How to Design Your Own Hydraulic System

1. Calculate the force used to hold the workpiece during machining.
   To convert the torque applied to a fastener into holding force use the following formula:

   $$P = \frac{T}{KD}$$

   Where: P = Holding Force (lbs.)
   T = Torque (in. lbs.)
   D = Nominal Thread Diameter (in.)
   K = Friction Factor
   (K Varies with material, finish, and lubrication, .19 to .25)

   Example: 1/2-13 bolt tightened to 30 ft. lbs
   (360 in. lbs.) provides 3600 lbs. of force.

   $$P = \frac{360}{(.2 \times .5)} = 3600$$

2. Calculate the force required at each work unit.

   $$\frac{\text{Total Force}}{\text{Number of work units}} = \text{Force per unit}$$

3. Select the style of work unit to be used at each location. Select units which can be easily mounted and will allow access for loading and unloading of the workpiece.

4. Compare the force required by each work unit with the maximum force available from the unit selected. If the required force is greater than the available force, substitute larger work units or increase the number of work units to be used.

5. Calculate the hydraulic pressure required to provide the force needed at each work unit. To determine pressure, divide the force required at the work unit by the effective piston area of the unit selected.

   $$\frac{\text{Force}}{\text{Area}} = \text{Pressure}$$

   The unit requiring the highest pressure determines the requirement for the entire system.

6. Determine the total volume of oil required to operate all of the work units (Volume = Piston Area x Stroke).
   Operating volume requirements for work units are listed in the specifications chart for the item.

7. Select a power source which will provide the required pressure, using the available air pressure. To determine if a power source will provide the required pressure from available air pressure, multiply the available air pressure by the boost ratio of the power source.

   Example: (90 psi air pressure) (15:1 boost ratio) = 1350 psi hydraulic pressure

   The power source must also provide the total volume of oil required by the system. When using a standard booster, the high pressure volume of the unit must exceed the system requirement.

8. If you need help, call Jergens Technical Sales at: 1-800-JERGENS (537-4367).