U.S.C.G. Merchant Marine Exam

First Assistant Engineer

Q517 Electrical-Electronic-Control Engineering

(Sample Examination)
Choose the best answer to the following Multiple Choice Questions.

1. In figure "B" of the illustrated circuit, if the resistance of R1 is 10 ohms, R2 is 10 ohms, and R3 is 10 ohms, what is the total resistance? Illustration EL-0032
   - (A) 15 ohms
   - (B) 20 ohms
   - (C) 25 ohms
   - (D) 30 ohms

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

2. If the values of "C1" and "R1" shown in the illustration were 1 microfarad and 3 megohms respectively, which of the listed intervals of time would equal one "time constant"? Illustration EL-0086
   - (A) 0.33 second
   - (B) 3 seconds
   - (C) 6 seconds
   - (D) 15 seconds

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

3. As shown in figure "D" of the illustrated digital power meter, what type of single-phase load is under test for power measurement? Illustration EL-0256
   - (A) a purely resistive load
   - (B) a purely inductive load
   - (C) a resistive-capacitive load
   - (D) an inductive-resistive load

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

4. As shown in figures "B" and "C" of the illustration, what should be the switch position and which test lead terminal jacks should be used if your intent is to measure AC currents anticipated as high as 5 amps? Illustration EL-0047
   - (A) switch position "1" and terminal jacks "1 and 4"
   - (B) switch position "6" and terminal jacks "1 and 4"
   - (C) switch position "7" and terminal jacks "1 and 2"
   - (D) switch position "7" and terminal jacks "2 and 4"

   *If choice D is selected set score to 1.*
5. Under what circumstance would a hand-held portable phase sequence indicator be used should the main switchboard mounted fixed phase sequence indicator be inoperative?

- (A) installing a new synchroscope
- (B) preparing to make the shore power connection
- (C) paralleling alternators
- (D) replacing a defective solenoid

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

6. How should the shunt used in an ammeter be connected?

- (A) in parallel with the load and in series with the meter movement
- (B) in series with the load and in series with the meter movement
- (C) in series with the load and in parallel with the meter movement
- (D) in parallel with the load and in parallel with the meter movement

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

7. To properly use a clamp-on type ammeter to check current flow, what must be done FIRST?

- (A) short the test leads and calibrate the instrument to zero
- (B) hook the jaws of the instrument around the insulated single conductor
- (C) connect the voltage test leads to the appropriate terminals
- (D) de-energize the circuit to allow connection of the instrument in series

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

8. A three-phase, induction-type motor experiences an open in one phase. Which of the listed automatic protective devices will prevent the motor from being damaged?

- (A) Thermal overload relay
- (B) Magnetic blowout coil
- (C) Overspeed trip
- (D) Three-pole safety switch

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

9. As shown in the illustration, what type of motor is controlled as depicted in both figure "A" and in figure "B"? Illustration EL-0144

- (A) three-phase wound rotor induction motor
- (B) single-phase wound rotor induction motor
- (C) three-phase squirrel cage induction motor
- (D) three-phase synchronous motor

*If choice A is selected set score to 1.*
10. By what means should motor controller contacts be routinely cleaned?

   - (A) filing with a bastard file
   - (B) blowing with compressed air
   - (C) dressing with crocus cloth
   - (D) wiping with a clean dry cloth

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

11. Using the catalog selection chart shown in Illustration EL-0180, determine the correct catalog number for a motor starter that meets the following criteria:

   - NEMA Open enclosure
   - 3-pole Rated at 45 continuous amperes
   - Vertically mounted Electronic overload relay-Ground fault feature set;
   - Reversing starter Operating coil rated at 24 VAC/60 Hz

   - (A) AE19GNVB5G045
   - (B) AN19AN0A5E005
   - (C) AN59GNVT5G045
   - (D) CN16GNVT5G045

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

12. As shown in the illustration, what mechanism will disconnect the motor from the line in case of a sustained motor overload? Illustration EL-0080

   - (A) transformer primary fuses FU4 and FU5
   - (B) overload relay heaters and overload relay NC contacts (OL)
   - (C) disconnect switch fuses FU1, FU2, and FU3
   - (D) transformer secondary fuses FU6 and FU7

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

13. If a digital multimeter is set up as shown in figure "A" of the illustration to test an AC contactor coil, what would the display read if the coil is open-circuited? Illustration EL-0214

   - (A) 0.03 ohms
   - (B) 22 ohms
   - (C) OL ohms
   - (D) 110 V

   *If choice C is selected set score to 1.*
14. As shown in figure "A" of the illustrated propulsion motor variable speed drive, what statement is true? Illustration EL-0140

- (A) both the bridge rectifier and the controller inverter bridge are thyristor controlled in terms of switching
- (B) both the bridge rectifier and the controller inverter bridge are transistor controlled in terms of switching
- (C) the bridge rectifier is uncontrolled and the controller inverter bridge is thyristor controlled in terms of switching
- (D) the bridge rectifier is uncontrolled and the controller inverter bridge is transistor controlled in terms of switching

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

15. Propulsion AC generators creating 4160 VAC use transformers to provide nominally 120 VAC to the automatic voltage regulator. What is the turns ratio of this step-down transformer?

- (A) 1:4
- (B) 4:1
- (C) 35:1
- (D) 40:1

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

16. Which of the listed devices is most likely to be installed on a large modern diesel-electric alternating current propulsion generator for commercial ship propulsion for the purposes of fire suppression?

- (A) A dry chemical fire extinguishing system.
- (B) A foam fire extinguishing system.
- (C) A Halon fire extinguishing system.
- (D) A CO₂ fire extinguishing system.

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

17. As shown in figure "B" of the illustration, what statement is true concerning "regenerating" operation? Illustration EL-0162

- (A) by applying torque in the opposite direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly speeds up the motor
- (B) by applying torque in the same direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly speeds up the motor
- (C) by applying torque in the same direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly slows down the motor
- (D) by applying torque in the opposite direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly slows down the motor

*If choice D is selected set score to 1.*
18. Which of the following is a disadvantage of electric drive propulsion systems?

- (A) Main propulsion power may also be directed to ships electrical service distribution.
- (B) Location of electric power generation machinery is flexible.
- (C) Propulsion motors are required along with electrical power generation machinery.
- (D) The propeller speed and direction of rotation are easily controllable.

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

19. Which of the following electric propulsion motor types requires no brushes or electrical connections to the rotor?

- (A) DC shunt wound motor
- (B) AC synchronous motor
- (C) AC wound rotor induction motor
- (D) AC squirrel cage induction motor

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

20. An AC diesel-electric drive ship with synchronous propulsion motors has the capability for power factor correction. If the power factor associated with the main power distribution including all motors is 0.7 leading, what statement is true?

- (A) The synchronous propulsion motors are over-excited.
- (B) The excitation status of the synchronous motor cannot be determined.
- (C) The synchronous propulsion motors are under-excited.
- (D) The synchronous propulsion motors are normally excited.

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

21. In addition to improper brush pressure or seating, what can result in excessive sparking at the brushes of a DC propulsion motor?

- (A) reversed armature polarity with respect to the field
- (B) reversed main field polarity with respect to the armature
- (C) operating at continuously varying loads such as during maneuvering
- (D) improper positioning of brush rigging outside the neutral plane

*If choice D is selected set score to 1.*
22. What equipment for modern SCR rectified DC propulsion drive systems is usually included in the package?

- (A) propulsion generators which produce AC power that is converted to DC power for the shunt wound DC propulsion motor
- (B) propulsion generators which produce DC power that is converted to AC power for the propulsion motor
- (C) propulsion generators which produce AC power that is directly delivered to the synchronous AC propulsion motor
- (D) propulsion generators which produce DC power that is directly delivered to the series-wound DC propulsion motor

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

23. Refer to the two-generator, two-motor, DC diesel-electric drive propulsion system simplified schematic shown in the illustration. While in two-generator, two-motor operation, which of the following conditions would cause the propulsion shaft speed to be approximately one-half the desired speed? Illustration EL-0141

- (A) The armature winding of one of the propulsion motors is open-circuited.
- (B) The field winding of one of the propulsion motors is open-circuited.
- (C) The field winding of one of the propulsion generators is open-circuited.
- (D) The armature winding of one of the propulsion generators is open-circuited.

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

24. What is the purpose of the device labeled "Man-Auto Sw." in the illustrated switchboard? Illustration EL-0003

- (A) to shift from the automatic voltage regulator to manual voltage control or vice versa
- (B) to shift the governor control from manual to automatic/zero droop or vice versa
- (C) to enable the operator to read the field voltage on device "Volt. Reg. Adj. Pot." or device "Man. Volt. Adj. Rheo."
- (D) to supply regulated control power to the switchboard

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

25. Which of the listed sections of an emergency switchboard is used to supply power for alarm signals under emergency conditions?

- (A) The 24 volt DC bus
- (B) The 120 volt, 60 cycle, 3-phase bus
- (C) The 450 volt, 60 cycle, 3-phase bus
- (D) The generator and bus transfer section

*If choice A is selected set score to 1.*
26. As shown in figures "E" and "F" of the pictured high voltage rack mounted circuit breaker, which figure represents the circuit breaker position when in the open or tripped position? Illustration EL-0167

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

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

27. What are the operating characteristics of a step-down potential transformer in terms of the secondary load?

- (A) reduced current and increased voltage
- (B) reduced power (kVA)
- (C) reduced voltage and increased current
- (D) reduced voltage and reduced current

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

28. How are power transformers rated?

- (A) kilowatt-volts
- (B) ampere-turns
- (C) kilovoltamperes
- (D) kilowatts-amps

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

29. Due to the operating characteristics of the system, time lag fuses (or dual-element fuses) are necessary for use in what types of circuits?

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

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

30. A fuse is the most common type of protection against a short-circuit fault in LV distribution circuits, motor circuits and for portable appliances. What is a major drawback or deficiency with the use of fuse?

- (A) It does not provide protection in case of a short circuit.
- (B) It generates a lot of heat when activated.
- (C) It has a very slow-speed of operation at high short-circuit fault current.
- (D) It is insensitive to small overcurrent.

*If choice D is selected set score to 1.*
31. Which of the listed conditions describes the effect on intrinsic semiconductor operation as a result of a temperature increase?

- (A) Conductivity will increase
  - (B) Resistivity will increase
  - (C) Capacitive reactance will decrease
  - (D) Inductive reactance will decrease

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

32. As shown in figure "A" of the illustration, what is true concerning the illustrated frequency response curve? Illustration EL-0076

- (A) Low frequencies below the cutoff-frequency are attenuated and high frequencies above the cutoff-frequency are passed.
- (B) Low frequencies below the cutoff-frequency are passed and high frequencies above the cutoff-frequency are passed.
- (C) Low frequencies below the cutoff-frequency are passed and high frequencies above the cutoff-frequency are attenuated.
- (D) Low frequencies below the cutoff-frequency are attenuated and high frequencies above the cutoff-frequency are attenuated.

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

33. What is the functional purpose of a heat sink, as frequently used with transistors?

- (A) to decrease the forward current
- (B) to prevent excessive temperature rise
- (C) to compensate for excessive doping
- (D) to increase the reverse current

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

34. Why is it necessary to perform periodic testing of correctly rated and properly installed circuit breakers?

- (A) to insure they do not exceed their interrupting capacity
- (B) to insure they will continue to provide the original degree of protection
- (C) to insure they can trip faster as they increase in age
- (D) to insure they will be able to withstand at least 125% of applied voltage

*If choice B is selected set score to 1.*
35. Which of the following procedures should be used to maintain a large electric motor during periods of inactivity?

- (A) Space heaters should be used to prevent condensation of moisture.
- (B) Compressed air should be blown over areas where dust is deposited.
- (C) A thin layer of air-drying varnish should be applied on the windings.
- (D) Spraying a solvent periodically to remove carbon dust.

If choice A is selected set score to 1.

36. To check the three-line fuses protecting a three-phase motor using a multimeter set up as a voltmeter, what should be done FIRST?

- (A) place the starter in the "stop" position
- (B) place the leads across the "hot" ends of the fuses
- (C) make sure the motor is operating at full load to guard against a false reading
- (D) place the leads across the bottom ends of the fuses

If choice A is selected set score to 1.

37. If a digital multimeter is set up as shown in figure "A" of the illustration, what would be displayed on the screen if the fuse being tested is blown? Illustration EL-0210

- (A) OL volts
- (B) 0.001 ohms
- (C) 470 ohms
- (D) OL ohms

If choice D is selected set score to 1.

38. In the lighting distribution circuit shown in the illustrated lighting panel L110 of the illustration, if all circuit breakers are closed and due to a problem with the relevant feeder circuit breaker, there is a loss of power on the incoming phase A, which of the following statements is true? Illustration EL-0013

- (A) Half of the passageway lighting circuits on the 01 deck would lose power.
- (B) Half of the accommodation lighting circuits on the 01 deck; port side would lose power.
- (C) All of the accommodation lighting circuits on the 01 deck; starboard side would lose power.
- (D) All of the receptacles in the laundry would lose power.

If choice B is selected set score to 1.
39. As shown in figure "A" of the illustration, what type of converter unit is represented? Illustration EL-0240
   - (A) multiplexer
   - (B) analog to digital converter
   - (C) digital to analog converter
   - (D) de-multiplexer

   If choice B is selected set score to 1.

40. What is the name of the digital logic gate represented by figure "1" of the illustration? Illustration EL-0035
   - (A) AND gate
   - (B) NOR gate
   - (C) Exclusive OR gate
   - (D) OR gate

   If choice D is selected set score to 1.

41. In process control terminology, continuously variable values which change without distinct increments, such as temperature, pressure, or level are correctly referred to as what type of values?
   - (A) bumpless values
   - (B) digital values
   - (C) binary values
   - (D) analog values

   If choice D is selected set score to 1.

42. As shown in figures "A", "B", and "C" of the illustration, what is the purpose of the differential amplifier segment of the 741 operational amplifier? Illustration EL-0111
   - (A) detect and amplify the voltage difference between the inputs at pins 1 and 2
   - (B) detect and amplify the voltage difference between the inputs at pins 1 and 5
   - (C) detect and amplify the voltage difference between the inputs at pins 2 and 3
   - (D) detect and amplify the voltage difference between the inputs at pins 3 and 5

   If choice C is selected set score to 1.
43. If a digital multimeter is set up as shown in figure "B" of the illustration to test a capacitor, what would the display read if the capacitor was functioning properly? Illustration EL-0213

- (A) the actual capacitance value of the capacitor will be displayed which should be within the tolerance range of the capacitor
  - (B) initially a very low ohmic value will be displayed, followed by a gradual rise in resistance until a very high value is displayed (OL ohms)
  - (C) the charging voltage would be displayed which will initially be low and gradually rise to the internal battery voltage
  - (D) initially a very high ohmic value will be displayed (OL ohms), followed by a gradual drop in resistance until a very low value is displayed

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

44. An ohmmeter used to test for front-to-back resistance of a PN junction diode should produce roughly what ratio?

- (A) 100:1
  - (B) 500:1
  - (C) 1000:1
  - (D) 5000:1

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

45. What problem with a printed circuit board may resolve itself once a board is removed from its edge card connector and then reinstalled?

- (A) Discolored or darkened components
- (B) Leaking components
- (C) Open traces or broken connections
- (D) Corroded pin connectors

*If choice D is selected set score to 1.*
46. When troubleshooting a printed circuit board, one technique that can be used is swapping the suspected damaged board with a new board. When installing the new board which was stored in a specially manufactured antistatic bag, how may damage due to electrostatic discharge be prevented?

- (A) Before touching the board, you should discharge any static buildup on yourself by touching a conductive surface or use a grounding wrist strap, and the board should be handled by its insulated edges only.
- (B) Before touching the board, you should discharge any static buildup on the board by touching the board to a conductive surface, and the board should be handled by grasping trace solder surfaces.
- (C) Before touching the board, you should discharge any static buildup on yourself by touching a conductive surface or use a grounding wrist strap, and the board should be handled by grasping trace solder surfaces.
- (D) Before touching the board, you should discharge any static buildup on the board by touching the board to a conductive surface, and the board should be handled by its insulated edges only.

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

47. 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 maximize the magnitude of the ground fault current
- (B) To minimize the magnitude of the ground fault current
- (C) To completely eliminate ground fault current
- (D) To prevent nuisance ground fault trips

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

48. For the purposes of shipboard practice, voltages above what threshold would be considered high voltage?

- (A) 440 VAC
- (B) 1000 VAC
- (C) 4160 VAC
- (D) 6600 VAC

*If choice B is selected set score to 1.*
49. In order for a live-line tester to be used to test and prove dead a high voltage circuit, what must be done to verify the ability of the tester to detect a voltage?

- (A) The live-line tester should be checked by connecting to a known high voltage source only after testing the circuit to be worked upon.
- (B) 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.
- (C) The live-line tester should be checked by connecting to a known high voltage source only before testing the circuit to be worked upon.
- (D) 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.

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

50. When a high voltage system insulation test value is suspect or recorded during an annual survey, a polarization index test is performed. What is the polarization index?

- (A) The polarization index is the insulation resistance taken at ten minutes.
- (B) The polarization index is the ratio of the insulation resistance taken at thirty minutes to the insulation resistance taken at one minute.
- (C) The polarization index is the ratio of the insulation resistance taken at one minute to the insulation resistance taken at ten minutes.
- (D) The polarization index is the ratio of the insulation resistance taken at ten minutes to the insulation resistance taken at one minute.

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

51. Overheating is suspected in a high voltage bolted bus-bar joint. If the local continuity resistance is to be checked off-line after the necessary safety precautions have been taken, what instrument would be used for the resistance test?

- (A) A conventional ohmmeter.
- (B) A special high resistance tester (megohmmeter).
- (C) A special low resistance tester (microhmmeter).
- (D) Any of the above ohmmeters would be suitable.

*If choice C is selected set score to 1.*
52. Without the benefit of a specially designed enclosure window for thermographic analysis, what must be done to obtain accurate, but safe readings using infrared thermographic techniques?

- (A) The infrared camera recording is taken while energized with the enclosure door open in accordance with safety procedures.
- (B) The infrared camera recording is taken before de-energizing and isolating in accordance with safety procedures.
- (C) The infrared camera recording is taken after waiting a suitable period of time after de-energizing and isolating in accordance with safety procedures.
- (D) The infrared camera recording is taken immediately after de-energizing and isolating in accordance with safety procedures.

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

53. What statement is true concerning random-access memory (RAM)?

- (A) RAM is non-volatile memory and the contents of RAM are not lost when the power is removed.
- (B) RAM is volatile memory and the contents of RAM are not lost when the power is removed.
- (C) RAM is non-volatile memory and the contents of RAM are lost when the power is removed.
- (D) RAM is volatile memory and the contents of RAM are lost when the power is removed.

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

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

- (A) Thick Ethernet
- (B) Gigabit Ethernet
- (C) Thin Ethernet
- (D) Fast Ethernet

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

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

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

*If choice B is selected set score to 1.*
56. If a mechanical mouse of a computer workstation is operating erratically, what maintenance should be performed?

- (A) Remove the plastic surround on the underside of the mouse, and after removing the ball, mechanically clean the limit switches.
- (B) Compressed air should be directed onto the underside of the mouse.
- (C) Remove the plastic surround on the underside of the mouse, and after removing the ball, mechanically clean the two wheels.
- (D) Solvent should be sprayed onto the underside of the mouse.

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

57. A very useful Windows utility for discovering or verifying IP addressing information of a network is "ipconfig". How is this utility program launched?

- (A) It is run by clicking on the TCP/IP shortcut icon on the desktop.
- (B) It is run from the command prompt screen by default by simply bringing up the command prompt.
- (C) It is run from the command prompt screen by typing "ipconfig/all".
- (D) It is run by clicking on the "ipconfig" icon in start menu or under programs.

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

58. What is the name of a TCP/IP application run from the command prompt that sends datagrams once every second in the hope of an echo response from another machine (network device) being addressed to test network connectivity and to verify that TCP/IP is running?

- (A) TRACERT
- (B) IPCONFIG
- (C) PING
- (D) FTP

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

59. According to the liquid crystal data display for the depth sounder shown in the illustration, what is the instantaneous depth currently being displayed? Illustration EL-0186

- (A) 43.5 meters below the surface
- (B) 43.5 meters below the transducer
- (C) 47.5 meters below the surface
- (D) 47.5 meters below the transducer

*If choice D is selected set score to 1.*
60. As shown in the illustrated block diagram for a digitized echo sounding system, what statement is true concerning the function of the transducer? Illustration EL-0185

- (A) The transducer converts audio frequency (AF) electromagnetic energy to acoustical energy while transmitting and converts the reflected acoustical energy back into AF electromagnetic energy while receiving.
- (B) The transducer converts radio frequency (RF) electromagnetic energy to acoustical energy while transmitting and converts the reflected acoustical energy back into RF electromagnetic energy while receiving.
- (C) The transducer converts audio frequency (AF) electromagnetic energy to acoustical energy while receiving and converts the reflected acoustical energy back into AF electromagnetic energy while transmitting.
- (D) The transducer converts radio frequency (RF) electromagnetic energy to acoustical energy while receiving and converts the reflected acoustical energy back into RF electromagnetic energy while transmitting.

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

61. As shown in the illustrated adaptive digital steering control system functional block diagram and listed system interface signals table, what would the rudder order signal output voltage to the rudder servo amplifier be for a rudder order of 15 degrees right rudder, assuming left rudder signals are negative and right order signals are positive in polarity? Illustration EL-0191

- (A) -1.33 VDC
- (B) -3.75 VDC
- (C) +3.75 VDC
- (D) +5.0 VDC

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

62. As shown in the illustrated adaptive digital steering control system functional block diagram and listed system interface signals table, what would the rudder order signal output voltage to the rudder servo amplifier be for a rudder order of 20 degrees left rudder, assuming left rudder signals are negative and right order signals are positive in polarity? Illustration EL-0191

- (A) -2.25 VDC
- (B) -4.0 VDC
- (C) -5.0 VDC
- (D) +5.0 VDC

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

63. Which of the illustrated resistors represents the schematic symbol shown in figure "B"? Illustration EL-0021

- (A) figure "4"
- (B) figure "6"
- (C) figure "10"
- (D) figure "11"

*If choice C is selected set score to 1.*
64. Which of the following electrical schematic symbols represents a normally closed flow switch? Illustration EL-0059

- (A) 6
- (B) 7
- (C) 11
- (D) 14

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

65. While standing "at sea watch" onboard a modern rectified DC diesel-electric drive ship you notice the transformer core temperature slowly rising. What should be your FIRST action?

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

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

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

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

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

67. 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. Flushing the field is the procedure used to restore the residual magnetism. Using a 12 volt storage battery, how is this performed?

- (A) 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.
- (B) 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.
- (C) 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.
- (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 C is selected set score to 1.*
68. 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) De-energize the applicable switchboard bus.
- (D) Secure and tag the supply circuit breaker in the open position.

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

69. When performing an absence-of-voltage test before commencing repair work, at the minimum where must the absence-of-voltage test be performed?

- (A) At the load side disconnect switch
- (B) At the source disconnect branch circuit breaker
- (C) At the point of contact where the work will take place
- (D) At the main feeder circuit breaker

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

70. In a 60 Hz AC system, what is the duration in seconds for one complete cycle?

- (A) 60 seconds
- (B) 6 seconds
- (C) 1 second
- (D) 0.016 of a second

*If choice D is selected set score to 1.*
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EL-0059

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A

Hand-held Programming Unit

Control Electronics

DC Link Capacitor

IGBT

Controlled Inverter Bridge

Variable Frequency
3-Ph 0.5 to 120 Hz

3-Phase Motor

Variable Speed Drive

440 VAC
3-Ph 60 Hz

B

DC Voltage Input

IGBT

PWM Inverter Bridge

PWM Voltage Output

Phase Width Modulation Principle
(Only one phase shown)

Average Low Frequency

Average High Frequency

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Where R = Direction of Actual Rotation
T = Direction of Applied Torque
EL-0180
Catalog Number Selection Chart

Example Catalog Number

<table>
<thead>
<tr>
<th>A</th>
<th>N</th>
<th>1</th>
<th>9</th>
<th>A</th>
<th>N</th>
<th>0</th>
<th>A</th>
<th>5E</th>
<th>005</th>
</tr>
</thead>
</table>

- **Device Type**
  - A = Starter
  - C = Contactor

- **Standard**
  - E = IEC
  - N = NEMA

- **Device Assembly Configurations**
  - 70 = Multi-speed
  - 1 = Non-reversing
  - 5 = Reversing

- **OLR Type**
  - 5 = Contactor only-no overload relay
  - 6 = Starter w/C336 bi-metallic OLR
  - 9 = Starter w/C440 electronic overload

- **NEMA Enclosures**
  - N = Open

- **Contactor Frame Size**
  - Suffix | NEMA Size | Continuous Amperes
  - A | 00 | 9
  - B | 0 | 18
  - D | 1 | 27
  - G | 2 | 45
  - K | 3 | 90
  - N | 4 | 135
  - S | 5 | 270
  - T | 6 | 540
  - U | 7 | 810
  - V | 8 | 1215

- **For Starters**
  - Starter Mounting Options
    - 0 = Horizontal
    - V = Vertical
  - For Contactors Only
    - 2 = Two-pole
    - 3 = Three-pole
    - 4 = Four-pole
    - 5 = Five pole

- **C440 OLR Designation**
  - (FVNR and FVR only)
    - 5E = Standard feature set
      - SEL Reset, SEL Class (10A, 10, 20, 30)
    - 5G = Ground fault feature set
      - SEL Reset, SEL Class (10, 20)

- **AC Coil Suffix**
  - Suffix | Coil Volts and Hertz
  - A | 120/60 or 110/50
  - B | 240/60 or 220/50
  - C | 480/60 or 440/60
  - D | 600/60 or 550/60
  - E | 208/60
  - H | 277/60
  - J | 208-240/60 **
  - K | 240/50
  - L | 380/415/50
  - N | 550/50
  - T | 240/40, 24/50 ***
  - U | 24/50
  - V | 32/50
  - W | 48/60
  - Y | 48/50

**NOTES:**
* For contactor only orders, add B to end of catalog number if NEMA size 00-2, 6.
** NEMA sizes 00 and 0 only.
*** NEMA sizes 00 and 0 only. Sizes 1-8 are 24/60 only.
**** NEMA sizes 4 and 5 require the use of CTs with 1 - 5A OLR relay. Size 4 starters are not shipped as assembled units.
  Order CN15NNN01 contactor 1 - 5A OL (C440A1A005SAX or C440A2A 005SAX) with 60 - 300A CTs (ZEB-XCT300).

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EL-0185
Digitized Echo Sounding System

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**Echo Sounder Range vs. Pulse Length vs. PRF**

<table>
<thead>
<tr>
<th>Depth (Meters)</th>
<th>Pulse Length (ms)</th>
<th>PRF (Pulses Per Minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5, 10 and 20</td>
<td>0.25</td>
<td>760</td>
</tr>
<tr>
<td>40</td>
<td>0.38</td>
<td>375</td>
</tr>
<tr>
<td>100</td>
<td>1.00</td>
<td>150</td>
</tr>
<tr>
<td>200</td>
<td>2.00</td>
<td>76</td>
</tr>
<tr>
<td>400 and 800</td>
<td>3.60</td>
<td>42</td>
</tr>
</tbody>
</table>

**Sea Bed Consistency and Attenuation**

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Attenuation (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft mud</td>
<td>15</td>
</tr>
<tr>
<td>Mud / sand</td>
<td>9</td>
</tr>
<tr>
<td>Sand / mud</td>
<td>6</td>
</tr>
<tr>
<td>Sand</td>
<td>3</td>
</tr>
<tr>
<td>Stone / rock</td>
<td>1</td>
</tr>
</tbody>
</table>

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Adapted Digital Steering Control System Functional Block Diagram

- **Inputs**
  - **Speed Log Input**
    - Pulsed Serial
  - **Navigator (Vessel Management System) Input**
  - **Compass**
    - Step Data
    - Syncro
  - **Data**
    - Serial Data
  - **Mode Switch Sense Contact**
  - **NFU Sense Contacts**
  - **Power Failure Circuit**

- **Outputs**
  - Interface to External Rudder Servo Control Amplifiers
  - Rate of Turn Interface

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A

B

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