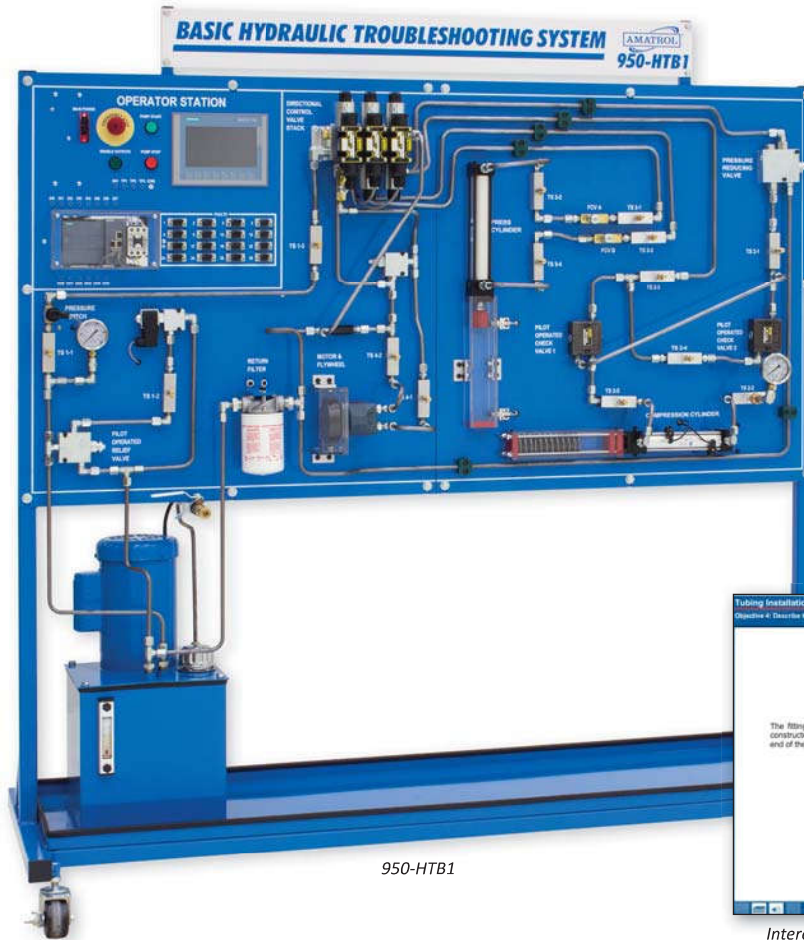


# Basic Hydraulic Troubleshooting Learning System

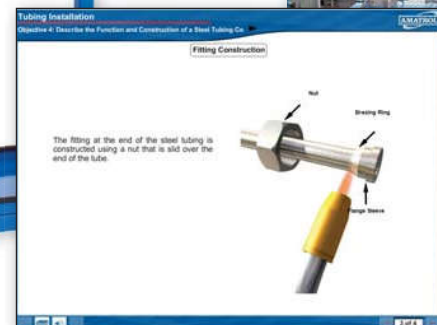
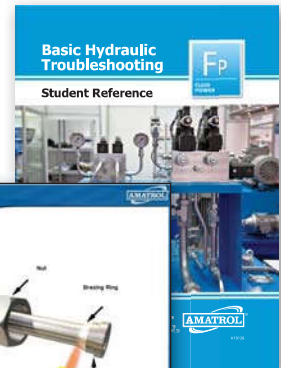
950-HTB1

Fp

FLUID  
POWER



950-HTB1



Interactive Multimedia and Student Reference Guide

## Learning Topics:

- Hydraulic Pump Troubleshooting
- Flow Measurement
- Hydraulic Actuator Troubleshooting
- Cylinder Cushions and Boots
- Motor Troubleshooting
- Hydraulic Directional Control Valve Troubleshooting
- Hydraulic Valve Troubleshooting
- Hydraulic Systems Troubleshooting
- Systems Level Troubleshooting
- Machine Sequence Troubleshooting
- Machine Performance Troubleshooting

Amatrol's Basic Hydraulic Troubleshooting Learning System (950-HTB1) teaches how to troubleshoot hydraulic systems and components such as hydraulic motors, directional control valves, and cylinders. The knowledge gained from the 950-HTB1's hardware and curriculum is extremely valuable for maintenance technicians within industries like manufacturing, automotive, agriculture, construction, and many more! This learning system will also serve as a solid foundation towards attaining certifications. The 950-HTB1 is a vital training opportunity for learning how to diagnose and correct common problems with hydraulic circuits and components. In fact, this learning system features over 35 faults for learners to practice troubleshooting.

The 950-HTB1 will include a mobile workstation, control cabinet with Siemens S71200 PLC, hydraulic power distribution, four hydraulic actuator branches, a hydraulic power unit, flow meter, pressure gauge, and multimeter. Learners will use these components in real-world applications while studying major topics like hydraulic pump troubleshooting, hydraulic actuator and directional control valve troubleshooting, hydraulic valve troubleshooting, and hydraulic systems troubleshooting. This system includes industry-grade components for both greater learner comprehension and durability to stand up to frequent use.



## Technical Data

Complete technical specifications available upon request.

### Mobile Workstation

- Welded Steel
- Drip Pan

### Control Cabinet

- Siemens S71200 PLC w/ HMI
- Discrete I/O
- Lockout/Tagout
- Control Power Pushbutton
- Emergency Stop

### Hydraulic Power Distribution

- Supply and Return Lines
- Pressure Switch
- Pilot Operated Relief Valve
- Direct Operated Relief Valve

### Hydraulic Actuator Branches

- Directional Control Valve Manifold
- Directional Control Valves (3)
- Cylinder, double-acting (2)
- Proximity Switches (3)
- Pressure Reducing Valve
- Pilot Operated Check Valves
- Magnetic Reed Sensors (2)
- Braking Valve
- Air Ingestion Valve
- Cavitation Valve
- Motor with Flywheel

### Hydraulic Power Unit

- Flow Meter, detached
- Pressure Gauge, detached

### Multimeter

### Multimedia Curriculum (M19126)

### Instructors' Guide (C19126)

### Installation Guide (D19126)

### Student Reference Guide (H19126)

### Additional Requirements:

None

### Utilities:

Electricity (110 VAC/60 Hz/1 phase) OR

Electricity (230 VAC/50 Hz/3 phase) OR

Electricity (220 VAC/60 Hz/3 phase)

## Get Hands-On Practice Troubleshooting Over 35 Faults On Valves, Pumps, and Motors

The 950-HTB1 includes a large array of industrial-grade components on a mobile workstation, such as a Siemens S71200 PLC with HMI, a hydraulic power supply, supply and return lines, motor with flywheel, proximity switches, magnetic reed sensors, and a large selection of valves including relief, directional control, pressure reducing, check, cavitation, and air ingestion. Learners will use these components to practice hands-on troubleshooting skills that they can apply to real-world, on-the-job applications. Some of these skills include using an in-circuit test to troubleshoot a fixed-displacement pump, adjusting a cylinder cushion, troubleshooting a check valve, testing a hydraulic system by measuring fluid flow, and troubleshooting vibration in a hydraulic system.



950-HTB1 Operator Station

## Study the Symptoms of Hydraulic Component and System Failure for In-Depth Comprehension

The 950-HTB1's curriculum first covers component-level faults before teaching learners how to troubleshooting system-wide problems. Sample topics include: describing the construction of three types of pressure test points, defining cavitation and explaining its effect, describing five symptoms of motor failure, describing seven symptoms of non-compensated flow control valve failure, and understand how to troubleshoot zero system pressure. This curriculum is presented in user-friendly interactive multimedia format that can be used in a classroom environment or for self-paced learning. This multimedia features stunning 3D graphics and videos, voiceovers of all of the text, and interactive activities and quizzes.



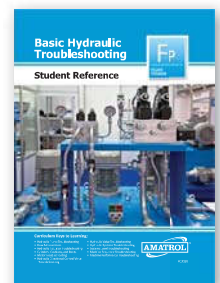
Interactive Multimedia

## Includes Over Thirty-Five Hydraulic and Electrical Faults

The 950-HTB1 features over thirty-five manually inserted faults to help learners understand and practice common problems found in hydraulic systems. Some of these faults include: motor starter failure, defective pump, worn cylinder seals, blocked flow control valves, and blocked inlet ports.

## Student Reference Guide

A sample copy of the Hydraulic Troubleshooting Student Reference Guide is also included with the system for your evaluation. Sourced from the system's curriculum, the Student Reference Guide takes the entire series' technical content contained in the learning objectives and combines them into one perfectly-bound book. Student Reference Guides supplement this course by providing a condensed, inexpensive reference tool that learners will find invaluable once they finish their training making it the perfect course takeaway.



## **BASIC HYDRAULIC TROUBLESHOOTING LEARNING SYSTEM**

This system shall teach how to troubleshoot hydraulic systems and components such as hydraulic motors, directional control valves, and cylinders. This system features the following components:

### **Mobile Workstation**

- Drip Pan

### **Operator Station**

- Siemens Simatic HMI
- Siemens PLC
- Push Button, Green
- Push Button, Red
- Push Button, Illuminated Green
- Push Button, Mushroom, Push/Pull, Red
- Safety Lockout

### **Directional Control Valve Stack**

- DCV, 3 Position, 4 Way Closed Center
- DCV, 3 Position, 4 Way Free Float Center
- DCV, 2 Position, 4 Way Closed Center

### **Pressure Switch**

- 200 PSI

### **Pilot Operated Relief Valve**

### **Return Filter**

### **Motor & Flywheel**

- Flywheel, Black Oxide
- Hydraulic Motor

### **Press Cylinder**

- Press Load
- Guard

### **Pilot Operated Check Valve 1**

### **Pilot Operated Check Valve 2**

### **Pressure Reducing Valve**

### **Compression Cylinder**

- Spring, Load, 50LB/IN

### **Hydraulic Power Unit**

- Motor, 1 HP

## **Student Curriculum**

The curriculum shall consist of one (1) set of four (4) interactive multimedia modules. This curriculum shall contain at least twenty-five (25) industry skills covering: hydraulic pump troubleshooting, troubleshooting hydraulic actuators and directional control valves, troubleshooting hydraulic valves, and troubleshooting hydraulic systems.

The student curriculum supplied shall be designed in a skill-based format that focuses on teaching industry-relevant tasks. The objectives shall be accomplished by organizing the learning material into a series of learning activity packets, which are further subdivided into three or more segments per packet. All learning material needed shall be contained in the packets including text material, laboratory equipment activities, and multimedia directions. No external text sources shall be required. The specific cognitive skills taught by each text passage shall be identified next to the passage. Each lab activity shall be identified by the industrial task taught. All activities shall be highly detailed with step-by-step instructions to facilitate a self-directed learning environment. A combination of step-by-step enabling activities and creative, problem-solving activities shall be provided. A self-review of five to ten questions shall be provided after each segment. The curriculum must be capable of both self-directed and instructor directed study. All activities must correlate directly to the hardware supplied, with detailed illustrations and diagrams.

**Teacher's Assessment/ Portfolio Guides**

A teacher's guide shall be provided. It shall contain student data sheets, data sheet solutions, self review answers, quizzes, quiz answers, student skill record sheets, and authentic assessment. A quiz shall be provided for each packet. A question shall be provided in each quiz for each cognitive objective taught. All tasks listed in the packet shall be listed on personalized student record sheets. The Instructor's Package shall include directions for authentic skill assessment.

**Amatrol Model No. 950-HTB1 or equal**

**950-HTB1**  
**BASIC HYDRAULICS TROUBLESHOOTING LEARNING SYSTEM**

**MODULE 1    HYDRAULIC PUMP TROUBLESHOOTING**

<b>SEGMENT 1</b>	<b>HYDRAULIC TROUBLESHOOTING CONCEPTS</b>
OBJECTIVE 1	Define hydraulic troubleshooting and explain its importance
OBJECTIVE 2	Describe two levels of hydraulic troubleshooting and give an application of each
OBJECTIVE 3	Describe two methods of testing a hydraulic component and give an application of each
OBJECTIVE 4	Describe six hydraulic safe dress rules
OBJECTIVE 5	Describe eight hydraulic troubleshooting safety rules
<b>SEGMENT 2</b>	<b>IN-CIRCUIT HYDRAULIC COMPONENT TESTING</b>
OBJECTIVE 6	Describe four types of in-circuit component tests and give an application of each
OBJECTIVE 7	Describe three hydraulic troubleshooting measurements and give an application of each
OBJECTIVE 8	Describe the construction of three types of pressure test points and give an application of each
OBJECTIVE 9	Name the two typical locations of pressure test points
SKILL 1	Use a pressure test point to troubleshoot a hydraulic system
<b>SEGMENT 3</b>	<b>FLOW MEASUREMENT</b>
OBJECTIVE 10	Describe three ways to use a flow meter to troubleshoot a hydraulic system
OBJECTIVE 11	Describe two methods of measuring flow
SKILL 2	Test a hydraulic system by measuring fluid flow
<b>SEGMENT 4</b>	<b>PUMP FAILURE – CAVITATION AND PSEUDO-CAVITATION</b>
OBJECTIVE 12	Define cavitation and explain its effects
OBJECTIVE 13	Describe eight causes of cavitation
OBJECTIVE 14	Define pseudo-cavitation and explain its effect
OBJECTIVE 15	Describe four causes of pseudo-cavitation
SKILL 3	Recognize the sound of cavitation
SKILL 4	Recognize the sound of pseudo-cavitation
<b>SEGMENT 5</b>	<b>FIXED-DISPLACEMENT PUMP TROUBLESHOOTING</b>
OBJECTIVE 16	Describe nine symptoms of fixed-displacement pump failure and their causes
OBJECTIVE 17	Describe how to use a hydraulic troubleshooting chart
OBJECTIVE 18	Describe how to troubleshoot a fixed-displacement hydraulic pump
SKILL 5	Troubleshoot a fixed-displacement pump using an in-circuit test

**MODULE 2    TROUBLESHOOTING HYDRAULIC ACTUATORS AND DCVS**

<b>SEGMENT 1</b>	<b>CYLINDER CUSHIONS AND BOOTS</b>
OBJECTIVE 1	Describe the operation of a cylinder cushion and give its schematic symbol
OBJECTIVE 2	Describe how to adjust a cylinder cushion
SKILL 1	Adjust a cylinder cushion
OBJECTIVE 3	Describe the operation of a cylinder rod boot

OBJECTIVE 4	Describe how to install a cylinder rod boot
<b>SEGMENT 2</b>	<b>CYLINDER TROUBLESHOOTING</b>
OBJECTIVE 5	Describe five symptoms of hydraulic cylinder failure and their causes
OBJECTIVE 6	Describe how to troubleshoot a hydraulic cylinder
SKILL 2	Troubleshoot a cylinder using an in-circuit test
<b>SEGMENT 3</b>	<b>MOTOR TROUBLESHOOTING</b>
OBJECTIVE 7	Describe five symptoms of motor failure and their causes
OBJECTIVE 8	Describe how to troubleshoot a hydraulic motor
SKILL 3	Troubleshoot a motor using an in-circuit test
<b>SEGMENT 4</b>	<b>DIRECT-OPERATED DCV TROUBLESHOOTING</b>
OBJECTIVE 9	Describe five symptoms of direct-operating DCV failure and their causes
OBJECTIVE 10	Describe how to troubleshoot a direct-operating DCV
SKILL 4	Troubleshoot a direct-operated DCV using an in-circuit test

### **MODULE 3 TROUBLESHOOTING HYDRAULIC VALVES**

<b>SEGMENT 1</b>	<b>NON-COMPENSATED FLOW CONTROL VALVE TROUBLESHOOTING</b>
OBJECTIVE 1	Describe seven symptoms of non-compensated flow control valve failure and their causes
OBJECTIVE 2	Describe how to troubleshoot a non-compensated flow control valve
SKILL 1	Troubleshoot a non-compensated flow control valve using an in-circuit test
<b>SEGMENT 2</b>	<b>CHECK VALVE TROUBLESHOOTING</b>
OBJECTIVE 3	Describe five symptoms of check valve failure and their causes
OBJECTIVE 4	Describe how to inspect and troubleshoot a check valve
<b>SEGMENT 3</b>	<b>PILOT-OPERATED CHECK VALVE TROUBLESHOOTING</b>
OBJECTIVE 5	Describe five symptoms of pilot-operated check valve failure and their causes
OBJECTIVE 6	Describe how to inspect and troubleshoot a pilot-operated check valve
SKILL 2	Troubleshoot a pilot-operated check valve using an in-circuit test
<b>SEGMENT 4</b>	<b>RELIEF VALVE TROUBLESHOOTING</b>
OBJECTIVE 7	Describe six symptoms of relief valve failure and their causes
OBJECTIVE 8	Describe how to inspect and troubleshoot a relief valve
SKILL 3	Troubleshoot a relief valve using in-circuit tests
<b>SEGMENT 5</b>	<b>PRESSURE-REDUCING VALVE TROUBLESHOOTING</b>
OBJECTIVE 9	Describe seven symptoms of pressure-reducing valve failure and their causes
OBJECTIVE 10	Describe how to inspect and troubleshoot a pressure-reducing valve
SKILL 4	Troubleshoot a pressure-reducing valve using an in-circuit test

### **MODULE 4 TROUBLESHOOTING HYDRAULIC SYSTEMS**

<b>SEGMENT 1</b>	<b>INTRODUCTION TO TROUBLESHOOTING HYDRAULIC SYSTEMS</b>
OBJECTIVE 1	Describe three categories of hydraulic system faults and give an example of each
OBJECTIVE 2	Describe the four methods of system-level troubleshooting
OBJECTIVE 3	Describe the function of a troubleshooting flowchart
OBJECTIVE 4	Describe the construction of a troubleshooting flowchart
OBJECTIVE 5	Describe how to use a flowchart to aid in troubleshooting

OBJECTIVE 6	Describe how to use PLC I/O indicators to troubleshoot a hydraulic system process
SKILL 1	Troubleshoot a hydraulic system using PLC indicator lights
<b>SEGMENT 2</b>	<b>TROUBLESHOOTING SYSTEMS-LEVEL FAULTS</b>
OBJECTIVE 7	Describe how to troubleshoot zero system pressure
SKILL 2	Troubleshoot zero system pressure
OBJECTIVE 8	Describe how to troubleshoot low system pressure
SKILL 3	Troubleshoot low system pressure
OBJECTIVE 9	Describe how to troubleshoot high system pressure
OBJECTIVE 10	Describe how to troubleshoot a hot hydraulic system
OBJECTIVE 11	Describe how to troubleshoot vibration in a hydraulic system
<b>SEGMENT 3</b>	<b>TROUBLESHOOTING MACHINE SEQUENCE FAULTS</b>
OBJECTIVE 12	Describe how to troubleshoot an actuator that will not move
SKILL 4	Troubleshoot an actuator that will not move
OBJECTIVE 13	Describe how to troubleshoot an actuator that moves out of sequence
OBJECTIVE 14	Describe how to troubleshoot a pressure change problem in a multiple pressure circuit
<b>SEGMENT 4</b>	<b>TROUBLESHOOTING MACHINE PERFORMANCE FAULTS</b>
OBJECTIVE 15	Describe how to troubleshoot erratic actuator movement
SKILL 5	Troubleshoot erratic actuator movement
OBJECTIVE 16	Describe how to troubleshoot slow actuator speed
SKILL 6	Troubleshoot slow actuator speed
OBJECTIVE 17	Describe how to troubleshoot fast actuator speed
OBJECTIVE 18	Describe how to troubleshoot incorrect acceleration or deceleration