

## U.S.C.G. Merchant Marine Exam

### Third Assistant Engineer

#### Q537 Steam Plants I

#### (Sample Examination)

**Choose the best answer to the following Multiple-Choice Questions:**

1. How is boiler water forced to circulate faster in accelerated natural circulation boilers as compared to free natural circulation boilers?
- A. Installing a water circulating pump, such as a hydrokineter
  - B. Increasing the density of the water
  - C. Increasing the inclined angle of the generating tubes
  - D. Increasing the surface area of the economizer exposed to the combustion gases

Correct answer: C

2. Reaching which "end point" will result in the most severe damage to the boiler?
- A. Combustion
  - B. Carryover
  - C. Circulation
  - D. Atomization

Correct answer: C

3. Proper bracing and support of the boiler safety valve escape piping is necessary to \_\_\_\_\_.
- A. prevent stressing of the safety valves
  - B. prevent condensate from accumulating in lines
  - C. prevent scale from lodging on the valve seat
  - D. allow for back pressure formation in the line

Correct answer: A

4. When excessive static boiler pressure has resulted in the initial lift of the valve disc, a huddling chamber safety valve will continue to lift open as a result of \_\_\_\_\_.
- A. Steam pressure acting on the enlarged area of projecting lip or ring
  - B. The resulting reactive force created by the rapid expansion of escaping steam
  - C. An increase in steam velocity through an adjustable orifice ring
  - D. Steam pressure transmitted through a pipe connected to the superheater outlet

Correct answer: A

5. When heated, brickwork in a boiler is kept from buckling by the installation of \_\_\_\_\_.
- A. Insulating blocks
  - B. Insulating bricks
  - C. Sliding saddles
  - D. Expansion joints

Correct answer: D

6. A corbel is used in a boiler furnace to \_\_\_\_\_.
- A. contain the furnace heat
  - B. protect the expansion joints
  - C. direct the flow of gases
  - D. reduce gas turbulence

Correct answer: B

7. In most marine boilers, the primary reason the first few rows of generating tubes, called screen or furnace row tubes, are made larger in diameter than the rest of the generating tubes is because \_\_\_\_\_.
- A. they must act as downcomers to ensure proper circulation
  - B. their main function is to retard combustion gas flow for maximum heat transfer rates
  - C. they must screen the superheater from the direct radiant heat of the burners
  - D. they require more water flow since they are exposed to the greatest heat

Correct answer: D

8. Which of the following statements represents the primary function of handholes used on a boiler?
- A. To allow access into the steam and water drum
  - B. To provide access for cleaning out the firebox
  - C. To allow access for cleaning in the stack
  - D. To allow access into the headers

Correct answer: D

9. Desuperheated steam can be found at the \_\_\_\_\_.
- A. Spray attemperator outlet
  - B. Main steam stop
  - C. Generator steam stop
  - D. High-pressure turbine steam chest

Correct answer: A

10. With an increase in the saturation pressure of a fluid, the value represented by line "5" on the graph will \_\_\_\_\_. Illustration SG-0001
- A. represent an increase in the specific heat of the vapor
  - B. represent virtually no change in the specific heat of the vapor
  - C. represent a decrease in the specific heat of the vapor
  - D. represent virtually no change in the latent heat of vaporization

Correct answer: B

11. When vapor is in contact with and remains at the same temperature as the boiling liquid from which it was generated, the vapor and liquid are said to be in which of the following?
- A. critical state
  - B. saturated condition
  - C. latent contact
  - D. sensible contact

Correct answer: B

12. 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 blowdown, 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.

Correct answer: B

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

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

Correct answer: A

14. A check valve is located between the economizer and the steam drum to \_\_\_\_\_.

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

Correct answer: B

15. Boiler fuel savings gained by the use of an economizer can amount to \_\_\_\_\_.

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

Correct answer: B

16. Scavenging air is supplied to steam sootblower elements to \_\_\_\_\_.

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

Correct answer: B

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

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

Correct answer: C

18. In a boiler equipped with a convection type superheater, the superheater tubes are located \_\_\_\_\_.

- A. In a position screened from the furnace
- B. Between the downtake nipple and circulator tube
- C. Between the economizer and generating tubes
- D. In the path of the radiant heat of combustion

Correct answer: A

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

- A. Regenerative air heater
- B. Separately fired superheater
- C. Retractable sootblower
- D. Integral or interdeck superheater

Correct answer: D

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

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

Correct answer: D

21. Many steam plants are designed so that diesel oil can be provided to the burners when \_\_\_\_\_.

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

Correct answer: D

22. When raising steam on a cold boiler under normal conditions, you should always \_\_\_\_\_.

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

Correct answer: D

23. When raising steam on a boiler, the superheater drains should \_\_\_\_\_.

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

Correct answer: A

24. 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. Drain and refill the boiler with cold water.
- D. Relieve all fuel oil service pressure to that boiler.

Correct answer: D

25. Before blowing tubes in a boiler equipped with steam sootblowers, you should \_\_\_\_\_.
- A. Increase the boiler water level
  - B. Lower the boiler steam pressure
  - C. Reduce the forced draft fan speed
  - D. Decrease the boiler water level

Correct answer: A

26. One factor for determining the minimum feedwater inlet temperature to a boiler economizer is the \_\_\_\_\_.
- A. Dew point temperature of the stack gases
  - B. Temperature of steam bled off the LP turbine
  - C. Desuperheater outlet temperature
  - D. Superheater inlet temperature

Correct answer: A

27. To safely decrease the boiler firing rate, you should always reduce the fuel pressure \_\_\_\_\_.
- A. By opening the fuel pump relief valve
  - B. After reducing the forced draft pressure
  - C. By opening the oil recirculating valve
  - D. Before reducing the forced draft pressure

Correct answer: D

28. Which of the following items should be checked each time the firing rate or forced draft pressure is adjusted?
- A. Atomizing steam pressure
  - B. Fuel oil suction pressure
  - C. Fuel oil heater inlet temperature
  - D. Smoke periscope

Correct answer: D

29. 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. Replace the tube with a spare, if available, or plug it.
  - C. Heat the tube and use a soft mallet to straighten it.
  - D. Use a hydraulic jack to cold bend the tube.

Correct answer: B

30. Improper water washing of the water-tube boiler firesides can cause \_\_\_\_\_.
- A. erosion of tubes and drums
  - B. sulfuric acid corrosion
  - C. decreased heat transfer capabilities
  - D. loss of ductility in boiler tubes

Correct answer: B

31. 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. properly secure refractory with anchor bolts
  - C. avoid rapid temperature changes and follow recommended operating procedures
  - D. patch refractory with plastic chrome ore

Correct answer: C

32. When installing new safety valve escape piping, precautions should include assuring that \_\_\_\_\_.
- A. the piping leads directly to the bilge
  - B. the quick-closing valve operates freely
  - C. bends or elbows in the line do not exist
  - D. no stress is transmitted to the valve

Correct answer: D

33. If while filling the boiler a newly installed gasket on a water-tube handhole plate weeps, you should \_\_\_\_\_.
- A. Retighten the stud nut with an air wrench
  - B. Use a double gasket
  - C. Center and tighten with correct size wrench
  - D. Coat the gasket with graphite

Correct answer: C

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

Correct answer: B

35. The MOST common cause of heat blisters developing on boiler generating tubes is due to \_\_\_\_\_.
- A. insufficient water circulation
  - B. flame impingement
  - C. gas laning
  - D. waterside deposits

Correct answer: D

36. Oil or scale deposits on boiler tube walls will cause \_\_\_\_\_.
- A. decreased boiler steam pressure
  - B. an explosion in the boiler
  - C. those tubes to overheat
  - D. increased boiler steam pressure

Correct answer: C

37. If the engineer on watch has reason to doubt the accuracy of the water level showing in the boiler gauge glass, he should FIRST \_\_\_\_\_.
- A. replace the gauge glass
  - B. start the standby feed pump
  - C. open the auxiliary feed line
  - D. blowdown the gauge glass

Correct answer: D

38. Lower boiler efficiency results from carrying too much excess air because \_\_\_\_\_.
- A. it increases the volume and temperature of the furnace gas leaving the stack
  - B. it varies the degree of deposits on heat absorbing surfaces
  - C. the flame temperatures are lower
  - D. it decreases the volatility of the fuel

Correct answer: A

39. In the boiler steam and water system, pressure is highest in the \_\_\_\_\_.
- A. steam stop
  - B. dry pipe
  - C. mud drum
  - D. feed line

Correct answer: D

40. Which of the listed conditions aids in directing gland leakoff steam from the low-pressure propulsion turbine to pass through the gland exhaust condenser?
- A. Steam pressure from the low-pressure turbine
  - B. Steam pressure from the high-pressure turbine
  - C. The use of a gland exhaust fan
  - D. Compressed air in the air pilot

Correct answer: C

41. The two-element feedwater regulator functions similarly to the three-element feedwater regulator, but does not utilize \_\_\_\_\_.
- A. feedwater flow measurement
  - B. steam flow measurement
  - C. water level
  - D. drum pressure

Correct answer: A

42. If it is necessary to operate a turbine driven main feed pump at shut off head, or at less than 20% of its rated capacity, what will prevent the pump from overheating?
- A. Throttling of the steam supply valve
  - B. A bypass or recirculating line led back to the pump impeller eye or suction
  - C. Throttling of the liquid discharge valve
  - D. A bypass or recirculating line led back to the source of suction supply

Correct answer: D



43. During cold ship start-up, you should open the feedwater outlet and condensate valves to a DC heater in order to \_\_\_\_\_.
- A. prevent excessive pressure
  - B. avoid running the feed pump "dry"
  - C. expel non-condensable vapors from the vent
  - D. thoroughly atomize incoming condensate

Correct answer: B

44. Which of the following statements is correct regarding the start-up operation of a non-condensing turbine-driven feed pump?
- A. Open the pump suction valve prior to admitting steam to the turbine.
  - B. Keep the steam exhaust valve closed until steam is applied to ensure that the auxiliary exhaust line pressure does not drop.
  - C. Keep the pump casing vent valve closed until flow is established through the pump.
  - D. Secure all drains prior to admitting any steam to avoid damage to traps.

Correct answer: A

45. While underway on watch in the engine room of a steam vessel, the proper valve positions for controlling feedwater to the boiler using the auxiliary feed system should be \_\_\_\_\_.
- A. The stop and stop-check valves fully open and the feed pump speed used to regulate the amount of flow
  - B. The auxiliary check valve fully open and the stop-check valve used to regulate the amount of flow
  - C. The check valve fully open and the stop-check valve regulated by the feedwater regulator
  - D. The stop valve fully open and the auxiliary stop-check valve used to regulate the amount of flow

Correct answer: D

46. If the DC heater relief valve lifts frequently, the cause can be excessive \_\_\_\_\_.
- A. auxiliary exhaust steam pressure
  - B. feedwater recirculated from the feed pump
  - C. condensate supplied to the DC heater
  - D. makeup feed introduced to the system

Correct answer: A

47. The differential temperature of the main condenser cooling water will be significantly affected by a change in \_\_\_\_\_.
- A. condensate pump pressure
  - B. sea temperature
  - C. volume of cooling water flow
  - D. boiler feed pump pressure

Correct answer: C

48. Air accumulated in the intercondenser of the air ejector assembly is discharged directly to the \_\_\_\_\_.
- A. aftercondenser
  - B. main condenser
  - C. high-pressure turbine
  - D. atmosphere

Correct answer: A

49. While vacuum is being raised on the main unit and the turbine is being warmed, condensate is recirculated to the main condenser to \_\_\_\_\_.
- A. ensure the condensation of air ejector steam
  - B. cool the main condenser shell for better vacuum
  - C. provide a condenser vacuum seal
  - D. maintain a proper DC heater water level

Correct answer: A

50. The function of item "E" shown in the illustration is to \_\_\_\_\_. Illustration GS-0099
- A. control the admission of steam into chamber "L" as part of the process to produce sound
  - B. act as a reed to enable the production of sound
  - C. pulse supply steam or air to chamber "M"
  - D. allow steam/condensate or air to be evacuated from the unit as sound is produced

Correct answer: A

51. 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 hotwell level being low. For this condition you should \_\_\_\_\_.
- A. increase steam pressure to the air ejectors
  - B. speed up the condensate pump
  - C. manually recirculate condensate and add some makeup feed
  - D. decrease gland sealing steam pressure

Correct answer: C

52. 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. Galley steam tables
  - C. Fuel oil tank heating coils
  - D. Laundry steam pressing machines

Correct answer: A

53. The temperature of the fuel oil received during bunkering operations is critical in determining the \_\_\_\_\_.
- A. flash point at which the fuel will burn
  - B. expansion space to leave in a tank
  - C. rate at which the fuel can be pumped during transfer operations
  - D. temperature to which the fuel must be heated

Correct answer: B

54. The minimum temperature requirements for fuel oil in storage tanks is related to the \_\_\_\_\_.
- A. size of the vents
  - B. pumpability of the oil
  - C. fire point of the oil
  - D. size of the containment area in case of overflow

Correct answer: B

55. When heated, fuel oil will \_\_\_\_\_.

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

Correct answer: C

56. Which of the following chemicals is used in an Orsat apparatus to absorb carbon dioxide?

- A. Potassium hydroxide
- B. Potassium chromate
- C. Cuprous chloride
- D. Pyrogallic acid

Correct answer: A

57. When burning fuel oil in a boiler, a high CO<sub>2</sub> content is desired in the stack gas because \_\_\_\_\_.

- A. less excess air is required to produce CO<sub>2</sub> than CO
- B. efficient combustion is indicated even though the heat liberated is less than the heat produced by burning to 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 CO<sub>2</sub> than CO

Correct answer: D

58. A flue gas analysis is performed to determine the \_\_\_\_\_.

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

Correct answer: D

59. When you are transferring fuel oil to the settling tanks, precautions to be observed should include \_\_\_\_\_.

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

Correct answer: A

60. Which of the following fuel oil characteristics establishes the danger point when transferring, pumping, and firing procedures are concerned?

- A. Fire point
- B. Viscosity
- C. Flash point
- D. Specific gravity

Correct answer: C

61. The component labeled "F" as shown in the illustration is \_\_\_\_\_. Illustration SG-0007
- A. One of the retractable sootblower elements
  - B. A permanently installed Orsat apparatus
  - C. A regenerative air heater
  - D. One of the main burner assemblies

Correct answer: D

62. According to the illustration, what part number identifies the "igniter"? Illustration SG-0016
- A. 2
  - B. 3
  - C. 7
  - D. 9

Correct answer: A

63. The last two digits stamped on a fuel oil atomizer sprayer plate represents the cross-sectional area ratios of the tangential slots and orifice. This ratio determines the \_\_\_\_\_.
- A. capacity of the atomizer
  - B. degree of atomization
  - C. angle of the cone
  - D. density of the oil spray

Correct answer: C

64. All oil-fired main propulsion burners with automatic safety control systems must automatically close the burner valve when \_\_\_\_\_.
- A. Actuated by a boiler safety trip
  - B. The burner is properly seated
  - C. The flame in boiler furnace is confirmed
  - D. Starting "trial for ignition"

Correct answer: A

65. A flame scanner installed in modern boiler combustion control systems, functions to \_\_\_\_\_.
- A. regulate burner fuel oil pressure
  - B. regulate the air flow to the furnace
  - C. monitor the stack for soot fires
  - D. monitor the intensity of the burner flame

Correct answer: D

66. 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. Bright yellow or orange
  - D. Light brown haze

Correct answer: C

67. Which of the terms listed represents the ratio between the highest and lowest fuel oil pressure at which the burners will remain ignited?

- A. Air/fuel ratio
- B. Firing range ratio
- C. Modulating band ratio
- D. Turndown ratio

Correct answer: D

68. A leaky fuel oil heater relief valve could be indicated by an increase in the \_\_\_\_\_.

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

Correct answer: C

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

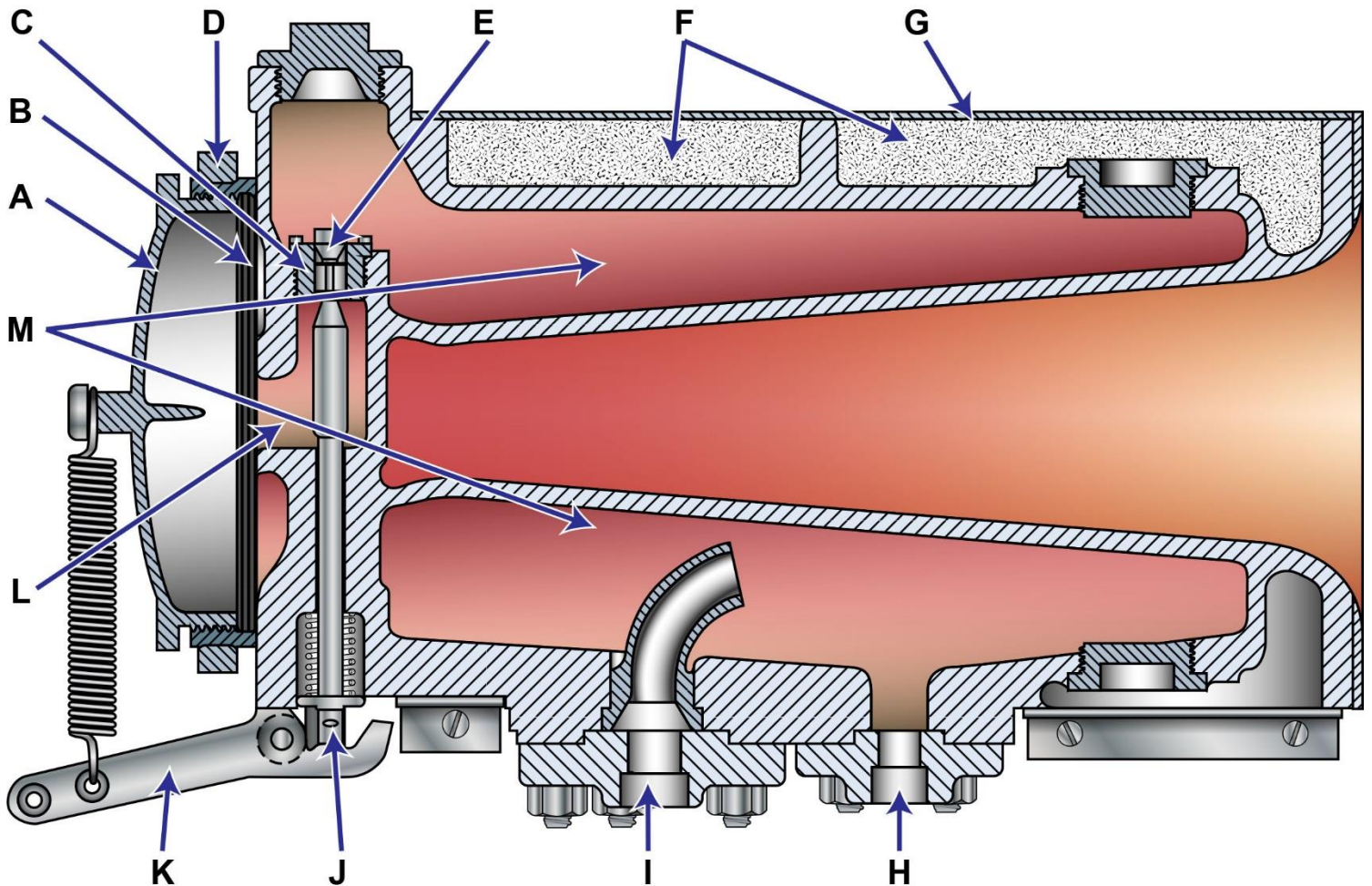
Correct answer: B

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

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

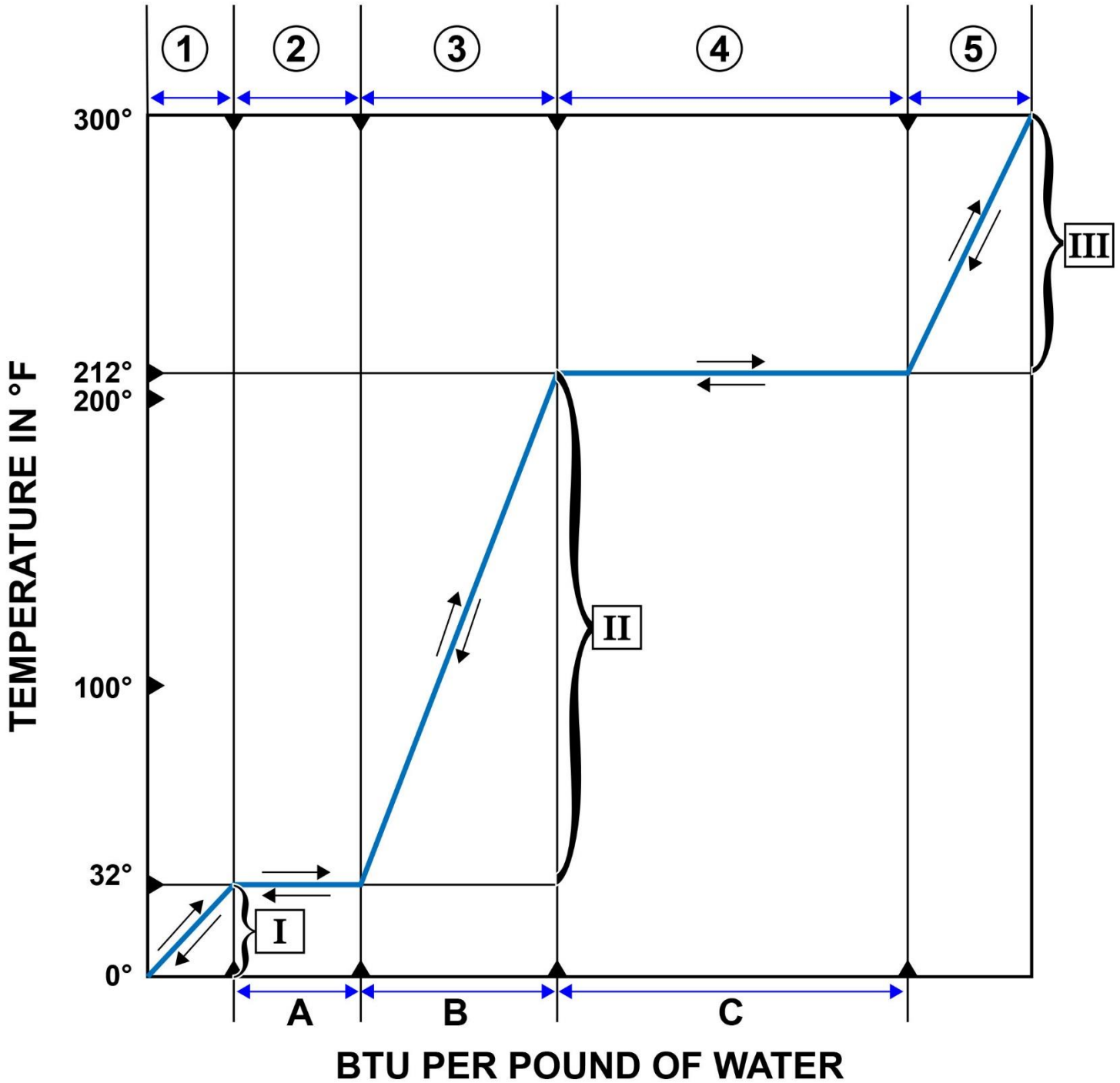
Correct answer: D

## GS-0099



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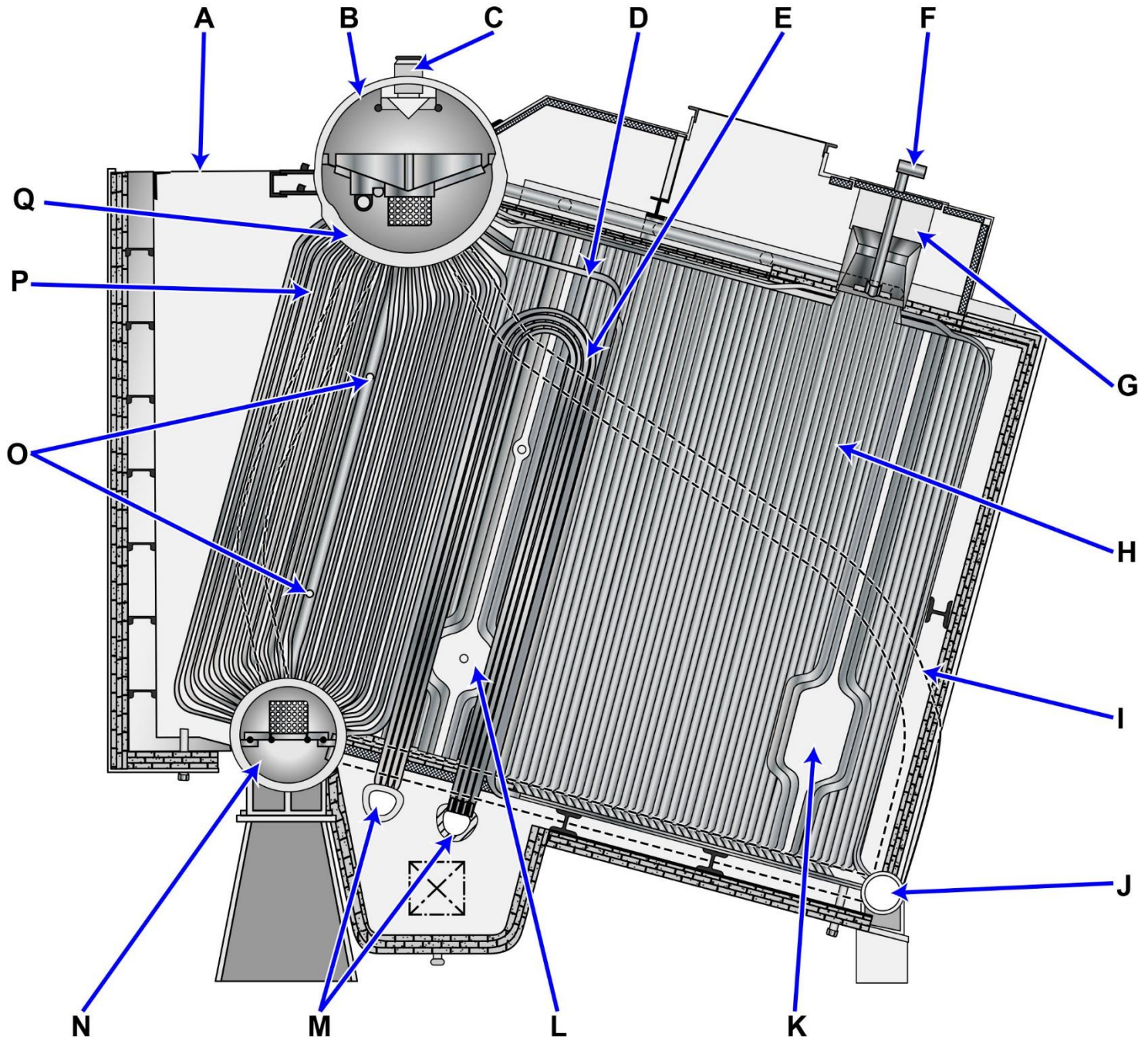
## SG-0001



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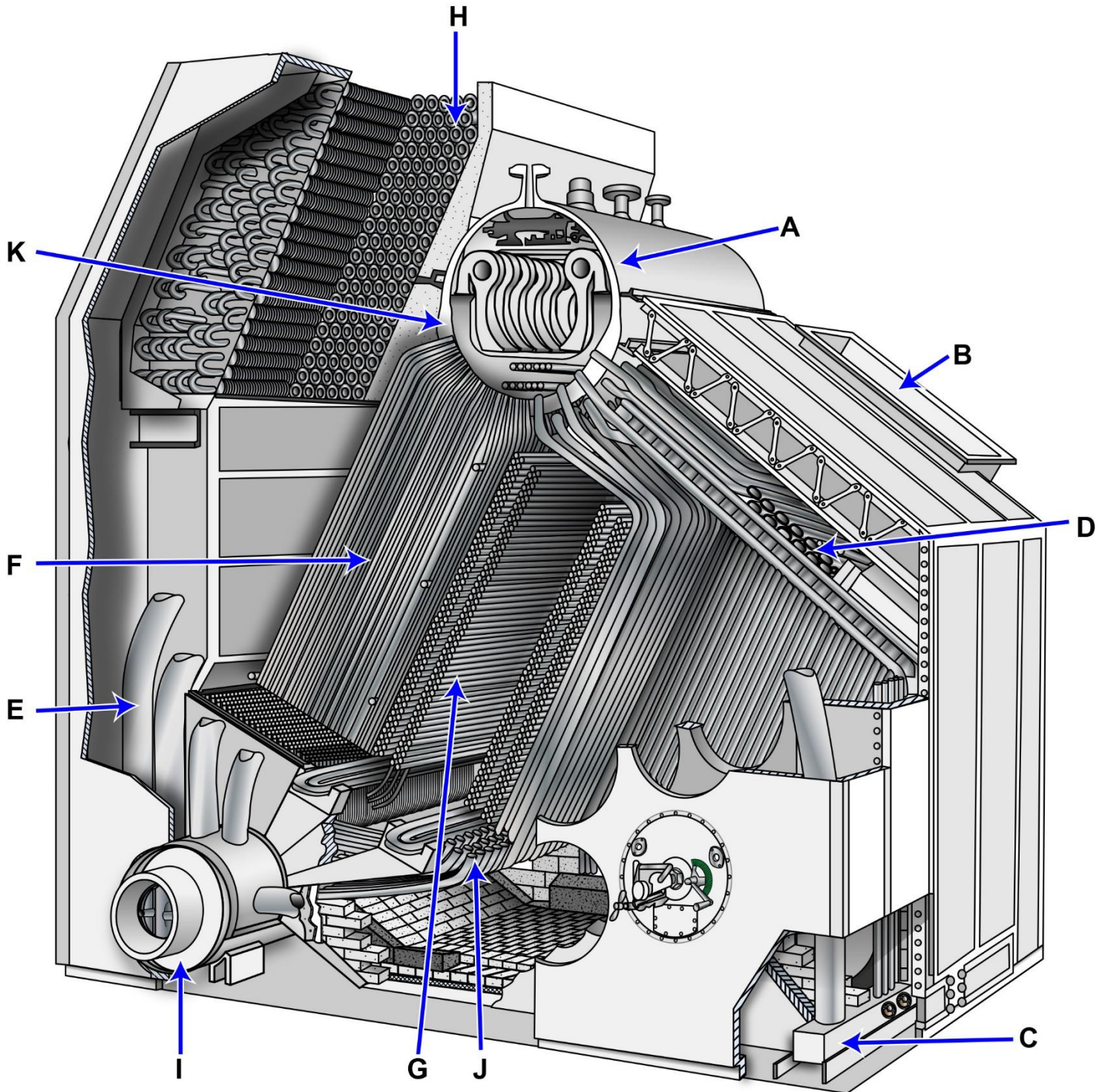
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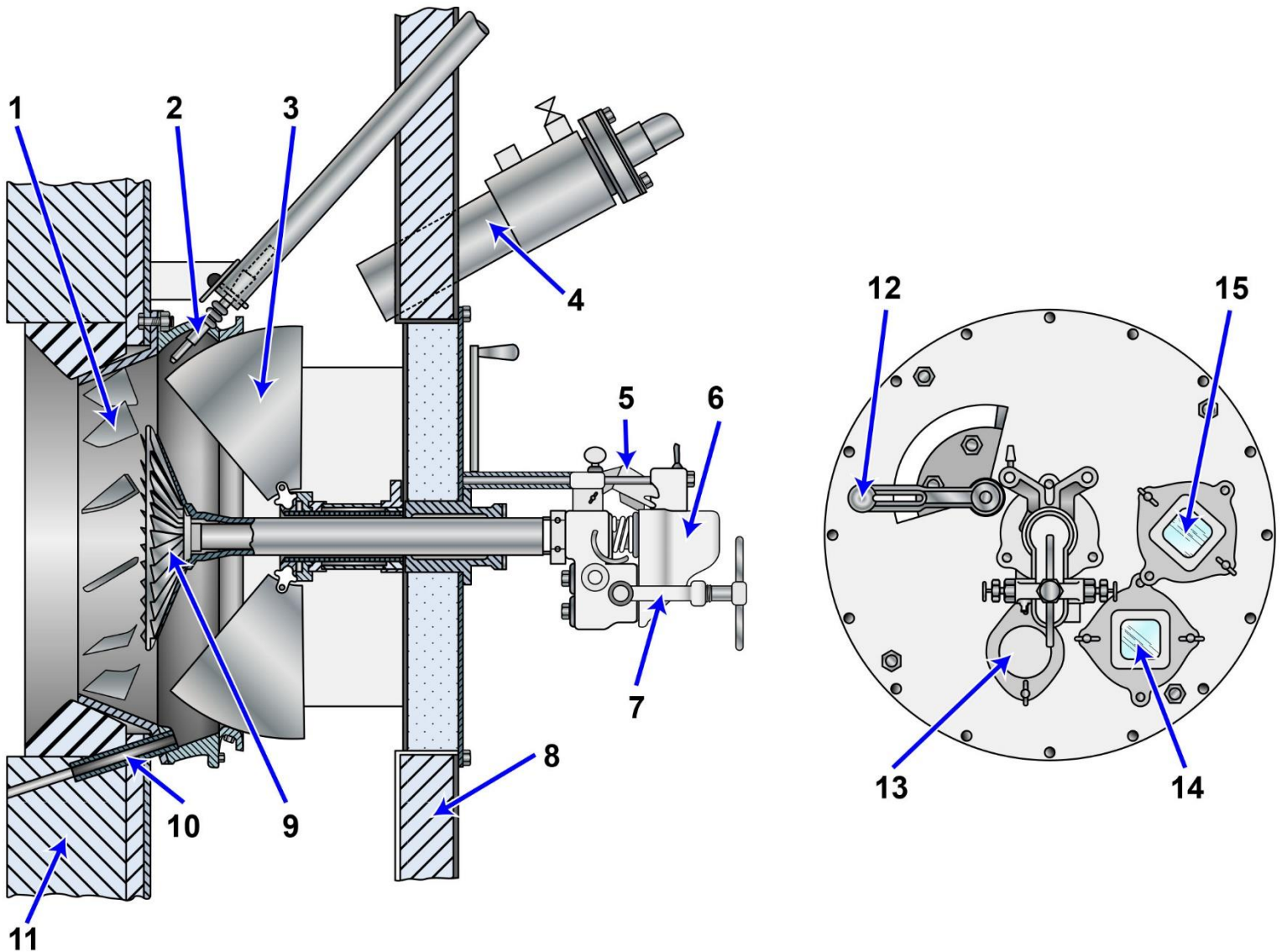


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## SG-0016



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