**Steam and Gas Power Systems**
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**Module No # 02**
**Lecture No # 09**
**Boilers Mountings and Accessories**

Hello I welcome you all in this course on steam and gas power systems we have already discussed different kind of boilers today we will discuss about boiler mountings and accessories. Now boiler mounting boiler mountings are integral part of boiler of any boiler without mountings a boiler cannot work or boiler cannot function however without boiler accessories boiler can work but may be with relatively lower efficiency.

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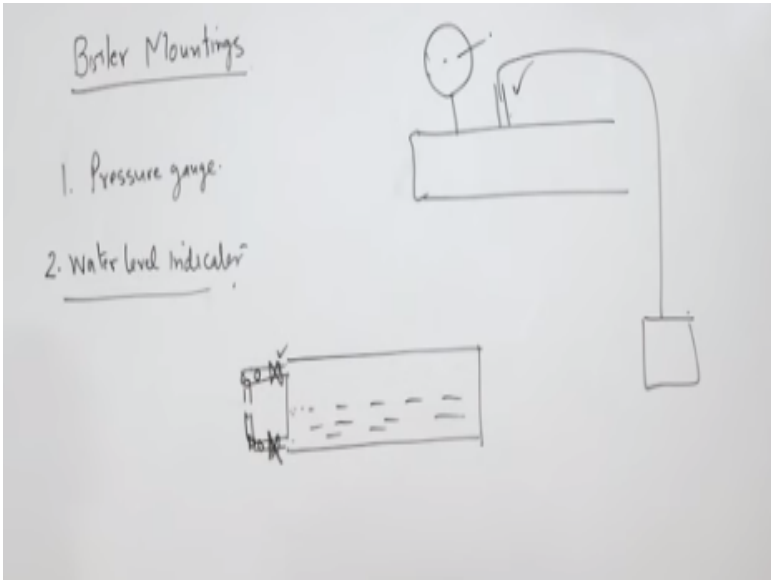


So first of all we will discuss about the boiler mountings now the first and fore most thing in the boiler is a pressure gauge because we must know what order of pressure is existing inside the boiler. So that boiler in a boiler the pressure gauge is fixed on the shell it is a dial type pressure gauge now a days digital pressure gauge is also available and pressure transmitter are also available and pressure transmitter are also available.

They are pressure transmitters are simply transducers and signals are sent to the display unit right but a dial type pressure gauge is must even in this case this type a dial type of pressure gauge is

must and this pressure gauge displays the pressure in different units you go to industries you will find pressure in KG kilogram force per centimeter square this is typical of NKR system of expressing the pressure.

You can find the pressure in kilo pascal, mega pascal and PSI pounds per square inch now pounds per square inch is a each pound system of pressure measurement this is MKS system and this is SI system which we follow. But if you go the industries you will find that this because these equipment's are purchased may be 30 or 40 years back this type of pressure gauge is display with this one and may be pound per square inch also right.

So you have to be very converse with the units conversion from this NK system to MK system and IP system to SI system. Now after the pressure gauge is water level indicator because when the boiler is in operation the operator must know what is the level of water in the boiler and the arrangement of water level indicator is very simple. In order to find level of water in the boiler shell suppose this is boiler shell and I want to know the level of boiler in the boiler shell is closed.

So this is the level of water in the boiler shell a pipe is connected from the top and the bottom and at the end of the pipe there is a glass and show you the schematically element in actual arrangement you will find the wall here you will find it is not a that simple right. But here I am giving a schematic representation so that you can understand how a pressure level indicator works in a system.

So this is attached to the system here there is a wall to close supply here also there is a wall and this is a glass tube right. So whatever level is there because water like to maintain the level so this level can be displayed here also outside the so the operator can see what is the level of water inside the shell this may not be working as long as the boiler is working you can close this walls and whenever you want to see the level you want to open the level this can also be done.

But the problem is suppose this tube breaks all the steam or all the fluid inside the container will come out because this is a high pressure fluid. So entire fluid will turn out of the system so in

order to provide that bounce are provided steam bounce are provided ordinary steam bounce are provided and the moment the fluid comes the pressure these balls they close this openings so the fluid does not go out right.

So the basic level of water level indicator is to show the level of water in the boiler a boiler as safety arrangement also. Because the fluid is because the water at high pressure contains a lot of energy in comparison to the other fluids right so safety measurements safety precautions have to be taken and for the purpose of safety at least two safety walls have to be provided there are four types of safety walls.

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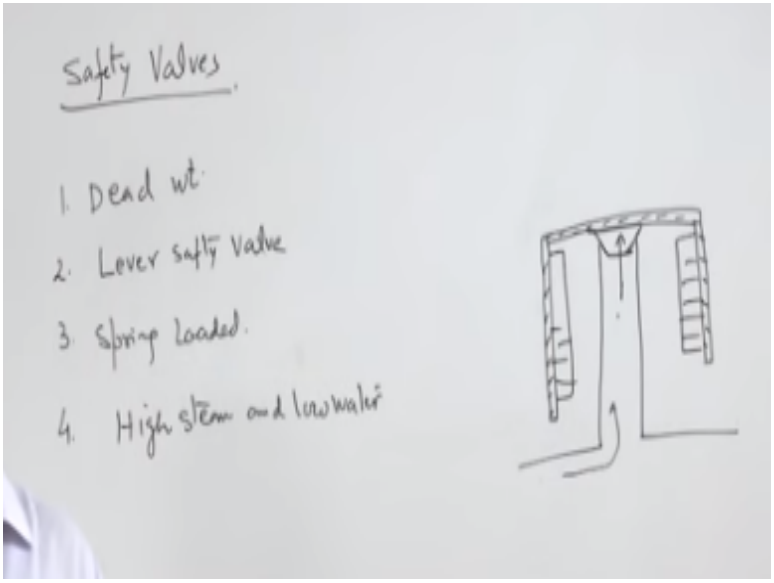


Now safety walls there are four types of safety walls one is dead wid safety wall and the second is lever safety wall third is spring loaded safety wall and the fourth is high steam and low water. High steam is high pressure of the steam high pressure is steam or low level of water now these safety walls are fixed on the boiler shell dead weight safety wall.

Now dead weight safety wall consist of course as it implies on the name itself consist of dead wids suppose there is passage of steam and this connected to the water shell. Now through this passage steam is coming and there is a closing arrangement for this and there is a housing. So the steam in the boiling shell when pressure exceeds the working pressure or the pressure we have decides the boiler to work.

In that case this steam exact force on this closing body and it opens the valve this entire body it lifts as you must have seen in the pressure cooker. When the pressure exceeds to the certain limit the whistle of the pressure cooker it lifts then the steam went off in same fashion if works there is there is a promising and for putting blades because you may like to weigh the steam and pressure for different applications.

So you can keep on adding the weights adding pressure for this in safety wall it keep on changing it is a very it is very simple in construction and it is I mean very very convenient to operate now another one is leave and safety wall.

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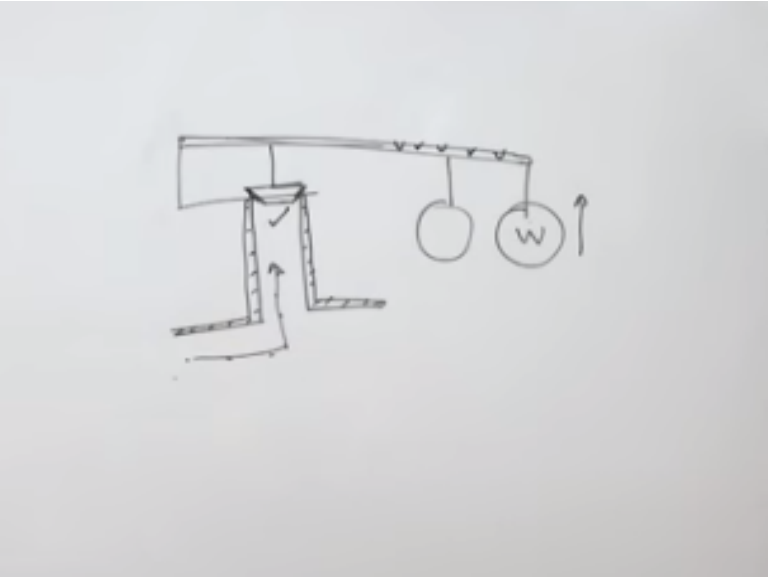


Level safety wall is almost like a diapered safety wall in this wall suppose there is a passage again and this side is fill with the team it as a lever that is why it is called as lever safety wall and this lever are on this lever arm on the extreme side there is a dead weight a lever safety wall. Now this dead weight it is edge here and this again is connected to a system which closes this open.

Now again if pressure is exerted on this the steam will push this closing body and this is also a body of the wall right. And because it is heat here this weight will be lifted and steam will be vented off. Now I want to operate this level safety wall at different pressure. Suppose I want to

operate on reduced pressure instead of vending of the steam let us say 10 bar went steam at 9 bar or 7 bar.

Simply what I will do I will shift this way to this place so manipulation is in dead with the safety wall we will have to insert the weight here simply we have to pull it and shifted to another place they are roofs on the arm and by shifting this weight you can monitor you can manipulate the working pressure of this level safety wall right.

Now the third one is spring loaded safety wall because this safety wall always a balancing force is required in that safety wall it was the weight of that weight which was put on the wall.

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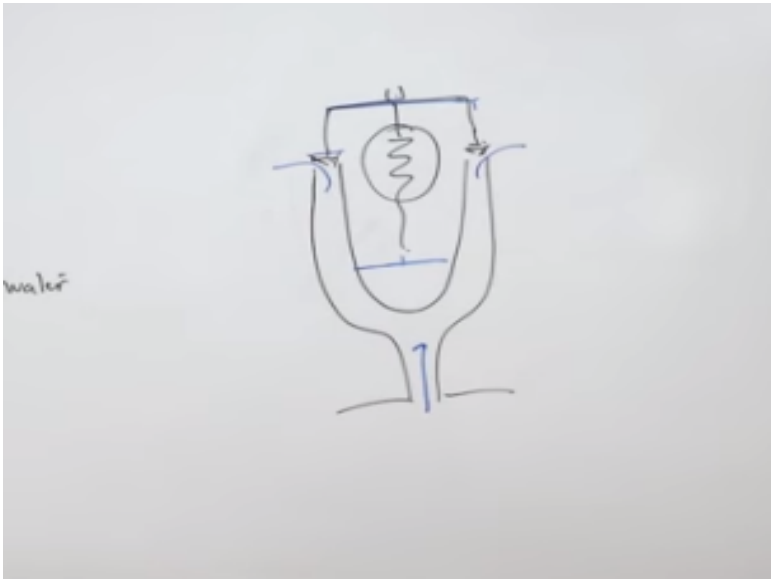

Here instead of putting weight if spring force is used for controlling the opening of the wall become in different shapes am taking a particular shape but they may come in different shapes this is a U type system on the both sides the valve is closed and steam is coming from this side. Steam I will show with glue pen so steam is coming from this side right and here there is a spring.

A spring type of arrangement sorry here there is a spring so the pressure is exerted in this this two openings right this two closings right then they open this they are lifted from the seat and spring is stretched. Steam is vented off steamed is vented off and when the pressure is reduced

the original pressure restored a spring it pulls back these stoppers to the original position right. This is how it operates and tension in the spring you can control from here there is nut and bold type of arrangements.

Sorry there is a nut which are simply tighten the nut the tension of spring can be manipulated right. So it can have this shape it can have this shape also another type of arrangement of spring loaded safety wall it is something like.

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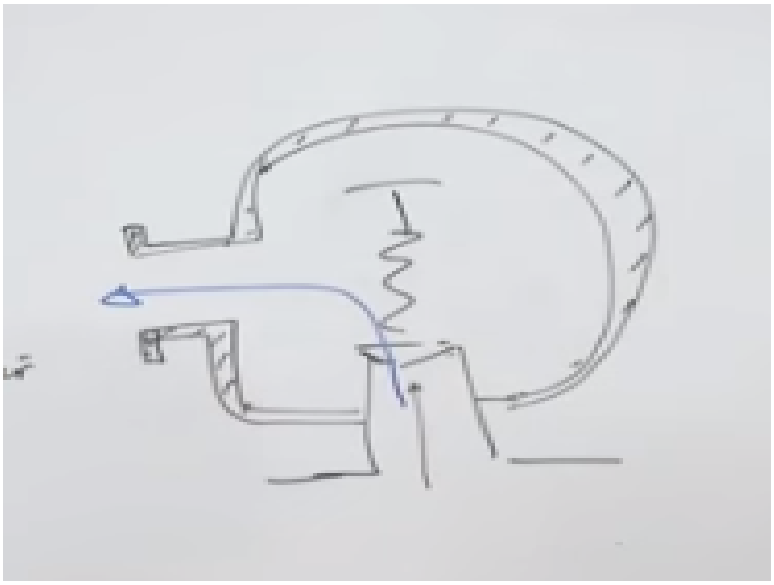

This is boiler shell this is opening this is stopper right above it there is a spring this is valve housing from here the exit of the steam is taking place they are flanges. So when the steam is exhaust the force on this stopper again it is lifted and steam is vented off through this opening. So there can be many arrangements so the working principle is the pressure of his steam is balanced with the help of tension in tension in the history.

Now the fourth one is high steam in low water wall now high steam low water valve it shows two purposes first is when the pressure the steam is high steam will be vented off when the water level is low right. In that case also some indicator have to be there so that operator sitting in the operation room may know that there is low level of water right.

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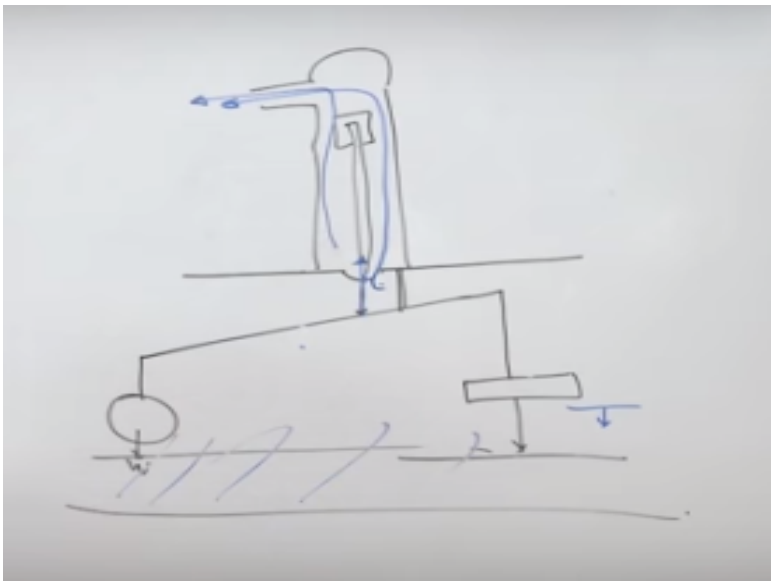

So in this type of wall there is a boiler shell wall of the boiler shell and there is opening this is semi-circular disk. It is connected it is exerting force on lever there is lever there is a counter weight W here there is float and it is reached here this lever is not end here it is changed here right. Above this again there is housing and provision for steam to vent.

And again there is a (()) (14:42) here connected to the (()) (14:44) safety wall now what happens. Suppose the water level in the shell goes down when the water level goes down this float will also come down because it will floating on the water surface. So this float will also come down when the float comes down this R of the level will twist and this will cause opening of this disk and steam will escape from here and it will give a different kind of sound.

And the sound will be distinct from the normal steam vending so the operator can be easily identify that the water level has got down. Another device is water level indicator but water level indicator always want to monitor you have to watch that or operator as to watch when the water level is going down or not but here in this case when the float is settle on the on the surface of the boiler and the water level goes down below a certain level in that case this this opening will went of the steam and it will come out with the different sound right.

And the operator will control that water level has gone down on the other side suppose the pressure exceeds because this shell is partially filled with the water and the partially filled with

the steam. Suppose lower part is filled with the water definitely lower part has to be filled with the water and upper part is filled with the steam pressure of the steam exits the design pressure.

Now in that case this force should be exhorted on this disk because this will exert force on the disk this disk will open and this arrangement is sort of dead weight safety wall type of arrangement. And again the steam will vent off but this sound will be different from previous sound so the operator will come to know this is the normal venting when the pressure of the steam is high and this is the vending previous one was the vending was the sound of the vending steam when the water level was low in the boiler right.

This are four safety devices and it is recommended at least two safety walls in the system because safety has a very important role to play because of safety walls fails accident may happen so that is why for the safety purpose two of the safety wall are recommended to put on the boiler mounting as a boiler mounting. Another safety device is in the boiler is fusible plug.

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Now fusible plug very small in size and they are used in fire tube boiler and they are put on the surface of the fire tube right and this plugs have fusible materials we are filled with the fusible material means the major which melts in the high temperature right. So when the temperature exceeds from the certain limit the material filled in this fusible plug melts and water enters the grate and fire is extinguish and accident is prevented.

But in this case the boiler will shut down I mean it cannot be a it cannot operate in the running boiler once it is operated this fusible plug is operated the fusible material has a copper cap also right so when it the material is melted the water will enter the fire tube it will go to the grate or it will take the heat from the fire tube right or the flue gases fluting in the fire tube.

Ultimately the heating in the boiler will slow down or it will be reduced right and in that case the accident can be prevented. But when this becomes operative we will have to replace this fusible with another fusible plug and then the boiler can be restarted. Now after fusible plug there is a steam in stop wall.

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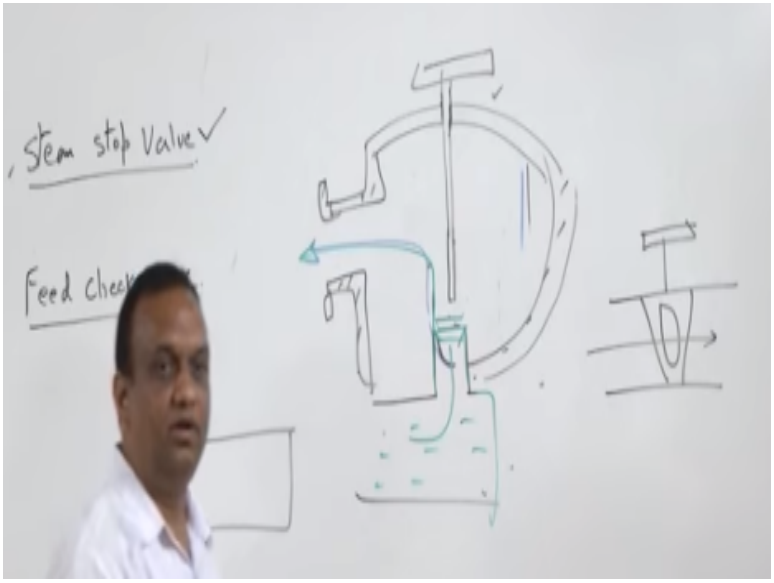


Steam stop wall is a normal valve to take steam out of the boiler as we have walls in the container to take water out of the container in similar fashion there is a steam stop wall which is connected on the boiler again there is a I mean this which closes this opening and this is of operated with a arm operated wheel right this is this keeps disk in the place this is the housing and from here we can get the steam.

So the sorry this is this should be outside this this has to be outside of this housing so this has to be outside this housing and this mechanically fixed from this. Now simply when the steam if you want to steam at any moment from boiler simply turn this wheel this this rod or tunese will rotate

and this which is closing the mouth of this opening will open up and steam will flow from this passage and will come out of the steam stop wall it is simply a steam supplying wall.

It is a steam supplying wall and closing the opening arrangements is same as in the case of normal water supply ball okay. And this wall is also placed at the highest point in the boiler because steam is accumulated in the highest point in the upper half of the boiler right. So it has to be placed at the highest point of the boiler another valve is feed check valve. Now in feed check valve this construction is almost same I can explain with this figure only.

Now feed check valve is a valve like this it is a non-return wall and it is fixed at the supply line of water supply line. So when the water is pumped in the boiler it passes through feed check wall when water pushes this disk the disk opens and the water is passed through this passage. Suppose water is flowing here it is coming from the pump right and it is put in series the supply water line so this side is closed.

So water will push this disk is simply plastic on this body it is not connected to this (()) (22:09) so the water will push this disk in upward direction the moment is disk opening though this opening the water will come out of this valve and why it is non-return wall because we have to use the non-written wall in the case of feed water supply because when the boiler pressure is high there will be tendency for the flow.

So when the flow is reversed this this will again fix on the street and it will prevent the reverse flow of water from the boiler shell to the pump towards the pump size. So this type of wall is a feed check valve in addition to this a boiler has man hole in the function of the simply hole in the boiler shell or in the body of the boiler just for the inspection and the maintenance purpose.

A boiler has blow of cock is paste in the bottom side of the boiler this is blow of cork and the function of the blow of cork is to remove the sediment and impurities from the boiler because during the hours of operating of the boiler sedimentation takes place in the boiler. So intermittently this blow of cork is open and it is a simple wall and type of gate wall something like this.

So when this opening is turned is in line with the supply of this the line of the supply this valve is open and the sediments and impurities are removed from the boiler after that we will take up the accessories in the boiler now accessories in the boiler now it is they are necessary because we want to have the higher efficiency of the boiler if you want to attain the higher efficiency of the boiler.

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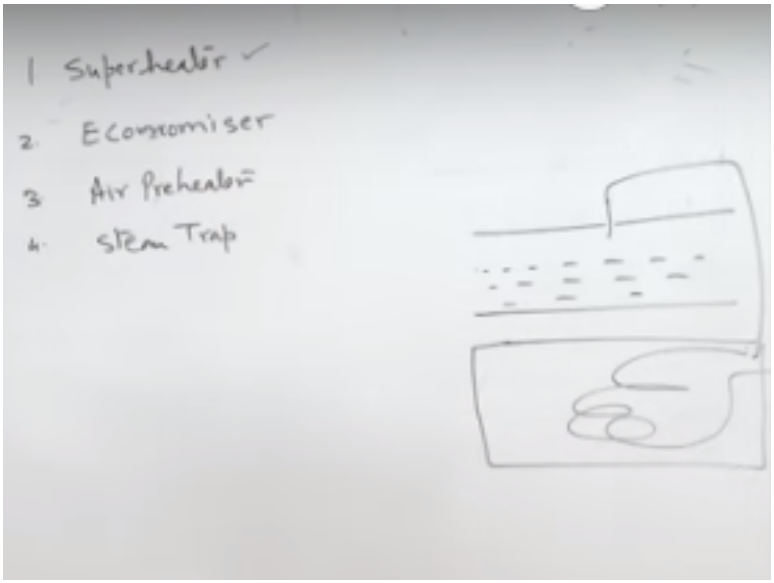


Accessories are necessary and accessories are number one super heater number two economizer number three air free heater and number four is steam trap. Now super heater means steam super heater because we need super heater steam in order to have higher efficiency because when we super heat the working fluid then average temperature hear addition increases and this imparts the higher efficiency to the cycle.

So for super heater normally we shell you must have seen in the previous lectures also a steam because shell there is mixture of liquid and vapor. So steam is taken from the shell and again it is put to the grate or in front of the flue gases so that it picks the heat from the flue gases and super heated steam is available for the use. So the super heater works it is simply arrangement of the pipes the team is saturated steam is taken from the shell and it is re-circulated it is re-circulated in the grade also when it is re-circulated with the grade it is known as radiant heating.

So super heating can be done in two ways either in convective heating or radiant heating radiant heating is done because in the grade the temperature is very high so heat transmission to the working fluid is through the radiation, majority of the heat transfer right. So that is why it is known as radiant heat transfer and then it is radiant heat transfer the tube can have heat either it is simply heat exchanges the working fluid can exchange heat with the flue gases also.

Because flue gases are higher temperature so that is known as convective super heating so radiant super heating is convective super heating. The purpose of super heating to improve the efficiency of the cycle so now a days in water boilers super heaters also integral part. Another is economizer because in boiler a lot of heat goes out with the flue gases. So objectives is as a engineer to tap as much as heat is possible from the flue gases.

So super heaters is also doing the same job now same job is done by the economizer. In economizer the feed water which is going to the boiler it is heated so if feed water is heated.

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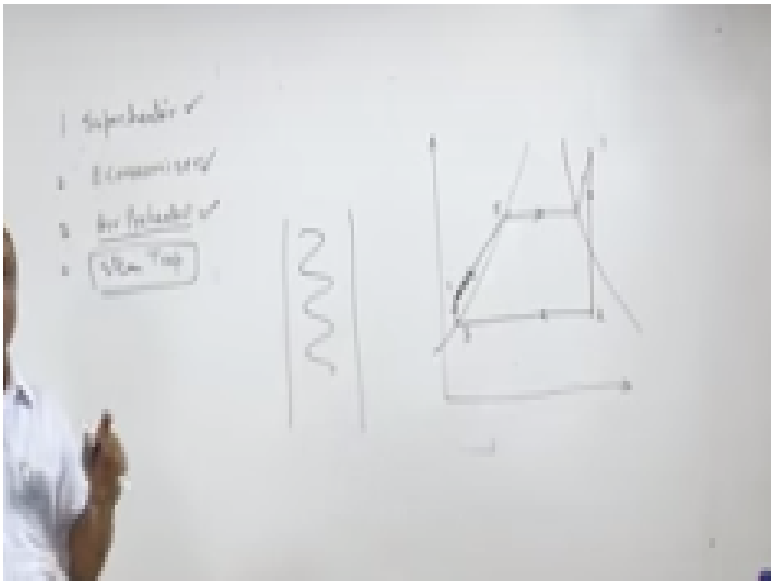

If you look at the rankine cycle this is feed water this is high pressure feed water if we heat feed water then in that case net temperature will also increase or less will be heated in the boiler either way we can say less heat will be required in the boiler right. At this heat is coming from the flue gases so it is coming from free of cost. That is how we are increasing the efficiency of the boiler so this is the function of economizer.

The another one is air preheater now the air is going to the heat is surrounding there is going to that grade or burning the fuel. This air is first circulated before the flue gases so it takes heat from the flue gases it takes heat from the flue gases and it takes heat from the flue gases and it when it takes heat from the flue gases the temperature of this air rises that is why it is known as air preheater.

So air preheater is also heat exchanger, economizer is also heat exchanger, super heater is also heat exchanger and purpose of necessary exchanger is to increase the efficiency of the cycle or efficiency of the boiler for first of all the efficiency of the boiler right if the efficiency of the boiler is increase the efficiency of the cycle will also automatically increased.

So air preheater also takes heat from the flue gases economizer also take heat from the flue gases super heater is again it takes heat from the grate the flue gases flowing the boiler. In addition to that there is device which is known as steam trap now what happens there is a flow of the steam in a pipe piper are insulated but no insulation is perfect insulation right. So in that course when the steam is going in that pipe some condensation will takes place right at this condensation this condensate will get accumulated will keep on accumulating in the pipe.

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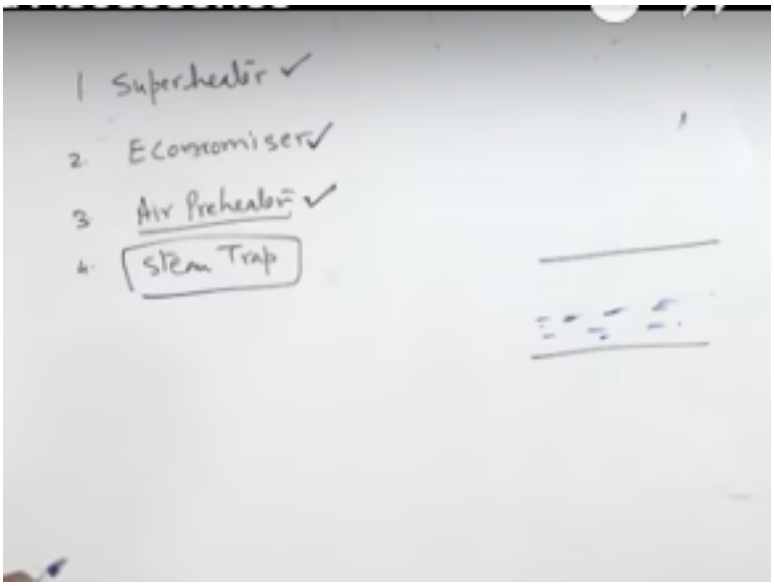

If we do not remove this condensate from the pipe it will start choking the pipe the condensate will be accumulated in the bottom of the pipe and if we do not remove the condensate from the bottom of the pipe it will keep on choking the pipe. So steam trap is provided the function of the steam trap is to remove the water in the mixture of steam water mixture okay.

It removes the water and steam is let go there are different type of arrangements right hmm like flow type, steam trap reverse bucket type steam trap is also available bucket traps, steam traps is also available but the function of all the this steam trap is to remove the steam from the flowing steam. That is all for today now in the next class we will start with the high pressure boilers