



LETTER AGREEMENT NO. 07-43-PGE



PACIFIC GAS AND ELECTRIC COMPANY
LABOR 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 RAYBURN
DIRECTOR AND CHIEF NEGOTIATOR

TOM DALZELL
BUSINESS MANAGER

August 16, 2007

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

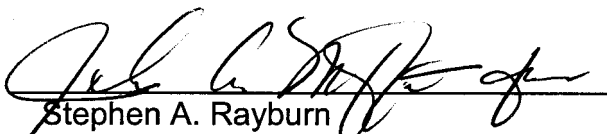
Dear Mr. Dalzell:

In Letter of Agreement 05-28 the parties recommended and approved the Apprentice Electrical Technician training program and two-part qualification examination. The qualification examination included Part A which was required for entrance into the classification and Part B which the employee was expected to successfully complete within 6 months of placement. Since that time, a subcommittee commissioned by the Joint Apprenticeship Training Committee, developed a revised recommendation that test Part A is now the entrance exam and test Part B is the first step wage progression test. Attached is the revised test procedure process and Study Guide. This proposal cancels and supersedes LA 05-28.

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
Director and Chief Negotiator

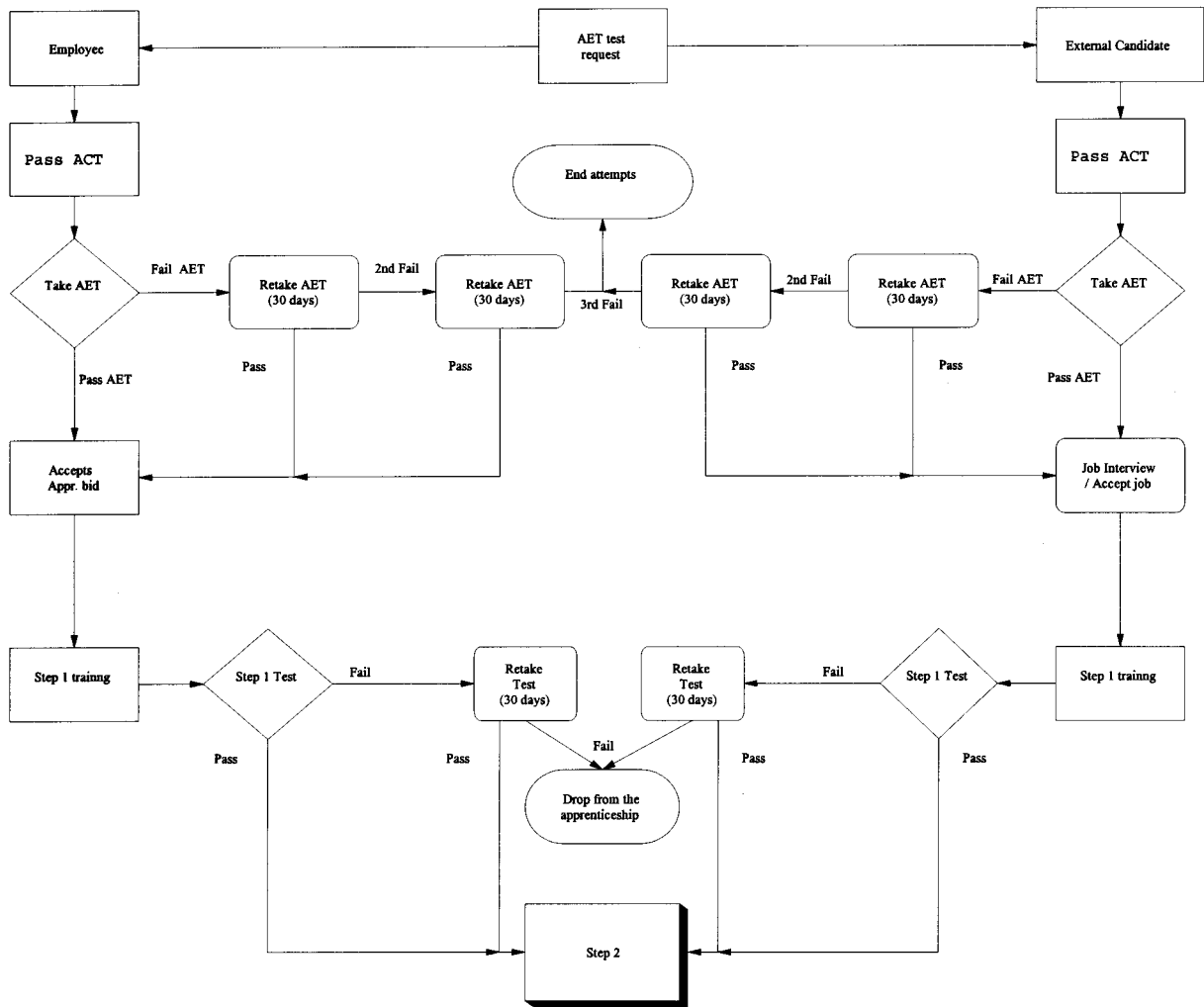
The Union is in accord with the foregoing and agrees thereto as of the date hereof.

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

November 29, 2007

By: 
Tom Dalzell
Business Manager

Apprentice Electrical Technician Testing Flowchart



Apprentice Electrical Technician Test

AET Test:

AET Entrance Examination:

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

Total = 40 questions / three hours to complete

Step 1 Wage Progression Test:

- 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

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.)
Training: 1. Introduction to Schematics – 40 hr. 2. Basic Relays and Phasors – 40 hr. 3. Substation Schematics and Automation – 24 hr. Step 1 OJT Step 1 WPT	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

05/30/2006

**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 forty questions with a maximum time limit of three hours. This is a closed book test and calculators are allowed. AET test contains questions on the following:

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

Note: The Arithmetic Computation Test (ACT) must be successfully passed before taking the Apprentice Electrical Technician (AET) test.

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Test Administration

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

Most high school, junior college, or electrical apprenticeship course materials and textbooks on the topics described on the previous page should be sufficient.

Sample Questions

Attachment 1 contains sample questions for the person to have some idea of what to expect. It, by no means, is a complete test and is only a tool for the person to determine how much preparation is needed.

AET Test Question Details

1. Electrical Theory - 19 questions

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

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AET Test Question Details, *continued*

2. Electronics - 8 questions

- a. The properties and operating principle of a diode
- b. Operational tests for a diode
- c. Half and full wave rectification circuit connections and operation
- d. Diode ratings and replacement values
- e. Rectifier filter construction and operation
- f. Soldering
- g. Basic logic gates symbols and operation, including the exclusive OR gate

3. Power and Current Transformers - 9 questions

- a. Transformer theory and operation
- b. Transformer operating losses (hysteresis, eddy currents, and copper losses)
- 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. Current transformer (CT) theory and operation
- h. Multi-ratio (tapped) CT's
- i. Safety precautions working with CT's
- j. Wye system operation with connected meters and relays
- k. CT ratings and classifications
- l. CT burden
- m. Polarity markings

4. Electrical Drawings - 4 questions

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

Attachment 1

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.

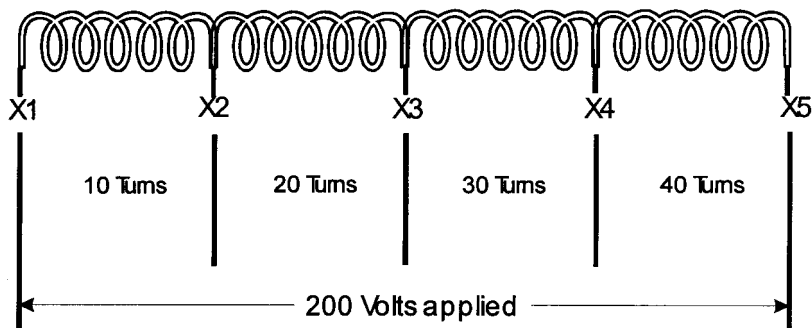
4. Calculate the turns-ratio for a power transformer with a nameplate voltage rating of 34.655 kV to 11.95 kV. Write your answer in the space provided.

Turns-ratio = _____ :1

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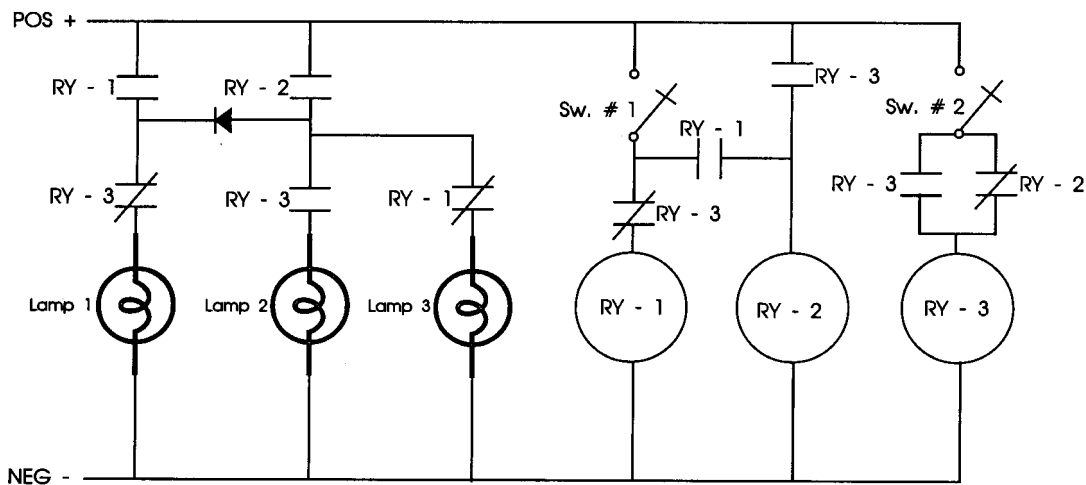
Sample Questions, continued

5. 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

6. Analyze the circuit below. Assume that all switches are open initially and then Sw. #1 is closed. Circle the correct statement.
- Lamp # 1 only is on.
 - Lamp #2 only is on.
 - Lamps #1, #2 and #3 are on.
 - Lamps #2 and #3 are on.
 - Lamp #1 and #3 are on.



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Sample Questions, continued

7. During a saturation test of a 1500/5 multi-ratio CT, 400 volts is applied to the X1 to X4 tap. The X1 to X4 tap is the 1200/5 ratio. What is the expected voltage across the X1 to X5 tap? Circle the correct answer below.
- a. 500 V
 - b. 400 V
 - c. 320 V
 - d. 240 V maximum
 - e. 0 V
8. A phase-to-phase secondary ratio test is being conducted on a wye connected set of current transformers. Test current is applied through both the A and B-phase secondary leads. Circle the statement below where the secondary ratio current is read.
- a. A-phase ammeter, A-phase relay, and the Ground relay.
 - b. A and B-phase ammeters, A and B-phase relays, and the Ground relay.
 - c. A and B-phase ammeters and A and B-phase relays.
 - d. B-phase ammeter, B-phase relay, and the Ground relay.
 - e. C-phase ammeter, C-phase relay, and the Ground relay.
9. Write in the space provided the calculated power consumed in a dc circuit that has a current of 154 amperes and a circuit resistance of 25 ohms.

Power = _____ W

10. Circle the correct statement from the list below for an ac circuit containing resistance, and capacitive reactance,
- a. The voltage and current are in-phase.
 - b. The current leads the voltage.
 - c. The voltage leads the current.
 - d. The phase angle between the voltage and current is 90°.

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. X1 to X3 = 60 Volts
6. a. Lamp # 1 only is on
7. a. 500 V
8. c. A and B-phase ammeters, A and B-phase relays.
9. 592.9 kW
10. b. The current leads the voltage

Attachment 3

Sample Questions

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

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

f. $12.47 kV =$ _____ V

g. $0.123 A =$ _____ mA

h. $10.6 Mw =$ _____ 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.

e. The circuit resistance increases.

f. The circuit current increases.

g. The voltage across each of the two remaining resistors increases.

h. The amount of power consumed in the circuit remains the same.

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

e. Diodes allow current to flow when the anode is negative in relation to the cathode.

f. Diodes allow current to flow when the anode is positive in relation to the cathode.

g. Diodes are only used in dc systems.

h. 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

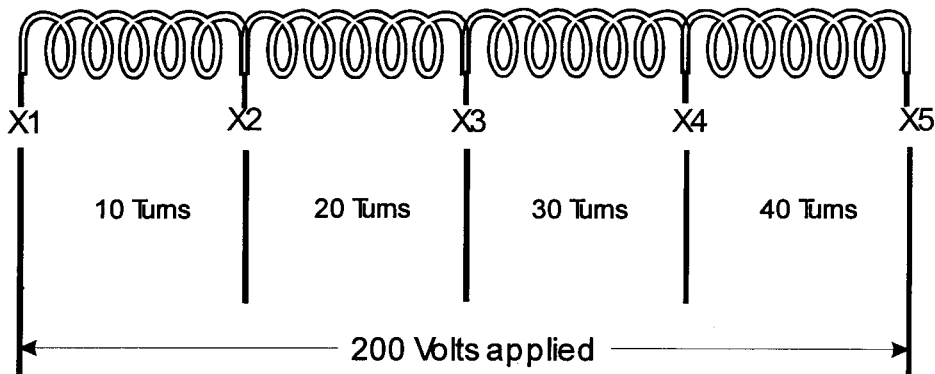
6. In the space provided, match the wire code to its function.

- 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).



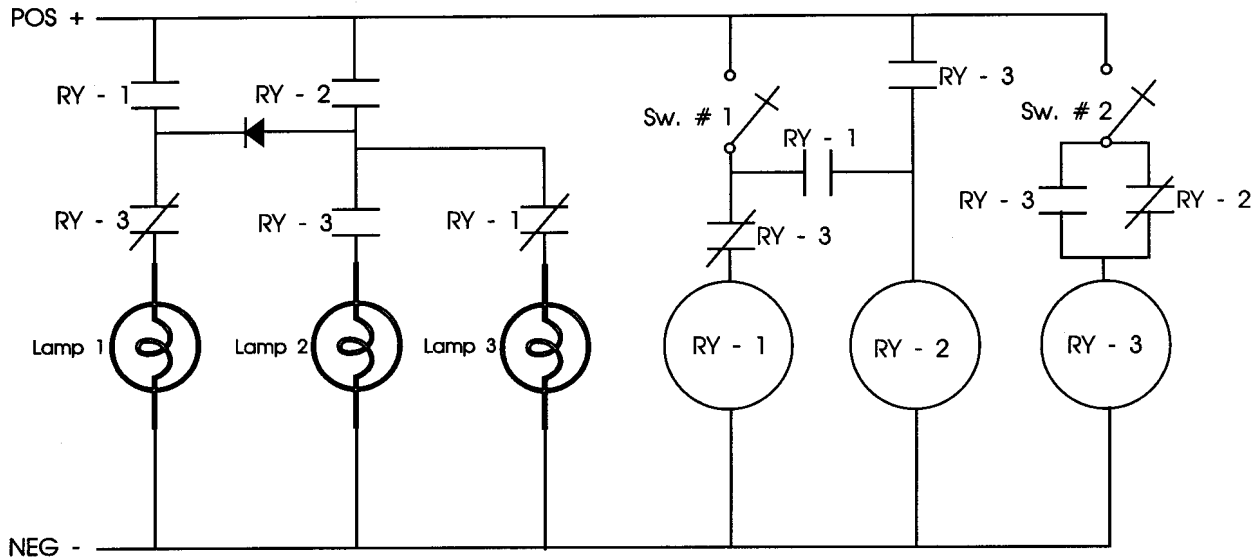
X1 to X3 = _____ Volts

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.

- f. Lamp # 1 only is on.

- g. Lamp #2 only is on.
- h. Lamps #1, #2 and #3 are on.
- i. Lamps #2 and #3 are on.
- j. 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

11. a. $10.05 \text{ k}\Omega$, b. $12,470 \text{ V}$, c. 123 mA , d. $10,600,000 \text{ w}$
12. a. The circuit resistance increases.
13. b. Diodes allow current to flow when the anode is positive in relation to the cathode.
14. Turns-ratio = 2.9:1
15. Ammeter current = 3.75 A
16. a, d, b, c
17. a. The battery terminal voltage has decreased.
18. X1 to X3 = 60 Volts
19. a. Lamp # 1 only is on.
20. d. Power Fail

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"