

U.S.C.G. Merchant Marine Exam
Third Assistant Engineer, Unlimited
Q537 Steam Plants I
(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

1. Which of the actions listed should be carried out immediately after securing the fires in one boiler of a two boiler ship?
- (A) Open the air registers wide to cool the furnace.
 - (B) Secure the main feed pump.
 - (C) Relieve all fuel oil service pressure to that boiler.
 - (D) Drain and refill the boiler with cold water.

If choice C is selected set score to 1.

2. To safely decrease the boiler firing rate, you should always reduce the fuel pressure _____.
- (A) before reducing the forced draft pressure
 - (B) after reducing the forced draft pressure
 - (C) by opening the oil recirculating valve
 - (D) by opening the fuel pump relief valve

If choice A is selected set score to 1.

3. As found in a basic pneumatic automatic combustion control system, the function of a standardizing relay is to _____.
- (A) introduce a control for maintaining constant steam pressure regardless of boiler load
 - (B) introduce a control for maintaining constant superheated steam temperature regardless of boiler load
 - (C) control the boiler drum water level within acceptable limits regardless of the load
 - (D) provide a backup means for manual control of the system

If choice A is selected set score to 1.

4. While maneuvering out of port, you answer a stop bell. You notice a lot of steam coming out of the gland exhaust condenser vent, in addition to the main condenser hot well level being low. For this condition you should _____.
- (A) increase steam pressure to the air ejectors
 - (B) manually recirculate condensate and add some makeup feed
 - (C) speed up the condensate pump
 - (D) decrease gland sealing steam pressure

If choice B is selected set score to 1.

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

- (A) a permanently installed Orsat apparatus
- (B) one of the retractable soot blower elements
- (C) a regenerative air heater
- (D) one of the main burner assemblies

If choice D is selected set score to 1.

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

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

If choice D is selected set score to 1.

7. According to the illustration, what part number identifies the "air doors"? Illustration SG-0016

- (A) 1
- (B) 3
- (C) 9
- (D) 4

If choice B is selected set score to 1.

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

- (A) high feed water consumption
- (B) the fires to sputter
- (C) low superheater outlet temperature
- (D) high stack temperature

If choice C is selected set score to 1.

9. 8 ounces of oxygen, dissolved in 500,000 pounds of water, is a concentration of _____.

- (A) 1.0 ppm
- (B) 4.0 ppm
- (C) 8.0 ppm
- (D) 16.0 ppm

If choice A is selected set score to 1.

10. Boiler water hardness is increased by _____.

- (A) zero alkalinity in the water
- (B) improper operation of the DC heater
- (C) dissolved gases in the water
- (D) scale forming salts in the feed water

If choice D is selected set score to 1.

11. What boiler water chemistry is necessary to ensure the precipitation of hard scale forming calcium?

- (A) Boiler water should be slightly acidic.
- (B) Boiler water hardness should be high.
- (C) Boiler water should have a reserve of phosphates.
- (D) Hydrazine concentrations should be at the proper level.

If choice C is selected set score to 1.

12. In accordance with 46 CFR Subchapter F (Marine Engineering), when preparing to hydrostatically test a water-tube boiler, which of the following steps must be followed?

- (A) Remove all inspection plates and manhole covers as required by the marine inspector.
- (B) Fill the boiler with water not less than 70°F (21.1°C), nor more than 160°F (71.1°C).
- (C) Make arrangements for simultaneously testing main and auxiliary steam stops with water and steam pressure.
- (D) Warm the boiler to a temperature not exceeding 100°F (37.8°C).

If choice B is selected set score to 1.

13. Treatment of boiler feed water for the control of hardness is necessary to prevent _____.

- (A) excessive feed water alkalinity
- (B) foaming
- (C) waterside scale deposits
- (D) carryover

If choice C is selected set score to 1.

14. Which of the following represents the proper color of the flame end farthest from the boiler burner during normal operations?

- (A) Dark brown
- (B) Dazzling white
- (C) Light brown haze
- (D) Bright yellow or orange

If choice D is selected set score to 1.

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

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

If choice B is selected set score to 1.

16. A photoelectric cell is installed in an oil fired boiler safeguard system to introduce proper resistance values to the electronic control circuit. This device is primarily sensitive to _____.

- (A) light emitted from the back wall incandescent brickwork
- (B) the blue portion of the flame spectrum
- (C) light emitted from the front wall incandescent brickwork
- (D) the orange portion of the flame spectrum

If choice B is selected set score to 1.

17. The advantage of installing waterwall tubes in a boiler furnace is to _____.

- (A) permit higher combustion rates
- (B) increase heat transfer to the mud drum
- (C) decrease the flow of gases through the furnace
- (D) increase the flow of gases through the furnace

If choice A is selected set score to 1.

18. The best conductor of heat in a marine boiler is _____.

- (A) water
- (B) brick
- (C) steel
- (D) steam

If choice C is selected set score to 1.

19. That portion of the steam drum, containing a manhole for internal access to the drum, for the purpose of cleaning, inspecting, and carrying out repairs, is called the _____.

- (A) wrapper sheet
- (B) tube sheet
- (C) drumhead
- (D) end plate

If choice C is selected set score to 1.

20. A water-tube boiler can be laid up either wet or dry. If it is to be laid up wet, you should _____.

- (A) completely fill the boiler with deaerated feed water and maintain a slight pressure
- (B) drain and refill the boiler when the pH goes above 6
- (C) drain and refill the boiler each week
- (D) completely fill the boiler with water, then blow down to steaming level

If choice A is selected set score to 1.

21. Which of the types of superheaters listed has the flattest superheat temperature curve?

- (A) Convection
- (B) Radiant-convection
- (C) Radiant
- (D) Conduction-convection

If choice B is selected set score to 1.

22. When raising steam on an idle boiler and the steam pressure has risen to about 5 pounds more than the pressure of the boiler already on the line, you can _____.

- (A) put the boiler on the line
- (B) close the superheater vent
- (C) increase the boiler firing rate
- (D) close the air cock

If choice A is selected set score to 1.

23. Which of the following items should be checked each time the firing rate or forced draft pressure is adjusted?

- (A) Atomizing steam pressure
- (B) Smoke periscope
- (C) Fuel oil suction pressure
- (D) Fuel oil heater inlet temperature

If choice B is selected set score to 1.

24. Which of the listed components would be considered the dividing line separating the condensate system from the feed water system?

- (A) Deaerating feed tank
- (B) Main air ejectors
- (C) Boiler drum
- (D) Main condenser

If choice A is selected set score to 1.

25. If a major flareback occurs to a boiler, which of the following actions should be immediately taken?

- (A) Secure all fire room ventilation.
- (B) Secure the forced draft fan.
- (C) Secure the fuel to the burners.
- (D) Purge the fuel oil system.

If choice C is selected set score to 1.

26. Which of the following represents the function of the diffuser used with a mechanical atomizing oil burner?

- (A) Complete the vaporization of the fuel for combustion.
- (B) Control the amount of secondary combustion air.
- (C) Finely divide the fuel particles into a cone-shaped spray.
- (D) Provide flame stability at the atomizer tip.

If choice D is selected set score to 1.

27. When the flame scanner senses flame failure during boiler operation, which of the listed events will occur FIRST?

- (A) The automatic purge cycle commences.
- (B) The "trial for ignition" period commences.
- (C) The fuel oil solenoid valve is de-energized.
- (D) The fuel oil service pump is stopped.

If choice C is selected set score to 1.

28. The function of item "E" shown in the illustration is to _____. Illustration GS-0099

- (A) allow steam/condensate or air to be evacuated from the unit as sound is produced
- (B) act as a reed to enable the production of sound
- (C) pulse supply steam or air to chamber "M"
- (D) control the admission of steam into chamber "L" as part of the process to produce sound

If choice D is selected set score to 1.

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

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

If choice B is selected set score to 1.

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

- (A) plugging gooseneck tank vents to prevent accidental overflow
- (B) maintaining a high transfer rate until a slight trickle of oil is observed flowing from the overflow line
- (C) maintaining a supply of chemical dispersant to cleanup minor oil spills adjacent to the ship
- (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.

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

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

If choice D is selected set score to 1.

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

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

If choice B is selected set score to 1.

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

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

If choice B is selected set score to 1.

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

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

If choice D is selected set score to 1.

35. Which of the following locations could desuperheated steam be considered to occur?

- (A) Spray attemperator
- (B) Main engine extractions
- (C) Both "A" and "B"
- (D) Neither "A" nor "B"

If choice C is selected set score to 1.

36. If the DC heater relief valve lifts frequently, the cause can be excessive _____.

- (A) condensate supplied to the DC heater
- (B) feed water recirculated from the feed pump
- (C) makeup feed introduced to the system
- (D) auxiliary exhaust steam pressure

If choice D is selected set score to 1.

37. Which of the water supplies listed below is typically used as a cooling medium for the gland exhaust condenser, inter condenser, and after condenser of an air ejector unit?

- (A) Condensate
- (B) Sea water
- (C) Potable water
- (D) Evaporator distillate

If choice A is selected set score to 1.

38. The pressure in the feed water system must exceed boiler steam drum pressure in order to _____.

- (A) force the feed water into the boiler
- (B) remove the steam from the steam drum
- (C) prevent water hammer in the lines
- (D) prevent air leakage into the feed water system

If choice A is selected set score to 1.

39. Before an explosion can occur in a boiler furnace, there must be an accumulation of unburned fuel, sufficient air to form an explosive mixture, and a _____.

- (A) source of ignition for the explosive mixture
- (B) space large enough for the explosion to occur
- (C) high steam demand on the boiler
- (D) ground in the burner ignition electrode

If choice A is selected set score to 1.

40. The most harmful slag forming compounds found in fuel oils are _____.

- (A) potassium and nickel
- (B) vanadium and sodium
- (C) calcium and silica
- (D) iron and sulfur

If choice B is selected set score to 1.

41. In accordance with 46 CFR Subchapter F (Marine Engineering), new fuel oil service piping between pumps and burners are required to be subjected to _____.

- (A) a hydrostatic leak test to the design pressure specified by the Coast Guard
- (B) a hydrostatic test of 1.25 times the maximum allowable pressure with the relief valves closed
- (C) spot radiographic examination of portions of the finished weld joints
- (D) a hydrostatic test of 1.5 times the maximum allowable pressure but not less than 500 psi (3447 kPa)

If choice D is selected set score to 1.

42. Arrow "B" shown in the illustration indicates the _____. Illustration SG-0008

- (A) retractable soot blower opening
- (B) uptakes
- (C) combustion air inlet
- (D) regenerative air heater

If choice C is selected set score to 1.

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

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

If choice A is selected set score to 1.

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

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

If choice A is selected set score to 1.

45. With reference to the chart, if a boiler generates saturated steam at 385.3 psig, how much heat per pound was required to change the water into steam if the feed water temperature was initially 220°F? Illustration SG-0004

- (A) 96.85 BTU
- (B) 97.15 BTU
- (C) 1016.40 BTU
- (D) 1196.45 BTU

If choice C is selected set score to 1.

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

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

If choice D is selected set score to 1.

47. In a steam assist atomizer, the fuel oil/steam mix takes place entirely within the _____.

- (A) mixing chamber
- (B) fuel oil swirlers
- (C) tangential slots
- (D) whirling chamber

If choice A is selected set score to 1.

48. Fuel oil solenoid valves at the burner fronts should be of the manual reset type to _____.

- (A) permit the operator to secure each burner during a blackout
- (B) prevent the furnace from filling with oil after restoration of power
- (C) permit the operator to secure each burner after a blackout
- (D) prevent the furnace from filling with oil during a power failure

If choice B is selected set score to 1.

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

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

If choice C is selected set score to 1.

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

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

If choice A is selected set score to 1.

51. To assure a long service life for boiler refractory materials after installation, the most effective method is to _____.

- (A) maintain a high furnace temperature at all times
- (B) avoid rapid temperature changes and follow recommended operating procedures
- (C) properly secure refractory with anchor bolts
- (D) patch refractory with plastic chrome ore

If choice B is selected set score to 1.

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

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

If choice D is selected set score to 1.

53. When heated, fuel oil will _____.

- (A) increase in specific gravity
- (B) increase in viscosity
- (C) expand in volume
- (D) have a higher specific heat

If choice C is selected set score to 1.

54. As the pH of the boiler water approaches zero, the water becomes increasingly _____.

- (A) acidic
- (B) neutral
- (C) alkaline
- (D) soft

If choice A is selected set score to 1.

55. In a main propulsion steam turbine installation, the condensate pump initially discharges to the _____.

- (A) air ejector condenser
- (B) distillate tank
- (C) first stage heater
- (D) deaerating feed tank

If choice A is selected set score to 1.

56. Which of the following repairs should be made to a badly warped boiler tube?

- (A) Assure that the warped tube does not touch adjacent tubes and then reroll it in the header.
- (B) Use a hydraulic jack to cold bend the tube.
- (C) Replace the tube with a spare, if available, or plug it.
- (D) Heat the tube and use a soft mallet to straighten it.

If choice C is selected set score to 1.

57. Before blowing tubes in a boiler equipped with steam soot blowers, you should _____.

- (A) decrease the boiler water level
- (B) lower the boiler steam pressure
- (C) increase the boiler water level
- (D) reduce the forced draft fan speed

If choice C is selected set score to 1.

58. Which of the precautions listed should be taken when gagging a boiler safety valve?

- (A) Tighten the gag only with the special wrench supplied with the gag.
- (B) Tighten the gag only finger tight to prevent damage to the valve stem, disc or seat.
- (C) Ensure that all moving parts of the safety valve are free to move before installing the gag.
- (D) Do not allow the gag to contact the safety valve stem.

If choice B is selected set score to 1.

59. Accumulation of fuel oil in the boiler double casing could be caused by _____.

- (A) dripping atomizers
- (B) leaking fuel oil strainers
- (C) high atomizing steam pressure
- (D) faulty steam atomizer return traps

If choice A is selected set score to 1.

60. Air accumulated in the inter condenser of the air ejector assembly is discharged directly to the _____.

- (A) after condenser
- (B) high-pressure turbine
- (C) main condenser
- (D) atmosphere

If choice A is selected set score to 1.

61. 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 plus reset action
- (D) proportional action

If choice C is selected set score to 1.

62. The two-element feed water regulator functions similarly to the three-element feed water regulator, but does not utilize _____.

- (A) water level
- (B) steam flow measurement
- (C) feed water flow measurement
- (D) drum pressure

If choice C is selected set score to 1.

63. 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.

64. In addition to a nozzle, a fuel oil atomizer uses which of the listed parts?

- (A) Burner cone
- (B) Air cone
- (C) Sprayer plate
- (D) Ignition electrode

If choice C is selected set score to 1.

65. The primary operational difference between a huddling chamber type safety valve and a nozzle reaction type safety valve is the _____.

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

If choice C is selected set score to 1.

66. All fuel oil service pumps are equipped with a _____.

- (A) remote means of stopping the pump
- (B) combustion control valve on the discharge side
- (C) relief valve on the suction side
- (D) direct suction to the double bottom tanks

If choice A is selected set score to 1.

67. Reaching which "end point" will result in the most severe damage to the boiler?

- (A) Combustion
- (B) Circulation
- (C) Atomization
- (D) Carryover

If choice B is selected set score to 1.

68. Throttling the burner air register of a lit burner could result in _____.

- (A) excess combustion temperature in the furnace
- (B) carbon deposits on the register doors
- (C) carbon deposits on the furnace walls
- (D) too much excess air for combustion

If choice C is selected set score to 1.

69. The greatest deterrent to heat transfer from the fireside to the waterside of a boiler is _____.

- (A) water film
- (B) gas film
- (C) water eddies
- (D) gas eddies

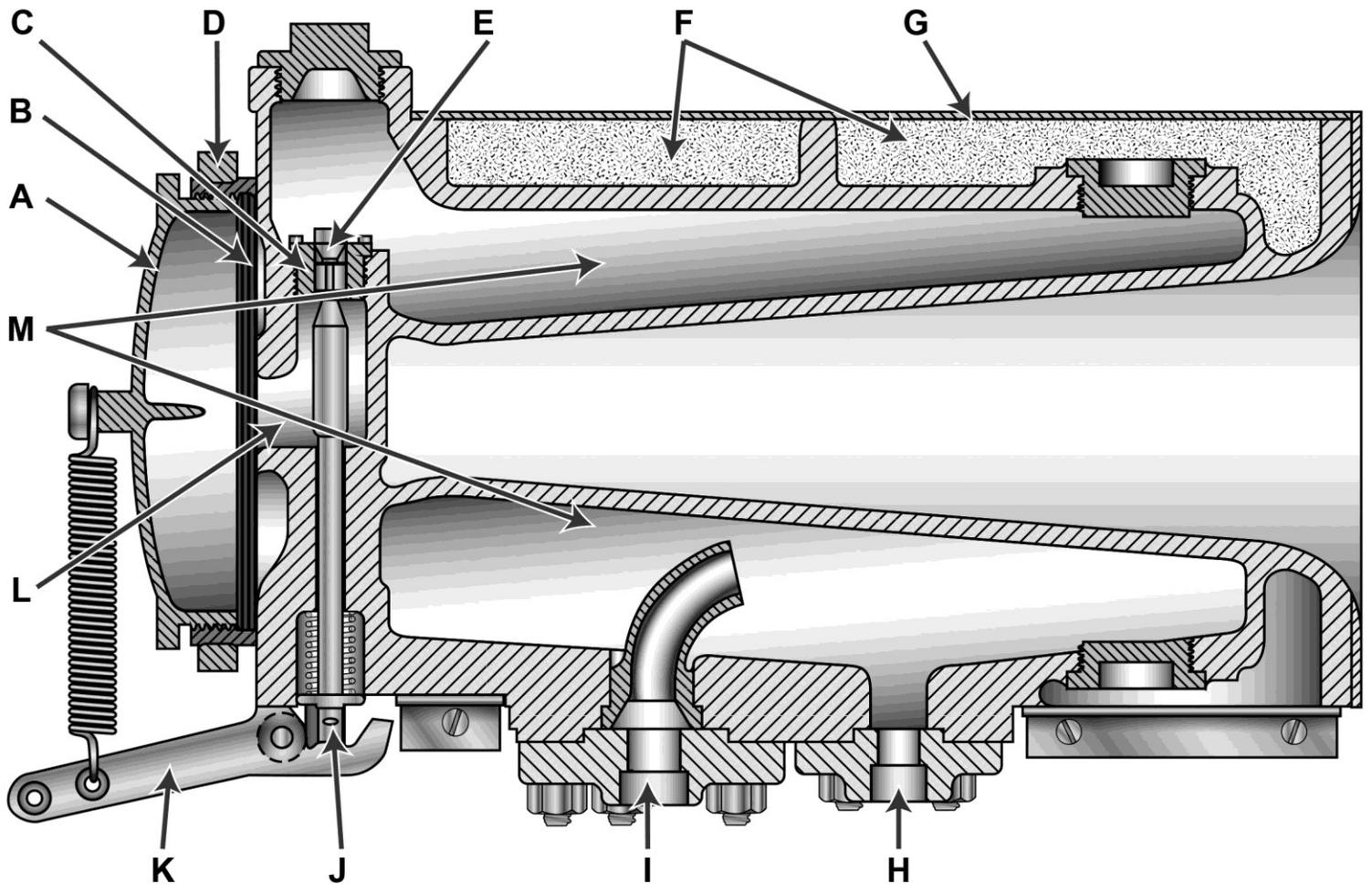
If choice B is selected set score to 1.

70. 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) Increasing the fuel pressure.
- (C) Increasing the feed water flow.
- (D) Decreasing the steam pressure.

If choice A is selected set score to 1.

GS-0099



Adapted for testing purposes only from Naval Auxiliary Machinery

Copyright © 1952 by United States Naval Institute

Further reproduction prohibited without permission

SG-0004

Table 1. Saturation, Temperatures

Temp, °F	Abs press, psi	Specific vol		Enthalpy (heat)		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor
32	0.08859	0.01602	3304.7	0.01	1075.5	1075.5
40	0.12170	0.01602	2444	8.05	1071.3	1079.3
50	0.17811	0.01603	1703.2	18.07	1065.6	1083.7
60	0.2563	0.01604	1206.7	28.06	1059.9	1088.0
70	0.3631	0.01606	867.9	38.04	1054.3	1092.3
80	0.5069	0.01608	633.1	43.02	1048.6	1096.6
90	0.6982	0.01610	468.0	57.99	1042.9	1100.9
100	0.9492	0.01613	350.4	67.97	1037.2	1105.2
110	1.2748	0.01617	265.4	77.94	1031.6	1109.5
120	1.6924	0.01620	203.27	87.92	1025.8	1113.7
130	2.2225	0.01625	157.34	97.90	1020.0	1117.9
140	2.8886	0.01629	123.01	107.9	1014.1	1122.0
150	3.718	0.01634	97.07	117.9	1008.2	1126.1
160	4.741	0.01639	77.29	127.9	1002.3	1130.2
170	5.992	0.01645	62.06	137.9	996.3	1134.2
180	7.510	0.01651	50.23	147.9	990.2	1138.1
190	9.339	0.01657	40.96	157.9	984.1	1142.0
200	11.526	0.01663	33.64	168.0	977.9	1145.9
212	14.696	0.01672	26.80	180.0	970.4	1150.4
220	17.186	0.01677	23.15	188.1	965.2	1153.4
240	24.969	0.01692	16.323	208.3	952.2	1160.5
280	49.203	0.01726	8.645	249.1	924.7	1173.8
300	67.013	0.01745	6.466	269.6	910.1	1179.7
340	118.01	0.01787	3.788	311.1	879.0	1190.1
380	195.77	0.01836	2.335	353.5	844.6	1198.1
400	247.31	0.01864	1.8633	375.0	826.0	1201.0

Table 2. Saturation, Pressures

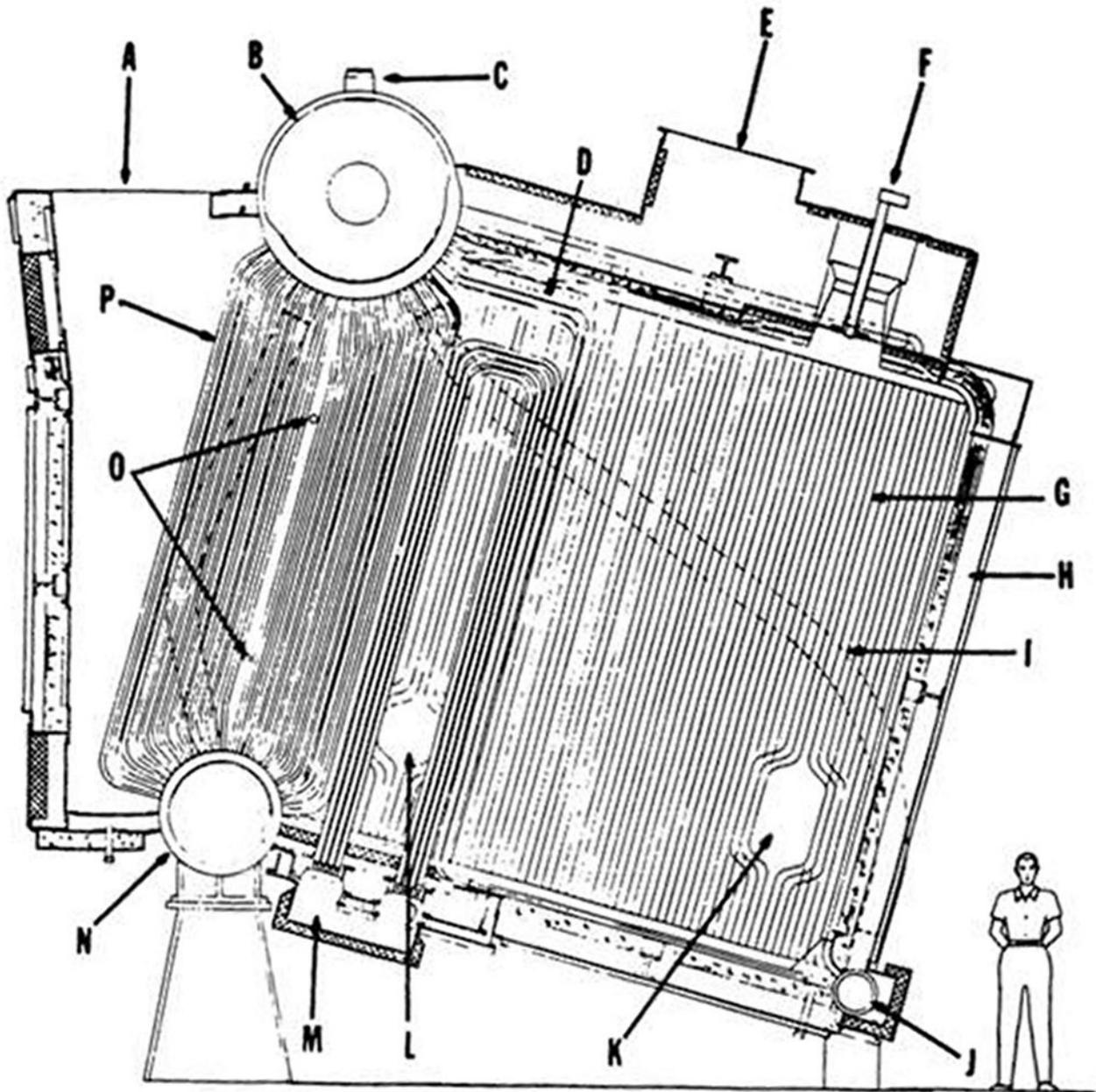
Abs press, psi	Temp, °F	Specific vol		Enthalpy (heat)		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor
0.50	79.58	0.01608	641.4	47.6	1048.8	1096.4
1.0	101.74	0.01614	333.6	69.7	1036.3	1106.0
5.0	162.24	0.01640	73.52	130.1	1001.0	1131.1
10	193.21	0.01659	38.42	161.2	982.1	1143.3
14.7	212.00	0.01672	26.80	180.0	970.4	1150.4
15	213.03	0.01672	26.29	181.1	969.7	1150.8
20	227.96	0.01683	20.089	196.2	960.1	1156.3
25	240.07	0.01692	16.303	208.5	952.1	1160.6
30	250.33	0.01701	13.746	218.8	945.3	1164.1
40	267.25	0.01715	10.498	236.0	933.7	1169.7
50	281.01	0.01727	8.515	250.1	924.0	1174.1
60	292.71	0.01738	7.175	262.1	915.5	1177.6
70	302.92	0.01748	6.206	272.6	907.9	1180.6
80	312.03	0.01757	5.472	282.0	901.1	1183.1
90	320.27	0.01766	4.896	290.6	894.7	1185.3
100	327.81	0.01774	4.432	298.4	888.8	1187.2
110	334.77	0.01782	4.049	305.7	883.2	1188.9
120	341.25	0.01789	3.728	312.4	877.9	1190.4
130	347.32	0.01796	3.455	318.8	872.9	1191.7
140	353.02	0.01802	3.220	324.8	868.2	1193.0
150	358.42	0.01809	3.015	330.5	863.6	1194.1
200	381.79	0.01839	2.288	355.4	843.0	1198.4
250	400.95	0.01865	1.8438	376.0	825.1	1201.1
300	417.33	0.01890	1.5433	393.8	809.0	1202.8
350	431.72	0.01913	1.3260	409.7	794.2	1203.9
400	444.59	0.0193	1.1613	424.0	780.5	1204.5

Adapted for testing purposes only from HUNT, Modern Marine Engineer's Manual, Volume I

Copyright © 1999 by Cornell Maritime Press

Further reproduction prohibited without permission

SG-0007

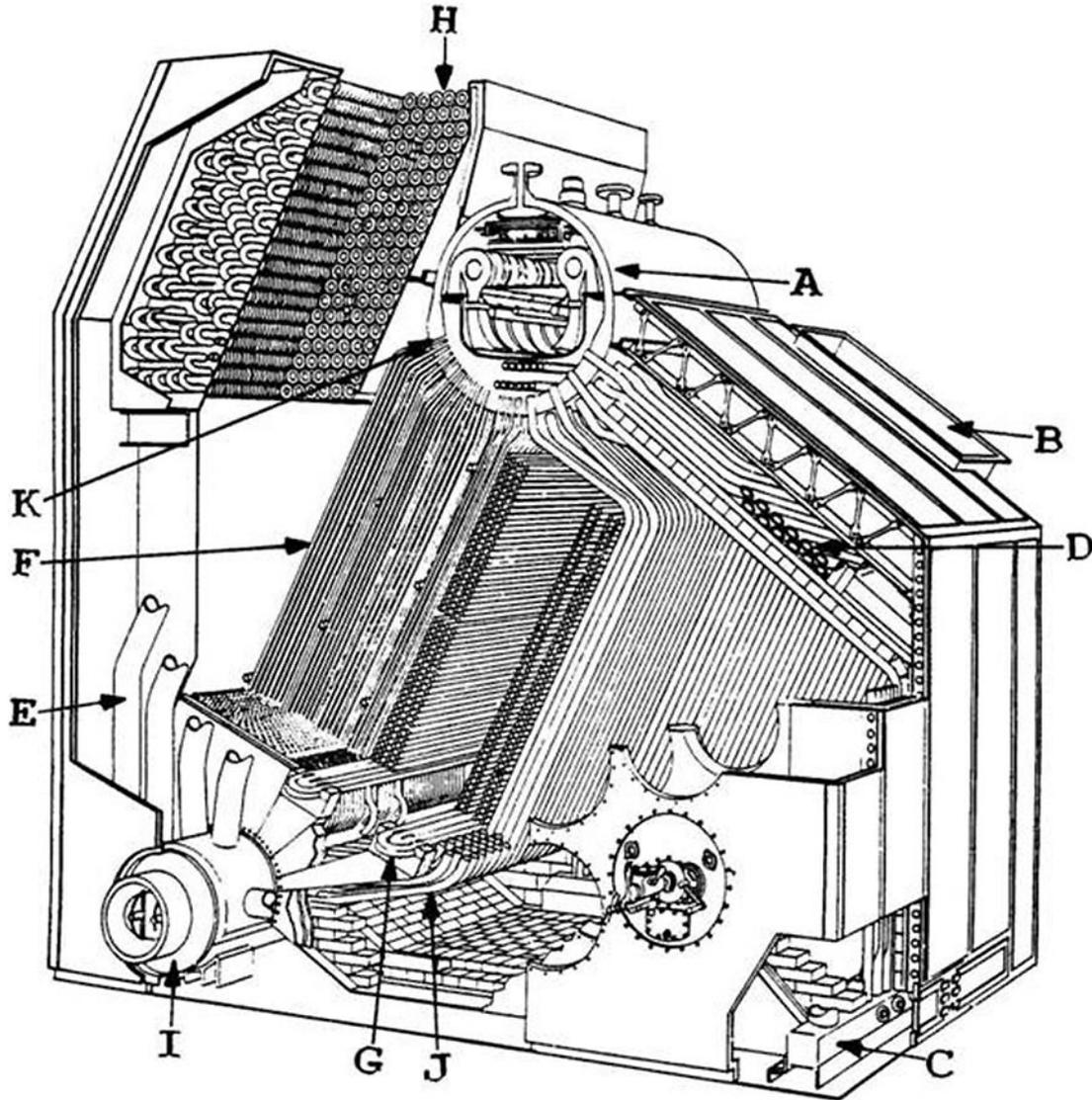


Adapted for testing purposes only from HUNT, Modern Marine Engineer's Manual, Volume I

Copyright © 1999 by Cornell Maritime Press

Further reproduction prohibited without permission

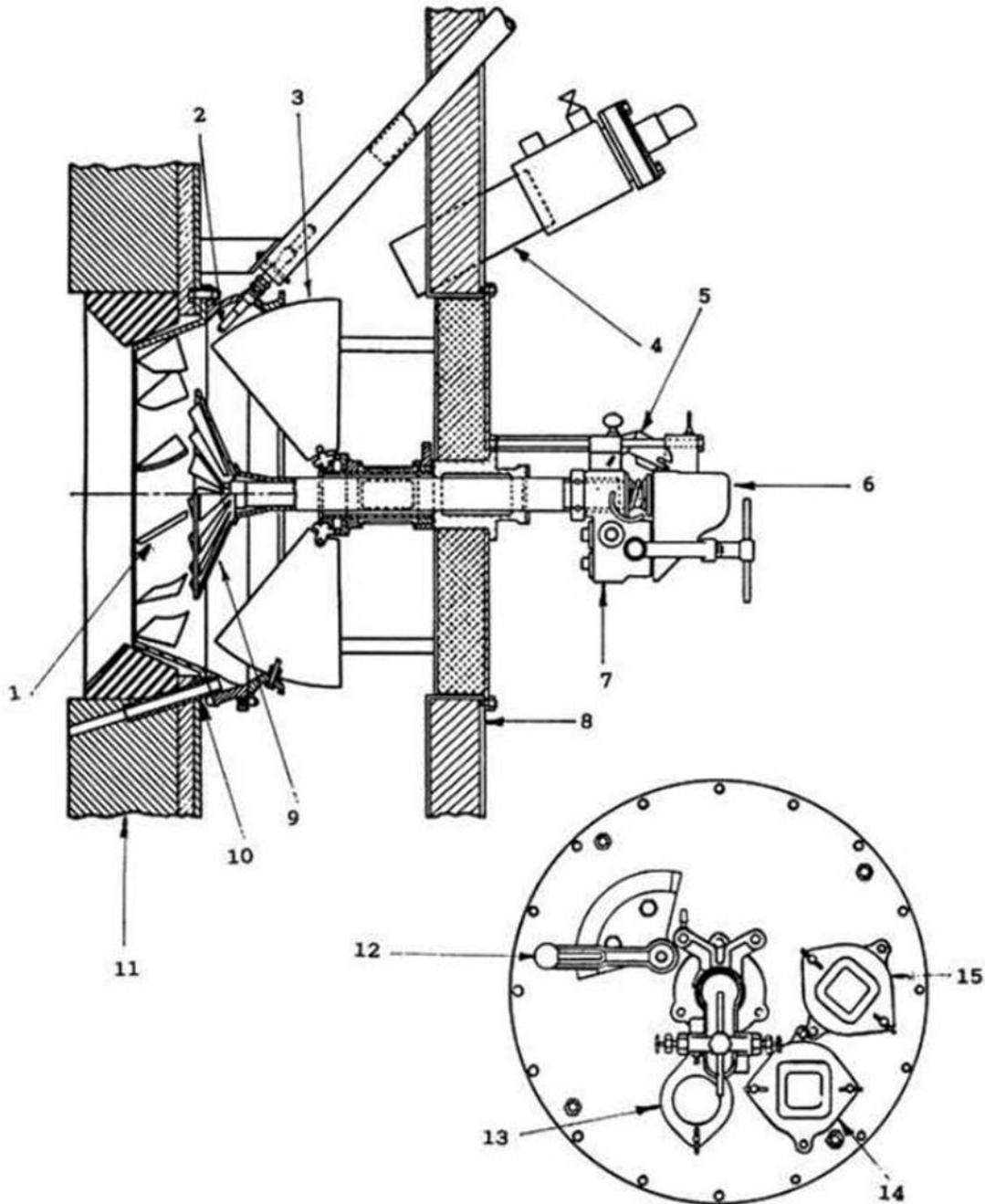
SG-0008



Adapted for testing purposes only from Principles of Naval Engineering
NAVPERS 10788-B

Further reproduction prohibited without permission

SG-0016



Adapted for testing purposes only from HARRINGTON, Marine Engineering
Copyright © 1992 by the Society of Naval Architects and Marine Engineers

Further reproduction prohibited without permission