Best Technology Solutions (BTS)

Welding Codes & Metallurgy (ASME Section IX) - Training program

Introduction:

This is an introductory course to provide the basic understanding of the proper use and interpretation of ASME Section IX - Welding Qualifications Code and its related ASME construction codes. To accomplish this objective, the course starts with a review of the ASME Sec. IX, followed by one day of studying the base metal metallurgy and welding metallurgy that ASME IX is based on. The fourth day covers the welding portions of related ASME construction codes (Section VIII-1, B31.1, and B31.3) and how ASME Sec. IX interacts with each, including the metallurgy previously covered through a series of workshops. It is also intended to prepare exam candidates for the ABSA Welding Examiner on Regulations and Codes and most parts covering properties and structures of metals, welding metallurgy and material specifications (i.e., steel manufacturing will not be covered).

This course focuses on imparting a comprehensive understanding of 'stated' and 'implied' requirements (i.e. Content and Intent) of the Welding Qualification code. The candidates would gain insight into ASME Section IX to facilitate interpreting, understanding and complying with the Code rules. The program covers a quick review of common welding processes, their merits and demerits, detailed methodology of Procedure and Performance Qualifications; step by-step explanation for preparation of WPS, PQR and WPQ records. The course covers detailed Road Maps for the review of welding qualifications for different Processes, and extensive case studies for application of the Road Map. Attendees will come away from this course with a clear understanding of the methodology of using Section IX and how code requirements are to be addressed. Emphasis will be placed on writing welding procedures, prepare welding specifications and welder qualifications.

Who Should Attend?

Inspectors, welders, welding supervisors, quality control personnel, technologists, and engineers involved with new welding procedure and welder qualifications for new fabrication, repairs, maintenance, and inspection for pressure vessel or piping. This course is also designed to assist ABSA Welding Examiner, Pressure Equipment Inspector and CSA W178.2 exam candidates

Course Objectives:

By the end of this course delegates will be able to:

- To introduce participants to the purpose and methodology of Welding Qualifications
- Learn how to understand, interpret, and comply with ASME Section IX requirements
- How to conduct Procedure and Welder Tests, and certification of welders
- To provide step-by step approach in preparation of WPS, PQR, and WPQ records
- To know Essential, Non-essential and Supplementary Essential Variables, and their use
- Review welding processes / variables and basic welding metallurgy
- Review, scrutinize and accept or reject sub-contractor's Welding procedures and Welders

Course Outline:

- Safety Codes Acts
    - Overview of Pressure Equipment Safety Regulations
    - Pressure Welders Regulation
- General Review to ASME IX
    - General requirements
    - Procedure qualifications
    - Performance qualifications
    - Welding data
    - Development of ASME Section IX
    - Overview of ASME Section IX
    - Relationship of Section IX to Other Codes
    - Brief review of Welding processes SMAW, SAW, GTAW, GMAW,
    - Brief review of Welding consumables, AWS and ASME classification
    - Requirements for Procedure Qualification
    - Requirement of performance qualification
    - Welding variables- Essential, non-essential, Supplementary
    - Documentation of PQR tests
- ASME Section IX - WPS, PQR, WPQ Reviews
    - Several workshops will be conducted to allow each participant to develop the required skills to review WPS, PQR, and WPQ documents

- Base Metal Metallurgy of Carbon and Alloy Steels

    - Basic carbon steel metallurgy (crystalline structures, grains, microstructures: ferrite, pearlite, banite, martensite)
    - Using the Fe-Fe3C phase diagram in practical terms
    - Common heat treatments for carbon steel and effect on mechanical properties (annealing, normalizing, quench and tempering)
    - Ductile to brittle behaviour of steels - grain size (ASTM No.), microstructures, low temperature notch toughness, and anisotropy
    - Alloying steels and their effects on hardenability and weldability
    - Material test reports and what they really mean

- Welding Metallurgy of Carbon and Alloy Steels

    - The various weld zones and metallurgical heat affected zones using fundamental principles of welding metallurgy
    - Use of carbon equivalence to predict weldability
    - Hydrogen assisted cracking related to welding (toe cracking, cold cracking, delayed cracking, HAZ cracking, and underbead cracking)
    - Preheating and postweld heat treat in practical terms to avoid cracking and improve weldability

- Base Metal and Filler Metal Specifications (ASME Section II Parts A and C)

    - Classification of steels - UNS, SAE, ASTM, ASME
    - ASME SA-106, SA-516, SA-333, SA-387, and SA-312
    - AWS classification of filler metals, SFA No., F No., and A No.
    - ASME SFA-5.1 and SFA-5.5

- Developing a WPS/PQR for ASME Sec. VIII-1, B31.1, B31.3
    - Each attendee will participate to write new construction and maintenance welding procedures in accordance with ASME Section VIII - Pressure Vessels, ASME B31.1 - Power Boilers and ASME B31.3 - Process Piping
    - These welding procedures will be reviewed and discussed in detail during the class