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.