U.S.C.G. Merchant Marine Exam

First Assistant Engineer

Q514 Motor Plants

(Sample Examination)

Q514 Motor Plants
U.S.C.G. Merchant Marine Exam
First Assistant Engineer
Illustrations: 19

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

1. As an engineer of a slow-speed diesel powered vessel, you note that the indicator card diagrams have a flat horizontal profile around TDC. To rectify this, what would be your best course of action?

A. Use a spring with a higher spring constant (k value) in the indicator.
B. Use a spring with a lower spring constant (k value) in the indicator.
C. Increase the RPM at which the readings are taken.
D. Reduce the RPM at which the readings are taken.

Correct answer: A

2. When analyzing indicator card diagrams you are calculating the work output from the cylinder by obtaining the area within the curve of what type of diagram?

A. pressure/volume
B. temperature/entropy
C. pressure/temperature
D. pressure/enthalpy

Correct answer: A

3. When one cylinder has a lower compression pressure and higher exhaust gas temperature than any of the other engine cylinders, which of the conditions listed will be indicated?

A. Advanced ignition
B. Clogged air intake
C. Leaky exhaust valve
D. High exhaust pressure

Correct answer: C

4. If a valve seat insert, similar to that shown in the illustration is cracked, this may be indicated by _____. Illustration MO-0043

A. white vapor in the exhaust gas
B. high exhaust pyrometer readings on that particular cylinder
C. continuous spring surge
D. a jammed indicator cock

Correct answer: A

5. Worn diesel engine intake valve guides can result in _____.

A. increased engine breathing efficiency
B. excessive valve lash
C. excessive lube oil consumption
D. lower than normal fuel consumption

Correct answer: C

6. One experiences evidence of high temperature corrosion on diesel engine combustion space components. This is exhibited by 'wire drawing' marks on exhaust valves/seats or metal reduction on cylinder heads. What causes this degradation of components?

A. Excessive combustion temperatures.
B. Water contamination of the fuel.
C. Vanadium, sodium and sulfur in the fuel.
D. Improper fuel injection/combustion in cylinders.

Correct answer: C

7. The most practical way of detecting an overload in one cylinder of an operating large, low-speed, main propulsion diesel engine is to _____.

A. listen for combustion knock in that cylinder
B. check the cylinder exhaust temperature frequently
C. check the cylinder exhausts for black smoke
D. isolate each cylinder and inspect the injector

Correct answer: B

8. Which of the following procedures should be carried out to permit the continued operation of a crosshead engine with a leaky aftercooler?

A. Nothing needs to be done due to the low heating value of heavy fuel.
B. Switch to diesel fuel and run at reduced speed.
C. Blank off the cooling water lines and run at reduced speed.
D. Bypass the aftercooler to operate at sea speed.

Correct answer: C

9. A main propulsion diesel engine crankshaft bearing lacking sufficient 'crush', will _____.

A. tend to rotate with the journal
B. be lubricated more easily than with sufficient crush
C. pound under load
D. have a thicker layer of babbitt

Correct answer: A

10. In an auxiliary diesel engine, one reason for knurling the piston skirt is to _____.

A. allow for heat expansion
B. transmit forces evenly
C. improve the piston seal
D. improve skirt lubrication

Correct answer: D

11. On small diesel engines, a noticeable decrease in the time interval between the replacement of the lube filter cartridge indicates _____.

A. excessive oil temperature
B. piston ring blow-by
C. excessive oil pressure
D. dirty air filter

Correct answer: B

12. In a four-stroke cycle diesel engine, badly worn intake valve guides can cause excessive _____.

A. exhaust temperatures
B. cooling water temperatures
C. exhaust pressure
D. lube oil consumption

Correct answer: D

13. In the illustrated engine, the main camshaft controls the timing of which of the following components? Illustration MO-0003

A. Intake valves
B. exhaust valves
C. fuel pumps
D. all of the above

Correct answer: C

14. The item labeled "T" as shown in figure 4 of the illustration is identified as the _____. Illustration MO-0025

A. Exhaust gas turbine
B. Exhaust manifold
C. Scavenge manifold
D. Aftercooler

Correct answer: B

15. Telescopic pipes which are attached to water cooled pistons of large, slow-speed, main propulsion diesel engines are designed to _____.

A. overcome excessive crankcase pressure
B. prevent excessive lube oil temperature
C. allow piston cooling water to efficiently enter the piston despite its reciprocating piston motion without contaminating the engine lube oil
D. prevent contamination of the cylinder cooling water with engine lube oil

Correct answer: C

16. If the speed of the propeller is 135 RPM, the speed of the engine camshaft shown in the illustration will be _____. Illustration MO-0003

A. 135 RPM
B. 270 RPM
C. variable depending on the camshaft gear train gear ratios
D. variable depending on the ratio between engine rpm and propeller shaft rpm

Correct answer: A

17. High-speed, multi-cylinder, diesel engines commonly use counterweights placed opposite to the crankpins to _____.

A. prevent bearing loads
B. provide dynamic balance by equalizing centrifugal force
C. counteract inertia forces
D. provide a balance of rocking couples around the crankshaft

Correct answer: B

18. According to the illustration, which of the following is true? Illustration MO-0067

A. The piston has five compression rings.
B. The piston has one oil scraper ring.
C. The piston has a replaceable crown.
D. All of the above.

Correct answer: C

19. Which of the following statements is correct concerning the connecting rod and piston assembly shown in the illustration? Illustration MO-0011

A. The piston is free to rotate on the carrier thrust washer.
B. The piston has a heat dam.
C. The piston pin is bolted to the connecting rod.
D. All of the above.

Correct answer: D

20. In an internal combustion engine, which of the devices listed will force the compression rings to seal the compression gases in the space above the piston?

A. Use of bimetallic piston rings
B. Ring gap pre-tensioning
C. Thermal increase in ring-end clearance
D. Gas pressure acting against the back of the ring

Correct answer: D

21. A 'Blotter test' is a test performed on the lube oil of a diesel engine which can determine _____.

A. the specific gravity of the oil
B. the TBN number of the oil
C. the flash point of the oil
D. a change in the oils viscosity

Correct answer: D

22. Oil oxidation, as a result of excessively high lube oil temperature, is harmful to a diesel engine because _____.

A. lube oil viscosity is always decreased
B. corrosive by-products are usually formed
C. large quantities of oil are consumed
D. oil foaming will occur

Correct answer: B

23. Crankcase explosions in propulsion diesel engines result from _____.

A. broken fuel lines spraying oil on the crankcase
B. the ignition of unburned fuel and air in the crankcase
C. the dilution of crankcase oil with particles of combustion
D. the splashing of lubrication oil by the crankshaft

Correct answer: B

24. The time between injection and ignition of the fuel is known as _____.

A. afterburning ratio
B. injection lag
C. ignition delay
D. turbulence lag

Correct answer: C

25. Fuel combustion in a diesel engine cylinder should begin just before the piston reaches top dead center and should _____.

A. end at bottom dead center
B. end when fuel injection has been completed
C. continue through the afterburning period
D. be completed exactly at top dead center

Correct answer: C

26. Heavy fuel oils generally have an upper average ash content of 0.1% by weight. Which of the following conditions could be expected if the ash content increases above this amount?

A. Excessive bearing wear
B. Increased exhaust valve wear
C. Glazing of the cylinder liners
D. Increased MEP

Correct answer: B

27. In the device shown in the illustration, the component lettered "A" is the _____. Illustration MO-0012

A. dirty oil input port
B. seal water input port
C. light phase discharge port
D. heavy phase discharge port

Correct answer: A

28. When changing over from residual to distillate fuel on a slow-speed diesel propelled vessel, you should limit the rate of temperature change of the fuel in order to prevent what operational difficulty?

A. Carbonization in the fuel heater.
B. Seizing and scuffing of fuel pump plungers and injector needle valves due to thermal effects on close clearance components.
C. Dezincification of the fuel in the mixing tank.
D. Surging/hunting of the governor due to rack sticking.

Correct answer: B

29. In pre-treating fuel oil on a motor vessel, what would you consider the most important factor to prevent high temperature corrosion on an engine's combustion components?

A. Recycle the fuel between the settling tank(s) and service tank via centrifuges more than once.
B. Monitor engine(s) exhaust temperatures more closely.
C. Run one centrifuge as a purifier at a reduced rate to minimize water, especially salt water, in the fuel.
D. Drain settling tank(s) and service tank more often only.

Correct answer: C

30. From the graph shown in the illustration, if the separating temperature required is to be 167°F, and the specific gravity of the oil is 0.98 kg/dm3 at 59°F, what size regulating ring is required? Illustration MO-0113

A. 86 mm
B. 89 mm
C. 92 mm
D. 95 mm

Correct answer: C

31. When tightening the lock ring "G" of the device shown in the illustration, two events are simultaneously accomplished. Which of the following statements represents these events? Illustration MO-0112

A. The lock ring ensures proper contact between the bowl top and the sliding bowl bottom, in addition to compressing the disc stack.
B. When tightened, the lock ring allows for movement of the sliding piston and positions the sliding piston within the bowl bottom.
C. The lock ring ensures proper positioning of the disc stack and maintains a positive contact of the bowl top and bowl bottom.
D. The lock ring forces the disc stack onto the spindle, providing a positive means of rotation and locating the bowl top to seal the separation chamber.

Correct answer: B

32. As shown in the illustration, which of the following conditions would be responsible for a "low-pressure in oil outlet" alarm to be indicated? Illustration MO-0127

A. Emergency stop button not reset
B. Separating temperature too low
C. Throughput too low
D. Controller setpoint changed

Correct answer: C

33. While operating the fuel oil centrifuge shown in the illustration, the fuel oil is being continuously ejected with the sludge and the seal water. The probable cause is the _____. Illustration MO-0012

A. gravity disk inside diameter is too small
B. back pressure is too low
C. gravity disk inside diameter is too large
D. incorrect number of disks have been placed in the disk stack

Correct answer: C

34. While operating the fuel oil centrifuge shown in the illustration, the bowl fails to open for sludge ejection. The probable cause is that _____. Illustration MO-0012

A. the operating water pressure is too high
B. the bowl disk set is clogged
C. the seal ring on the operating slide is defective
D. one or more of the sludge ports is partially clogged

Correct answer: C

35. Which of the following conditions would be the most probable cause for the 'low oil temperature after preheater' LED indicators, as shown in the illustration, to be illuminated? Illustration MO-0127

A. Too low a temperature in day tank.
B. Too high a temperature in settling tank.
C. Incorrect steam control valve setting.
D. Improper steam trap selection.

Correct answer: C

36. Differential needle valves used in fuel injectors are directly closed by _____.

A. spring force
B. cam action
C. firing pressure
D. fuel oil pressure

Correct answer: A

37. The amount of fuel delivered by a unit injector is controlled by the _____.

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

Correct answer: A

38. The component shown in the illustration would be identified as a/an _____. Illustration MO-0097

A. injector cooling system pump
B. slow-speed engine fuel pump
C. slow-speed engine cylinder liner lubricator
D. centrifugal flyweight governor

Correct answer: B

39. Because of the close tolerances used in diesel engine fuel oil pumps, a worn plunger requires _____.

A. grinding the spare plunger to the barrel
B. replacing the plunger and the barrel
C. highly polishing both the plunger and barrel
D. replacing plunger only

Correct answer: B

40. You are testing a closed fuel injection nozzle using a nozzle tester. A pressure slightly less than design valve opening pressure is applied. If no fuel appears at the spray tip, the _____.

A. nozzle orifices are too small
B. needle valve is operating properly
C. needle valve spring is defective
D. nozzle orifices are eroded

Correct answer: B

41. Poor combustion in a diesel engine can be caused by _____.

A. low compression temperature
B. high compression pressure
C. high scavenge air pressure
D. low exhaust pressure

Correct answer: A

42. Injection lag in a diesel engine may be caused by _____.

A. the flexibility of high-pressure fuel lines
B. a decrease in compression pressure
C. a decrease in the air temperature
D. a change in the cetane number of the fuel

Correct answer: A

43. High firing pressures and a low exhaust temperature in a diesel engine may result from _____.

A. early exhaust valve opening
B. early fuel injection timing
C. low scavenge air temperature
D. increased exhaust system back pressure

Correct answer: B

44. The circuit shown in the illustration represents a/an _____. Illustration MO-0115

A. infinitely positioned pneumatic control
B. pneumatic actuated, multiple position, control unit
C. hydraulic actuated, multi-position control unit
D. detented, control air pressure, reducing and filtering unit

Correct answer: D

45. Which of the following statements describes the primary reason for the device shown in the illustration to be incorporated into the air start system? Illustration MO-0116

A. The shuttle valve compensates for any decrease in the operator's physical abilities.
B. The three-position valve prevents the fuel flow from reaching the fuel injection pumps.
C. This unit controls the air operated turning motor exhaust when the unit is in operation.
D. The unit shown is used to prevent starting of the main engine when the turning gear is engaged.

Correct answer: D

46. The pneumatic circuit shown in the illustration is part of a complex large low-speed engine control system. Which of the following statements describes the function of this circuit? Illustration MO-0117

A. The piston labeled A provides a low-pressure signal to the other components illustrated.
B. The circuit shown is used to shift the camshaft position when reversing the engine.
C. Valve D, when depressed, allows the retained pneumatic pressure within the shutdown servomotor to be relieved.
D. When oil pressure to valve C is diminished, a pressure decrease is developed at valve D, causing it to shift, and nullifying the actuating signal to device A.

Correct answer: C

47. Clearance volume scavenging in a turbocharged, four-stroke cycle diesel engine is accomplished _____.

A. at a pressure below atmospheric
B. without cooling the cylinders or pistons
C. with only the exhaust valve open
D. during the valve overlap period

Correct answer: D

48. The diesel engine shown in the illustration is provided with an auxiliary blower to _____. Illustration MO-0003

A. maintain a positive pressure on the crankcase
B. provide scavenge air pressure at low load
C. increase scavenge air pressure at full load
D. maintain a vacuum on the crankcase

Correct answer: B

49. A sudden power loss from a turbocharged and aftercooled diesel engine is an indication of a/an _____.

A. crankcase exhauster overload
B. overload on the intercooler
C. turbocharger malfunction or failure
D. obstruction in the engine cylinders

Correct answer: C

50. The device shown in the illustration is used to secure the air supply to a diesel engine when the engine overspeeds. In order for this to occur, supplied oil pressure must _____. Illustration MO-0103

A. move the piston rod to the left
B. move the piston rod to the right
C. decrease allowing the spring to move the piston rod to the right
D. decrease allowing the butterfly valve to turn counterclockwise

Correct answer: C

51. A propulsion engine, using the speed control circuit shown in the illustration, fails to function at speeds lower than the low end of the critical speed range. Which of the following statements describes what should be done to correct this malfunction? Illustration MO-0114

A. The critical speed range will be varied as the setpoints of 17A or 17B are reset, therefore, another segment of the speed control circuit must be repaired.
B. Device 17A needs to be replaced, repaired, or reset to the setpoint coinciding with the RPM value for the low end of the critical speed range.
C. To increase the critical speed range of the engine, reduce the setpoint of 17A and 17B respectively, to 0.80 bar and 1.0 bar.
D. Both 17A and 17B need to be reset to decrease the critical speed range, although this procedure will increase the operating range of the engine.

Correct answer: B

52. As the load is being decreased on the engine controlled by the governor shown in the illustration, the _____. Illustration MO-0092

A. right hand end of the floating lever will move up
B. pilot valve plunger will move down
C. oil pressure under the power piston will increase
D. speeder rod will move down

Correct answer: A

53. In the illustrated auxiliary diesel engine governor, decreasing the distance between piece 6 and piece 10 will affect the engine by _____. Illustration MO-0094

A. decreasing the speed
B. increasing the speed
C. increasing the speed droop setting
D. decreasing the overspeed trip setting

Correct answer: B

54. A schematic diagram of an isochronous hydraulic governor is shown in the illustration. When the load is removed the speed increases, and the _____. Illustration MO-0100

A. pilot valve (piece 10) moves upward
B. proportioner piston (piece 25) moves upward
C. flyweights (piece 8 and 9) move inward and the pilot valve (piece 10) moves downward
D. balance piston (piece 22) moves downward

Correct answer: A

55. A diesel-generator governor is hunting. After changing the oil, the governor is flushed and the compensation needle valve is adjusted, but the hunting persists. You should NOW _____.

A. calibrate the fuel pump rack settings
B. check air intake manifold pressure
C. carefully check for binding in the governor linkage
D. set the speed droop adjustment to zero

Correct answer: C

56. The most common contaminate of governor hydraulic fluid is _____.

A. moisture
B. dirt
C. air
D. acid

Correct answer: B

57. Governor hunting is caused by _____.

A. governor under-control
B. governor over-control
C. excessive speed droop
D. insufficient speed droop

Correct answer: B

58. Which of the automatic boiler controls listed should be tested prior to lighting off an auxiliary boiler?

A. Low water level cutoff switch
B. Voltage output of the ignition transformer
C. Automatic bottom blow valve
D. Insulation resistance readings in the ignition system high tension leads

Correct answer: A

59. When preparing to light off a cold boiler equipped with a return flow fuel oil system, the recirculating valve directs the flow of oil _____.

A. back to the suction side of the service pump
B. directly to the fuel oil heater inlet for further warm-up
C. directly to the deep tanks
D. back to the fuel oil settler for further filtration

Correct answer: A

60. In the water level electrode assembly, shown in the illustration, the feed pump should restart when the level of the water reaches the position indicated by arrow '____'. Illustration MO-0047

A. E
B. B
C. C
D. D

Correct answer: C

61. With which of the following types of diesel engine arrangements is a waste heat boiler most likely to produce the maximum steam pressure, temperature, and flow conditions?

A. Supercharged, four-stroke cycle diesel engine
B. Supercharged, loop scavenged diesel engine
C. Turbocharged, cross flow scavenged diesel engine
D. Turbocharged, return flow diesel engine

Correct answer: A

62. In general, diesel engine waste heat boiler construction is usually of the _____.

A. dry back boiler type
B. critical circulation boiler type
C. water-tube type
D. cyclone furnace boiler type

Correct answer: C

63. A photoelectric cell installed in an automatically fired auxiliary 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

64. During unsafe firing conditions in a large automatic auxiliary boiler, various control actuators are interlocked with the burner circuit to prevent start-up, in addition to safety shutdown. These controls are referred to as _____.

A. limit controls
B. flame safeguard controls
C. combustion controls
D. programming controls

Correct answer: A

65. A variable capacity, pressure atomizing, fuel oil burner functions to _____.

A. maintain a constant fuel temperature
B. provide a wide range of combustion
C. provide a constant fuel return pressure
D. maintain smokeless fuel oil atomization

Correct answer: B

66. A safety valve on an auxiliary boiler simmers constantly and cannot be stopped by several quick blow-offs using the hand-relieving gear. The problem may be _____.

A. loose dirt on the seat
B. exposed valve springs
C. a clogged drain line
D. a damaged seat

Correct answer: D

67. Heavy soot accumulations in an auxiliary boiler could be caused by _____.

A. water in the fuel oil
B. excessive cycling
C. high fuel oil pressure
D. improper burner maintenance

Correct answer: D

68. If a crankcase explosion due to a hot spot were to occur, the size of the explosion is dependent on which of the following?

A. The amount of water in the oil in the crankcase.
B. The ratio of oil mist to air in the crankcase.
C. The amount of debris in the oil in the crankcase.
D. The temperature of the hot spot in the crankcase.

Correct answer: B

69. If a scavenging air space fire occurs on a slow-speed diesel engine and the engine is stopped, which of the following should be done to prevent distortion due to heat?

A. Open the engine to inspect the hot area.
B. Let the fire burn out naturally.
C. Engage and turn the engine with the jacking gear.
D. Use CO2 to extinguish the fire and cool the engine.

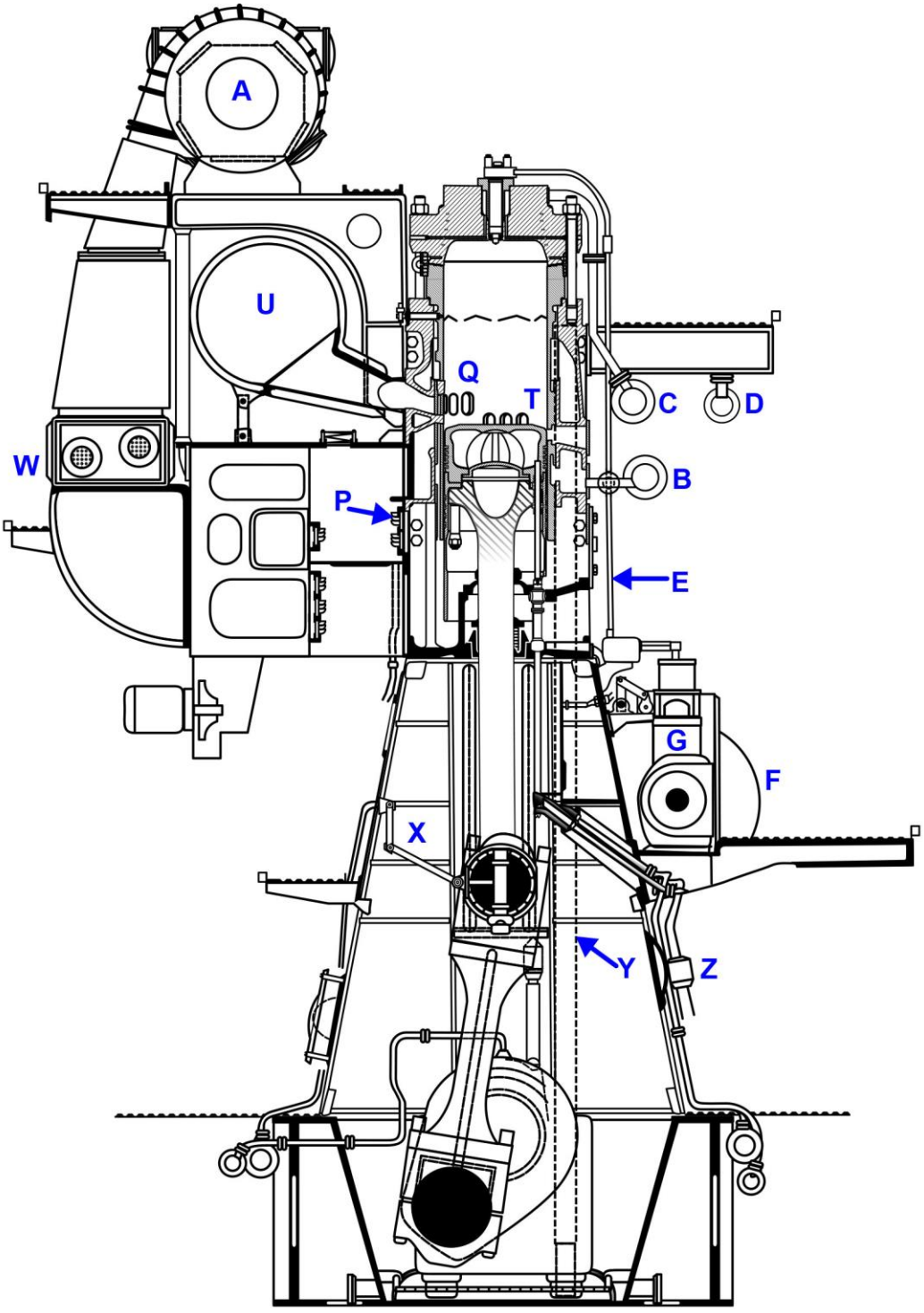
Correct answer: C

70. In accordance with 46 CFR Subchapter J, which of the listed starting aids is acceptable for use with the emergency diesel-generator?

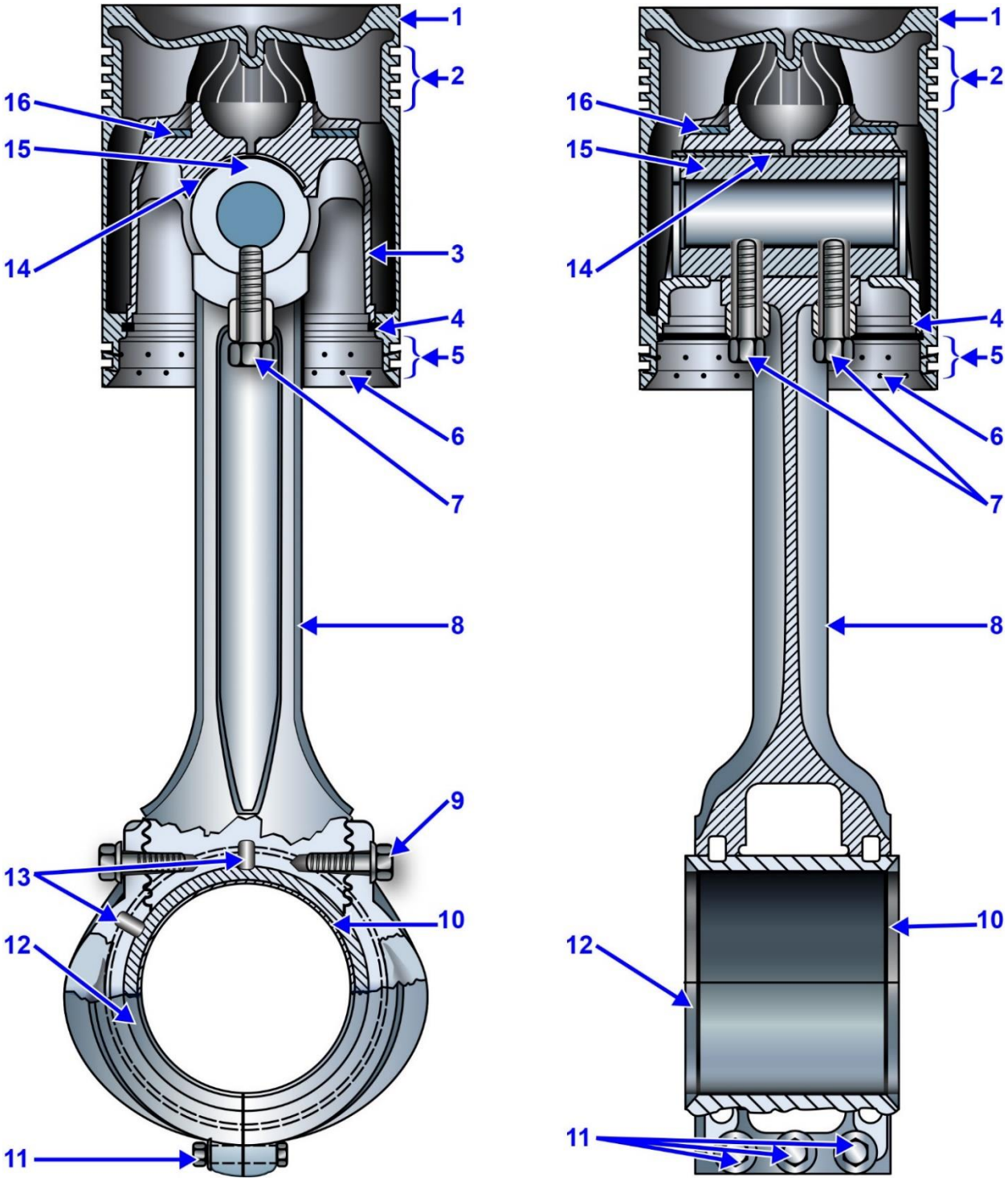
A. Injection of ether into the air intake.
B. Thermostatically controlled electric water jacket heater.
C. Thermostatically controlled electric oil sump heater.
D. Heating the starting battery.

Correct answer: B

MO-0003



MO-0011



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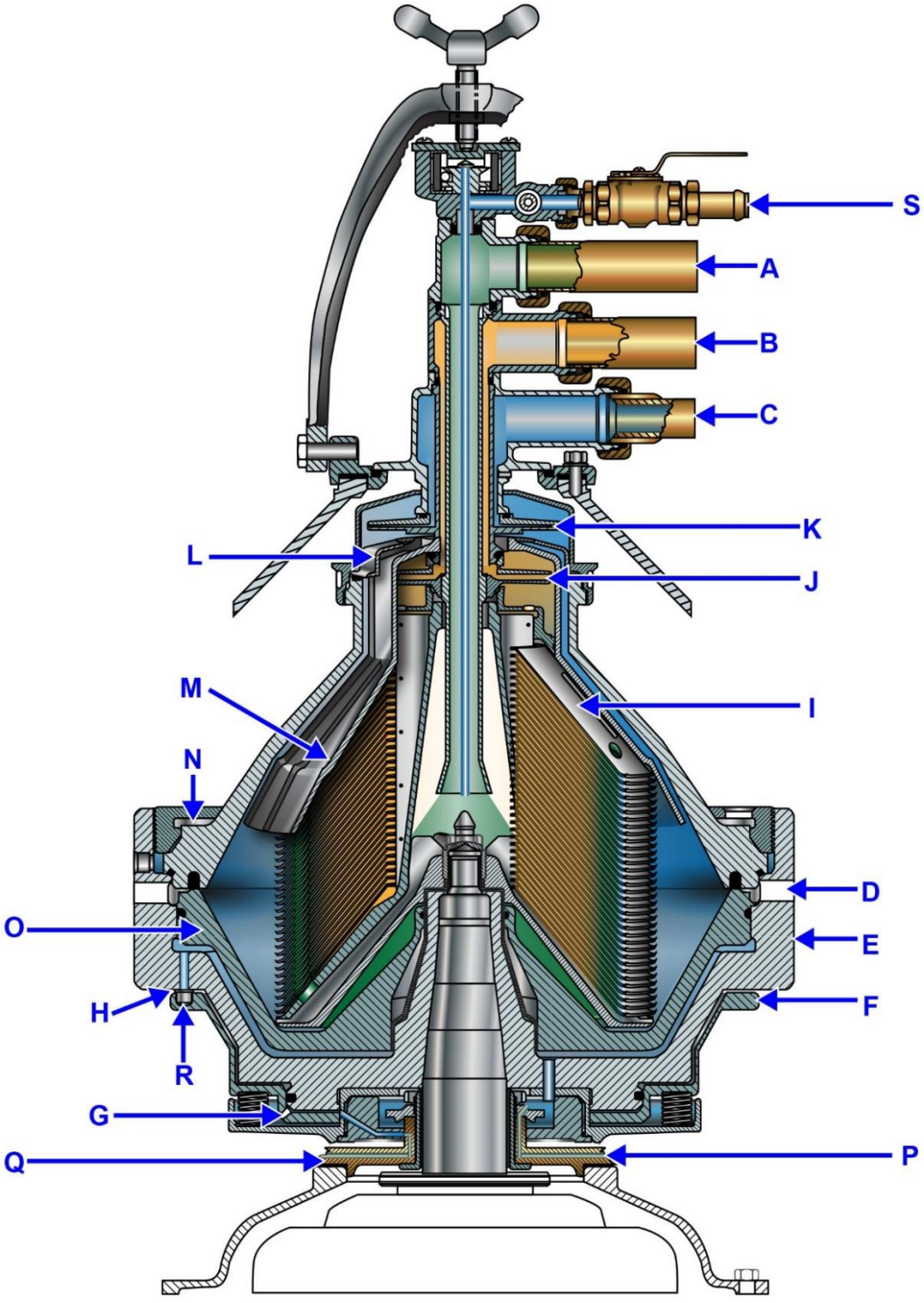

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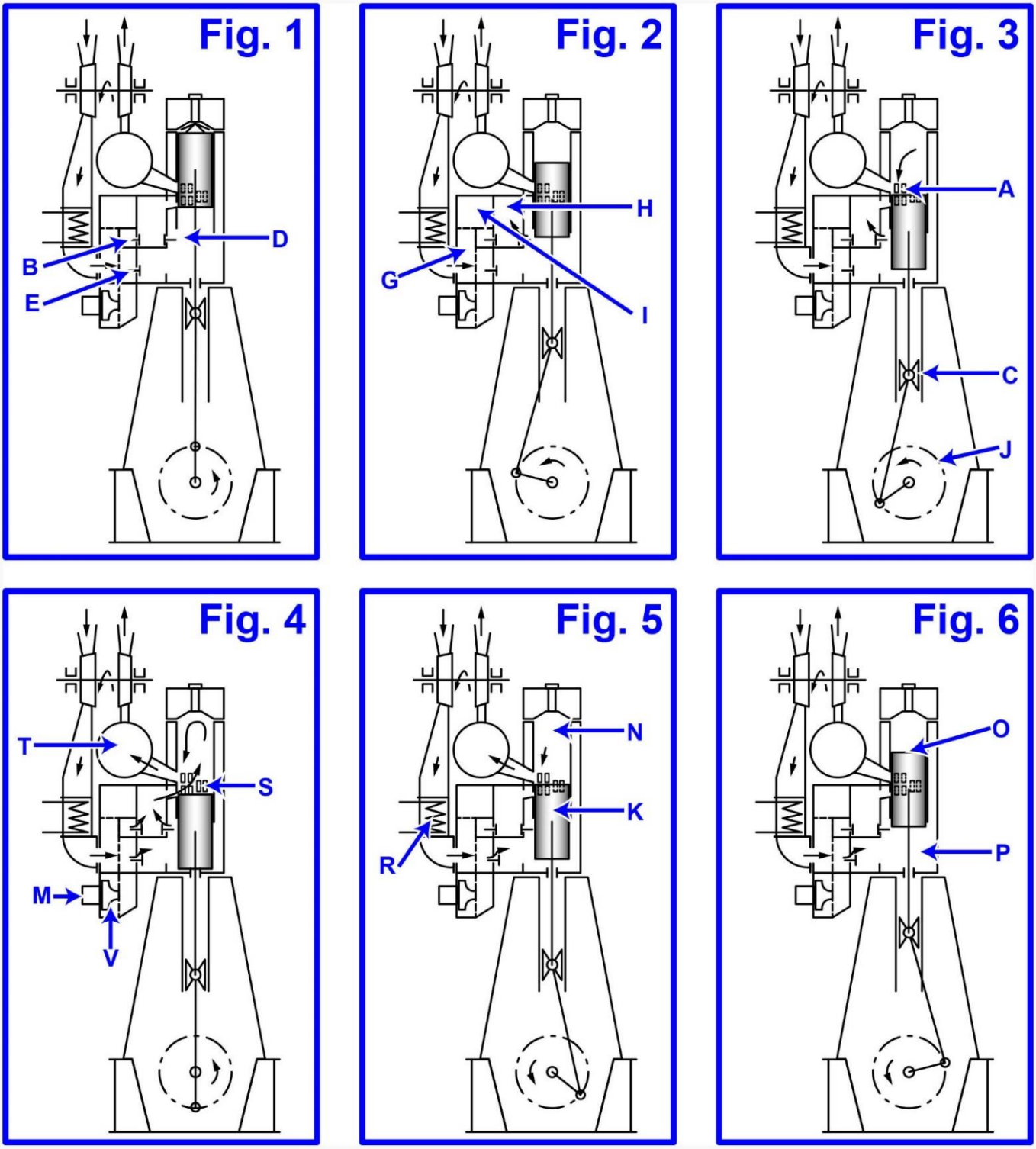

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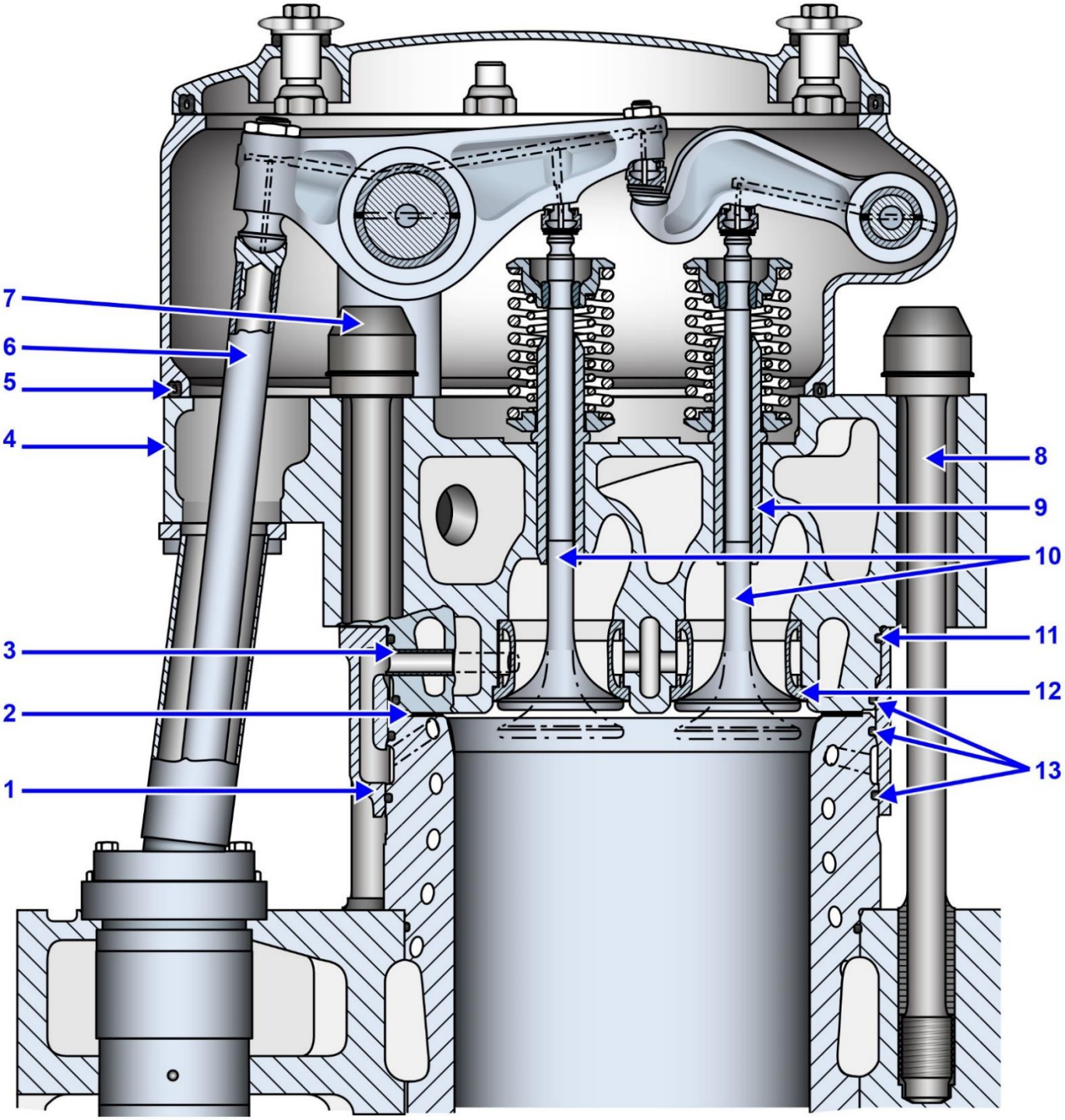

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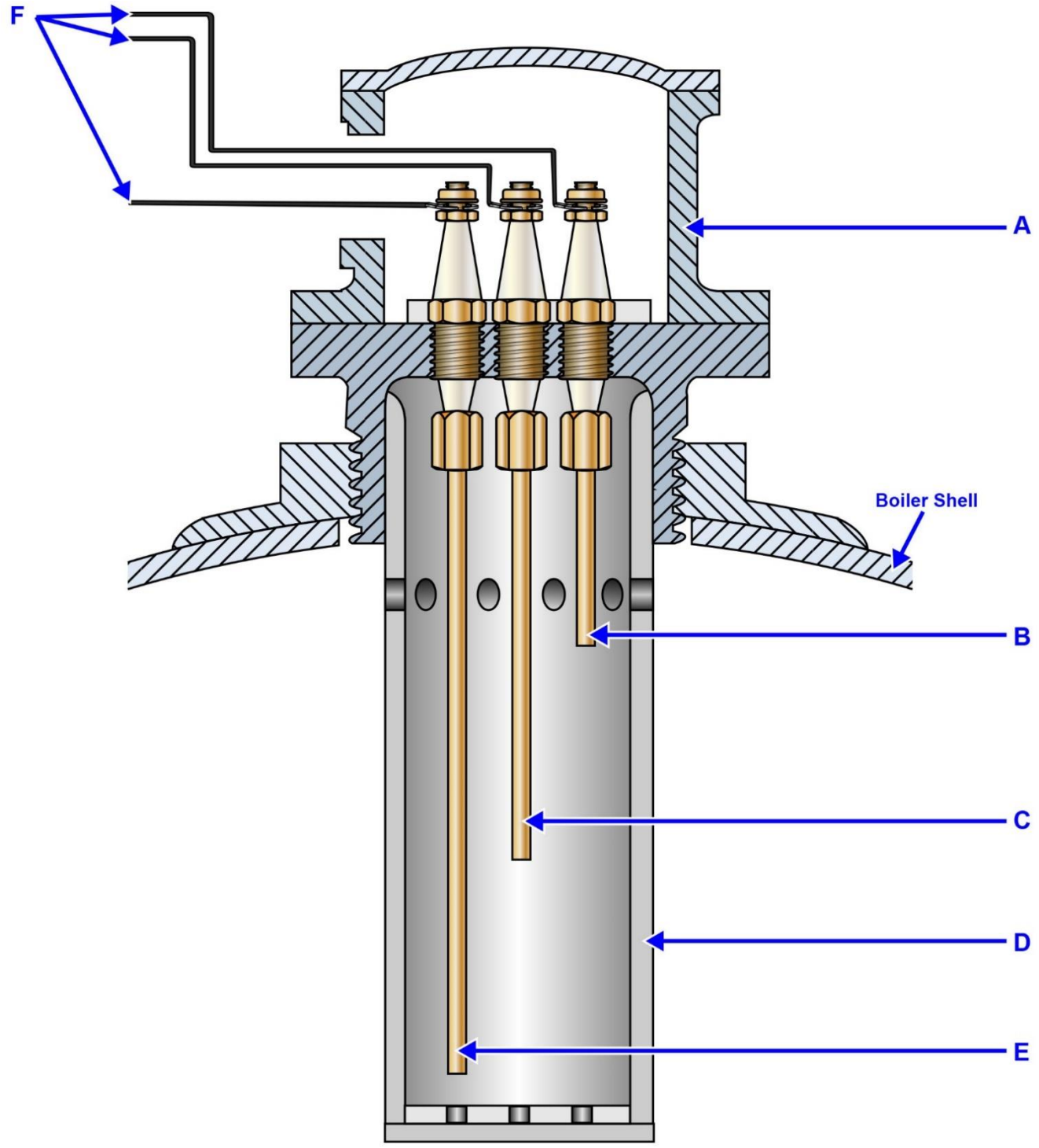

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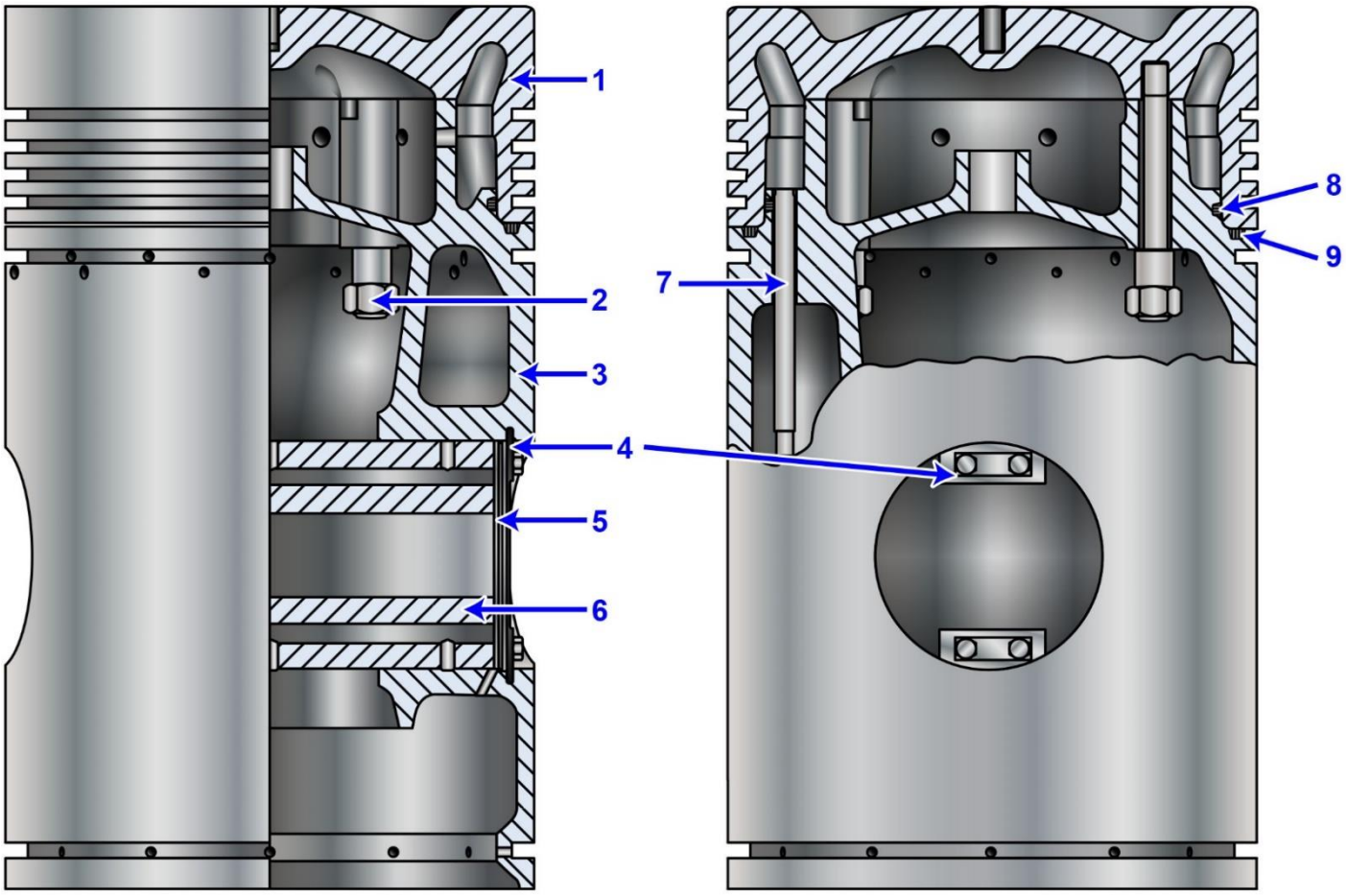

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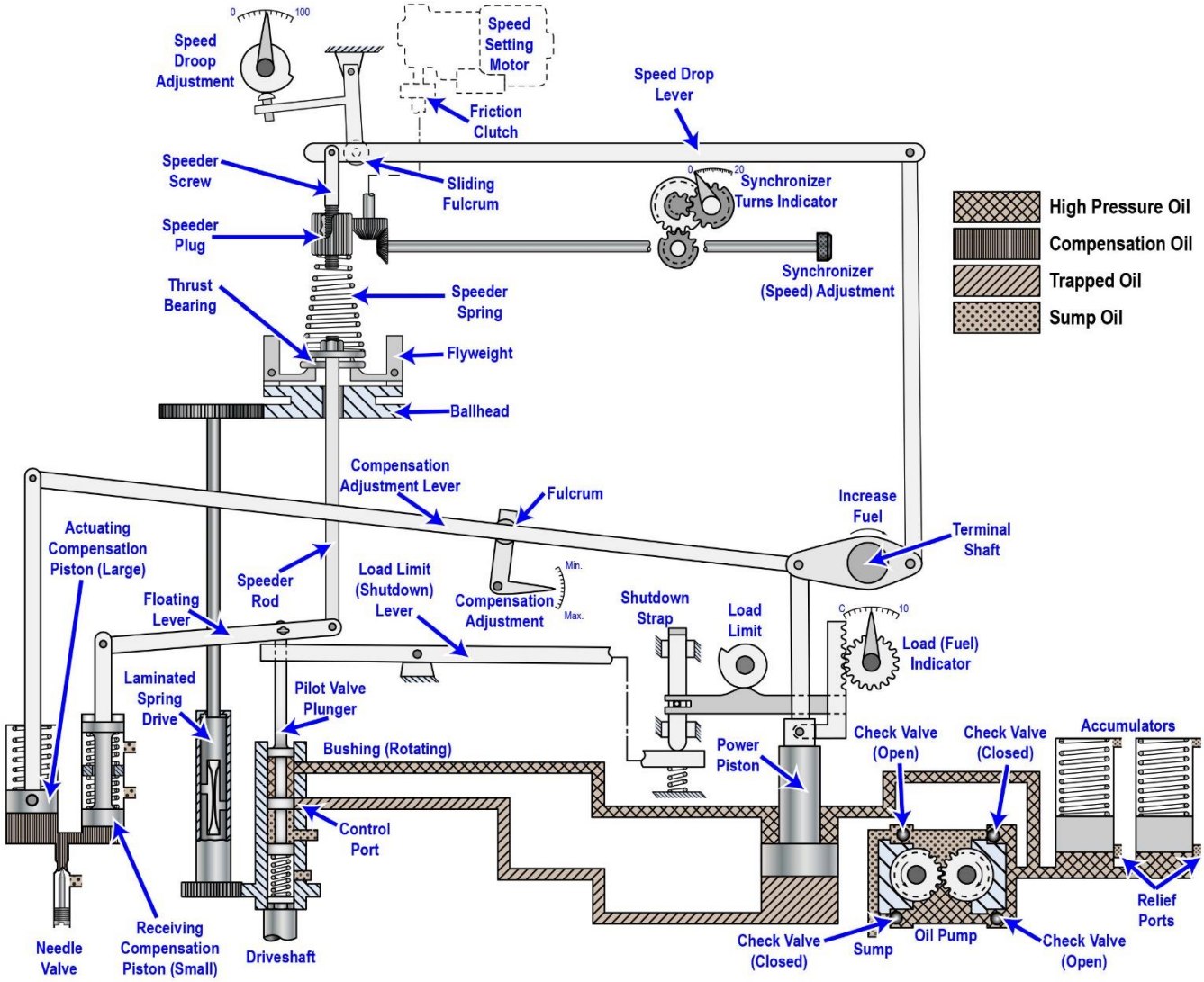

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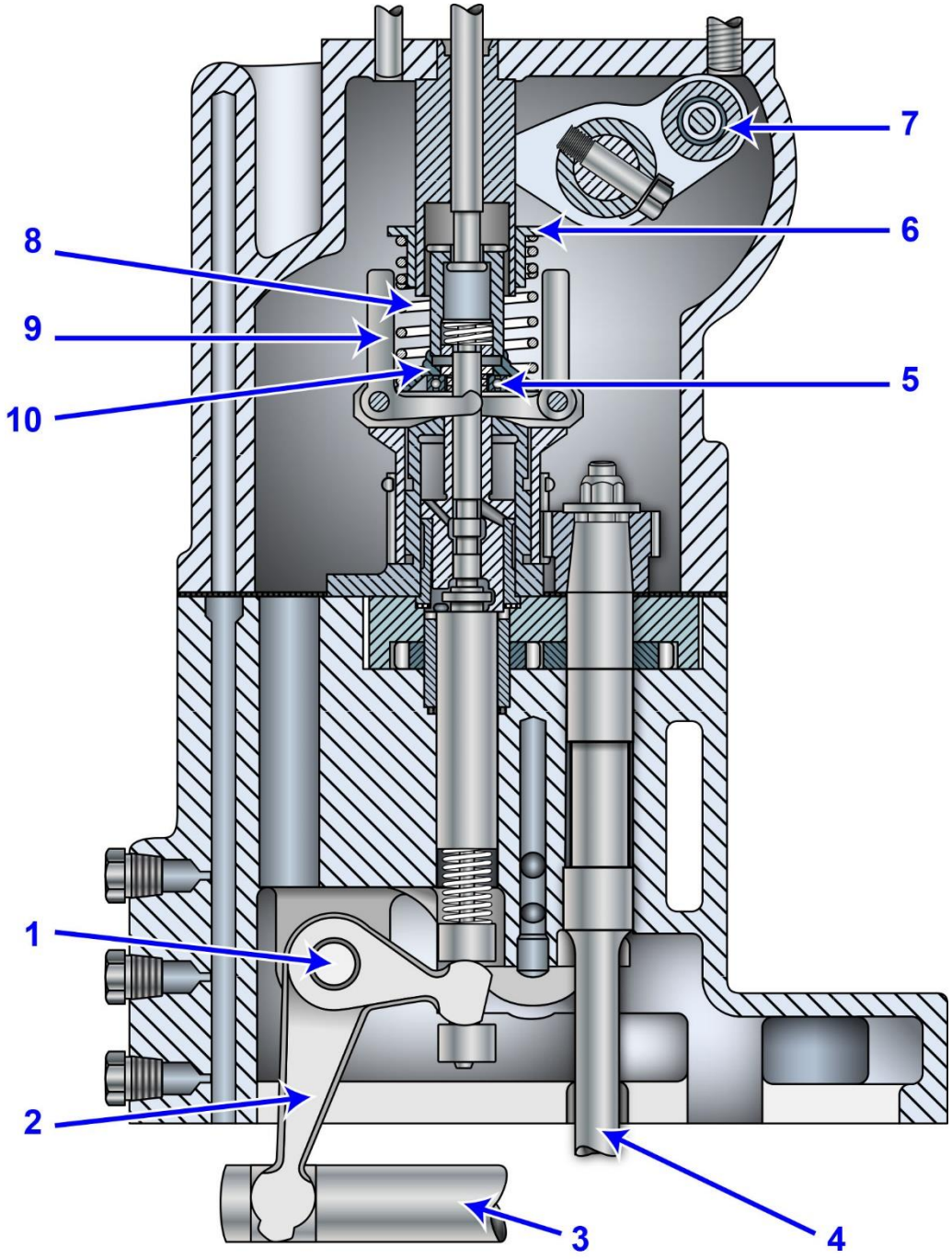

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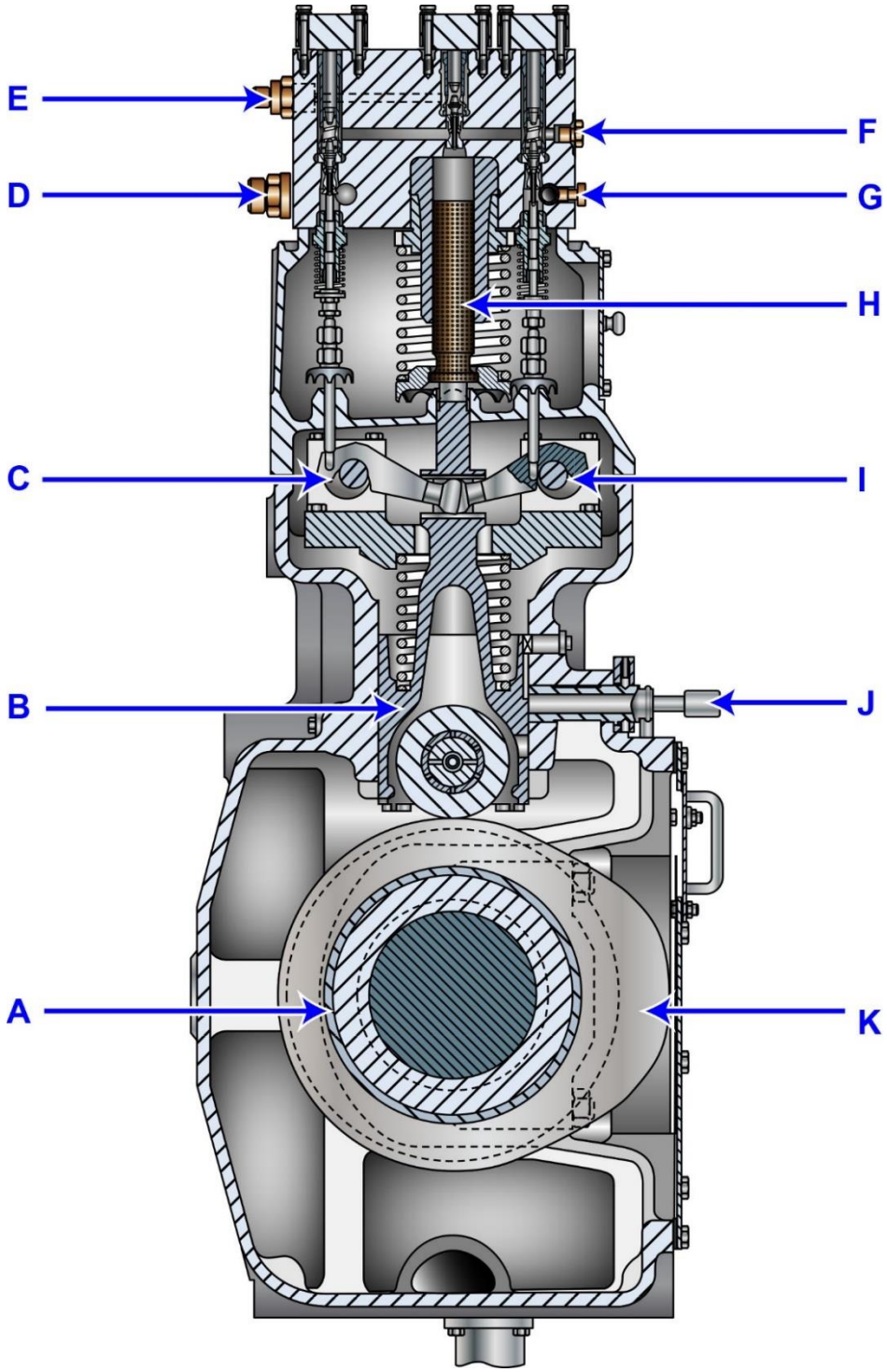

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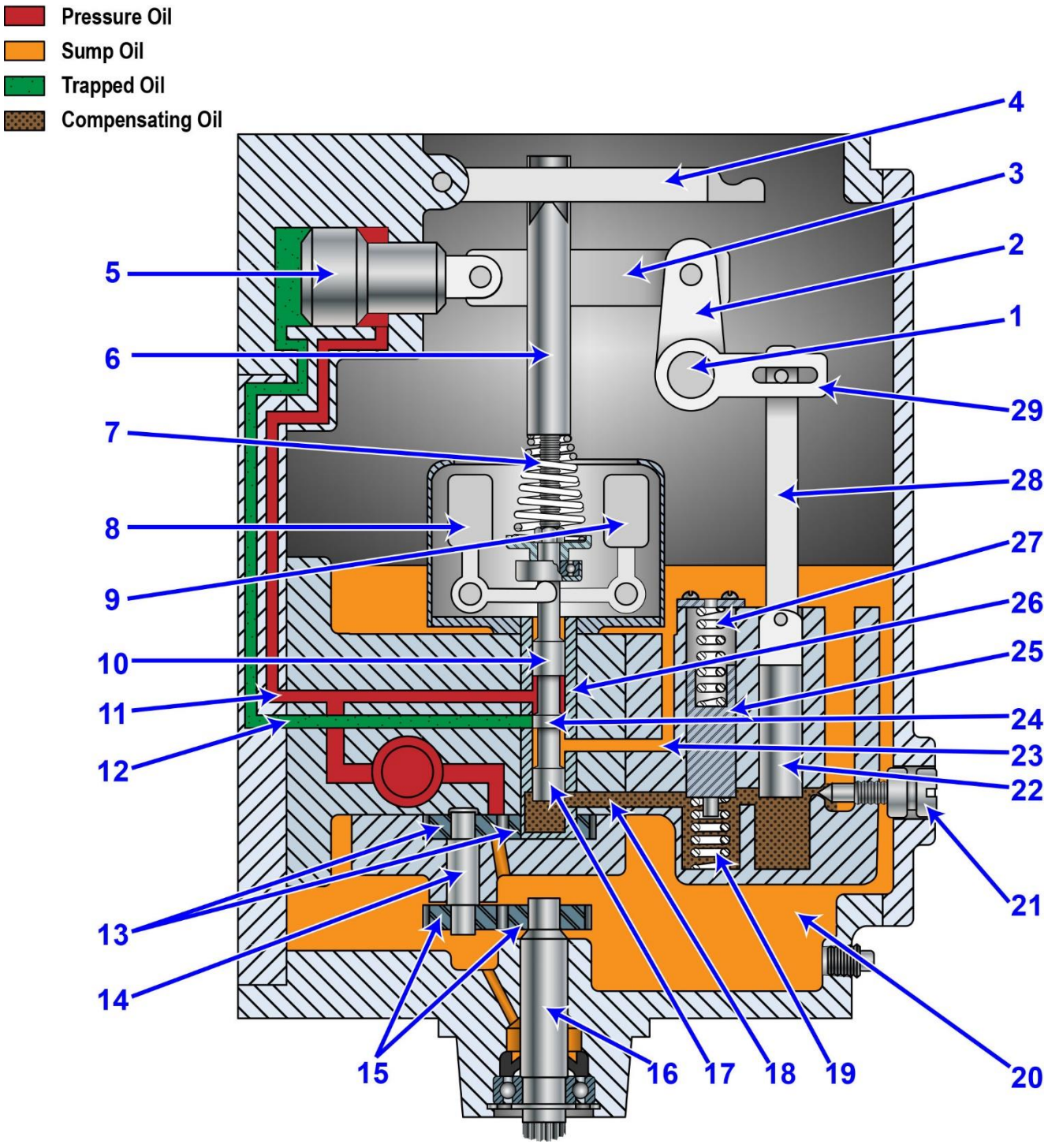

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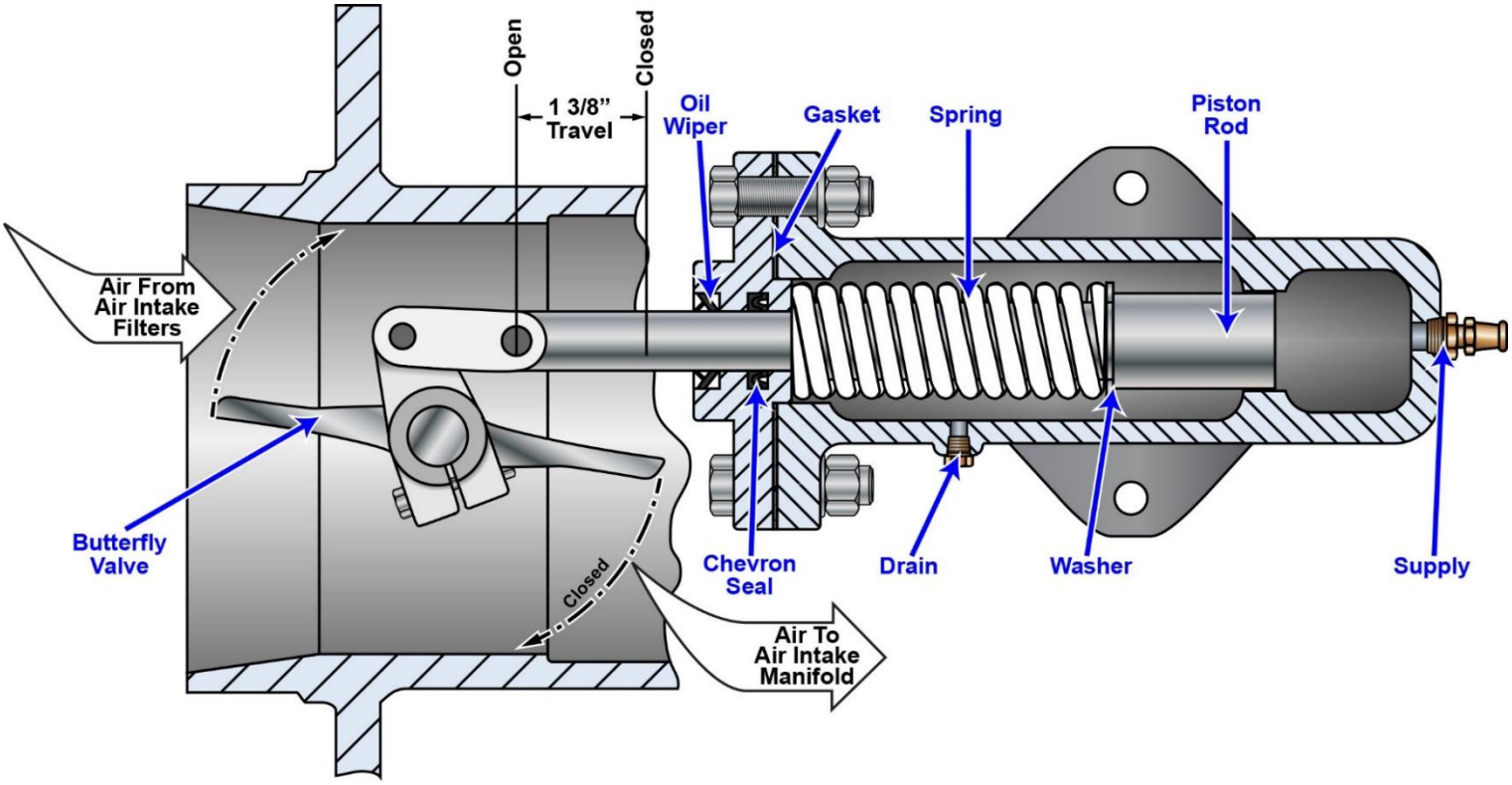

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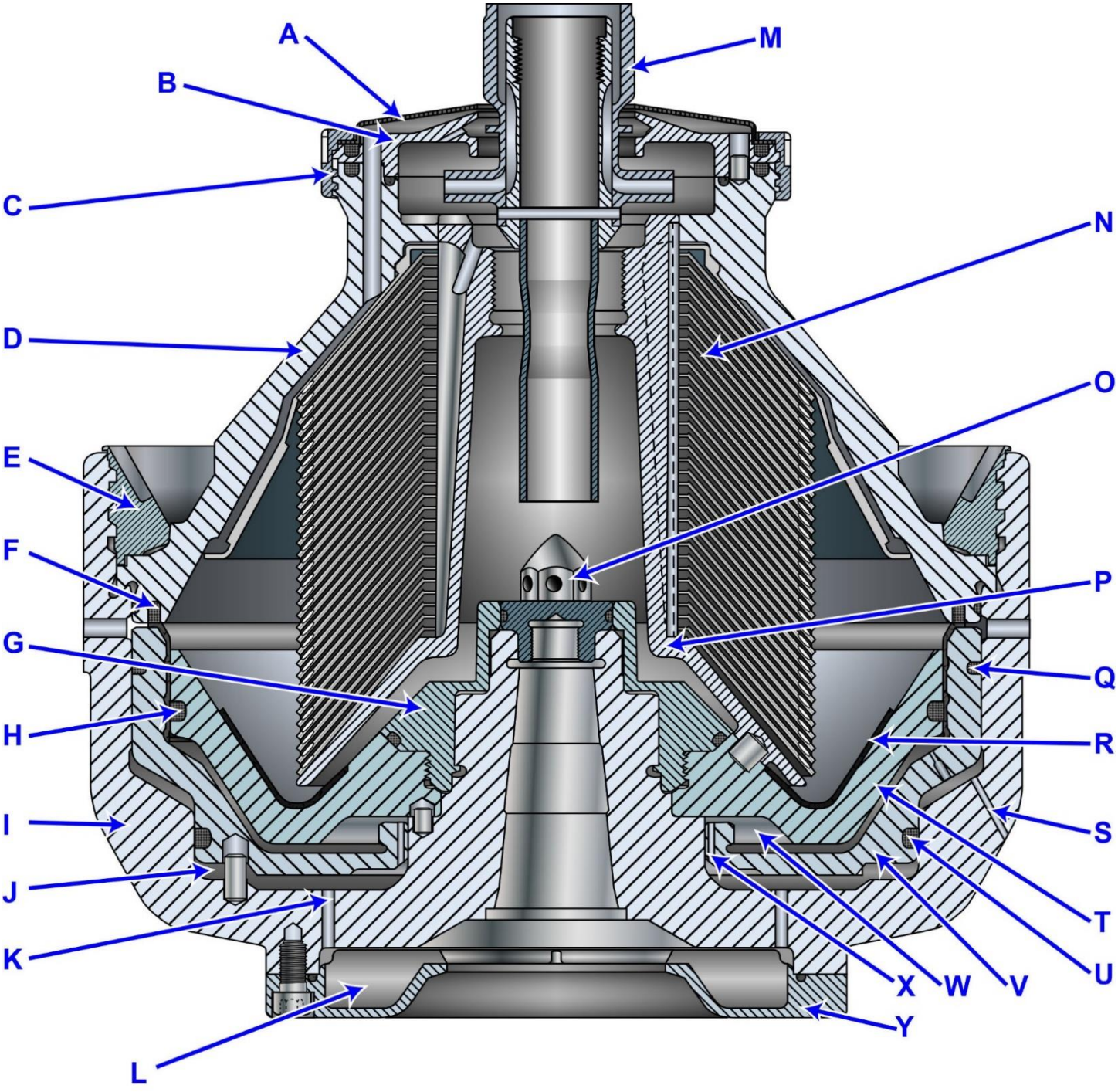
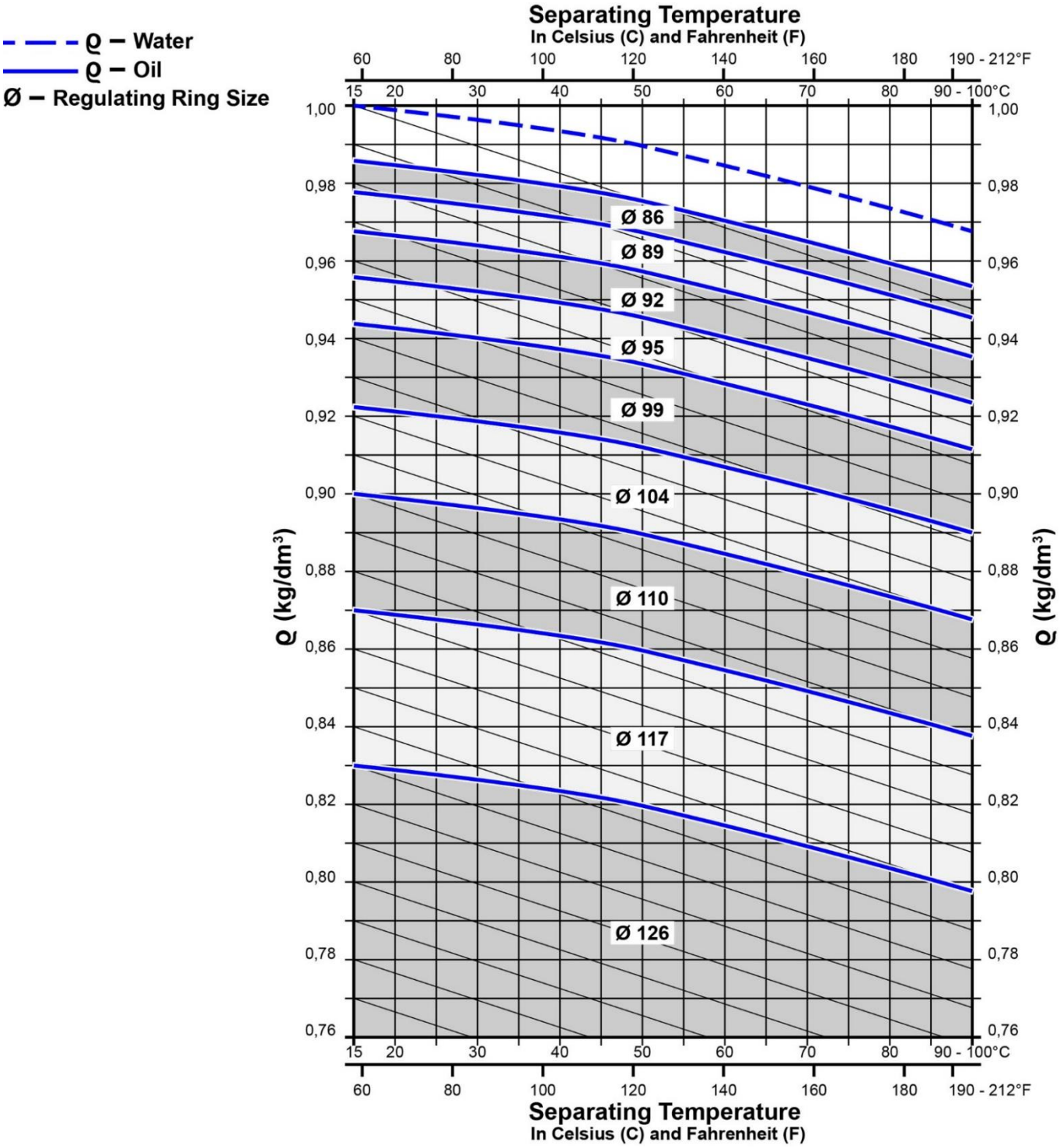


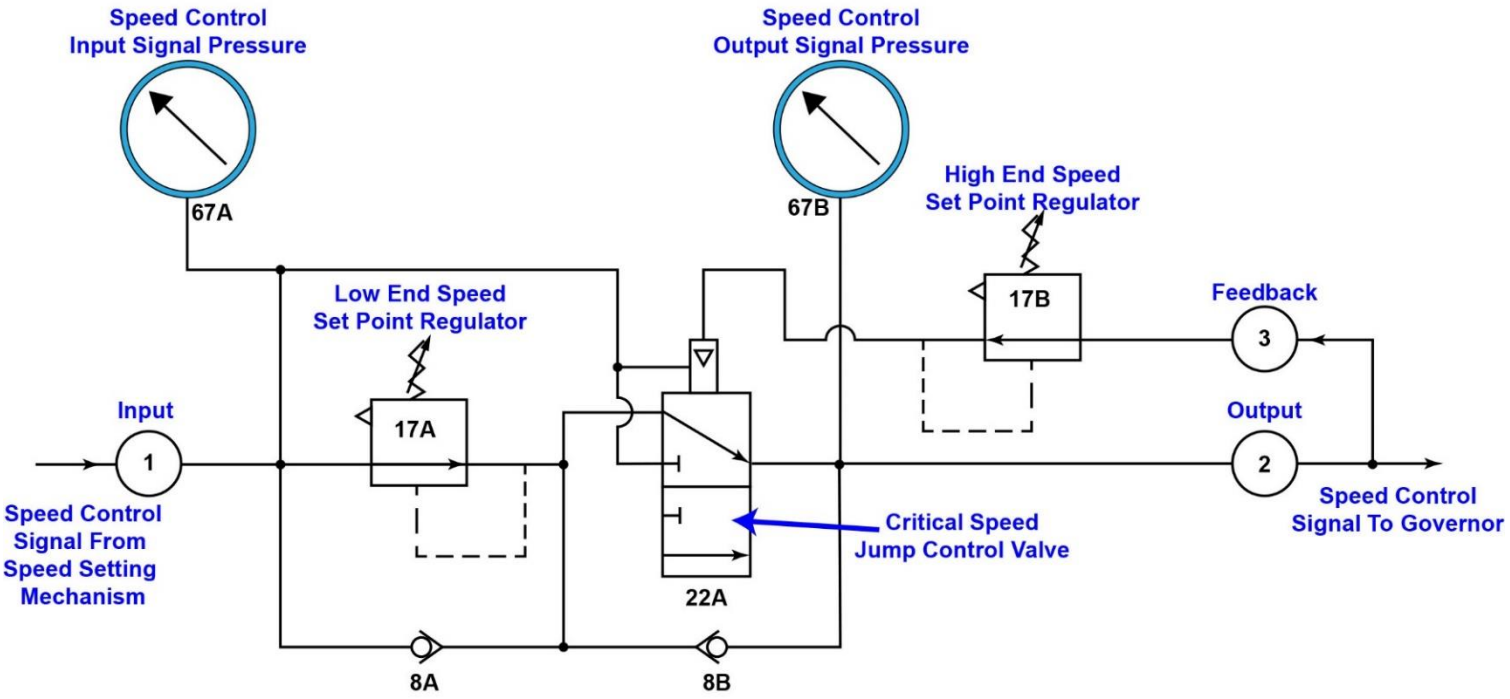
**Adapted for testing purposes only from Instruction Manual and Parts List,
Mineral Oil Separator with Self-Cleaning Bowl, Model OSA 20-02-066**

MO-0113



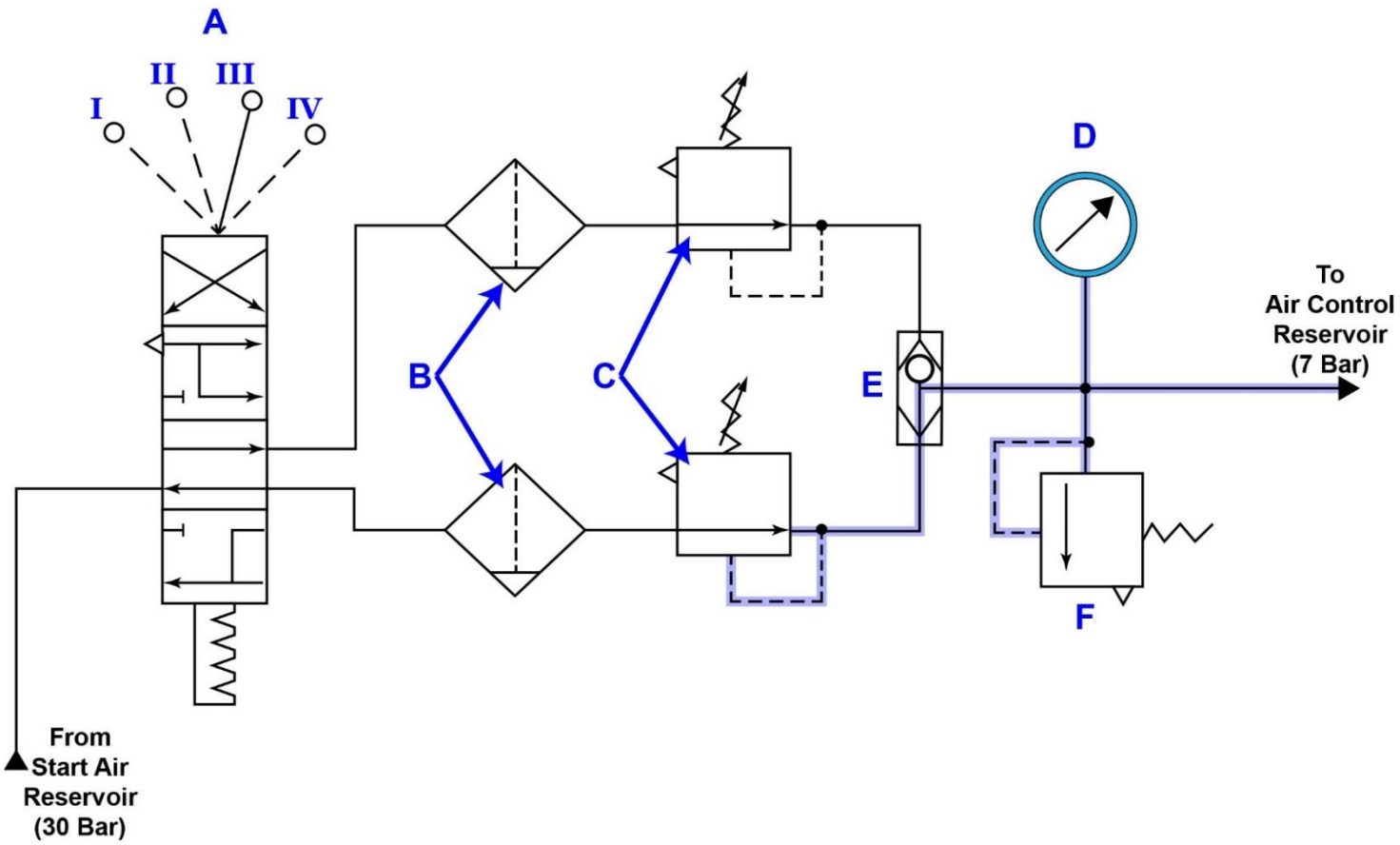
MO-0114

Critical Speed Jump Valves Group

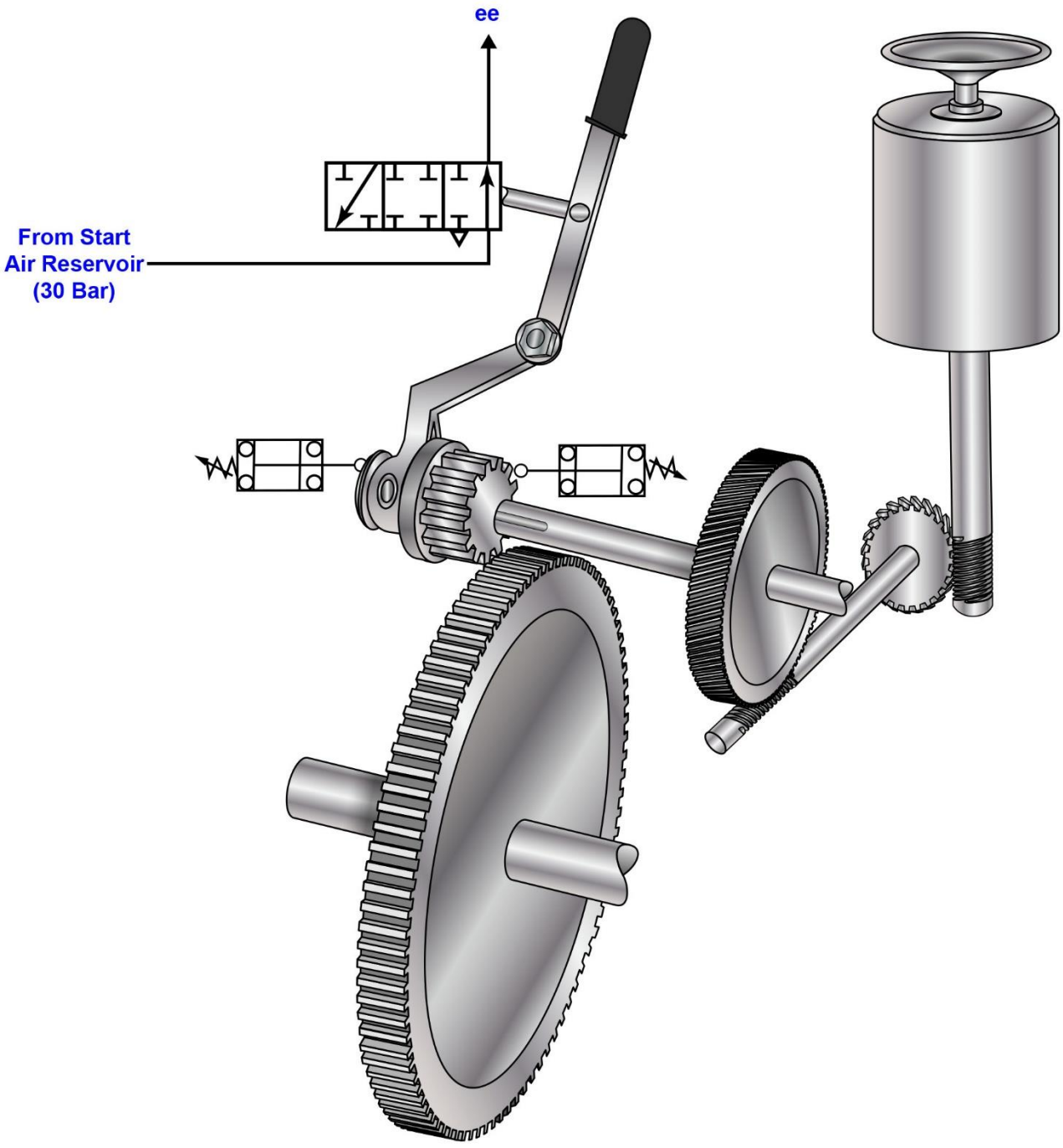


MO-0115

Control Air Pressure-Reducing Unit
Valves Group

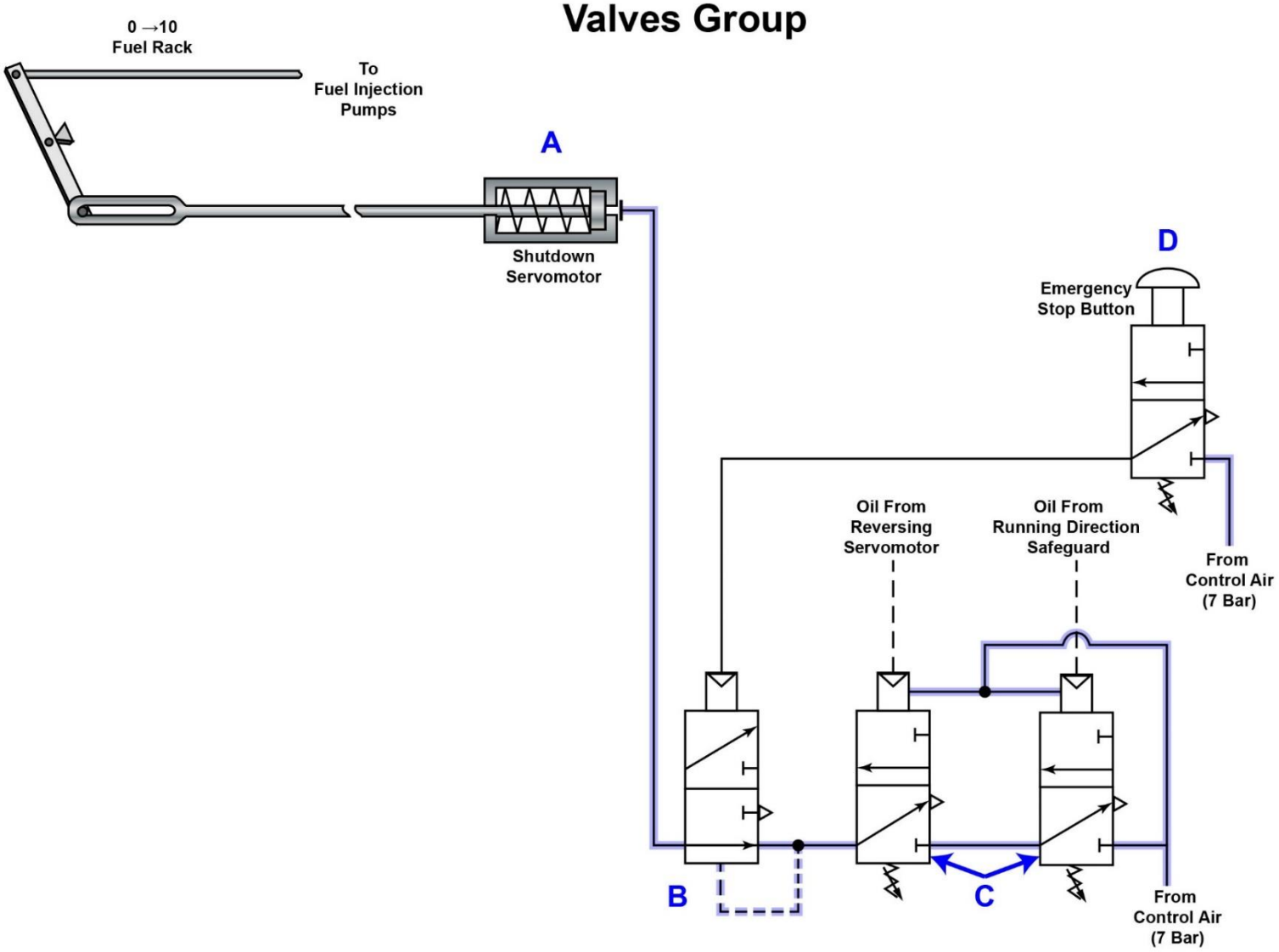


MO-0116



MO-0117

Fuel Blocking Valves Group



MO-0127

EPC Alarm Indications Program Unit			
Alarm from MARST1	Low pressure in oil outlet	High oil temperature after preheater	Low oil temperature after preheater
Emergency stopping or vibrations	No discharge	Logically wrong signal from 1st separator	Remote alarm signal only

MARST1 Alarm Indications Program Unit			
A01	**A02**	**A03**	**A04**
Abnormal water content	Transducer signal minimum value	No discharge feedback signal	Drain valve insufficient
A05	**A06**	**A07**	
Micro-processor error	Liquid indication	Transducer fault