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Introduction to Steel Weldment Design Training Topics

A training course delivered by Matrix Engineering Consultants.

Introduction to Steel Weldment Design

COURSE OVERVIEW

This course, presented over 1 1/2 days is designed to introduce engineers, designers and other technical professionals to the skills needed to produce robust, cost effective and manufacturable weldments. This course approaches weldment design through the lenses of engineering, manufacturing and business requirements. Interactive team-based breakout sessions bring light to design challenges which may be encountered during a product development cycle.

Note: This course blends fundamental design concepts and introduces concepts found in select welding standards (e.g. AWS D14.0 and BS 7608). The course is not intended to provide in depth information on any given standard.

TARGET AUDIENCE

This course was developed for engineers or technical staff tasked with the design or specification of steel weldments used in machinery such as off-highway equipment.

PREREQUISITES

This is an introductory technical course that includes equations which require algebraic solutions. Engineering fundamentals found in coursework such as: statics, strength of materials, materials science and fatigue will be discussed.

IN-PERSON OR ON-LINE LEARNING

Students may choose to attend in person or via a live online stream concurrent with the in-person training. The in-person session will be held in the training facilities at Matrix Engineering Consultants, 12986 Valley View Road, Eden Prairie, Minnesota 55344.

PROFESSIONAL DEVELOPMENT HOURS (PDHS)

The 1 1/2-day course is worth 10 PDHs.

Introduction to Steel Weldment Design

Module I: Introduction to Steel Weldments

- *Steel Weldment Advantages*
- *Design & Program Goals*
  - *Understanding the Customers*
  - *Product Program Types & Business Goals*
- *Weldment Functional Requirements*
  - *Space & Weight Constraints*
  - *Manufacturing & Assembly Goals*
  - *Quality Considerations*

Module II: Piece Part Design

- *Material Selection*
  - *Basic Steel Metallurgy*
  - *Impact on Fabrication*
  - *Physical Properties*
  - *Business Considerations*

- *Part Dimensions & Variability*
  - *Stock Material and Tolerances*
- *Part Design – Manufacturing Guidelines*
  - *Cutting Processes*
  - *Formed parts*
  - *Machining*
- *Fatigue and Stress Transition*

Module III: Welds and Welding

- *Welding Basics*
  - *Weld Terminology*
  - *Basic Weld Processes*
    - *SMAW*
    - *GMAW*
    - *GTAW (TIG)*
    - *FCAW*
- *Welding Professionals*
  - *People & the Knowledge they bring.*
- *Weld Basics*
  - *Weld Joints*
  - *Weld Types*
    - *Terminology*
    - *Geometry*
    - *Symbols*

        - *Selection- Which weld should be used?*
- *Weld Design Considerations*
    - *Accessibility*
    - *Position*
    - *Weld Distortion*
        - *Why Distortion Occurs*
        - *Methods to Control*
- *Models & Drawings*
    - *Clarity & Relaying Design Intent*
- *Weld Quality*
    - *What is a Weld Audit?*
    - *Using a Fillet Weld Gage*
    - *Basic Weld defects*

Module IV: Weldment Design Basics

- *Where to Begin - Selecting a Basis for Design*
- *Loads & Loading*
    - *When Loading Occurs*
    - *Determining Which Loads Affect Weldment*
    - *Determining Load Magnitude*
- *How to Begin*
    - *Space Constraints*
    - *Load Path*
    - *Section Property Basics*
    - *Initial Cross Section Sizing*
    - *Designing for:*
        - *Rigidity*
        - *Strength*
        - *Impact*
        - *Vibration*
        - *Fatigue Life*
- *Weldment Stress Transitions*
- *Weld Sizing*
    - *Practical Considerations in Weld Sizing*
        - *Maximum Fillet Weld Size*
        - *Minimum Fillet Weld Size*
        - *Weld Length Requirements*
    - *Sizing for Strength*
        - *Basics of Weld Failure*
        - *Static Loads*
        - *Fatigue*
        - *Weld Capacity*
            - *Treating Weld as a Line Design*

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Module V: Weldment Fatigue & Design Validation

- *What is Fatigue?*
- *Material Fatigue Life Curves*
- *How Welds Affect Fatigue in Weldments*
  - *Driving factors*
  - *Common initiation points*
- *Increasing Fatigue life through Design*
- *Overview of Weld Fatigue Life Estimation Methods*
    - *Determining Fatigue Load Cycles from Load History*
    - *Using Miner's Rule to Estimate Damage from a Load History*
- *Methods to Validate & Verify Weldment*
    - *What is Validation vs. Verification?*
    - *Weldment Verification Methods & Considerations*
    - *Understanding FEA /Test Results*
        - *Section Problem vs. Detail Problem*