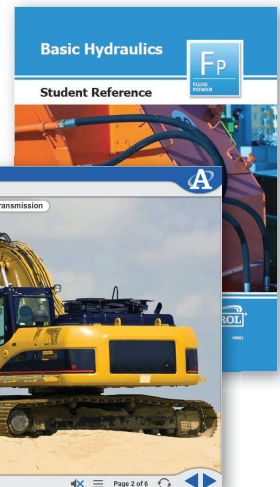
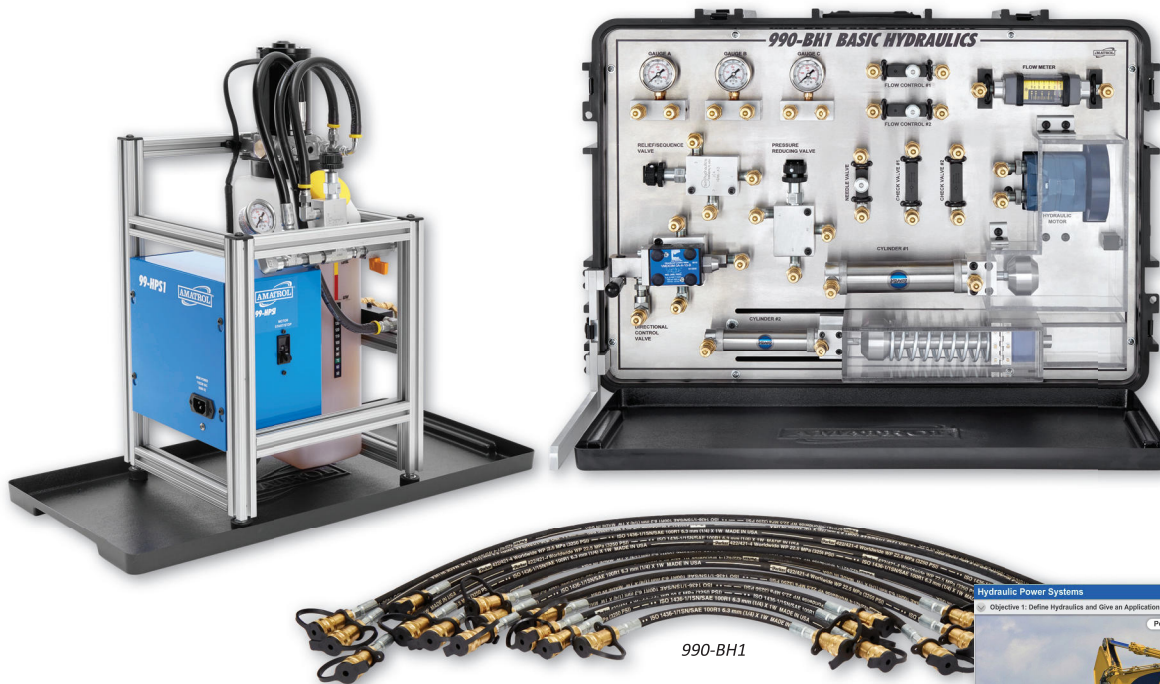


Portable Basic Hydraulics Learning System

990-BH1

Fp

FLUID
POWER



Interactive Multimedia Curriculum and Student Reference Guide

Learning Topics:

- Hydraulic Power Systems
- Basic Hydraulic Circuits
- Principles of Hydraulic - Pressure and Flow
- Hydraulic Speed Control
- Pressure Control Circuits
- Pumps
- Hydraulic Schematics
- Relief, Check, and Flow Control Valves
- Meter-In, Meter-Out, and Flow Control Circuits
- Sequence Valves
- Pressure Reducing Valves
- Troubleshooting

Amatrol's Portable Basic Hydraulics Learning System (990-BH1) allows learners to gain skills by studying topics like basic hydraulic circuits, pressure control circuits, hydraulic schematics, and sequence valves. Also, given the compact nature of the 990-BH1, for the first time you can teach hydraulics in a limited space. This learning system will allow learners to study and practice how to read a pressure gauge, as well as liquid level and temperature in the reservoir, connecting hydraulic circuits, operating a bi-directional hydraulic motor, converting between absolute and gauge pressure, and connecting and adjusting the pressure setting of a pressure relief valve (PRV).

This 990-BH1 includes gauges, manifolds, cylinders, valves (relief/sequence, pressure reducing, check, directional control), flow meter, and hydraulic motor. The components of this portable trainer are all industrial quality, not only to ensure durability, but also to help learners become better prepared for what they will encounter on the job. All Amatrol products are made from top-notch materials and carefully crafted to create tough, attractive, well designed learning systems that facilitate learning and will serve teachers and students for years. Amatrol uses components that learners will find on-the-job in order to give the best opportunity to build confidence and industrial competencies.



Technical Data

Complete technical specifications available upon request.

Portable Console
99-HHF Hydraulic Hose and Fittings Package
99-HPS1 Compact Hydraulic Power Unit
Drip Pan
Bracket Stabilizer
Instructor Guide (C19144)
Multimedia Curriculum (M19144)
Install Guide (D19144)
Student Reference Guide (H19144)

Additional Requirements:

Computer: see requirements <http://www.amatrol.com/support/computer-requirements>

Utilities:

Electricity (115/230 VAC, 50/60 Hz, Single Phase)

Real-World Applications for Hydraulics Principles

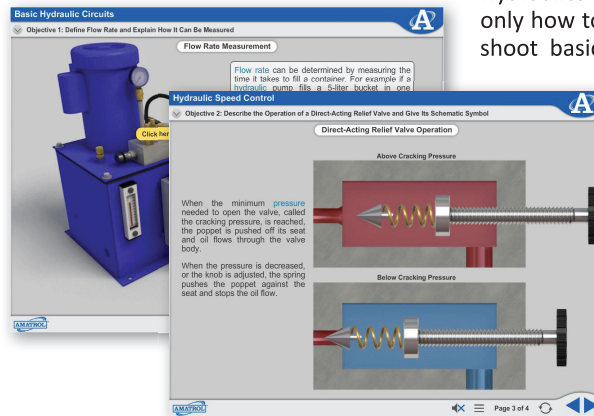
The 990-BH1 has a remarkably small footprint, allowing hydraulics to be taught in spaces that precluded that training previously. Its components are all industrial quality, not only to ensure durability, but also to help learners become better prepared for what they will encounter on the job. Learners will use these components to practice vital hydraulics skills, such as: connecting and adjusting a flow control valve to control the speed of an actuator; designing an independent speed control circuit and two-speed actuator circuit; and operating a double-acting cylinder, and operating of an integral check valve.



Interactive Curriculum and Hands-On Skills

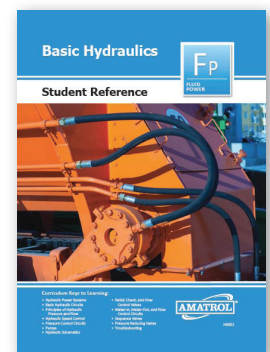
This learning system also includes Amatrol's world-class Multimedia curriculum, which combines strong theoretical knowledge and concepts with hands-on skills for the best industrial competency-building on the market. This thorough, exceptionally detailed curriculum is built to begin with the basics and steadily advance to more complex concepts and skill. The Basic

Hydraulics Learning System teaches learners not only how to operate, install, design, and troubleshoot basic hydraulics for various applications, but also to understand concepts like flow rate versus cylinder speed and pressure versus cylinder force. The 990-BH1 curriculum covers major objectives like pumps, gauges, hydraulic motors, cylinders, and numerous valves, including schematic symbols for each component, creating the ability to read and draw their own hydraulic schematics.



Student Reference Guide

A sample copy of the Portable Basic Hydraulics Student Reference Guide is also included with the system for your evaluation. Sourced from the system's multimedia 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.



PORTABLE BASIC HYDRAULICS LEARNING SYSTEM

This learning system is designed to teach basic hydraulics operations, skills, and applications used in industry today. It shall include a mobile carrying case, a variety of valves, gauges, and cylinders mounted to a work surface, a portable hydraulic power unit, a hydraulic hose set, student curriculum and teacher's assessment guide. The minimum requirements include:

Workstation

- Mobile Carrying Case: 29.5-in W x 20.5-in H x 12-in D
- Workstation Mounting Panel
- Drip Pan
- Bracket, Stabilizer

Mechanical Assembly

- (2) Hydraulic Cylinder Assemblies
- Directional Control Valve
- (2) Check Valves
- Hydraulic Motor
- Needle Valve
- Pressure Reducing Valve
- Relief Sequencing Valve
- Flow Meter
- (2) Flow Control Valves
- (3) Pressure Gauges

Compact Hydraulic Power Unit

- Hydraulic Power Unit
- Hydraulic Fluid Reservoir
- Manifold, 4 POS, 1/4 NPT
- Supply Hose
- Liquid-Filled Gauge, 0-600 psi
- Pilot-Operated Relief Valve
- Power Supply, 24VDC, 10A

Hydraulic Hose and Fitting Package

- (1) Hydraulic Hose Assembly, 1.5-ft.
- (3) Hydraulic Hose Assembly, 2-ft.
- (3) Hydraulic Hose Assembly, 3-ft.
- (3) Hydraulic Hose Assembly, 4-ft.
- (3) Hydraulic Hose Assembly, 5-ft.
- (3) Quick Connect, Tee Assembly

Student Curriculum

Shall include one set of multimedia divided into five (5) modules containing at least forty-one (41) skills in basic hydraulics applications and concepts. Sample topics include: hydraulic power systems, basic hydraulic circuits, principles of hydraulic pressure and flow, hydraulic speed control, and pressure control circuits.

The student curriculum 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 modules, which are further subdivided into three or more segments per module. All learning materials 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 Guide

A teacher's assessment 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 teacher's assessment guide shall include directions for authentic skill assessment.

Amatrol Model No. 990-BH1 or equal

990-BH1
PORTABLE BASIC HYDRAULICS LEARNING SYSTEM

MODULE 1 HYDRAULIC POWER SYSTEMS

SEGMENT 1	INTRODUCTION TO HYDRAULICS
OBJECTIVE 1	Define hydraulics and give an application
OBJECTIVE 2	Describe the functions of five basic components of a hydraulic system
OBJECTIVE 3	Define hydraulic pressure and give its units of measurement
OBJECTIVE 4	Describe how to read a pressure gauge
SKILL 1	Read a hydraulic pressure gauge
SEGMENT 2	POWER UNIT OPERATION
OBJECTIVE 5	Describe the operation of a hydraulic power unit
SKILL 2	Read the liquid level and temperature in the reservoir
SKILL 3	Operate a hydraulic power unit
SEGMENT 3	CIRCUIT CONNECTIONS
OBJECTIVE 6	Describe the function of a hydraulic schematic
OBJECTIVE 7	Describe the function of a hydraulic quick-connect fitting and give its schematic symbol
SKILL 4	Connect and disconnect a hydraulic hose that uses quick-connect fittings
OBJECTIVE 8	Describe the function of a tee and give its schematic symbol
SKILL 5	Use a tee to connect two circuit branches together
OBJECTIVE 9	Describe the operation of a pressure gauge and give its schematic symbol
SEGMENT 4	BASIC CYLINDER CIRCUITS
OBJECTIVE 10	Describe the function of a hydraulic cylinder and give an application
OBJECTIVE 11	Describe the operation of a double-acting hydraulic cylinder and give its schematic symbol
OBJECTIVE 12	Describe the function of a 4-way, 3-position DCV and give an application
OBJECTIVE 13	Describe the operation of a 4-way, 3-position DCV and give its schematic symbol
SKILL 6	Connect and operate a double-acting hydraulic cylinder using a 3-position, manually-operated DCV
SKILL 7	Design a dual cylinder hydraulic circuit

MODULE 2 BASIC HYDRAULIC CIRCUITS

SEGMENT 1	PUMPS
OBJECTIVE 1	Define flow rate and explain how it can be measured
OBJECTIVE 2	Describe the operation of two types of flowmeters and give their schematic symbol
SKILL 1	Connect and read a flowmeter
OBJECTIVE 3	Describe the operation of a fixed-displacement pump and give its schematic symbol
SKILL 2	Operate a fixed-displacement pump
OBJECTIVE 4	Describe the operation of three types of fixed-displacement pumps and give an application of each

SEGMENT 2	NEEDLE VALVES
OBJECTIVE 5	Describe the main function of a needle valve
OBJECTIVE 6	Describe the operation of a needle valve and give its schematic symbol
SKILL 3	Connect and operate a needle valve to control the speed of an actuator
SKILL 4	Control the speed of an actuator using a manually-operated DCV
SEGMENT 3	BASIC MOTOR CIRCUITS
OBJECTIVE 7	Describe the function of a hydraulic motor and give an application
OBJECTIVE 8	Describe the operation of a hydraulic motor and give its schematic symbol
SKILL 5	Connect and operate a bi-directional hydraulic motor using a 3-position, manually-operated DCV
OBJECTIVE 9	List three types of hydraulic motors and give an application of each
SEGMENT 4	HYDRAULIC SCHEMATICS
OBJECTIVE 10	Describe eight basic rules for drawing hydraulic schematics
SKILL 6	Draw a hydraulic schematic from the actual circuit connections on a pictorial
SKILL 7	Draw a hydraulic circuit given a schematic
SKILL 8	Design a multiple actuator hydraulic circuit

MODULE 3 PRINCIPLES OF HYDRAULIC PRESSURE AND FLOW

SEGMENT 1	PRESSURE VS. CYLINDER FORCE
OBJECTIVE 1	Describe how to calculate the force output of an extending cylinder
SKILL 1	Calculate the extension force of a cylinder given its size and pressure
SKILL 2	Measure the force output of an extending cylinder
OBJECTIVE 2	Describe how to calculate the force output of a hydraulic cylinder in retraction (pull)
SKILL 3	Calculate the retraction force of a cylinder given its size and pressure
SKILL 4	Measure the force output of a retracting cylinder
SEGMENT 2	HYDRAULIC LEVERAGE
OBJECTIVE 3	State Pascal's Law and explain its significance in hydraulics
OBJECTIVE 4	Explain how force is multiplied using Pascal's Law
SEGMENT 3	FLUID FRICTION
OBJECTIVE 5	Describe two types of resistance in a hydraulic system
OBJECTIVE 6	Explain how Delta P describes hydraulic resistance
OBJECTIVE 7	Explain how pressure is distributed in a hydraulic system
SKILL 5	Measure Delta P across a hydraulic component
SEGMENT 4	ABSOLUTE VS. GAUGE PRESSURE
OBJECTIVE 8	Describe two methods of representing hydraulic pressure
SKILL 6	Convert between absolute pressure and gauge hydraulic pressure
OBJECTIVE 9	Describe how oil flows on the suction side of the pump

MODULE 4 HYDRAULIC SPEED CONTROL

SEGMENT 1	RELIEF VALVES
OBJECTIVE 1	Describe the function of a relief valve and give an application
OBJECTIVE 2	Describe the operation of a direct-acting relief valve and give its schematic symbol

OBJECTIVE 3	Describe how a relief valve is used for system protection
SKILL 1	Connect a relief valve in a circuit to limit pressure in the system
OBJECTIVE 4	Describe how a relief valve is used for speed control assistance
SEGMENT 2	CHECK VALVES
OBJECTIVE 5	Describe the function of a check valve and give an application
OBJECTIVE 6	Describe the operation of three types of check valves and give their schematic symbol
SKILL 2	Test the operation of a check valve
SKILL 3	Design a circuit to provide bypass flow
SEGMENT 3	FLOW CONTROL VALVES
OBJECTIVE 7	Describe the function of the flow control valve and give an application
OBJECTIVE 8	Describe the operation of a flow control valve and give its schematic symbol
SKILL 4	Connect and adjust a flow control valve to control speed of an actuator
OBJECTIVE 9	Describe the effect of actuator load changes on flow control valve operation
SEGMENT 4	METER-IN AND METER-OUT CIRCUITS
OBJECTIVE 10	Describe the operation of a meter-in flow control circuit and give an application
SKILL 5	Connect and operate a meter-in flow control circuit
OBJECTIVE 11	Describe the operation of a meter-out flow control circuit and give an application
SKILL 6	Connect and operate a meter-out flow control circuit
SEGMENT 5	FLOW CONTROL CIRCUIT DESIGN
OBJECTIVE 12	Define independent speed control and give an application
SKILL 7	Design an independent speed control circuit
OBJECTIVE 13	Explain how speed control valves can be used to provide multiple speeds
SKILL 8	Design a two-speed actuator circuit
SEGMENT 6	FLOW RATE VS. CYLINDER SPEED
OBJECTIVE 14	Describe how to calculate the extend speed of a hydraulic cylinder
SKILL 9	Calculate the extend speed of a hydraulic cylinder given its size and a flow rate
OBJECTIVE 15	Describe how to calculate the retract speed of a cylinder
SKILL 10	Calculate the retract speed of a cylinder given its size and a flow rate
OBJECTIVE 16	Describe how to calculate the stroke time of a cylinder
SKILL 11	Calculate the cylinder stroke time given its size and a flow rate

MODULE 5 PRESSURE CONTROL CIRCUITS

SEGMENT 1	SEQUENCE VALVES
OBJECTIVE 1	Describe the function of a pressure sequence valve and give an application
OBJECTIVE 2	Describe the operation of a direct-acting sequence valve and give its schematic symbol
SKILL 1	Connect and adjust the pressure setting of a sequence valve
SKILL 2	Connect and operate a pressure sequence circuit
SEGMENT 2	SEQUENCE VALVE APPLICATIONS
OBJECTIVE 3	Describe the function of a bypass check valve in a sequence valve circuit

OBJECTIVE 4	Describe the operation of an integral check valve and give its schematic symbol
SKILL 3	Design a pressure sequence circuit
OBJECTIVE 5	Describe the function of a two-sequence valve control circuit
SKILL 4	Design a two-sequence valve control circuit
OBJECTIVE 6	Explain why a sequence valve is externally drained
SEGMENT 3	PRESSURE REDUCING VALVES
OBJECTIVE 7	Describe the function of a pressure reducing valve and give an application
OBJECTIVE 8	Describe the operation of a direct-acting PRV and give its schematic symbol
SKILL 5	Connect and adjust the pressure setting of a PRV
SKILL 6	Connect and operate a reduced pressure circuit
SEGMENT 4	PRV APPLICATIONS
OBJECTIVE 9	Describe the function of a PRV's bypass check valve
SKILL 7	Design a hydraulic circuit that uses a pressure reducing valve
OBJECTIVE 10	Explain why a PRV is externally drained