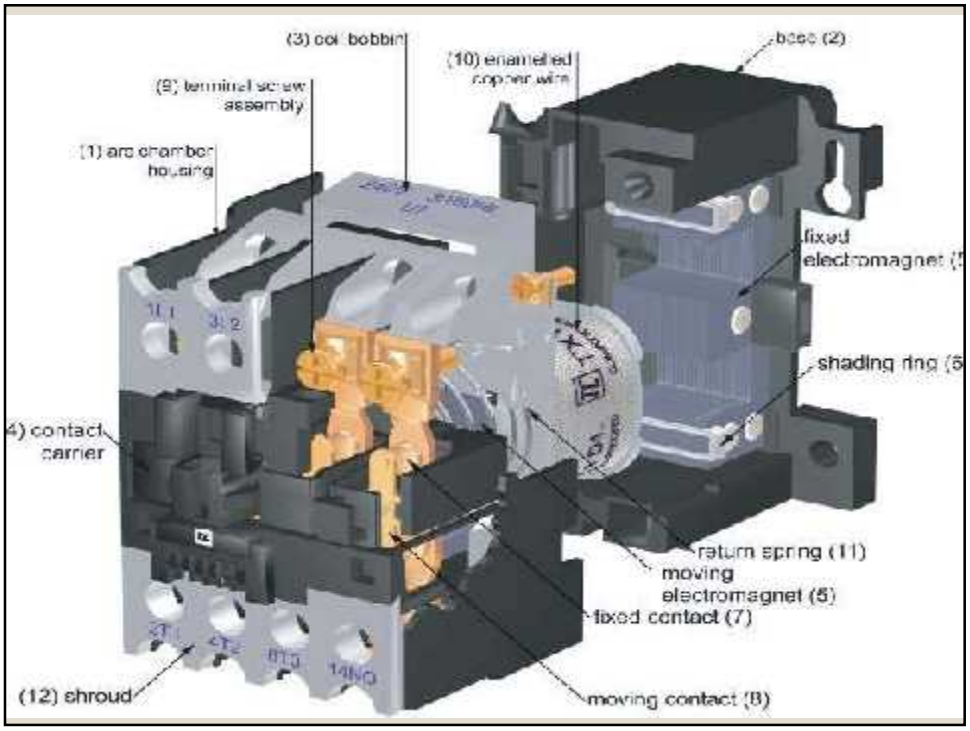

Module – 2
CONTROL SYSTEM COMPONENTS
Lecture - 3
CONTACTOR
Shameer A Koya
1


(3) coil bobbin
(10) enamelled copper wire
base (2)
(9) terminal screw assembly
(1) arc chamber housing
fixed electromagnet
shading ring
(4) contact carrier
return spring (11)
moving electromagnet (5)
fixed contact (7)
(12) shroud
moving contact (8)

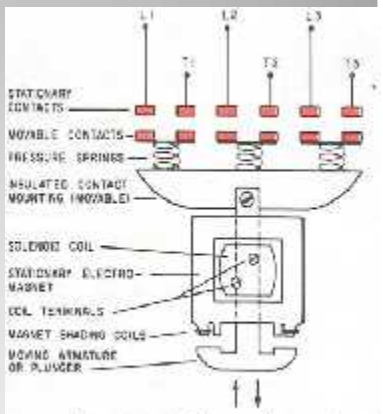
Introduction

- A contactor is an electromagnetically controlled switch used for switching a power circuit.
- A contactor is controlled by a circuit which has a much lower power level than the switched circuit.
- Contactors are used in combination with pilot control devices to switch lighting and heating loads.
  - Pilot devices - push buttons, float switches, pressure switches, limit switches, thermostats, etc.
- When used to control ac motors an overload protection is provided separately – called Motor Starter.

3

Operating principle

- When current passes through the electromagnet, a magnetic field is produced, which attracts the moving core of the contactor
- the force developed by the electromagnet holds the moving and fixed contacts together
- When the contactor coil is de-energized, gravity or a spring returns the electromagnet core to its initial position and opens the contacts.



Three-pole, solenoid-operated magnetic switch

4

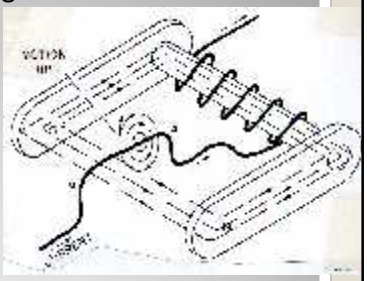
Arc suppression

- An electrical arc occurs between the two contacts when they open (break arc) or close (make arc)
- The break arc is typically more energetic and thus more destructive
- The arc energy slowly destroys the contact metal over time, ultimately resulting in device failure
- Most motor control contactors at low voltages (600 volts and less) are air break contactors;
  - air at atmospheric pressure surrounds the contacts and extinguishes the arc when interrupting the circuit
  - For better arc suppression magnetic blowout is used

5

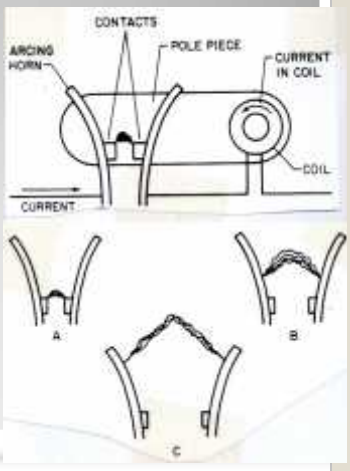
Magnetic Blowout

- The magnetic blowout coils help to extinguish an electric arc at contacts opening.
- heavy copper coils called blowout coils, are mounted above the contacts in series with the load
- The function of the blowout magnet is to move the arc upward at the same time that the contacts are opening.
  - Using the principle of motor action – Fleming's Left Hand Rule
- As a result, the arc is lengthened at a faster rate than will normally occur because of the opening of the contacts alone.



6

- The arc can be lengthened, and extinguished by motor action if it is in a magnetic field.
- This magnetic field is provided by the magnetic blowout coil
- The figure shows what happens because of the magnetic action.
  - The arc is the conductor in the magnetic field.
  - Part A shows the beginning deflection of the arc because of the effect of the motor action.
  - Part B shows that the contacts are separated more than in A and the arc is beginning to climb up the horns
  - Part C shows the arc near the tips of the horns and the arc is so lengthened that it will be extinguished.

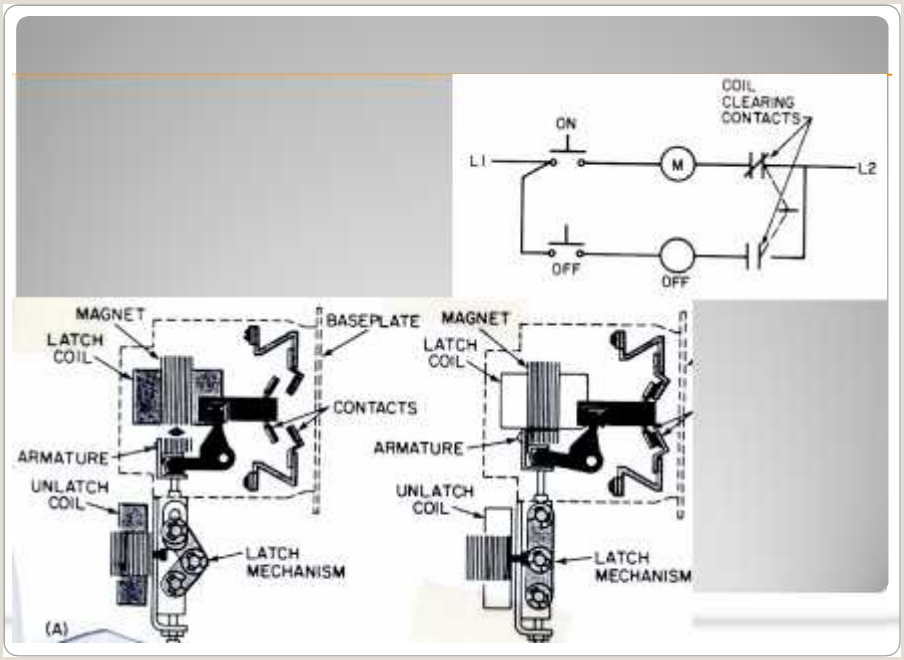


7

Mechanically held Contactors

- A mechanically held contactor, is operated by electromagnets
- After closing, electromagnets are automatically disconnected.
- contacts are mechanically held in position and no current flows through the operating coil after switching.
- generally used in locations where the humming noise of ac magnetic devices is objectionable.
- Advantages
  - continuous operation of multiple units of substantial size will lower the electrical energy requirements
  - magnetically held contactor will change contact position upon loss of voltage to the coil, whereas the mechanically held contactor will respond only to the action of the control device

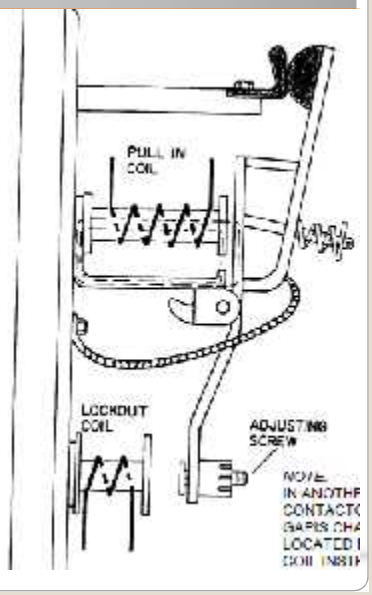
8



9

DC Series Magnetic Lockout Contactor

- The dc series lockout relay, consists of two coils connected in series.
- One coil, the lockout coil, acts to hold the contactor open.
- The other coil, the pull-in coil, acts to close the contactor.



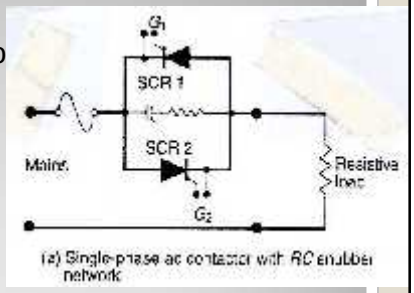
10

Solid-State Contactor

- A solid-state contactor is a power-switching device designed to replace magnetic contactors.
- Solid-state contactors now replace three-pole electromechanical contactors in industrial furnaces and ovens, mining, and other industrial heating applications.
- Silicon-controlled rectifiers (SCR) are used as switching device.
- The SCR, like a contact, is in either the ON state (closed contact) or the OFF state (open contact).

11

- The SCR is analogous to a "latched contact" circuit – once the SCR is triggered, it will stay ON until its current decreases to zero.
- When current through the SCR stops, the "SCR switch" will open and stay open until re-triggered.
- Since an SCR passes current in one direction only, two SCRs are necessary to switch ac power.
- The two SCRs are connected in inverse-parallel (back-to-back)



(a) Single-phase ac contactor with RC snubber network

12

Thank You

- Next Lecture:
  - Relays

13