

(ME#05) PIPING VIBRATION ANALYSIS & PRACTICAL ENGINEERING SOLUTIONS IN PROCESS PLANTS

Turning GOOD Engineers into GREAT Engineers!

COURSE OVERVIEW

This course provides a background on fundamental causes of piping vibration and describes how to identify sources of vibration. The course also describes rules of thumb and simplified methods for evaluating vibration severity, as well as methods of treatment. A wide variety of causes of vibration are covered in order to enable the participant to properly evaluate the variety of piping vibration problems that can occur in piping systems. The causes of vibration, where possible, are discussed with respect to very basic energy and momentum principles that enable the participant to understand what is happening with and to the piping system. This course provides a foundation of knowledge necessary for those responsible for assuring the mechanical integrity of existing piping systems, as well as those responsible for designing and constructing new piping systems.

WHO SHOULD ATTEND

This course directed towards engineers responsible for operating piping systems. However, designers of new piping systems will also find the broad coverage of potential vibration problems a time saving briefing on the variety of vibration problems that can occur in piping systems.

LEARNING APPROACH

Each session will be conducted in a lecture/discussion/problem solving format designed to provide intensive instruction and guidance on understanding Code requirements. The instructors will be available following each day's session to provide participants with further opportunity for discussion and consideration of specific problems.

AMONG INTERESTING TOPICS COVERED DURING THE COURSE

- **Mechanical Vibration**
 - Vibration Single Degree of Freedom System
 - Displacement, Velocity and Acceleration
 - Damping
 - Multiple Degrees of Freedom
 - Estimating Natural Frequencies of Piping
 - Acceptance Criteria
 - Types of Analyses
- **Acoustic Resonance**
 - Causes
 - Analysis Methods
 - API 618
 - Methods to Reduce Pressure Pulsations
 - Energy Institute Guidelines
- **High Frequency Vibration**
 - Causes, Examples, Acceptance Criteria and Treatment
- **Surge & Slug Flow**
 - Causes, Treatment and Examples
- **Other Water Hammer**
- **Reciprocating Pumps**
 - Pressure Pulsation
 - Piping Restraint Devices
- **Examples**
 - Energy Institute Guidelines
- **Other Sources of Vibration: Cavitations, vortex shedding, wind, chattering valves, relief valves, heat exchangers, flashing, earthquakes**
- **Vibration Screening Rules**
 - How long has it lasted?
 - How loud is it?
 - How fast is it moving?
 - How much is it moving?
- **Solutions to Vibration Problems**
 - Remove source
 - Protect piping
 - Eliminate resonance
 - Restrain piping
 - Strengthen weak points prone to vibration failure
- **Practical Examples**
 - Power Plant Water System
 - Pump Suction Piping
 - Cooling Water System
 - Furnace Outlet Line
 - Hydraulic Piping