

U.S.C.G. Merchant Marine Exam

Chief Engineer – Limited

Q602 Motor Plants

(Sample Examination)

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

1. Exhaust valve timing for the engine, shown in the illustration, is to be set at 106° after top dead center. To what position should the flywheel be rotated to set the exhaust valve timing on the No.11 cylinder? Illustration MO-0039
- A. 61°
 - B. 209°
 - C. 315°
 - D. 360°

Correct answer: A

2. When inspecting the valve mechanism shown in the illustration, normal maintenance would include _____. Illustration MO-0074
- A. mechanically adjusting the valve at point "D"
 - B. mechanically adjusting the valve at point "E"
 - C. changing the tappet clearance as measured between points "A" and "B"
 - D. measuring the cold valve clearance between components "C" and "D"

Correct answer: D

3. During main engine performance testing it is noticed that one cylinder has firing and compression pressures lower than average. Which of the following would most likely be the cause?
- A. Low engine load
 - B. Early fuel injection
 - C. Worn piston rings
 - D. Late fuel injection

Correct answer: C

4. 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/enthalpy
 - D. pressure/temperature

Correct answer: A

5. All modern medium and slow speed diesel engines have components assembled via bolts that are tensioned hydraulically, both for removal and reassembly. When using such hydraulic devices, to what metallurgical state are you subjecting such bolts?
- A. Initially above the metal's elastic limit.
 - B. When tightened, they are above the metal's elastic limit.
 - C. When tightened, they are below the metal's elastic limit.
 - D. When tightened, they are at the metal's elastic limit.

Correct answer: C

6. On a slow-speed diesel engine vessel you are supervising a routine piston pull on a cylinder with 10000 hours on the liner. The piston rod is disconnected. Why must the ridge on the liner be removed before lifting the piston?
- A. The ridge is part of the exhaust trunk that extends into the path of the piston removal.
 - B. The ridge is a protrusion on the piston crown and must be removed to fit through the liner opening.
 - C. The ridge interferes with the piston removal and must be ground down.
 - D. The ridge is an expansion of the exhaust vents that interfere with the piston removal.

Correct answer: C

7. Excessive wear at part #11, as shown in the illustration, would result in _____. Illustration MO-0027
- A. improper timing
 - B. increased oil consumption
 - C. lost compression
 - D. low oil pressure

Correct answer: B

8. Oil accumulating in the exhaust piping or manifold of a diesel engine can be caused by _____.
- A. collapsed hydraulic valve lifters
 - B. worn valve guides
 - C. excessive crankcase vacuum
 - D. excessive lube oil pressure

Correct answer: B

9. Evidence of low temperature corrosion is observed on the combustion space components of a slow-speed diesel engine. What causes this corrosion and what can one do to mitigate this situation?
- A. Vanadium from fuel melting in the exhaust gases. Maintain lower cooling water temperature to prevent vanadium from melting.
 - B. Sulfur from the fuel condensing on cold surfaces forming sulfuric acid. Ensure cooling water temperatures maintain the combustion space temperatures above the dew point of sulfuric acid.
 - C. Low temperature corrosion cannot be observed; it has to be determined by metallurgical testing. Maintain cooling water temperatures as per manufacturer's specifications.
 - D. Sulfur in exhaust gas mixing with water vapor condensation. Order cylinder oil of lower total base number.

Correct answer: B

10. 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

11. On small diesel engines, a noticeable decrease in the time interval between the replacement of the lube filter cartridge indicates _____.
- A. piston ring blow-by
 - B. excessive oil pressure
 - C. dirty air filter
 - D. excessive oil temperature

Correct answer: A

12. One remedy for a high firing pressure, in addition to a high exhaust temperature in one cylinder of a diesel engine, is to _____.
- A. reduce fuel booster pump pressure
 - B. increase scavenge air pressure
 - C. adjust the fuel rack
 - D. retard fuel injector timing

Correct answer: C

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

Correct answer: A

14. While underway, a slow-speed diesel engine lube oil sump level slowly begins to decrease. Which of the following should be checked?
- A. The lubricating oil cooler for leakage into the cooling system.
 - B. The standby lube oil pump to ensure it is not operating.
 - C. The piston oil scraper rings for excessive wear.
 - D. The tank heating coils to ensure they are secured.

Correct answer: A

15. A dirty lube oil strainer can result in _____.
- A. crankcase dilution
 - B. excessive oil consumption
 - C. low bearing oil pressure
 - D. low lube oil temperature

Correct answer: C

16. Which statement about diesel engine combustion is true?
- A. Turbulence in the cylinder causes a delay in ignition.
 - B. Combustion does not begin until the piston starts down on the power stroke.
 - C. Maximum combustion pressure is reached before TDC.
 - D. Maximum cylinder firing pressure is not developed until the piston passes TDC.

Correct answer: D

17. What is a major initial ramification of receiving bunkers with a water content of 0.75% by volume?
- A. Vessel will have to use additional efforts to reduce the water content, the oily-water separators can deal with the discharge wastewater.
 - B. Economic loss of receiving less fuel, by volume, but still within ISO 8217:2010 fuel specifications.
 - C. Loss of specific heating value of fuel's thus effecting fuel consumption and engine efficiency, as well as an economic loss.
 - D. All water may be dealt with by proper use of centrifuges, thus not a significant onboard or economic/engineering problem.

Correct answer: C

18. Catalytic fines comprised of aluminum oxide and/or silicon dioxide are a common contaminant of residual fuels. Which diesel engine components would be most affected by catalytic fines in fuel?
- A. High pressure fuel pumps and fuel injectors.
 - B. High pressure fuel pumps and cylinder liners.
 - C. Fuel injectors and turbocharger blading.
 - D. Fuel injectors and piston rings.

Correct answer: A

19. While bunkering heavy fuel, what quick/easy test can one perform onboard to determine the compatibility of 'old' with 'new' fuel?
- A. Use blotter paper with a single concentric drop of 'old' and 'new' fuel, if they do not form separate circles, the fuels may be deemed compatible.
 - B. Perform a running viscosity test of both fuels, at the same temperature, if the viscosities are equal, they should be compatible.
 - C. Take equal samples of both fuels, elevate their temperature, and mix them vigorously. If no frothing occurs, they are compatible.
 - D. Mix two equal samples of the two fuels at elevated temperatures and determine if they become a homogeneous mixture.

Correct answer: A

20. If the separating temperature is to remain constant, what is the relationship between the specific gravity of the oil and the required size of the regulating ring? Illustration MO-0113
- A. The larger sized regulating rings are designed to be used with oils of lower specific gravities.
 - B. The specific gravity of the oil and the size of the regulating ring are related only during the initial design stages of the centrifuge.
 - C. With oils of greater specific viscosities, it is proper to select smaller regulating rings regardless of the operating temperatures desired.
 - D. For a constant operating temperature, the greater the specific gravity of the oil the larger the regulating ring.

Correct answer: A

21. From the graph shown in the illustration, determine the size of the regulating ring required for the proper operation of the fuel oil centrifuge if the fuel oil specific gravity is 0.9 kg/dm³ at 68°F, and the separating temperature is 158°F. Illustration MO-0113
- A. 86 mm
 - B. 104 mm
 - C. 110 mm
 - D. 117 mm

Correct answer: C

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

Correct answer: A

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

Correct answer: B

24. As Chief Engineer of a slow-speed diesel engine vessel equipped with an ALCAP fuel oil purification system. You note a definite increase in the rate at which the purifier sludge tank is rising. One of the first items to check on your system would be which of the following?
- A. The voltage to the EPC control cabinet.
 - B. The water transducer located in the dirty oil supply line.
 - C. The opening water solenoid for leak through.
 - D. The RPM of the bowl.

Correct answer: C

25. When disassembling or assembling an injection pump plunger and barrel you should _____.
- A. keep the parts immersed in diesel fuel
 - B. always keep the plunger and barrel as a matched set
 - C. work over a linoleum-type surface
 - D. all of the above

Correct answer: D

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

Correct answer: A

27. High cylinder firing pressure, accompanied by low exhaust temperature, can result from _____.
- A. lengthy exhaust valve duration
 - B. extended operation at light load
 - C. improper fuel rack positioning
 - D. excessively early injection timing

Correct answer: D

28. Faulty operation of diesel engine fuel injection nozzles can be a direct result of _____.
- A. sediment in the fuel supply
 - B. excessive fuel nozzle holder cooling
 - C. low lube oil pressure
 - D. distortion of the fuel spray pattern

Correct answer: A

29. Which of the following statements concerning the factors affecting ignition delay is correct?
- A. An increase in intake air temperature will increase ignition delay.
 - B. An increase in coolant temperature will decrease ignition delay.
 - C. An increase in compression ratio will increase ignition delay.
 - D. An increase in combustion chamber turbulence will increase ignition delay.

Correct answer: B

30. While examining a used fuel injection nozzle(s), one finds worn and enlarged orifices. What does this indicate about that cylinder's performance prior to nozzle replacement(s)?
- A. Volume of fuel injected is increased, reduced injection pressure, decreased ignition delay.
 - B. Volume of atomization is increased, penetration is reduced, vaporization is increased, and efficiency is not affected.
 - C. Reduced combustion efficiency, increased ignition delay, reduced atomization, and prolonged penetration.
 - D. Penetration is increased, air/fuel mixture is increased, and cylinder efficiency is not substantially affected.

Correct answer: C

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

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

Correct answer: C

32. A diesel engine operates erratically, overspeeds, and fails to restart when cranked at normal speed. Which of the following problems is the most likely cause for the engine failing to restart?

- A. Failure to reset the overspeed trip
- B. Damage to the governor due to excessive speed
- C. Failure to reposition the fuel rack
- D. Improper governor operation due to excess oil pressure

Correct answer: A

33. What is the maximum allowable clearance permitted between the bearing, shown in the illustration and the shaft along its vertical axis? Illustration MO-0121

- A. 0.30 mm
- B. 0.46 mm
- C. 0.80 mm
- D. 1.00 mm

Correct answer: C

34. When an additional load is applied to a diesel engine which is using an inadequately inflated air bladder clutch unit, you can expect _____.

- A. pneumatic seizure
- B. excessive wear on the thrust bearings
- C. overheating because of slipping shoes
- D. chipped reduction gear teeth

Correct answer: C

35. A large change in ambient temperature or using an oil of a viscosity different than the one recommended by the manufacturer in a mechanical hydraulic governor, will result in the need to adjust the _____.

- A. pilot valve opening
- B. compensating spring tension
- C. compensating needle valve
- D. accumulator spring tension

Correct answer: C

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

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

Correct answer: C

37. If the operating speed of a diesel engine increases without an apparent change in the engine control settings, you may suspect a _____.

- A. leaking air starting valve
- B. clogged intake air intercooler
- C. malfunctioning governor
- D. control air leak

Correct answer: C

38. A feed pump for an auxiliary boiler might lose suction if the _____.

- A. boiler water level is low
- B. feedwater is too hot
- C. boiler steam demand is low
- D. feedwater is too cold

Correct answer: B

39. 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

40. A burner producing black smoke in an automatic auxiliary boiler, would be caused by a/an _____.

- A. incorrect electrode setting
- B. defective solenoid valve
- C. grounded high tension lead
- D. incorrect primary air setting

Correct answer: D

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

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

Correct answer: B

42. Item #16 of the piston shown in the illustration is a/an _____. Illustration MO-0011

- A. bearing insert tang
- B. thrust plate or thrust washer
- C. piston carrier pin
- D. oil drain passage

Correct answer: B

43. Which construction detail is apparent in the connecting rod and piston assembly shown in the illustration? Illustration MO-0011

- A. The piston is designed with a heat dam.
- B. It is a fork assembly.
- C. The piston is water cooled.
- D. The wrist pin is free floating.

Correct answer: A

44. In accordance with 46 CFR Subchapter F, diesel fuel oil system valves for removing water or impurities are _____.

- A. permitted, provided they are fitted with caps or plugs
- B. required, if there are no separators installed on board
- C. not required, provided there is a high and low tank suction
- D. strictly prohibited

Correct answer: A

45. The device shown in the illustration is classified as a/an _____. Illustration MO-0008

- A. exhaust gas vapor condenser
- B. reflective type explosion meter
- C. comparator type mist detector
- D. Ringelmann exhaust gas analyzer

Correct answer: C

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

Correct answer: D

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

Correct answer: D

48. Mechanical lubricators for diesel engine cylinders are usually small reciprocating pumps which are _____.

- A. adjustable to meet lubrication requirements
- B. placed into operation only at maximum load
- C. operated until the engine has started
- D. operated manually once each hour

Correct answer: A

49. The illustrated device is used to _____. Illustration MO-0050

- A. actuate exhaust valves in the correct sequence
- B. meter fuel oil to the injectors
- C. admit the correct amount of starting air to the cylinders in proper order
- D. supply cylinder lubricating oil to the engine

Correct answer: D

50. The area indicated by the letter "W", shown in the illustration is correctly termed the _____. Illustration MO-0112

- A. upper sliding piston chamber
- B. opening chamber
- C. closing chamber
- D. parting chamber

Correct answer: B

51. Which of the following precautions should be taken prior to starting the separator shown in the illustration? Illustration MO-0127

- A. Release the bowl brake and confirm proper valve line up.
- B. Make sure the separator is properly assembled.
- C. Check for the correct oil level in the gear housing.
- D. All of the above are correct.

Correct answer: D

52. A motor vessel has three centrifuges to pre-treat the fuel which can be configured to operate in series, parallel, and series-parallel. A large quantity of water is determined to be present in the fuel. How would you configure the centrifuges to deal with this problem?

- A. Run two centrifuges in parallel as purifiers discharging to the third one in series as a clarifier.
- B. Run all three centrifuges as purifiers and decrease throughput.
- C. Drain settling and service tanks more often and run two centrifuges in series, purifier and clarifier.
- D. Increase 'shoot' cycles and run two centrifuges in series as purifiers.

Correct answer: A

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

Correct answer: C

54. The amount of fuel delivered by a unit injector is controlled by the _____.
- A. engine speed
 - B. main spring
 - C. rack position
 - D. camshaft

Correct answer: C

55. Differential needle valves used in fuel injectors are directly closed by _____.
- A. cam action
 - B. firing pressure
 - C. fuel oil pressure
 - D. spring force

Correct answer: D

56. In a turbocharger, inlet air velocity is increased in the _____.
- A. compressor outlet volute
 - B. stationary diffuser passages
 - C. rotating impeller vanes
 - D. inlet nozzle ring

Correct answer: C

57. An engine is equipped with the overspeed trip similar to that shown in the illustration. The throw out weight is designed to run at 900 RPM and trip out at 10% overspeed. However, the overspeed trip is currently activating at 930 RPM. In order to correct this problem, _____. Illustration MO-0101
- A. decrease compression on spring #12
 - B. increase compression on spring #12
 - C. install a larger throw out weight piece #10
 - D. change the angle of the operating face by machining piece #10

Correct answer: B

58. The pinion gear shown in the illustration, is located _____. Illustration MO-0086
- A. below #1 and #3
 - B. between #1 and #3
 - C. below #2 and #4
 - D. between #2 and #4

Correct answer: B

59. In the reversing reduction gear shown in the illustration, the forward and reverse main pinions are in constant mesh with the main gear. This means the _____. Illustration MO-0085
- A. idling gears rotate in a direction opposite to their rotation when carrying load
 - B. set that is clutched in will rotate as idlers driven from the main gear
 - C. synchromesh coupling will maintain transition torque control
 - D. clutches are engaged by a reduction in control air pressure

Correct answer: A

60. Increasing the oil pressure acting on the power piston of the hydraulic governor shown in the illustration will _____. Illustration MO-0092
- A. increase the speed droop
 - B. require the overspeed trip setting to be adjusted
 - C. increase the governor output power
 - D. decrease the speed droop

Correct answer: C

61. The direct acting mechanical governor used with some small diesel engines, controls fuel flow to the engine by _____.
- A. positioning a servomotor piston attached to the fuel controls
 - B. positioning a butterfly valve in the fuel delivery system
 - C. governor flyweight action on a pilot valve which controls fuel injection
 - D. governor flyweight motion acting on fuel controls through suitable linkage

Correct answer: D

62. Which of the listed problems will happen when the water level of a fire-tube type auxiliary boiler approaches the crown sheet?
- A. Excess steam will be generated.
 - B. The furnace will overheat.
 - C. The fusible plugs will melt.
 - D. The furnace will explode.

Correct answer: C

63. Which of the automatic boiler controls listed should be tested prior to lighting off an auxiliary boiler?
- A. Automatic bottom blow valve
 - B. Low water level cutoff switch
 - C. Voltage output of the ignition transformer
 - D. Insulation resistance readings in the ignition system high tension leads

Correct answer: B

64. Why should the main steam stop valve of an auxiliary boiler be eased off its seat and then gently closed before lighting off?
- A. To examine the valve stem for scars or nicks.
 - B. To check for a tight bonnet seal.
 - C. To check the valve packing.
 - D. To ensure that the valve will not be seized shut when hot.

Correct answer: D

65. The primary function of a flame safeguard system, as used on an automatically fired auxiliary boiler, is to prevent _____.
- A. accidental dry firing and overpressure
 - B. uncontrolled fires in the furnace
 - C. explosions in the boiler furnace
 - D. overheating of the pressure parts

Correct answer: C

66. In diesel engines, hydraulic valve lifters are used to _____.
- A. reduce valve gear pounding
 - B. increase valve operating lash
 - C. obtain greater valve lift
 - D. create longer valve duration

Correct answer: A

67. The intake and exhaust valves used in a diesel engine are returned to their seats by _____.
- A. exhaust pressure
 - B. push rod pressure
 - C. combustion pressure
 - D. spring force

Correct answer: D

68. 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. a valve actuating cam
 - B. the spring force and cylinder pressure
 - C. the starting air pressure
 - D. a pneumatic bellows assembly

Correct answer: B

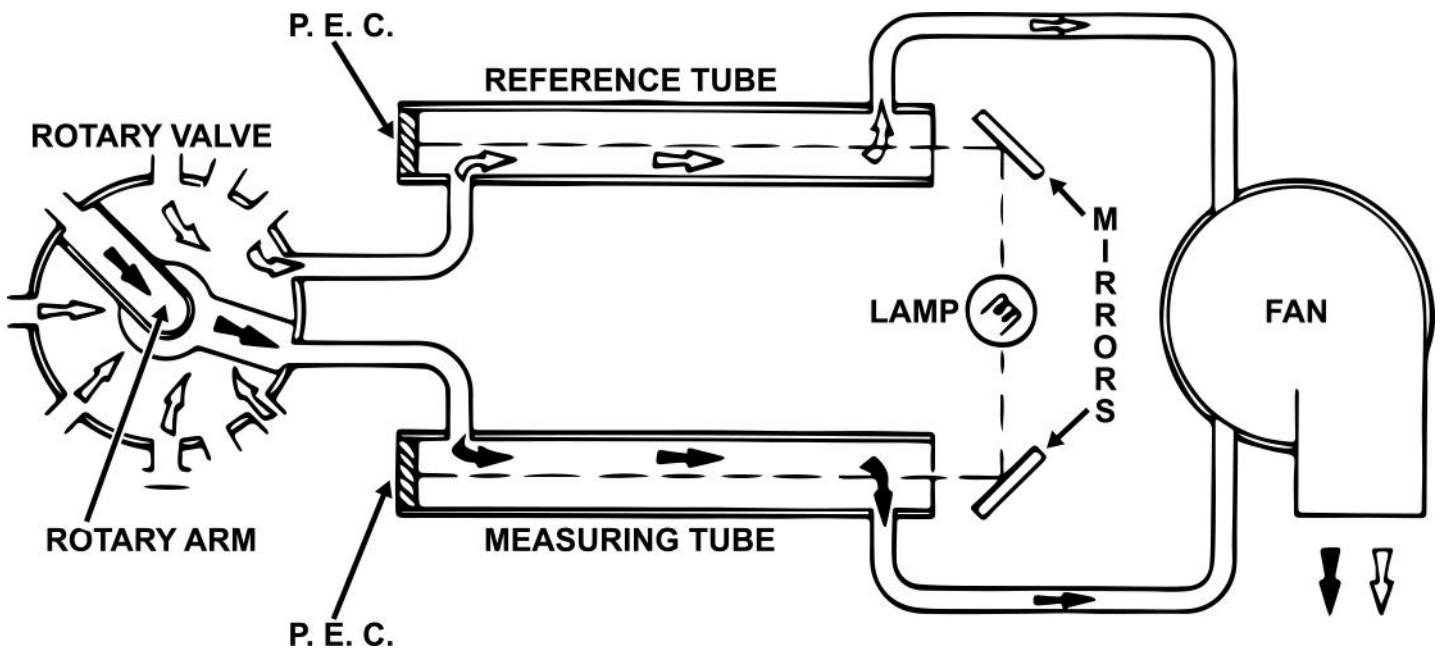
69. In a Bendix starter drive, the pinion engagement with the flywheel ring gear is initiated by _____.
- A. Bendix spring pressure
 - B. starter drive shaft rotation
 - C. a differential spring
 - D. solenoid throw out action

Correct answer: B

70. When an engine fitted with a hydraulic starting system starts up, the starter is protected from the higher speed of the engine by _____.
- A. the overrunning clutch
 - B. the pivoting of the shaft from being engaged with the flywheel
 - C. closing the starting check valves
 - D. the immediate increase in hydraulic pressure

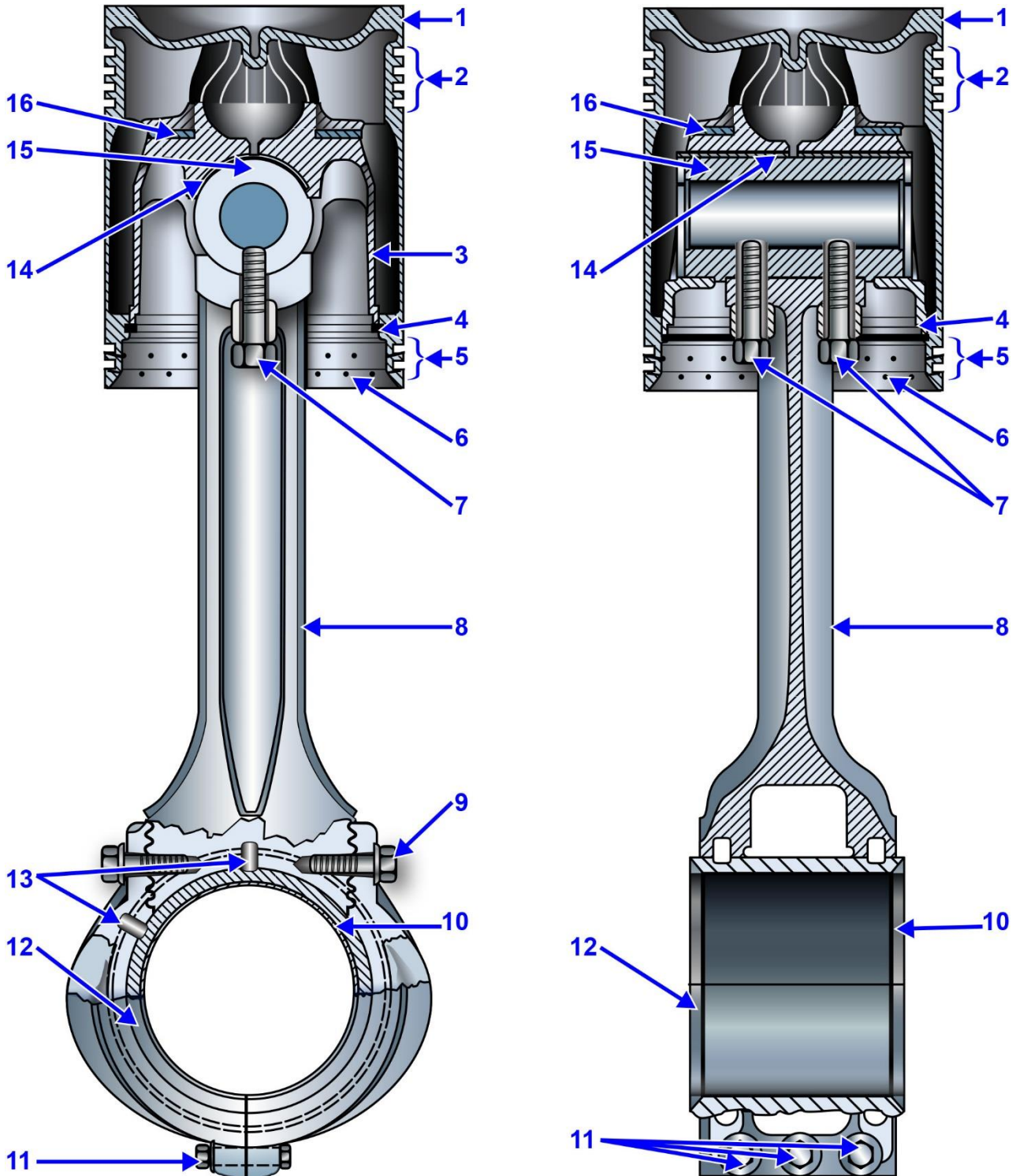
Correct answer: A

MO-0008



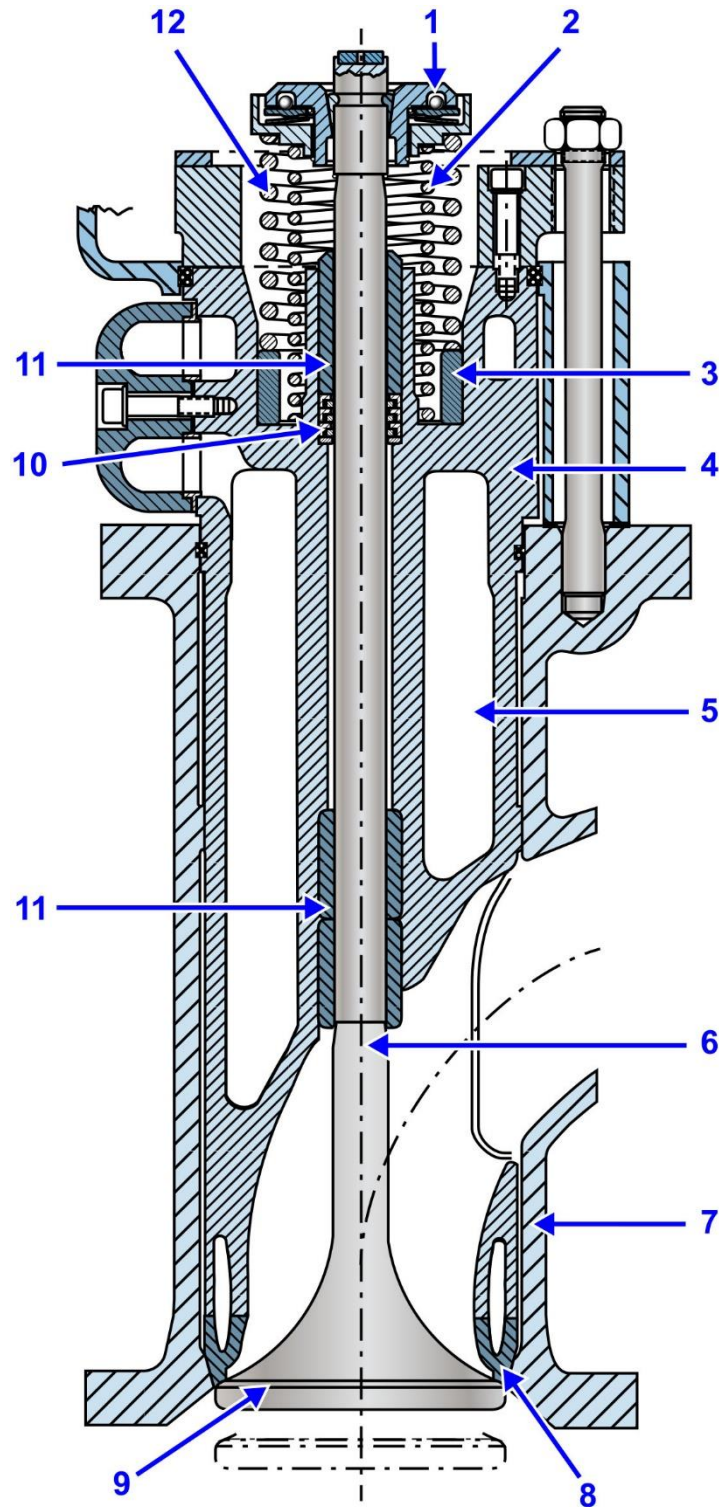
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MO-0011



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MO-0027



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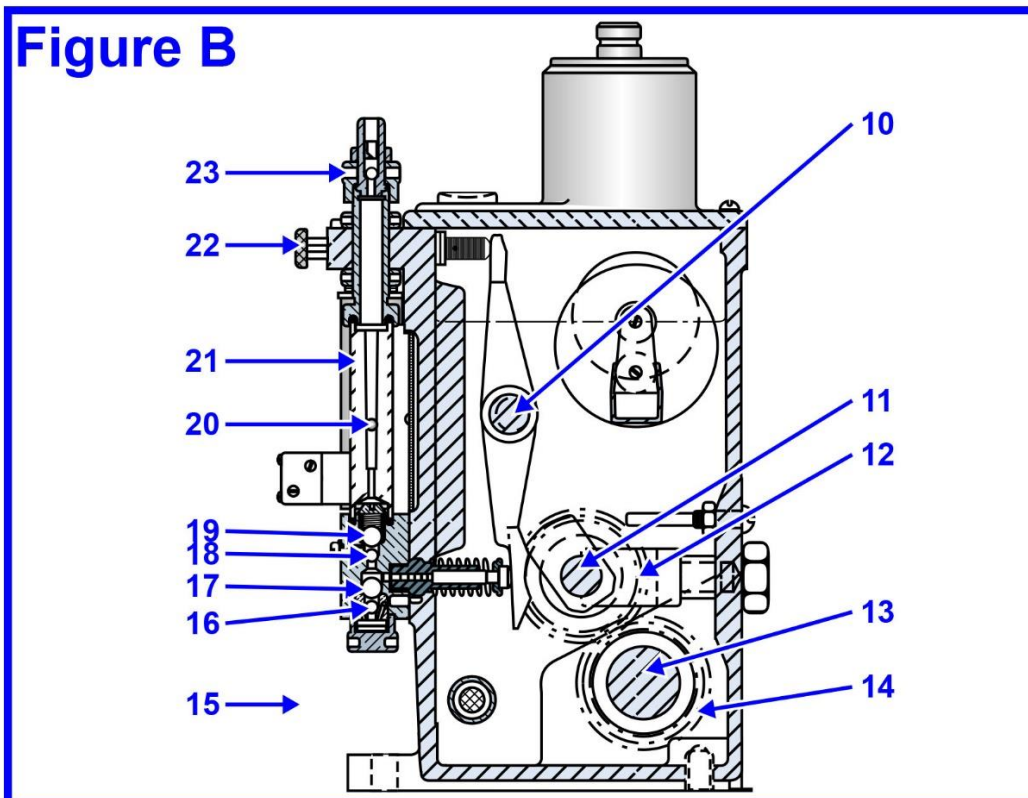
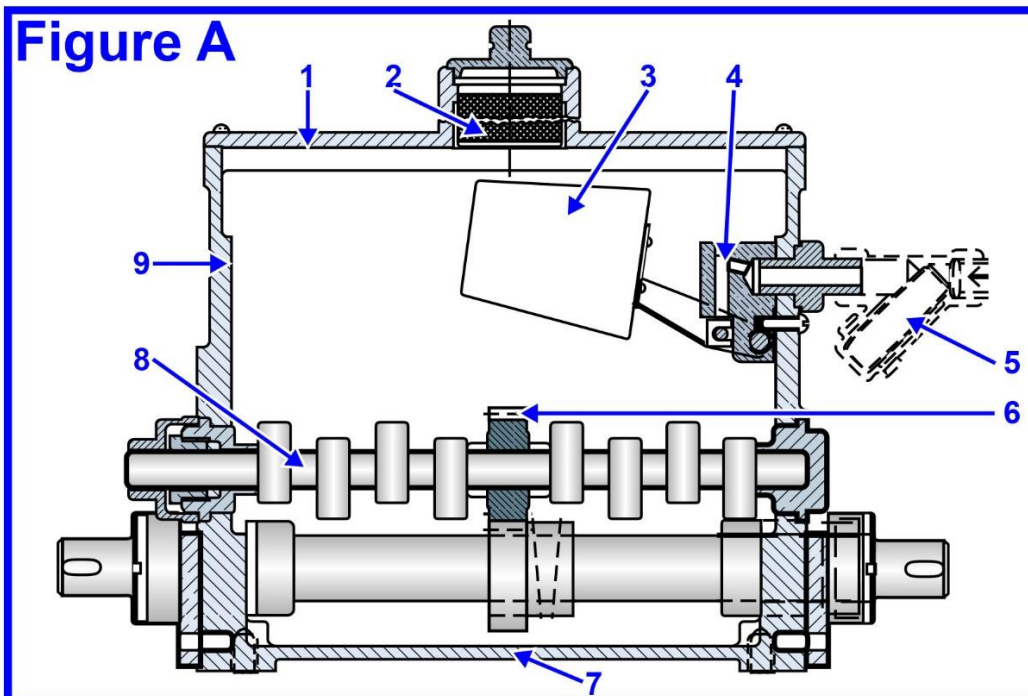
MO-0039

This information is for a two-stroke cycle marine engine and the flywheel is marked with reference to number one cylinder.

20-Cylinder	
Firing Order	Top Dead Center
1	0 DEGREES
14	27 “
9	36 “
16	63 ”
4	72 “
13	99 “
6	108 “
20	135 “
3	144 “
12	171 “
10	180 “
17	207 “
2	216 “
15	243 “
7	252 “
18	279 “
5	288 “
11	315 “
8	324 “
19	351 “

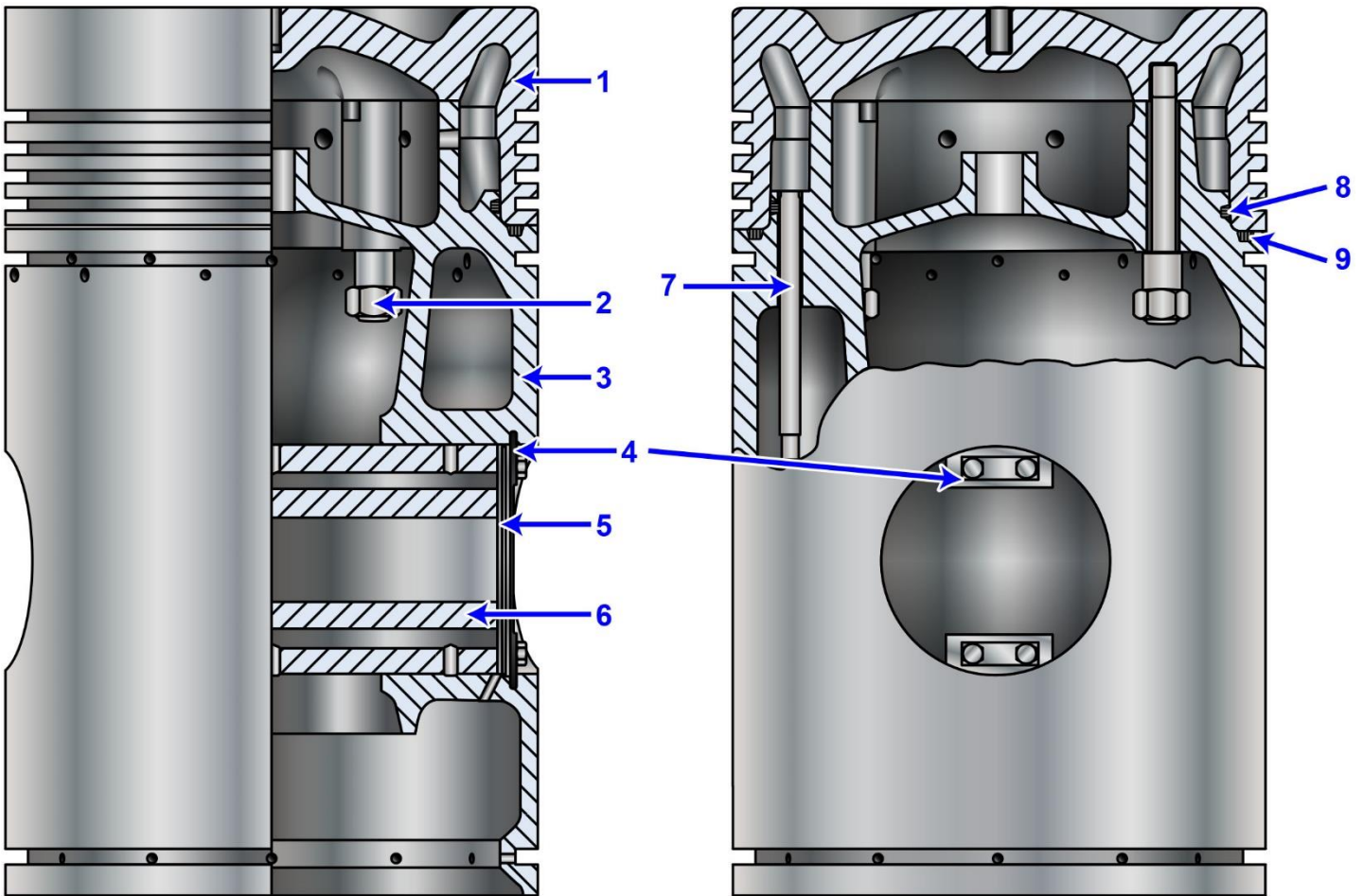
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MO-0050



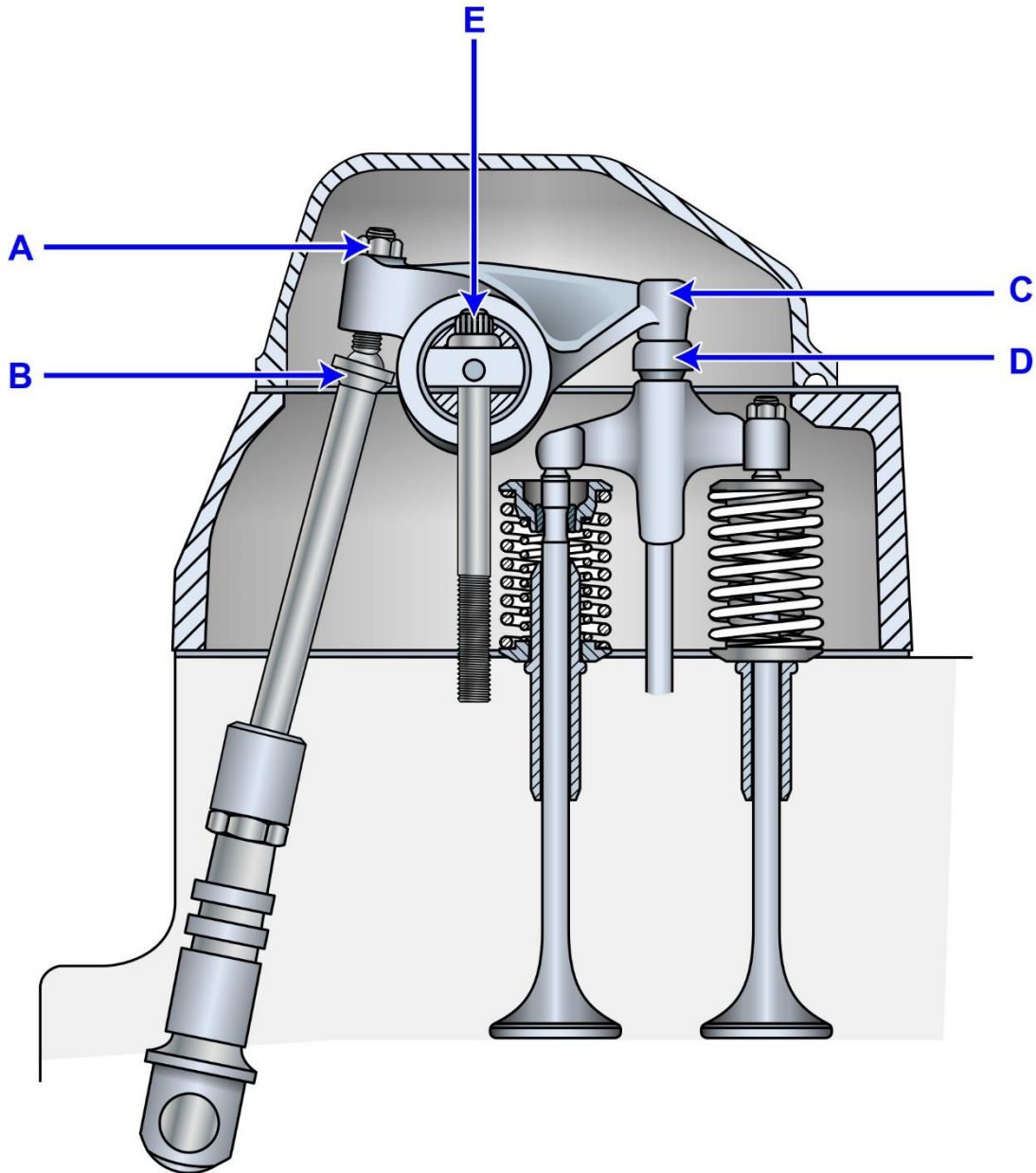
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MO-0067



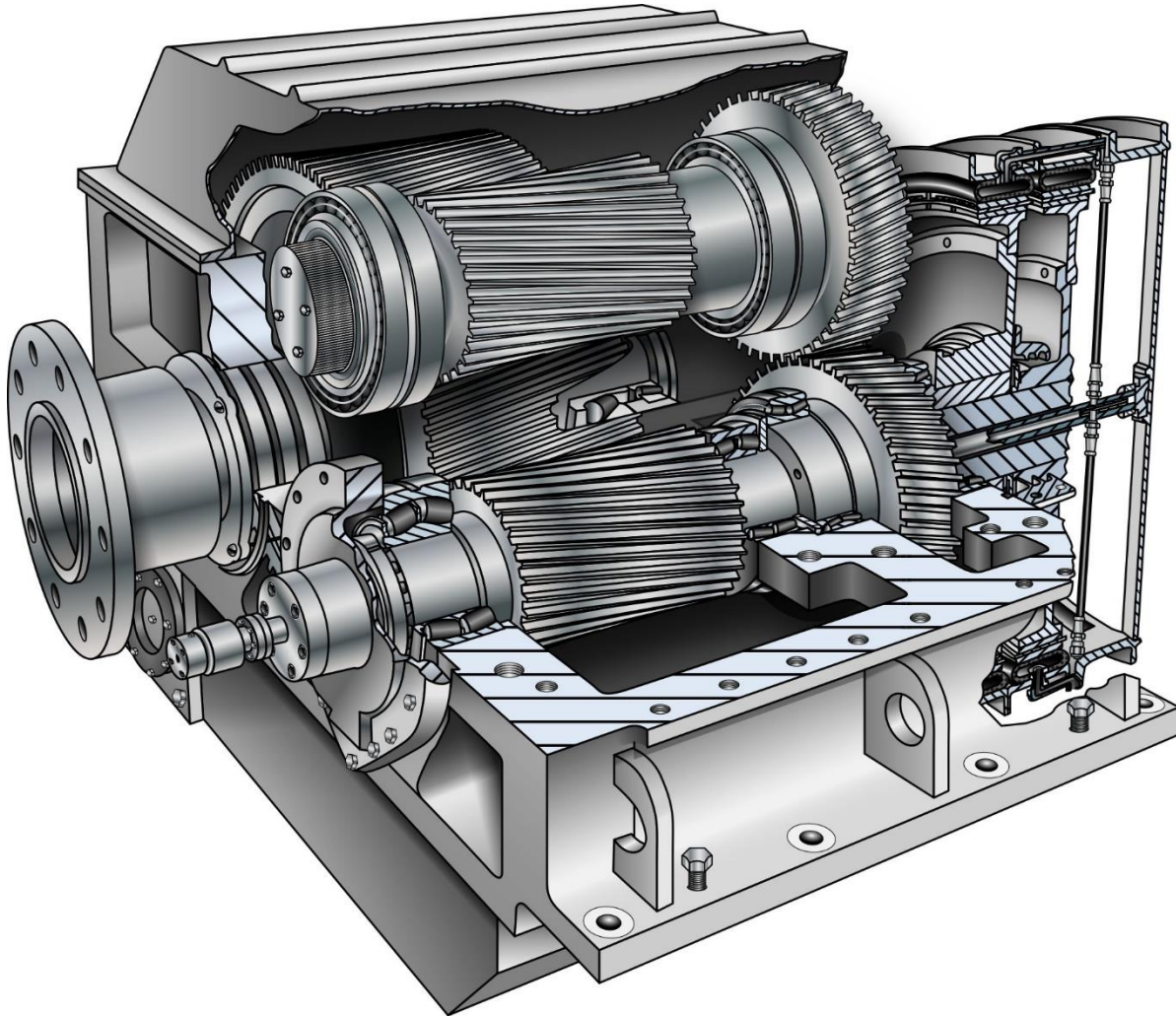
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MO-0074



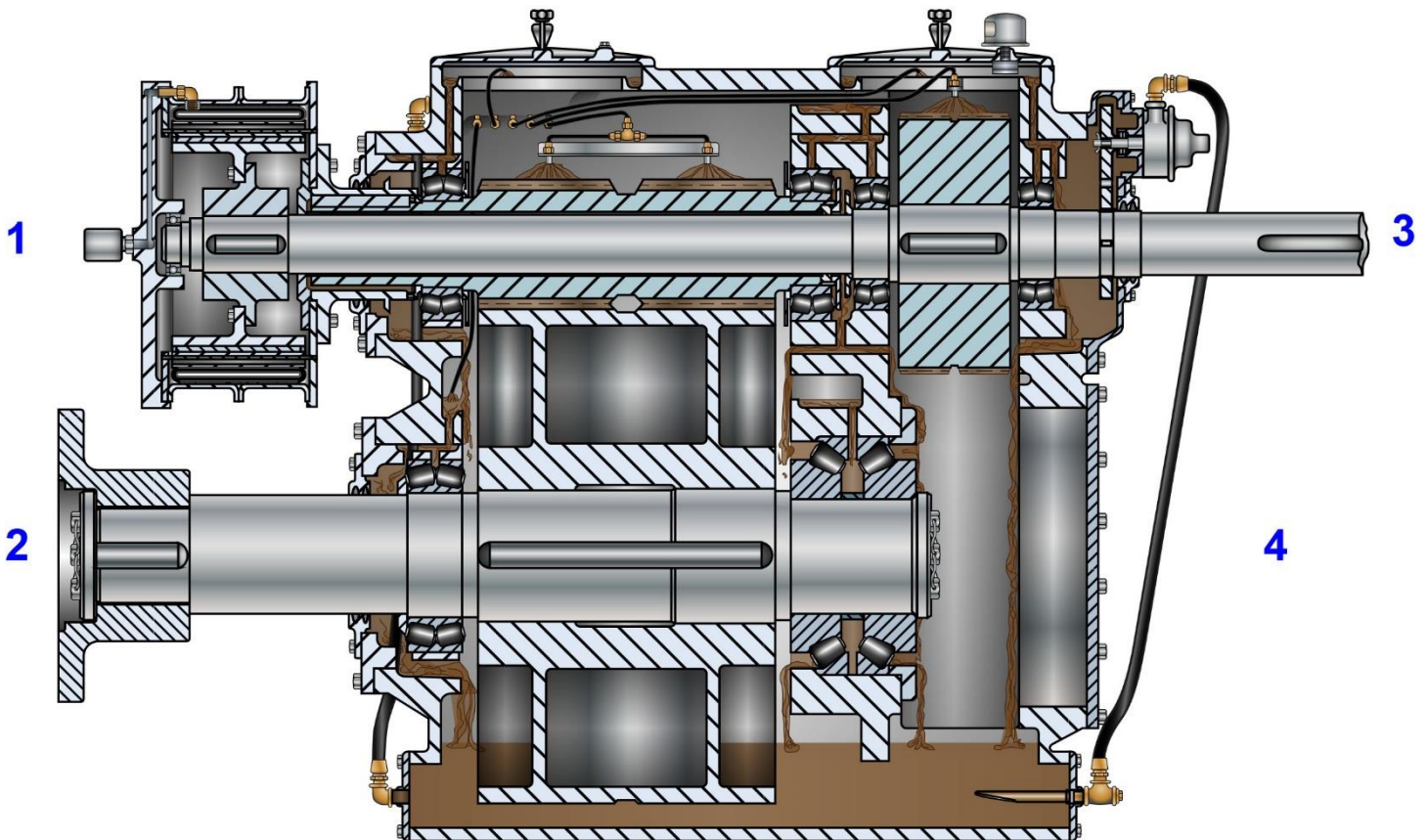
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MO-0085



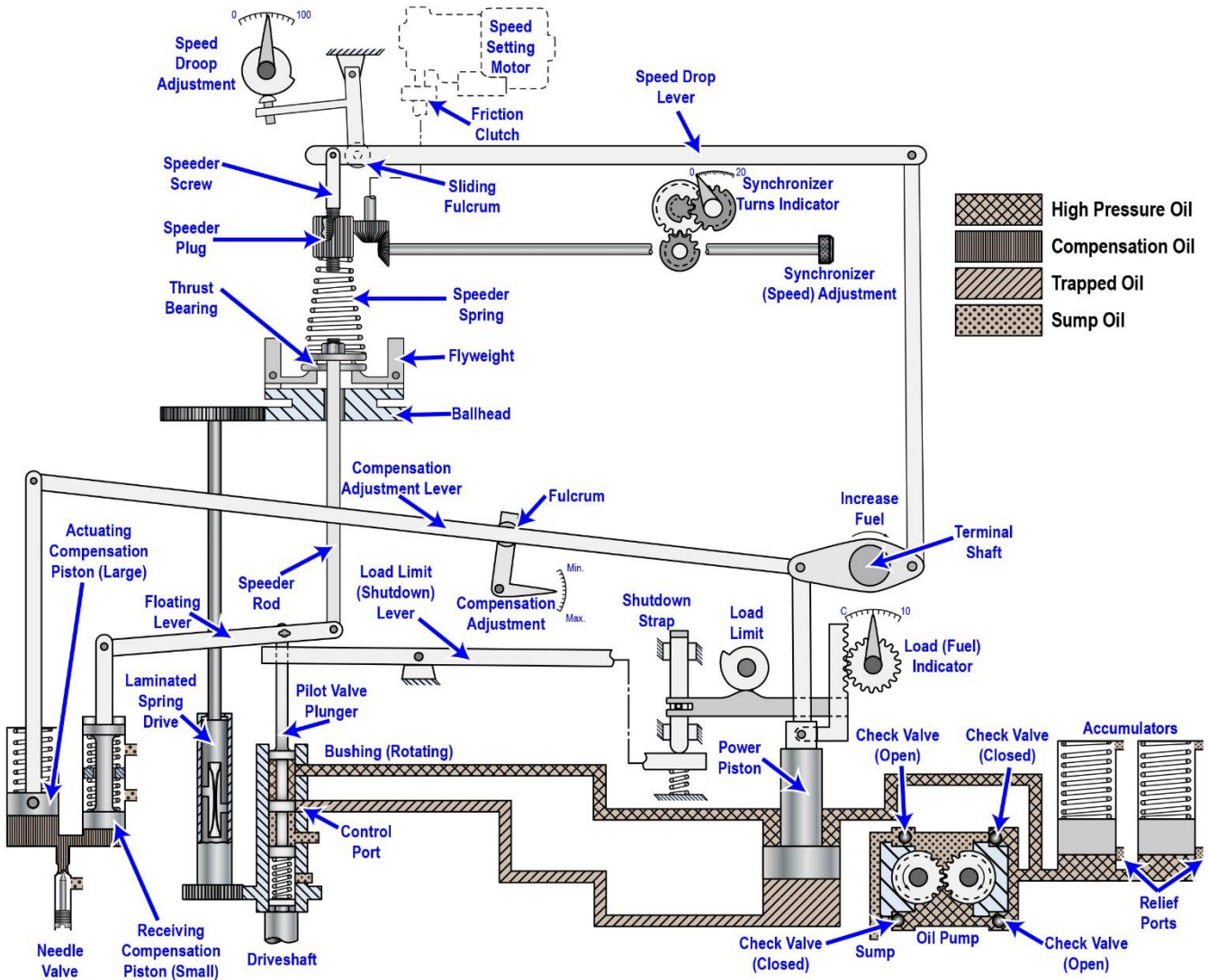
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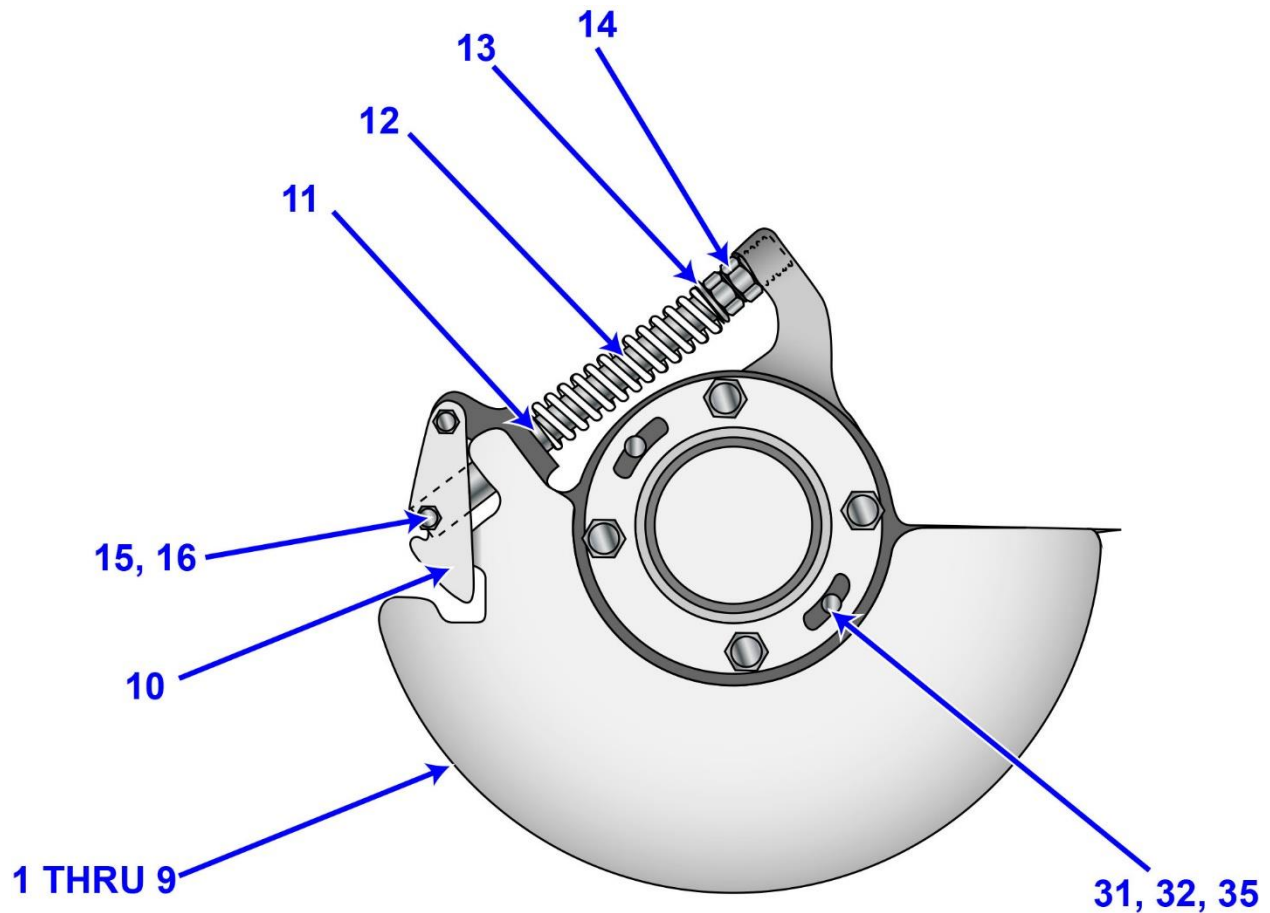
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MO-0092



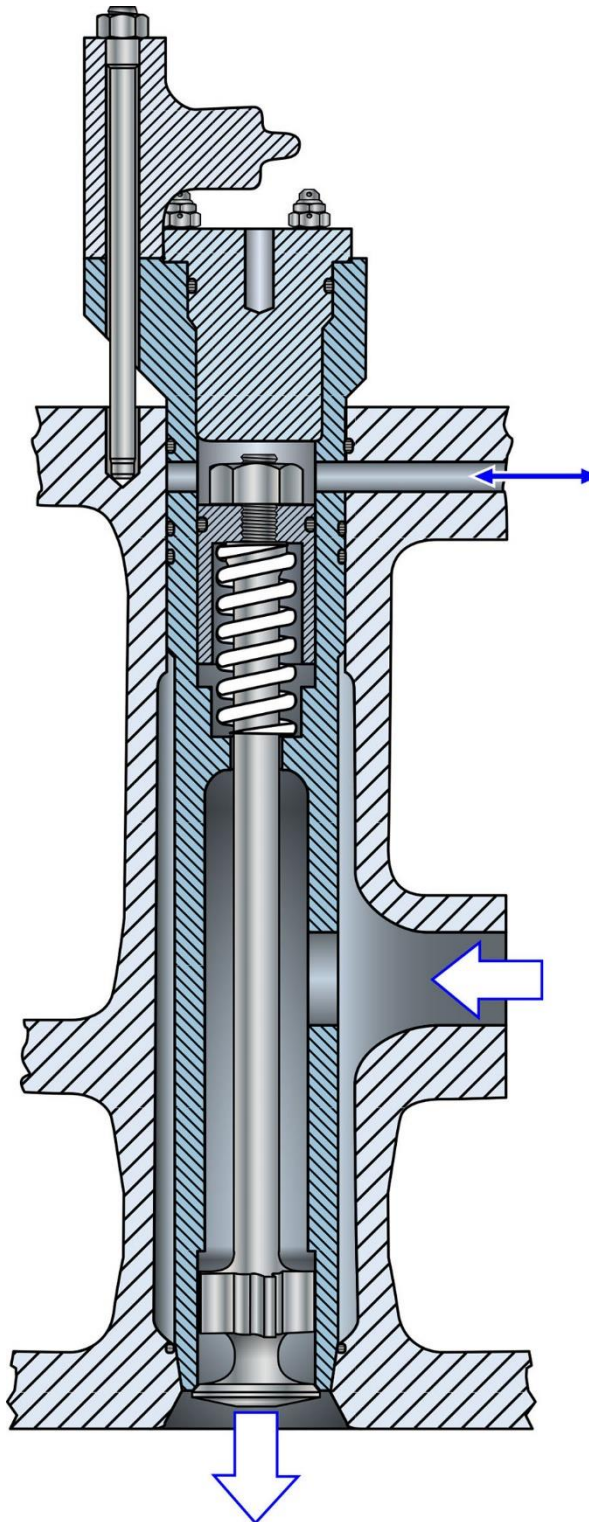
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MO-0101



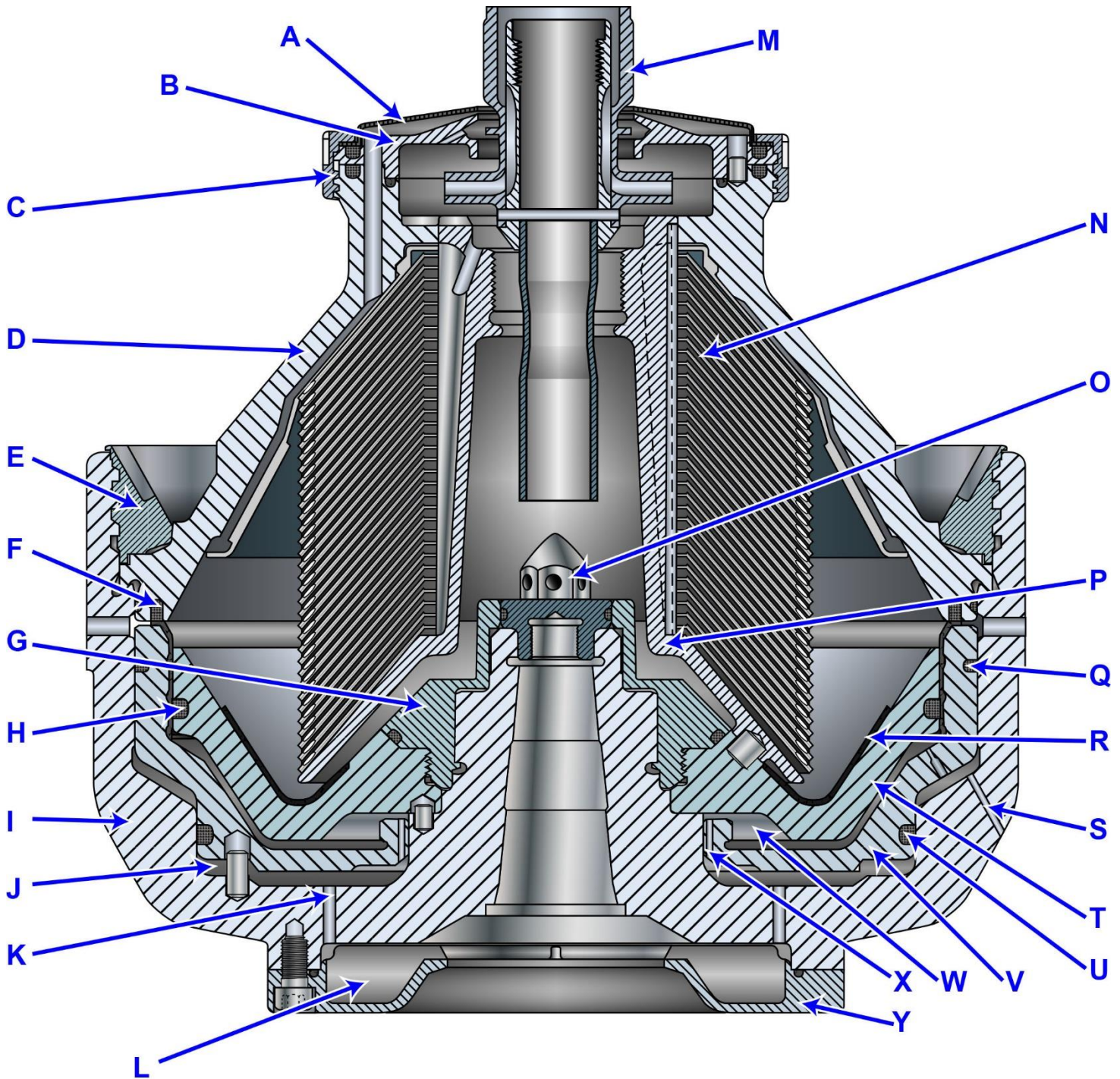
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MO-0107



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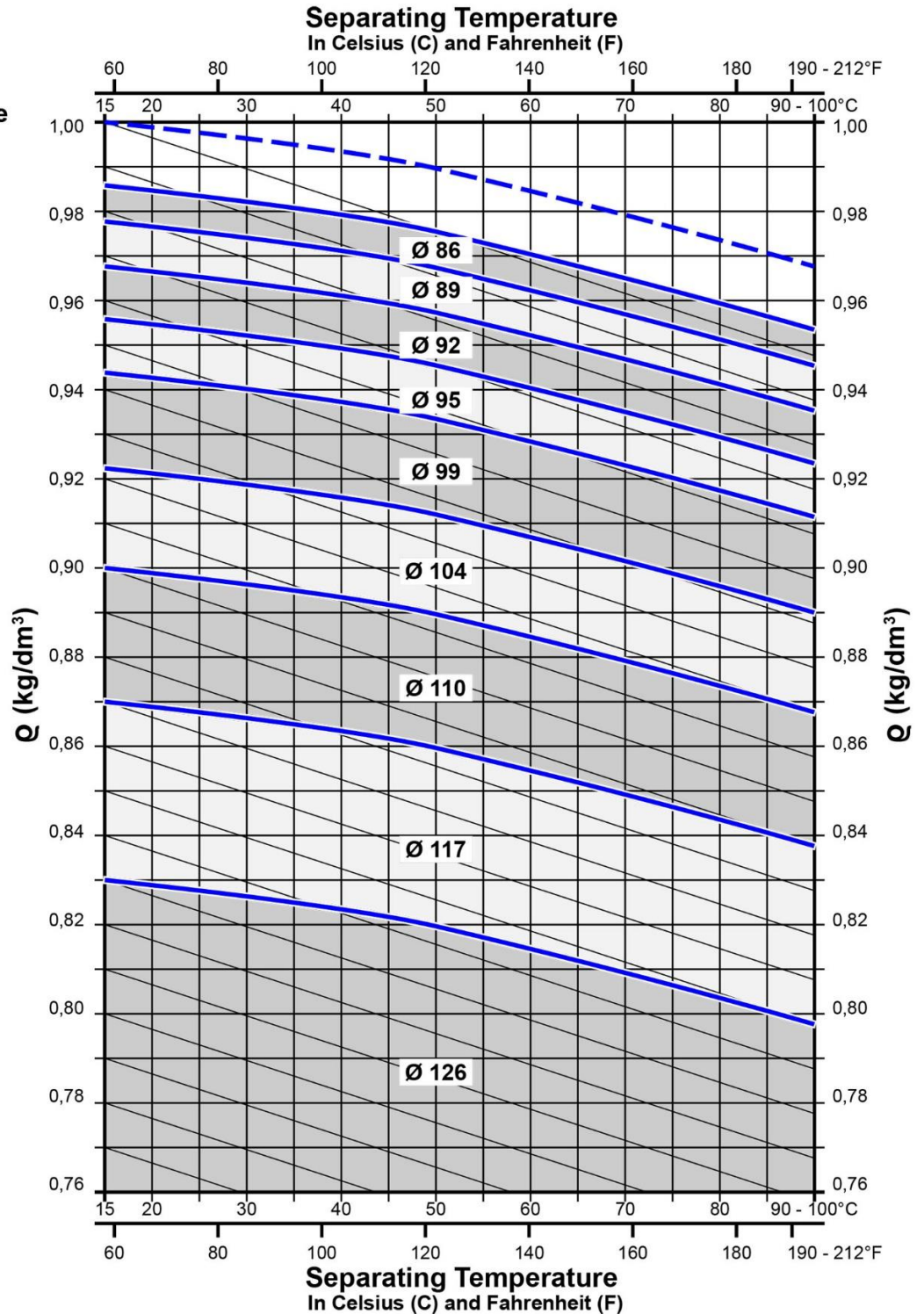
MO-0112



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Self-Cleaning Bowl, Model OSA 20-02-066
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MO-0113

- - - ρ - Water
 — ρ - Oil
 Ø - Regulating Ring Size



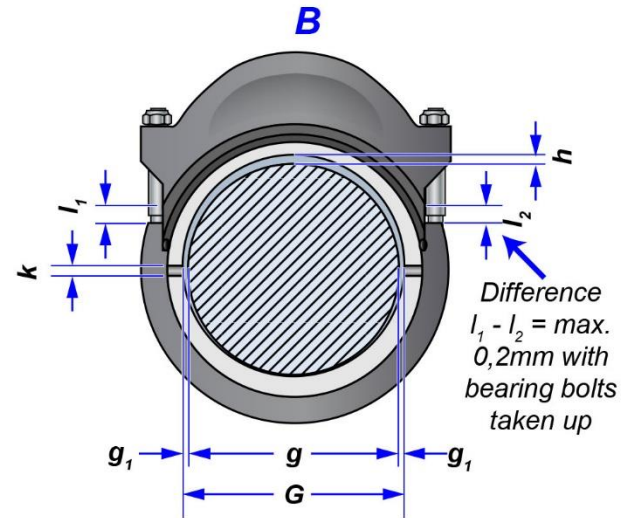
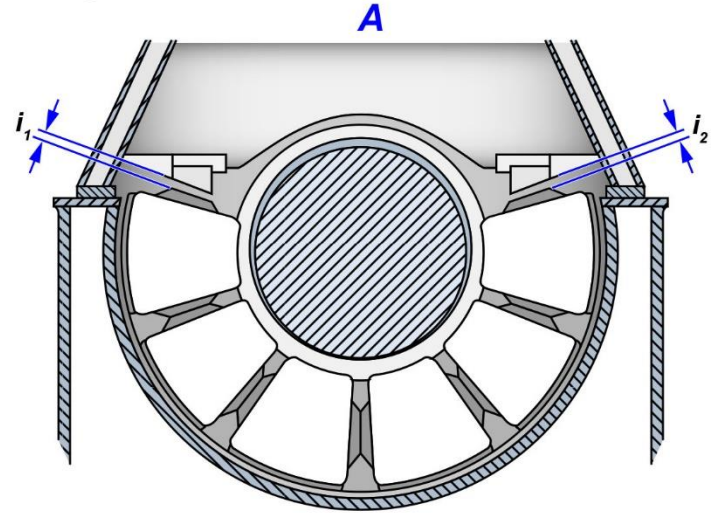
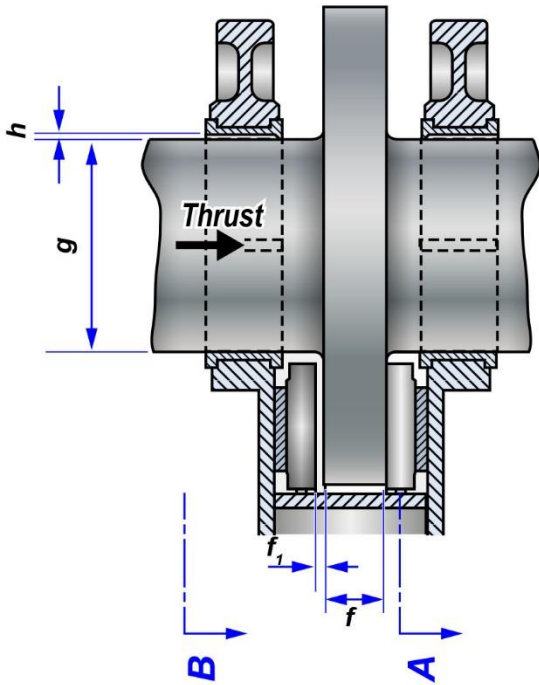
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MO-0121

Thrust Bearing



Nominal dimension	Normal play	Max. play (worn)
$f = 200$	$f_1 = 1,0$	2,0
$g = 540 \begin{matrix} +0 \\ -0,08 \end{matrix}$	$g_1 = \text{min. } 0,10$	
$G = 540 \begin{matrix} +0,38 \\ +0,30 \end{matrix}$	$h = \begin{matrix} +0,46 \\ +0,30 \end{matrix}$	0,8
	$i_1, i_2 = 5$	
$k = 20$		

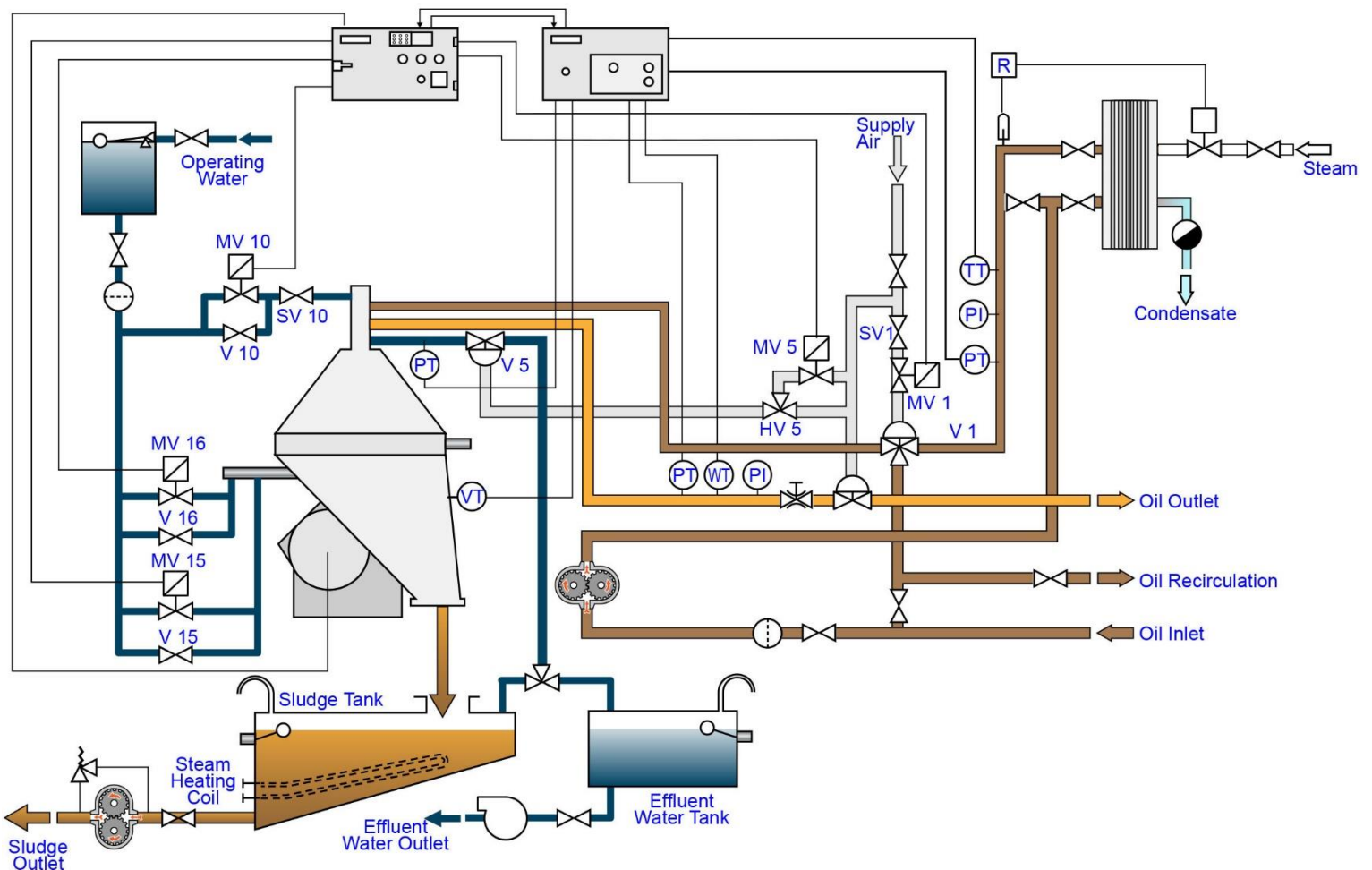
RND 68	Principal Clearances Crankshaft and Thrust Bearing	<i>All dimensions in mm</i>	7 354 366 - E
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Adapted for testing purposes only from SULZER, Description of and Operating Instructions for Sulzer Diesel Engines RND-M
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MO-0127

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	



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