HOMEWORK #1

PROCESS & INSTRUMENTATION DIAGRAM

SUBMISSION DATE: 1 OCT. 2012
**Question 1**

Name the following equipments based on standard P&ID symbols and notations.

- **PG**
- **PI**
- **PT**
- **PAH**
- **TT**
- **TAL**
- **TR**
- **TA**

- **FE**
- **FI**
- **FT**
- **FAH**
- **LC**
- **LS**

**Question 2**

What are the differences between these devices?

a)  ![PG](image1) vs. ![PI](image2)

b)  ![Device1](image3) vs. ![Device2](image4)

c)  ![Device3](image5) vs. ![Device4](image6)

d)  ![Device5](image7) vs. ![Device6](image8)
Vertical longitudinal flow separator must perform four distinct functions: inlet momentum control, vapor demisting, liquid retention, and liquid outlet control. The inlet is on one end of the horizontal separator, and the gas and liquid outlets are on the opposite end. As fluid enters, bulk separation occurs at the inlet device. The phases separate within the liquid retention section and flow to their respective outlets. Demisting and coalescing devices assist in the phase separation, and vortex breakers prevent the re-entrainment of phases. (http://www.pipingguide.net/2009/04/flow-separator.html)

![Diagram](image)

**Figure 1**

Draw the following devices to the vessel and respective pipings by using standard P&ID notations and symbols.

a. Pressure gauges to gas pipings (inlet and outlet).
b. Pressure gauge between coalescer and impingement baffle.
c. Pressure relief valve between coalescer and impingement baffle.
d. Liquid level gauge (sight-glass type).
e. Pressure alarm high below coalescer but above maximum allowable liquid level.
f. High and low liquid level alarm.
g. Flow gauges to gas piping (inlet and outlet).
Question 4

Reboiler is used in the petroleum industry to vaporize a fraction of the bottom product from a distillation column. Liquid flows from the column into a shell in which there is a horizontal tube bundle, boiling taking place from the outside this bundle. The vapor passes back to the column as shown. (http://www.thermopedia.com/content/1078/)

![Diagram of reboiler](http://www.thermopedia.com/content/1078/)

**Figure 2**

Draw the following devices to the vessel and respective pipings (Fig. 2b) by using standard P&ID notations and symbols.

a. Pressure gauges to steam inlet piping and reboiler vapor piping.
b. Temperature gauges to all inlet and outlet pipings.
c. Temperature gauge at heated liquid compartment.
d. Liquid level gauges at heated liquid compartment and over flow liquid compartment.
e. Pressure relief valve on top of vessel.
f. Pressure relief valve to steam inlet piping.
g. Liquid level alarm high at over flow liquid compartment.
h. Liquid level alarm low at heated liquid compartment.
i. Flow indicators for liquid from “tower bottom” and “reboiler vapor to tower”. 
Question 5

The influent flow enters the tank at the bottom and exits the tank, through a distant port at the top. The objective with port placement is to create the longest possible path between the inlet and discharge ports. In this system the treatment tank remains full all of time. Therefore one gallon entering the influent port displaces one gallon through the discharge port. As the influent flow enters the treatment tank it is thoroughly mixed with the tank contents. If the pH of the influent varies from the tank contents then the influent flow will be pH adjusted through the resultant chemical reaction that occurs as the influent mixes with the contents. There will obviously be an equal and opposite reaction within the tank contents. This opposite reaction is sensed by the pH probe which provides a continuous pH signal to the pH controller. The controller then paces the appropriate metering pump to bring the body of water within the tank back into range. If the influent flow was alkaline, for example, the result would be a steady rise in the pH of the tank contents as measured by the pH probe at the discharge port. The pH controller would then pace the acid metering pump at an appropriate rate to bring the pH back down into range. (http://www.phadjustment.com/pH.htm)

![Diagram of a treatment tank with components labeled](image.png)

**Figure 3**

Draw the following devices to the vessel and respective pipings by using standard P&ID notations and symbols.

a. Flow indicating transmitters for each stream (inlet and outlet).
b. pH recorder
c. Liquid level gauge
d. Liquid level switch is connected to a normally open solenoid valve at untreated influent stream.
e. pH transmitter is connected to a pH controller which connected to caustic pump.
Figure 4 show a P&ID obtained from a website (http://www.vantran3d.com/HTML%20Image%20Gallery/14P&ID.html). Analyze and comment on the P&ID drawn according to the standard. Make correction to the drawing.
Question 7

Figure 5 show a P&ID obtained from a website (http://3.bp.blogspot.com/__JI9jLv9gM/TBsq3d6Am7I/AAAAAAAAAFI/CFI2EkibDWR/s1600/cats1.jpg). Analyze and comment on the P&ID drawn according to the standard. Make correction to the drawing.