Course 305: Pumps
Covers typical applications of various types of pumps. Describes factors affecting pump selection. Explains operating principles of centrifugal, propeller, and turbine, rotary, reciprocating, and metering pumps. Includes special-purpose pumps, diaphragm pumps, and others designed to handle corrosive and abrasive substances. Covers pump maintenance, packing gland, seal, and bearing replacement.

TPC Training is accredited by IACET to offer 1.0 CEU for this program.

Lesson 1: Pump Development and Application
Topics
- The Development of Pumps;
- Pumping Systems;
- Water Pumping Systems;
- Chemical Pumping Systems;
- Waste Pumping Systems;
- High-Viscosity Material Pumping Systems;
- Solids Pumping Systems

Objectives
- Describe dead-end and recirculating hot water distribution systems.
- List several special considerations involved in chemical pumping systems.
- Define the term viscosity and give examples of high-viscosity materials.
- Tell the effects of heat on the pumping of high-viscosity materials.
- List some special problems involved in the pumping of solids.

Lesson 2: Basic Pump Hydraulics
Topics
- Pumping Terminology;
- Calculating Total Head;
- Horsepower Calculations;
- Total Energy vs. Available NPSH;
- Available NPSH vs. Required NPSH;
- Pump Performance Curves;
- Head Capacity Curves;
- Efficiency Curves;
- Horsepower Curves;
- Curve Families;
- Pump Selection

Objectives
- Describe suction head and suction lift pumping conditions.
- Tell what three elements make up total dynamic head.
- Define static suction head.
- Contrast liquid, brake, and electrical horsepower.
- Tell what useful information can be gained from pump curves.

Lesson 3: End-Suction Centrifugal Pumps
Topics
- Introduction to Centrifugal Pumps;
- Pump Operation;
- Pump Part Definitions;
- Pump Casing Materials;
- End-Suction Casing Configurations;
- Split-Case Centrifugal Pumps;
- Double-Volute Pumps;
- Impeller Types;
- Wearing Rings;
- Shafts, Bearings, and Sleeves

Objectives
- Describe the function of the following: pump casing, shaft, impeller, wearing rings, and stuffing box.
- Contrast frame-mounted and close-coupled end-suction pumps.
- Give characteristics of fluids pumped with open, semi-open, and closed impellers.
- Name an advantage and a disadvantage each for stainless steel and brass shaft sleeves.

Lesson 4: Propeller and Turbine Pumps
Topics
- Turbine Pump Introduction;
- Lineshaft Turbines’ Submersible Turbines;
- Flow Patterns;
- Axial-Flow Propeller Pumps;
- Mixed-Flow Propeller Pumps;
- Special Propeller Pumps;
- Turbine Pump Construction;
- Vertical Turbine Pump Applications;
- Regenerative Turbine Pumps

Objectives
- Explain the construction of a line-shaft turbine pump.
- Name the two types of flow possible in a propeller pump.
- Tell the function of diffuser vanes in an axial-flow propeller pump.
- Define electrochemical corrosion and state its cause.
- Describe fluids that can be pumped by a regenerative turbine pump.

Lesson 5: Rotary Pumps
Topics
- Introduction to Rotary Pumps;
- External-Gear Pumps;
- Internal-Gear Pumps;
- Lobe Pumps;
- Screw Pumps;
- Vane Pumps;
- Rotary Piston Pumps;
- Flexible-Member Pumps;
- Rotary Pump Installations

Objectives
- Describe the fluids that can be pumped by a rotary pump.
- Explain the operation of external- and internal-gear pumps.
- Describe the parts and construction of a lobe pump.
- Compare and contrast timed and untimed screw pumps.
- Tell why sealed bearings might be used in a vane pump.

Lesson 6: Reciprocating Pumps
Topics
- Reciprocating Pump Applications, Parts and Classifications;
- Steam-Driven Pump Operation;
- The Fluid End;
- The Steam End;
- Power Pump Operations;
- Horizontal and Vertical Plunger Pumps;
- Flexible-Member Pumps;
- Rotary Pump Installations

Objectives
- Name the parts that make up the power end of a reciprocating pump and describe their operation.
- Define the terms single-acting pump and double-acting pump.
- Compare simplex and duplex pumps.
- Explain how the pumped fluid lubricates a reciprocating pump.
- Calculate the discharge pressure of an air-driven pump when given the piston ratio and motor air supply.
Lesson 7: Metering Pumps

Topics
Introduction to Metering Pumps; Metering Pump Classifications; Plunger and Piston Metering Pumps; Diaphragm Pumps; Air-Operated Metering Pumps; Rotary Metering Pumps

Objectives
• Tell what kinds of pumps are used for metering applications.
• Describe metering pump lubrication techniques.
• Name the parts of a diagram metering pump and state the function of each.
• Explain the operation of a diaphragm metering pump.

Lesson 8: Special-Purpose Pumps

Topics
Handling Difficult Materials; Chemical Pumps; Special Chemical Pumps; Magnetic-Drive Pumps; Canned-Motor Pumps; Centrifugal Slurry Pumps; Pulp-Handling Pumps; Trash and Sewage Pumps; Diaphragm Pumps; Reciprocating Slurry Pumps; Vortex Pumps

Objectives
• Describe the operation of a flexible-tube pump.
• Give an application for a progressing-cavity pump.
• Name one disadvantage of a seal-less magnetic-drive pump.
• Explain how to prepare a new centrifugal pump for operation.
• Tell which parts of a reciprocating slurry pump require the most maintenance.

Lesson 9: Packings and Seals

Topics
Pump Sealing Requirements; Stuffing Boxes; Types of Stuffing Boxes; Packing Materials; Installing Packing; Mechanical Seals; Special Seals

Objectives
• Tell why slight leakage through shaft seals is necessary.
• Name the type of stuffing box required for pumps operating under suction lift conditions.
• Give a typical application each for cotton, Teflon®, and aluminum packing.
• Describe the procedure involved in replacing pump packing.
• Describe a packingless seal.

Lesson 10: Pump Maintenance

Topics
Pump Bearings; Sleeve Bearings; Antifriction Bearings; Special Bearings; Bearing Lubrication; Bearing Seals; Pump Installation; Pump Maintenance; End-Suction Centrifugal Pumps; Vertical Turbine Pumps; Rotary Pumps; Reciprocating Pumps; Difficult Material Pumps; Other Maintenance Problems

Objectives
• Name three types of antifriction bearings.
• Name three factors to consider when preparing pump lubrication schedules.
• Describe a typical application for each of the following bearing seals: felt, leather, synthetic.
• Tell the two major maintenance problems encountered in rotary pumps.
• Explain how to identify worn piston rings in a reciprocating pump.