

U.S.C.G. Merchant Marine Exam
First Assistant Engineer, Unlimited
Q513 Steam Plants
(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

1. Which of the following conditions may exist if you detect an excessive amount of metal particles on a main engine lube oil strainer magnet?
- (A) Reduction gear damage.
 - (B) Main shaft bearing damage.
 - (C) Journal bearing damage.
 - (D) Turbine shrouding damage.

If choice A is selected set score to 1.

2. Which of the following statements represents the significance of the differential pressure existing between the nozzle block and steam chest of a turbo generator equipped with a lifting beam mechanism?
- (A) The pressure differential necessitates the use of a special balance piston.
 - (B) The pressure differential requires the installation of a special biasing spring to open the valves.
 - (C) The pressure differential assists in seating the valves when the lifting beam is lowered.
 - (D) The pressure differential eliminates the possibility of valve binding in the lifting beam.

If choice C is selected set score to 1.

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

If choice A is selected set score to 1.

4. A common cause of the Babbitt linings cracking in a turbine journal bearing is from _____.
- (A) prolonged operation at low-speed
 - (B) prolonged operation at full-speed
 - (C) excessive thrust bearing wear
 - (D) vibration generated by the rotor

If choice D is selected set score to 1.

5. To determine the extent of lube oil system contamination you would _____.

- (A) observe the oil flow in the sight glasses
- (B) inspect the purifier for separated foreign matter
- (C) maintain a close watch on bearing temperatures
- (D) watch for variations in the lube oil pump discharge pressure

If choice B is selected set score to 1.

6. Modern day boiler automation allows bypassing the "flame safeguard" system to permit a burner to have a "trial for ignition" period during burner light-off. This period may not exceed _____.

- (A) 5 seconds
- (B) 10 seconds
- (C) 15 seconds
- (D) 30 seconds

If choice C is selected set score to 1.

7. The safety valve nominal size for propulsion boilers and superheaters must be not less than 1 1/2 inches and not more than 4 inches. The term 'nominal size' refers to the _____.

- (A) free spring length
- (B) diameter of the inlet opening
- (C) diameter of the huddling chamber
- (D) diameter of the feather

If choice B is selected set score to 1.

8. From which of the areas listed are condensate drains normally collected and returned to the low-pressure drain system?

- (A) Steam systems operating in excess of 150 psi
- (B) Steam whistle separator/trap
- (C) Main and auxiliary air ejector after condensers
- (D) Each main feed pump steam supply line

If choice C is selected set score to 1.

9. An excess pressure governor would normally be used on a _____.

- (A) low-pressure propulsion turbine
- (B) turbine-driven feed pump
- (C) forced draft fan
- (D) main circulator pump

If choice B is selected set score to 1.

10. When you are transferring fuel oil from one double bottom tank to another, precautions to be observed should include _____.

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

If choice A is selected set score to 1.

11. The astern element of a main propulsion turbine is usually designed as a/an _____.

- (A) Curtis stage, impulse turbine
- (B) single entry, double flow turbine
- (C) Parsons stage, reaction turbine
- (D) multiple entry, helical flow turbine

If choice A is selected set score to 1.

12. What is the primary operational difference between a nozzle reaction safety valve and a huddling chamber safety valve?

- (A) The principle by which blow down is accomplished.
- (B) The manner in which lifting pressure is adjusted.
- (C) The difference in valve relieving capacities.
- (D) The manner in which steam pressure causes initial valve opening.

If choice A is selected set score to 1.

13. When turbine rotor shafts extend through the casing, an external source of sealing steam is used in conjunction with labyrinth packing to _____.

- (A) seal the casing during periods of low casing pressure
- (B) maintain the rotor journal temperature
- (C) seal the casing during periods of high casing pressure
- (D) provide a constant flow to the gland leak off condenser

If choice A is selected set score to 1.

14. Condensate accumulation in the steam side of a fuel oil heater could result in _____.

- (A) scale accumulation in an operating heater
- (B) reduced heating capacity in an operating heater
- (C) water contamination of the fuel oil
- (D) annealing of the heater tube bundles

If choice B is selected set score to 1.

15. Which of the pumps listed takes fuel oil suction from the double bottom tanks and discharges it to the settling tanks?

- (A) Centrifugal type general service pump
- (B) Fuel oil transfer pump
- (C) Settler service pump
- (D) Fuel oil service pump

If choice B is selected set score to 1.

16. Which of the following statements is true concerning boiler inspections?

- (A) If the thickness found as a result of gauging is less than original thickness, the boiler must be condemned.
- (B) The marine inspector may require any boiler to be drilled to determine its actual thickness any time its safety is in doubt.
- (C) At the first inspection for certification after a water-tube boiler has been installed for ten years, it shall be gauged by drilling to determine the actual extent of deterioration.
- (D) Any user of a non-destructive testing device must demonstrate that results with an accuracy of plus or minus one percent are consistently obtainable.

If choice B is selected set score to 1.

17. Compared to the return flow oil burner system, an internally mixed steam atomizer requires _____.

- (A) greater turbulence in the air/oil stream
- (B) less excess air
- (C) higher air velocity
- (D) higher fuel oil viscosity

If choice B is selected set score to 1.

18. High pressure steam drains are normally discharged to the _____.

- (A) reserve feed tank
- (B) DC heater
- (C) atmospheric drain line
- (D) drain and inspection tank

If choice B is selected set score to 1.

19. In a boiler equipped with an automatic feed water regulator, erratic variations in the water level could be caused by _____.

- (A) high solids content and foaming in the drum
- (B) ruptured feed water control valve diaphragm
- (C) high feed water temperature
- (D) low feed water temperature

If choice A is selected set score to 1.

20. While underway on a steam ship, the engineer on watch reports a loss of oil flow in the oil head tank bull's eye. Which of the following should be done?

- (A) The boiler auxiliary feed valve should be opened.
- (B) The lube oil head tank vent should be checked to ensure clear.
- (C) Steps should be taken to immediately stop the shaft.
- (D) Nothing as oil overflowing in this glass is not normal.

If choice C is selected set score to 1.

21. The over speed tripping device installed on an auxiliary turbine is automatically actuated by _____.

- (A) centrifugal force
- (B) high back pressure
- (C) hydraulic pressure
- (D) pneumatic force

If choice A is selected set score to 1.

22. When water washing a boiler, the proper sequence for washing the sections should be the _____.

- (A) generating tubes, superheater, and then economizer
- (B) screen tubes, generating tubes, and then superheater
- (C) superheater, economizer, and then generating tubes
- (D) economizer, superheater, generating, and then screen tubes

If choice D is selected set score to 1.

23. After restoring the normal water level in a boiler following a high water casualty, you should _____.

- (A) immediately put the boiler on the line
- (B) immediately drain the economizer
- (C) blow down the water gage glass
- (D) completely drain the superheater

If choice D is selected set score to 1.

24. If an analysis of boiler flue gas determines there is no excess air for combustion, you should expect the nitrogen content of the flue gas to be approximately _____.

- (A) 10.5%
- (B) 14.0%
- (C) 21.0%
- (D) 79.0%

If choice D is selected set score to 1.

25. A sample of boiler water can be chemically tested for alkalinity by initially adding a few drops of phenolphthalein and then slowly titrating the water sample until the _____.

- (A) sample color changes from pink to clear
- (B) water sample pH reaches 10.5
- (C) entire concentration of chlorides have been neutralized
- (D) sample color changes from clear to pink

If choice A is selected set score to 1.

26. Oil supply pressure to the main lube oil header of a gravity feed lube oil system is _____.

- (A) the sum of the lube oil static head pressure and service pump discharge pressure
- (B) the result of the height of the gravity tank above the manifold
- (C) the difference between the lube oil static head pressure and service pump discharge pressure
- (D) equal to the service pump discharge pressure, since the static heads of the lines to and from the gravity tank cancel out one another

If choice B is selected set score to 1.

27. When reviewing the engine log on a steam ship, you notice a lower than normal feed water temperature, high furnace pressure and higher than normal superheater temperature. Which of the following could be a possible cause?

- (A) Excessively fouled boiler economizer gas side.
- (B) Excessively fouled superheater gas side.
- (C) Too much excess air.
- (D) Excessively fouled water screen tubes.

If choice A is selected set score to 1.

28. According to the data given in illustration, which of the following would be the physical state of the fluid at a gage vacuum of 28.09 inches Hg, and 117.99 degrees Fahrenheit? Illustration SG-0026

- (A) Mixture of saturated liquid and vapor.
- (B) Sub cooled liquid.
- (C) Saturated liquid.
- (D) Superheated vapor.

If choice D is selected set score to 1.

29. Calcium minerals in boiler water are precipitated out of solution by the use of which of the listed chemicals?

- (A) Phenolphthalein
- (B) Caustic soda
- (C) Sodium hydroxide
- (D) Sodium phosphate

If choice D is selected set score to 1.

30. The absence of carbon monoxide in the flue gas of a boiler indicates _____.

- (A) low carbon content of fuel
- (B) efficient combustion
- (C) insufficient air
- (D) contaminated fuel oil

If choice B is selected set score to 1.

31. The turbine of a turbo-electric drive should be secured by _____.

- (A) dynamic braking of the generator
- (B) closing the throttle by hand
- (C) tripping the throttle trip by hand
- (D) closing the main steam stops

If choice C is selected set score to 1.

32. A pneumatic dual element, main propulsion, boiler feed water regulating system commonly used aboard ship utilizes _____.

- (A) two-position differential action
- (B) on off reset action
- (C) proportional action
- (D) proportional plus reset action

If choice D is selected set score to 1.

33. If boiler water chemicals are decreasing in one boiler and increasing in the other boiler, while both are steaming at normal rates, a leak probably exists in the _____.

- (A) superheater tubes
- (B) economizer tubes
- (C) feed water crossover line
- (D) internal desuperheater flange

If choice D is selected set score to 1.

34. Which immediate action should you take when the temperature of one line shaft bearing increases above its normal operating temperature?

- (A) Stop the unit and replace the bearing.
- (B) Check the bearing for proper lubrication.
- (C) Stop the unit and carefully inspect the bearing.
- (D) Check for proper water circulation to the lube oil coolers.

If choice B is selected set score to 1.

35. If a line shaft bearing begins to overheat, the shaft speed should be reduced. If overheating persists, you should then _____.

- (A) apply emergency cooling water externally to the bearing
- (B) increase lube oil pressure to the bearing
- (C) flood the bearing with a higher viscosity oil to provide emergency lubrication and cooling
- (D) decrease lube oil pressure to the bearing

If choice A is selected set score to 1.

36. Cratering and water tracking in boiler tubes is caused by _____.

- (A) water trapped between tubes and refractory
- (B) burning a fuel with a high vanadium content
- (C) soot corrosion
- (D) baked on slag deposits

If choice A is selected set score to 1.

37. The major heat loss in an oil fired boiler is the heat _____.

- (A) required to change water into steam
- (B) passing through the boiler casing
- (C) going up the stack
- (D) used in the economizer and air heater

If choice C is selected set score to 1.

38. The property of a fuel oil which is a measurement of its available energy is known as its _____.

- (A) viscosity index
- (B) cetane number
- (C) cetane index
- (D) heating value

If choice D is selected set score to 1.

39. On a boiler safety valve, the blow down adjusting ring is locked in place by a _____.

- (A) wire seal
- (B) locknut
- (C) set screw
- (D) cotter pin

If choice C is selected set score to 1.

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

- (A) insulating bricks
- (B) insulating blocks
- (C) expansion joints
- (D) sliding saddles

If choice C is selected set score to 1.

41. Which of the conditions listed occurs when glassy slag, formed by the burning of fuel oil contaminated with salt water, melts and runs over the furnace wall?

- (A) Formation of a protective coating.
- (B) Cracks through the furnace floor.
- (C) Increased furnace temperature.
- (D) Damage to the furnace refractory.

If choice D is selected set score to 1.

42. Which of the conditions listed could prevent a centrifugal condensate pump from developing its rated capacity?

- (A) Closing the water seal line to the packing gland.
- (B) Operating the pump with a positive suction head.
- (C) Venting the pump to the vacuum side of the condenser.
- (D) Flooding of the main condenser hot well.

If choice A is selected set score to 1.

43. Which of the listed procedures is the most important factor to take into consideration when making repairs to the refractory surrounding the burner openings?

- (A) Design refractory cone angle must be maintained.
- (B) All cracks must be completely filled.
- (C) Plastic firebrick must be used.
- (D) Finished repair surfaces must be smooth.

If choice A is selected set score to 1.

44. Deaeration of condensate primarily occurs in what section of the illustration shown? Illustration SG-0010

- (A) distilled water tank
- (B) main condenser hot well
- (C) DFT
- (D) first stage feed heater

If choice C is selected set score to 1.

45. Steam traps are essential components of any steam cycle. When malfunctioning, they will reduce cycle's energy efficiency and may cause other problems in the condensate drain system. What simple, definite, technique may one use to identify a malfunctioning trap?

- (A) Listen to the trap's function sounds, such as hissing, condensate flow.
- (B) Open a drain line downstream of trap to see if steam is emitted.
- (C) Use a surface temperature indicating instrument on upstream and downstream piping of trap and compare the two readings.
- (D) Intermittent noises may/would indicate a malfunctioning trap.

If choice C is selected set score to 1.

46. Which of the listed operational checks should be made "continuously" on the main propulsion reduction gears?

- (A) Check radial bearing wear.
- (B) Check bearing lube oil temperatures.
- (C) Inspect alignment between gears and turbine.
- (D) Check teeth for pitting and scuffing.

If choice B is selected set score to 1.

47. Which of the listed parts illustrated in the turbo-generator governing system, provides the follow-up to prevent the nozzle valves from cycling between the fully open and fully closed positions, with each variation in turbine speed? Illustration SE-0009

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

If choice B is selected set score to 1.

48. If the temperature of the fuel oil entering an atomizer is too low, the burner will _____.

- (A) require more fuel for atomization
- (B) produce smoke white
- (C) require more excess air for combustion
- (D) produce heavy black smoke at any load condition

If choice D is selected set score to 1.

49. In an air register assembly, the majority of air passes through the _____.

- (A) stationary air foil or blade cone
- (B) distance piece
- (C) diffuser or impeller
- (D) atomizer assembly

If choice A is selected set score to 1.

50. In a boiler automation system, if a burner fuel oil solenoid valve continually trips closed under normal steaming conditions, you should _____.

- (A) wedge the valve in the open position and reduce the fuel oil pressure at that burner
- (B) bypass the solenoid valve and enter the fact in the logbook
- (C) wedge the valve in the open position and report it to the chief engineer
- (D) secure the burner and determine the cause of the valve failure

If choice D is selected set score to 1.

51. The main propulsion turbine can be damaged by _____.

- (A) maintaining vacuum too high
- (B) water carryover from the boilers
- (C) operating at slow speeds
- (D) using the jacking gear when there is no vacuum

If choice B is selected set score to 1.

52. If the water level in one boiler of a two boiler plant rapidly falls out of sight, which of the following actions should be carried out FIRST?

- (A) Raise the feed pump pressure.
- (B) Secure the steam stop to that boiler.
- (C) Secure the fuel oil to that boiler.
- (D) Blow down the gage glass.

If choice C is selected set score to 1.

53. If a lube oil pump fails to build up discharge pressure, the cause could be the _____.

- (A) discharge valve is open
- (B) suction vacuum is high
- (C) bypass valve is closed
- (D) suction valve is closed

If choice D is selected set score to 1.

54. After properly lining up the main propulsion turbine for warm up, steam should first be admitted to the rotor through the _____.

- (A) HP turbine bleed valve
- (B) ahead throttle valve
- (C) LP turbine bleed valve
- (D) astern throttle valve

If choice D is selected set score to 1.

55. Under EMERGENCY operating conditions, the proper valve positions for controlling feed water to the boiler should be the _____.

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

If choice A is selected set score to 1.

56. What is the FIRST thing that will happen if both the main and standby lube oil pumps fail on a geared main propulsion turbine operating at full sea speed?

- (A) Ahead throttle will close.
- (B) Lube oil sump will overflow.
- (C) HP turbine bearings will overheat.
- (D) Vacuum will be lost.

If choice A is selected set score to 1.

57. As found in a reduction gear drive system, thrust bearings serve to _____.

- (A) transmit the force produced by the propeller to the structure of the ship
- (B) hold the main engine in place
- (C) increase the shaft speed
- (D) limit the radial movement of the shaft

If choice A is selected set score to 1.

58. When operating under constant load, the superheated steam temperature may rise above normal if the _____.

- (A) excess air is too low
- (B) feed water temperature is too high
- (C) boiler is priming
- (D) feed water temperature is too low

If choice D is selected set score to 1.

59. If the main propulsion turbine begins to vibrate severely while you are increasing speed, you should _____.

- (A) stop the turbine and not answer any more bells
- (B) open the throttle wider to pass through the critical speed
- (C) hold the turbine at that speed until vibration stops
- (D) immediately slow the turbine to see if the vibration will stop

If choice D is selected set score to 1.

60. The BTU value of fuel oil is determined by a/an _____.

- (A) open cup test
- (B) hydrometer
- (C) calorimeter
- (D) viscosimeter

If choice C is selected set score to 1.

61. As Chief Engineer, while at sea, the engine room reports the superheater outlet temperature is erratic and fluctuating. Which of the following could be a possible cause?

- (A) Boiler carryover.
- (B) Too much excess air.
- (C) Low boiler water level.
- (D) Low feed water temperature.

If choice A is selected set score to 1.

62. Which of the following actions should be taken FIRST when water is found in the fuel oil settling tank?

- (A) Shift pump suction to an alternate settling tank.
- (B) Shift to alternate or standby fuel oil service pump.
- (C) Determine the extent of water contamination by reading the pneumerators.
- (D) Sound the settling tank with water indicating paste.

If choice A is selected set score to 1.

63. A malfunction in the DC heater is indicated by _____.

- (A) condensate coming in contact with steam inside the heater
- (B) air flowing from vent condenser vent
- (C) the boiler requiring excessive amounts of oxygen scavenging chemicals
- (D) water and steam entering the DC heater at different temperatures

If choice C is selected set score to 1.

64. (3.7.3.1.1-1) Which piping system is described in the illustration provided? Illustration SG-0010

- (A) Auxiliary desuperheated steam system
- (B) Boiler feed and condensate system
- (C) Main superheated steam system
- (D) Turbine bleed steam system

If choice B is selected set score to 1.

65. (3.8.6.3.1-3) In the illustrated device, what would be a reason for oil being discharged from port "N"? Illustration GS-0124

- (A) This would be normal for the operation.
- (B) The device being operated as a clarifier.
- (C) The ring dam size is too small.
- (D) The ring dam size is too large.

If choice D is selected set score to 1.

66. High pressure steam drains are normally discharged to the _____.

- (A) drain and inspection tank
- (B) DC heater
- (C) reserve feed tank
- (D) atmospheric drain line

If choice B is selected set score to 1.

67. Fluctuations in the atomizing steam pressure at the burners could be caused by a/an _____.

- (A) partially opened recirculating valve
- (B) partially closed atomizing fuel valve
- (C) incorrectly assembled air register
- (D) malfunctioning steam trap in the atomizing steam system

If choice D is selected set score to 1.

68. 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) Marine growth on the cooling water side of the main condenser.
- (C) Condensate recirculating back to the condenser during maneuvering.
- (D) Steam leaking from the turbine glands.

If choice B is selected set score to 1.

69. Excessive water loss from the main feed system can be caused by _____.

- (A) an atmospheric drain tank trap frozen in the closed position
- (B) a leak in the desuperheater internal gasket
- (C) a vapor bound main condensate pump
- (D) excessive recirculation of condensate from the outlet of the air ejector condenser to the main condenser

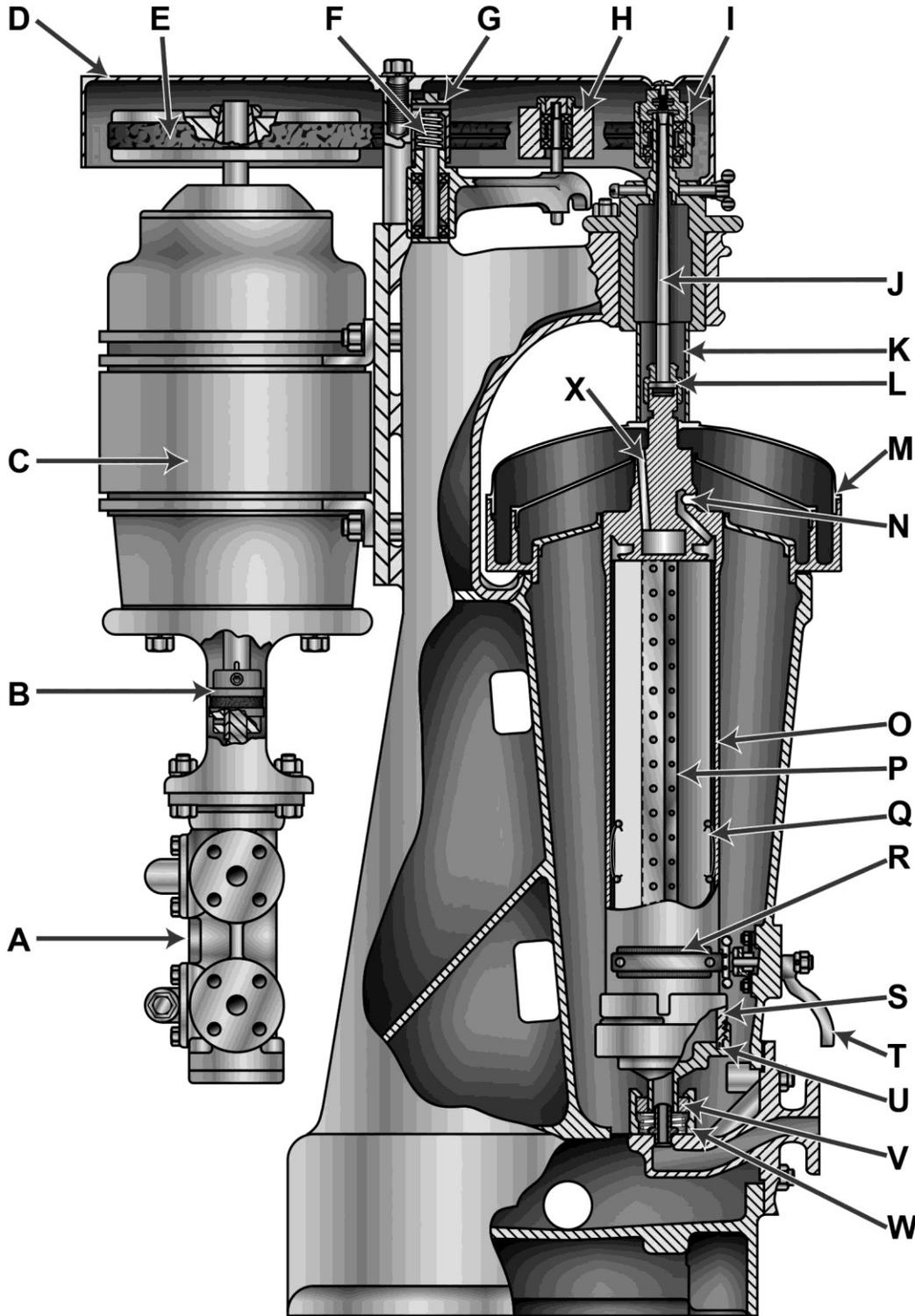
If choice A is selected set score to 1.

70. With vacuum up and the main propulsion turbine standing by while awaiting engine orders, it is necessary to roll the unit alternately ahead and astern every five minutes to _____.

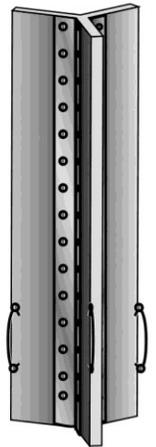
- (A) reduce the possibility of warping the turbine rotors
- (B) warm the astern guarding valve and the low lube oil pressure throttle trip
- (C) slowly bring the lube oil and bearings to operating temperature
- (D) distribute the gland sealing steam evenly throughout the glands

If choice A is selected set score to 1.

GS-0124



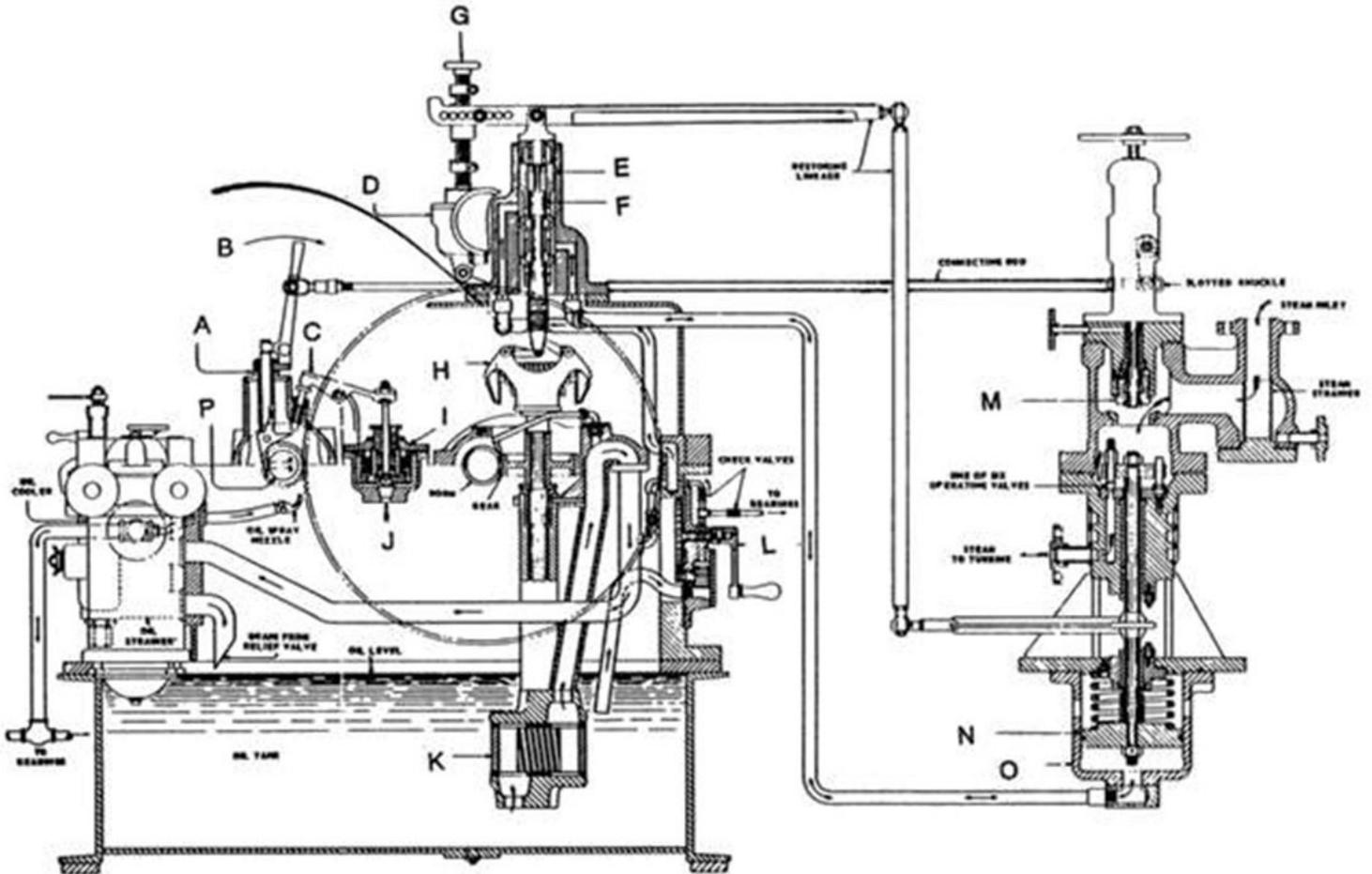
Three-Wing Device



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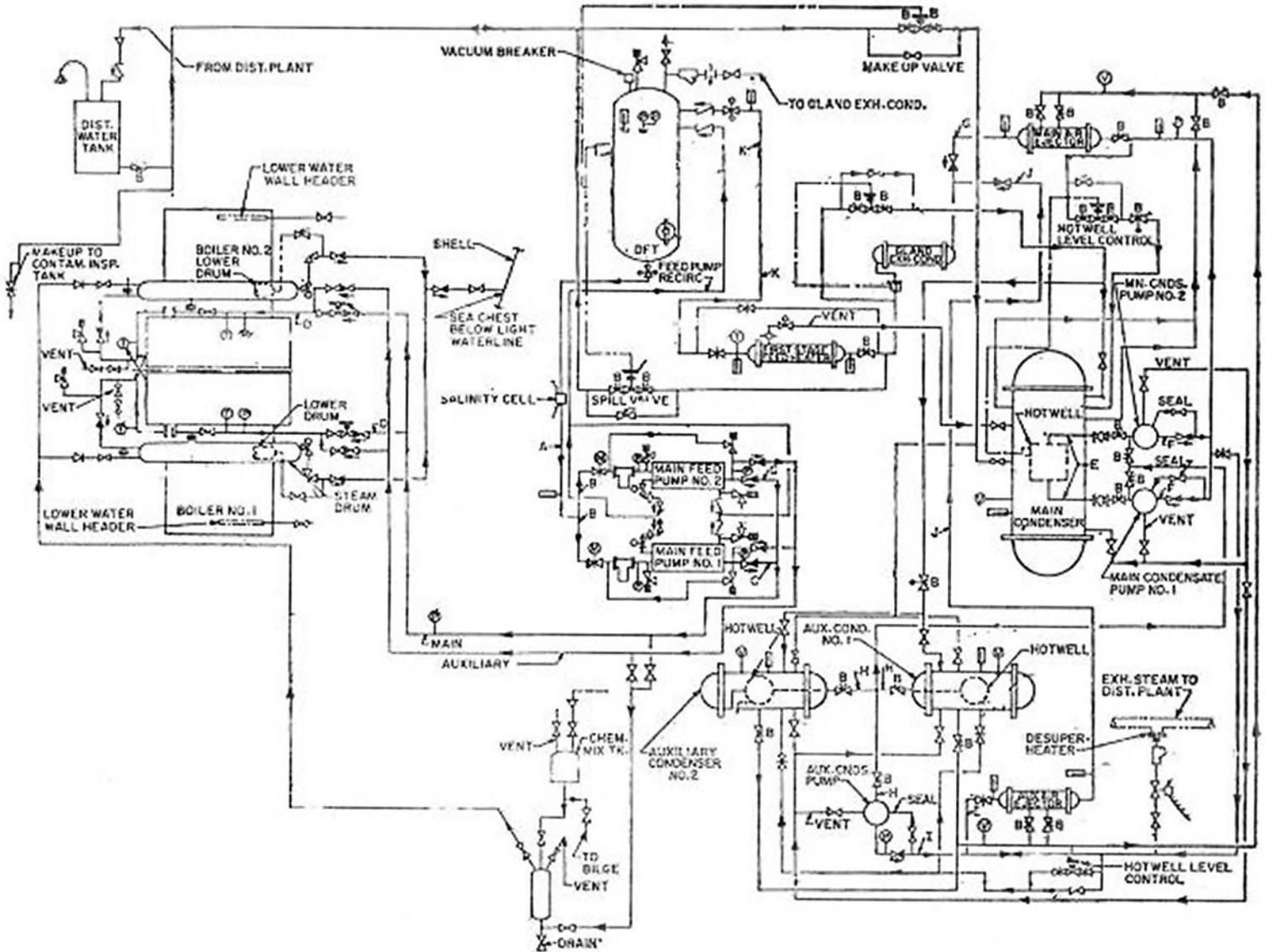
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SG-0010



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SG-0026

-Properties of Saturated Steam

<u>Absolute Pressure</u>		Vacuum Inches of Hg Gage	<u>Temperature</u>	
Lb. per Sq. In.	Inches of Hg		°C	°F
0.20	0.41	29.51	11.74	53.14
0.25	0.51	29.41	15.17	59.30
0.30	0.61	29.31	18.04	64.47
0.35	0.71	29.21	20.52	68.93
0.40	0.81	29.11	22.70	72.86
0.45	0.92	29.00	24.66	76.38
0.50	1.02	28.90	26.43	79.58
0.60	1.22	28.70	29.56	85.21
0.70	1.43	28.49	32.27	90.08
0.80	1.63	28.29	34.66	94.38
0.90	1.83	28.09	36.80	98.24
1.0	2.04	27.88	38.74	101.74
1.2	2.44	27.48	42.18	107.92
1.4	2.85	27.06	45.14	113.26
1.6	3.26	26.66	47.77	117.99
1.8	3.66	26.26	50.13	122.23
2.0	4.07	25.85	52.27	126.08
2.2	4.48	25.44	54.23	129.62
2.4	4.89	25.03	56.05	132.89
2.6	5.29	24.63	57.74	135.94
2.8	5.70	24.22	59.33	138.79
3.0	6.11	23.81	60.82	141.48
3.5	7.13	22.79	64.21	147.57
4.0	8.14	21.78	67.21	152.97
4.5	9.16	20.76	69.91	157.83
5.0	10.18	19.74	72.36	162.24
5.5	11.20	18.72	74.61	166.30
6.0	12.22	17.70	76.70	170.06
6.5	13.23	16.69	78.64	173.56
7.0	14.25	15.67	80.47	176.85
7.5	15.27	14.65	80.52	176.94
8.0	16.29	13.63	83.81	182.86
8.5	17.31	12.61	85.36	185.64
9.0	18.32	11.60	86.82	188.28
9.5	19.34	10.58	88.22	190.80
10.0	20.36	9.56	89.57	193.21
11.0	22.40	7.52	92.08	197.75
12.0	24.43	5.49	94.42	201.96
13.0	26.47	3.45	96.60	205.88
14.0	28.50	1.42	98.64	209.56

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