MARINE ENGINEERING

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Lecture62

Fire Fighting Machinery

Good morning everybody. Today I will start the topic firefighting machinery. The firefighting machinery includes like fixed installation, portable installation, different types of machineries are there, different types of chemicals are there, different types of fires are there. Then what are the different types of fires? How to extinguish and what are the machinery or mechanism will be required for handling fire?

when you are in the ocean let's say ship or offshore platform oil platform or maybe research platform research vessel your cargo ships anywhere fire can occur so that fire if not controlled properly that can be disastrous okay and the content i have taken from basically from da taylor and many topics figures i have taken from different sources i've given link also if you like to study further you can go through the link and you can study and if you go to marine engineering book d.a taylor chapter 13 you can see the fire safety chapter is there so fire substance combined chemically with oxygen so let's say wood or paper anything you just keep on fire source it will burn and when it is burning it will take oxygen okay so air is required air means oxygen must be there So typically it gives out light, heat and smoke. Smoke is basically some particles or some chemical agent and it looks like gray or blackish color. Old English a fire this term derived to fire.

uh if you see indian uh book rigveda so their agni word is used the first word laid down in the rigveda the oldest extent of sanskrit writing is rigveda okay and many fire fighting websites they write fire as a fine inform restrict extinguish when you say see any fire and so first you have to inform that okay there is fire or if you know somewhere there is any fire extinguisher or you can handle the fire then you can go through and go to go to that place and handle the fire okay and let's say fire is gradually extending so you have to restrict also within certain limit and you can handle man or machine accordingly and finally you can extinguish completely okay so because if you are untrained then may not you may not

be able to handle completely so maybe you can find you can inform that two things you can do uh here one picture i have even timing flames igniting safety so different companies are making the different fire safety system this is one carbon dioxide based system so carbon dioxide on funnel sort of thing is there so far carbon dioxide will be coming out from the cylinder and it will be extinguishing fire but again the same carbon dioxide cannot be used for all type of fire For example, another type will be their water.

Water also can be extinguishing fire. But if there is an electrical short circuit, there you cannot add water. So, you should have different types of fire extinguishing system. So, that will be handling fire for different chemical or different conditions. So, we will see one by one what are the different fires and how to extinguish or the different mechanism used for that.

First, we should know what are the disasters happened in the recent past. Deepwater horizon oil spill happened in 2010, April 20. so it was the what was largest disaster actually oil disaster lots of oil went into the sea and because of this one lots of sea creatures animals that got died and lots of environmental loss was there and this depot horizon was made by south korean company it was halliburton was doing for cementing job and british petroleum uh got the contract and they're drilling and trying to get oil and gas from the wellwood Normally, this oil rig will have one blowout preventer. Let us say this is water surface.

This is your seabed. So, from water, your semi-submersible is here. Deepwater horizontal is actually semi-submersible. So, the semi-submersible is here. From here, you are drilling wellbore.

And when you are drilling, uh oil and gas will be there maybe somewhere here so when oil and gas is there you are drilling suddenly this oil and gas because of high pressure when you are drilling actually sometimes it is very much high pressure under the earth surface so that high pressure will be pushing oil and gas out of the weld bowl so to handle that one normally they will have one blow out preventer called BOP or blowout preventer and if there is sudden kick or suddenly oil and gas coming out from the well bowl so blowout preventer will be stopping even sometimes it will be cutting the pipe and stopping the flow okay that mechanism is there but somehow the BOP did not work and oil and gas move through riser this is actual riser okay riser means the pipeline inside water carrying oil and gas or drill pipe anything going to platform or platform to wellbore so that pipe is called riser so through riser it went to the platform so their platform they had engine they have safety mechanism everything but still somehow it got some spark because of the spark fire

started and fire will be contained but there was source of oil and gas continuously and gas was coming out from wellbore so that made everything disastrous so oil gas is coming out and fire is there so fire continued and finally 11 workers died and many got injured

and finally the whole deep water horizon semi submersible got sunk in the water and then when sunk then oil and gas water oil and gas is coming out from wellbore you cannot handle and your man everything was removed from there Now we have to control the oil, control the fire. You have to stop oil and gas coming out to the ocean because oil will be creating pollution, oil pollution. Gas may be evaporating, but both, whatever oil and gas you are getting, you have to stop things. So lots of effort was applied and finally they controlled the production of oil and gas and later they started producing again.

But it is very much disastrous, this event. So, fire boat responses responded in Deepwater Horizon Gulf of Mexico 2010. Now, similar event, smaller event happened at Mumbai High North fire. Mumbai High North fire happened in 2005. So, 100 kilometer off coast the Mumbai.

So, from Mumbai coast to inside sea 100 kilometer. So, support vessel and production platform collided. Production platform, normally spar platforms are there in Mumbai offshore and they are producing power from the last about 50 years. And about 22 engineers died and damaged about 370 million USD. So, huge amount of losses was there.

So, main thing happened in offshore case is like one is life will be in danger if you are not handling fire properly. next thing is that your machine and production and environmental other issues also there so somehow you have to design things which will be like fireproof and if there is any fire source how to handle it how let's say oil and gas already it is combustible if it is mixing with air that will be combustion mixture so the oil and gas engineers they always try to make everything safe But still things happen. So first you have to know whenever you are working or designing or working for offshore areas or designing offshore systems, then you have to consider all the aspects. If any combustible fluid is there, let's say cargo will be carrying combustible fluid, let's say coal, Australian coal is coming to India.

or Middle East oil or gas or something is coming to India or India exporting that oil and gas or coal or something to outside country. So, combustion mixtures also getting transported. So, if there is any small fire source, then everything can be a disaster. So, you have to handle it. During design stage, actually you have to consider all the aspects and

accordingly you have to design your shapes or your machinery, whatever you want to design.

Now there is one example of fire on ships. Fire on ships like one news item was there. This is Forbes news item. The number of fires large shipping vessel increased actually. In 2022 the highest number of fire incident of ships happened.

200 large ships fired and 43 were cargo container ships. and insurance agency because when fire will be there insurance agents will be coming into play normally uh everything will be insured uh by the companies uh so they did all the calculation because they need to get the information how many fires are there how much money they are taking because they want to get profit also okay so huge amount of money will be investing and they should get profit so they should know the statistics how many fires are happening and how much money they are paying so based on that they will be calculating the emi okay so insurance firm indicated that cargo ships they are handling dangerous goods uh especially the flameable goods they if they are transporting the fire probability is higher okay here you can see right side one picture a cargo ship in north sea caught fire in 2013. Okay, there will be many such examples. For example, 200 ship fire already there in large ships.

So, if you google it, you will find lots of such example of fire. So, when you are designing ship, you have to consider fire safety aspect. How things will be getting safe. For example, one is life, another is machinery, environment. So, actually three things.

Machinery, environment, life. Three things you make safe, then you design. so what about the international code FSS code of the international maritime organization or IMO FSS code or fire safety systems fire safety systems code international treaties organized by IMO under the international convention of safety of life at sea SOLAS okay so they had created FSS code reduce fire risk and aid in emergency response about ships so code covers international shore connection so specify how to connect shows and ports to refill and flight fires well dock personal protection equipment ppe apparel and breathing apparatus okay so here one thing i want to explain you that i was working for oil industry in in the uk so there in laboratory if you enter actually you have to wear personal protective equipment india normally we do not follow that much of strict rules but in uk universities industries they should follow because they have hsc health safety executives so they will be accessing your industry or university at any time if they want and they will check whether things are safe okay so whenever you are entering into laboratory then you have to wear hard hat goggles you have to wear high vis dress you have to wear gloves you have to wear hard shoes

if you are working but if you are only entering then at least we should do your hard hat and hard shoe and your jacket like high visa your jacket like one strips will be there so it will be glazy and in dark also it will be you can see the color yellow color strips will be there you can see from long distance so that to make everything safe like say if something goes wrong and some worker is got sick and he cannot move so at least the color will indicate the way that person or something is located in that location so people can take action okay so there are several other rules also there only single person should not walk in the laboratory so that rule also there and that rule is followed by industry and university both and fire extinguish type in fsc code fire extinguisher the specification of portable extinguisher will be there fsc code Fixed gas, different types of extinguishers, fixed gas, foam, pressure, water, we will discuss later of all this, sprinkler, 5D irrigation. So, several types of extinguishing systems are there and the code specify all these things. uh fire detection and alarm system smoke detection system low location lighting systems and how to escape from system so normally there will be one assembly point if there is any build fire in one building so how to escape there will be proper clear escaping way and there will be one fire door safety door also everywhere in every building and people will be moving

out of from there and they'll be assembling somewhere uh some in one place where uh they can be safe okay and fire machines fire trucks they can move directly to the fire place okay so that sort of management arrangement should be there so that is the regulation from the uk higher hsc in india also there lots of regulations but many many time people violates their rules So when you are talking about fire, so first you have to talk about fire triangle. What is fire triangle? Actually it will have three sides. You can see right side picture, oxygen, fuel and heat.

So three sides, it presents one oxygen, one heat, one fuel. So if you break any one of the sides, for example, if you have heat and fuel, there is no oxygen, so there will not be any combustion, no fire will be there. or if you have oxygen and fuel heat is not there again no uh okay if you oxygen and fuel and if you don't have heat then fire may not be there so what happens let's say you have certain amount of wood okay let's say this cloth is there okay cloth is there it is fuel and oxygen also interacting it interacting with this one although oxygen is interacting uh okay but there is no fire so so it will not be burning but in other way if you see uh if you have heat source and oxygen there is no field so there is no meaning of fire okay so all three must be there then fire will be there okay now fire triangle con if you read this one fire triangle or combustion triangle is three component is having three component actually heat fuel and oxygen fire tetrahedron so some other theory says there

it there must be fire tetrahedron tetrahedron means like one will be heat another oxygen another is fuel and another is chemical chain reaction must be there so if chain reaction what is reaction reaction means like it is exothermic reaction okay when you are getting fire actually it's exothermic reaction

okay so let's say wood is burning with oxygen it will create carbon dioxide and other products and carbon dioxide water and other products now let's say you started burning but there is no change reaction exothermic reaction not happening because you cool down because you added water okay so heat is there somewhere but it's not connected and change action not happening so fire will not be occurring actually it will be stopping fire so to get a continuous fire you should get all the four heat oxygen chemical change reaction also so you see abs guideline note they have written like this the tetrahedron illustrates how flaming combustion is supported and sustained through the chain reaction of the oxygen oxidation process in a sense the chain reaction phase keeps the other three phases from falling apart okay they'd be connecting all uh all other three phases like heat oxygen fuel this is an important point because the extinguishing agent used in many modern portal fire extinguisher automatic extinguishing system and explosion suppression system directly attack and break the chain reaction sequence in order to extinguish a fire okay so fire tetrahedron actually picture will be like this okay it will be like this okay so you got four phases so one phase is oxygen another phase is heat and back side of oxygen this is front side back side of oxygen is fuel and let's say bottom side you can make chemical change action okay so force uh four sides we should have four um component like heat oxygen chemical reaction fuel then a continuous fire will be there so next when you're talking about fire so fire every time you see yellowish color one flame a flame or flamma in latin word if

is a fire's visible gaseous part. It is exothermic chemical reaction. I already told. So, ionized gases will be created. You see this candle.

One candle is burning right side. Solid wax is here and it will be melted because of temperature will be coming. Heat is coming from here. So, because of that, top portion will be melted. When melted, after melting, some portion will be getting evaporated.

When it is getting evaporated or it and it is getting heat, so combustion will be occurring. so at the central core oxygen deficiency will be there so lots of fuel particle will be there but oxygen deficiency will be there but outside oxygen will be huge amount okay so outside oxygen will be entering the center core and reaction will be proper and it will be moving

up now if oxygen amount amount is lower so in that case fuel will not be burning completely so in that case black smoke can come so if you see your gas cylinder that you get gas oven at your home so there you do not see black flame because the combustion is complete okay when combustion is complete you get carbon dioxide okay complete combustion you get co2 okay co2 actually colorless okay so if it is oxidizing flame it will be like yellowish bluish color some flame will be there but no black smoke will be coming But if oxygen supply is lower, so in that case CO2 will not be formed rather oxygen deficiency because of oxygen deficiency CO will be formed, sorry CO carbon monoxide and some carbon particle will be unburnt also.

okay so unburned carbon particle at high temperature nearby flame middle so it will be yellowish color at high temperature the carbon will be becoming yellowish color and when it is going out of the flame so temperature being it will be going down so when temperature is down the carbon particle will be forming black smoke very small small tiny tiny particle it will create black smoke so if you have pot and cooking and if you have lots of black smoke so all around the pot you will see black some black color thick material will be deposited that is actually carbon particle unburned carbon particle and lots of carbon monoxide also will be created so that will be harmful okay so you should have sufficient amount of oxygen to burn a fuel so now smoke uh i said like carbon particle will be there but some more particle also be there so what is smoke a mixture of airborne solid and liquid particulates gases emitted from a combustion or pyrolysis pyrolysis means fire so using fire some analysis okay so from burning something coming out together with the quantity of air entrained or otherwise mixed into the mass typically visible as cloud or haze varying in color from white to gray to black okay so different color may be possible because different concentration will be there depending on the nature of the particle and amount of the incomplete combustion it contains chemical including co2 okay co or carbon monoxide water particle water vapor also be there for example if you burn any organic compounds say wood or paper anything so some water vapor also will be produced water will be produced that will be formed at high temperature vapor form

So, particulate matter will be there, other volatile component, organic component may be there because based on your whatever you are burning. So, if that combustion is happening because of this simple methane gas, then lots of component may not be there, only carbon dioxide and water will be there. But if you have wood, wood will have lots of components. So, you will have carbon dioxide, water and many other components. So, based on your fuel, what fuel you are burning, you will get that constituent in your flame, in your smoke.

so uh i told you that there are different types of fires so let's see what are the different types of fires so solid combustion like say you have wood you have paper you have chair table wooden made so you can burn so this is called class a fire as per indian standard so same symbol is not used for different countries in let's say first consider india one okay so indian As per Indian standard, class A fire means solid combustible material, wood, paper, all these things. Flammable liquid, some liquid you are burning, so class B fire. Flammable gas under pressure, let us say your Indian cooker is having fire, that is class C fire. Combustible metal, some metal, magnesium and other can burn also, they can create class D fire.

cooking made a kitchen fire say oil frying pot is there and some combustion happened so in that case it is called class F fire electrical circuitry short circuitry happening because of the fire so in as per Indian standard there is no class defined okay but if you see US class A class A same US India class B class B also same class C you can see changed okay uh uk europe and india other classes are same but us is having some difference so whenever you are reading this classes of fire so you should see okay so for our exam purpose we will follow the indian stand in indian classes okay uh combustible material d same uh cooking media kitchen also again differing okay austria australia also having some difference for example electrical fire australia is having class e okay for india case there is no class for electrical fire other classes almost same for australia and india So, carbon dioxide, it should not be used for kitchen fires because carbon dioxide will be creating further problem because whole kitchen will be oxygen shortage. So, any person, anything is there.

So, especially living spaces, carbon dioxide should not be used because oxygen shortage will be there because it will be replacing oxygen. So, that will be disastrous. So, no for materials like paper. So, carbon dioxide you can use for, you can't use for material like paper, wood or textile. Good for electrical and class B fire.

Okay, class B flammable liquid and electrical means like short circuit anything is there, you can use carbon dioxide. Powder. Powder will be created on blanket, say one fire is happening and if you apply some chemical powder is there. So, powder if you apply, so it will be covering and it will be cut the oxygen supply and it will be reducing some temperature also or like flammable temperature. So, that will be, it will be extinguishing fire.

But powder will not be used for involving cooking purpose. So, CO and CO2, carbon dioxide and powder should not be used for kitchen. Now, see different types of fire and

how to extinguish it. So, water you can use for paper, wood, coal, cardboard, other solid fuel. So, it will be created on blanket, some fire is there, if you are applying water means it will be cutting oxygen supply because it will be creating water layer and it will be reducing temperature also.

So, flammable temperature will be going down and it will cut water, oxygen supply, so that way fire will be extinguished. okay and fire extinguisher color will be solid red color okay this is the class a fire and foam so foam can be used for class b and a type fires okay so foam like dry chemical powder dcp the large portion of mono ammonium phosphate the powder coats the fuel and cuts oxygen supply okay and if you see This is powder and powder can be used for almost all type of fire. Dry powder can be used for almost all type of fire, A, B, C, D electrical all type of fire. This is more common, but normally it will not be kept everywhere because based on the fire classes people will be using because of cheaper and other conditions.

Carbon dioxide fire. So, carbon dioxide takes away oxygen, it will be replacing oxygen, it will be covering that area, no harmful residue will be there. So, it may not displace oxygen, may be ineffective for class A fire. For class A fire, it will be ineffective. and color will be black color and can be used on that cylinder color actually wet chemical used for on cooking oil fire as well as combustion fire solid material yellow color can be used for a and f okay and if you see this one a wet chemical a solution of potassium after reaction with the cooking medium a thick soap like substance will be formed and will be sealing the surface

okay so another type of fire extinguishing system used for kitchen especially when i was uk i was cooking in the kitchen they will have one blanket like silk type one blanket will be there so if there is any fire immediately cover the fire and it will be cut the supply of oxygen and it will be everything will be safe so materials should not be combustible material blanket material standards on fire extinguishers so fire extinguishers the first line of defense in small fires they are called fast aid fire extinguisher and different standards are there bis standard for example one five six eight three two thousand eighteen portable fire extinguisher then wheeled fire extinguishers portable fire extinguishers actually very small fire extinguishers less than 17 kg weight will be there so you can carry actually you can lift it and you can go to fire and you can uh push oxygen or whatever you have in in in the cylinder you can put there but if you have larger fire and you want to carry it so one person cannot carry in that case wheel fire extreme will be there so portable wheel some small cart will be there so you just carry it and you can apply your fire extinguisher to the

fire and wheel 17 kg limit is there if it is portable type like it portable type will be there in your office buildings in your every places this fire extinguishing will be there but for your larger systems 17 to 450 kg so you need a wheeled system okay now you got fire different types of fire you know you knew this kitchen fire and gas fire so how to handle it so to handle first you have to identify the fire is there or not okay let's say if visually you can see some fire is there then okay you can take action but in many cases you may not see visually but temperature is going up maybe somewhere fire is there but it is out of your range of your eyes so in that case you have to handle so you have certain sensors so sensors will eject and it will be sending alarm signal to the people okay so

there will be three type of sensors one will be smoke sensor flame sensor heat sensor okay smoke sensor lots of smoke coming so sensor will be sensing okay smoke is coming so in that case what will happen it will send signal to the alarm noise bell or some other signal so that way other people will be taking action okay in some cases and smoke is coming from frame normally and flame sensor infrared sensors will be there so if there is any flame it will be sensed heat sensor if temperature increasing of the room for example so heat sensor will be sensing it will be sending message or it will be giving alarm signal so flame texture rarely used on both boats these days okay so flame detectors are almost not used heat detectors used at gallery and laundry places smoke detectors used in machinery and accommodation areas for ships okay and smoke let's say start with smoke detector because three type detectors we have smoke flame and heat so first smoke detector it will have two ionized chamber open to atmosphere so ion chamber will have msm 241 or am241 material electric material and it will be ionizing gas okay and continuously electrons will be flowing now if there is no resistance then it will be flowing continuously now if you have lots of smoke smoke will have lots of particle non-ionic particles so that will be interfering this ion motion when ion motion is interfered so this this amount of ion reaching to other electrode will be lesser so it will be sensing that and after sensing it will be sending signal okay or it will be creating alarm so more particles change the balance of currents inside the chamber because the number of smoke particle is larger than the ionized air particle or ionized air molecules so because of that this balance will be disturbance and immediately alarm signal will be sent flame detector

so uh flame actually it will be releasing ultraviolet ray infrared red ray and visible light also okay so you can see the right side picture this is u v c ultraviolet this is ultraviolet zone uv zone so ultraviolet rays will have like uvc a uvc b uvc c three types of ultraviolet rays okay based on frequency and this is your visible range this is infrared range okay so the

scientists they develop develop the sensor using uvc sensor and infrared resistance so light is giving uvc as well as uv as well as ir so this one sensor will have sensor can have only uv detector or ir detector or both okay ultraviolet detector detects uv radiation emitted by fire suitable for special hazards like hydrocarbon halogen and metal fire infrared sensor it will be observing ir radiation emitted by flame prone to false alarm triggered by non-fire sources okay uv ir so it will be sensing both so it will be more complex and it will be sensing both multi-spectrum infrared flame detector multiple ir wavelength are used to distinguish flame produced by producing radiation and other sources and they can detect fire up to 200 feet away. So if it is away from the system still it can detect.

Visual flame imaging system also possible and these days AI and other machine learning algorithm also being used to develop newer type of technologies. heat detector so we have seen flame detector and smoke detector now we see heat detector heat detector is very simple if you have bimetallic metallic strip so you can detect actually so it is designed to temperature change okay there are two main types of detector one will be rate of rise of detect raise of rise of rate of rise of temperature and fixed temperature okay so it will be detecting a rate of temperature rises and fixed temperature, it will have fixed set of temperature. If temperature crossing, your room temperature is crossing that set temperature, then it will be sending alarm. For example, a fixed temperature heat detector might set to trigger an alarm when temperature in the room crosses 50 degree.

So, 50 degree is my set temperature. Shifts, rate of rise detectors are used in the gallery. smoke room and laundry room because smoke is present in these areas and smoke rate okay shift rate of rise objector is in the gallery smoke room laundry room because smoke is present if somewhere smoke is already there so and you are fixing smoke detector so it will not work because already this smoke will be interfering ionization and it will not detect or it will be giving false alarm so in that case you can use rate of rise heat detector Heat detectors principle operation, liquid expansion, so liquid expansion also possible, low melting point material, biometric strip, biometric strip even remember two metals will be there and with different thermal expansion coefficient. So, if you increase temperature of these two because of the different thermal expansion, this biometric strip will be making more curve or more flatter.

okay and because of that you will have some connected electronic sensor so that will be saying that okay temperature increase because of that biometric strips changes radius of curvature and when it is change radius curvature your sensor will say okay temperature increase send alarm signal to the people now is detecting element of the heat detector is the

relative movement of two coiled bimetallic thermostat one exposed another shield okay uh it will be protecting property based on temperature smoke it has put a property in uh people and property okay so heat director may not be used for your room and other applications so but it will be used for where uh cargo ships and other things are available uh and maybe many human being and things are not there only machines are there so heat detector may be helping But for room and other applications, you should use smoke detector instead of heat detector. And heat detector is based on temperature. So, it will not respond if there is any smoke or iron.

So, now fire main system. So, one portable system will be there. Another fixed system will be there. A crucial component of a vessel's firefighting capabilities comprising sea inlet, suction pipe, fire pump. So, pumps will be there actually.

So, it is a high pressure pump. And distributed piping system, fire hydrant will be there, hose will be there, nozzle. So, purpose provide source to combat fire. So, these are fixed type fire installations and for larger fire handling. For smaller fire handling, so you have portable system.

For large amount of fire, so big systems, big rooms. So, in that case, big buildings, in that case you should have fixed fire handling system. okay so water distributed by hose lines straight stream formed by nozzles however only small portion of the water surface contact the fire limiting its efficiency okay so whenever any fire is there on board so you have to control the fire also okay so small portable device should be there and large fire main fire systems will be there so small portion uh it will be in the corridor it will be in a staircase to the kitchen everywhere but large systems will have whole building or whole ship there will be piping systems and will be controlling so portable extinguishing system usually four portable systems are there uh soda sting uh soda acid extinguishing system foam dry powder carbon dioxide basically four there may be many others also a newer research also going on so a new technology also be coming up so so does this system it will be having sodium bicarbonate and sulfur sulfic acid in separate container now when there is any fire just break the container in a in between wall and allow them to mix up when they are mixing up it will create sodium sulfate

water and carbon dioxide so lots of carbon dioxide will be produced so lots of carbon dioxide will be produced and is target the nozzle towards the flame so it will be fire it will be extinguished and normally it will be used for plus a fire and foam extinguisher so foam extinguisher again it will be having aluminium sulphate and ammonium sodium

bicarbonate so together after reaction it will be creating lots of carbon dioxide, aluminum, hydroxide, sodium sulfide. So this will create lots of foam, carbon dioxide will create lots of foam and it will be covering the flame area or combustible material area and it will be cutting the oxygen supply. Carbon dioxide exchange, liquid carbon dioxide at high pressure it will be kept inside cylinder and when you purge or you create small leak, so liquid carbon dioxide will be coming out and because of low pressure it will be expanding. When it is expanding, it will be covering the whole fire area and it will cut oxygen supply.

And again liquid carbon dioxide when it is evaporating, it will be creating cold air, cold carbon dioxide actually, cold gas of carbon dioxide. So, it will take lots of heat also. dry powder extinguisher so it will be like general purpose extinguishing system sodium bicarbonate again at high temperature will be in carbon dioxide so that will be used for your extinguishing fires so fixed installation fixed fire finding installation are designed for uh there are different types of fixed uh firefighting installations and they were designed for different types of ships okay every ship has sea water supply system connected to fire hydrant multiple pumps in the engine room will be supplying water to the system and the number and capacity are regulated by maritime legislation any emergency fire pump will be there okay so using this one you are controlling your fire on the onboard thank you very much for today's lecture next day we'll come with new topic thank you very much