



# Self-Study Worksheet HI03 Compare Hydraulic, Pneu, Electric

## Explore Hydraulics

Email:

Course:

Provider:

### Learning Objectives/Expected Outcomes: (1 - 2 hrs)

1. To know why hydraulic technology is used in preference to pneumatic or electrical systems.
2. To appreciate how hydraulic, mechanical advantage is used to lift heavy loads.
3. To appreciate the power to weight advantages that hydraulic equipment provides.
4. To appreciate how hydraulic actuators can be placed where need, e.g. away from the power source.

### Previous Knowledge Required:

No previous knowledge is required. Students already working with hydraulic equipment including hydraulic pumps, actuators, and control valves, etc. may not require this worksheet.

### Terminology:

Fluid power, hydraulics, pneumatics, electrical drives, energy, pressure, power.

### Record of Achievement:

Record progress, times, scores, etc. on this training record sheet and keep together with any additional written work or sample calculations.

### Coursework investigations

**Approx. Power Unit Size Comparison**

130 kW (170hp)  
360 mm (14.2 in)  
340 mm (13.4 in)

110 kW (147hp)  
1045 mm (41.1 in)

132 kW (175hp)  
1070 mm (42.5 in)

Hydraulic pump    Electric motor    Diesel engine

Compare the size and power of hydraulic, electrical, and petrol power supplies.

Note how a hydraulic pump can be attached to an engine but the actuators are placed where the movement is needed and the fluid is delivered via flexible pipes. See [www.e4training.com/hyd\\_newbie/compare1.php](http://www.e4training.com/hyd_newbie/compare1.php)

**Estimated time:** 15 minutes, skill level 1-2

**Submit notes:**

**Linear Drives Comparison**

30 mm  
7 bar air  
100 mm stroke  
500 mm stroke

25 mm  
120 mm/sec  
8000 mm stroke

1400 mm  
300 bar  
500 mm/sec  
6000 mm stroke

Pneumatic    Electric    Hydraulic

Compare actuator sizes and forces

[www.e4training.com/hyd\\_newbie/compare1.php](http://www.e4training.com/hyd_newbie/compare1.php)

Explore examples of electrical and pneumatic drives to compare the maximum force capabilities or try to quantify the work they do. Also, consider how robust the actuators might need to be in different environments e.g. super clean for food (no hydraulics), robust outside (no electronics).

**Estimated time:** 15 minutes, skill level 1-2

**Submit notes:**



## Practical exercises



Estimated time: 25 minutes, skill level 1-2  
Submit notes:

Complete

Raise and lower heavy objects safely with a hydraulic jack. Calculate the forces involved at [www.e4training.com/hyd\\_formula/pressure1.php](http://www.e4training.com/hyd_formula/pressure1.php)  
Understand mechanical advantage by using a ruler or wood seesaw, pivoting off centre. See how a small mass can lift a large mass with the appropriate pivot point.



Estimated time: 30 minutes, skill level 1-2  
Submit notes:

Complete

Make simple force calculations to compare the size and load capability of hydraulic, pneumatic, and electrical actuators.  
Make basic load and energy approximations to compare the power of pneumatics, electrical, hydraulic systems.

## Key questions / Plenary

Can you describe here hydraulics might be used?  
Can you explain the benefits of fluid power and why it is used in mobile excavators?  
Can you quantify how many cars pneumatic, electrical, and hydraulic linear actuator could lift?

### 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:  
HI04 – Basic hydraulic components

For specialist course worksheets visit [www.e4training.com/hydraulic\\_courses/worksheets1.php](http://www.e4training.com/hydraulic_courses/worksheets1.php)

### Notes