



## Worksheet HP01 & Training Record Hydraulic Control Principles

## Hydraulics Principles

Email:

Course:

Provider:

### Learning Objectives/Expected Outcomes: (60-120mins)

1. To understand the basic principles on which hydraulic system control is based.
2. To appreciate the different spool and poppet valve design features.
3. To be able to interpret a valve's function and performance by reviewing the component parts.

### Previous Knowledge Required:

Students should have completed all of the basic pump and valve 'operation and uses' sections, HD and HV (odd numbers) and have a good understanding of different hydraulic systems.

### Terminology:

Control, proportional, spool, notch, clearance, leakage, seal, friction, damping, spring rate.

### Record of Achievement:



Click the email button (that will appear within each app) to post your results, once training is complete. Enter your training provider or your own email address. Also record progress, times, scores etc. on this training record sheet and keep together with any additional written work or sample calculations.

### Coursework investigations

Study the detailed information and instructional video at [www.e4training.com/hyd\\_princip/princip1.php](http://www.e4training.com/hyd_princip/princip1.php) and [princip2.php](http://www.e4training.com/hyd_princip/princip2.php)

- Learn about the different design features in a typical spool valve.
- Learn to recognise operating characteristics that will result from each design feature.

Complete

Study the detailed information and instructional video at [www.e4training.com/hydraulic\\_valves/checkpro1.php](http://www.e4training.com/hydraulic_valves/checkpro1.php):

- Learn about the different design features in a typical poppet valve.
- Learn to recognise operating characteristics that will result from each design feature.

Complete



## Virtual test rig experiments

Experiment with Spool Valve Fundamentals simulation at [www.e4training.com/hyd\\_princip/princip3.php](http://www.e4training.com/hyd_princip/princip3.php)

- Follow the suggested exercises and observations list below the simulation.
- Run the experiments, answer the questions, and click the buttons to see the answers.

Observe how pressure moves the spools against the spring, the orifice area changes, and the hydraulic motor load pressure changes affect pressure drops and flows.

App date & duration
Complete

## Interactive tutorial

Complete the 'check valve training' tutorial at [www.e4training.com/hydraulic\\_courses/microtutor1.php?wtvalvescheck](http://www.e4training.com/hydraulic_courses/microtutor1.php?wtvalvescheck)

Complete quick quiz at end and post results.

Date, score & time:
Tick when posted

## Practical and coursework assignments

Draw a design for a pilot operated relief valve noting the following design features:

- Include a leak free pilot and tank drain line.
- Identify pilot flow and main flow paths.
- Identify the spool leakage path and highlight where contaminants in the fluid are most likely to collect.
- Identify factors that may affect the speed of operation.
- Identify any concentricity, manufacturing quality or areas of physical contact that may be life restricted.

Coursework submission
Submit marked up design drawing

## Interactive quiz to check and reinforce learning

Complete the 'hydraulic principles' quiz questions at [www.e4training.com/hydraulic\\_test2.php? Quiz - Hydraulics part 1](http://www.e4training.com/hydraulic_test2.php?Quiz-Hydraulics%20part%201)

Post result when complete.

Quiz name, date, score
Tick when posted



## Key questions / Plenary

Can you recognise a spool area, poppet, orifice, leak path, high pressure drop, and damped volume?  
Can you recognise a ball, shaped poppet, hard or soft seat, and bore to seat alignment issues?  
Can you recognise direct acting valves and two stage, pilot operation valves?  
Can you predict the different performance characteristics and durability for each design feature?

Record answers:

Tick when complete

### And Finally:

Complete this worksheet and keep for your certification records. Submit any written coursework etc. to your training course provider.

### Follow-on Course Worksheets:

Potential follow-on worksheets include: HP02 – Hydraulic design priorities and specifications  
Or refer to your individual lesson plan or search the worksheet lists at  
[www.e4training.com/hydraulic\\_courses/worksheets1.php](http://www.e4training.com/hydraulic_courses/worksheets1.php) or [courses1.php](http://www.e4training.com/courses1.php)