CAD PIPING INTRODUCTION
Course Syllabus

Course Number: TTC-0327
OCAS Code: None
Course Length: 60 Hours
Career Cluster: Architecture and Construction, Manufacturing
Career Pathway: Design/Pre-Construction, Manufacturing Production Process Development
Career Major(s): Advanced CAD Drafter-Architectural Emphasis

Pre-requisite(s):

Course Description: CAD Technician (Entry Level), CAD Drafter, Advanced CAD Drafter-Architectural Emphasis, Advanced CAD Drafter-Civil/Structural Emphasis, Advanced CAD Drafter-Piping Emphasis

Textbooks: CAD Piping Introduction

Course Objectives:

A. Discuss Introduction to Piping.
   1. Discuss the uses of piping.
   2. Define a refinery and list some of the by-products it produces.
   3. Compare and contrast a refinery to a gasoline plant and list some of the by-products a gasoline plant produces.
   4. Discuss the hydrocarbon compound.
   5. Discuss chemical plants, their products and processes.
   6. Explain the purpose of a tank farm.

B. Demonstrate Knowledge of Standard Fittings.
   1. Identify five different types of pipe flanges and their uses.
   2. Identify three different types of pipe couplings and their uses.
   3. Identify five different types of 90 degree elbows.
   4. Name three different types of 45 degree elbows.
   5. Identify two different types of 180 degree returns and their uses.
   6. Identify four different types of tee connections and their uses.
   7. Name three different types of reducers.
   8. Name two different types of pipe caps.
   9. Name three different types of threaded plugs.

C. Use Reference Material.
   1. Explain the usage of the Vinson Supply Co. pipe size and weight chart.
   2. Explain the usage of the Taylor-Forge Co. pipe flange and welded fitting size chart.
   3. Explain the usage of the Moorelane Co. coupling size chart.
   4. Discuss the general usage of manufacturers’ catalogs for material ratings and dimensions.

D. Demonstrate Valve and Fitting.
   1. Define the basic function of a pipe valve.
   2. Identify five different types of valves and their applications.
   3. Discuss the differences between “block” valves and throttling valves.
   4. Discuss the difference between manually operated and instrument control valves.
   5. Name four different types of end fittings in which a valve may be equipped.

E. Demonstrate Pipe Racks and Supports.
   1. Define a pipeway.
2. Discuss the purpose and maximum spacing of pipe racks in a pipeway.
3. Discuss multiple level pipe racks and recommended vertical spacing.
4. Discuss maximum rack width allowance for level rack construction.
5. Compare the use of pipe supports to that of pipe racks.
6. Identify three different types of pipe supports.

F. **Draw Single Line Orthographic Views.**
1. Define orthographic projection drawing.
2. Discuss and draw single line orthographic symbols for flanges, fittings, and valving.
3. Draw the four principal single line orthographic views for each single line piping configuration given.
4. Draw the four principal single line orthographic views from the given double line frontal view of a piping configuration.
5. Trace the given single line orthographic piping configuration frontal views and draw the four principal orthographic projection views for each.
6. Trace the given double line orthographic plan view of a piping configuration with three reducing fittings and redraw as a single line orthographic plan view.
7. Draw two single line orthographic frontal views from the two given rough sketched single line piping configurations and draw the four principal orthographic views projected from each frontal view all to a scale of 3/4"=1'-0".
8. Draw four single line orthographic frontal views from the four given rough sketch single line piping configurations and draw the four principal orthographic views projected from each frontal view and determine an appropriate scale for each.

G. **Draw and Dimension Single Line Isometric Views.**
1. Define isometric drawing.
2. Define a "spool drawing" and discuss their application.
3. Illustrate true isometric axes.
4. Define polar isometric axes and draw standard directional symbol.
5. Discuss polar directions related to the plan view of an orthographic piping configuration and compare the polar axes relationship to the same piping configuration in isometric form.
6. Discuss and draw single line isometric symbols for flanges, fittings, and valving.
7. Trace single line orthographic plan view and end view of given piping configurat draw a isometric polar directional symbol; draw single line isometric view by transferring sizes from orthographic views.
8. Trace single line orthographic plan view and end view of given piping configurat containing 45 degree turn; draw a isometric polar directional symbol; calculate length of 45 degree run; draw single line isometric view by transferring sizes from orthographic views and locating end points of 45 degree run.
9. Draw single line orthographic plan view and end view of given piping configuratio using a scale of 3/8"=1'-0" and dimension; draw a isometric polar directional symbol; draw single line isometric view by transferring sizes from orthographic views.
10. Discuss rules and requirements for dimensioning isometric pipe spools.
11. Illustrate dimensioning requirements for an engineering pipe spool.
12. Draw an engineering pipe spool of the given piping configuration connecting a pump and a vertical vessel.
13. Illustrate dimensioning requirements for a fabrication pipe spool.
14. Draw and dimension a fabrication pipe spool of the given orthographic fabrication drawing.

H. **Demonstrate Knowledge of Piping Drawing.**
1. Analyze and locate the inlet and outlet lines of the vertical vessel shown on the given plan view of a piping assembly drawing.
2. Determine the sizes and pressure ratings of the inlet and outlet lines of the vertic
vessel shown on the given plan view of a piping assembly drawing.
3. Track the origin and termination connections of both the inlet and outlet lines of the vertical vessel shown on the given plan view of a piping assembly drawing.
4. Create an isometric fabrication spool drawing of the inlet line of the vertical vessel shown on the given plan view of a piping assembly drawing complete with dimensions, polar directional symbol, Bill of Materials, and necessary notes.
5. Create an isometric fabrication spool drawing of the outlet line of the vertical vessel shown on the given plan view of a piping assembly drawing complete with dimensions, polar directional symbol, Bill of Materials, and necessary notes.

I. Demonstrate Knowledge of Types of Flow Diagrams.
1. Compare the different types of flow diagrams.
2. Discuss Process Flow Diagrams (PFD).
3. Identify abbreviations on flow diagrams.
5. Compare and contrast (PFD) and (P&ID) diagrams.
6. Identify flow diagram instrument symbols.
7. Discuss terms used with flow diagrams.
8. Discuss Mechanical diagrams.
9. Demonstrate the ability to read mechanical flow diagrams.
10. Discuss the difference between mechanical and utility flow diagrams.
11. Identify symbols used on utility flow diagrams.
12. Explain the use of auxiliary diagrams.
13. Discuss underground diagrams and processes.
14. Draw PFD from given rough sketch.
15. Draw P&ID from given rough sketch.

J. Demonstrate Knowledge of Double Line Orthographic Views.
1. Discuss and draw double line orthographic symbols for flanges, fittings, and valuing.
2. Discuss and draw double line orthographic symbols for insulation.
3. Draw double line pipe elevation of given double line piping drawing using a scale 3/8"=1'-0".
4. Draw a double line plan view of given double line valuing configuration drawing using a scale of 3/8"=1'-0".
5. Draw a double line plan view and front elevation of given skid mounted piping assembly using a scale of 3/8"=1'-0".

K. Discuss Theory and Basic Principles.
1. Define "pressure vessel".
2. Differentiate vessels that operate at atmospheric pressure from vessels that operate at measurable internal pressure.
3. Identify vessel nomenclature.
4. Interpret Section VIII of the SAME Code for Unaired Pressure Vessels.
5. Recognize horizontal, vertical, and spherical vessels.
6. Define hydrocarbon compounds and their relation to petroleum.
7. Classify hydrocarbons into three physical forms.
8. Identify the industrial applications in which pressure vessels are used.
9. Distinguish storage type vessels from process type vessels.
10. Name three types of petroleum processing plants in which pressure vessels are essential.

L. Demonstrate Knowledge of Types of Vessels.
1. Discuss separators and scrubbers.
2. Discuss fractionating towers.
3. Discuss accumulators.
4. Discuss reactors or catalytic crackers.
5. Discuss treaters.
6. Discuss storage tanks.
7. Discuss indirect heaters.
8. Discuss "shell and tube" heat exchanger.

M. **Demonstrate Knowledge of Heat Exchanger.**
1. Discuss the applications of heat exchanger.
2. Discuss the basic design principles of heat exchanger.
3. Distinguish the major design difference in a "U"-tube exchanger and that of a straight tube exchanger.
4. Define "floating head".
5. Explain what is meant by two pass, four pass, six pass, and eight pass "U"-tube exchanger.

N. **Demonstrate Knowledge of Basic Components of Exchangers.**
1. Identify the four major parts of a heat exchanger.
2. Sketch the shell side and explain its purpose.
3. Sketch the channel or tube side and explain its purpose.
4. Sketch the tube bundle and explain its purpose.
5. Describe two types of tubesheets.
6. Sketch a full end section of the channel for each of the two, four, six, and eight tube pass configuration.
7. Discuss location requirements of inlet and outlet connections for both the shell side and the channel.
8. Discuss saddles and support standards for both single units and double mounted ("piggy-back") units.
9. Identify specific heat exchanger nomenclature.

O. **Perform Drawing Studies.**
1. Identify heat exchanger component parts and assemblies on industrial drawing sets.
2. Layout tube hole pattern at 45 degree square pitch, tierod hole pattern, and completely detail an (8) pass tubesheet.
3. Layout tube hole pattern at 60 degree triangular pitch, tierod hole pattern, and completely detail a (4) pass tubesheet.
5. Draw details for (8) pass channel.
6. Draw details for (8) pass channel cover.
7. Draw details for shell and saddles.

P. **Demonstrate Knowledge of Bill of Materials (BOM).**
1. Discuss the purpose and importance of an accurate bill of materials.
2. Illustrate the format of the bill of materials and its preferred placement on drawing.
3. Group "like" items together on the BOM and leave line spaces between complete groupings for future additions.
4. Discuss item identification and item marking.
5. Specify accurate quantities.
6. Discuss adequate space allowance for description section and emphasize importance for clear, complete, accurate descriptions.
7. Explain material identifications and references to properly identify unusual materi

---

1 ODCTE Objective
All unmarked objectives are TTC instructor developed.
CAD PIPING INTRODUCTION

Teaching Methods: The class will primarily be taught by the lecture and demonstration method and supported by various media materials to address various learning styles. There will be question and answer sessions over material covered in lecture and media presentations. Supervised lab time is provided for students to complete required projects.

Grading Procedures: 1. Students are graded on theory and shop practice and performance.
2. Each course must be passed with seventy (70%) percent or better.
3. Grading scale: A=90-100%, B=80-89%, C=70-79%, D=60-69%, F=50-59%.

Description of Classroom, Laboratories, and Equipment: Tulsa Technology Center campuses are owned and operated by Tulsa Technology Center School District No. 18. All programs provide students the opportunity to work with professionally certified instructors in modern, well-equipped facilities.

Available Certifications/College Credit: The student may be eligible to take state, national or industry exam after completion of the program. College credit may be issued from Oklahoma State University-Okmulgee or Tulsa Community College. See program counselor for additional information.

College Credit Eligibility: The student must maintain a grade point average of 2.0 or better.