



**Pacific Gas and
Electric Company™**

LETTER AGREEMENT NO. 05-28-PGE

IBEW



PACIFIC GAS AND ELECTRIC COMPANY
INDUSTRIAL RELATIONS DEPARTMENT
2850 SHADELANDS DRIVE, SUITE 100
WALNUT CREEK, CALIFORNIA 94598
(925) 974-4104

INTERNATIONAL BROTHERHOOD OF
ELECTRICAL WORKERS, AFL-CIO
LOCAL UNION 1245, I.B.E.W.
P.O. BOX 2547
VACAVILLE, CALIFORNIA 95696
(707) 452-2700

STEPHEN A. RAYBURN,
DIRECTOR AND CHIEF NEGOTIATOR

PERRY ZIMMERMAN,
BUSINESS MANAGER

June 21, 2005

Mr. Perry Zimmerman, Business Manager
Local Union No. 1245
International Brotherhood of
Electrical Workers, AFL-CIO
P.O. Box 2547
Vacaville, CA 95696

Dear Mr. Zimmerman:

The Joint Company and Union Apprenticeship Committee (JATC) proposes to modify the Apprentice Electrical Technician Training Program as well as the existing testing procedure, associated Study Guide, and requirements for entrance into the Apprentice Electrical Technician program for both internal and external candidates. The recommended changes were developed by a joint Company-IBEW subcommittee established by the JATC.

Changes recommended to the test and testing procedure will include a two-part examination. Successfully passing Part A of the examination will be considered as qualifying for entrance into the Apprentice Electrical Technician program. Once in the program, one must either meet the exam qualifications of both Part A and Part B prior to entrance into the program, or qualify on Part B of the exam within the first 6 months upon entering the program. Failure to qualify on Part B of the exam will subject the employee to removal from the program in accordance with Subsection 206.15 or Section 306 of the Physical Labor Agreement.

The parties further recommend modification of the training content and courses required for completion within the various Apprentice steps, allowing training in the first six months to assist in qualifying for Part B of the examination. Attached is a flow chart defining the proposed qualification process and Study Guide.

If you are in accord with the foregoing and agree thereto, please so indicate in the space provided below and return one executed copy of this letter to the Company.

Very truly yours,

PACIFIC GAS & ELECTRIC COMPANY

By: _____

Stephen A. Rayburn
Stephen A. Rayburn
Director and Chief Negotiator

The Union is in accord with the foregoing and agrees thereto as of the date hereof.

LOCAL UNION NO. 1245, INTERNATIONAL
BROTHERHOOD OF ELECTRICAL WORKERS, AFL-CIO

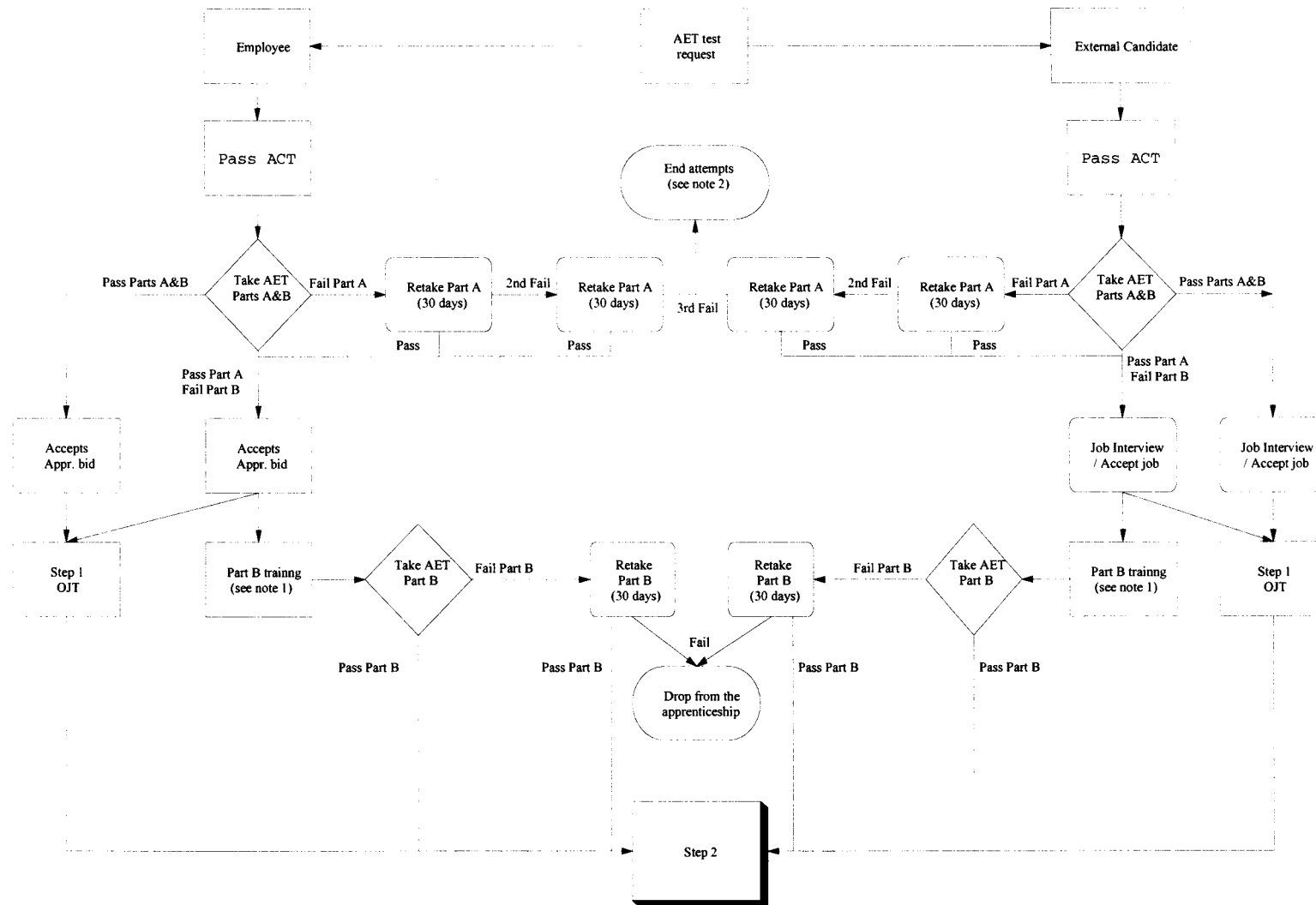
By: _____

Perry Zimmerman
Perry Zimmerman
Business Manager

Aug 10, 2005

Apprentice Electrical Technician Test Proposal

Testing Process Flowchart



Note 1: Candidates complete three courses within four months.

1. Introduction to Schematics - 5 days
2. Basic Relays and Phasors - 5 days
3. Substation Schematics and Automation - 3 days

Note 2: After a third attempt the candidate must wait a minimum of 180 days and present satisfactory evidence of additional training to justify a fourth attempt.

Apprentice Electrical Technician Test Proposal

AET Test:

AET test part A:

- Electrical Theory = 19 questions
- Electronics = 8 questions
- Power and Current Transformers = 9 questions
- Electrical Drawings = 4 questions

Total = 40 questions / three hours to complete

AET test part B:

- Electrical Theory = 6 questions
- Substation Power Transformers = 5 questions
- Substation Current Transformers = 5 questions
- Substation Relays = 9 questions
- Wire Codes and Device Numbers = 5 questions
- Substation Electrical Drawings = 10 questions

Total = 40 questions / three hours to complete

Proposed Apprenticeship Timeline:

Step 1 (0 – 6 mo.)	Step 2 (7 – 12 mo.)	Step 3 (13 – 18 mo.)	Step 4 (19 – 24 mo.)	Step 5 (25 – 30 mo.)
Part B Training: <ol style="list-style-type: none"> 1. Introduction to Schematics – 40 hr. 2. Basic Relays and Phasors – 40 hr. 3. Substation Schematics and Automation – 24 hr 	Relays and Phasors I – 40 hr. Step 2 OJT	Relays and Phasors II – 80 hr. Step 3 OJT	Relays and Phasors III – 80 hr. Step 4 OJT	Rounding Out
Step 1 OJT				

5/18 /2005

**STUDY GUIDE
FOR
APPRENTICE ELECTRICAL TECHNICIAN (AET)
QUALIFICATION TEST**

About the Job

This job is one of the more demanding and prestigious positions within the Transmission / Substation Maintenance and Construction (TS M&C) and Hydro organizations. Continuous self-improvement and motivation are essential to stay abreast of the latest technology. Electrical Technicians work in high voltage environments that would be extremely hazardous to an untrained person. They are often called upon to work alone and without immediate supervision. Their work has a direct impact on the electric system reliability as well as employee and public safety. This work must be performed competently or else serious consequences can occur.

During the training program the Apprentice Electrical Technician is expected to learn and become proficient in the installation, maintenance, and operation of the following:

- High voltage power transformer banks
- High voltage power circuit breakers
- Current and potential transformer banks
- Transmission and distribution relays (microprocessor and electro-mechanical)
- Substation and electric utility protection systems
- Station automation and supervisory control and data acquisition (SCADA) systems

About the Test

The Apprentice Electrical Technician (AET) test consists of parts A and B. Each part has forty questions and candidates are given three hours to complete part A and another three hours to complete part B. This is a closed book test and calculators are allowed.

Part A contains questions on the following:

- electrical theory
- power and current transformers
- electronics
- electrical drawings

Part B contains questions on the following:

- advanced electrical theory
- substation current transformers
- wire codes and device numbers
- substation power transformers
- relays
- substation electrical drawings

Continued on next page

Taking the Test

All candidates initially take both parts of the AET test. All candidates must pass Part A of the test to enter the apprenticeship. Should a candidate pass part A, but fails part B, the candidate enters the apprenticeship, receives training, and is then required to pass part B within six months. A candidate who passes both parts of the test is not required to do the part B test preparation training. For more details, refer to attachment 1.

Note: all test candidates who have not passed the Arithmetic Computation Test (ACT) must first pass this test before taking the Apprentice Electrical Technician (AET) test.

Test Administration

To request the AET test, refer to attachment 2. Complete and submit the Employee Placement Screening Request Form to the Placement Screening Administrator. The request can be expedited by faxing it to the fax number listed at the top of the form. After receipt of the form and normally within two weeks, you will be contacted to schedule a test date. Within seven calendar days after taking the test, you will receive an e-mail or letter from Human Resources with your test results.

Reference Materials

For candidates who are not employees or employees not in the line of progression, listed below are some examples of reference materials that may be helpful. Candidates who are employees in the line of progression may want to refer to their Apprentice Electrician materials, the SM&C manual, and the PESTP manual.

- ***Electricity, Principles and Applications***
by Richard J. Fowler
- ***Electric Utility Systems and Practices***
by Homer M. Rustebakke
- ***Protective Relaying: Principles and Applications***
by J. Lewis Blackburn
- ***Protective Relaying Theory and Applications***
by Walter A. Elmore
- ***Delmar's Standard Guide to Transformers***
by Stephen L. Herman, Donald Singleton

Sample Questions

Attachment 3 contains sample questions for the candidate to have some idea of what to expect. It, by no means, is a complete test and is only a tool for the candidate to determine how much preparation is needed.

Continued on next page

AET Test, Part A

Reference materials: Most high school or junior college level electrical theory and electronics textbooks, and prior training materials including instruction on interpreting schematics.

1. Electrical Theory

There are 19 questions related to electrical theory.

- a. DC and AC voltage, current, and power properties
- b. AC sine wave, voltage and current polarities
- c. Rms, peak, and peak-to-peak conversions of AC voltages
- d. Mathematical units, such as kilo, mega, and milli
- e. Conversion of cycles to seconds or visa versa
- f. Electrical units of measurement, such as resistance measured in units of ohms
- g. Ohm's law, Kirchhoff's current law, and Kirchhoff's voltage law
- h. Motor efficiency
- i. Sizing resistors for electrical circuits
- j. Series and parallel circuit operation
- k. Open or short circuit symptoms
- l. AC Electromagnetic fields
- m. Effects caused by inductance and capacitance
- n. Phase displacement between voltage and current in inductive and capacitive AC circuits (conditions that cause current to lead or lag voltage)
- o. True power (W), apparent power (VA), reactive power (VAR), and power factor (%)
- p. Voltage and current calculations for the coil source and the line in a either a wye or delta connected system
- q. Phase matching (phasing) three-phase circuits

2. Electronics

There are 8 questions related to electronics.

- a. Diode properties, operation, and tests
- b. Half and full wave rectification circuit connections and operation
- c. Diode ratings and replacement
- d. Rectifier filter construction and operation
- e. Soldering
- f. Basic logic gates symbols and operation, including the XOR gate

Continued on next page

AET Test, Part A Test continued

3. Power and Current Transformers

There are 9 questions related to power and current transformers.

- a. Transformer theory and operation
- b. Transformer operating losses (hysteresis, eddy currents, copper losses, etc.)
- c. Single-line symbols for three-phase transformer banks
- d. Three-phase transformer bank power, primary current, and secondary current calculations using nameplate values
- e. Transformer primary and secondary connections (internal and external)
- f. Transformer polarity and insulation tests
- g. Load Tap Changer (LTC) voltage steps
- h. Current transformer (CT) theory and operation
- i. Multi-ratio (tapped) CT's
- j. Safety precautions working with CT's
- k. Wye system operation with connected meters and relays
- l. CT ratings and classifications
- m. CT burden
- n. Polarity markings

4. Electrical Drawings

There are 4 questions related to electrical drawings.

- a. Clapper or plunger relays with associated contacts
- b. Schematic diagram interpretation

AET Test, Part B

Reference materials: For candidates who are not employees or employees not in the line of progression refer to the materials list on page 2. Candidates who are employees in the line of progression can refer to their apprenticeship materials, their SM&C manual and a PESTP manual.

1. Advanced Electrical Theory

There are 6 questions related to the advanced electrical theory.

- a. Purpose of capacitors on transmission and distribution lines
- b. Algebraic sum of three-phase current
- c. Panel wattmeters, varmeters, ammeters, voltmeters, and synchronous scopes ratings and operation
- d. Distribution feeder breaker meter and relay schemes
- e. Station batteries and battery systems
- f. Station battery ground detectors

Continued on next page

AET Test, Part B *continued*

2. Substation Power Transformers

There are 5 questions related to substation power transformers.

- a. Calculate either primary or secondary line current using a single line transformer bank schematic
- b. Additive and subtractive transformers operation and ratings
- c. Transformer losses
- d. Load tap changer operation and ratings
- e. Transformer diagnostic tests
- f. Electrical tests on transformers under vacuum

3. Substation Current Transformers (CT)

There are 5 questions related to substation current transformers.

- a. CT operation and ratings
- b. CT diagnostic tests

4. Substation Relays

There are 9 questions related to relays.

- a. Electromechanical overcurrent relay operation and ratings
- b. Overcurrent relay inverse time curves
- c. Overcurrent relays settings and adjustments
- d. Distribution breaker overcurrent relay schemes
- e. Overcurrent relay target operation (three-phase schemes)
- f. Installation and routine tests for overcurrent relays
- g. Purpose of auxiliary relays
- h. RC reclosing relay purpose and operation, including the anti-pump scheme

5. Wire Codes and Devices Numbers

There are 5 questions related to wire codes and device numbers.

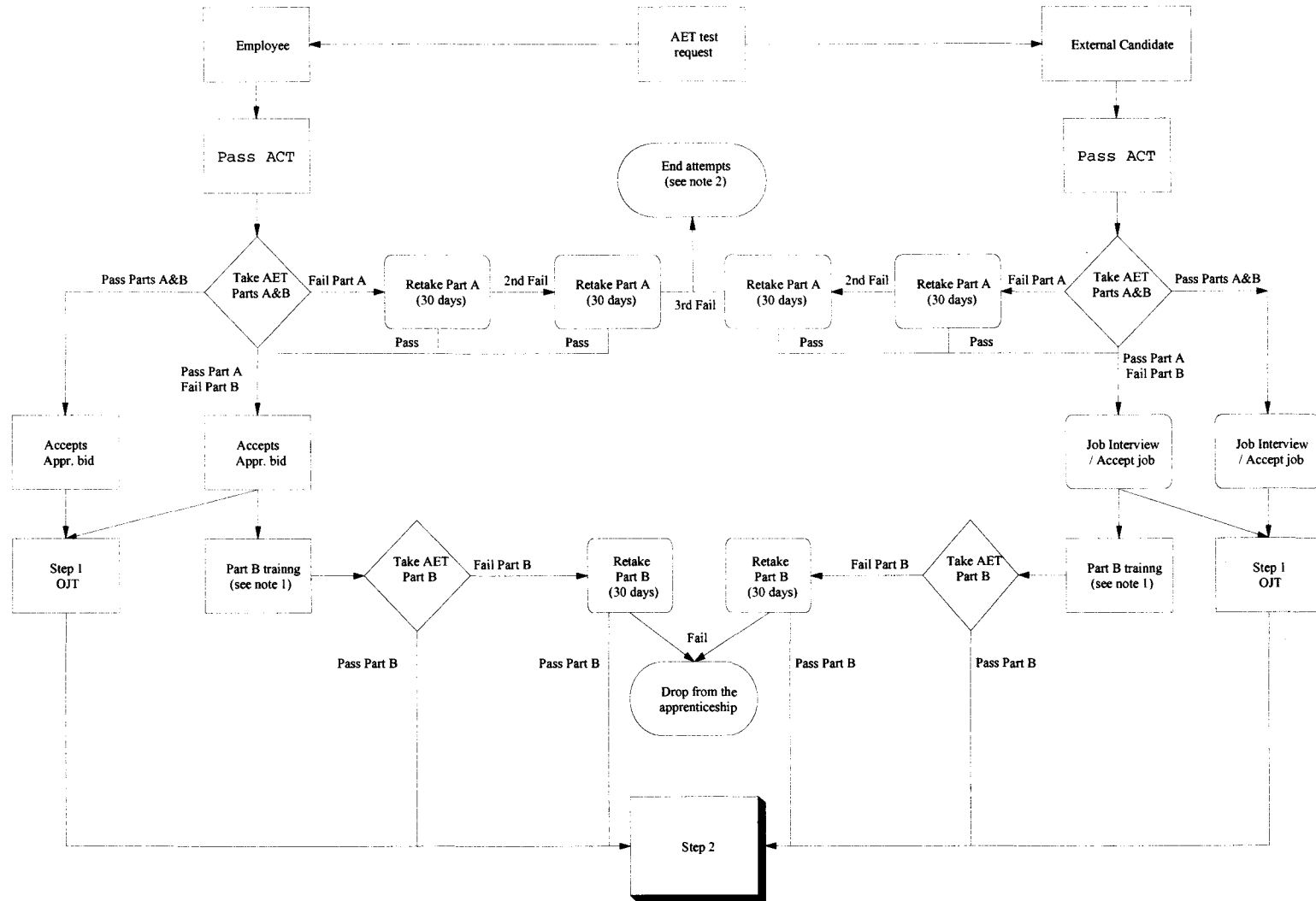
- a. Wire designation codes
- b. Device numbers
- c. Device specification and ordering information (Bill of Materials)
- d. Lamp color code

6. Substation Electrical Drawings

There are 10 questions related to substation electrical drawings.

- a. Single Line Meter and Relay (SLM&R) interpretation
- b. DC and AC Schematic diagram interpretation
- c. Current test switches and shorting blocks purpose and operation
- d. Substation automatic features: line test (L), restore (R), parallel (P), and power failure (PF), see attachment 4 for more details
- e. Electrical troubleshooting

Attachment 1 – Testing Process Flowchart



Note 1: Candidates complete three courses within four months.

- 4. Introduction to Schematics - 5 days
- 5. Basic Relays and Phasors - 5 days
- 6. Substation Schematics and Automation - 3 days

Note 2: After a third attempt the candidate must wait a minimum of 180 days and present satisfactory evidence of additional training to justify a fourth attempt.

Attachment 2

**HUMAN RESOURCES SERVICE CENTER (HRSC)
EMPLOYEE PLACEMENT SCREENING REQUEST FORM**

**E-mail at: HR TestReq
Fax to: 223-4542 or
415-973-4542**

**Mail to: Placement Screening Administrator
245 Market St., MC: N3Y,
San Francisco, CA 94177**

(Please Print)

Employee Name: _____

LAN ID (if applicable): _____ Social Security Number: _____

Work Location: _____
Street Address, City

Phone Number Where You Can be Contacted: _____
Internal and External (include area code)

Supervisor's Name: _____ Phone Number: _____

Supervisor LAN ID: _____

Placement Screen(s) Requested (e.g., Meter Reader, POSS, Typing, etc.):

Reason requesting test (bid or transfer promotional requirement, demotion/displacement activity, etc.):

Preferred Test Location: _____

Employee Signature: _____ Date: _____

Date Received in HRSC: _____

Note: Placement screening will be scheduled to accommodate immediate needs such as job placement or displacement requests. However, most placement screening sessions will be scheduled to best meet the overall business needs of the organization by scheduling a minimum of three individuals per session.

Rev5-Jan-01Draft

Attachment 3

Sample Questions

1. In the spaces provided, write the following conversions:

a. $10,050 \Omega =$ _____ $k\Omega$

b. $12.47 kV =$ _____ V

c. $0.123 A =$ _____ mA

d. $10.6 Mw =$ _____ w

2. Circle the correct statement that describes what happens to a circuit with 3 resistors connected in parallel when one of the resistors is open-circuited.

- a. The circuit resistance increases.
- b. The circuit current increases.
- c. The voltage across each of the two remaining resistors increases.
- d. The amount of power consumed in the circuit remains the same.

3. Circle the correct statement that describes the operation of diodes.

- a. Diodes allow current to flow when the anode is negative in relation to the cathode.
- b. Diodes allow current to flow when the anode is positive in relation to the cathode.
- c. Diodes are only used in dc systems.
- d. Never use a diode to rectify ac.

4. Calculate the turns-ratio for a power transformer with a nameplate voltage rating of 34.655 kV to 11.95 kV. Write your answer in the space provided.

Turns-ratio = _____

Sample Questions, continued

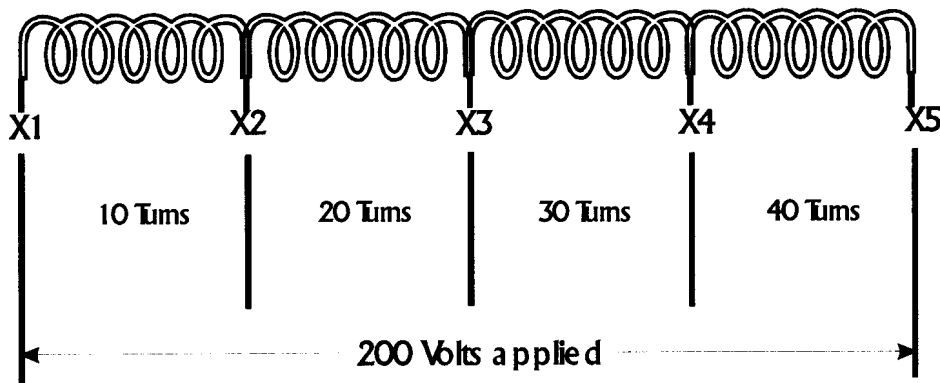
5. Given a 0-5 A analog ammeter scaled to a maximum of 1800A. Calculate the amount of current flowing in the ammeter when it indicates 1350 amperes. Write your answer in the space provided.

Ammeter current = _____A

6. In the space provided, match the wire code to its function.
- | | | |
|----------|-------|-----------------------------|
| a. 7B | _____ | Current - B phase, Bus side |
| b. 8L-1 | _____ | Current - neutral, line 1 |
| c. NK | _____ | Potential - C phase, line 1 |
| d. OCL-1 | _____ | Negative - alarm DC bus |

7. Circle the statement that describes a symptom of a discharged lead-acid battery.
- a. The battery terminal voltage has decreased.
 - b. The internal battery resistance has decreased.
 - c. The acidity of the electrolyte has decreased.
 - d. The specific gravity has increased.

8. Shown below is a current transformer with the number of turns between taps. In the space provided, write the calculated voltage for taps X1 to X3 when 200 V is applied to the full secondary winding (X1 to X5).

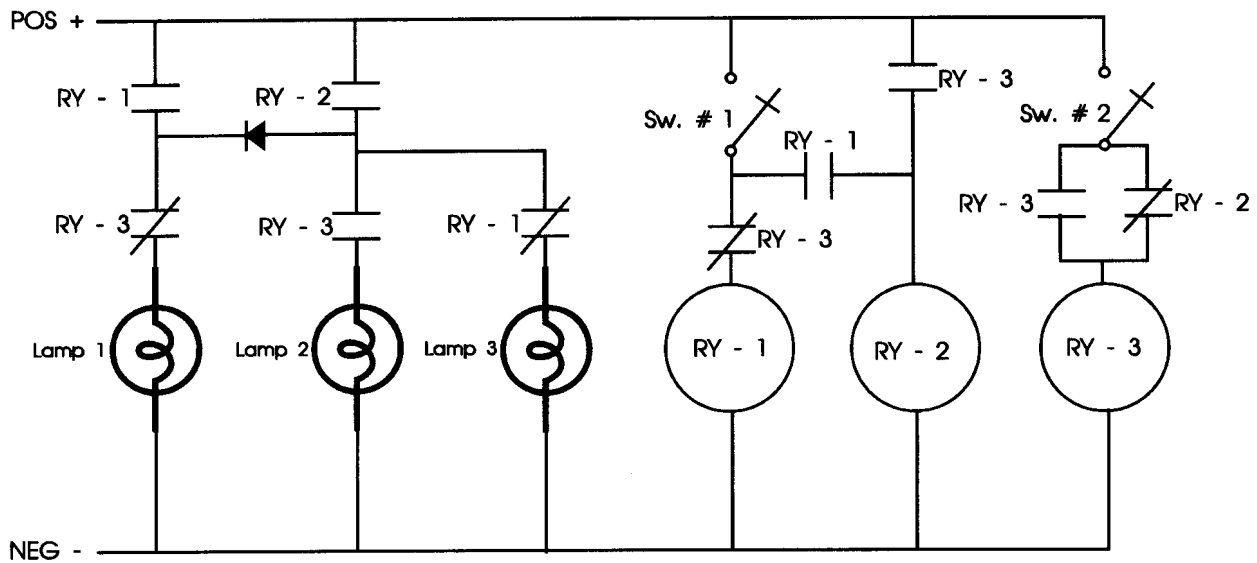


X1 to X3 = _____ Volts

Sample Questions, continued

9. Analyze the circuit below. Assume that all switches are open initially and then Sw. #1 is closed. Circle the correct statement.

- a. Lamp # 1 only is on.
- b. Lamp #2 only is on.
- c. Lamps #1, #2 and #3 are on.
- d. Lamps #2 and #3 are on.
- e. Lamp #1 and #3 are on.



10. Of the four station automatic functions which one will not close the power circuit breaker?
Circle the correct answer.

- a. Parallel
- b. Restore
- c. Line Test
- d. Power Fail

Answers to sample questions listed on the following page.

Sample Questions Answers

1. a. $10.05 \text{ k}\Omega$, b. $12,470 \text{ V}$, c. 123 mA , d. $10,600,0000 \text{ w}$
2. a. The circuit resistance increases.
3. b. Diodes allow current to flow when the anode is positive in relation to the cathode.
4. Turns-ratio = 2.9:1
5. Ammeter current = 3.75 A
6. a, d, b, c
7. a. The battery terminal voltage has decreased.
8. X1 to X3 = 60 Volts
9. a. Lamp # 1 only is on.
10. d. Power Fail

Attachment 4

AUTOMATIC STATION OPERATION

A High Voltage Circuit Breaker (HVCB) trips by power failure when:

- ◆ Man / Auto switch is on Auto
- ◆ HVCB is Closed
- ◆ Line potential is De-energized
- ◆ Bus potential is De-energized
- ◆ Power Failure feature switch is Cut-in

A HVCB will close to restore power when:

- ◆ Man / Auto switch is on Auto
- ◆ HVCB is Open
- ◆ Line potential is Energized
- ◆ Bus potential is De-energized
- ◆ Restore Power feature switch is Cut-in

A HVCB will close to line test when:

- ◆ Man / Auto Switch is on Auto
- ◆ HVCB is Open
- ◆ Line potential is De-energized
- ◆ Bus potential is Energized
- ◆ Line Test feature switch is Cut-in

A HVCB will close to parallel when:

- ◆ Man / Auto Switch on Auto
- ◆ HVCB is Open
- ◆ Line potential is Energized
- ◆ Bus potential is Energized
- ◆ Parallel feature switch is Cut-in
- ◆ Synchronous relay verifies system is "In synch"