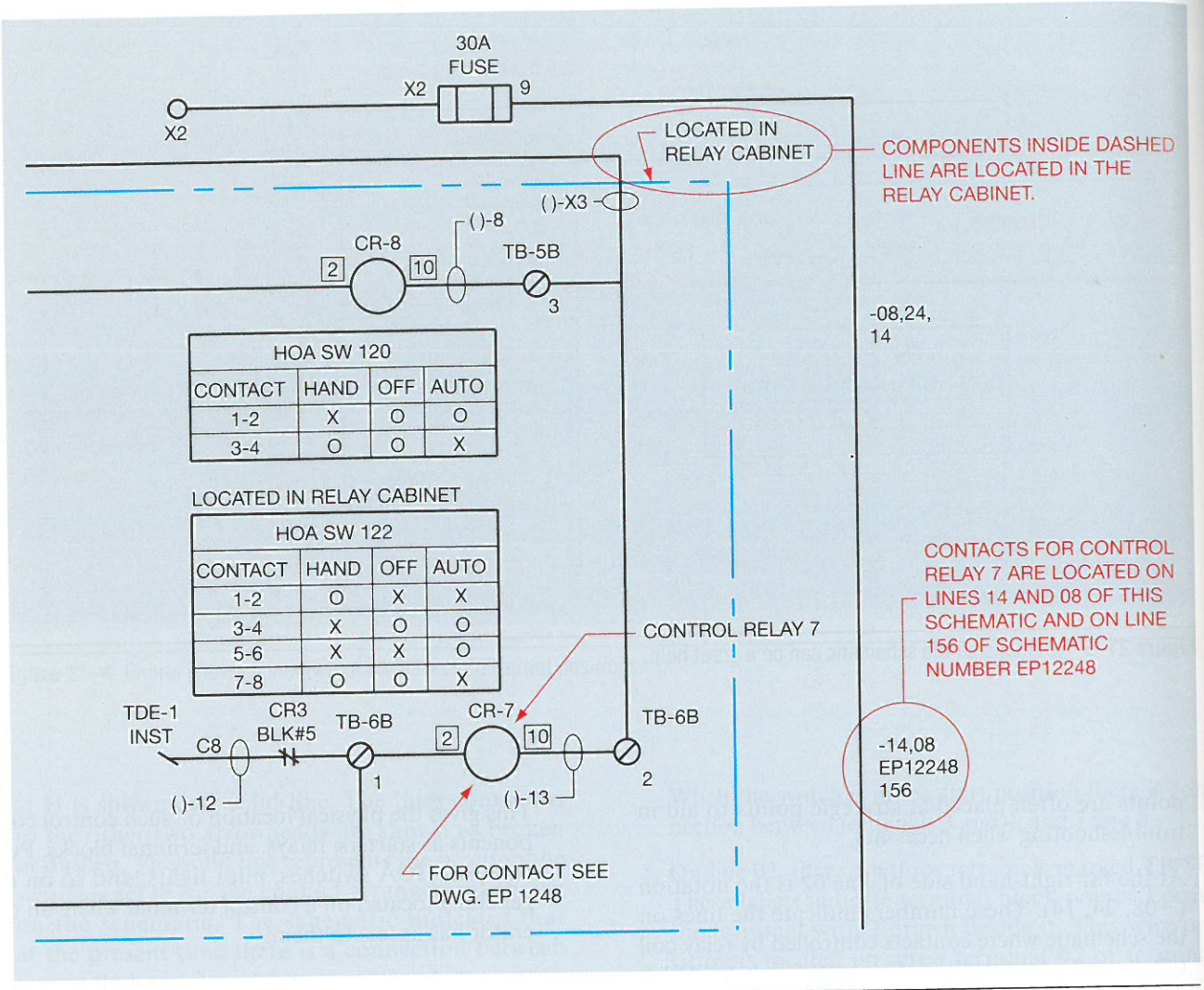



**Figure 21–6** Multi-page schematics generally employ some type of notation to indicate where the contacts controlled by a relay are located.

# Chapter 21

## Review Questions

Refer to Figure 21–1 to answer the following questions.

1. When switch HOA SW 122 is in the off position, which contacts have connection between them?
2. How much voltage will be applied to coil 1CR when it is energized?
3. Referring to switch (RS SW 123), in what position must the switch be set to make connection between terminals 3 and 4?
4. What are the terminal numbers for the two normally open spare contacts controlled by coil 2CR?
5. How much voltage is applied to coil CR-7 when it is energized?
6. What contact(s) are located between screw numbers 8 and 9 of terminal block 5B?
7. Relay coil CR-7 is located between what terminal block and screw numbers?
8. Assume that HOA SW 120 has been set in the auto position. List four ways by which coil CR-8 could be energized.
9. In what position must switch SW 123 be set to make connection between terminals 3 and 4?
10. If one of the magnetic overload relays should open its contact, how can it be reset?

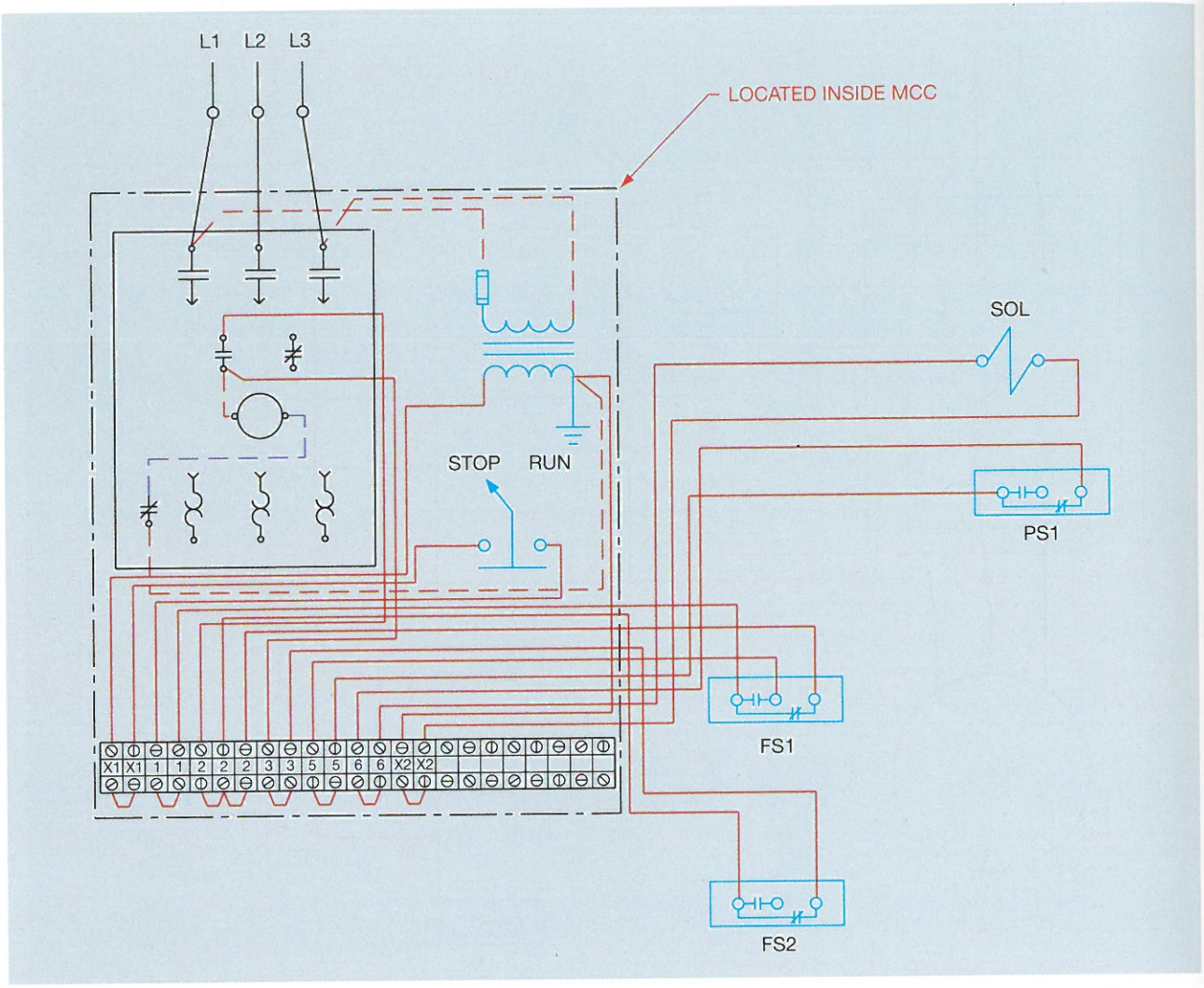



**Figure 22–6** Connections are made to a terminal strip.

# Chapter 22

## Review Questions

1. What is an advantage of the point-to-point method of connecting circuit components?
2. When connecting a control system, what should be done each time a wire termination is made to any component?
3. What should be done to each component to help identify it?
4. What is the disadvantage of wiring components to a terminal strip?
5. What is the main advantage of making connections at a terminal strip?
6. Refer to the circuit shown in Figure 22–1. Should float switch FS2 be wired as normally open or normally closed? Explain your answer.
7. What does the dashed line between the two floa switch contacts labeled FS1 indicate?

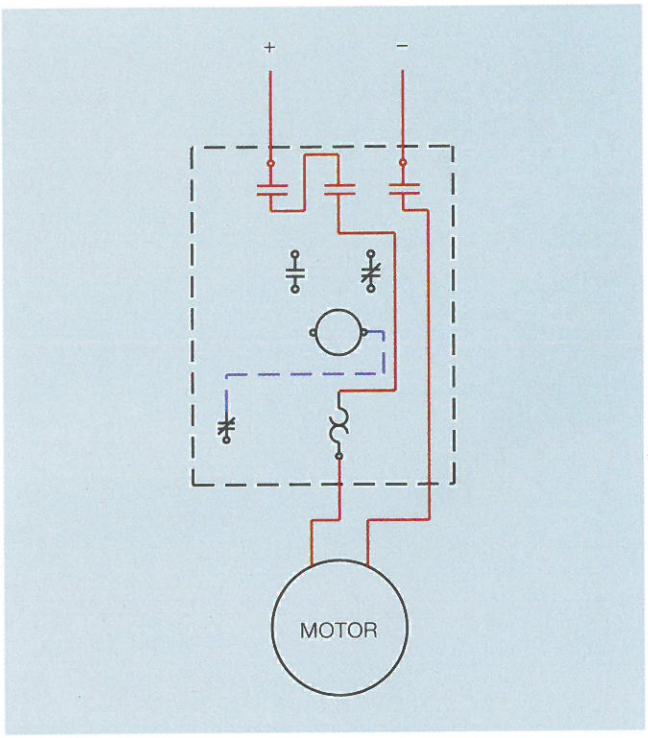



Figure 23–14 Load contacts are connected in a series.

# Chapter 23

## Review Questions

1. How is across-the-line starting accomplished?
2. How many overload sensing devices are required for single-phase AC and DC motors?
3. If a direct current motor is connected to a grounded DC power system, should the over current sensing device be placed in the grounded or ungrounded conductor?
4. Some direct current contactors contain two coils, the hold coil and the pick-up coil. Explain the function of each coil.
5. What method is used to disconnect the pick-up coil of a DC contactor?

# Chapter 24



## Review Questions

1. What two electrical components are commonly connected in series with a motor to limit starting current?

2. What advantage does a reactor have when limiting in-rush current that is not available with a resistor?

3. Refer to the circuit shown in Figure 24–1. Assume that timer TR is set for a delay of 10 seconds. When the START button is pressed the motor starts in low speed. After a delay of 30 seconds the motor is still in its lowest speed and has not accelerated to normal speed. Which of the following could *not* cause this condition?
   a. The START button is shorted.
   b. Timer coil TR is open.
   c. Contactor coil R is open.
   d. Timed contact TR did not close after a delay of 10 seconds.

4. Refer to the circuit shown in Figure 24–7. Assume that each timer is set for a delay of 5 seconds. When the START button is pressed, the motor starts in its lowest speed. After a delay of 5 seconds the motor accelerates to second speed. After another delay of 5 seconds, the motor stops running. During troubleshooting, you discover that the control transformer fuse is blown. Which of the following could cause this condition?
   a. TR1 coil is shorted.
   b. S1 coil is open.
   c. S2 coil is shorted.
   d. TR2 coil is open.

5. Refer to the circuit shown in Figure 24–7. Assume that each timer is set for a delay of 5 seconds. When the START button is pressed, the motor starts in its highest speed. Which of the following could cause this condition?
   a. The STOP button is shorted.
   b. TR1 timer coil is open.
   c. S1 auxiliary contact is shorted.
   d. TR2 timer coil is shorted.

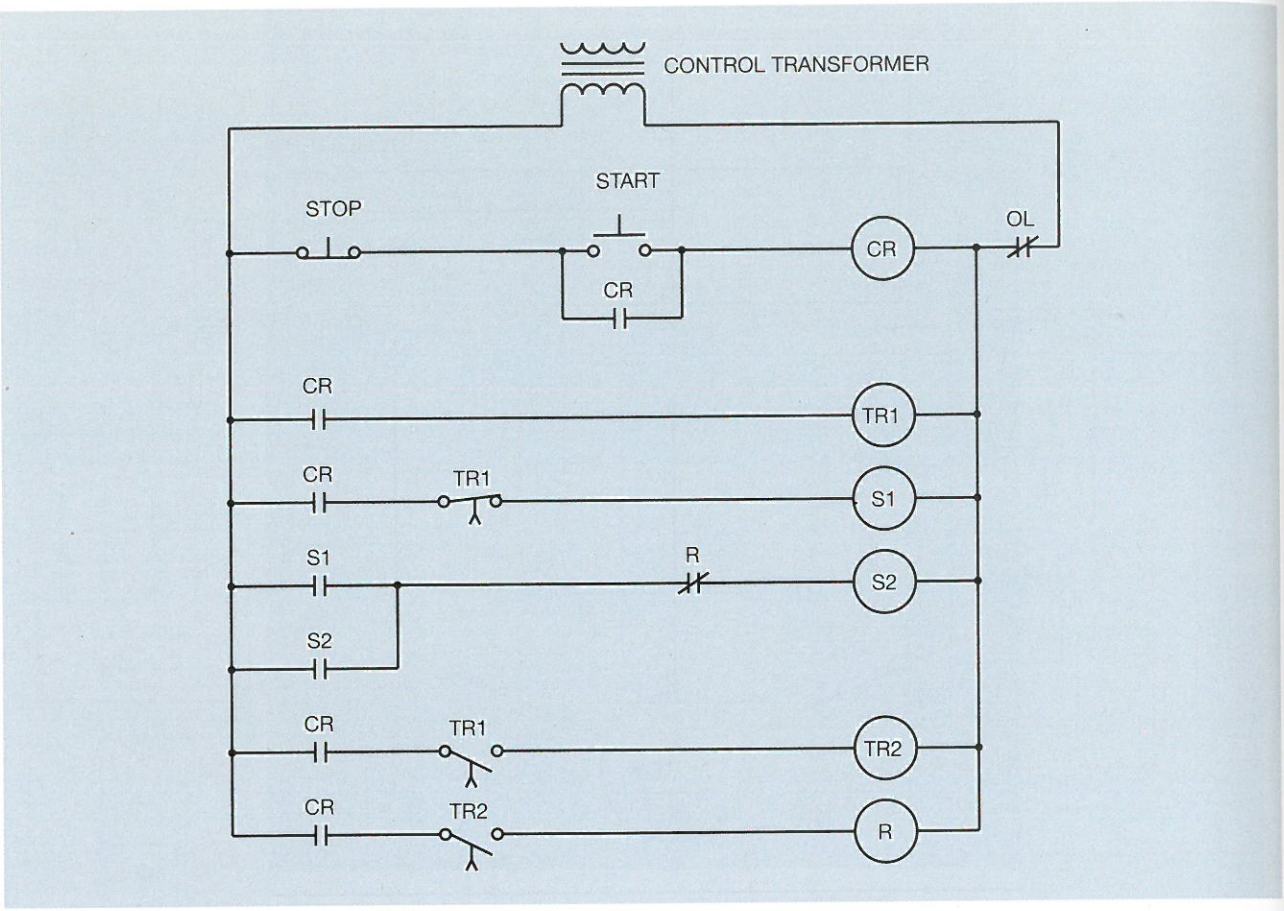
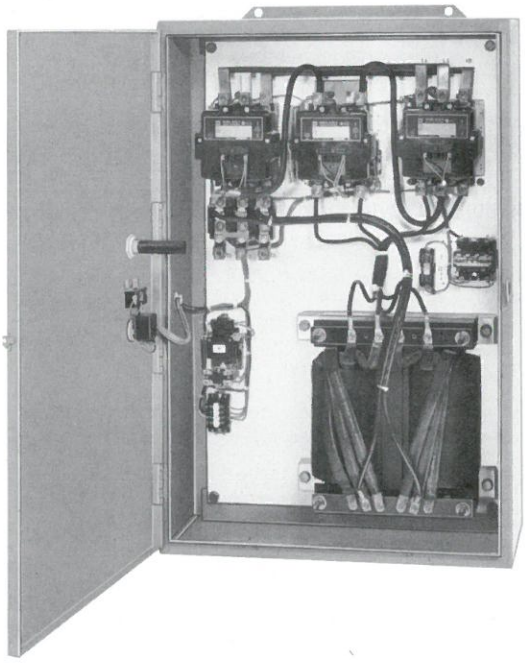



Figure 25–5 Closed transition starting circuit.

# Chapter 25



Courtesy Schneider Electric USA, Inc.

Figure 25–6 Typical autotransformer starter.

## Review Questions

1. Why is it desirable to disconnect the autotransformer from the circuit when the motor reaches the run stage?
2. Explain the differences between open and closed transition starting.
3. Autotransformers often contain taps that permit different percentages of line voltages to be connected to the motor during starting. What are three common percentages?
4. Refer to the circuit shown in Figure 25–2. Assume that timer TR is set for a time delay of 10 seconds. When the START button is pressed, the motor does not start. After a period of 10 seconds, the motor starts with full line voltage applied to it. Which of the following could cause this condition?

Continued on next page

# Chapter 25 Continued



a. Timer TR coil is open.
b. CR coil is open.
c. Contactor S coil is open.
d. Contactor R coil is open.

5. Refer to the circuit shown in Figure 25–2. Assume that timer TR is set for a delay of 10 seconds. Assume that contactor coil R is open. Explain the operation of the circuit if the START button is pressed.

6. Refer to the circuit shown in Figure 25–5. Assume that timer TR1 is set for a delay of 10 seconds and timer TR2 is set for a delay of 5 seconds. After the START button is pressed, how long is the time delay before the S1 contacts open?

7. Refer to the circuit shown in Figure 25–5. Assume that timer TR1 is set for a delay of 10 seconds and timer TR2 is set for a delay of 5 seconds. From the time the START button is pressed, how long will it take the motor to be connected to full line voltage?

8. Refer to the circuit shown in Figure 25–5. Explain the steps necessary for coil S2 to energize.

9. Refer to the circuit shown in Figure 25–5. What causes contactor coil S2 to de-energize after the motor reaches the full run stage?

10. Refer to the circuit shown in Figure 25–5. Assume that timer TR1 is set for a delay of 10 seconds and timer TR2 is set for a delay of 5 seconds. When the START button is pressed, the motor starts. After 10 seconds the S1 contacts open and the motor continues to accelerate, but never reaches full speed. After a delay of about 30 seconds, the motor trips out on overload. Which of the following could cause this problem?
a. TR1 coil is open. .
b. S2 coil is open.
c. S1 coil is open.
d. R coil is open.