



## Basic Design and Pipe Drafting

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- 1) Introduction to design concept, engineering design process, how to do design, conceptual design, design cases, design software.
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- 5) Valves
- 6) Mechanical Equipment
- 7) Flow Diagrams and Instrumentation
- 8) Codes and Specifications
- 9) Isometrics

Lecture Times : Tuesdays EST 14-16 on class days

Tutorial Times: Sunday EST 14-15

# How to Use Design Software

To start with, we will watch design software videos:  
[AutoCAD 2015](#) (15min); Solidworks [link](#) (5min)

# Overview of Pipe Draft and Design



This chapter introduces overview of pipe drafting and design.

Pipe Drafting and Design video [1](#), [2](#)

# Overview of Pipe Draft 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 apply the knowledge and experience gained in the office and field to **design and lay out 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.



## Overview of Pipe Draft and Design

- **The piping group** must provide all other design groups with the information.
- **Drafters and designers** must coordinate their efforts with other groups.
- It may be necessary for designers to visit the construction site to verify information.

# Overview of Pipe Draft and Design-



## Types of Design Projects

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 processing plants; **synthetic fuel plants; offshore platforms; pipe line installations; water treatment facilities; environmental waste disposal.**

# Overview of Pipe Draft and Design-



## Types of Design Projects

**Bonus:** Many projects will offer the designer opportunities for travel to expand their skills and knowledge of the field of piping design.



# Overview of Pipe Draft and Design-Employers



Employers seek to hire pipe drafters and designers range for various companies:

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

# Overview of Pipe Draft and Design-



## Engineering and Construction Companies

Many clients award **the engineering and design phase** of a project **to one firm** and **the construction phase to another**. Many operating companies have a small engineering design team, they do not have the manpower to design and engineer a grassroots plant or major add-on.

# Overview of Pipe Draft and Design-Operating Companies



Operating companies are the clients who engage in the day-to-day operation of a facility.

Designers are exposed to the day-to-day operations of the facility and **follow the construction of small projects.**

# Overview of Pipe Draft and Design-Architectural Engineering Companies



Pipe drafters and designers employed by architectural engineering companies apply their skills to **commercial and high-rise buildings**.

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.

# Overview of Pipe Draft and Design-Construction Companies



Specialize only in the construction of plants .

The designer is often called upon to make **small design changes**.

# Overview of Pipe Draft and Design- 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.

# Overview of Pipe Draft and Design- Preparing for Piping 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 **knowledge of the latest drafting software programs (AutoCAD, MicroStation etc.)**.

# Overview of Pipe Draft and Design- Technical Skills



A pipe drafter must become **familiar with the numerous symbols** used to represent fittings, flanges, valves, and mechanical equipment by searching. Often beginning **drafters start out making corrections to existing drawings** that will allow them to advance to the position of **pipng 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.



# Overview of Pipe Draft and Design- 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**.

**Honesty, reliability, dedication, and a positive attitude** contribute much to the successful career of the designer. 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.

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# Overview of Pipe Draft and Design- Creation of Pipe Drawings



## Manual Drafting

When older facilities that were originally drawn manually need to be revamped, designers and drafters may **still find the need to use traditional drafting techniques.**

**Need quality line work and lettering:** use a **4H lead** to draw projection lines and guidelines, and use an **H or F lead** for other line work and lettering needs.

# Overview of Pipe Draft and Design- Creation of Pipe Drawings



## CAD Software Tools

There are many different CAD software tools on the market today. To be competitive in the job market, the pipe drafter must learn how to use **AutoCAD and/or MicroStation**.

Most **pipng software** packages provide the end user with the ability to develop 3D computer models of the completed facility such as PDMS (**Plant Design Management System**), PDS, SmartPlant3D, CADWorx, PLANT-4D, and MPDS4 etc.

# Steel Pipe



This chapter introduces **pipe size, pipe materials, pipe manufacturing and drawing**. Pipe is a term used to designate **a hollow, tubular body** used to transport any commodity possessing flow characteristics such as those found in liquids and gases.



## Steel Pipe – History of Pipe

- Long ago someone discovered that carrying water was time-consuming and laborious. Ingenuity gave birth to invention and the pipe was born.
- Early humans probably fashioned the first pipe from **bamboo**.
- Egyptian and Aztec civilizations made pipes from **clay**.
- The first metallic pipes were made from **lead and bronze** by the Greeks and Romans.
- The use of **iron** as a material to manufacture pipe came about with the invention of gun powder. Gun powder, necessitated the invention of stronger gun barrels. Eventually, **exotic (rare)** metals were developed.



## Steel Pipe –Piping Materials

Pipe is a term used to **designate a hollow, tubular body** used to transport any commodity possessing flow characteristics.

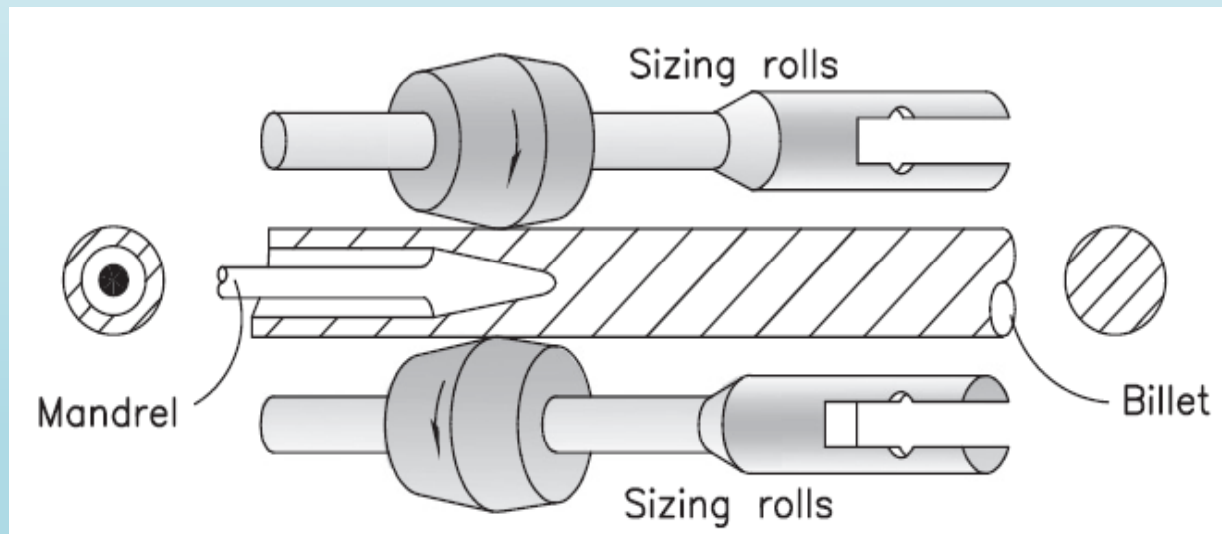
Some of the materials include **concrete, glass, lead, brass, copper, plastic, aluminium, cast iron, carbon steel, and steel alloys.**

**Carbon steel pipe is the most common** material.

# Steel Pipe –Manufacturing Methods



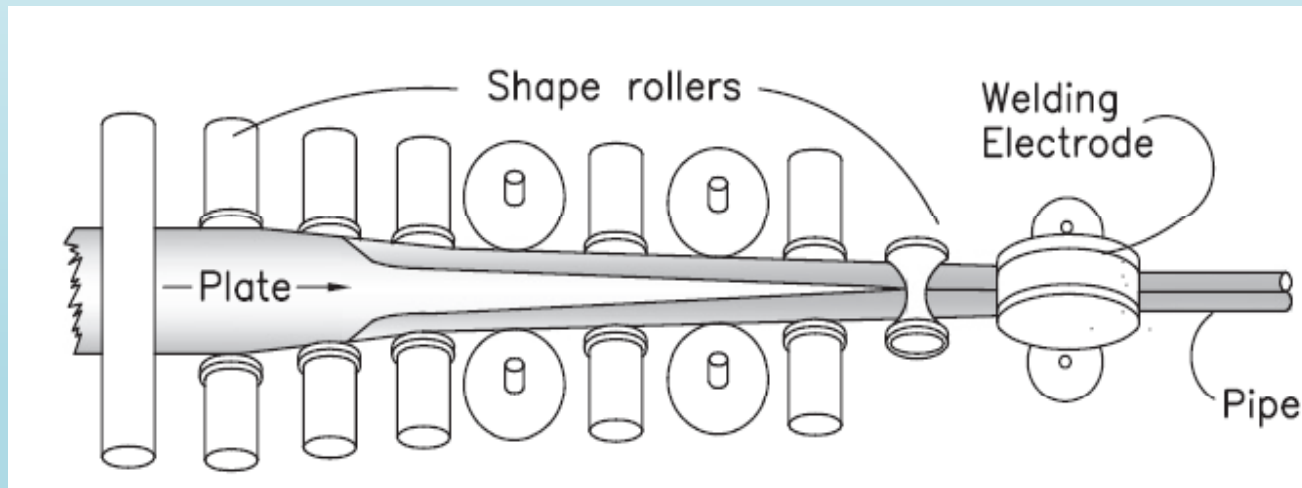
**Seamless pipe** is formed by piercing a solid, near-molten, steel rod, called a billet, with a mandrel to produce a pipe that has no seams or joints.



# Steel Pipe –Manufacturing Methods



**Butt-welded pipe** is formed by feeding a hot steel plate through shapers that will roll it into a hollow circular shape. Forcibly squeezing the two ends of the plate together will produce a fused joint or seam.





# Steel Pipe –Manufacturing Methods



Least common **spiral-welded pipe** is formed by twisting strips of metal into a spiral shape, then welding where the edges join one another to form a seam. This type of pipe is restricted to piping systems using **low pressures** due to its thin walls.



# Steel Pipe –Manufacturing Methods



Each of the three methods for producing pipe has its advantages and disadvantages. **Butt-welded** pipe formed from rolled plate that has a more **uniform wall** thickness and can be inspected for defects prior to forming and welding. This method is particularly useful when thin walls and long lengths are needed.

As a result, the American National Standards Institute (ANSI) developed strict guidelines for the manufacture of pipe. **Pressure Piping Code B31** was written to govern the manufacture of pipe. In particular, code B31.1.0 assigns a strength factor of **85% for rolled pipe, 60% for spiral-welded pipe, and 100% efficiency for seamless pipe.**