ATPF-1803: SPECIAL TOPICS: ADVANCED PIPING LAYOUT

Cuyahoga Community College

Viewing: ATPF-1803 : Special Topics: Advanced Piping Layout

Academic Term:
Fall 2026

Subject Code
ATPF - Applied Ind Tech - Pipefitters

Course Number:
1803

Title:
Special Topics: Advanced Piping Layout

Catalog Description:
A study of advanced layout for pipefitters and technicians in the construction industry. The course deals with calculations involved in designing, installing, and repairing piping runs. The course reviews calculations involving geometric figures and also application of the use of trigonometry in figuring offsets.

Credit Hour(s):
1

Lecture Hour(s):
1

Requisites

Prerequisite and Corequisite
Departmental approval: Admission to Pipefitter's apprenticeship program.

Outcomes

Course Outcome(s):
Understand and Apply Geometric Calculations for Pipe Installation

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):
• Calculate the areas of rectangles, triangles, and circles.
• Solve problems involving the volume of rectangular solids and cylinders.
• Determine the length of an unknown side of a right triangle using geometric formulas.

Course Outcome(s):
Accurately Interpret and Perform Piping Measurements

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):
• Apply take#out dimensions for threaded and grooved fittings.
• Convert center#to#center measurements into end#to#end dimensions.

• Translate dimensions from piping diagrams into precise pipe measurements.

Course Outcome(s):

Analyze and Solve Problems Involving Swing Offsets

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

• Identify situations where the Pythagorean theorem is required to compute travel lengths.
• Calculate center#to#center travel lengths for 90#degree swing offsets.
• Determine end#to#end dimensions of a 90#degree swing.

Course Outcome(s):

Perform Calculations for Straight Offsets

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

• Define and explain the terms travel, set, and advance.
• Compute center#to#center travel for offsets using 45° and 22½° elbows.
• Calculate set distances for straight offsets.
• Determine pipe lengths required to connect straight offsets.

Course Outcome(s):

Calculate and Interpret Rolling Pipe Offsets

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

• Interpret drawings and diagrams related to rolling pipe offsets.
• Calculate the diagonal (c) of a rolling offset.
• Compute the advance measurement of a rolling offset.
• Compute the set measurement of a rolling offset.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Final exam

Course Content Outline:

I. Working with Geometric Calculations for Pipe Installation

A. Rectangles and Rectangular Solids

1. Perimeter

2. Area
3. Volume of rectangular solids

B. Volumes

1. Rectangular solids
2. Cylinders

C. Circles

1. Circumference
2. Area

D. Triangles

1. Isosceles, Right triangle review
2. Hypotenuse
3. Pythagorean Formula
4. Determining missing sides
5. Area

II. Pipe Dimensions

A. Measurements Over a Fitting

1. Center references
2. End references
3. Face references

B. Types of Piping Measurements

1. End#to#end measurements
2. Center#to#center measurements
3. End#to#center measurements

C. Using Piping Diagrams

1. Interpreting dimensions on diagrams
2. Translating diagram information into measurement requirements

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III. Swing Offsets

A. Pythagorean Formula in Swing Calculations

1. Travel
2. Vertical change
3. Horizontal change
4. When to apply the formula

B. Approximating Travel

1. Methods for estimating travel length without exact calculation

C. Center#to#Center Distances Using 90° Elbows

1. Determining center#to#center travel for 90° swings
2. Determining end#to#end dimensions of a 90° swing

IV. Straight Offsets

A. 45#45#90 Offsets

1. Set and advance × 1.414
2. Travel × 0.707

B. Center#to#Center Measurements

1. Using offset geometry to calculate travel distance

C. End#to#End Measurements

1. Converting between center and end references

D. Crossmains

1. Applying straight offset calculations to parallel or intersecting piping

E. Definitions

1. Travel
2. Set

3. Advance

V. Rolling Pipe Offsets

A. Drawings of Rolling Offsets

1. Understanding 3#dimensional offset diagrams
2. Recognizing vertical, horizontal, and diagonal components

B. Calculate Diagonal “c”

1. Calculate the travel of the rolling offset
2. Calculate the set of the rolling offset
3. Calculate the advance of the rolling offset

C. Applying Rolling Offset Measurements

1. Using formulas to compute all three components: set, rise, and advance

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: https://portal2.tri-c.edu/ReligiousAccommodation/ Religious Accommodation Form. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf

Weekly Schedule

	Topics
Week 1	Topic: Rectangles & Rectangular Solids Perimeter Area Volume of rectangular solids
Week 2	Topic: Volumes of Shapes Volume of rectangular solids (reinforcement) Volume of cylinders
Week 3	Topic: Circles Circumference Area
Week 4	Topic: Triangles Isosceles, right triangle review Hypotenuse Pythagorean Formula Determining missing sides Area
Week 5	Topic: Measurements Over a Fitting Center references End references Face references

Week 6	Topic: Types of Piping Measurements End#to#end measurements Center#to#center measurements End#to#center measurements
Week 7	Topic: Using Piping Diagrams Interpreting dimensions on diagrams Translating diagram information into measurement requirements
Week 8	Topic: Swing Offsets: Pythagorean Formula Applications Travel Vertical change Horizontal change When to apply the formula
Week 9	Topic: Swing Offsets: Travel Approximation & 90° Elbows Methods for approximating travel Center#to#center distances using 90° elbows End#to#end dimensions of a 90° swing
Week 10	Topic: Straight Offsets (45#45#90 Geometry) Set and advance × 1.414 Travel × 0.707
Week 11	Topic: Straight Offset Measurements Center#to#center measurements End#to#end measurements
Week 12	Topic: Crossmains & Offset Definitions Crossmains Definitions of travel Definitions of set Definitions of advance
Week 13	Topic: Rolling Offsets: Drawings & Interpretation Understanding 3#dimensional offset drawings Recognizing vertical, horizontal, and diagonal components
Week 14	Topic: Rolling Offsets: Calculating Diagonal “c” Calculate travel of the rolling offset Calculate set of the rolling offset Calculate advance of the rolling offset
Week 15	Topic: Applying Rolling Offset Measurements Using formulas to compute set Using formulas to compute rise Using formulas to compute advance
Week 16	Topic: Full Review & Integrated Practice Integrated practice of geometric calculations Integrated piping measurements Swing offsets Straight offsets Rolling offsets Applying formulas across all offset types

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings
Instructor-provided materials

Resources for the Instructor
www.firesprinkler.org/

National Fire Protection Association. *NFPA 13: Standard for the Installation of Sprinkler Systems*. 2025.

Pipefitters Local 120 JATC. *Pipefitters Local 120 Joint Apprenticeship Training Committee. (n.d.). PowerPoints and handouts*.

"Modern pipefitter's manual" *Pipefitter.com*. Pipefitter.com

Calculated Industries. (n.d.). Pipe Trades Pro™ 4095 pocket reference manual. Calculated Industries..

Lindsey, F., & Calculated Industries. (2020). Pipefitters handbook (3rd ed.). Industrial Press..

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