

## **Expansion Joint Application 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:**

Expansion Joint Application and Design Course covers how to provide flexibility in the piping system by employing expansion joints to accommodate thermal expansion and contraction of sections of pipes or ducts. It discusses the parameters and conditions specified by the piping system designer and how to design an expansion joint as a cost-effective component of the piping system.

### **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**

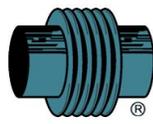
#### **Required Text**

No required text

#### **Recommended References & Other Readings**

1. U.S. Bellows, Inc. Product Catalogs
  - a. Metallic Expansion Joint Catalog  
[http://www.usbellows.com/PDF\\_Files/expansion-joint-catalog.pdf](http://www.usbellows.com/PDF_Files/expansion-joint-catalog.pdf)
  - b. Fabric Expansion Joint Catalog  
[http://www.usbellows.com/PDF\\_Files/usbellows\\_fabric\\_catalog\\_small.pdf](http://www.usbellows.com/PDF_Files/usbellows_fabric_catalog_small.pdf)
2. Webinar Recordings
  - a. Expansion Joints for Beginners  
[http://www.usbellows.com/news/webinar\\_v13.html](http://www.usbellows.com/news/webinar_v13.html)
  - b. U.S. Bellows 101: Expansion Joint Basics  
<http://www.usbellows.com/news/ej-us-bellows-101-webinar.html>
  - c. Fabric Expansion Joints

NOTE: Information contained in this class syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.



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<http://www.usbellows.com/news/ej-fabric-webinar.html>

d. U.S. Bellows Expansion Joints In-Depth

<http://www.usbellows.com/news/ej-in-depth-webinar.html>

3. FAQ's on Expansion Joints

<http://www.usbellows.com/faq/>

4. Technical Bulletins & Articles

<http://www.usbellows.com/literature/index.html>

## Part 2: Course Objectives

### **Learning Outcomes:**

Expansion Joint Course Learning Objectives

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

- Understand the thermal expansion of pipes and know the different types of piping system designer tools. Be able do the steps to acquire a metal bellows expansion joint and walk through an example of a U.S. Bellows job.
- Become familiar with metal expansion joints, types and applications, single bellows, multiple bellows and slip-type expansion joints. Learn the basics of anchors and guides in piping system design.
- Review the different types of expansion joints, including fabric and refractory-lines. Learn about bellows geometry, bellows instability, cycle life and metal bellows convolution parameters. Develop an understanding of related software and databases.
- Learn about fabric expansion joints more in-depth, along with the different types of materials and the importance of the belt details. Review the differences between metallic and fabric expansion joints.
- Overview expansion joint stress analysis and metallic bellows materials. Learn about bellows geometry more in-depth and the types of stresses on metal bellows. Understand the design considerations when designing expansion joints for the piping system.
- Know about the forces and moments on the piping systems due to spring and pressure forces of metal expansion joints. Go over equilibrium conditions, main anchors and anchor force calculations.
- Cover planning major turnarounds and emergency shutdowns. Review inspection criteria and turnaround procedures. Learn what happens during unscheduled maintenance and go over all the field services related to expansion joints in the piping system.
- Review the course conclusion and learn about U.S. Bellows Houston plant facilities. Review business concners, quality control and continuing education.

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## **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 – Why Expansion Joints  
This section serves as an introductory overview of expansion joints.
  - Thermal Expansion of pipes
  - Piping system designer tools
  - Steps to acquire a metal bellows expansion joint
  - A US Bellows example job
- Section #2: System Design: Anchors, Guides and Expansion Joints
  - Metal expansion joints
  - Types and applications
    - Single bellows
    - Multiple bellows
    - Slip type
- Section #3: Fabric Expansion Joints and Bellows Geometry
  - Refractory lined expansion joints
  - Metal bellows convolution parameters
  - Software and Databases
  - Bellows instability & cycle life
  - Fabric expansion joints



- Section #4: Fabric Expansion Joints
  - Metallic vs. Fabric
  - Fabric materials
  - Importance of the belt
- Section #5: Expansion Joint Stress Analysis

- Metallic bellows materials
- Metallic bellows geometry
- Type of stresses in metal bellows
- Design considerations

- Section #6: Forces and Movements

Forces and moments on piping systems due to spring and pressure forces of Metal Expansion Joints

- Equilibrium Conditions
- Main Anchors
- Anchor Force Calculations

- Section #7: Field Services

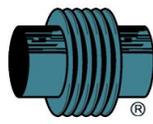
Planning major turnarounds and emergency shutdowns

- Inspection
- Turnarounds
- Unscheduled maintenance
- Field services

- Section #8: Course Conclusion

- Houston plant facilities
- Business concerns
- Quality control
- Course review – continuing education

## Part 4: Grading



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### 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 – Why Expansion Joints**  
 Quizzes throughout this section – all True / False  
 ✓ **10 Questions**  
 Totals 1/8 of 20% of final grade
- **Assignment 2 Description: Section #2 System Design – Anchors, Guides and Expansion Joints**  
 Quizzes throughout this section – all True / False  
 ✓ **14 Questions**  
 Totals 1/8 of 20% of final grade
- **Assignment 3 Description: Section #3 Fabric Expansion Joints and Bellows Geometry**  
 Quizzes throughout this section – all True/False  
 ✓ **15 Questions**  
 Totals 1/8 of 20% of final grade
- **Assignment 4 Description: Section #4 Fabric Expansion Joint Design**  
 Quizzes throughout this section – all True/False  
 ✓ **12 Questions**  
 Totals 1/8 of 20% of final grade
- **Assignment 5 Description: Section #5 Expansion Joint Stress Analysis**  
 Quizzes throughout this section – all True/False  
 ✓ **12 Questions**  
 Totals 1/8 of 20% of final grade
- **Assignment 6 Description: Section #6 Forces and Moments**  
 Quizzes throughout this section – all True/False  
 ✓ **15 Questions**  
 Totals 1/8 of 20% of final grade
- **Assignment 5 Description: Section #7 Field Services**  
 Quizzes throughout this section – all True/False  
 ✓ **15 Questions**  
 Totals 1/8 of 20% of final grade
- **Assignment 5 Description: Section #8 Course Conclusion**  
 Quizzes throughout this section – all True/False  
 ✓ **9 Questions**  
 Totals 1/8 of 20% of final grade

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- **Exam 1: Final test**  
20 questions – 5 multiple choice and 15 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.

**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 encouraged 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](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:

- Supported operating system (e.g. Windows/PC or Apple/MAC computer) 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](mailto:enews@pipingtech.com). All technical related questions should be submitted via [https://sso.teachable.com/secure/teachable\\_accounts/tickets/new#/](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 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.
- **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.