PD539
Bolted Joints and Gasket Behavior

Day One

- Introduction to the Bolted Joint
  - Basic Concepts & Mechanics of Bolted Joints
  - Bolt Flange Joint as a Single Mechanical System
  - Importance of Distinguishing Between Bolt Load and Clamping Force
  - Bolting Strength, both Elastic and Plastic Properties
  - Stress Distribution within a Bolt
  - Introduction to Actual Versus Ideal Loadings on a Bolt
  - Combining Tensile and Shear Stresses, Both Ductile and Brittle Material
  - Threading Basics
- Properties Affecting In-service Conditions
  - Transient Loads
  - Effect of Changes in Elasticity
  - Clamping Force Stability
  - Nut Selection and Condition
  - High and Low Temperature Operation
- Stress and Strain Considerations:
  - Hook's Law and Understanding Spring Rate
  - Application of Spring Rate to Evaluate Bolt Stretch
  - Spring Rate(s) Inherent in the Gasketed, Bolted Flange Joint
  - Introduction to Bolt Loading Diagrams
  - Estimating Preload Variability
  - Understanding the Importance of Load Factor
- Gasket Behavior, Selection and Specification
  - Introduction to the Concept of PVRC Leak-Tightness Prediction
  - **R**oom **O**nly **T**emperature **T**esting, the Basis of a, G_b and G_s
  - Historical Perspective on the Evolution of Leak-Tightness Predictability
  - How to Evaluate the Leak Tightness Parameter, T_{Pmin}
  - The Meaning of Leak Tightness Class
  - Gasket Limits
  - Gasket Selection Criteria
  - Understanding Gasket Blowout and How to Prevent it

Day Two

- Introduction to Assembly and Clamping Force
  - How to Evaluate Torque, Short and Long Form Equations
  - Understand Nut Factor and its Potential Variability
  - Real-world Challenges to Getting and Maintaining Preload
  - Bolting Procedures and Why No-Nut-Movement can be so Important
  - Preload Methods; Hydraulic, Stretch, Turn-of nut and Ultrasonic
- ASME PCC-1 Guidelines
  - Scope
  - Assembly; Bolting Specialist Training Program
  - Conditional Assessment of Equipment; Damage and Alignment Requirements
  - Tightening Procedures
  - Important Terms
  - Record Keeping
- Understanding & Preventing Gasket Failure
  - Excessive Bolt Loading
  - Uneven Bolt Loading
  - Corrosion
  - Galling
  - Self-Loosening
  - Fatigue
  - Basic Cause Investigation
- Joint Calculation Methods
  - ASME Section VIII, Division 1, Appendix 2
  - EN 1591-1 Flange Analysis
  - Finite Element Analysis (FEA)
  - Importance of Component Elasticity in Creating Gasket Stress Distribution
  - Pressure Vessel Research Council Leak Tightness Evaluation and Use
  - ASME BFJ Leak-tightness Based Flange Design … future considerations