



Worksheet HF01 & Training Record General Theories and Formulas

Hydraulics Fundamentals

Email:

Course:

Provider:

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

1. To appreciate the basic principles of fluid power including pressure transmission, basic control, heat generation, trapped in pressure, fluid compressibility.
2. To appreciate gauge and absolute pressure.
3. To be able to perform basic dimensional analysis.

Previous Knowledge Required:

Students should have completed worksheet HI05 'Hydraulic circuit basics' or have a good working knowledge of hydraulic components and systems.

Terminology:

Gauge pressure, absolute pressure, compressibility, thermal expansion, power, dimensional analysis.

Record of Achievement:



Click the email icon to post your results, once training is complete. Enter an LRS username and endpoint details or see www.e4training.com/xapi/ for free examples. Keep a record of any written work or worked calculations etc.

Hydraulics is Fun!

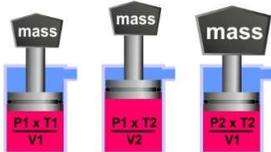


Lift a car using your own strength

Hydraulic jacks make it easy for a human to lift the weight of a car or lorry. Each large hand pump moves a small volume of fluid which raises the vehicle a tiny distance. Try it yourself.

Coursework investigation and instructional video

Beware trapped volumes



Study the 'General Theories and Formulas' section and video at www.e4training.com/hyd_formula/theory1.php and theory2.php

- Learn how pressure acts around a circuit.
- Learn fluid volumes flow around a circuit.
- Learn how restricting flow controls movement.
- Learn how energy lost in pressure drops is converted to heat.
- Note that pressure will change with temperature in a fixed volume or volume will change with constant pressure as temperature changes.
- Learn the difference between gauge and absolute pressure.
- Learn how to convert units using dimensional analysis.

Estimated time: 40 minutes, skill level 4-6

Date:

Complete



Interactive tutorial



Estimated time: 15 minutes, skill level 4-6

Date, score:

Complete the 'Formulas and Fundamentals' tutorial at

www.e4training.com/hydraulic_courses/microtutor1.php?wtformula

Complete quick quiz at end and post results.

Tick when posted

Coursework exercises

Dimensional analysis - or Unit conversion

Convert 100L/min to US GPM (1 US Gal = 3.785 L)

$$100 \frac{\text{L}}{\text{min}} \left[\frac{1 \text{ US Gal}}{3.785 \text{ L}} \right] \left[\frac{1 \text{ min}}{60 \text{ sec}} \right]$$

$$= \frac{100}{3.785 \times 60} = 0.4403 \frac{\text{US Gal}}{\text{sec}}$$

Estimated time: 15 minutes, skill level 4-6

Date, calculation:

- Calculate the pressure change with a temperature change in a fixed volume of fluid.
- Convert units using dimensional analysis.

See examples www.e4training.com/hyd_formula/theory1.php

Submit calculations on separate sheet

Virtual test rig experiments



Experiment with the 'control valve fundamentals' simulation at

www.e4training.com/hyd_formula/theory3.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.

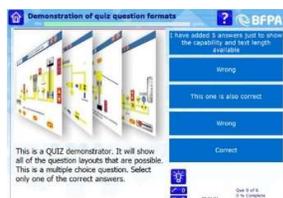
Make some basic observations as you operate the power unit. Explore the visual calculator to understand the difference between absolute and gauge pressure.

Estimated time: 20 minutes, skill level 4-6

Date, score:

Tick when posted

Interactive quiz to check and reinforce learning



Estimated time: 10 minutes, skill level 4-6

Quiz name, date, score:

Complete the 'Formulas and fundamentals' questions at

www.e4training.com/hydraulic_test2.php?Quiz - Hydraulics part 1

Post result when complete.

Tick when posted

Do you understand how pressure and energy are transmitted around the hydraulic pipework?

Can you explain how external loads are controlled?

Do you appreciate the relationship between pressure, temperature, and volume?

Do you know the difference between gauge and absolute pressure?

Can you convert minutes to seconds using dimensional analysis techniques?

Repeat above if the answer is no

And Finally:

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

Follow-on Course Worksheets:

Potential follow-on worksheets include:

HF02 – Pressure and force fundamentals

For more specialist course worksheets visit

www.e4training.com/hydraulic_courses/worksheets1.php

Notes