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Case Study on Heat Recovery from Continuous blow down Water of CFBC boiler

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***Abstract* - Heat transfer is important criteria in boiler operation. By maintaining clean heat transfer surfaces energy savings can be occur. The operating costs are made less by reducing the amount of oil or coil that would be burn to convert the boiler water into steam. The fouling of heat transfer surfaces could be reduced by maintaining proper boiler water chemistry.**

Specifically be reducing the impurity levels that are suspended in boiler water. Removing impurities has been a problem ever since boilers start to operate. Draining impure water and addition of new water to the boiler is the best method to reduce these levels. These methods are utilized commonly in the boiler operation as boiler blow down.

Boiler blow down is important to reduce operation and maintenance costs but it requires heating the incoming feed water. By utilizing some of the heat from this blow down water could save the boiler operating cost. In addition to use some of the heat from blow down water lot of savings may be done. If some of the blow down water could be treated and again use in boiler.

Keywords - Fouling, Blow Down, Treated

I. INTRODUCTION

The boilers that generate steam in the electrical power generation field always operate continuously at high power levels until maintenance periods require these boilers to be shutdown. Preventive maintenance shutdowns are typically schedule to reduce the time a boiler is not operating so that maximum profits may be done. Periodic maintenance shutdown is also required when a boiler is operating continuous. Maintaining proper boiler water chemistry is necessary. Times to time the boilers are required to be blown down to remove sediment and scale causing materials that accumulate inside the boiler from the feed water that is added to it. If boilers were not blown down then concentration of these impurities in the boiler water will increase. Due to increase of concentration it will reduce heat transfer surface. Blow downs are done by draining a quantity of water from the boiler.

Two methods of blow down are intermittent and continuous. In second method of blow down is to continuously drain a portion of the boiler water as waste. The blow down water is continuously drained to remove from the boiler. It is not use but thrown away either into a drain tank or a sewer for disposal. This blow down operation needs extra feed water to help to maintain boiler water level. Continuous blow down will help for not reducing the boiler heat and pressure. Another additional method to this system would be to try to store this waste water and then remove the impurities from it to use as boiler make up water.

II. LITERATURE SURVEY

When water is boiled this water in converted into steam, any dissolved solids present in the water remain in the boiler. If more suspended solids are put in with the feed water then concentration and may eventually reach a level where their solubility in the water is increase and then deposition will increase. At a certain level of concentration, these solids produce foaming and cause carryover of water into the steam. These solid deposits may also help for scale formation inside the boiler, due to this increase the problem of localized overheating and finally facing the problem of boiler tube failure. Therefore it is important to control the level of concentration of the solids and this is achieved by the process of 'blow down' where a unknown volume of water is blown off and it is automatically replaced by feed water using control valve – thus maintaining the minimum level of total dissolved solids (TDS) in the boiler water. Blow down is needed to save the surfaces of the heat exchanger in the boiler. However, blow down could be a significant source of heat loss, if it is not handled carefully. The maximum amount of total dissolved solids (TDS) concentration limit in various types of boilers is

TABLE: RECOMMENDED TDS LEVELS FOR VARIOUS BOILERS

	Boiler Type	**Maximum TDS (ppm)**
1.	Lancashire	10,000 ppm
2.	Smoke and water tube boilers (12 kg/cm2)	5,000 ppm
3.	Low pressure Water tube boiler 2000–3000	2000-3000 ppm
4.	High Pressure Water tube boiler with super heater	3,000–3,500 ppm
5.	Package and economic boilers	3,000 ppm
6.	Coil boilers and steam generators	2000 ppm

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A. Conductivity as Indicator of Boiler Water Quality

It is time consuming and tedious to measure total dissolved solids (TDS) in boiler water system, conductivity measurement by using conductivity meter is used for monitoring the overall TDS present in the boiler. An increase in conductivity indicates a rise in the "contamination" of the boiler water. Two method are commonly used for blow down boiler water– intermittent and continuous

B. Intermittent Blow down

The intermittent blown down is done by manually operating a globe valve fitted to discharge pipe which is at the lowest point of boiler shell. It is help to reduce parameters like TDS or conductivity, pH, Silica and Phosphates concentration within our given limits so that steam is not contaminated. In intermittent blow down, a line is opened for a short period of time; a thumb rule is used for such process as "once in a shift for 2 minutes". Intermittent blow down is short-term process which required very little amount of feed water put into the boiler, and hence may not required larger feed water pumps than if continuous blow down is used. Also, Total dissolve solid level will be varying, thereby causes fluctuations of the water level in the boiler due to variation in steam bubble size and distribution which accompany changes in concentration of solids. Also lot of energy is lost due to intermittent blow down.

C. Continuous Blow down

There is a constant and steady dispatch of small stream of concentrated boiler water, and replacement by steady and constant flow of feed water. This give the surety of constant TDS and purity of steam at given steam load. Once blow down valve is set for a given load conditions, there is no need for any extra precaution for operator to handle blow down valve. By utilization of flash tank large quantities of heat which is lost are save and opportunity exists for recovering this heat by generating flash steam using flash tank. This flash steam can be used for pre- heating boiler feed water or for any other purpose.

III. PROBLEM DESCRIPTION

The system which is used to remove boiler water impurities has some areas for improvement that are required to be considered prior to doing the project. First of all, the boiler is operating at high pressure and temperature. The water requiring pre treatment is already near saturation. It is possible to take some of the boiler water that is a heat saturated liquid under high pressure and then send it to a flash tank or expansion chamber which is maintained at a lower pressure. In the flash chamber the water at high pressure is flash into steam very quickly when allowed to expand. The impurities in the boiler water will be no longer being able to be retained in the saturated vapor and it would be collected at the bottom of the flash tank in a collection pan. Due to condensing coil at top of the flash tank the steam remaining in the flash tank could be condensed. The condensate water could collect into a collection pan located below the condensing coils and go back to the boiler as impurity free water. Since pressure in the flash tank is lower than the boiler this system requires installation of a pump to return the treated water back to the boiler. Increase cost of project by addition of a pump as well as increase the maintenance cost to the operator. If the demineralized water is not go back to the closed system of the steam power plant cycle boiler water level could be reduce as the blow down system operated

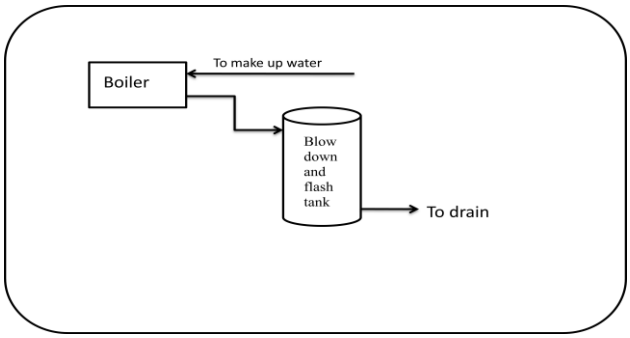

Figure 1 Existing process

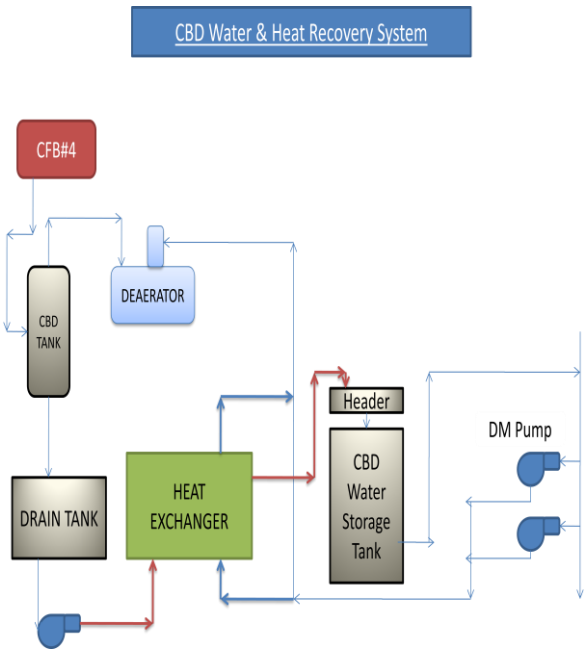

Figure 2 proposed method to recover heat

IV. PROPOSED METHODOLOGY

The approach of this project will use the underlying convection heat transfer equation Q= hA(dt) this equation will be used to find out the change in enthalpy required to boil the water in the system. A boiler working at high pressure and high temperature will have to be selected. Most industrial application boilers operate at high pressures and temperature. Hence pressure of the boiler will be close or more than 88 kg/cm2. The variation in enthalpy needed to turn water into steam is very important at the boiler working pressure. A steam pressure and steam temperature will have to be chosen perfectly to create the necessary heat flux in the heating element. Once heat fluxes have been calculated it could be used to calculate the conduction of heat through the heating element based upon conduction equations through a solid material. This will need an overall heat transfer coefficient due to the possibility of deposition of impurity forming on the

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heat transfer surfaces of the heating elements. When a temperature of surface is calculated based on the discussion above we can calculate the heat used to boil the feed water for boiler. The LMTD "Log mean temperature difference method" can be used to size this heat exchanger since this method can be used when a phase change is occurring.

After designing heat exchanger we pass feed water into the heat exchanger so this feed water get heat from drain water then feed water is passed into dearator. In dearator oxygen is removed from feed water and pump feed water to boiler by using boiler feed pump. In many power plant blow water is directly drain. If we drain blow down water lots of heat is loss. To recover this heat loss we will pass this water into condensing polishing unit where we can reduce silica percentage from blow down water and this water can be used as feed water. If this water is used as feed water then we required less feed water to make up, so we reduce consumption of feed water.

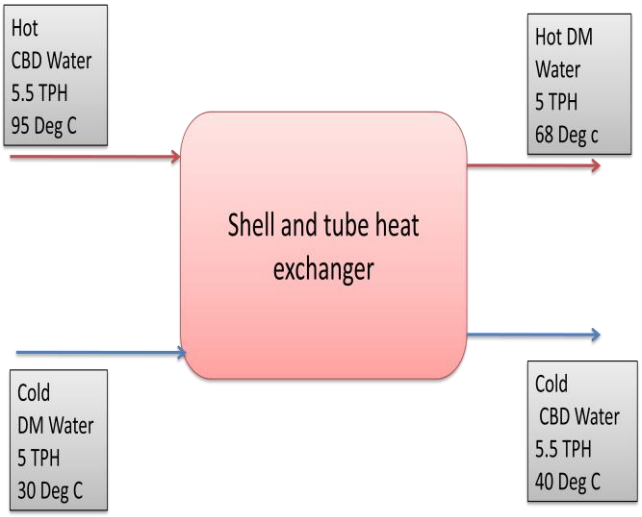

Figure 3 parameter of heat exchanger

V. CALCULATION OF HEAT EXCHANGER

Heat given by CBD water = mcp (Tin - Tout)

= 5.5 x 4.1 x (95-40)

Heat taken by DM water = mcp(Tout - Tin)

= 5 x 4.1x (x-30)

Equate both the relations

5.5 x 4.1 x (95-40) = 5x4.1x(x-30)

60.5 = x-30

X = 90.5

Consider efficiency of heat exchanger is 75%

Hence, outlet temperature of DM Water will be 68 Deg C

VI. OBJECTIVE OF DISSERTATION

[0] To recover heat from blow down water.
[1] To reduce feed water consumption by using blow down water as feed water.
[2] To reduce cost of feed water to heat.
[3] To reduce quantity of makeup water.

VII. EXPECTED RESULT

The expected result of this project is that the system will be useful in locations where water available for boiler is less to feed boilers in boiler. The system would be used in steam power plant where fresh water is used for boiler feed water. The feed water on this plant is typically generated by distillation. This project could be used in an area where ground water has lot of impurities which must be removed when water is pumped from wells. These impurities would require purification first before it is to being used as boiler make up water. The initial costs required for treatment of that feed water would be saved by saving some of the already treated water and by removing the impurities from the boiler blow down water.

The overall aim of this project will be to reduce the cost of draining boiler water during boiler water blow downs by dematerializing a small amount of it and return this water back to the boiler water cycle. In this way this system must be able to provide savings to the plant operator and not be an additional cost. Systems are operating and have been designed presently that saving heat by using the boiler blow down water in a heat exchanger to pre-heat the incoming boiler feed water.

VIII. FACILITIES REQUIRED

I intend to use thermodynamics books as well as some convective heat transfer books. I am working in JK paper LTD so I request to my superior to help me in this project. Similar systems have been operating and are designing in steam powered facilities today. I have found many websites that explain the lot of benefit of maintaining proper boiler water chemistry. Many websites are available which describe the basic design of the heat recovery systems and boiler blow down.

CONCLUSION

Blow down heat recovery system give you maximum amount of saving to power plant. It helps to increase boiler efficiency. By utilization of blow down water in dm plant as feed water it reduces quantity of water required for demineralization. So by application of this system we reduce heat loss.

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