CM3215 ChemE Transport Lab:

Laboratory Orientation

Pre-laboratory Assignment
Meet your Cycle 1 lab partner, exchange contact numbers, and determine your work schedule for report 1. Note the schedule in your laboratory notebook for checking by the TA.

Introduction
There are several types of engineering drawings that are commonly created in the engineering, design, construction, and operation of chemical-processing equipment. Each drawing has a specific purpose and each is necessary to communicate information to others working on the same project.

A block flow diagram is developed during the conceptual design phase of a project; in CM2110 we used block flow diagrams to develop mass and energy balances for processes. Some units may be lumped together in a block flow diagram; for example, a block may be labeled "separator" rather than show the two or more units that perform that function.

When a process moves from the conceptual stage towards construction, a process flow diagram (PFD) is created. The PFD identifies the individual pieces of equipment in a process; process control requirements are also included. Capital costs are estimated based on the PFD.

When process design is complete, the PFD and any supporting documentation are passed on to the detail design team, who produce a piping and instrumentation diagram (P&ID). The P&ID is a connectivity diagram, showing the relative location of all equipment, valves, and instrumentation. The P&ID shows line sizes, insulation, and references the appropriate instrument data sheet and piping and equipment specifications. The Equipment Schedule is linked to the P&ID and lists details on each unit (see the web for the Equipment Schedule for your lab station).

Although other drawings will be created for a typical process (fabrication drawings, installation detail drawings, etc.), the P&ID is the master document to which all other documents refer. The P&ID follows a process "from cradle to grave" and is kept current with all changes throughout the life of the process.

The Instrumentation, Systems, and Automation Society (ISA, www.isa.org) publishes a set of standard rules and symbols for construction of a P&ID.

Experimental Procedure
Create a P&ID for the CM3215 experimental stations as follows:

1. Inspect your laboratory station and identify all the major pieces of equipment in the process.
2. Sketch the layout of the lab station directly in your lab notebook. Note that you must always use blue or black ink when writing in your lab notebook. Cross out any errors with one or two lines.
3. Be sure to include the Honeywell differential pressure (DP) meter. What is the model number of the Honeywell DP meter?
4. Using Visio and the ISA standards, create a P&ID for the process. Some of the elements (valves, open tank) are available as pre-set units in Visio. Some (the balance that weighs the tank) you will need to draw yourself. Instructions on getting started in Visio are available on the course webpage. Also

available on the web is a PDF of what your completed P&ID might look like; *this is guaranteed to be incorrect*.

In all your CM3215 reports that involve the pumping loop, you will need to refer to specific valves or devices. *For these reports, the equipment diagram (your P&ID), or a simplified version, should be included as Figure 1*. The diagram is necessary to make sure the reader knows which valve is, for example, WV-5.

Data Analysis and Reporting

Prepare a cover memo to transmit your completed P&ID and all requested information to the instructor. In your cover memo of transmittal, list all the valves and devices in the path that would direct water from the feed tank, through the ¼" line and back to the discharge tank. Affix a copy of your P&ID into your laboratory notebook. Affix a copy of the table of conversion factors http://www.chem.mtu.edu/~fmorriso/cm310/convert.pdf) into your laboratory notebook. Turn in a printed copy of the memo and the P&ID to Homework box A on the assigned due date. Both team members must your memo in black or blue ink.

References

1. Riggs, James B, *Chemical Process Control*, (Ferret, Lubbock, TX: 2001), Appendix A.
2. Caspary, David, "A guide for preparing equipment diagrams as part of the JSA for CM4110 Unit operations Laboratory," Michigan Technological University, Houghton, MI USA, Sept 2007, www.chem.mtu.edu/chem_eng/current/new_courses/CM4110/2009/equipment%20diagram%20symbols.pdf, accessed 19 September 2009.