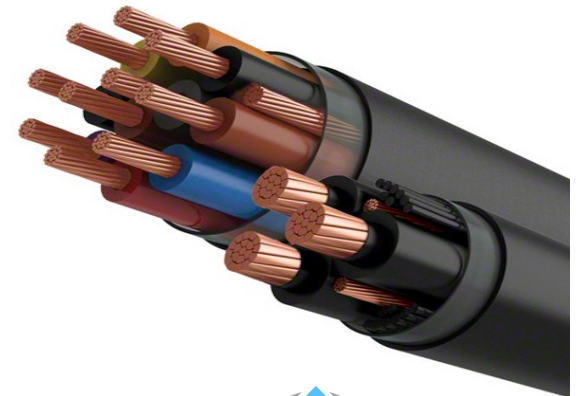


# 2020 NEC Example D8

NEC Motor Circuit Conductors, Overload Protection, Short Circuit and Ground Fault Protection



# Introduction

Given Information

Conductor Ampacity

Motor Overload Protection

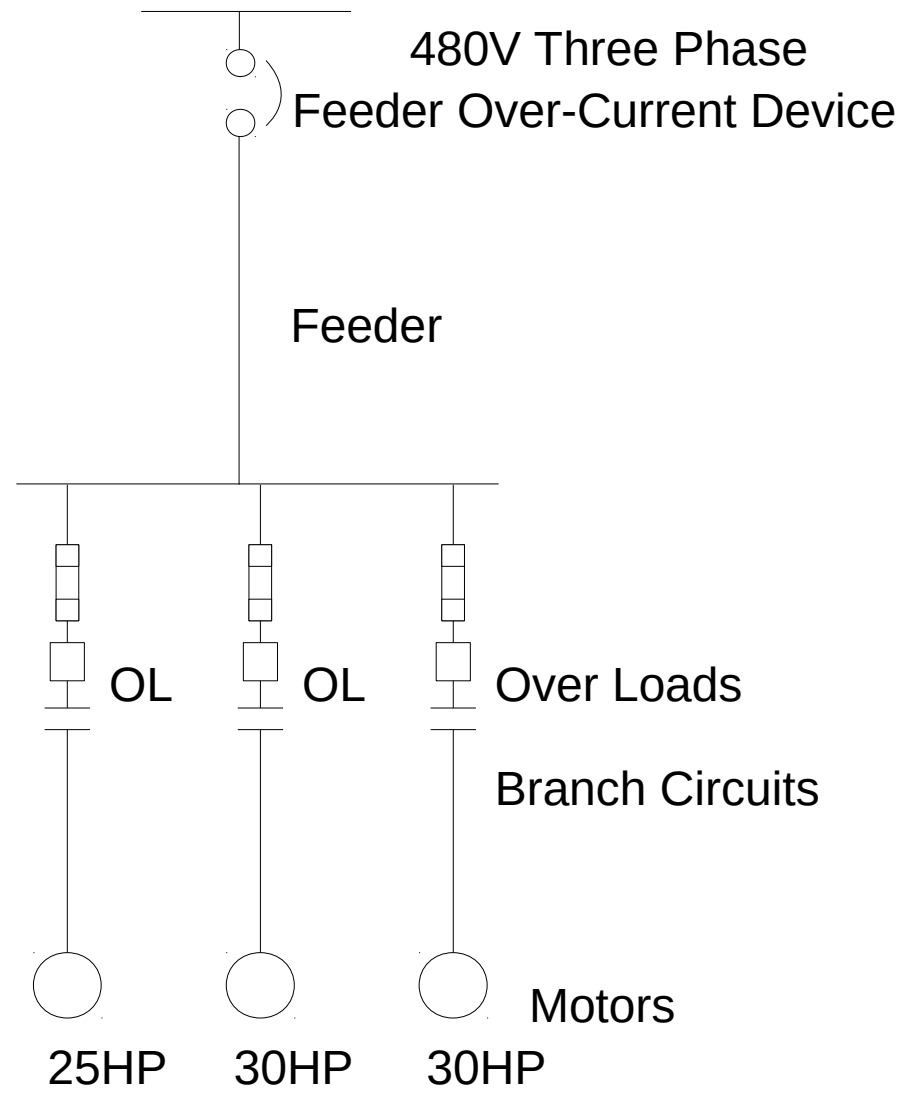
Branch Circuit Short Circuit Protection

Feeder Load Calculation and Over-current Device Selection

Feeder Voltage Drop Calculation

Feeder Equipment Grounding Conductor and Conduit Size

# One Line



# Given Information

- 480V/277 V three phase feeder
- Motor 1, 25HP 460V Squirrel Cage, Design B, Service Factor 1.15 32 FLA Nameplate Amps
- Motor 2, 30HP 460V Wound Rotor, 38 FLA Nameplate Amps
- 30 Deg. C ambient temperature
- Equipment terminations are rated at 75 Deg. C. and 80% of the Ampere nameplate.
- Use XHHW-2 copper wire
- Motors are continuous loads
- 3 Current Carrying Conductors Per Raceway
- Use Rigid Metal Conduit RMC
- Use an Auxillary Equipment Ground
- Motor Branch Circuits are 25 feet long
- The Feeder is 600 feet long
- Allowable feeder voltage drop is when all motors are running is 3%
- Use time delay fuses for motor short circuit protection

# Motor Branch Circuit Conductor Ampacity

- Motor 1, Induction Design B, 25HP 34A X 1.25 = 43 Amps
- Motor 2, Wound Rotor, 30HP 40A X 1.25 = 50 Amps
- Motor 3, Wound Rotor, 30HP 40A X 1.25 = 50 Amps
- <https://industrialengineeringllc.com/NEC/motor.php>
- NEC Table 430.250 motor full load amps is used to size conductors
- Motor 1, Table 310.16, 43 Amps, Conductor size is: 8 copper at 75C.
- Motor 2, Motor 3, 50 Amps, Conductor size is: 8 copper at 75C.
- <https://industrialengineeringllc.com/NEC/cond.php>

# Motor Overload Protection

- Overloads are set at 1.25% of the motor nameplate amps  
430.6A
- Motor 1, Induction Design B, 25HP 32A X 1.25 = 40 Amps
- Motor 2, Wound Rotor, 30HP 38A X 1.25 = 48 Amps
- Motor 3, Wound Rotor, 30HP 38A X 1.25 = 48 Amps
- Overloads also thermally protect the conductors

# Motor Branch Circuit Short Circuit Protection Time Delay Fuses

- Motor 1, Induction Design B, 25HP  $34A \times 1.75 = 59.5$  Amps  
Choose 60A fuses
- Motor 2, Motor 3, Wound Rotor, 30HP  $40A \times 1.50 = 60.0$  Amps  
choose 60A fuses, Table 430.52
- <https://industrialengineeringllc.com/NEC/motor.php>

# Motor Branch Circuit Equipment Ground Conductor and Conduit Size

- Motor 1, 60A fuses
- Motor 2, 60A fuses, Table 430.52
- Choose #10 AWG copper equipment grounding conductor from Table 250.122
- <https://industrialengineeringllc.com/NEC/eqgnd.php>
- Conduit Size for 3#8AWG and 1#10 ground is 3/4" RMC at 40% fill.
- <https://industrialengineeringllc.com/NEC/conduit.php>



# Feeder Load Calculation and Over-current Device Selection

- Motor 1, 34A full load
- Motor 2, Motor 3, 40A full load
- Feeder load =  $34 + 40 + 1.25 \times 40 = 124$  Amps
- Over current device set at the largest branch circuit over current device plus the sum of full load amps of other motors 430.62
- $60A + 40A + 40A = 140$  Amps. Choose 125 Amp circuit breaker does not exceed 140 Amps.

# Feeder Load Calculation and Over-current Device Selection

- 125A over-current device
- Select #1 Copper based on 75 Degree C
- <https://industrialengineeringllc.com/NEC/cond.php>

# Feeder Voltage Drop Calculation

- Check voltage drop for 600 feet of #1/0 copper. Use running full load amps for voltage drop.  $34+40+40 = 114$  Amps
- Voltage drop is 4.19% for #1 feeder, unacceptable at greater than 3%
- Choose 2/0 copper at 2.8%, acceptable at less than 3%
- <https://industrialengineeringllc.com/NEC/cvoltage.php>

# Feeder Equipment Grounding Conductor and Conduit Size

- Over-current device is 125 Amps
- Use #6 AWG copper from table 250.122
- <https://industrialengineeringllc.com/NEC/eqgnd.php>
- Size conduit for 3 - 2/0 AWG and one #6 AWG ground
- Use 1-1/2" RMC with 40% fill
- <https://industrialengineeringllc.com/NEC/conduit.php>

# Summary

- Motor Branch Circuit Conductors sized at #8 AWG
- 3/4" RMC conduit selected with #10 equipment ground
- Motor overloads sized at 125% of the motor nameplate amps
- Motor branch circuit short circuit protection sized at 60 amps for time delay fuses
- Feeder over-current device set at 125A
- Feeder up-sized to 2/0 due to voltage drop
- 1 1/2" RMC conduit selected with #6 equipment ground

# One Line

