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Notes

HOW TO PREPARE FOR THE EXAM

This book is a guide to preparing for the electricians' exams. It will not make you a competent electrician nor teach you the electrical trade, but it will give you an idea of the type of questions asked on most electricians' exams and how to answer them correctly.

Most exams consist of multiple-choice questions and these are the type reflected in this exam guide. They will give you a feel for how the examinations are structured and are based on many questions the author has encountered while taking numerous exams in recent years.

Begin your pre-exam preparation with two points in mind.

- OPPORTUNITIES in life will ARISE – be prepared for them.
- The more you LEARN – the more you EARN.

Attempting to take an exam without preparation is a complete waste of time. Attend classes at your local community college. Attend seminars, electrical code updates and company sponsored programs. Many major electrical suppliers and local unions sponsor classes of this type at no cost. Take advantage of them.

Become familiar with the National Electrical Code®; the Code has a LANGUAGE all its own. Understanding this language will help you to better interpret the NEC®. Do not become intimidated by its length. Become thoroughly familiar with the definitions in Chapter One; if you don't, the remainder of the NEC® will be difficult to comprehend. Remember, on the job we use different "lingo" and phrases compared to the way the NEC® is written and to the way many test questions are expressed.

HOW TO STUDY

Before beginning to study, get into the right frame of mind and relax. Study in a quiet place that is conducive to learning. If such a place is not available, go to your local library. It is important that you have the right atmosphere in which to study.

It is much better to study many short lengths of time than attempt to study fewer, longer lengths of time. Try to study about an hour every evening. You will need the support and understanding of your family to set aside this much needed time.

As you study this exam preparation book, the NEC® and other references, always highlight the important points. This makes it easier to locate Code references when taking the exam.

TRUE POWER AND APPARENT POWER

True power is the actual power used in an electrical circuit and is expressed in watts (W). Apparent power is the product of voltage and current in a circuit calculated without considering the phase shift that may be present between total voltage and current in the circuit. Apparent power is measured in volt-amperes (VA).

True power equals apparent power in an electrical circuit containing only resistance. True power is less than apparent power in a circuit containing inductance or capacitance. A phase shift exists in most AC circuits that contain devices causing capacitance or inductance.

Capacitance is the property of a device that permits the storage of electrically separated charges when potential differences exist between the conductors. Inductance is the property of a circuit that causes it to oppose a change in current due to energy stored in a magnetic field; i.e., coils.

To calculate true power, apply the formula:

$$P_T = (I)^2 \times R$$

where

P_T = true power (in watts)

I = total circuit current (in amperes)

R = total resistive component of the circuit (in ohms)

To calculate apparent power, apply the formula:

$$P_A = E \times I$$

where

P_A = apparent power (in volt-amperes)

E = measured voltage (in volts)

I = measured current (in amperes)

POWER FACTOR FORMULA

Power factor is the ratio of true power used in an AC circuit to apparent power delivered to the circuit.

$$PF = \frac{P_T}{P_A}$$

where

PF = power factor (percentage)

P_T = true power (in watts)

P_A = apparent power (in volt-amperes)

Notes

**Maintenance Electrician
Practice Exam #1**

1. The National Electrical Code is NOT _____.
 - a. designed for future expansion of electrical use
 - b. designed to safeguard people and property from electrical hazards
 - c. published by the NFPA
 - d. intended as a specification manual for trained persons

2. The NEC mandates specific branch circuits, receptacle outlets and utilization equipment to be provided with a ground-fault circuit interrupter (GFCI); this device is intended _____.
 - a. to prevent overloading the conductors
 - b. to prevent overloading the circuit breakers
 - c. for the protection of equipment from ground-faults
 - d. for the protection of personnel

3. Electrical wiring installed _____ is considered to be installed in a damp location.
 - a. under canopies or roofed open porches
 - b. underground
 - c. outside
 - d. none of these apply

4. When a 20 ampere, 120 volt receptacle outlet is installed, in which of the following listed locations is the receptacle required to have GFCI protection?
 - a. in a classroom of an educational facility
 - b. in the lobby of a movie theater
 - c. under an outdoor canopy, near the entrance of a public library
 - d. in the walkway of an enclosed retail shopping mall

ANSWER	NEC PAGE #	REFERENCE
15. c	66	Table 220.103
16. a	409	620.22(A)
17. b	465	551.71
18. d	527 & 528	675.11(A)&(C)
19. b	323	Table 450.3(B) Three-Phase Current Formula $I = \frac{VA}{E \times 1.732} \quad I = \frac{25,000 \text{ VA}}{208 \times 1.732}$ $I = \frac{25,000}{360.25} \quad I = 69.3 \text{ amperes} \times 125\% = 86.62 \text{ amperes}$
20. b	112	250.122(F)
21. a	445	547.9(D)
22. c	311 291 142	Table 430.250 430.24 Table 310.16 40 HP FLC = 52 amperes \times 100% = 52 amperes 50 HP FLC = 65 amperes \times 100% = 65 amperes 60 HP FLC = 77 amperes \times 125% = 96 amperes <u>Total = 213 amperes</u> *NOTE: Size 4/0 THWN copper ampacity = 230 amperes
23. d	297	430.53(A)(1)
24. a	389	511.3(A)(7)
25. c	635	Chapter 9, Table 8 Three-Phase Voltage Drop Conductor Size Formula *NOTE: Voltage drop permitted is 3% 480 volts \times 3% = 14.4 volts (permitted drop) $CM = \frac{1.732 \times K \times I \times D}{VD}$ $CM = \frac{1.732 \times 21.2 \times 100 \text{ amperes} \times 390 \text{ ft.}}{14.4} = 99,446 \text{ CM}$ Size 1/0 AWG Aluminum = 105,600 CM