Understanding Motor Controls 3rd edition Herman Solutions Manual

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SECTION I

Basic Control Circuits and Components

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. Semi-automatic control employs 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 employs 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.

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.

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Answers to Review Questions

1. d. Normally open contact
2. c. Normally open held closed switch
3. a. Iron core transformer
4. d. Normally open temperature switch
5. c. Three-position selector switch
6. b. Normally open
7. Normally closed. It is a normally closed held open switch.
8. CR coil
9. So that letters and/or numbers can be written in the circle to identify the coil
10. De-energized or off

CHAPTER 3
MANUAL STARTERS

Objectives

- Discuss the operation of manual motor starters.
- Discuss low-voltage release.
- Connect a manual motor starter.

Answers to Review Questions

1. The motor has tripped on overload.
2. The motor starter must be reset by moving the switch handle to the full off position and then turning it back on.
3. Because of safety. If a starter with only one load contact is employed, one line will remain hot even if the motor is turned off.
4. Press the stop button with more than normal pressure.
5. Line voltage devices have contacts with a high enough current rating that they can be used to connect a motor to the power line.
6. Starters that provide low-voltage release are equipped with a solenoid coil that holds a mechanical mechanism in place. If the voltage fails, the mechanical mechanism causes the contacts to open. The starter cannot be reset until power is restored.
7. Determine the full-load motor current from the motor nameplate. Then, check the current draw with an ammeter.
8. Temperature switch. Normally open
9. c. Anytime the manual starter is turned on
10. Normally closed held open

CHAPTER 4
OVERLOAD RELAYS

Objectives

- Discuss differences between fuses and overloads.
- List different types of overload relays.
- Describe how thermal overload relays operate.
- Describe how magnetic overload relays operate.
- Describe how dashpot overload relays operate.

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