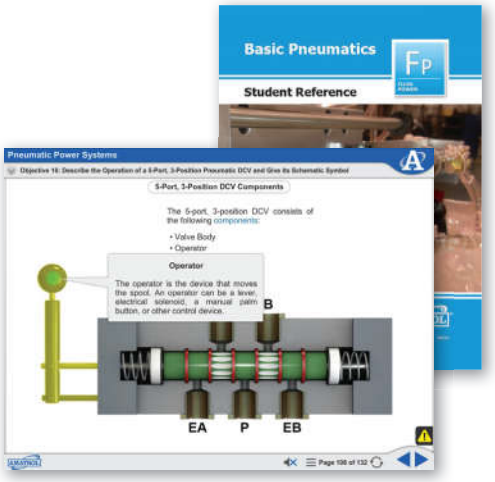
Basic Pneumatics Learning System

85-BP

FP
FLUID POWER

85-BP



Interactive Multimedia and Student Reference Guide

Learning Topics:

- Pneumatic Power Systems
- Circuit Connections
- Basic Cylinder Circuits
- Basic Pneumatic Circuits
- Pneumatic Schematics
- Single-Acting Cylinder Circuits
- Principles of Pneumatic Pressure and Flow
- Pressure vs. Cylinder Force
- Air Flow and Resistance
- Pneumatic Control Circuits
- Flow Control Calves
- Speed Control

Amatrol's Basic Pneumatics Learning System (85-BP) introduces pneumatic principles through a combination of Amatrol's topflight curriculum with hands-on skills; this attention to marrying the "why" and "how" of pneumatics will reinforce both concept and theory, resulting in a thorough understanding of the topic. Topics covered in this learning system include single-acting cylinder circuits, pressure vs. cylinder force, and flow control valves, while the panels can be used to practice skills such as connecting and operating a needle valve to control actuator speed.

The 85-BP features pneumatic cylinders, flow controls, directional control valve, air motor, pressure gauges, rotameter, manometer, and air filter. These components are mounted on Amatrol panels, which are carefully crafted (hand-welded and painted) to provide a durable, well designed learning system that will serve teachers and students for years.

The skills acquired by successfully completing the 85-BP will prepare learners for more advanced systems, including Amatrol's Intermediate Pneumatics (85-IP) and Advanced Pneumatics (85-AP). The 85-IP covers topics such as cam-operated valves, cylinder sequencing, and shuttle valves, while 85-AP topics include pneumatic cylinder loads and quick exhaust valves.

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Technical Data

Complete technical specifications available upon request.

Basic Pneumatics Instrumentation Panel
- Pressure Gauge Assembly (3)
- Filter Regulator Assembly
- Rotometer Assembly
- Manometer Assembly

Basic Pneumatics Actuator/Valve Module
- Air Motor Assembly
- Spring Return Cylinder Assembly
- Cylinder Assembly, 1-1/8-in.
- Flow Control Assembly (2)
- Lever-Operated Assembly
- Cylinder Assembly, 1-1/2-in.
- Rail Assembly, 10-in.
- Rail Assembly, 11-in.

Pneumatic Hose and Fittings Package (85-PHF)
- Hose Assembly, 42-in.
- Hose Assembly, 36-in. (2)
- Hose Assembly, 24-in. (4)
- Hose Assembly, 16-in. (4)
- Hose Assembly, 12-in. (2)
- Cross Assembly
- Basic Pneumatics Coiled Hose Assembly
- Tee (2)

Interactive Multimedia Curriculum (MB834)

Instructor's Guide (CB834)

Installation Guide (DB834)

Student Reference Guide (HB834)

Additional Requirements
- Hand Tool Package (41220)

Additional Recommendations
- Controls Technology Bench (850-CTB-B)

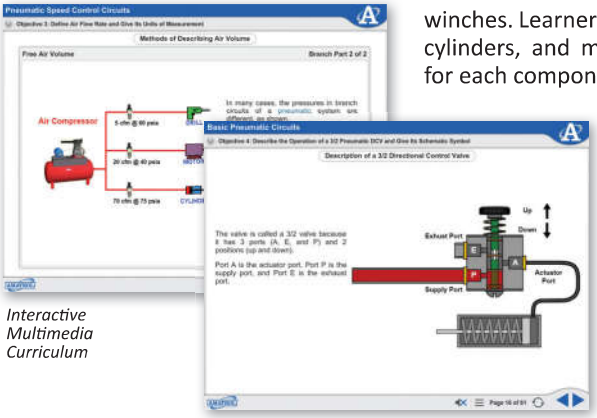
Utilities
- Pneumatics power supply or conditioned shop air (2 CFM @ 100 PSIG/0.06 cmm @ 690 kPa)

Industrial Components

Amatrol's commitment to using industry-standard components provides learners with an opportunity to train on mechanisms that they will see on the job. Components included with the 85-BP are pre-mounted in an orderly, user-friendly design on stainless steel circuit panels with hand-painted shadow labels, which makes it easy to identify and inventory components.

Pneumatic Application

Amatrol's curriculum explains how basic pneumatic components are integrated into real-world applications such as robots, rock drills, and truck brakes. As an example, learners will practice on a pneumatic motor and study the principles behind how it works, while also reading about how it is utilized on pneumatic drills and small winches. Learners will study pneumatic gauges, valves, cylinders, and motors, including schematic symbols for each component.



Interactive Multimedia Curriculum

This Basic Pneumatics curriculum is presented in an interactive multimedia format that that combines text, audio, 3D illustrations, and loads of interaction to fully engage learners as they begin at the foundation of pneumatics.

Expanded Options & Add-Ons

Alternately, Amatrol conveniently offers the 85-BP as part of the separate 850-P1 Basic Pneumatics Learning System or Controls Technology Learning System (850-PD1). The 850-P1 is a single-sided workstation that allows up to three learners at a time to practice pneumatics skills, and the 850-PD1 is a double-sided workstation that allows for six learners to work simultaneously. If there is a need to teach both pneumatics and hydraulics, the 85-BP is also included with the Basic Fluid Power – Double Sided A-Frame Bench with Two Hydraulic Manifolds (850-CD1) or Basic Fluid Power – Double Sided A-Frame Bench with One Hydraulic Manifold (850-CD2).

850-CD2 for Combination Pneumatic and Hydraulic Training

Student Reference Guide

A sample copy of the Basic Pneumatics 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 perfect-bound book.

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BASIC PNEUMATIC LEARNING SYSTEM
This system shall provide basic pneumatic training. This learning system requires a Mobile Technology Workstation – 6-ft. (82-610) or equivalent work surface and a pneumatic power supply or conditioned (dry and filtered) shop air. This learning system shall include: (1) Basic Pneumatic Instrumentation Panel, (1) Basic Pneumatics Actuator/Valve Module, and (1) Pneumatic Hose and Fittings Package.

Each module shall allow quick setup and easy inventory by providing pneumatic components pre-mounted on circuit panels; silk-screened identifications next to each component showing each component's standard symbol, description and part number; and quick connect fittings. To give equipment durability and realistic exposure all components shall be 100 PSI min. rated - industrial grade and the circuit panels shall be of welded stainless steel construction.

Provisions shall also be made to allow each module to be used on mobile workstation or as a satellite station on any standard work surface. These provisions shall include as a minimum: (2) permanent-mounted lift handles for mobility, mounting surface scuff protection, and mounting guides for the instrumentation module. The components for each module shall include as a minimum:

Basic Pneumatic Instrumentation Panel
- (3) – Pressure Gauges, 0-160 PSIG range, 2 ½-in.
- (1) – Pressure Regulator and Gauge, 0-160 PSIG range
- (1) – Air Filter
- (1) – Supply Manifold, 4-port with quick connects
- (1) – Rotameter, 20-200 SCFH range
- (1) – Manometer, inclined, 7-in. H

Basic Pneumatics Actuator/Valve Module
- (1) – Air Motor Assembly, vane-type
- (1) – Cylinder, double-acting, 1 1/8-in. bore, 6-in. stroke, with cam
- (1) – Cylinder, double-acting, 1 ½-in. bore, 4-in. stroke, with cam
- (2) – Flow Controls, with integral reverse free-flow check valve
- (1) – Cylinder, single-acting, 3/4" Bore, 1" Stroke, spring return, transparent
- (1) – Directional Control Valve, 3-position, 5-ported/4-way, spring centered, closed center, transparent
- (1) – Rail Assembly, 10-in.
- (1) – Rail Assembly, 11-in.

Pneumatic Hose and Fittings Package
- (1) – Hose Assembly, 42-in.
- (2) – Hose Assembly, 36-in.
- (4) – Hose Assembly, 24-in.
- (4) – Hose Assembly, 16-in.
- (2) – Hose Assembly, 12-in.
- (1) – Basic Pneumatics Coiled Hose Assembly
- (2) – Fitting tees
- (1) – Fitting Cross

Student Curriculum
The student curriculum shall consist of an interactive multimedia course divided into four (4) modules covering thirty-one (31) skills in basic pneumatic systems. The major topic areas covered shall include: pneumatic power, circuit connections, basic cylinder circuits, single-acting cylinder circuits, basic motor circuits, pneumatic schematics, pressure vs. cylinder force, pneumatic leverage, pressure and volume, air flow and resistance, air flow control and measurement, flow control valves, and speed control.

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

interactive multimedia modules, which are further subdivided into three or more segments per module. All learning material needed shall be contained in the modules 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. 85-BP or equal

85-BP
BASIC PNEUMATICS LEARNING SYSTEM

LAP 1 PNEUMATIC POWER SYSTEMS

SEGMENT 1	**INTRODUCTION TO PNEUMATICS**
OBJECTIVE 1	Define pneumatics and give an application
OBJECTIVE 2	Describe the functions of basic components of a pneumatic system
Activity 1	Pneumatic trainer
OBJECTIVE 3	Define pneumatic pressure and give its units of measurement
SKILL 1	Read a pneumatic pressure gauge
OBJECTIVE 4	Describe the function of a pneumatic schematic
SEGMENT 2	**PNEUMATIC POWER**
OBJECTIVE 5	Explain six pneumatic safety rules
OBJECTIVE 6	Describe the function of a pressure regulator valve and give an application
OBJECTIVE 7	Describe the operation of a pressure regulator and give its schematic symbol
SKILL 2	Connect and adjust a pressure regulator
OBJECTIVE 8	Describe the function of an air filter
OBJECTIVE 9	Describe the operation of an air filter and give its schematic symbol
SKILL 3	Drain a pneumatic filter
SEGMENT 3	**CIRCUIT CONNECTIONS**
OBJECTIVE 10	Describe the function of a pneumatic quick-connect fitting and give its schematic symbol
SKILL 4	Connect a pneumatic hose that uses quick-connect fittings
OBJECTIVE 11	Describe the function of a tee and a cross and give their schematic symbols
SKILL 5	Use a tee to connect two circuit branches together
SKILL 6	Use a cross to connect three circuit branches together
SEGMENT 4	**BASIC CYLINDER CIRCUITS**
OBJECTIVE 12	Describe the function of a pneumatic cylinder and give an application
OBJECTIVE 13	Describe the operation of a double-acting pneumatic cylinder and give its schematic symbol
Activity 2	Basic operation of a double-acting cylinder
OBJECTIVE 14	Describe the function of a 4-way, 3-position pneumatic DCV and give an application
OBJECTIVE 15	Describe the operation of a 4-way, 3-position pneumatic DCV and give its schematic symbol
SKILL 7	Connect and operate a double-acting pneumatic cylinder using a 3-position, manually-operated DCV
SKILL 8	Design a multiple cylinder pneumatic circuit

LAP 2 BASIC PNEUMATIC CIRCUITS

SEGMENT 1	**SINGLE-ACTING CYLINDER CIRCUITS**
OBJECTIVE 1	Describe the function of a single-acting pneumatic cylinder and give an application
OBJECTIVE 2	Describe the operation of a single-acting, spring-return cylinder and give its schematic symbol
Activity 1	Basic operation of a single-acting, spring-return cylinder

OBJECTIVE 3	Describe the function of a 3/2 pneumatic DCV and give an application
OBJECTIVE 4	Describe the operation of a 3/2 pneumatic DCV and give its schematic symbol
SKILL 1	Connect and operate a single-acting pneumatic cylinder using a 3/2 manually-operated DCV

SEGMENT 2	**BASIC MOTOR CIRCUITS**
OBJECTIVE 5	Describe the function of a pneumatic motor and give an application
OBJECTIVE 6	Describe the operation of a pneumatic motor and give its schematic symbol
SKILL 2	Connect and operate a unidirectional pneumatic motor using a 3-way, manually-operated DCV
OBJECTIVE 7	Describe the function of a muffler and give its schematic symbol
Activity 2	Air muffler operation
OBJECTIVE 8	List three common pneumatic motor designs and explain where they are used

SEGMENT 3	**PNEUMATIC SCHEMATICS**
OBJECTIVE 9	Describe the line symbols used with fluid power circuits
SKILL 3	Identify pneumatic symbols
OBJECTIVE 10	Describe seven basic rules for drawing pneumatic schematics
SKILL 4	Draw a pneumatic schematic from the actual circuit connections on the machine
SKILL 5	Connect a pneumatic circuit given a schematic
SKILL 6	Design a multiple actuator pneumatic circuit

LAP 3 PRINCIPLES OF PNEUMATIC 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 cylinder in retraction (pull)
SKILL 3	Calculate the retraction force of a cylinder given its size and pressure

SEGMENT 2	**PNEUMATIC LEVERAGE**
OBJECTIVE 3	State Pascal's Law and explain its significance in pneumatics
Activity 1	Verification of Pascal's Law
OBJECTIVE 4	Explain how force is multiplied using Pascal's Law
Activity 2	Demonstrate how distance is sacrificed to obtain force multiplication

SEGMENT 3	**PRESSURE AND VOLUME**
OBJECTIVE 5	Describe two methods of representing pressure
SKILL 4	Convert between gauge and absolute pressures
OBJECTIVE 6	Explain how air pressure is created in a pneumatic system
OBJECTIVE 7	State Boyle's Law and explain its significance
SKILL 5	Use Boyle's Law to calculate changes in pressure and volume
Activity 3	Verification of Boyle's Law

SEGMENT 4	**AIR FLOW AND RESISTANCE**
OBJECTIVE 8	Explain how a pneumatic system creates air flow
OBJECTIVE 9	Describe two types of resistance in a pneumatic system
OBJECTIVE 10	Explain how Delta P describes pneumatic resistance and explain its importance
SKILL 6	Measure Delta P across pneumatic components

OBJECTIVE 11	Describe what determines the speed of a pneumatic actuator
Activity 4	Effect of pressure on pneumatic actuator speed

LAP 4 PNEUMATIC SPEED CONTROL CIRCUITS

SEGMENT 1	**AIR FLOW CONTROL AND MEASUREMENT**
OBJECTIVE 1	Describe the main function of a pneumatic needle valve and give an application
OBJECTIVE 2	Describe the operation of a needle valve and give its schematic symbol
SKILL 1	Connect and operate a needle valve to control actuator speed
OBJECTIVE 3	Define air flow rate and give its units of measurement
SKILL 2	Convert air volumes at pressures to free air volumes
OBJECTIVE 4	Describe the function of a flowmeter and give an application
OBJECTIVE 5	Describe the operation of a rotameter and give its schematic symbol
SKILL 3	Connect and read a flowmeter
SEGMENT 2	**FLOW CONTROL VALVES**
OBJECTIVE 6	Describe the function of a pneumatic check valve and give an application
OBJECTIVE 7	Describe the operation of two types of pneumatic check valves and give their schematic symbol
SKILL 4	Connect and operate a check valve
OBJECTIVE 8	Describe the function of the flow control valve and give an application
OBJECTIVE 9	Describe the operation of a flow control valve and give its schematic symbol
SKILL 5	Connect and adjust a flow control valve to control speed of an actuator
OBJECTIVE 10	Describe the effect of actuator load changes on flow control operation
Activity 1	Effect of actuator load changes on flow control valve operation
SEGMENT 3	**SPEED CONTROL**
OBJECTIVE 11	Describe the operation of a meter-in flow control circuit and give an application
SKILL 6	Connect and operate a meter-in flow control circuit
OBJECTIVE 12	Describe the operation of a meter-out flow control circuit and give an application
SKILL 7	Connect and operate a meter-out flow control circuit
OBJECTIVE 13	Describe the operation of an exhaust port speed control and give an application
SKILL 8	Connect and operate an exhaust port speed control circuit
OBJECTIVE 14	Describe the operation of a pressure port speed control and give an application
SKILL 9	Connect and operate a pressure port speed control circuit
SKILL 10	Design speed control circuits
OBJECTIVE 15	Define independent speed control and give an application
SKILL 11	Design an independent speed control circuit