



Mechanical Testing Laboratory Course: Tensile, Hardness, Charpy Impact and Fatigue of Metals



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Introduction:

Mechanical testing laboratory training in tensile, hardness, Charpy impact and fatigue of metals is a 5-day course for specimen preparation, testing and laboratory supervision teams that ends with a Mechanical Test Laboratory Operating Plan for a case organisation. Laboratories serving fabrication, oil and gas and construction lose client trust when coupons are machined out of tolerance, machines drift past verification or invalid results are released. Nominees already prepare specimens or run test machines and work through case studies built on test records, machine data and failed specimens. CoreConcept Training Center delivers this mechanical testing laboratory course.

Course Objectives:

- Plan specimen orientation, cut-out location and machining tolerances so that coupons represent the plate, pipe or forging under test
- Run tensile tests to ISO 6892-1 and ASTM E8/E8M with correct strain-rate control and calculate proof strength, tensile strength, elongation and reduction of area
- Select and perform Vickers, Brinell and Rockwell hardness tests and Charpy V-notch impact tests with correct conditioning, spacing and transfer time
- Verify force, extensometer, hardness and pendulum performance against ISO 7500-1, ASTM E4 and reference blocks and specimens before results are released
- Execute guided bend, fatigue and weld procedure qualification coupon tests and judge whether a failed specimen invalidates the result
- Estimate measurement uncertainty for tensile strength and absorbed energy and prepare test reports a client engineer can accept

Target Audience:

- Mechanical testing technicians responsible for running tensile, hardness, impact and bend tests on metal coupons
 - Specimen preparation and machining staff responsible for cutting, machining and measuring test pieces
 - Materials and QA/QC laboratory engineers responsible for reviewing test data and releasing results to clients
 - Laboratory section leads responsible for machine verification schedules, test throughput and retest decisions
 - Fabrication and construction QC staff responsible for witnessing qualification coupon tests at the laboratory
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Course Outline:

Day 1: Test Requests, Specimen Preparation and Laboratory Current State

- Destructive Test Request Review Against Material Specifications and Codes
- Specimen Orientation and Cut-Out Plans for Plate and Pipe
- Specimen Machining Tolerances, Surface Finish and Dimensional Measurement Records
- Electromechanical, Servo-Hydraulic and Pendulum Testing Machine Configurations
- Laboratory Workload Current-State Review Using Test Request Logs

Day 2: Test Method Standards and Machine Verification

- ISO 6892-1 and ASTM E8/E8M Tensile Method Requirements Compared
- ISO 148-1 and ASTM E23 Charpy Pendulum Test Requirements
- ISO 6506, ISO 6508 and ISO 6507-1 Hardness Scale Selection
- ISO 7500-1 and ASTM E4 Force Verification of Testing Machines
- Extensometer Classes, Hardness Reference Blocks and Pendulum Verification Specimens

Day 3: Running Tensile, Hardness, Impact and Bend Tests

- Tensile Test Execution With Strain-Rate Control and Extensometer Removal
- Proof Strength, Tensile Strength, Elongation and Reduction of Area Calculation
- Vickers, Brinell and Rockwell Indentation With Spacing and Thickness Checks
- Charpy V-Notch Specimen Conditioning, Transfer Time and Absorbed Energy
- Guided Bend Testing With Mandrel Selection and Bend Orientation

Day 4: Fatigue Testing, Weld Qualification Coupons and Invalid Results

- Load-Controlled Fatigue Coupon Testing With S-N Curves and Run-Out
- Fatigue Crack Growth Rate Testing With CT and SENT Specimens
- Weld Procedure Qualification Coupons for Transverse Tensile, Macro and Hardness
- Charpy Notch Positions in Weld Metal and Heat-Affected Zone
- Measurement Uncertainty Budgets for Tensile Strength and Absorbed Energy

Day 5: Case Study: Mechanical Test Laboratory Operating Plan

- Case Organisation Test Request Pack From Fabrication and Construction Clients
 - Failed Specimen Review With Invalid Test and Retest Decisions
 - Test Report Content for Tensile, Impact and Hardness Results
 - Machine Verification Calendar and Specimen Throughput Capacity Planning
 - Mechanical Test Laboratory Operating Plan Completion and Peer Defence
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Skills You Will Gain:

- Specimen Cut-Out Planning
- Coupon Machining Control
- Tensile Property Calculation
- Hardness Scale Selection
- Impact Specimen Conditioning
- Testing Machine Verification
- Fatigue Test Setup
- Test Uncertainty Estimation

Why Attend This Course:

- Deliver a Mechanical Test Laboratory Operating Plan for a case organisation to the laboratory manager and the QA/QC lead who sign off results
- Decide when a broken-outside-gauge tensile piece, a mis-notched Charpy bar or an edge-close indent must be retested rather than reported
- Prevent recut coupons, rejected qualification records and client disputes caused by unverified machines or out-of-tolerance specimens
- Coach fellow technicians on strain-rate settings, conditioning transfer times, indent spacing and verification checks at the test machine

Conclusion:

Back at the laboratory, the participant presents the Mechanical Test Laboratory Operating Plan to the laboratory manager, the QA/QC lead and the section leads for tensile, hardness and impact testing. They use it to decide machine verification intervals, specimen machining tolerances, retest rules and the staffing needed for the expected coupon workload. After the first month of operation under the plan, the laboratory should review retest rates, verification findings, report corrections and turnaround for weld qualification coupons, then adjust the plan.

Frequently Asked Questions FAQ:

What should participants know before the mechanical testing laboratory course on tensile, hardness, Charpy impact and fatigue of metals?

Participants should already prepare specimens, operate test machines or review test results for metals. Bringing anonymised test requests, a sample tensile or Charpy report and the laboratory's machine verification records helps them apply the case study work to their own laboratory.

How does a mechanical testing laboratory course differ from a metallurgy or laboratory management system course?

It concentrates on test execution at the machine: specimen machining, tensile, hardness, impact, bend and fatigue methods, machine verification, uncertainty and reporting. Metallurgy courses explain why metals behave as they do, and management system courses cover the documented system that surrounds every laboratory activity.

Why does the mechanical testing laboratory verify tensile and impact machines between calibrations?

A force cell, extensometer or pendulum can drift between external verifications. Intermediate checks with reference blocks, verification specimens and force proving devices show the machine is still within its class, so results released since the last check remain defensible.

What do participants take back from the mechanical testing laboratory course?

Participants take back a Mechanical Test Laboratory Operating Plan for a case organisation, plus a specimen cut-out and machining checklist, a retest decision table, a machine verification calendar and an uncertainty worksheet for tensile strength and Charpy absorbed energy.
