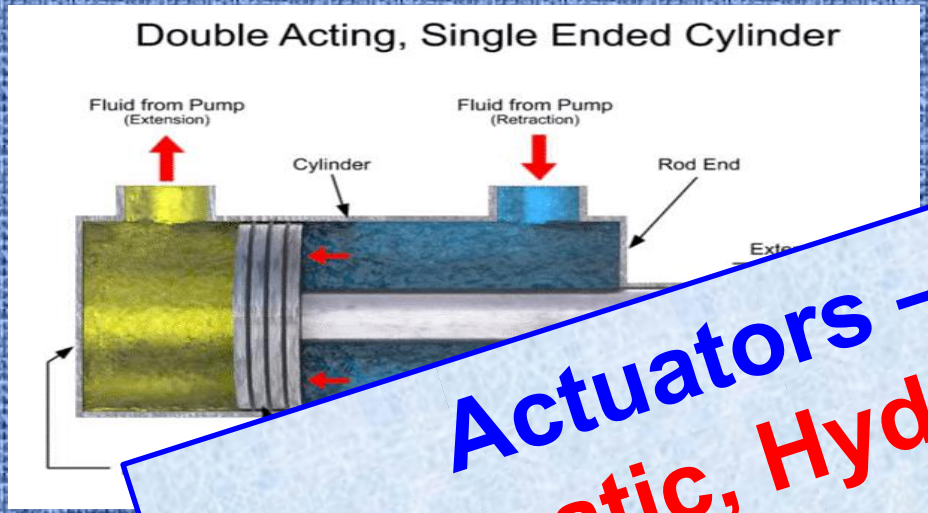
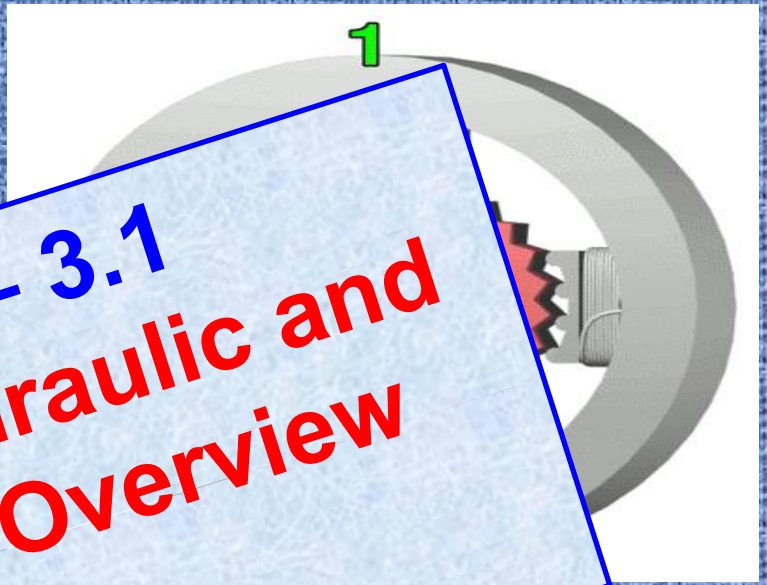
Vishwakarma Institute of Technology

FY - Department of Engineering, Sciences and Humanities





Actuators – 3.1

Pneumatic, Hydraulic and Electric – An Overview

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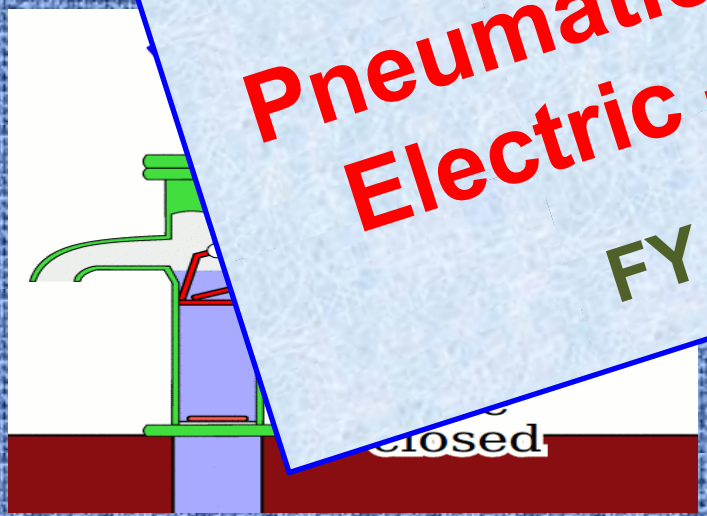


Flow of Information and Energy –

Sensor

Sensor – It is a device which will understand some change taking place in the surrounding and will create a response signal for the same.

For e.g. – Eye of a human body – senses the light rays coming from a surface.

Thermometer – Mercury in the thermometer senses the temperature of a body.

Flow of Information and Energy –

Sensor → Transducer

Transducer – It is a device which will collects the findings from a sensor and converts it proportionately into some other suitable quantity. (generally electrical)

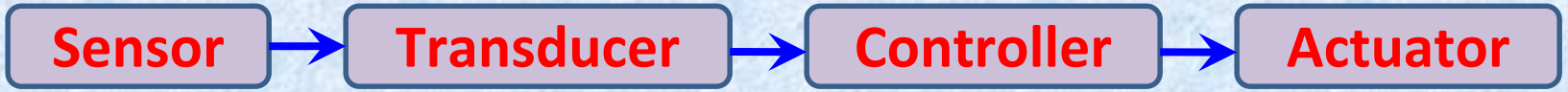
For e.g. – A a microphone senses sound waves and converts to electrical signal. On the contrary a loudspeaker senses the electrical signal and converts it into sound waves.

In some cases the sensing and transducing job is done in one single device.

Flow of Information and Energy –

Controller – This is the Brain of the system which makes decisions and sends orders to the actuator to work as per the signals received.

Flow of Information and Energy –



Actuator – It is the Linear or Rotational motion creating device of the system.

Types of Actuators –

1) Pneumatic (Air pressured)
2) Hydraulic (Oil or Water pressured)
3) Electric (Motors or Solenoids)

Pneumatic Actuators :

Useful Features :-

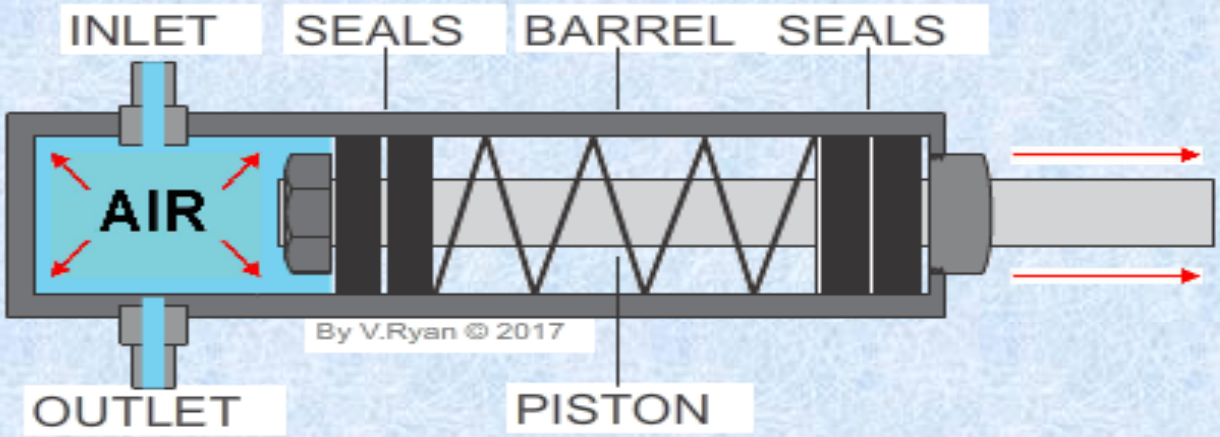
- Fast process.
- Can be used in areas of extreme temperatures.

Disadvantages :-

- Limited stroke length.
- Loss of Air Pressure is always a problem.
- Entry of a moisture in the system, drops the air pressure.
- Air may be contaminated by moisture, oil or lubrication, leading to downtime and maintenance.
- Low pressure system as compared to hydraulic system.
- Noisy operation.

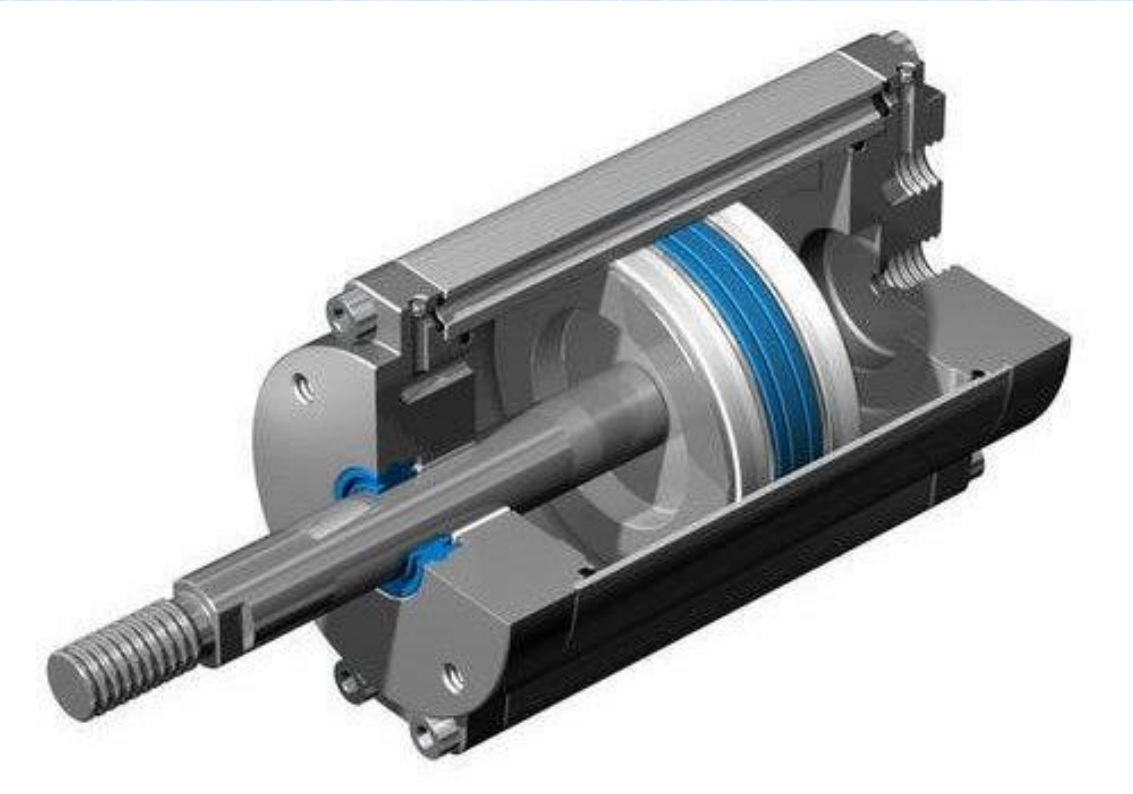
Pneumatic Actuator – Air pressure is used

Pneumatic Actuators – 1) Linear type



Pneumatic Actuator – Air pressure is used

Pneumatic Actuators – 1) Linear type



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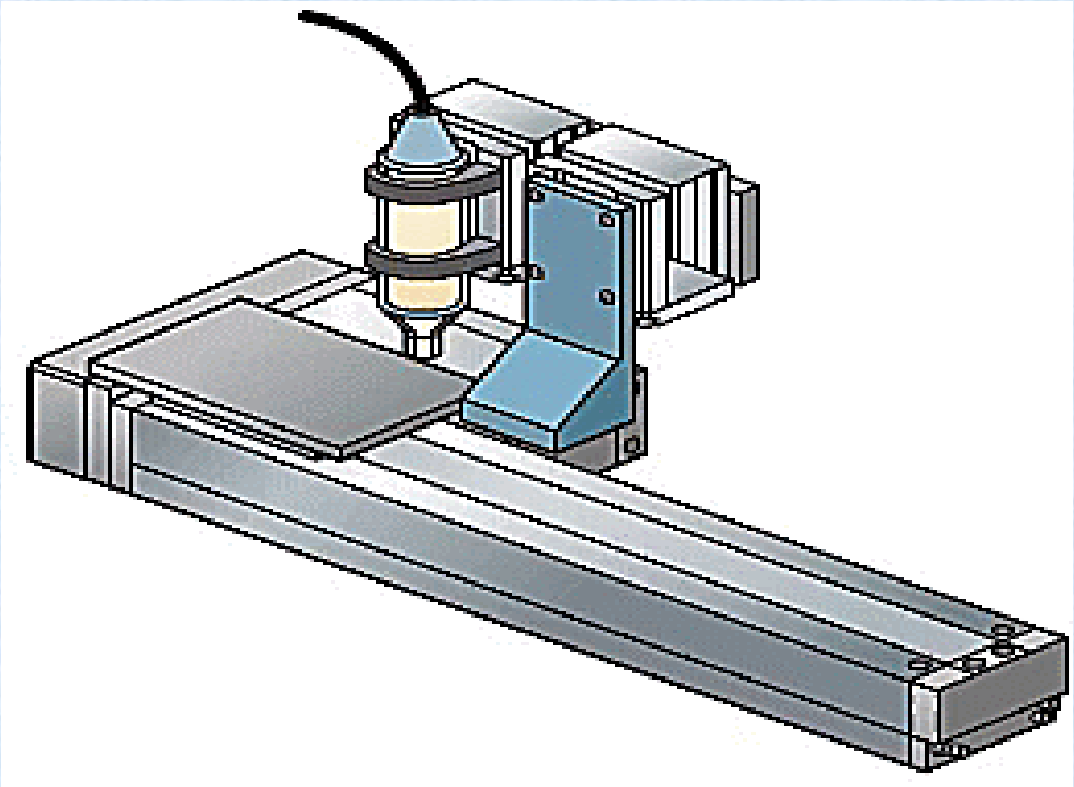
Pneumatic Actuators – 1) Linear type



Pneumatic Actuator – Air pressure is used

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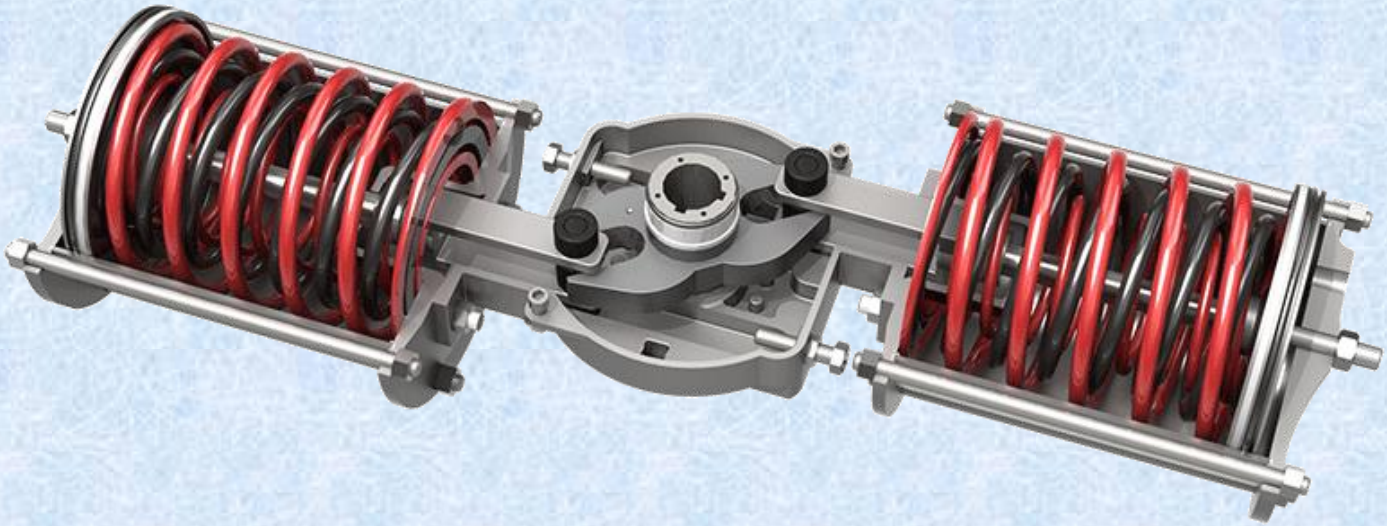

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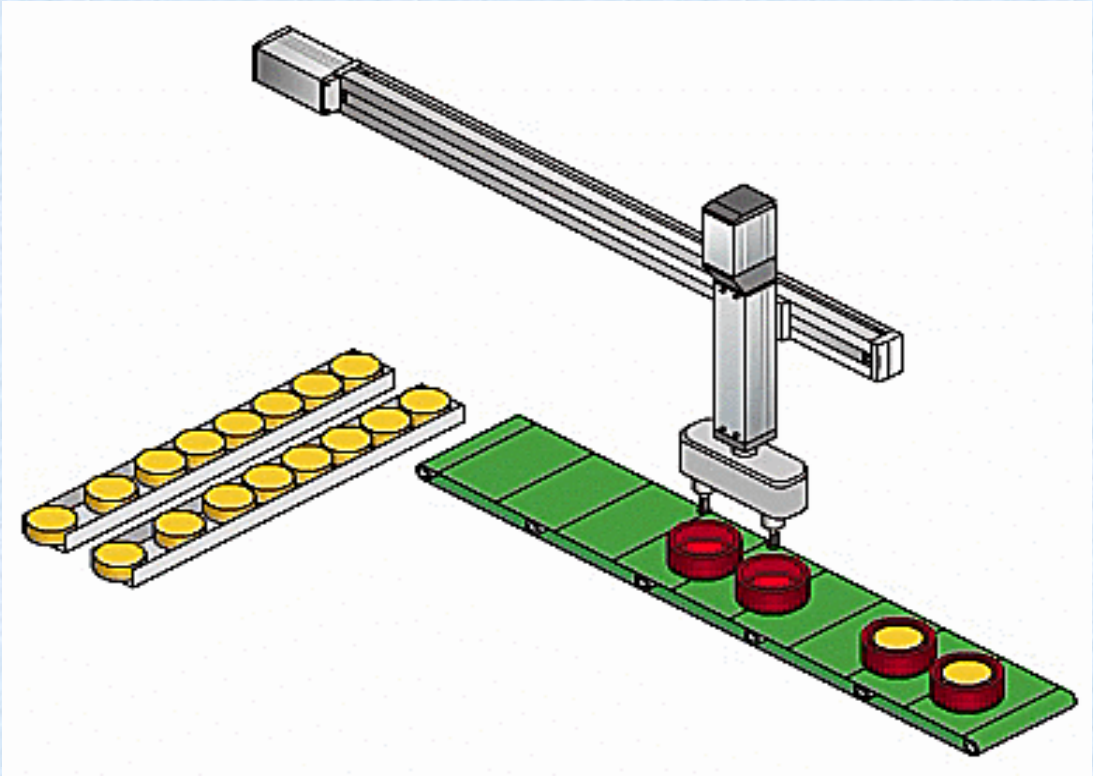
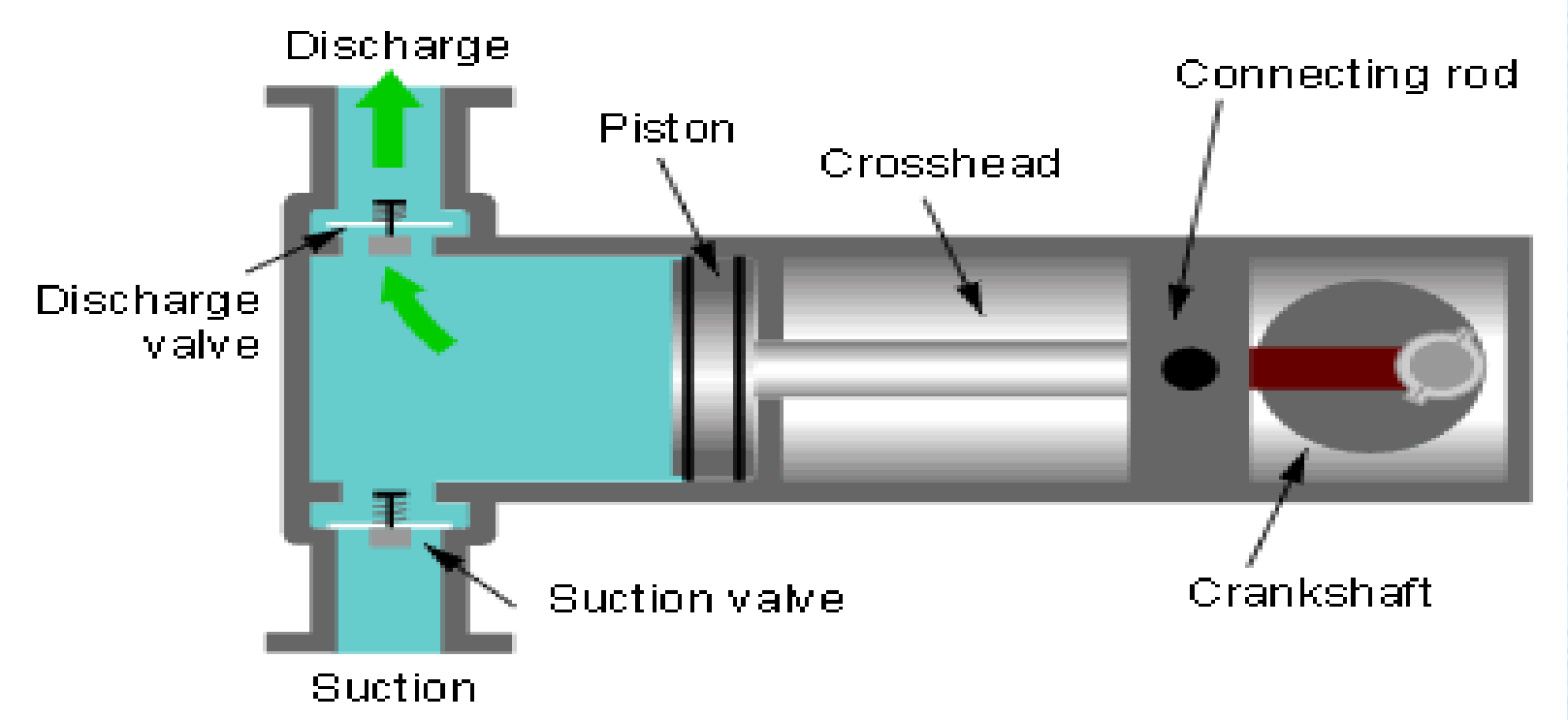
Pneumatic Actuators – 1) Linear type



Pneumatic Actuator – Air pressure is used

Pneumatic Actuators – 1) Linear type



Pneumatic Actuator – Air pressure is used

Pneumatic Actuators – 1) Linear type

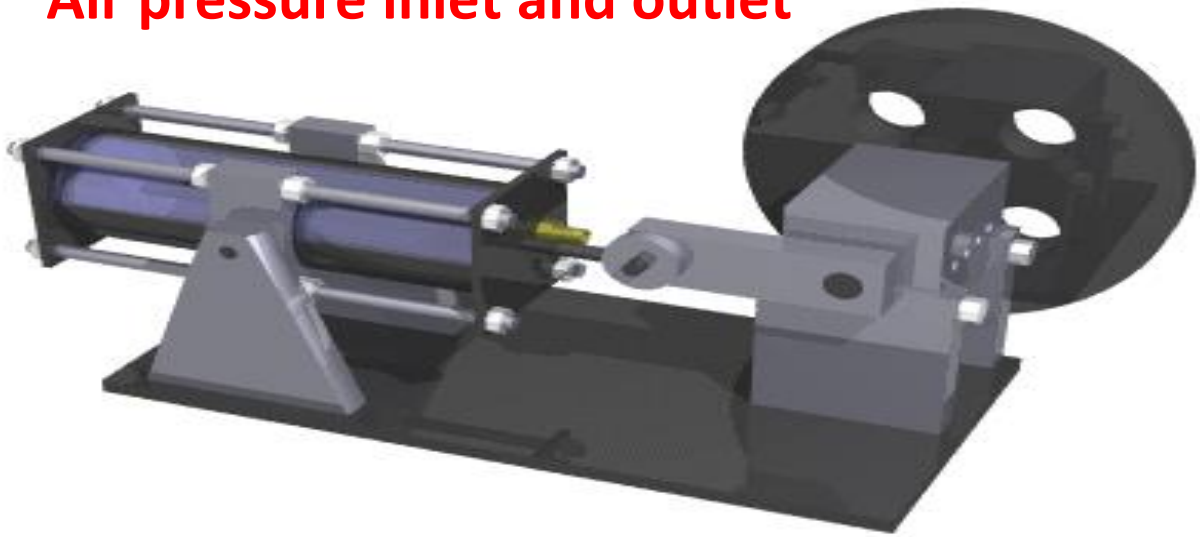
Pneumatic Actuator – Air pressure is used

Pneumatic Actuators – 1) Linear type 2) Rotary type

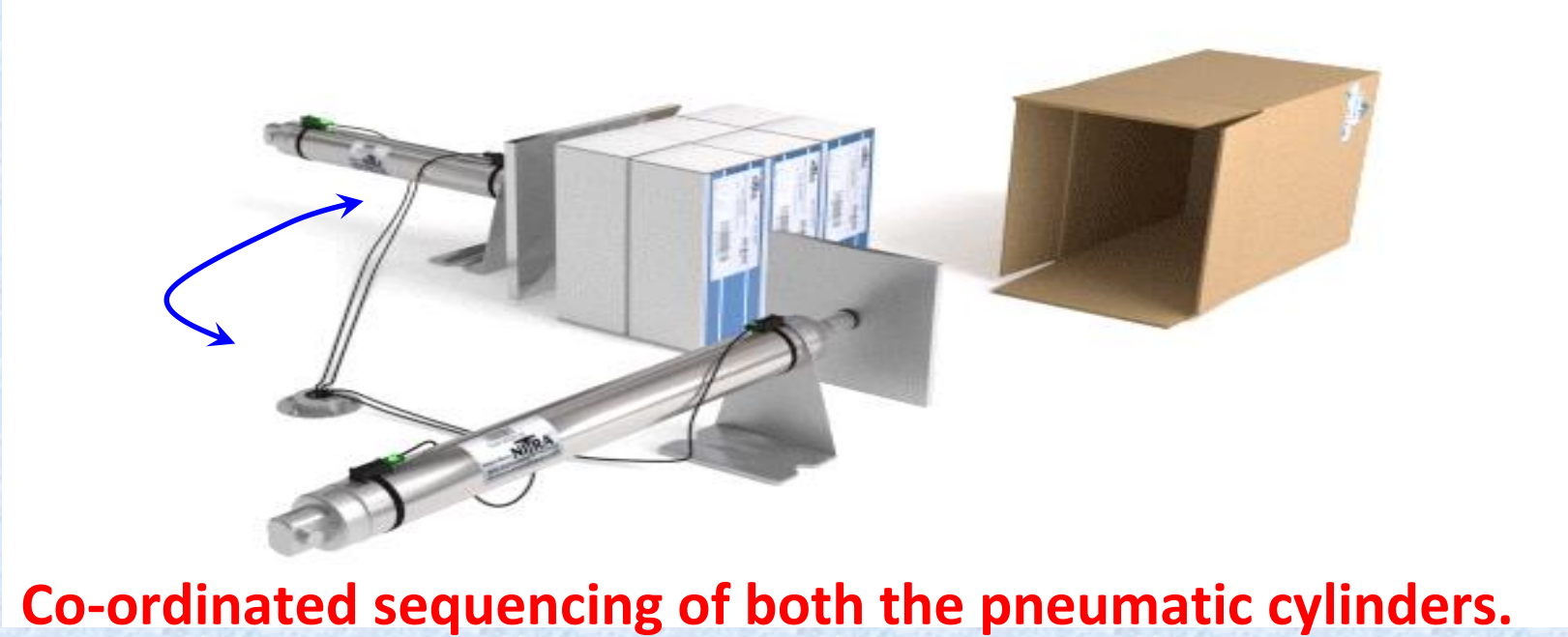
Inlet and Outlet for air from compressor

Pneumatic Actuator used to convert Linear to Rotary Motion

Air pressure inlet and outlet



Pneumatic Linear actuator in packaging industry -



Co-ordinated sequencing of both the pneumatic cylinders.

Hydraulic Actuators :

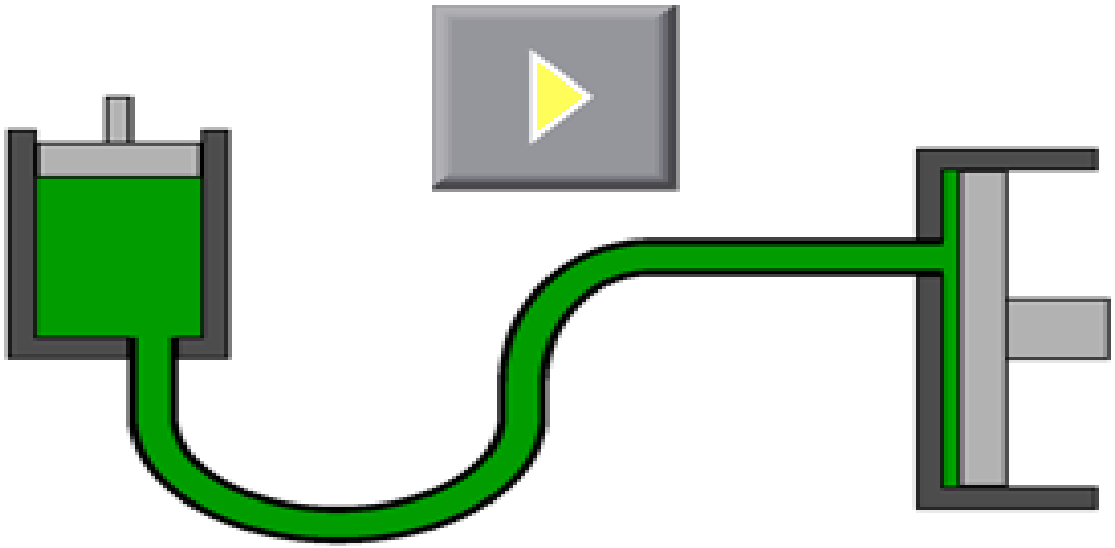
Useful Features :

- Hydraulic actuators are rugged and robust.
- Best suited for high force / power applications.
- A hydraulic actuator can hold force and torque constant without the pump supplying more fluid.
- Hydraulic actuators can have their pumps and motors located a considerable distance away with minimal loss of power.

Disadvantages :

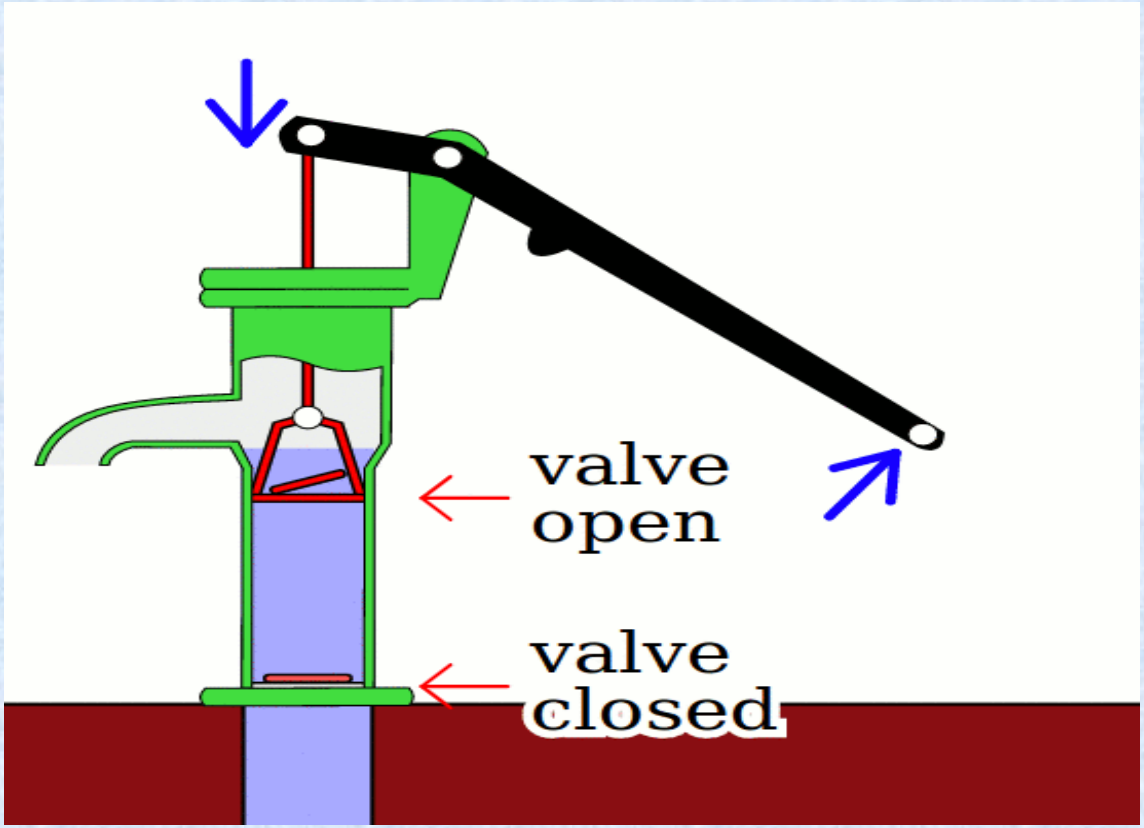
- Leakage of fluid is a common issue in Hydraulic system. The efficiency drops.
- Hydraulic actuators require many spares parts.

Hydraulic Linear Actuators – Basic Working Principle –

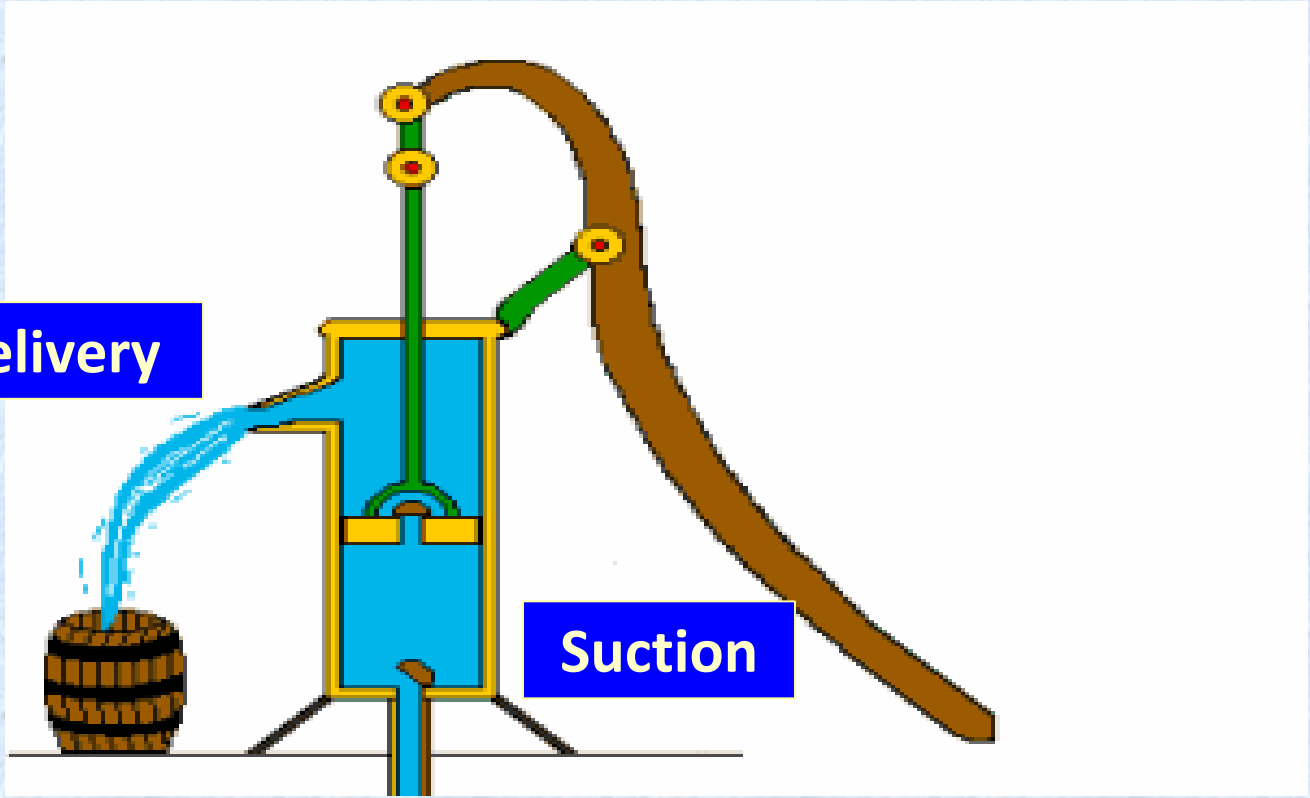


Relation between Volume and Stroke Length

Hydraulic Linear Actuators – Simple Hand Pump –

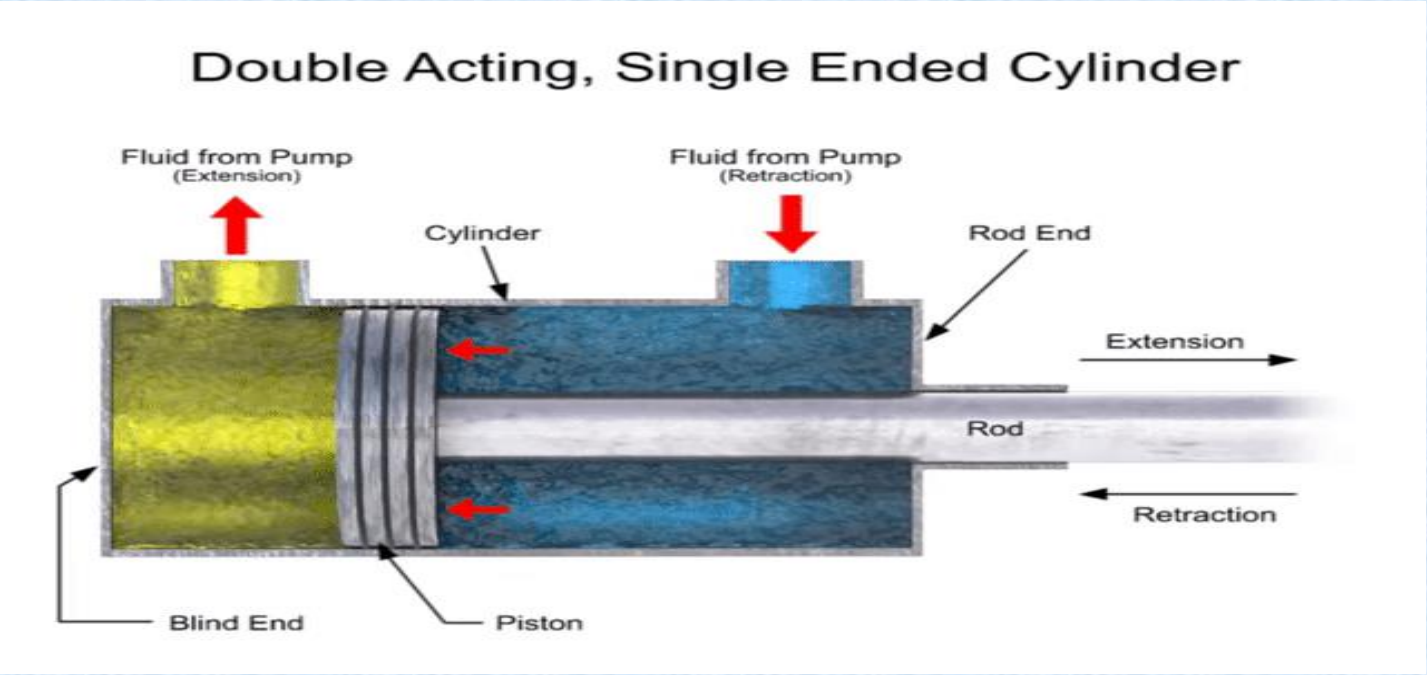


Hydraulic Linear Actuators – Simple Hand Pump –



Pneumatic Actuator – Air pressure is used

Pneumatic Actuators – 1) Linear type



Hydraulic Linear Actuators – Application Prototype

Hydraulic Linear Actuators – Car washing system

Electric Actuators :

Useful Features :

- Electrical actuators offer the highest precision and control.
- Overall Efficiency is very high.
- Electric actuators can be networked and programmed.
- In terms of noise, they are quieter than pneumatic and hydraulic actuators.
- Because there are no fluids leaks, environmental hazards are eliminated. Clean system.

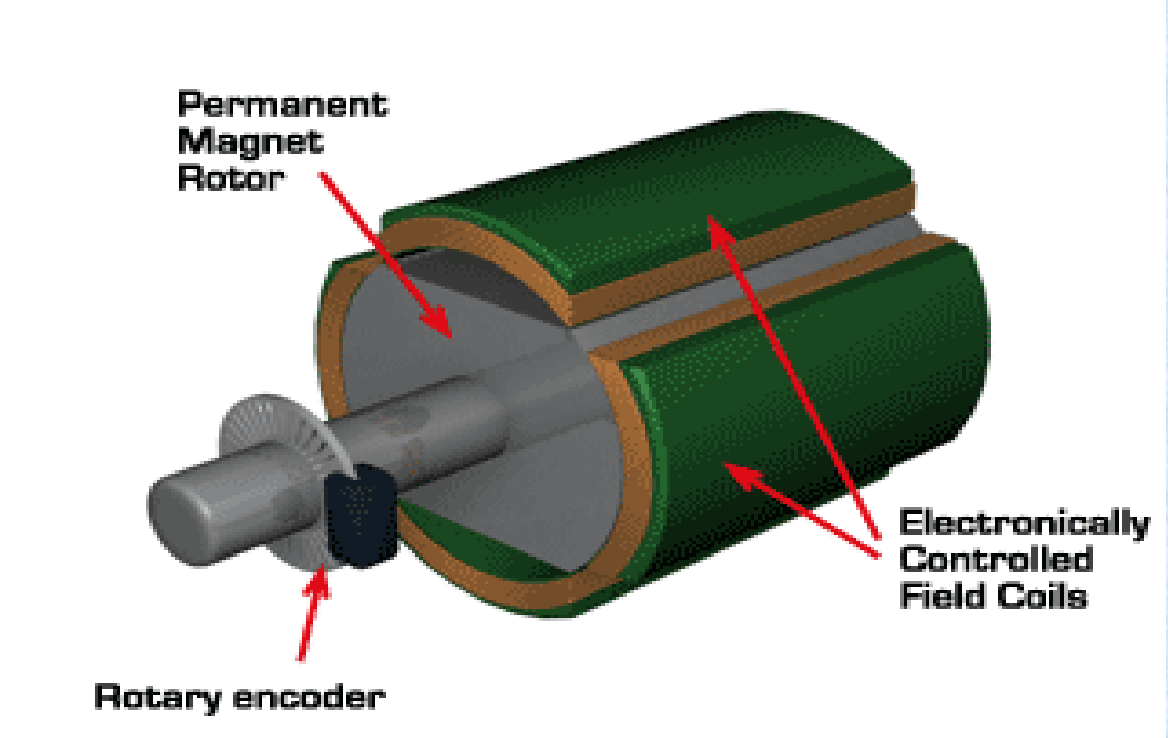
Disadvantages :

- The initial unit cost of an electrical actuator is higher than that of pneumatic and hydraulic actuators.
- A continuously running motor will overheat, increasing wear and tear on the Mechanical parts.

Electric Actuators : Solenoid Coil –

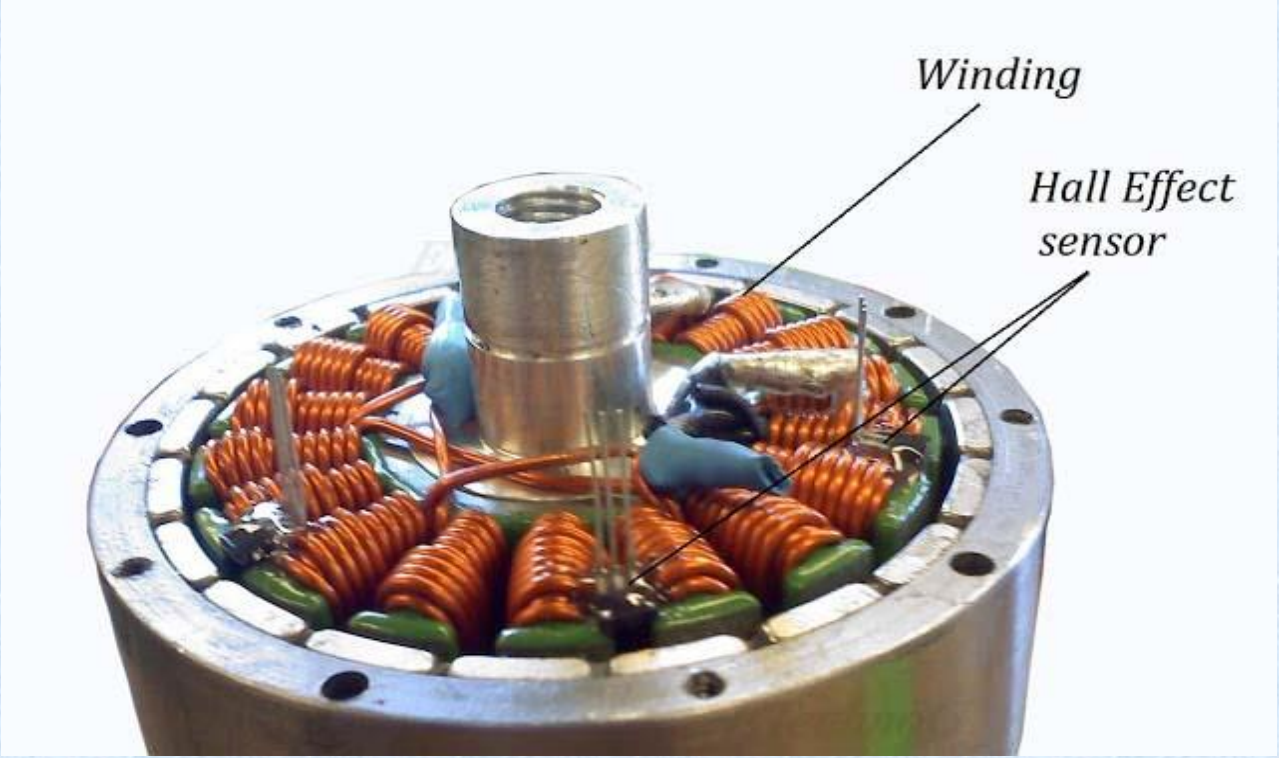
Solenoid Coil - Attraction and Repulsion Principle -

Electric Actuators – DC Motor with sensor –

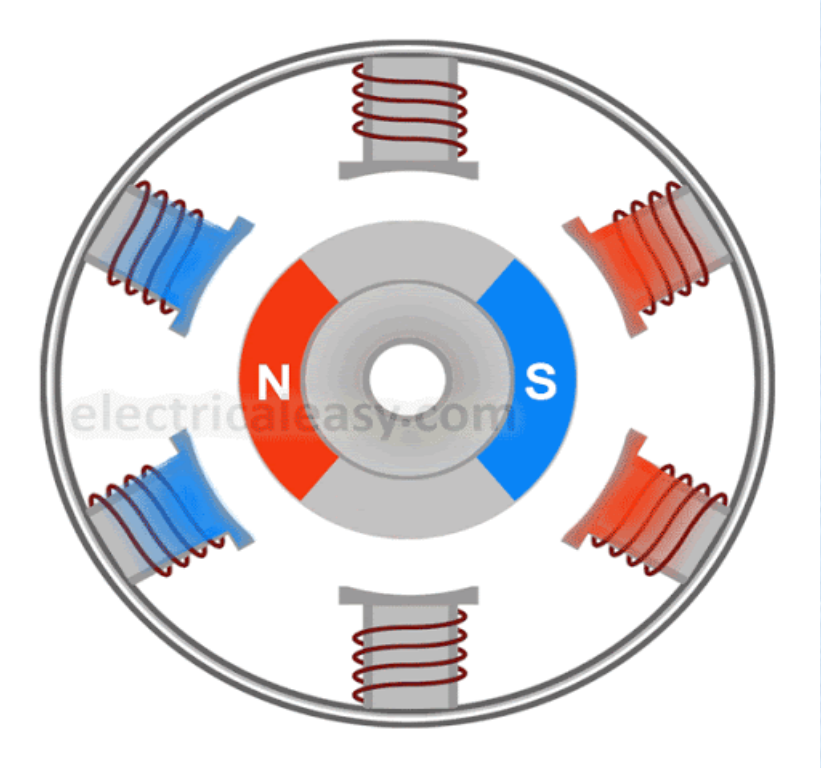


Electric Actuators – DC Motor with Commutator and Brushes –

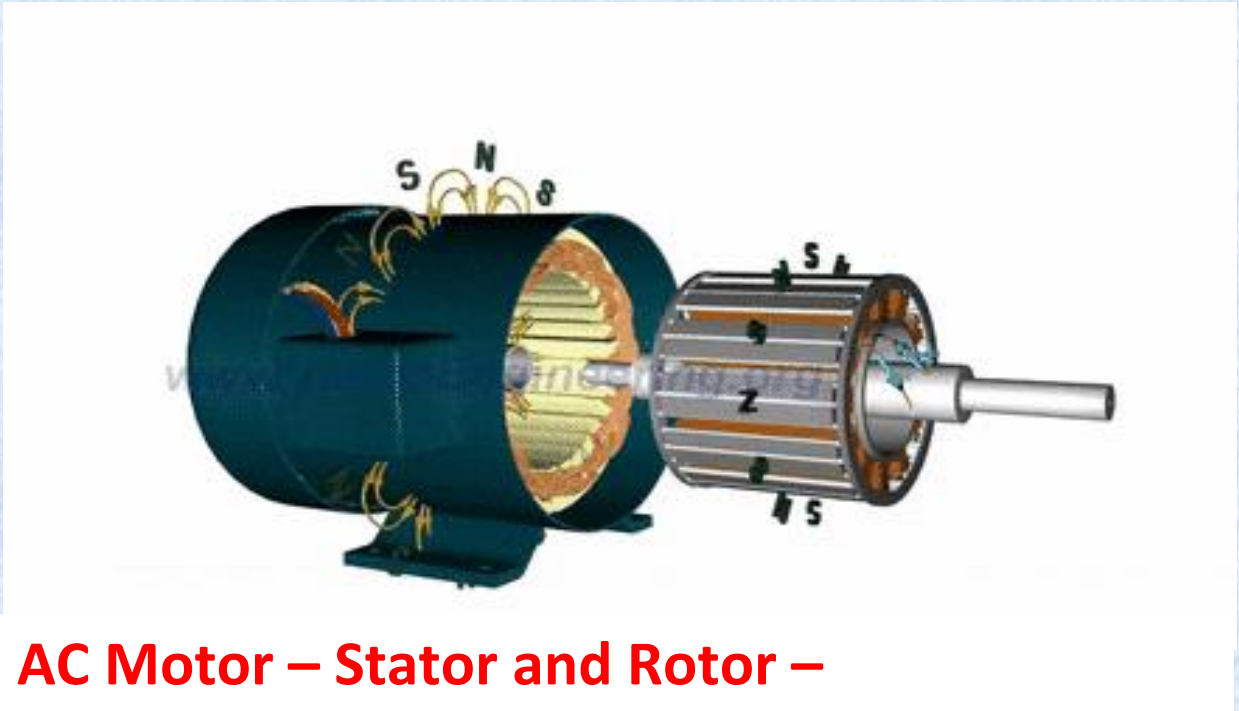
Electric Actuators – Brushless DC Motor – Internal view



Electric Actuators – Brushless DC Motor –

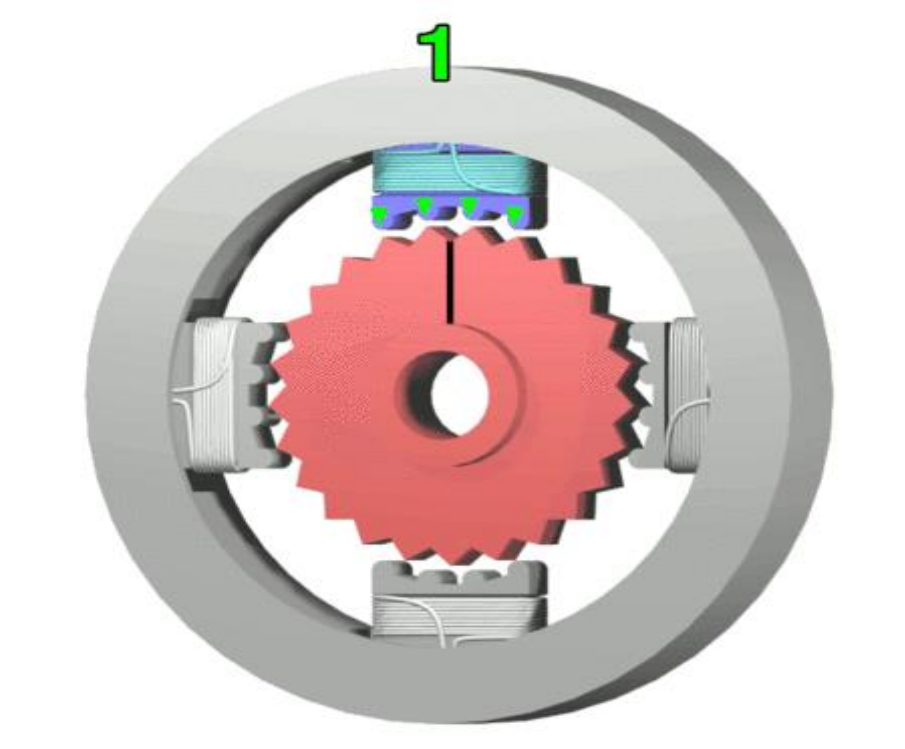


Electric Actuators – AC Motor –



AC Motor – Stator and Rotor –

Electric Actuators – Stepper Motor –



Stepper Motor rotates in steps (not continuously)

Electric Actuators – Servo Motor –

Servo Motor rotates through specific degrees

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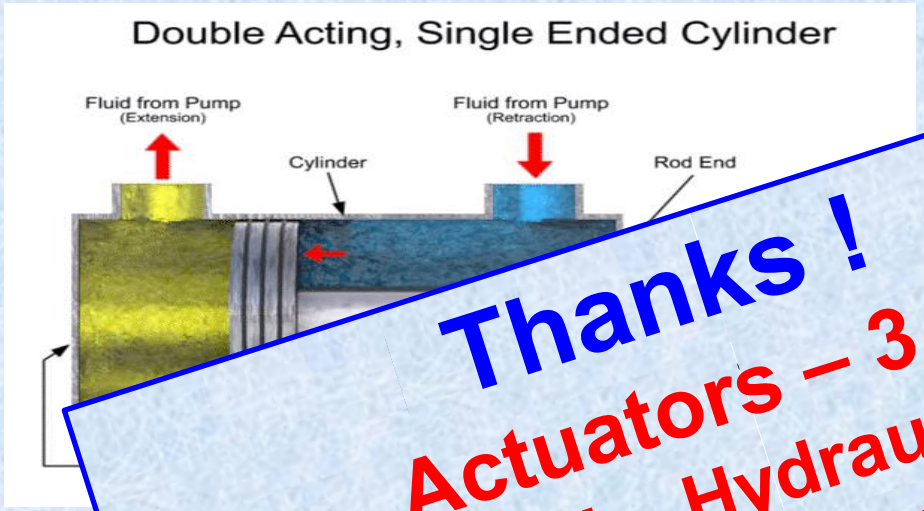

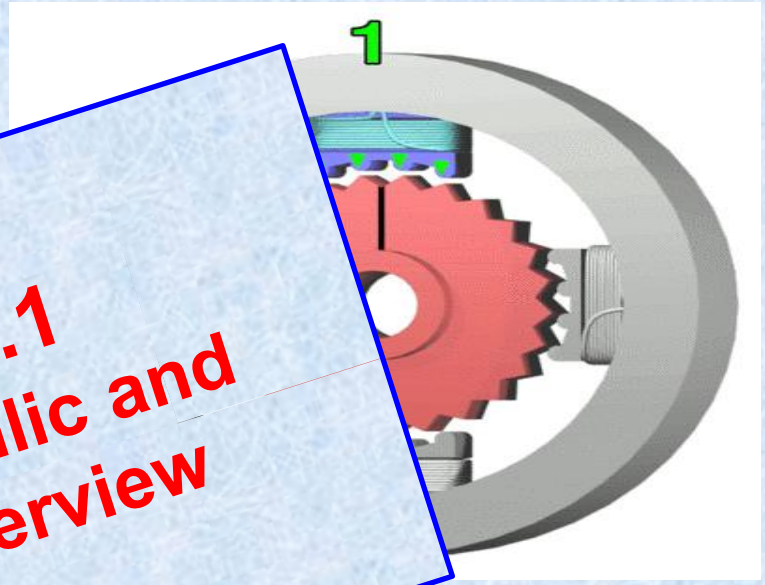

Thanks !

Actuators – 3.1

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