

# **SNS COLLEGE OF ENGINEERING**

Kurumbapalayam (Po), Coimbatore – 641 107

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## **DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

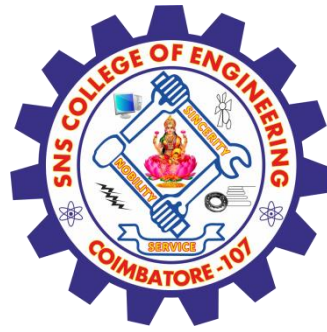
**COURSE NAME : 190E219 BUILDING AUTOMATION**

IV YEAR /VII SEMESTER

Unit 1- HVAC SYSTEM

Topic : Valves and Actuators





# Introduction



- Valve actuators are devices used to position valves.
- They can be used to fully open and shut a valve, or in an application that requires constant and precise control, such as regulating the flow of fuel to a gas turbine, modulate the position of the valve.



# Applications



- Automating a process
- Positioning valves that require large amounts of torque to operate
- Instantaneous operation of systems used to protect personnel and equipment from dangerous conditions
- Use in controlling areas where manual operation is impractical or impossible
- Continually adjusting systems that must maintain desired parameters



# Types of Valve Actuators



- There are three basic types of automatic valve actuators:  
those that are controlled by
  - i. pressurized air,
  - ii. by electrical power, or
  - iii. by hydraulic force.



## Selecting the proper actuator is based on the following considerations:



- The valve application
- The means available to power the actuator
- The speed at which the valve needs to operate
- The amount of force required to operate the valve
- The type of valve to be operated
- The cost versus the benefit for using each type of actuator

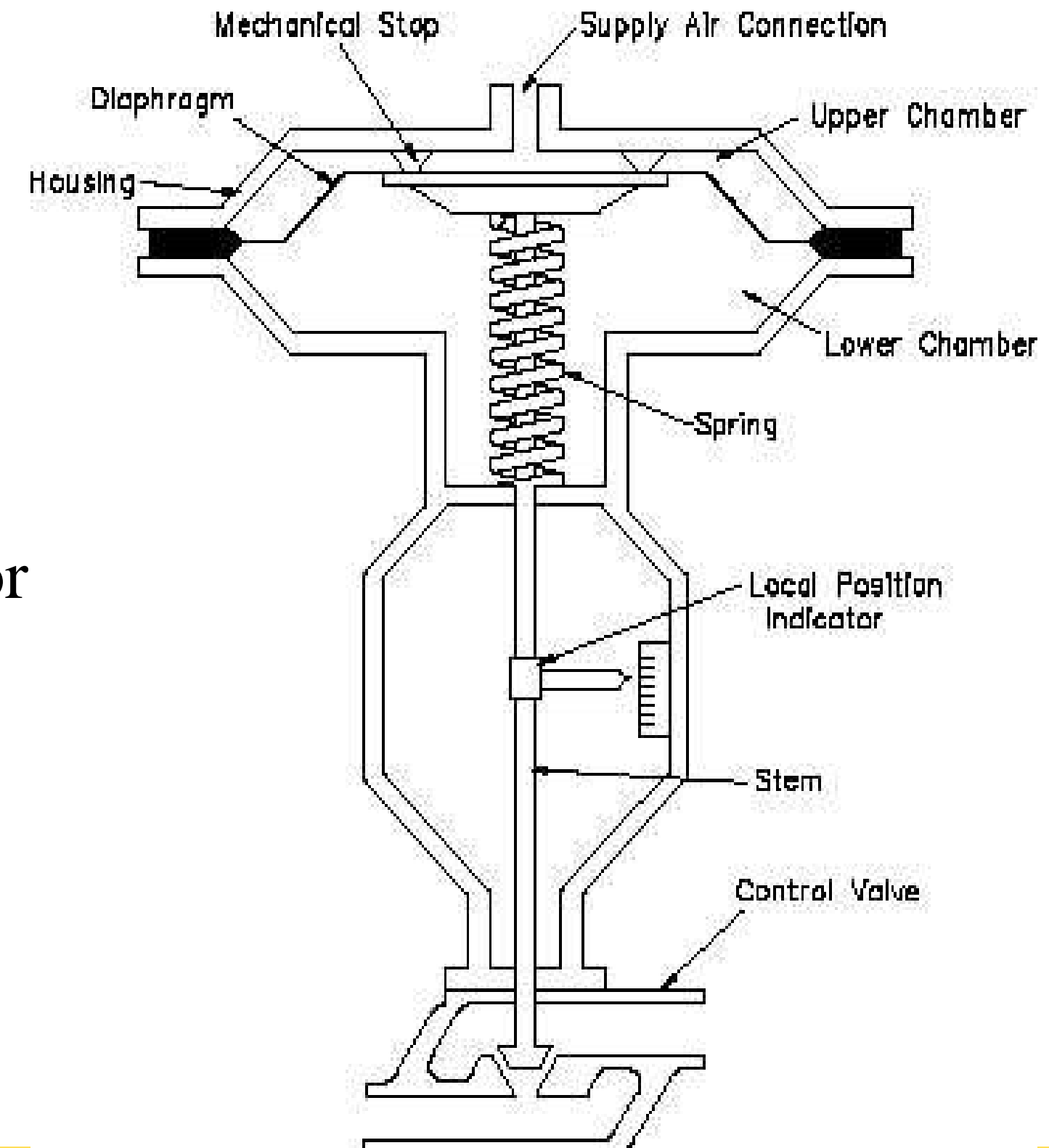


- Manual valve actuators do not require an outside power source.
- They use a handwheel or lever to drive a series of gears whose ratio results in a higher output torque compared to the input (manual) torque.





- Pneumatic actuators use pressurized air to operate a valve.
- They do this by applying the force of the air to a piston or a diaphragm attached to the valve stem.
- Pneumatic actuators are used to provide automatic or semi-automatic valve operation, and are the most popular type in use due to their dependability and simplicity of design.
- Pneumatic valve actuators adjust valve position by converting air pressure into linear or rotary motion.



# Pneumatic Actuator

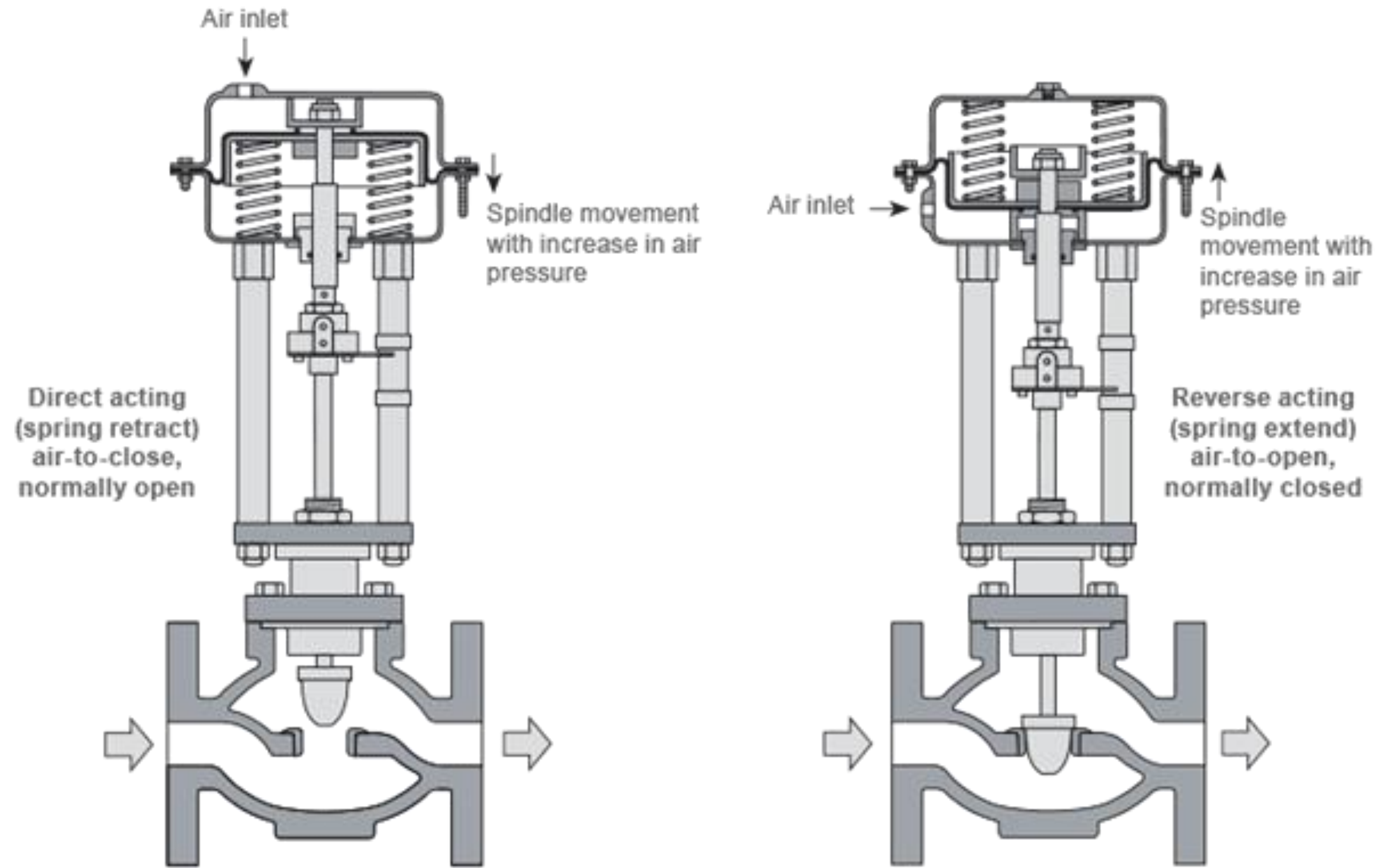


Fig. 6.6.3 Valve and actuator configurations





## advantages



- Dependability and simplicity of design
- Fast stroking speeds
- Low fire risk
- Low costs
- Pressurized air can be stored, so the valves can be operated when power is lost



## disadvantages



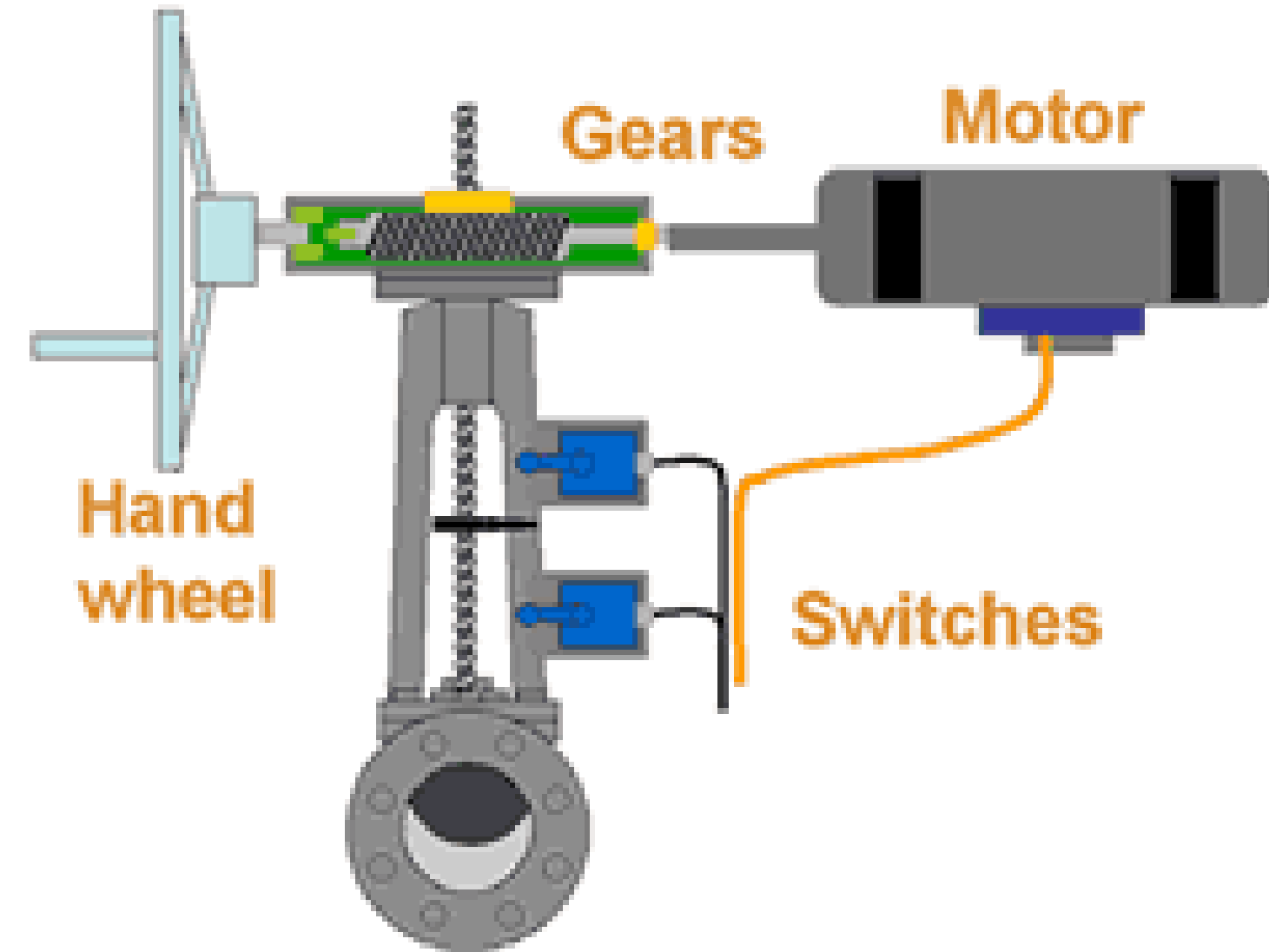
- Poor performance at slow speeds
- Compressibility of air, which can lead to inconsistent speeds of shaft movement
- Impossible to precisely control position, unless fully open or shut

## Applications

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- Due to their simple design, high reliability, and low cost, pneumatic diaphragm actuators are used in many industrial applications.
- For example, pneumatic diaphragm actuators are often used to control cooling water flow in power plants.

# Electrical Actuator

- Electric actuators include electric motors and solenoid-actuated valves.
- Electric motors can be used to open, close, and position a valve manually, automatically, or semi-automatically.
- The motor operates in both directions and drives the valve stem by means of gear couplings. Solenoid valves use electric power to attract a magnetic slug attached to the valve stem and are used in automatic open-close applications.



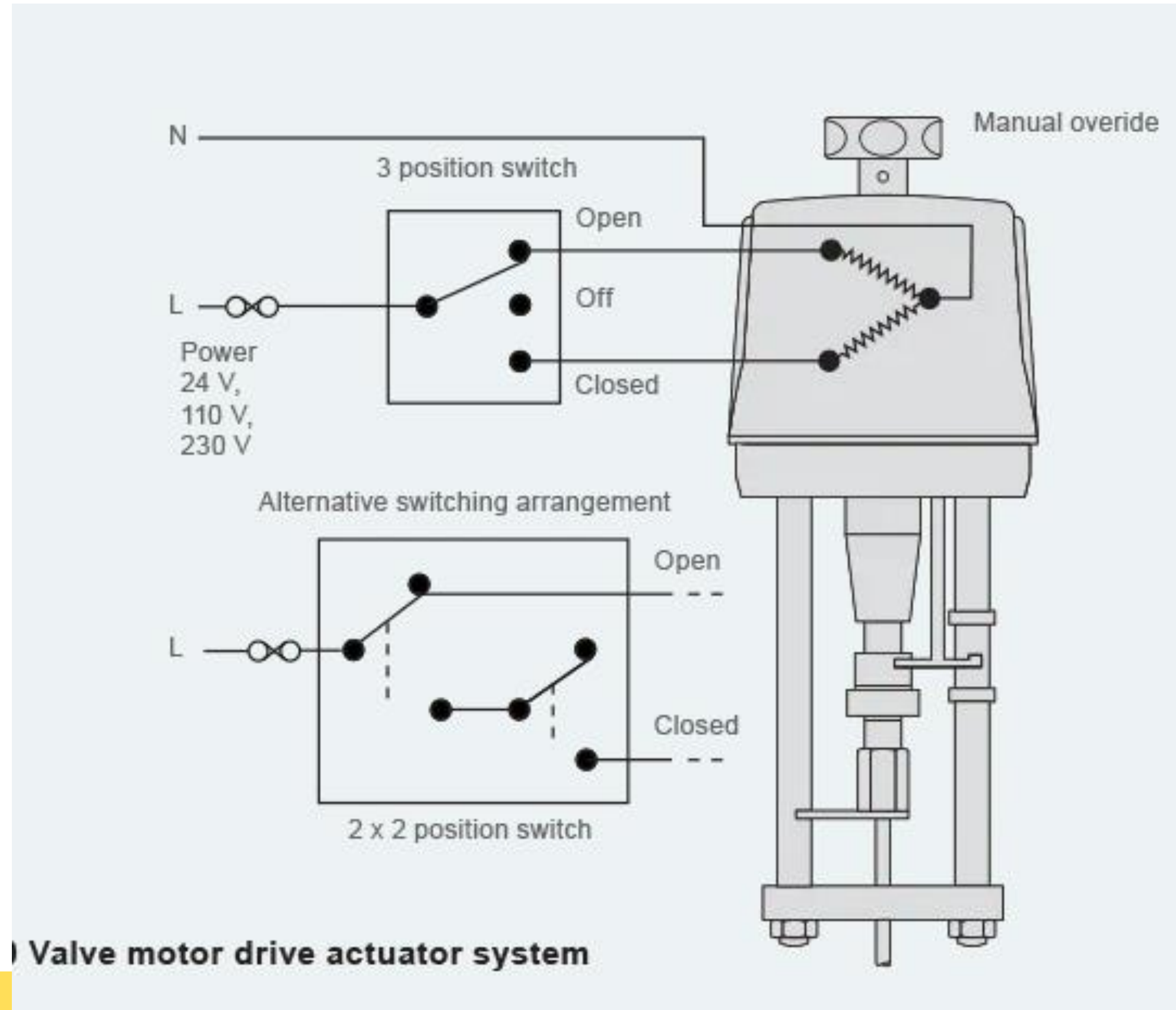


## advantages



- No source of pressurized air or fluid required
- Useful where low temperatures could cause freezing of condensation in air supply lines
- Capable of producing very large amounts of torque
- Capable of producing consistent and adjustable operating speeds
- Electric cables are easier than piping to route to an actuator

# Electrical Actuator







## disadvantages



- More expensive and complex than other types of actuators
  - Slower comparative operation speeds
  - Susceptible to a loss of power
  - Potential fire hazard
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- When a facility is located in a cold enough climate, any moisture trapped in pneumatic control lines can freeze, removing control of that valve.
  - In conditions such as this, many facilities will rely on electric motor actuators for reliability and efficiency during extreme temperatures.



## Hydraulic Actuator



- **Hydraulic actuators** use a pressurized fluid to control valve movement.
- The hydraulic fluid used is either water or oil and is fed to either one or both sides of a piston to cause movement.
- Hydraulic valves provide for automatic and semi-automatic valve operation.





## advantages



- More powerful than a pneumatic actuator of the same size
- Precise control of valve position
- Capable of converting a small input pressure into a large output pressure
- Incompressibility of the fluid, which means very little energy is lost during operation

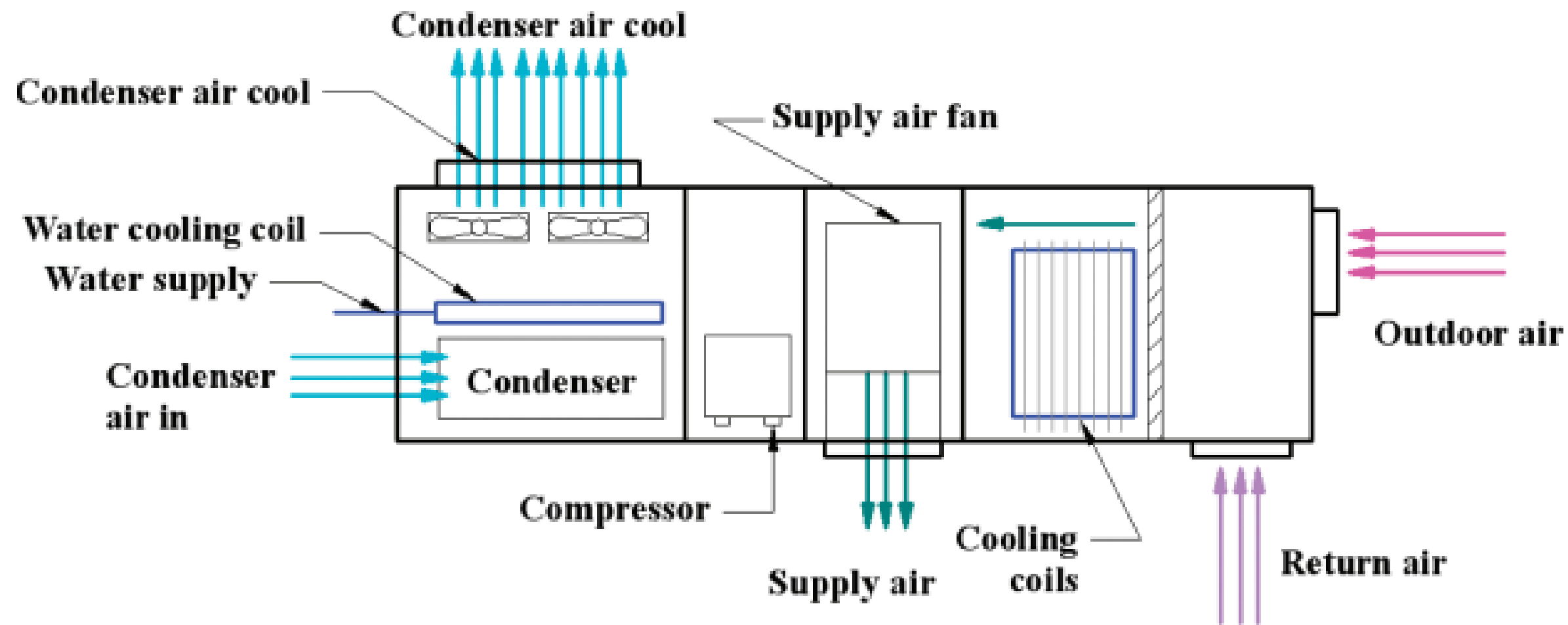


## disadvantages



- External hydraulic pump required
- Efficiency can be influenced by changes in temperature
- More expensive and complex than pneumatic actuators
- Can leak, causing a potential fire hazard

1. Can you say this shown in fig. is the example of which method of HVAC?







# References



1. Shengwei Wang, “ Intelligent Buildings and Building Automation”, Routledge 2010.
2. Reinhold A, Carlson Robert A, Di Giandomenico, “Understanding Building Automation Systems: Direct Digital Control, Energy Management, Life Safety, Security Access Control, Lightning, Building”, R. S Means company limited, 1<sup>st</sup> edition, 1991.

**Thank You**