Chapter 31

motor load. If the motor is connected to a light load, the rotor gains speed rapidly, causing the motor to accelerate rapidly. If the load is heavy, the rotor gains speed at a slower rate, causing a more gradual increase in speed to help the motor overcome the inertia of the load.

Review Questions

1. How many slip rings are on the rotor shaft of a wound rotor motor?
2. What is the purpose of the slip rings located on the rotor shaft of a wound rotor motor?
3. A wound rotor induction motor has a stator that contains six poles per phase. How many poles per phase are in the rotor circuit?
4. Name three factors that determine the amount of torque developed by a wound rotor induction motor.
5. Explain why the wound rotor motor produces the greatest amount of starting torque per amp of starting current of any three phase motor.
6. Explain why controlling the rotor current also controls the stator current.
7. What is the function of a micro limit switch when used with a manual controller for a wound rotor motor?
8. Why are the resistors used in the rotor circuit smaller for a starter than for a controller?
9. What is rotor slip?
10. A wound rotor has a synchronous speed of 1200 RPM. The rotor is rotating at a speed of 1075 RPM. What is the percent of rotor slip and what is the frequency of the induced rotor voltage?
11. Refer to the circuit shown in Figure 31–6. Assume that the motor is running at full speed and the STOP button is pressed. The motor stops running. When the manual control knob is returned to the highest resistance setting, the motor immediately starts running in its lowest speed. Which of the following could cause this problem?
    a. The STOP push button is shorted.
    b. The START push button is shorted.
    c. M auxiliary contact is shorted.
    d. The micro limit switch contact did not reclose when the control was returned to the highest resistance setting.
12. Refer to the circuit shown in Figure 31–7. Assume that the timers are set for a delay of 3 seconds each. When the START button is pressed, the motor starts in its lowest speed. After 3 seconds the motor accelerates to second speed, but never reaches third speed. Which of the following *cannot* cause this problem?
    a. TR1 timer coil is open.
    b. S1 contactor coil is open.
    c. TR2 timer coil is open.
    d. S2 contactor coil is open.
13. Refer to the schematic diagram in Figure 31–8. Assume that the motor is not running. When the third speed push button is pressed, the motor starts in its lowest speed. After a delay of 3 seconds, the motor accelerates to second speed and 3 seconds later to third speed. After a period of about 1 minute, the fourth speed push button is pressed, but the motor does not accelerate to fourth speed. Which of the following could cause this problem?
    a. Control relay CR2 coil is open.
    b. S2 contactor coil is open.
    c. CR3 coil is shorted.
    d. S3 contactor coil is open.

Review Questions

1. What is a synchronous motor called when it is operated without load and used for power factor correction?
2. What is an amortisseur winding and what function does it serve?
3. Should the excitation current be applied to the rotor of a synchronous motor before it is started?
4. What is the function of a field discharge resistor?
5. What controls the output voltage of the alternator when a brushless exciter is used to supply the excitation current of the rotor?
6. What is the purpose of the DC coil on a polarized field frequency relay?
7. What is the purpose of an out-of-step relay?
8. Why is it possible for a synchronous motor to operate at the speed of the rotating magnetic field?
9. Name two factors that indicate when normal excitation current is being applied to the motor.
10. How can a synchronous motor be made to produce a leading power factor?

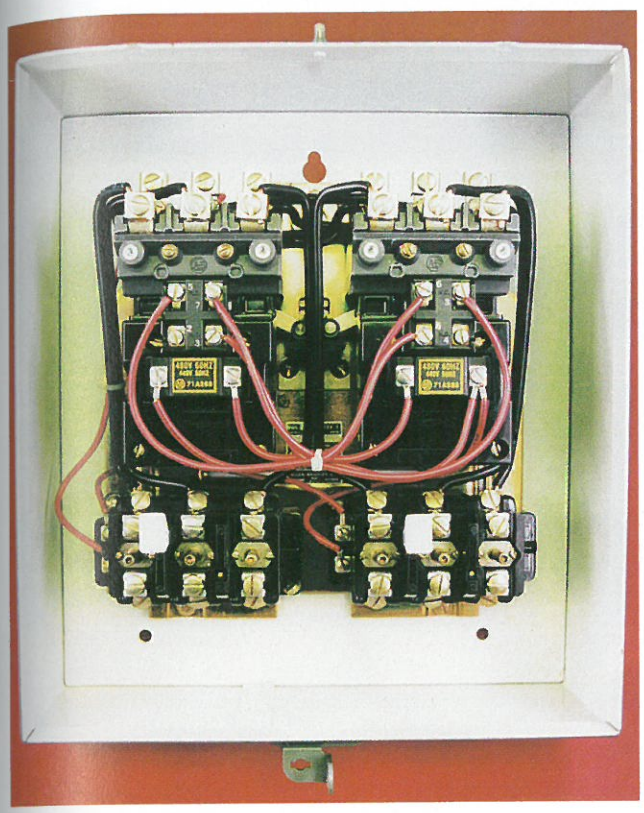


Figure 33–12 Two-speed, two-winding motor controller.

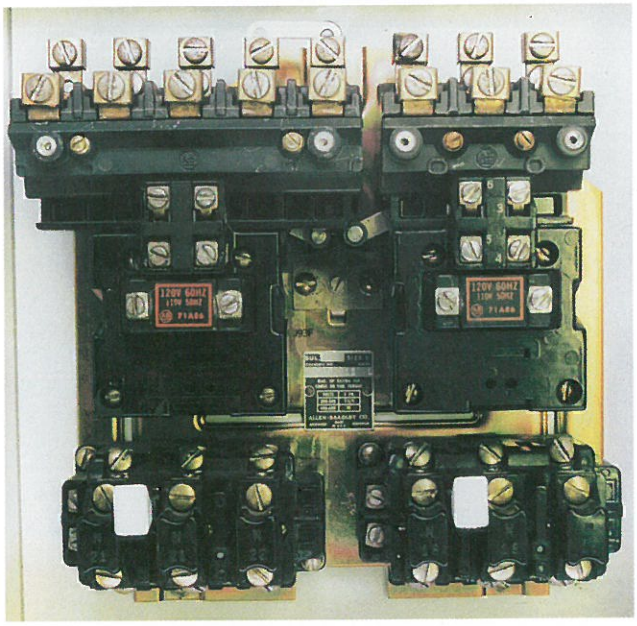


Figure 33–13 Two-speed, one-winding motor controller.

Cahpter 33

Review Questions

1. Name two factors that determine the synchronous speed of a motor.
2. How many speeds can be obtained from a consequent pole motor that contains only one stator winding?
3. What is the advantage of consequent pole motors over some other types of variable speed motors?
4. A consequent pole motor has synchronous speeds of 1800, 1200, and 900 RPM. How many stator windings does this motor have?
5. Refer to the circuit shown in Figure 33–6. You are to install this control system. How many auxiliary contacts should starter 1L contain and how many are normally open and how many are normally closed?
6. Refer to the circuit shown in Figure 33–6. What is the function of contactor 2L?
7. Refer to the circuit shown in Figure 33–7. When the low speed push button is pressed, the motor begins to run in low speed. When the high speed push button is pressed, the motor stops running. Which of the following could cause this problem?
   a. The 1L contactor coil is open
   b. H contactor coil is open
   c. PR relay coil is open
   d. The 2L contactor coil is open
8. Refer to the circuit shown in Figure 33–11. Assume that coil 2CR is shorted. Would it be possible to run the motor in the third speed?
9. Refer to the circuit shown in Figure 33–11. Explain the action of the circuit if coil 2CR is shorted and the second speed push button is pressed.
10. Refer to the circuit shown in Figure 33–11. You are to construct this circuit on the job. Would it be possible to used an 11 pin control relay for 4CR?

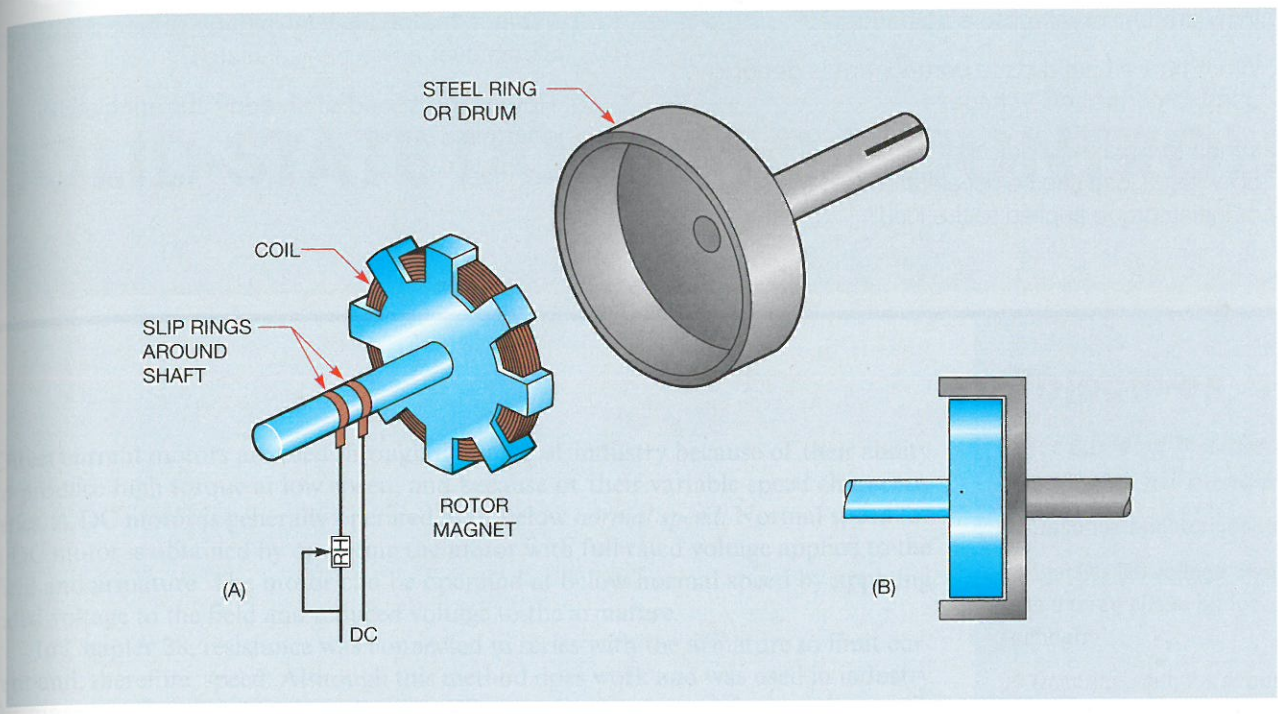


Figure 34–8 Diagram A shows magnetic armature or rotor and drum. Diagram B shows rotor mounted inside the drum. The rotor is the input shaft of the clutch and the drum is the output shaft.

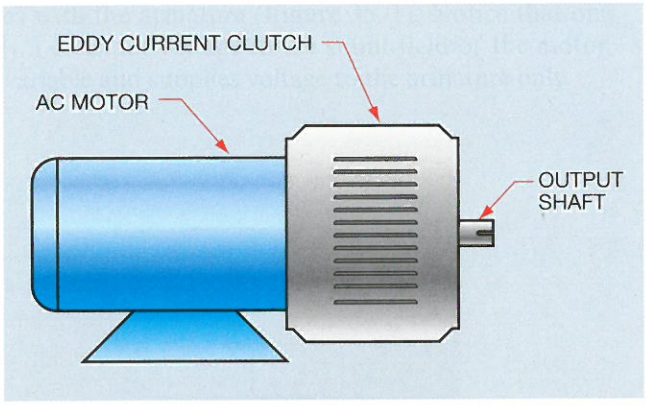


Figure 34–9 An AC motor is coupled to an eddy current clutch.

Chapter 34

Review Questions

1. Does varying the voltage to an AC induction motor cause a change in synchronous speed?
2. Why do induction motors that are intended to be controlled by variable voltage contain high impedance stator windings?
3. What is the disadvantage of a motor that contains a high impedance stator winding?
4. What type of AC induction motor is used with variable voltage control when it is desirable for the motor to reverse direction?
5. What type of motor, which can be controlled with variable voltage, is used to operate power drills, vacuum cleaners, or routers?

Continued on next page

Chapter 34 Continued

6. Why are universal motors so named?
7. What type of solid-state component is generally used to control AC voltage?
8. When using a mechanical clutch, what determines how fast a load can be accelerated and the amount of initial torque applied to the load?
9. What is the primary advantage of an eddy current clutch over a mechanical clutch?
10. How is the speed of an eddy current clutch controlled?

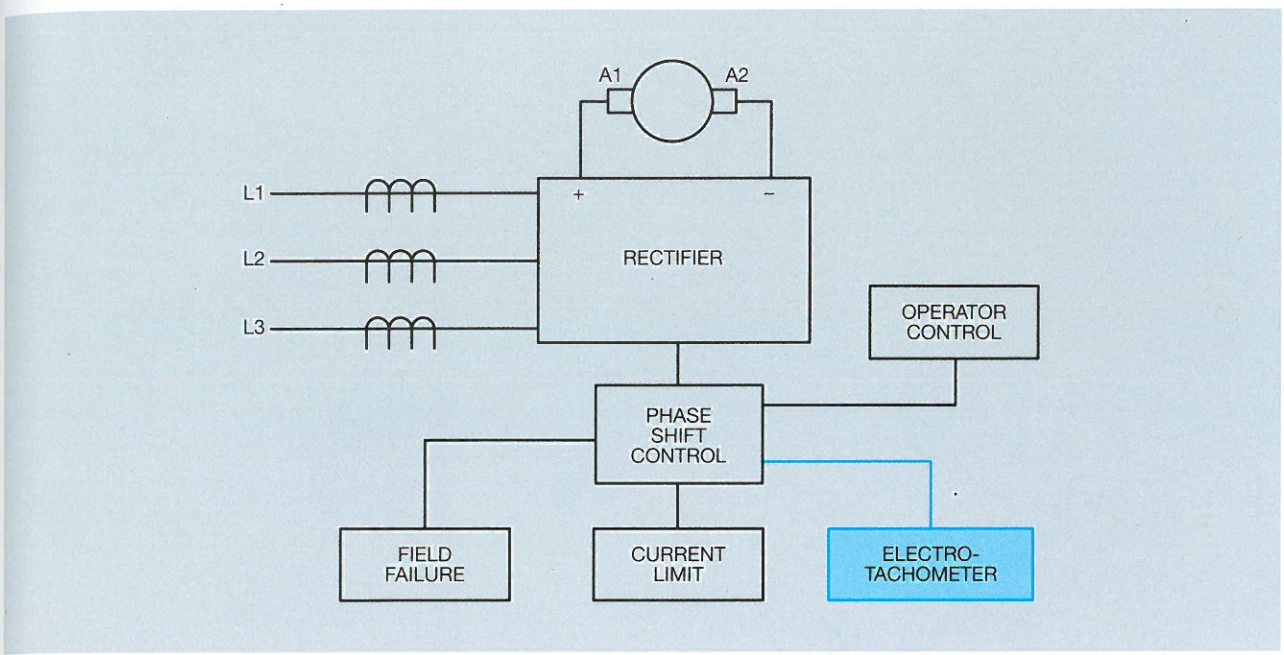
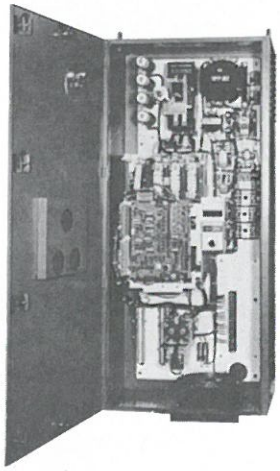


Figure 35–12 Electrotachometer measures motor speed.



Courtesy of Rockwell Automation, Inc.

Courtesy of Eaton Corporation

Figure 35–13 An SCR motor control unit mounted in a cabinet.

detects the increase of tachometer voltage and causes a decrease in the voltage applied to the armature. Electronic components respond so fast that there is almost no noticeable change in motor speed when load is added or removed. An SCR motor control unit is shown in Figure 35–13.

Chapter 35

Review Questions

1. What electronic component is generally used to change the AC voltage into DC voltage in large DC motor controllers?
2. Why is this component used instead of a diode?
3. What is a freewheeling or kickback diode?
4. Name two methods of sensing the current flow through the shunt field.
5. Name two methods of sensing armature current.
6. What unit controls the voltage applied to the armature?
7. What device is often used to sense motor speed?
8. If the motor speed decreases, does the output voltage of the electrotachometer increase or decrease?