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COURSE BROCHURE

Material Strength Analysis for Machine Component Repairs Training Course

7 – 11 June 2027
Madrid

jupiterprime.uk

info@jupiterprime.uk

Registered in the United Kingdom and Saudi Arabia

Material Strength Analysis for Machine Component Repairs Training Course

Ref: 1664_61018 **Date:** 7 – 11 June 2027 **Location:** Madrid **Fees:** 6200 GBP

Material Strength Analysis for Machine Component Repairs is a 1-week training course for mechanical and maintenance engineers who must judge whether a cracked shaft, worn bracket or thinned casing can be repaired, re-rated or must be replaced, producing a component repair strength calculation file. Longer asset lives and scarce spare parts push more repair decisions onto site engineers. Jupiter Prime Training runs this course to give those decisions sound stress arithmetic.

Why Material Strength Analysis for Machine Component Repairs Matters Now

Three pressures shape this subject: owners extending plant life well beyond original design intent, long lead times for forged and cast replacement parts, and repair contractors proposing weld build-up or sleeving nobody has checked. A site that sizes repairs with stress, fatigue and fracture reasoning returns parts to service with known margins; one that relies on habit sees repeat cracking and unplanned outages. The course rests on classical strength of materials, the S-N fatigue approach, Goodman mean-stress correction, linear elastic fracture mechanics LEFM and Larson-Miller creep parameters.

Who Gains Most from Material Strength Analysis for Machine Component Repairs

- Engineers approving repair methods for shafts, couplings and housings
- Specialists deciding whether a cracked part runs, is repaired or is scrapped
- Machine shop engineers specifying weld build-up, sleeving and machining limits
- Engineers re-rating components after a change of duty or speed
- Staff reviewing contractor repair proposals and calculation packs

A maintenance department gains most when its rotating equipment, machine shop and reliability engineers attend together and agree one method for checking repair margins.

Material Strength Analysis for Machine Component Repairs Capabilities

Participants leave able to put numbers behind every repair, re-rate or scrap call on a loaded machine part.

- Calculate bending, torsional and combined stresses in shafts and pins — repair approval
- Apply stress concentration factors at keyways, fillets and holes — redesign of repaired features
- Assess fatigue life with S-N curves and Goodman correction — run-or-replace decisions
- Test crack tolerance using fracture toughness and critical crack size — inspection intervals
- Weigh creep damage in hot components with Larson-Miller estimates — remaining life planning

- Specify safety factors and acceptance limits for repaired parts — machine shop and contractors

Key Material Strength Analysis for Machine Component Repairs Terms

- Yield strength — the stress at which a metal begins to deform permanently and no longer returns to its original shape.
- Stress concentration factor — the ratio of peak local stress at a notch, hole or fillet to the nominal stress nearby.
- Endurance limit — the stress amplitude below which a steel part can, in principle, withstand unlimited load cycles.
- Goodman diagram — a chart combining mean and alternating stress to judge whether a fluctuating load stays within fatigue limits.
- Fracture toughness — a material's resistance to the growth of an existing crack under load.
- Creep — slow, time-dependent deformation of metal held under stress at high temperature.

Material Strength Analysis for Machine Component Repairs Day by Day

Day 1: Loads, Stresses and Material Behaviour

- Stress-Strain Curves — Reading Yield, Tensile and Ductility Values
- Free Body Diagrams — Tracing Loads Through Shafts and Supports
- Axial, Bending and Torsional Stress — Sizing Simple Machine Members
- Combined Stress With Von Mises Criterion — Judging Ductile Part Yielding
- Material Certificates — Checking Grade and Properties Before a Repair

Day 2: Notches and Stress Raisers

- Stress Concentration Factor Charts — Rating Keyways, Fillets and Holes
- Shaft Shoulder and Fillet Redesign — Lowering Peak Stress After Repair
- Interference Fit and Press Fit Stresses — Sizing Sleeves and Hubs
- Bolted Joint Preload — Preventing Loosening and Thread Failure
- Weld Build-Up Effects — Judging Residual Stress and Heat-Affected Zones

Day 3: Fatigue of Rotating and Cyclic Parts

- S-N Curves and Endurance Limits — Estimating Cycles to Failure
- Goodman Mean-Stress Correction — Checking Parts Under Fluctuating Loads
- Miner's Rule Damage Summation — Combining Variable Duty Cycles
- Surface Finish and Size Factors — Correcting Laboratory Fatigue Data
- Fatigue Fracture Surface Reading — Locating Origin and Crack Growth Direction

Day 4: Cracks, Fracture and Hot Service

- Linear Elastic Fracture Mechanics — Finding Critical Crack Size for Parts
- Paris Law Crack Growth — Setting Inspection Intervals for Known Cracks
- Brittle Fracture and Low-Temperature Toughness — Screening Older Steels
- Larson-Miller Creep Estimates — Judging Remaining Life of Hot Components
- Repair, Re-Rate or Replace Logic — Choosing the Least-Risk Outcome

Day 5: Practising the Component Repair Strength Calculation File

- Cracked Shaft Case — Applying Stress Concentration and Fatigue Checks
- Pump Casing Thinning Case — Applying Combined Stress and Safety Factors
- Hot Bolt Case — Applying Creep and Preload Calculations Together
- Contractor Repair Proposal Review — Testing Assumptions and Acceptance Limits
- Component Repair Strength Calculation File — Recording Loads, Margins and Verdict

Applying Material Strength Analysis for Machine Component Repairs After the Course

- Recheck the fatigue margin of one recently repaired shaft using S-N data and the Goodman correction.
- Build a standard calculation sheet for reviewing contractor weld build-up and sleeving proposals.

Material Strength Analysis for Machine Component Repairs Questions FAQ

What is material strength analysis for machine component repairs, and why does it matter now?

It is the use of stress, fatigue, fracture and creep calculations to decide how a damaged machine part is repaired or replaced. It matters now because plants run longer and spare parts take longer to arrive.

Which roles gain most from material strength analysis for machine component repairs?

Mechanical, rotating equipment and machine shop engineers who approve or specify repairs gain most. Examples come from water pumping stations and cement plant drives.

How does material strength analysis for machine component repairs differ from a metallurgy course?

It centres on calculating loads, stresses and margins for a specific repair. A metallurgy course explains why metals crack and corrode.

What do you bring back from material strength analysis for machine component repairs?

You bring back worked calculation sheets for shafts, casings and bolts, ready to reuse on your own repair decisions.

Material Strength Analysis for Machine Component Repairs: The Way Forward

The component repair strength calculation file records loads, stress raisers, fatigue and fracture margins and the final verdict for each repaired part. Its first use is approving or rejecting the next contractor repair proposal. Machine shop and reliability engineers share it, and after a repaired part has run for a season its inspection results deserve comparison with the predicted margins.