



Worksheet HF04 & Training Record Power Formulas and Fundamentals

Hydraulics Fundamentals

Email:

Course:

Provider:

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

1. To understand the relationship between input power, system losses and output power.
2. To perform simple system energy transfer calculations.
3. To understand the relationship between pressure, displacement and torque.

Previous Knowledge Required:

Students should have completed worksheet HF03 'Flow theories and formula' along with a basic knowledge of hydraulic components and systems.

Terminology:

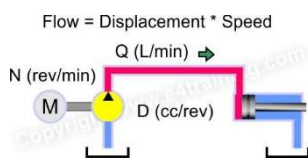
Power, torque, energy transfer, losses, efficiency, displacement, swept volume.

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 investigation and instructional video

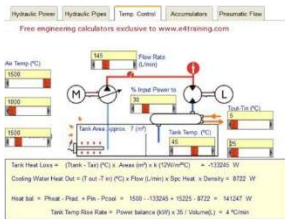


Study the 'Power, losses and torque' relationships at

www.e4training.com/hyd_formula/power1.php and [power2.php](#)

- Follow the complete path from power in, component efficiencies, losses, to output power.
- Understand the power is measured in kW.
- Appreciate the energy changes form from electrical, rotational, hydraulic, heat and noise.
- To understand how to calculate the torque produced by hydraulic pumps and motors.

Complete



Experiment with the 'power unit calculator' at

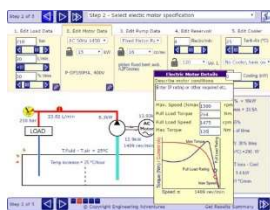
www.e4training.com/hyd_formula/power3.php

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

Change the input and output settings and compare the results given with your own calculations.

Date, score & time:

Tick when posted



Review the more complex performance calculations in the 'power unit design' simulation at

www.e4training.com/design_guides/designpu3.php

- Observe how complex the loads can be.
- Observe how motor and pump efficiency varies with operating conditions
- Observe how tanks and coolers can remove the excess heat generated.

Review the energy transfer issues although these will be covered in more detail in later exercises.

Observations only

Tick when complete

Practical & Coursework exercises



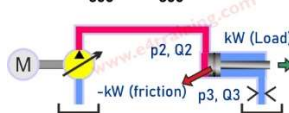
Raise and mass safely with a hydraulic jack. Calculate the work done, energy in and therefore the power required to complete the lift in the time taken www.e4training.com/hyd_formula/power1.php Compare the power of different individuals.

Submit notes

Submit calculations on separate sheet

Output Power Calculations

$$P_{load} = \frac{p_2 \cdot Q_2}{600} - \frac{p_3 \cdot Q_3}{600} - \text{kW friction}$$



Based on your own equipment or using the scissor lift project as an example.

- Calculate the output power required to lift the load in a given time.
- Calculate the potential losses with flow set by pump displacement.
- Calculate the potential losses with flow set by an orifice.
- Calculate the input power required.

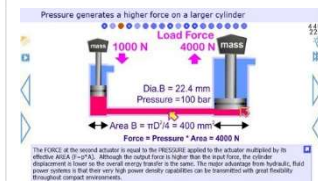
See project HW02 calculations www.e4training.com/Hydraulic_projects/scissorlift1.php

Submit calculations

Submit calculations on separate sheet



Interactive tutorial



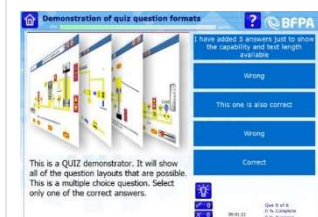
Complete the 'Formulas and Fundamentals' tutorial at www.e4training.com/hydraulic_courses/microtutor1.php?wtformula

Complete quick quiz at end and post results.

Date, score & time:

Tick when posted

Interactive quiz to check and reinforce learning



Complete the 'Formulas and fundamentals' questions at www.e4training.com/hydraulic_test2.php? Quiz - Hydraulics part 1

Post result when complete.

Quiz name, date, score:

Tick when posted

Key questions / Plenary

- Can you explain the relationship between input power, system losses and output power?
- Can you describe what typical losses there may be in a hydraulic system?
- Can you explain the relationship between pump displacement, pressure and torque?

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:

HF04 – Hydraulic power and torque fundamentals

For more specialist course worksheets visit

www.e4training.com/hydraulic_courses/worksheets1.php