Module – 2

CONTROL SYSTEM COMPONENTS

Lecture - 5

Motor Starter
Pilot Devices

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TYPES OF MOTOR STARTERS

- A motor starters in its simplest form consists of some means of connecting and disconnecting the motor loads from the power line plus overload protection of the motor.
- Two types
  - Manual
  - Automatic
Manual Motor Starter

- depend upon the operator closing the line contacts by pushing a button or moving a lever which is physically linked to contacts in some manner.
- The chief disadvantage is the lack of flexibility of control
- must be operated from the starter location
- Three types for ac motor
  - Thermal switch - for very small single-phase motors
  - size 0 / size 1 manual across the line – for 1 and 3 phase IM
  - manual reduced-voltage starter - for large motors
- For dc motors:
  - Three terminal starters
  - Four terminal starters

Automatic Motor Starter

- also known as magnetic starter
- operate motors from a remote location or to operate motors automatically in response to a signal from a thermostat, a pressure float switch, a limit switch or other sensing devices
- consists of a magnetic contactor with the addition of overload protection

Advantages:
- unlimited control flexibility
- dependable
- long life
- reasonable maintenance
Types of Automatic Starters

- clapper type,
- vertical type,
- horizontal type,
- bell-crank type.

Pilot Devices

- A primary control device is one which connects the load to the line, such as a motor starter, whether it is manual or automatic.
- Pilot control devices are those which control or modulate the primary control devices.
- There may be many pilot devices used in parallel and series combinations to control the function of start and stop performed by the primary control device.
  - Push Buttons
  - Pressure Switches and Regulators
  - Float Switches
  - Flow Switches
  - Limit Switches
  - Proximity Switches
  - Temperature Switches
**Pressure Switches and Regulators**

- Any industrial application which has a pressure sensing requirement can use a pressure switch
- welding equipment, machine tools, high pressure lubricating systems, and motor-driven pumps and air compressors
- Pressure regulators provide accurate control of pressure or vacuum conditions for systems.
- used as pilot control devices with magnetic starters,
- to control liquid pump or air compressor motors

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**Float Switches**

- A float switch is used when a pump motor must be started and stopped according to changes in the water (or other liquid) level in a tank or sump.
- The operation of a float switch is controlled by the upward or downward movement of a float placed in a water tank
**Flow Switches**
- A flow switch is a device which can be inserted in a pipe so that when liquid or air flows against a part of the device called a paddle, a switch is activated.
- This switch either closes or opens a set of electrical contacts.
- The contacts may be connected to energize motor starter coils, relays, or indicating lights.

![Flow Switch Diagram](image1)

**Limit Switches**
- The limit switch is used to convert this mechanical motion into an electrical signal to switch circuits.
- Operation of a limit switch begins when the moving machine or moving part of a machine strikes an operating lever which actuates the switch.
- Used as pilot devices in the control circuits of magnetic starters to start, stop, speed up, slow down or reverse electric motors.

![Limit Switch Diagram](image2)
Proximity Switches

- Can be switched by a nearby or passing object
- No physical contact is necessary

Types

- Capacity Proximity Sensor
  - designed to detect both metallic and nonmetallic targets.

- Solid-State Proximity Switches

- Inductive Proximity Sensors
  - designed to detect the presence of all metals without making contact.
  - operates on the eddy current principle
  - Used
    - to detect metal objects through nonmetal barriers
    - where metal objects must be differentiated from nonmetal objects
    - for counting

Temperature Switches

- designed to provide automatic control of temperature regulating equipment.
- used to control circuits in order to operate heaters, blowers, fans, solenoid valves, pumps, and other devices

Solid-State Temperature Control Systems

- designed with three high-accuracy thermistor temperature sensors.
- sensors transmit the internal coil temperatures to a microprocessor (minicomputer)
- The temperature will be displayed in degrees on the front panel of the control module
- The processor will give the signal to switch the contacts.
- can be used to protect three-phase transformer coils from overheating.
Thank You