PIPING AND INSTRUMENTATION DAIGRAM OF (P&ID) THERMAL POWER STATION

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Abstract

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.

Keywords*-piping design, line sizing, steam velocity, pressure drop, stress analysis*

I. INTRODUCTION

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.

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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.

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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 COMPONENT OF P&IDs

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) lines 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

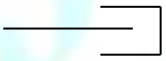
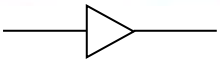
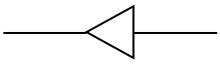
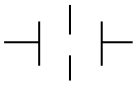
- Instrumentation and designation
- Mechanical equipment with names and numbers.
- All valves and their identifications.
- Process piping, sizes and identification.
- Miscellaneous - vents, drains, special fittings, sampling lines, reducers, increasers and swaggers.
- Permanent start-up and flush lines.
- 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.

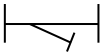
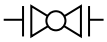
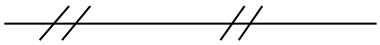
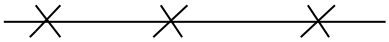
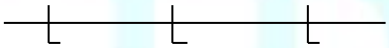
IMPORTANCE OF P&IDs

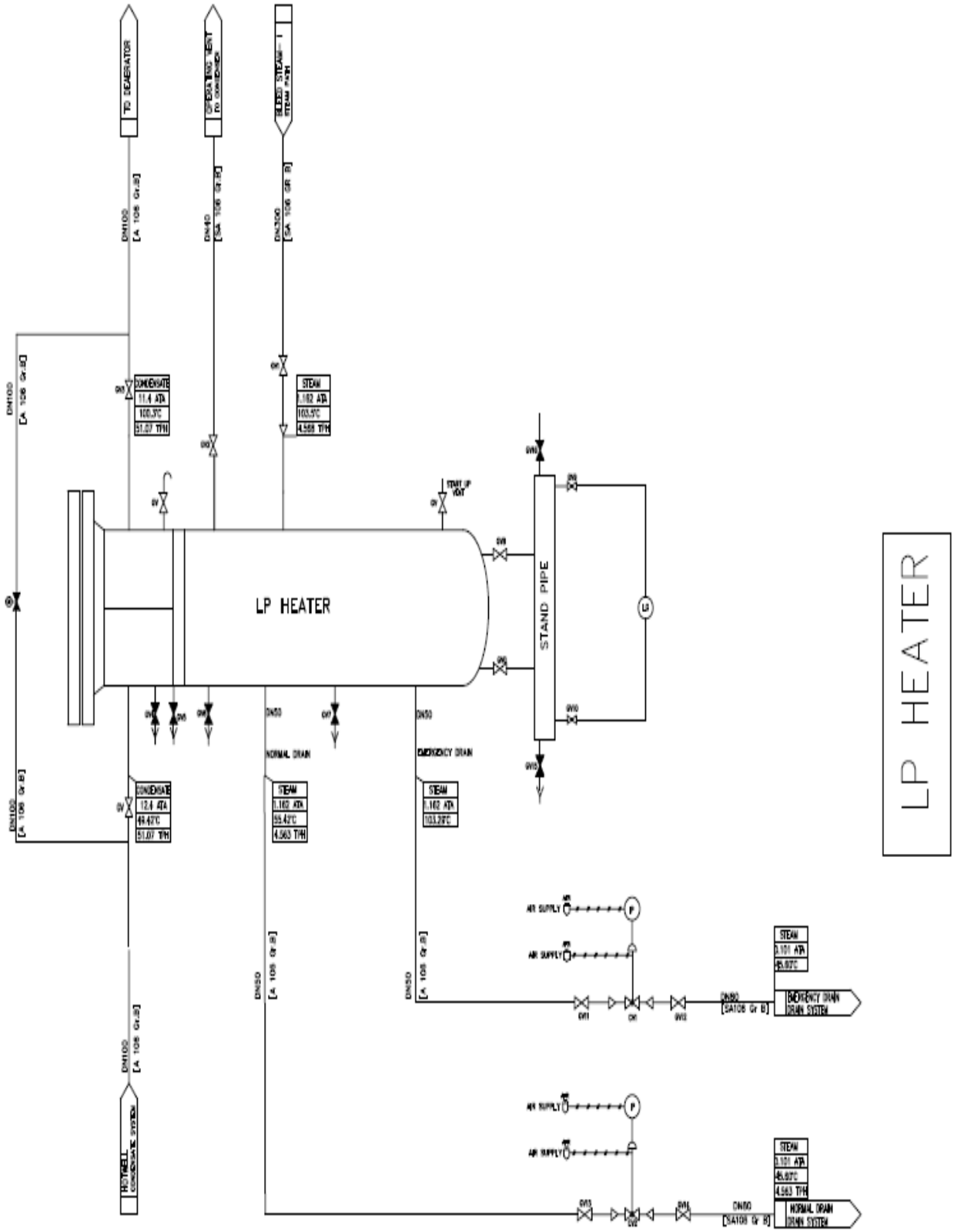
P&IDs are important tools for:

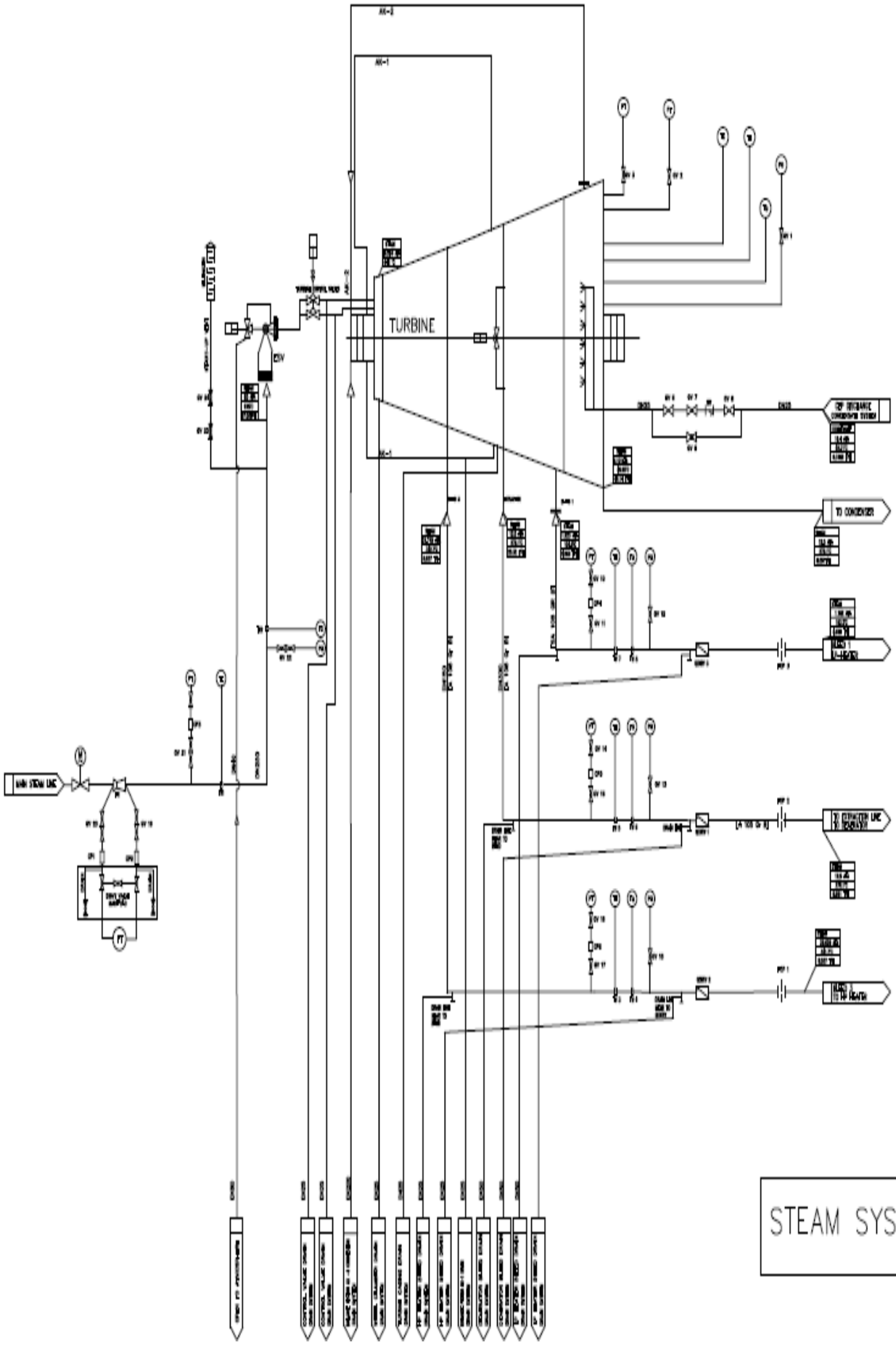
- Working safety
- Maintaining a process operation
- Understanding
- communication about a process

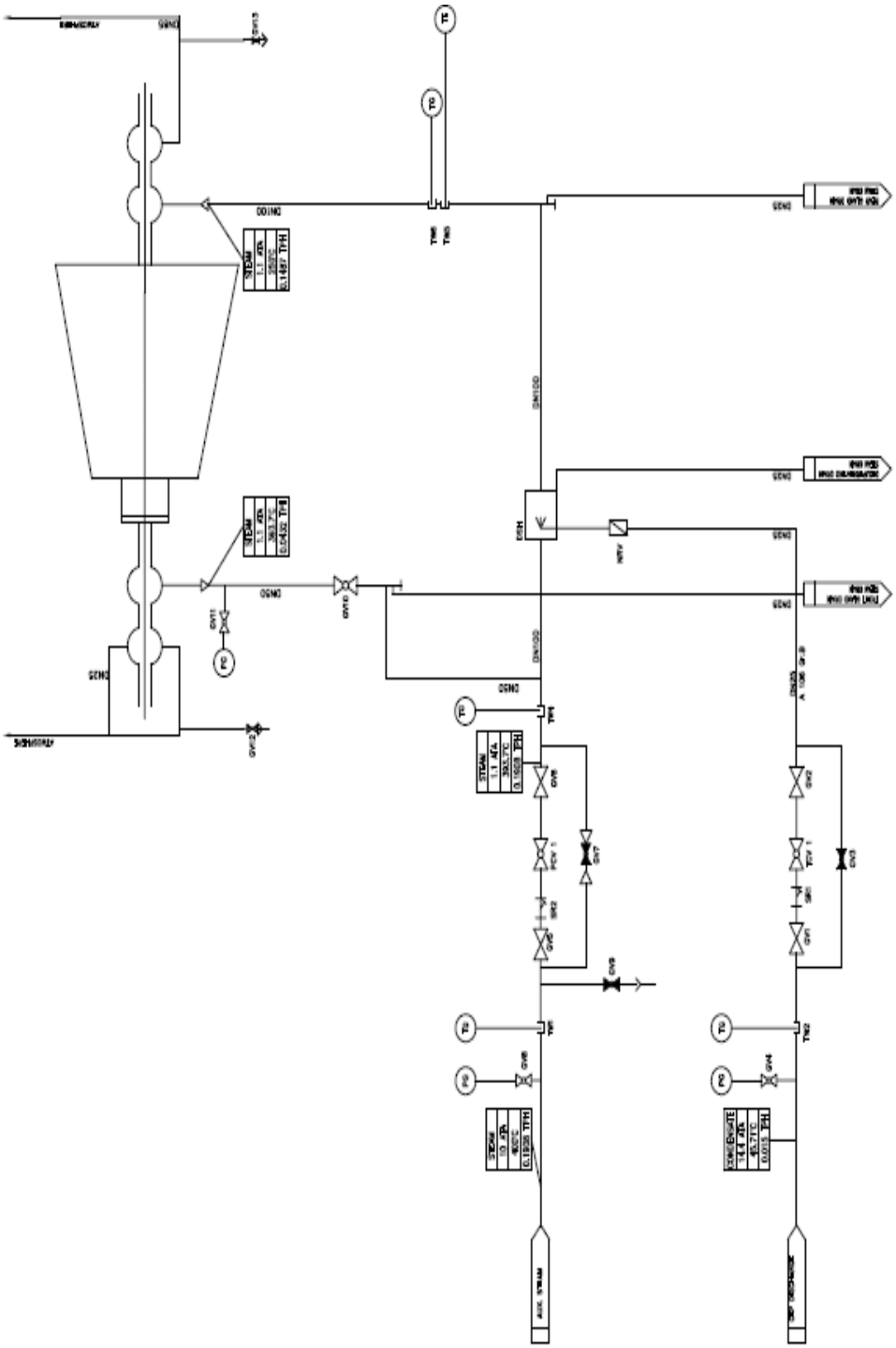
Different types of symbol used in P&ID

SR NO.	SYMBOL	DESCRIPTION
1		GATE VALVE (NORMALLY OPEN)
2		GLOBE VALVE (NORMALLY OPEN)
3		GLOBE VALVE (NORMALLY CLOSED)
4		GATE VALVE (NORMALLY CLOSE)
5		THERMODYNAMIC STEAM TRAP
6		TEMPERATURE GAUAGE
7		TEMPERATURE ELEMENT
8		PRESSURE GAUAGE
9		PRESSURE ELEMENT
70		THERMO WELL
11		REDUCER
12		EXPANDER
13		MOTOR CONTROL
14		AIR FLOW REGULATOR
15		CURRENT TO PRESSURE CONVERTOR
16		FLOW ORIFICE PLATE
17		NON RETURN VALVE
18		QUICK CLOSING NON RETURN VALVE

19		ORIFICE PLATE
20		Y STARINER
21		BALL VALVE
22		BUTTERFLY VALVE
23		SAFETY RELIEF VALVE
24		CONNECTION TO PROCESS OR INSTRUMENT SUPLY
25		PNEUMATIC SIGNAL
26		ELECTRIC SIGNAL
27		CAPILLARY TUBING (FILLED SYSTEM)
28		HYDRAULIC SIGNAL


LP HEATER
STAND PIPE
TO DEAERATOR
CONDENSATE
STEAM
NORMAL DRAIN
EMERGENCY DRAIN
AIR SUPPLY
HOTWELL
LP HEATER


TURBINE
STEAM SYSTEM



GLAND CEILING SYSTEM

III CONCLUSION

- We can give actual line diagram of definite power plant with help of P&ID.
- We can do line sizing.
- Economical consideration can be by preventing pipe from over sizing & under sizing
- With help of this, we can recommend class of orifices, valves and steam straps with accordance to ANSI B31.1

IV. REFERENCES

- Bureau of energy efficiency hand book
- Piping calculation manual BY Shashi Menon
- ANSI (American National Standards Institute)
- / ASME (American Society of Mechanical Engineers) PTC 39.1, "Performance Test Codes for Condensate Removal Devices for Steam Systems"
- ANSI (American National Standards Institute) / FCI (Fluid Controls Institute) 69-1, "Pressure Rating Standards for Steam Traps" 85-1, "Standards for Production and Performance Tests for Steam Traps"
- Spirax-Sarco Training Information at http://www.spiraxsarco-usa.com/framedefs/faq.htm t http://www.pnl.gov/fta/15_steamtrap/15_steamtrap.htm
- Van Duyne, Daniel A. Chapter C3 Steam Systems Piping. C.83-.133. Scribd.com. Web. Oct. 2010. <http://www.scribd.com/doc/18812666/Steam-System-Piping>.
- Armstrong Steam University at http://www.armstrong-intl.com/university/su.html
- Field Data Specialists, Inc. at http://www.trapbase.com

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- Friedman, Glenn P. E. "Energy-Saving Dorms." ASHRAE Journal 52.5 (2010): 20,21-24. . 10/7/2010 <www.ashrae.org>.
  - .
- Field Data Specialists, Inc. at
  - http://www.trapbase.com
- "Heat Loss Diagrams of Insulated Pipes." *The Engineering Toolbox*. Google. Web. Oct. 2010.
  - http://www.engineeringtoolbox.com/heat-loss-insulated-pipes-d_1151.html
- http://www.tlv.com/global/SG/products/080000.html
- www.pipingdesign.com/steamtraps.html
- www.engineeringtoolbox.com