QUEST
Professional Center

PROFESSIONAL TRAINING COURSE

Course No. 2034

Centrifugal Pumps Operation, Maintenance & Reliability Training Course

MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION
5 Days

DELIVERY
Classroom

Course Overview

The Centrifugal Pumps Operation, Maintenance & Reliability Training Course provides a comprehensive and practical framework for the operation, maintenance, troubleshooting, and reliability improvement of centrifugal pumps used across industrial and process facilities. The programme is designed to strengthen participants' ability to operate pumping systems efficiently, identify abnormal conditions, and implement maintenance practices that improve equipment availability and service life.

The course examines the operating principles, construction, performance characteristics, and application requirements of centrifugal pumps, including impellers, casings, shafts, bearings, mechanical seals, wear rings, couplings, baseplates, and auxiliary systems. Participants will understand pump curves, system characteristics, flow, head, pressure, efficiency, power consumption, and operating points.

Particular emphasis is placed on common pump problems such as cavitation, insufficient flow or pressure, vibration, excessive bearing temperature, seal leakage, impeller damage, wear, misalignment, imbalance, recirculation, and hydraulic instability. Participants will learn to combine operating data, inspection findings, vibration measurements, maintenance history, and process conditions to identify failure causes and determine appropriate corrective actions.

The programme also covers preventive and predictive maintenance, condition monitoring, alignment, lubrication, mechanical seals, bearings, performance testing, spare parts, maintenance planning, and reliability improvement. Practical exercises and case studies enable participants to develop effective strategies for maximizing centrifugal pump reliability, reducing unplanned downtime, and improving lifecycle performance.

Objectives

- By the end of this training course, participants will be able to:
- Analyze the operating principles and construction of centrifugal pumps.
- Evaluate pump performance using flow, head, pressure, efficiency, and power parameters.
- Assess pump operating conditions against system requirements.
- Identify common hydraulic and mechanical pump failure mechanisms.

- Diagnose cavitation, recirculation, vibration, and hydraulic instability.
- Evaluate the condition of bearings, mechanical seals, shafts, couplings, and impellers.
- Analyze the causes of abnormal vibration and pump performance deterioration.
- Apply appropriate pump alignment and balancing principles.
- Evaluate lubrication requirements for pump bearings and associated components.
- Develop preventive and predictive maintenance strategies for centrifugal pumps.
- Apply condition monitoring techniques to assess pump health.
- Diagnose recurring pump failures using systematic troubleshooting methods.
- Optimize pump maintenance intervals and intervention priorities.
- Evaluate pump repair, overhaul, and replacement requirements.
- Establish reliability and performance indicators for centrifugal pump systems.
- Develop an integrated centrifugal pump operation, maintenance, and reliability strategy.

Who Should Attend

This course is designed for mechanical engineers, rotating equipment engineers, maintenance engineers, reliability engineers, pump specialists, maintenance managers, and equipment engineers responsible for centrifugal pump operation, maintenance, and reliability.

It is also suitable for operations engineers, maintenance planners, condition monitoring specialists, vibration analysts, lubrication specialists, inspection engineers, supervisors, technicians, and technical personnel involved in pump troubleshooting and maintenance activities.

The programme is particularly relevant to professionals working in oil and gas, refineries, petrochemicals, power generation, water and wastewater, utilities, chemical processing, manufacturing, mining, marine operations, and other process industries where centrifugal pumps are critical to production.

Learning Outcomes

- Upon completion of the course, participants will be able to:
- Explain centrifugal pump operating principles and major component functions.
- Interpret pump performance curves and determine appropriate operating points.
- Assess the relationship between pump characteristics and system requirements.
- Identify hydraulic and mechanical causes of pump performance problems.
- Diagnose cavitation and determine its contributing factors.
- Analyze vibration patterns associated with centrifugal pump faults.
- Assess the condition of impellers, shafts, bearings, seals, and couplings.
- Identify causes of mechanical seal leakage and premature component failure.
- Evaluate lubrication practices and bearing operating conditions.
- Apply effective pump alignment and installation practices.
- Develop condition monitoring programmes for critical centrifugal pumps.
- Apply structured troubleshooting methods to recurring pump failures.
- Determine appropriate preventive, predictive, and corrective maintenance actions.
- Optimize maintenance planning and pump lifecycle performance.
- Establish pump reliability, availability, and maintenance performance measures.
- Prepare a comprehensive operation, maintenance, and reliability improvement plan for centrifugal pumps.

Course Outline

DAY 01

Centrifugal Pump Fundamentals, Operation and Performance

- Principles of centrifugal pumping
- Pump types and industrial applications
- Pump construction and major components
- Impellers, casings, shafts, bearings, and mechanical seals
- Pump curves and system curves
- Flow, head, pressure, efficiency, and power

DAY 01 — CONTINUED

- Best efficiency point and operating range
- Series and parallel pump operation
- Pump operating conditions and process requirements

PRACTICAL APPLICATION

Evaluating centrifugal pump performance and operating conditions

DAY 02

Pump Maintenance and Component Reliability

- Centrifugal pump maintenance strategies
- Preventive and predictive maintenance
- Inspection of impellers and casings
- Bearings and bearing reliability
- Mechanical seals and packing systems
- Couplings and shaft condition
- Lubrication requirements and practices
- Wear rings and internal clearances
- Installation and maintenance quality

PRACTICAL APPLICATION

Developing a maintenance programme for a critical centrifugal pump

DAY 03

Pump Troubleshooting and Failure Diagnosis

- Systematic pump troubleshooting methodology
- Cavitation and suction-side problems
- Insufficient flow and low discharge pressure
- Excessive vibration and noise
- Pump imbalance and shaft misalignment

DAY 03 — CONTINUED

- Bearing overheating and premature failure
- Mechanical seal leakage
- Impeller erosion, corrosion, and damage
- Recirculation and hydraulic instability

PRACTICAL APPLICATION

Diagnosing a complex centrifugal pump failure

DAY 04

Condition Monitoring, Reliability and Performance Improvement

- Pump condition monitoring principles
- Vibration measurement and analysis
- Temperature and lubrication monitoring
- Pressure, flow, and performance monitoring
- Early detection of pump degradation
- Failure trend and maintenance history analysis
- Reliability-centered maintenance for centrifugal pumps
- Maintenance interval optimization
- Spare parts and critical component management

PRACTICAL APPLICATION

Developing a condition monitoring and reliability improvement programme

DAY 05

Advanced Pump Reliability and Maintenance Management

- Root cause analysis of recurring pump failures
- Pump performance testing and verification
- Reliability and availability improvement

DAY 05 — CONTINUED

- Maintenance cost and lifecycle analysis
- Repair, overhaul, and replacement decisions
- Corrective and preventive action management
- Reliability and maintenance performance indicators
- Pump lifecycle management
- Continuous improvement and maintenance optimization
- Final Integrated Workshop: Developing a comprehensive Centrifugal Pump Operation, Maintenance & Reliability Strategy for a critical pumping system

Register or Request More Information

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