

## 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. The turns ratio of the tapped step-down transformer shown in figure "C" of the illustration is four to one and all taps are evenly spaced. If 120 volts were applied to terminals "H1" and "H3", what would appear at "X1" and "X2"? Illustration EL-0082
- (A) 15 volts
  - (B) 30 volts
  - (C) 480 volts
  - (D) 960 volts

*If choice A is selected set score to 1.*

2. Which of the procedures or conditions listed could result in damaging a transistor beyond repair?
- (A) Providing incorrect polarity to the collector circuit.
  - (B) Installing a transistor whose current rating exceeds the design circuit current.
  - (C) Providing insufficient voltage to the input circuit.
  - (D) Applying silicone grease between the heat sink and the transistor mounting.

*If choice A is selected set score to 1.*

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) Low resistance value on the primary coil.
  - (C) An infinite resistance value on the secondary coil.
  - (D) Overloaded secondary coil.

*If choice A is selected set score to 1.*

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

*If choice C is selected set score to 1.*

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

*If choice D is selected set score to 1.*

6. The torque load that a synchronous motor can handle is dependent on the hold-in strength of the poles. Hence, to increase the hold-in torque, it is necessary to \_\_\_\_\_.
- (A) decrease the resistance of the field rheostat
  - (B) decrease the 3-phase armature winding current
  - (C) increase the torque angle of the rotor magnets
  - (D) increase the direct current supplied to the rotor magnets

*If choice D is selected set score to 1.*

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

*If choice B is selected set score to 1.*

8. Regulations require that shipboard cabling use stranded copper conductors. Why is copper a superior conductor compared to aluminum?
- (A) Even though copper is more corrosive than aluminum, copper is lighter in weight than aluminum.
  - (B) Even though copper has more resistance than aluminum, copper is lighter in weight than aluminum.
  - (C) Even though copper is lower in conductivity than aluminum, copper has more resistance than aluminum.
  - (D) Even though copper is heavier in weight than aluminum, copper has less resistance than aluminum.

*If choice D is selected set score to 1.*

9. As shown in figure "A" of the illustration, with the switch closed what statement is true if "R<sub>1</sub>" and "R<sub>2</sub>" have unequal resistance values? Illustration EL-0019
- (A) The voltage drop across "R<sub>1</sub>" will not be equal to the voltage drop across "R<sub>2</sub>".
  - (B) The current flow through "R<sub>1</sub>" will equal the current flow through "R<sub>2</sub>".
  - (C) The current flow through "R<sub>1</sub>" will differ from the current flow through "R<sub>2</sub>".
  - (D) The energy dissipated in "R<sub>1</sub>" will be the same as the energy dissipated in "R<sub>2</sub>".

*If choice C is selected set score to 1.*

**10.** 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.*

**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  $R_1$  is 12 ohms, the resistance for  $R_2$  is 24 ohms, and the resistance for  $R_3$  is 36 ohms? Illustration EL-0032

- (A) 0.33 amperes
- (B) 0.75 amperes
- (C) 1.25 amperes
- (D) 1.33 amperes

*If choice D is selected set score to 1.*

**12.** What type of electrical diagram for the electrical distribution system is shown in the illustration? Illustration EL-0014

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

*If choice C is selected set score to 1.*

**13.** Periodic testing using a special sensing device may be performed to detect potentially dangerous loose or corroded bus bar and controller connections. What is the name of this testing technology?

- (A) visual pyrotronics
- (B) infra-red thermography
- (C) corrosion electrolysis
- (D) electric vibro-analysis

*If choice B is selected set score to 1.*

**14.** What is an ammeter used to measure?

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

*If choice A is selected set score to 1.*

- 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.

*If choice D is selected set score to 1.*

- 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 is contaminated with moisture.
  - (C) The insulation is in good condition.
  - (D) The insulation has direct continuity with ground.

*If choice C is selected set score to 1.*

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

*If choice C is selected set score to 1.*

- 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

*If choice C is selected set score to 1.*

- 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 overload relay (OL) heaters for continuity, replace as necessary
  - (C) check the disconnect switch open, open as necessary
  - (D) check the overload relay for tripped condition, reset as necessary

*If choice D is selected set score to 1.*

- 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

*If choice B is selected set score to 1.*

- 21.** How can the loss of residual magnetism in an alternator with a brushless excitation system be corrected?
- (A) using a storage battery or battery charger to "flash" the field
  - (B) running the rotor in the opposite direction for 5 minutes
  - (C) running the generator at normal speed with the field rheostat fully counter-clockwise
  - (D) allowing the generator to run at 10% of normal speed for 5 minutes

*If choice A is selected set score to 1.*

- 22.** The nominal voltage of one cell of a wet cell nickel-cadmium battery is approximately how many volts?
- (A) 1.2 volts
  - (B) 1.5 volts
  - (C) 2.0 volts
  - (D) 3.0 volts

*If choice A is selected set score to 1.*

- 23.** How is the difference between the synchronous speed of a three-phase induction motor and its operating speed correctly expressed?
- (A) slip
  - (B) a decimal fraction of full load speed
  - (C) deviation
  - (D) a percent of full load speed

*If choice A is selected set score to 1.*

**24.** 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.*

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

- (A) electrical interlock device
- (B) mechanical limit device
- (C) monitoring device
- (D) modulating device

*If choice A is selected set score to 1.*

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

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

*If choice C is selected set score to 1.*

**27.** As shown in the illustration of an electrically operated watertight door controller, how is reversal of the direction of the DC motor rotation achieved? Illustration EL-0115

- (A) The reset close master switch is closed.
- (B) The individual remote closing switch is closed.
- (C) The LSO switch or LSC switch is opened.
- (D) Either the open coil or closed coil is energized.

*If choice D is selected set score to 1.*

**28.** By what means is an AC generator prevented from becoming motorized?

- (A) overspeed trip
- (B) governor controls
- (C) reverse power relay
- (D) back pressure trip

*If choice C 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.** 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.

*If choice D is selected set score to 1.*

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

- (A) Magnetic resonator
- (B) Laser
- (C) Ballast
- (D) Magnetron

*If choice C is selected set score to 1.*

**32.** Referring to the containership one-line distribution diagram shown in the illustration, what is the purpose of the feedback circuit breaker as used to bypass the automatic bus transfer device?  
Illustration EL-0014

- (A) Since it is normally closed, it is the means by which the emergency generator control circuit senses the voltage at the emergency bus.
- (B) It allows the emergency generator to feed the main bus during dead ship start-up; otherwise it is generally open and not used.
- (C) Since it is normally closed, it is the means by which the emergency generator control circuit senses the voltage at the main bus.
- (D) It allows the emergency generator to be paralleled with the ship's service generators when additional power is needed.

*If choice B is selected set score to 1.*



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

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

*If choice D is selected set score to 1.*

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

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

*If choice A is selected set score to 1.*

**35.** Silicon diodes which are designed for a specific reverse breakdown voltage, and are most often used as electronic power supply voltage regulators, are specifically what type of diode?

- (A) tunnel diodes
- (B) Zener diodes
- (C) compensating diodes
- (D) hot-carrier diodes

*If choice B is selected set score to 1.*

**36.** 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) Notch filter circuit
- (C) High-pass filter circuit
- (D) Bandpass filter circuit

*If choice A is selected set score to 1.*

**37.** Referring to figure "4" of the illustration, what type of logic gate is symbolized? Illustration EL-0035

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

*If choice A is selected set score to 1.*

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

- (A) Rudder angle indicator system
- (B) Centrifuge RPM indicator system
- (C) Turbocharger RPM indicator system
- (D) Shaft revolution indicator system

*If choice A is selected set score to 1.*

**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 the other automation area network.
- (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 both redundant engine control process area networks.
- (D) Each connects one of two redundant automation area networks with both redundant cargo process area networks.

*If choice B is selected set score to 1.*

**40.** As shown in the illustrated block diagram for a distributed automation system, what statement is true concerning the units labeled "ROS" which are remote operating system workstations? Illustration EL-0096

- (A) The ROS located in the ship's office is designated as the master ROS.
- (B) The ROS located in the wheelhouse is designated as the master ROS.
- (C) Operator access to control functions among the various ROS locations are all identical.
- (D) Operator access to control functions among the various ROS locations differ depending system configuration and need.

*If choice D is selected set score to 1.*

**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 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.*

**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 **CLOSED**  
The control relay contacts will be **OPEN**
- (B) The overload relay contacts will be **OPEN**  
The control relay contacts will be **OPEN**
- (C) The overload relay contacts will be **CLOSED**  
The control relay contacts will be **CLOSED**
- (D) The overload relay contacts will be **OPEN**  
The control relay contacts will be **CLOSED**

*If choice A is selected set score to 1.*

**43.** 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.*

**44.** 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.*

**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) 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.*

- 46.** When a self-excited alternator's field has lost its residual magnetism due to a prolonged idle period, it will fail to produce a voltage. Flashing the field is the procedure used to restore the residual magnetism. Using a 12 volt storage battery, how is this performed?
- (A) The F+ and F- leads are disconnected from the alternator field. The F+ lead is connected to the negative terminal of the battery, and the F- lead is connected to the positive terminal.
  - (B) The F+ and F- leads are disconnected from the alternator field. The F+ lead is connected to the positive terminal of the battery, and the F- lead is connected to the negative terminal.
  - (C) The S+ and S- leads are disconnected from the alternator stator. The S+ lead is connected to the negative terminal of the battery, and the S- lead is connected to the positive terminal.
  - (D) The S+ and S- leads are disconnected from the alternator stator. The S+ lead is connected to the positive terminal of the battery, and the S- lead is connected to the negative terminal.

*If choice B is selected set score to 1.*

- 47.** After prior isolation and lock-out/tag-out procedures are performed, it is still possible that stored electrical energy within the circuit can pose an electrical shock hazard. Which electrical device requires discharging any stored electrical energy before any work may safely begin?
- (A) potential transformer
  - (B) resistor bank
  - (C) choke coil
  - (D) capacitor

*If choice D is selected set score to 1.*

- 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.

*If choice C is selected set score to 1.*

- 49.** Which of the listed temperature measuring devices installed on a large turbo-electric alternating current propulsion generator would be the most reliable for monitoring generator temperatures to avoid premature winding insulation failure?
- (A) Temperature sensors measuring the temperature of the cooling air associated with the generator air cooler.
  - (B) Temperature sensors inserted in the stator slots for measuring stator winding temperature.
  - (C) Temperature sensors measuring the temperature of the cooling water associated with the generator air cooler.
  - (D) Current transformers are the most reliable means of monitoring generator temperatures.

*If choice B is selected set score to 1.*

- 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 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.*

- 51.** 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.*

- 52.** Before work may safely commence on a high voltage system, what must first be done after disconnection and isolation?
- (A) The circuit must be grounded first, then tested and proved dead with an off-line tester.
  - (B) The circuit must be tested and proved dead first with a live-line tester, then grounded.
  - (C) The circuit must be tested and proved dead first with an off-line tester, then grounded.
  - (D) The circuit must be grounded first, then tested and proved dead with a live-line tester.

*If choice B is selected set score to 1.*

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

*If choice B is selected set score to 1.*

- 54.** Referring to the sound-powered telephone circuit shown in the illustration, what statement is true?  
Illustration EL-0093

- (A) The sound-powered telephone circuitry consists of a selective-talk circuit and a common-ringing circuit.
- (B) The sound-powered telephone circuitry consists of selective-talk and selective-ringing circuits.
- (C) The sound-powered telephone circuitry consists of common-talk and common-ringing circuits.
- (D) The sound-powered telephone circuitry consists of a common-talk circuit and a selective-ringing circuit.

*If choice D is selected set score to 1.*

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

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

*If choice C is selected set score to 1.*

- 56.** A low voltage, high current testing unit consisting of an autotransformer, ammeter, and timer may be used to test the proper tripping function of a three-pole magnetic circuit breaker. What is the correct procedure for using this apparatus?

- (A) Each pole is tested individually with the clamp-on ammeter clamped around a single conductor with the common tripping bar removed throughout the procedure.
- (B) Each pole is tested individually with the clamp-on ammeter clamped around a single conductor with the common tripping bar attached throughout the test procedure.
- (C) All poles are tested simultaneously with the clamp-on ammeter clamped around all three conductors with the common tripping bar removed.
- (D) All poles are tested simultaneously with the clamp-on ammeter clamped around all three conductors with the common tripping bar attached.

*If choice B is selected set score to 1.*

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

- (A) cycles per second
- (B) revolutions per minute
- (C) revolutions per second
- (D) coulombs per second

*If choice A is selected set score to 1.*

**58.** An AC generator produces 60 Hz at 1800 RPM. If the generator speed is increased to 1830 RPM, what will happen to the frequency in Hz?

- (A) decrease to 59 Hz
- (B) remain at 60 Hz
- (C) increase to 61 Hz
- (D) increase to 63 Hz

*If choice C is selected set score to 1.*

**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

*If choice C is selected set score to 1.*

**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

*If choice A is selected set score to 1.*

**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) send the oiler to look for fires in the transformer
- (C) check the transformer ventilation fans for proper operation
- (D) reduce load by tripping lighting circuits

*If choice C is selected set score to 1.*

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

*If choice D is selected set score to 1.*

**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 low starting torque with power factor correction
- (B) Relatively high starting torque with no power factor correction
- (C) Relatively low starting torque with no power factor correction
- (D) Relatively high starting torque with power factor correction

*If choice C is selected set score to 1.*

**64.** In which of the following branch circuit types would time lag fuses (or dual-element fuses) be MOST likely used?

- (A) general alarm circuits
- (B) emergency lighting circuits
- (C) motor starting circuits
- (D) main lighting circuits

*If choice C is selected set score to 1.*

**65.** Which of the listed figures shown in the illustration represents a three-phase transformer connected in a wye-wye configuration? Illustration EL-0084

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

*If choice B is selected set score to 1.*



**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

*If choice A is selected set score to 1.*

**67.** What type of motor is generally used in DC propulsion drive systems?

- (A) differentially compounded
- (B) shunt-wound or separately excited
- (C) permanent magnet
- (D) series-wound

*If choice B is selected set score to 1.*

**68.** 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.*

**69.** What does figure "C" of the illustration represent? Illustration EL-0092

- (A) a synchronous transmission system with a single transmitter and two receivers each equipped with a single rotor winding and three wye-connected stator windings
- (B) a synchronous transmission system with two transmitters and a single receiver each equipped with a single stator winding and three wye-connected rotor windings
- (C) a synchronous transmission system with two transmitters and a single receiver each equipped with a single rotor winding and three wye-connected stator windings
- (D) a synchronous transmission system with a single transmitter and two receivers each equipped with a two pole stator winding and three wye-connected rotor windings

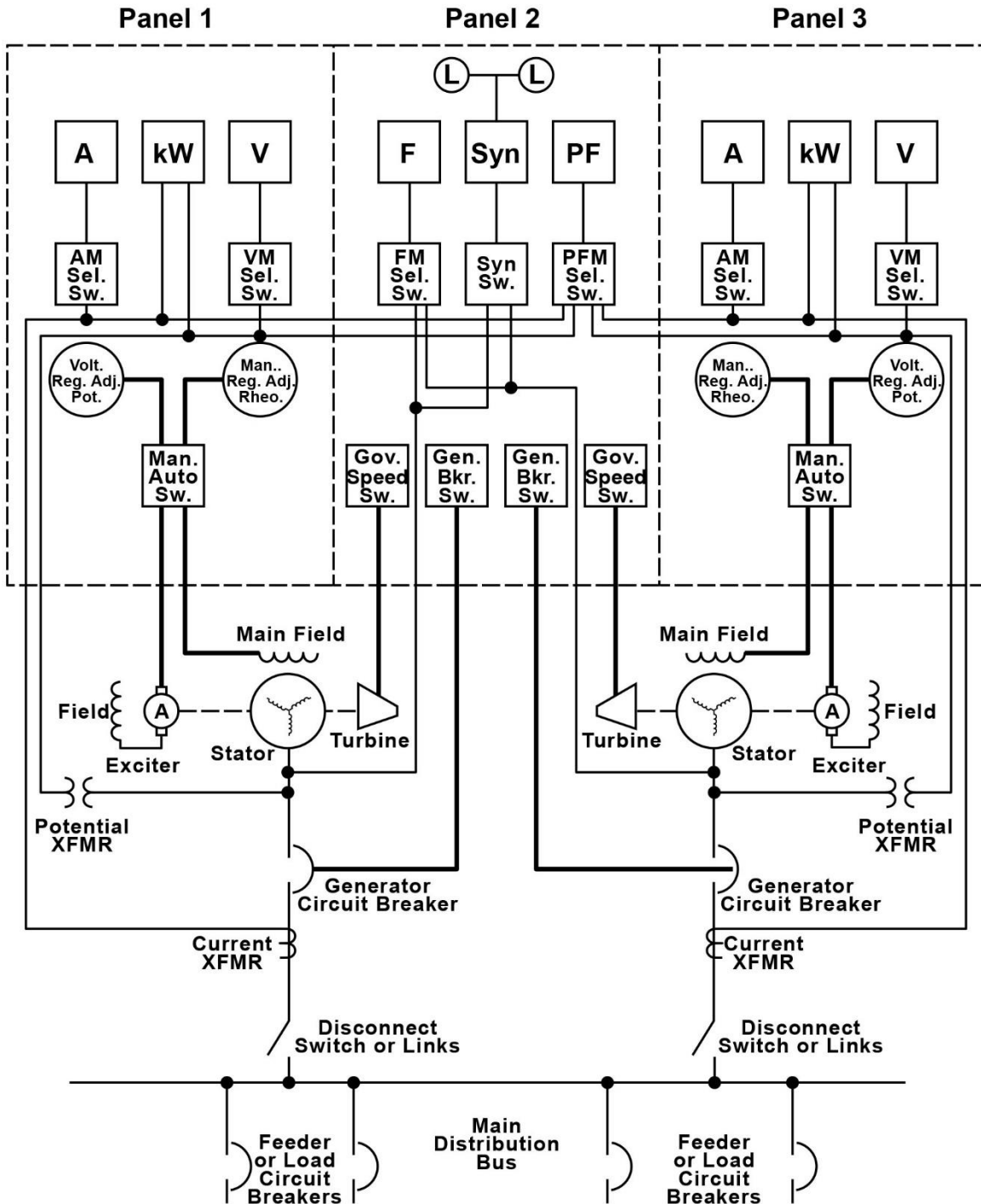
*If choice D is selected set score to 1.*

**70.** 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.*

## EL-0003



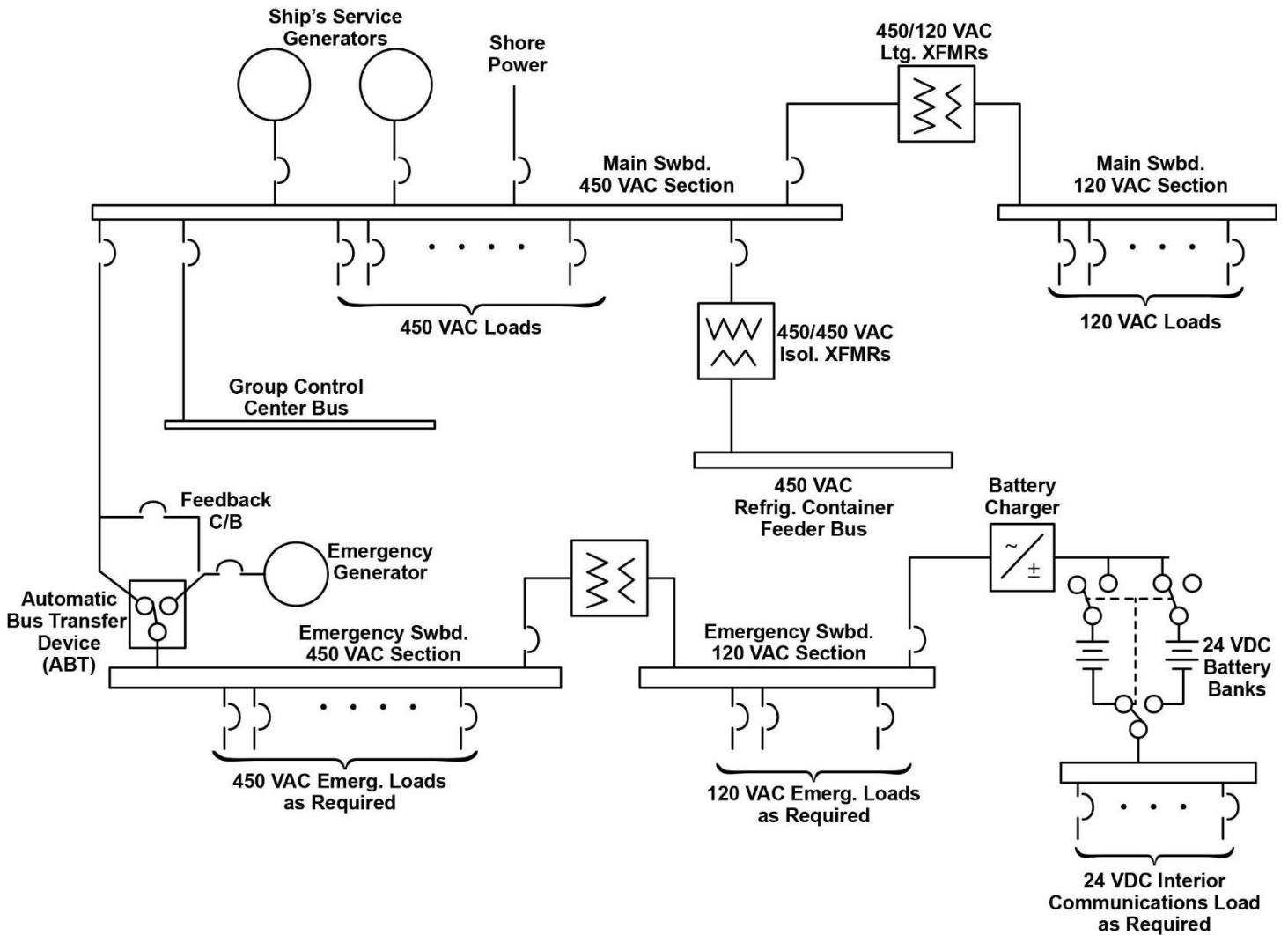
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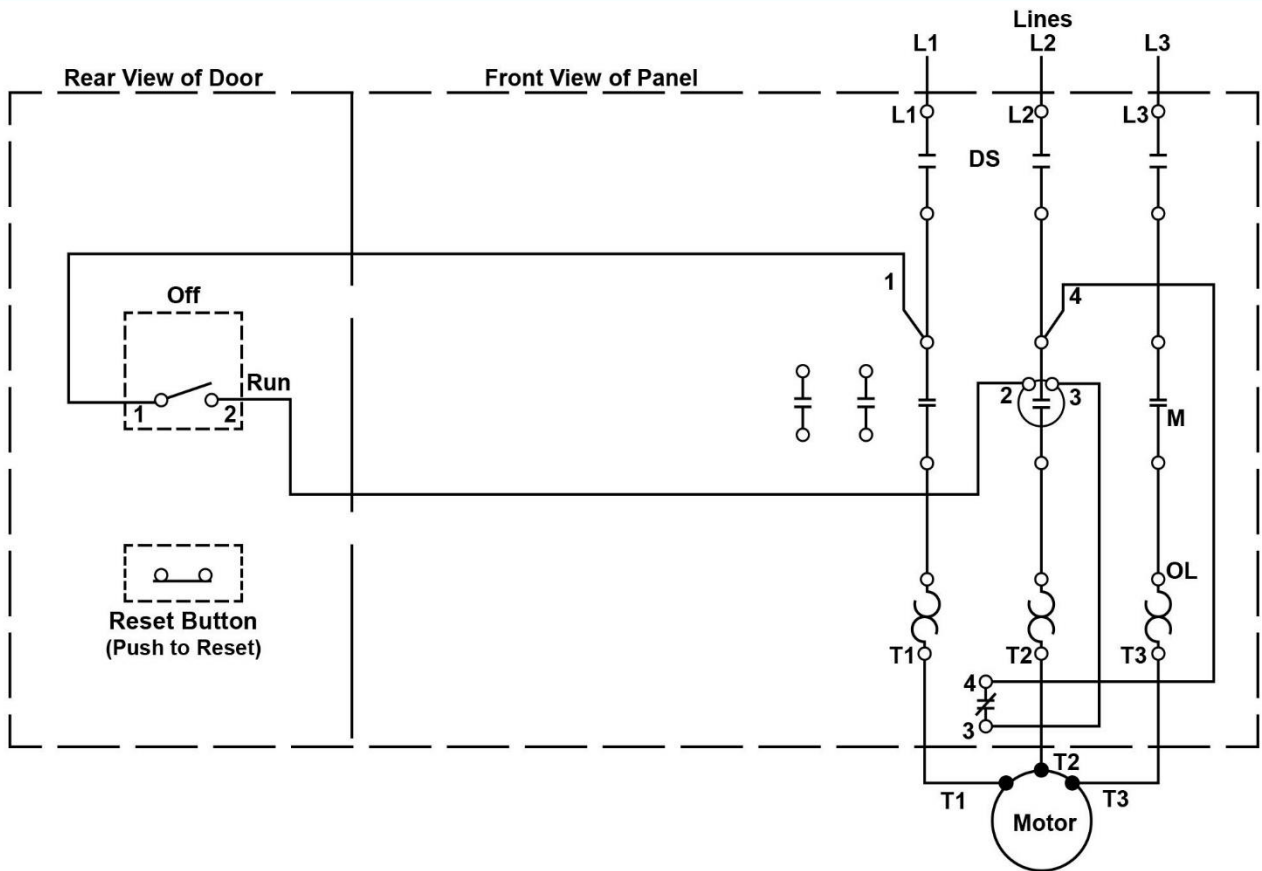


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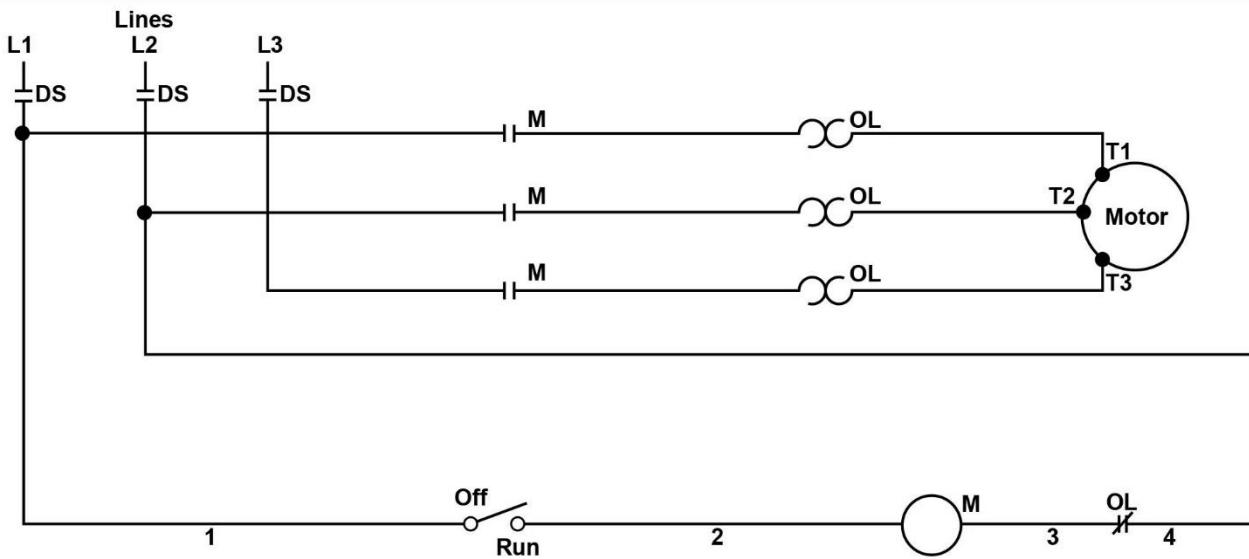
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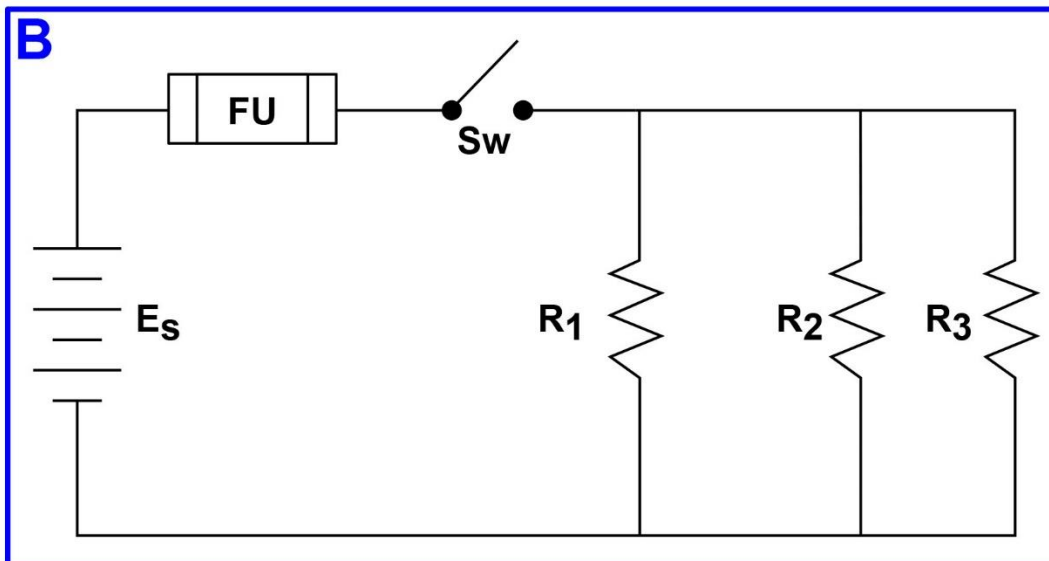
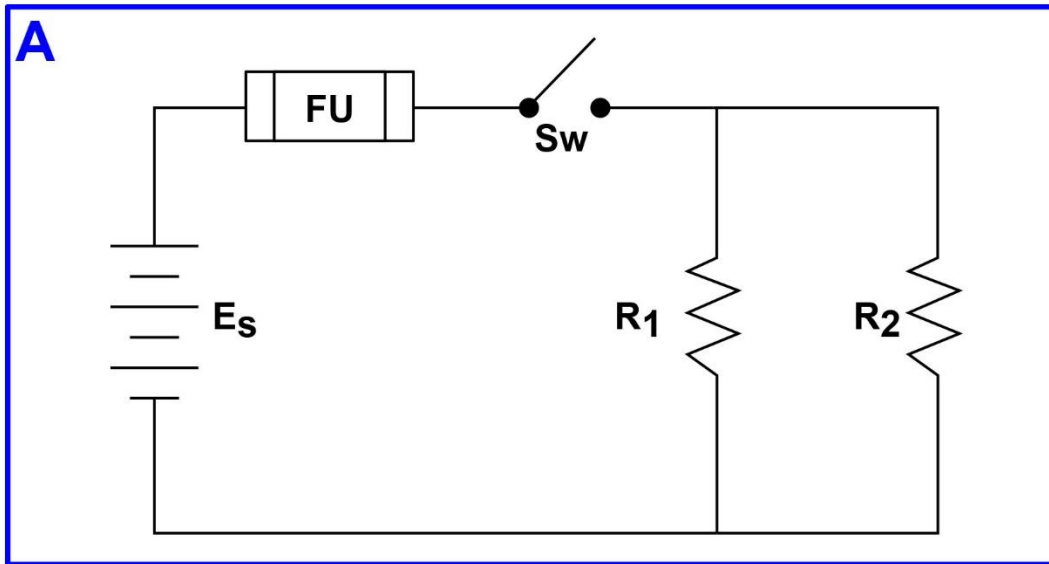
**A**



**B**

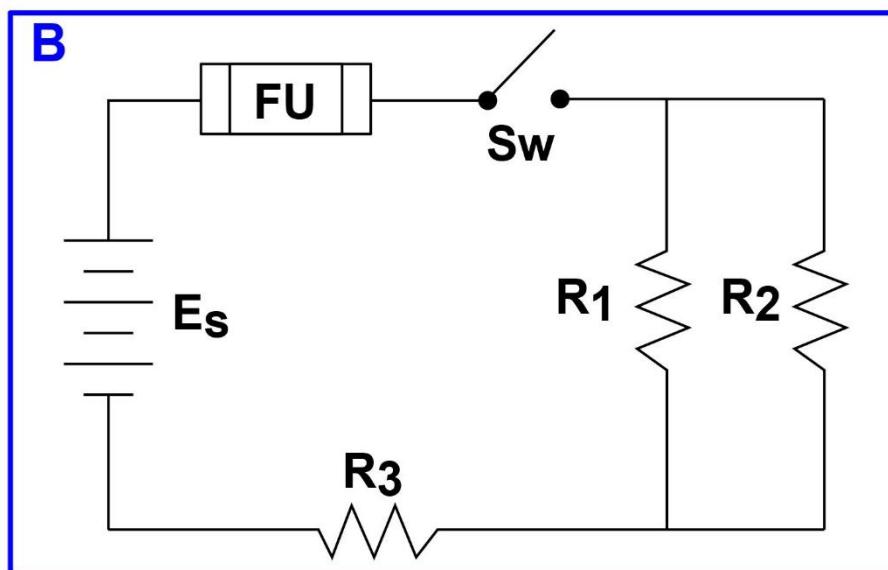
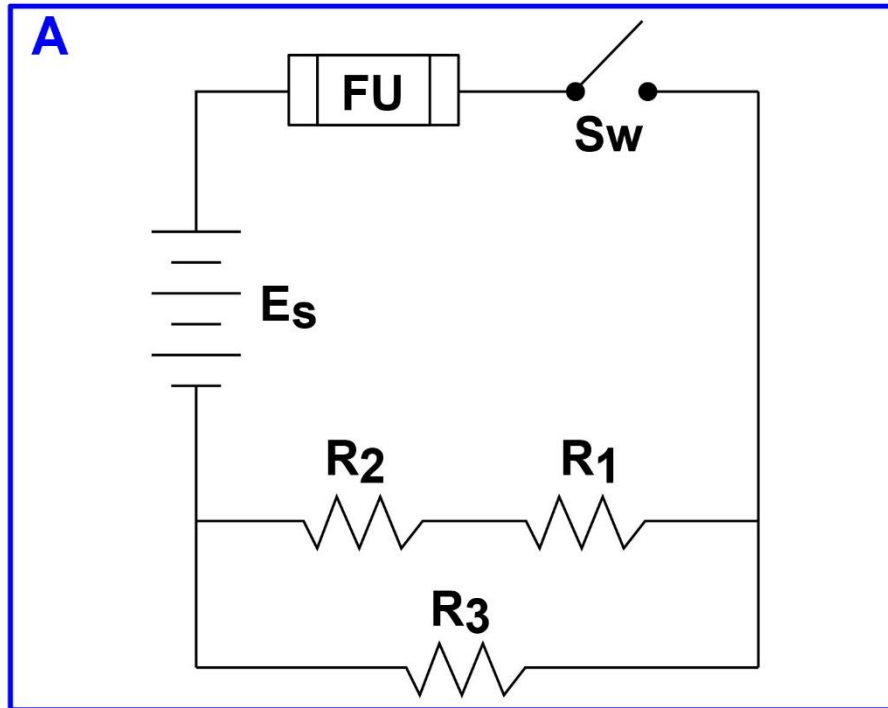
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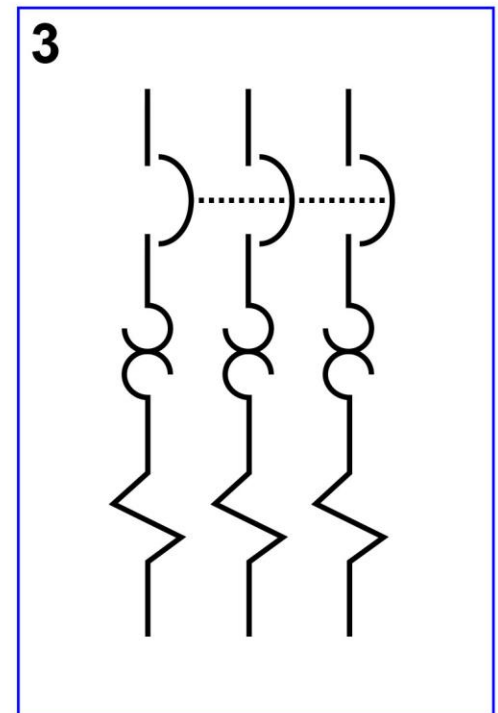
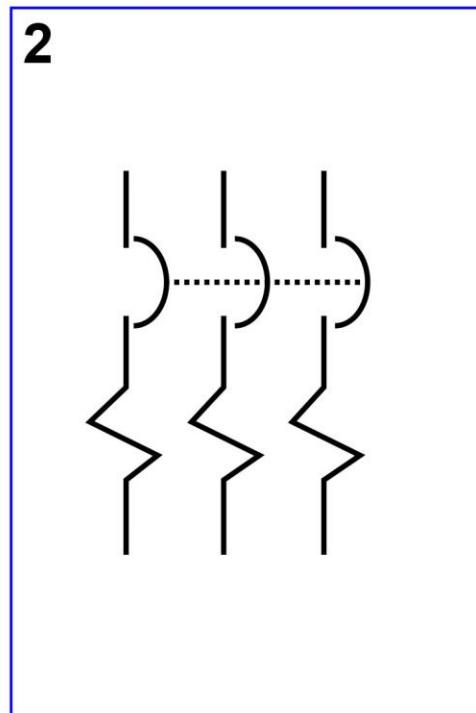
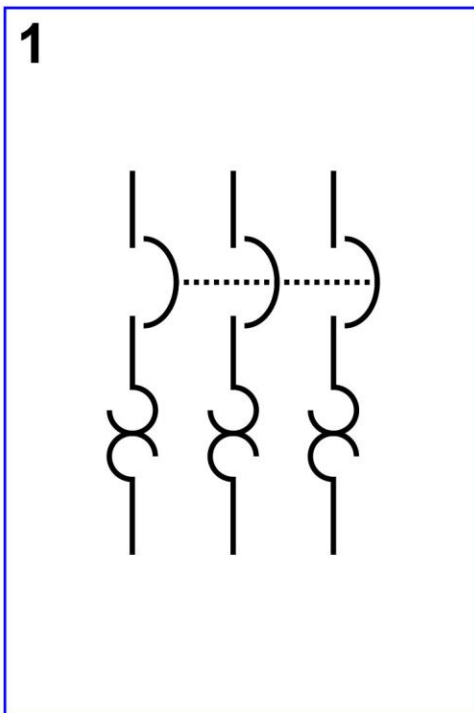
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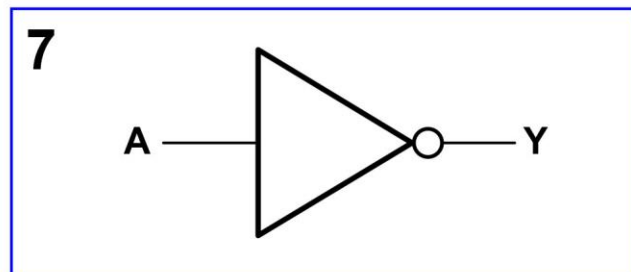
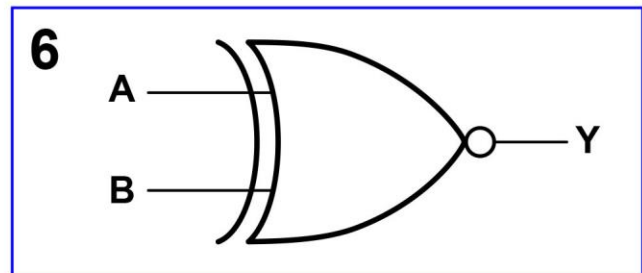
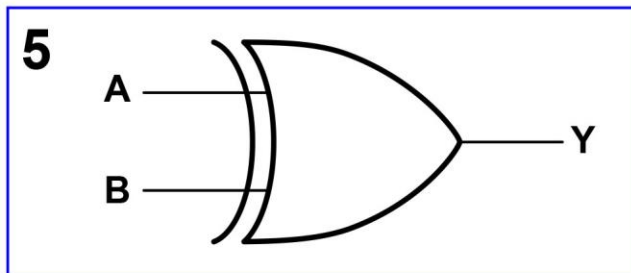
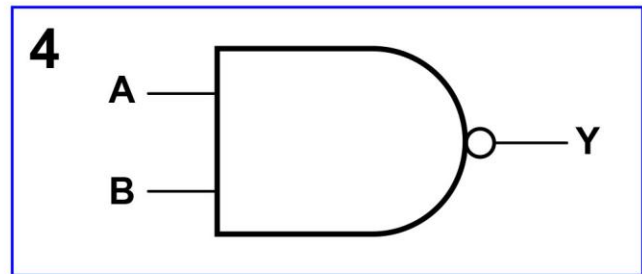
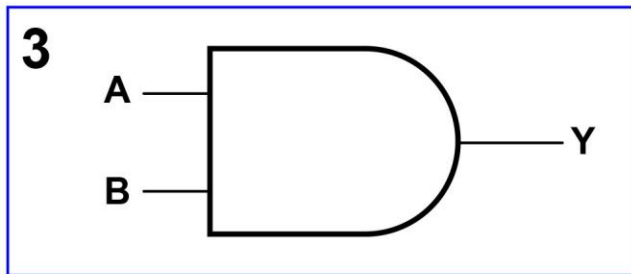
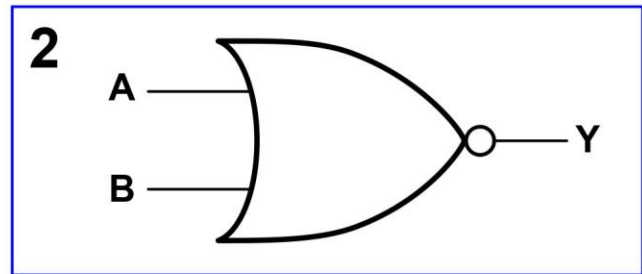
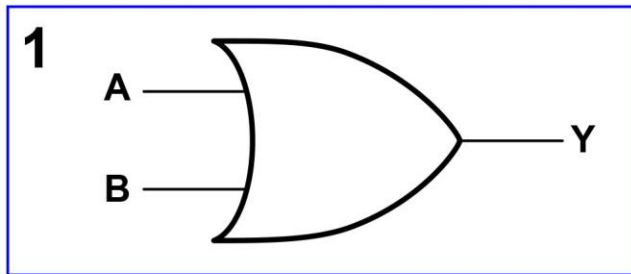
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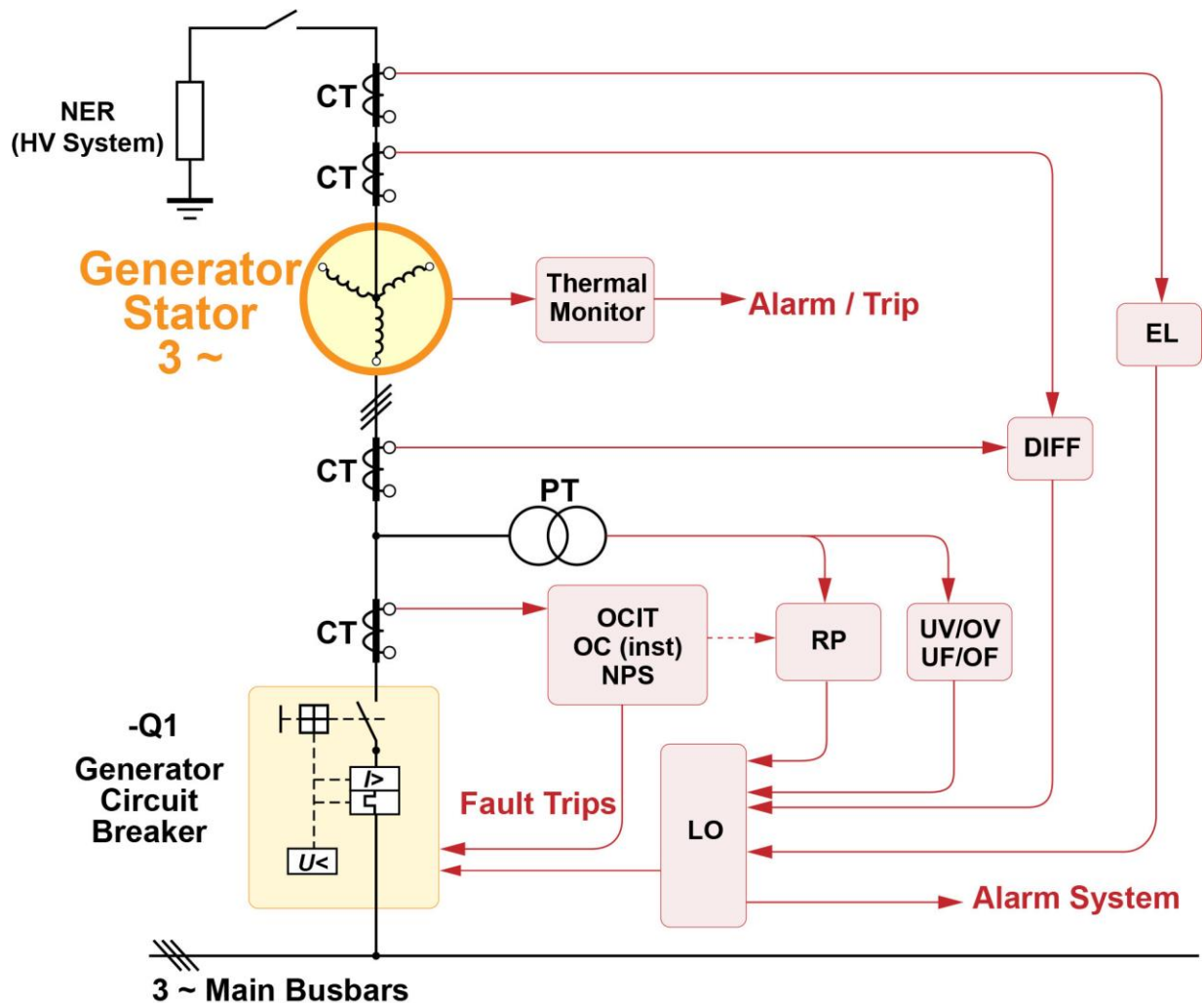
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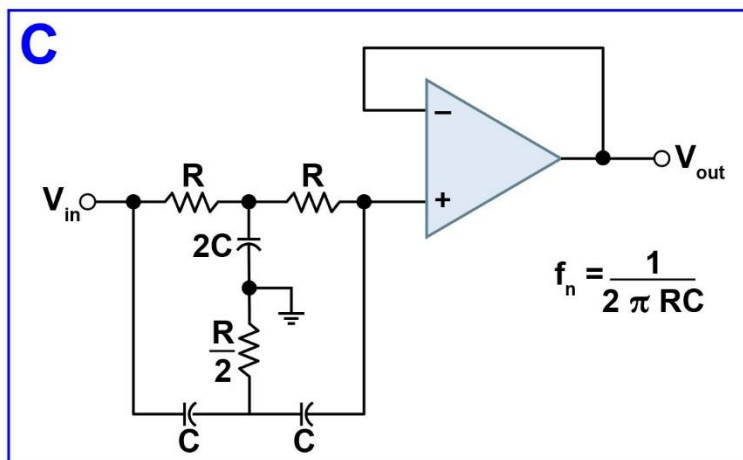
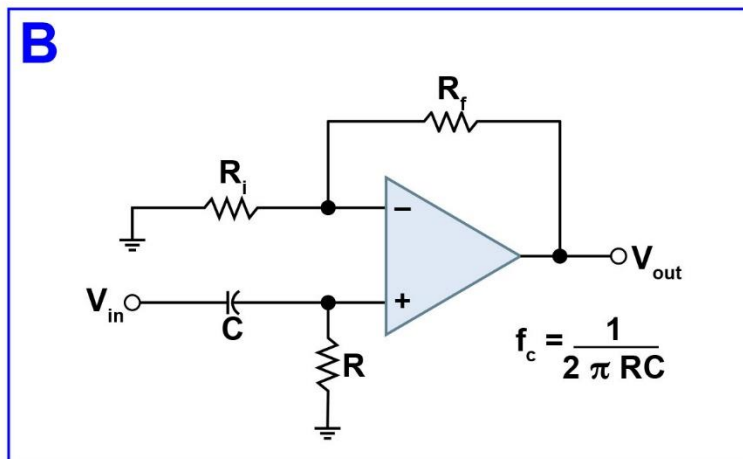
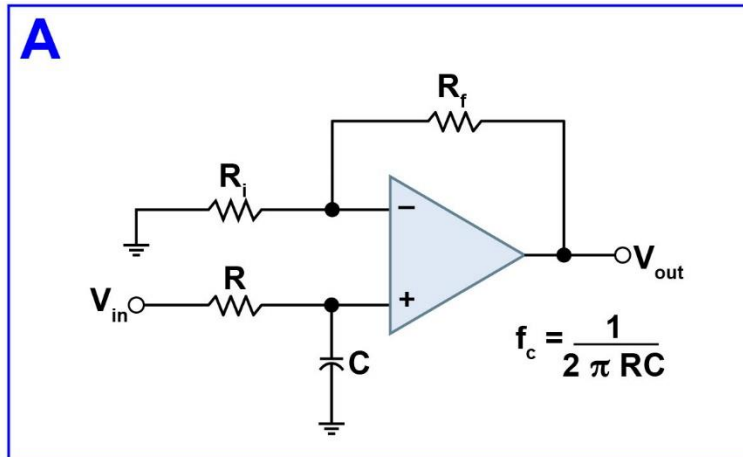
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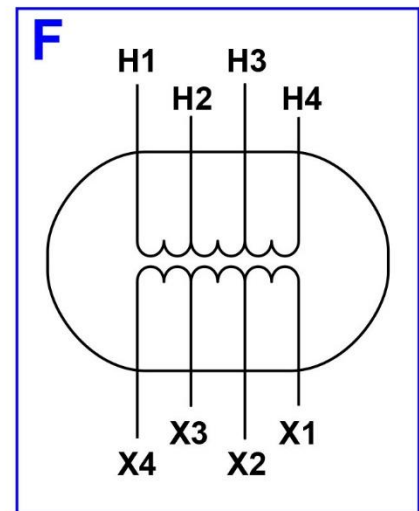
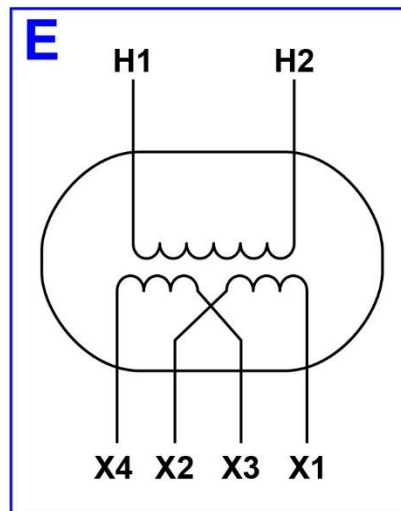
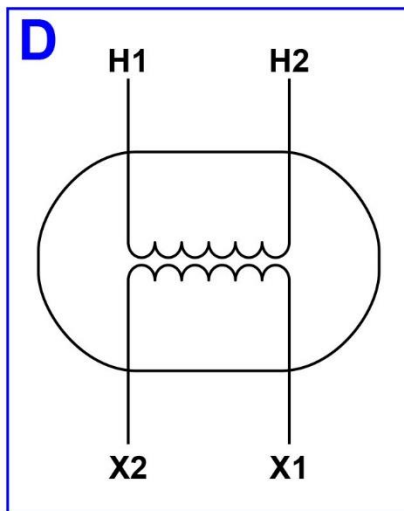
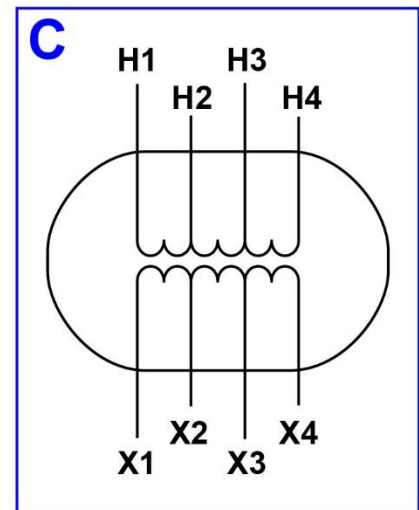
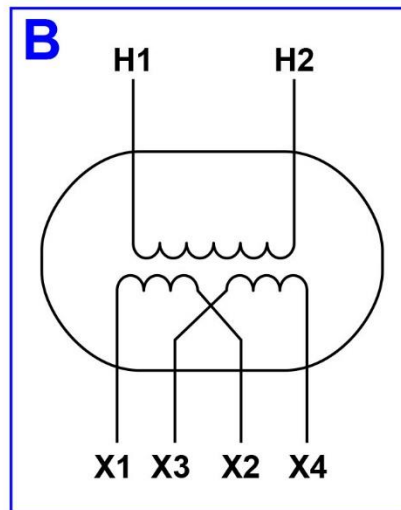
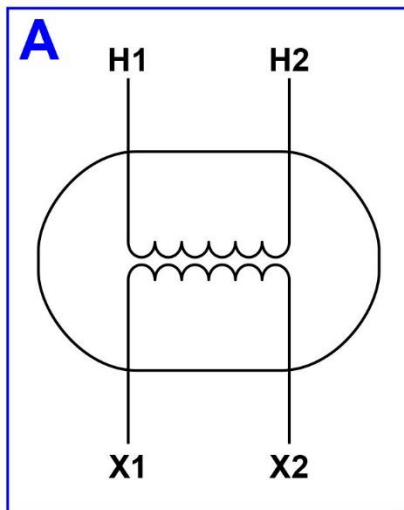
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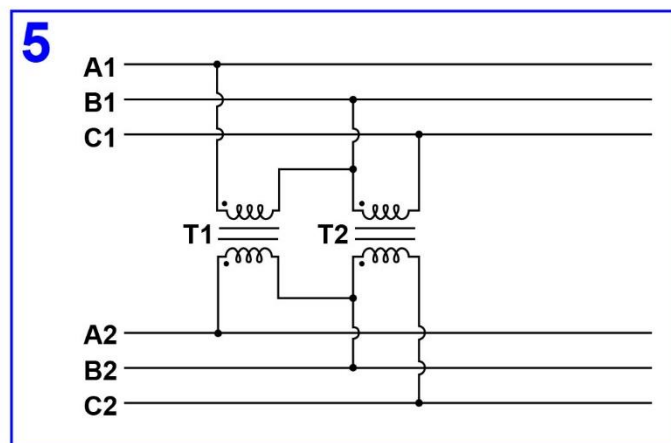
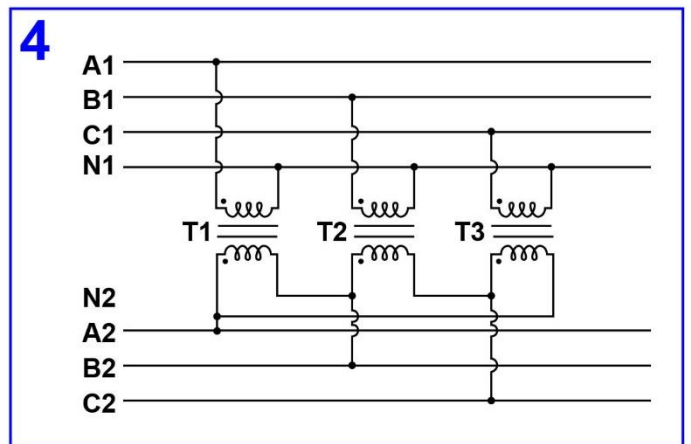
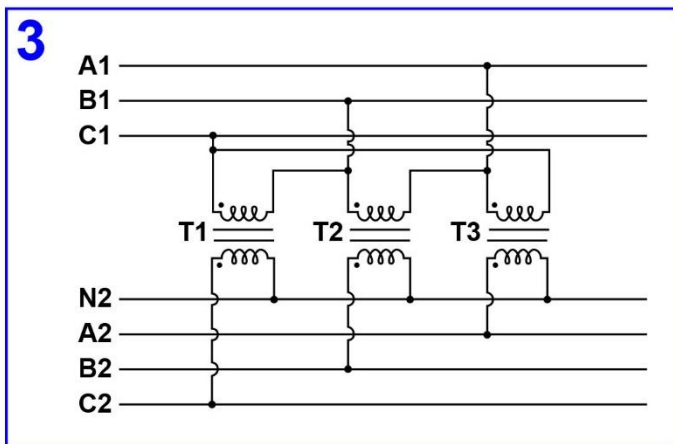
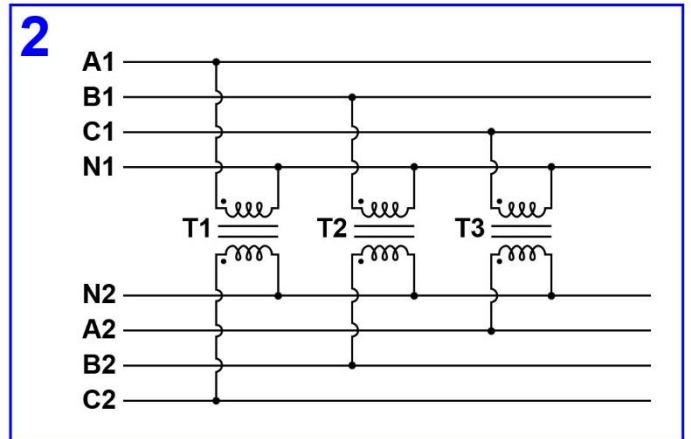
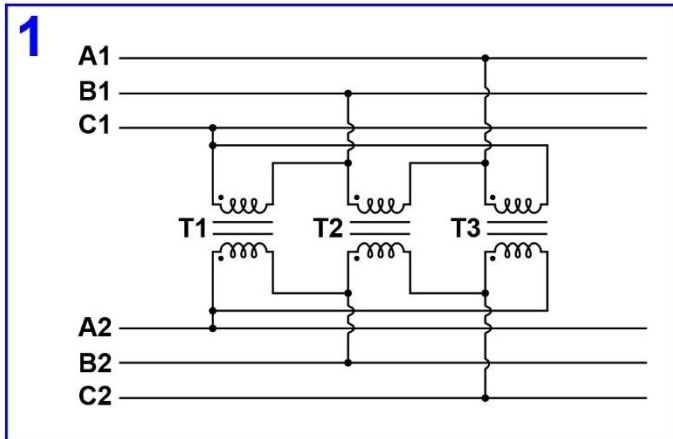
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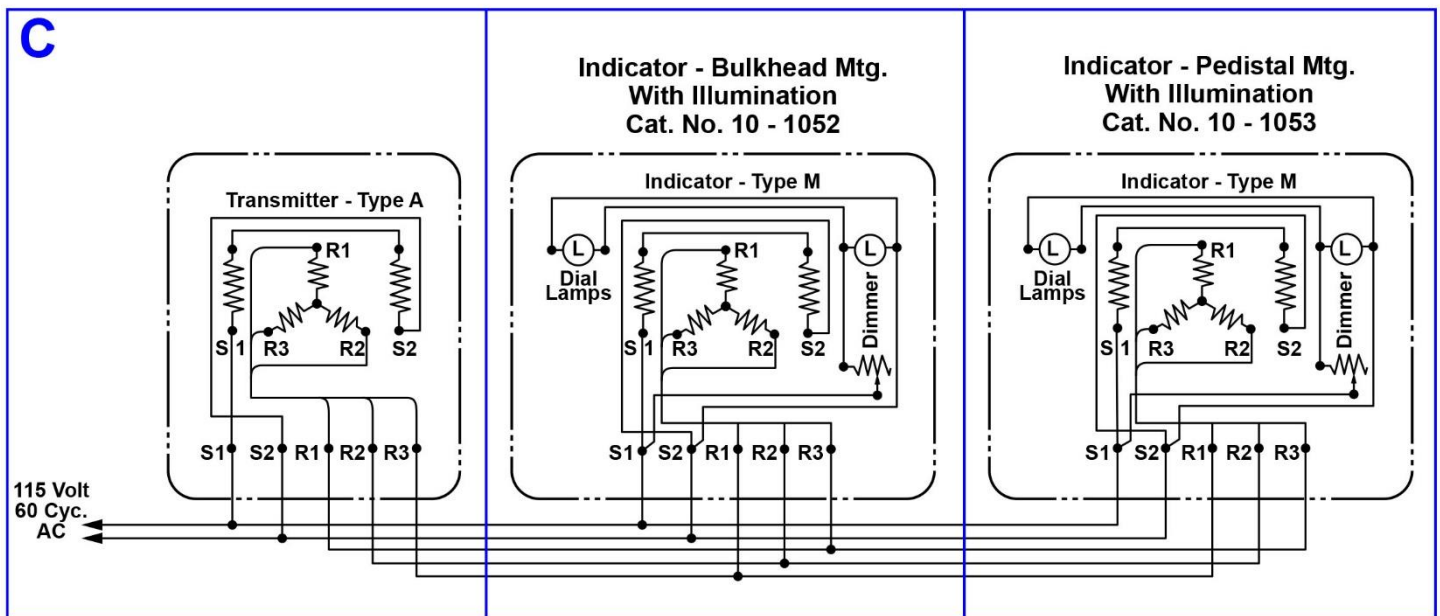
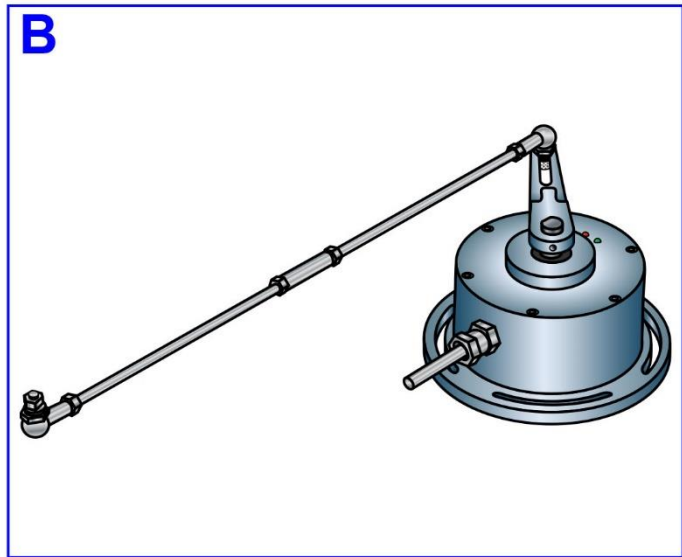
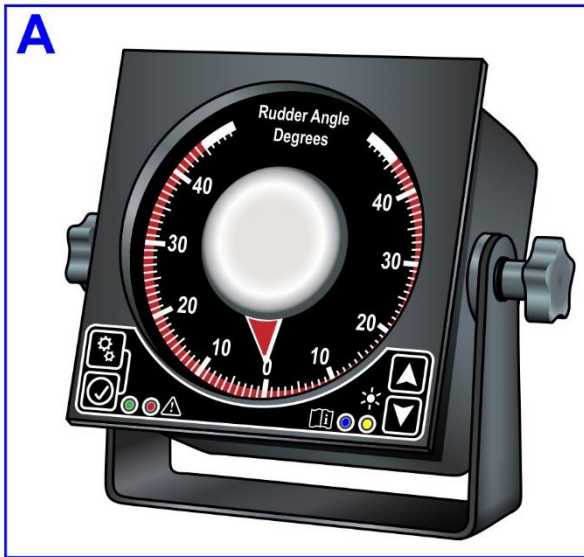
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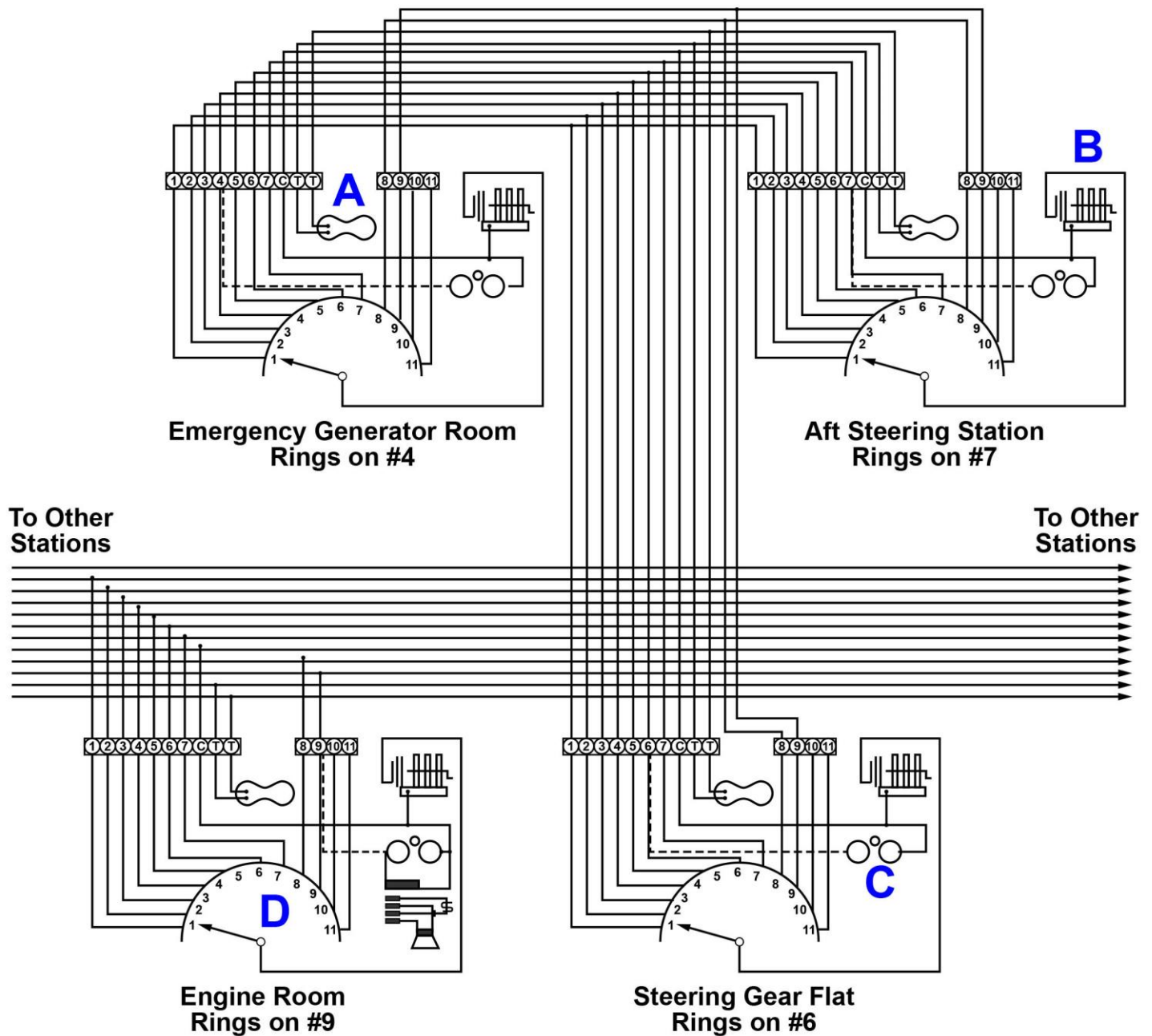
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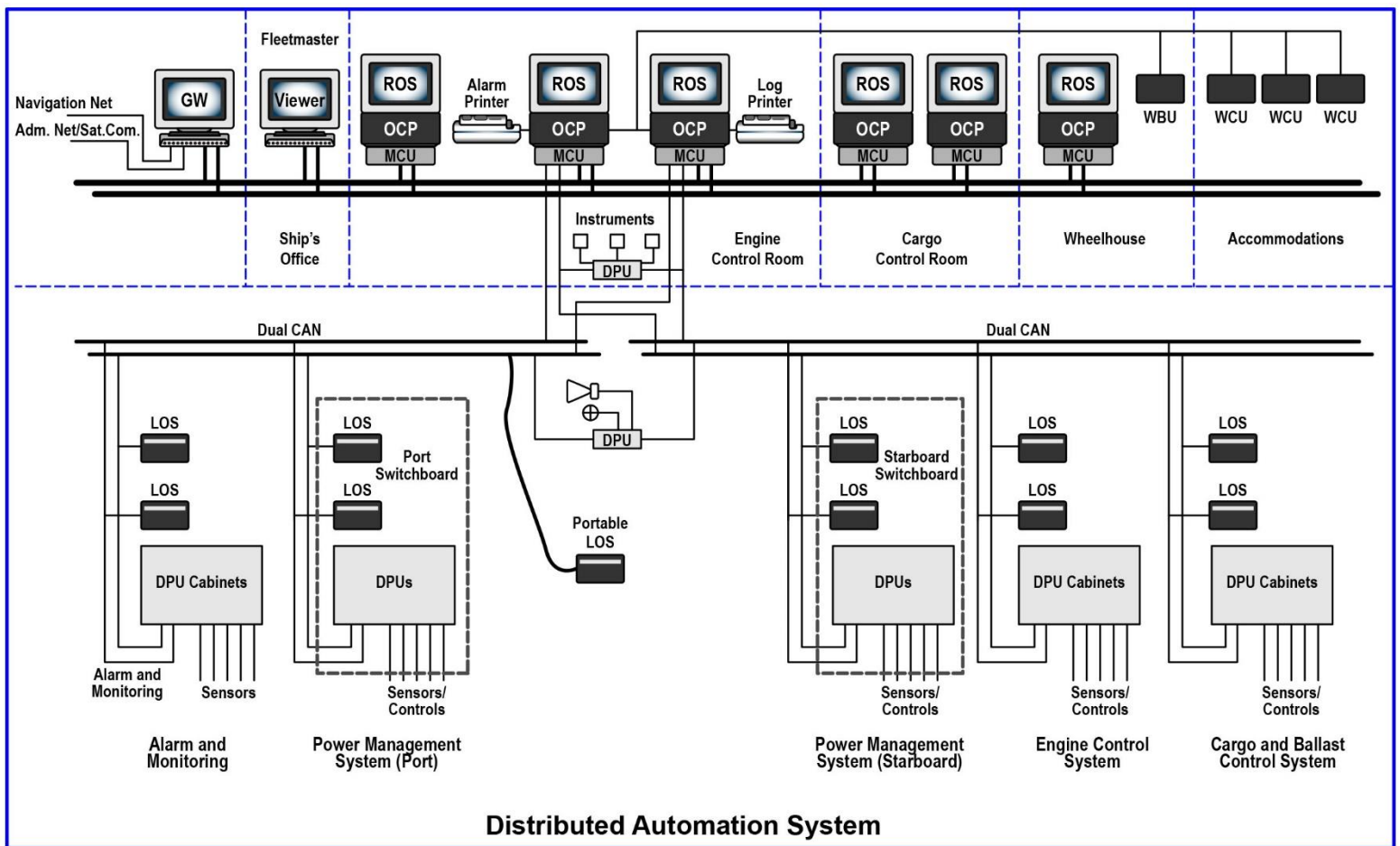
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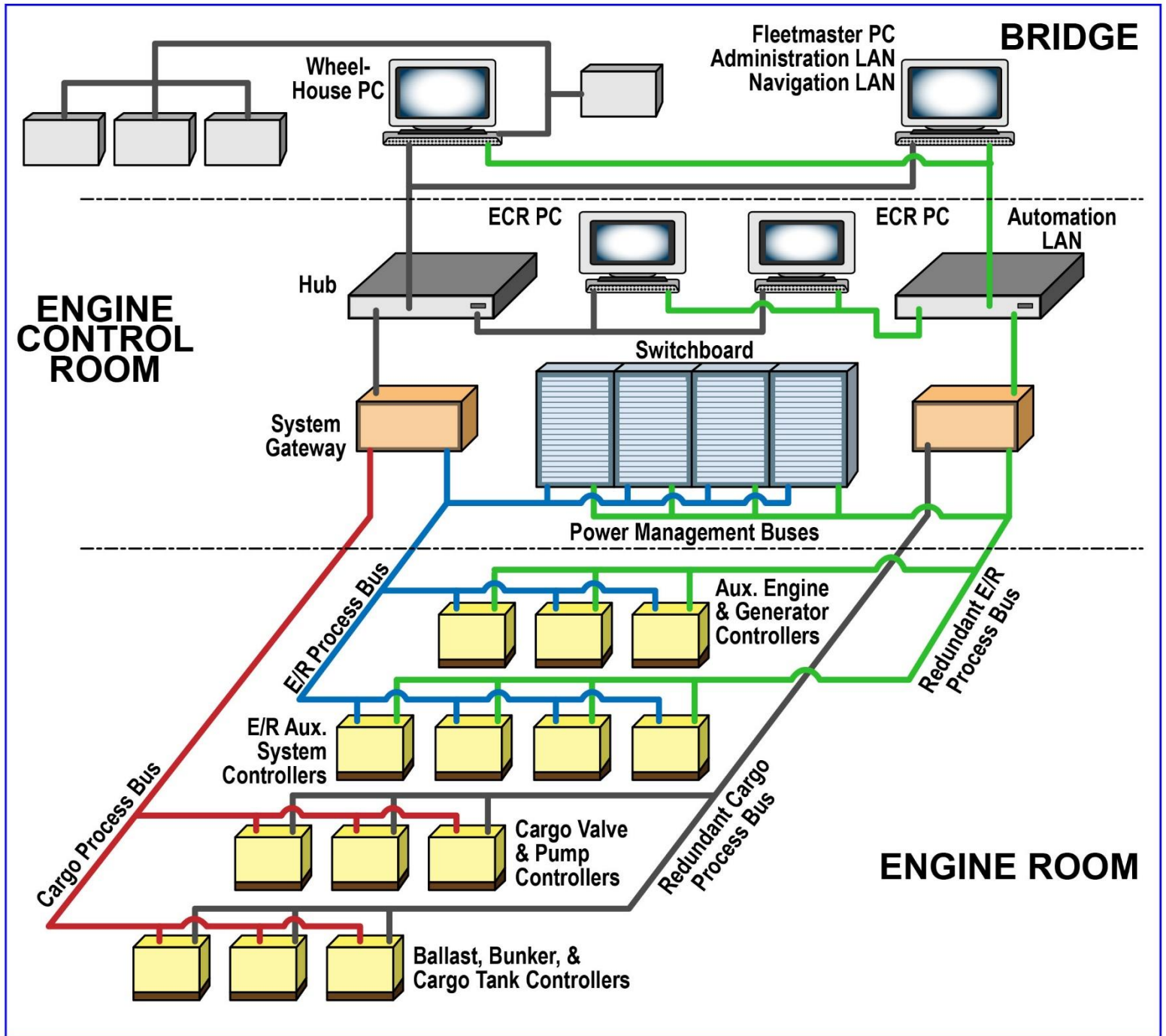


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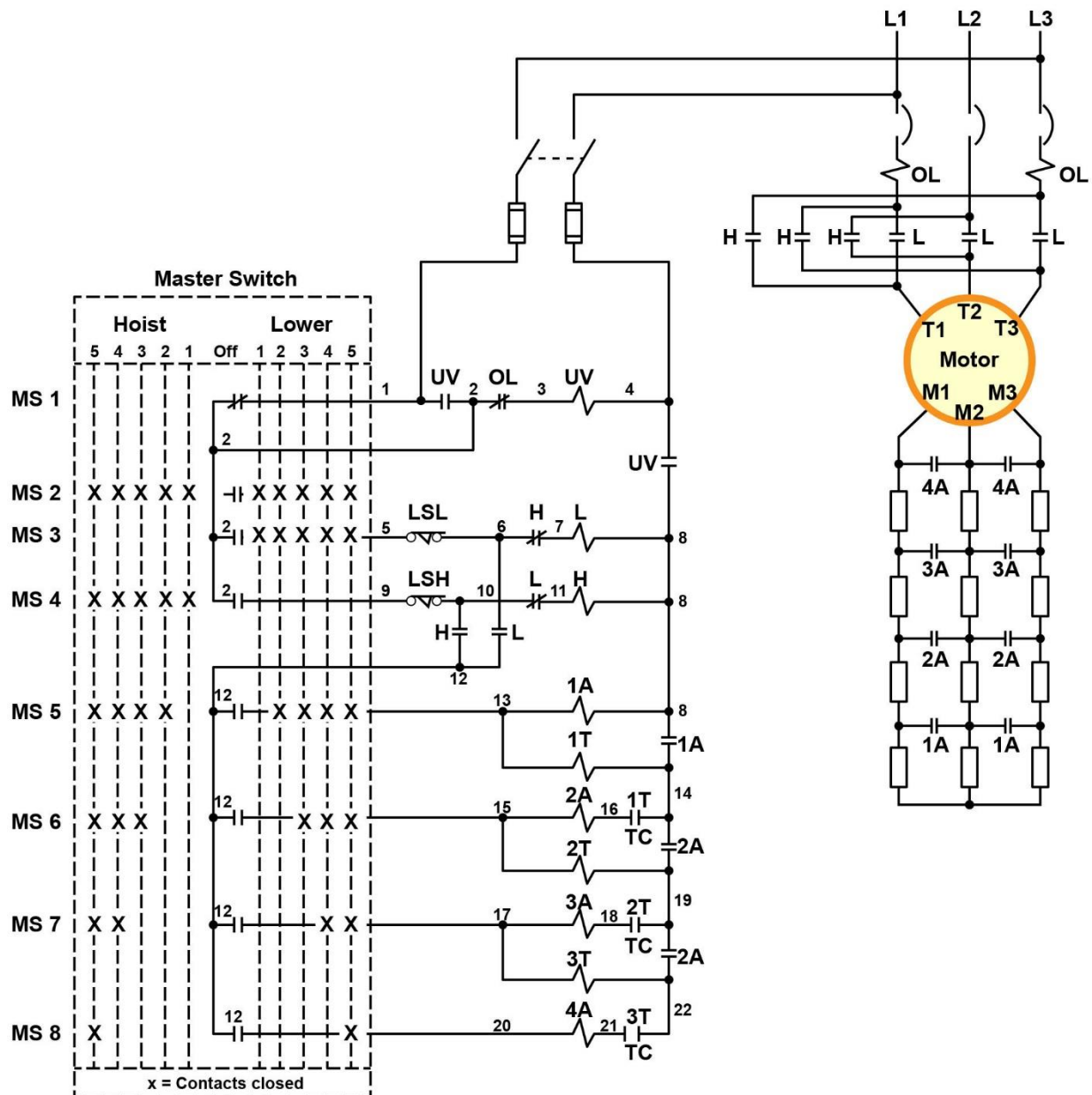


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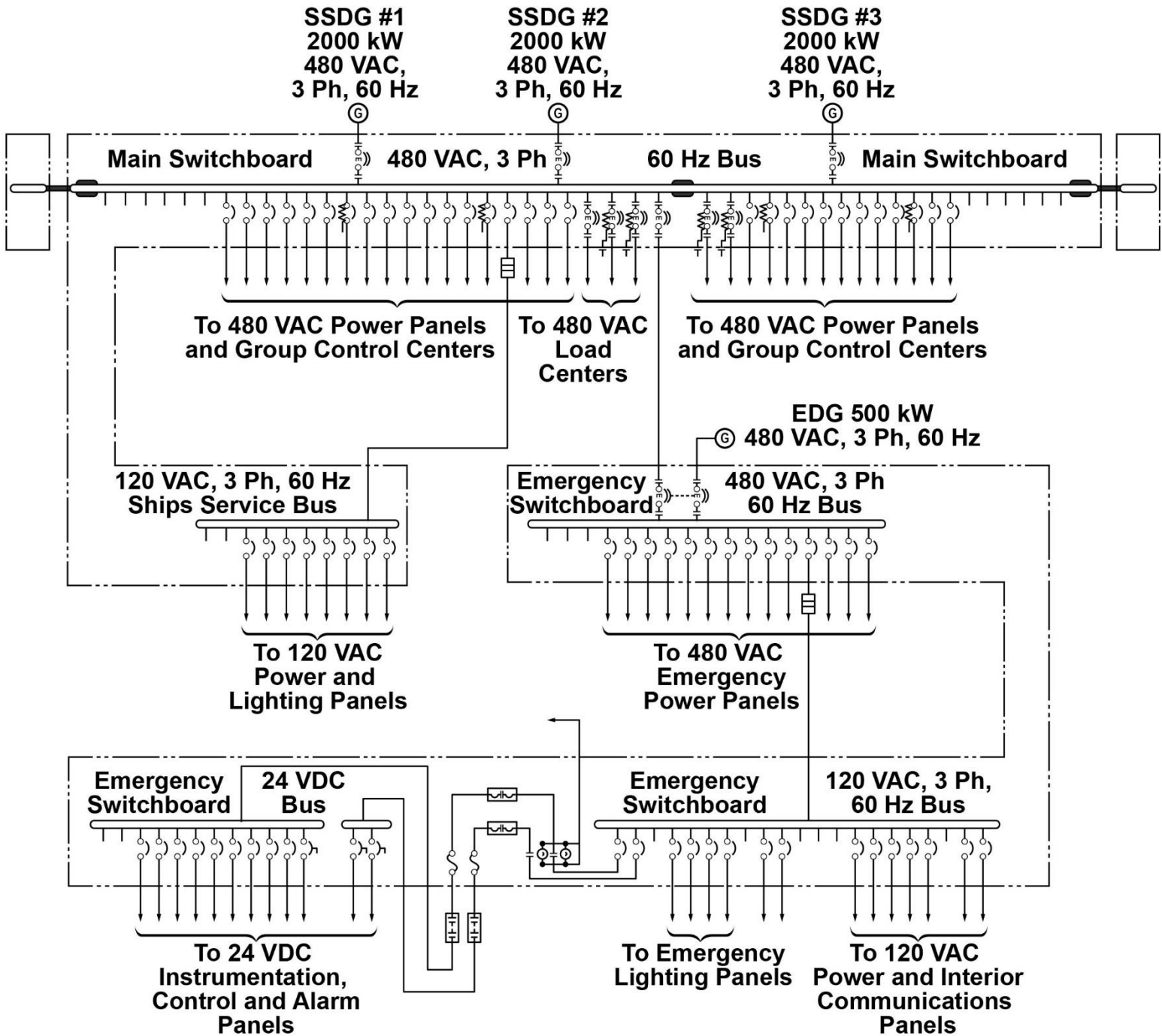
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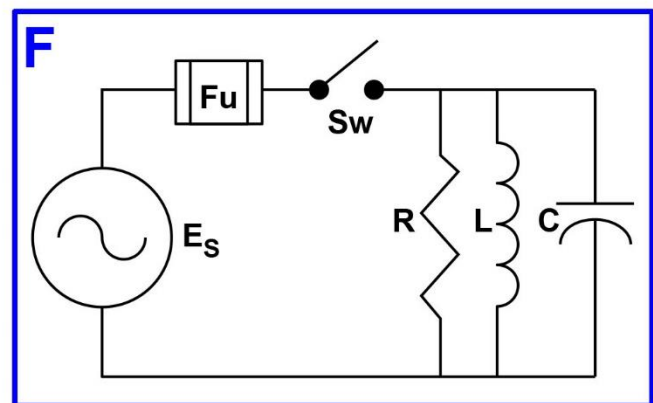
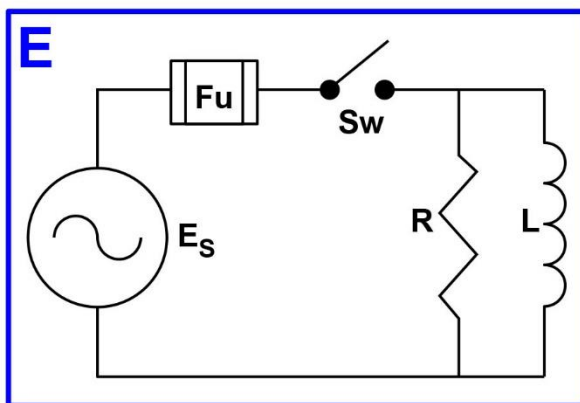
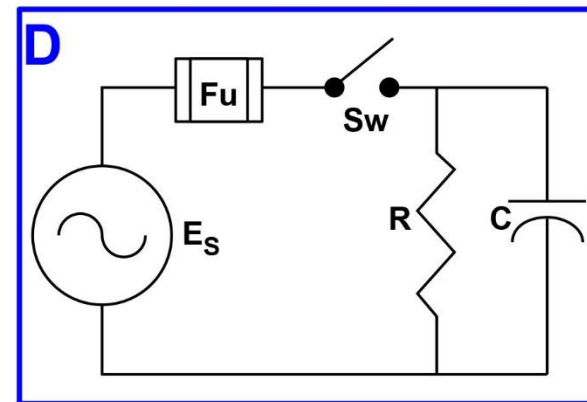
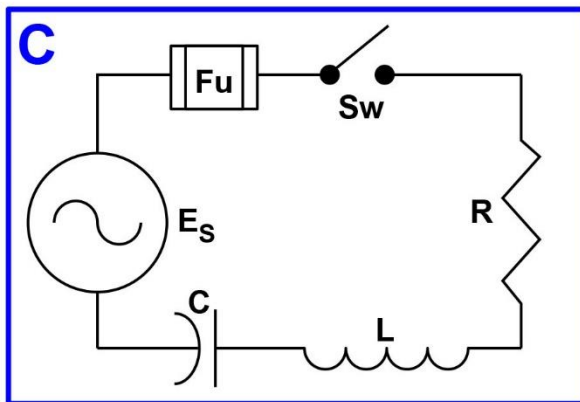
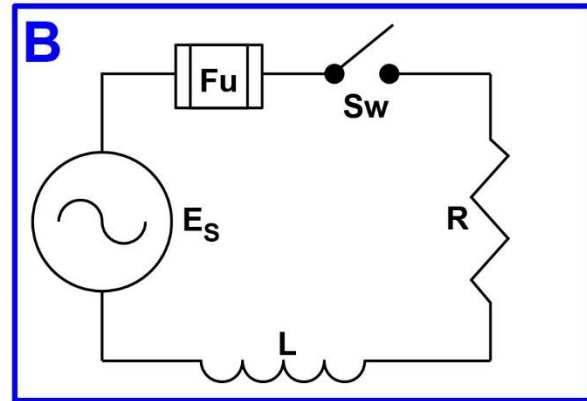
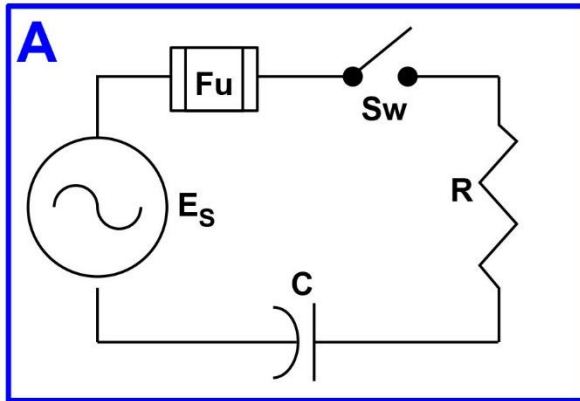
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## EL-0106 One Line Distribution Diagram



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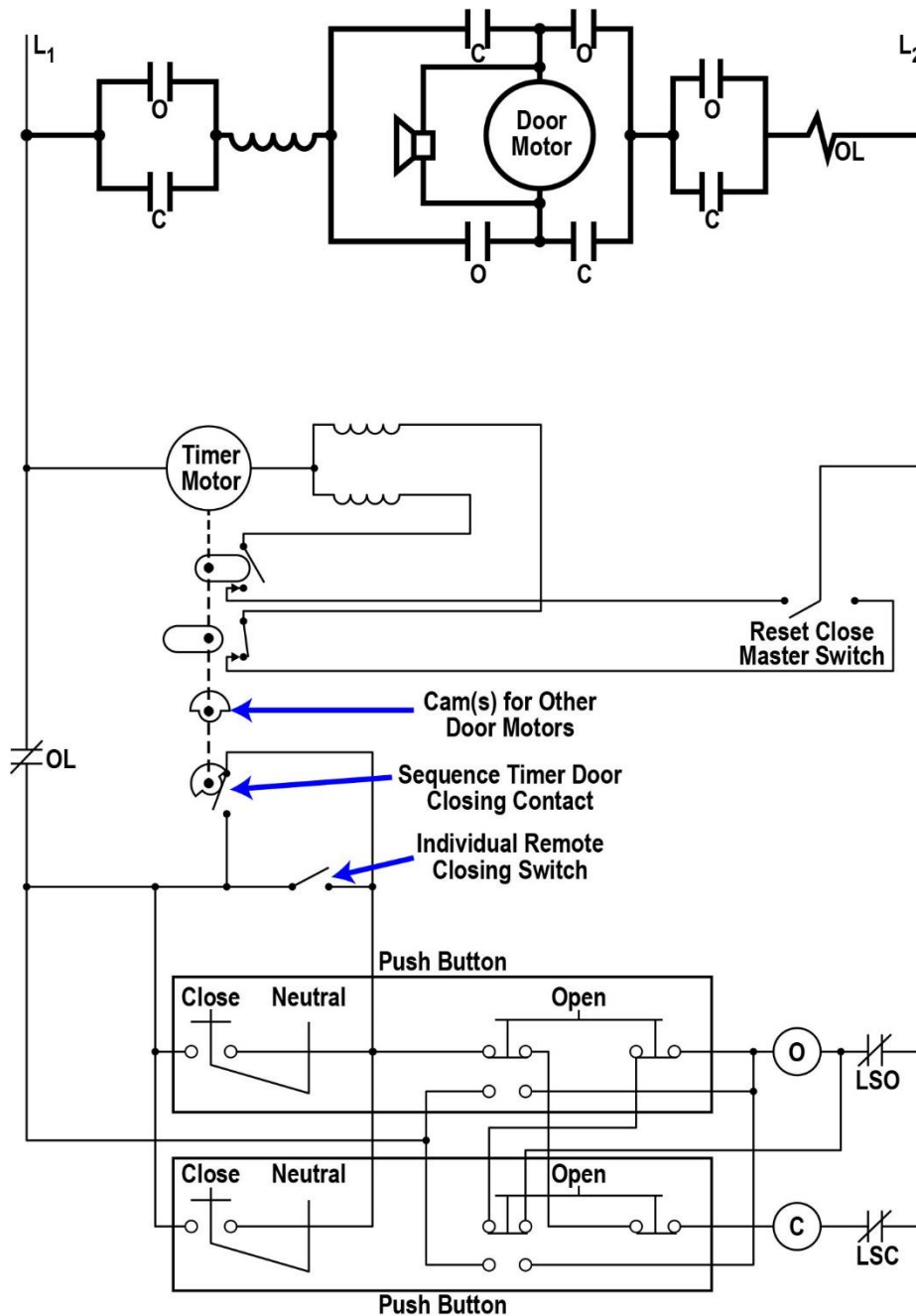
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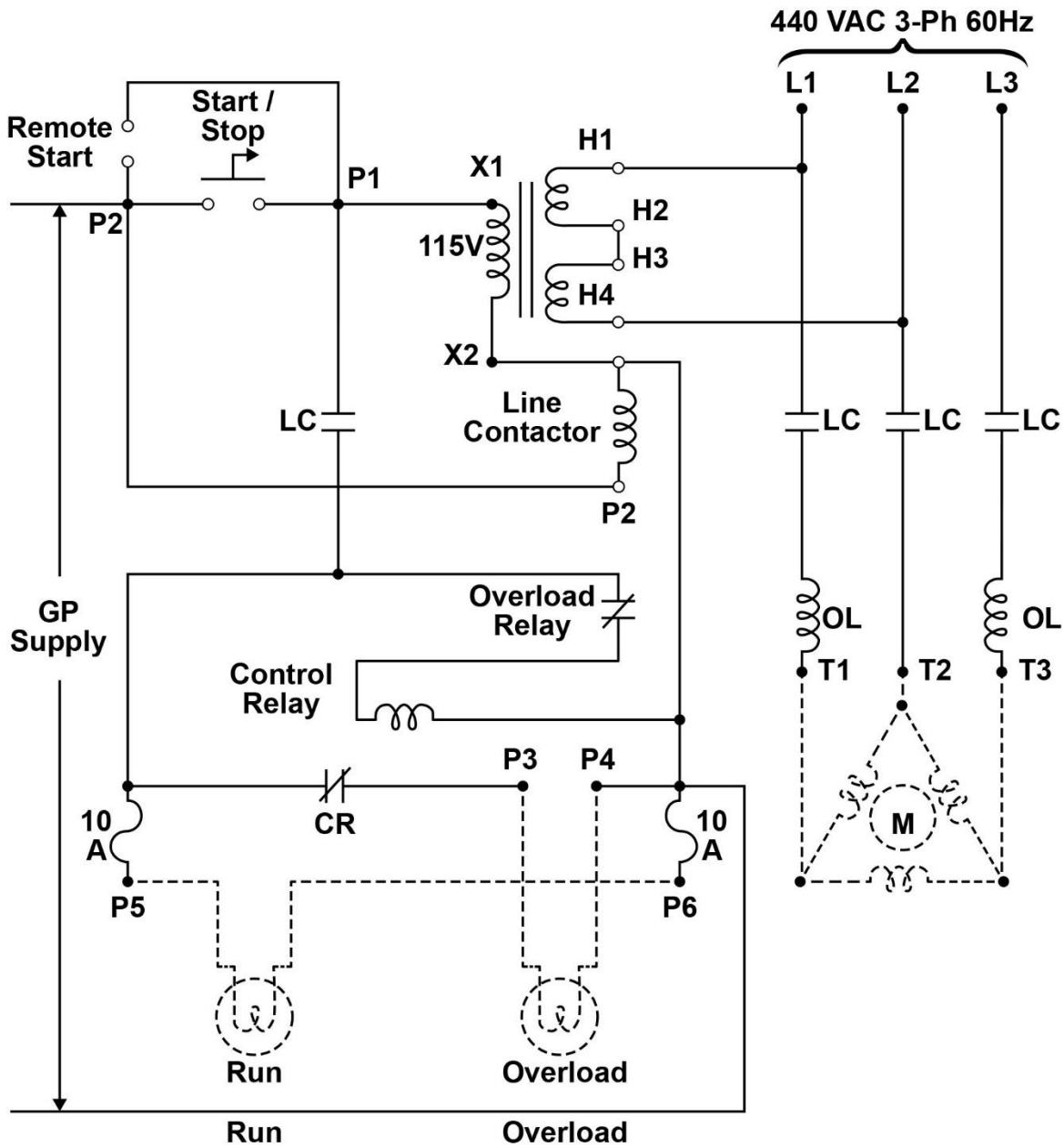


## EL-0115 Watertight Door Controller



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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 or 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

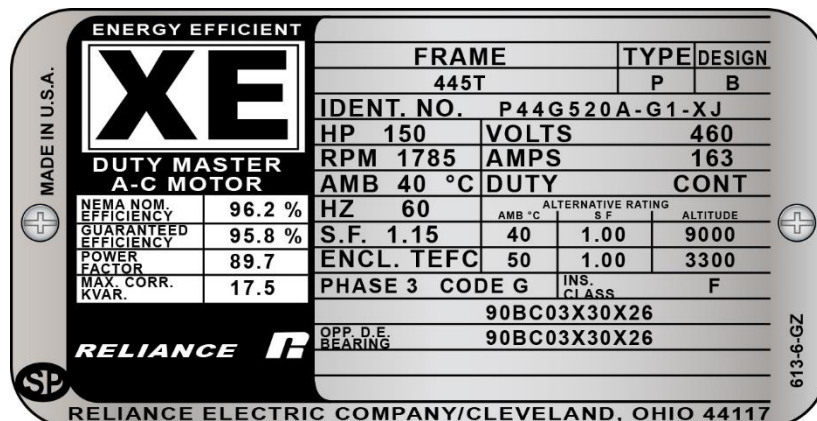
Motor continuous rating ° C rise	Ambient temperature same at starter and motor	Ambient temperature higher at starter than at motor	Ambient temperature lower at starter than at motor
1.5 service factor 40° C rise	As specified from tables	One size larger than specified for each 15° C difference	One size 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



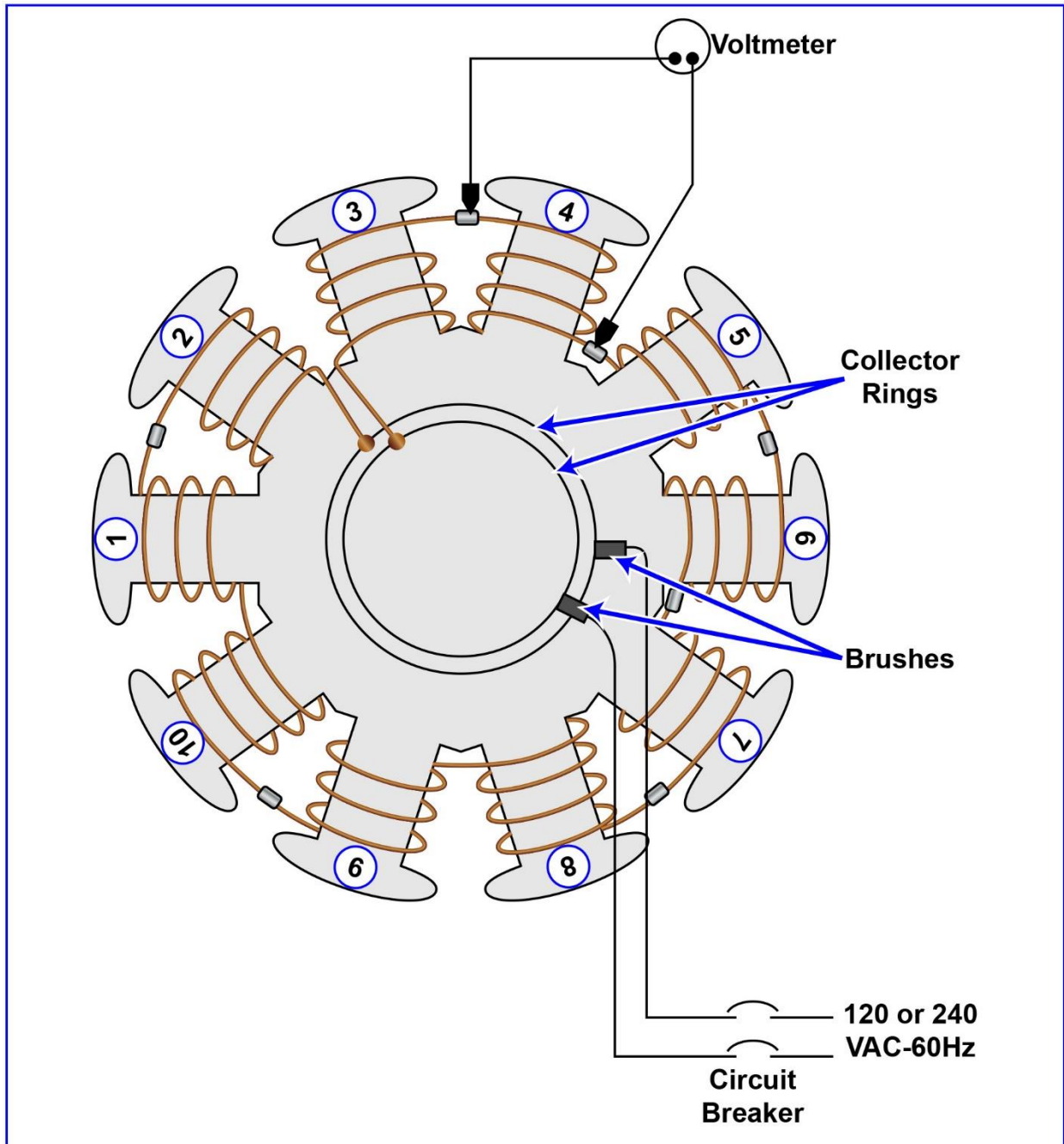
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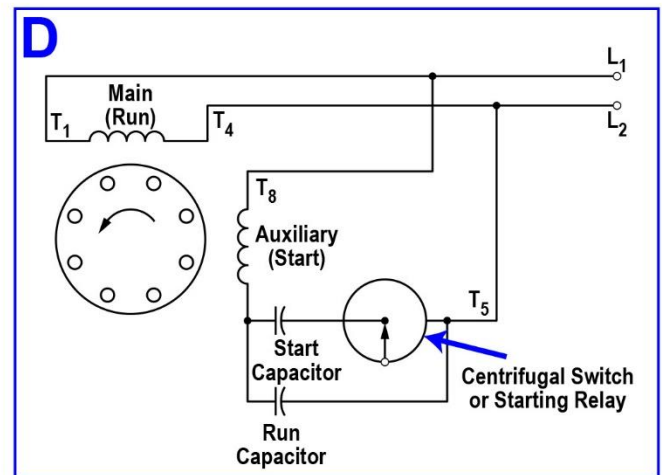
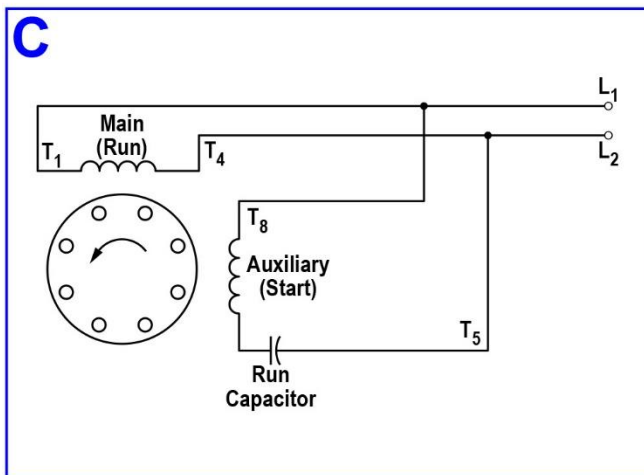
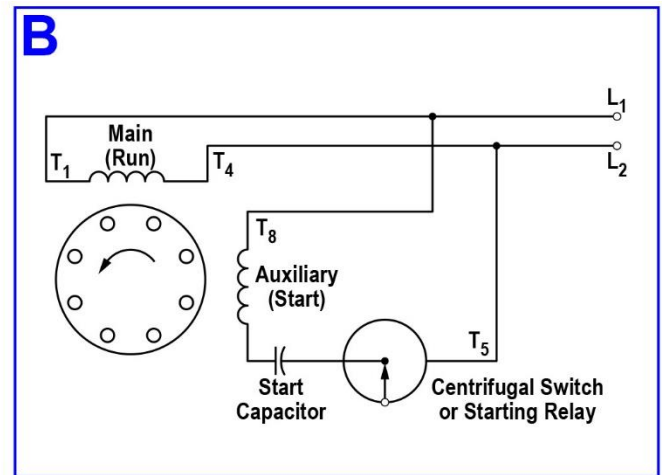
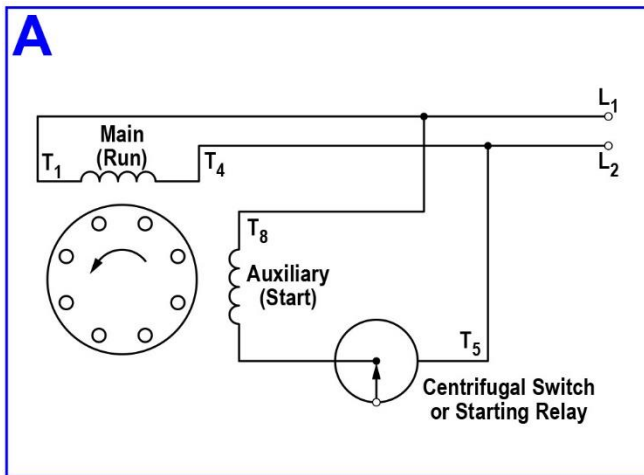


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