

Hydraulic Troubleshooting

Course 308: Hydraulic Troubleshooting

Covers understanding the systems, using schematic diagrams, installation procedures, cleanliness and safety. Includes tubing cutting, bending, and flaring, identification and selection of proper fluid, and charging the system. Discusses planned maintenance, specific repair/replacement recommendations, system diagnosis, and troubleshooting.

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



Lesson 1: Hydraulic Systems

Topics

Hydraulic Systems; Pumps and Their Drive Units; Actuators; Control Valves; Conductors and Connectors; Hydraulic Fluids; Fluid Storage and Conditioning Equipment; Tracing the System; Getting to Know the System; Circuit and System Diagrams; Cutaway Drawings; Mechanical Setup; Understanding Components; Convertible Components; System Operation

Objectives

- Name the six basic elements of a hydraulic system.
- Explain the functions of hydraulic pumps, actuators, control valves, conductors and connectors, hydraulic fluid, and fluid storage and conditioning equipment.
- Describe how to trace a system.

Lesson 2: Hydraulic Schematic Diagrams

Topics

Types of Hydraulic Diagrams; What is a Schematic?; Characteristics of Schematics; Lines; Symbols; What Kind of Schematic?; Guidelines for Reading Schematics; Look for Flow Patterns; Look for Guides; Read Diagrams Carefully; Read Symbols Carefully; Use the Step-by-Step Approach; Basic Elements of a Hydraulic System; Pumps; Actuators; Control Valves; Conductors and Connectors; Fluid Storage and Conditioning Equipment; A Hydraulic Circuit; Sequence-Valve Circuit

Objectives

- Name three basic types of hydraulic diagrams, and explain the purposes of each.
- Describe how a valve symbol is constructed.
- List the steps to follow when reading a schematic diagram.
- Identify common hydraulic symbols.

Lesson 3: Installing Hydraulic Components

Topics

Installation Considerations; Cleanliness; Installation Safety; Pump and Drive Installations; Pump Start-up; Control Valve Installation; Extra Valve Ports for Convenience; Valve Port Identification; Mechanical Valve Installation; Pneumatically Actuated Valves; Electrically Controlled Valves

Objectives

- Explain the importance of cleanliness in hydraulic installations.
- Describe possible consequences of neglecting safety precautions.
- Explain how motor and pump shafts are aligned before coupling.
- Explain the correct method for checking direction of pump rotation.
- List several useful hints for solenoid valve installation.

Lesson 4: Installing Pipes and Tubes

Topics

Installing Conductors and Connectors; Hydraulic Pipe; General Installation Procedures; Hydraulic Tubing; Tube Flaring; Checking the Flare; Tube Bending; Tubing Assembly; Hydraulic Hose; Hose Installation; Seal Installation; Reservoir Installation; Filter Installation; Cooler and Heat Exchanger Installation; Actuator Installation

Objectives

- Explain how pipe sizes are specified.
- Name the common types of pipe joints.
- List six important rules for good piping installation.
- Describe the advantages of hydraulic tubing over pipes.
- Describe the correct methods for bending and flaring tubing.
- List the key points for correctly installing hydraulic hoses, seals, reservoirs, filters, and actuators.

Lesson 5: Selecting Hydraulic Fluids

Topics

Hydraulic Fluid Selection; Lubricating Properties; Viscosity and Viscosity Index; Resistance to Chemical and Physical Changes; Low-Temperature Properties; Demulsibility; Antirust Properties; Fire Resistance; Compatibility; Fluid Selection; Filling the System; Filter Installation

Objectives

- List ten important properties of hydraulic fluids.
- Explain the difference between hydrodynamic and boundary lubrication.
- Explain what a fluid's viscosity index means.
- Define demulsibility and emulsibility.
- Describe how to read a viscosity-temperature chart.
- List the proper procedures for installing hydraulic fluid.

Lesson 6: Planning System Maintenance

Topics

Classifying Maintenance; Inspections; Organizing the Maintenance Plan; Maintenance Requirements; Regular Inspections; Reservoir Fluid Level; Reservoir Fluid Temperature; External Leaks; External Condition of System Structures; Operating Pressure; Fluid Quality; Filters; Machine Performance; Repair Planning; Reconditioning Planning; System Servicing; A Typical System Plan

Objectives

- List the major categories of hydraulic system maintenance.
- Name and describe the six essential items in a maintenance file.
- List the steps involved in reconditioning a hydraulic component.
- Explain how to set up a maintenance plan for a typical hydraulic system.

Hydraulic Troubleshooting

Lesson 7: Troubleshooting Systems

Topics

What is Troubleshooting?; Diagnosis and Symptoms; Evaluating Recent Maintenance History; Evaluating Symptoms; Determining the Cause; Providing the Solution; Tools and Gauges; Wrenches; Gauges; Typical Troubleshooting Application; Troubleshooting Charts

Objectives

- Describe the troubleshooting process.
- Explain how to evaluate recent maintenance history.
- List typical symptoms of common hydraulic system problems.
- Explain how to determine the cause of and provide a solution to a problem.
- Explain how a portable tester works.
- Describe how to keep and use troubleshooting charts.

Lesson 8: Troubleshooting Valves

Topics

Valve Problems; Valve Test Procedures; Repair Procedures; Disassembly; Cleaning; Inspection; Repair or Replacement; Inspection Troubleshooting; Solenoid Problems; Reassembly; Testing

Objectives

- Name five common valve problems and explain the sequence of steps to be followed in troubleshooting them.
- Describe the proper procedures for valve disassembly, cleaning, and inspection.
- Explain how to determine whether to repair or replace a malfunctioning valve.
- Describe the reasons for hydraulic “wire drawing.”
- List the reasons for electrical and mechanical failures of solenoid valves.
- Explain the procedures for reassembling, reinstalling, and testing valves.

Lesson 9: Troubleshooting Cylinders

Topics

Cylinder Descriptions; Troubleshooting a Cylinder; Cylinder Testing; Cylinder Repair; Cylinder Installation; Shock Absorbers

Objectives

- Name the most common types of hydraulic cylinders and identify their major parts.
- List the symptoms of internal and external cylinder misalignment.
- Explain what to do if you find internal leakage in a cylinder.
- Name the cylinder components most frequently replaced.
- Explain the purpose of a piston rod boot.
- Describe the symptoms of shock absorber failure.

Lesson 10: Troubleshooting Pumps and Motors

Topics

Pumps and Motors; Troubleshooting; Gear Pump Problems; Vane Pump Problems; Vane Motors; Axial-Piston Pump Problems; Radial-Piston Pump Problems; Pump and Motor Repair; Pump Maintenance Checks; Troubleshooting Chart (Pumps); Troubleshooting Chart (Motors)

Objectives

- List the proper procedures for troubleshooting pumps and motors.
- Name some common causes of pump failure.
- Describe typical causes of cavitation.
- Discuss the major sources of problems in gear pumps and vane pumps.
- Describe the effects of contaminants in axial-piston and radial-piston pumps.
- Explain the differences between a vane motor and a vane pump.