Overview of Pipe Drafting and Design

In the design of an industrial facility, engineers develop process flow sheets, set up project specifications and design or select equipment. The design drafters use the information supplied by engineers and equipment vendors and applies the knowledge and experience gained in the office and field to design and layout the facility.

In the design and layout of an industrial complex, thousands of piping drawings are needed to provide detailed information to the craftsmen who will construct the facility. Facility design and layout must meet the customer’s expectations as well as comply with safety codes, government standards, client specifications, budget, and start-up date.

The piping group has the main responsibility for the design and layout of the facility. Drafters and designers must coordinate their efforts with the civil, structural, electrical, and instrumentation groups throughout the design process. The piping group must provide each design group the necessary information needed to complete their part of the project and have the complete set of plan and construction drawings finished on time. During this time, it may be necessary for designers to visit the plant construction site to establish tie-ins or verify information necessary to complete the design.

TYPES OF PROJECTS

The field of pipe drafting and design includes the widest range of opportunities of any field of design drafting. The types of design projects one could expect to work on may include:

- power plants
- petrochemical complex
- pulp and paper plants
- fertilizer plants
- pipe systems for hospitals and high-rise office buildings
- pharmaceutical plants
- food and beverage plants
- synthetic fuel plants
- offshore platforms
- pipeline installations
- water treatment facilities
- environmental waste disposal

Many projects will be designed for construction in other countries, offering the designer opportunities for travel. Each project presents drafters and designers with opportunities to expand their skills and knowledge of the field of piping design.

EMPLOYERS OF PIPE DRAFTERS AND DESIGNERS

Employers seek to hire pipe drafters and designers range for various companies. Among them are:

- engineering and construction companies
- operating companies
- architectural firms
- construction companies
- fabrication companies

ENGINEERING AND CONSTRUCTION COMPANIES

Engineering and construction companies provide the design and layout of a facility. Many clients award the engineering and design phase of a project to one firm and the construction phase to another. While many operating companies have a small engineering staff who handle the
day-to-day needs of changing and updating drawings, such as adding a pump or other small equipment, they do not have the manpower to design and engineer a grass-roots plant or major add-on. Total plant design and construction may require hundreds of workers and may entail years in the design and construction of the plant.

**OPERATING COMPANIES**

Operating companies are the clients who engage in the day-to-day operation of a facility and who seek out the services of engineering and construction firms when expanding existing facilities or constructing a new project. Many operating companies keep a small engineering staff in the home office or at the plant job site. Designers are exposed to the day-to-day operations of the facility and follow the construction of small projects. This situation may require that the designer have a broad range of knowledge and skills, as he or she often may be asked to design and lay out the complete project. The design may prepare foundation, steel, and piping drawings as needed, and may even do some electrical and instrumentation design when required.

**ARCHITECTURAL ENGINEERING COMPANIES**

Pipe drafters and designers employed by architectural engineering companies apply their skills to commercial and high-rise buildings. These may include multi-story office buildings, hospitals, condominiums, shopping malls, or other similar structures. In addition to the industrial piping components such as those found in a typical boiler room, supplementary piping systems must be designed for plumbing, HVAC, and drainage systems that are also required in these structures.

Pipe drafters and designers must therefore be able to develop drawings such as:

- piping flow sheets
- plot plans
- equipment location drawings
- piping arrangement drawings
- piping isometric drawings

Learning the “language” of piping prepares employees for advancement to other departments within the engineering firms. These departments include not only the drafting and design departments but also:

- purchasing
- material control
- material take-off
- estimating
- pipe stress and pipe supports
- CAD support
- project management

**CONSTRUCTION COMPANIES**

Many firms specialize only in the construction of plants. Here the piping designer may actually help oversee the construction of the facility while working under the supervision of a construction superintendent. The designer is often called upon to make small design changes resulting from mistakes discovered during the construction phase or as customers dictate changes. At the completion of the project, drawings are updated to reflect the many changes made during construction. These drawings are called or referred to as “as-built” drawings.

**FABRICATION COMPANIES**

Fabrication companies fabricate and ship much of the piping necessary for the construction of the plant to the job site. Many fabrication drawings called piping spool drawings must be prepared. These drawings give detailed dimensions from which welders can fabricate the pipe. The drafter who prepares these drawings will not be required to have an extensive background in plant layout, however, the position provides the drafter with valuable experience in materials and material science.

**PREPARATION FOR PIPING DRAFTING**

Students must have a good background in basic drafting before pursuing a job in the field of pipe drafting and design. Students should have good manual drafting skills related to line quality and freehand lettering. At the same time, students must acquire the necessary background to use the latest software tools such as AutoCAD and PROPIPE, which allows them to be more productive. As students advance, they will use a variety of sophisticated software packages, ranging from basic CAD software to 3D solid modeling.
TECHNICAL SKILLS

The drafter must become familiar with the uses of fittings, flanges, valves, and equipment. This will require time and effort to master the recognition of symbol shapes as well as research to find the dimensions needed to draw these items to scale. Often beginning drafters start out making corrections to existing drawings. This is where they acquire the skills and knowledge of piping that will allow them to advance to the position of piping designer.

Drafters who have held field positions as pipe fitters or welders find this real world experience valuable. Many times this experience allows them to advance at a faster pace.

PERSONAL SKILLS

Students should not neglect their speaking, writing, and math skills. Every company appraises future employees during the interview process, not only for technical skills, but also for the personal skills needed to interact with the engineering team. This interaction is a must for the team in order to complete the job with a minimal amount of mistakes. Honesty, reliability, dedication to improving skills, and a positive attitude contribute much to the successful career of the designer. You will be a member of a design team. You may work with people from countries all over the world. Getting along with fellow workers has much to do with successful yearly evaluations and compensation for your efforts.

CREATION OF PIPE DRAWINGS

Manual Drafting

Manual drafters use a variety of triangles, plastic templates (circle and ellipse), and scales to layout piping drawings. While electric erasers are not necessary, they make the job of erasing much easier and faster. Pencils and leads come in a wide range of sizes and shapes. Drafters usually use a 4H lead to draw projection lines and guidelines, and use an H or F lead for other line work and lettering needs. Line thickness also has an important role on piping drawings. A .7mm or wider lead holder is commonly used on major elements of the drawing such as pipe and lettering. Background components such as equipment, foundations, support structures, and dimension lines are typically drawn with a .5mm lead.

One cannot stress enough the importance of quality line work and lettering. Manual drawings are constantly slid in and out of the file drawers and run through blueprint machines. This requires that lettering and line work be neat and of good quality to maintain clarity of dimensions and callouts.

CAD Software Tools

There are many different CAD software tools on the market today. Many engineering companies require their designers to know and use several different CAD software tools. Engineering companies must be prepared to accommodate the client’s preference of CAD programs. In today’s marketplace, the pipe drafter and designer should learn how to use AutoCAD and MicroStation. These two CAD programs are widely used by engineering firms in the United States and throughout the world.

As with CAD programs, there are several piping software programs on the market today. Engineering firms must be responsive to the needs and preferences of their clients. Software developers steadily develop, revise, and refine programs to meet the demands of engineering and design firms. As with any business each software developer tries to incorporate the special features and amenities into their software package that will attract potential users. Often clients will dictate that all bid packages submitted for a project shall be completed using a particular piping software program. Most piping software packages provide the end user with the ability to develop three dimensional computer models of the completed facility. Software packages such as AutoPLANT, PDS, and PDMS, among others, have the intelligence to create either 2D or 3D drawings.