

# Fastening Technology and Bolted/Screwed Joint Design

## About the Seminar:

This two-day seminar was developed to give engineers and other technical personnel current specifications for, and a better understanding of, the complexities of mechanical joining with fasteners. Insufficient guidelines and outdated information are not adequately equipping engineers for real life design challenges. This can lead to catastrophic failures or costly over-designs. The Federal regulations (Fastener Quality Act) on these often safety critical design elements has caused a renewed focus on the proper use of fasteners. This seminar incorporates the most recent techniques and guidelines from both international and domestic engineering societies and research groups and provides attendees with immediately applicable knowledge.

## Who Should Attend:

Since most manufactured products involve the use of fasteners for assembly, this seminar is very beneficial to professionals working on design and development, maintenance, and procurement of fasteners and bolted interfaces. If you are involved in design engineering, manufacturing and assembly, standardization, testing, quality control, or otherwise involved with technical aspects of fasteners, this course is designed especially for you.

## Benefits of Attending

- ▶ Gain a better understanding of the bolted/screwed joint, elastic interactions and preload stress
- ▶ Understand loosening causalities
- ▶ Select proper tightening methods
- ▶ Calculate safety factors and limitations
- ▶ Select the optimal fasteners for the design
- ▶ Evaluate dissimilar materials for thermal expansion and galvanic properties
- ▶ Gain insights into materials, threads and product standards

## Concepts Covered

- ▶ Standards and specifications
- ▶ Material standards
- ▶ Fastener manufacturing
- ▶ Screw threads
- ▶ Corrosion and protection
- ▶ Quality
- ▶ Joint design
- ▶ Safety factors
- ▶ Tightening strategies
- ▶ Locking methods



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## Course Syllabus

### DAY 1

#### Standards and Specifications

- National and International Standards
- Load bearing fasteners – applications
- Fasteners for place-keeping, positioning
- Blind rivets, snap-fits, etc.
- Drive systems (ergonomics, space req., etc.)

#### Material Standards

- Material Groups – applications
- Heat treatment
- Mechanical properties, inch and metric standards
- Chemical compositions
- Marking requirements
- Corrosion resistant steels
- Thread engagements, blind holes

#### Fastener Manufacturing

- Cold and hot forming
- Machining and powder metallurgy

#### Screw Threads

- Definition (tolerances, fit, etc.)
- Inch standards
- Metric standards
- Mismatch potentials, inch/metric
- Thread gaging methods

#### Corrosion and Protection

- The mechanism of corrosion
- Material combinations
- Types of corrosion
- Plating and coating
- Hydrogen assisted cracking (embitterment)
- Environmental considerations

#### Quality

- Quality Assurance Standards
- AQL or In-Process Control
- Impact of the Fastener Quality Act
- Selecting a quality supplier

#### Joint Design

- Introduction and overview of approaches
- Preparation and design goals
- Design steps (suggested sequence)

### DAY 2

#### Joint Design (cont.)

- Joint types and load conditions
- Fastener (joint) Failure Facts
- Factors influencing joint design
- The highly stressed joint
- 5 basic rules for joint design
- Joint calculation approach
- Modeling the joint
- Balance of joint forces
- Developing a joint/force diagram
- Calculating elasticities, bolt/joint
- Force ratio and force introduction
- Work sheets for estimation of sizes, properties and friction coefficients
- Calculating embedment (force loss)
- Influence of torsional stresses
- Temperature influence on joints
- Design examples using manual or computer aided approaches

#### Safety Factors

- Preload stress
- External work load
- Fatigue resistance (endurance limit)
- Surface pressure allowance
- Transverse, shear and comb. loads
- Loosening
- Good and bad joints, a summary

#### Tightening Strategies

- Qualifying Joint integrity
- Tooling choices
- Auditing torque and tension
- Joint signature analysis
- Tension scatter with various tools
- Load control systems

#### Locking Methods

- Mechanism of loosening
- Effectiveness of locking devices
- Chemical locking
- Mechanical locking

#### Technical Communication

- SI Metric – units and usage
- Blueprints – projection methods
- ISO Tolerance System