CONCEPT

Reverse Engineering of Spare Parts: 3D Scanning, CAD Reconstruction and Qualification

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Introduction:

Reverse engineering of spare parts becomes urgent when an original manufacturer discontinues a component, quotes lead times longer than the plant can tolerate, or no longer holds drawings for equipment still in service. Copying a worn sample without method produces parts that fit poorly, fail early or expose the owner to warranty and ownership disputes. This Core Concept course trains engineers to select candidate parts, capture geometry with CMM and 3D scanning, identify materials, rebuild CAD models and drawings, choose a manufacturing route and qualify the first article. Participants produce a Reverse Engineering Part Dossier.

Course Objectives:

- Rank spare parts for reverse engineering by criticality, obsolescence, lead time and total cost, and record the case in a feasibility scorecard
- Capture part geometry with manual gauges, coordinate measuring machines and 3D scanners, and turn the raw point cloud into a clean mesh
- Identify the material of a sample part from hardness, chemical composition and microstructure evidence and specify an equivalent grade
- Rebuild a parametric CAD model and production drawing with tolerances, fits and surface finish derived from the mating assembly
- Select a manufacturing route and screen intellectual property and warranty risks before a replacement part is ordered
- Qualify a reproduced part through first article inspection, field trial and an engineering approval workflow

Target Audience:

- Maintenance engineers who restore equipment when original replacement parts are unavailable or late
- Reliability engineers who investigate repeat failures and specify improved replacement components
- Materials and inspection engineers who verify the grade, hardness and heat treatment of supplied parts
- Procurement and supply engineers who source spare parts from new or local manufacturers
- Engineers in parts localisation teams who move imported spares to domestic workshops and foundries
- Workshop and design engineers who prepare drawings and machining instructions for replacement parts

Course Outline:

Day 1: Candidate Part Selection and the Reverse Engineering Business Case

- Spare Parts Criticality Ranking Matrix: Consequence of Failure and Stock-Out Impact
- Obsolescence Screening: Discontinued Components and Last-Time-Buy Signals
- Lead Time and Total Cost Comparison: Original Supply Versus Reproduced Part
- Sample Condition Assessment: Worn, Damaged and Deformed Reference Parts
- Candidate Part Register and Reverse Engineering Feasibility Scorecard

Day 2: Geometry Capture with Gauges, CMM and 3D Scanning

- Manual Metrology Toolkit: Calipers, Micrometers, Bore Gauges, Thread and Radius Gauges
- Coordinate Measuring Machine Probing Strategy for Datums, Bores and Profiles
- Laser Triangulation Versus Structured-Light Scanning: Accuracy, Reach and Surface Preparation
- Industrial CT Scanning for Internal Passages and Hidden Geometry
- Point Cloud Cleaning, Alignment and Polygon Mesh Generation

Day 3: Material Identification and CAD Reconstruction

- Hardness Test Selection: Rockwell, Brinell and Vickers Readings on Sample Parts
- Chemical Composition by Portable XRF and Optical Emission Spectrometry
- Microstructure and Heat Treatment Indicators at Overview Level
- Design Intent Recovery: Analytic Surfaces, NURBS and Boundary-Representation Solids
- Hybrid Modelling of Cast and Machined Features with Wear Compensation

Day 4: Tolerances, Manufacturing Routes and Ownership Risks

- Tolerance Assignment from Mating Parts: Clearance, Transition and Interference Fits
- Surface Finish Specification: Roughness Values for Sealing, Bearing and Sliding Surfaces
- Manufacturing Route Selection Matrix: Machining, Casting, Forging and Additive Manufacturing
- Intellectual Property Screening: Patents, Design Rights, Trade Secrets and Licence Terms
- Warranty and Liability Exposure When Fitting Non-Original Replacement Parts

Day 5: Part Walkthroughs, Qualification and the Part Dossier

- Pump Impeller Walkthrough: Scan Data, Material Result and Route Decision
- Gearbox Shaft Walkthrough: First Article Inspection Report on SAE AS9102 Forms
- Valve Trim Field Trial Plan with Engineering Approval and Cataloguing Workflow
- Local Spare-Parts Programme Roadmap: Supplier Capability Audit and Part Family Waves
- Reverse Engineering Part Dossier Build and Peer Review

Skills You Will Gain:

- Spare Parts Criticality Ranking
- 3D Scan Data Processing
- Dimensional Measurement Planning
- Material Grade Identification
- CAD Model Reconstruction
- Fits and Surface Finish Specification
- Manufacturing Route Selection
- First Article Qualification

Why Attend This Course:

- Return with a Reverse Engineering Part Dossier built on a real replacement part from your own plant
- Cut the downtime caused by discontinued or long-lead spare parts with a repeatable reproduction method
- Challenge workshops and suppliers on scan accuracy, material equivalence and drawing tolerances before parts are fitted
- Compare reproduction and localisation practice with peers from oil and gas, power, water, mining and manufacturing plants

Conclusion:

A reproduced spare part is only as reliable as the evidence behind it: a sound selection case, accurate geometry, a confirmed material, a drawing with realistic fits and finishes, and a qualified first article. The five days move from candidate selection and geometry capture through material identification and CAD reconstruction to tolerances, manufacturing routes and ownership risks. The final day applies the method to impeller, shaft and valve trim walkthroughs and closes with a Reverse Engineering Part Dossier ready for the next localisation review.