

Instructor's Guide

Understanding Motor Controls, 4E

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# SECTION I

## Basic Control Circuits and Components

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### CHAPTER 1

#### GENERAL PRINCIPLES OF MOTOR CONTROL

##### Objectives

- State the purpose and general principles of motor control.
- Discuss the differences between manual and automatic motor control.
- Discuss considerations when installing motors or control equipment.
- Discuss the basic functions of a control system.
- Discuss surge protection for control systems.

##### Answers to Review Questions

1. a. Is the motor single-phase or three-phase?  
b. What is motor horsepower?  
c. Must the in-rush current be reduced?  
d. Is the present power system capable of handling the new installation?
2. On the motor nameplate
3. No. It may become law if made so by a local authority.
4. Manual control is characterized by the fact that the operator must go to the location of the controller to perform some change of action in the control system. Semiautomatic control uses magnetic contactors and starters, and other pilot devices to control the operation of the motor. The operator must initiate certain actions in the control system. Automatic control also uses devices similar to semiautomatic control, but once set by the operator, the control circuit continues to operate without further operator assistance.
5. Across-the-line starting
6. Jogging is accomplished by applying power in short jabs at full voltage. Inching is accomplished by applying power in short jabs at reduced voltage.
7. Variable frequency control
8. OSHA
9. To permit the motor to accelerate to its full speed over some period of time
10. Safety—to provide protection for the operator or other persons in the vicinity of the machine.

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### CHAPTER 2

#### SYMBOLS AND SCHEMATIC DIAGRAMS

##### Objectives

- Discuss symbols used in the drawing of schematic diagrams.
- Determine the difference between switches that are drawn normally open, normally closed, normally open held closed, and normally closed held open.
- Draw standard NEMA control symbols.
- State rules that apply to schematic or ladder diagrams.
- Interpret the logic of simple ladder diagrams.

# SECTION X

## Laboratory Exercises

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### **EXERCISE 1**

#### **BASIC CONTROL**

##### Procedure #1

6. No. The lamps should be turned off.
8. Yes. The relay should have energized and turned on both lamps.
15. Yes. One lamp should be turned on and one turned off.
17. Yes.

##### Procedure #2

24. The amber lamp should be turned on and the red and green lamps should be turned off.
26. The red and green lamps should be turned on and the amber lamp should be turned off.

##### Procedure #3

34. No, the motor should not start.
36. Yes, the motor should have starter running.

##### Answers to Review Questions

1. 2 sets
2. The coil
3. 2 and 7
4. 2 and 10
5. Normally closed
6. 1 and 3, 6 and 7, and 11 and 9

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### **EXERCISE 2**

#### **START-STOP PUSH BUTTON CONTROL**

##### Answers to Review Questions

1. When the start button is pressed, the motor will start. When the start button is released, the motor will stop.
2.
  1. No incoming three-phase power
  2. Control transformer fuse is blown.
  3. Control transformer is bad.
  4. Stop push button is open.
  5. Start button is not making connection.
  6. M coil is open.
  7. The normally open overload contact is open.
3. A motor starter is a contactor that is connected to an overload relay. A contactor is not connected to an overload relay. Both the motor starter and contactor contain load contacts.
4. M coil is shorted.