College of Engineering & Technology

Mechanical Engineering Department

Hydraulic and Pneumatic Systems (ME464)

SHEET 1

1- (Example 3-4)

For the hydraulic jack in figure 1, the following data are given:

$A_1 = 2\ in^2$ $A_2 = 20\ in^2$

$S_1 = 1\ in$ $F_1 = 100\ lb$

Determine each of the following:

a. F_2

b. S_2

c. The energy input

d. The energy output

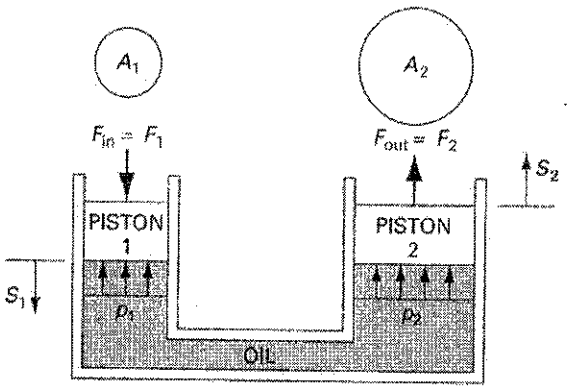

Figure 1

2- (Example 3-5)

An operator makes one complete cycle per second interval using the hydraulic jack of figure 2. Each complete cycle consists of two pump cylinder strokes (intake and power). The pump cylinder has a 1-in diameter piston and the load cylinder has a 3.25-in diameter piston. If the average hand force is 25 lb during the power stroke

a. How much load can be lifted

b. How many cycles are required to lift the load 10-in assuming no oil leakage? The pump piston has 2-in stroke.

c. What is the output power assuming 100% efficiency?

d. What is the output power assuming 80% efficiency?

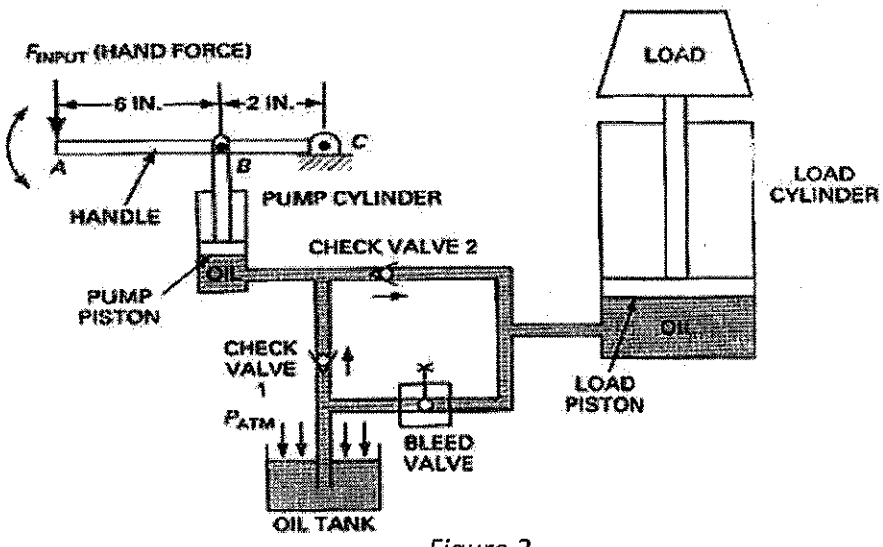

Figure 2

3- (Example 3-6)

Figure 3 shows a pressure booster used to drive a load F via a hydraulic cylinder. The following data are given:

Inlet air pressure (P_1) = 100 psi
Air piston area (A_1) = 20 in^2
Oil piston area (A_2) = 1 in^2
Load piston area (A_3) = 25 in^2

Find the load carrying capacity F of the system

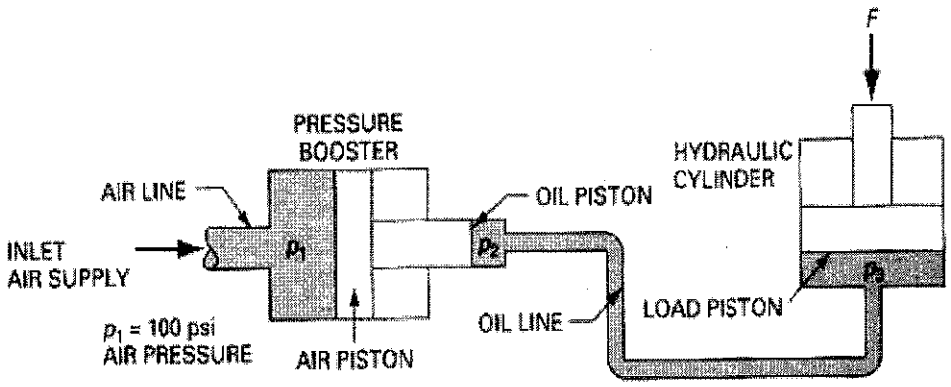

Figure 3

4- (Example 3-8)

A hydraulic cylinder is to compress a car body down to bale size in 10 s. The operation requires a 10-ft stroke and a 8000-lb force. If a 1000-psi pump has been selected, and assuming the cylinder is 100% efficient, find

a. The required piston area
b. The necessary pump flow rate
c. The hydraulic power delivered to the cylinder
d. The output power delivered by the cylinder to the load

5- (Example 3-9)

Solve problem 4, assuming a frictional forcr of 100 lb and a leakage of 0.8 in^3/s. In addition, find the cylinder efficiency.

6- For the hydraulic system shown in figure 4, the following SI metric data are given:

a. The pump is adding 3.73 Kw (pump hydraulic power =3.73 kW) to the fluid.
b. Pump flow is 0.001896 m^3/s
c. The pipe has a 0.0254-m inside diameter. (2.54 cm or 25.4 mm)
d. The specific gravity of the oil is 0.9
e. The elevation difference between stations 1 and 2 is 6.096 m

Find the pressure available at the inlet to the hydraulic motor (station 2). The pressure at station 1 in the hydraulic tank is atmospheric pressure (0 Pa gauge). The head lost H_L due to friction between stations 1 and 2 is 9.144-m of oil.

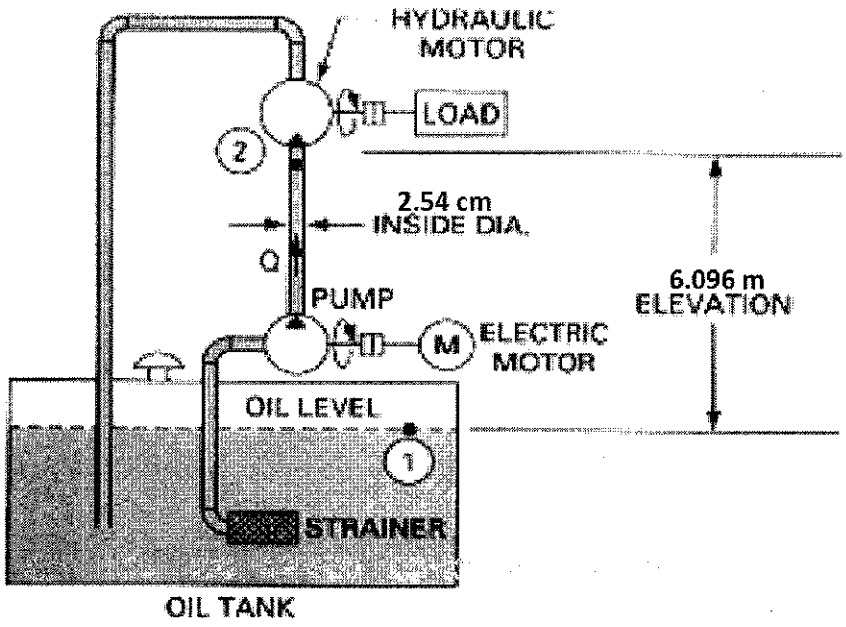

Figure 4