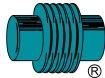


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Page 1 of 10

Piping Design and Analysis Influence on Pipe Support Selection and Design Semester/Year: Summer/Fall Meeting Time: Online

Part 1: Course Information

Instructor Information

Instructor: David Baker

Office: Virtual

Office Hours: Anytime

Phone: 713-452-4790

Email: davidb@pipingtech.com

Course Description:

Piping Design and Analysis Influence on Pipe Support Selection and Design is an overview on piping design and analysis, including factors that effect overall configuration, piping layout, the total system, as well as an introductory into pipe stress analysis (flexibility concerns and other design considerations); and how all those factors ultimately influence pipe support and pipe hanger design.

Course Structure

This is a lecture type course. The time requirement is a total of 8 hours plus 1-2 hours for quizzes and test.

Textbook & Course Materials

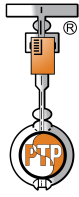
Required Text

No required text

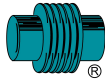
Recommended References & Other Readings

1. Piping Handbook, 7th Edition, Mohinder L. Nayyar
 - a. View online: <http://kianaco.net/download/ebook/Handbook%20-%20Piping.pdf>
 - b. Purchase at: <https://www.amazon.com/Piping-Handbook-Mohinder-Nayyar/dp/0070471061>
2. Webinar Recordings
 - a. Engineered Spring Supports (Practical, Hands-on Approach)
<https://pipingtech.com/resources/media/webinars/engineered-spring-supports-practical-hands-approach-webinar/>
 - b. Shock Control, Restraint and Support Devices Webinar
<https://pipingtech.com/resources/media/webinars/shock-control-restraint-support-devices->

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Page 2 of 10

[webinar/](#)

- c. Design, Application & Installation of Pipe Clamps
<https://pipingtech.com/resources/media/webinars/design-application-installation-pipe-clamps-webinar/>
3. FAQ's on Piping Systems <https://pipingtech.com/resources/faqs/piping-systems-faq/>
4. Technical Bulletins
 - a. Considering all Movement in Pipe Support Design <https://pipingtech.com/resources/technical-bulletins/considering-all-movement-in-pipe-support-design/>
 - b. Vibration in a Piping System <https://pipingtech.com/resources/technical-bulletins/vibration-piping-system/>
 - c. Snubbers: A General Overview <https://pipingtech.com/resources/technical-bulletins/snubbers-general-overview/>
 - d. Hydraulic Snubbers <https://pipingtech.com/resources/technical-bulletins/hydraulic-snubbers/>

Part 2: Course Objectives

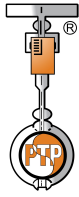
Learning Outcomes:

Piping Design Course Learning Objectives

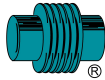
Upon successful completion of this course, you will be able to:

- Understand the purpose of piping and where it is used, along with the classifications and design consideration involved. You will have a basic understanding of internal and external forces on the piping system. You will be able to identify the modes of failure and know the applicable codes and standards related to piping system design.
- Be familiar with fluid properties, material, terminology and the laws of fluid flow. You will have a basic knowledge of piping and fittings, along with size and selection and piping system components and process types. You will understand the different types of valves, pumps, tanks and pressure vessels.
- Have a basic understanding of water, process and power piping systems. You will know how pipe networks work in series, parallel and branching. You will be able to calculate flow rate, friction, loss and head loss. You will be able to review the Hardy Cross Method and know pipe size criteria, along with the Siphon effect, backflow, system static and dynamic head. You will be able to troubleshoot based on the 5 P's.
- Understand basic analysis and more complex systems, along with how to do hand calculations. You will learn the importance of different methods and how to review the piping design flow chart.
- Review documentation and know the three stages of project evaluation. You will go over the physical attributes, conditions, factors, joint design and specifications in the design basis. You will know about pipe vibration, natural frequency, span limitation and fatigue.

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Page 3 of 10

- Integrate rigid supports into the piping system and know what requirements and standards to follow. You will know about the guidelines, applications and different styles as well. You will be able to spot the design influences when related to load movement, temperature, material, dimension and adjustability.
- Integrate pipe support restraints into the piping system. Know the requirements and standards. Understand the major factors that influence the piping system, as in operating conditions, standard vs. custom and adjustability. Learn about the different types of snubbers, sway struts and auxiliary steel.
- Identify the influences on pipe support design for spring supports. Know the necessity of pipe supports, requirements and standards, along with the operating conditions. Briefly recognize the support styles and functions for snubbers, variables, constants and sway braces.

Assessment Measures

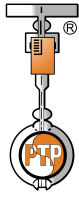
You will meet the objectives listed above through a combination of the following activities in this course:

1. There will be periodic quizzes throughout the course sections.
2. There will be a final exam at the end of the course.

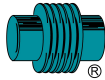
Part 3: Topics Outline/Schedule

- Section #1: Introduction - Overview of Piping
 - Purpose of piping; Where piping is used; Types of piping and support classifications; Design considerations
 - Project planning; Operating conditions; Forces: internal and external
 - Modes of failure: stress types, fracture types and fatigue; Stress theories; principle and shear
 - Applicable codes and standards: ASME-Power and process; MSS-uniform guidelines; Misc. codes
- Section #2: Preliminary Piping Design - Components
 - System Components: the total system; Fluid properties: material, terminology and laws of fluid flow
 - Piping system components and process types; Piping & fittings: characteristics, size and selection, calculations and considerations
 - Valves: types, functions, operation and control valves; Centrifugal pumps: types, operation and application; Tanks and pressure vessels: design and application
- Section #3: Preliminary Piping Design – The Total System

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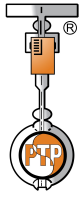
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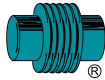
Page 4 of 10

- Types of piping systems: water, process and power
- Pipelines and pipe networks: series, parallel and branching; Calculation: flow rate, friction loss and head loss
- Network analysis: Hardy Cross Method
- Pipe size criteria; Siphon effect: backflow; System static and Dynamic head; Accounting for energy: addition and losses; Other considerations: liquid systems, two phase flow
- Troubleshooting; Rules of Thumb: the 5 P's, specific industry rules: piping layouts, pumps and power plants
- Section #4: Basic Concepts of Stress Analysis – Flexibility Analysis
 - Brief history; Applications / temperature range; Basic analysis of in-plane system; More complex systems analysis; Hand calculation examples
 - Importance; Flexibility building methods; Modified beam analysis; Span limitations; Guided cantilever method; Analytical vs. computer simulated results; Excessive flexibility
 - Piping design flow chart; Design considerations; Piping components and interface equipment; Today's atmosphere; Knowledge base; Codes and standards
 - Stress-Strain curve; What is stress analysis; Purpose of piping stress analysis; Modes of failure; Theories of failure: 6 main theories; Stress intensification factor
- Section #5: Basics Concepts of Stress Analysis – Design Bases
 - Development of documentation; Project evaluation: 3 stages
 - Design bases: physical attributes, conditions, factors, joint design, specifications
 - Modeling; Finite element method: analysis points, forces and movement, local to global coordinates, assembling process
 - Pipe Vibration: natural frequency, span limitation, fatigue; Analysis summary
- Section #6: Influences on Pipe Support Design – Rigid Supports
 - Integration; Pipe support necessity; Pipe support requirements and standards; Major factors: Operating conditions, standard vs. custom and adjustability
 - Support styles & functions: guidelines; Rigid support applications: guidelines; Rigid support styles: 1.) Base mounted: functionality and general arrangement, 2.) Suspended: functionality and general arrangement
 - Rigid Support Design Influences: load, movement, temperature, material, dimensions, adjustability; Rigid Support Design: Recommendations
- Section #7: Influences on Pipe Support Design – Restraints
 - Integration; Pipe support necessity; Pipe support: requirements and standards; Major factors:

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- operating condtions, standard vs. custom and adjustability
- Support styles & functions: snubber types and guidelines; Snubbers characteristics and support design influences
- Support styles & functions: guidelines; Sway struts characteristics and support design influences
- Pipe Support Assembly: auxiliary Steel, guidelines, major support categories, standardized supports, field fabrication, adjustability and maintenance
- Section #8 Influences on Pipe Support Design – Spring Supports
 - Integration; Pipe support necessity; Pipe support: requirements and standards; Major factors: operating conditions, standard vs. custom and adjustability
 - General support styles: snubber types, design parameters, guidelines and general characteristics
 - Support styles & functions: guidelines; Variable spring supports characteristics and support design influences
 - Support styles & functions: guidelines; Constant spring supports characteristics and support design influences
 - Support styles & functions: guidelines; Sway braces characteristics and support design influences

Part 4: Grading

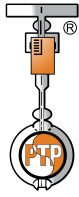
Graded Assignment Details

Visit Teachable and learn about the various quizzes given throughout each section and the final exam at the end of the course. For details about the weight of each quiz is listed below. Points you receive for graded activities will be posted in the Teachable Learn Grade Book. Click on the Grades link on the left navigation bar to view your points. The grades for the quizzes will be updated right after the quiz. For the final exam, your grades will be upgraded after 2 weeks.

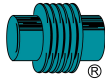
Assignment	Weight or Points	Due Date
Quizzes	20%	During each section
Final Exam	80%	At the end of the course
Total	100%	90 days after start of course

- **Assignment 1 Description: Section #1 Introduction - Overview of Piping**
Quizzes throughout this section – all multiple choice
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 2 Description: Section #2 Preliminary Piping Design – Piping System Components**
Quizzes throughout this section – all multiple choice
✓ **3 Quizzes**

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Page 6 of 10

Totals 1/8 of 20% of final grade

- **Assignment 3 Description: Section #3 Preliminary Piping Design – The Total System**
Quizzes throughout this section – 2 multiple choice and 3 True/False
✓ **5 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 4 Description: Section #4 Basic Concepts of Stress Analysis – Flexibility Analysis**
Quizzes throughout this section – 2 multiple choice and 2 True/False
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 5 Description: Section #5 Basic Concepts of Stress Analysis – Design Bases**
Quizzes throughout this section – 3 multiple choice and 1 True/False
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 6 Description: Section #6 Influences on Pipe Support Design – Rigid Supports**
Quizzes throughout this section – 2 multiple choice and 2 True/False
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 5 Description: Section #7 Influences on Pipe Support Design – Spring Supports**
Quizzes throughout this section – all True/False
✓ **5 Quizzes**
Totals 1/8 of 20% of final grade
- **Assignment 5 Description: Section #8 Influences on Pipe Support Design – Restraints**
Quizzes throughout this section – all True/False
✓ **4 Quizzes**
Totals 1/8 of 20% of final grade

- **Exam 1: Final test**
5 questions – 4 multiple choice and 11 True/False
Totals 80% of final grade

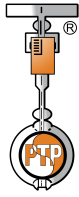
Participation/Attendance:

Students are responsible for knowing and adhering to all dates and deadlines.

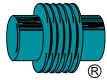
Late Work Policy

Be sure to pay close attention to deadlines—there will be no makeup assignments or quizzes, or late work accepted without a serious and compelling reason and instructor approval.

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Letter Grade Assignment

Final grades assigned for this course will be based on the percentage of total points earned and are assigned as follows:

Letter Grade	Percentage	Performance
A	93-100%	Excellent Work
A-	90-92%	Nearly Excellent Work
B+	87-89%	Very Good Work
B	83-86%	Good Work
B-	80-82%	Mostly Good Work
C+	77-79%	Above Average Work
C	73-76%	Average Work
C-	70-72%	Mostly Average Work
D+	67-69%	Below Average Work
D	60-66%	Poor Work
F	0-59%	Failing Work

Part 5: Course Assistance

Students are encourage to start assignments early to help reduce last minute technical issues.

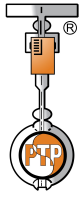
Support Services:

Student assistance for Teachable can be found by visiting https://sso.teachable.com/secure/teachable_accounts/tickets/new#/form/bug

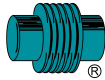
Technology Requirements

This course uses a learning management system called Teachable to post assignment details, announcements, and provide collaborative opportunities. This course is best viewed through the use of a full desktop or laptop computer. The use of mobile devices may prevent course materials to not display or work properly. Below are the minimum technology requirements to be successful in this course:

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Page 8 of 10

- Accessibility testing is conducted with Chrome and Safari with VoiceOver on macOS. Teachable is not compatible with all versions of Internet Explorer.
- USB Flash Drive (at least 1 GIG)
- Stable internet connection (Ethernet connection preferred over wireless)
- Personal Email account
- Microsoft Office 2007 or later
- Adobe PDF Reader <http://get.adobe.com/reader/>
- Two supported internet browsers (e.g. Mozilla Firefox, Google Chrome)
- Pop-up blockers disabled for trusted sites
- Cookies enabled for trusted sites
- Java plug-in <http://www.java.com/en/download/installed.jsp>

Technology Competencies/Skills:

Students enrolled in the course must be prepared to perform the basic tasks below.

1. Send and receive email;
2. Attach files to an email message;
3. Locate system information (e.g. browser version, operating system, etc) for trouble shooting;
4. Recognize, use, and create hyperlinks;
5. Use of basic Microsoft Office programs;
6. Download and install software (including utilities, plug-ins, and/or apps);
7. Copy and paste text using a computer;
8. Scan and remove computer viruses;
9. Plug in external devices to a computer ;
10. Save files to an external device (e.g. flash drive, CD, or DVD);
11. Use an internet search engine to locate online credible resources;
12. Post and reply to discussion forums or chat via instant messaging tool;
13. Send computer screenshot for technical assistance.

Part 6: Course Policies

Attend Class

Students are expected to view all sections, answer all quizzes to complete the final exam.

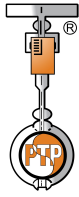
Participate

All content related questions should be emailed to enews@pipingtech.com. All technical related questions should be submitted via https://sso.teachable.com/secure/teachable_accounts/tickets/new#/

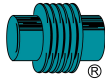
Build Rapport

If you find that you have any trouble keeping up with assignments or other aspects of the course, make sure you let your instructor know as early as possible. As you will find, building rapport and effective relationships are key

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Page 9 of 10

to becoming an effective professional. Make sure that you are proactive in informing your instructor when difficulties arise during the semester so that they can help you find a solution.

Complete Assignments

All assignments for this course will be submitted electronically through Teachable unless otherwise instructed. Assignments must be submitted by the given deadline or special permission must be requested from instructor *before the due date*. Extensions will not be given beyond the next assignment except under extreme circumstances.

All discussion assignments must be completed by the assignment due date and time. Late or missing discussion assignments will affect the student's grade.

Incomplete Policy

Under emergency/special circumstances, a student may petition for an incomplete grade. An incomplete will only be assigned if [**insert condition here*]. All incomplete course assignments must be completed within [**insert timeframe here*]. There is a link for the incomplete grade that may be helpful to include.

Inform Your Instructor of Any Accommodations Needed

Piping Technology and Products would like to help students who have disabilities achieve their highest potential. In accordance with 504/ADA guidelines, reasonable academic accommodations will be provided to students who request and require them. Students must contact the instructor as soon as possible but no later than the second week of the course.

Commit to Integrity

As a student in this course you are expected to maintain high degrees of professionalism, commitment to active learning and participation in this class and also integrity in your behavior.

Academic Dishonesty Policy

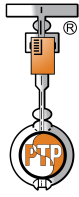
Any violation will result in an investigation. Please refer to the examples of plagiarism, and consult the instructor if you have specific questions. Please also note that plagiarism also includes reusing your own work submitted for another class. Notification to all concerned parties will be made immediately.

Online Student Etiquette:

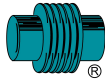
This course may host synchronous online meetings. During those meetings consider the following:

- **Keep chats on topic.** Avoid inappropriate conversations that may distract others from the course topic or objective.
- **Avoid strong/loud language.** Be polite. Language can easily be misinterpreted in written communication. Before sending an email or chat message make sure it clearly conveys the intended feeling.

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Page 10 of 10

- **Use emoticons to express feelings.** Nonverbal cues can reinforce the feeling of a message. Use sparingly. :-)
- **Respect privacy of peers.** Do not post someone's personal information online without their expressed permission.
- **Use appropriate dress code on camera.** During a video conference dress as if attending a face-to-face class. Avoid offensive clothing.
- **Be mindful of background noise and scene/location.** Take advantage of quiet areas to avoid distractions to fellow classmates. Avoid offensive décor or noise.
- **Be helpful.** Assist fellow classmates in understanding course materials.