

CMGT 235 – Electrical and Mechanical Systems

Department of Construction Management ☼ California State University, Chico

Exam #3 – Electrical Systems

All problems refer to the NEC [Unless Noted Otherwise]

5 points Each Answer

Name: Solution

1. The transformer on a power pole steps down the voltage from 10,800 volts to 120 volts. If the secondary coil contains 360 turns, how many turns are found on the primary coil?

$$N_p = \frac{E_p}{E_s} N_s = \frac{10,800V}{120V} (360) = 32,400$$

2. An electric dryer consumes 1667 Wh of energy when operating at 220 volts for 30 minutes. During operation approximately how much current does the dryer draw?

$$I = \frac{P}{E} = \frac{1667 \text{ Wh}}{0.5 \text{ hr}} = 3334 \text{ W} \quad \text{or} \quad 15.2 \text{ A}$$

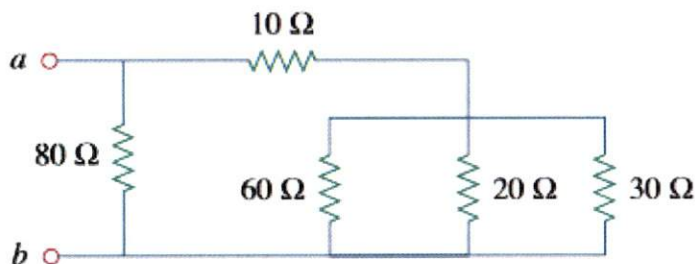
$$\frac{3334 \text{ W}}{220 \text{ V}} = 15.2 \text{ A}$$

3. A department store is illuminated with 215 fluorescent lighting fixtures and connected to a 120-volt supply. Each lighting fixture draws 2.2 amperes. How many 20 A branch circuits are necessary to feed these fixtures if each branch circuit must not exceed 80% of the branch circuit rating?

$$I_T = 215 \times 2.2 \text{ A} = 473 \text{ A}$$

$$80\% \times 20 \text{ A} = 16 \text{ A} \quad \text{total circuits} = \frac{473 \text{ A}}{16 \text{ A}} = 30 \text{ circuits}$$

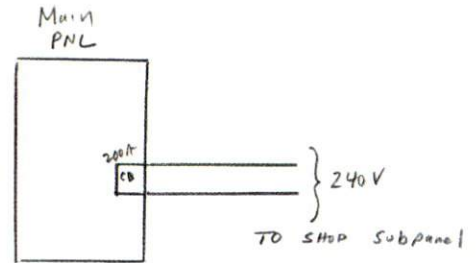
4. Determine the equivalent resistance R_{ab} at terminals a-b for the circuit shown:



$$R = \frac{1}{\frac{1}{60} + \frac{1}{20} + \frac{1}{30}} + 10 \Omega = 20 \Omega$$

$$R_{ab} = \frac{1}{\frac{1}{80} + \frac{1}{20}} = 16 \Omega$$

5. A homeowner is building a shop 95 feet from the main power source and needs a 200A service.



A. What size THHN 75°C CU wire is required for the feeders (conductors) to the subpanel and where in the NEC is the answer found?

3/0 Table 310.15(B)(16)

B. If the minimum ampacity for the neutral service-entrance conductor is 97A what size neutral conductor is required at the shop's subpanel and where in the NEC is the answer found?

3 Table 310.15(B)(16)

C. What size grounding electrode conductor is required at the shop's subpanel and where in the NEC is the answer found?

4 Table 250.66

D. What is the smallest trade size PVC Sched 40 raceway required for installing the ungrounded feeders?

QTY	GAUGE	TYPE	Cross-Section Area	
2	3/0	THHN	$2 \times 0.2679 = 0.5358$	PVC Sched. 40
1	3	THHN	$1 \times 0.0973 = 0.0973$	
Total Cross-Section Area			0.6331	1 1/2

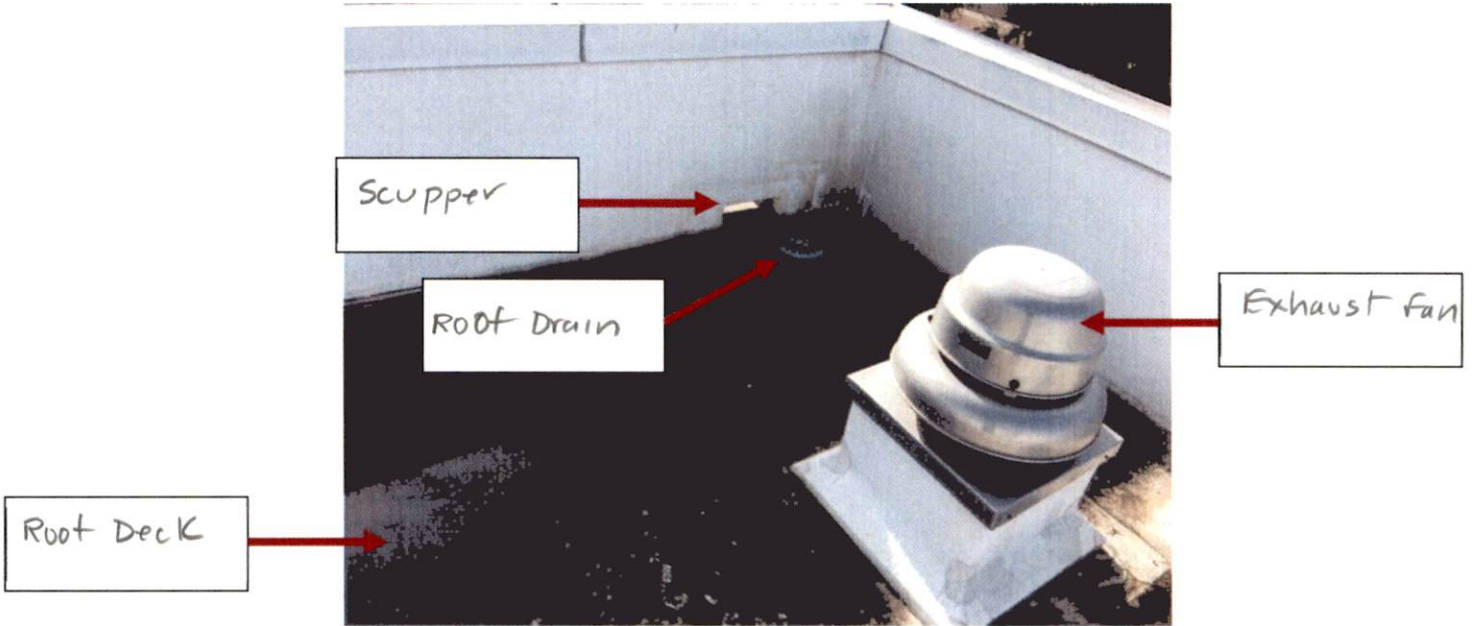
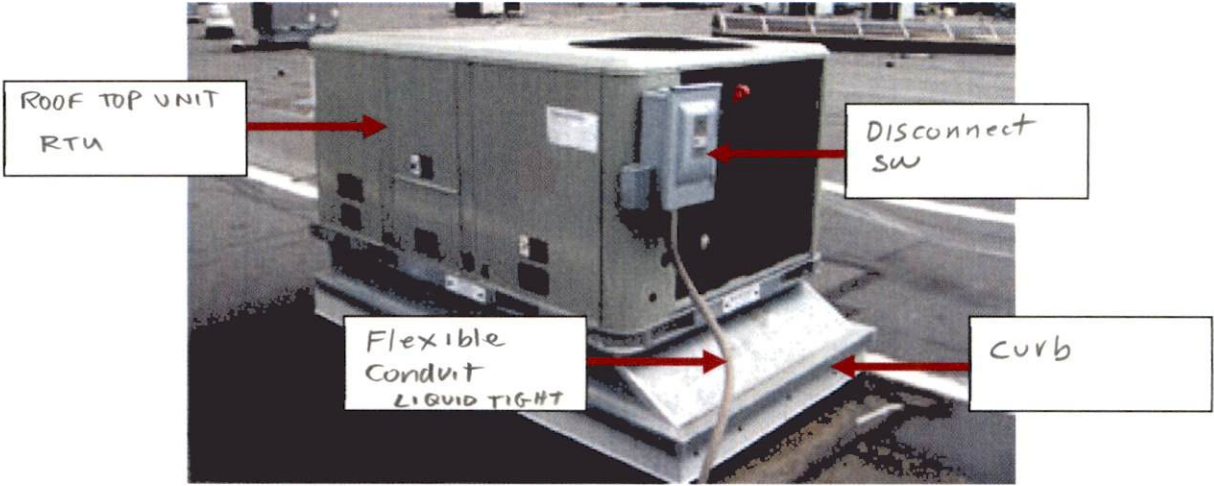
E. What is the percentage voltage loss for the ungrounded service conductors? Is it acceptable per the NEC recommendation? If not, what should be done to reduce the VD?

$$VD = \frac{2 \times L \times R \times I}{1000} = \frac{2 \times 95ft \times 0.0766 \times 200A}{1000} = 2.91$$

$$2.91V < 7.2V$$

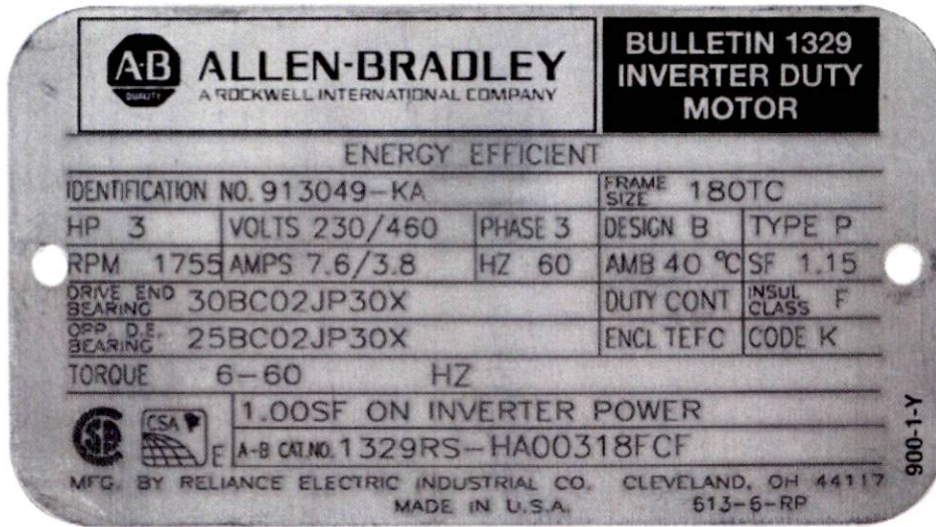
$$240V \times 3\% = 7.2V$$

6. Fill in the box with the name of the item. [1 pt each answer]



7. What is the power rating in watts for the motor shown below if the power factor is 70%?

$$P = 7.6 A (230V) \times 0.7 \times 1.73 = 2117 W$$



8. What organization publishes a set of regulations governing the construction and installation of electrical wiring and apparatus, established by the National Fire Protection Association and suitable for mandatory application by governing bodies exercising legal jurisdiction?

National Electrical Code

9. 1 Hp = 33,000 ft-lb/min. = 745 W or 746 W

10. What is the ratio of the active power (W) to the apparent power (VA) expressed as a percentage called?

Power Factor

11. What is UL an abbreviation for?

Underwriter's Laboratories

12. What license is required in the state of California to be a licensed electrical contractor?

C-10

13. The amount of power required to maintain a current of one ampere at a pressure of one volt is called a Watt.

14. List two overcurrent protection devices:

1. Fuse
2. circuit Breaker