U.S.C.G. Merchant Marine Exam

First Assistant Engineer

Q513 Steam Plants

(Sample Examination)

Choose the best answer to the following Multiple-Choice Questions.

1. Boiler refractory firebrick is secured to the casing by _____.

A. high strength tensile fasteners
B. slots in the brick engaging anchor bolts
C. studding on the waterwall tubes
D. fast drying plastic refractory mortar

Correct answer: B

2. Which of the listed types of safety valves is shown in the illustration? Illustration SG-0018

A. Nozzle reaction type
B. Huddling chamber type
C. Jet flow type
D. Pressure-loaded type

Correct answer: B

3. On a boiler safety valve, the blowdown adjusting ring is locked in place by a _____.

A. locknut
B. set screw
C. wire seal
D. cotter pin

Correct answer: B

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

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

Correct answer: C

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

Correct answer: D

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

A. generating tubes, superheater, and then economizer
B. economizer, superheater, generating, and then screen tubes
C. superheater, economizer, and then generating tubes
D. screen tubes, generating tubes, and then superheater

Correct answer: B

7. According to the data given in the illustration which of the following would be the physical state of the fluid at a gauge vacuum of 25.03 inches Hg, and 126.08 degrees Fahrenheit? Illustration SG-0026

A. Saturated liquid.
B. Mixture of saturated liquid and vapor.
C. Subcooled liquid.
D. Superheated vapor.

Correct answer: C

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

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

Correct answer: B

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

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

Correct answer: A

10. Under normal operating conditions, a drop in the steam temperature leaving an uncontrolled interdeck superheater could be caused by a _____.

A. decrease in steam velocity through the superheater
B. decrease in combustion gas velocity through the superheater
C. badly fouled economizer
D. drop in the feedwater temperature

Correct answer: B

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

A. excess air is too low
B. feedwater temperature is too high
C. boiler is priming
D. feedwater temperature is too low

Correct answer: D

12. Which of the conditions listed would indicate excessive soot buildup on the economizer?

A. High superheater temperature
B. Low air temperature entering the boiler
C. High feedwater temperature entering the boiler
D. Lower than usual air pressure in the furnace

Correct answer: A

13. 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. Increased furnace temperature.
C. Damage to the furnace refractory.
D. Cracks through the furnace floor.

Correct answer: C

14. Rapid fluctuation in the superheater temperature of a steady steaming boiler indicates _____.

A. improper positioning of superheater fires
B. leaky desuperheater tubes
C. moisture carryover
D. leaky superheater tubes

Correct answer: C

15. The boiler main feed stop check valve is located nearest the _____.

A. first stage feedwater heater outlet
B. main feedwater regulator inlet
C. boiler water drum inlet
D. DC heater feedwater outlet

Correct answer: B

16. To provide emergency feedwater supply to a steaming boiler, if it becomes necessary to secure the DC heater, suction should be taken on the distilled water tank using the _____.

A. emergency injector discharge
B. emergency feed pump
C. feed booster pump
D. main condensate pump

Correct answer: B

17. A two-element boiler feedwater regulator is controlled by _____.

A. steam flow and feedwater flow
B. drum water level and feedwater flow
C. steam flow and drum water level
D. drum water level and drum pressure

Correct answer: C

18. 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.

Correct answer: D

19. Which of the conditions listed may be indicated by the lifting of the DC heater relief valve?

A. Low back pressure in the auxiliary exhaust line.
B. A malfunctioning auxiliary exhaust make-up steam regulating valve.
C. Low water level continually maintained in the DC heater.
D. Excessive deaeration of the feedwater.

Correct answer: B

20. Scale in the air ejector first-stage nozzle could cause a decrease in the _____.

A. low pressure turbine exhaust temperature
B. air ejector steam supply pressure
C. condensing temperature in the condenser
D. condenser vacuum

Correct answer: D

21. If the cooling water flow through the air ejector intercondensers and aftercondensers is inadequate, which of the problems listed will occur?

A. Air ejector nozzles will erode.
B. Aftercondenser will be flooded.
C. DC heater level will rise
D. Main condenser absolute pressure will increase.

Correct answer: D

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

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

Correct answer: C

23. A basic comparison can be made between a low-pressure evaporator operation and a main condenser with regards to the removal of non-condensable gases. The vacuum drag line for the main condenser is specifically connected in which area?

A. steam lane
B. hotwell
C. main tube bank
D. air cooler section

Correct answer: D

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

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

Correct answer: B

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

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

Correct answer: B

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

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

Correct answer: A

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

A. hydrometer
B. calorimeter
C. viscosimeter
D. open cup test

Correct answer: B

28. Generally, a 12% to 14% content of carbon dioxide in boiler flue gases indicates _____.

A. proper combustion of the fuel oil
B. carbon deposits in the uptakes
C. too much excess air
D. a high vanadium content in the fuel oil

Correct answer: A

29. When burning fuel oil in a boiler, a high CO2 content is desired in the stack gas because _____.

A. efficient combustion is indicated even though the heat liberated is less than the heat produced by burning to CO
B. less excess air is required to produce CO2 than CO
C. efficient combustion is indicated and the heat liberated is equal to the heat produced by the formation of CO
D. more heat is liberated by the production of CO2 than CO

Correct answer: D

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

A. insufficient air
B. low carbon content of fuel
C. contaminated fuel oil
D. efficient combustion

Correct answer: D

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

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

Correct answer: D

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

A. Fuel oil service pump
B. Settler service pump
C. Centrifugal type general service pump
D. Fuel oil transfer pump

Correct answer: D

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

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

Correct answer: A

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

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

Correct answer: A

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

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

Correct answer: C

36. Which of the conditions listed can cause the flame of a mechanically atomized burner to be blown away from the burner tip when you are attempting to light off?

A. The secondary air cone is improperly adjusted.
B. Fuel oil viscosity is too low.
C. Insufficient excess air is being supplied to the furnace.
D. The diffuser is burned out.

Correct answer: D

37. The rate of fouling on the oil side of a fuel oil heater is inversely related to the _____.

A. flow rate of fuel oil through the heater
B. quality of steam flowing through the heater
C. pressure on the oil in the heater
D. shape of the heating coils in the heater

Correct answer: A

38. Testing boiler water for chloride content will indicate the amount of _____.

A. total alkalinity in the water
B. methyl orange that should be added
C. phosphates present in the water
D. dissolved salts from sea contamination

Correct answer: D

39. When a boiler water test indicates a pH value of 6, you should _____.

A. chemically treat to raise the pH to normal level
B. chemically treat to lower the pH to normal level
C. check the DC heater for possible malfunction
D. begin a continuous boiler blowdown

Correct answer: A

40. Carbon dioxide dissolved in boiler water is dangerous in a modern power boiler because the gas _____.

A. combines with oxygen to cause severe waterside scaling
B. breaks the magnetic iron oxide film inside boiler tubes
C. combines with sulfates to cause severe waterside pitting
D. forms carbonic acid which attacks the watersides

Correct answer: D

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

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

Correct answer: A

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

Correct answer: D

43. If an automatically fired burner ignites, but repeatedly goes out within two seconds, the cause could be a/an _____.

A. faulty pressure signal to the time delay relay circuit
B. dirty flame scanner window
C. excessively high fuel oil temperature
D. burned out solenoid coil in the low fire oil valve

Correct answer: B

44. While underway, the boiler water level in a steaming boiler begins dropping rapidly and cannot be kept at the normal level by standard practices. The engineer's next action should be to _____.

A. secure the steam stop and then secure the fires
B. continue to speed up the feed pump to raise the water level
C. blowdown the gage glass to find the true water level
D. secure the fires and then secure the main feed stop-check valve to the boiler

Correct answer: D

45. 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. blowdown the water gage glass
C. immediately drain the economizer
D. completely drain the superheater

Correct answer: D

46. In the event of a failure of the pneumatic control system, a multi-element feedwater regulator is designed to operate as a _____.

A. constant-pressure regulator
B. manually controlled feedwater regulator
C. constant-volume feedwater regulator
D. thermo-hydraulic feedwater regulator

Correct answer: B

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

A. The marine inspector may require any boiler to be drilled to determine its actual thickness any time its safety is in doubt.
B. 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.
C. If the thickness found as a result of gauging is less than original thickness, the boiler must be condemned.
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.

Correct answer: A

48. In accordance with 46 CFR Subchapter F (Marine Engineering), which of the following statements is true concerning the inspection of water-tube boilers?

A. Boiler mountings attached to boiler nozzles must be opened and removed for examination every 8 years.
B. All boiler mounting studs or bolts shall be removed for examination by a Coast Guard inspector every 4 years after initial inspection.
C. Boiler mountings attached directly to the boiler plating by screwed studs and nuts shall be removed and examined every 10 years.
D. All mountings shall be opened up and examined by a Coast Guard inspector at eight-year intervals after the initial inspection.

Correct answer: C

49. 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 huddling chamber
C. diameter of the feather
D. diameter of the inlet opening

Correct answer: D

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

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

Correct answer: A

51. The labyrinth seals used on rotating steam turbine shafts reduces external leakage by causing _____.

A. pressure increases through successive seal stages
B. successive temperature drops through the seal stages
C. successive pressure drops through the seal stages
D. increased turbulence through successively larger labyrinth clearances

Correct answer: C

52. 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. LP turbine bleed valve
C. ahead throttle valve
D. astern throttle valve

Correct answer: D

53. What must you do before placing the jacking gear in operation on a main turbine unit?

A. Ensure that the main lube oil system is operating
B. Ensure that the main saltwater circulating pump is operating
C. Ensure that the gland seal steam system is operating
D. Ensure that the condensate system is operating

Correct answer: A

54. A common cause of the Babbitt linings cracking in a turbine journal bearing is from _____.

A. vibration generated by the rotor
B. prolonged operation at low-speed
C. prolonged operation at full-speed
D. excessive thrust bearing wear

Correct answer: A

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

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

Correct answer: B

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

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

Correct answer: C

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

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

Correct answer: D

58. 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

Correct answer: B

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

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

Correct answer: C

60. A sequential lift, nozzle valve control bar on a turbo-generator, utilizes which of the following operating principles?

A. A hydraulic piston raises or lowers individual valves according to pressure received from a governor.
B. A hydraulic piston raises or lowers groups of valves according to pressure received from a governor.
C. A servomotor, mechanically connected to nozzle valve handwheels, opens or closes the valves in accordance with the type of electrical signal received.
D. A lifting beam mechanism engages nozzle valve stems of varying lengths.

Correct answer: D

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

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

Correct answer: D

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

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

Correct answer: B

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

Correct answer: A

64. When a sudden increase in pressure occurs in a forced lubrication system, you should check for a _____.

A. clogged lube oil pump suction
B. loss of oil flow across one of the bearings
C. high lube oil sump level
D. ruptured tube in the lube oil cooler

Correct answer: B

65. Water retained in the lube oil system of a main propulsion turbine installation is undesirable because it _____.

A. causes pitting of the gear teeth
B. results in excessive cooling of bearing surfaces
C. causes the turbine to overspeed
D. raises the flash point of the oil to a dangerously high level

Correct answer: A

66. A cloudy or milky appearing lube oil sample, taken from the main lubricating oil system could be caused by _____.

A. insufficient gland sealing steam
B. excessive gland sealing steam
C. insufficient cooling water to the lube oil cooler
D. excessive cooling water to the lube oil cooler

Correct answer: B

67. In the diagrammatic arrangement of the thrust bearing, shown in the illustration, the direction of shaft rotation and the direction of thrust are indicated respectively by arrows _____. Illustration SE-0012

A. F and H
B. F and J
C. G and J
D. G and H

Correct answer: B

68. Which of the following operational practices is helpful in avoiding the accumulation of condensate in the main reduction gear casing?

A. The temperature of the lubricating oil should not exceed the gear manufacturer's recommendation when the unit is operating at full load.
B. Avoid applying gland sealing steam to the low-pressure turbine until you are ready to start up the first stage air ejector.
C. Always ensure that the lubricating oil pressure is 14-17 psi when operating in unusually cold waters.
D. After the main unit is secured, lubricating oil should be circulated until the temperature of the oil and reduction gear casing approximates the engine room temperature.

Correct answer: D

69. 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 for proper water circulation to the lube oil coolers.
C. Stop the unit and carefully inspect the bearing.
D. Check the bearing for proper lubrication.

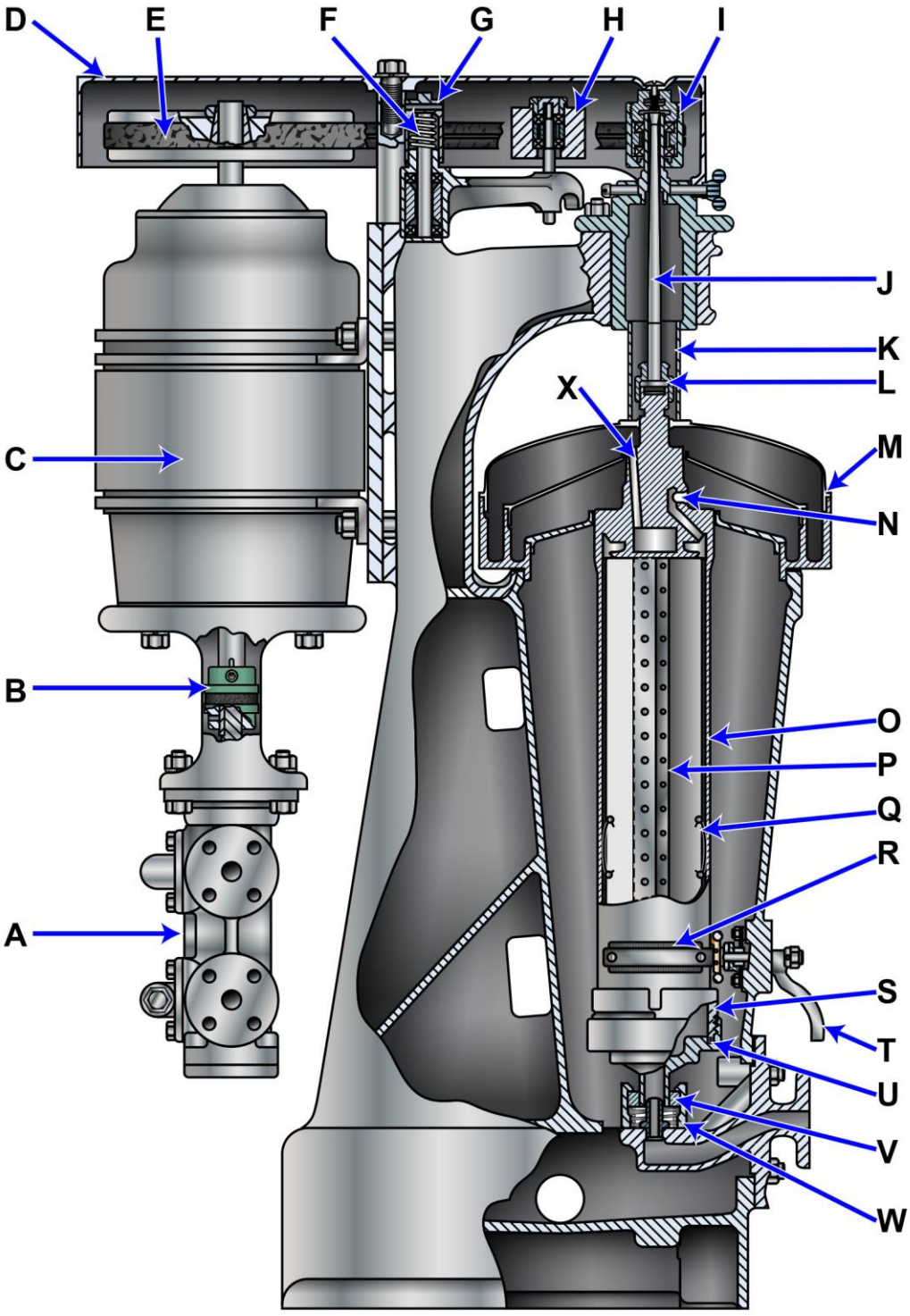
Correct answer: D

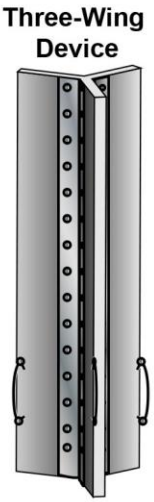
70. If a line shaft bearing begins to overheat, the shaft speed should be reduced. If overheating persists, you should then _____.

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

Correct answer: B

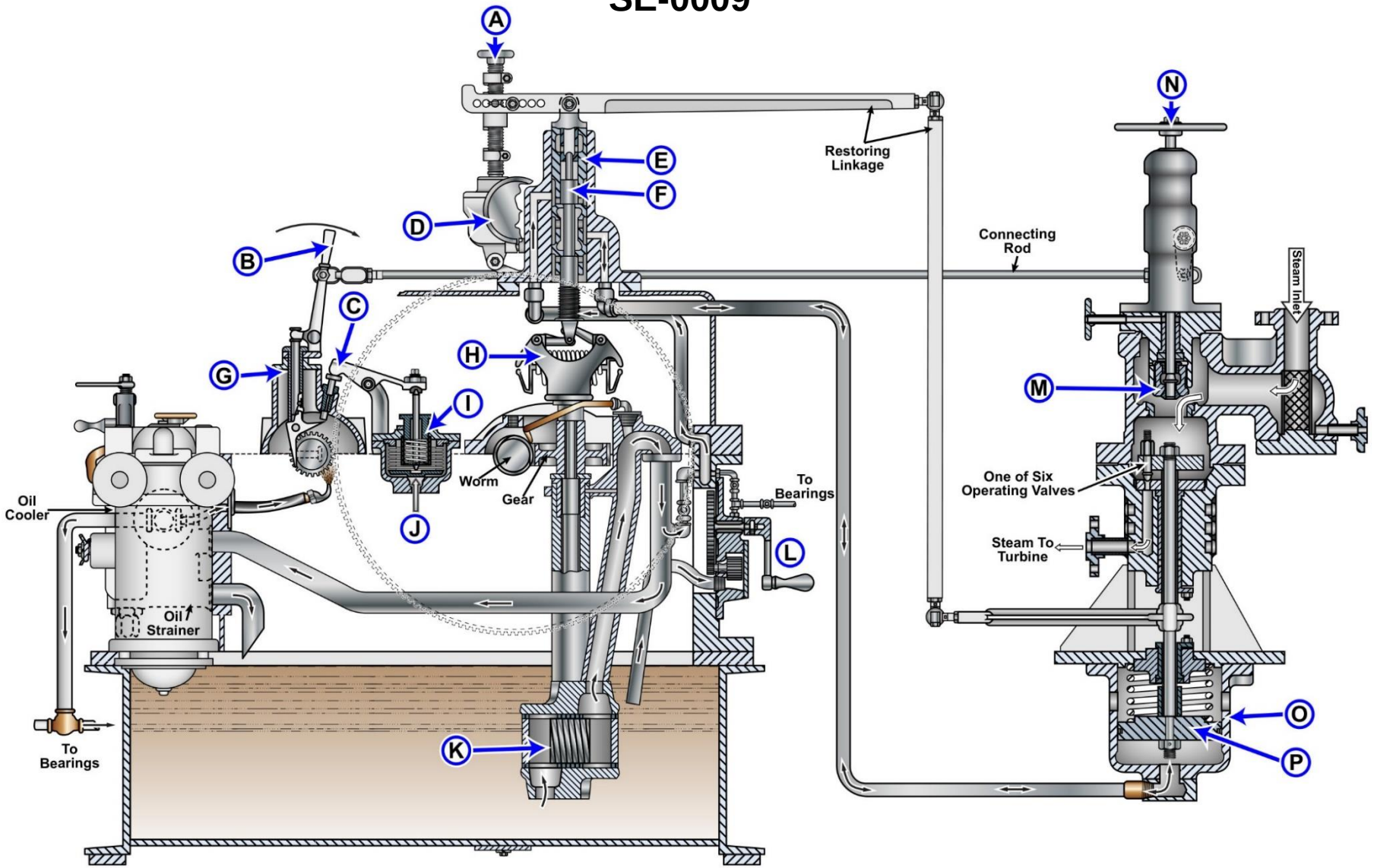
GS-0124





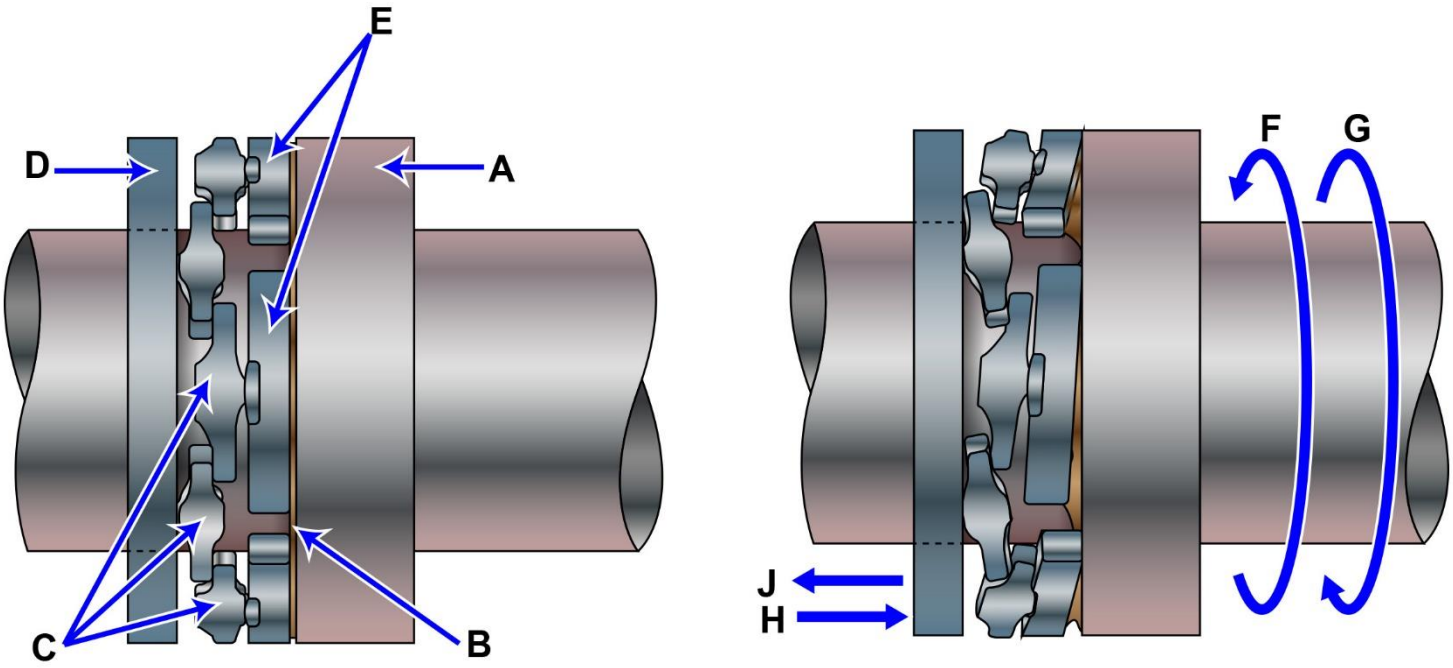
Adapted for testing purposes only from Fireman
NAVEDTRA 14104

SE-0009



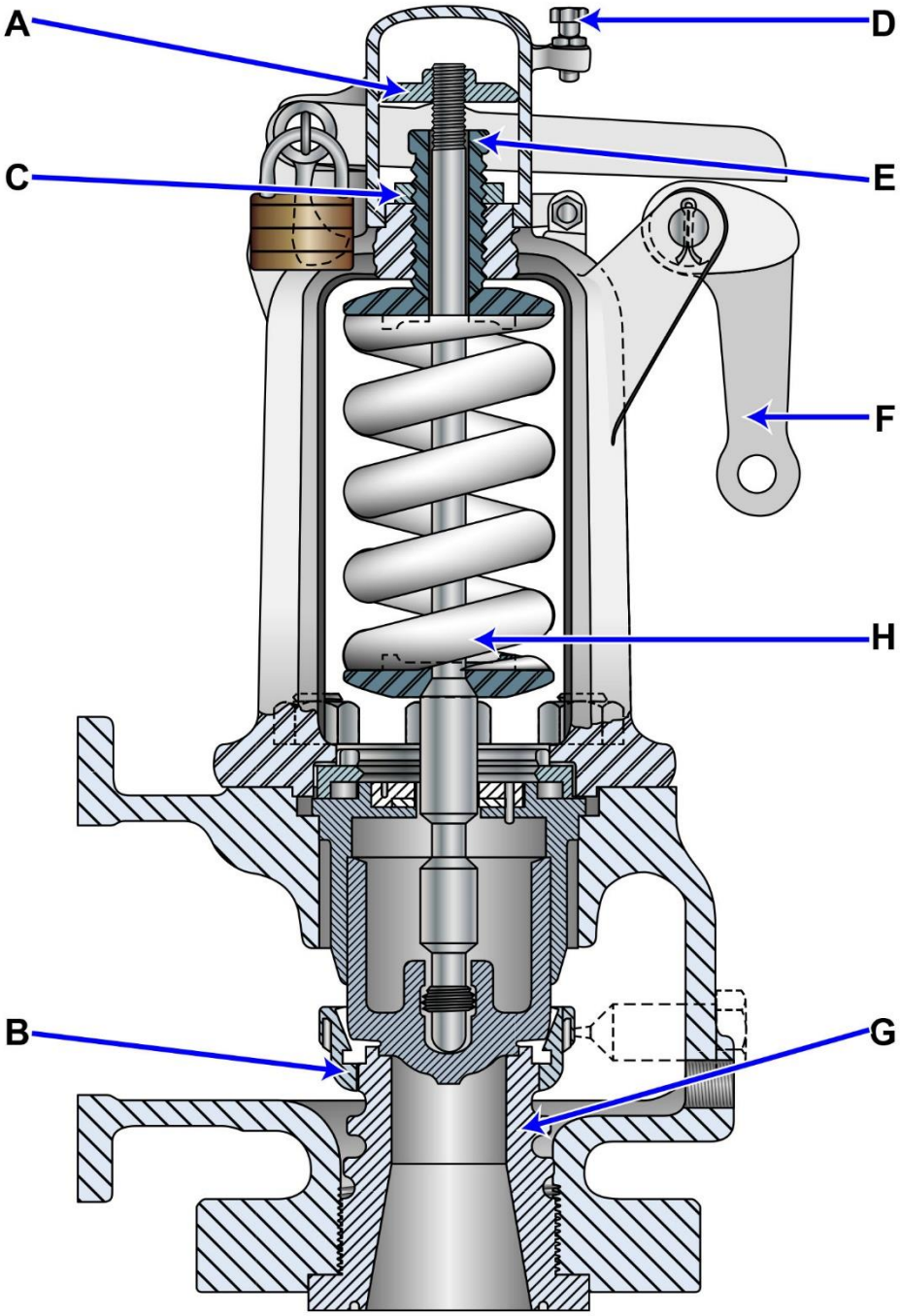
Adapted for testing purposes only from Machinist's Mate 3 & 2
NAVEDTRA 14151

SE-0012



Stationary View **Rotating View**

SG-0018



SG-0026

Properties of Saturated Steam

Vacuum Inches of Hg Gauge	Temperature °C	Temperature °F
29.51	11.74	53.14
29.41	15.17	59.30
29.31	18.04	64.47
29.21	20.52	68.93
29.11	22.70	72.86
29.00	24.66	76.38
28.90	26.43	79.58
28.70	29.56	85.21
28.49	32.27	90.08
28.29	34.66	94.38
28.09	36.80	98.24
27.88	38.74	101.74
27.48	42.18	107.92
27.06	45.14	113.26
26.66	47.77	117.99
26.26	50.13	122.23
25.85	52.27	126.08
25.44	54.23	129.62
25.03	56.05	132.89
24.63	57.74	135.94
24.22	59.33	138.79
23.81	60.82	141.48
22.79	64.21	147.57
21.78	67.21	152.97
20.76	69.91	157.83
19.74	72.36	162.24
18.72	74.61	166.30
17.70	76.70	170.06
16.69	78.64	173.56
15.67	80.47	176.85
14.65	82.14	179.86
13.63	83.81	182.86
12.61	85.36	185.64
11.60	86.82	188.28
10.58	88.22	190.80
9.56	89.57	193.21
7.52	92.08	197.75
5.49	94.42	201.96
3.45	96.60	205.88
1.42	98.64	209.56