Steam System Engineering, Operations and Design Training
Two Day Program
(CEU Credits)

October 25th and 26th, 2022

at Cleaver Brooks "New Training Facility"

Milwaukee, WI Location

$ 580.00 per person

- All training materials
- In-depth training manual
- Lunch each day
- Contact: wendy.harwood@invenoeng.com for more information
- Or, call 239-289-4498

Cleaver Brooks and Inveno Engineering, LLC will be delivering an exciting two-day Steam System Engineering Design and Operation. The two-day course will provide the attendees with knowledge of steam safety, optimization, reliability, and energy efficiency.

Cleaver Brooks and Inveno Engineering, LLC uses a Steam Team Group Concept where the attendees work in teams of two or three people per training team. Our instructors will provide the knowledge and demonstrate the knowledge to the class using specifically designed "Steam System Training Prints". The training teams will work with steam training prints and complete tasks to exercise the acquired knowledge from the instructors.

The Steam Team Group Concept is to ensure maximized comprehension of the training course. The training course will provide of an overview of each subject that is listed in the course syllabus.

Our senior steam field engineering instructors are available at any time to go further in detail on any subject matter that the attendees would like to have further information or discussions.

The in-depth training manuals that the attendees will receive are written by leaders in steam system engineering, therefore providing the attendee with a tremendous reference book for the class and in the future on steam systems.

COURSE SYLLABUS:

Introductions

1.1. Steam Overview

1) General overview
2) How to calculate Btu usage
3) Understanding the vapor
4) Superheat
    a. Benefits
    b. Superheat production
5) **Tasks:**
    a. Equipment Btu calculations
    b. Understanding equipment steam requirements

1.2. Steam Tables

1) Using steam tables

1.3. Different Names and Terminology for Steam

1) What are the different names used for steam?
2) Knowing the terminology and its meaning

1.4. Flash Steam

1) Why flash occurs
2) Effects on the system
3) Calculating the flash percentage
4) **Tasks:**
    a. Using tables to determine the quantity of flash steam
    b. Calculations on energy losses when flash steam is not recovered

1.5. Flash Steam Recovery

1) Recovery system
2) How to manage flash steam generation

3) Different flash steam operating systems
4) When to recover and how to recover
    a. Advantages and disadvantages of each type of recovery system
5) Flash tank sizing
6) **Tasks:**
    a. Implementing a flash recovery system on a modulating system
    b. Implementing a flash recovery system on a non-modulating system

1.6. Steam quality

1) What is steam quality
2) Effects on the process operation and other steam components
3) How to quantify and test in the field
4) What are the calorimeters that are available for testing
5) What are the necessary steps to improve the steam quality
6) **Tasks:**
    a. Review steam quality testing procedures
    b. What are the testing points for steam quality

1.7. Boiler Combustion Testing Methods

1.8. Yearly Boiler Checks and Why

1.9. Deaerator Operation – Why it is Critical to the Steam System

1.10. Steam and Condensate Systems

1) Overview of the codes
2) Sizing a steam line properly
3) What are the acceptable steam velocities
4) Installation best practices for steam lines
    a. Connections (overview of each type)
    b. Condensate removal from steam lines
    c. Materials for the different steam systems
5) Overview of condensate line installation

6) What are the different types of condensate systems
7) How properly size a condensate line
8) **Tasks:**
    a. Steam line condensate removal
    b. Steam line air venting
    c. Sizing process steam lines and non-process steam lines
    d. Installation of condensate lines
    e. Sizing of condensate lines

1.11. Steam Valves

1) Overview of all valves used in steam
2) Operational design
3) Where to use what valve for what application
4) **Tasks:**
    a. Review and do CV calculations
    b. Selecting the correct valve arrangement
    c. Develop an installation detail
    a. Review different applications

1.12. Condensate Recovery Systems (Tanks and Pumping Systems)

1) Why return condensate
    a. Reduce emissions
    b. Optimization
    c. Reduction of energy
2) How to calculate the energy losses for failure to return condensate
3) Different condensate pump unit types
    a. Advantages and disadvantages
    b. Operation
    c. Sizing condensate tanks
4) Why is NPSH so critical
5) **Tasks:**
    a. Sizing a condensate pumping system
    b. Selecting the proper condensate tank unit for a system

c. Design of a condensate tank system
d. Sizing NPSH for the pumping units

1.13. Steam Trap Stations

1) What are the functions of the steam trap?
2) Types of steam traps
3) Steam trap operation
4) Selection process
5) Sizing process
6) **Tasks:**
    a. Selecting a steam trap for two different applications
    b. Sizing steam trap for the applications
    c. Testing methods

1.14. Waterhammer

1) Overview of waterhammer
2) Different causes of waterhammer
3) Solutions to waterhammer

1.15. Pressure Let Down Control Valves

1) Application in the steam system
2) Selection process
    a. Types of steam valves
    b. Turn down
3) Installation considerations
4) **Tasks:**
    a. Size a pressure let down station

1.14. Steam Leakage (Causes and Corrections)

1) Different steam leakage areas
2) Estimating the energy losses
3) Calculations on emissions

4) Root cause analysis
5) How to start a program
6) Things to review when analyzing
7) Methods to prevent steam leakage

1.15. Safety Valves

1) Types
2) Codes
3) Sizing and selection
4) Sizing for correct flows
5) **Tasks:**
    a. Safety valve placement for a steam system
    b. Size a safety valve for a process application

1.16. Standard Operating Procedures

1) Why are Standard Operating Procedures critical for a steam system
2) Proper steam system start-up and shut down procedures
3) What is the appropriate allocated time for a steam system startup
4) What are the necessary different steps
5) Why are warmup valves so important in a steam system SOP
6) **Tasks:**
    a. Write a start-up procedure for a steam line

1.17. Steam Balancing

1) Understanding the dynamics for steam balancing
2) How to develop a steam balance
3) Benefits of a steam balance
4) **Tasks**
    a. Balancing a steam system (training print)

1.18. Pressurized Condensate Systems

1.) What is a pressurized condensate system?

2.) Benefits

3.) Applying to the steam and condensate system

4.) Components necessary to implement

5.) Optimization benefits

6.) **Tasks:**

a. Reviewing training CAD prints and implement