



Consulting and Training | Reach New Heights

Course Name

Mechanical Failure Analysis & Engineering Investigation

Sector Name

Mechanical Engineering

Document Type

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Mechanical Failure Analysis & Engineering Investigation

Course Introduction

Mechanical components rarely fail without leaving evidence behind. Fracture surfaces, wear patterns, deformation, discoloration, material loss, overheating, corrosion, and changes in component geometry can reveal how failure developed. However, when investigation begins with assumptions or focuses only on the visibly damaged part, important evidence can be lost, and the organization may correct the consequence rather than the mechanism that produced it.

Boost Consulting & Training offers this course to develop a practical engineering approach to investigating mechanical failures. Participants learn how to preserve and examine failure evidence, reconstruct operating conditions, distinguish different damage mechanisms, interpret fracture and wear characteristics, evaluate material and loading influences, and test competing failure explanations. The course focuses on building conclusions from physical and operational evidence rather than assigning causes prematurely.

The **main concept of this course** is to reconstruct how a mechanical component failed from the evidence it leaves behind

and use that understanding to support technically justified corrective action.

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Target Audience

- ✓ Mechanical and equipment engineers
- ✓ Plant and technical engineers
- ✓ Mechanical integrity and inspection professionals
- ✓ Engineers involved in equipment failure investigations

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Mechanical Failure Analysis & Engineering Investigation

Learning Objectives

- ✓ Apply a structured engineering process to mechanical failure investigations.
- ✓ Preserve and document physical evidence before it is altered or lost.
- ✓ Distinguish between failure symptoms, damage mechanisms, contributing factors, and underlying causes.
- ✓ Recognize common fracture, fatigue, wear, deformation, and overheating characteristics.
- ✓ Evaluate the influence of materials, loading, manufacturing, installation, and operating conditions.
- ✓ Use equipment history and physical evidence to develop credible failure hypotheses.
- ✓ Test competing explanations and determine when additional technical analysis is required.
- ✓ Develop engineering recommendations that address the identified failure mechanism.

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Mechanical Failure Analysis & Engineering Investigation

Course Outline

✓ Day 01

Starting the Mechanical Investigation

Preserving Failure Evidence

- ✓ Secure failed components and relevant evidence before cleaning, repair, or disposal.
- ✓ Document component position, damage location, operating state, and surrounding conditions.
- ✓ Identify operating records, drawings, photographs, samples, and history required for investigation.

Reconstructing the Failure Event

- ✓ Establish what happened before, during, and immediately after the failure.
- ✓ Separate verified observations from assumptions and second-hand explanations.
- ✓ Build a **Mechanical Failure Timeline** from incomplete field evidence.

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Course Outline

✓ Day 02

Reading Fracture and Deformation Evidence

Understanding Mechanical Fracture

- ✓ Distinguish ductile, brittle, fatigue, and overload-related fracture behavior.
- ✓ Examine fracture appearance and progression for evidence of failure development.
- ✓ Identify possible initiation areas without jumping prematurely to a root cause.

Investigating Loading and Deformation

- ✓ Evaluate bending, torsion, tension, compression, impact, and combined loading.
- ✓ Recognize permanent deformation and distortion as evidence of abnormal mechanical conditions.
- ✓ Complete a **Fracture Evidence Investigation** using failed-component scenarios.

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Course Outline

✓ Day 03

Investigating Wear and Surface Damage

Recognizing Wear Mechanisms

- ✓ Distinguish adhesive, abrasive, erosive, fretting, and other common wear patterns.
- ✓ Connect surface damage with motion, contact, loading, lubrication, and contamination.
- ✓ Determine whether observed wear is the initiating mechanism or secondary damage.

Evaluating Thermal and Surface Deterioration

- ✓ Identify evidence of overheating, thermal distortion, scoring, discoloration, and material degradation.
- ✓ Examine how friction, lubrication loss, operating temperature, and abnormal loading can interact.
- ✓ Conduct a **Mechanical Damage Pattern Analysis** using multiple physical evidence sets.

Mechanical Failure Analysis & Engineering Investigation

Course Outline

✓ Day 04

Connecting Component Damage with Its Causes

Evaluating Material and Manufacturing Factors

- ✓ Examine material selection, properties, heat treatment, geometry, and manufacturing condition.
- ✓ Consider defects and stress concentrations without assuming that every imperfection caused the failure.
- ✓ Determine when laboratory or specialist material analysis is required.

Testing Competing Failure Hypotheses

- ✓ Develop possible explanations from physical, operational, and historical evidence.
- ✓ Test each hypothesis against facts that should be present if the explanation is correct.
- ✓ Run an **Engineering Investigation Challenge** to eliminate unsupported causes and identify the strongest failure scenario.

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Course Outline

✓ Day 05

Converting Evidence into Engineering Action

Establishing the Failure Mechanism

- ✓ Connect initiation, progression, final damage, and contributing conditions into a coherent failure sequence.
- ✓ Distinguish the physical failure mechanism from organizational or process contributors.
- ✓ Assess confidence in conclusions and clearly identify unresolved uncertainties.

Developing Defensible Engineering Recommendations

- ✓ Select design, material, operating, installation, or technical actions that address the verified mechanism.
- ✓ Avoid recommendations that simply replace the failed component without preventing recurrence.
- ✓ Complete a **Mechanical Failure Investigation Case** from initial evidence through failure reconstruction, technical conclusion, and recommended engineering action.

Mechanical Failure Analysis & Engineering Investigation

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
Dec. 7, 2026	Dec. 11, 2026	5 days	4250.00 \$	UAE , Dubai

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