U.S.C.G. Merchant Marine Exam

Third Assistant Engineer

Q535 General Subjects

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

1. If one drive belt on an air compressor is found to be worn you should __________.
   - (A) replace that belt only
   - (B) dress the worn belt
   - (C) adjust belt tension
   - (D) replace all of the belts

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

2. In order to distribute the side pressures over a wide area of the cylinder walls and liners, which of the listed types of pistons are used in modern low-pressure air compressors?
   - (A) Trunk
   - (B) Differential
   - (C) Valve-in-head
   - (D) Barrel

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

3. What is the primary purpose of the lead-lag arrangement of the two potable water pumps supporting a typical potable water system?
   - (A) Enabling the lag pump to cycle on and off during periods of relatively low demand and the lead pump to assist the lag pump only when the demand is high.
   - (B) Enabling both potable water pumps to cycle on and off together in response to system demand changes.
   - (C) Enabling the lead pump to cycle on and off during periods of relatively low demand and the lag pump to assist the lead pump only when the demand is high.
   - (D) Enabling the lead pump to pump against a shut-off head during periods of relatively low demand and the lag pump to recirculate when the demand is high.

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

4. In accordance with 33 CFR Subchapter O (Pollution), which type of Marine Sanitation Device (MSD) is used solely for the storage of sewage and flush water at ambient air pressure and temperature?
   - (A) Type I
   - (B) Type II
   - (C) Type III
   - (D) Type IV

   *If choice C is selected set score to 1.*
5. With regard to a ballast system associated with a dry cargo ship, what is the primary purpose of the double bottom ballast tanks?

- (A) Correcting a condition of hogging of the vessel.
- (B) Adjusting the trim of the vessel.
- (C) Correcting a condition of sagging of the vessel.
- (D) Adjusting the overall draft of the vessel or correcting a condition of list.

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

6. Which of the following could be a probable cause of abnormal valve wear and breakage?

- (A) Faulty operation of a cylinder unloader.
- (B) Lifting of intercooler relief valve.
- (C) Carbon build up in the piston ring belt.
- (D) Compressor operation in an area of high relative humidity.

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

7. As shown in figure "B" of the illustrated block diagram of a central operating system configured for supervisory control, which statement is true concerning the block "COMPUTER" with respect to closed-loop control processes? Illustration EL-0094

- (A) The computer normally has no role in the various closed-loop control processes. It is only used for backup control purposes.
- (B) The computer provides the set point input data to the analog controllers, but the analog controllers actually control the closed-loop processes.
- (C) The computer provides the set point input data to the process control loop, as well as the measured variable data. The analog controllers are only used for manual backup control.
- (D) The computer has no role in the various closed-loop control processes regardless of the control mode.

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

8. In a closed-loop process control system, what term is used to describe the action of measuring the difference between the actual result and the desired result and using that difference to drive the actual result toward the desired result?

- (A) Feedback
- (B) Deadband
- (C) Instability
- (D) Gain

*If choice A is selected set score to 1.*
9. A ball or roller bearing has an interference fit with the housing in which it is being installed with a hydraulic or arbor press. Upon what surface should the sleeve of the press be applied?

- (A) the outer race
- (B) the shaft
- (C) the housing
- (D) the inner race

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

10. If the demister used in the device shown in the illustration is improperly installed, which of the following will occur? Illustration MO-0110

- (A) The vacuum of the device will increase.
- (B) The temperature of the device will decrease.
- (C) Interstage leakage will cause a decrease in output.
- (D) There will be an increase of chlorides measured at the distillate pump salinity cell.

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

11. Which of the conditions listed would indicate a large condenser tube leak within the distiller shown in the illustration? Illustration MO-0111

- (A) A slow continuous rise in the lube oil cooler outlet temperature indicated at device "4".
- (B) An increase in distiller output resulting from the combination of jacket water and the distillate produced.
- (C) The activation of the salinity monitoring equipment's annunciator circuit
- (D) A decrease in the level of the main engine expansion tank as indicated by a low-level alarm.

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

12. If a reverse-osmosis freshwater generator has fouled membrane modules, what statement is true?

- (A) The freshwater production rate would be lower than normal, and the feed pressure would be lower than normal.
- (B) The freshwater production rate would be higher than normal, and the feed pressure would be lower than normal.
- (C) The freshwater production rate would be lower than normal, and the feed pressure would be higher than normal.
- (D) The freshwater production rate would be higher than normal, and the feed pressure would be higher than normal.

*If choice C is selected set score to 1.*
13. When securing a flash-type evaporator for an extended period of time, you should __________.
   - (A) fill the unit with descaling compound
   - (B) fill the unit with salt water
   - (C) completely drain the unit
   - (D) tightly seal the unit to exclude air

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

14. Concerning governor speed droop, what statement is true?
   - (A) If speed droop is permanent, the prime mover's final speed is different for each amount of loading.
   - (B) If speed droop is temporary, there will be no transient speed changes associated with load changes.
   - (C) If speed droop is temporary, the prime mover's final speed is different for each amount of loading.
   - (D) If speed droop is permanent, the prime mover's final speed is constant regardless of the load.

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

15. How may a suspected tube leak on a shell-and-tube jacket water cooler most easily be located?
   - (A) Isolate, drain, and dry the salt water side of the heat exchanger. Pressurize the sea water side with compressed air. Visually inspect the jacket water expansion tank for bubbles.
   - (B) Isolate, drain, and dry both the salt water and jacket water sides of the heat exchanger. Remove the waterbox inspection plates. Visually inspect the tube sheets for signs of seepage at each of the tube ends.
   - (C) Isolate, drain, and dry the salt water side of the heat exchanger. Remove the waterbox inspection plates. Visually inspect the tube sheets for signs of seepage at each of the tube ends.
   - (D) Isolate, drain, and dry the jacket water side of the heat exchanger. Remove the shell inspection plates. Visually inspect the tubes along the tube lengths for seepage.

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

16. For a given shell diameter and tube sizes for a shell-and-tube heat exchanger, which tube pitch pattern would be the most compact design allowing for the most tubes?
   - (A) Rotated square tube pitch
   - (B) Triangular tube pitch
   - (C) Rotated triangular tube pitch
   - (D) Square tube pitch

   *If choice B is selected set score to 1.*
17. When taking a shell-and-tube heat exchanger with a removable tube bundle such as a bayonet-tube heavy fuel oil service heater out of service, to prevent water hammer what statement represents the correct operating procedure?

- (A) Open wide the condensate drains first. Gradually close down and secure the steam, then close the condensate drains when no longer issuing dry steam. Finally, secure the heavy fuel oil.
- (B) Secure the heavy fuel oil first, then crack open the condensate drains. Gradually close down and secure the steam, then close the condensate drains when no longer draining condensate.
- (C) Secure the heavy fuel oil first, then crack open the condensate drains. Gradually close down and secure the steam, then close the condensate drains when no longer issuing dry steam.
- (D) Crack open the condensate drains first. Gradually close down and secure the steam, then close the condensate drains when no longer draining condensate. Finally, secure the heavy fuel oil.

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

18. When normal operating pressure is applied to the hydraulic oil in a high-pressure system, the oil ________.

- (A) viscosity will increase
- (B) floc point will increase
- (C) volume will increase
- (D) viscosity will decrease

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

19. You press start button on the hydraulic power unit shown in the illustration, and the motor does not start. The first thing you should check is the ________. Illustration GS-0161

- (A) suction strainer condition
- (B) controller circuit breaker
- (C) controller contactor operating coil
- (D) pump discharge relief valve setting is too low

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

20. Both the direction of flow and fluid flow rate of a variable displacement radial piston pump are determined by the relative positions of the ________.

- (A) floating ring and pump shaft
- (B) pump shaft and horizontal ports
- (C) floating ring and cylinder body
- (D) pump shaft and central valve

*If choice C is selected set score to 1.*
21. Which of the following statements will be true if the position of the manual control lever, shown in the illustration, remains unchanged after the pump is placed on stroke? Illustration GS-0039

- (A) Regardless of the control handle position, the pump will gradually return to neutral stroke.
- (B) Although oil will leak past part “B”, the amount of pump stroke will be maintained until the control handle position is changed.
- (C) Regardless of the control handle position, the pump will gradually move to full stroke.
- (D) Although the control handle position was set, the pump displacement will fluctuate from zero to maximum flow rate until the handle is placed in its neutral position.

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

22. Which of the listed components of a hydraulic system would enable the pump to be temporarily shut down, and yet still provide an instantaneous source of hydraulic force?

- (A) Pressure compensator valve
- (B) Modulator
- (C) Accumulator
- (D) Sump actuator

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

23. If the bearings of a piece of machinery are fed by a gravity feed lubricating oil system, what statement is true?

- (A) The lube oil pump draws a suction on the lube oil gravity tank and discharges directly to the bearings. The return oil then gravity drains to the lube oil gravity tank.
- (B) The lube oil pump draws a suction on the lube oil reservoir/sump and discharges directly to the bearings. The return oil then gravity drains to the lube oil gravity tank which overflows to the lube oil reservoir/sump.
- (C) The lube oil pump draws a suction on the lube oil reservoir/sump and discharges directly to the bearings. The return oil then gravity drains to the lube oil reservoir/sump.
- (D) The lube oil pump draws a suction on the lube oil reservoir/sump and discharges to the lube oil gravity tank. The oil then gravity feeds the bearings and the return oil drains to the lube oil reservoir/sump.

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

24. What is meant by the term toughness as it applies to a material?

- (A) The ability to resist repeated application and release of force.
- (B) The ability to resist continuous compression.
- (C) The ability to resist penetration.
- (D) The ability to resist continuous tension.

*If choice A is selected set score to 1.*
25. What is the normal direction of flow through the device shown in the illustration while operating in the processing mode? Illustration GS-0153

- (A) The oily-water mixture enters through the pressure control valve "2" and exits with the processed liquid through valve "14".
- (B) The oily-water mixture enters through valve "4" and exits as processed liquid through valve "14".
- (C) The oily-water mixture enters through valve "5" and exits the separator through valve "14" as processed liquid.
- (D) The oily-water mixture enters through valve "14" and exits with the processed liquid through valve "4".

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

26. What type of fuel oil as part of an oily-water mixture is most likely to have a density approaching that of water?

- (A) Marine diesel oil.
- (B) Distillate/residual fuel oil blends.
- (C) Light distillate oil.
- (D) Heavy residual fuel oil.

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

27. How would the pressure setting of the illustrated self-contained, internal-pilot, piston-operated steam pressure-reducer be raised to a higher setpoint? Illustration GS-0044

- (A) The adjusting spring would need to have its compression load increased by rotating the adjusting screw clockwise further into the adjusting spring chamber.
- (B) The adjusting spring would need to have its compression load reduced by rotating the adjusting screw counter-clockwise further out of the adjusting spring chamber.
- (C) The adjusting spring would need to have its compression load reduced by rotating the adjusting screw clockwise further into the adjusting spring chamber.
- (D) The adjusting spring would need to have its compression load increased by rotating the adjusting screw counter-clockwise further out of the adjusting spring chamber.

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

28. In the illustrated pneumatically operated, diaphragm actuated control valve, what statement is true concerning the opening and closing forces acting upon the control diaphragm? Illustration GS-0051

- (A) The spring force acting on the control diaphragm is a valve opening force, and the pilot pressure acting on the bottom of the control diaphragm is a valve closing force.
- (B) The spring force acting on the control diaphragm is a valve opening force, and the pilot pressure acting on the top of the control diaphragm is a valve closing force.
- (C) The spring force acting on the control diaphragm is a valve closing force, and the pilot pressure acting on the top of the control diaphragm is a valve opening force.
- (D) The spring force acting on the control diaphragm is a valve closing force, and the pilot pressure acting on the bottom of the control diaphragm is a valve opening force.

*If choice B is selected set score to 1.*
29. The illustration shown represents a blueprint of a metal __________. Illustration GS-0028

- (A) rod with a conventional break
- (B) tube with a broken-out section
- (C) pipe with a missing center section
- (D) bar with a sawn out section

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

30. Which of the following couplings or clutches allows, within limits, a certain degree of slip?

- (A) Inflatable tire type clutch
- (B) Flexible coupling
- (C) Multiple disk friction clutch
- (D) Electromagnetic clutch

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

31. When an electricity generating plant features shaft-driven generators, what type of propulsor would be the most practicable for main propulsion?

- (A) Fixed-pitch propeller
- (B) Controllable-pitch propeller
- (C) Detachable-blade (built-up) propeller
- (D) Tandem propeller

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

32. A centrifugal pump gradually develops insufficient discharge pressure. What corrective action is required?

- (A) Replace the lantern rings.
- (B) Replace the wearing rings.
- (C) Throttle in on the discharge valve.
- (D) Throttle in on the suction valve.

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

33. A spur gear pump should be operated with the discharge valves __________.

- (A) halfway opened
- (B) slightly opened
- (C) fully opened
- (D) throttled

*If choice C is selected set score to 1.*
34. Which of the following conditions would prevent a steam reciprocating pump from delivering its rated capacity?

- (A) A leaking snifter valve allowing air to enter the suction side of the pump
- (B) Air trapped in the discharge expansion chamber
- (C) Excessive suction lift
- (D) All of the above

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

35. The rudder torque capacity of the four-ram steering gear illustrated, is rated at 44,210,000 inch-pounds with one power unit in operation. If the four-ram system was able to be operated as a two-ram system with both power units on line, what would be the available torque? Illustration GS-0067

- (A) 11,052,500 inch-pounds
- (B) 22,105,000 inch-pounds
- (C) 44,210,000 inch-pounds
- (D) 88,420,000 inch-pounds

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

36. The action necessary to use the steering gear room trick wheel when transferring the steering control from the wheelhouse to local control is to __________.

- (A) align the trick wheel to the rudder angle position before engaging
- (B) set the six-way control valve in the trick wheel position
- (C) open the power transfer switch before engaging the trick wheel
- (D) always place the rudder in the amidships position to engage the trick wheel

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

37. How would you prevent the rudder from moving while a repair is made on the steering system using the illustrated actuator? Illustration GS-0116

- (A) secure the valves in the supply and return lines
- (B) screw in the locking pin, item "J"
- (C) tighten the locking pins, item "H" at each position of item "I" to keep the rudder from swinging
- (D) tighten the locking screws in item "S"

*If choice A is selected set score to 1.*
38. Referring to the illustrated drawing of the central-station hookup for a hot water heating system, what statement is true concerning the air separator on the heated water outlet of the converter? Illustration GS-0151

- (A) The air separator removes the entrained air introduced with the makeup water at the expansion tank and ultimately released by the heating process within the converter.
- (B) The air separator removes the entrained air introduced within the converter and ultimately released by the expansion tank vent.
- (C) The air separator removes the entrained air introduced by the heating steam and ultimately released by the condensate returns gravity draining to the atmospheric drains tank.
- (D) The air separator removes the entrained air introduced by the heated air via the zone return lines and ultimately released by the heating process within the converter.

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

39. In the illustrated single zone HVAC system, what statement represents the functioning of the diverting relay as it controls the cooling coil flow and the exhaust, outside air and recirculation dampers? Illustration RA-0009

- (A) The diverting relay processes the humidistat control signal as long as the space humidity is below the humidistat setpoint. The diverting relay processes the room thermostat control signal if the space humidity exceeds the humidistat setpoint.
- (B) The diverting relay processes the room thermostat control signal as long as the space temperature is below the thermostat setpoint. The diverting relay processes the room humidistat control signal if the space temperature exceeds the thermostat setpoint.
- (C) The diverting relay processes the room thermostat control signal as long as the space humidity is below the humidistat setpoint. The diverting relay processes the room humidistat control signal if the space humidity exceeds the humidistat setpoint.
- (D) The diverting relay processes the humidistat control signal as long as the space temperature is below the thermostat setpoint. The diverting relay processes the room thermostat control signal if the space temperature exceeds the thermostat setpoint.

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

40. What type of centrifugal fan is characterized by the highest operating efficiency?

- (A) Radial blade fans
- (B) Forward-curved blade fans
- (C) Backward-curved blade fans
- (D) Flat blade fans

*If choice C is selected set score to 1.*
41. Which statement is true concerning a liquid desiccant cargo-hold dehumidification system?

- (A) Water vapor from the humid air inlet from the cargo-hold is condensed and absorbed into the liquid desiccant by means of a heating coil located in the humidification chamber.
- (B) Water from the humid air inlet from the cargo-hold is evaporated and driven out of the liquid desiccant by means of a heating coil located in the humidification chamber.
- (C) Water from the humid air inlet from the cargo-hold is evaporated and driven out of the liquid desiccant by means of a cooling coil located in the humidification chamber.
- (D) Water vapor from the humid air inlet from the cargo-hold is condensed and absorbed into the liquid desiccant by means of a cooling coil located in the humidification chamber.

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

42. In accordance with federal regulations under 33 CFR Subchapter O (Pollution), for U.S. non-oceangoing ships, what is the required means for preventing pollution by oil as it pertains to handling bilge slops?

- (A) The non-oceangoing ship is required to be equipped with an approved 15 parts per million oily-water separator, AND it is required to have a high oil content bilge alarm and a means to automatically stop the oily-water discharge when the oil content exceeds 15 ppm.
- (B) The non-oceangoing ship is required to be equipped with an approved 15 parts per million oily-water separator, but it is NOT required to have a high oil content bilge alarm or a means to automatically stop the oily-water discharge when the oil content exceeds 15 ppm.
- (C) The non-oceangoing ship is required to retain onboard all oily mixtures either in the bilges or in a slops tank, and it is required to be equipped to discharge these mixtures to a reception facility.
- (D) The non-oceangoing ship is required to retain onboard all oily mixtures in a slops tank, and it is required to be equipped to discharge these mixtures to a reception facility.

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

43. All straight shank twist drills must be mounted or held in a __________.

- (A) drill chuck
- (B) drill socket
- (C) Morse sleeve
- (D) tapered sleeve

*If choice A is selected set score to 1.*
44. What statement is true concerning the operation of continuous-level liquid level detectors?

- (A) Continuous-level detectors produce an analog signal proportional to the liquid level in the tank.
  - (B) Continuous-level detectors produce a digital signal proportional to the liquid level in the tank.
  - (C) Continuous-level detectors produce a digital signal inversely proportional to the liquid level in the tank.
  - (D) Continuous-level detectors produce an analog signal inversely proportional to the liquid level in the tank.

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

45. A radiation pyrometer is sensitive to what form of radiation?

- (A) Ultrared radiation
  - (B) Ultraviolet radiation
  - (C) Infraviolet radiation
  - (D) Infrared radiation

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

46. Assuming that a standard micrometer (without a Vernier scale) has the ability to read to the nearest one thousandths of an inch, such a micrometer with a Vernier scale would make it possible to read to the nearest __________.

- (A) five thousandths of an inch
  - (B) ten thousandths of an inch
  - (C) twenty five thousandths of an inch
  - (D) one fortieth of an inch

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

47. Referring to the illustrated bellows-type thermostatic steam trap, what statement is true concerning its operation? Illustration GS-0005

- (A) When the bellows comes into contact with relatively hot steam, the vapor within the bellows condenses resulting in bellows contraction and valve opening.
  - (B) When the bellows comes into contact with relatively cool condensate, the vapor within the bellows condenses resulting in bellows contraction and valve opening.
  - (C) When the bellows comes into contact with relatively hot steam, the liquid within the bellows vaporizes resulting in bellows contraction and valve opening.
  - (D) When the bellows comes into contact with relatively cool condensate, the liquid within the bellows vaporizes resulting in bellows expansion and valve closing.

*If choice B is selected set score to 1.*
48. As it pertains to the automatic electric brake of a horizontal electro-mechanical anchor windlass, what statement is true?

- (A) The brake is electrically set and spring released, and the brake automatically releases when electric power is removed from the electric drive motor.
- (B) The brake is spring set and electrically released, and the brake automatically sets when electric power is removed from the electric drive motor.
- (C) The brake is spring set and electrically released, and the brake automatically releases when electric power is removed from the electric drive motor.
- (D) The brake is electrically set and spring released, and the brake automatically sets when electric power is removed from the electric drive motor.

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

49. What is the name of an internal passage of watertight construction fitted along the centerline between the double bottoms of some ships, usually from the forepeak to the forward machinery space bulkhead, used to carry pipe work along the length of the ship to the various holds or tanks?

- (A) Pipe keel
- (B) Vertical keel
- (C) Bar keel
- (D) Duct keel

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

50. Even though bilge keels do provide some improvement in longitudinal strength at the bilge radius, what is the primary purpose of the bilge keels?

- (A) Dampen the tendency the ship has to pitch.
- (B) Dampen the tendency the ship has to yaw.
- (C) Dampen the tendency the ship has to heave.
- (D) Dampen the tendency the ship has to roll.

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

51. When arc welding, the flux that covers the electrode is used to __________.

- (A) reduce oxidation
- (B) reduce metal fatigue and warpage
- (C) control penetration
- (D) increase heat transfer

*If choice A is selected set score to 1.*
52. What statement is true concerning the construction of watertight bulkheads?

- (A) The strakes of the bulkhead are vertical and the stiffeners are horizontal and the bulkhead must have increasingly greater strength towards the top.
- (B) The strakes of the bulkhead are horizontal and the stiffeners are vertical and the bulkhead must have increasingly greater strength towards the base.
- (C) The strakes of the bulkhead are vertical and the stiffeners are horizontal and the bulkhead must have increasingly greater strength towards the base.
- (D) The strakes of the bulkhead are horizontal and the stiffeners are vertical and the bulkhead must have increasingly greater strength towards the top.

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

53. Referring to the illustrated motorship fresh water cooling system drawing, what statement is true concerning the evaporator? Illustration MO-0212

- (A) The evaporator uses heat recovered from the jacket water cooler sea water as a heat source to generate fresh water and is piped in series with and prior to the jacket water cooler.
- (B) The evaporator uses heat recovered from the main engine cooling water as a heat source to generate fresh water and is piped in series with and after the jacket water cooler.
- (C) The evaporator uses heat recovered from the main engine cooling water as a heat source to generate fresh water and is piped in parallel with the jacket water cooler.
- (D) The evaporator uses heat recovered from the main engine cooling water as a heat source to generate fresh water and is piped in series with and prior to the jacket water cooler.

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

54. The carbon seal ring of a refrigeration compressor crankshaft mechanical seal is held in position against the stationary ring face by using what device?

- (A) spring
- (B) thrust washer
- (C) snap ring
- (D) woodruff key

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

55. When one belt of a multiple V-belt drive requires replacing, what will be required?

- (A) season the new belt prior to installation
- (B) ensure the proper belt dressing is applied
- (C) replace the entire belt set
- (D) ensure the seasoned belts are reinstalled in their proper sequence

*If choice C is selected set score to 1.*
56. Unusual noise coming from a refrigeration compressor can be caused by which of the following conditions?

- (A) too much oil in circulation
- (B) slugging due to flooding back
- (C) worn bearings and piston pins
- (D) all of the above

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

57. When pumping down an air conditioning system to test the low-pressure cut-out switch, assuming that the compressor is running, what should be done to initiate the test?

- (A) secure the condenser
- (B) close the “king” valve
- (C) stop the circulating pump
- (D) stop the compressor

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

58. The air temperature associated with a direct reciprocating air conditioning plant is found to be too warm, and the compressor is not operating. A service check determines the compressor suction pressure to be above the normal cut-in point, with a normal head pressure, and high evaporator superheat. Which of the following could be the cause of this problem?

- (A) A liquid line solenoid valve has failed closed.
- (B) The low-pressure switch contacts are not operating correctly.
- (C) Cooling water flow to the condenser is excessive.
- (D) A liquid line solenoid valve has failed open.

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

59. Which of the processes listed would be the most satisfactory method to use to lower the humidity of the air being circulated by an air conditioning system?

- (A) Cooling the air to a point below dew point, then reheating it.
- (B) Heating the air and then cooling it to a point below dew point.
- (C) Heating the air to a point at which moisture will boil off, then recooling it.
- (D) Cooling the air to a temperature just above dew point.

*If choice A is selected set score to 1.*
60. During operating periods of a multi-box refrigeration system using a capacity-controlled compressor, when all of the evaporators of a four-box plant are actively being fed with liquid refrigerant, the control oil pressure acting on the hydraulic relay piston shown in the illustration will be at what value? Illustration RA-0013

- (A) the lowest
- (B) at its mid-range
- (C) the highest
- (D) of no consequence as the lube oil is not used in the operation of the unloader

If choice C is selected set score to 1.

61. The device shown in the illustration which is used for removing moisture from the liquid refrigerant in the system is labeled with what letter? Illustration RA-0012

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

If choice A is selected set score to 1.

62. Given that valve "14" is the king solenoid valve, which of the following statements is true? Illustration RA-0012

- (A) Valves "28" and "36" are both chill box solenoids.
- (B) Valve "36" is the chill box solenoid, and valve "28" is the freeze box solenoid.
- (C) Valves "28" and "36" are both freeze box solenoids.
- (D) Valve "28" is the chill box solenoid, and valve "36" is the freeze box solenoid.

If choice D is selected set score to 1.

63. If the evaporator coil horizontal return line of a refrigeration system is less than 7/8" (2.21 cm) in diameter (considered small), which figure in the illustration represents the proper orientation and placement of the thermostatic expansion valve sensing bulb? Illustration RA-0049

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

If choice C is selected set score to 1.
64. If the superheat setting of a thermostatic expansion valve is set too low, what would be the result, assuming that the system has a single evaporator?

- (A) the suction line will be abnormally cold and liquid may flood back to the compressor
- (B) the box temperature will be pulled way down below the normal temperature range
- (C) the receiver level will be abnormally high due to a reduced amount of refrigerant returning back to the compressor
- (D) the suction line will be abnormally warm due to a reduced amount of refrigerant returning back to the compressor

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

65. A high-pressure centrifugal chiller currently charged with R-134a is being evaluated for the need for leak testing. Using the leak test procedures decision tree illustrated and the R-134a pressure-temperature chart illustrated, with the machine idle and the pressures equalized at 10 psig with an ambient temperature of 60°F, what statement is true? Illustrations RA-0011 and RA-0047

- (A) The machine has a suspected leak; therefore nitrogen should be added to bring the pressure to 70 psig prior to checking for leaks.
- (B) The machine has a suspected leak; therefore the refrigerant pressure should be raised to 35 psig by adding refrigerant prior to checking for leaks.
- (C) The machine definitely does not have a leak; therefore no attempt at leak detection is necessary.
- (D) The machine may or may not have a leak; therefore the machine should be checked for leaks without any adjustments in pressure.

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

66. Release of refrigerant to the atmosphere during the process of purging of air and non-condensable gases can be kept to a permissible minimum by what action?

- (A) cracking the purge valve briefly and allowing the refrigerant to re-settle between purges
- (B) purging through the discharge service valve rather than the top of the condenser
- (C) purging through a dehydrator
- (D) purging through the top of the receiver rather than the top of the condenser

*If choice A is selected set score to 1.*
67. As shown in the illustrated flow diagram for a self-contained recovery unit designed for the recovery of refrigerants from high-pressure appliances as defined by the EPA Clean Air Act rules, what is the functional purpose of the item labeled “FS2”? Illustration RA-0032

- (A) It automatically shuts down the recovery unit compressor when the discharge pressure becomes excessive.
- (B) It automatically shuts down the recovery unit compressor when the recovery cylinder becomes 80% full.
- (C) It automatically shuts down the recovery unit compressor when the refrigeration system has reached a depth of 15” Hg.
- (D) It automatically transitions the recovery unit from the direct liquid recovery mode to the direct vapor recovery mode.

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

68. Which of the illustrated devices would be the LEAST accurate for the purposes of weighing-in a refrigerant charge? Illustration RA-0045

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

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

69. Personnel servicing refrigeration systems and subject to the exposure to commonly used refrigerants should wear what type of personal protective equipment?

- (A) goggles and gloves
- (B) a respirator
- (C) rubber soled shoes
- (D) an all-purpose gas mask

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

70. Which of the following statements is true concerning the illustrated gauge manifold set? Illustration RA-0001

- (A) The valves labeled "G" and "C" must both be open to read system pressures on the respective gages labeled "A" and "B".
- (B) Closing the valve labeled "G" isolates the port labeled "H" from the gauge labeled "A".
- (C) Closing the valve labeled "G" isolates the port labeled "H" from the port labeled "J".
- (D) Opening fully and backseating the valve labeled "G" isolates the gauge labeled "A" from the port labeled "H".

*If choice C is selected set score to 1.*
GS-0028

1/16 R Both Ends

60°

1/2 Dia — 1/16 Deep

10

+0.001

-0.001

1.250

Allow 0.012 to 0.015 for Grinding
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Notes
1. Mount convector on exposed (cold) bulkhead or bulkhead lining with 0.5" air space.
2. Clean-out plates should be 24" x 24" if possible.
3. Provide 24" x 24" hinged panel in joiner ceiling. Locate for easy access to air vent, valves, and clean-out.
4. The convector hook-up also applies to fin pipe elements.
5. Locate the shut-off valve for down-feed convectors approximately 6' above the deck.
6. The air vent must be operable through a side or discharge grille.

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Adapted for testing purposes only from Operator, Unit and Direct Support Maintenance Manual Including Repair Parts and Special Tools List for Oil Water Separator TM 55-1925-285-13 & P
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RA-0009

Recirculation-Exhaust
From Space

Optional

To Space

Steam

Exhaust

Outside
Air

N.C. P

N.O. P

N.C. P

2.P.

F

P

C

F

Supply Fan

Chilled Water

Humidistat

Fan

Filter

Cooling Coil

Preheater (Steam)

Reheater (Steam)

Duct Thermostat

Room Thermostat

Diverting Relay

Pneumatic Damper and Motor

Pneumatic Relay

N.C. Normally Closed (Valve or Damper)

N.O. Normally Open (Valve or Damper)

B.P. Minimum Outside Air Bypass

P Positive Positioning Relay

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### R-134a Pressure-Temperature Chart

<table>
<thead>
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<th>Temperature °F</th>
<th>Vacuum &quot;Hg</th>
<th>Temperature °F</th>
<th>Pressure psig</th>
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<td>28</td>
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If Pneumatic Control is not used, this port must be vented. DO NOT PLUG

Surge Chamber (SH Compressor Only)

Control Oil Pressure

Oil Pump Pressure

Crankcase Pressure

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RA-0047
Leak Test Procedure for Idle Centrifugal Chiller Charged with R-134a Refrigerant

1. Record condenser and cooler pressures and ambient temperature.
2. Does condenser pressure at saturation conditions correspond to ambient temperature and is cooler pressure 15 psig or higher?
   - Yes: Leak not suspected; however, a minor or recently developed leak may exist.
   - No: Power up controls to energize oil heater, and when oil is hot equalize condenser and cooler pressures.
3. Perform leak test using soap bubbles solution, ultrasonic or electronic leak detector.
4. Top-off refrigerant charge as necessary.
5. Are leaks detected?
   - Yes: Locate and mark all leaks.
   - No: Perform refrigerant recovery and repair all leaks.
6. Leak is suspected; may be major or the consequence of long-term leakage.
7. Is either condenser or cooler pressure at 0 psig?
   - Yes: Raise pressure to 70 psig with nitrogen, and if using electronic leak detector add trace gas.
   - No: Power up controls to energize oil heater, and when oil is hot equalize condenser and cooler pressures.
8. Add refrigerant until pressure is above 35 psig.
10. Are leaks detected?
    - Yes: Perform refrigerant recovery.
    - No: Perform refrigerant recovery and repair all leaks.
11. Perform dehydration evacuation of machine.
12. Charge machine with refrigerant.
15. Are leaks detected?
    - Yes: Locate and mark all leaks.
    - No: Release nitrogen pressure from machine and repair all leaks.
17. Perform refrigerant recovery.
18. Does vacuum hold?
   - Yes: Perform dehydration evacuation of machine.
   - No: Charge machine with refrigerant.
19. Perform refrigerant recovery and repair all leaks.
20. Locate and mark all leaks.

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RA-0049
TXV Feeler Bulb on Small Suction Line
(less than ¾")

A

B

C

D

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