

The Power of Fluids

We use fluids every day to help us do work. Machines such as excavators, backhoes, and front-end loaders use hydraulic rams to do work (Figure 1(a)). Rams are similar to syringes: they are composed of a piston (plunger) inside a cylinder. The cylinder is connected by pipes to a reservoir of hydraulic fluid. A pump provides the pressure, and fluid is directed into the cylinder on either side of the piston, depending on the movement desired (Figure 1(b)). This lets the piston move in or out with tremendous force and great precision.

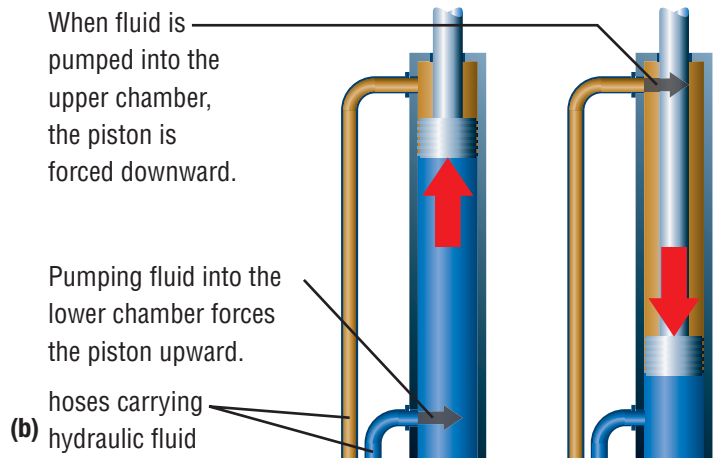


Figure 1 (a) Hydraulic rams allow this single worker to do the work of many people. (b) The rams work by forcing fluid into either side of the piston, allowing powerful and precise movement in both directions.

Fire pumps and hoses are hydraulic systems designed to cause fluids (either water or foam) to leave the system with great force. Water coming from a fire hydrant is already under some pressure. The pumping unit and nozzle design significantly increase this pressure to project the water a considerable distance away (Figure 2(a)).

Human-made devices are not the only users of hydraulic power. Animals use it as well (Figure 2(b)).

To learn more about the archer fish,

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Figure 2 Like water shooting from a fire hose (a), the archer fish uses hydraulic power to shoot insects off low-hanging vegetation (b).

While fire pumps take in water and eject it under pressure, hovercraft use the power of air in a similar way (Figure 3). Large motors draw in air from the atmosphere and drive it out under intense pressure below the craft, allowing the craft to ride on this cushion of air over land or water. Often, the craft uses rear propellers to move the machine forward.



Figure 3 A hovercraft is a pneumatic system.

Pneumatic power can also be used to move heavy loads. Kneeling buses (Figure 4) use forced air to raise and lower the bus, making it easier for people to enter or exit. One advantage of using pneumatics instead of hydraulics is that the viscosity of air, unlike many liquids, is not significantly affected by changes in temperature.



Figure 4 Kneeling buses make it easier for many people to access public transportation.

Some systems use a combination of hydraulic and pneumatic power. Some automobile hoists, for example, pump compressed air into a master cylinder filled with hydraulic fluid (usually oil). This oil is then forced into a closed chamber that drives a piston upward. The piston is attached to a platform on which the car sits (Figure 5).

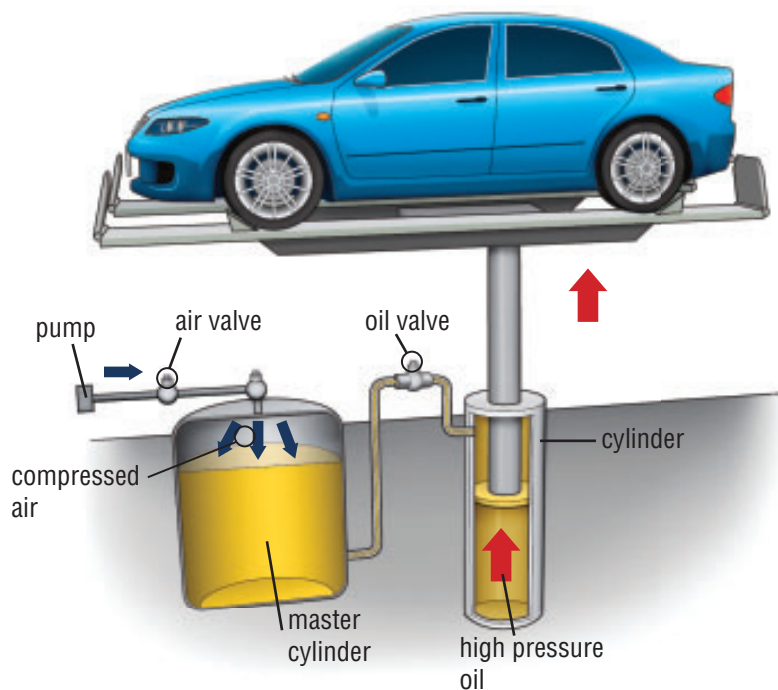


Figure 5 An automobile hoist uses a combination of gases and liquids under pressure.

Unit Task How might you use some of these examples of hydraulics and pneumatics to help you with the Unit Task?

✓ CHECK YOUR LEARNING

1. What is a hydraulic ram?
2. What benefits have you enjoyed personally from using the power of hydraulics and pneumatics?
3. What is one advantage of using pneumatic power over hydraulic power?