

U.S.C.G. Merchant Marine Exam
Assistant Engineer, Limited
Q611 Steam Plants
(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

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

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

If choice D is selected set score to 1.

2. An excess pressure governor is a special type of control device which would normally be found on a _____.

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

If choice C is selected set score to 1.

3. While raising steam on a cold boiler, the air cock is to be closed after _____.

- (A) the economizer drain is closed
- (B) steam has formed and all air is vented
- (C) the boiler is cut in on the line
- (D) all burners have been lit and firing normally

If choice B is selected set score to 1.

4. 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) E
- (B) H
- (C) O
- (D) D

If choice A is selected set score to 1.

5. Which of the following is used to hold the poppet valves closed in a turbo-generators nozzle control speed regulator?

- (A) Oil pressure
- (B) Springs
- (C) Lifting beam
- (D) Steam pressure

If choice D is selected set score to 1.

6. A pressure-velocity compounded impulse turbine consists of _____.

- (A) several rows of moving blades attached to diaphragms
- (B) velocity compounding with reaction pressure compounding
- (C) two or more rows of nozzles in which no pressure drop exists
- (D) two or more stages of velocity compounding

If choice D is selected set score to 1.

7. In the illustration of a typical ship service turbo-generator control system, the handle labeled "B" is used to _____. Illustration SE-0009

- (A) pump up the lube oil manifold
- (B) reset the over speed trip
- (C) bypass the governor control
- (D) roll over the high-speed pinion

If choice B is selected set score to 1.

8. Steam drum water level indicators must be calibrated to compensate for density differences between the indicated drum water level, and the actual drum water level. If no compensation is made, the indicator will show a _____.

- (A) lower level than exists in the drum with the error becoming greater as the drum pressure decreases
- (B) lower level than exists in the drum with the error becoming greater as the drum pressure increases
- (C) higher level than exists in the drum with the error becoming greater as the drum pressure decreases
- (D) higher level than exists in the drum with the error becoming greater as the drum pressure increases

If choice B is selected set score to 1.

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

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

If choice C is selected set score to 1.

10. The feed water heater shown in the illustration is actually comprised of three separately functioning heat exchangers. These heat exchangers are identified as the _____. Illustration SG-0025

- (A) first stage heater, gland exhaust condenser, and drain cooler
- (B) drain cooler, distillate condenser, and fresh water drain collector
- (C) inter condenser, after condenser, and gland exhaust condenser
- (D) first stage heater, inter condenser, and after condenser

If choice A is selected set score to 1.

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

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

If choice B is selected set score to 1.

12. In a pressure type main propulsion turbine lubrication system, the lube oil service pumps normally take suction from the main sump and discharge directly to the _____.

- (A) gravity feed tank
- (B) main thrust bearing
- (C) lube oil coolers
- (D) lube oil header

If choice C is selected set score to 1.

13. To make temporary emergency repairs to brickwork in a boiler furnace, which of the materials listed should be used?

- (A) Calcined diatomaceous earth
- (B) Plastic refractory
- (C) Insulating block
- (D) Air setting mortar

If choice B is selected set score to 1.

14. Which type of packing is primarily utilized to control steam leakage from the casing of a modern auxiliary turbine?

- (A) labyrinth
- (B) Teflon
- (C) dovetail
- (D) carbon

If choice A is selected set score to 1.

15. In an impulse turbine, the fixed blades function to _____.

- (A) decrease steam velocity
- (B) equalize pressure differences
- (C) change the direction of steam flow
- (D) prevent steam turbulence

If choice C is selected set score to 1.

16. When operating with the auxiliary feed line, feed water flow is controlled _____.

- (A) automatically by the main feed water regulator
- (B) manually by throttling the auxiliary feed stop-check valve
- (C) manually by adjustment of the auxiliary feed water regulator spring setting
- (D) automatically by the economizer bypass

If choice B is selected set score to 1.

17. Scavenging air is supplied to steam soot blower elements to _____.

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

If choice D is selected set score to 1.

18. 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.

19. During initial starting of the standby turbine-driven boiler feed pump, which of the listed valves should remain closed?

- (A) Pump suction valve
- (B) Turbine steam supply valve
- (C) Turbine exhaust valve
- (D) Pump discharge check valve

If choice D is selected set score to 1.

20. A constant speed hydraulic governor would more than likely be installed on a _____.

- (A) turbo-generator
- (B) main condensate pump
- (C) main propulsion turbine
- (D) main feed pump

If choice A is selected set score to 1.

21. Which of the stated pressure conditions identifies the boiler design pressure?

- (A) The pressure specified by the manufacturer as a criterion for boiler design.
- (B) The pressure at which a boiler is operated during overload conditions.
- (C) The same pressure as the boiler operating pressure at full power capacity.
- (D) A pressure lower than boiler operating pressure.

If choice A is selected set score to 1.

22. The reduction gear shown in the illustration is a/an _____. Illustration SE-0013

- (A) locked-train double reduction gear
- (B) nested four-step reduction gear
- (C) nested double reduction gear
- (D) articulated double reduction gear

If choice D is selected set score to 1.

23. A higher than normal stack gas temperature could indicate _____.

- (A) dirty firesides or watersides
- (B) eroded water screen tube walls
- (C) inner or outer casing leakage
- (D) defects in burner cone refractory

If choice A is selected set score to 1.

24. What is generally found at the end of the low-pressure turbine rotor of a cross compound turbine arrangement?

- (A) Cruising turbine
- (B) Back pressure turbine
- (C) High-pressure turbine
- (D) Astern turbine

If choice D is selected set score to 1.

25. Which of the following statements is true concerning the coupling shown in the illustration?
Illustration SE-0001

- (A) It is commonly used between the first reduction pinion and the second reduction gear.
- (B) It is suitable for use on small auxiliary turbines only.
- (C) It allows for any misalignment between the main turbine and the second reduction gear.
- (D) It can be used to connect the main turbine to the high-speed pinion.

If choice D is selected set score to 1.

26. After a boiler has been taken off the line and is cooling, the air cock is opened to _____.

- (A) purge all air from the steam drum
- (B) guard against entrapped gas pockets in the superheater
- (C) allow even cooling of the steam drum
- (D) prevent the formation of a vacuum within the boiler

If choice D is selected set score to 1.

27. The purpose of the mica used in a boiler water gage glass assembly is to prevent _____.

- (A) light refraction in the glass
- (B) leakage from the glass
- (C) etching of the glass
- (D) overheating of the glass

If choice C is selected set score to 1.

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

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

If choice C is selected set score to 1.

29. 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.

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

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

If choice D is selected set score to 1.

31. (2.7.1.3.3-5) for a short period of time in order to _____.

- (A) ensure equal cooling of the main turbine bearings
- (B) prevent excessive condensate depression
- (C) remove the excessive amount of non-condensable vapors which accumulated during maneuvering operations
- (D) dry out the main turbines

If choice D is selected set score to 1.

32. An advantage of using boiler furnace studded waterwall tubes packed with refractory is that _____.

- (A) thinner tubes can be used
- (B) the use of dense firebricks is not required
- (C) thicker tubes are required
- (D) lower quality steel can be used

If choice B is selected set score to 1.

33. Which of the following is the advantage of operating a typical closed feed water system for a marine boiler when compared to an open feed water system?

- (A) Reduced requirement for condensate purity.
- (B) Allows for lower feed pump operating pressures.
- (C) Reduced steam requirement for feed water heating.
- (D) Increased capability of removing and controlling dissolved oxygen.

If choice D is selected set score to 1.

34. An auxiliary turbine boiler feed pump should normally be stopped by _____.

- (A) increasing the load on the driven unit
- (B) closing the exhaust valve slightly
- (C) actuating the throttle hand tripping device
- (D) rotating the hand lube oil pump backwards

If choice C is selected set score to 1.

35. Condensate pumps have distinctly noticeable characteristics and can usually be recognized by their _____.

- (A) open impellers and power ends
- (B) large suction chambers and impeller eyes
- (C) speed-limiting governors and closed impellers
- (D) multiple impellers and pump shaft positions

If choice B is selected set score to 1.

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

If choice A is selected set score to 1.

37. When a turbine rotor is not rotating during maneuvering, the heat tends to be concentrated at the _____.

- (A) top of the turbine
- (B) exhaust trunk
- (C) turbine bleed lines
- (D) casing joints

If choice A is selected set score to 1.

38. When starting a turbo-generator, you must provide lube oil pressure to the governor power piston by means of _____.

- (A) the hand-operated or auxiliary lube oil pump
- (B) a line from the gravity tank
- (C) the main lube oil pump
- (D) a line from the other generator

If choice A is selected set score to 1.

39. In a boiler equipped with a convection type superheater, the superheater tubes are located _____.

- (A) between the economizer and generating tubes
- (B) between the downtake nipple and circulator tube
- (C) in the path of the radiant heat of combustion
- (D) in a position screened from the furnace

If choice D is selected set score to 1.

40. When the temperature of the main turbine lubricating oil is lowered, an increase will occur in the _____.

- (A) pour point
- (B) viscosity
- (C) flash point
- (D) concentration of contaminants

If choice B is selected set score to 1.

41. When answering a full astern bell from half ahead, the superheater outlet temperature on a single furnace boiler will _____.

- (A) remain the same
- (B) decrease due to the increased steam volume used
- (C) increase sharply with the increased firing rate
- (D) decrease momentarily and then increase proportionately with load demand

If choice B is selected set score to 1.

42. When a turbine is in operation, a rotor position micrometer is used to determine any change in rotor _____.

- (A) axial position relative to the micrometer
- (B) radial position relative to the casing
- (C) axial position relative to the casing
- (D) radial position relative to the micrometer

If choice C is selected set score to 1.

43. 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.

44. Vent condensers are usually an integral part of deaerating feed heaters and serve to condense _____.

- (A) the gases liberated by the deaeration process
- (B) only steam vented from high-pressure steam traps
- (C) steam vented from high-pressure steam glands
- (D) the steam vapor entrained with the non-condensable gases

If choice D is selected set score to 1.

45. Which of the parts listed for a reaction turbine serve the same function as the nozzles of an impulse turbine?

- (A) Moving blades only
- (B) Moving nozzles
- (C) Fixed nozzles
- (D) Fixed blades and moving blades

If choice D is selected set score to 1.

46. Which of the listed conditions can cause high superheater outlet steam temperature in an automated boiler?

- (A) Insufficient excess air.
- (B) Operating with a bypassed economizer.
- (C) Excessive heat transfer in the control desuperheater.
- (D) High water level in the steam drum.

If choice B is selected set score to 1.

47. Which of the following methods is used to securely fasten the Babbitt lining of a reduction gear bearing to its shell?

- (A) The Babbitt is securely bonded to the shell by the pressure of the hydrodynamic oil wedge.
- (B) The Babbitt has a crescent shaped pocket cast symmetrically about the bearing split.
- (C) The Babbitt is relieved in way of the split and held in place by locking pins.
- (D) The Babbitt is centrifugally spun into the bearings or cast under a pressure head.

If choice D is selected set score to 1.

48. Chemicals are added to boiler water to _____.

- (A) stabilize feed water if a boiler becomes salted up
- (B) eliminate the need for blow downs
- (C) maintain an acidic condition in the feed water
- (D) prevent scale forming deposits

If choice D is selected set score to 1.

49. As compared with a typical front fired boiler, which of the listed conditions represents an advantage of a top fired boiler?

- (A) More uniform heat distribution and gas dwell is obtained within the furnace.
- (B) No division tube wall separating the convection and radiant sections of the furnace is ever required.
- (C) A lower fuel flow rate can be allowed, thus increasing economy.
- (D) Superheating diaphragms may be omitted.

If choice A is selected set score to 1.

50. Operating a steam turbine propulsion unit at medium-speed, in an area with extremely cold sea water and the main circulating pump providing full cooling water flow to the condenser will result in _____.

- (A) increased condensate aeration due to the inability of the air ejectors to remove excessive air accumulation from the condenser
- (B) increased effectiveness of the air ejectors due to the increased main condenser vacuum
- (C) increased plant efficiency due to increased condensate depression
- (D) excellent plant efficiency due to higher attainable vacuum

If choice A is selected set score to 1.

51. The main feed check valve functions to _____.

- (A) reduce feed pump discharge pressure loading
- (B) prevent backflow of water from the boiler in the event of a feed pump failure
- (C) check pressure pulsations in the feed line
- (D) provide feed pump positive discharge head

If choice B is selected set score to 1.

52. Which of the listed operating practices is considered as safe, and should be followed when opening and inspecting the waterside of a boiler?

- (A) Wire all valves closed that connect to other boilers.
- (B) Open the water drum manhole before opening the steam drum manhole.
- (C) Ventilate the waterside until completely dry.
- (D) Remove handhold plate dogs with a slugging wrench.

If choice A is selected set score to 1.

53. According to the data given in the illustration, which of the following would be the physical state of the fluid at a gage vacuum of 29.00 inches Hg, and 85.21 degrees Fahrenheit? Illustration SG-0026

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

If choice C is selected set score to 1.

54. Which of the following statements concerning boiler steam drum surface blow piping is correct?

- (A) The centerline of the pipe is normally situated at a distance from the bottom of the steam drum equal to approximately one fourth the diameter of the drum.
- (B) Usually the surface blow pipe is perforated with holes along its top surface; however, when a scum pan is also employed, the holes are located along the bottom of the pipe surface.
- (C) To ensure adequate blow down, the aggregate cross-sectional area of these perforated holes must be equal to approximately twice the cross-sectional area of the pipe.
- (D) All of the above.

If choice B is selected set score to 1.

55. Which of the devices listed is generally used to engage the main engine turning gear to the high-pressure turbine high-speed pinion?

- (A) Manually operated band brake
- (B) Quill shaft
- (C) Sleeve coupling
- (D) Manually operated sliding jaw clutch

If choice D is selected set score to 1.

56. For a large main propulsion turbine, the most commonly used turbine thrust bearing is the _____.

- (A) self-aligning shell
- (B) self-oiling sleeve
- (C) pivoted segmental shoe
- (D) overhung turbine wheel

If choice C is selected set score to 1.

57. The superheater vents should always be open when _____.

- (A) blowing down the boiler
- (B) the water level is lower than normal
- (C) blowing tubes
- (D) lighting off the boiler

If choice D is selected set score to 1.

58. 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.

59. A boiler with a water capacity of 10 tons generates steam at the rate of 30 tons per hour. If the feed water quality is 0.5 ppm, the concentration of solids will increase 1.5 ppm every hour. What would be the increase in the concentration of solids within 24 hours?

- (A) 12 ppm
- (B) 24 ppm
- (C) 36 ppm
- (D) 48 ppm

If choice C is selected set score to 1.

60. When firing a boiler in local manual control, an increase in boiler load must be accompanied by a/an _____.

- (A) decrease in the forced draft air pressure before a decrease in the fuel oil flow
- (B) increase in the forced draft air pressure before an increase in the fuel oil flow
- (C) increase in the fuel oil flow before an increase in the forced draft pressure
- (D) increase or a decrease in the fuel oil flow and forced draft air pressure simultaneously

If choice B is selected set score to 1.

61. The gravity tank in a gravity lube oil system serves to _____.

- (A) settle lube oil prior to purifying
- (B) maintain oil supply for several minutes to bearings should the lube oil service pump fail
- (C) store heated lube oil
- (D) supply the lube oil service pump with a positive suction head

If choice B is selected set score to 1.

62. Before placing the jacking gear in operation on a main turbine unit, you must always ensure that _____.

- (A) the gland seal steam system is operating
- (B) the main lube oil system is operating
- (C) the condensate system is operating
- (D) the main salt water circulating pump is operating

If choice B is selected set score to 1.

63. After routine blowing of tubes at sea, there should be a decrease in the _____.

- (A) CO₂ in the stack gas
- (B) fuel oil temperature
- (C) excess air required for complete combustion
- (D) stack temperature

If choice D is selected set score to 1.

64. At a given pressure, erosion of steam piping and machinery will be minimized by utilizing _____.

- (A) saturated steam
- (B) desuperheated vapor
- (C) superheated steam
- (D) wet steam

If choice C is selected set score to 1.

65. If the main condenser were operating at a vacuum of 28.5" Hg, a condensate discharge temperature of 86°F, a sea water inlet temperature of 72°F, and a sea water outlet temperature of 79°F, what would be the condensate depression? Illustration SG-0026

- (A) 0.2 inches Hg
- (B) 0.7 inches Hg
- (C) 4 degrees Fahrenheit
- (D) 7 degrees Fahrenheit

If choice C is selected set score to 1.

66. As the percentage of CO₂ in the stack gas decreases, you can assume that _____.

- (A) the fuel to air ratio is increasing
- (B) fuel is being burned with increasing economy
- (C) you are approaching secondary combustion
- (D) excess air is increasing

If choice D is selected set score to 1.

67. (2.6.9.2-6) An adequate phosphate reserve should be maintained in boiler water to _____.

- (A) remove dissolved oxygen concentrations
- (B) reduce the blow down frequency
- (C) maintain a pH of 7
- (D) prevent hard scale formation

If choice D is selected set score to 1.

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

- (A) after condenser
- (B) vent condenser
- (C) inter condenser
- (D) all of the above

If choice C is selected set score to 1.

69. Which of the following statements is true concerning the turbine shown in the illustration?
Illustration SE-0016

- (A) The low-pressure turbine is designed with reaction type stages.
- (B) The astern element is of the Curtis type consisting of two three-row stages.
- (C) The ahead rotor can be classified as a helical flow, Parsons type turbine.
- (D) A steam deflector is provided between the astern element and the ahead stages of the LP turbine.

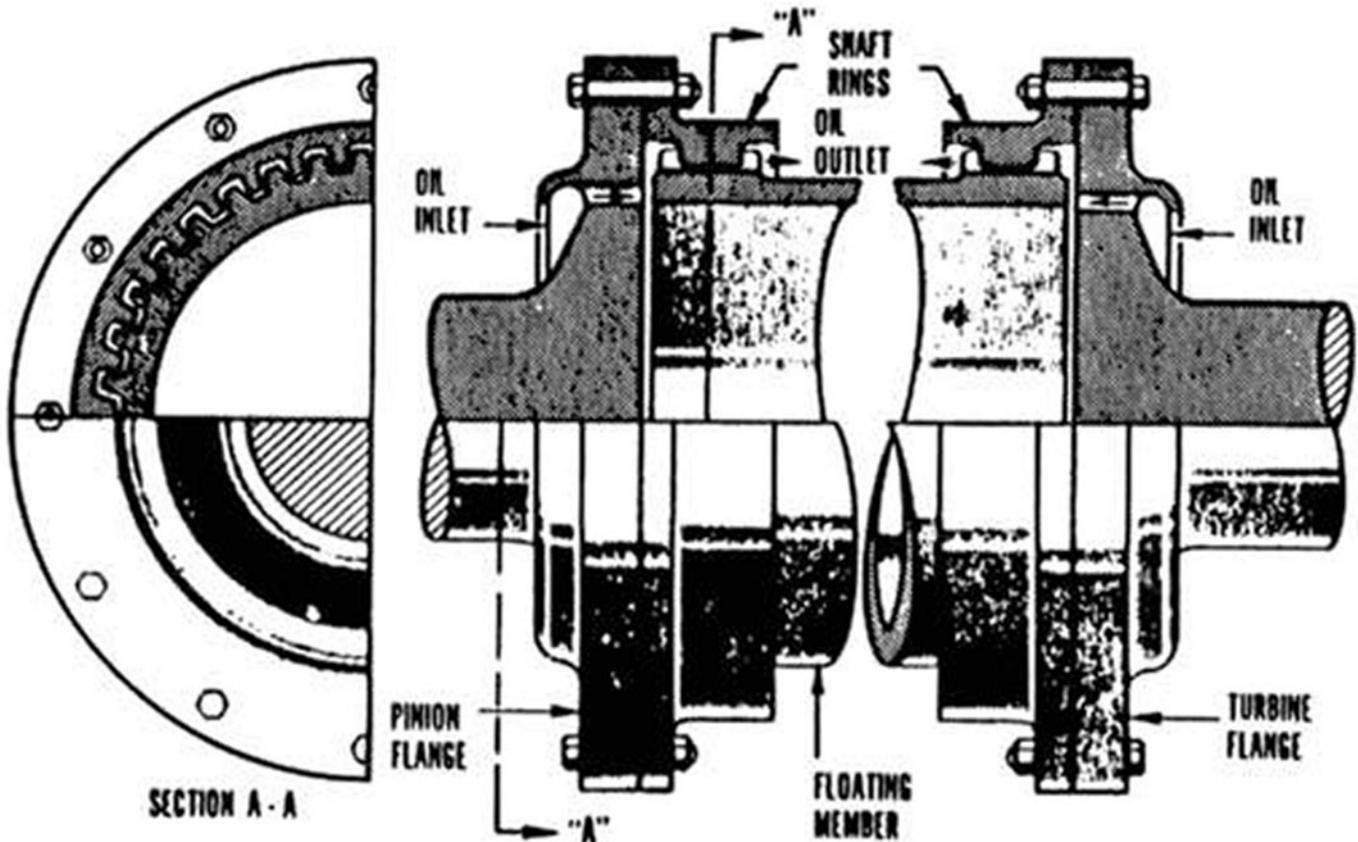
If choice D is selected set score to 1.

70. Magnets are installed in the main propulsion turbine lube oil strainers to attract metal particles released through wearing of the _____.

- (A) Babbitt bearings
- (B) reduction gears
- (C) turbine blades
- (D) turbine labyrinth

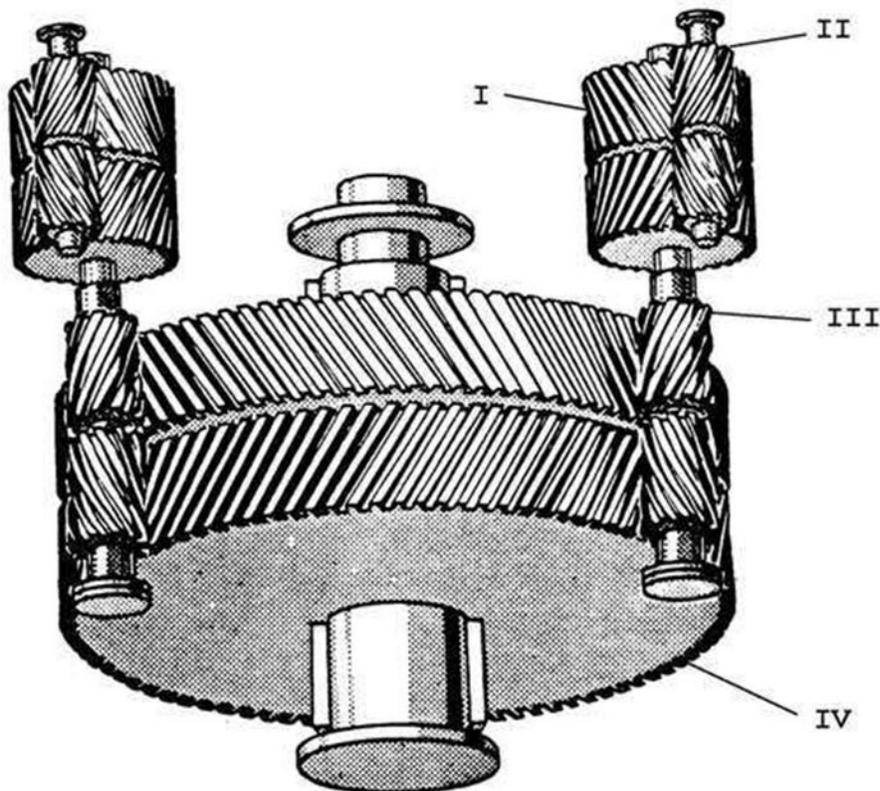
If choice B is selected set score to 1.

SE-0001



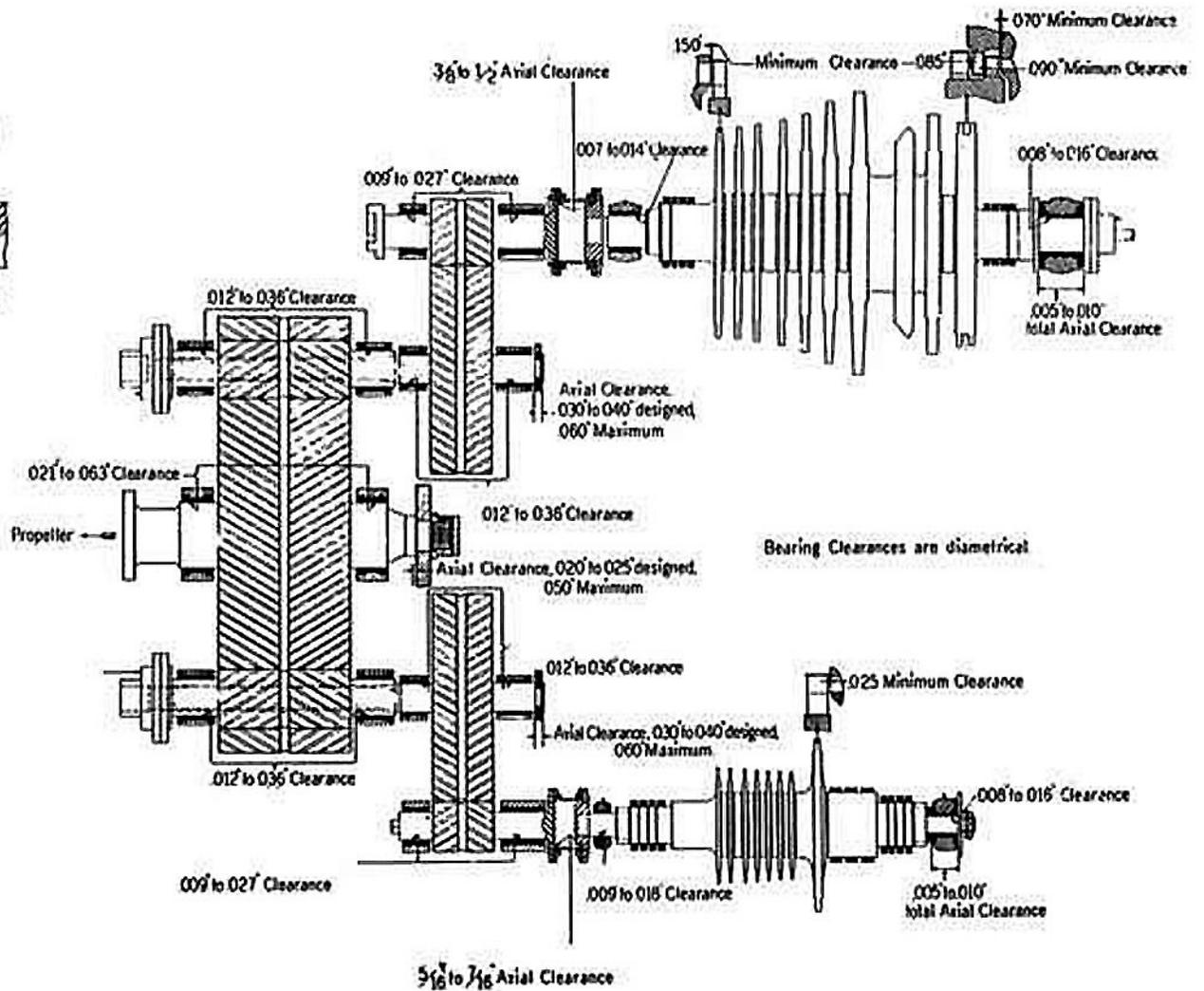
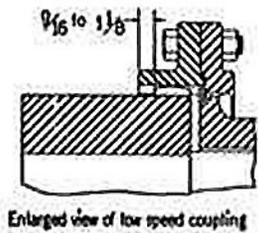
Adapted for testing purposes only from Machinist's Mate 3 & 2
NAVEDTRA 14151

SE-0013

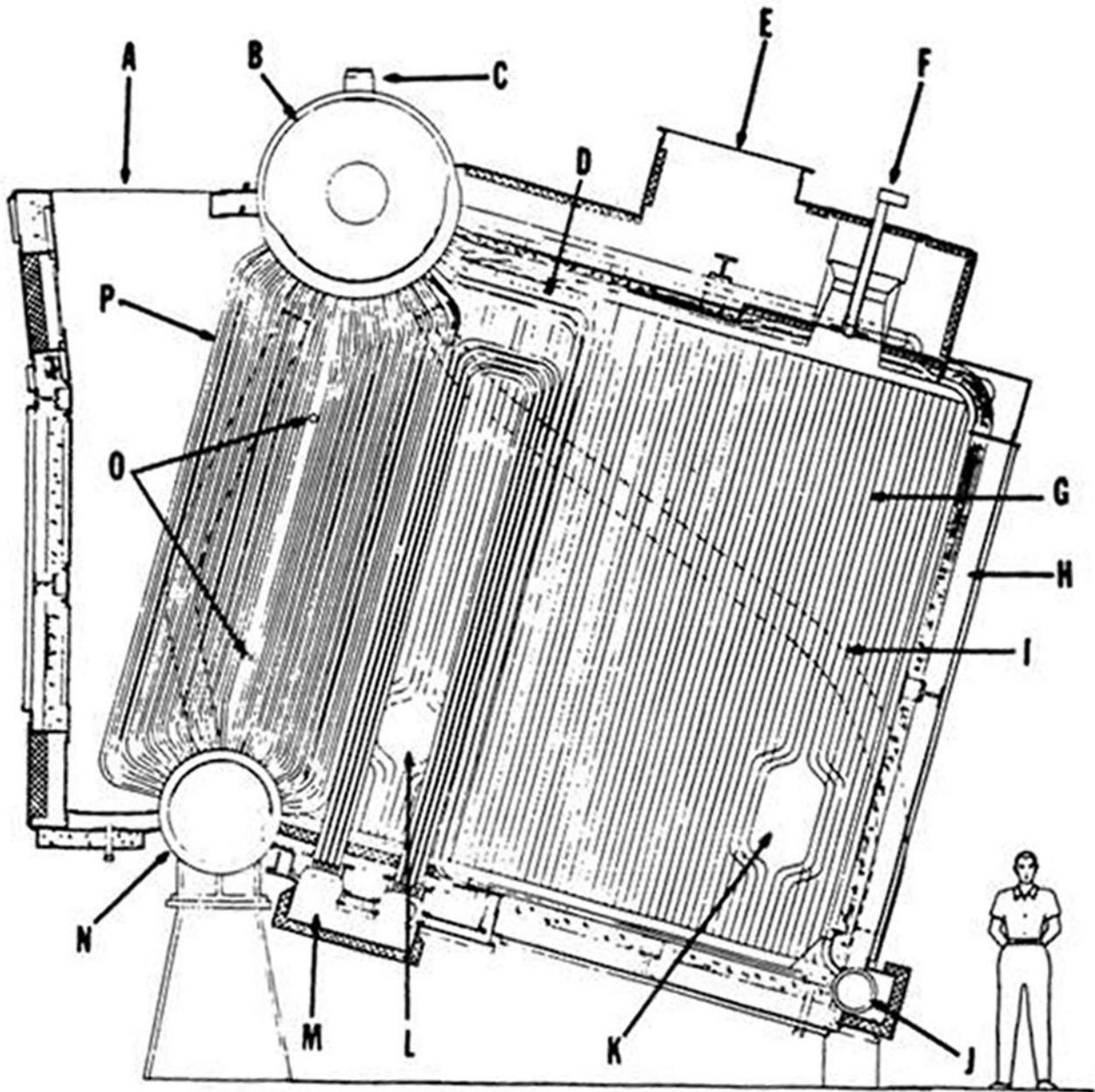


Adapted for testing purposes only from HARRINGTON, Marine Engineering
Copyright © 1992 by the Society of Naval Architects and Marine Engineers

SE-0016



SG-0007

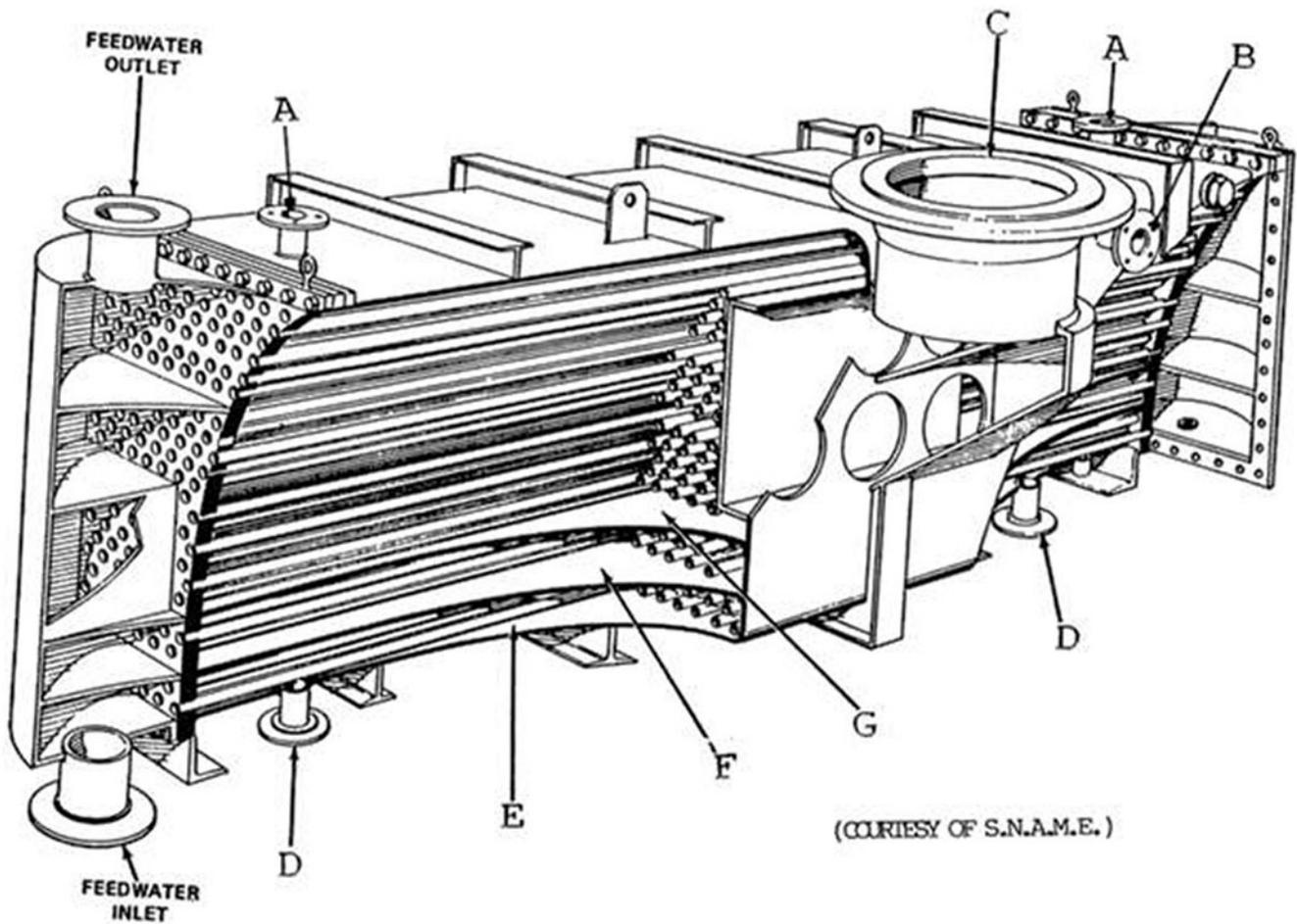


Adapted for testing purposes only from HUNT, Modern Marine Engineer's Manual, Volume I

Copyright © 1999 by Cornell Maritime Press

Further reproduction prohibited without permission

SG-0025



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

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

Adapted for testing purposes only from Machinist's Mate 3 & 2
NAVEDTRA 10524-E1