CONCEPT

Flange Joint Integrity: Bolt Tensioning, Torque and Leak-Free Assembly

29 March – 2 April 2027
London - Central London four-star



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Introduction:

Flange joint integrity decides whether a plant restarts cleanly after a shutdown or chases weeping gaskets for weeks. Most flanged joint leaks trace back to uneven bolt preload, a wrong or damaged gasket, misaligned faces, poor lubrication or a tightening method chosen without a target bolt stress. This Core Concept course gives maintenance and bolting staff a disciplined way to specify, tighten, record and verify bolted flange joints, using torque and hydraulic tensioning methods. Participants build a Bolted Joint Assembly Procedure and Joint Register Pack for joints at their own site.

Course Objectives:

- Diagnose the mechanical causes of a flanged joint leak from face condition, gasket state, bolt load scatter and alignment evidence
- Select flange facings, gasket types and stud bolt and nut grades that suit the pressure, temperature and fluid of a named joint
- Calculate a target bolt stress and convert it into a torque value using the nut factor, or into a tensioner pressure using a load transfer factor
- Apply ASME PCC-1 style tightening patterns, passes and checks to assemble a joint with torque wrenches or hydraulic bolt tensioners
- Prepare joint assembly procedures, tags and completion records and plan the leak test that closes each joint
- Run a joint management programme that ranks critical joints, controls bolting technician competence and tracks leak recurrence

Target Audience:

- Maintenance engineers responsible for shutdown and turnaround joint breaking and reinstatement
- Bolting supervisors responsible for torque and tensioning crews and the tools they use
- Joint integrity coordinators responsible for joint registers, tagging and completion records
- Mechanical inspectors responsible for verifying flange faces, gaskets and bolt condition before closure
- Operations and commissioning staff responsible for leak testing and restart acceptance of reinstated joints

Course Outline:

Day 1: Why Flanged Joints Leak and Current Joint Performance

- Bolted Flange Joint Mechanics: Bolt Preload, Gasket Seating Stress and Hydrostatic End Force
- Leak Path Map: Uneven Preload, Face Damage, Misalignment and Gasket Relaxation
- Flange Types to ASME B16.5: Weld Neck, Slip-On, Lap Joint, Socket Weld, Threaded and Blind
- Flange Facings: Raised Face, Flat Face and Ring Type Joint Grooves and Surface Finish Checks
- Site Leak History Review: Repeat Leakers, Shutdown Findings and Restart Losses

Day 2: Gaskets, Bolting Materials and Target Bolt Stress

- Gasket Selection Matrix: Sheet, Spiral Wound, Kammprofile and Ring Type Joint Gaskets
- Stud Bolt and Nut Grades, Coatings and Bolting for Low and High Temperature Service
- Target Bolt Stress Selection Between Gasket Crush, Flange Rotation and Bolt Yield Limits
- Gasket Creep Relaxation, Thermal Cycling and Vibration Effects on Retained Bolt Load
- Joint Data Sheet: Flange Rating, Bolt Count, Bolt Size and Gasket Dimensions

Day 3: Torque Tightening, Hydraulic Tensioning and Lubrication

- Torque-Tension Relationship, Thread and Nut Face Friction and Nut Factor K
- Lubricant and Anti-Seize Selection and Its Effect on Torque Scatter
- Hydraulic Torque Wrenches, Manual Torque Multipliers and Calibration Records
- Hydraulic Bolt Tensioners: Load Transfer Factor, Tool Coverage and Pressure Setting
- ASME PCC-1 Tightening Patterns, Pass Sequence and Final Check Pass

Day 4: Assembly Control, Leak Testing and Leak Troubleshooting

- Joint Assembly Procedure: Face Inspection, Alignment Tolerances and Gasket Installation Steps
- Joint Tagging, Quality Hold Points and Completion Record Sign-Off
- Leak Test Methods for Reinstated Joints: Service Test, Pressure Test and Bubble or Sniffer Checks
- Leak Troubleshooting Tree: Hot Bolting Limits, Re-Torque Decisions and Gasket Replacement
- Bolt Load Verification by Elongation Measurement and Ultrasonic Methods

Day 5: Joint Walkthrough and Joint Register Pack

- Inspection Walkthrough: Heat Exchanger Girth Flange Assembly Checked Against Procedure
- Inspection Walkthrough: Small-Bore and Valve Body Joints on a Hydrocarbon Line
- Critical Joint Ranking and Joint Management Programme Set-Up
- Bolting Technician Competence Matrix and Supervised Assessment Plan
- Bolted Joint Assembly Procedure and Joint Register Pack Peer Review

Skills You Will Gain:

- Flanged Joint Leak Diagnosis
- Gasket and Bolting Selection
- Target Bolt Stress Calculation
- Torque Value Derivation
- Hydraulic Bolt Tensioning
- Joint Assembly Record Keeping
- Critical Joint Ranking
- Bolting Crew Competence Planning

Why Attend This Course:

- Return with a Bolted Joint Assembly Procedure and Joint Register Pack ready for your next shutdown
- Cut repeat leaks at restart by setting each joint's bolt load from a calculated target rather than habit
- Choose between torque and hydraulic tensioning on evidence of accuracy, access and bolt size
- Compare bolting practice with staff from refining, petrochemicals, gas processing, power and water plants

Conclusion:

A flanged joint stays tight only when the right gasket, sound faces, correct bolting, a calculated bolt load and a controlled tightening sequence come together and are recorded. The course moves from leak mechanics and flange types, through gaskets, bolt grades and target bolt stress, to torque, lubrication, hydraulic tensioning, assembly control, leak testing and troubleshooting. The final day applies these checks on joint walkthroughs and completes the Bolted Joint Assembly Procedure and Joint Register Pack for use at the participant's plant.