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# Pneumatics and Hydraulics

Daniel Kohn  
University of Memphis  
TECH 3821  
Fall 2015

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- Pneumatics – the use of air to transmit force
- Hydraulics – the use of a liquid (usually oil) to transmit force.
- Both are used extensively in industry

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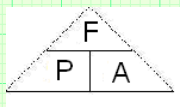
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Calculating Pressure



- Pressure ( $P$ ) =  $\frac{\text{Force } (F)}{\text{Area } (A)}$  or  $P = \frac{F}{A}$
- Force = Pressure x Area    Area =  $\frac{\text{Force}}{\text{Pressure}}$

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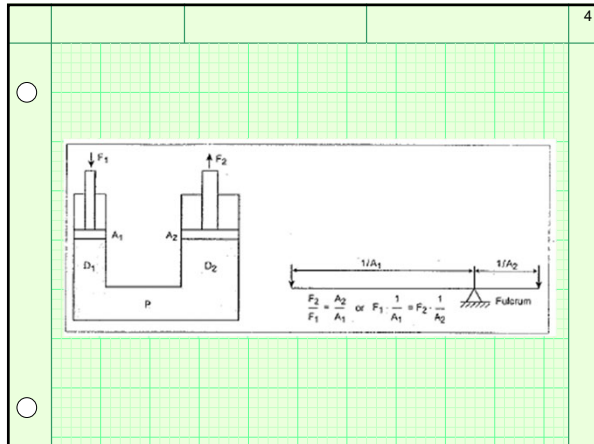
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### Pneumatics

Pros	Cons
Clean (can be used in food manufacturing – no risk of contamination)	Lower force (or larger cylinder needed for same amount of force to be applied)
Rapid movement	Air is compressible
Smaller size	Heat generation (when compressed)
No return lines needed (vent to atmosphere)	Higher energy cost.

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### Hydraulics

Pros	Cons
Higher forces can be produced	Hydraulic oil (cost)
Lower energy costs (less heat generated when compressed)	Need of return lines
	Contamination (oil leaks)
	Slower (friction caused by return lines limit speed)

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- Compressor (increase pressure)



Pneumatic Compressor  
With air tank  
(air stored under pressure)



Hydraulic compressor with  
Oil tank (unpressureized)

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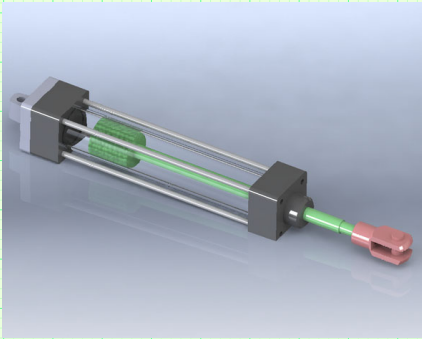
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- Cylinders



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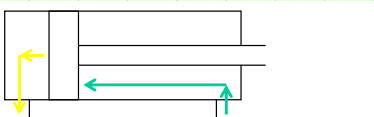
10/12/2020

Dual Acting Cylinder

IENG 475: Computer-Controlled Manufacturing Systems

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- To extend the cylinder, air flows in the left side, exhausting the right side..



- To retract the cylinder, air enters on the right side, exhausting the left side.

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• **Dual Acting Cylinder**

A. Piston Rod Moving Out.      B. Piston Rod Moving In.

Courtesy of Womack

• **Spring Return Cylinder**

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• **Valves**

Manual Hydraulic Valve

Manual Pneumatic valve

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Signal / Control Valves      IENG 475: Computer-Controlled Manufacturing Systems

• **Signal & Control Valves:**

- Number of ports may be counted from the lines exiting the normal position square
- Number of squares is the number of positions
  - Example: 3/2 manually actuated signal valve

- Function is evident by shifting position squares

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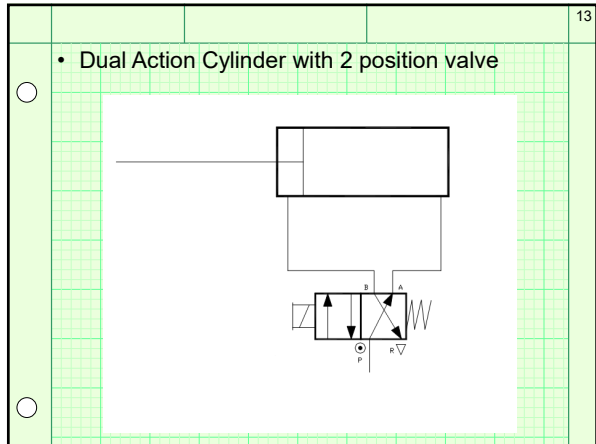
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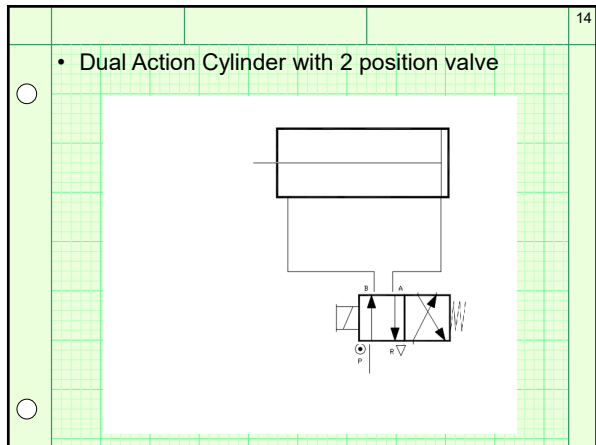
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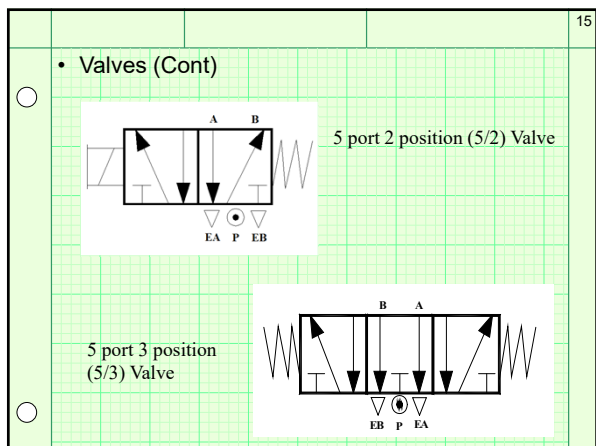
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			16
○	<ul style="list-style-type: none"><li>Valves can be operated:<ul style="list-style-type: none"><li>– Manually</li><li>– Electronically</li><li>– Pneumatically or hydraulically</li></ul></li></ul>		
○			

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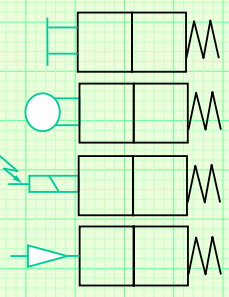
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	10/12/2020	Valve Actuation	IENG 475: Computer-Controlled Manufacturing Systems	17
○		<ul style="list-style-type: none"><li>General (Manual) Actuation</li><li>Mechanical Actuation</li><li>Solenoid Actuation</li><li>Air Actuation</li></ul>		
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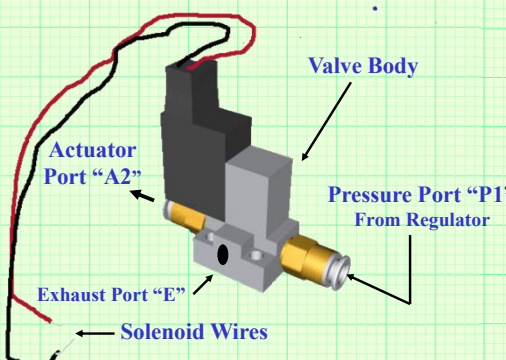
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○	<h3>3/2 Solenoid Valve</h3> 			
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### One Touch Quick Connectors

1. Cut the 4 MM tubing end square
2. Fully depress the outer barrel ring
3. Insert the tubing until it stops and release the outer barrel

**Gears**  
Educational Systems, LLC

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**QUICK DISCONNECTS HYDRAULIC HOSE CONNECTORS**  
Quick Disconnects (QD's) are the very best and easiest way to connect a hydraulic line or to break into a line.

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### • Check Valves

1. Spring  
2. Cone or sleeve  
3. Valve seat

Figure 5-16. Spring-loaded check valve

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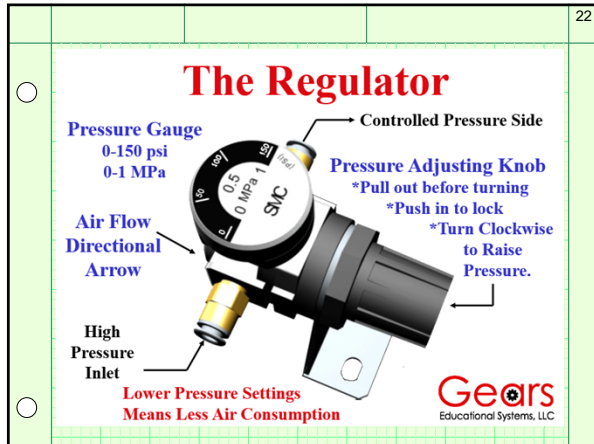
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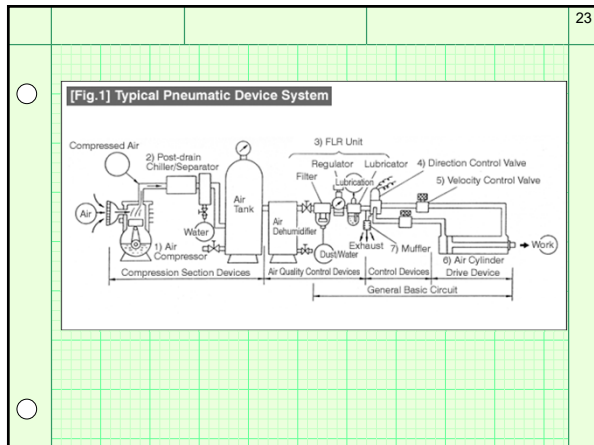
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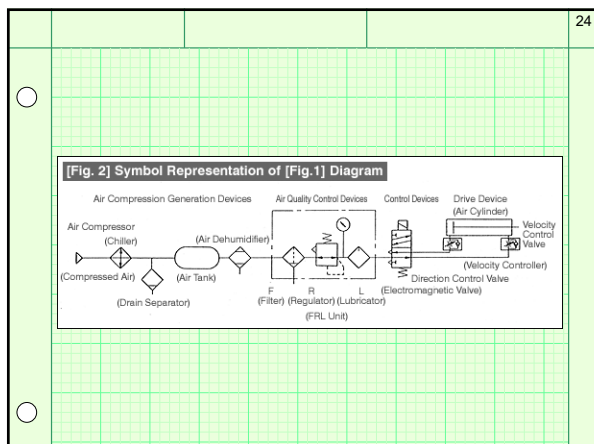
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