UNIT

7 Motor and Air-Conditioning Calculations

INTRODUCTION TO UNIT 7—MOTOR AND AIR-CONDITIONING CALCULATIONS

Motor circuits have special requirements that affect how the overcurrent protection is sized and installed. Motors typically draw about six times as much current at start-up as they draw during normal operation. Article 430 provides guidance on how to properly protect the motor from overcurrent and still avoid nuisance tripping of the fuse or circuit breaker protecting the motor. Similar rules are included in Article 440 for air conditioners.

The *Code* definition of "Overcurrent" is made up of three factors: short circuits, ground faults, and overloads. For motors, the function of overcurrent protection is divided into two parts. The short-circuit and ground-fault protection of a motor is usually provided by a fuse or circuit breaker which is sized large enough to let the motor start, but too large to provide overload protection. Overload protection is provided to protect the motor and wiring at a value close to the actual running current of the motor, but with sufficient time delay to allow the motor to start. This protection is often provided by the "heaters" which are overload sensing devices in a magnetic starter.

Article 430 spells out the minimum sizing of conductors for motor branch circuits and feeders as well. When conductors and short-circuit ground-fault protection are sized based on Article 430, the fuse or circuit breaker may appear to be much larger than it should be for the conductors selected. Make sure everything is sized correctly based on Article 430, then don't be concerned. The overcurrent protection rules of Article 240 don't apply to motors or air conditioners, so often an installation may not "look right," even though it complies with Article 430 requirements for motors and Article 440 for air conditioners.

Careful study of this unit will help you understand the sometimes confusing requirements of Articles 430 and 440.

PART A—MOTOR CALCULATIONS

7.1 Scope of Article 430

Scope [430.1]. Article 430 covers motors, motor branch-circuit and feeder conductors and their protection, motor overload protection, motor control circuits, motor controllers, and motor control centers. This article is divided into many parts, the most important being: Figure 7–1

- General—Part I
- Circuit Conductors—Part II
- Overload Protection—Part III
- Branch-Circuit Short-Circuit and Ground-Fault Protection—Part IV
- Feeder-Circuit Short-Circuit and Ground-Fault Protection—Part V
- Control Circuits—Part VI
- Controllers—Part VII
- Motor Control Centers—Part VIII
- Disconnecting Means—Part IX

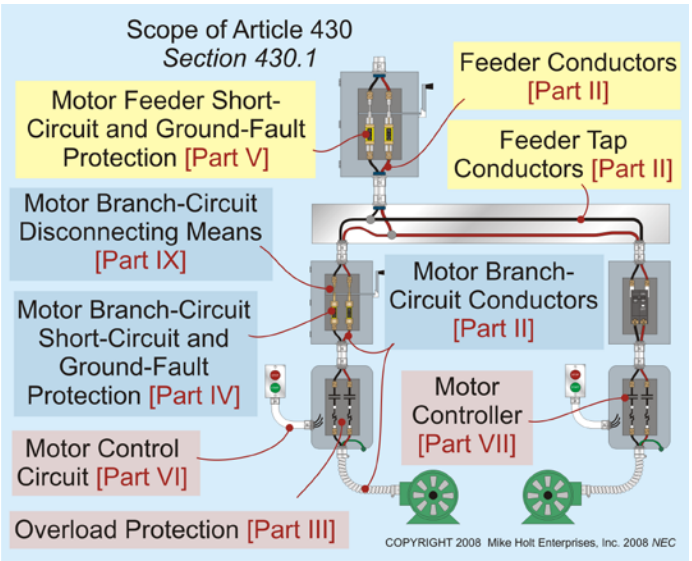

Figure 7–1