
Theory and Practical Application of Pump Technology

Course No. 820

FOR WHOM INTENDED This course is intended for personnel involved in specifying, selecting, purchasing or using pumps. Degreed engineers whose primary training is not in this field will benefit, as will technicians, quality assurance inspectors and manufacturing engineers. Course 820 will also benefit managers and supervisors in charge of these functions.

BRIEF DESCRIPTION OF COURSE The course commences by introducing pump types and parameters, then covers cavitation and hydraulic phenomena. Centrifugal pumps are covered in detail, followed by pump operation and performance curves, pump operation and mechanical issues and pump seals. The instructor addresses bearing problems, lubrication and failure analysis before moving on to pump imbalance, alignment and coupling.

The presentation then delves into into pump foundations and mountings as well as pumpjacks and blowout preventers. Avoiding pump seal failure and troubleshooting are covered before a detailed unit on maintenance, including predictive maintenance and management. The course concludes with thermography, oil analysis and pump materials.

DIPLOMA PROGRAMS This course is required for TTI's Piping, Valves and Pump Specialist (PV&PS) Diploma Program. It may be used as an optional course for any [TTi specialist diploma program](#).

RELATED COURSES TTI is developing a complete pipes and valves curriculum, including Course 631, on safety lockout and tagout procedures, Course 651 on Piping and Instrumentation Diagrams (P&ID), Course 652 on piping system layout and design, Course 652 on pipe support design, Course 654 on pipe inspection and maintenance and Course 825 on pump technology.

PREREQUISITES There are no definite prerequisites. This course is aimed toward individuals actively involved in related technical fields.

TEXT Each student will receive 180 days access to the on-line electronic course workbook. Renewals and printed textbooks are available for an additional fee.

COURSE HOURS, CERTIFICATE AND CEUS On-site courses can vary from 14–35 hours over 2–5 days as requested by our clients. Upon successful course completion, each participant receives a certificate of completion and one Continuing Education Unit (CEU) for every ten class hours.

Course Outline

Introduction to Pumps

Pump Types and Terminology • Components, materials and selection

Pump Types

Centrifugal Pumps: Roto-Jet, Multi-Stage, Single-Stage

Positive Displacement Rotating Pumps: vane, gear, scoll/screw, lobe.

Positive Displacement Reciprocating Pumps: linear, diaphragm, piston axial, piston radial, piston standard.

Magnetic drive, canned motor, displacement • Booster • Duplex

Pump Parameters: Head • Darcy-Weisbach • NPSH • Calculating Head

Cavitation: Introduction • Causes

Hydraulic Pulses, Vibration and Water Hammer

Centrifugal Pumps: Components • Centrifugal Pump Theory • Construction •

Operation and Performance • Process aspects: specific gravity, specific speed and viscosity • Fluids, Laminar and Turbulent Flow

Pump Operation and Performance Curves

Pump Affinity Laws • Pump Performance Curves • Pump Curves: Head vs. Flow

Rate, Operation and Performance • Operating parameters, RPM

Pump Operation and Mechanical Issues

Parallel Pumping, identical pumps, different pumps

Series Pumping • Submersible pumps • Pump selection

Pump Seals: Conventional Packing • Mechanical Seals: single seal, balanced

seal, inside mounted, outside mounted, rotating, stationary, dual, double, metal

bellows, cartridge, split • Seal operation

Preventing premature seal failures

Pump Bearings: Physical Failure Analysis

Journal, rolling element bearings

Bearing Problems: Journal Bearings • Rolling Element Bearing Faults • Vibration

Analysis • Bearing Mounting Defects—Envelope Analysis • Displacement

Transducers • Orbits • Ultrasound

Bearing Lubrication and Failure Analysis: Lubricants • Hydrodynamic

Lubrication • Failure Stages • Dry, Marked, Spalled Bearings

Pump Imbalance, Alignment, Coupling

Imbalance: amount, type • Specifications G6.3, G2.5, G1

Alignment: introduction and methods • Coupling: Lovejoy Jaw, Magnaloy,

Chain, Lovejoy Tire, Falk • Effect of poor alignment

Pump Foundations and Mountings

Pumpjacks and Blow Out Preventers

Avoiding Pump Seal Failure

Installation causes of seal faces to open • How to avoid seal failures

Possible causes of seal failures • Seal repair and repackaging

Trouble Shooting Pumps

Maintenance, Planning and Scheduling

Maintenance techniques and strategies • Vehicle maintenance analogy: life,

reactive, preventative and predictive • Maintenance planning schedule

Managing planned maintenance • Computerized Management System

Pump Predictive Maintenance: Maintenance strategies

Potential failure analysis using Thermography

Potential failure analysis using Vibration analysis • Ultrasound

Thermography: Infrared sensing • Heat sources • Heat exchanger

Oil Analysis: Best practices for pump, motor, blower and fan bearings

Feedback tools for proper greasing • Measurement parameters

Materials: Ferrous materials: cast iron, steel, stainless steel, stainless steel and

nickel alloys • Non-Ferrous materials: aluminum alloys (wrought and cast),

copper alloys • Material stresses

Final Review • Certificates for Successful Completion



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