

# Hydraulics (40-assignment)



This is an integrated instructional module designed specifically to operate within the LJ ScanTEK Modular Technology Program environment. It includes a 10-assignment exploratory curriculum and a further 30-assignment in-depth curriculum. The exploratory curriculum and the in-depth curriculum are each split into two parts. Each part includes a pre-test and post test. The module includes hardware, software and curriculum materials sufficient to provide a complete learning experience.

The curriculum incorporates continuous assessment through questions. When used in conjunction with a ClassAct networked management system, this provides instant feedback of student performance. The assessments begin with a comprehensive pre-test. This quiz includes questions for each subsequent assignment, together with questions that will specifically test math and reading ability.

Every assignment starts with a series of questions designed to track inventory. These ensure that any missing items are located before they are needed.

Each assignment is divided into a series of tasks. Hands-on tasks form the core of the student work. Where appropriate, these are accompanied by research tasks based upon illustrated textbooks and on-screen applications. Assessment questions are incorporated into each task.

**Typical 10-assignment topic areas include:**

- Building and testing hydraulic circuits
- Pressure, force and area relationship
- Hydraulic component symbols
- Compression of gases
- Cylinder diameter and speed relationship
- Hydraulic valves to control a circuit
- Energy flow in a hydraulic system
- Hydraulic lever.
- Hydraulic cylinders
- Volumetric efficiency
- Bernoulli's law

**Typical 10-assignment activities include:**

- Find out what hydraulics is and the basic parts of all hydraulic systems.
- Investigate compressibility and compare the performance of oil and air.
- Explain compressibility using the structure of matter.
- Look at the pressure, force and area relationship.
- Discover Pascal's law and how it relates to hydraulic technology.
- Recognize how symbols can be used in hydraulics to simplify the design and drawing of circuits and components.
- Investigate hydraulic valves and how they are used to control what happens in a hydraulic circuit.
- Look at the output part of hydraulic systems – cylinders.
- Investigate fluid flow and how it is measured.
- Discover Bernoulli's law which relates fluid flow and pressure. See how flow rate affects cylinder speed.
- Investigate the formula  $F = P \times A$
- Discover the principle of the hydraulic lever and how hydraulic systems can be used to magnify forces.

**Typical 10-assignment activities include (continued):**

- Design a hydraulic system to operate two cylinders in sequence and simulate an aircraft undercarriage system.

**Typical 30-assignment topic areas include:**

- Power control system
- Pressure measurement
- Compressibility of oil and air
- Force, pressure and area
- Hydraulic pumps
- Hydraulic symbols
- Compressibility of gases and liquids
- SI units
- Control valves
- Fluid flow
- Fluid velocity calculations
- Boyle's law
- Mechanical levers and mechanical advantage
- Bore size stroke time
- Flow control valves
- Check valves
- Hydraulic seals
- Sequencing hydraulics
- Hydraulic lift design
- Hydraulic braking system
- Shock absorbing system
- Accumulators

**Typical 30-assignment activities include:**

- Learn about how to use the hydraulics training system safely.
- Find out what hydraulics is and the basic parts of all hydraulic systems.
- Investigate the inputs and outputs of a hydraulic systems.
- Find out about energy and how it flows through a hydraulic system.
- Define pressure and look at different scales of pressure.
- Discover how pressure is measured and how atmospheric pressure is taken into account.
- Discover Pascal's law and how it relates to hydraulic technology.
- Discover that the weight of fluid can also create pressure.
- Discover how hydraulic symbols are used to simplify the design and communication of hydraulic systems.
- Investigate compressibility and compare the performance of oil and air.
- Explain compressibility using the structure of matter.
- Look at the output part of hydraulic systems – cylinders.
- Examine the factors that affect cylinder performance.
- Revise the formula  $F = P \times A$ .
- Investigate SI units and use them to solve force, pressure and area problems.
- Investigate hydraulic valves and how they are used to control what happens in a hydraulic circuit.
- Look at fluid flow; how it is defined and how it is measured.

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**Typical 30-assignment activities include (continued):**

- Calculate fluid velocity in a number of situations.
- Discover Bernoulli's law, which relates pressure and fluid flow.
- Investigate hydraulic pipes and how they are selected.
- Build a simple hand pump to demonstrate the principle of positive displacement pumps.
- Investigate the basics of hydraulic pumps.
- Build a hydraulic machine and perform an energy analysis on it to determine its efficiency.
- Review basic pump types.
- Calculate pump efficiency.
- Look in detail at the most common type of hydraulic pumps.
- Recognize the properties of a hydraulic fluid.
- Define viscosity.
- Explore the filtering and pre-treatment of hydraulic fluid.
- Revise the principle of the mechanical lever.
- Demonstrate the principle of the hydraulic lever.
- Explore the principle of the hydraulic lever.
- Solve hydraulic lever problems.
- Determine the factors that influence cylinder speed.
- Calculate extension and retraction rates for cylinders.
- Investigate flow control valves and how they can be used to control the speed of hydraulic cylinders.
- Design a hydraulic system to operate a car park lift with unidirectional flow control.
- Explore the function of a check valve and its application in hydraulic systems.
- Select a cylinder for a hydraulic press application based on performance and cost factors.
- Perform an energy analysis to determine the performance of a hydraulic cylinder.
- Explore how hydraulics is used in braking systems.
- Compare the performance of water and air as a hydraulic fluid.
- Design a hydraulic system to operate two cylinders in sequence and simulate an aircraft undercarriage system.
- Investigate how hydraulic circuits are protected from the effects of high pressure.
- Explore how hydraulics technology is used in shock absorbing systems.
- Investigate the compression of gas and discover Boyle's law which relates pressure and volume at constant temperature.
- Design an aircraft safety system for use in the event of hydraulic pump failure.
- Explore hydraulic accumulator technology.
- Discover how heat is generated and dissipated from hydraulic systems.

Each assignment is designed around a list of performance objectives. These lists include academic, technical and occupational objectives. The assignments are written in such a way as to enable a student to attain the performance objectives, with the assessment questions linked to these in order to provide a measure of true competency.

The performance objectives are used by the ClassAct management system to generate a comprehensive portfolio of student competency reports. Default reports supplied with this module include:

- Entry report
- Technical/Occupational Exit report
- Basic Skills report based upon the federal SCAN's report.

**The items supplied with this instructional module include:**

- 10-assignment On-Screen Student Assignment Guide CD
- 10-assignment Student Assignment Guide
- 10-assignment Student Workbook
- 10-assignment Instructor's Guide
- 30-assignment Student Assignment Guide
- 30-assignment Student Workbook
- 30-assignment Instructor's Guide
- Computer Aided Instruction Software
- Hydraulics fact file
- Hydraulics Trainer
- Drip tray
- Hydraulic hoses
- Lever arm
- Swivel guard
- Fulcrum
- Pivot pins
- Stopwatch
- Hydraulic oil
- Funnel
- Paper towels
- Hydraulic brake simulator
- Tray
- Beaker

**Additional items required:**

- Computer

**Module Facts**

For Technology Program, order as: ST280/40 Hydraulics

	No.	Average time
Assignments	40	45 minutes
Extension Activities	4	45 minutes
<b>Total</b>		<b>33 hours</b>



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