U.S.C.G. Merchant Marine Exam

Third Assistant Engineer

Q536 Electrical – Electronic – Control Engineering

(Sample Examination)

Choose the best answer to the following Multiple-Choice Questions:

1. In figure "4" of the diagram in the illustration, the three-phase step-down power transformer has a turns ratio of five to one. If a three-phase 4160 volt supply is connected to terminals "A1-B1-C1", what voltage should develop across terminals "A2-B2-C2"? Illustration EL-0084

   A. 240 volts
   B. 415 volts
   C. 480 volts
   D. 832 volts

   Correct answer: C

2. Which of the procedures or conditions listed could result in damaging a transistor beyond repair?

   A. Providing insufficient voltage to the input circuit
   B. Applying silicone grease between the heat sink and the transistor mounting
   C. Installing a transistor whose current rating exceeds the design circuit current
   D. Providing incorrect polarity to the collector circuit

   Correct answer: D

3. An open primary coil in a voltage transformer (VT) will be indicated by which of the listed conditions?

   A. No voltage on the output of the secondary coil
   B. An infinite resistance value on the secondary coil
   C. Low resistance value on the primary coil
   D. Overloaded secondary coil

   Correct answer: A

4. 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

   Correct answer: C

5. As shown in figure "A" of the illustrated motor nameplate, how much current could the motor safely draw on a continuous basis at sea level without overheating? Illustration EL-0171

   A. 142 amps
   B. 156 amps
   C. 163 amps
   D. 187 amps

   Correct answer: D

6. 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 three-phase AC power source, and the stator winding is directly connected to a single-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 single-phase AC power source, and the stator winding is directly connected to a three-phase AC power source.

   Correct answer: C

7. From the information given in the illustration, what would be the maximum output amperage available from the emergency generator if it operated with a power factor of 0.9? Illustration EL-0106

   A. 541 amps
   B. 669 amps
   C. 937 amps
   D. 1156 amps

   Correct answer: B

8. Regulations require that shipboard cabling use stranded copper conductors. Why is copper a superior conductor compared to aluminum?

   A. Even though copper is lower in conductivity than aluminum, copper has more resistance than aluminum.
   B. Even though copper is heavier in weight than aluminum, copper has less resistance than aluminum.
   C. Even though copper has more resistance than aluminum, copper is lighter in weight than aluminum.
   D. Even though copper is more corrosive than aluminum, copper is lighter in weight than aluminum.

   Correct answer: B

9. Four incandescent lamps are connected in parallel in a single circuit. If one of the lamp filaments burns out, what will happen to the other lamps?

   A. all go out
   B. become dimmer
   C. no change in brightness
   D. become brighter

   Correct answer: C

10. As shown in figure "6" of the illustration, what does the symbol represent as used in electrical drawings? Illustration EL-0026

    A. maintaining type push button with an electrical interlock
    B. limit switch with one set of normally open contacts
    C. maintaining type push button with a mechanical interlock
    D. normally closed contact held open mechanically by an interlock

    Correct answer: C

11. What would be the total current draw of the circuit as shown in figure "A" of the illustration if the source voltage is 24 volts, the resistance for R1 is 12 ohms, the resistance for R2 is 24 ohms, and the resistance for R3 is 36 ohms? Illustration EL-0032

    A. 0.33 amperes
    B. 0.75 amperes
    C. 1.25 amperes
    D. 1.33 amperes

    Correct answer: D

12. What type of electrical diagram for the autotransformer type motor controller is shown in the illustration? Illustration EL-0012

    A. The diagram is a wiring diagram.
    B. The diagram is a one-line diagram.
    C. The diagram is a ladder or line diagram (schematic).
    D. The diagram is a block diagram.

    Correct answer: C

13. What practice could potentially damage a multimeter?

    A. placing the test leads across a de-energized and isolated resistance to measure resistance while in the ammeter mode
    B. placing the test leads across a voltage source to measure voltage while in the resistance mode
    C. placing the test leads in series with the load of a circuit to measure current while in the voltmeter mode
    D. placing the test leads across a de-energized and isolated resistance to measure resistance while in the voltmeter mode

    Correct answer: B

14. What is an ammeter used to measure?

    A. resistance
    B. continuity
    C. voltage
    D. current

    Correct answer: D

15. When configuring a digital multimeter as an ohmmeter, what will MOST likely be displayed on the screen when the test leads are shorted together?

    A. A reading of "OL" ohms will be displayed.
    B. A reading of residual test lead and internal resistance will be displayed (typically .2 to .5 ohms).
    C. A reading of 0 ohms will be displayed.
    D. B or C could be correct depending upon the digital multimeter.

    Correct answer: D

16. When a battery-operated megohmmeter (insulation tester) is used to perform a dielectric absorption test, the resistance is measured and recorded from each conductor to ground each minute for 10 consecutive minutes. What condition accounts for a gradual rise in resistance each successive minute?

    A. The insulation is cracked and otherwise deteriorated.
    B. The insulation has direct continuity with ground.
    C. The insulation is contaminated with moisture.
    D. The insulation is in good condition.

    Correct answer: D

17. As the electrolyte level in the cells of a lead-acid battery evaporates over time, what will tend to happen to the specific gravity of the electrolyte in the cells as the level drops due to evaporation?

    A. The specific gravity of the electrolyte will decrease as only the sulfuric acid will evaporate from the electrolyte solution.
    B. The specific gravity of the electrolyte will increase as only the water will evaporate from the electrolyte solution.
    C. The specific gravity of the electrolyte will remain unchanged as both the water and sulfuric acid will evaporate from the electrolyte solution.
    D. Although the specific gravity will change due to evaporation, there is no predictable tendency either way.

    Correct answer: B

18. As shown in the illustrated diagnostic setup for locating a shorted field coil of a ten-pole synchronous motor, if 240 VAC/60 Hz is applied across the brushes, what would be the individual voltage drops measured across each field coil assuming that none of the field coils are shorted? Illustration EL-0202

    A. 6 VAC
    B. 12 VAC
    C. 24 VAC
    D. 48 VAC

    Correct answer: C

19. If the motor shown in the illustration will not start when the "off-run" switch is placed in the run position, which of the listed components should be checked FIRST? Illustration EL-0017

    A. check the main contactor coil for continuity, replace as necessary
    B. check the disconnect switch open, open as necessary
    C. check the overload relay (OL) heaters for continuity, replace as necessary
    D. check the overload relay for tripped condition, reset as necessary

    Correct answer: D

20. From the information given in the illustration, what would be the ampere capacity at full load of each of the main ship service diesel-generators if operating at the rated power factor of 0.8? Illustration EL-0106

    A. 2500 amps
    B. 3011 amps
    C. 4325 amps
    D. 5208 amps

    Correct answer: B

21. No.1 SSDG was operating in parallel with No.2 SSDG in supplying the 480 VAC main bus while sharing the electrical load evenly. As a result of a problem, if No.1 SSDG begins to motorize, but the generator has not yet tripped out by the action of the reverse power relay, what would be the indication of this?

    A. The ammeter of No.1 SSDG would indicate a higher amperage compared to when the load was equally shared.
    B. The kilowatt meter of No.1 SSDG would indicate a higher wattage compared to when the load was equally shared.
    C. The kilowatt meter of No.1 SSDG would drop below 0 kW.
    D. The power factor meter of No.1 SSDG would indicate unity (1.0).

    Correct answer: C

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

    Correct answer: D

23. The torque-speed and current-speed curves for a three-phase induction motor with a squirrel-cage rotor are shown in figures "A" and "B" of the illustration. Which of the following statements is true concerning the depicted curves? Illustration EL-0056

    A. The pull-up point on the torque curve is about 20% of the normal full load torque value.
    B. The starting current is nearly 1.5 times the normal full load current value.
    C. Rated torque and rated current occur at approximately 20% slip.
    D. Starting current is approximately 4.75 times the normal full load current value.

    Correct answer: D

24. A degree of control over the speed of a slip ring induction motor can be obtained by what means?

    A. inserting resistance into the rotor circuit
    B. adjusting governor linkage
    C. inserting resistance into the stator circuit
    D. changing the number of phases to the motor

    Correct answer: A

25. What is the functional name of an electrical device which prevents simultaneous energization of loads thereby preventing damage or injury?

    A. mechanical limit device
    B. modulating device
    C. electrical interlock device
    D. monitoring device

    Correct answer: C

26. Concerning the illustrated motor controller circuit, where is the location of the motor "run" indicator light? Illustration EL-0004

    A. There is no motor "run" light. It is, instead, a motor "stopped" light.
    B. At the local control station
    C. At the remote operating station
    D. At the motor

    Correct answer: C

27. As shown in the illustration of an electrically operated watertight door controller, how is the motor stopped automatically when the door is wedged closed? Illustration EL-0115

    A. Action of door closed limit switch (LSC)
    B. Action of motor overload (OL)
    C. Momentarily depressing open push button switch
    D. Action of door open limit switch (LSO)

    Correct answer: A

28. Diesel-generators #1 and #2 are operating in parallel with each machine operating at half-capacity. Diesel-generator #1 suddenly trips out mechanically due to low lube oil pressure. The reverse power relay functions properly and trips generator #1 electrically off the board. In the absence of an automated power management system, which of the following actions should you carry out FIRST?

    A. Start the emergency generator.
    B. Secure alarms, reset reverse power relay, and restart #1 engine.
    C. Strip the board of all nonvital circuits.
    D. Ascertain cause of the low lube oil pressure.

    Correct answer: C

29. Which of the following statements about a three-phase wye connected alternator is correct?

    A. The phase current is 1.73 times the line current.
    B. The line voltage is 1.73 times the phase voltage.
    C. The line current is 1.73 times the phase current.
    D. The phase voltage is 1.73 times the line voltage.

    Correct answer: B

30. A thermal-magnetic molded case circuit breaker for a 300 kW alternator is rated at 500 amperes at full continuous load. Which of the following conditions will MOST likely trip the breaker?

    A. Sustained current draw of 450 amperes indefinitely
    B. Sustained current draw of 500 amperes for 3 hours
    C. Momentary current draw of 1000 amperes for 3 seconds
    D. Instantaneous current draw of 10,000 amperes for .03 seconds

    Correct answer: D

31. Besides the fluorescent lamp itself and possibly a starter, which of the following components is included in a fluorescent lighting fixture?

    A. Ballast
    B. Laser
    C. Magnetron
    D. Magnetic resonator

    Correct answer: A

32. 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. Prevent any unintentional grounds in the refrigerated container distribution system from affecting the 450 VAC main distribution system.
    C. Step down the voltage from the 450 VAC main bus to the voltage required for the refrigerated container feeder bus.
    D. Reduce the kVA loading on the 450 VAC main distribution system main switchboard.

    Correct answer: B

33. When placed in a magnetic field, which of the materials listed has the highest permeability?

    A. Iron
    B. Glass
    C. Bakelite
    D. Aluminum

    Correct answer: A

34. A silicon-controlled rectifier (SCR) is a solid-state device used for what functional purpose?

    A. attenuating of voltage, current, and/or power
    B. triggering the operation of a switching function
    C. amplifying voltage, current, and/or power
    D. automatic impedance matching function

    Correct answer: B

35. A common-emitter circuit has an input voltage of 0.1 volt, an output voltage of 2.0 volts, an input current of 0.5 milliamps, and an output current of 10 milliamps. What is the power gain?

    A. 20
    B. 40
    C. 400
    D. 4000

    Correct answer: C

36. 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 180o 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 shifted 90o from the input.
    C. 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.
    D. 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.

    Correct answer: B

37. Referring to figure "3" of the illustration, what type of logic gate is symbolized? Illustration EL-0035

    A. XOR gate
    B. OR gate
    C. NOR gate
    D. AND gate

    Correct answer: D

38. Of the following, what shipboard system is MOST likely to use the synchronous transmission system featuring a transmitter and receiver?

    A. Shaft revolution indicator system
    B. Centrifuge RPM indicator system
    C. Rudder angle indicator system
    D. Turbocharger RPM indicator system

    Correct answer: C

39. As shown in the illustration, what statement is true concerning each of the system gateways? Illustration EL-0098

    A. Each connects one of two redundant automation area networks with both redundant cargo process area networks.
    B. Each connects one of two redundant automation area networks with one of two redundant engine control process area networks and one of two redundant cargo process area networks.
    C. Each connects one of two redundant automation area networks with the other automation area network.
    D. Each connects one of two redundant automation area networks with both redundant engine control process area networks.

    Correct answer: B

40. What Ethernet cabling technology supports the greatest data transfer speeds?

    A. Thin Ethernet
    B. Gigabit Ethernet
    C. Fast Ethernet
    D. Thick Ethernet

    Correct answer: B

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

    Correct answer: B

42. Referring to the illustration of a steering gear hydraulic power unit motor controller, if the motor is drawing current no greater than full load current, what will the status of the overload relay contacts and the control relay contacts be? Illustration EL-0119

    A. The overload relay contacts will be OPEN
       The control relay contacts will be CLOSED
    B. The overload relay contacts will be CLOSED
       The control relay contacts will be CLOSED
    C. The overload relay contacts will be OPEN
       The control relay contacts will be OPEN
    D. The overload relay contacts will be CLOSED
       The control relay contacts will be OPEN

    Correct answer: D

43. The current at which a magnetic-type overload relay tends to trip may be decreased by raising the plunger further into the magnetic circuit of the relay. What effect does this action have?

    A. increases magnetic pull on the plunger and requires more current to trip the relay
    B. increases magnetic pull on the plunger and requires less current to trip the relay
    C. reduces magnetic pull on the plunger and requires less current to trip the relay
    D. reduces magnetic pull on the plunger and requires more current to trip the relay

    Correct answer: B

44. You are replacing a three-phase induction motor in an application where equipment could be damaged if the direction of rotation of the motor is incorrect when connected. Assuming that even momentarily jogging the motor could damage equipment and that the feeder phase sequence is ABC clockwise as tested with a phase sequence indicator, what should then be done to ensure that the motor rotation will be correct (clockwise) when connected electrically to the line and mechanically to the load? Assume that the power is off and that the contact-type motor rotation indicator leads are connected to the motor terminals.

    A. Rotate the shaft by hand in the clockwise direction as viewed from the drive end. With the push to test pushbutton depressed, if the sequence indicates ABC, phase sequence and motor rotation are NOT in agreement and any two leads must be interchanged.
    B. Rotate the shaft by hand in the clockwise direction as viewed from the drive end. With the push to test pushbutton depressed, if the sequence indicates ACB, phase sequence and motor rotation are in agreement and no connection changes are necessary.
    C. Rotate the shaft by hand in the clockwise direction as viewed from the drive end. With the push to test pushbutton depressed, if the sequence indicates ACB, phase sequence and motor rotation are NOT in agreement and all three leads must be interchanged.
    D. Rotate the shaft by hand in the clockwise direction as viewed from the drive end. With the push to test pushbutton depressed, if the sequence indicates ABC, phase sequence and motor rotation are in agreement and no connection changes are necessary.

    Correct answer: D

45. 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. Quick charging circuit
    B. Trickle charging circuit
    C. High ampere charging circuit
    D. Normal charging circuit

    Correct answer: B

46. Upon loss of field excitation of a generator operating in parallel with others, what must be done?

    A. The parallel connected generators still producing a voltage must have their fields over-excited to compensate for the loss of field excitation of the one generator.
    B. The parallel connected generator which has suffered the loss of field excitation must be immediately disconnected from the bus by tripping its circuit breaker.
    C. The parallel connected generator which has suffered the loss of field excitation must have its prime mover immediately stopped.
    D. The parallel connected generator which has suffered the loss of field excitation must have its prime mover immediately reduced to idle speed.

    Correct answer: B

47. Before electrical work can be safely undertaken, the equipment must be de-energized, locked and tagged out, and verification must be made that the circuit is actually dead. What testing device is most certain to reliably verify that a circuit is actually dead?

    A. a non-contact voltage tester
    B. a solenoid type voltage tester
    C. a non-autoranging digital multimeter
    D. an autoranging digital multimeter

    Correct answer: D

48. In accordance with 46 CFR Subchapter J (Electrical Engineering), on vessels equipped with both temporary and final emergency power sources, emergency generators are required to automatically start upon a loss of normal supply voltage. When the potential of the normal source is eventually restored, what statement is true?

    A. The emergency loads must be manually transferred to the normal source, and the emergency generator must be manually stopped.
    B. The emergency loads must be configured to automatically transfer to the normal source, and the emergency generator must be configured to automatically stop.
    C. The emergency loads must be either manually or automatically transferred to the normal source, and the emergency generator must be manually or automatically stopped.
    D. The emergency loads must be configured to automatically transfer to the normal source, and the emergency generator must be manually stopped.

    Correct answer: C

49. An electric propulsion drive system in which the propulsion generator supplies power to both the propulsion motor and ship service loads is referred to as what type of system?

    A. a dedicated system
    B. an integrated system
    C. a multi-purpose system
    D. a composite system

    Correct answer: B

50. 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 both the input frequency and voltage to the motor
    C. by varying the input frequency to the motor, but not the voltage
    D. by varying the input voltage to the motor, but not the frequency

    Correct answer: B

51. Before work may safely commence on a high voltage system, what must first be done after disconnection and isolation?

    A. The circuit must be tested and proved dead first with an off-line tester, then grounded.
    B. The circuit must be grounded first, then tested and proved dead with a live-line tester.
    C. The circuit must be tested and proved dead first with a live-line tester, then grounded.
    D. The circuit must be grounded first, then tested and proved dead with an off-line tester.

    Correct answer: C

52. Some shipboard high voltage systems have the neutral point of the generators bonded to the ship's hull with a neutral grounding resistor. What is the purpose of this resistor?

    A. To prevent nuisance ground fault trips
    B. To minimize the magnitude of the ground fault current
    C. To completely eliminate ground fault current
    D. To maximize the magnitude of the ground fault current

    Correct answer: B

53. In a podded azimuthing propulsion system, how is three-phase, frequency and voltage-controlled power delivered to the synchronous propulsion motor stator windings?

    A. By direct connection to the stator windings
    B. By rotary transformer action
    C. By the use of commutator bars and brushes
    D. By the use of slip rings and brushes

    Correct answer: D

54. Referring to the sound-powered telephone circuit shown in illustration, what statement is true concerning the button on the handset as represented by the component labeled "A"? Illustration EL-0093

    A. The push button is depressed only for the purposes of talking, and it should be released for listening.
    B. The push button is depressed for the purposes of listening and talking.
    C. The push button is depressed only for the purposes of listening, and it should be released for talking.
    D. The push button is depressed only for the purposes of conversing with multiple stations. For a conversation between two stations, it is not needed.

    Correct answer: B

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

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

    Correct answer: C

56. 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. short circuiting of adjacent lighting circuits
    C. damaging the lamp's ballast circuit
    D. exploding of the lamp, causing glass to fly in all directions

    Correct answer: C

57. How may the unit "hertz" be best described?

    A. revolutions per second
    B. revolutions per minute
    C. cycles per second
    D. coulombs per second

    Correct answer: C

58. An electrical component is connected across a 120 volt 60 hertz AC supply. What is the current drawn by the component if the impedance is 200 ohms?

    A. 0.01 amperes
    B. 0.60 amperes
    C. 1.67 amperes
    D. 100 amperes

    Correct answer: B

59. As shown in figure "A" of the illustration, what would be the circuit impedance if the capacitive reactance is 10 ohms and the resistance is 10 ohms? Illustration EL-0109

    A. 4.47 ohms capacitive
    B. 6.32 ohms capacitive
    C. 14.14 ohms capacitive
    D. 20 ohms capacitive

    Correct answer: C

60. What would be the actual rotor speed for a 4-pole three-phase squirrel-cage induction motor operating at 60 Hz if the rotor slip is 3%?

    A. 1746 RPM
    B. 1793 RPM
    C. 1800 RPM
    D. 1854 RPM

    Correct answer: A

61. While standing an "at sea watch" onboard a ship fitted with electrical propulsion motors, you notice the propulsion transformer core temperature slowly rising. What should be your FIRST action?

    A. notify the bridge that you need to slow down
    B. check the transformer ventilation fans for proper operation
    C. reduce load by tripping lighting circuits
    D. send the oiler to look for fires in the transformer

    Correct answer: B

62. The winch shown in the illustration operates in any of the positions with the master switch in the 'lower' direction, but will not 'hoist' in any of the master switch hoist speed positions. Which of the listed faults would MOST likely be the cause? Illustration EL-0102

    A. The hoist limit switch (LSH) contacts across terminals 9 and 10 have failed open.
    B. The AC hoist motor has tripped out on overload, permitting only lowering.
    C. The undervoltage relay contacts between terminals 1 and 2 have failed open.
    D. The lower limit switch (LSL) contacts across terminals 5 and 6 have failed open.

    Correct answer: A

63. Within the split-phase family of single-phase motors, what are the operational characteristics of the motor shown in figure "A" of the illustration? Illustration EL-0207

    A. Relatively high starting torque with power factor correction
    B. Relatively high starting torque with no power factor correction
    C. Relatively low starting torque with power factor correction
    D. Relatively low starting torque with no power factor correction

    Correct answer: D

64. A common type of molded case circuit breaker has both thermal and magnetic trip elements. If a branch circuit breaker has only thermal or magnetic trip elements (but not both), it is common to use multiple series-connected protective devices to provide both short-circuit and overload protection. If a motor branch circuit is protected with both a thermal trip-type circuit breaker and fuses, what is the protective purpose of the fuses used in this arrangement?

    A. time-delay protection
    B. short duration surge protection
    C. sustained overload protection
    D. short-circuit protection

    Correct answer: D

65. When a transformer is used to step down voltage, what statement is true?

    A. The low voltage winding is part of the core.
    B. The low voltage winding is the primary coil.
    C. The low voltage winding is the secondary coil.
    D. The low voltage winding is not insulated.

    Correct answer: C

66. In the diagram of the switchboard shown in the illustration, what is the purpose of the current transformers? Illustration EL-0003

    A. transform relatively high generator load current to low instrument input current for ammeters, wattmeters, and the power factor meter
    B. transform relatively low generator load current to high instrument input current for ammeters, wattmeters, and the power factor meter
    C. transform relatively high generator load current to low instrument input current for voltmeters
    D. transform relatively low generator load current to high instrument input current for voltmeters

    Correct answer: A

67. How is the main propeller shaft rotation of a rectified DC diesel-electric drive normally reversed?

    A. reversing the field or armature polarity of the DC motor
    B. reversing the field polarity in the AC generator
    C. reversing the diesel engine rotation
    D. reversing the polarity of the interpoles

    Correct answer: A

68. Referring to the illustration pertaining to a steering system hydraulic power unit motor controller, what statement is true concerning a response to a motor overload condition as visualized by the indicator lamps? Illustration EL-0119

    A. Run indicator lamp is OFF
       Overload indicator lamp is OFF
    B. Run indicator lamp is ON
       Overload indicator lamp is ON
    C. Run indicator lamp is ON
       Overload indicator lamp is OFF
    D. Run indicator lamp is OFF
       Overload indicator lamp is ON

    Correct answer: B

69. In actual applications, electrical connections associated with "R1, R2 and R3" of the transmitter to "R1, R2, and R3" of the indicators shown in figure "C" of the illustration are made by what means? Illustration EL-0092

    A. soldered contacts
    B. slip rings and brushes
    C. spliced and taped connections
    D. solderless crimp-on connectors

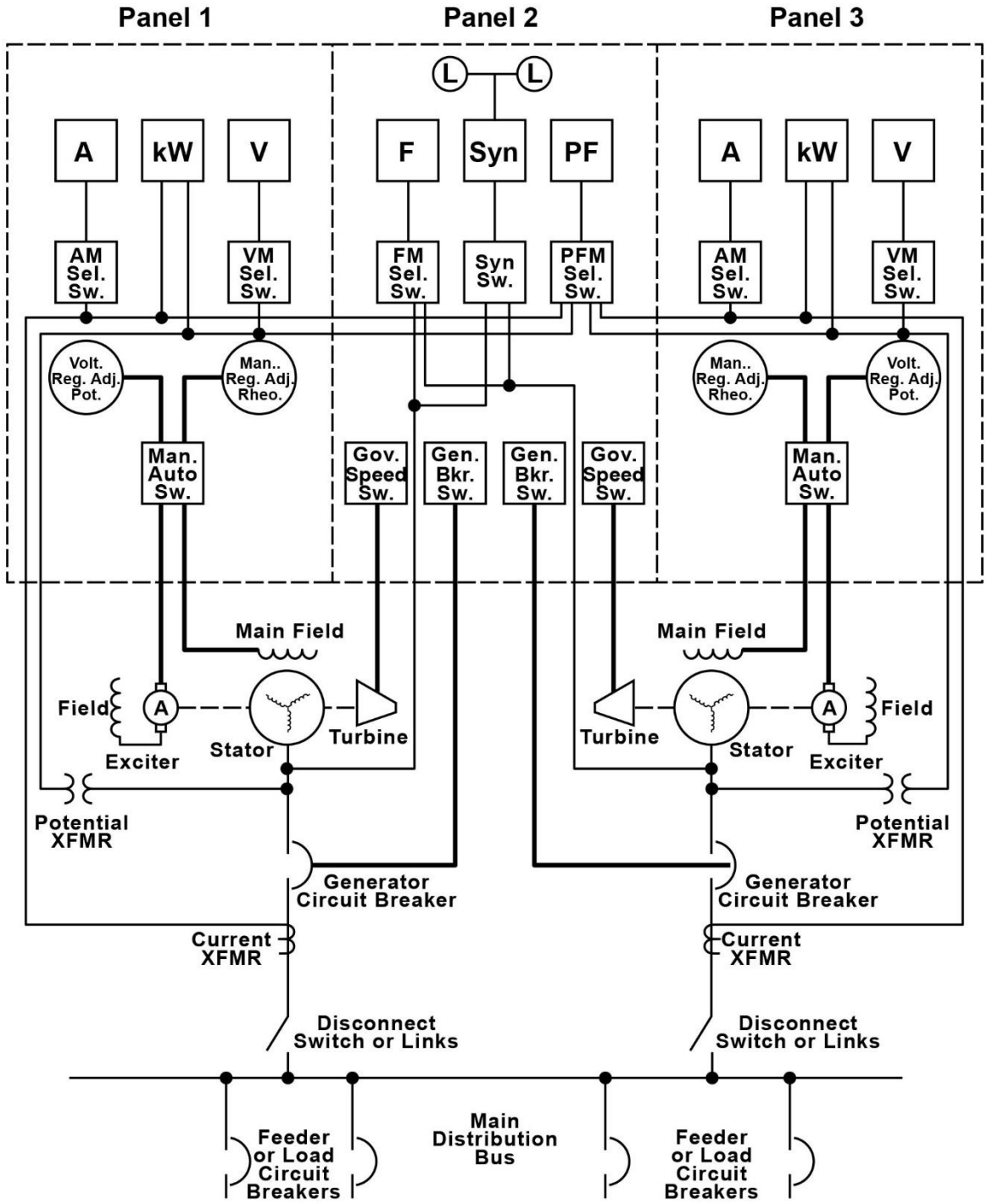
    Correct answer: B

70. Which of the following statements, concerning the cleaning maintenance of a brushless generator, is correct?

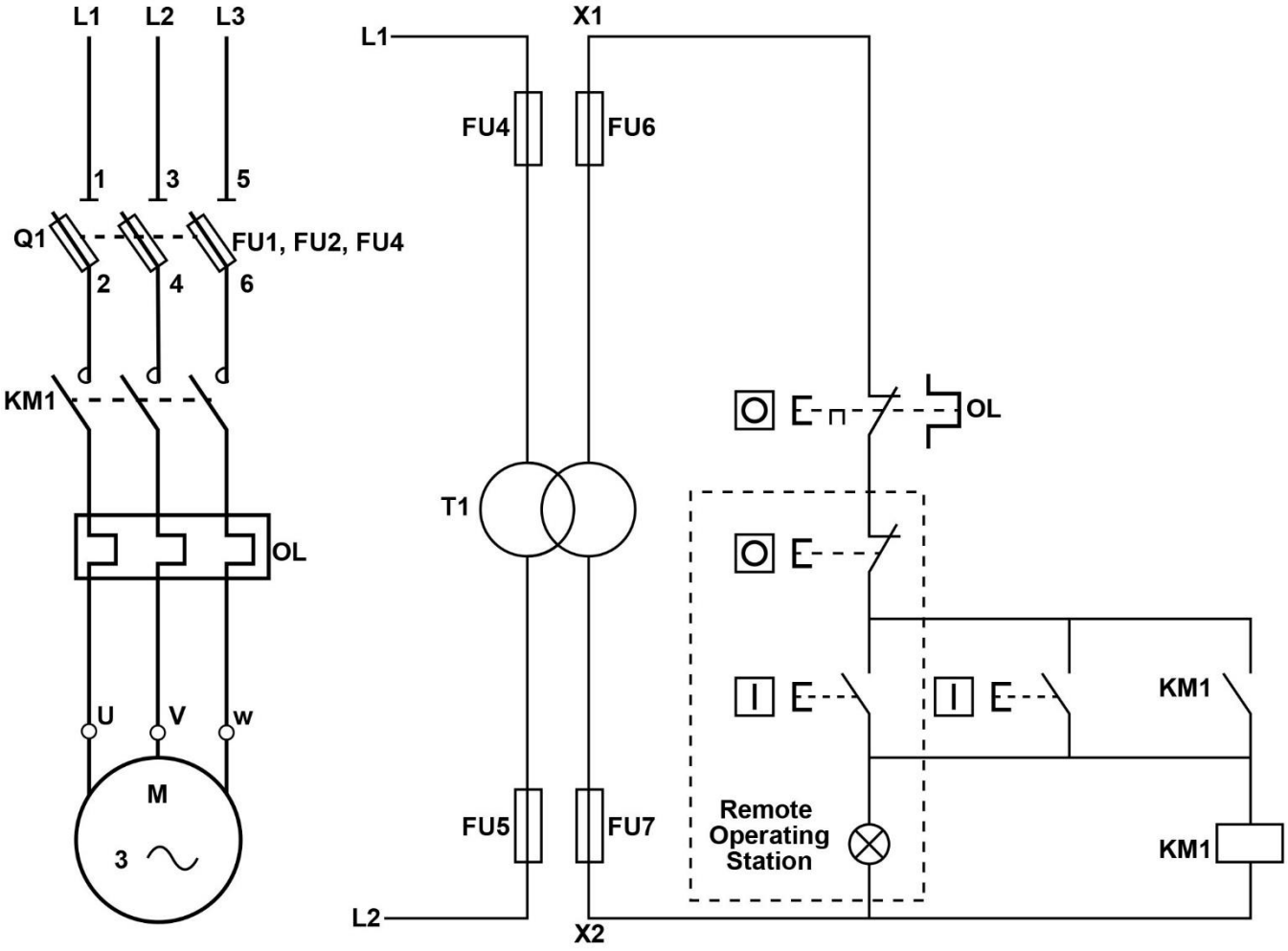
    A. Cleaning of windings should be performed on a conditional basis using a vacuum or using a clean, dry, lint-free rag.
    B. Cleaning of windings should be performed on a periodic basis regardless of the state of cleanliness.
    C. Hot soapy water should be used to remove dust and grime from windings.
    D. High-pressure air should be used to blow out dust and grime from the windings.

    Correct answer: A

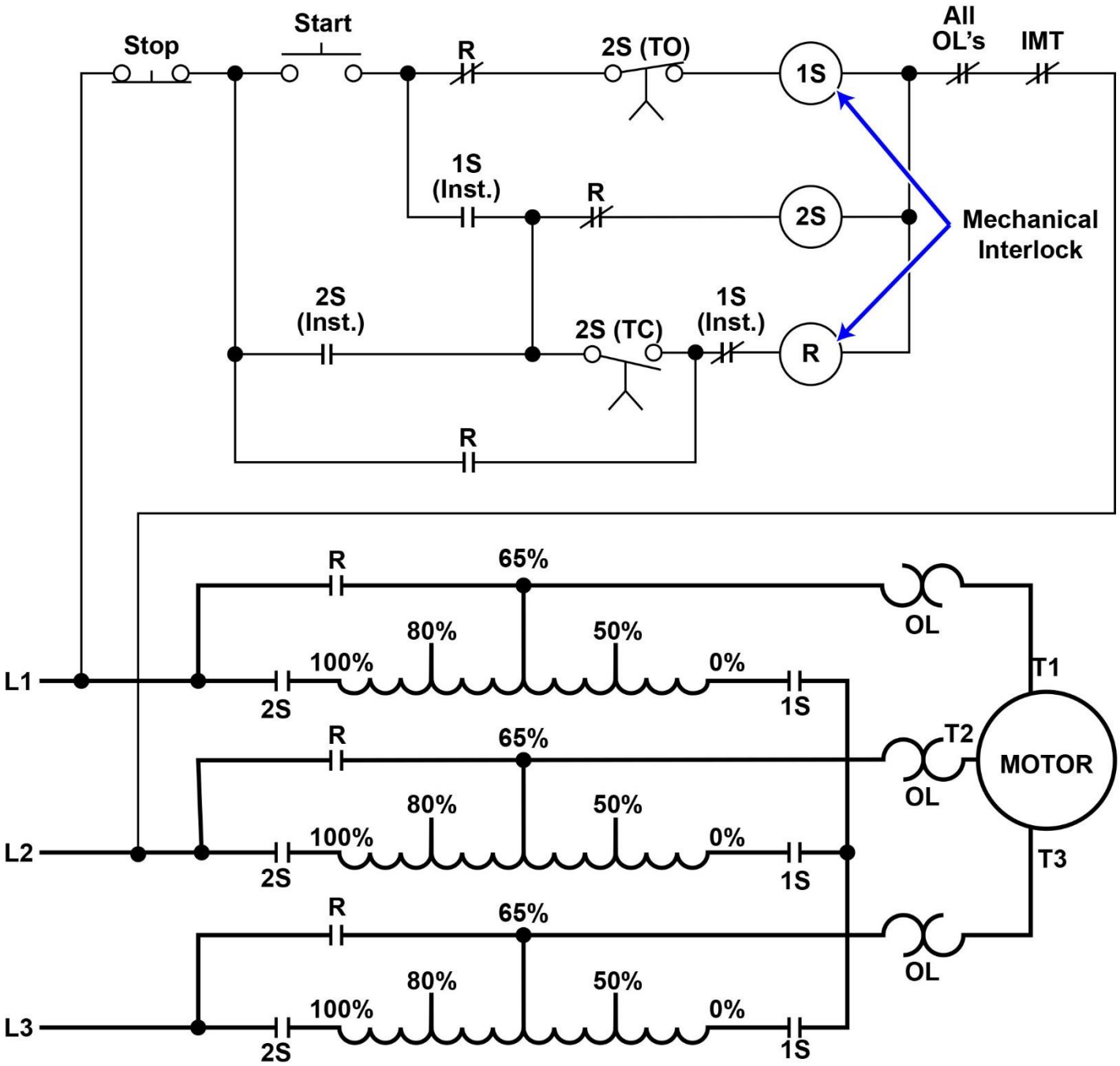
EL-0003



EL-0004



EL-0012



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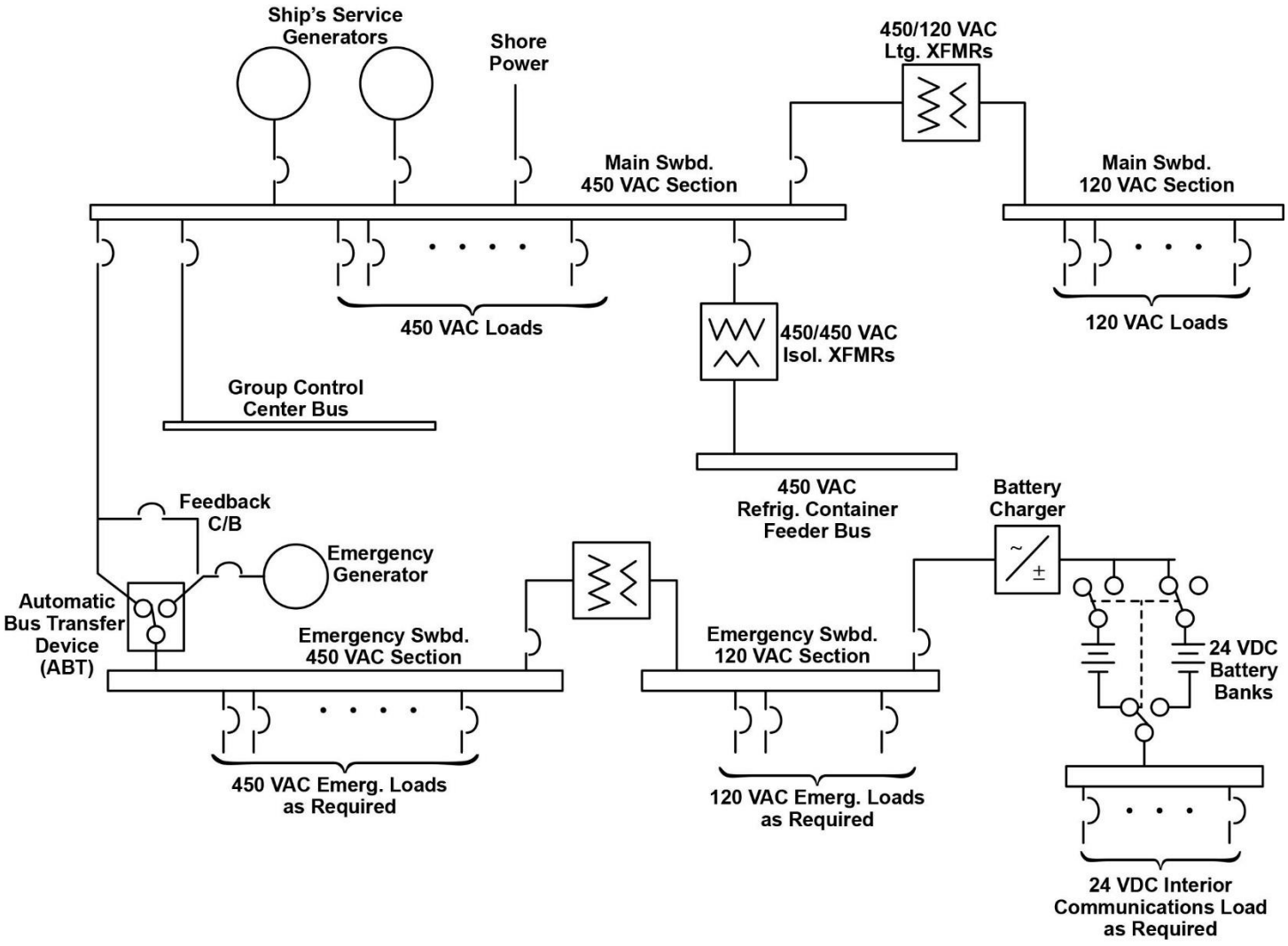

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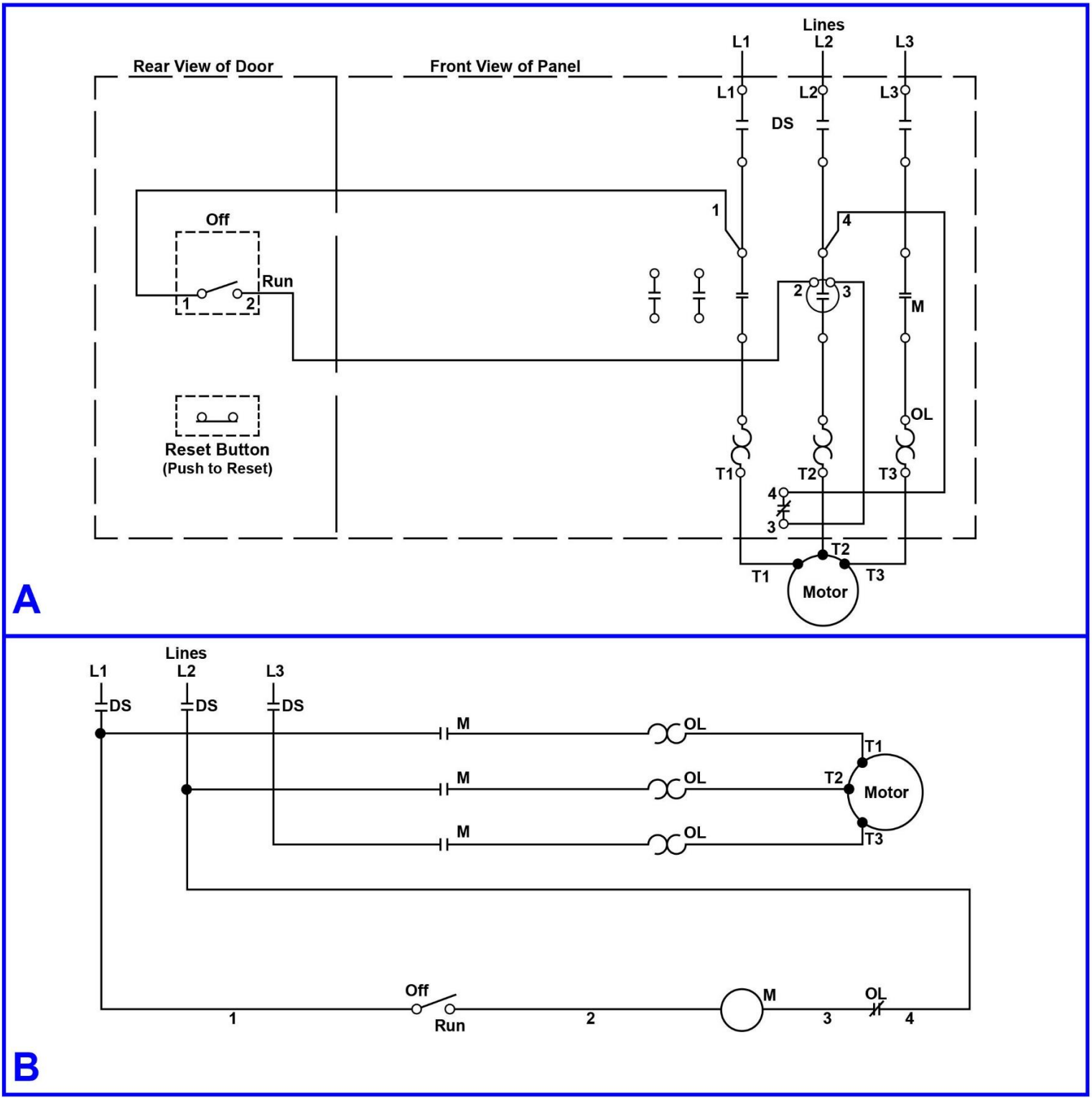

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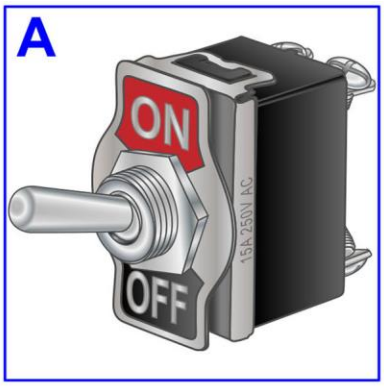

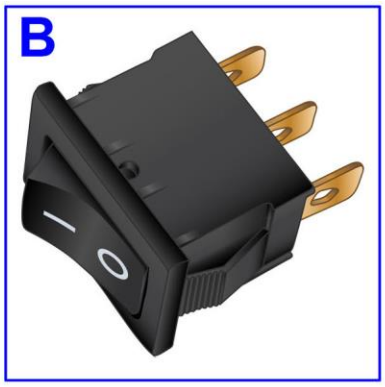

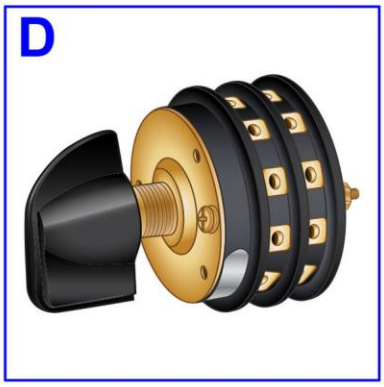

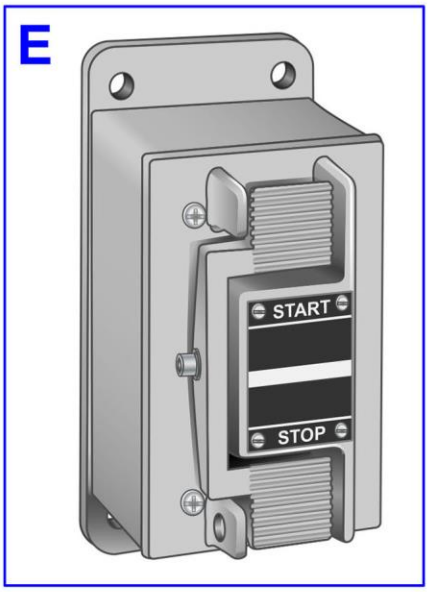

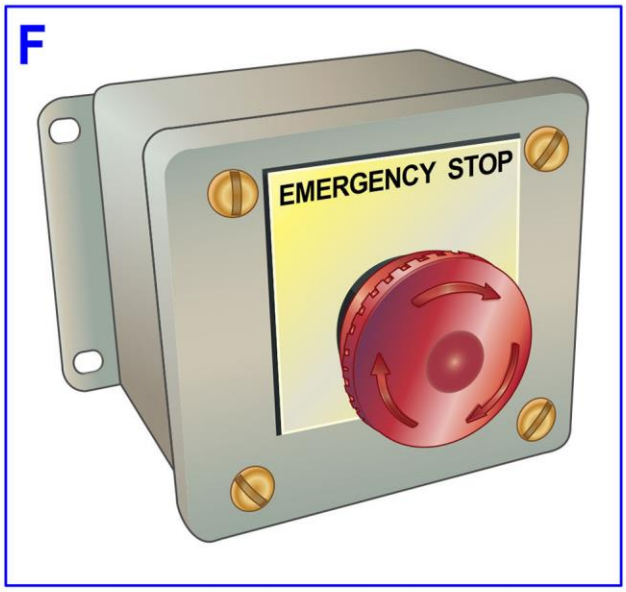

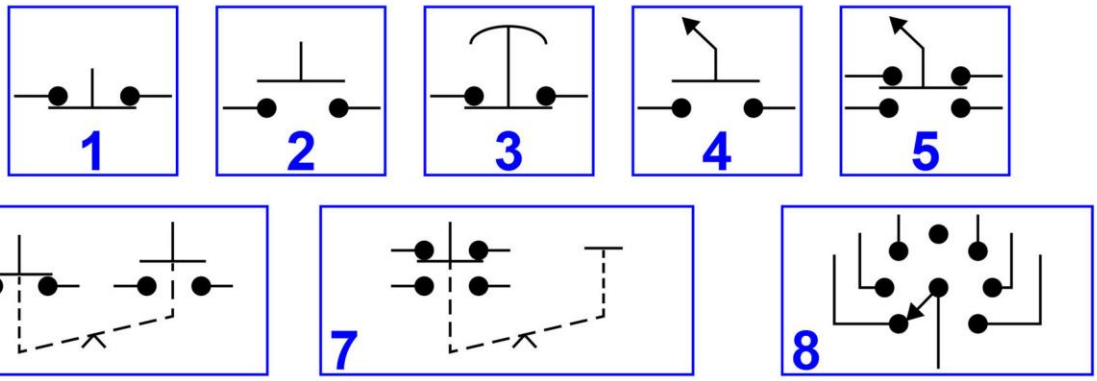

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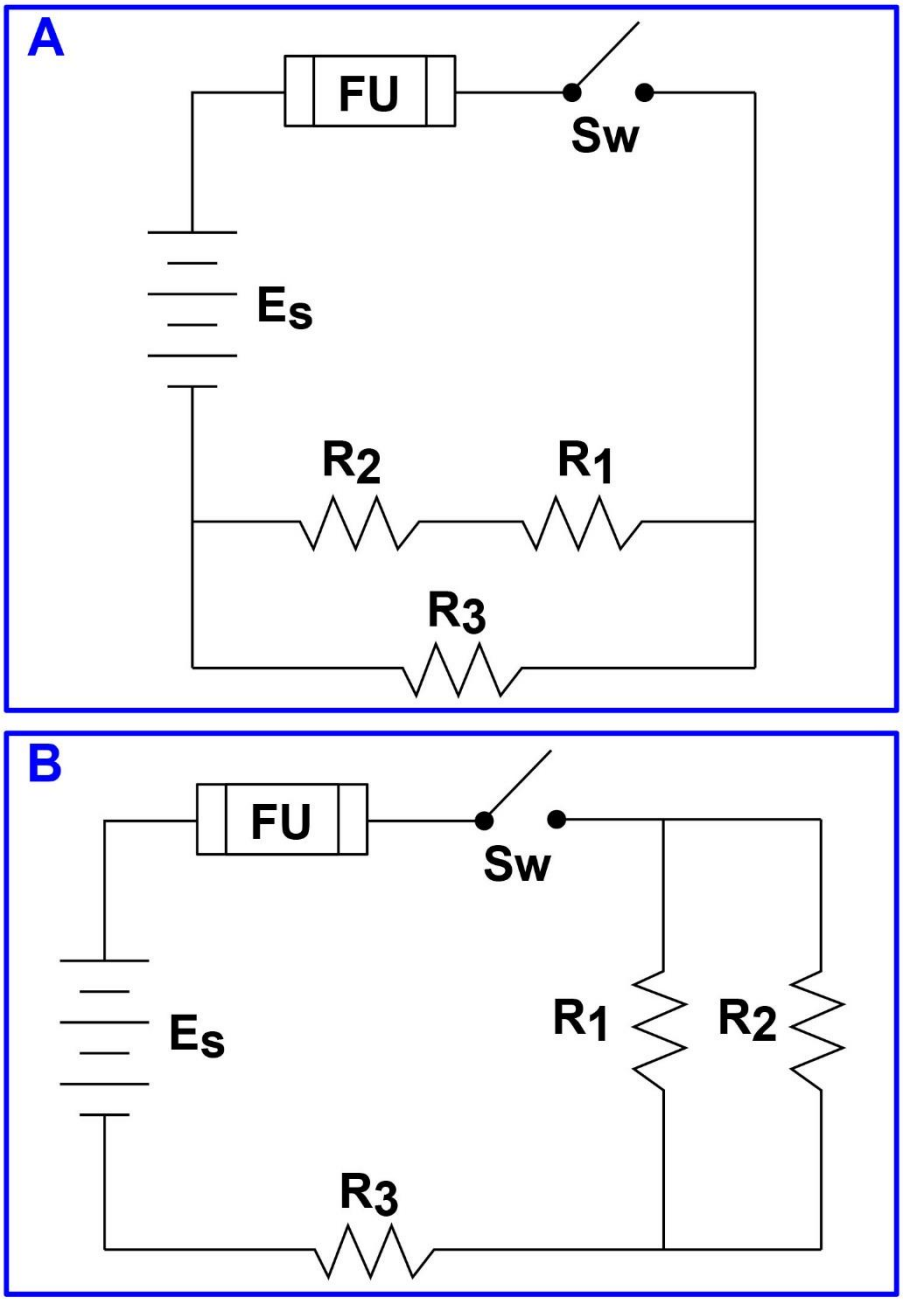

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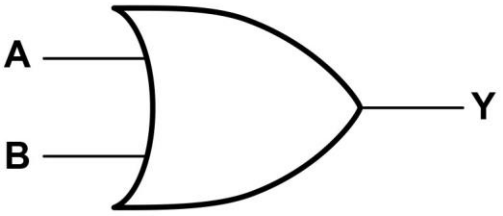

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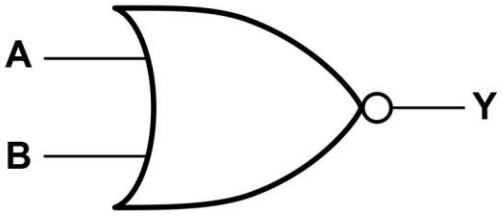

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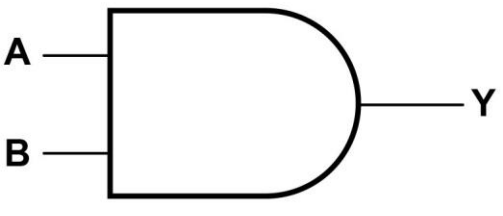

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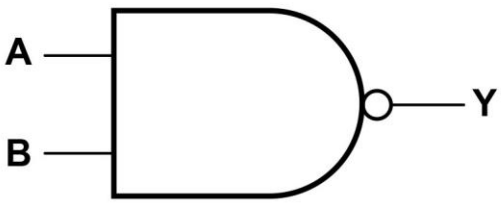

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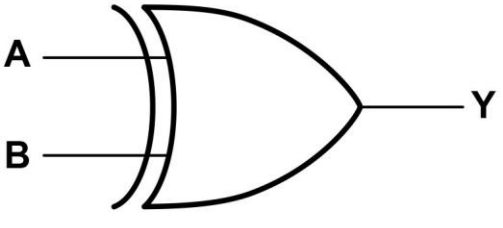

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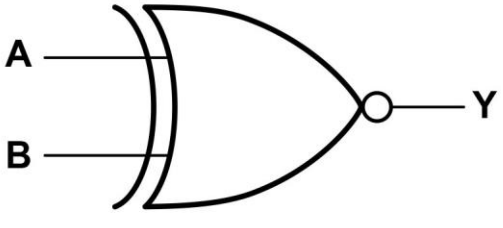

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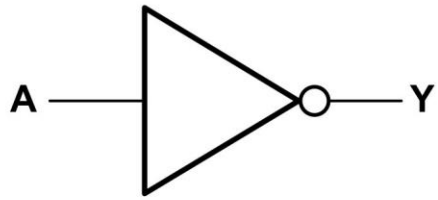

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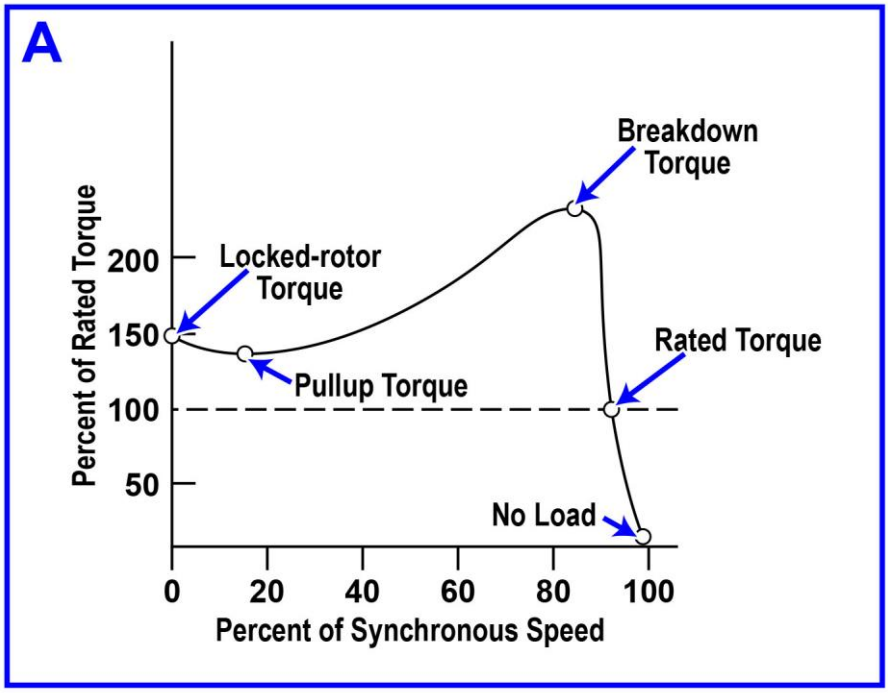

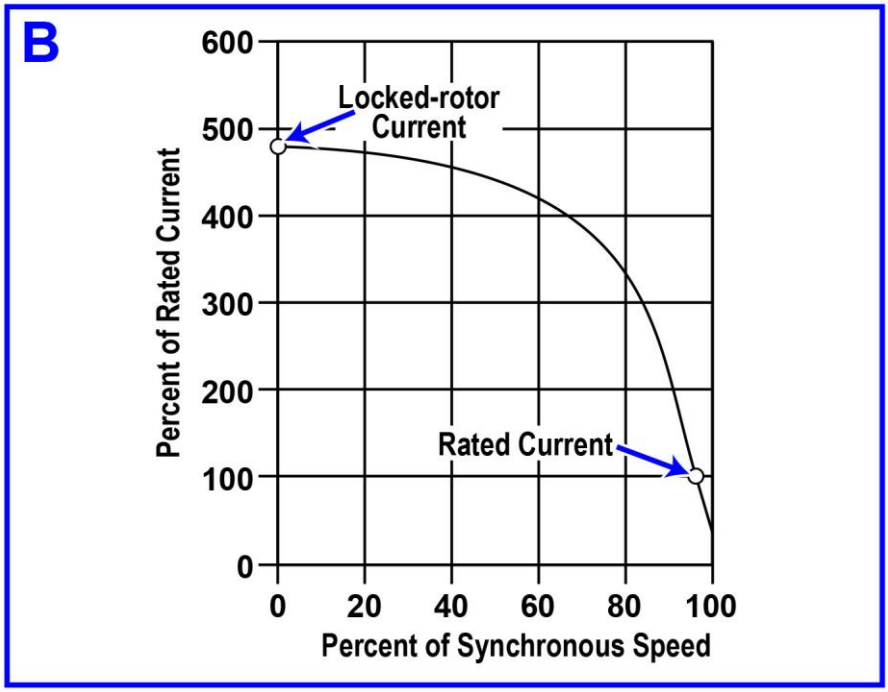

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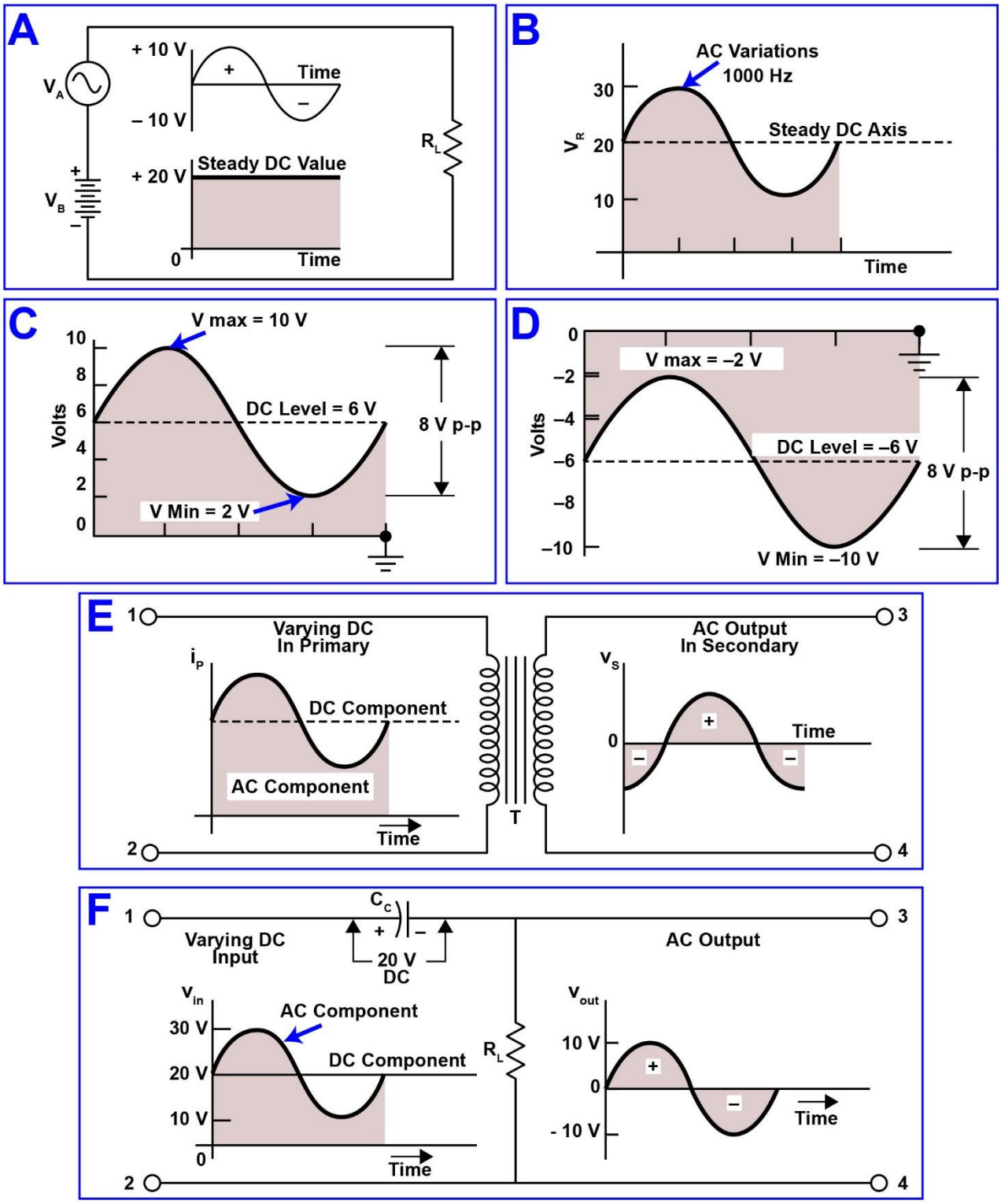

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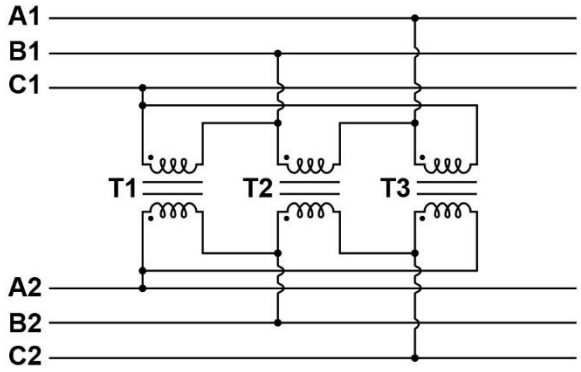

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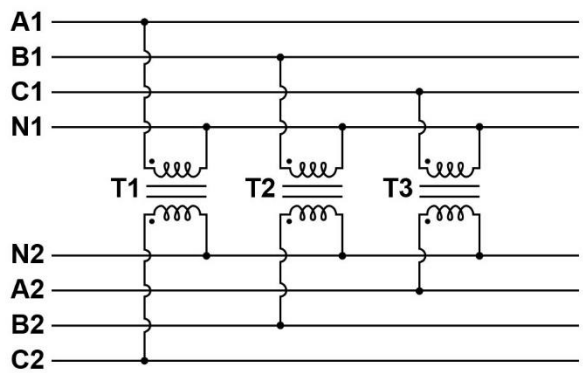

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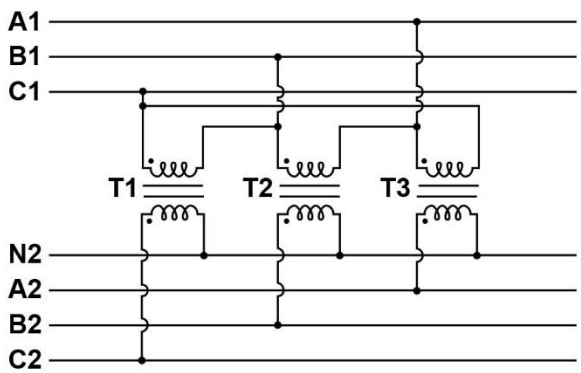

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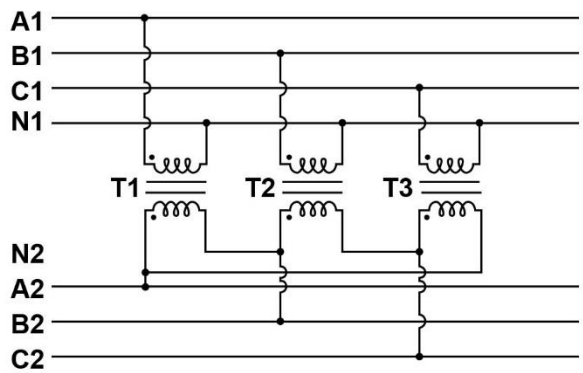

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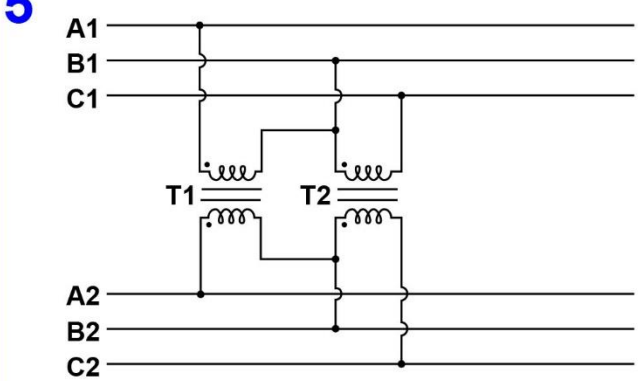

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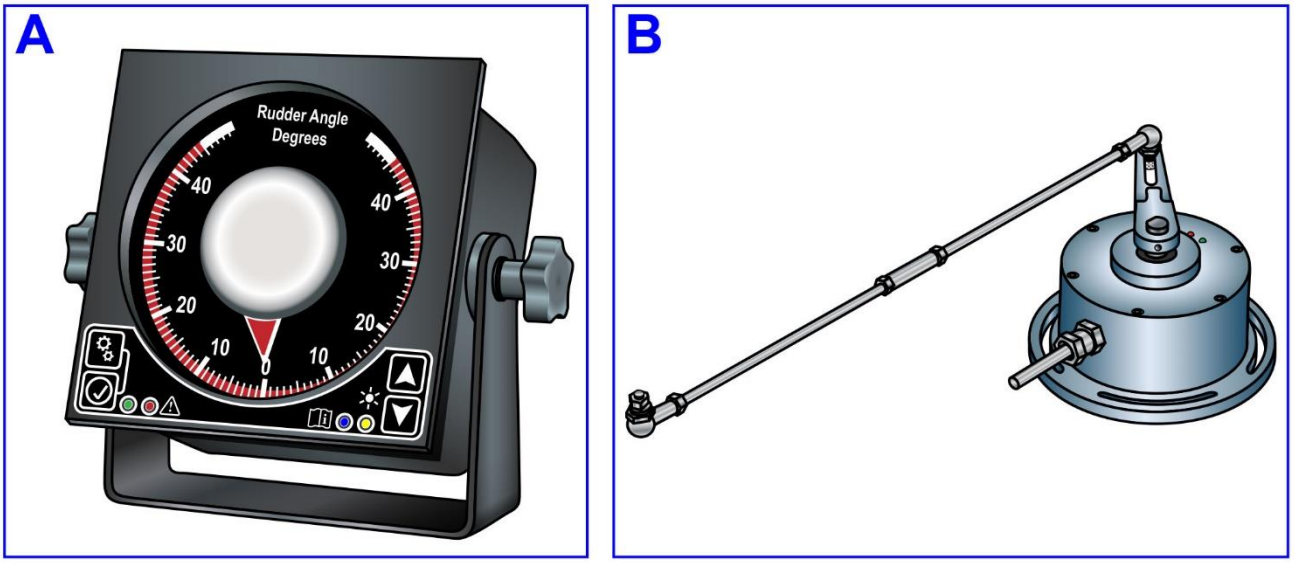

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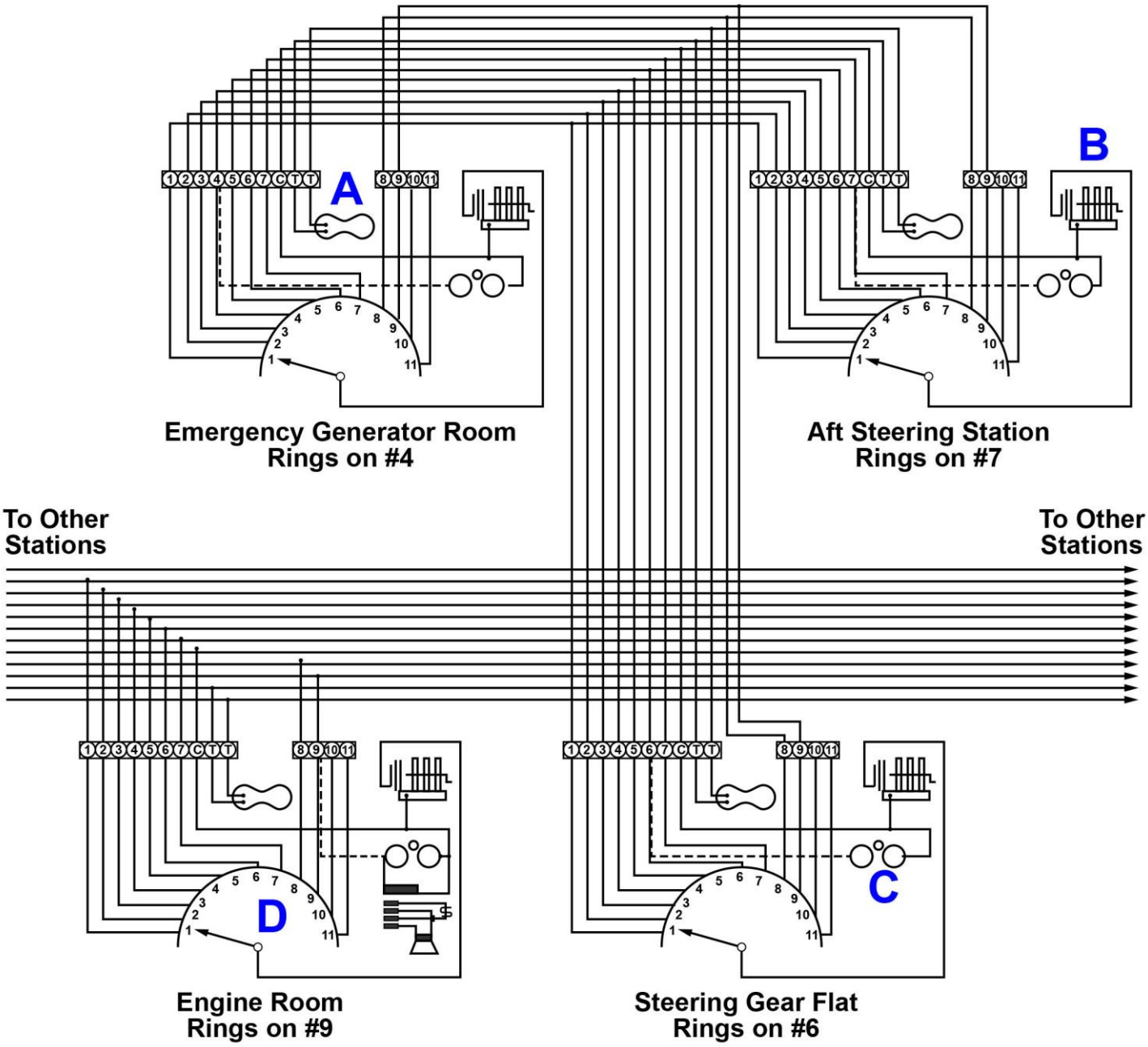

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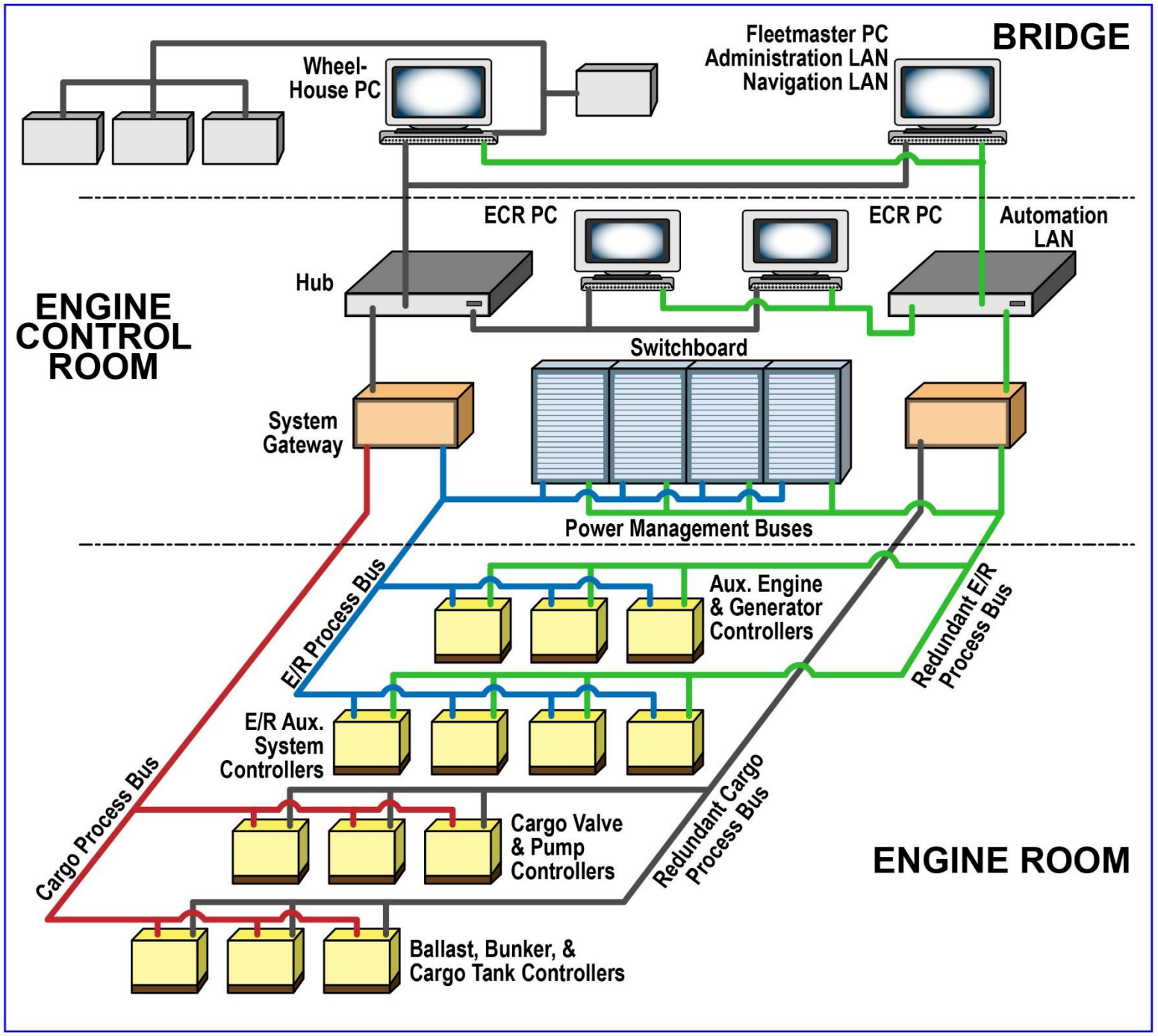

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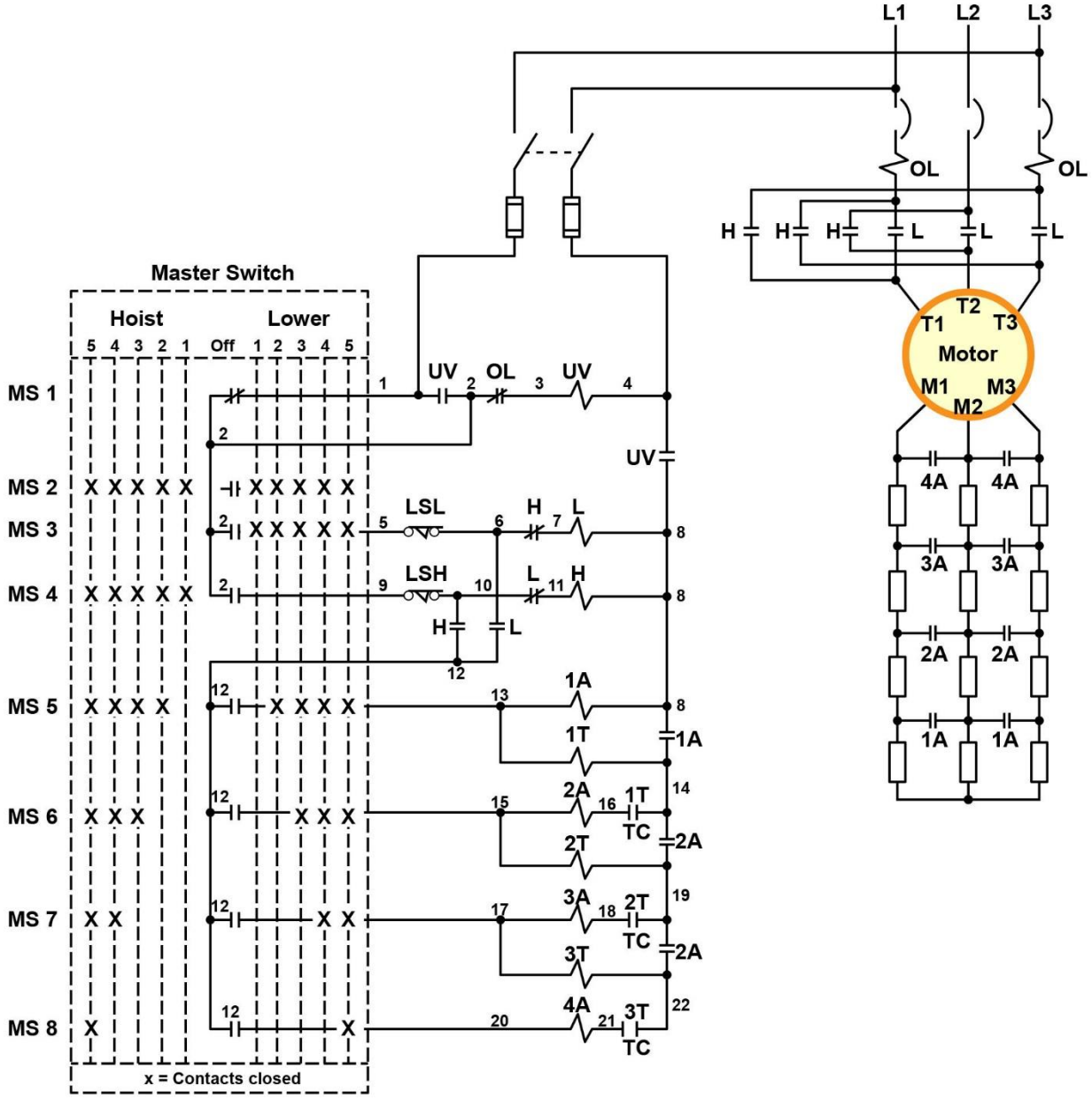
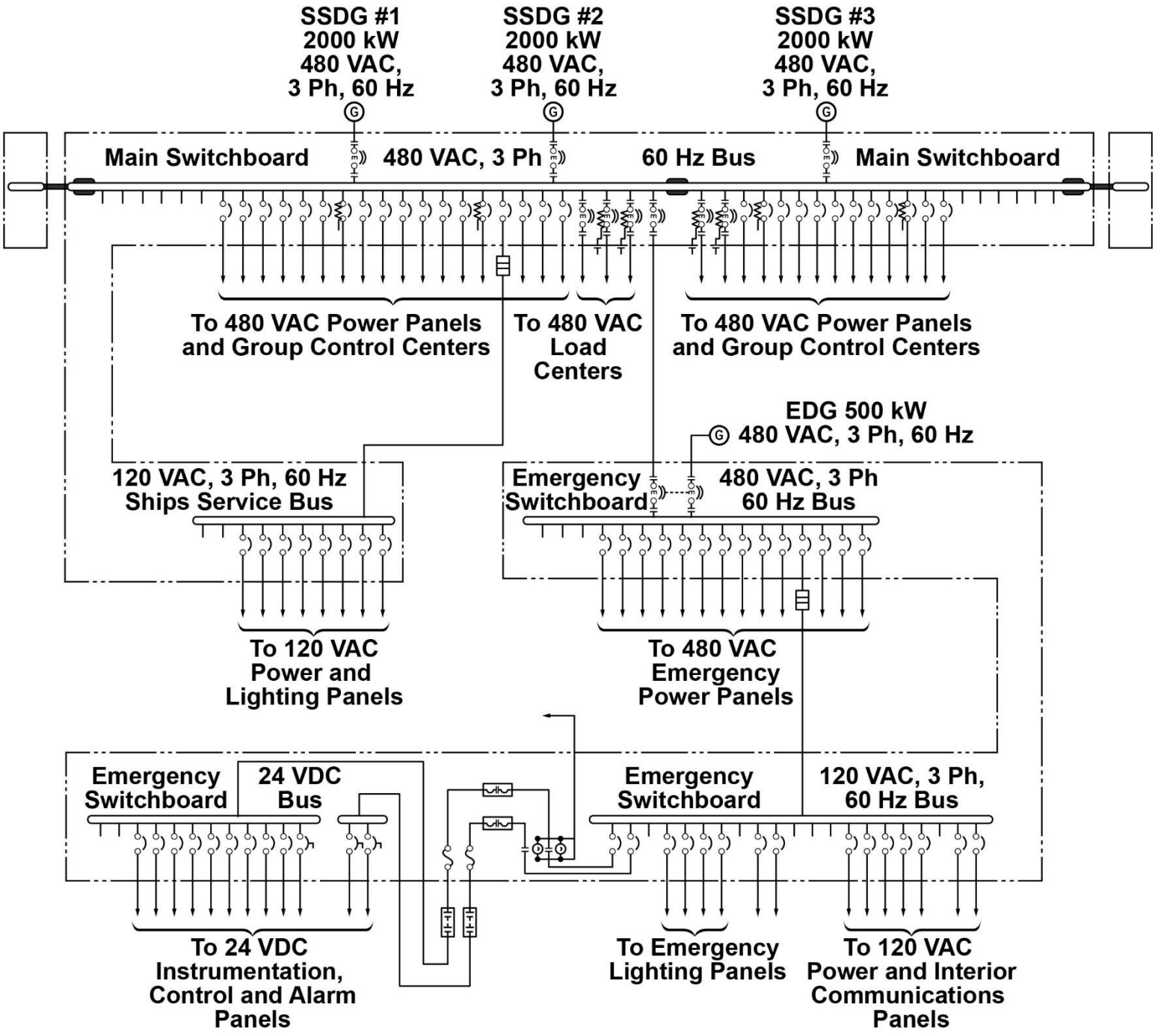


EL-0106
One Line Distribution Diagram



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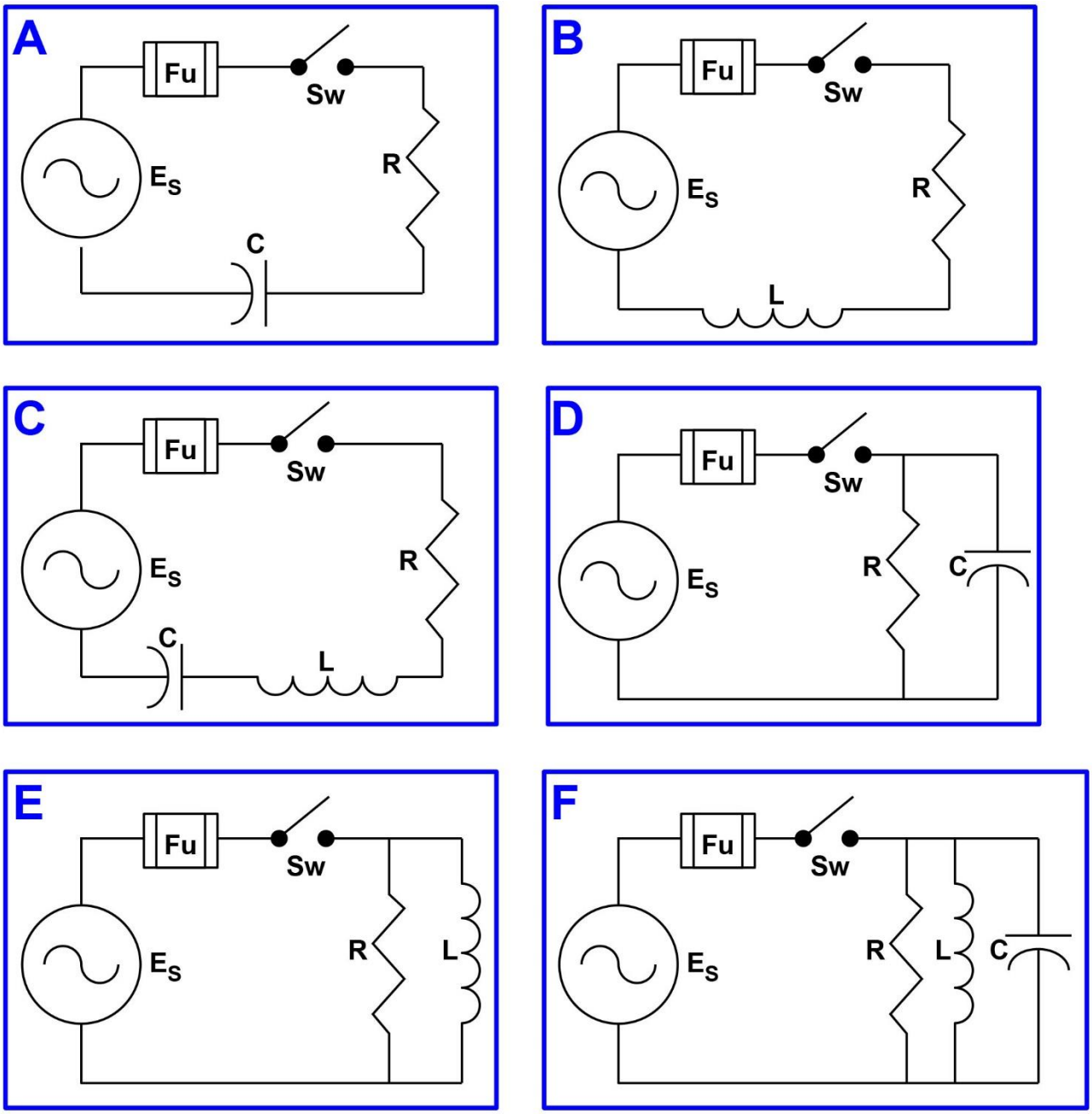
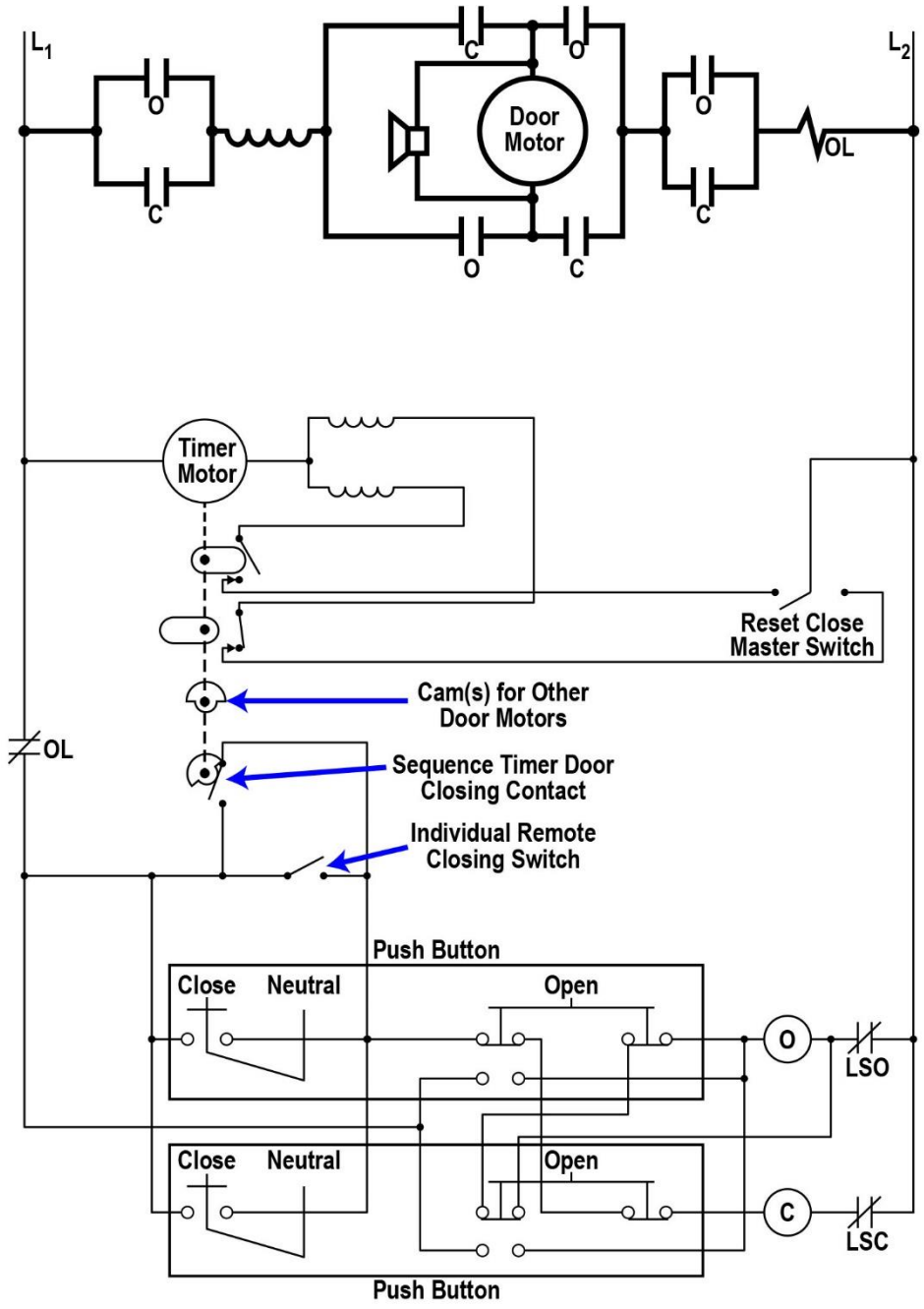


EL-0115
Watertight Door Controller



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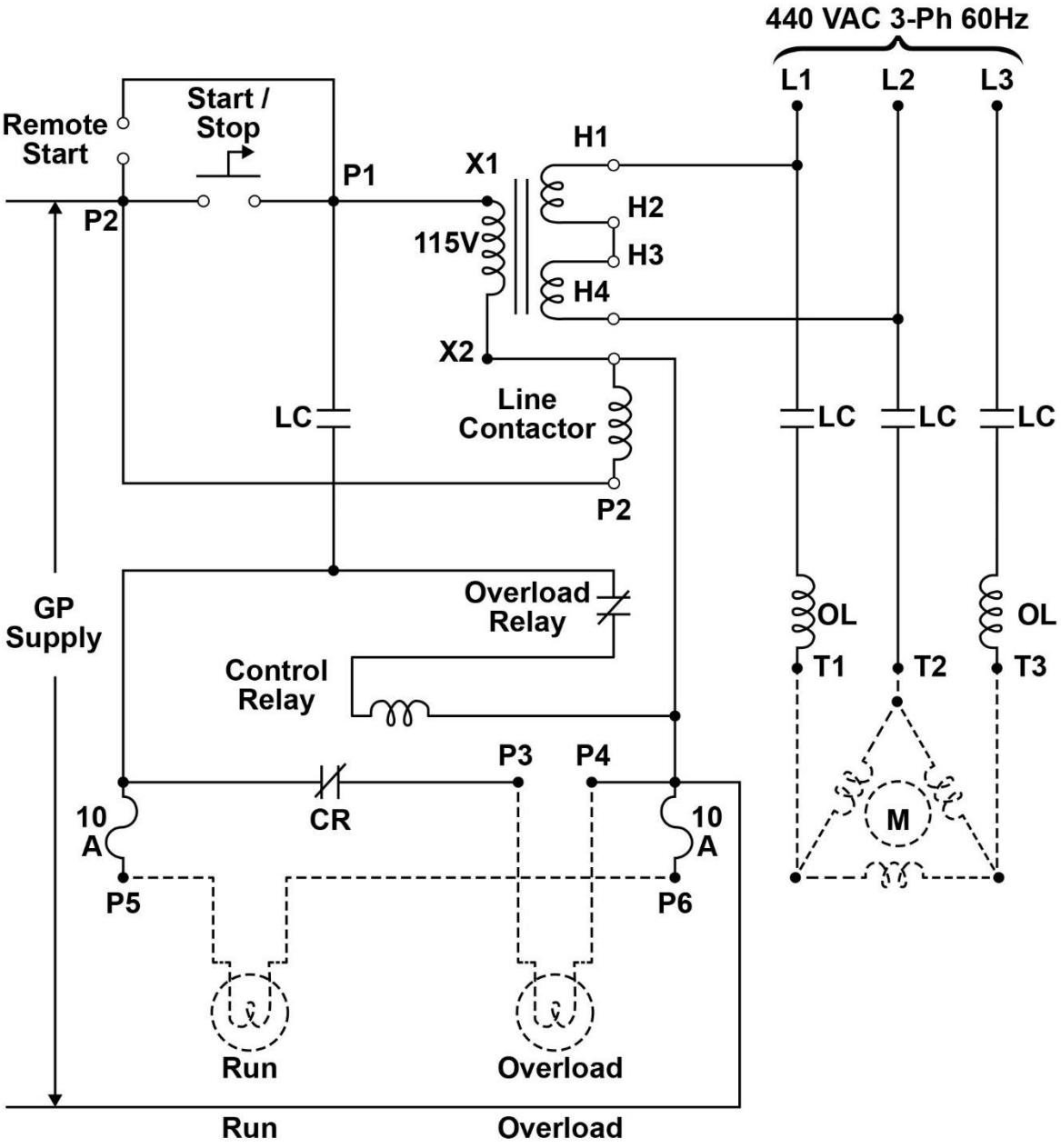


EL-0171

Standard Overload Relays

General Instructions for Selection of Overload Relay Heater Elements:

1. **Obtain full load current and service factor from motor nameplate of from motor manufacturer. Do not estimate full-load motor current from horsepower tables.**
2. **Determine if 1, 2, or 3 overload relays are needed.**
3. **Select proper heater from appropriate table according to class, size, type of enclosure and number of overload relays being used. Full load motor currents should be within the Min.-Max. ratings shown for the number of overload relays being used.**
4. **The tables apply only to standard, open type or totally enclosed fan-cooled, continuous duty motors (with a service factor of 1.15 and rated for 40 degrees C rise) in applications where motor and starter are located in the same ambient temperature. For applications of other motors with a service factor of 1, 50-55 degrees C rise, totally enclosed non-ventilated, explosion proof, or for installations where ambient temperatures of motor and starter are different, refer to Chart "A" for selection of overload heater units.**

Chart A: Variations by Operating Conditions

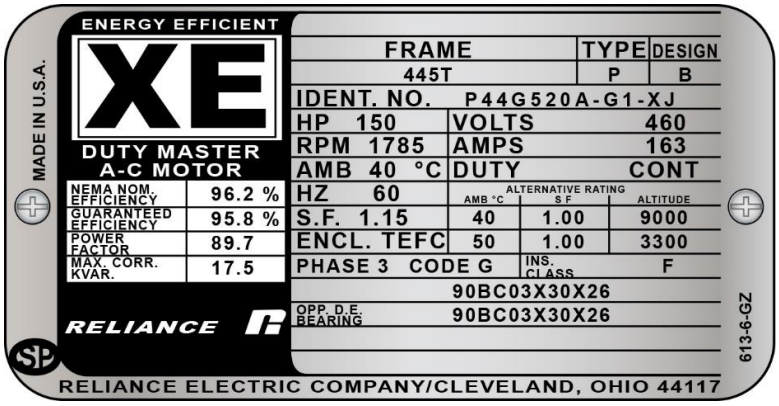
Motor continuous rating ° C rise	Ambient temperature same at starter and motor	Ambient temperature higher at starter than at motor	Ambient temperature lower at starter than at motor
1.5 service factor 40° C rise	As specified from tables	One size larger than specified for each 15° C difference	One size smaller than specified for each 15° C difference
1.0 service factor 50-55° C rise	One size smaller than for 1.15 service factor as above	One size smaller than for 1.15 service factor as above	One size smaller than for 1.15 service factor as above

Table 24: NEMA Size 6 for all Standard Enclosures Three Overload Relays per Starter

Heater Cat. No	Motor Current	
	Min.	Max.
G30T19	142	157
G30T20	158	171
G30T21	172	188
G30T22	189	207
G30T23	208	229

Heater Cat. No	Motor Current	
	Min.	Max.
G30T24	230	252
G30T25	253	277
G30T26	278	306
G30T27	307	336
G30T28	337	368

Heater Cat. No	Motor Current	
	Min.	Max.
G30T29	369	405
G30T30	406	459
G30T31	460	480



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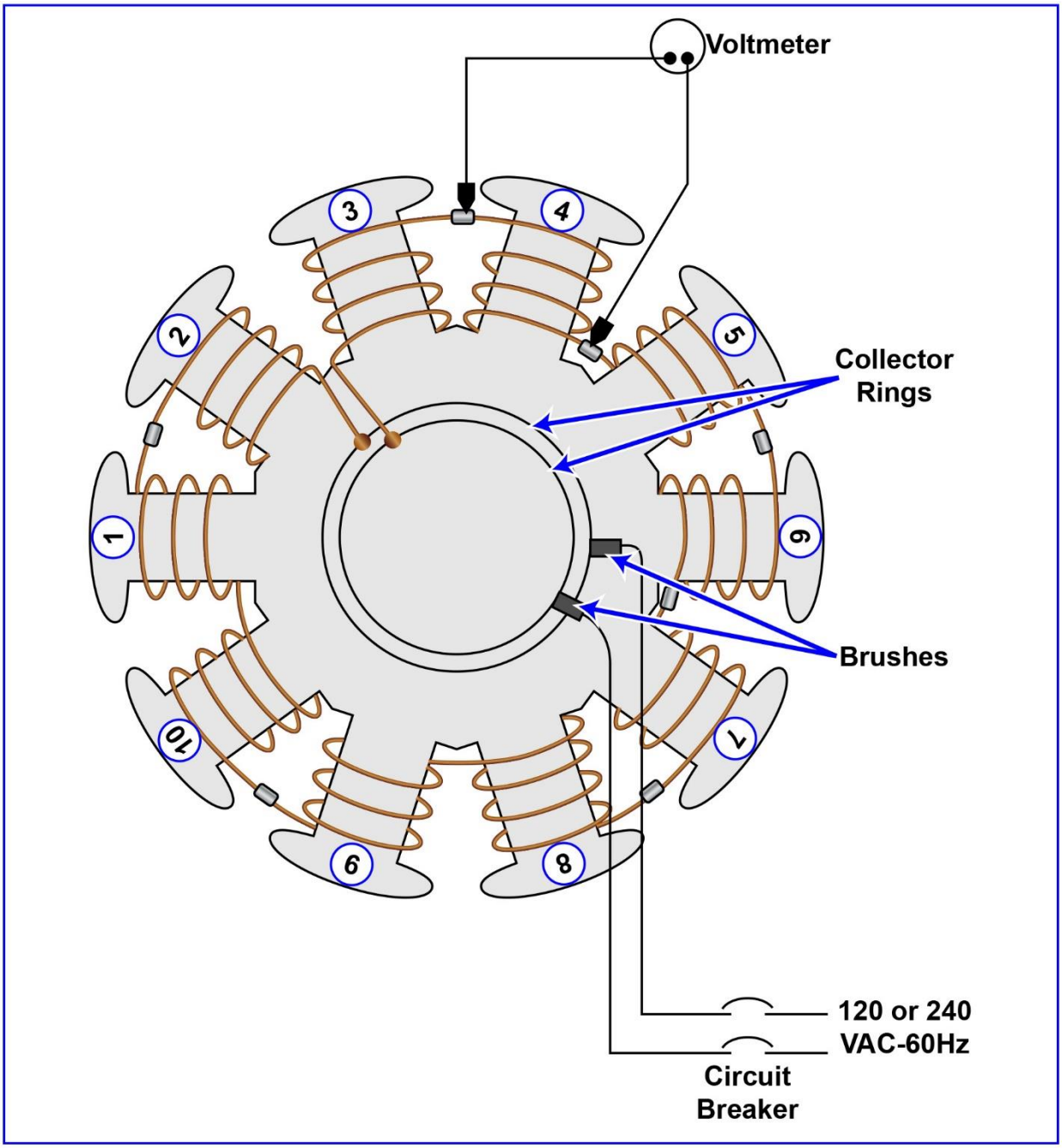

EL-0207