

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

DDE – Unlimited HP

Q621 Steam Plants

(Sample Examination)

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

1. Which type of energy conversion is associated with an operating steam boiler?

- A. Thermal
- B. Kinetic
- C. Mechanical
- D. Specific

Correct answer: A

2. The best conductor of heat in a marine boiler is \_\_\_\_\_.

- A. water
- B. brick
- C. steam
- D. steel

Correct answer: D

3. The rate of heat transfer in a water-tube boiler can be increased by \_\_\_\_\_.

- A. operating the boiler at less than normal water level
- B. installing fins on the firesides of water-tubes
- C. increasing the amount of excess air to the burners
- D. treating the boiler water with chemical oxygen scavengers

Correct answer: B

4. The purpose of the separating nozzle in the accumulator of a water-tube, coil-type, steam generator is to separate \_\_\_\_\_.

- A. dry steam from the steam and water mixture
- B. condensate from feedwater
- C. superheated steam from saturated steam
- D. sludge accumulations from feedwater

Correct answer: A

5. Which of the following statements concerning fire-tube boilers is correct?

- A. Combustion gases flow through the tubes.
- B. Flames impinge on the tubes.
- C. Combustion occurs in the tubes.
- D. Water flows through the tubes.

Correct answer: A

6. A boiler pressuretrol senses steam pressure changes and \_\_\_\_\_.

- A. controls the flow of feedwater to the boiler
- B. monitors the boiler high water level
- C. secures the fires when a fusible plug burns out
- D. automatically regulates the quantity of oil and air flow to the burner

Correct answer: D

7. A photoelectric cell installed in a boiler burner management system \_\_\_\_\_.
- A. opens the burner circuit upon sensing a flame failure
  - B. detects a flame failure by monitoring radiant heat from glowing refractory
  - C. requires mechanical linkage to secure the burner fuel supply
  - D. must be bypassed at low firing rates

Correct answer: A

8. Bi-color water level indicators, connected directly to the boiler drum, operate on the principle of \_\_\_\_\_.
- A. different chemical properties of steam and water
  - B. special insoluble indicating fluids
  - C. different densities which result from the comparison of the varying steam pressure in the drum
  - D. different refractive properties of steam and water

Correct answer: D

9. The purpose of the mica used in a boiler water gauge 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

Correct answer: C

10. A boiler safety valve must be capable of \_\_\_\_\_.
- A. remaining open until all pressure in the steam drum is relieved
  - B. opening gradually above a designated pressure
  - C. closing with a chattering motion to free scale deposits from the seats
  - D. remaining open until a preset pressure drop occurs

Correct answer: D

11. Which of the listed types of safety valves is shown in the illustration? Illustration SG-0018
- A. Pressure loaded type
  - B. Jet flow type
  - C. Huddling chamber type
  - D. Nozzle reaction type

Correct answer: C

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

Correct answer: C

**13.** Boiler refractory previously baked out and fired is most sensitive to \_\_\_\_\_.

- A. sustained high furnace temperature
- B. rapid heating
- C. radiant heat of the burner
- D. rapid cooling

Correct answer: D

**14.** As the percentage of CO<sub>2</sub> in the stack gas decreases, you can assume that \_\_\_\_\_.

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

Correct answer: A

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

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

Correct answer: B

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

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

Correct answer: A

**17.** Which of the following is the best reason for opening the air cock when draining a water-tube boiler?

- A. Water flows out of the boiler too rapidly with the air cock closed.
- B. With the air cock open, the boiler drains without producing a vacuum.
- C. Air coming into the boiler will help dry out the boiler's surface.
- D. Air mixed with the water will create a cleansing effect in the tubes.

Correct answer: B

**18.** Before using a boiler compressed air soot blower system, you should \_\_\_\_\_.

- A. drain the soot blower pneumatic operating lines
- B. reduce the boiler pressure
- C. decrease the forced draft fan speed
- D. lower the water level

Correct answer: A

- 19.** A hole should be made in the sagged tube occurring in a water-tube boiler, prior to plugging the tube to prevent a \_\_\_\_\_.
- A. complete sagging failure of the tube
  - B. quick burnout of the tube
  - C. pressure buildup in the tube
  - D. crack failure of the tube

Correct answer: C

- 20.** If while filling the boiler a newly installed gasket on a water-tube hand-hole plate weeps, you should \_\_\_\_\_.
- A. use a double gasket
  - B. retighten the stud nut with an air wrench
  - C. coat the gasket with graphite
  - D. center and tighten with correct size wrench

Correct answer: D

- 21.** 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

Correct answer: B

- 22.** To prevent a small plastic refractory wall patch repair from falling into the furnace of a boiler, you should \_\_\_\_\_.
- A. reinforce the patch with fine mesh metal screen
  - B. attach anchor bolts to the furnace casing
  - C. undercut the existing brick around the area to be patched
  - D. mix the plastic with concrete prior to using

Correct answer: C

- 23.** Which procedure should be followed to dry out the fireside of a boiler after water washing?
- A. Use a wire reinforced steam hose to put superheated steam in the furnace for 6 hours.
  - B. Place trays of silica gel in the furnace.
  - C. Open the furnace registers and run the forced draft fans for 3 hours.
  - D. Alternately fire one burner for 15-minute intervals during a 5-hour period.

Correct answer: D

**24.** The boiler water gauge glasses should be blown down \_\_\_\_\_.

- A. when you are in doubt about the water level
- B. twice each day on the midnight and afternoon watches
- C. when the boiler water level changes in a steaming boiler
- D. every 12 hours of steady boiler steaming operation

Correct answer: A

**25.** Water in the fuel supply to a steaming boiler can be detected by \_\_\_\_\_.

- A. dense white smoke being observed in the periscope
- B. panting of the casing
- C. sputtering of the fires
- D. observation of the fuel oil heater drains

Correct answer: C

**26.** Which color burner flame would indicate too much excess air?

- A. Bright red
- B. Incandescent white
- C. Orange red
- D. Yellowish orange

Correct answer: B

**27.** Oil accumulation in boiler water would \_\_\_\_\_.

- A. practically eliminate boiler sludge formation
- B. increase the heat transfer rate
- C. cause foaming and carryover from the boiler
- D. prevent acid attack on the boiler tubes

Correct answer: C

**28.** Boiler tube failures can result from \_\_\_\_\_.

- A. mechanical stress
- B. overheating
- C. corrosion
- D. all of the above

Correct answer: D

**29.** The most troublesome corrosive substances in boiler water are oxygen and \_\_\_\_\_.

- A. ammonia
- B. hydrogen sulfide
- C. carbon dioxide
- D. sulfur dioxide

Correct answer: C

**30.** Normally a boiler water sample should be taken \_\_\_\_\_.

- A. after the boiler has been blown down
- B. when the boiler has been refilled with makeup
- C. before the boiler has been blown down or chemicals added
- D. from the highest point in the feed system

Correct answer: C

**31.** In the prevention of moisture carryover from a marine boiler, one important consideration is to \_\_\_\_\_.

- A. add foaming agents to the boiler water
- B. maintain a high boiler water level
- C. properly treat the boiler water with hydrazine
- D. control the amount of boiler water solids

Correct answer: D

**32.** The BTU value of fuel oil is determined by a/an \_\_\_\_\_.

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

Correct answer: A

**33.** The property of a fuel oil which is a measurement of its available energy, is known as its \_\_\_\_\_.

- A. cetane index
- B. heating value
- C. cetane number
- D. viscosity index

Correct answer: B

**34.** In terms of the completeness of combustion, in viewing the flame through the peephole, what would be the indication of the MOST complete combustion?

- A. Orange flame
- B. Reddish flame
- C. Yellow flame
- D. Golden yellow flame

Correct answer: D

**35.** Control of the fuel oil metering valve in an automatically fired boiler is accomplished by a \_\_\_\_\_.

- A. pressure magnifying device in the steam coil outlet
- B. steam pressure sensing device with linkage to the damper air vanes
- C. metering device in the air supply line
- D. signal from the feedwater electrode

Correct answer: B

**36.** The solenoid valves in the fuel oil supply line to a boiler are automatically closed by \_\_\_\_\_.

- A. a decrease in feed temperature
- B. high furnace air pressure
- C. high steam pressure
- D. low steam pressure

Correct answer: C

**37.** In the boiler steam and water system, pressure is highest in the \_\_\_\_\_.

- A. mud drum
- B. feed line
- C. dry pipe
- D. steam stop

Correct answer: B

**38.** When operating with the auxiliary feed line, feed water flow is controlled \_\_\_\_\_.

- A. manually by throttling the auxiliary feed stop-check valve
- B. manually by adjustment of the auxiliary feedwater regulator spring setting
- C. automatically by the main feedwater regulator
- D. automatically by the eco by-pass

Correct answer: A

**39.** Under normal conditions, the rate of heat transfer in a feed water heater is most greatly affected by the \_\_\_\_\_.

- A. speed of the feed pump
- B. density of the feed water
- C. temperature differential between the steam and feed water
- D. pH of the feed water

Correct answer: C

**40.** Design characteristics of a velocity-compounded impulse turbine include the utilization of \_\_\_\_\_.

- A. two or more simple impulse stages
- B. one or more nozzles with one row of rotating blades
- C. a low velocity steam jet from a nozzle
- D. a single pressure stage with two or more velocity stages

Correct answer: D

**41.** Because of the pressure drop existing across each diaphragm, the flow of steam between the nozzle diaphragm and the rotor of the turbine is held to a minimum by \_\_\_\_\_.

- A. a Babbitt liner
- B. a fluid seal
- C. deflector rings
- D. a labyrinth packing ring

Correct answer: D

- 42.** Large temperature and pressure drops which occur in the first stage of a combination impulse and reaction turbine are caused by steam passing through \_\_\_\_\_.
- A. one or more velocity-compounded impulse stages at the high-pressure end of the turbine
  - B. a nozzle diaphragm in the low-pressure end of the turbine
  - C. a single row of blades more than once
  - D. a dummy piston and cylinder to offset axial thrust

Correct answer: A

- 43.** As steam accomplishes work in an engine or turbine, the pressure of the steam is reduced because it \_\_\_\_\_.
- A. becomes superheated again
  - B. expands in volume
  - C. becomes saturated again
  - D. diminishes in volume

Correct answer: B

- 44.** A turbine assembly in which steam flows in series through a high-pressure turbine and then on to a low-pressure turbine, with both turbines driving a common reduction gear through separate shafts, is classified as \_\_\_\_\_.
- A. cross compound
  - B. tandem compound
  - C. tandem, double flow
  - D. dual series

Correct answer: A

- 45.** Main steam turbine bearings are lined with \_\_\_\_\_.
- A. Babbitt
  - B. cast-iron
  - C. ferrous oxide
  - D. steel

Correct answer: A

- 46.** The correct radial clearances between the rotor and the casing in a propulsion turbine are maintained by the turbine \_\_\_\_\_.
- A. thrust bearing
  - B. journal bearings
  - C. diaphragms
  - D. interstage packing

Correct answer: B

**47.** Allowance for axial expansion of a steam turbine due to temperature changes is provided for by the use of \_\_\_\_\_.

- A. casing flexible joints
- B. rotor position indicators
- C. a deep flexible I beam support
- D. pivoted-shoe type thrust bearings

Correct answer: C

**48.** The adjustable spherically seated self-aligning bearing housings used in turbines are provided with oil deflector rings. The function of these rings is to \_\_\_\_\_.

- A. ensure efficient lubrication of the bearing
- B. prevent the leakage of main steam into the oil
- C. prevent the external leakage of oil out of the bearing housing
- D. direct the flow of oil through the bearing

Correct answer: C

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

- A. Dovetail
- B. Labyrinth
- C. Teflon
- D. Carbon

Correct answer: B

**50.** If contaminated lube oil were allowed to settle undisturbed in a tank, into which layers would the contaminants separate?

- A. Water on the bottom, sediment in the middle, and oil on top.
- B. Sediment on the bottom, oil in the middle, and water on top.
- C. Sediment on the bottom, water in the middle, and oil on top.
- D. Water on the bottom, oil in the middle, and sediment on top.

Correct answer: C

**51.** Which of the following conditions is indicated by oil flowing through a lube oil gravity tank overflow sight glass?

- A. Insufficient oil is being pumped to the gravity tank.
- B. Sufficient oil flow is being supplied to the gravity tank.
- C. Excessive oil is stored in the gravity tank.
- D. Turbine bearing failure has occurred.

Correct answer: B

**52.** 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

Correct answer: C

**53.** The lube oil coolers installed in a gravity lubricating oil system are located between the \_\_\_\_\_.

- A. lube oil pumps and gravity tanks
- B. gravity tanks and main units
- C. gravity tanks and lube oil sump
- D. lube oil sump and lube oil pumps

Correct answer: A

**54.** What type of strainer is used in a turbine lube oil system to remove metallic particles?

- A. Fuller's earth filter
- B. Simplex filter
- C. Magnetic basket strainer
- D. Metal edge strainer

Correct answer: C

**55.** Of the many impurities commonly found in marine lubricating oil, which of the following CANNOT be removed by a centrifugal purifier at normal operating speeds and temperatures?

- A. Metal particles
- B. Water
- C. Diesel fuel oil
- D. Carbon particles

Correct answer: C

**56.** When monitoring steam propulsion plant lubricating oil temperatures while underway, what represents the temperature rise across an individual bearing?

- A. The temperature difference between the bearing lube oil outlet temperature and the lube oil cooler oil outlet temperature.
- B. The temperature difference between the bearing lube oil outlet temperature and the lube oil cooler oil inlet temperature.
- C. The temperature difference between the lube oil cooler oil inlet temperature and the lube oil cooler oil outlet temperature.
- D. It is NOT possible to determine individual bearing temperature rises for lubricating oil.

Correct answer: A

**57.** The splits located in the halves of main reduction gear bearings are aligned at an angle to the horizontal in order to resist \_\_\_\_\_.

- A. steam loss
- B. wiping
- C. axial stress
- D. oil loss

Correct answer: B

**58.** On main turbine propulsion units, gear-type flexible couplings are generally used between the \_\_\_\_\_.

- A. second reduction and the shaft thrust bearing
- B. quill shaft and high-speed pinion
- C. rotor shaft and quill shaft
- D. rotor shaft and pinion shaft

Correct answer: D

**59.** The component shown in the illustration, labeled "I", is the \_\_\_\_\_. Illustration SE-0013

- A. second reduction pinion
- B. first reduction gear
- C. first reduction pinion
- D. second reduction gear

Correct answer: B

**60.** 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. G and H
- B. F and J
- C. F and H
- D. G and J

Correct answer: B

**61.** While your vessel is underway at normal speed, a steam drum safety valve develops a significant leak. Your first corrective action should be to \_\_\_\_\_.

- A. secure the boiler and blank off the valve flange
- B. attempt to reseat the valve using the hand releasing gear
- C. secure the boiler and check the valve spring compression
- D. inspect the escape piping for binding on the valve body

Correct answer: B

**62.** Where do fuel oil vapors tend to accumulate in an engine room?

- A. In the upper engine room spaces, especially in the fidley
- B. Oil vapors tend to distribute throughout the engine room evenly
- C. At the point in the engine room where the vapors were initially formed
- D. In the lower engine room spaces, especially in the bilges

Correct answer: D

**63.** Before any auxiliary diesel engine hydraulic starting system is opened for servicing or repair, you must \_\_\_\_\_.

- A. place all control levers in the 'HOLD' position
- B. ensure that the hydraulic fluid reservoir is full
- C. block all hydraulic hoses using high-pressure covers
- D. bleed off all hydraulic pressure from the system

Correct answer: D

**64.** In diesel engines, hydraulic valve lifters are used to \_\_\_\_\_.

- A. obtain greater valve lift
- B. reduce valve gear pounding
- C. increase valve operating lash
- D. create longer valve duration

Correct answer: B

**65.** The Fairbanks Morse part labeled "G", as shown in the illustration, is a \_\_\_\_\_. Illustration MO-0040

- A. connecting rod bushing
- B. bearing shell
- C. piston bushing
- D. connecting rod cap

Correct answer: A

**66.** The service life of a worn aluminum piston for an auxiliary diesel, for which no spares are readily available, can be extended by \_\_\_\_\_.

- A. turning down the piston skirt to concentric values
- B. building up the piston skirt with a liquid epoxy material and then re-machining
- C. knurling the piston skirt surface
- D. increasing the dimensions of the ring land grooves

Correct answer: C

**67.** If an auxiliary diesel engine equipped with an electric starting system cranks very slowly after repeated attempts to start, the cause could be a/an \_\_\_\_\_.

- A. low compression pressure
- B. ring gear with broken teeth
- C. overheated motor windings
- D. low lube oil viscosity

Correct answer: C

**68.** Fuel oil contamination of an auxiliary diesel engine lube oil can result in \_\_\_\_\_.

- A. emulsion
- B. higher lube oil pressures
- C. an increased viscosity
- D. lower lube oil pressures

Correct answer: D

**69.** High exhaust temperature and black smoke exhausting from an auxiliary diesel engine can be caused by \_\_\_\_\_.

- A. low combustion temperature
- B. engine overload
- C. excessive compression pressure
- D. plugged fuel nozzle holes

Correct answer: B

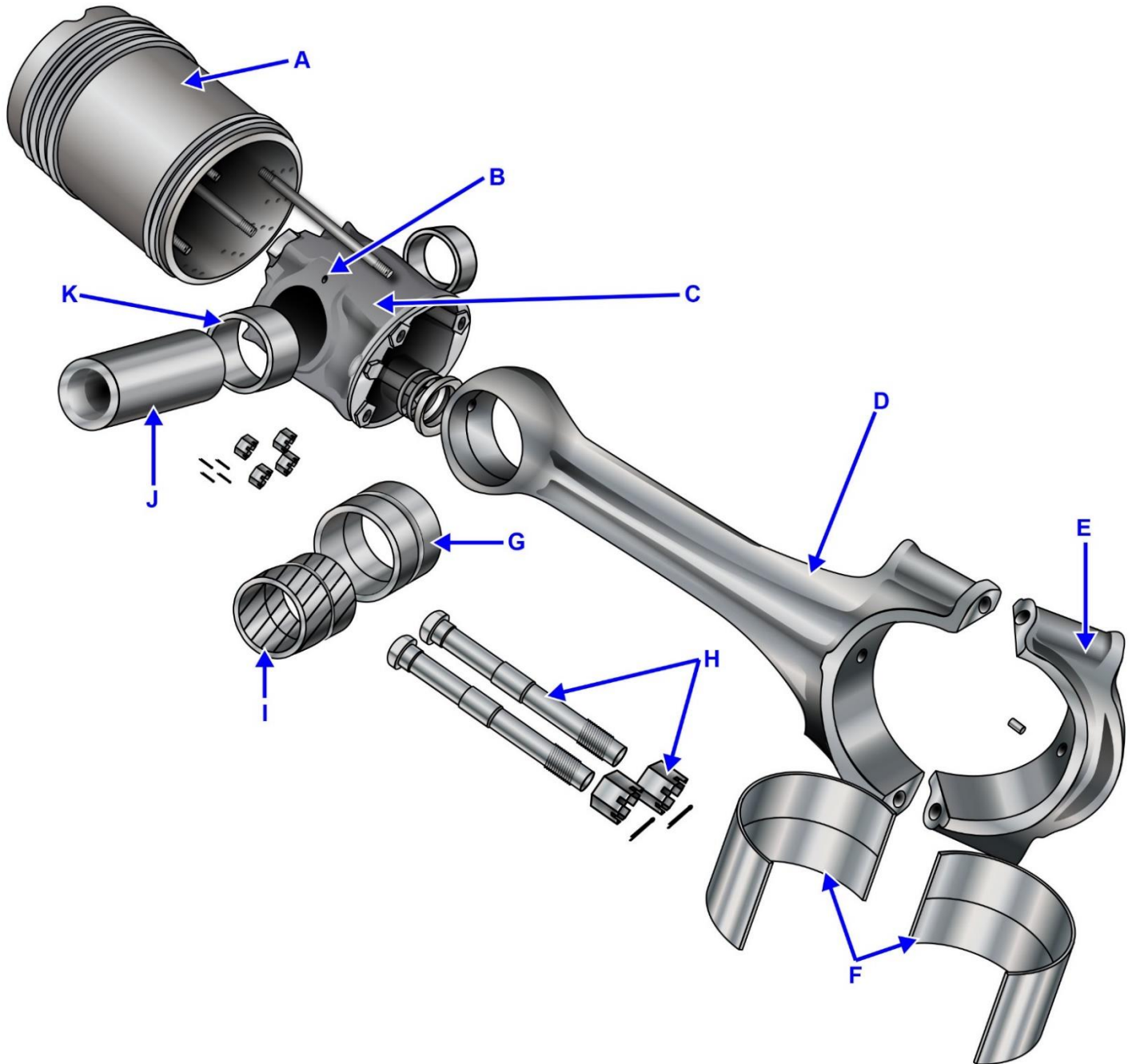
**70.** All of the diesel engine cylinder firing pressures are normal, yet all of the exhaust temperatures are low. Which of the following situations is responsible for this condition?

- A. Leaking piston rings
- B. Excessively early injection timing
- C. Combustion knock
- D. Light load

Correct answer: D



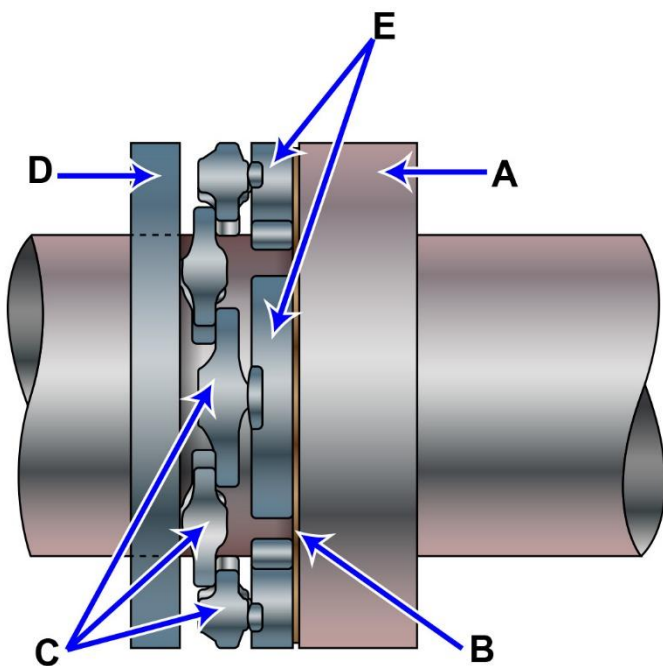
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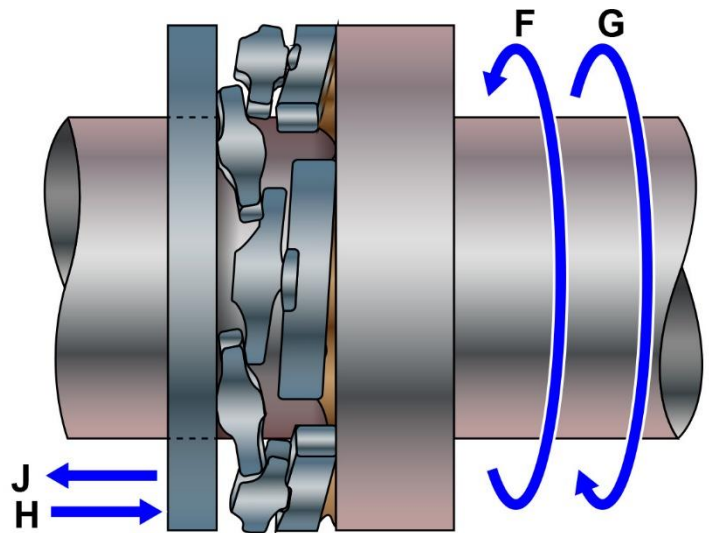
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SE-0012



Stationary View

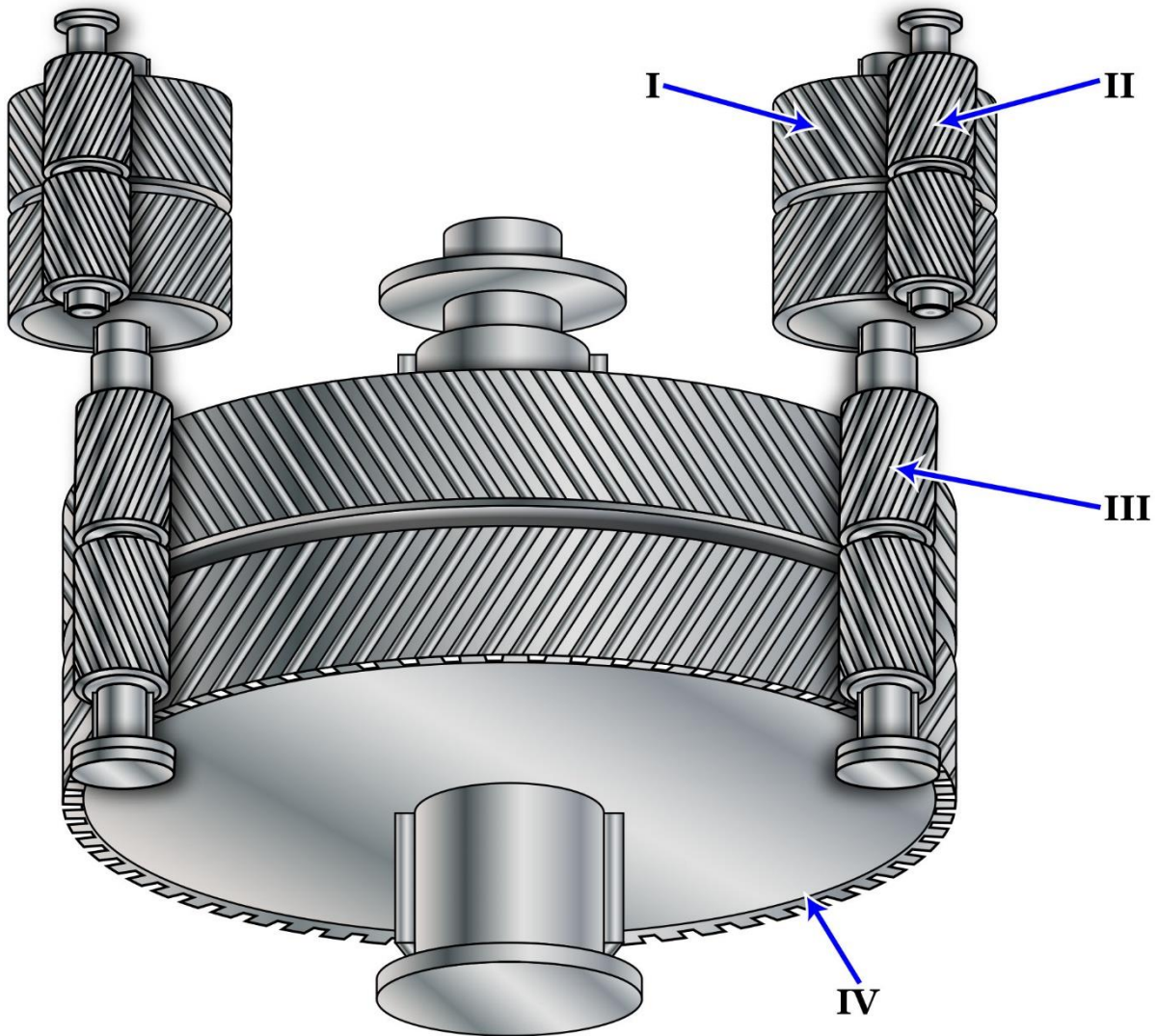


Rotating View

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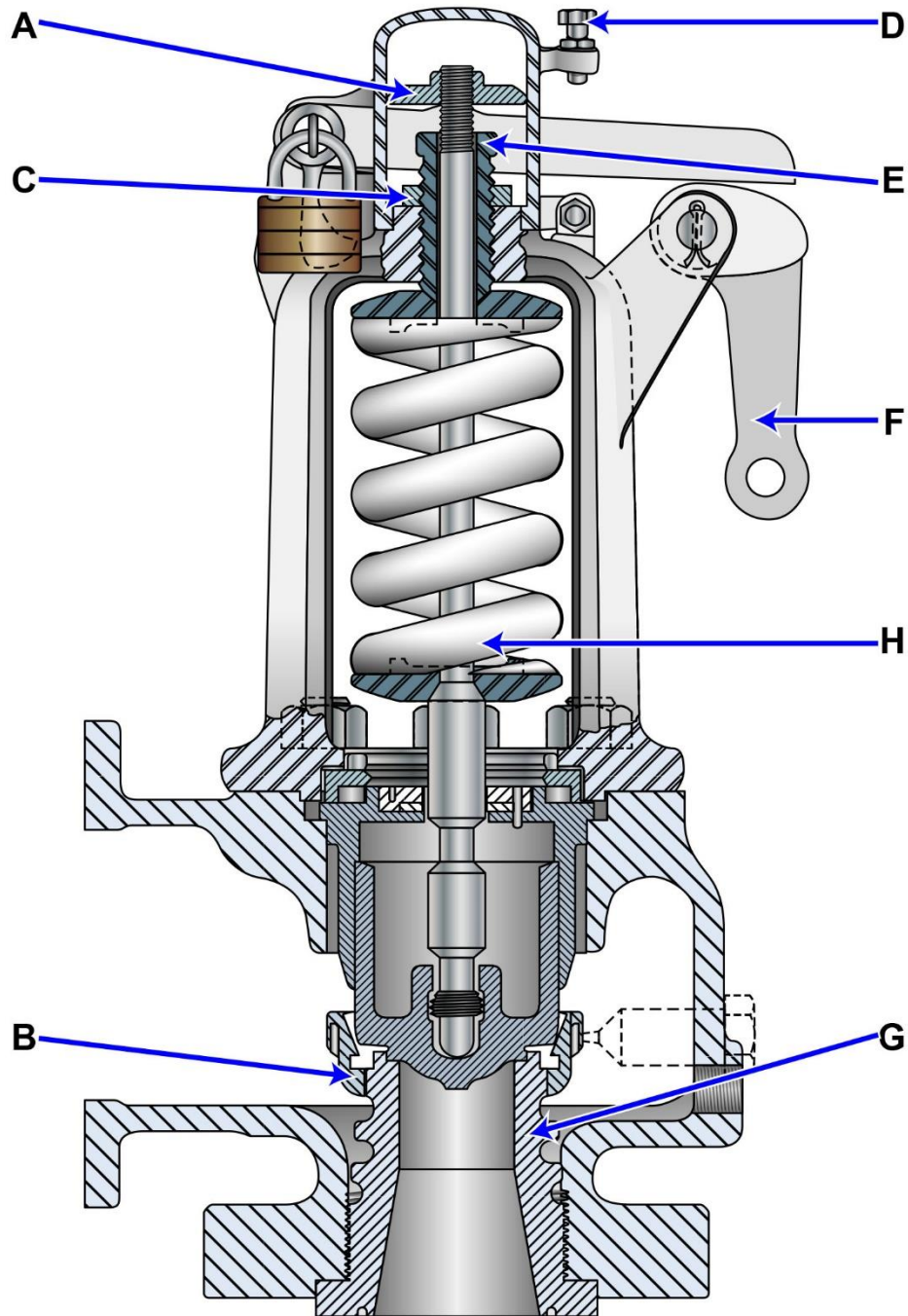
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**SG-0018**



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