Fundamentals of Structural Bolted Joint Design and Installation Training Topics

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Training Topics

Following is a summary of potential training topics that can be delivered to suit a company's or organization's specific requirements. Customization may include unique materials or conditions, particular problems, or other topics the client provides.

Course Introduction

- *Introductions.*
- *Primary Bolted Joint Application Types.*
- *References Standards.*

Structural Bolted Parts

- *Bolted parts.*
- *Holes.*

Threaded Fasteners[1]

- *Common thread and fastener terminology.*
- *Common head styles, thread points, and nut styles.*
- *Background to modern threads - the roles of Whitworth and Sellers and the development of the modern thread form.*
- *The basic profile of unified thread forms.*
- *Thread tolerance classes.*
- *Structural bolting components and assemblies.*

Strength of Threaded Fasteners[1]

- *The principles of bolt elongation, bolt stress, load.*
- *Yield, tensile strength, and proof load properties.*
- *Details of the common bolt and nut specifications and markings.*
- *Nut/bolt combinations, nut strength versus bolt strength.*
- *Relationships between bolt size, area, stress, bolt elongation, and load.*

Washers[1]

- *Washer purposes and requirements.*
- *Compressive Stress under Bolt Head & Nut Face.*
- *Explanation of compressive stress.*
- *The bolted joint 'stress cone'.*
- *Simplified equation to calculate compressive stress.*
- *The effect of the washer.*
- *Slotted joint plates.*
- *Demonstration of compressive yield failure and the effect of the washer.*

Fastener Finishes and Corrosion[1]

- *Background and corrosion mechanisms.*
- *Common corrosion protection methods.*
- *The galvanic series, barrier, and sacrificial protection.*
- *Common fastener coatings.*
- *Effect of the coating thickness on thread dimensions.*
- *Limits of coating thickness on the threads.*

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Structural Bolted Joint Types

- *Structural bolted joint types.*
- *Load types.*

Pretensioned Fasteners

- *Minimum Pretension.*
- *Methods of Pretension.*
  - *Turn-of-Nut.*
  - *Calibrated Wrench.*
  - *Tension-Control Bolt.*
  - *Direct-Tension-Indicator.*
  - *Pros and Cons of each Method.*
- *Pre-installation Verification.*
- *Inspection.*
- *Marking of Bolts.*

Pretensioning Demonstrations

- *Demonstration of Turn-of-Nut Pretensioning.*
- *Demonstration of Calibrated Wrench Pretensioning.*
- *Demonstration of Direct-Tension-Indicator Pretensioning.*

Tightening Procedures[1]

- *Problems associated with the tightening of the multi-bolt joint.*
- *Elastic interaction.*
- *Single pass tightening sequence.*
- *Two-pass and multi-pass tightening sequences.*
- *Tightening sequences for non-circular bolted joints.*
- *Tests investigating the effects of elastic interaction.*
- *Use of multiple tightening tools.*

Loads and Limit States

- *Load cases.*
- *Limit States in bolted joints.*

Work Problem

- *Bolted joint in shear and tension.*
- *Determine joint type.*
- *Determine applicable load case.*
- *Calculate limit states.*

Training Course Instructors

Breanna Veltkamp is an Instructor and Consulting Engineer specializing in bolted joints at Matrix Engineering with over 8 years of engineering and design experience. Her experience includes designing buildings and shipboard structures, including bolted and welded steel connections and aluminum balcony connections. She also has experience in investigating bolted joint failures. She received a Bachelor of Science in engineering from Dordt University.

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[1]Matrix is an approved provider of Bolt Science© Training.