

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

### MODU – Assistant Engineer

#### Q715 Motor Plants

#### (Sample Examination)

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

1. The ratio of the brake horsepower to the indicated horsepower of a diesel engine is its \_\_\_\_\_.
- A. thermal efficiency
  - B. mechanical efficiency
  - C. brake thermal efficiency
  - D. volumetric efficiency

Correct answer: B

2. The bore of a diesel engine cylinder describes the \_\_\_\_\_.
- A. swept volume of the cylinder
  - B. inside diameter of the cylinder
  - C. piston displacement in the cylinder
  - D. length of the piston stroke

Correct answer: B

3. Which of the terms listed below represents the speed at which the natural period of vibration of a shaft or other machine part is in synchronism with the power impulses?
- A. Non-harmonic speed
  - B. Critical speed
  - C. Maximum speed
  - D. Design maximum speed

Correct answer: B

4. The proper location for journal bearing oil grooves is \_\_\_\_\_.
- A. in the region of the load bearing surface
  - B. as a side relief where the two shells meet
  - C. at the bottom of the bearing
  - D. halfway between bottom and where shells meet

Correct answer: B

5. In the diesel engine shown in the illustration, which of the following statements is true? Illustration MO-0005
- A. The engine utilizes wet cylinder liners
  - B. The camshaft turns at half the speed of the crankshaft
  - C. The intake valves are operated with a valve bridge
  - D. All of the above

Correct answer: D

6. The piston shown in the illustration is a \_\_\_\_\_. Illustration MO-0011
- A. single-acting trunk piston
  - B. double-acting trunk piston
  - C. single-acting crosshead piston
  - D. double-acting crosshead piston

Correct answer: A

7. Camshafts are usually driven by timing gears or \_\_\_\_\_.

- A. push rods
- B. chain drives
- C. rocker arms
- D. flywheels

Correct answer: B

8. Which of the listed design features is found in an exhaust valve and NOT in an intake valve?

- A. High alloy steel
- B. Zinc alloy stems
- C. Swirling vanes
- D. Low alloy steel

Correct answer: A

9. The diesel engine wrist pin in the illustration is indicated by the component labeled \_\_\_\_\_.  
Illustration MO-0122

- A. "7"
- B. "17"
- C. "G"
- D. "S"

Correct answer: A

10. Which of the following represents the diesel engine camshaft shown in the illustration and its relative rotating speed? Illustration MO-0122

- A. "B" is the camshaft and it rotates at one-half of the crankshaft speed.
- B. "T" is the camshaft and its speed equals crankshaft speed.
- C. "B" is the camshaft and its rpm will match that of the flywheel.
- D. "Y" is the main camshaft drive and rotates at crankshaft speed.

Correct answer: C

11. In the diesel engine illustration provided, which of the given choices indicate rocker arm assemblies?  
Illustration MO-0122

- A. "D" and "ZZ"
- B. "B" and "Z"
- C. "C" and "Y"
- D. "C" and "Z"

Correct answer: C

12. An accumulator used in a hydraulic starting system is generally located between the \_\_\_\_\_.

- A. pump and the compressor
- B. storage tank and the pump
- C. starting motor and the reserve tank
- D. pump and the starting motor

Correct answer: D

13. A two-stroke cycle diesel engine requires less starting air than a four-stroke cycle diesel engine of equal displacement, because the two-stroke cycle diesel engine \_\_\_\_\_.
- A. has little or no internal friction
  - B. has a lower effective compression ratio
  - C. operates with scavenge air under a positive pressure
  - D. operates without energy absorbing intake and exhaust strokes

Correct answer: D

14. Auxiliary diesel engine electric starting motors use \_\_\_\_\_.
- A. 400 cycle per second motor-generator power
  - B. battery power direct current
  - C. alternating current transformers
  - D. low amperage, high voltage AC power

Correct answer: B

15. Air motors used for starting some auxiliary diesel engines are generally the type known as \_\_\_\_\_.
- A. plunger motors
  - B. gear motors
  - C. vane motors
  - D. accumulator motors

Correct answer: C

16. In a direct cylinder admission air starting system, once the engine begins to fire, the air starting check valve illustrated, is closed by \_\_\_\_\_. Illustration MO-0107
- A. the starting air pressure
  - B. the spring force and cylinder pressure
  - C. a valve actuating cam
  - D. a pneumatic bellows assembly

Correct answer: B

17. A diesel engine should use which type of lubricating oil?
- A. Low viscosity
  - B. Cutting oil
  - C. High grade vegetable oil
  - D. Detergent oil

Correct answer: D

18. The TBN value of diesel engine lube oil refers to its ability to \_\_\_\_\_.
- A. resist changes in viscosity with changes in temperature
  - B. resist emulsification
  - C. neutralize acids
  - D. resist oxidation at high temperatures

Correct answer: C

19. The lube oil strainer shown in the illustration is used on the reduction gear of a mid-size diesel engine. The strainer elements consist of \_\_\_\_\_. Illustration MO-0057
- A. pleated paper
  - B. wire mesh
  - C. fibrous braid
  - D. metal disks

Correct answer: D

20. The Wartsila 64 engine is equipped with automatic backflushing lube oil filter systems. These type of filtration systems require \_\_\_\_\_.
- A. minimal maintenance and no disposable filter cartridges
  - B. draining of sediment every watch
  - C. shifting of filter units on a daily basis
  - D. frequent monitoring of differential pressure gauges

Correct answer: A

21. The lube oil cooler is located after the lube oil filter in order for \_\_\_\_\_.
- A. the filter to operate more efficiently
  - B. the lube oil cooler to be bypassed
  - C. positive lube oil pump suction to be assured
  - D. galvanic action in the cooler to be minimized

Correct answer: A

22. The vessel to which you are assigned is fitted with generator engines as shown in the illustration. What statement is true concerning the cylinders? Illustration MO-0163
- A. The cylinder liners are of the dry type and are replaceable inserts.
  - B. The cylinder liners are of the jacketed type and are replaceable inserts.
  - C. The cylinder walls are integral (non-replaceable) to the cylinder block.
  - D. The cylinder liners are of the wet type and are replaceable inserts.

Correct answer: D

23. If the analysis of used lube oil indicates a high content of iron particles, this could indicate \_\_\_\_\_.
- A. corrosive deterioration of a bearing
  - B. inadequate air filtration
  - C. excessive ring and liner wear
  - D. excessive cooling of lubricating oil

Correct answer: C

24. Pre-combustion chambers and energy cells in high-speed, small bore diesel engines all serve to increase \_\_\_\_\_.
- A. firing pressure
  - B. ignition quality of fuel
  - C. fuel/air ratio during compression
  - D. turbulence

Correct answer: D

25. Open combustion chambers are designed to \_\_\_\_\_.

- A. eliminate carbon buildup
- B. improve piston cooling
- C. prevent air charge turbulence
- D. provide proper fuel/air mixing

Correct answer: D

26. Pre-combustion chamber engines inject fuel into an antechamber located in the cylinder wall or cylinder head. What is the antechamber referred to when the injection nozzle is located in the main combustion chamber, outside of the antechamber?

- A. swirl chamber
- B. charging cell
- C. pressure pocket
- D. energy cell

Correct answer: D

27. With respect to diesel fuel, the ease with which a cold engine will start is dependent upon the \_\_\_\_\_.

- A. ignition quality of the fuel
- B. high heating value of the fuel
- C. amount of carbon residue after combustion
- D. internal flow resistance in the injectors

Correct answer: A

28. The unit of measure expressed as centistokes (cSt) is a measure of what fuel property?

- A. Heating value
- B. Density
- C. Viscosity
- D. Cetane rating

Correct answer: C

29. Fuel injection systems are designed to primarily meter fuel, atomize fuel, and \_\_\_\_\_.

- A. create turbulence in the combustion chamber
- B. aid in completing cylinder scavenging
- C. inject fuel at the proper time
- D. minimize fuel penetration into the cylinder

Correct answer: C

30. Fuel injector nozzles are usually of the multi-orifice type with the number and placement of the holes arranged according to the \_\_\_\_\_.

- A. type of piston rings
- B. pressure of the fuel system
- C. size of the pump plunger spring
- D. design of the combustion chamber

Correct answer: D

31. The amount of fuel delivered by a unit injector is controlled by the \_\_\_\_\_.

- A. camshaft
- B. main spring
- C. rack position
- D. engine speed

Correct answer: C

32. What is the purpose of the "window" installed in the housing of an individual jerk pump?

- A. To allow the pump to be timed to the engine
- B. To check for sludge on the pump barrel
- C. To check that fuel oil return passages are clear
- D. To set up the fuel rack calibration in cubic millimeters

Correct answer: A

33. As shown in the illustration of the fuel injection pump, the function of the area designated as "G" is to \_\_\_\_\_ . Illustration MO-0061

- A. control the fuel injection rate
- B. provide a fuel supply to the pump
- C. lubricate the plunger
- D. relieve excessive injector discharge pressure

Correct answer: B

34. Which of the following is a benefit of the common rail fuel injection system?

- A. Lower specific fuel consumption
- B. Smoke reduction over the entire load range
- C. Nitrous oxide (emissions) reduction
- D. all of the above

Correct answer: D

35. What is the approximate fuel pressure in a common rail fuel injection system?

- A. 1,000-2,000 psi
- B. 300-1,000 psi
- C. 15,000-30,000 psi
- D. 100,000-200,000 psi

Correct answer: C

36. In an engine with a common rail fuel injection system, the amount of fuel delivered to the cylinder is controlled by \_\_\_\_\_.

- A. camshaft
- B. rack position
- C. electronic control unit
- D. engine speed

Correct answer: C

37. Cooling the intake air supplied to a diesel engine will \_\_\_\_\_.

- A. reduce mean effective pressure
- B. decrease average compression ratio
- C. decrease air charge density
- D. increase peak power output

Correct answer: D

38. Which of the following exhaust gas emissions from an LNG fueled diesel engine is the most potent greenhouse gas?

- A. Hydrogen sulfide
- B. Methane
- C. Methyl mercaptan
- D. CO<sub>2</sub>

Correct answer: B

39. Of the various components of LNG (Liquefied natural gas) and CNG (Compressed natural gas) which of the following comprises 90 percent of the gas?

- A. Octane
- B. Methane
- C. Sulphur Hexafluoride
- D. Nitrous Oxide

Correct answer: B

40. What is the function of the device labeled "3" shown in the illustration? Illustration MO-0111

- A. The device specifically serves to remove the latent heat of vaporization from the jacket water.
- B. The jacket water cooler is used to raise the temperature of the sea water flowing through it.
- C. The heat exchanger serves to heat the jacket water during cold water operation.
- D. The cooler removes sensible heat from the jacket water.

Correct answer: D

41. The average exhaust temperature of a two-stroke cycle diesel engine with a turbine-driven supercharger is lower than a similar four-stroke cycle diesel engine at equal loads because \_\_\_\_\_.

- A. Two-stroke cycle diesel engines have a higher M.E.P. than four-stroke cycle diesel engines
- B. Four-stroke cycle diesel engine exhaust is cooled by scavenging air
- C. Two-stroke cycle diesel engines have a lower M.E.P. than four-stroke cycle diesel engines
- D. The opening of the two-stroke cycle diesel exhaust ports or valves occurs much later than in four-stroke cycle diesel engines

Correct answer: C

42. What is the function of the after coolers installed in the diesel engine air intake system?

- A. Decrease the air density
- B. Increase the exhaust temperature
- C. Decrease the lube oil temperature
- D. Increase the air density

Correct answer: D



43. Which of the designs listed will keep the lobes from making contact in a Roots-type blower?

- A. Drive chain
- B. Blower timing gears
- C. Air trapped between blower lobes
- D. Oil filter between blower lobes

Correct answer: B

44. In a turbocharger, inlet air velocity is increased in the \_\_\_\_\_.

- A. Inlet nozzle ring
- B. Stationary diffuser passages
- C. Compressor outlet volute
- D. Rotating impeller vanes

Correct answer: D

45. The pressure-volume diagrams illustrated are of four internal combustion engine cycles. Which one represents the theoretical diesel cycle? Illustration MO-0102

- A. A
- B. B
- C. C
- D. D

Correct answer: B

46. The direct acting mechanical governor used with some small diesel engines, controls fuel flow to the engine by \_\_\_\_\_.

- A. Governor flyweight action on a pilot valve which controls fuel injection
- B. Positioning a butterfly valve in the fuel delivery system
- C. Governor flyweight motion acting on fuel controls through suitable linkage
- D. Positioning a servomotor piston attached to the fuel controls

Correct answer: C

47. The exhaust ports shown in the illustration are initially uncovered in figure \_\_\_\_\_. Illustration MO-0025

- A. 3
- B. 4
- C. 5
- D. 6

Correct answer: A

48. Which segment of the two-stroke cycle engine diagram shown represents the power stroke? Illustration MO-0037

- A. I
- B. IV
- C. V
- D. VI

Correct answer: D

49. In the illustration, the intake valve closes at what point on the four-stroke cycle engine diagram shown? Illustration MO-0084

- A. 45 degrees after BDC
- B. 55 degrees before BDC
- C. 75 degrees before TDC
- D. 85 degrees after TDC

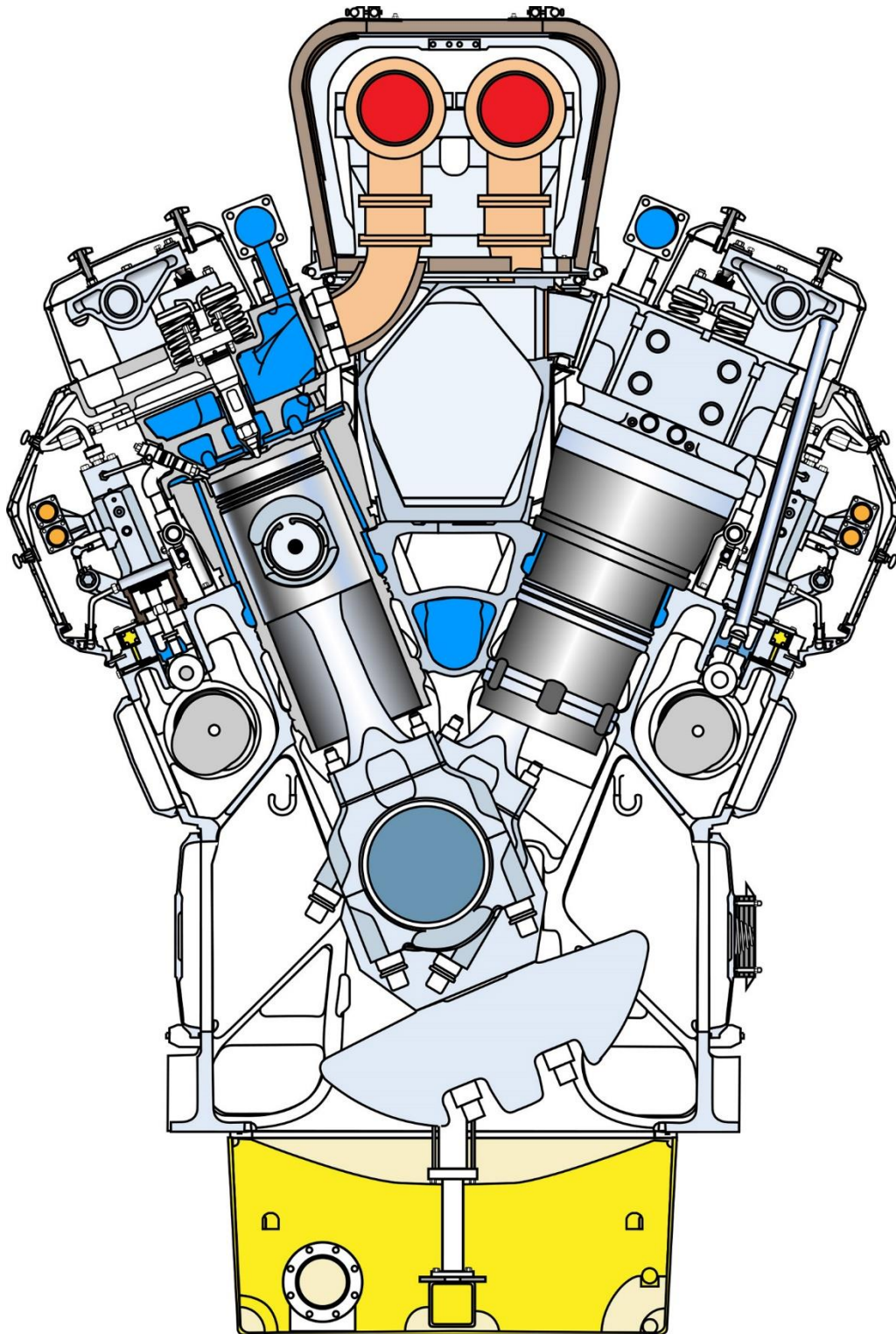
Correct answer: A

50. A four-stroke eight cylinder in-line medium-speed diesel engine has a firing order of 1-5-2-6-8-4-7-3. If No.4 piston is at TDC and firing, how many degrees of crankshaft rotation will occur when No.5 piston reaches TDC and fires?

- A. 120 degrees
- B. 180 degrees
- C. 240 degrees
- D. 360 degrees

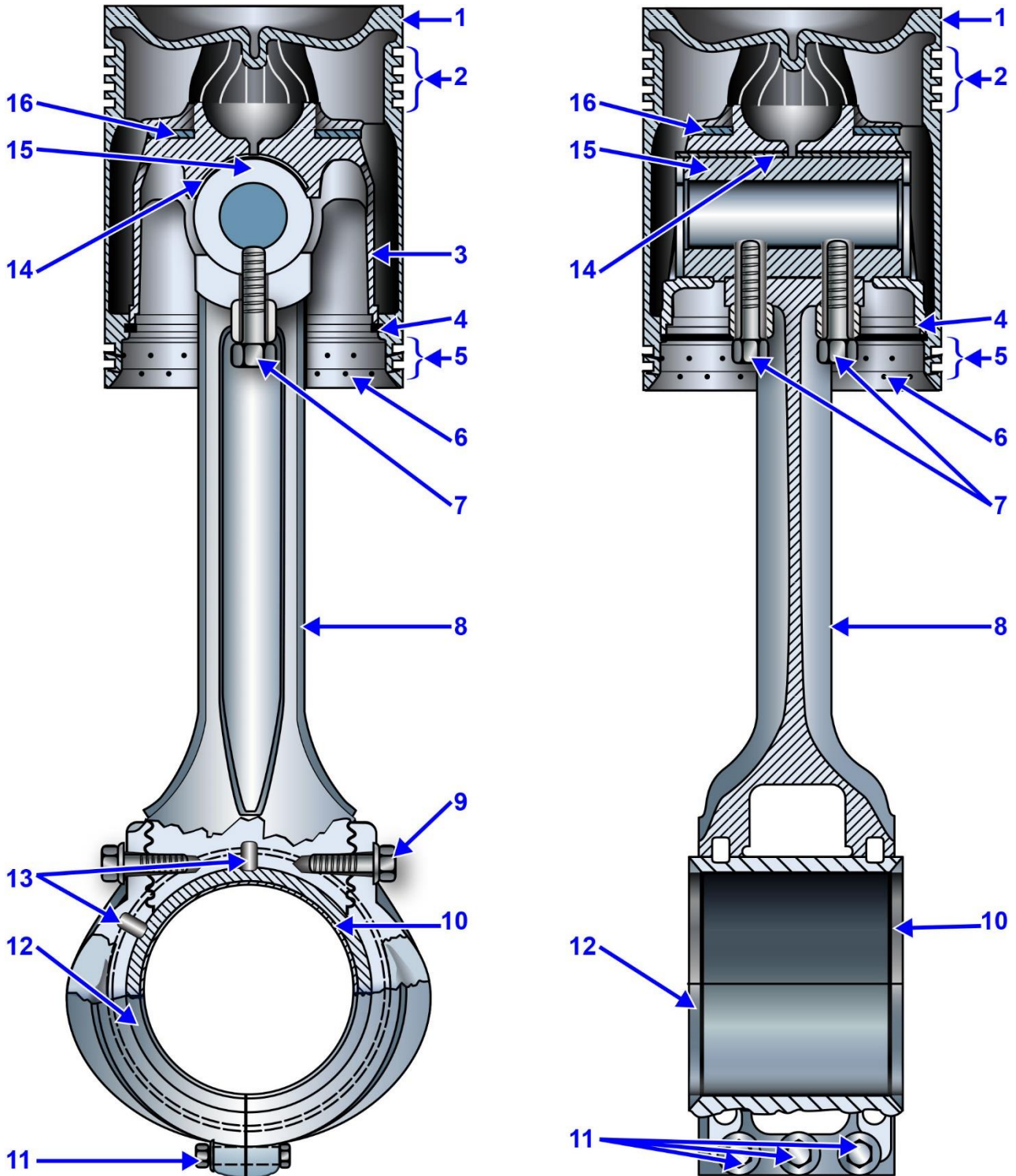
Correct answer: D

## MO-0005



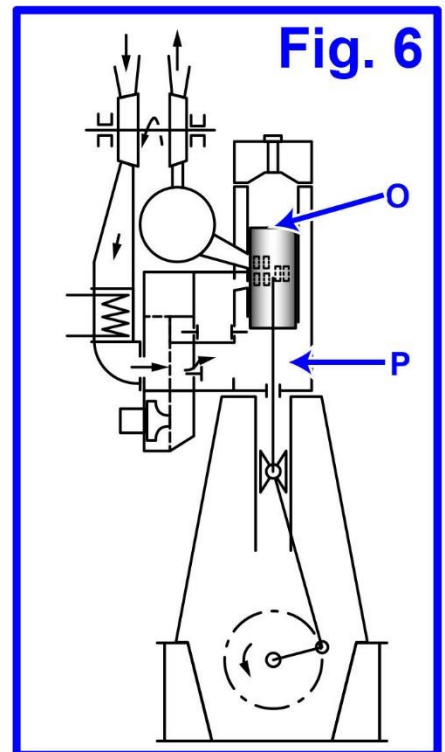
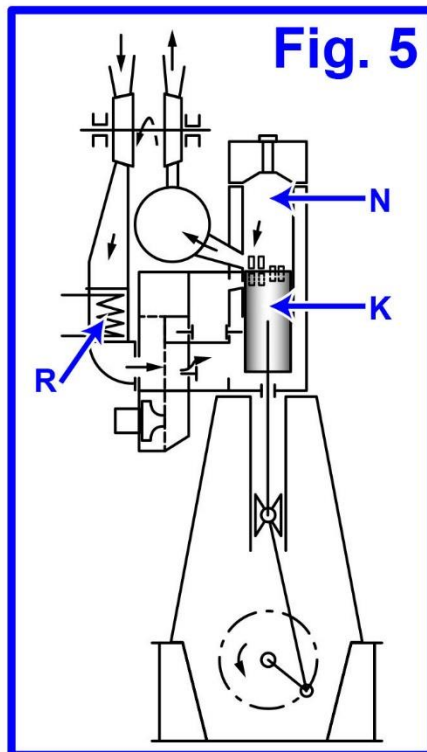
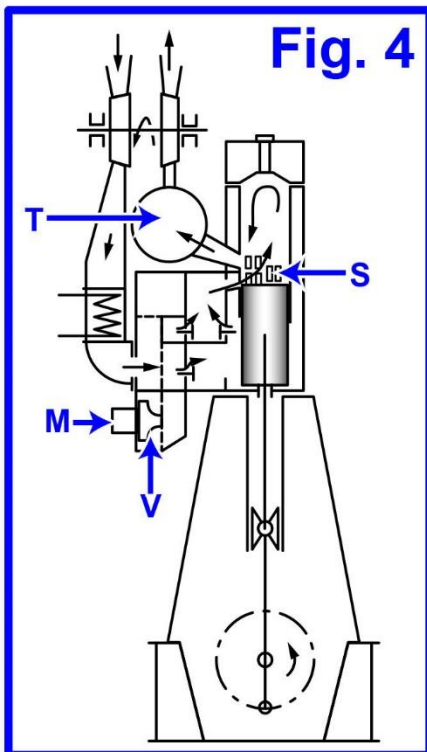
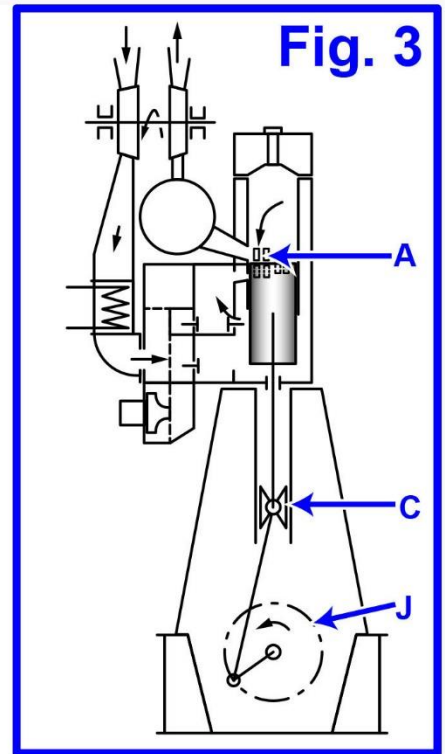
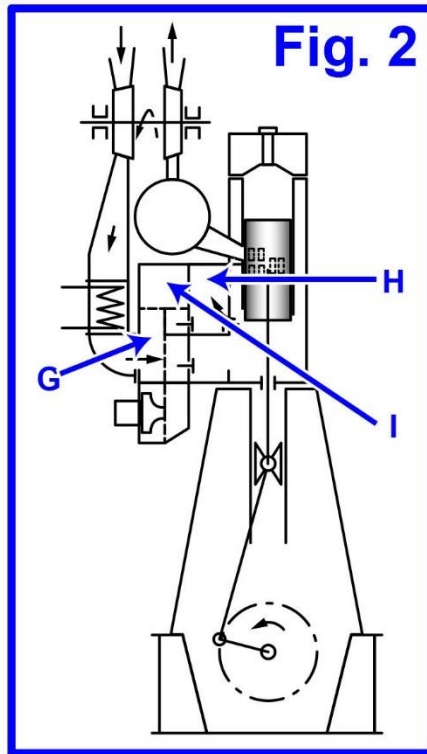
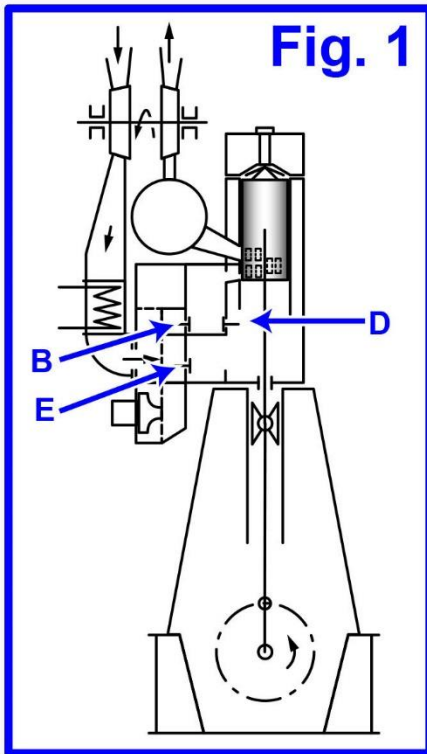
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## MO-0011



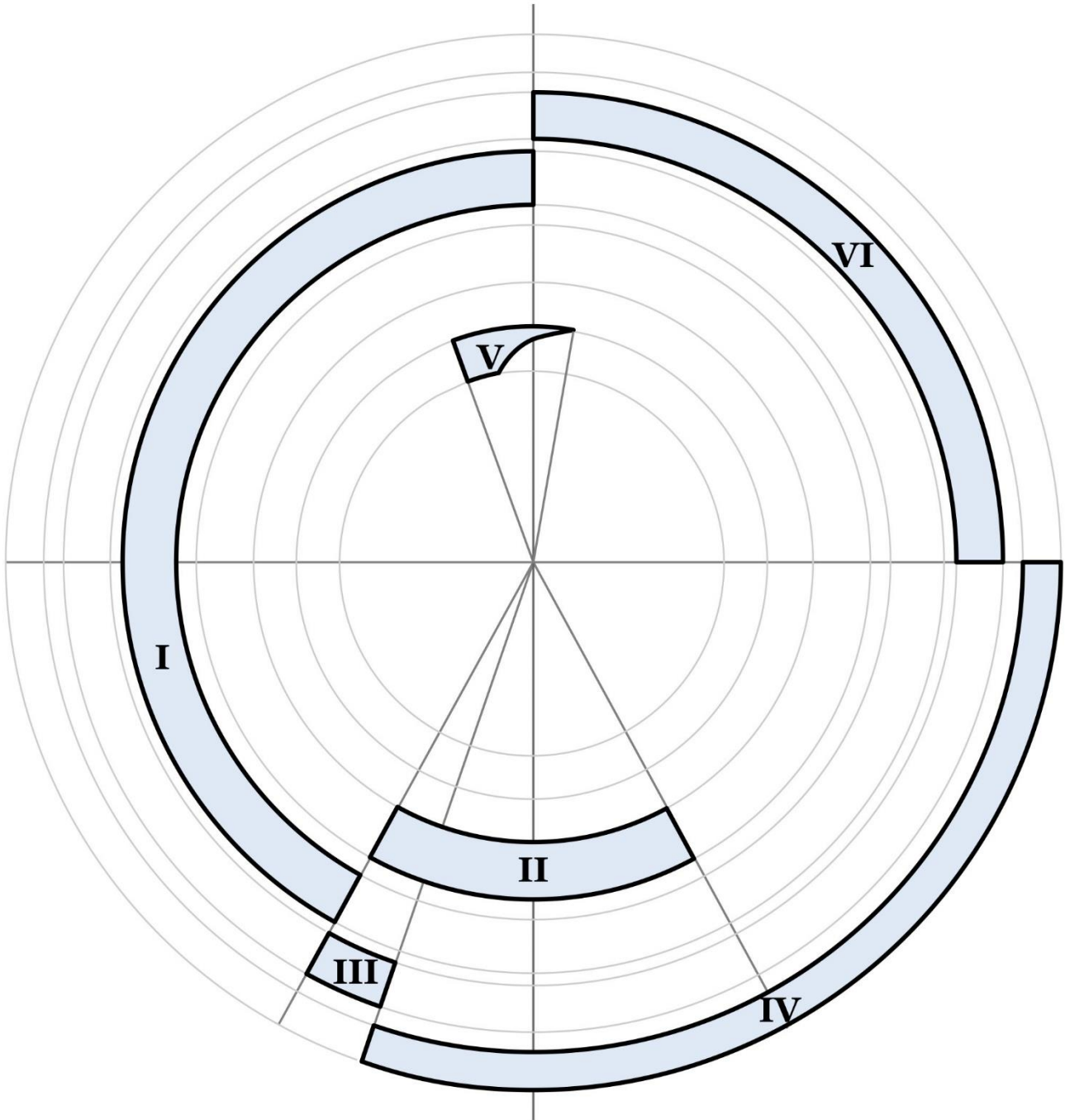
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## MO-0025



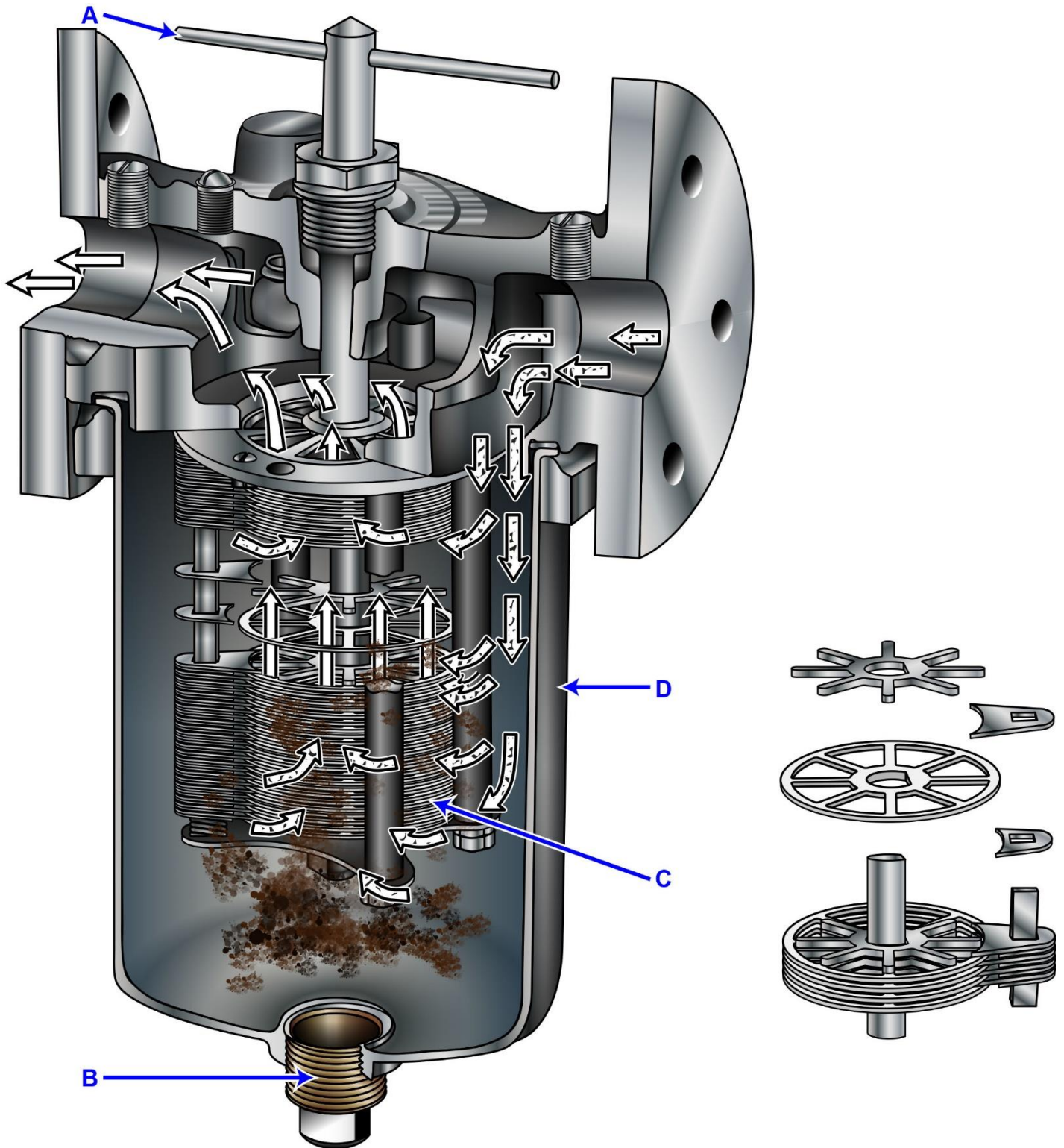
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## MO-0037



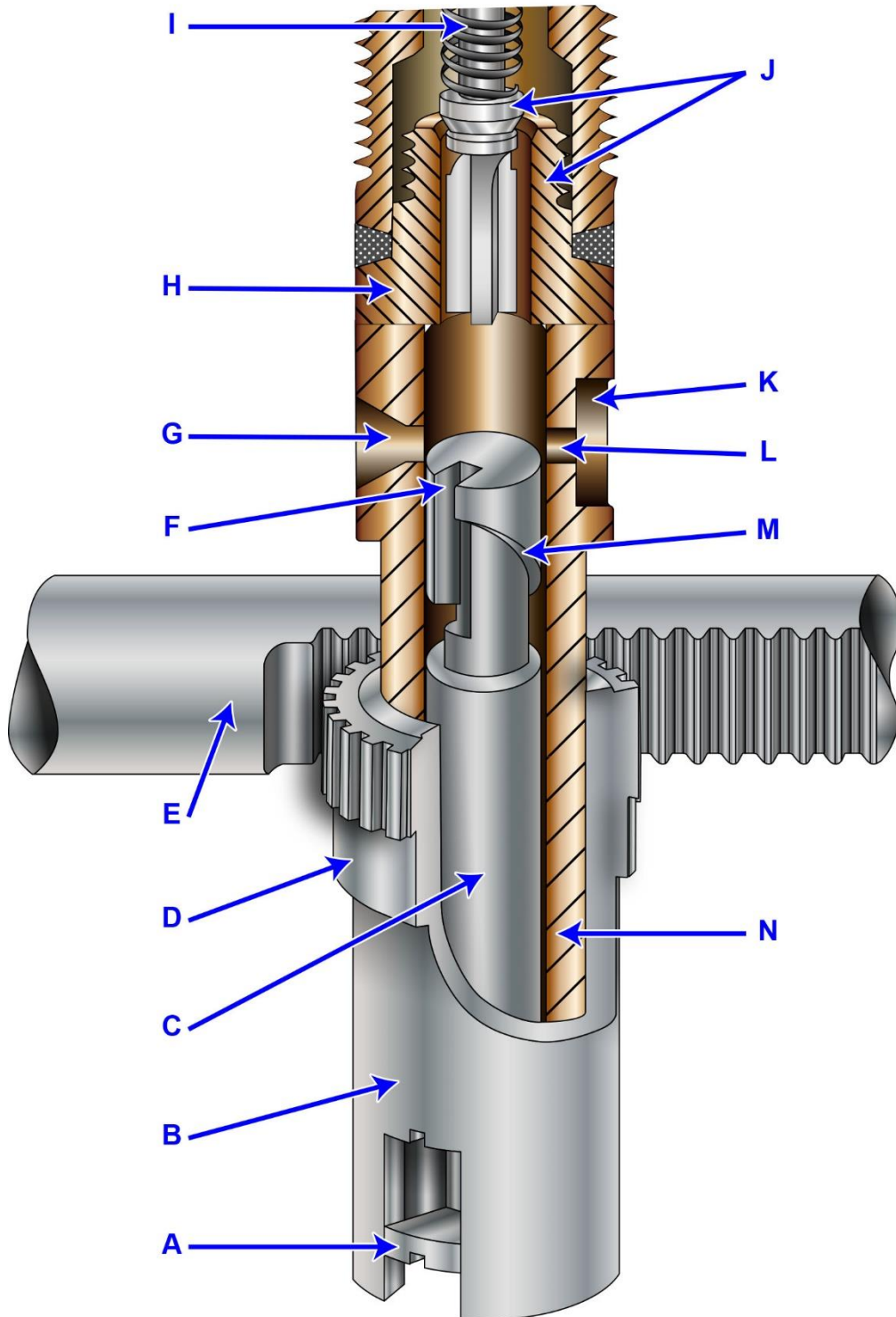
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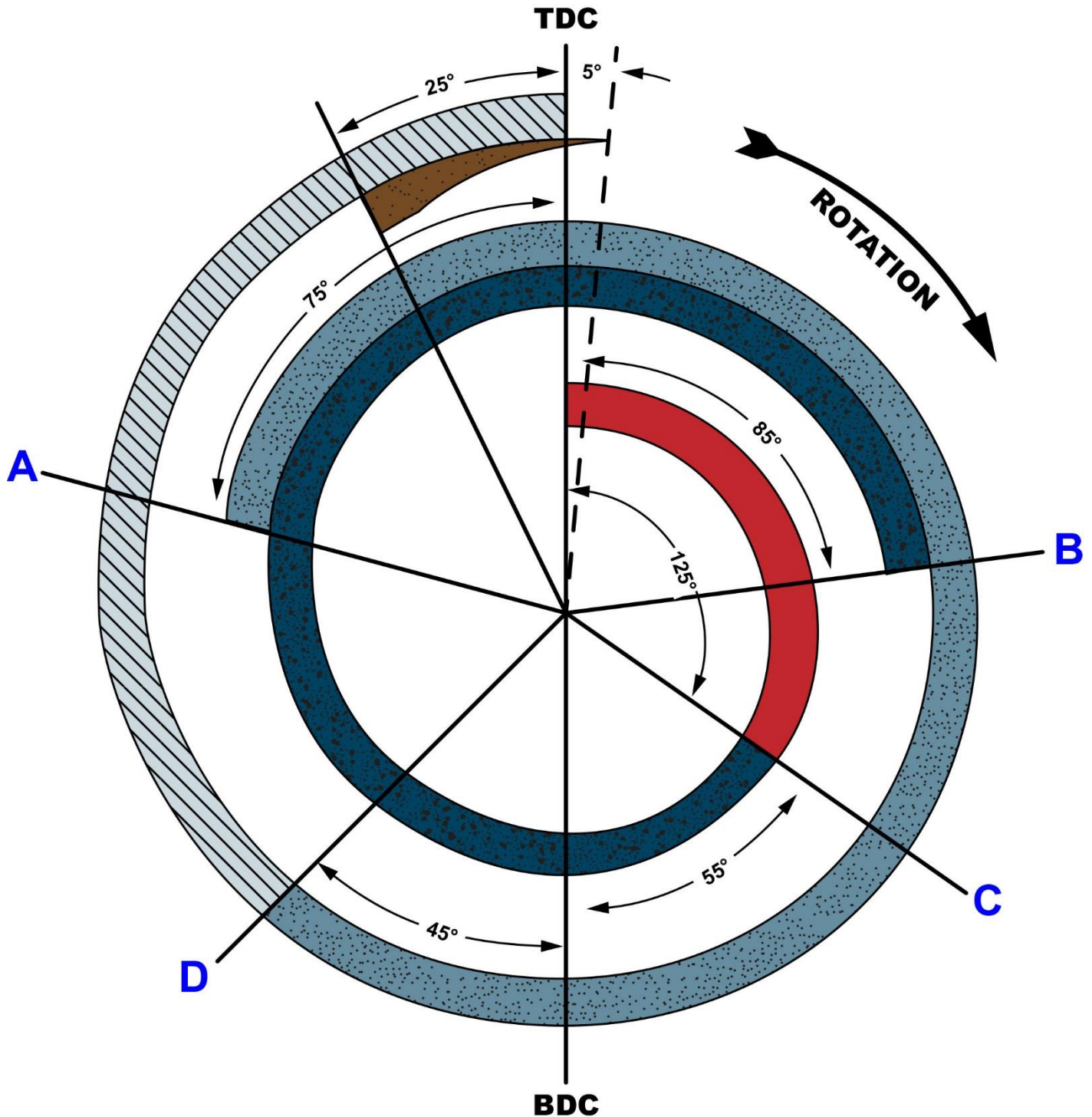
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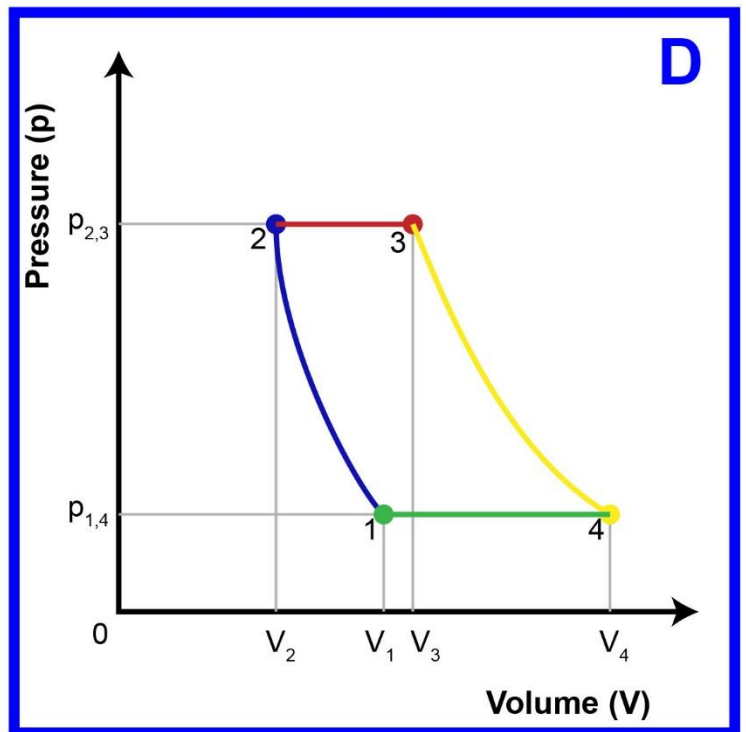
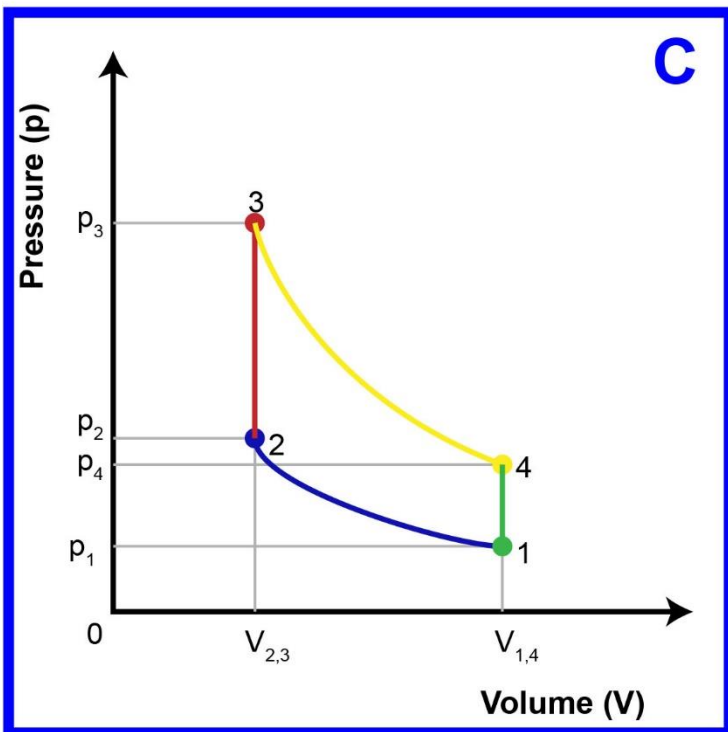
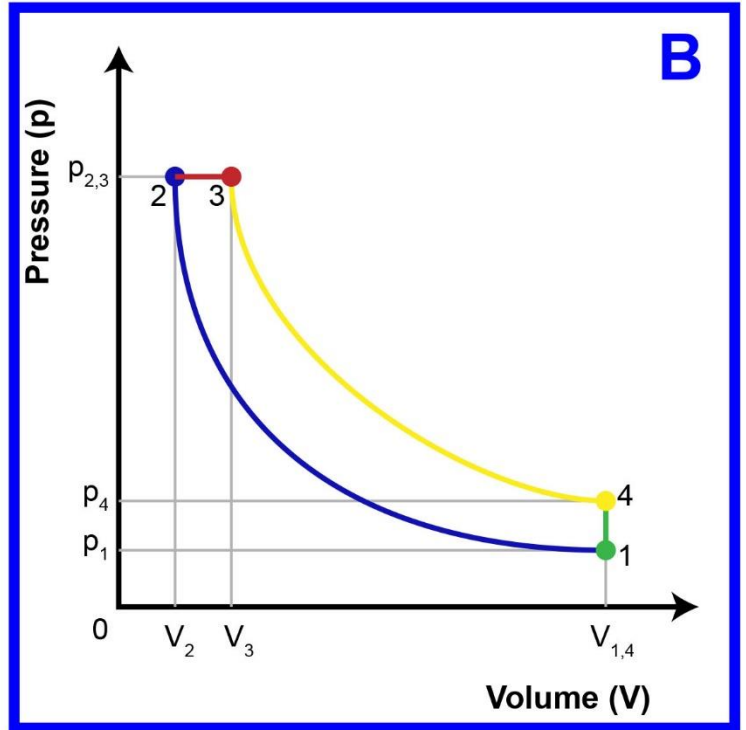
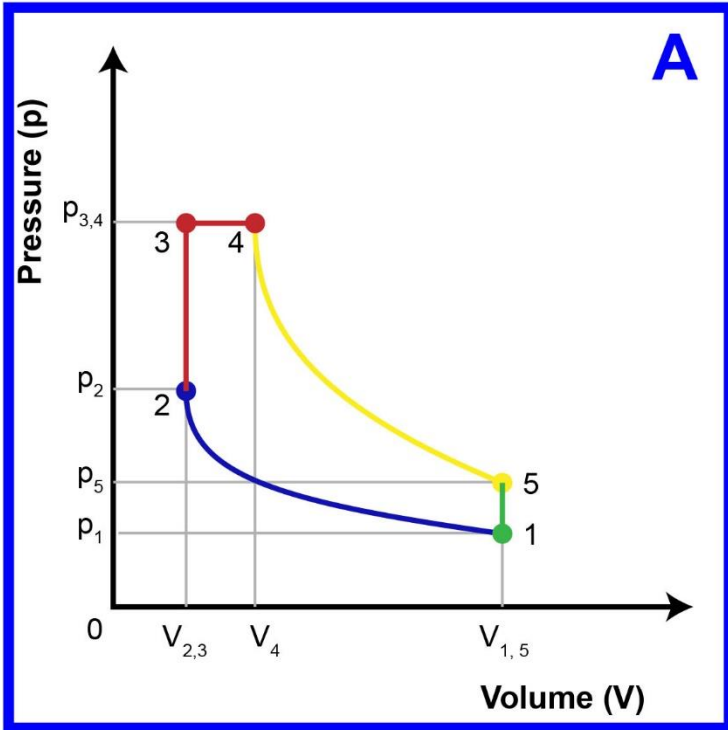


## MO-0084



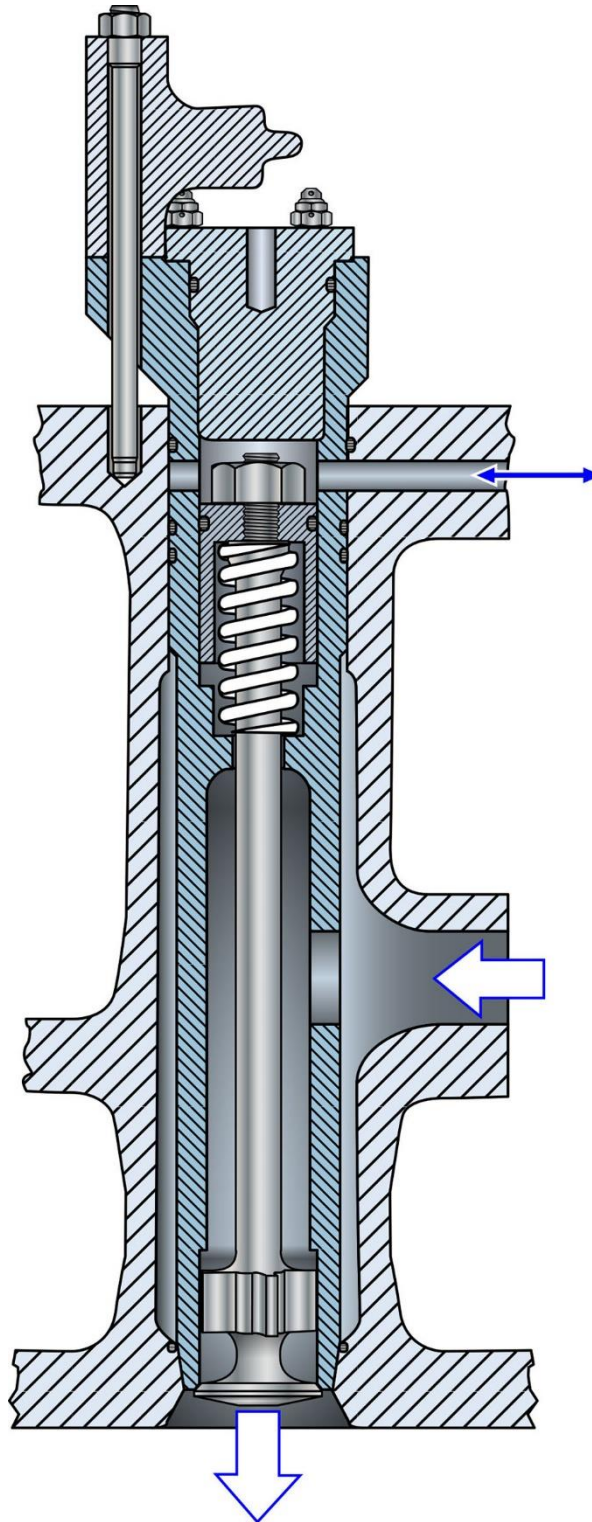
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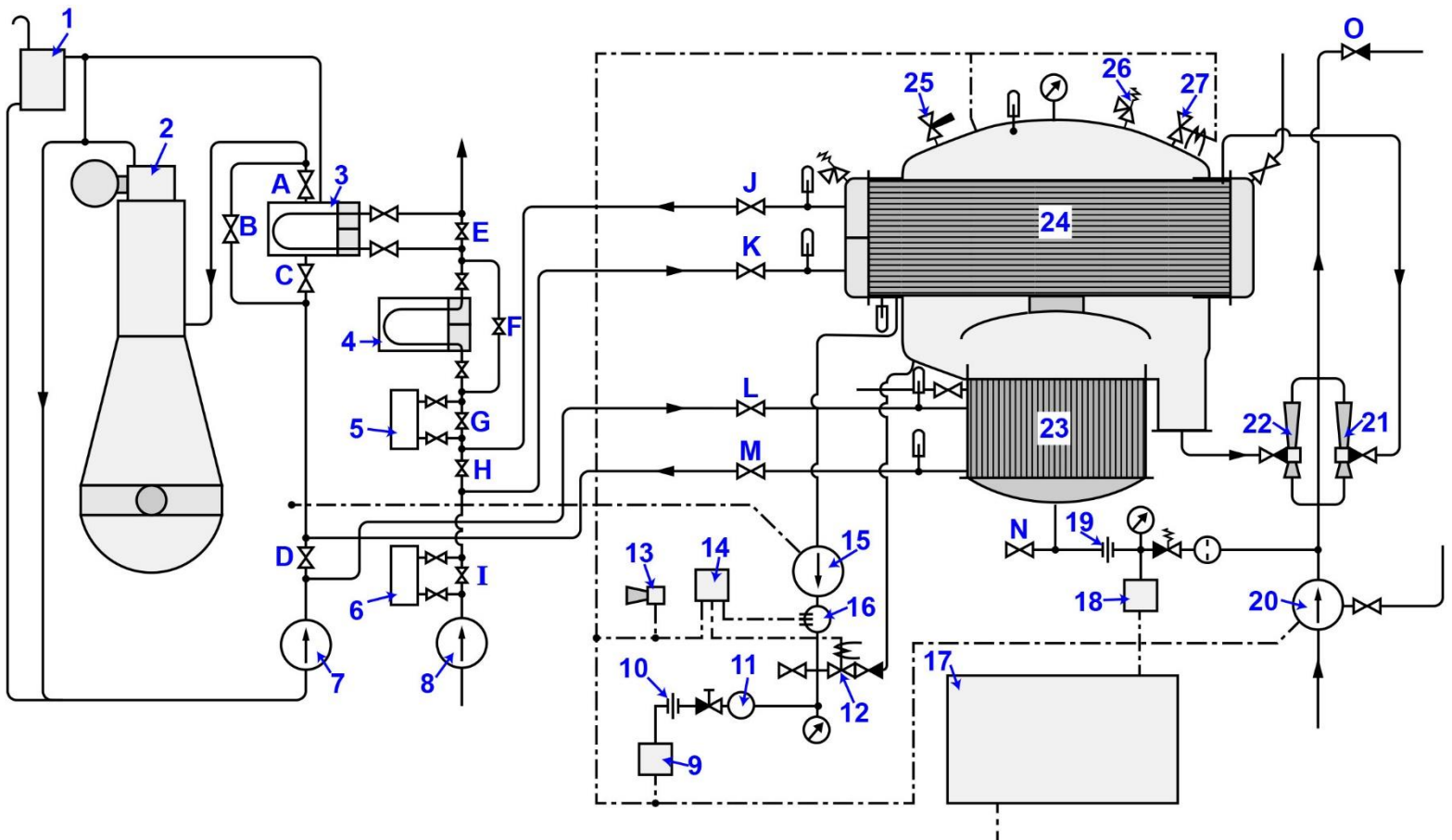
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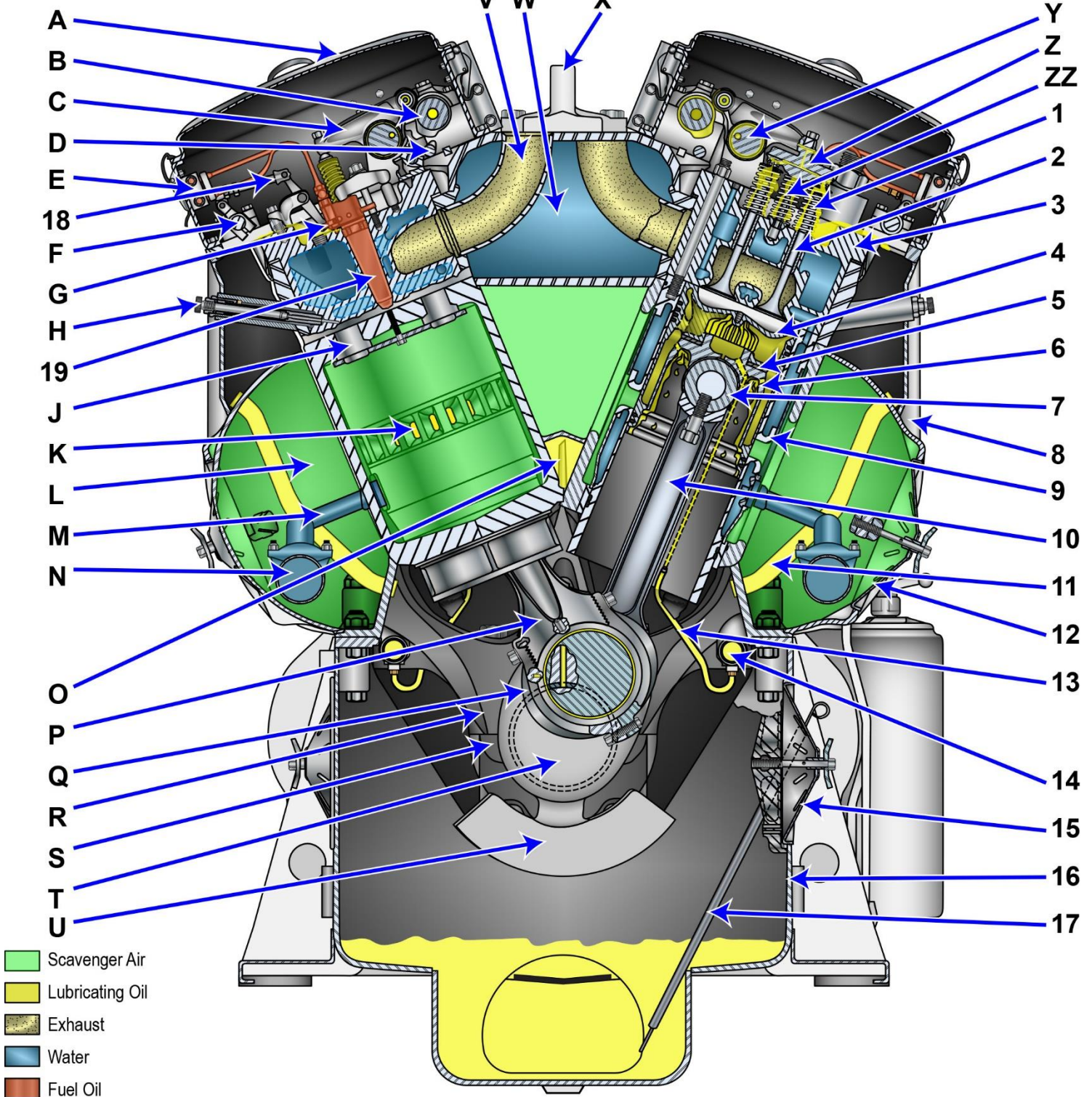
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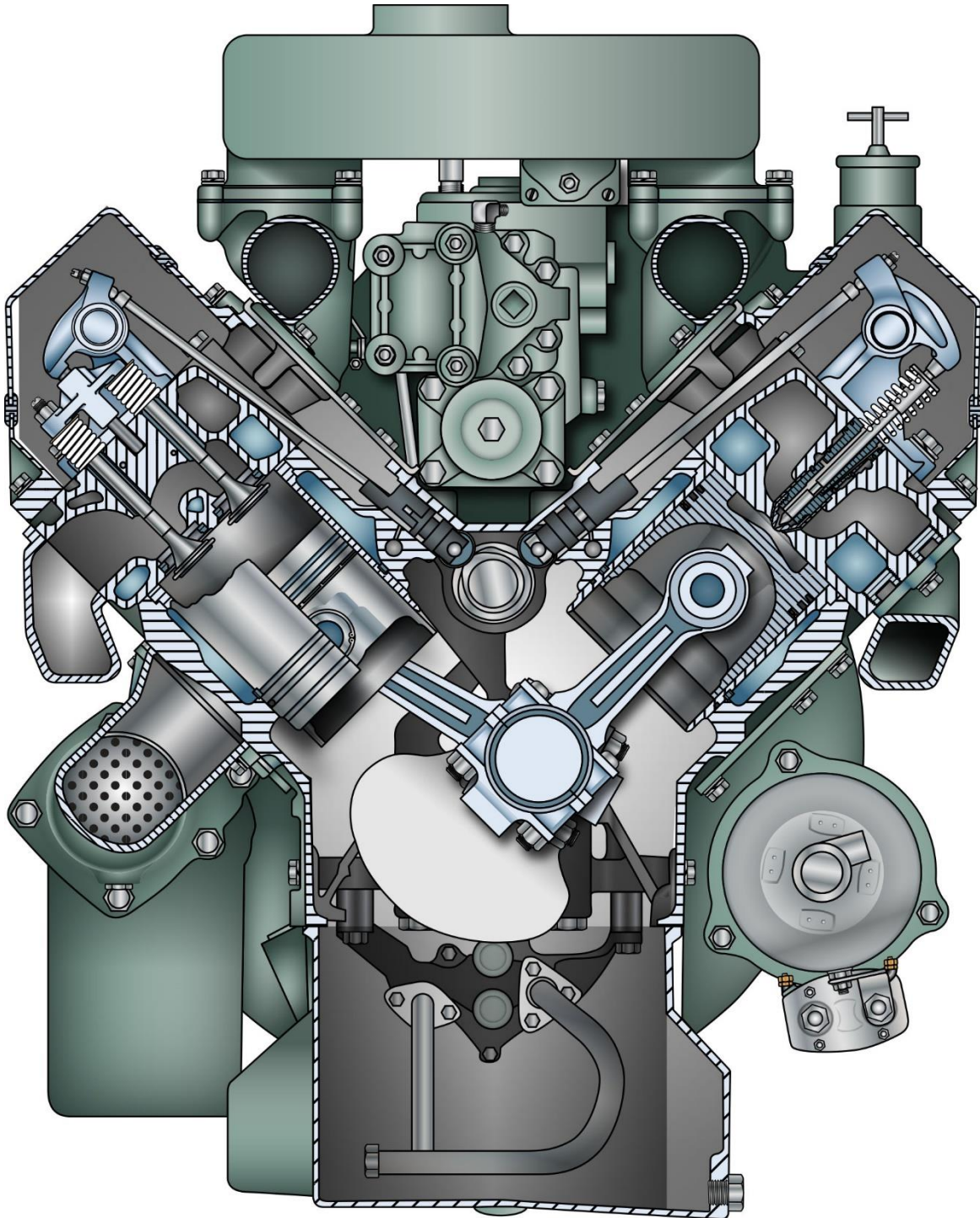
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V W X



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