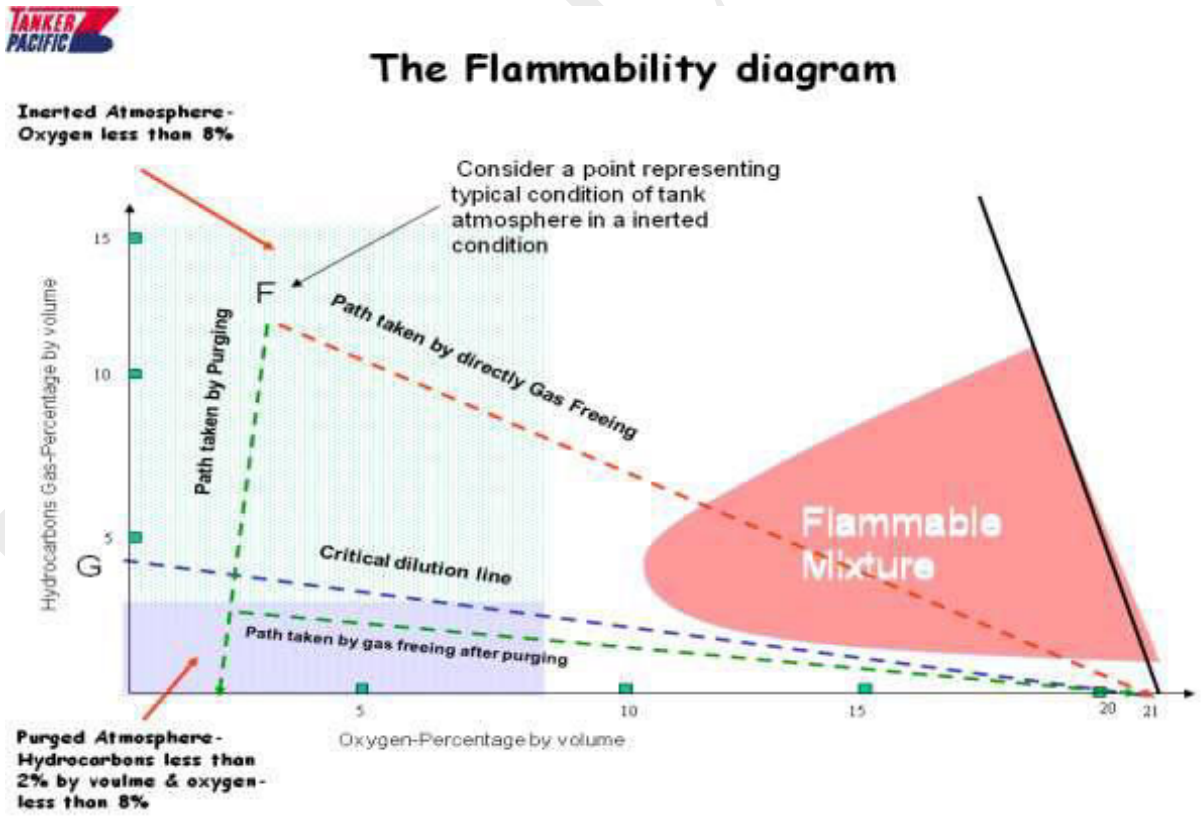


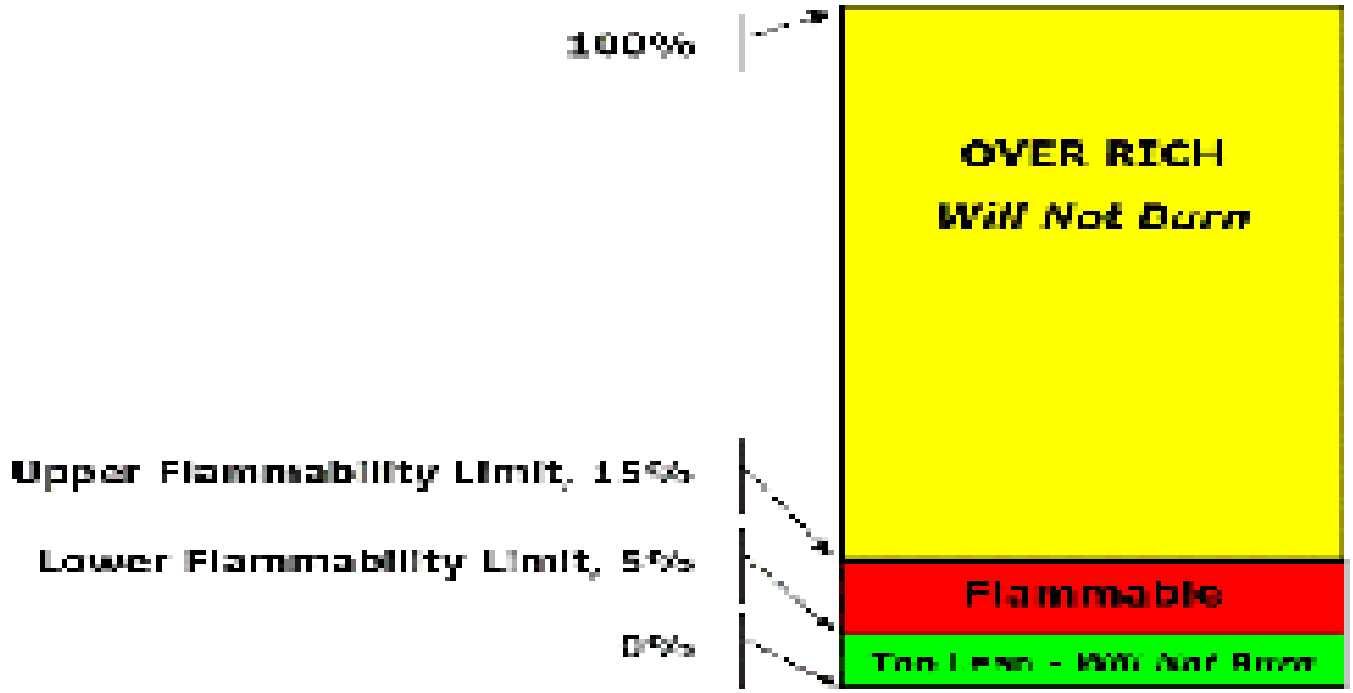
SCHEMATIC DIAGRAM OF IG SYSTEM

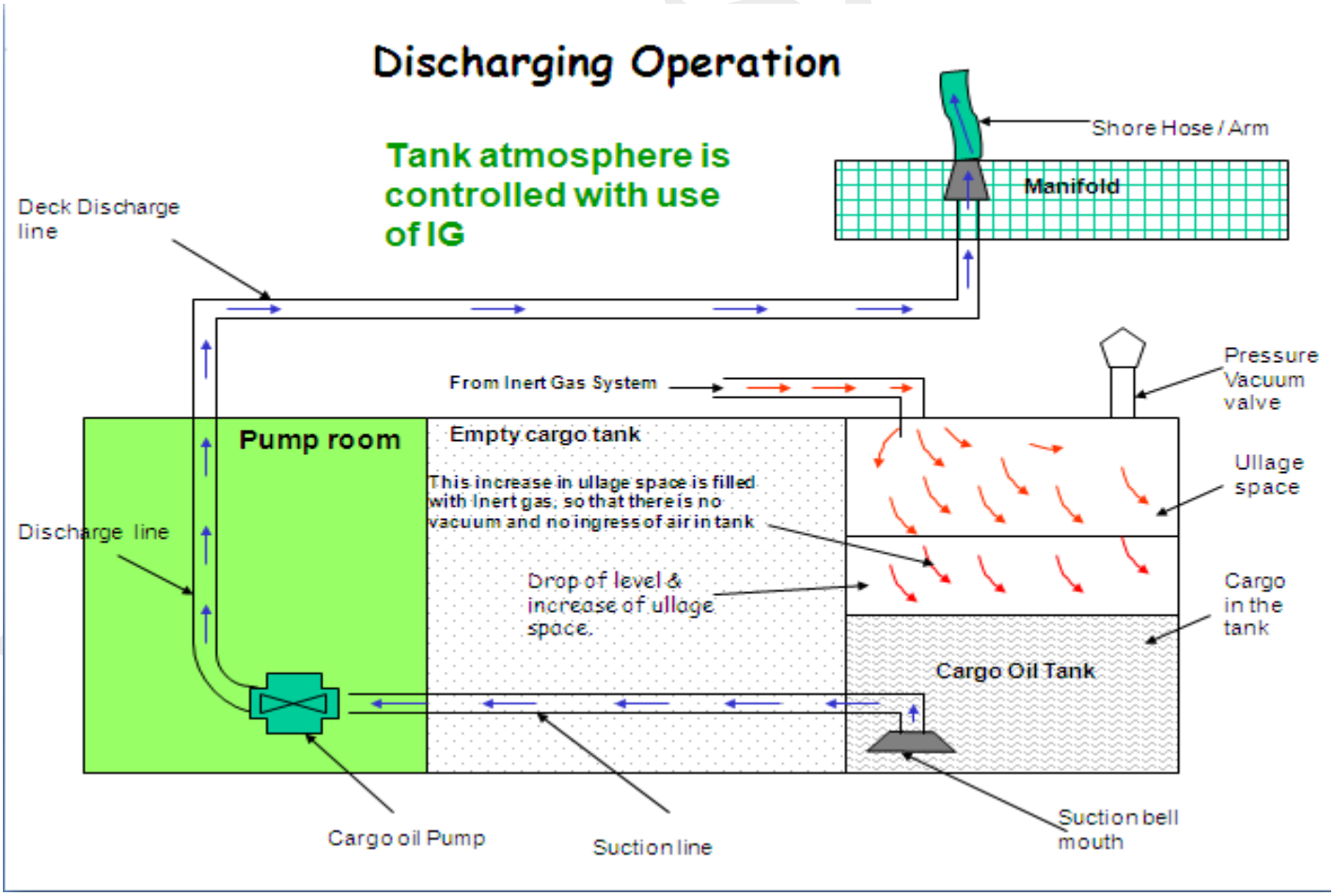


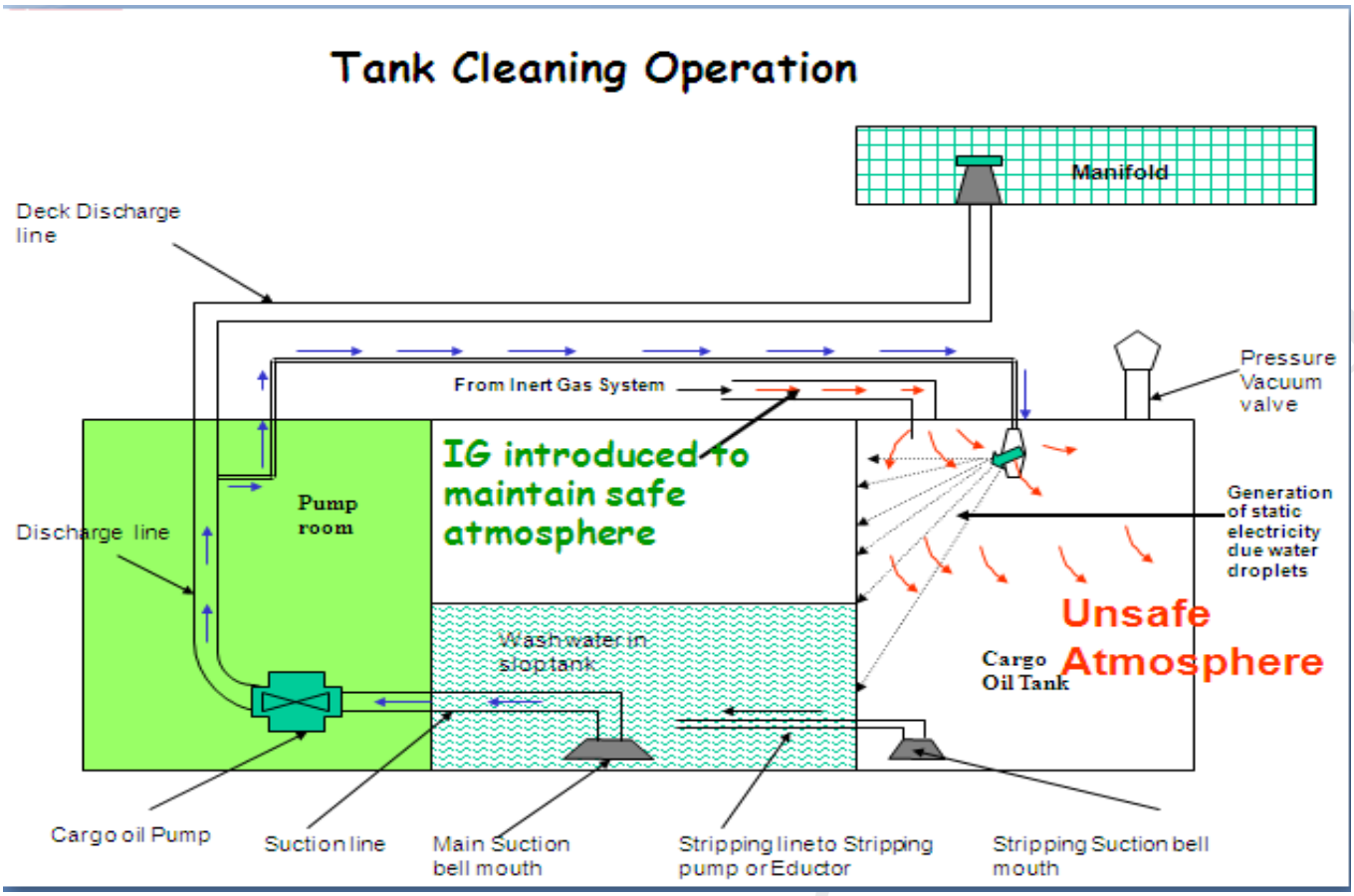
Working:

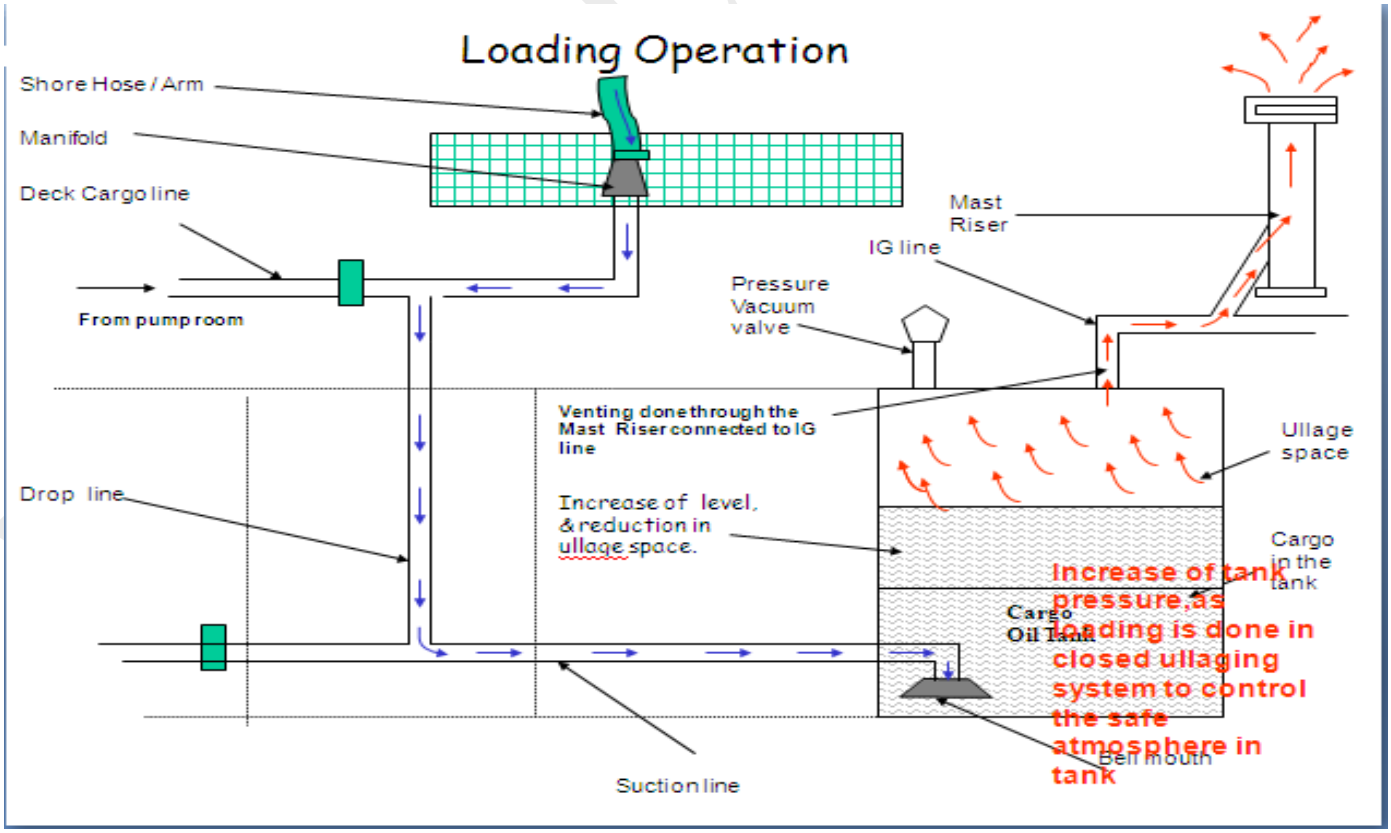
- Exhaust gases enter the system through Boiler Uptake valve and then are sprayed with water in Scrubber unit.
- Water cools the exhaust gases and also dissolves the impurities in exhaust gases.
- This washing water is then drained to overboard (in IG generator unit, in case of flame failure, the water is transferred to bilge holding tank).
- Then the exhaust gases pass through a demister, which traps the moisture content from gases.
- The two blowers are provided in the system (out of which one is standby) to force the exhaust gases for transfer.
- The capacity of blower is 125% more than incoming exhaust gases ensuring the positive direction transfer of gases.
- The flue gases are now analyzed for oxygen content by Oxygen analyzer provided just before the Deck water seal.
- If O2 content is more than 8%, the flue gases are vented out to atmosphere through an air vent.
- IF O2 content is 8% or less, the flue gases are passed to the deck water seal arrangement, which acts as a non-return safety valve. A Pressure/Vacuum breaker is provided on discharge line, to release the pressure or reduce the vacuum if excess to avoid exploding or collapsing of cargo tank separately.




100%
OVER RICH
Will Not Burn
Upper Flammability Limit, 15%
Lower Flammability Limit, 5%
0%
Flammable
Too Lean - Will Not Burn


Discharging Operation
Tank atmosphere is controlled with use of IG
Shore Hose / Arm
Manifold
Deck Discharge line
From Inert Gas System
Pressure Vacuum valve
Pump room
Empty cargo tank
This increase in ullage space is filled with Inert gas, so that there is no vacuum and no ingress of air in tank
Ullage space
Discharge line
Drop of level & increase of ullage space.
Cargo in the tank
Cargo Oil Tank
Cargo oil Pump
Suction line
Suction bell mouth


Tank Cleaning Operation
Manifold
Deck Discharge line
From Inert Gas System
Pressure Vacuum valve
IG introduced to maintain safe atmosphere
Pump room
Discharge line
Generation of static electricity due water droplets
Unsafe Atmosphere
Wash water in slop tank
Cargo Oil Tank
Cargo oil Pump
Suction line
Main Suction bell mouth
Stripping line to Stripping pump or Eductor
Stripping Suction bell mouth


Loading Operation
Shore Hose / Arm
Manifold
Deck Cargo line
From pump room
Mast Riser
IG line
Pressure Vacuum valve
Venting done through the Mast Riser connected to IG line
Ullage space
Drop line
Increase of level, & reduction in ullage space.
Cargo in the tank
Increase of tank pressure, as loading is done in closed ullaging system to control the safe atmosphere in tank
Cargo Oil Tank
Bell mouth
Suction line

Oxygen-Control

- Theoretically any mix with less than 11.5% oxygen will not support combustion,
- However, for safety the level is reduced to 8% vol. This allows for calibration errors in monitoring equipment as well as any lack of homogeneity in the tanks.
- The tank is kept at positive pressure to ensure no ingress of air. (say 100mmwg at the deck).

Hydrocarbon-Control

- The principle means of ensuring safe operation is the reduction in oxygen, high levels of HC should not affect the safe operation and may in fact aid by producing an over rich atmosphere.
- If it is required to gas free then the level of HC must be reduced to prevent the mix entering the flammable range, then the HC level is reduced by purging.

Gas-Replacement

- There are two principle means of gas replacement, these are; Dilution-The important factors for these is that the vent is situated at the top of the tank and the inlet gas stream must have sufficient velocity to reach the bottom of the tank

Displacement-

- This requires a stable interface between the heavier and lighter gas, if the replacement gas is heavier it enters at the top with low velocity , the lighter gas is vented up a purge pipe reaching the base of the tank.

Frankly speaking friends I don't know much more about I.G. system, just I tried to give you those notes which I have. So if any mistake or any thing left in this topic just to tell you SORRY for that, no one is perfect in this world. But whatever I gave you may be it will helpful to you around 5%.

==========

Q 27: Explain about FIRE PLAN? Location? Content inside? Approved by?

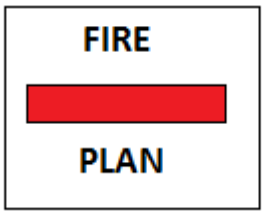
A 27:

FIRE CONTROL & SAFETY PLAN

Location:

- **Entrance of the ship on both side.**
- **On bridge**
- **In ECR**
- **In ship's office**

Symbol:



FIRE CONTROL & SAFETY PLAN

- It will give the details of all the fire fighting appliances are located of that particular ship, either may be Fixed type, Portable type or Semi Portable type.
- **It is located inside the RED COLOR container.**
- Importance to locate outside is if in case of fire in ship, so any external agency come from the port they can easily understand about appliances and the way to reach near by the fire and escape way from there.
- It include:
  - **Fire detection and alarm system**
  - **Sprinkler installation**
  - **CO_2 nozzle installation**
  - **Location of all extinguisher.**
  - **Ventilation system.**
  - **Position of damper.**
  - **Detail of escape route from E/R.**
  - **All detector location.**
  - **EEBD location.**
  - **Total no. of Fire Hose, Nozzle etc.**
  - **Life raft and immersion suit location.**

IT IS CONFIDENTIAL DOCUMENT APPROVED BY ADMINSTRATION

Q 28: Explain about MUSTER LIST?

A 28:

SOLAS CHAPTER =3 , SECTION 5, REGULATION 37

Muster list and emergency instructions:

- The muster list shall specify details of the general emergency alarm and public address system
- The muster list shall also specify how the order to abandon ship will be given.
- The muster list shall show the duties assigned to the different members of the crew including:
  - **closing of the watertight doors, fire doors, valves, scuppers, sidescuttles, skylights, portholes and other similar openings in the ship.**
  - **equipping of the survival craft and other life-saving appliances.**
  - **preparation and launching of survival craft.**
  - **general preparations of other life-saving appliances.**
  - **muster of passengers.**
  - **use of communication equipment.**
  - **manning of fire parties assigned to deal with fires.**
  - **special duties assigned in respect to the use of fire-fighting equipment and installations.**
- The muster list shall specify which officers are assigned to ensure that life-saving and fire appliances are maintained in good condition and are ready for immediate use.
- The muster list shall specify substitutes for key persons who may become disabled, taking into account that different emergencies may call for different actions.
- The muster list shall show the duties assigned to members of the crew in relation to passengers in case of emergency.
- **These duties shall include:**
  - **warning the passengers.**
  - **seeing that they are suitably clad and have donned their lifejackets correctly.**
  - **assembling passengers at muster stations.**
  - **keeping order in the passageways and on the stairways and generally controlling the movements of the passengers.**
  - **ensuring that a supply of blankets is taken to the survival craft.**
- The muster list shall be prepared before the ship proceeds to sea.
- After the muster list has been prepared, if any change takes place in the crew which necessitates an alteration in the muster list.
- **the master shall either revise the list or prepare a new list.**

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<u>Q 29 : FLOODING IN ENGINE ROOM, WHAT WILL BE YOUR ACTION?</u>

A 29 :

- Inform bridge & Chief engineer.
- Raise engineer's call/emergency alarm.
- Before starting bilge pump note down the position of vessel & time of starting.
- Other engineers will in between try to locate the hole or burst of pipe and repair.
- If ingress of water very high, start another pump.
- Reduce the engine r.p.m.
- Change over main seawater suction to emergency bilge suction.
- If level is still coming up try to protect the motor from short-circuiting,
- If situation is not coming in control, prepare lifeboat for lowering.

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So Friend these are all about "FIRE FIGHTING APPLIANCE", I hope you will understand easily and if you have any doubt just go through the F.F.A code book, or any reference if you have. I just share what I know from my side.

"Correction Accepted"

PREPARED BY
KUNJAL S. SHAH

In next page you have, about Bulkhead, beam, frame,chain locker,rudder,bulbous bow,keels,tanks,coaming, etc etc….so this is the 3rd section of my file. And it will include some diagram also.