

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. For the purpose of calculating line current, which of the following procedures should be used to determine the total line current of a three-phase, delta wound, AC generator?

- (A) Multiply the amperage in one phase by the square root of three.
- (B) Divide the total amperage in all phases by the square root of three.
- (C) Multiply the amperage in one phase by three.
- (D) Divide the total amperage in all phases by three.

If choice A is selected set score to 1.

2. 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 no impact on the total resistance. The sum of the resistances is the total resistance of the circuit.
- (C) 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.
- (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 B is selected set score to 1.

3. What statement is true concerning the total resistance of a parallel circuit?

- (A) The total resistance is less than that of the branch with the lowest resistance.
- (B) The total resistance is equal to the sum of the individual branch resistances.
- (C) The total resistance is larger than that of the branch with the greatest resistance.
- (D) The total resistance is equal to the sum of the individual branch resistances divided by the number of branches.

If choice A is selected set score to 1.

4. 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.

5. A resistance is added in series and internally with the analog meter movement of which of the following instruments?

- (A) AC frequency meter
- (B) AC ammeter
- (C) DC ammeter
- (D) DC voltmeter

If choice D is selected set score to 1.

6. In figure "2" of the diagram shown in the illustration, the three-phase step-down power transformer has a turns ratio of four to one. If a three-phase 480 volt supply is connected to terminals "A1-B1-C1", what voltage should develop across terminals "A2-B2-C2"? Illustration EL-0084

- (A) 69 volts
- (B) 120 volts
- (C) 208 volts
- (D) 277 volts

If choice B is selected set score to 1.

7. 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 wiring diagram.
- (C) The diagram is a pictorial drawing.
- (D) The diagram is a functional block diagram.

If choice D is selected set score to 1.

8. What is an ammeter used to measure?

- (A) current
- (B) voltage
- (C) resistance
- (D) continuity

If choice A is selected set score to 1.

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

If choice B is selected set score to 1.

10. What is the nominal output voltage of a 6 cell lead-acid battery?

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

If choice C is selected set score to 1.

11. Which type of AC single phase motor will also operate on direct current?

- (A) Split phase
- (B) Shaded-pole
- (C) Series-wound
- (D) Repulsion-start

If choice C is selected set score to 1.

12. What type of AC motor would use a rheostat in the rotor circuit to vary the speed of the motor?

- (A) squirrel-cage induction motor
- (B) wound-rotor induction motor
- (C) synchronous motor
- (D) regenerative braking motor

If choice B is selected set score to 1.

13. Which of the following is the only known perfect dielectric for the purpose of serving as electrical insulation?

- (A) vacuum
- (B) mica
- (C) ceramic
- (D) glass

If choice A is selected set score to 1.

- 14.** In preparing a battery-operated digital megohmmeter (resistance tester) for use, what statement is true?
- (A) The circuit or circuit component under test must be energized, AND the megohmmeter test voltage must be set to a value less than the equipment exposure voltage.
 - (B) The circuit or circuit component under test must be energized, AND the megohmmeter test voltage must be set to a value equal to or greater than the equipment exposure voltage.
 - (C) The circuit or circuit component under test must be de-energized, AND the megohmmeter test voltage must be set to a value less than the equipment exposure voltage.
 - (D) The circuit or circuit component under test must be de-energized, AND the megohmmeter test voltage must be set to a value equal to or greater than the equipment exposure voltage.

If choice D is selected set score to 1.

- 15.** The leads from an ohmmeter are attached to the leads of the opposite ends of an AC induction motor stator coil. If a reading of infinity (OL) is obtained, what does this indicate?
- (A) shorted stator coil
 - (B) open stator coil
 - (C) shunted stator coil
 - (D) grounded stator coil

If choice B is selected set score to 1.

- 16.** Contact with any energized electrical system conductor is potentially hazardous and precautions should be taken to prevent exposure. 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.

- 17.** Which of the following voltage testers would be associated with high quality, be safe to use, and minimize the electric shock hazard?
- (A) a voltage tester with a low input impedance and a higher voltage rating than any expected measured voltages
 - (B) a voltage tester with a low input impedance and a lower voltage rating than any expected measured voltages
 - (C) a voltage tester with a high input impedance and a voltage rating higher than any expected measured voltages
 - (D) a voltage tester with a high input impedance and a lower voltage rating than any expected measured voltages

If choice C is selected set score to 1.

18. If it becomes absolutely necessary to run an alternator at lower than 5% below its rated frequency, in terms of output voltage, what must be done?

- (A) The alternator output voltage must be maintained at the rated value for the alternator output voltage.
- (B) The alternator output voltage must be increased proportionately upward to compensate for the frequency decrease.
- (C) The alternator output voltage must be decreased proportionately downward with the frequency decrease.
- (D) Under no circumstances is it permissible to run an alternator at a frequency lower than 5% below its rated frequency.

If choice C is selected set score to 1.

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

- (A) dirty or pitted contacts
- (B) burned out operating coil
- (C) high ambient temperature
- (D) low motor starting torque

If choice A is selected set score to 1.

20. 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) sulfation of the plates due to consistent undercharging or leaving the battery in a discharged state
- (C) lime accumulation on both the positive and negative terminal posts
- (D) accumulation of sediment within the cells due to excessive overcharging and discharging

If choice D is selected set score to 1.

21. If the cooling water system is isolated for repairs, but in an operational emergency, it is still desirable to run the alternator pictured in figure "A" of the illustration, what must be done? Illustration EL-0037

- (A) The emergency air inlet panel and air outlet doors must be opened, but in doing so allows the alternator to be run at rated load.
- (B) The alternator may not be run without cooling water under any circumstances.
- (C) The emergency air inlet panel and air outlet doors must be opened and only then can the alternator be run, but at reduced load.
- (D) The emergency air inlet panel and air outlet doors must remain closed, which requires the alternator to be run only at reduced loads.

If choice C is selected set score to 1.

22. Why should battery rooms be well ventilated during the charging of lead-acid storage batteries?

- (A) highly flammable oxygen and hydrogen gases must not be allowed to accumulate
- (B) highly poisonous chlorine gas must not be allowed to accumulate
- (C) highly toxic sulfuric acid gas must not be allowed to accumulate
- (D) highly toxic lead gas must not be allowed to accumulate

If choice A is selected set score to 1.

23. What is the most reliable and preferred method for determining the state of charge of a wet cell NiCad battery while it is being charged?

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

If choice B is selected set score to 1.

24. Which of the illustrated motors has an open, drip-proof (ODP) motor enclosure? Illustration EL-0001

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

If choice C is selected set score to 1.

25. 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.

26. By what means is a synchronous motor started and brought nearly to synchronous speed?

- (A) By the use of interpoles, also known as commutating poles.
- (B) By the use of compensating windings, also known as starting windings.
- (C) By the use of starting capacitors, also known as condensers.
- (D) By the use of a squirrel-cage induction winding, also called an amortisseur winding.

If choice D is selected set score to 1.

27. Which of the following statements represents the main difference between an electromagnetic relay and an electromagnetic contactor as used in motor control and power circuits?

- (A) Contactors control current and relays control voltage.
- (B) Contactor contacts can handle heavier loads than relay contacts.
- (C) A relay is series connected and a contactor is parallel connected.
- (D) Contactor contacts are made from silver and relay contacts are made from copper.

If choice B is selected set score to 1.

28. Which of the following pictures represents a magnetic reversing or two-speed motor starter?

Illustration EL-0179

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

If choice D is selected set score to 1.

29. What is the name of the device that works in conjunction with an automatic voltage regulator and is used as the source of magnetizing direct current delivered to the rotating field of an AC generator?

- (A) exciter
- (B) alternator
- (C) governor
- (D) magnetizer

If choice A is selected set score to 1.

30. How are fuses usually rated?

- (A) watts only
- (B) amps only
- (C) volts and amps only
- (D) volts, amps, and interrupting capacity

If choice D is selected set score to 1.

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

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

If choice C is selected set score to 1.

32. If the illustrated device in figure "B" has a step-up ratio of 10 to 1 what voltage would be measured at the secondary shortly after the primary of the device is connected to 110 volts DC and the primary current stabilized with a current of 12 amps? Illustration EL-0055

- (A) 0 volts
- (B) 110 volts
- (C) 1000 volts
- (D) 1100 volts

If choice A is selected set score to 1.

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

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

If choice C is selected set score to 1.

34. 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.

35. Which of the substances listed can be used to shield sensitive equipment from static magnetic fields?

- (A) Glass
- (B) Mica
- (C) Bakelite
- (D) Iron

If choice D is selected set score to 1.

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

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

If choice C is selected set score to 1.

37. What is the functional purpose of the Zener diode "CR1" as shown in section "D" of the regulated DC power supply? Illustration EL-0085

- (A) aids in output voltage regulation
- (B) corrects power factor
- (C) is a temperature compensator
- (D) prevents excessive currents

If choice A is selected set score to 1.

38. In referring to the frequency response filters shown in the illustration, what determines the band pass or band stop frequencies as appropriate? Illustration EL-0078

- (A) The value of the RC time constant
- (B) The value of the resonant frequencies associated with L and C
- (C) The magnitude of the incoming voltage
- (D) The value of the total load resistance

If choice B is selected set score to 1.

39. How are operational amplifiers, used primarily in analog circuits, characterized?

- (A) low input impedance, low gain and high output impedance
- (B) high input impedance, high gain and low output impedance
- (C) high input impedance, high gain and high output impedance
- (D) low input impedance, high gain and low output impedance

If choice B is selected set score to 1.

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

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

If choice D is selected set score to 1.

41. Referring to figure "2" of the illustration, what type of logic gate is symbolized? Illustration EL-0035

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

If choice D is selected set score to 1.

42. Ships requiring extremely rapid maneuvering response using propeller shaft speed and direction as the sole means of controlling propeller thrust are most likely to use what type of drive system?

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

If choice A is selected set score to 1.

43. Which statement is TRUE concerning electric propulsion drives?

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

If choice C is selected set score to 1.

44. The propulsion motor most often utilized in an AC drive system operating in the moderate to high power range is of what type?

- (A) squirrel-cage induction type
- (B) split-phase induction type
- (C) synchronous type with wound field
- (D) wound rotor induction type

If choice C is selected set score to 1.

45. By what common means is the speed of an AC propulsion motor on a diesel-electric propulsion ship controlled?

- (A) by varying either the input voltage or frequency to the motor, but not both
- (B) by varying the input frequency to the motor, but not the voltage
- (C) by varying the input voltage to the motor, but not the frequency
- (D) by varying both the input frequency and voltage to the motor

If choice D is selected set score to 1.

46. What statement is TRUE concerning podded azimuthing propulsors?

- (A) It is an electric drive system using water jets.
- (B) It is an electric drive system that incorporates a DC motor.
- (C) It is an electric drive system in which the motor drives a controllable-pitch propeller (CPP).
- (D) It is an electric drive system where the propulsion motor is installed in a submerged housing capable of swiveling.

If choice D is selected set score to 1.

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

If choice B is selected set score to 1.

48. 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 before and after the circuit to be worked upon is tested.
- (B) The live-line tester should be checked by connecting to a known high voltage source only before testing the circuit to be worked upon.
- (C) The live-line tester should be checked by connecting to a known high voltage source only after testing the circuit to be worked upon.
- (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 A is selected set score to 1.

49. Assuming the vessel has an engine control room, where is an engineers' assistance-needed alarm required to produce an audible signal?

- (A) The crew's and officers' mess
- (B) The engineers' accommodation spaces
- (C) The engine room/machinery space
- (D) The wheelhouse/navigational bridge

If choice B is selected set score to 1.

50. A bearing temperature monitoring system such as that used for measuring selected propulsion plant bearings uses what technology?

- (A) self-powered thermocouples (TC)
- (B) self-powered resistance temperature detectors (RTD)
- (C) externally powered thermocouples (TC)
- (D) externally powered resistance temperature detectors (RTD)

If choice D is selected set score to 1.

51. As shown in the illustrated block diagram for a distributed automation system, what statement is true concerning the workstations labeled "LOS" associated with the port power management system?
Illustration EL-0096

- (A) These are local operating system workstations that allow local control of processes related to the operation and control of all functions within the engineering plant.
- (B) These are local operating system workstations that allow local control of processes related to the operation and control of the port generator.
- (C) These are lube oil system workstations that allow local control of processes related to the lubrication of the port generators.
- (D) These are lube oil system workstations that allow local control of processes related to the lubrication of all machinery within the engineering plant.

If choice B is selected set score to 1.

52. Modern ships use multiple computers arranged in a client/server network to perform various shipboard functions. What type of computer network would most likely be used aboard ship?

- (A) Wireless wide area network
- (B) Wired local area network
- (C) Wireless local area network
- (D) Wired wide area network

If choice B is selected set score to 1.

53. When regreasing the electric motor bearing as shown in figure "B" of the illustration, what practice should be avoided? Illustration EL-0218

- (A) Completely filling the bearing cavity with new grease.
- (B) Only partially filling the bearing cavity with new grease.
- (C) Flushing out the old grease with an approved solvent.
- (D) Flushing out the old grease while running the motor with no load.

If choice A is selected set score to 1.

54. What would be the indication of a grounded switch or cable as measured by a megohmmeter?

- (A) "zero"
- (B) being unsteady in the low range
- (C) being unsteady in the high range
- (D) infinity

If choice A is selected set score to 1.

55. Referring to the illustration pertaining to an alternator protection and alarm system, what statement is true concerning the component labeled "LO"? Illustration EL-0067

- (A) LO is an alternator prime mover low lube oil pressure safety shutdown and alarming device.
- (B) LO is an alternator phase loss safety shutdown and alarming device.
- (C) LO is an alternator electrical fault trip master lock-out and alarm device.
- (D) LO is an alternator bearing low lube oil pressure safety shutdown and alarming device.

If choice C is selected set score to 1.

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

If choice A is selected set score to 1.

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

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

If choice B is selected set score to 1.

58. As shown in the illustration, what is responsible for maintaining the "UV" relay energized when the master switch handle is moved away from the "off" position? Illustration EL-0102

- (A) normally closed "OL" contact
- (B) "MS 2" contact
- (C) "MS 1" contact
- (D) normally open "UV" sealing contact

If choice D is selected set score to 1.

59. As shown in the illustration, how are the rotor windings (terminating as marked motor leads M1, M2, and M3) of the motor configured? Illustration EL-0102

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

If choice B is selected set score to 1.

60. In figure "1" of the illustration, what type of circuit breaker trip element is featured? Illustration EL-0033

- (A) ambient compensated trip
- (B) shunt trip
- (C) thermal trip
- (D) magnetic trip

If choice C is selected set score to 1.

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

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

If choice B is selected set score to 1.

62. Which of the listed battery charging circuits is used to maintain a wet cell, lead-acid, storage battery in a fully charged state during long periods of disuse?

- (A) High ampere charging circuit
- (B) Quick charging circuit
- (C) Trickle charging circuit
- (D) Normal charging circuit

If choice C is selected set score to 1.

63. 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) Both plates change chemically to lead sulfate.
- (D) Oxygen gas is absorbed.

If choice B is selected set score to 1.

64. When an alternator is to remain idle for even a few days, what should be ensured or manually accomplished?

- (A) manually open the equalizing bus disconnect switch as required
- (B) manually lift the brushes and disconnect the pigtailed if applicable
- (C) insulate the collector rings with strips of cardboard if applicable
- (D) ensure energization the space heater circuit (usually automatic)

If choice D is selected set score to 1.

65. Rotor-to-stator air gap readings should be periodically taken for electrical generation equipment. What is the best tool to use to take these measurements?

- (A) tapered, long blade, feeler gage
- (B) dial indicator
- (C) cloth (non-metallic) tape measure
- (D) inside micrometer

If choice A is selected set score to 1.

66. Which of the following methods should be used to dress the face of silver-plated contacts?

- (A) Burnishing with a burnishing tool
- (B) Sanding with 400 grit sandpaper
- (C) Filing with a mill file
- (D) Knurling with a knurling tool

If choice B is selected set score to 1.

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

If choice C is selected set score to 1.

68. When you are making a high potential test (insulation resistance) on the motor coils of repaired electrical machinery to ground, what would a low resistance reading indicate?

- (A) bad insulation
- (B) high insulation power factor
- (C) good insulation
- (D) a high slot discharge factor

If choice A is selected set score to 1.

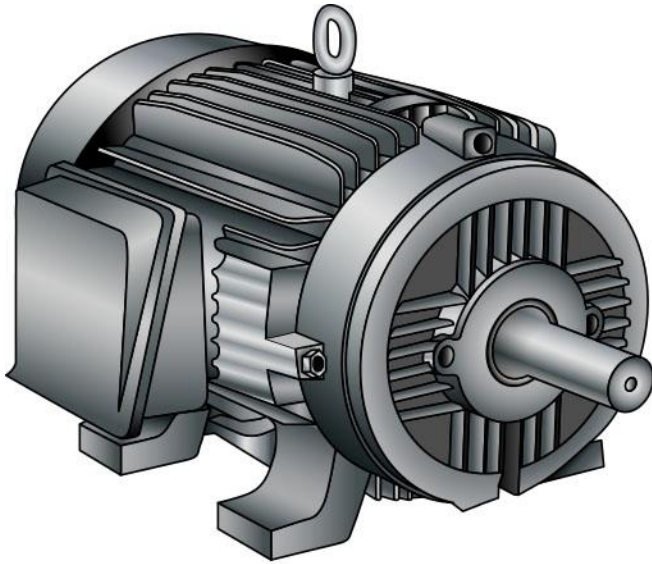
- 69.** Large machines undergoing a resistance insulation testing using a megohmmeter should be discharged to remove any accumulated electrostatic/capacitive/dielectric-absorption charge stored. When should this discharge be performed?
- (A) while performing the insulation resistance check only
 - (B) prior to conducting the insulation resistance check only
 - (C) after conducting the insulation resistance check only
 - (D) prior to and after conducting the insulation resistance check

If choice D is selected set score to 1.

- 70.** Referring to the containership one-line distribution diagram shown in the illustration, what is the purpose of the transformers providing power to the refrigerated container feeder bus? Illustration EL-0014
- (A) Step up the voltage from the 450 VAC main bus to the voltage required for the refrigerated container feeder bus.
 - (B) Reduce the kVA loading on the 450 VAC main distribution system main switchboard.
 - (C) Step down the voltage from the 450 VAC main bus to the voltage required for the refrigerated container feeder bus.
 - (D) Prevent any unintentional grounds in the refrigerated container distribution system from affecting the 450 VAC main distribution system.

If choice D is selected set score to 1.

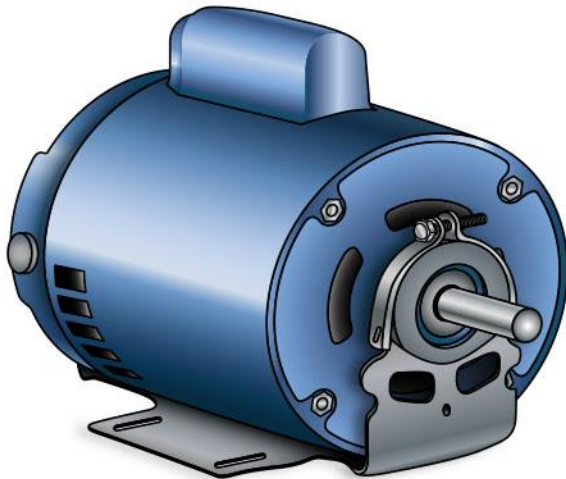
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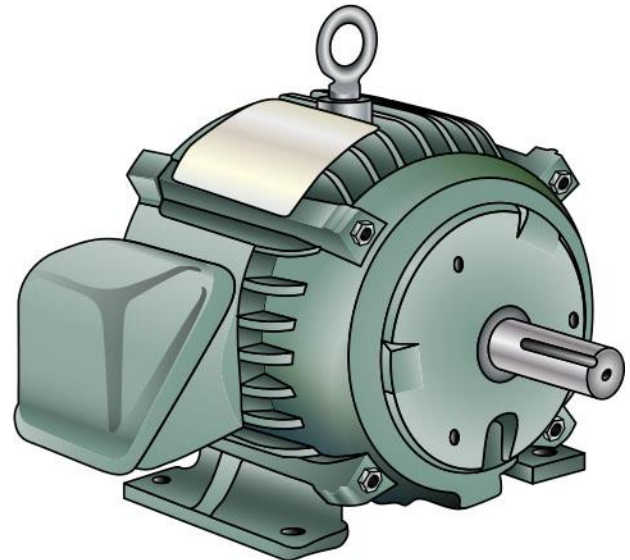
A



B



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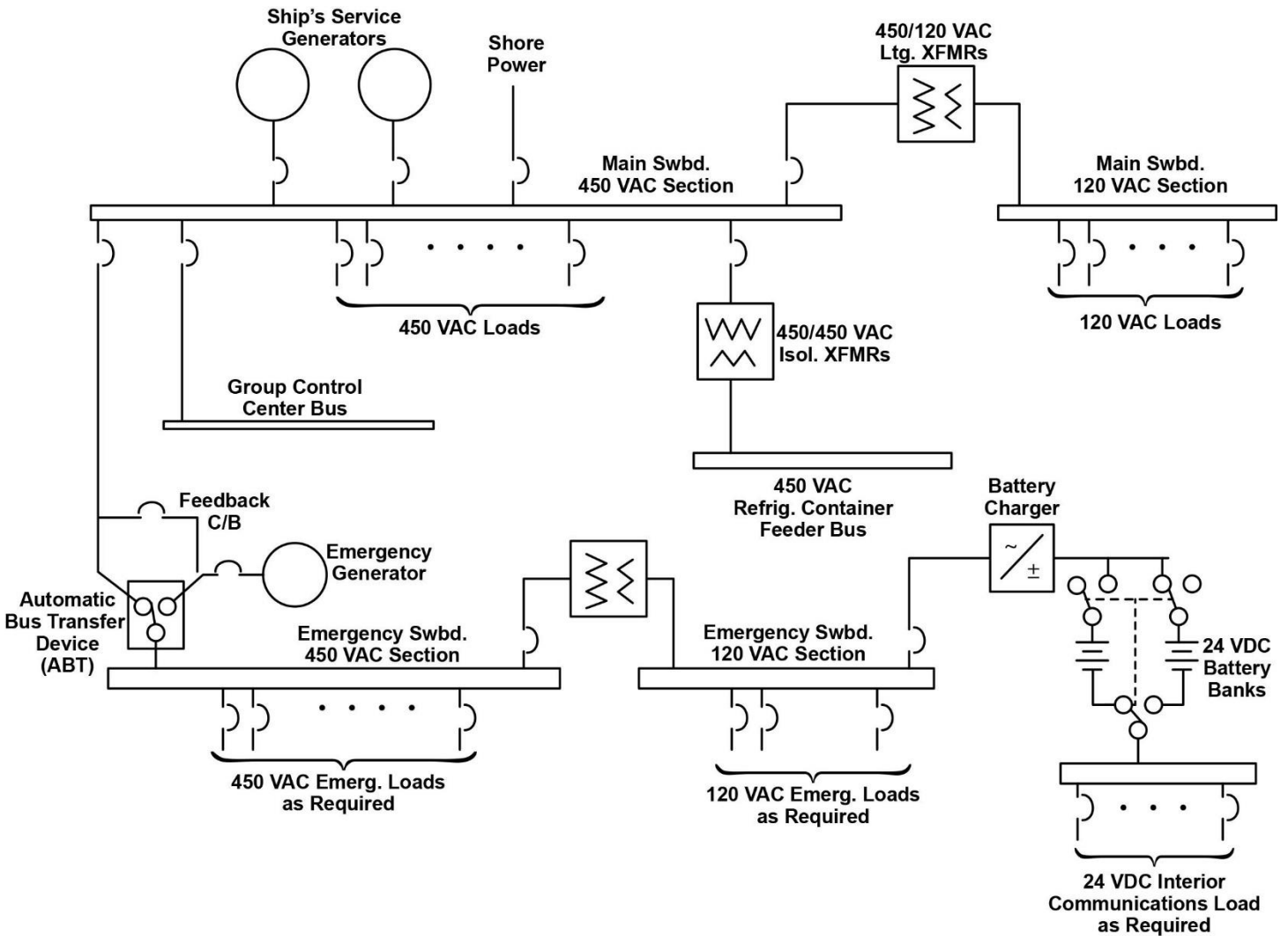
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EL-0014

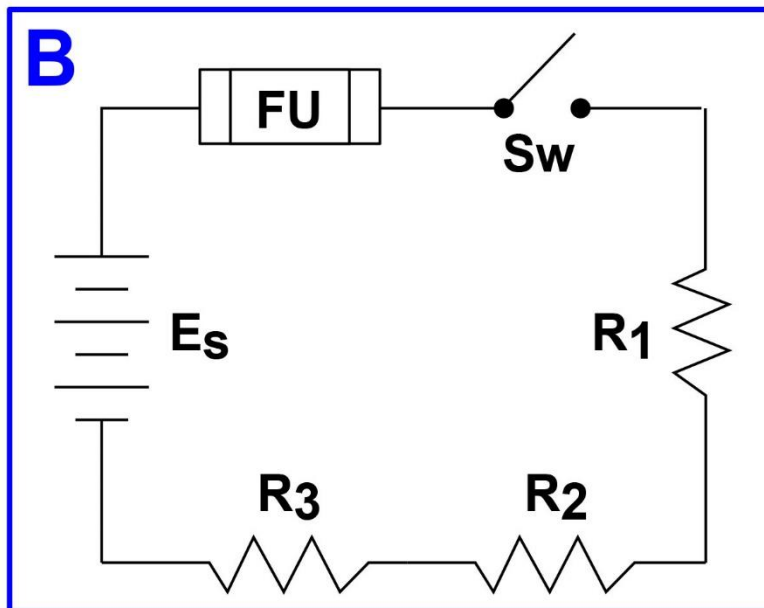
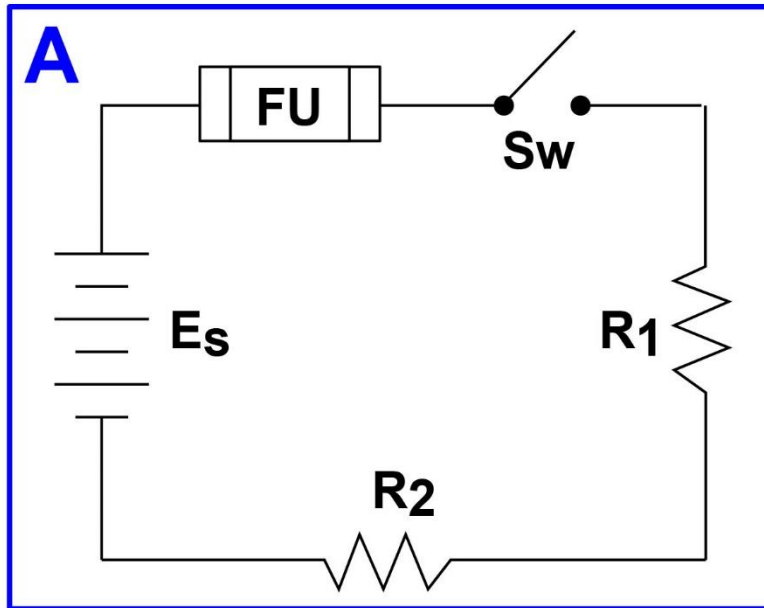


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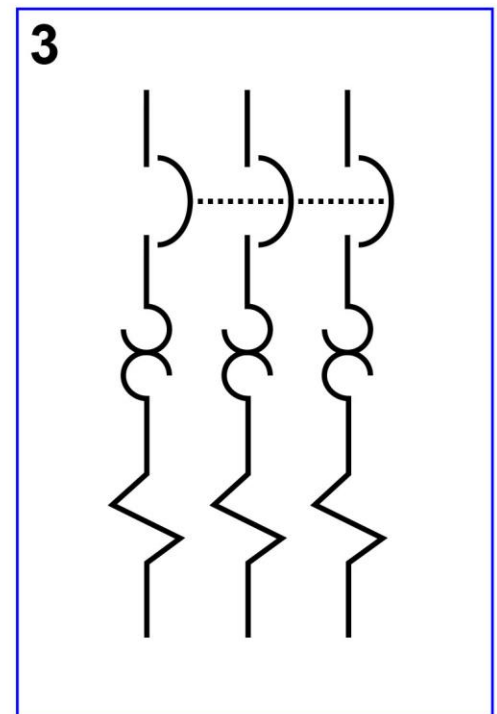
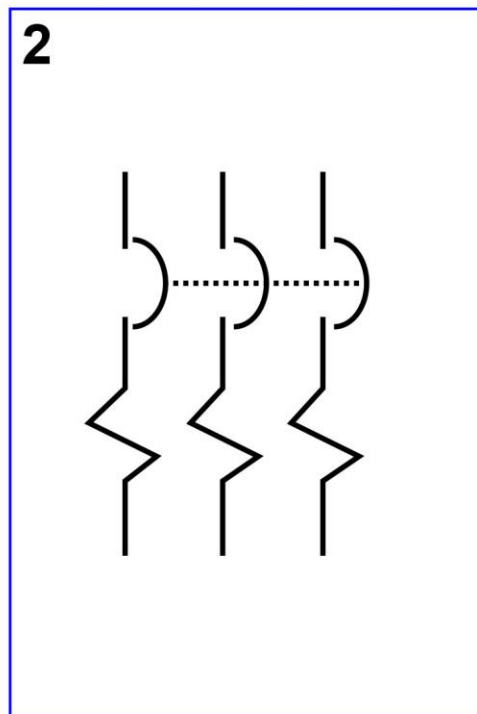
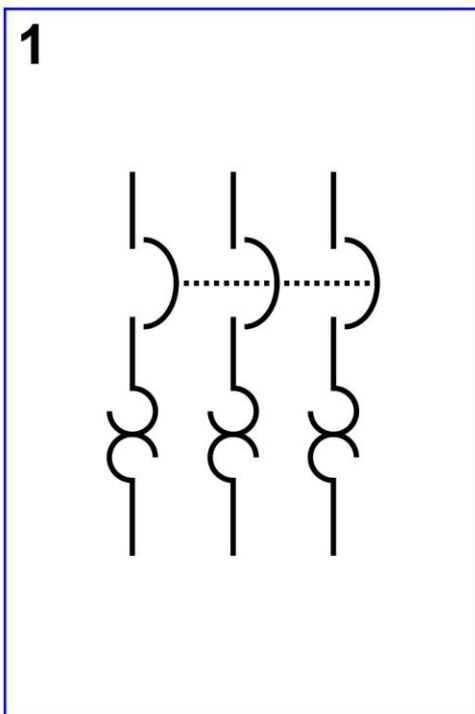
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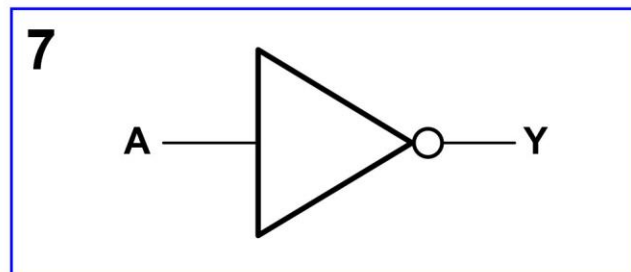
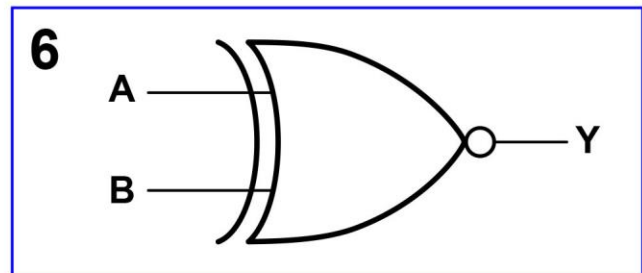
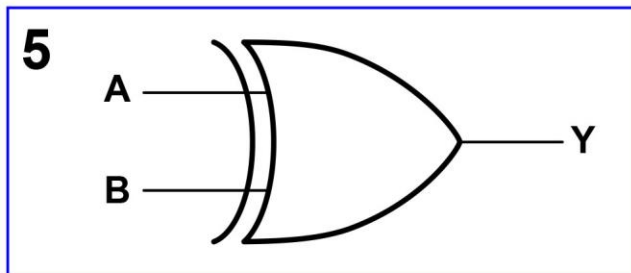
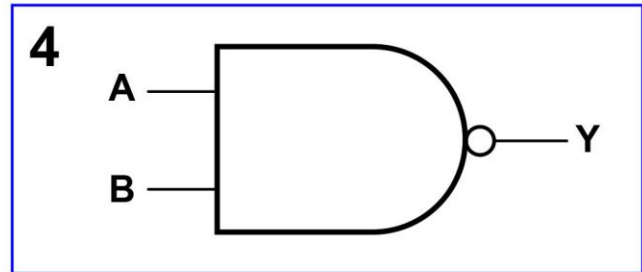
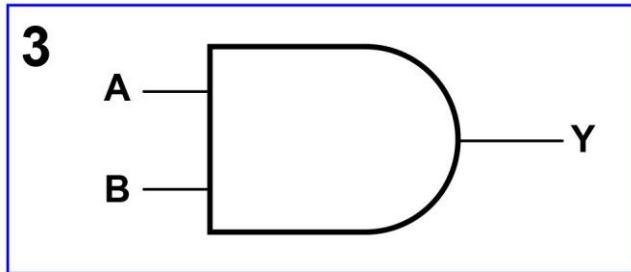
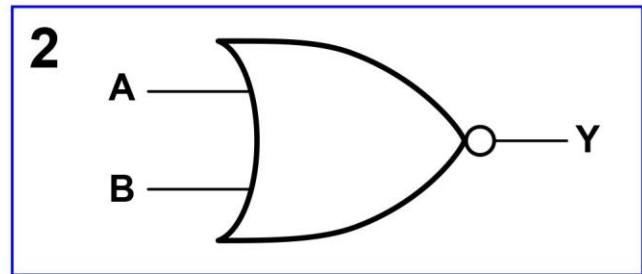
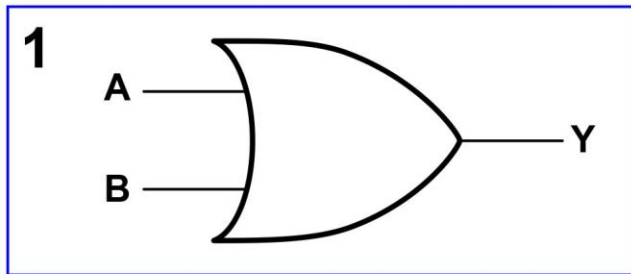


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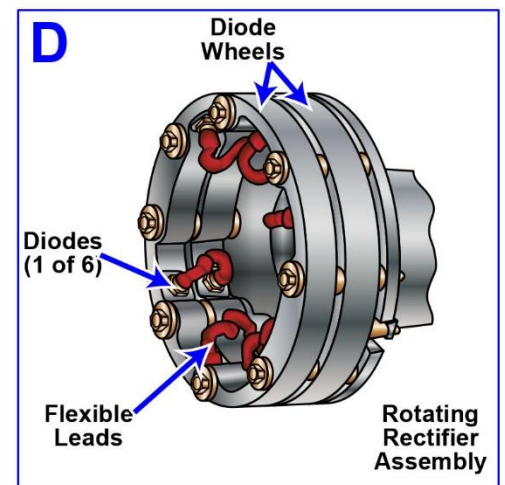
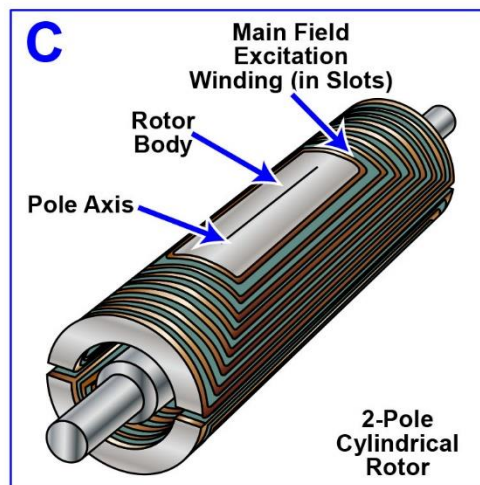
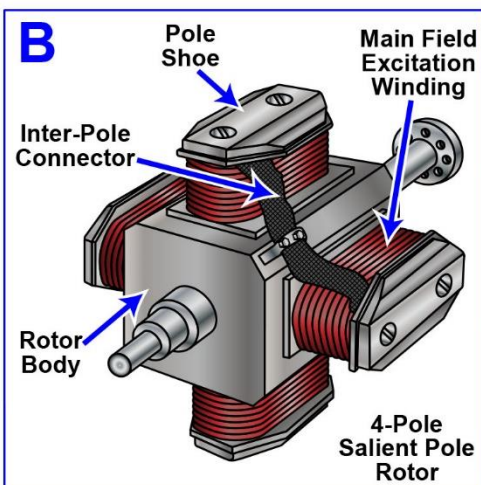
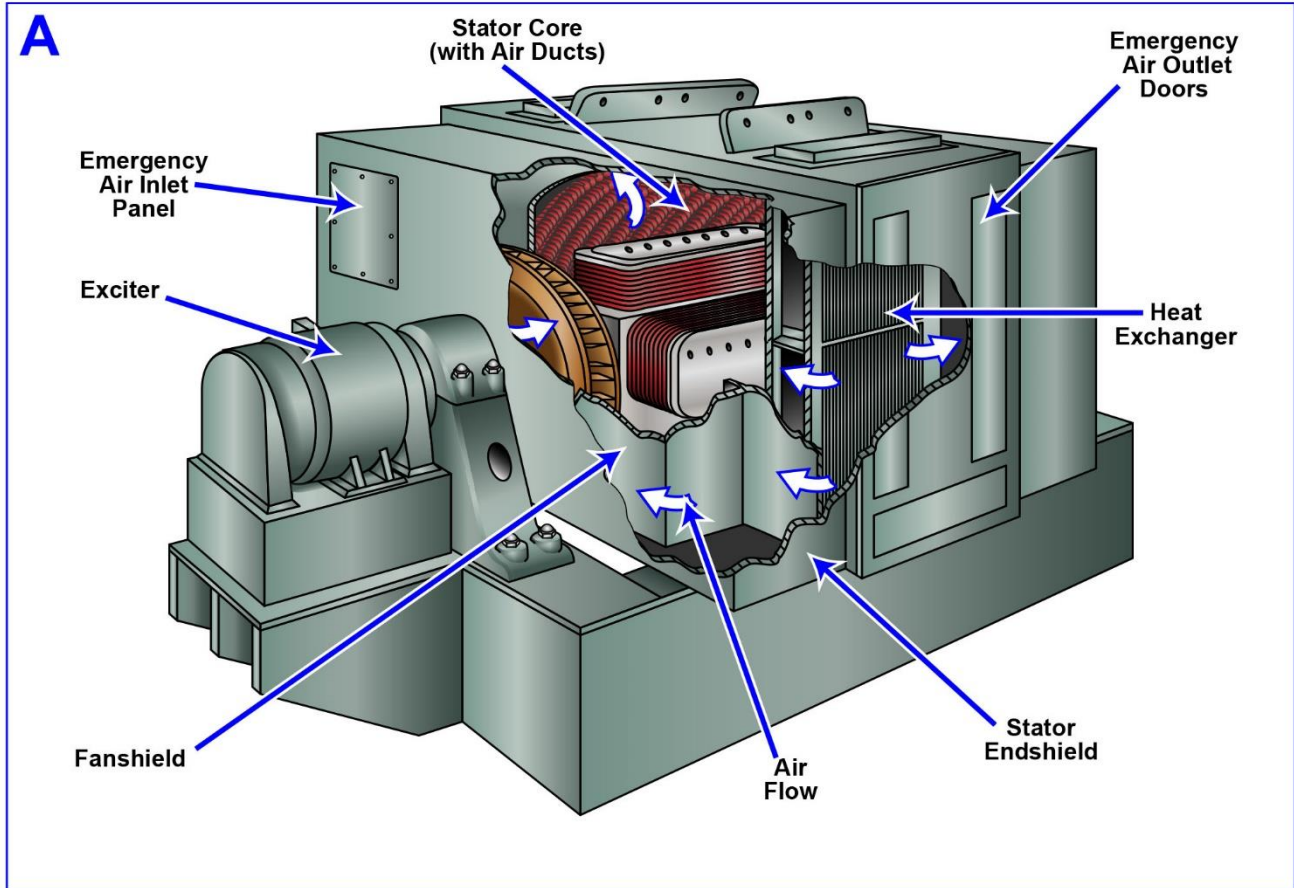


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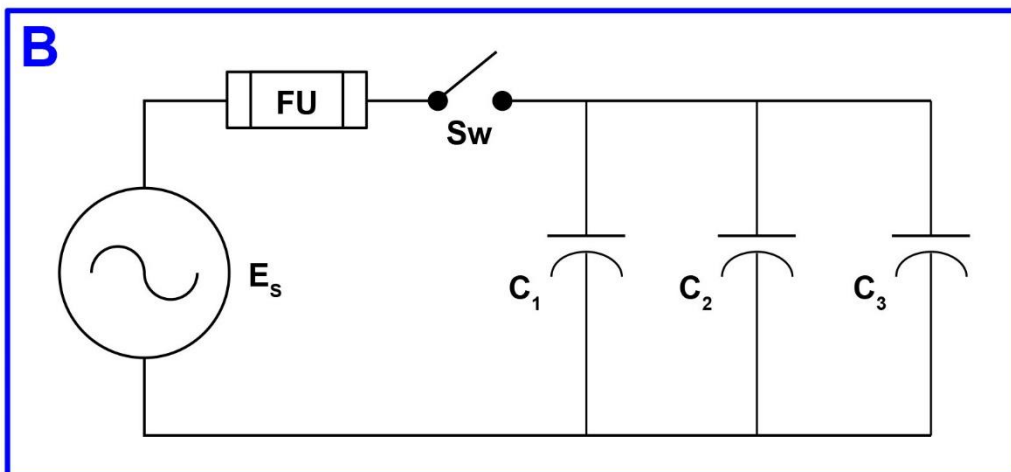
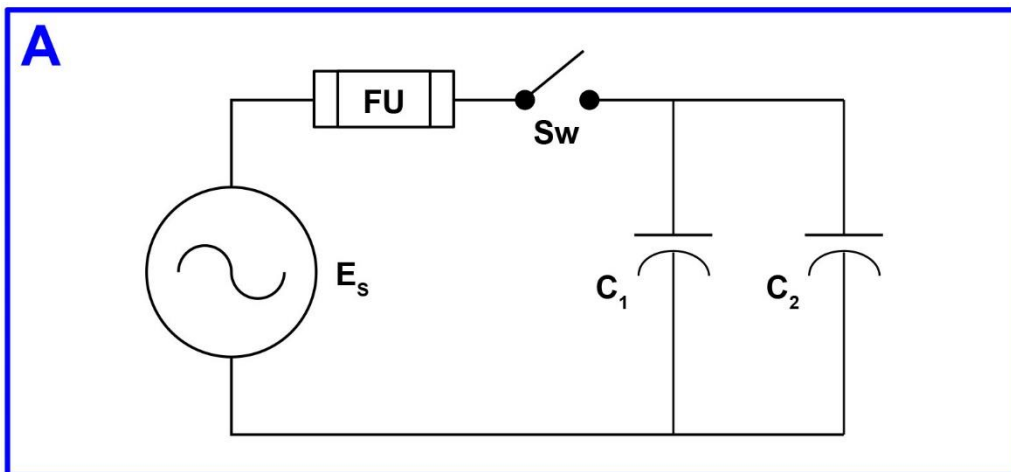


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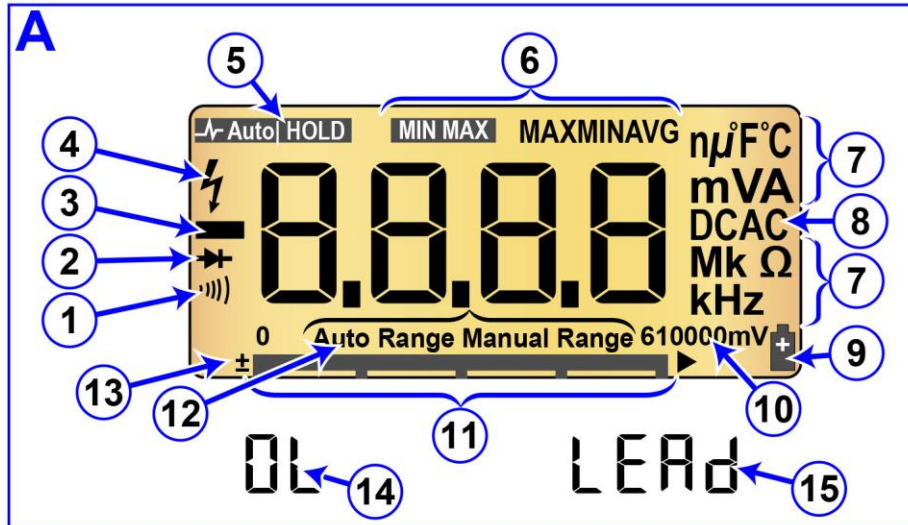


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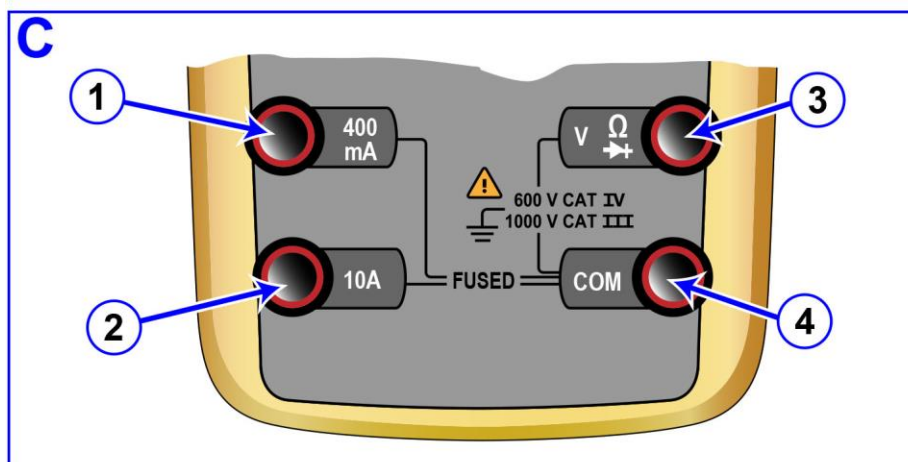


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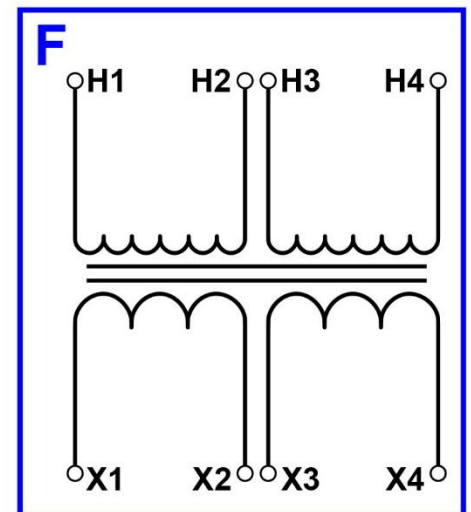
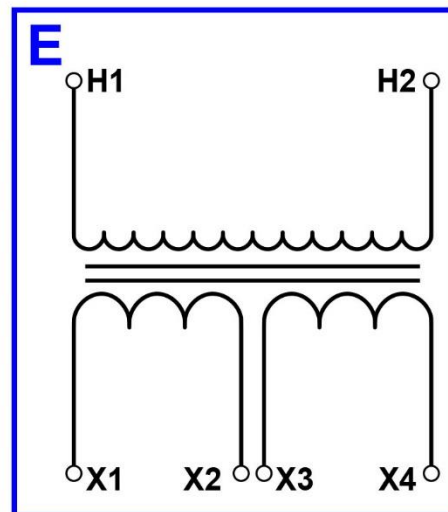
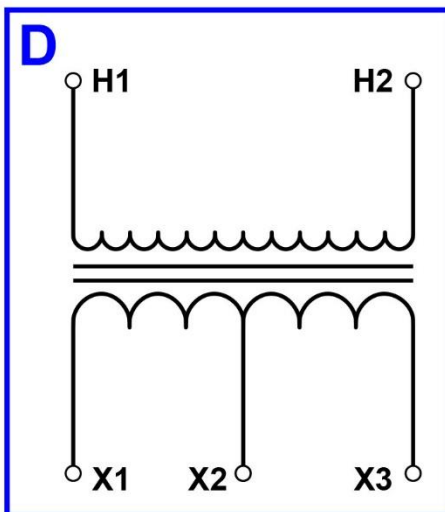
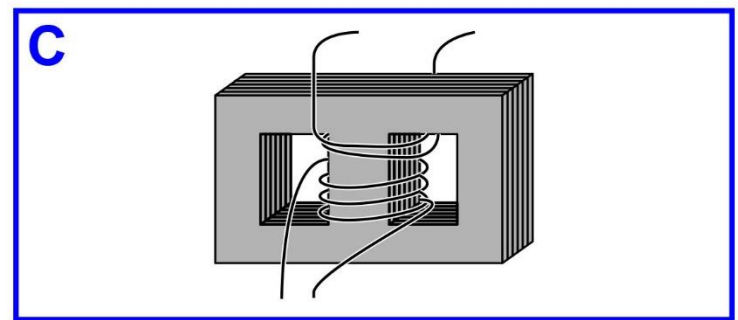
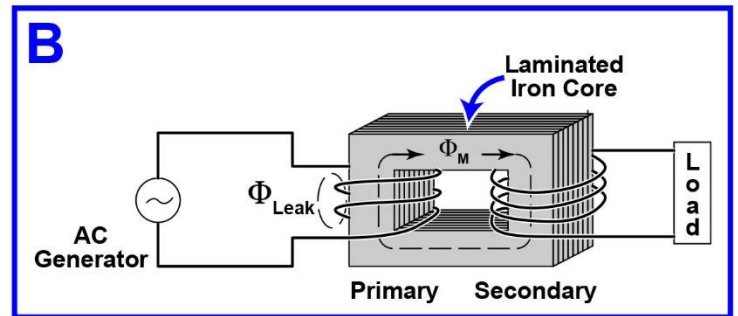
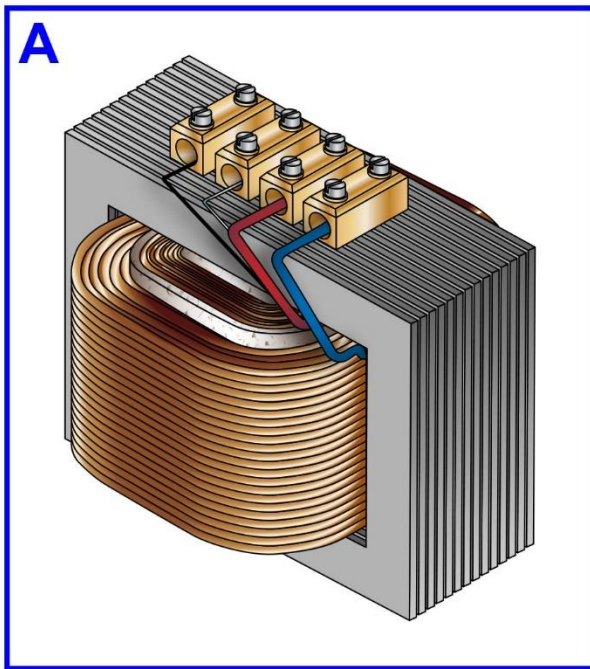


B

Switch Position	Measurement Function
\bar{V} Hz	1
\bar{V}	2
m \bar{V}	3
Ω k Ω	4
$\mu\Omega$	5
$\bar{\sim}$ mA	6
\sim A	7

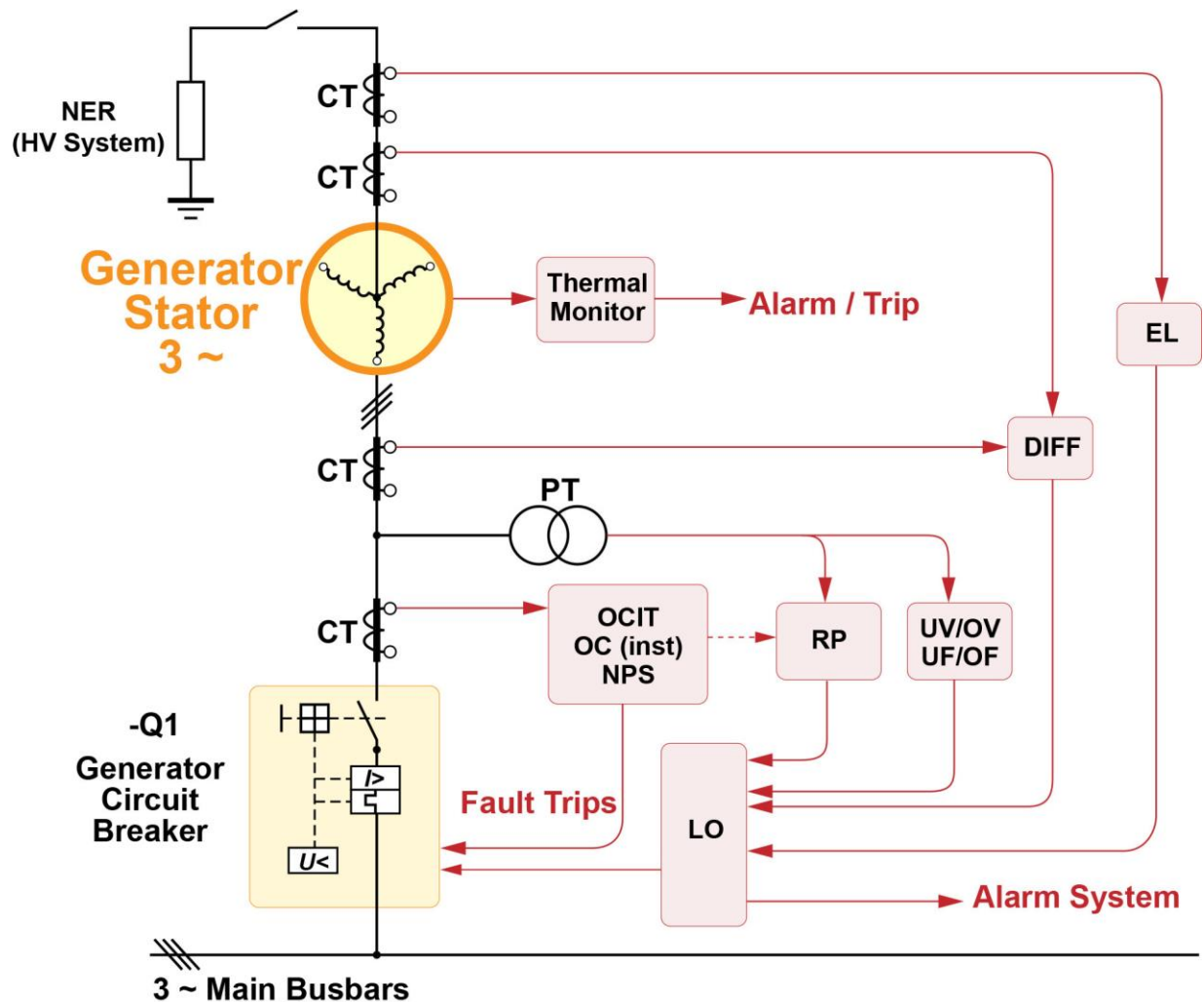


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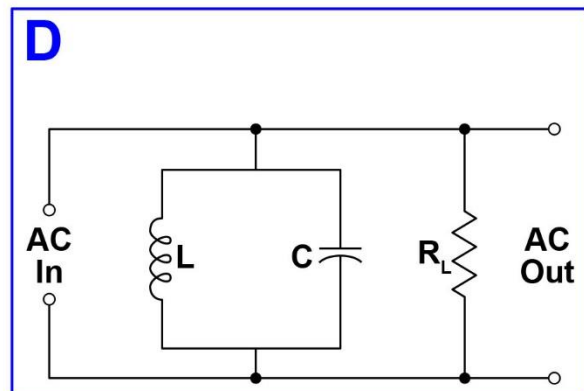
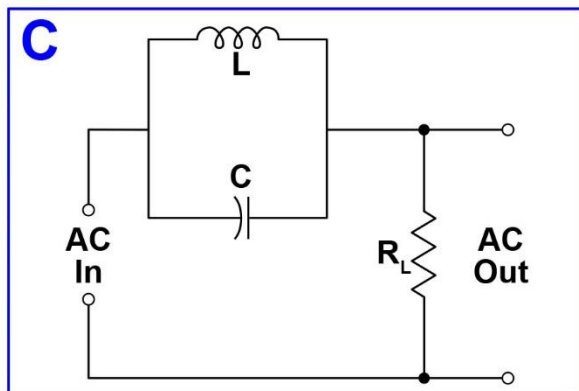
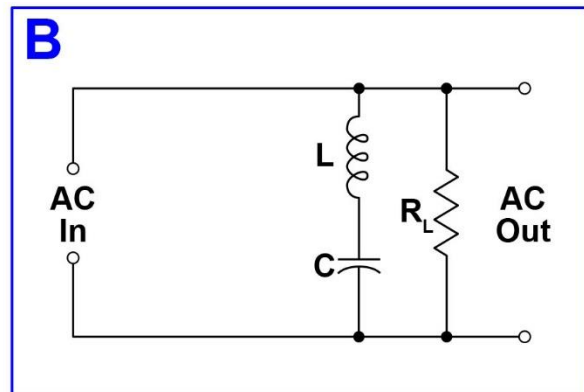
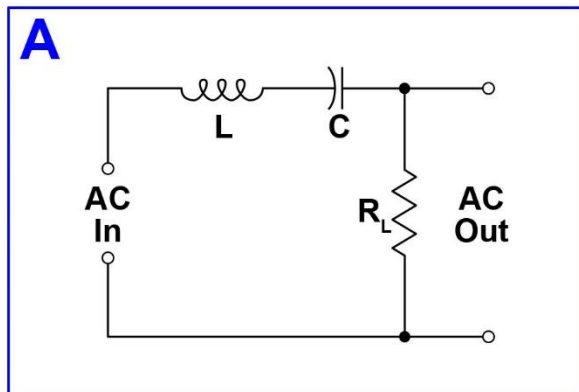


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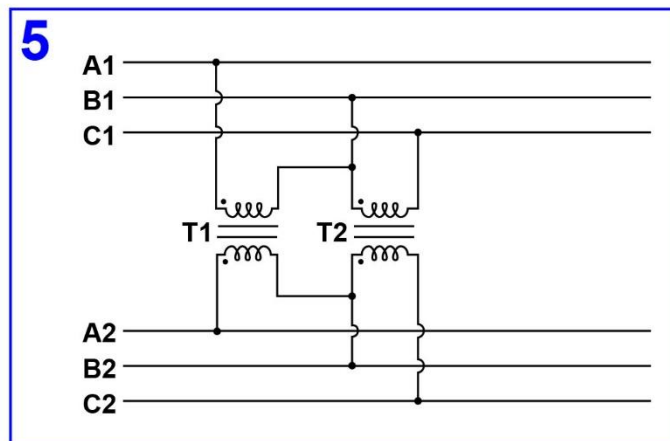
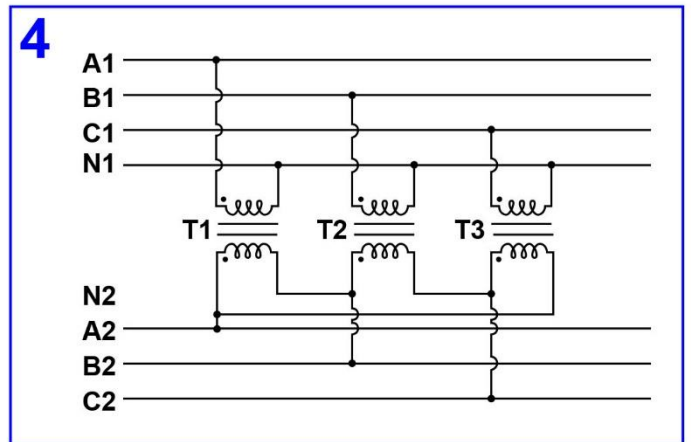
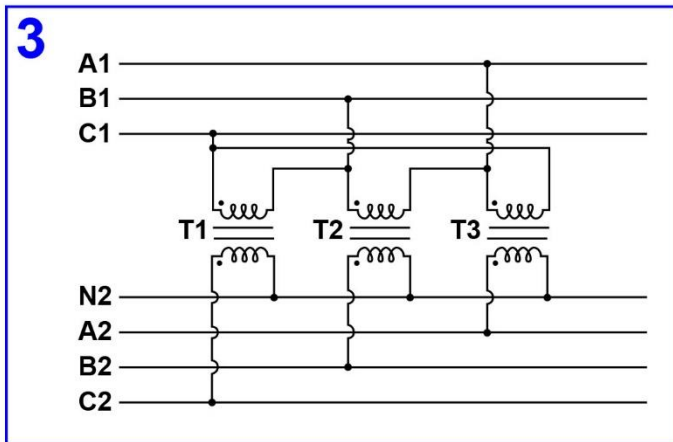
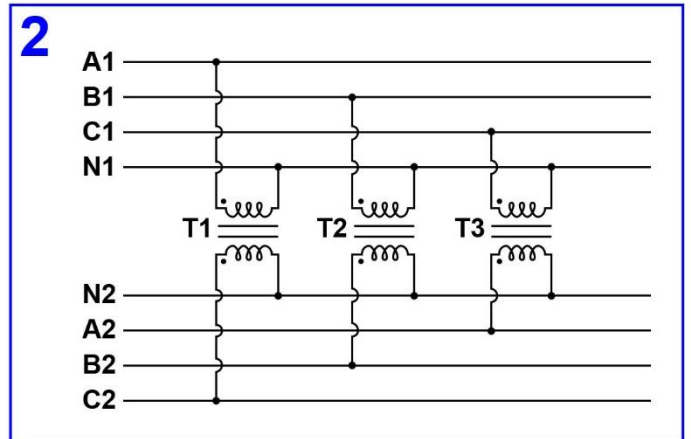
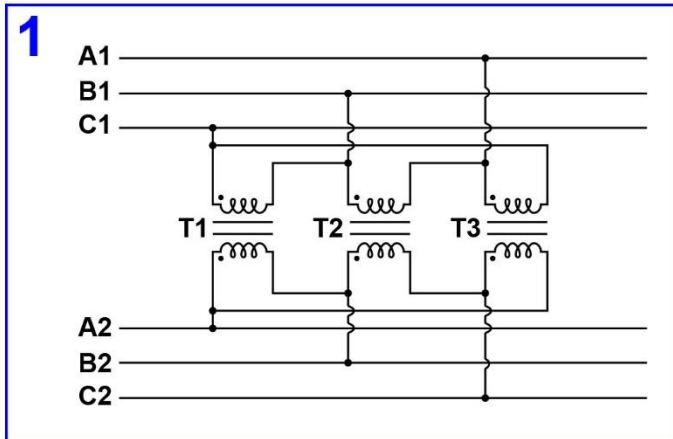


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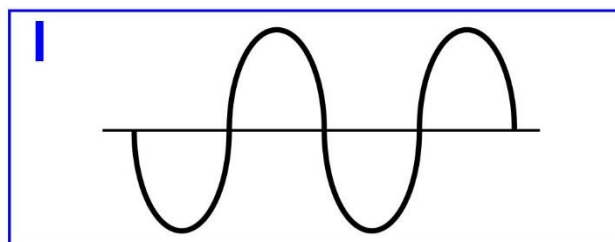
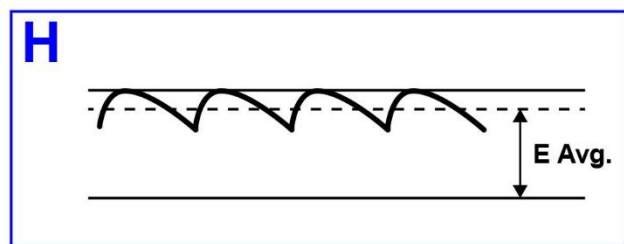
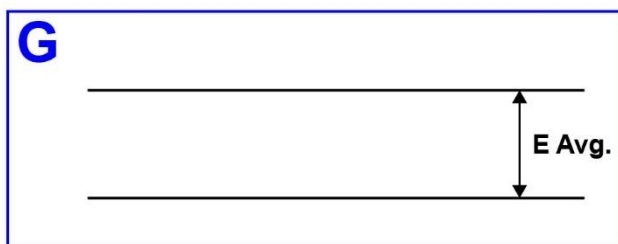
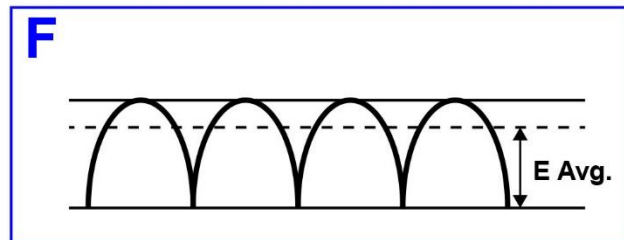
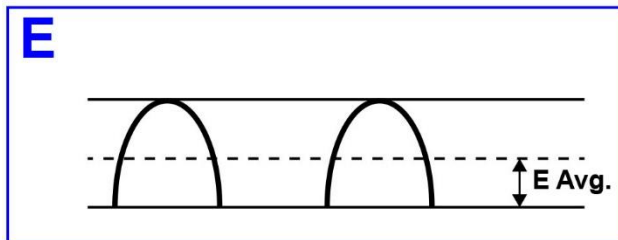
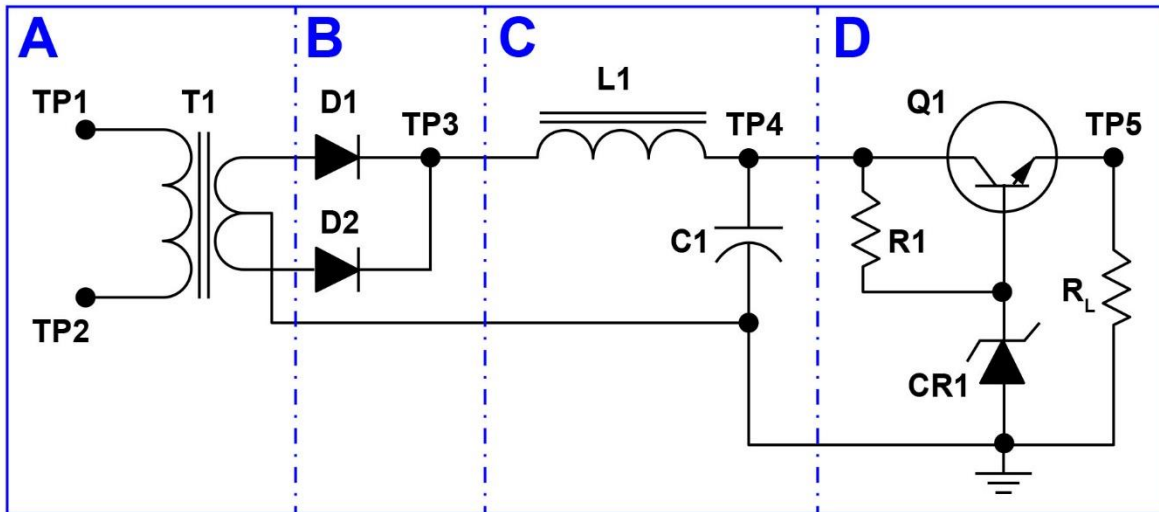
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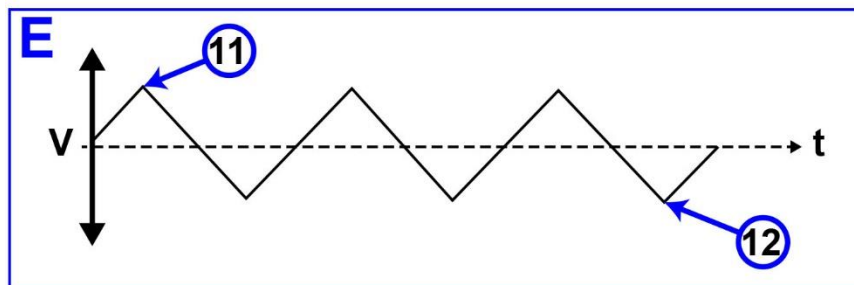
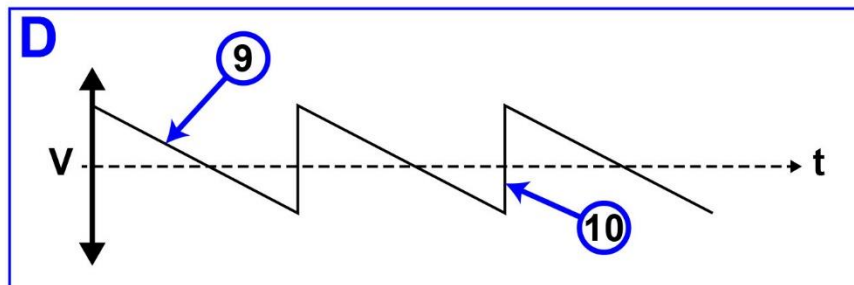
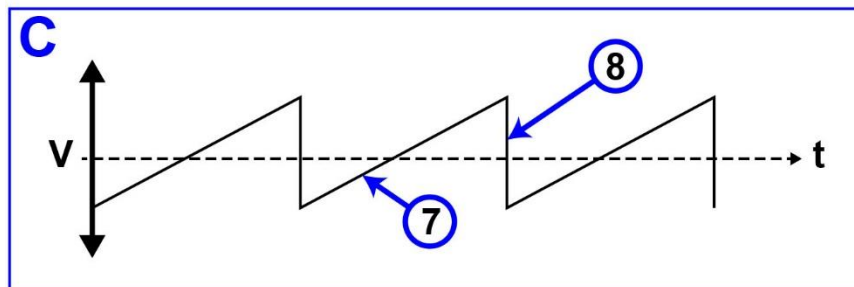
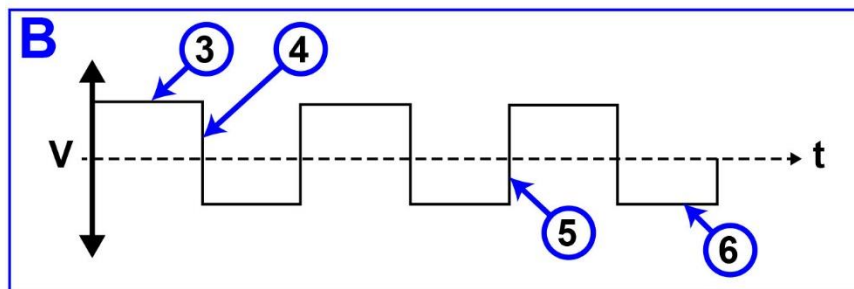
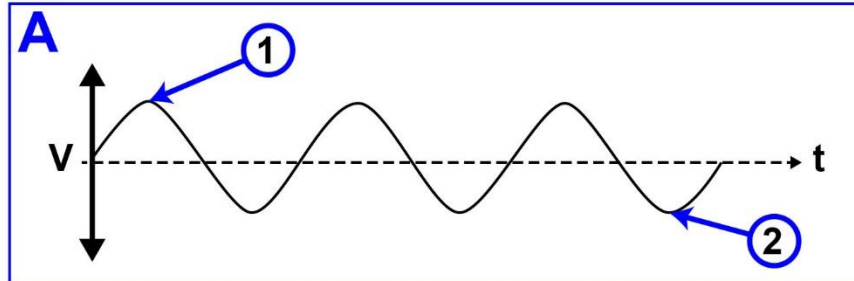
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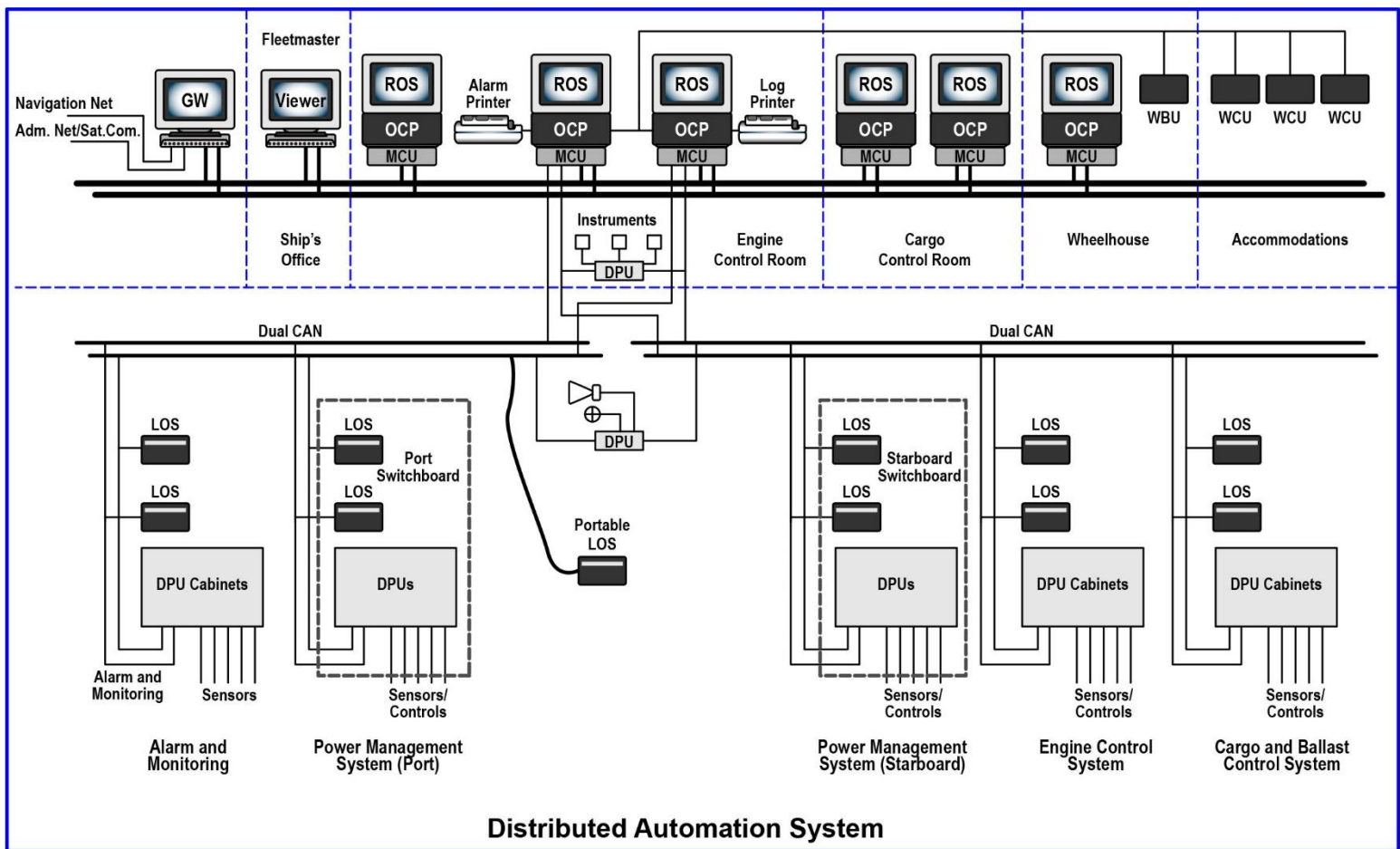


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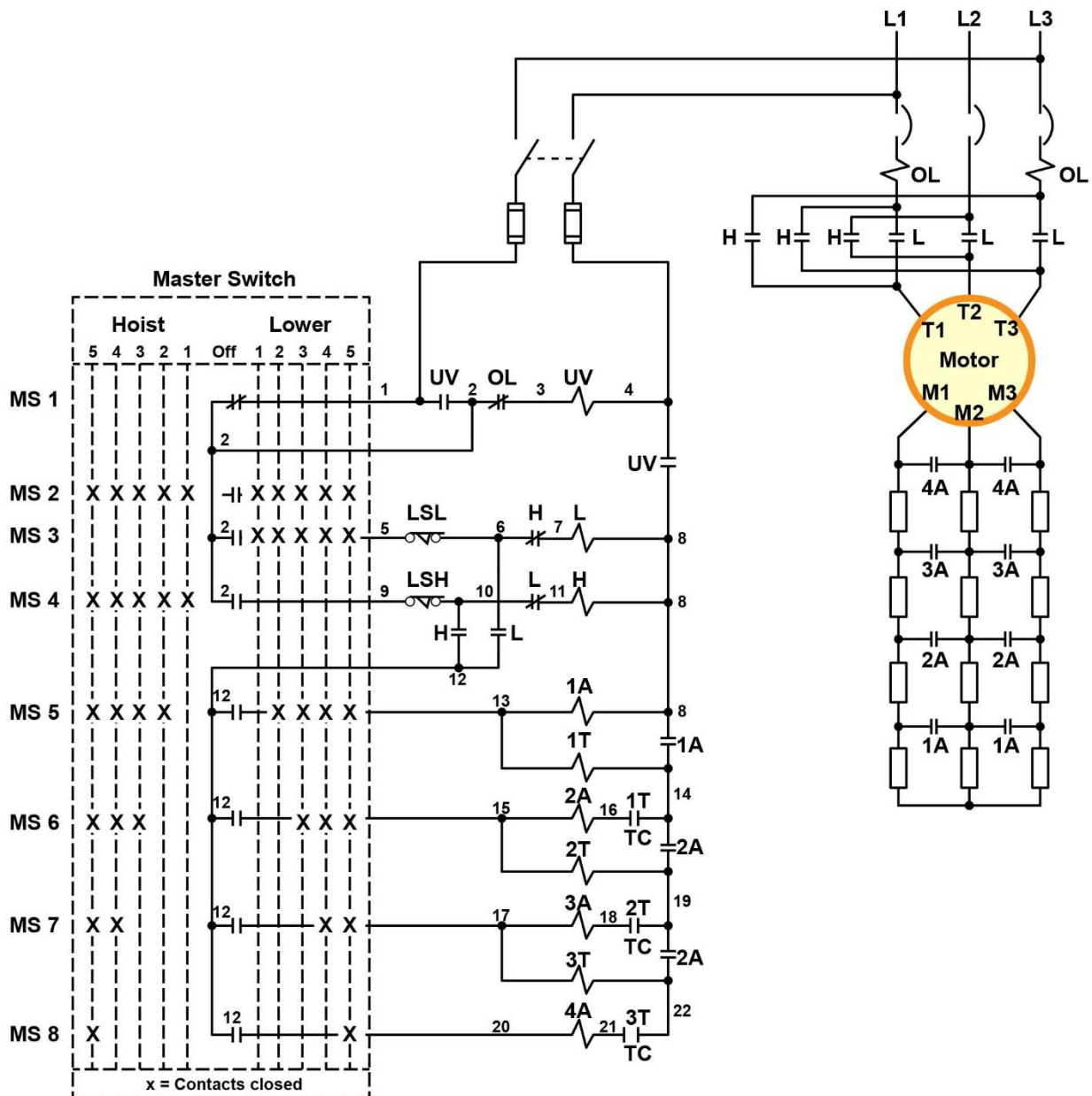
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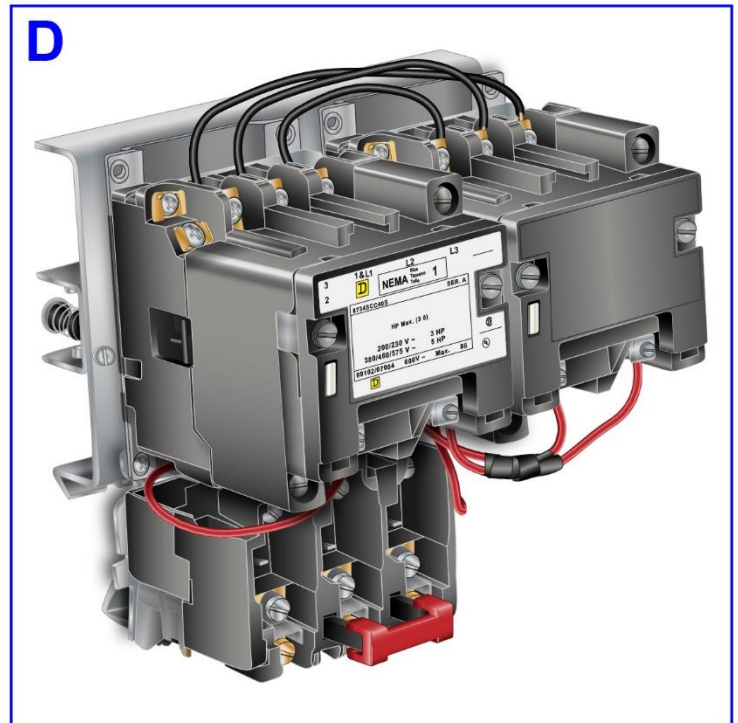
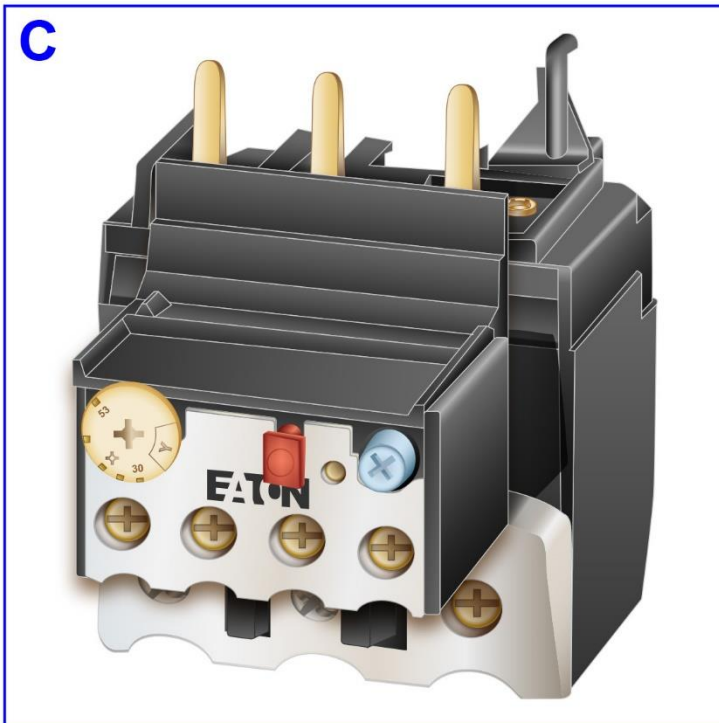
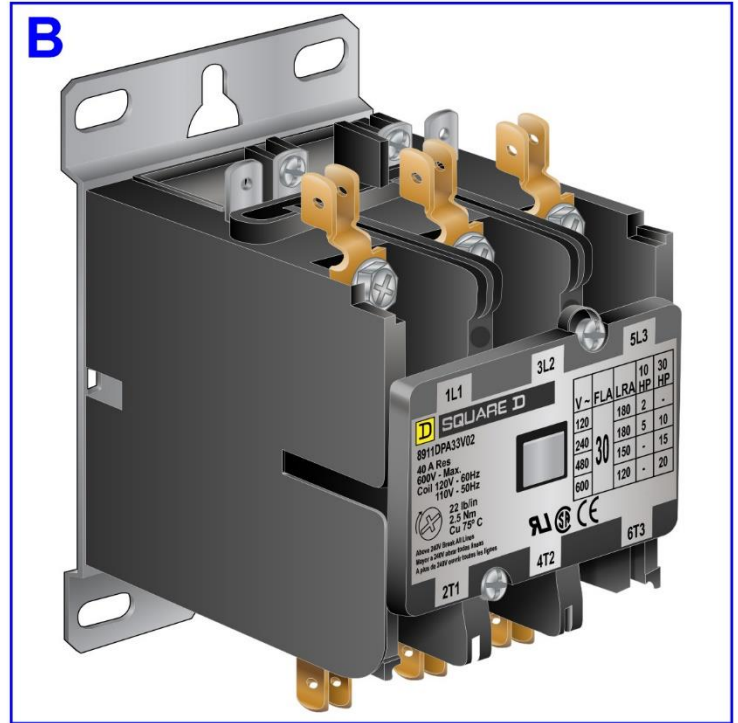
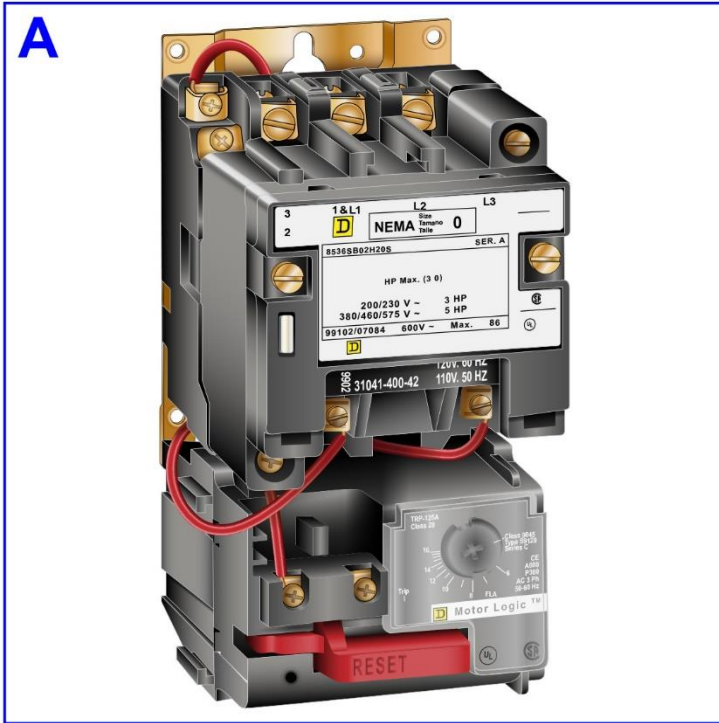
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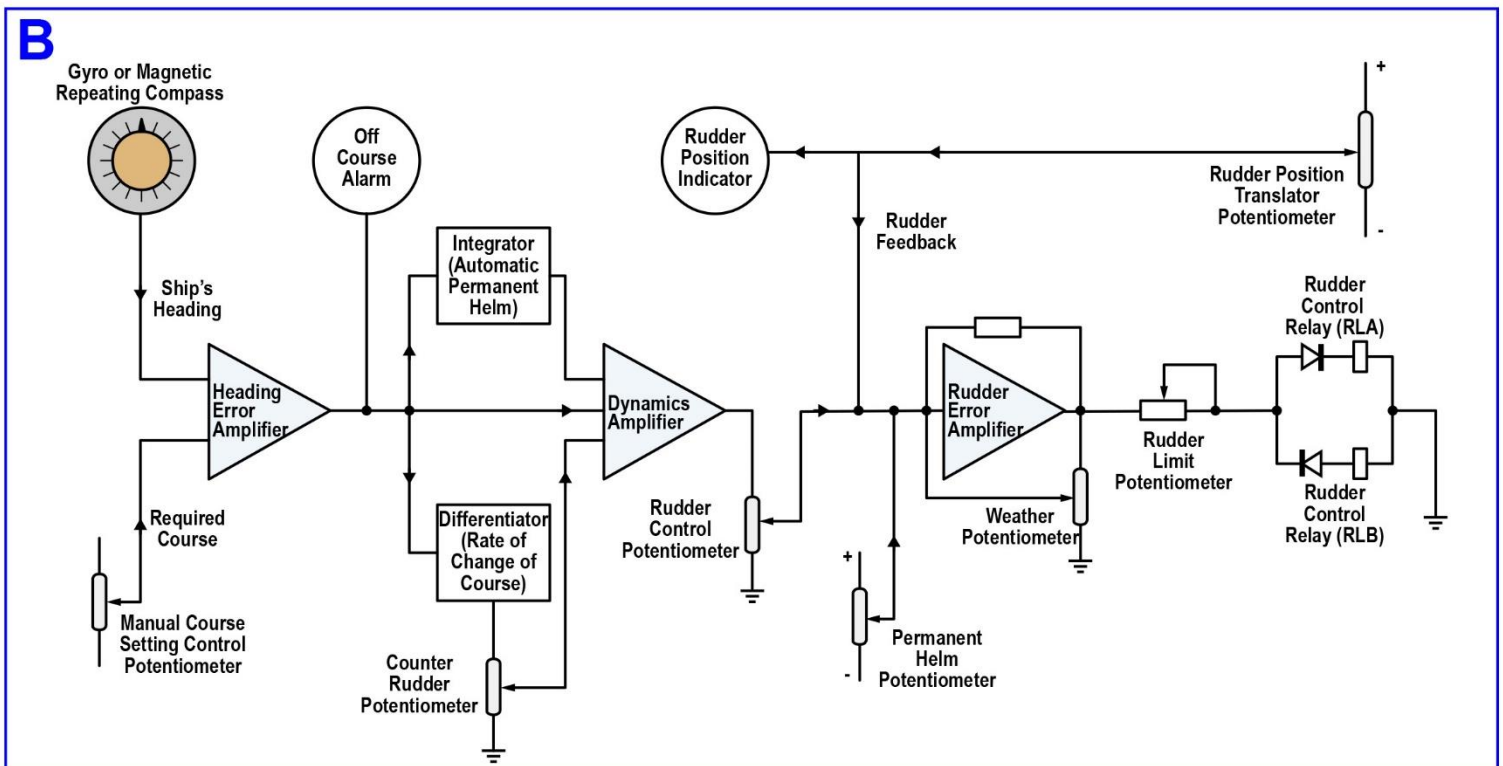
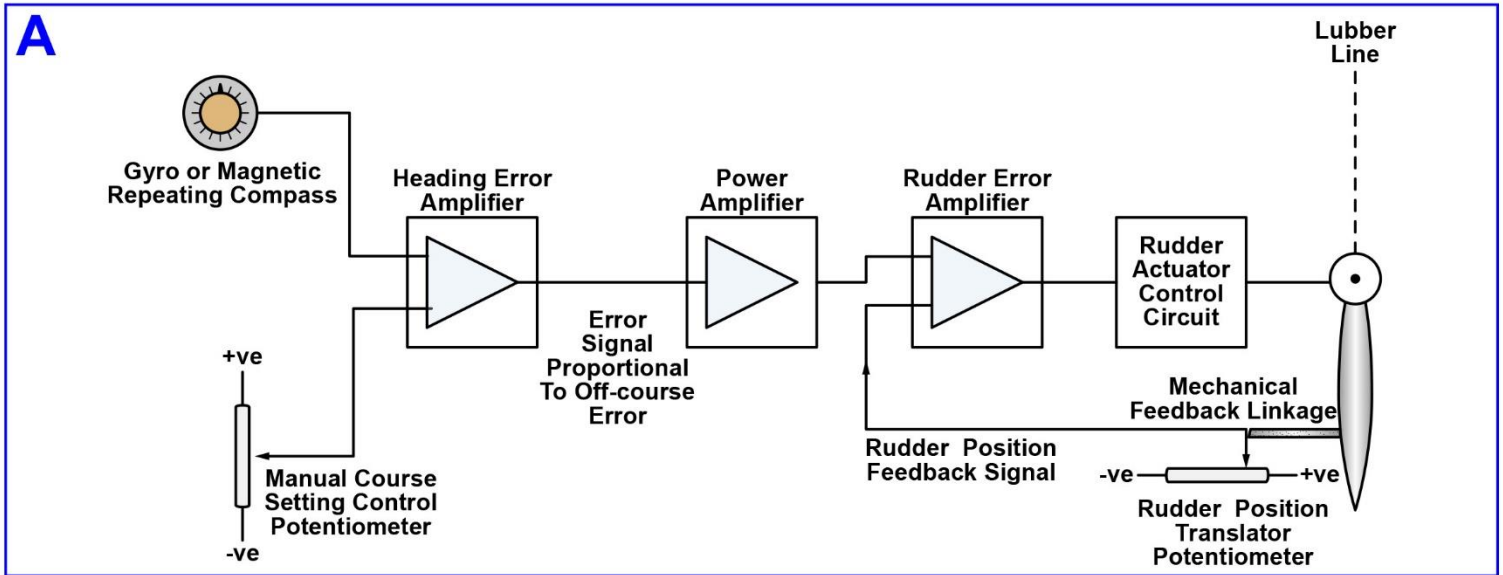
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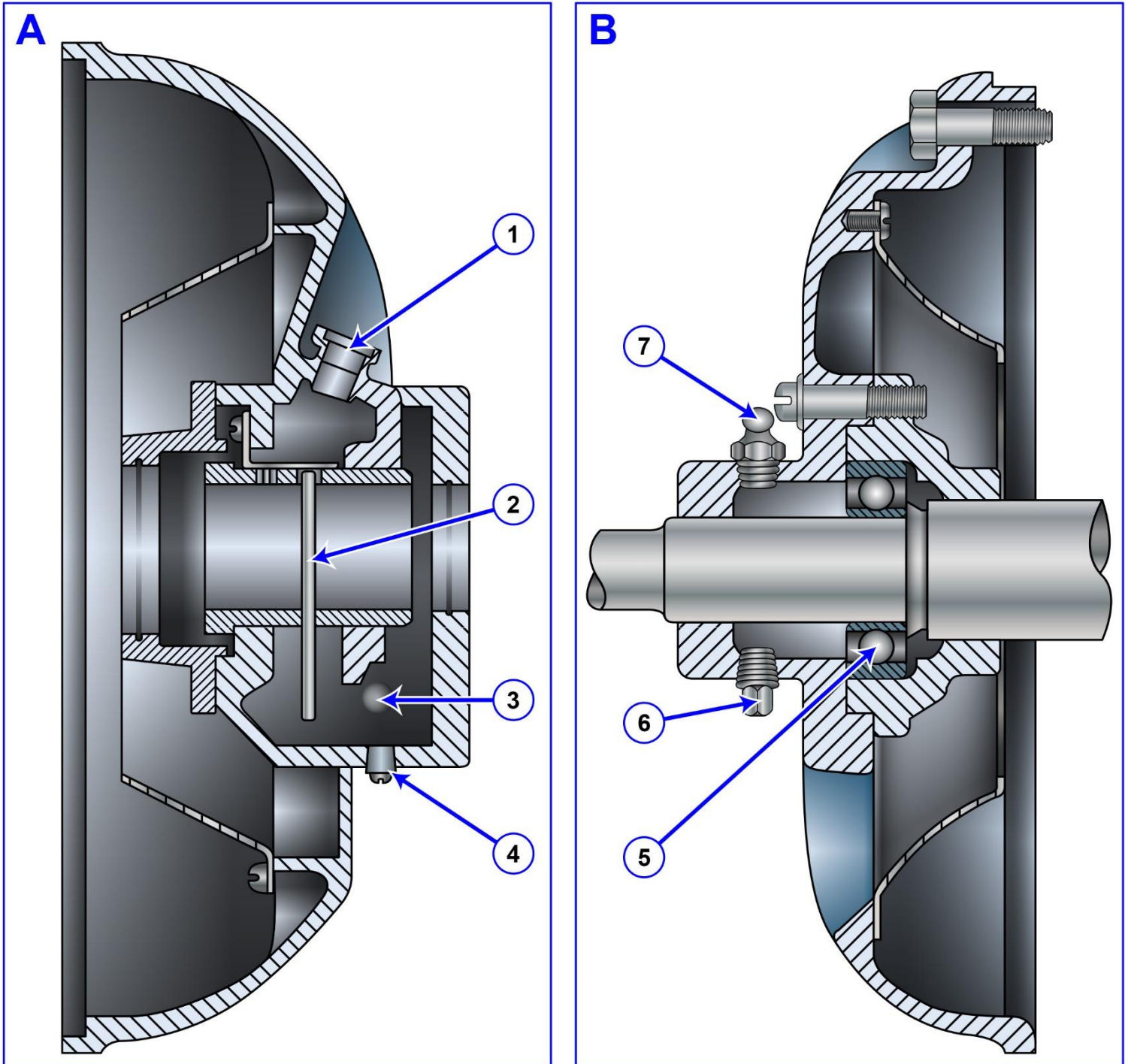
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EL-0227 Relay and PLC Logic Compared

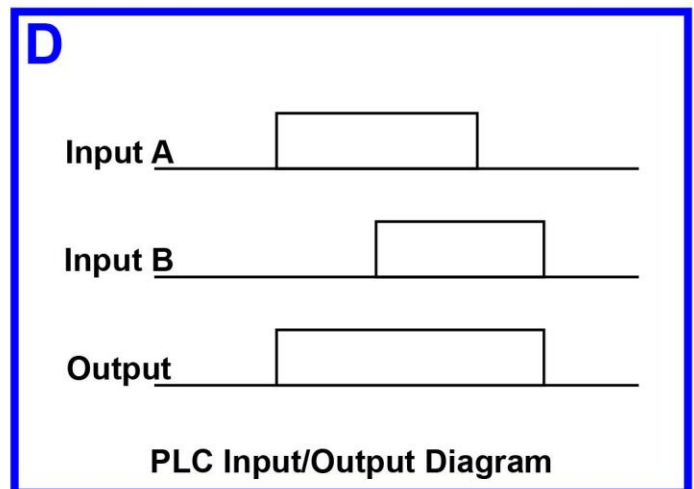
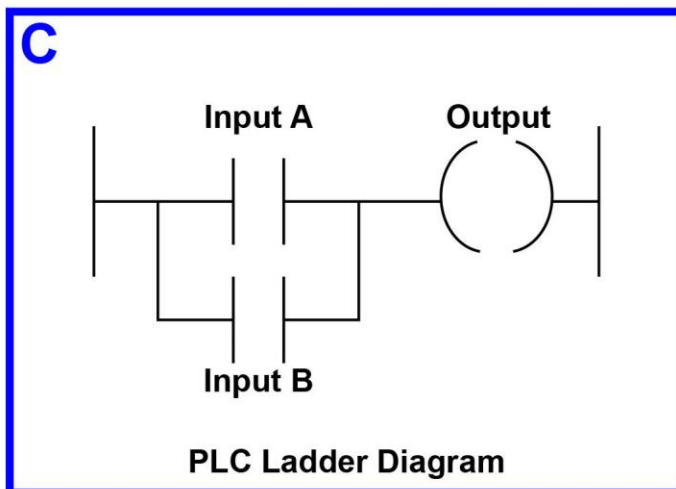
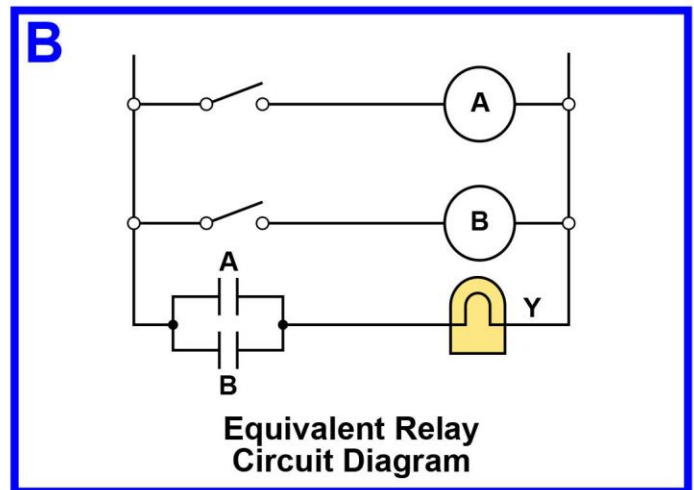
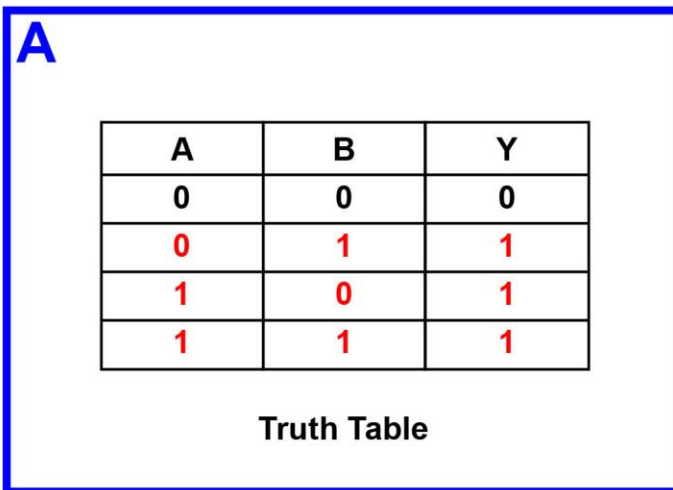


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