



# Assessment Descriptions

# Assessment Descriptions

## Maintenance Introduction Assessment

This assessment evaluates knowledge of essential practices for maintaining heavy equipment, including cleaning, lubrication, fastening, tool usage, and safety procedures within a heavy equipment shop environment. The questions cover a range of topics critical for ensuring equipment reliability, worker safety, and efficient shop operations. The assessment is designed to gauge understanding of:

- **Cleaning and Corrosion Prevention:** Proper selection and use of cleaning agents, degreasers, and rust removal techniques.
- **Safety Procedures:** Understanding and adhering to essential safety protocols, including PPE requirements, emergency response, and safe handling of tools and equipment.
- **Lubrication:** Understanding lubricant types, application methods, and their role in preventing wear and ensuring proper function.
- **Fasteners and Adhesives:** Knowledge of various fastener types, their applications, proper installation techniques, and the use of adhesives and sealants.
- **Tool Usage and Maintenance:** Safe and effective use of hand tools, power tools, measuring tools, and specialized equipment, along with proper maintenance procedures.
- **Rigging and Lifting:** Safe rigging practices, including sling selection, inspection, and proper use of lifting equipment.

This assessment is crucial for identifying areas of strength and weakness in an individual's understanding of heavy equipment maintenance and safety. The results can be used to tailor training programs and ensure a safe and productive work environment.

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## Air Conditioning Assessment

This comprehensive set of questions covers a wide range of topics related to Mobile Vehicle Air Conditioning (MVAC) systems, focusing on component identification, system operation, diagnostics, repairs, and safety. It assesses understanding of:

- **Component Identification:** Recognizing and naming key components like the compressor, condenser, evaporator, metering devices (orifice tube, TXV), dryer/accumulator, blower motor, and cooling fan.
- **Refrigerant Cycle:** Understanding the flow of refrigerant through the system, including its state (gas or liquid) at various points and the pressure/temperature relationships.
- **System Diagnostics:** Interpreting gauge readings (high side, low side) to diagnose common issues like low refrigerant, overcharge, restrictions, and component failures.
- **Metering Devices:** Knowledge of different metering devices (fixed orifice tube, variable TXV) and their function in controlling refrigerant flow.

# Assessment Descriptions

## Cont. Air Conditioning Assessment

- **Heat Transfer:** Understanding the principles of heat transfer (radiation, conduction, convection) and their application in the MVAC system.
- **Refrigerant Properties:** Understanding refrigerant properties, including pressure-temperature relationships, boiling points, and the impact of atmospheric pressure.
- **Humidity and Its Effects:** Understanding the concept of relative humidity and its influence on MVAC system performance.
- **Maintenance and Repair:** Knowledge of proper procedures for leak testing, component replacement (dryer, accumulator), oil inspection, and system evacuation.
- **Safety:** Understanding the hazards associated with MVAC systems, including refrigerant handling, and the importance of personal protective equipment (PPE).
- **Refrigerant Types and Oils:** Knowledge of different refrigerants (R-134a, R-1234yf), refrigerant oil types (PAG, POE), and compatibility.
- **System Failures:** Understanding common component failures (compressor, condenser fan, evaporator coil) and their impact on system performance.
- **Airflow and Ventilation:** Understanding the role of airflow and blend doors in controlling cabin temperature.
- **Vacuum and Evacuation:** Understanding the importance of evacuating the system before recharging and the principles of vacuum.
- **Pressure and Temperature Relationships:** Understanding the relationship between pressure and temperature in gases and its application in MVAC systems.
- **Latent Heat:** Understanding the concept of latent heat and its role in the evaporation and condensation processes.

This assessment is essential for evaluating an individual's knowledge and ability to work safely and effectively on MVAC systems. The results can be used to identify training needs and ensure competency in MVAC diagnostics, repair, and maintenance.

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## Electrical 1 Assessment

This extensive set of questions covers fundamental electrical concepts, components, and troubleshooting techniques relevant to maintaining heavy equipment. It assesses understanding of:

- **Multimeter Usage:** Identifying multimeter functions, symbols, and proper usage for measuring voltage (AC/DC), current, resistance, and continuity. Interpreting readings like source voltage, true zero, and ghost voltage.
- **Magnetism:** Understanding the properties and types of magnets (permanent, electromagnet).
- **Basic Electrical Terminology:** Defining key terms like alternating current (AC), direct current (DC), voltage, current, and resistance.
- **Electron Flow:** Explaining how electrons move in a conductor.

# Assessment Descriptions

## Cont. Electrical 1 Assessment

- Jump Starting: Understanding the correct procedure for jump-starting equipment with computer controls.
- Electrical Symbols: Recognizing and interpreting common electrical symbols for switches (SPST, DPDT), breakers, motors, and other components.
- Wiring and Connectors: Understanding proper wire stripping techniques, causes of corrosion in connectors, and wire gauge selection for current carrying capacity.
- Standards and Regulations: Awareness of symbol standards (ANSI, ISO) and their applicability.
- Circuit Protection: Understanding the function of circuit protection devices (fuses, breakers), their differences, and types used in DC circuits.
- Batteries: Understanding battery connections (series, parallel), safe charging practices, and battery cable removal/installation procedures.
- Ohm's Law and Electrical Formulas: Applying Ohm's Law ( $V=IR$ ) and power formulas ( $P=VI$ ) to calculate voltage, current, resistance, and power.
- Kirchhoff's Laws: Understanding and applying Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL).
- Relays and Solenoids: Understanding the purpose and operation of relays and solenoids, and the differences between them.
- Diodes: Understanding diode testing and behavior.
- Battery Ratings: Understanding battery ratings like Cold Cranking Amps (CCA).
- Charging Systems: Understanding the function of alternators and starter motors in charging and starting systems.
- Troubleshooting: Applying electrical knowledge to diagnose basic circuit problems.
- Electrical Measurement Units: Defining units of voltage (volts), current (amperes), and resistance (ohms).
- Schematic Reading: Understanding how to use schematics to identify components and measure values.

This assessment is crucial for evaluating an individual's understanding of electrical fundamentals and their ability to apply these concepts to troubleshoot and maintain electrical systems in heavy equipment. The results can be used to identify training needs and ensure competency in electrical diagnostics and repair.

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## Electrical 2 Assessment

This set of questions focuses on electrical circuits, components, and diagnostic procedures commonly encountered in heavy equipment maintenance. It assesses understanding of:

- Wiring Diagrams: Understanding the importance of interpreting wiring diagrams for troubleshooting and repair.
- Series and Parallel Circuits: Understanding current and resistance behavior in series and parallel circuits.

# Assessment Descriptions

## Cont. Electrical 2 Assessment

- Relays: Identifying relay terminals (common), understanding relay operation, and the purpose of suppression diodes.
- Solenoids: Understanding the behavior of a solenoid's magnetic field when current flows.
- Electrical Symbols: Recognizing and interpreting electrical symbols for various components.
- Diodes: Understanding the functions of a diode.
- Switches: Identifying different types of switches based on their symbols.
- Alternator Testing: Understanding the correct procedure for testing an alternator.
- Pull-in/Hold-in Solenoids: Understanding the operation of dual-coil solenoids.
- Electrical Diagrams: Recognizing different types of electrical diagrams.
- Crimp Terminals: Understanding crimp terminal color codes.
- Wire Sizing: Understanding wire gauge scales.
- Latching Relays: Understanding the operation of latching relay circuits.
- Voltage Testing: Understanding expected voltage readings for 12V and 24V systems, including alternator output.
- Fuse Sizing: Calculating appropriate fuse sizes based on wattage and voltage.
- Relay Benefits: Understanding the advantages of using relays in electrical circuits.
- Voltage Drop Testing: Describing the procedure for performing a voltage drop test.
- Circuit Configuration: Identifying series and parallel circuit configurations.
- Current Measurement: Describing the procedure for measuring current using a multimeter.
- Voltage Regulators: Understanding the function of voltage regulators in charging circuits.
- Ohm's Law Application: Applying Ohm's Law to calculate current based on wattage and voltage.

This assessment is vital for evaluating an individual's ability to understand and work with electrical systems in heavy equipment. The results can be used to identify training needs and ensure competency in electrical troubleshooting and repair.

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## Electrical 3 Assessment

This set of questions focuses on electrical components, signals, and troubleshooting techniques commonly used in heavy equipment. It assesses understanding of:

- Sensors: Understanding the primary function of sensors in heavy equipment.
- Analog vs. Digital Signals: Differentiating between analog and digital signals.
- Diodes: Understanding the uses of diodes in heavy equipment and identifying incorrect applications.
- Resistors: Recognizing temperature-sensitive resistors (thermistors).
- Rheostats: Understanding the number of terminals and function of a rheostat.
- Electrical Symbols: Identifying symbols for specific components.

# Assessment Descriptions

## Cont. Electrical 3 Assessment

- Electrical Signals: Interpreting different types of electrical signals.
- Pressure Switches: Understanding the concept of dead band in pressure switches.
- Load Pro Testing: Understanding the use of a Load Pro for troubleshooting wiring harnesses.
- Wiring Faults: Identifying the three common types of wiring faults.
- Time Delay Relays: Describing the operation of a circuit with a time delay relay.
- Suppression Diodes: Understanding the protective function of suppression diodes in relay circuits.

This assessment is important for evaluating an individual's knowledge of electrical components, signal types, and troubleshooting methods used in heavy equipment electrical systems. The results can be used to identify training needs and ensure competency in electrical diagnostics and repair.

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## Electrical 4 Assessment

This set of questions tests knowledge of electrical components, circuits, and signal types commonly found in heavy equipment. It assesses understanding of:

- Diode Protection: Understanding the effect of a reverse-biased diode across a motor in a 24V DC system.
  - 5-Pin Relays: Understanding the purpose and function of a 5-pin relay with NO, NC, and COM contacts in a 12/24V system.
  - Power Calculation: Calculating power consumption in a 12/24V system.
  - Current Calculation: Calculating current in a 12/24V system.
  - Digital vs. Analog Signals: Understanding the key advantages of digital signals.
  - Analog Sensors: Identifying examples of analog sensors in heavy equipment.
  - ECU: Understanding ECU communication and its role in the system.
  - Digital Speed Sensors: Identifying the characteristics of digital speed sensors.
  - Potentiometers: Knowing the functions and number of terminals on a potentiometer.
  - Semiconductor Enemies: Identifying the three main factors that can damage semiconductor components like ECUs.
  - Transformers: Understanding the purpose of a transformer.
  - Transformer Windings: Naming the two windings on a transformer (primary and secondary).
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# Assessment Descriptions

## Electrical 5 Assessment

This set of questions focuses on diagnostic terminology, tools, and communication protocols commonly used in heavy equipment maintenance. It assesses understanding of:

- Cummins Diagnostics: Identifying the diagnostic program used by Cummins.
  - PWM: Understanding the meaning of Pulse Width Modulation (PWM).
  - CEL: Understanding the meaning of Check Engine Light (CEL).
  - DTC: Understanding the meaning of Diagnostic Trouble Code (DTC).
  - OBDII: Understanding the meaning of On-Board Diagnostics II (OBDII).
  - Duty Cycle Measurement: Knowing the meter setting used to measure duty cycle.
  - Caterpillar Diagnostics: Identifying the diagnostic program used by Caterpillar.
  - Diagnostic Symbols: Recognizing and interpreting diagnostic symbols.
  - CAN Protocol Types: Identifying different types of CAN (Controller Area Network) protocols.
  - CAN Bus: Understanding what CAN bus is and how it functions.
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## Electrical 6 Assessment

This set of questions tests knowledge of diagnostic terminology and acronyms commonly used in heavy equipment and automotive industries. It assesses understanding of:

- Mercedes-Benz Diagnostics: Identifying the diagnostic program used by Mercedes-Benz.
  - PROM: Understanding the meaning of Programmable Read-Only Memory (PROM).
  - ROM: Understanding the meaning of Read-Only Memory (ROM).
  - RAM: Understanding the meaning of Random-Access Memory (RAM).
  - CAN: Understanding the meaning of Controller Area Network (CAN).
  - SEL: Understanding the meaning of System Event Log (SEL) or potentially other context-specific meanings.
  - CPU: Understanding the meaning of Central Processing Unit (CPU).
  - PLC: Understanding the meaning of Programmable Logic Controller (PLC).
  - ECM: Understanding the meaning of Engine Control Module (ECM).
  - OEM: Understanding the meaning of Original Equipment Manufacturer (OEM).
  - FMI: Understanding the meaning of Failure Mode Identifier (FMI).
  - SID: Understanding the meaning of Subsystem Identifier (SID).
  - PID: Understanding the meaning of Parameter Identification (PID).
  - MID: Understanding the meaning of Module Identifier (MID).
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# Assessment Descriptions

## Hydraulic 1 Assessment

This comprehensive set of questions covers a wide range of hydraulic principles, components, and maintenance practices relevant to heavy equipment. It assesses understanding of:

- **Component Identification:** Recognizing and naming key hydraulic components like pumps (fixed displacement, gear, vane), motors, actuators (linear, rotary), valves (relief, check, needle, flow control), reservoirs, filters, gauges, quick connects, and hoses.
- **Hydraulic Fundamentals:** Understanding basic concepts like fluid, pressure, force, area, and their relationships (Pascal's Law). Understanding pressure intensification, negative pressure, and cavitation.
- **Hose Fabrication:** Understanding procedures for correctly making hydraulic hoses.
- **Hydraulic Hazards:** Recognizing safety hazards associated with hydraulic systems, including high pressure, hot oil, and raised implements.
- **Safety Best Practices:** Knowing best practices for working on and around hydraulic systems, including personal protection and equipment safety.
- **Contamination:** Understanding the impact of contamination on hydraulic systems and its contribution to pump failures.
- **O-rings and Backup Rings:** Understanding the purpose and installation of backup rings.
- **Troubleshooting:** Diagnosing common hydraulic problems like erratic functions and foamy oil.
- **Flow Measurement and Control:** Understanding how to measure and control hydraulic fluid flow using flow meters and valves (needle, check).
- **Cycle Times:** Understanding the significance of checking cycle times.
- **Valve Functions and Settings:** Understanding the functions of various hydraulic valves (relief, check, flow control) and the procedures for setting them.
- **Pump Types and Operation:** Understanding different types of hydraulic pumps (fixed displacement, gear, vane), their operating principles (positive displacement), and limitations.
- **Actuator Operation:** Understanding the operation of linear and rotary actuators, including factors affecting force and speed (e.g., single-rod cylinder extension/retraction differences).
- **Hydraulic Circuits:** Understanding the basic flow path of hydraulic oil in a system.
- **Accumulators:** Understanding the functions of accumulators in hydraulic systems.
- **Hydraulic Fluid Selection:** Understanding the importance of selecting the correct hydraulic oil.
- **Post-Installation Procedures:** Understanding best practices to follow after installing new hydraulic components.
- **Gear Pump Limitations:** Understanding why gear pumps are not suitable for high-pressure applications.
- **Bernoulli's Principle:** Understanding Bernoulli's Principle and its relevance to hydraulics.

# Assessment Descriptions

## Cont. Hydraulic 1 Assessment

This assessment is crucial for evaluating an individual's knowledge and understanding of hydraulic systems, their components, and maintenance procedures. The results can be used to identify training needs and ensure competency in hydraulic system diagnostics, repair, and maintenance.

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## Hydraulic 2 Assessment

This set of questions further explores hydraulic system components, principles, safety, and troubleshooting. It assesses understanding of:

- Air Contamination: Recognizing symptoms of air in hydraulic systems.
- Component Identification: Identifying specific hydraulic components like sealed reservoirs, needle valves, and directional control valves.
- Negative Pressure and Cavitation: Understanding the concepts of negative pressure and cavitation.
- Fluid Properties: Defining viscosity, flow rate, and flow velocity.
- Accumulator Hazards: Recognizing safety hazards associated with accumulators.
- Fixed Orifice Flow Control: Understanding factors affecting flow rate through a fixed orifice.
- Sequence and Pressure Reducing Valves: Understanding why these valves have external drains.
- Valve Functions and Settings: Understanding the purpose and setting requirements for various hydraulic valves.
- Pressure and Flow Intensification: Understanding the causes and direction of pressure and flow intensification in single-rod cylinders.
- Hydraulic Fluid Functions: Identifying the basic functions of hydraulic fluid.
- Accumulator Types: Recognizing different types of accumulators.
- Oil Oxidation: Understanding the concept of hydraulic oil oxidation.
- Linear Actuators: Identifying types of linear actuators.
- Directional Control Valve Configurations and Functions: Recognizing common center configurations for directional control valves and their functions.
- Hydraulic Filters: Identifying hydraulic filters.
- Valve Flow Control: Understanding factors controlling flow rate through specific valves.

This assessment is crucial for evaluating an individual's knowledge and understanding of hydraulic system components, principles, safety, and troubleshooting. The results can be used to identify training needs and ensure competency in hydraulic system diagnostics, repair, and maintenance.

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# Assessment Descriptions

## Hydraulic 3 Assessment

This set of questions covers more advanced hydraulic circuit concepts, components, troubleshooting, and valve functions. It assesses understanding of:

- **Regeneration Circuits:** Understanding the flow of rod-end fluid in a regeneration circuit and the circuit's purpose.
- **Pressure Intensification:** Understanding the primary purpose of a pressure intensification circuit.
- **Energy Storage:** Identifying the component that stores energy in the form of pressurized fluid (accumulator).
- **Hydraulic Schematics:** Understanding advanced symbols in hydraulic schematics.
- **Component Identification:** Identifying components such as variable displacement pumps and a pilot-to-open check valve.
- **Pump Replacement:** Understanding the flow loss percentage that indicates pump replacement.
- **Flow Control Valves:** Naming different types of flow control valves.
- **Anaerobic Sealants:** Understanding the specific trait of anaerobic sealants.
- **Static vs. Dynamic Seals:** Differentiating between static and dynamic seals.
- **Valve Settings:** Understanding how to set counterbalance and pressure reducing valves.
- **Valve Functions:** Identifying the functions of specific hydraulic valves (pressure reducing, relief, flow divider, sequence, check, metering, flow control, pilot-operated check).
- **Vane Pump Wear Compensation:** Understanding that vane pumps can self-compensate for wear.
- **Valve Identification and Setting:** Identifying specific valves and their setting requirements.
- **Pressure Control Valves:** Naming different types of pressure control valves.
- **Four-Way Directional Control Valves:** Understanding applications for four-way directional control valves.
- **Cylinder Surface Areas:** Identifying the three different surface areas pressure is applied to in a double-acting single-rod hydraulic cylinder (cap end, rod end, annular area).

This assessment is crucial for evaluating an individual's knowledge and understanding of advanced hydraulic circuit concepts, components, troubleshooting, and valve functions. The results can be used to identify training needs and ensure competency in hydraulic system diagnostics, repair, and maintenance.

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# Assessment Descriptions

## Hydraulic 4 Assessment

This set of questions focuses on advanced hydraulic diagnostics, testing procedures, and specialized circuit components. It assesses understanding of:

- **Hydraulic Fault Diagnosis:** Understanding the steps involved in diagnosing complex hydraulic system faults.
- **Case Drain Flow Testing:** Knowing best practices for flow testing the case drain of a hydraulic pump.
- **Pressure Compensation:** Understanding which component limits system pressure in pressure-compensated piston pumps (the compensator).
- **Pressure-Compensated Pump Setting:** Knowing how to set a pressure-compensated pump.
- **Regeneration Circuits:** Recognizing the valve used to direct oil from the cylinder rod end to the barrel end for faster response in a regeneration circuit.
- **Variable Displacement Pump Operation:** Understanding the relationship between swashplate angle and flow/displacement in a variable displacement piston pump.
- **Valve Identification and Setting:** Identifying a specific valve and its setting requirements.
- **Relief Valve vs. Compensator:** Understanding the relationship between relief valve and compensator settings in circuits with pressure-compensated pumps.
- **Directional Control Valve Configurations:** Knowing which center configurations are used with pressure-compensated pumps.
- **Pressure-Compensated Pump Setting Procedures:** Identifying the two key procedures used when setting a pressure-compensated pump.

This assessment is crucial for evaluating an individual's knowledge and understanding of advanced hydraulic diagnostics, testing procedures, and specialized circuit components. The results can be used to identify training needs and ensure competency in hydraulic system diagnostics, repair, and maintenance.

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## Hydraulic 5 Assessment

This set of questions covers hydraulic diagnostics, component selection, circuit types, and advanced valve functions. It assesses understanding of:

- **Cylinder Diagnostics:** Using temperature differences to diagnose a weak cylinder issue.
- **O-Ring Compatibility:** Knowing which O-ring types are suitable for hydraulic oil and which are not, including high-temperature applications.
- **Cylinder Rod Seal Leaks:** Identifying the different seals in a cylinder.
- **Load-Sensing Circuits:** Understanding the function of the compensator valve and how the pump adjusts in a load-sensing circuit.
- **Pressure-Compensated Flow Controls:** Understanding the primary use of pressure-compensated flow controls.

# Assessment Descriptions

## Cont. Hydraulic 5 Assessment

- Servo vs. Proportional Valves: Differentiating between servo and proportional valves.
- Proportional Valve Use: Understanding the primary use of proportional valves.
- Variable Displacement Load Sensing Pump Testing: Knowing the procedure for flow testing this type of pump.
- Standby Pressure: Understanding the meaning of "standby pressure."
- Pump Flow Meter Placement: Knowing a suitable location for installing a flow meter when testing an axial piston pump.
- Valve and Pump Compatibility: Understanding whether a closed center directional control valve can be used with a fixed displacement pump.
- Pressure-Compensated Flow Control Advantages: Understanding the main advantage of using this type of valve.
- Pump-Actuator Combinations: Identifying correct pump-actuator pairings.
- Relief Valves in Pressure-Compensated Systems: Understanding why some systems with pressure-compensated pumps still have relief valves.
- Sequence Valve Setting: Knowing how to set a sequence valve.

This assessment is crucial for evaluating an individual's knowledge and understanding of hydraulic diagnostics, component selection, circuit types, and advanced valve functions. The results can be used to identify training needs and ensure competency in hydraulic system diagnostics, repair, and maintenance.

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## Hydraulic 6 Assessment

This set of questions explores hydrostatic drive systems, including open-loop and closed-loop configurations, along with related components and troubleshooting. It assesses understanding of:

- Open-Loop Hydrostatic Systems: Understanding fluid flow in an open-loop system.
- Closed-Loop Hydrostatic Pumps: Identifying the most common pump type used in closed-loop systems.
- Closed-Loop Feedback: Understanding how feedback operates in these systems.
- Closed-Loop Fluid Replenishment: Understanding how lost fluid is replenished.
- Closed-Loop Component Replacement: Knowing which components to replace after a pump failure in a closed-loop system.
- Closed-Loop Circulation: Identifying the essential component for maintaining fluid circulation.
- Charge Pump Function: Understanding the charge pump's role in closed-loop systems.
- Closed-Loop Characteristics: Identifying the primary feature of a closed-loop hydrostatic system.
- Variable Displacement Motor Speed: Understanding the relationship between swashplate angle and output shaft speed in a variable displacement motor.

# Assessment Descriptions

## Cont. Hydraulic 6 Assessment

- LSPC System Demands: Understanding what happens to actuator speeds in an LSPC (Load Sensing Pressure Compensated) system when circuit demands exceed pump capability.
- Cylinder Seal Testing: Interpreting pressure gauge readings when testing cylinder piston seals.
- LSPC System Operation: Understanding swashplate behavior in an LSPC system during stall and simultaneous function operation.

This assessment is crucial for evaluating an individual's knowledge and understanding of hydrostatic drive systems, including open-loop and closed-loop configurations, along with related components and troubleshooting. The results can be used to identify training needs and ensure competency in hydraulic system diagnostics, repair, and maintenance.

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