



U.S.C.G. Merchant Marine Exam

Assistant Engineer, Limited

Q615 Electrical Electronics and Control Engineering

(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

1. How is the main shaft rotation on an AC diesel-electric propulsion vessel normally reversed?

- (A) reversing the prime mover rotation
- (B) decreasing the generator frequency
- (C) increasing the generator frequency
- (D) reversing the phase sequence supplied to the motor

If choice D is selected set score to 1.

2. In addition to high voltage circuit grounding with ground-connecting switching devices, for additional operator safety and confidence, portable grounding straps may be used. What is the proper procedure for connecting these portable grounding straps?

- (A) The common to hull ground connection and the phase connections to common can be made in any sequence.
- (B) The common to hull ground connection and the phase connections to common should all be made simultaneously.
- (C) Connect the common connection to hull ground first, and then connect the phase connections to common.
- (D) Connect the phase connections to common first, and then connect the common connection to hull ground.

If choice C is selected set score to 1.

3. With all other factors considered equal (such as voltage, conducting path through the body and the duration of contact), contact with an energized electrical system conductor of which system type would produce the most damaging effect?

- (A) DC systems
- (B) 60 Hz AC systems
- (C) 10 kHz AC systems
- (D) All the above systems would be equally as damaging

If choice B is selected set score to 1.

4. In referring to figure "E" of the illustration, what statement is true concerning the functional purpose of the coupling transformer? Illustration EL-0075

- (A) The transformer functions as a filter by removing the DC component from the varying DC input to produce an AC output shifted 90° from the input.
- (B) The transformer functions as a filter by removing the DC component from the varying DC input to produce an AC output in phase with the input.
- (C) The transformer functions as a voltage transformer by changing the magnitude of the peak to peak AC voltage at the output proportional to the turns ratio.
- (D) The transformer functions as a filter by removing the DC component from the varying DC input to produce an AC output shifted 180° from the input.

If choice A is selected set score to 1.

5. The transformer diagram shown in figure "B" of the illustration represents what type of transformer?
Illustration EL-0082

- (A) open delta transformer
- (B) step-down transformer with dual voltage secondary
- (C) Scott-connected transformer
- (D) autotransformer

If choice B is selected set score to 1.

6. The turns ratio of the tapped step-down transformer shown in figure "C" of the illustration is four to one and all taps are equally spaced. If 440 volts were applied between "H1" and "H4", what would appear across "X1" and "X4"? Illustration EL-0082

- (A) 110 volts
- (B) 220 volts
- (C) 440 volts
- (D) 1760 volts

If choice A is selected set score to 1.

7. On vessels with AC distribution systems, which of the following statements represents the most difficult problem involved in obtaining a DC potential suitable for use by computer components?

- (A) Rectifiers cannot operate with voltage regulators.
- (B) A step-down transformer is always required.
- (C) The voltage must be rectified and made ripple free.
- (D) Vessel vibrations affect the voltage source.

If choice C is selected set score to 1.

8. What is the characteristic of a wound-rotor induction motor, with a high resistance inserted in series with the rotor winding at startup?

- (A) relatively low starting torque and low stator current
- (B) relatively low starting torque and high stator current
- (C) relatively high starting torque and high stator current
- (D) relatively high starting torque and low stator current

If choice D is selected set score to 1.

9. If a computer display is flickering, how may this be remedied?

- (A) Decrease the resolution bandwidth
- (B) Increase the resolution bandwidth
- (C) Increase the refresh rate
- (D) Decrease the refresh rate

If choice C is selected set score to 1.

10. Which of the following illustrated manual motor starters represents the wiring diagram illustrated in figure "A"? Illustration EL-0023

- (A) 1
- (B) 2
- (C) 3
- (D) 4

If choice A is selected set score to 1.

11. Which statement is TRUE concerning electric propulsion drives?

- (A) The propeller speed and direction of rotation are easily controllable.
- (B) Lower transmission losses compared to other types of propulsion drives.
- (C) Inability to be utilized as a source of ships service power.
- (D) Lack of flexibility of arrangement between the prime mover and motor.

If choice A is selected set score to 1.

12. What type of electrical diagram for the steering control systems is shown in the illustration? Illustration EL-0192

- (A) The diagram is a one-line diagram.
- (B) The diagram is a pictorial drawing.
- (C) The diagram is a wiring diagram.
- (D) The diagram is a functional block diagram.

If choice D is selected set score to 1.

13. The electrical energy necessary to power a sound-powered telephone's small vibrating bell is obtained from what power source?

- (A) the emergency batteries for the general alarm
- (B) normal 115 volt DC supplies
- (C) the emergency switchboard
- (D) each station's hand-cranked generator

If choice D is selected set score to 1.

14. In which section of the 24 VDC power supply circuit illustrated does the greatest change in voltage level take place when fed from 120 VAC ship's power? Illustration EL-0085

- (A) A
- (B) B
- (C) C
- (D) D

If choice A is selected set score to 1.

15. The arc resulting from the tripping of a circuit breaker is prevented from damaging the contacts. How is this done?

- (A) directing the arc into an arc chute
- (B) an inverse timed thermal trip for short circuit currents
- (C) instantaneous magnetic trip for overload currents
- (D) designing the contacts to open slowly

If choice A is selected set score to 1.

16. Referring to figure "B" of the illustration, what statement is true? Illustration EL-0020

- (A) The order of resistors connected in the series string has no impact on the total resistance. The total resistance of the circuit will be less than any one of the individual resistances.
- (B) The order of resistors connected in the series string has an impact on the total resistance. If the largest resistance is last in the circuit, the total resistance will be more than if it is not.
- (C) The order of resistors connected in the series string has no impact on the total resistance. The sum of the resistances is the total resistance of the circuit.
- (D) The order of resistors connected in the series string has an impact on the total resistance. If the largest resistance is first in the circuit, the total resistance will be more than if it is not.

If choice C is selected set score to 1.

17. What is the main function in the use of a capacitor for starting a single-phase motor?

- (A) Prolong the life of the starting contacts
- (B) Reduce the phase angle
- (C) Reduce radio interference
- (D) Split the phase to create greater starting torque

If choice D is selected set score to 1.

18. Which line in figure "B" shown in the illustration represents the trailing edge of the wave? Illustration EL-0088

- (A) 3
- (B) 4
- (C) 5
- (D) 6

If choice B is selected set score to 1.

19. In which of the situations listed will a megohmmeter give the most accurate readings?

- (A) While the machine is in operation.
- (B) Immediately prior to restarting the machine.
- (C) While the machine is discharging static electricity.
- (D) When the machine has been shut down and grounded for a period of 15 minutes.

If choice D is selected set score to 1.

20. Before any work on electrical or electronic equipment is performed, which of the following precautions should be carried out?

- (A) Secure and tag the supply circuit breaker in the open position.
- (B) De-energize the applicable switchboard bus.
- (C) Bypass the interlocks.
- (D) Station a man at the circuit supply switch.

If choice A is selected set score to 1.

21. A salinity indicator system such as that used to measure the salt content of potable water systems and boiler feed and condensate systems uses what technology?

- (A) a salinity cell that senses the pH of water
- (B) a salinity cell that senses the brine density of water
- (C) a salinity cell that senses the electrical conductivity of water
- (D) a salinity cell that senses the optical refraction of water

If choice C is selected set score to 1.

22. As shown in figure "A" of the digital multimeter screen shown in the illustration, what would be the significance of the symbol indicated by "1" being illuminated? Illustration EL-0047

- (A) the meter is subjected to a potentially unsafe voltage
- (B) the selector switch is selected for continuity/diode test and the secondary function push button is toggled for continuity
- (C) the meter test leads are placed in the wrong terminal jacks for the test being performed
- (D) the meter is in range of a wireless signal

If choice B is selected set score to 1.

23. Upon failure of the normal power supply, how is the emergency generator placed on the line to feed power to the emergency bus?

- (A) line connection feeder
- (B) power failure alarm bus
- (C) main bus tie feeder
- (D) automatic bus transfer device

If choice D is selected set score to 1.

24. Which of the following activities occurs during the charging process of a lead-acid storage battery?

- (A) Hydrogen gas is absorbed.
- (B) The specific gravity of the acid increases.
- (C) Oxygen gas is absorbed.
- (D) Both plates change chemically to lead sulfate.

If choice B is selected set score to 1.

25. If a three-phase motor controlled by the control circuit illustrated in figure "B" of the illustration is running in the forward direction, which of the following sequences must occur before the motor will reverse rotation? Illustration EL-0011

- (A) First, the motor must be stopped via the stop button, then normally open 'F' contacts must re-close, and finally the reverse start button must be depressed.
- (B) First, the motor must be stopped via the stop button, then normally closed 'F' contacts must re-open, and finally the reverse start button must be depressed.
- (C) First, the motor must be stopped via the stop button, then normally closed 'F' contacts must re-close, and finally the reverse start button must be depressed.
- (D) First, the motor must be stopped via the stop button, then normally open 'F' contacts must re-open, and finally the reverse start button must be depressed.

If choice C is selected set score to 1.

26. What statement is true concerning the "MS 1" contacts of the master switch shown in the illustration? Illustration EL-0102

- (A) They are closed only when the master switch is "off".
- (B) They are closed only when the master switch is selected for a "lower" position.
- (C) They are closed only when the master switch is selected for a "hoist" position.
- (D) They are opened only when the master switch is "off".

If choice A is selected set score to 1.

27. Which of the following statements is TRUE concerning azipod propulsion systems?

- (A) The system uses electric motors located inside the ship's hull.
- (B) The system requires the need for a separate rudder.
- (C) The system integrates propulsion and steering into one function.
- (D) The system requires the use of a controllable-pitch propeller.

If choice C is selected set score to 1.

28. Ships requiring rapid maneuvering response with a degree of propeller shaft control are most likely to use what type of drive system?

- (A) Gas turbine geared drive
- (B) Steam turbine geared drive
- (C) Direct or geared diesel drive
- (D) Diesel-electric drive

If choice D is selected set score to 1.

29. Which of the electrical properties listed will always be the same across each component in a parallel circuit?

- (A) Voltage
- (B) Resistance
- (C) Current
- (D) Impedance

If choice A is selected set score to 1.

30. As shown in all four diagrams included in the illustration, what type of logic circuit is represented?
Illustration EL-0226

- (A) OR gate
- (B) AND gate
- (C) NAND gate
- (D) NOR gate

If choice B is selected set score to 1.

31. What is "the voltage per millimeter of insulation thickness that the insulation can withstand without breaking down" called?

- (A) Tensile strength
- (B) Dielectric strength
- (C) Mechanical strength
- (D) Shear strength

If choice B is selected set score to 1.

32. The multiplier prefix "giga" (G) such as used in "gigabytes" represents what multiplication factor?

- (A) thousand (10 to the 3rd power)
- (B) million (10 to the 6th power)
- (C) billion (10 to the 9th power)
- (D) trillion (10 to the 12th power)

If choice C is selected set score to 1.

33. What would be the total capacitance of the circuit illustrated in figure "A" if the value of capacitor C_1 was 100 microfarads and capacitor C_2 was 200 microfarads? Illustration EL-0038

- (A) 66.6 microfarads
- (B) 150 microfarads
- (C) 166.6 microfarads
- (D) 300 microfarads

If choice D is selected set score to 1.

34. Which of the following statements correctly applies to bipolar junction transistors?

- (A) The emitter separates the base and collector.
- (B) The three terminals are called the emitter, base, and collector.
- (C) The collector separates the emitter and base.
- (D) LED and LCD are the two basic types of transistors.

If choice B is selected set score to 1.

35. Assuming that a three-phase synchronous motor is separately excited, what statement is true concerning power supplies?

- (A) The rotor windings via slip rings and brushes are connected to a three-phase AC power source, and the stator winding is directly connected to a DC power source.
- (B) The rotor winding via slip rings and brushes is connected to a single-phase AC power source, and the stator winding is directly connected to a three-phase AC power source.
- (C) The rotor winding via slip rings and brushes is connected to a DC power source, and the stator windings are directly connected to a three-phase AC power source.
- (D) The rotor winding via slip rings and brushes is connected to a three-phase AC power source, and the stator winding is directly connected to a single-phase AC power source.

If choice C is selected set score to 1.

36. AC circuits can possess characteristics of resistance, inductance, and capacitance. In terms of units of measure, how is the capacitive reactance of the circuit expressed?

- (A) farads
- (B) mhos
- (C) ohms
- (D) henrys

If choice C is selected set score to 1.

37. Which of the following materials is recommended for burnishing the slip rings of an alternator after grinding or turning?

- (A) canvas wiper
- (B) grade 00 sandpaper
- (C) hardwood block
- (D) smooth file

If choice C is selected set score to 1.

38. A DC generator which is used to supply direct current in order to provide magnetizing current to an AC generator field is commonly known as what?

- (A) armature
- (B) exciter
- (C) stator
- (D) rotor

If choice B is selected set score to 1.

39. Large machines undergoing a resistance insulation testing using a megohmmeter should be discharged to remove any accumulated electrostatic/capacitive charge stored. When should this discharge be performed?

- (A) prior to and after conducting the insulation resistance check
- (B) after conducting the insulation resistance check only
- (C) prior to conducting the insulation resistance check only
- (D) while performing the insulation resistance check only

If choice A is selected set score to 1.

40. As shown in figure "A" of the illustration, the load-commutated inverter drive illustrated has how many pulses? Illustration EL-0159

- (A) 3
- (B) 6
- (C) 9
- (D) 12

If choice B is selected set score to 1.

41. What is an ammeter used to measure?

- (A) total or partial circuit resistance
- (B) current flow in a circuit
- (C) the voltage between two points in a circuit
- (D) circuit continuity

If choice B is selected set score to 1.

42. After prior isolation and lock-out/tag-out procedures are performed, which electrical device requires discharging any stored electrical energy before any work may safely begin?

- (A) potential transformer
- (B) capacitor
- (C) resistor bank
- (D) choke coil

If choice B is selected set score to 1.

43. In an impressed current cathodic hull protection system, what statement is true concerning the composition and arrangement of the anodes?

- (A) The protective anodes are made of zinc and are electrically insulated from the hull.
- (B) The protective anodes are made of lead or platinized titanium and are electrically bonded to the hull.
- (C) The protective anodes are made of lead or platinized titanium and are electrically insulated from the hull.
- (D) The protective anodes are made of zinc and are electrically bonded to the hull.

If choice C is selected set score to 1.

44. How can the loss of residual magnetism in an alternator or generator be corrected?

- (A) allowing the generator to run at 10% of normal speed for 5 minutes
- (B) running the rotor in the opposite direction for 5 minutes
- (C) using a storage battery or battery charger to "flash" the field
- (D) running the generator at normal speed with the field rheostat fully counter-clockwise

If choice C is selected set score to 1.

45. Which pair of safety disconnect switches shown in the illustration represents the exterior and interior views of a double-throw switch? Illustrations EL-0176

- (A) A and B
- (B) B and D
- (C) C and D
- (D) A and C

If choice B is selected set score to 1.

46. As shown in the illustrated one-line diagram of a two-tiered emergency power system for a passenger ship, what statement is true? Illustration EL-0166

- (A) On a loss of normal ship's power, the temporary emergency loads power source is battery (from AC/DC UPS "B"), whereas the final emergency loads power source is the emergency generator.
- (B) On a loss of normal ship's power, the final emergency loads power source is battery (from AC/DC UPS "B"), whereas the temporary emergency loads power source is the emergency generator.
- (C) On a loss of normal ship's power, the final emergency loads power source is battery (from AC/DC UPS "A"), whereas the temporary emergency loads power source is the emergency generator.
- (D) On a loss of normal ship's power, the temporary emergency loads power source is battery (from AC/DC UPS "A"), whereas the final emergency loads power source is the emergency generator.

If choice A is selected set score to 1.

47. What is an ohmmeter used to measure?

- (A) voltage between two points in a circuit
- (B) circuit resistance
- (C) circuit power
- (D) the amount of current flow in a circuit

If choice B is selected set score to 1.

48. In a typical fire detection control unit, what would be indicated by an illuminated blue light?

- (A) normal power is on
- (B) trouble in the system
- (C) fire or smoke detected
- (D) backup power is on

If choice B is selected set score to 1.

49. Which of the electrical schematic symbols shown in the illustration represents a normally closed limit switch? Illustration EL-0059

- (A) 6
- (B) 10
- (C) 11
- (D) 14

If choice C is selected set score to 1.

50. Which of the conditions listed will indicate the need to clean the insulation on the windings of an electric motor?

- (A) Excessive vibration at normal speed.
- (B) Sparking at the brushes.
- (C) Higher than normal operating temperature.
- (D) High megger readings.

If choice C is selected set score to 1.

51. When testing insulation resistance of electric equipment and machinery, ideally when should the insulation resistance be tested for the lowest normal insulation values?

- (A) every time the brush rigging is adjusted
- (B) every 30 days whether the machine is in use or not
- (C) immediately after starting up the machine
- (D) immediately after shutting down the machine

If choice D is selected set score to 1.

52. In order for a live-line tester to be used to test and prove dead a high voltage circuit, what must be done to verify the ability of the tester to detect a voltage?

- (A) The live-line tester should be checked by connecting to a known high voltage source only before testing the circuit to be worked upon.
- (B) The live-line tester should be checked by connecting to a known high voltage source only after testing the circuit to be worked upon.
- (C) The live-line tester should be checked by connecting to a known high voltage source before and after the circuit to be worked upon is tested.
- (D) The live-line tester need not be checked prior to testing the circuit to be worked upon as long as it has not been declared inoperative.

If choice C is selected set score to 1.

53. What is the most reliable and preferred method for determining the state of charge of a wet cell NiCad battery?

- (A) Measuring the specific gravity of each cell with a hydrometer.
- (B) Measuring the battery voltage with a digital voltmeter during charge or discharge.
- (C) Measuring the battery voltage with a solenoid type voltage tester during charge or discharge.
- (D) Measuring the temperature corrected specific gravity of each cell with a hydrometer and thermometer.

If choice B is selected set score to 1.

54. When a fluorescent lamp has reached the end of its useful life, it should be replaced immediately. If not, what condition could the resultant flashing cause?

- (A) tripping of the lamp's circuit breaker
- (B) exploding of the lamp, causing glass to fly in all directions
- (C) damaging the lamps starter and ballast circuit
- (D) short circuiting of adjacent lighting circuits

If choice C is selected set score to 1.

55. In referring to figure "A" of the illustration, what type of active filter circuit is shown? Illustration EL-0077

- (A) Low-pass filter circuit
- (B) High-pass filter circuit
- (C) Notch filter circuit
- (D) Bandpass filter circuit

If choice A is selected set score to 1.

56. As shown in the cutaway view of the lead-acid battery in figure "A" of the illustration, if one-half of the battery's cells are revealed by the cutaway section (with the other half remaining hidden from view), what is the nominal output voltage of the battery? Illustration EL-0031

- (A) 6 volts
- (B) 7.5 volts
- (C) 12 volts
- (D) 18 volts

If choice C is selected set score to 1.

57. What can be the cause of excessive heat or burning contacts in an operating motor controller?

- (A) low motor starting torque
- (B) burned out operating coil
- (C) high ambient temperature
- (D) loose connections or low contact pressure

If choice D is selected set score to 1.

58. As shown in all four diagrams included in the illustration, what type of logic circuit is represented? Illustration EL-0227

- (A) NOR gate
- (B) OR gate
- (C) AND gate
- (D) NAND gate

If choice B is selected set score to 1.

59. Concerning the illustrated fire detection and alarm system, when the system is operating normally and under supervision, what is the status of the ground detector and the fire alarm relays?
Illustration EL-0114

- (A) The ground detector relay is energized and the fire alarm relay is de-energized.
- (B) Both the ground detector and the fire alarm relays are both de-energized.
- (C) The ground detector relay is de-energized and the fire alarm relay is energized.
- (D) Both the ground detector and the fire alarm relays are both energized.

If choice C is selected set score to 1.

60. What is the shape of the schematic symbol for an operational amplifier used in an analog circuit?

- (A) trapezoid
- (B) circle
- (C) square
- (D) triangle

If choice D is selected set score to 1.

61. What condition associated with a lead-acid battery cell can cause the plates to partially short-out and cause the cell to fail to hold a charge?

- (A) dirty or acid-wet tops and sides of batteries
- (B) accumulation of sediment within the cells due to excessive overcharging and discharging
- (C) sulfation of the plates due to consistent undercharging or leaving the battery in a discharged state
- (D) lime accumulation on both the positive and negative terminal posts

If choice B is selected set score to 1.

62. In performing routine maintenance of a ship's service alternator, what should be included?

- (A) lubricating exciter slip rings
- (B) megger testing of all rectifying diodes
- (C) changing the pedestal bearing insulation yearly
- (D) periodic cleaning of the air filters or screens

If choice D is selected set score to 1.

63. What is the best method of determining the state of charge of a lead-acid storage battery?

- (A) ampere-hour capacity of the battery
- (B) total cell voltages
- (C) testing of the individual cell voltages
- (D) specific gravity of the electrolyte

If choice D is selected set score to 1.

64. Which of the listed motors will operate at the highest RPM, assuming that each operates at the same frequency?

- (A) A four-pole synchronous motor under normal load.
- (B) A four-pole induction motor under no load.
- (C) A six-pole synchronous motor under normal load.
- (D) A six-pole induction motor under full load.

If choice A is selected set score to 1.

65. Regarding an induction motor, what does the power developed by the rotor automatically adjust itself to?

- (A) speed required to drive the load
- (B) torque developed by the rotating field
- (C) power required to drive the load
- (D) current flow in the motor stator

If choice C is selected set score to 1.

66. The timer element of a reverse power relay cannot be energized unless what condition is met?

- (A) the power flow is the same as the tripping direction
- (B) the movement of the disk is damped by a permanent magnet
- (C) the power flow is the opposite to the tripping direction
- (D) one generator is fully motorized

If choice A is selected set score to 1.

67. Before working on an electric cargo winch master switch or controller, what should be done?

- (A) heat the switch box to remove any moisture
- (B) open the circuit breaker in the power supply and tag-out
- (C) drain condensate from the box
- (D) spray the gasket surface with a solvent

If choice B is selected set score to 1.

68. As shown in the illustration, how are the rotor windings of the motor configured? Illustration EL-0102

- (A) wye
- (B) delta
- (C) series-parallel
- (D) open delta

If choice A is selected set score to 1.

69. The leads from an ohmmeter are attached to the leads of the opposite ends of an AC motor stator field coil. If a reading of infinity is obtained, what does this indicate?

- (A) grounded field coil
- (B) shunted field coil
- (C) shorted field coil
- (D) open field coil

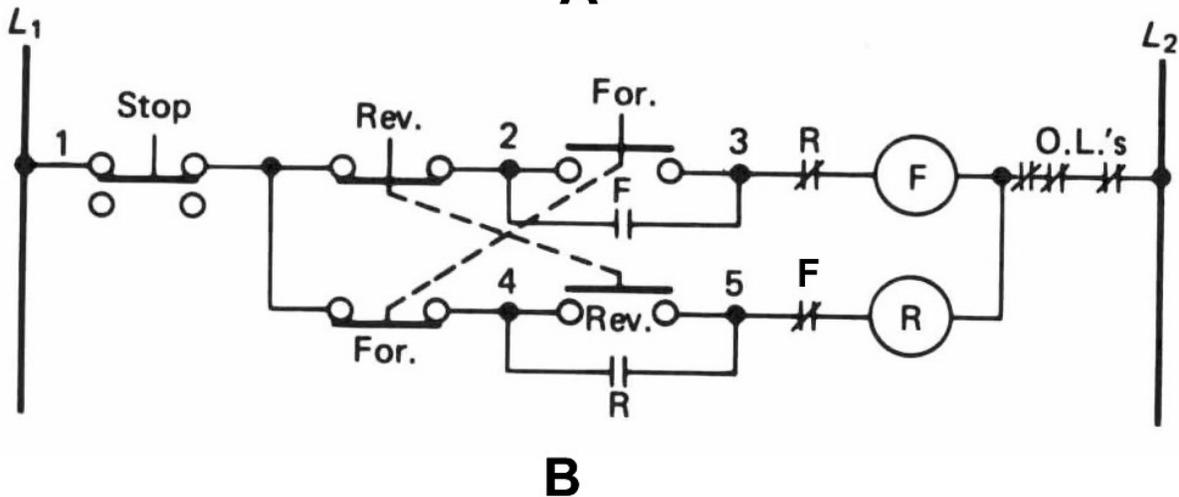
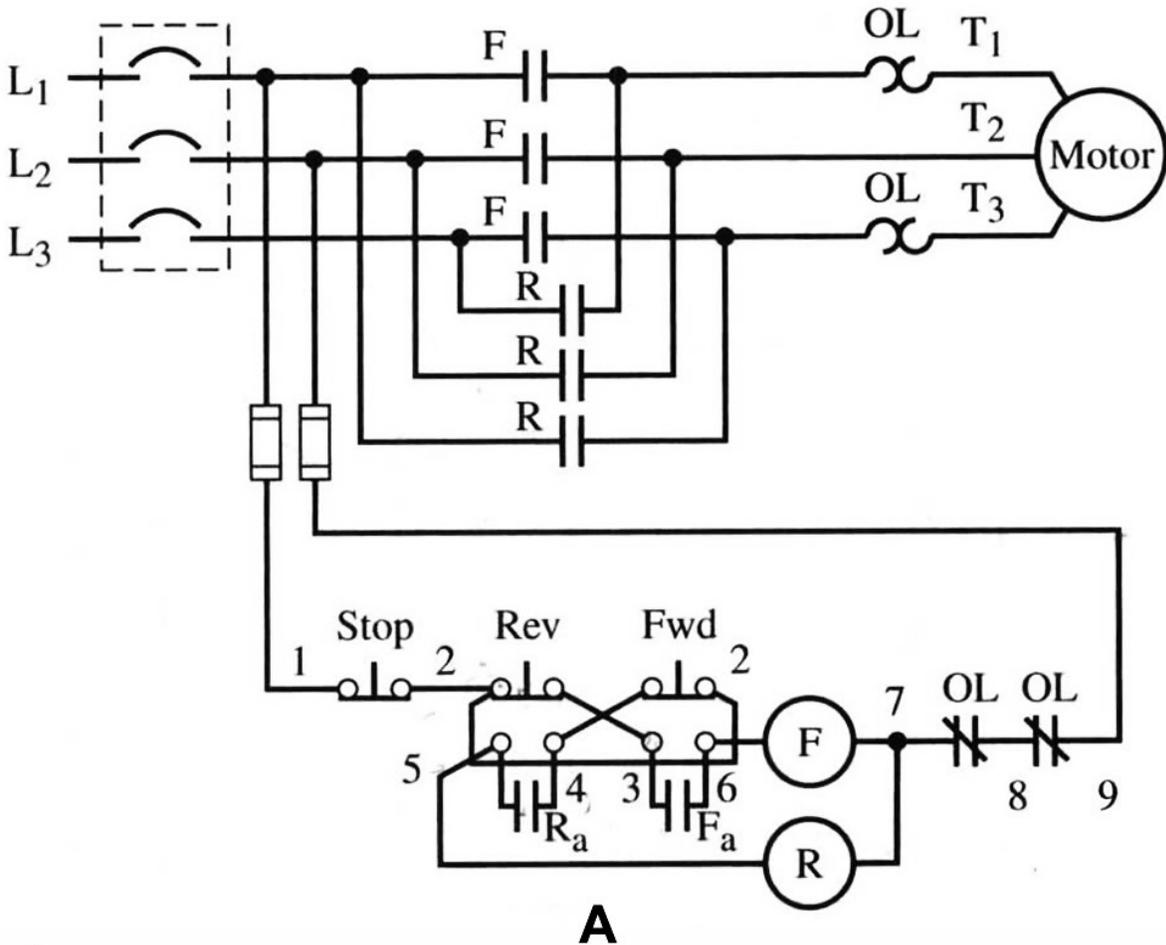
If choice D is selected set score to 1.

70. Why should battery rooms be well ventilated during the charging of storage batteries?

- (A) without ventilation the battery will not take a full charge
- (B) without ventilation excessive gassing will occur
- (C) highly explosive gases will otherwise accumulate
- (D) highly poisonous gases are released

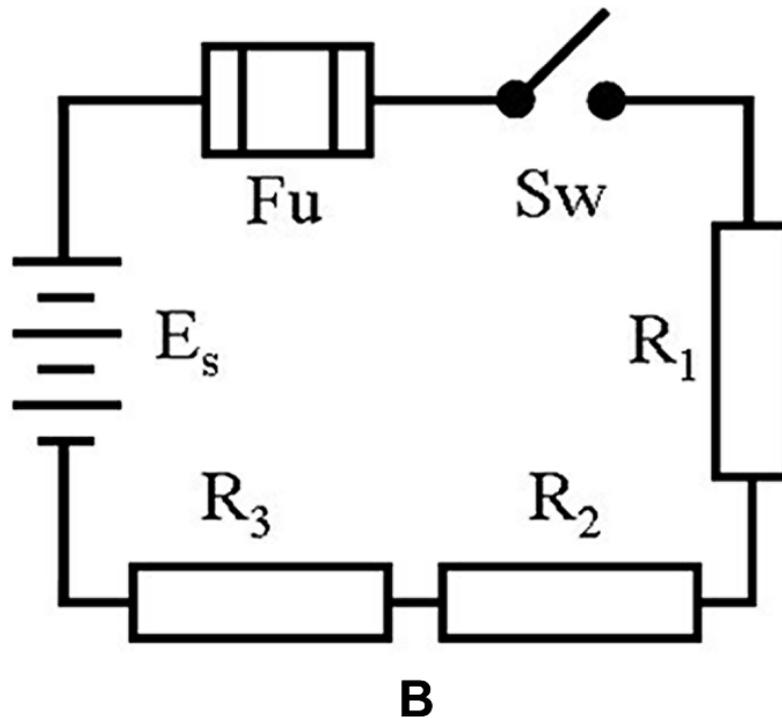
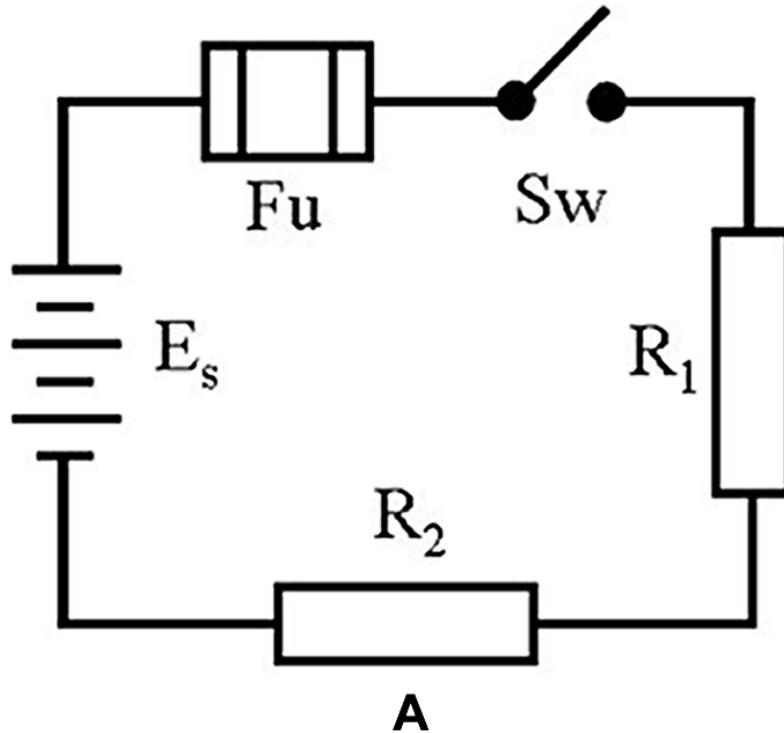
If choice C is selected set score to 1.

EL-0011



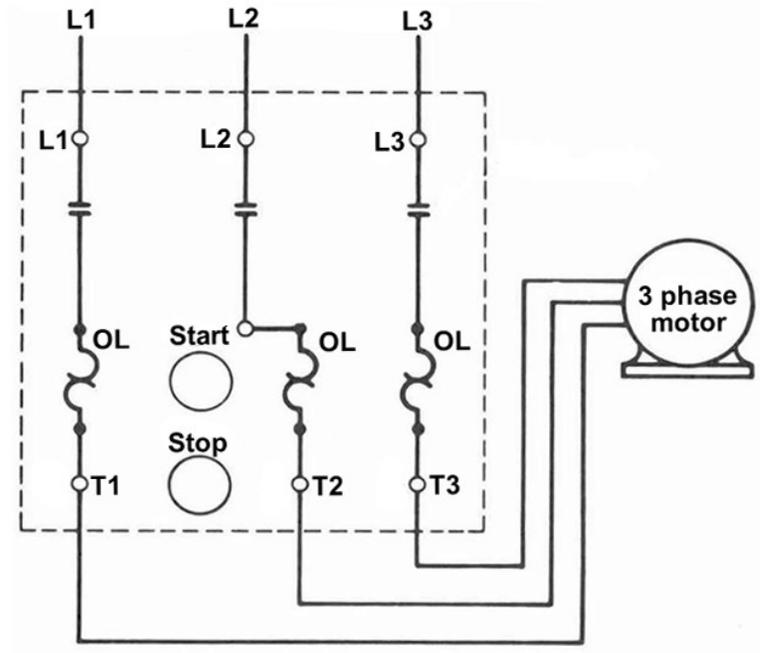
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EL-0020



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EL-0023



A



1



2



3

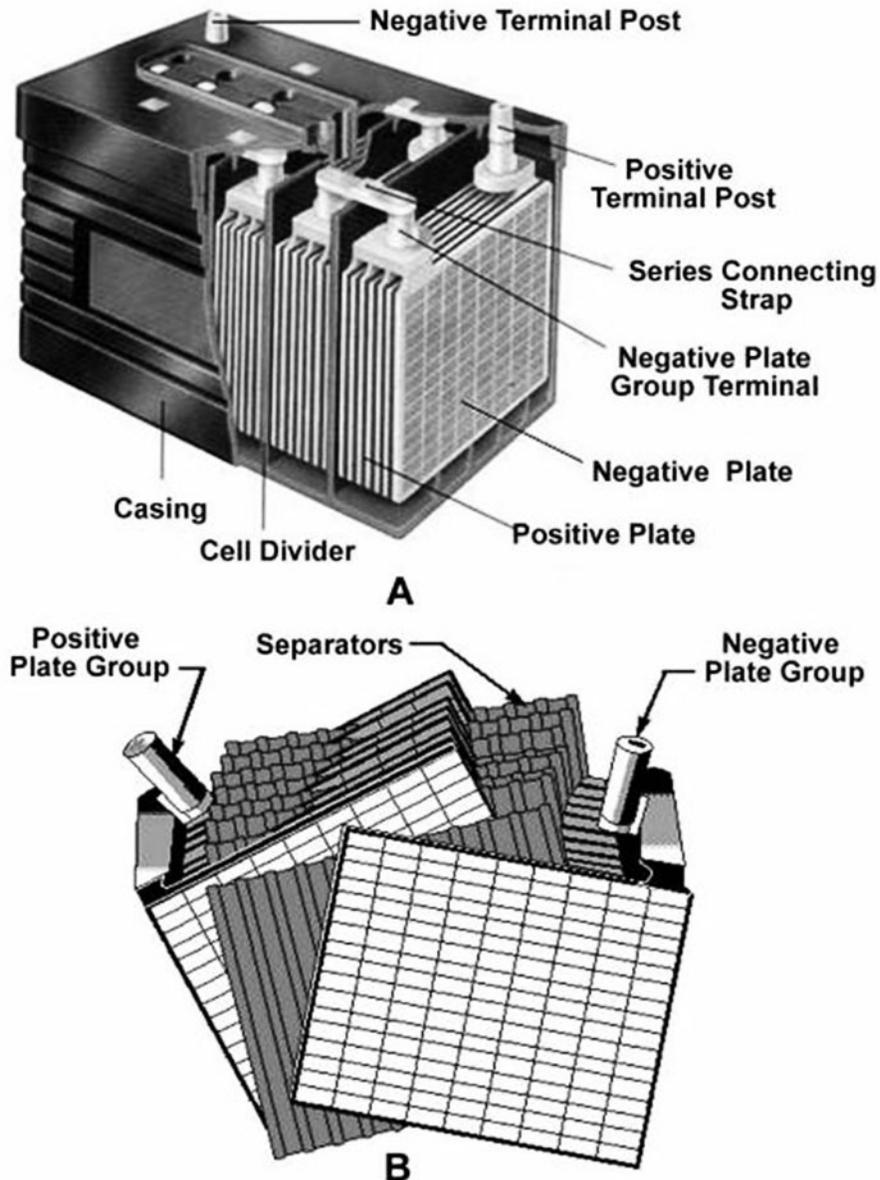


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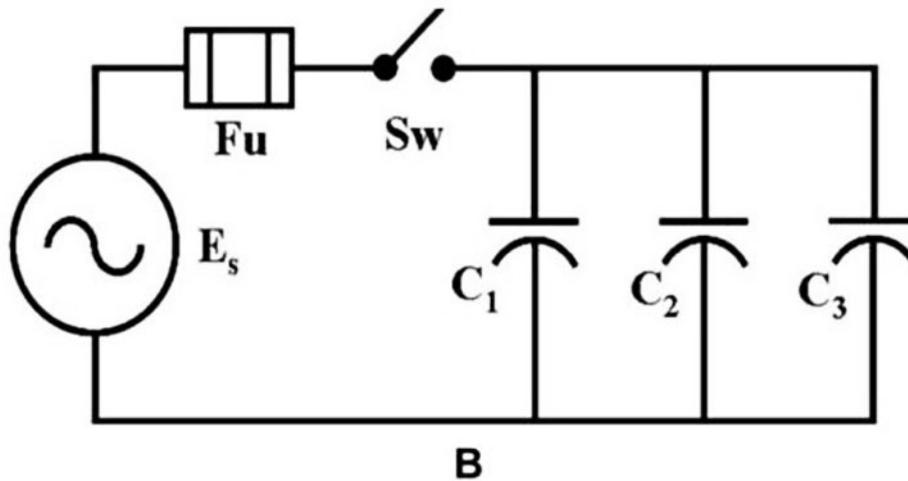
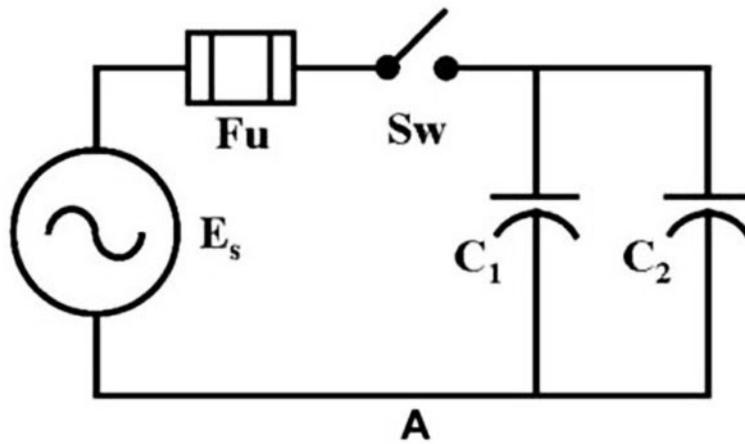
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EL-0031



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EL-0038



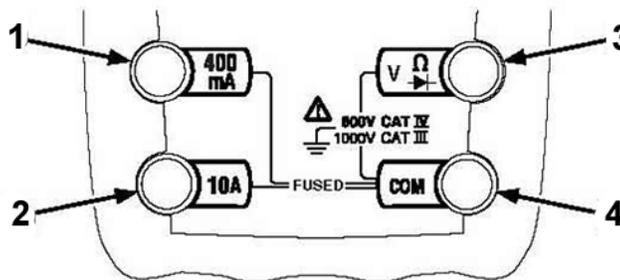
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EL-0047



Switch Position	Measurement Function
1	\tilde{V} Hz
2	\bar{V}
3	$m\bar{V}$
4	Ω ⎓
5	\tilde{V} ⎓
6	\bar{V} mA
7	\bar{V} ~A

B



C

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EL-0059



A



B



C



D



E



F



1



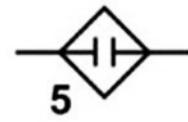
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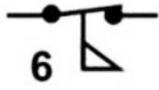
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4



5



6



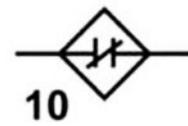
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8



9



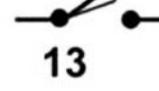
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11



12



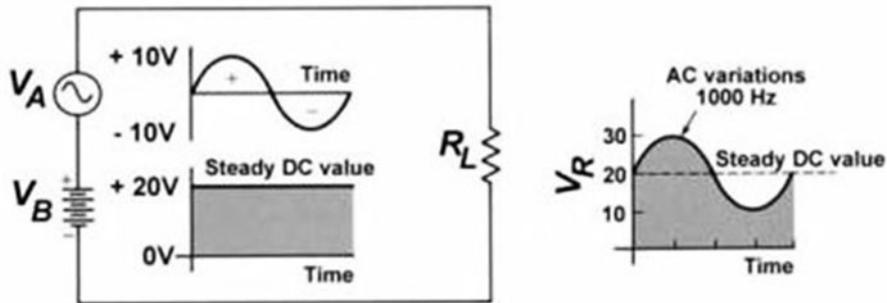
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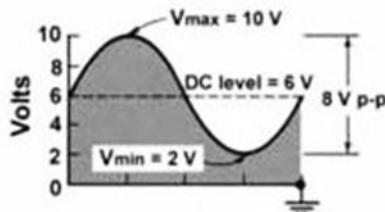
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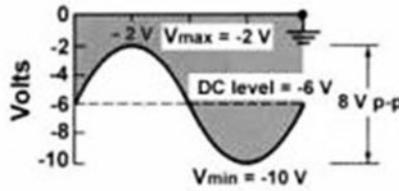


A

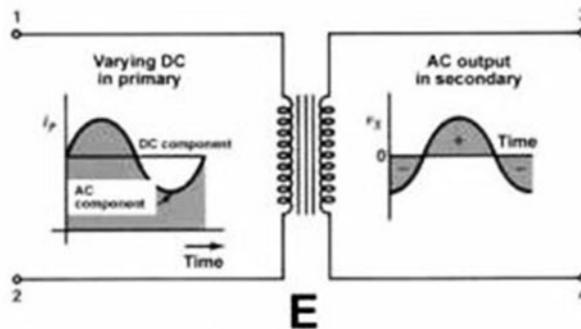
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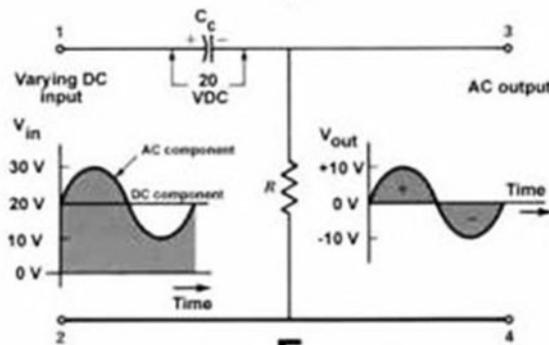
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D



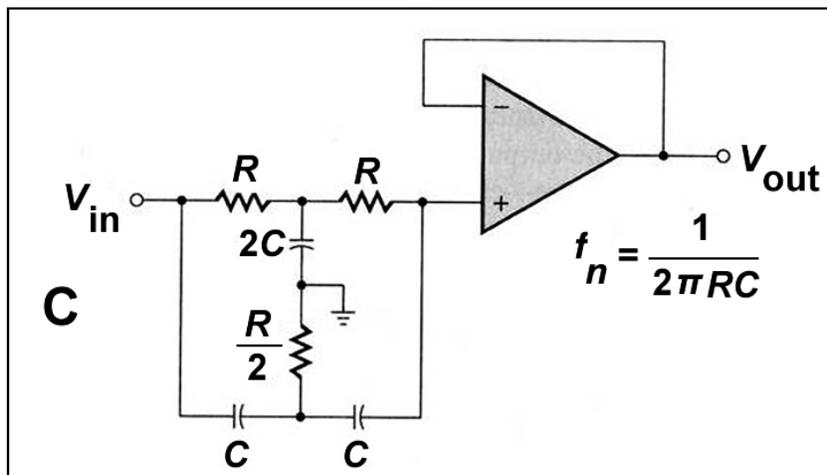
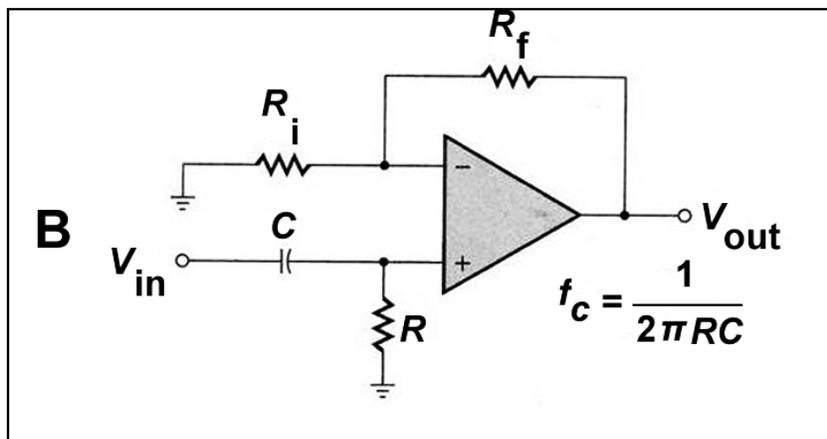
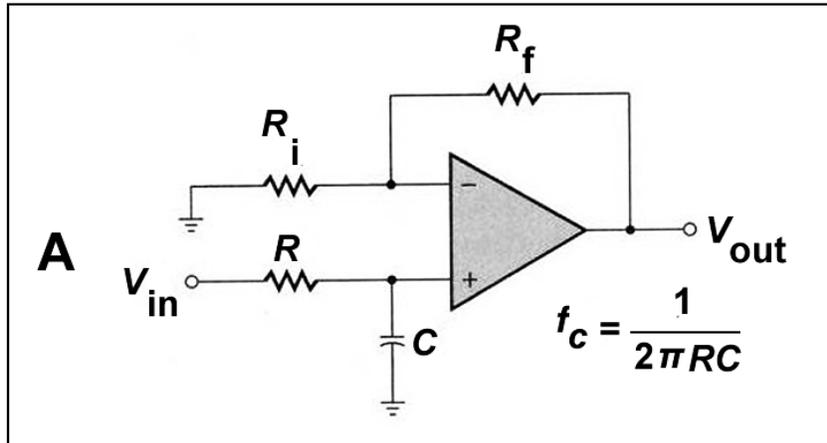
E



F

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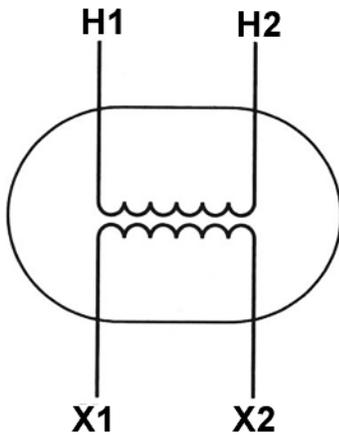


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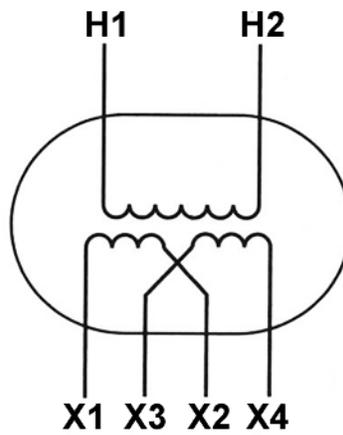
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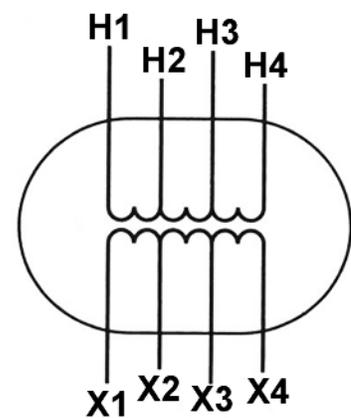
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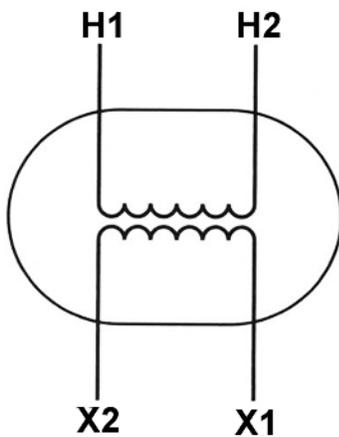
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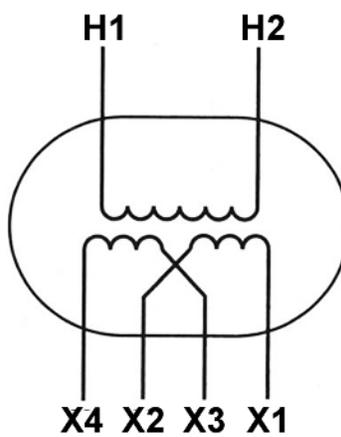
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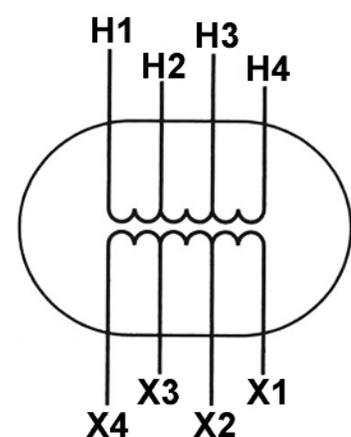
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D



E

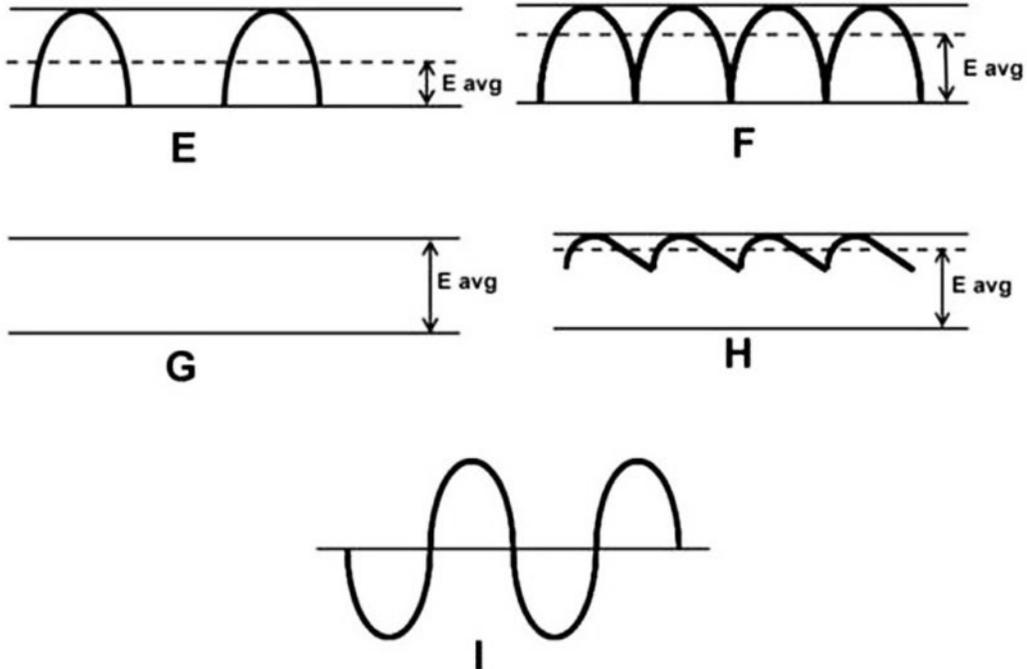
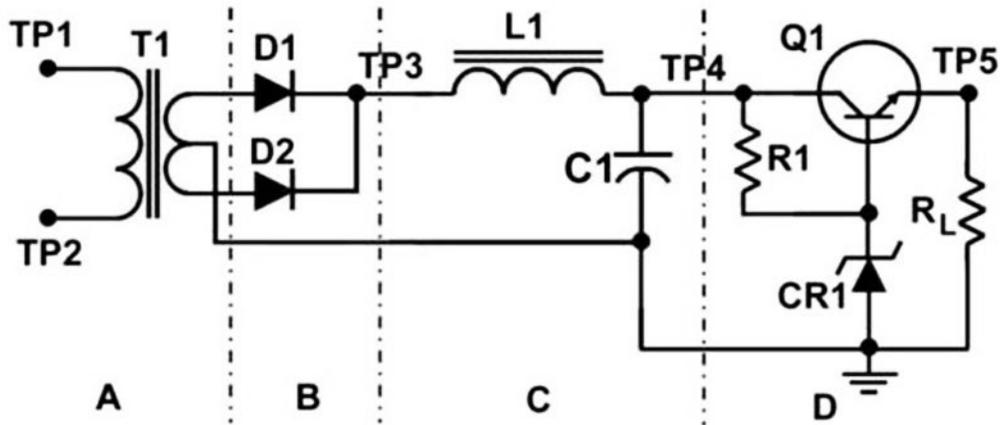


F

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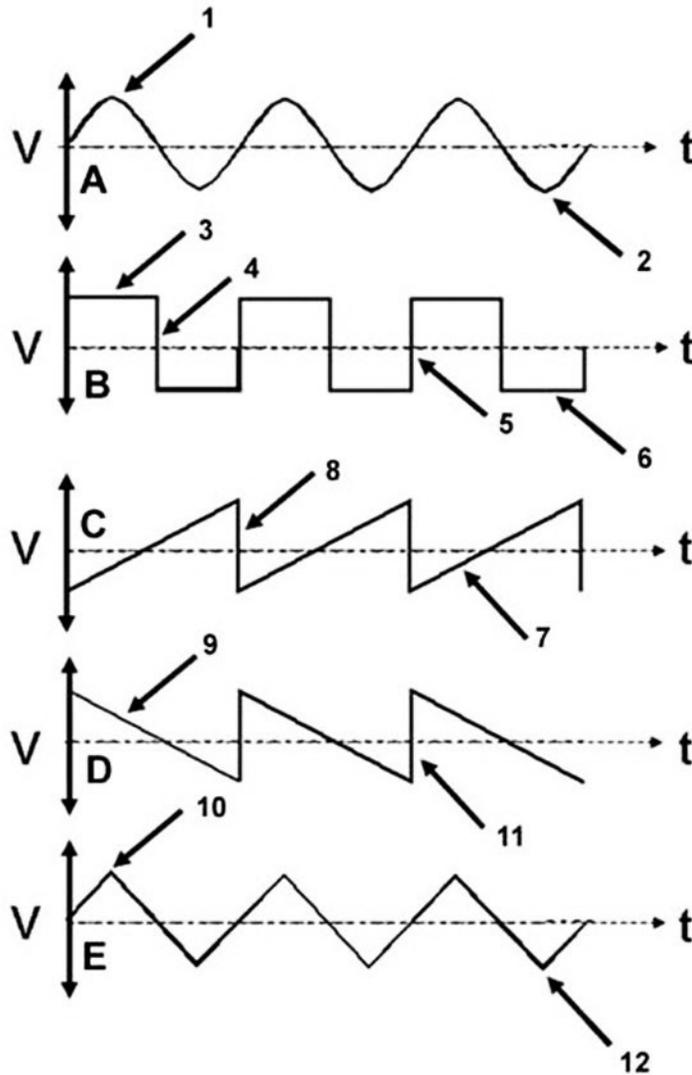
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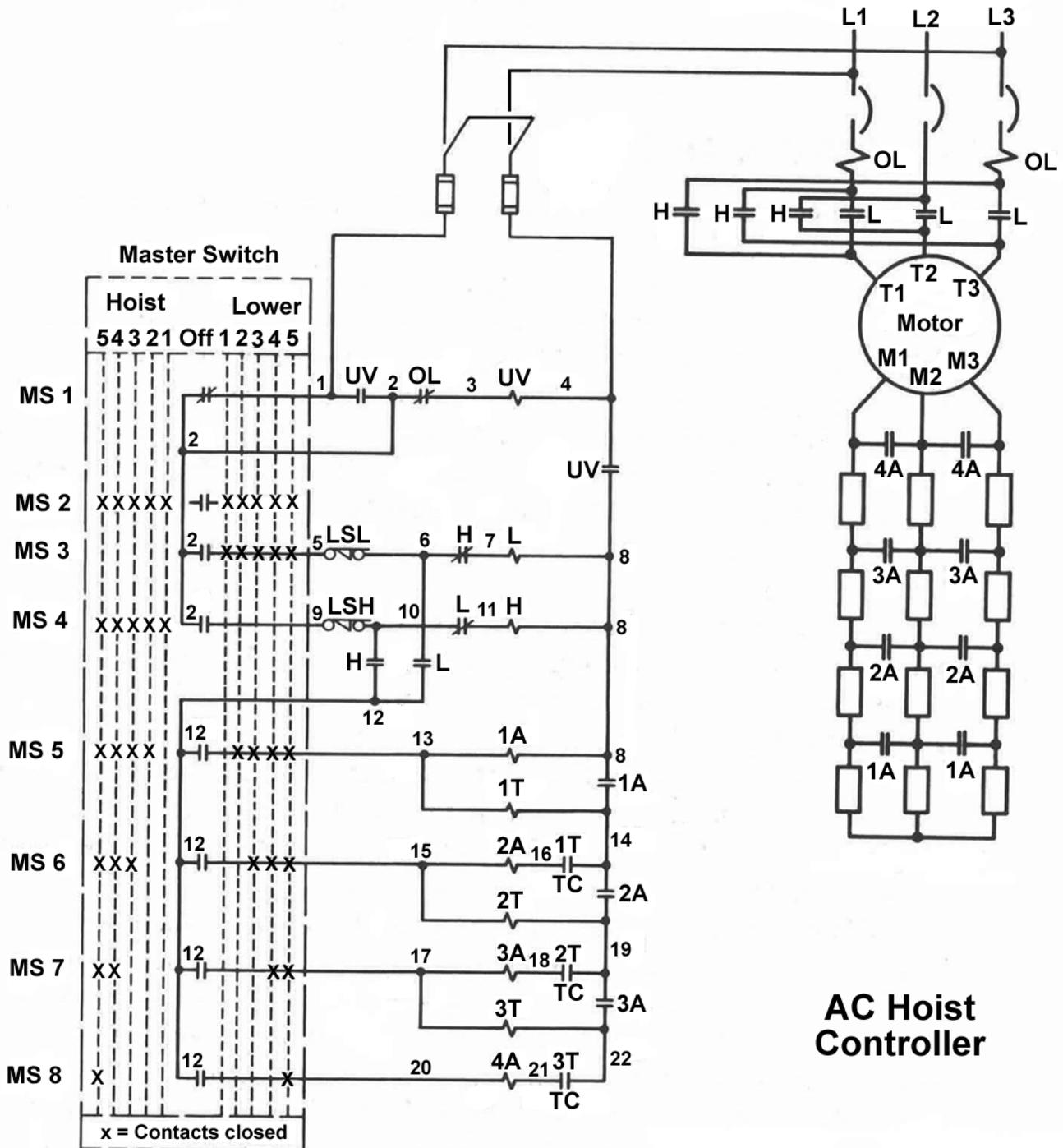
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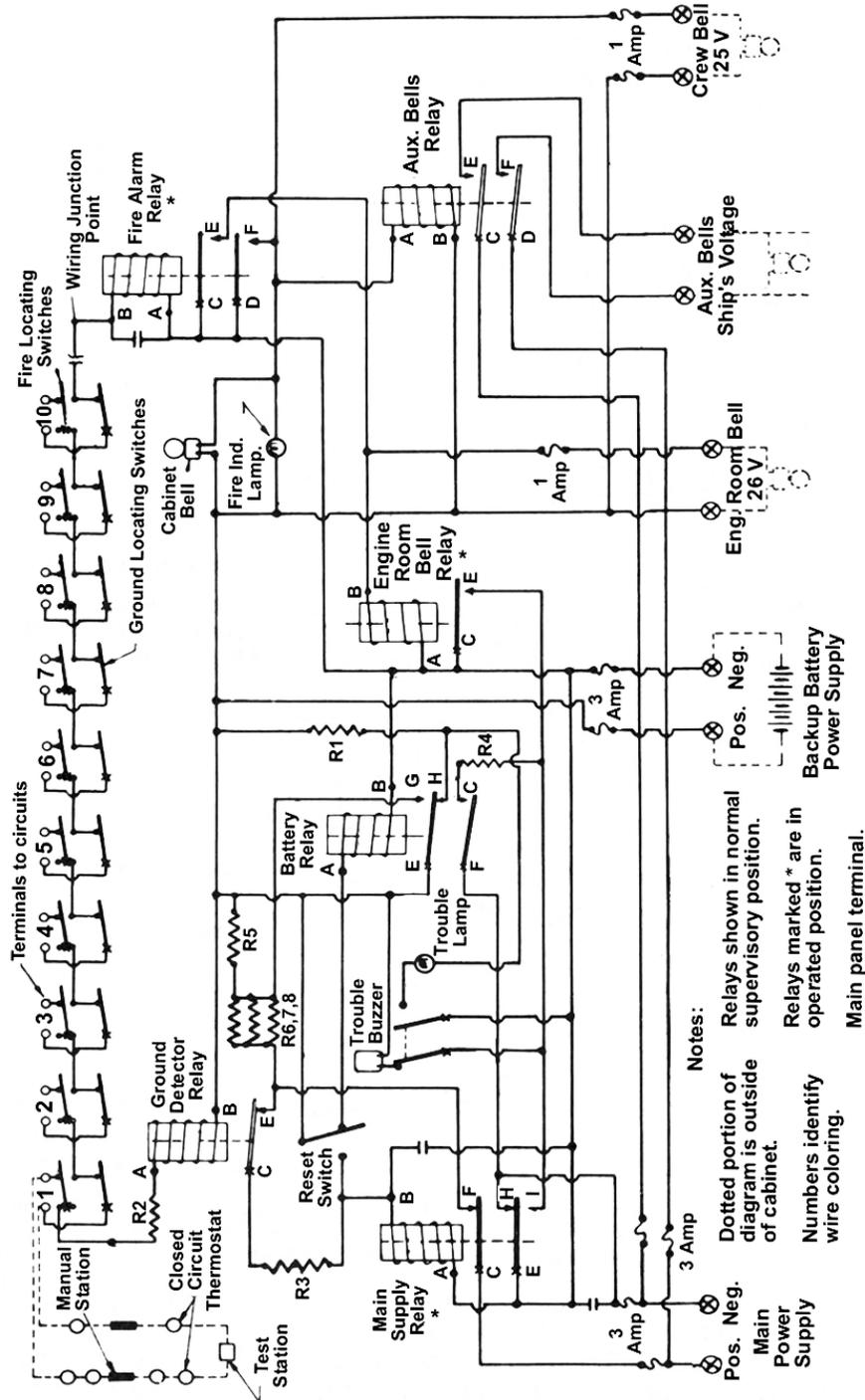


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EL-0114

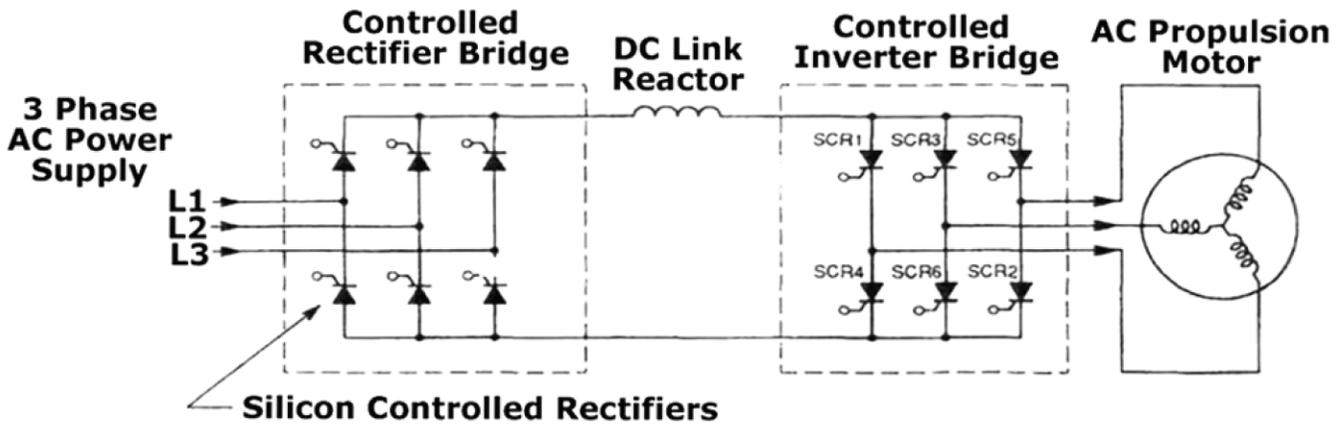
Fire Detection and Alarm System



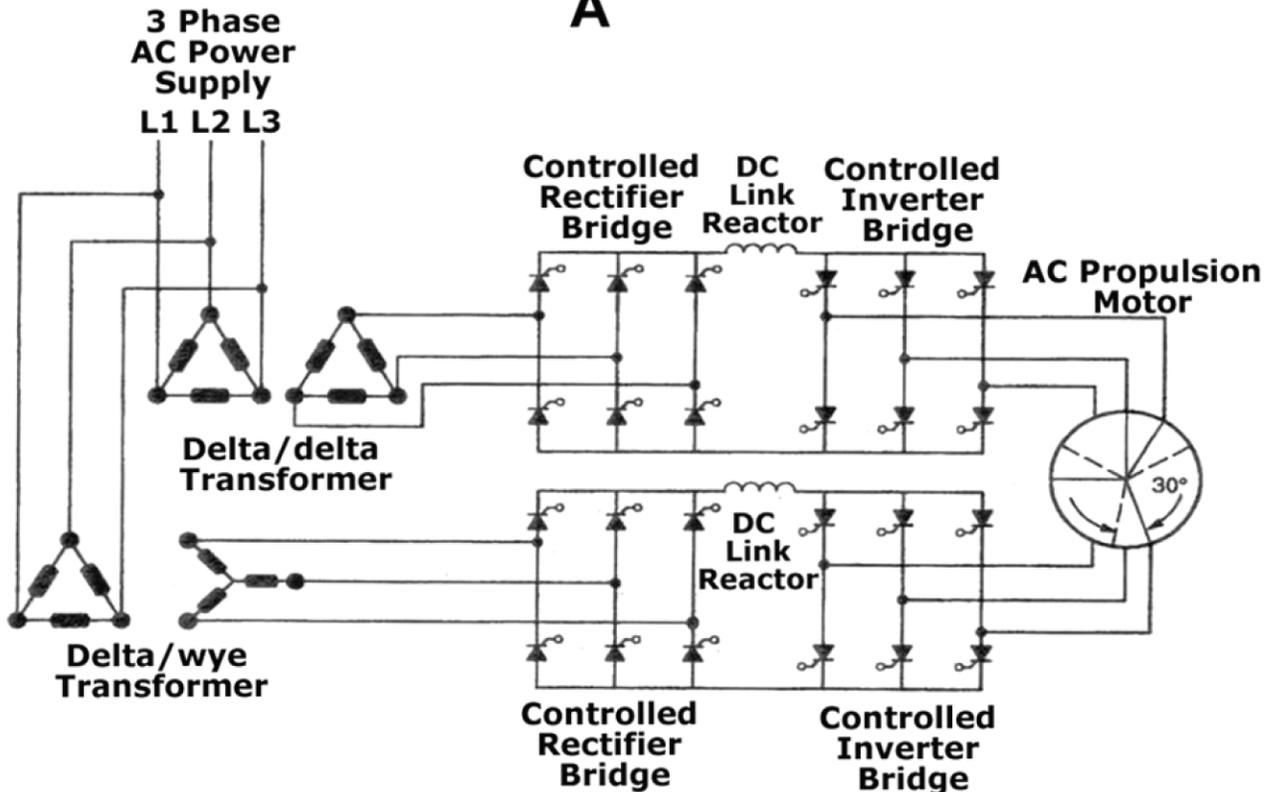
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EL-0159



A

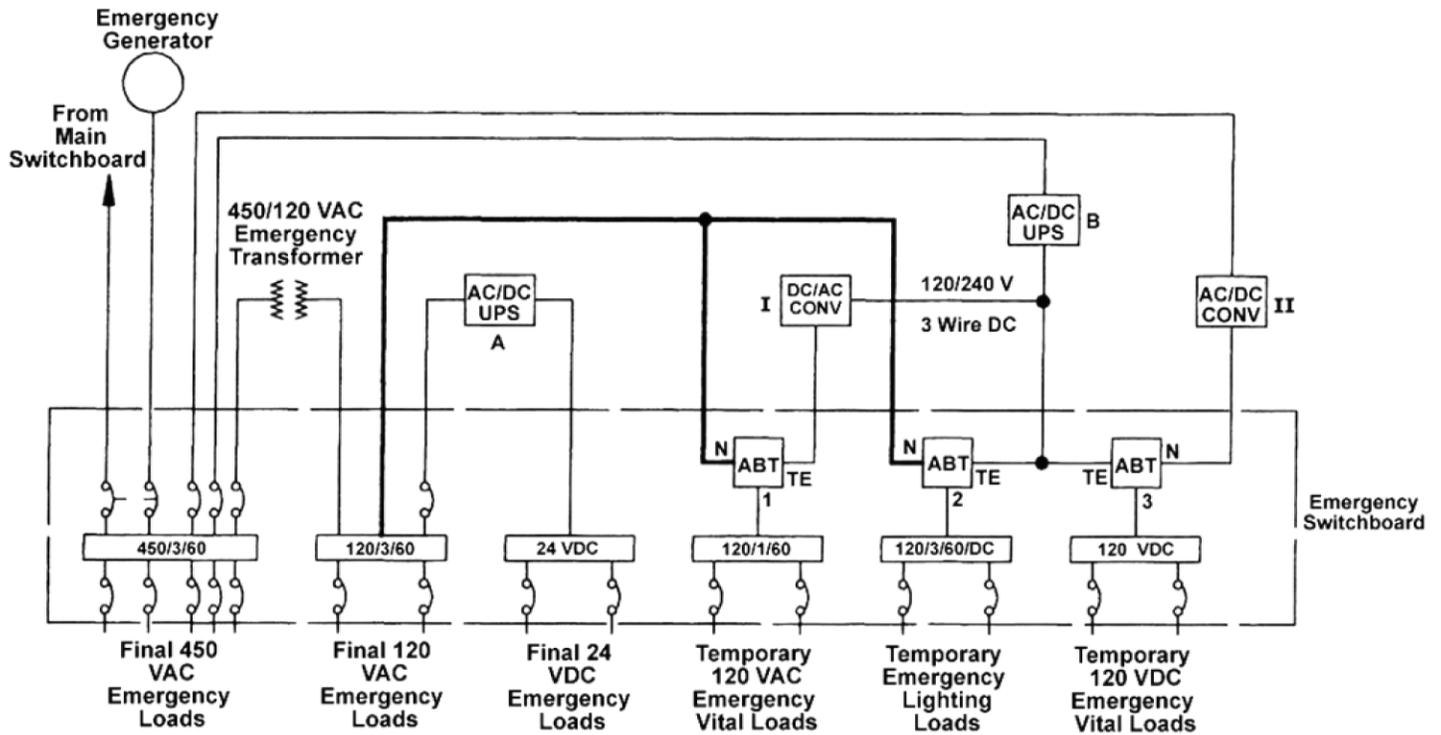


B

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EL-0166



Legend:

UPS: Uninterruptible Power Supply (Including Battery)

A - 120 VAC to 24 VDC

B - 450 VAC to 120/240 VDC

ABT: Automatic Bus Transfer Switch

1 - Transfers Vital AC Loads to UPS (B) via DC/AC Converter (I)

2 - Transfers Temporary Emergency Lighting to UPS (B)

3 - Transfers Vital DC Loads to UPS (B)

CONV: Converters

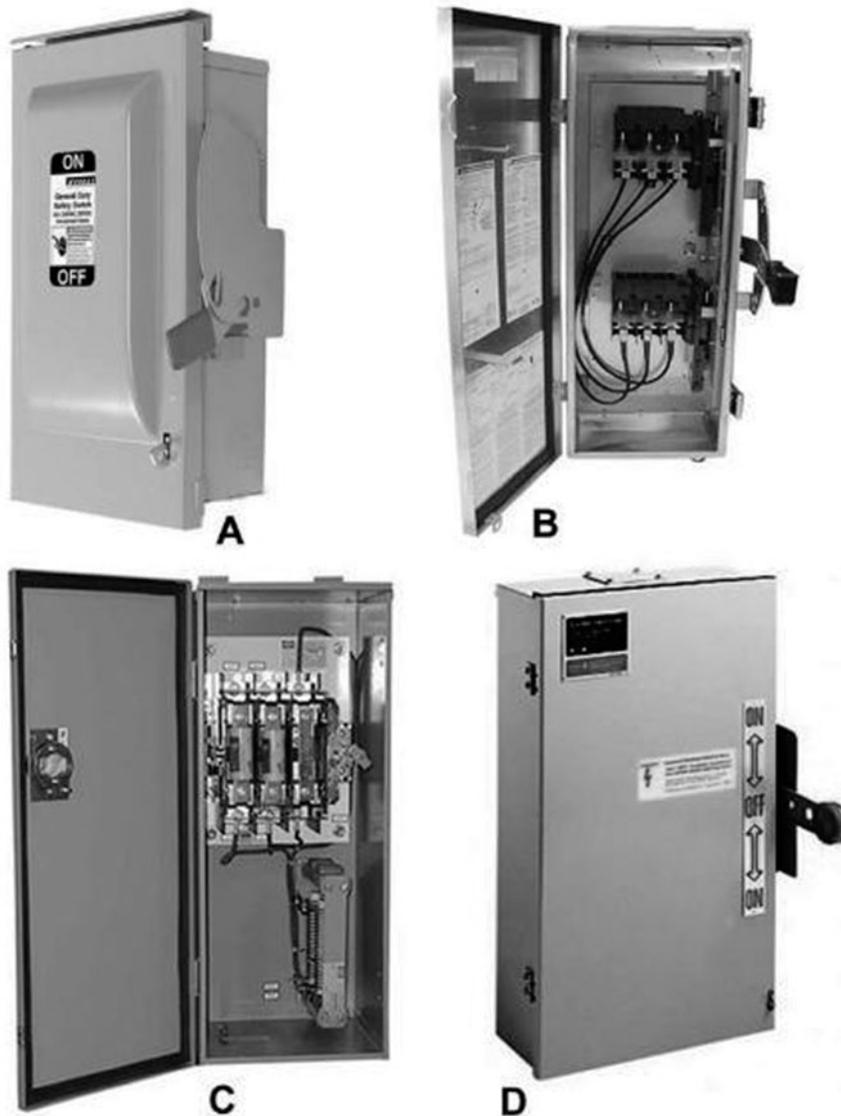
I - 240 VDC to 120 VAC

II - 450 VAC to 120VDC

N - Normal & Final Emergency Power Source

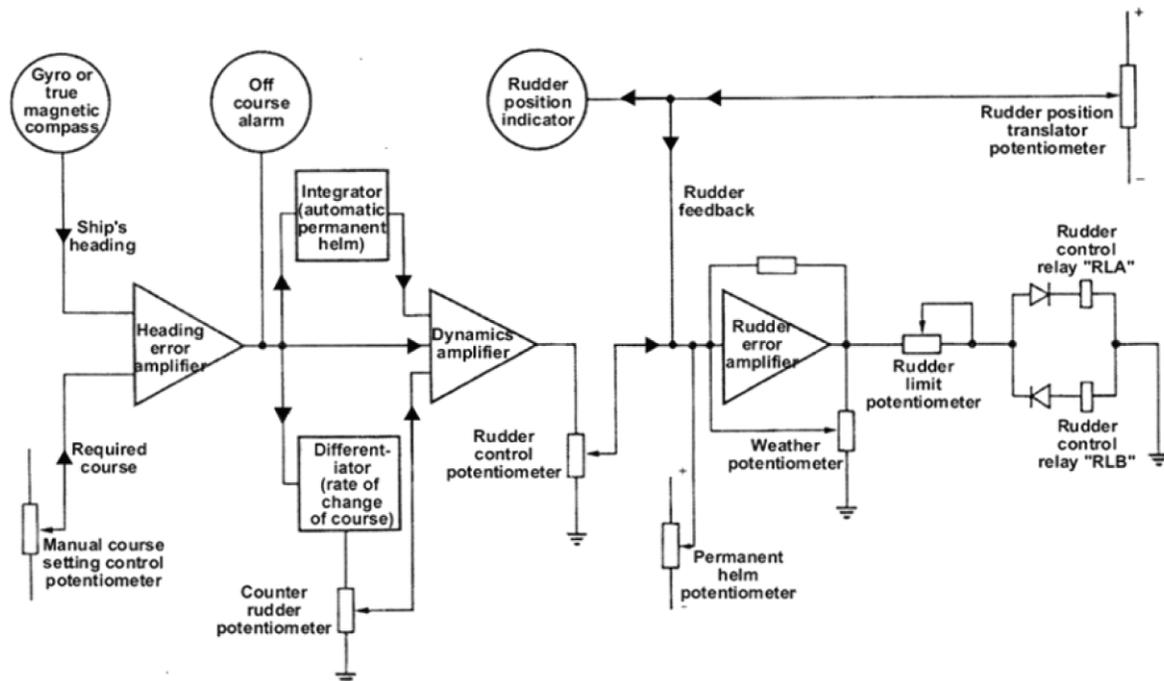
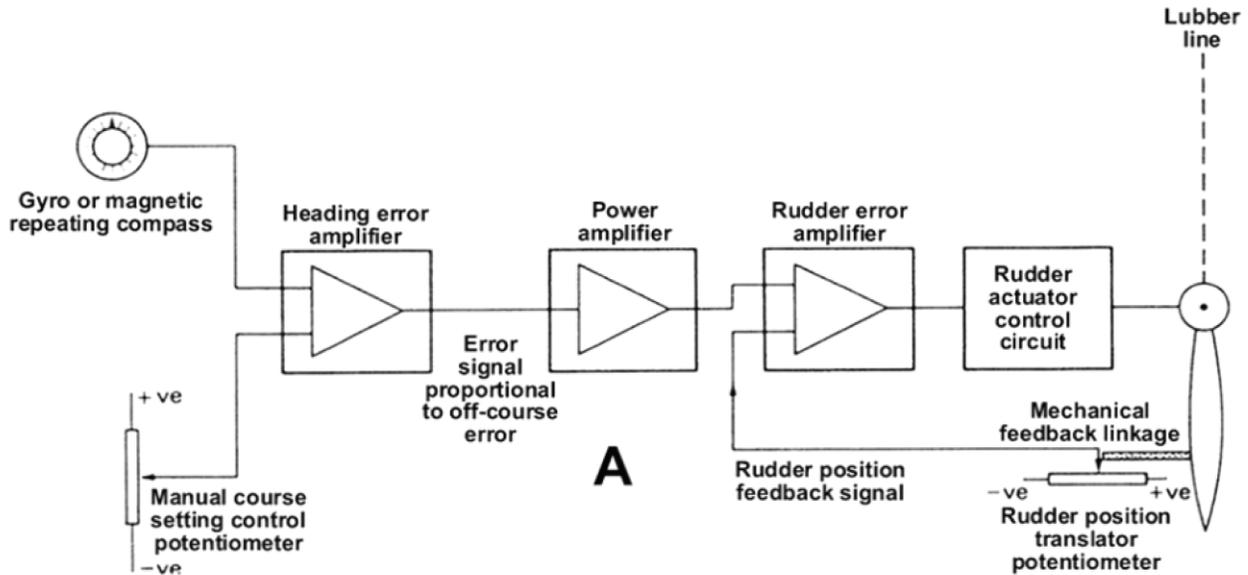
TE - Temporary Emergency Power Source

EL-0176



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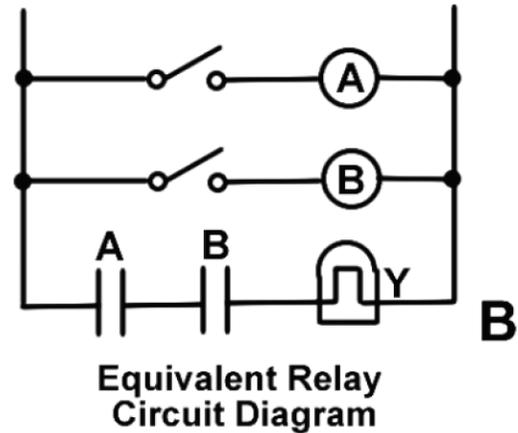
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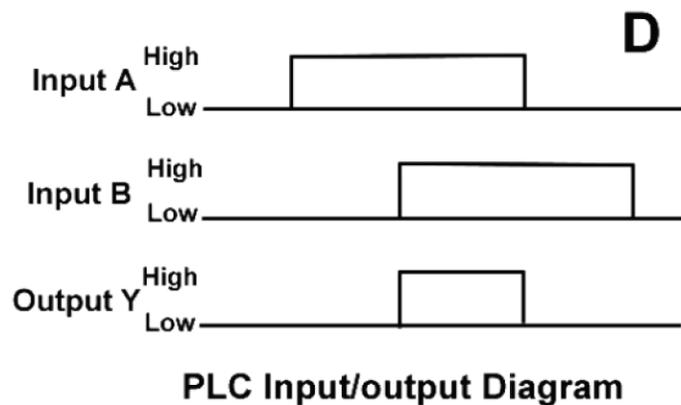
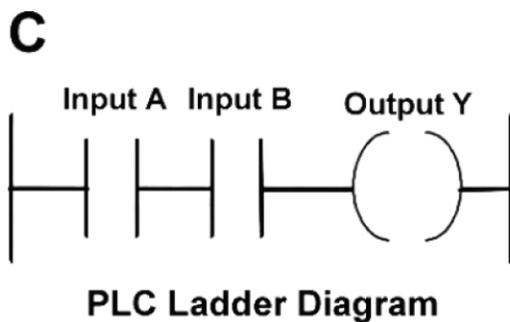
A

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Truth Table



Relay and PLC Logic Compared



Figures A and B

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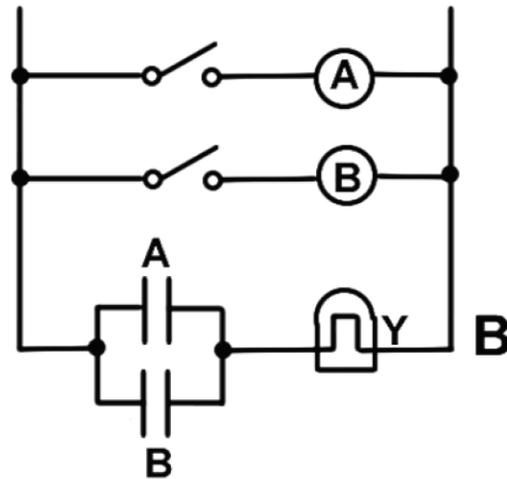
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EL-0227

A

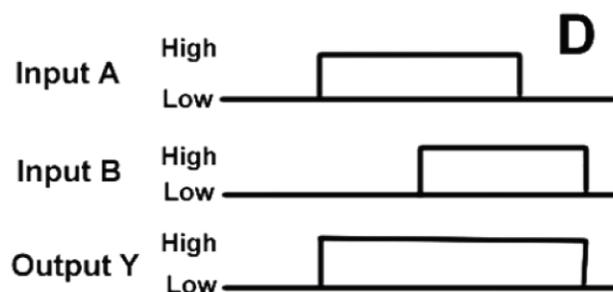
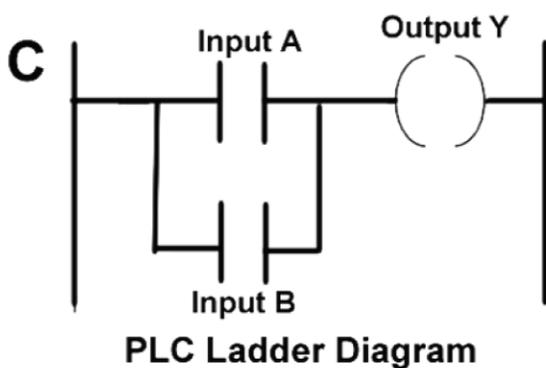
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

Truth Table



Equivalent Relay
Circuit Diagram

Relay and PLC Logic Compared



Figures A and B

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