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○	<h1>Actuators</h1> <p>Daniel Kohn University of Memphis TECH 3821 Fall 2017</p>			
○				

1

		Actuators		2
○	Actuator - a servomechanism that supplies and transmits a measured amount of energy for the operation of another mechanism or system.			
	<u>Categories</u>	<u>Types</u>		
	Valves	Electro-Magnetic		
	Motors	Pneumatic		
	Linear Actuators	Hydraulic		
○				

2

				3
○	<h1>Valves</h1>			
○				

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• Valves – Sliding-stem Valves

Single-ported globe valve Double-ported globe valve

Gate valve Diaphragm valve

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• Valves – Rotary-stem valves

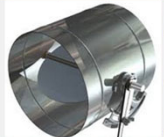

Ball valve Butterfly valve

Disk valve

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• Dampers and Louvers - a multi-element flow control device generally used to throttle large flows of air at low pressure

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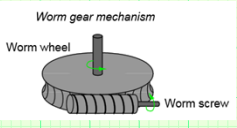
• Manual Valves



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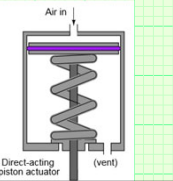
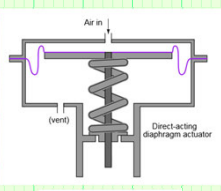
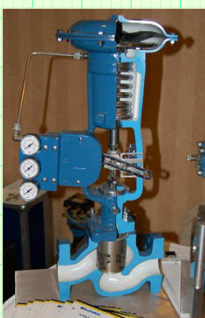
• Valve Actuation – Electro/Mechanical



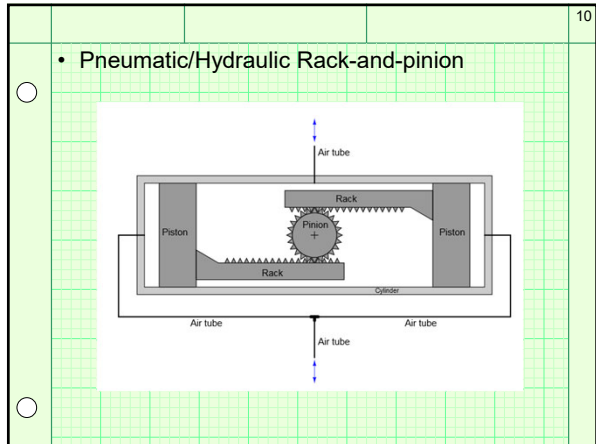
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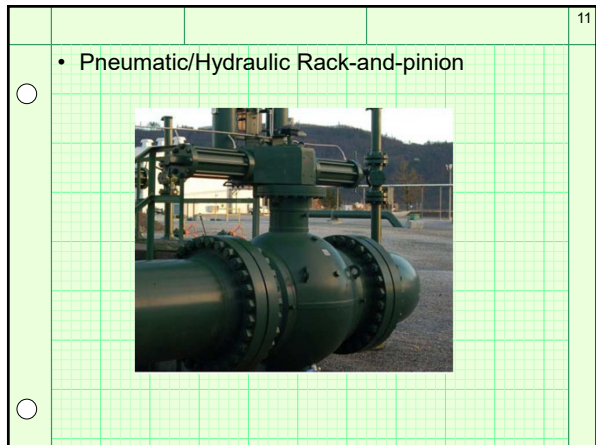
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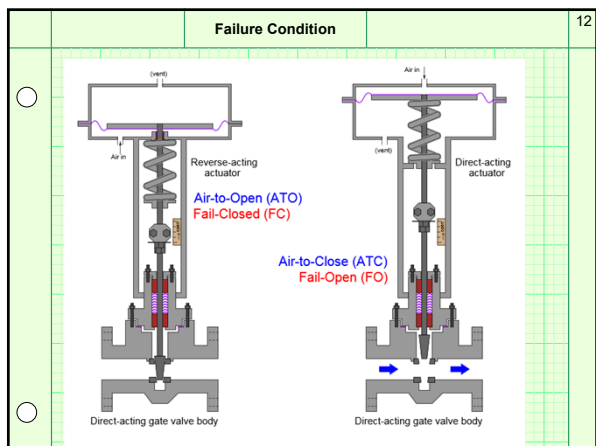
• Pneumatic Actuators



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• Piping Diagram symbols

Fail open (FO) (or)

Fail closed (FC) (or)

Fail locked (FL) (or)

Fail indeterminate

Fail last/drift open (FL/DO) (or)

Fail last/drift closed (FL/DC) (or)

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• Piping / Control Diagrams

TY TIC TT

TV (ATC)

Coolant

Engine

Air

Fuel

Exhaust

Power

Radiator

Pump

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• Actuator Response

A.S.

Pneumatic controller

Pneumatic signal from transmitter

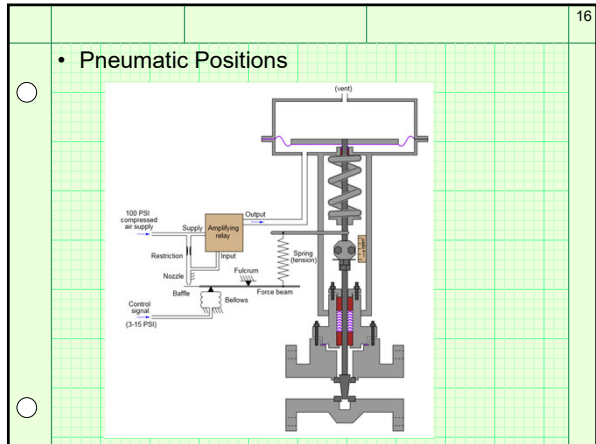
Valve position

Pneumatic actuator

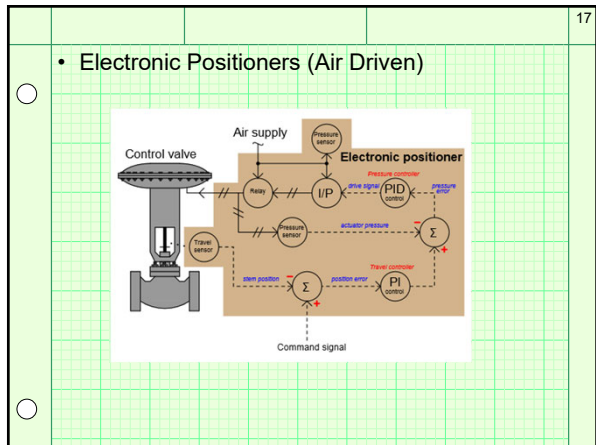
Controller output signal

tube

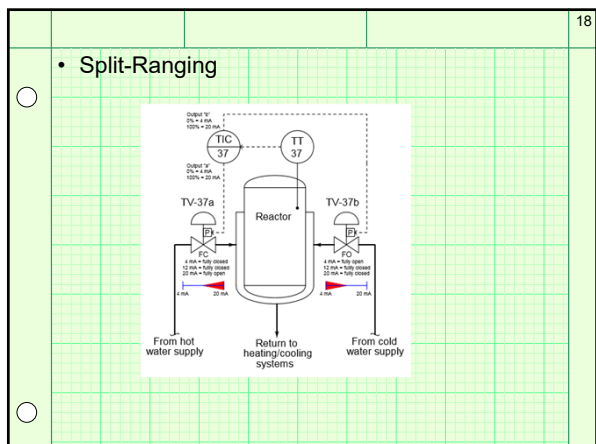
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• Valve Trim Shapes

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Control Valve Issues

- Mechanical Friction
- Flashing - a fluid passes through the constrictive passageways of a control valve, its average velocity increase

- Cavitation - vapor will re-condense back into liquid again
- Choked flow - rate of flow through a valve does not change substantially as downstream pressure is reduced

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Control Valve Issues

- Valve Noise - audible noise produced by turbulence as the fluid moves through a control valve
- Erosion

- Chemical attack
- Stiction and Backlash

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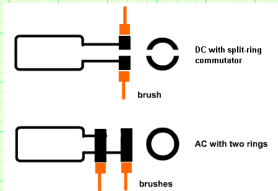
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Motors

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- Slip Ring vs Commutator

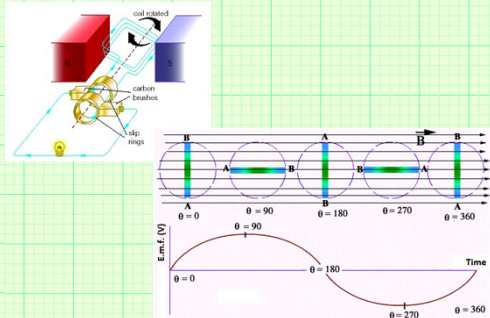


The diagram shows two motor configurations. The top one is labeled 'DC with split ring commutator' and shows a split ring commutator with a single brush. The bottom one is labeled 'AC with two rings' and shows two separate rings with two brushes.

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- AC Slip Ring

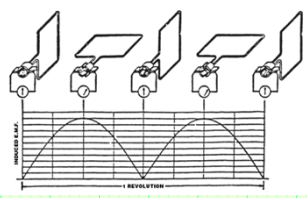


The diagram illustrates an AC slip ring motor. It shows a coil rotating between the North (N) and South (S) poles of a magnet. The coil is connected to two slip rings, which are in contact with carbon brushes. Below the diagram is a graph of induced EMF (E_{ind} [V]) versus Time. The graph shows a sine wave with peaks at $\theta = 0$ and $\theta = 360$, and troughs at $\theta = 180$. The x-axis is labeled with $\theta = 0, 90, 180, 270, 360$.

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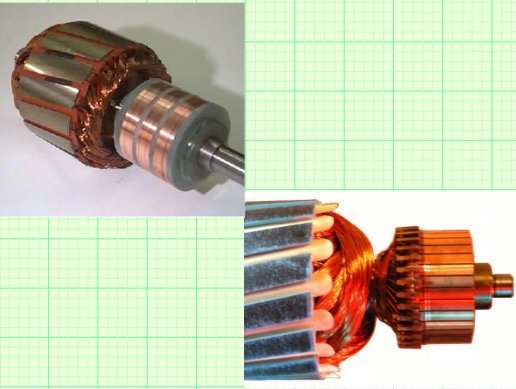
- DC - Commutator



The diagram illustrates the operation of a DC commutator. It shows a rotor coil with two brushes. As the coil rotates, the brushes make contact with the commutator segments, reversing the current in the coil. Below the diagram is a graph of induced EMF over one full revolution. The graph shows a sinusoidal wave that is rectified into a series of positive pulses, representing the DC output of the commutator.

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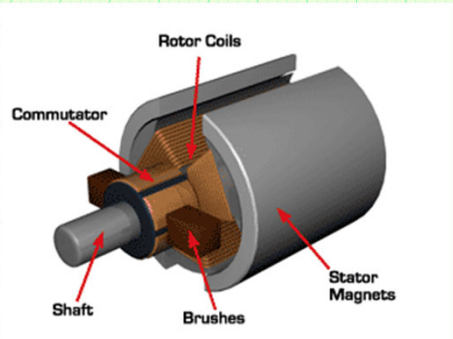
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The photograph shows a disassembled DC motor rotor assembly. On the left is the rotor with its copper windings and commutator segments. On the right is the commutator assembly, which includes the commutator segments and the brushes that make contact with them.

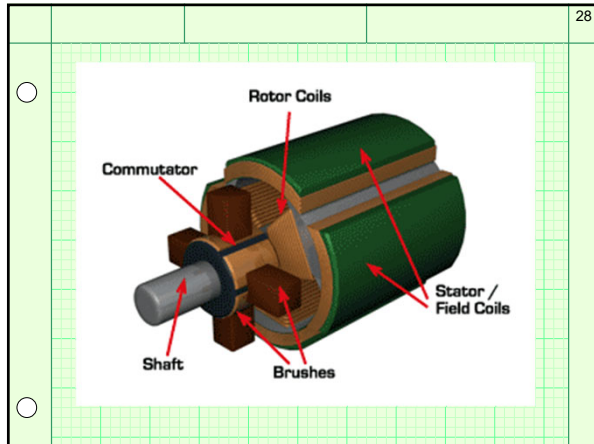
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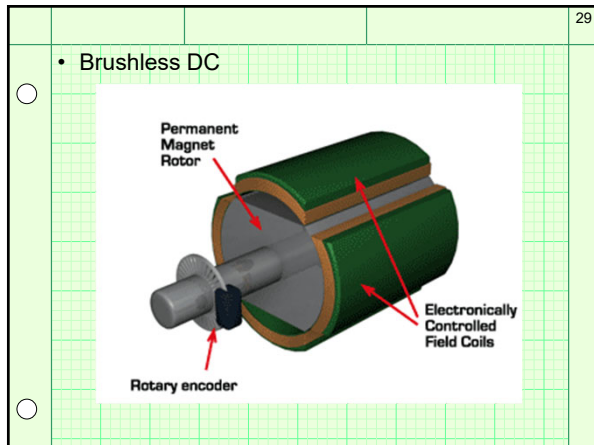


The 3D cutaway diagram shows the internal components of a DC motor. The labels include: Rotor Coils (the windings on the rotor), Commutator (the segmented ring on the rotor), Shaft (the central axis), Brushes (the contact points on the commutator), and Stator Magnets (the permanent magnets that create the magnetic field).

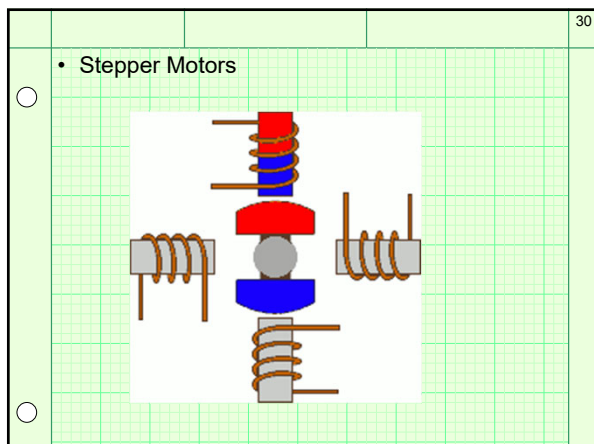
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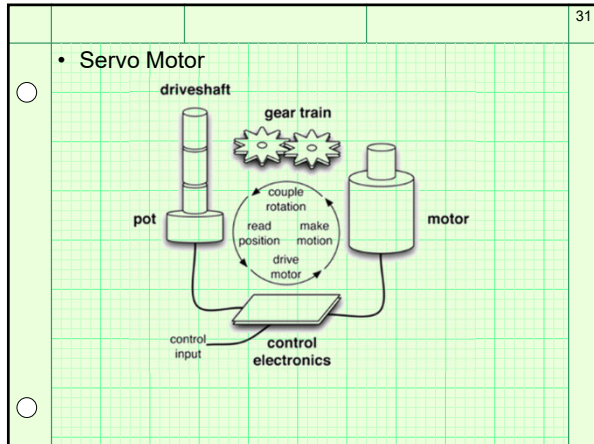
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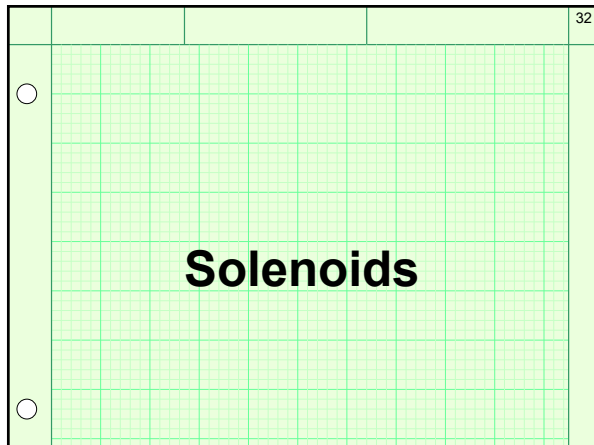
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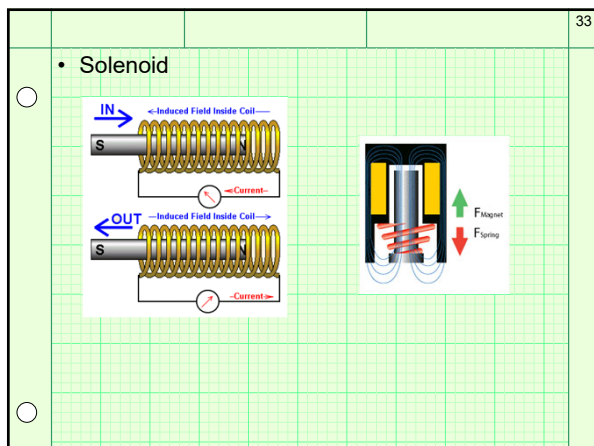
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