INTRODUCTION TO DRAIN HEADER OF THERMAL POWER STATION

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Abstract

This is about to reduce the cost of distilled water used in the thermal power station then reduce corrosion in the steam pipes, proper designing of steam pipes and selection of a proper insulation material. Everyday thermal power plant uses many liters of water for power generating process. This water first passed through D.M.Plant process. D.M.Plant's operating cost is the major factors which reduce the profit of power production. And every day in the power plant very much waste of water takes place. To solve this problem we design the drain header that result in less use of D.M.Plant and more use of condensed water. This will help in the problem of shortage of water for the power plant which is located at non raining area or too far from the water source

Keywords- condensate steam, recovery, drain analysis, piping design

I. INTRODUCTION

The aim of this research work is to save the energy in the form of the steam with the help of designing the drain header system & steam piping. Steam today is an integral and essential part of modern technology. Without it, our food, textile, chemical, medical, power, heating and transport industries could not exist or perform as they do.

During the training I thought about to design the drain header and steam piping for power plant unit. So I am going to work on design of drain header and steam piping pipe in my research work.

At there I saw that boiler piping, turbine in working condition. I also saw that leakage of steam takes place from different places. and these steam directly opened to atmosphere. So we know that this is a very large amount of energy loss takes place. In this modern world very small amount of energy is also important. so I have accepted that challenge and decided challenge as final semester project.

I have been collecting all the data regarding these steam leakage from different points. By using these data I have design steam pipe that will convey these steam from different places to such a drain header. I also planned for designing the drain header.

Designing of these drain header system proper material of pipe & proper dimensions of pipe are also recommended to that organization. For designing these systems I have refereed different codes & standards but I comply ASME B31.1 for power piping.

Features of Steam Piping

General layout and location of steam consuming equipment is of great importance in efficient distribution of steam. Steam pipes should be laid by the shortest possible distance rather than to follow a building layout or road etc. However, this may come in the way of aesthetic design and architect's plans and a compromise may be necessary while laying new pipes. Apart from proper sizing of pipe lines, provision must be made for proper draining of condensate which is bound to form as steam travels along the pipe.

For example, a 100mm well lagged pipe of 30-meter length carrying steam at 7 kg/cm2 pressure can condense nearly 10 kg. of water in the pipe in one hour unless it is removed from the pipe through traps.

The pipes should run with a fall of not less than 12.5 mm in 3 meter in the direction of flow. There should also be large pockets in the pipes to enable water to collect otherwise water will be carried along with steam. These drain pockets should be provided at every 30 to 50 meters and at any low point in the pipe network. The pocket should be fitted with a trap to discharge the condensate. Necessary expansion loops are required to take care of the expansion of pipes when they get heated up. Automatic air vents should be fixed at the dead end of steam mains, which will allow removal of air which will tend to accumulate.

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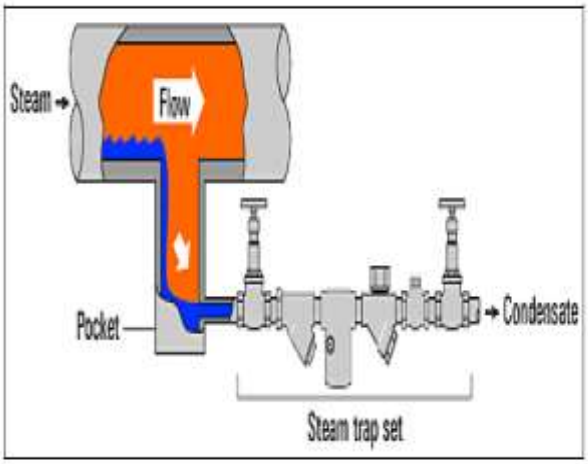
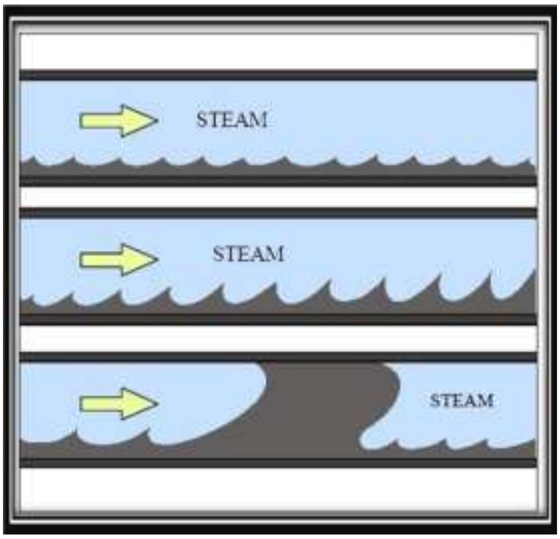


Draining condensate from Mains



Condensate in a straight pipe

Factors Considering In Steam Distribution System:

Removing air from steam lines:

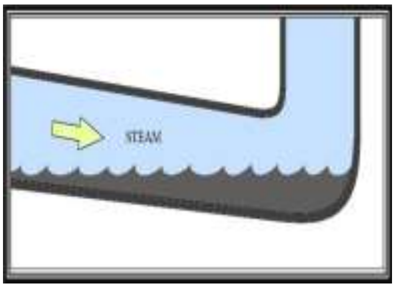
On-start-up, cold lines will be filled with air. Steam issuing from the source will mix some of this air, but will also act as a piston pushing air to the remote end of each line. Air in steam lines lowers the temperature for a given pressure, and calculated rates of heating may not be met.

The most economic means for removing air from steam lines is automatically through temperature-sensitive traps or traps fitted with temperature sensitive air venting devices placed at points remote from the steam supply. When full line temperature is attained the vent valves will close completely.

Removing condensate from steam lines:

As soon as steam leaves the boiler, some of it starts to condense as heat losses take place from the pipe work. The rate of condensation will be particularly heavy at start up when the pipe work is cold.

Figure 3 is a diagrammatic representation of the way in which droplets of condensate can build up in a straight pipe. Ultimately they can form a solid slug moving at steam velocity.



Half flooded pipe

The resultant water hammer can cause severe damage to pipe work and fittings. The likelihood of water hammer occurring will be increased if the pipe work is allowed to sag. This can occur when pipe hangers fail or when support is inadequate. There is the same sort of danger when water is allowed to collect at low points in the pipe work.

Figure shows an example when the pipe work is half flooded. This means quite simply that steam velocity will be doubled in the remaining free area of the pipe. The chance of slugs of water being picked up to create water hammer conditions is thereby increased. At the same time the restricted free area will mean high pressure drops even though the pipe work was sized correctly.

Recovery:

The condensate return system sends the condensate back to the boiler. The boiler already has certain amount of pressure. So feed pump is used to increase the feed water pressure to above boiler pressure and bring it into the boiler to complete the cycle.

II P&I Diagrams

P&ID stands for piping and instrumentation diagram. It is a drawing or blueprint of the systems in a section of a plant. A P&ID shows you the components needed to run, monitor and control specific purposes. It was made during the design and construction of the plant. A P&ID does not describe the chemical reaction involved or give you procedures.

A process and instrumentation diagram/drawing (P&ID) is defined by the Institute of Instrumentation and Control as,

"A diagram which shows the interconnection of process equipment and the instrumentation used to control the process."

The Process and Instrument diagram (P and I diagram or PID) shows the engineering details of the equipment, instruments, piping, valves and fittings and their arrangement. It is often called the Engineering Flow-sheet or Engineering Line Diagram.

A P&ID is a detailed graphical representation of a process including the hardware and software (e.g., piping, equipment, instrumentation) necessary to design, construct and operate the facility as well as demonstrates all the piping with flow direction and instruments details with their controls.

The equipments also show all the operational information at the top or bottom of the sheet. All the equipments and instruments including pipelines and values are tagged uniquely.

P&IDs often look very complicate because they show so much information in single sheet so it is broken down into small parts and then after it is studied.

P&IDs play a significant role in the maintenance and modification of the process. It is critical to demonstrate the physical sequence of equipment and systems, as well as how these systems connect. During the design stage, the diagram also provides the basis for the development of system control schemes, allowing for further safety and operational investigations, such as the Hazard Analysis and Critical Control Points.

P&ID diagram has to show the interconnection of all the process equipments and the instruments used. It is critical to show the actual sequence of equipment and other assets of the process, as well as how they are connect. During the design stage, the diagram also provides the basis for the development of process.

BASIC COMPONENTS

The P and I diagram shows the arrangement of the process equipment, piping, pumps, instruments, valves and other fittings. It includes:

All process equipment identified by an equipment number. The equipment should be drawn roughly in proportion, and the location of nozzles shown.

All pipes, identified by a line number. The pipe size and material of construction should be shown. The material may be included as part of the line identification number.

All valves control and block valves, with an identification number. The type and size should be shown. The type may be shown by the symbol used for the valve or included in the code used for the valve number.

Auxiliary fittings that are part of the piping system, such as inline sight-glasses, strainers and steam traps; with an identification number.

Pumps, identified by a suitable code number.

All control loops and instruments, with an identification number.

For simple processes, the utility (service) can be shown on the P and I diagram.

For complex processes, separate diagrams should be used to show the service lines, so the information can be shown clearly, without cluttering up the diagram.

The service connections to each unit should, however, be shown on the P and I diagram.

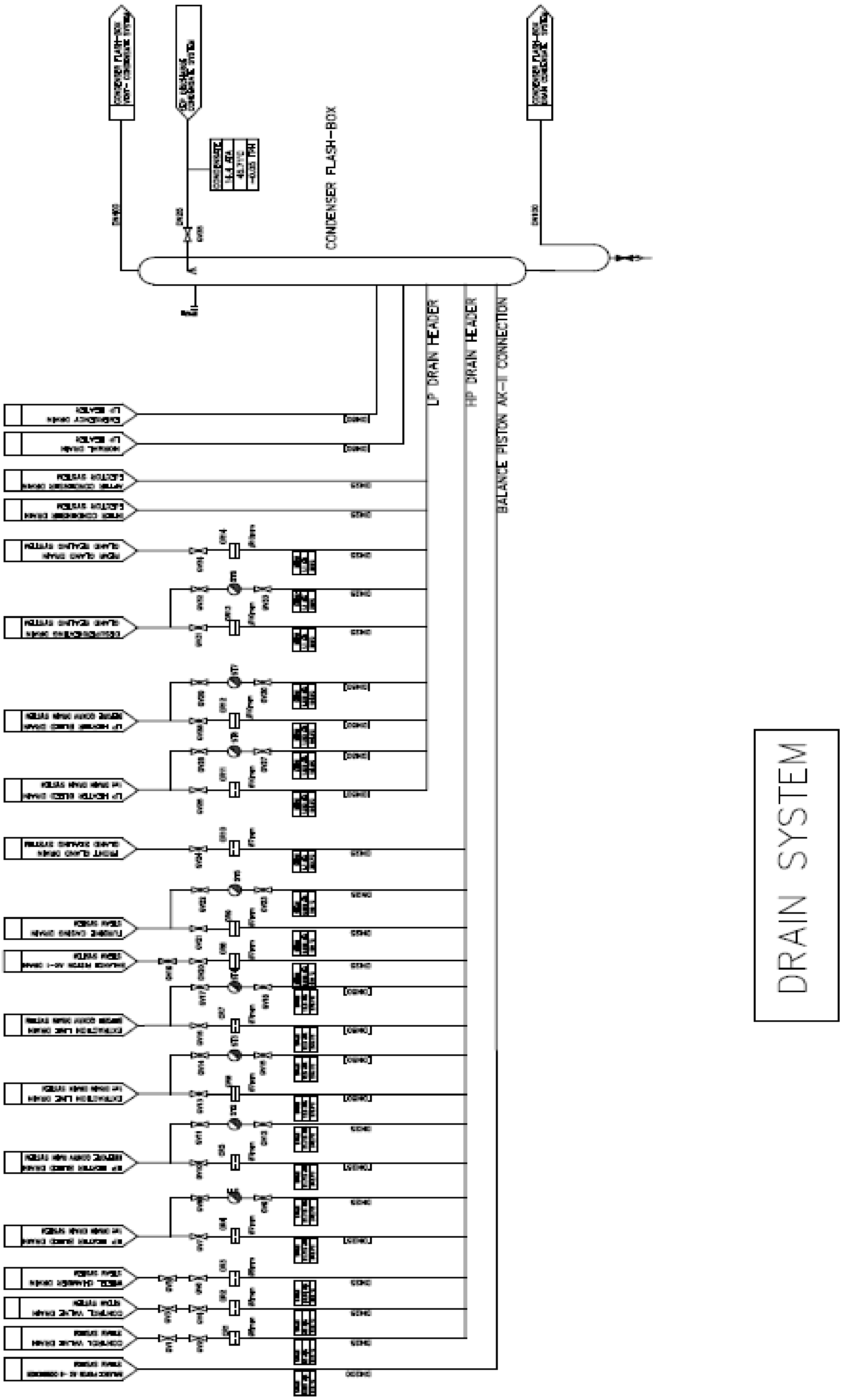
The P and I diagram will resemble the process flow-sheet, but the process information is not shown. The same equipment identification numbers should be used on both diagrams.

LIST OF P&ID CONSTITUENTS

- Instrumentation and designations.
- Mechanical equipment with names and numbers.
- All valves and their identifications.
- Process piping, sizes and identification.
- Miscellaneous - vents, drains, special fittings, sampling lines, reducers, increasers and swaggers.
- Permanent start-up and flush lines.
- Flow directions.
- Interconnections references.
- Control inputs and outputs, interlocks.
- Interfaces for class changes.
- Computer control system input.
- Identification of components and subsystems delivered by others.

IMPORTANCE OF P&IDS

- P&IDs are important tools for :
  - Working safety
  - Maintaining a process operation
  - Understanding and communication about a proces


CONDENSER FLASH-BOX
LP DRAIN HEADER
HP DRAIN HEADER
BALANCE PISTON AK-II CONNECTION
DRAIN SYSTEM

III DRAIN SYSTEM

The drain system performs the following tasks:

- Removal of condensate to protect the turbine from water damage and to prevent water hammer in the piping
- Warming up of the piping
- Maintaining constant temperatures in order to prevent condensation in the components during operation, and in order to avoid excessive thermal stresses occurring during start-up.

Start-up drains:

- The start-up drainremoves the condensate collected during start-up. These drains are controlled depending on the turbine load. The drain valves will open at loads < 15% and will be closed at load > 15%. (Example: drain of turbine casings)

Continuous drains:

- Task of the continuousdrainsisto remove t he water collected where Continuous condensation may occur during normal operation.

IV EXPECTED OUTCOMES

- By implementing drain header we can save around 101.38 TPH water for typical power station.
- 12660642 kcal/hr amount of energy can be saved by implementing drain header.
- With help of this, we can recommend class of orifices, valves and steam straps with accordance to ANSI B31.1

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