U.S.C.G. Merchant Marine Exam

Third Assistant Engineer

Q537 Steam Plants I

(Sample Examination)

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U.S.C.G. Merchant Marine Exam
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Illustrations: 5

Choose the best answer to the following Multiple Choice Questions:

1. Circulation of water and the steam/water mixture within a natural circulation boiler is retarded by _____.

- (A) Back pressure in the steam drum acting on the user tubes
- (B) Large changes in steam density
- (C) Fluid friction in the downcomers, drums, generating tubes, and headers
- (D) High feedwater pressure

If choice C is selected set score to 1.

2. Overheating of the generating tubes will occur when a boiler reaches its end point of _____.

- (A) Evaporation
- (B) Combustion
- (C) Moisture carryover
- (D) Circulation

If choice D is selected set score to 1.

3. In a boiler water gauge glass, a ball check valve is installed on the _____.

- (A) bottom connection only
- (B) top connection only
- (C) top and bottom connection
- (D) drain valve

If choice A is selected set score to 1.

4. When excessive static boiler pressure has resulted in the initial lift of the valve disc, a huddling chamber safety valve will continue to lift open as a result of _____,

- (A) Steam pressure transmitted through a pipe connected to the superheater outlet
- (B) An increase in steam velocity through an adjustable orifice ring
- (C) The resulting reactive force created by the rapid expansion of escaping steam
- (D) Steam pressure acting on the enlarged area of projecting lip or ring

If choice D is selected set score to 1.

5. When heated, brickwork in a boiler is kept from buckling by the installation of _____.

- (A) Insulating blocks
- (B) Insulating bricks
- (C) Expansion joints
- (D) Sliding saddles

If choice C is selected set score to 1.

6. Which of the listed refractory materials is capable of providing structural stability?

- (A) Firebrick
- (B) Insulating block
- (C) Chrome castable
- (D) Insulating brick

If choice A is selected set score to 1.

7. In most marine boilers, the primary reason the first few rows of generating tubes, called screen or furnace row tubes, are made larger in diameter than the rest of the generating tubes is because _____.

- (A) they must act as downcomers to ensure proper circulation
- (B) they must screen the superheater from the direct radiant heat of the burners
- (C) they require more water flow since they are exposed to the greatest heat
- (D) their main function is to retard combustion gas flow for maximum heat transfer rates

If choice C is selected set score to 1.

8. Which of the following statements represents the primary function of handholes used on a boiler?

- (A) To allow access into the steam and water drum.
- (B) To allow access into the headers.
- (C) To provide access for cleaning out the firebox.
- (D) To allow access for cleaning in the stack.

If choice B is selected set score to 1.

9. Desuperheated steam can be found at the _____.

- (A) Generator steam stop
- (B) Spray attemperator outlet
- (C) Main steam stop
- (D) High-pressure turbine steam chest

If choice B is selected set score to 1.

10. If a boiler generates saturated steam at 125.3 psig, how much heat is required to change the water into steam if the feed water temperature is 240°F? Illustration SG-0004

- (A) 30.5 Btu/lb.
- (B) 116.5 Btu/lb.
- (C) 582.7 Btu/lb.
- (D) 984.7 Btu/lb.

If choice D is selected set score to 1.

11. With an increase in the saturation pressure of a fluid, the value represented by line "5" on the graph will _____. Illustration SG-0001

- (A) represent an increase in the specific heat of the vapor
- (B) represent virtually no change in the latent heat of vaporization
- (C) represent a decrease in the specific heat of the vapor
- (D) represent virtually no change in the specific heat of the vapor

If choice D is selected set score to 1.

12. A boiler internal feed pipe is perforated to _____.

- (A) Provide positive flow to the downcomers
- (B) Create a slight turbulence in the steam drum
- (C) Reduce the weight of the steam drum internals
- (D) Distribute water evenly throughout the steam drum

If choice D is selected set score to 1.

13. Where is the "dry pipe" located in a boiler?

- (A) Behind the superheater screen tubes
- (B) In the top of the steam drum
- (C) At the superheater outlet
- (D) Below the generation tube bank

If choice B is selected set score to 1.

14. Scavenging air is supplied to steam sootblower elements to _____.

- (A) Prevent overheating of adjacent tubing
- (B) Prevent back up of combustion gases into sootblower heads
- (C) Provide cooling air when sootblower elements are rotating through blowing arcs
- (D) Prevent buildup of soot on the element

If choice B is selected set score to 1.

15. A check valve is located between the economizer and the steam drum to _____.

- (A) Assure a positive feedwater flow through the economizer
- (B) Assure a positive feedwater flow to the steam drum
- (C) Prevent the feed pump from becoming vapor bound
- (D) Prevent steam and water flow reversal from the drum should an economizer casualty occur

If choice D is selected set score to 1.

16. Which of the conditions listed could cause steam formation in the economizer?

- ○ (A) An open main feed pump recirculating line
- ○ (B) Soot buildup on the gill rings
- ○ (C) Excessive water flow rates
- • (D) Sudden large increase in the firing rate

If choice D is selected set score to 1.

17. Boiler fuel savings gained by the use of an economizer can amount to _____.

- ○ (A) One half percent for each 15°F rise in feedwater temperature
- • (B) One percent for each 10°F rise in feedwater temperature
- ○ (C) Three percent for each 5°F rise in feedwater temperature
- ○ (D) Three percent for each 20°F rise in feedwater temperature

If choice B is selected set score to 1.

18. Where is the superheater located in the boiler shown in the illustration? Illustration SG-0008

- • (A) G
- ○ (B) H
- ○ (C) I
- ○ (D) J

If choice A is selected set score to 1.

19. Which of the devices listed is shown in the boiler illustration? Illustration SG-0008

- ○ (A) Retractable sootblower
- • (B) Integral or interdeck superheater
- ○ (C) Separately fired superheater
- ○ (D) Regenerative air heater

If choice B is selected set score to 1.

20. Many steam plants are designed so that diesel oil can be provided to the burners when _____.

- • (A) Lighting off a cold ship
- ○ (B) Heavy smoking persists
- ○ (C) A heavy fuel must be blended
- ○ (D) Overload capacity is required

If choice A is selected set score to 1.

21. Why should the fuel oil be recirculated before lighting off a cold boiler?

- (A) To heat the fuel enough for proper atomization.
- (B) To allow the fuel strainers to thoroughly clean the fuel.
- (C) To ensure that all water is removed from the fuel.
- (D) To allow fuel pressure to buildup gradually.

If choice A is selected set score to 1.

22. When raising steam on a boiler, the superheater drains should _____.

- (A) Be opened to remove condensate, and then closed when the first burner is lit
- (B) Remain open or partially open until steam blows through the lines, and then the valves should be closed
- (C) Be closed until just before line pressure is reached, and then given a short blow period
- (D) Be closed until after the air cock is closed, and then opened until the boiler is placed on line

If choice B is selected set score to 1.

23. When raising steam on a cold boiler under normal conditions, you should always _____.

- (A) Raise steam within one hour or less
- (B) Use a small orifice burner sprayer plate to start
- (C) Use a large orifice burner sprayer plate to start
- (D) Take 24 hours to raise steam

If choice B is selected set score to 1.

24. Which of the actions listed should be carried out immediately after securing the fires in one boiler of a two boiler ship?

- (A) Drain and refill the boiler with cold water.
- (B) Secure the main feed pump.
- (C) Relieve all fuel oil service pressure to that boiler.
- (D) Open the air registers wide to cool the furnace.

If choice C is selected set score to 1.

25. To avoid acid corrosion of the economizer tubes when blowing tubes _____.

- (A) Raise boiler pressure
- (B) Lower water level
- (C) Drain the sootblowers headers
- (D) Lower boiler pressure

If choice C is selected set score to 1.

26. To safely decrease the boiler firing rate, you should always reduce the fuel pressure _____.

- (A) By opening the fuel pump relief valve
- (B) After reducing the forced draft pressure
- (C) Before reducing the forced draft pressure
- (D) By opening the oil recirculating valve

If choice C is selected set score to 1.

27. One factor for determining the minimum feedwater inlet temperature to a boiler economizer is the _____.

- (A) Temperature of steam bled off the LP turbine
- (B) Dew point temperature of the stack gases
- (C) Superheater inlet temperature
- (D) Desuperheater outlet temperature

If choice B is selected set score to 1.

28. When increasing the firing rate of a boiler, which of the following should be carried out FIRST?

- (A) Increasing the forced draft air pressure.
- (B) Decreasing the steam pressure.
- (C) Increasing the fuel pressure.
- (D) Increasing the feedwater flow.

If choice A is selected set score to 1.

29. When installing new safety valve escape piping, precautions should include assuring that _____.

- (A) bends or elbows in the line do not exist
- (B) the piping leads directly to the bilge
- (C) no stress is transmitted to the valve
- (D) the quick-closing valve operates freely

If choice C is selected set score to 1.

30. Radial cracks have developed in the castable refractory of the burner cones after the first firing since the installation of new furnace front refractory. This is an indication of _____.

- (A) inadequate cone angle
- (B) relieved stresses
- (C) a need for castable refractory patchwork
- (D) a need for plastic firebrick patchwork

If choice B is selected set score to 1.

31. When a propulsion boiler is removed from service for an extended period, why should the firesides be thoroughly dried after water washing?

- ○ (A) Prevent flarebacks on lighting off
- ○ (B) Prevent cracking of the brickwork
- • (C) Reduce the probability of corrosion
- ○ (D) Reduce the possibility of thermal spalling

If choice C is selected set score to 1.

32. You are standing watch in the engine room of a steam vessel. You should blow down a gauge glass periodically to _____.

- • (A) remove any sediment that has accumulated
- ○ (B) maintain the proper water level in the steam drum
- ○ (C) test the feedwater stop-check valve
- ○ (D) provide water samples for the second assistant

If choice A is selected set score to 1.

33. Improper water washing of the water-tube boiler firesides can cause _____.

- ○ (A) decreased heat transfer capabilities
- • (B) sulfuric acid corrosion
- ○ (C) loss of ductility in boiler tubes
- ○ (D) erosion of tubes and drums

If choice B is selected set score to 1.

34. While the vessel is rolling in heavy seas, the level in the boiler gauge glass remains steady, this is an indication that _____.

- ○ (A) the steam drum is adequately baffled
- ○ (B) the gauge glass is functioning normally
- • (C) there is most likely an obstruction in the lower valve
- ○ (D) the water level in the steam drum is too low

If choice C is selected set score to 1.

35. Oil or scale deposits on boiler tube walls will cause _____.

- • (A) those tubes to overheat
- ○ (B) increased boiler steam pressure
- ○ (C) decreased boiler steam pressure
- ○ (D) an explosion in the boiler

If choice A is selected set score to 1.

36. Insufficient combustion air supply to the furnace would cause _____.

- ○ (A) high stack temperature
- ○ (B) high feedwater consumption
- • (C) low superheater outlet temperature
- ○ (D) the fires to sputter

If choice C is selected set score to 1.

37. What is the cause of "laning" in a boiler tube bank?

- ○ (A) Low fuel oil pressure
- • (B) Excessive slag accumulation on the tubes
- ○ (C) Reduced furnace volume
- ○ (D) Insufficient air flow

If choice B is selected set score to 1.

38. Excessive foaming in a steaming boiler can cause damage to the _____.

- • (A) superheater
- ○ (B) desuperheater
- ○ (C) economizer
- ○ (D) internal feed pipe

If choice A is selected set score to 1.

39. The boiler feedwater control valve varies the unity relationship between steam and water flow during periods of _____.

- • (A) load change
- ○ (B) steady boiler load
- ○ (C) overload operation
- ○ (D) minimum boiler load

If choice A is selected set score to 1.

40. Which of the following statements is correct regarding the start-up operation of a non-condensing turbine-driven feed pump?

- ○ (A) Keep the pump casing vent valve closed until flow is established through the pump.
- ○ (B) Secure all drains prior to admitting any steam to avoid damage to traps.
- ○ (C) Keep the steam exhaust valve closed until steam is applied to ensure that the auxiliary exhaust line pressure does not drop.
- • (D) Open the pump suction valve prior to admitting steam to the turbine.

If choice D is selected set score to 1.

41. If it is necessary to operate a turbine driven main feed pump at shut off head, or at less than 20% of its rated capacity, what will prevent the pump from overheating?

- (A) Throttling of the liquid discharge valve.
- (B) A bypass or recirculating line led back to the source of suction supply.
- (C) A bypass or recirculating line led back to the pump impeller eye or suction.
- (D) Throttling of the steam supply valve.

If choice B is selected set score to 1.

42. A high water level in a deaerating feed heater will cause the automatic dump valve to divert condensate to the _____.

- (A) auxiliary condenser
- (B) atmospheric drain tank
- (C) main condenser
- (D) reserve feed tank

If choice D is selected set score to 1.

43. Which of the listed conditions aids in directing gland leakoff steam from the low-pressure propulsion turbine to pass through the gland exhaust condenser?

- (A) Steam pressure from the high-pressure turbine.
- (B) Steam pressure from the low-pressure turbine.
- (C) Compressed air in the air pilot.
- (D) The use of a gland exhauster fan.

If choice D is selected set score to 1.

44. A triple element, main propulsion, boiler feedwater regulating system commonly used aboard ship utilizes _____.

- (A) Proportional plus reset plus rate action
- (B) Proportional plus reset action
- (C) Two-position differential gap action
- (D) Proportional action

If choice A is selected set score to 1.

45. While underway on watch in the engine room of a steam vessel, the proper valve positions for controlling feedwater to the boiler using the auxiliary feed system should be _____.

- (A) The check valve fully open and the stop-check valve regulated by the feedwater regulator
- (B) The stop valve fully open and the auxiliary stop-check valve used to regulate the amount of flow
- (C) The auxiliary check valve fully open and the stop-check valve used to regulate the amount of flow
- (D) The stop and stop-check valves fully open and the feed pump speed used to regulate the amount of flow

If choice B is selected set score to 1.

46. In a closed feed and water cycle, which of the conditions listed could prevent vacuum from reaching the desired level?

- (A) Steam pressure to air ejectors maintained at 10 psig above designed supply pressure.
- (B) Condensate recirculating back to the condenser during maneuvering.
- (C) Steam leaking from the turbine glands.
- (D) Marine growth on the cooling water side of the main condenser.

If choice D is selected set score to 1.

47. The automatic recirculating valve in the main condensate recirculating line is controlled by a temperature sensor which is located at the _____.

- (A) condensate inlet to the main air ejectors
- (B) air ejector condensate discharge
- (C) main condensate pump discharge
- (D) main condensate pump suction

If choice B is selected set score to 1.

48. The loop seal connected to the main condenser returns the drains from the _____.

- (A) intercondenser
- (B) vent condenser
- (C) aftercondenser
- (D) all of the above

If choice A is selected set score to 1.

49. The differential temperature of the main condenser cooling water will be significantly affected by a change in _____.

- (A) sea temperature
- (B) boiler feed pump pressure
- (C) volume of cooling water flow
- (D) condensate pump pressure

If choice C is selected set score to 1.

50. Which of the listed conditions will always result in dissolved oxygen being carried over from the main condenser?

- (A) Excessive DC heater temperature
- (B) Taking on makeup feed
- (C) Priming in the boiler
- (D) Dumping auxiliary exhaust steam to the main condenser

If choice B is selected set score to 1.

51. Salt water contamination of condensate could occur at which component?

- (A) Inter condenser
- (B) Fresh water evaporator
- (C) After condenser
- (D) DC heater

If choice B is selected set score to 1.

52. Which of the listed systems would be a potential source for the high-pressure drain system?

- (A) Fuel oil tank heating coils
- (B) Galley steam tables
- (C) Laundry steam pressing machines
- (D) Steam systems operating in excess of 150 psi

If choice D is selected set score to 1.

53. Which combustible element in fuel oil is considered a significant and major source of air pollution?

- (A) Nitrogen
- (B) Hydrogen
- (C) Vanadium
- (D) Sulfur

If choice D is selected set score to 1.

54. The minimum temperature requirements for fuel oil in storage tanks is related to the _____.

- (A) size of the vents
- (B) fire point of the oil
- (C) pumpability of the oil
- (D) size of the containment area in case of overflow

If choice C is selected set score to 1.

55. The temperature of the fuel oil received during bunkering operations is critical in determining the _____.

- (A) rate at which the fuel can be pumped during transfer operations
- (B) flash point at which the fuel will burn
- (C) temperature to which the fuel must be heated
- (D) expansion space to leave in a tank

If choice D is selected set score to 1.

56. When testing boiler flue gas with a chemical absorption apparatus, to obtain accurate results _____.

- (A) prevent any air from contaminating the gas sample
- (B) analyze for nitrogen content before oxygen content
- (C) run each analysis for at least 3 minutes
- (D) purge the apparatus with air before use

If choice A is selected set score to 1.

57. A flue gas analysis is performed to determine the _____.

- (A) correct fuel/air ratio for efficient combustion
- (B) percentage of nitrogen by volume
- (C) specific heat of combustion products
- (D) carbon content of the fuel being burned

If choice A is selected set score to 1.

58. If the stack temperature is higher than normal, this could indicate _____.

- (A) high feedwater pressure
- (B) external boiler casing leakage
- (C) low fuel oil back pressure
- (D) too much excess air

If choice D is selected set score to 1.

59. Fuel oil is transferred to the settling tanks for _____.

- (A) heating to allow water and sediment to settle out
- (B) purging of any large air bubbles that have formed
- (C) heating to the correct temperature for proper burner atomization
- (D) the purpose of removing any volatile gases present in the fuel

If choice A is selected set score to 1.

60. When you are transferring fuel oil to the settling tanks, precautions to be observed should include _____.

- (A) maintaining a supply of chemical dispersant to cleanup minor oil spills adjacent to the ship
- (B) maintaining a high transfer rate until a slight trickle of oil is observed flowing from the overflow line
- (C) plugging gooseneck tank vents to prevent accidental overflow
- (D) sounding the tanks frequently and reducing the transfer rate as the level approaches maximum fill

If choice D is selected set score to 1.

61. While trying to light off a burner on a semi-automated boiler, you note that the fuel oil solenoid valve at the burner will not stay open. Which of the following conditions could cause this problem?

- (A) The flame scanner is adjusted for excessive time delay in the ignition trial circuit.
- (B) The forced draft air supply has failed.
- (C) The solenoid coil is energized causing the valve to remain closed.
- (D) The fuel oil pressure at that burner is too high.

If choice B is selected set score to 1.

62. The amount of oil atomized by a straight mechanical fuel oil burner depends on the sprayer plate size and the _____.

- (A) oil return pressure
- (B) forced draft pressure
- (C) furnace air pressure
- (D) fuel oil pressure

If choice D is selected set score to 1.

63. The component labeled "F" as shown in the illustration is _____. Illustration SG-0007

- (A) A regenerative air heater
- (B) A permanently installed Orsat apparatus
- (C) One of the main burner assemblies
- (D) One of the retractable sootblower elements

If choice C is selected set score to 1.

64. In the majority of marine power plants, the fuel oil heater installations are divided into several units because _____.

- (A) plant operation can be continued while repairs are being made to a defective unit
- (B) oil leakage into the condensate system is less likely with multiple systems
- (C) more heating is required for lower loads
- (D) auxiliary steam is better utilized in this system

If choice A is selected set score to 1.

65. Valve "H" shown in the illustration, functions to _____. Illustration SG-0009

- (A) regulate the amount of fuel burned
- (B) recirculate fuel oil during start-up
- (C) provide a quick shut off of fuel to the boiler
- (D) prevent a backflow from the manifold

If choice C is selected set score to 1.

66. Which of the following procedures represents the proper care of unused burners during low load conditions?

- (A) They should be removed, cleaned and stored in the rack on the burner bench.
- (B) They should be removed, cleaned, refitted with smaller tips and reinstalled to be ready for immediate use.
- (C) They may be left in place, with fuel and steam secured as long as they are not fouled.
- (D) They may be left in place, but only if they are clean and if fuel oil is recirculated to provide cooling.

If choice A is selected set score to 1.

67. If one burner of a group of operating steam atomizing burners in a steaming boiler is cut out, the register doors for that burner should be _____.

- (A) left wide open
- (B) closed halfway
- (C) left cracked open
- (D) closed tightly

If choice D is selected set score to 1.

68. Insufficient combustion air supply will cause an atomizer flame to appear as a _____.

- (A) pointed flame
- (B) dull red flame with black streaks
- (C) light yellow flame with white streaks
- (D) ragged flame

If choice B is selected set score to 1.

69. A leaky fuel oil heater relief valve could be indicated by an increase in the _____.

- (A) Contaminated drain tank level
- (B) Discharge piping temperature
- (C) Fuel oil service pump pressure
- (D) Sludge tank level

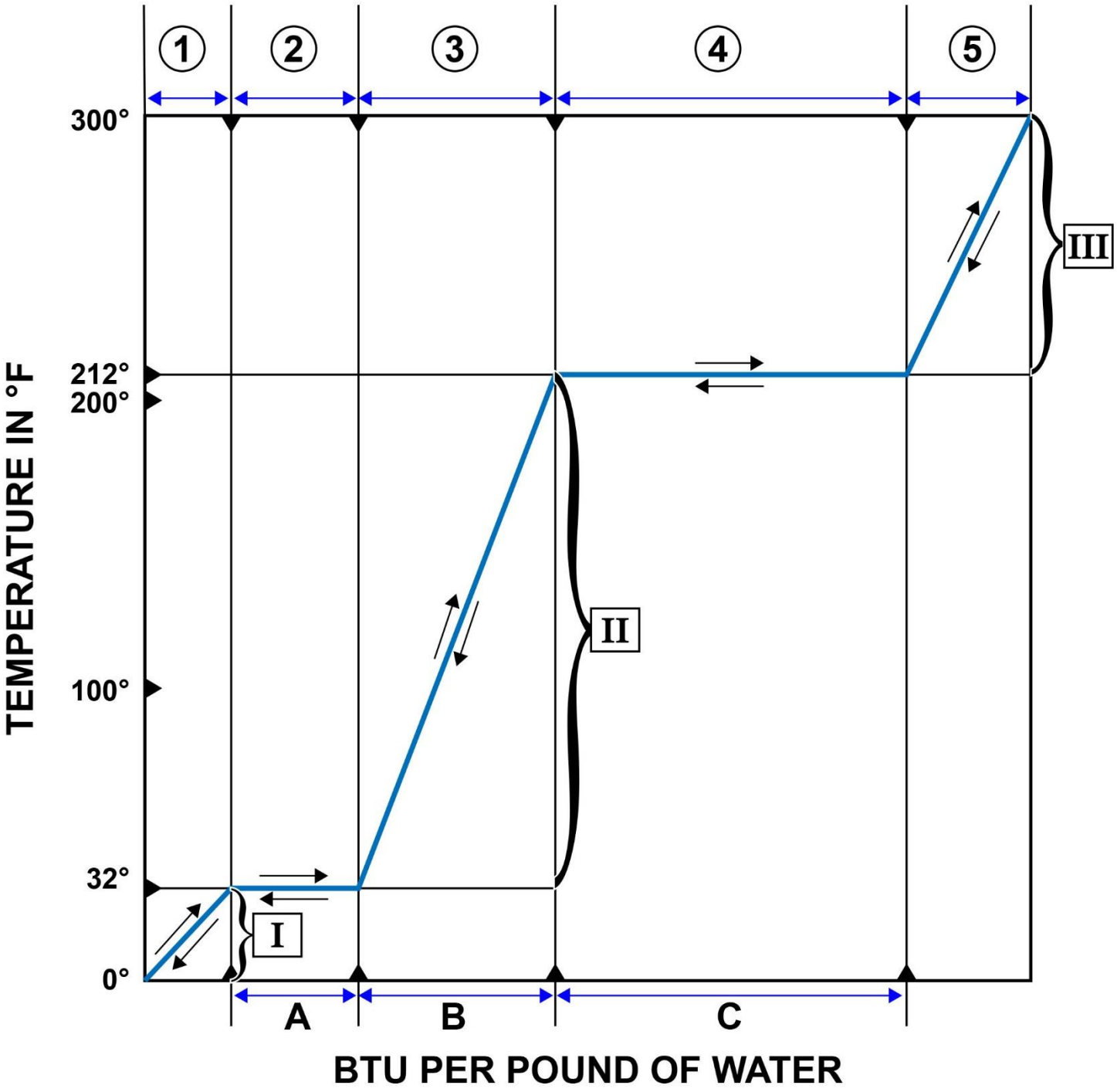
If choice B is selected set score to 1.

70. Boiler fuel oil atomizer parts should be cleaned by soaking in 'tip cleaner' or diesel fuel and _____.

- (A) brushed with a steel brush
- (B) scraped with a modified table knife
- (C) polished with emery cloth
- (D) scraped with a nonabrasive tool

If choice D is selected set score to 1.

SG-0001



SG-0004

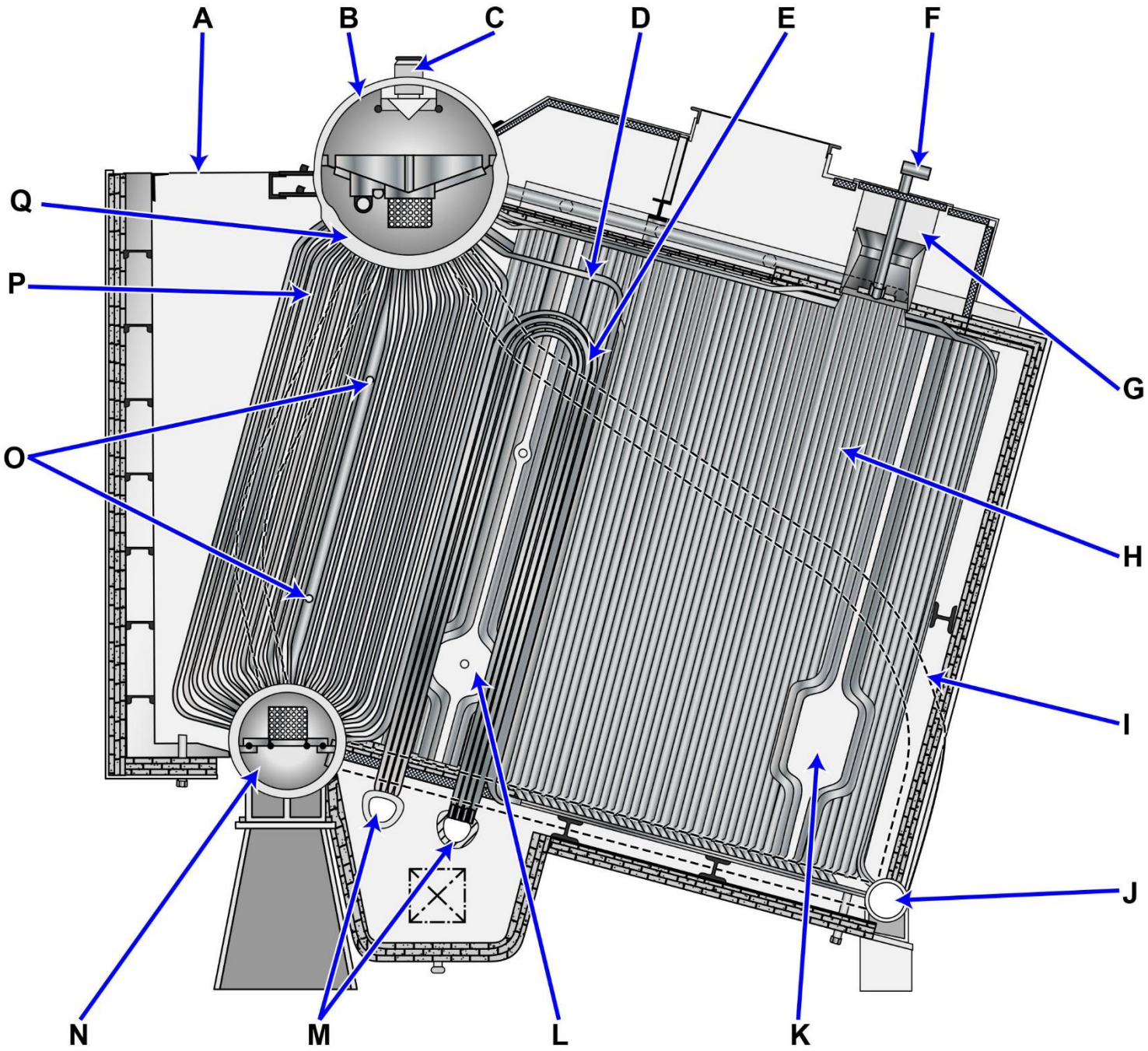
Table 1
Thermodynamic Properties of Saturated Steam (Temperature)

Temp, °F	Absolute. Pressure, psi	Enthalpy (BTU/lb) of Liquid	Enthalpy (BTU/lb) of Evaporation	Enthalpy (BTU/lb) of vapor
32	0.08859	0.01	1075.5	1075.5
40	0.12170	8.05	1071.3	1079.3
50	0.17811	18.07	1065.6	1083.7
60	0.25630	28.06	1059.9	1088.0
70	0.36310	38.04	1054.3	1092.3
80	0.50690	43.02	1048.6	1096.6
90	0.69820	57.99	1042.9	1100.9
100	0.94920	67.97	1037.2	1105.2
110	1.27480	77.94	1031.6	1109.5
120	1.69240	87.92	1025.8	1113.7
130	2.22250	97.90	1020.0	1117.9
140	2.88860	107.90	1014.1	1122.0
150	3.71800	117.90	1008.2	1126.1
160	4.74100	127.90	1002.3	1130.2
170	5.99200	137.90	996.3	1134.2
180	7.51000	147.90	990.2	1138.1
190	9.33900	157.90	984.1	1142.0
200	11.52600	168.00	977.9	1145.9
212	14.69600	180.00	970.4	1150.4
220	17.18600	188.10	965.2	1153.4
240	24.96900	208.30	952.2	1160.5
280	49.20300	249.10	924.7	1173.8
300	67.01300	269.60	910.1	1179.7
340	118.01000	311.10	879.0	1190.1
380	195.77000	353.50	844.6	1198.1
400	247.31000	375.00	826.0	1201.0

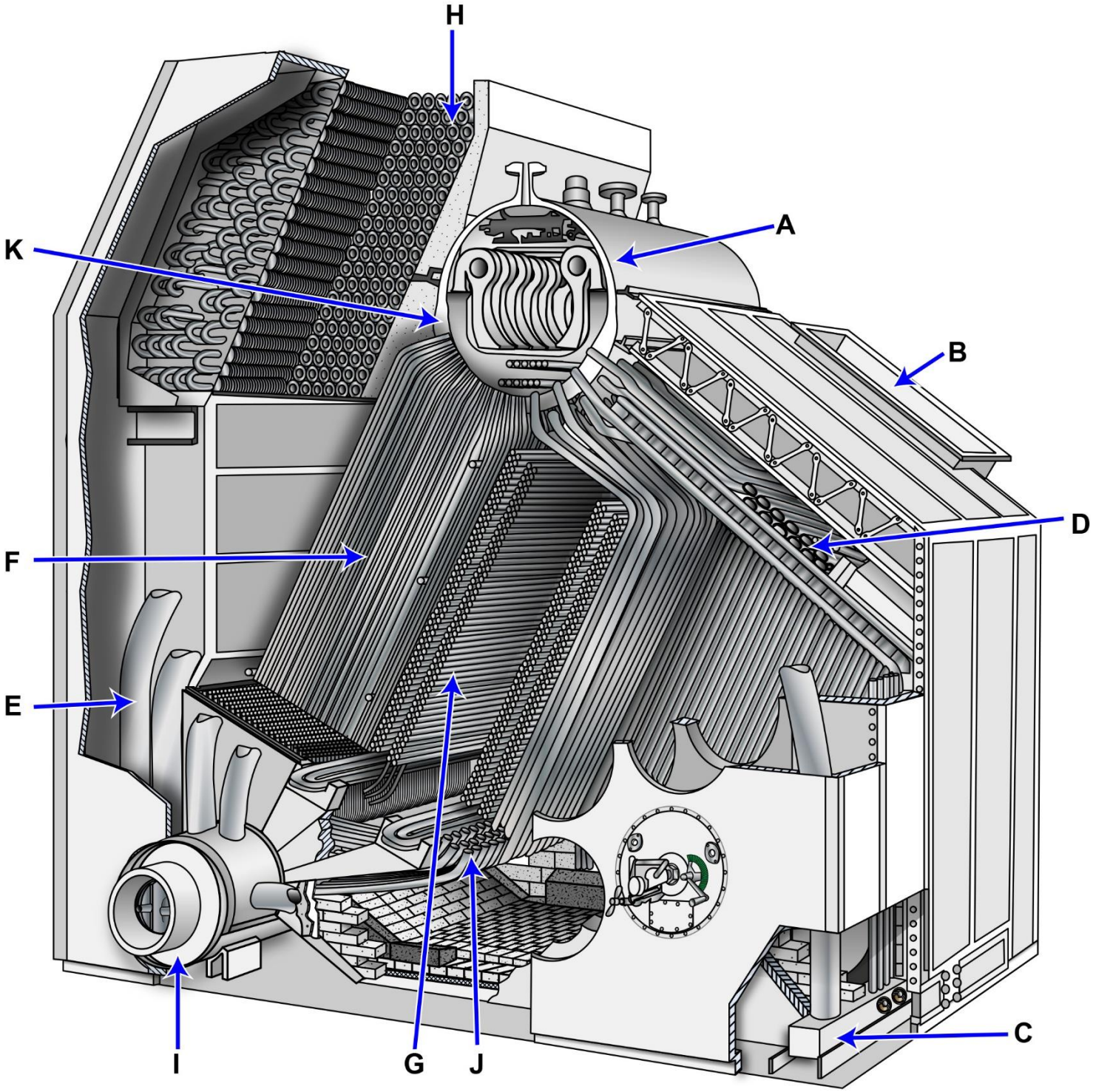
Table 2
Thermodynamic Properties of Saturated Steam (Pressure)

Absolute. Pressure, psi	Temp, °F	Enthalpy (BTU/lb) of Liquid	Enthalpy (BTU/lb) of Evaporation	Enthalpy (BTU/lb) of vapor
0.5	79.58	47.6	1048.8	1096.4
1.0	101.74	69.7	1036.3	1106.0
5.0	162.24	130.1	1001.0	1131.1
10.0	193.21	161.2	982.1	1143.3
14.7	212.00	180.0	970.4	1150.4
15.0	213.03	181.1	969.7	1150.8
20.0	227.96	196.2	960.1	1156.3
25.0	240.07	208.5	952.1	1160.6
30.0	250.33	218.8	945.3	1164.1
40.0	267.25	236.0	933.7	1169.7
50.0	281.01	250.1	924.0	1174.1
60.0	292.71	262.1	915.5	1177.6
70.0	302.92	272.6	907.9	1180.6
80.0	312.03	282.0	901.1	1183.1
90.0	320.27	290.6	894.7	1185.3
100.0	327.81	298.4	888.8	1187.2
110.0	334.77	305.7	883.2	1188.9
120.0	341.25	312.4	877.9	1190.4
130.0	347.32	318.8	872.9	1191.7
140.0	353.02	324.8	868.2	1193.0
150.0	358.42	330.5	863.6	1194.1
200.0	381.79	355.4	843.0	1198.4
250.0	400.95	376.0	825.1	1201.1
300.0	417.33	393.8	809.0	1202.8
350.0	431.72	409.7	794.2	1203.9
400.0	444.59	424.0	780.5	1204.5

SG-0007



SG-0008



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