

U.S.C.G. Merchant Marine Exam

Chief Engineer-MODU

Q730 Motor Plants

(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

1. While travelling in the tropics, the condensate draining from charge air receiver drain is flowing even though you have raised the inlet temperature to the allowable limit. What effect does excessive moisture have on the engine?
- (A) Increased moisture will have a cleansing effect on the components in the path of the intake air.
 - (B) Increased moisture in the intake air will dilute the acid in the exhaust trunk.
 - (C) Increased moisture will improve the combustion.
 - (D) Increased moisture will promote corrosion in the combustion chamber and along the exhaust path.

If choice D is selected set score to 1.

2. Faulty operation of diesel engine fuel injection nozzles can be a direct cause of _____.
- (A) excessive fuel nozzle holder cooling
 - (B) sediment in the fuel supply
 - (C) improper atomization of the fuel
 - (D) distortion of the fuel spray pattern

If choice B is selected set score to 1.

3. Decreasing the exhaust valve clearance of a diesel engine will cause the exhaust valve to open _____.
- (A) earlier and have less lift
 - (B) earlier and remain open longer
 - (C) later and have greater lift
 - (D) later and have less duration

If choice B is selected set score to 1.

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

If choice A is selected set score to 1.

5. 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

If choice B is selected set score to 1.

6. What could cause the bypass valve in a full-flow lubrication system to open?

- (A) Bypass valve setting is too high
- (B) Fuel dilution of the lubricant
- (C) Check valve stuck open
- (D) Clogged filter element

If choice D is selected set score to 1.

7. Which of the following statements is true concerning the air starting valve, labeled "III", as shown in the illustration? Illustration MO-0046

- (A) When starting, the air starting valve is held open by air pressure.
- (B) When starting air is secured, the air starting valve is closed.
- (C) During normal engine running, the air starting valve opens and closes constantly due to cam action.
- (D) The air starting valve is opened by cam action.

If choice D is selected set score to 1.

8. 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 debris in the oil in the crankcase.
- (C) The ratio of oil mist to air in the crankcase.
- (D) The amount of water in the oil in the crankcase.

If choice C is selected set score to 1.

9. The pressure in an operating diesel engine cylinder continues to rise for a short period after the piston passes top dead center as a result of the _____.
- (A) fuel injection occurring at that point and combustion begins
 - (B) exhaust and intake valves just closing
 - (C) maximum compression pressure is just being attained
 - (D) expansion during the combustion process

If choice D is selected set score to 1.

10. The starter control valve in the hydraulic system shown in the illustration is malfunctioning. Before removing the valve, you must first _____. Illustration MO-0049
- (A) drain the reservoir
 - (B) remove all plugs from the system
 - (C) bleed off all accumulator pressure in "E"
 - (D) ensure that the accumulator piston is in the charged position

If choice C is selected set score to 1.

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

If choice D is selected set score to 1.

12. When an additional load is applied to a diesel engine which is using an inadequately inflated air bladder clutch unit, you can expect _____.
- (A) excessive wear on the thrust bearings
 - (B) pneumatic seizure
 - (C) chipped reduction gear teeth
 - (D) overheating because of slipping shoes

If choice D is selected set score to 1.

13. Carbon deposit build up on the injection nozzle orifice is least likely to occur when using which type of fuel injector nozzle?
- (A) Hole
 - (B) Pintle
 - (C) Multi-pintle
 - (D) Multi-hole

If choice B is selected set score to 1.

14. Bouncing of the valve gear in a diesel engine can be caused by _____.

- (A) prolonged high-speed operation
- (B) spring surge
- (C) worn valve seats
- (D) excessively tightened spring retainers

If choice B is selected set score to 1.

15. You are onboard a vessel with a slow-speed crosshead type engine. The fuel just received has significantly lower sulfur content than the previous bunkers. Which of the following would be a concern due to the reduced sulfur content?

- (A) Fuel injection temperature
- (B) Base number of the cylinder oil
- (C) Fuel supply system pressure
- (D) Purifier gravity disk size

If choice B is selected set score to 1.

16. 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 tank heating coils to ensure they are secured.
- (D) The piston oil scraper rings for excessive wear.

If choice A is selected set score to 1.

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

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

If choice A is selected set score to 1.

18. In the illustration shown, moving the component labeled "E", further to the left, will result in _____.
Illustration MO-0061

- (A) a shorter fuel injection cycle
- (B) a greater quantity of fuel injected
- (C) an increase in the cylinder mean effective pressure
- (D) an increase in fuel pump delivery pressure

If choice A is selected set score to 1.

19. The thrust bearing shown in the illustration has over eight years of ahead running time. Measurements show "i1" is 4 mm and "i2" is 1mm. Which of the following conditions is indicated and what steps should be taken, if any? Illustration MO-0121

- (A) The stops in which the thrust bearing block rides are worn, and it is necessary to return these to their original specifications.
- (B) No appreciable wear has occurred, and the proper maintenance procedures should continue to be followed.
- (C) A wear rate of 1.6 mm per year is excessive and requires immediate assistance from the manufacturer's field support.
- (D) A wear rate of 1.6 mm per year occurred. Although not excessive, this condition may require more frequent monitoring.

If choice B is selected set score to 1.

20. 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) excessive oil pressure
- (C) dirty air filter
- (D) piston ring blow-by

If choice D is selected set score to 1.

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

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

If choice D is selected set score to 1.

22. Injection pressure in a common rail fuel system is controlled by _____.

- (A) a bypass valve
- (B) varying the injector needle valve clearance
- (C) engine speed
- (D) varying the fuel pump piston stroke

If choice A is selected set score to 1.

23. If a diesel engine has been stopped because of piston seizure due to severe overheating, the crankcase _____.

- (A) inspection covers should not be opened until the engine has cooled
- (B) ventilation system should be continued in operation for one hour for cooling
- (C) scavenge pump should be immediately secured to prevent loss of lube oil
- (D) explosion covers should be opened slightly to provide extra ventilation

If choice A is selected set score to 1.

24. As shown in the illustration of the fuel injection pump, the function of the area designated as "L" is to _____ . Illustration MO-0061

- (A) relieve excessive injector discharge pressure
- (B) control the fuel injection rate
- (C) allow excess fuel oil to return to the fuel oil system
- (D) provide for plunger lubrication

If choice C is selected set score to 1.

25. Adjustments to the compensating needle valve in a hydraulic governor should be made with the engine at _____.

- (A) half-speed and normal temperature
- (B) maximum power at a normal load
- (C) normal operating temperature without a load
- (D) maximum power and load under normal conditions

If choice C is selected set score to 1.

26. Many 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) Increased exhaust valve wear
- (B) Increased MEP
- (C) Excessive bearing wear
- (D) Glazing of the cylinder liners

If choice A is selected set score to 1.

27. During main engine performance testing it is noticed that the firing pressure of one cylinder is higher than the average, but cylinder compression pressure is normal. Which of the following would most likely be the cause?

- (A) Early fuel injection
- (B) Worn piston rings
- (C) High engine load
- (D) Late fuel injection

If choice A is selected set score to 1.

28. A decrease in the flash point of diesel engine lube oil indicates the lube oil has become _____.

- (A) diluted with fuel oil
- (B) contaminated with sludge
- (C) diluted with water
- (D) contaminated with carbon

If choice A is selected set score to 1.

29. Piston cooling fins are located _____.

- (A) on top of the piston crown
- (B) underneath the piston crown
- (C) at the base of the piston skirt
- (D) inside the cylinder liner cooling water jacket

If choice B is selected set score to 1.

30. One experiences evidences 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) Improper fuel injection/combustion in cylinders.
- (B) Water contamination of the fuel.
- (C) Vanadium, sodium and sulfur in the fuel.
- (D) Excessive combustion temperatures.

If choice C is selected set score to 1.

31. Which of the following problems is the main source of fuel pump and injection system malfunctions?

- (A) Coated fuel lines
- (B) Improper lubrication
- (C) Air in the fuel system
- (D) Excessive vibration

If choice C is selected set score to 1.

32. A bronze bearing liner with a lead-tin flashing has a milky-white color over most of its surface and some areas of exposed bronze. The white coloring indicates _____.

- (A) water contamination of the lube oil system
- (B) proper break-in wear
- (C) improper break-in wear
- (D) relocation of the overlay flashing

If choice A is selected set score to 1.

33. What is the normal bearing clearance permitted at the horizontal axis of the shaft for the bearing shown in the illustration? Illustration MO-0121

- (A) The tolerances established are dependent on machining processes used and will vary amongst manufacturers.
- (B) The normal play on both sides of the shaft will be one tenth of a millimeter.
- (C) The clearance on one side of the shaft at the axis will be one twentieth of a millimeter.
- (D) The clearance is determined by the thickness of the hydrodynamic wedge formed and is not usually measured while underway.

If choice B is selected set score to 1.

34. Auxiliary diesel engine electric starting motors use _____.

- (A) low amperage, high voltage AC power
- (B) alternating current transformers
- (C) 400 cycle per second motor-generator power
- (D) battery power direct current

If choice D is selected set score to 1.

35. The part labeled "G", as shown in the illustration, is a _____. Illustration MO-0040

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

If choice C is selected set score to 1.

36. The pinion of an auxiliary diesel-electric starting motor normally engages the flywheel ring gear by means of a/an _____.

- (A) magnetic type coupling
- (B) automatic follow-up
- (C) muff coupling and release
- (D) Bendix drive or similar mechanism

If choice D is selected set score to 1.

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

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

If choice D is selected set score to 1.

38. Before any auxiliary diesel engine hydraulic starting system is opened for servicing or repair, you must _____.

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

If choice A is selected set score to 1.

39. Which of the following statements concerning the factors affecting ignition delay is correct?

- (A) An increase in coolant temperature will decrease ignition delay.
- (B) An increase in intake air temperature will increase ignition delay.
- (C) An increase in compression ratio will increase ignition delay.
- (D) An increase in combustion chamber turbulence will increase ignition delay.

If choice A is selected set score to 1.

40. 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 atomization is increased, penetration is reduced, vaporization is increased, and efficiency is not affected.
- (B) Volume of fuel injected is increased, reduced injection pressure, decreased ignition delay.
- (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.

If choice C is selected set score to 1.

41. Surface irregularities, such as erosion and pitting on injection pump plungers, will _____.

- (A) affect fuel oil metering
- (B) affect engine performance at low-speed only
- (C) disappear due to fuel oil abrasion
- (D) increase ignition delay

If choice A is selected set score to 1.

42. The purpose of an oil mist detector in a main propulsion diesel engine is to warn of _____.

- (A) a possible overheated bearing
- (B) low cylinder oil pressure
- (C) excessively high crankcase vacuum
- (D) excessive carbon buildup in the lube oil

If choice A is selected set score to 1.

43. Oil control rings are designed with slotted holes to _____.

- (A) decrease ring contact area and cut down heat transfer
- (B) decrease contact pressure between ring and cylinder wall
- (C) increase contact pressure between ring and cylinder wall
- (D) permit excess oil to drain back to the sump

If choice D is selected set score to 1.

44. The intake and exhaust valves used in a diesel engine are returned to their seats by _____.

- (A) combustion pressure
- (B) push rod pressure
- (C) exhaust pressure
- (D) spring force

If choice D is selected set score to 1.

45. Governor hunting is caused by _____.

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

If choice A is selected set score to 1.

46. A diesel engine may fail to start when being cranked, due to _____.

- (A) insufficient compression
- (B) high cetane number
- (C) low lube oil viscosity
- (D) high lube oil pressure

If choice A is selected set score to 1.

47. In the auxiliary diesel engine, shown in the illustration, the _____. Illustration MO-0006

- (A) governor is linked to the fuel injection pump by vertical linkage
- (B) explosion relief doors are clearly visible on both sides of the crankcase
- (C) camshaft rotates at the same speed as the crankshaft
- (D) engine oil filter is outboard of the electric starter

If choice A is selected set score to 1.

48. During the starting of a diesel engine, compression gases are prevented from backing into the air starting system, shown in the illustration, by the _____. Illustration MO-0046

- (A) cylinder air starting check valves
- (B) air starting control valve
- (C) individual distribution valves
- (D) high-pressure in the starting air manifold

If choice A is selected set score to 1.

49. 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

If choice A is selected set score to 1.

50. Which fuel chemical elemental constituents contribute to hot and cold temperature corrosion of combustion space surfaces and components of a diesel engine?

- (A) Hot and cold corrosion is the same and is caused by combustion space surface heat distribution.
- (B) Cold and hot corrosions are not caused by fuel constituents but by combustion space temperature control.
- (C) Vanadium contributes to hot corrosion, sulfur contributes to cold corrosion.
- (D) Sulfur contributes to hot corrosion, vanadium contributes to cold corrosion.

If choice C is selected set score to 1.

51. 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°

If choice A is selected set score to 1.

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

- (A) spring force
- (B) firing pressure
- (C) cam action
- (D) fuel oil pressure

If choice A is selected set score to 1.

53. An operating diesel engine that suddenly loses power is due to a/an _____.

- (A) dribbling injector
- (B) oil leak into the turbocharger
- (C) low fuel viscosity
- (D) restricted turbocharger air intake

If choice D is selected set score to 1.

54. An engine is equipped with the over speed trip similar to that shown in the illustration. The throw out weight is designed to run at 900 RPM and trip out at 10% over speed. However, the over speed trip is currently activating at 930 RPM. In order to correct this problem, _____. Illustration MO-0101

- (A) increase compression on spring #12
- (B) install a larger throw out weight piece #10
- (C) decrease compression on spring #12
- (D) change the angle of the operating face by machining piece #10

If choice A is selected set score to 1.

55. Direct reversible main propulsion diesel engines would normally be fitted with a/an _____.

- (A) isochronous hunting governor
- (B) constant speed governor
- (C) nutating disk governor
- (D) variable speed governor

If choice D is selected set score to 1.

- 56.** 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) governor flyweight action on a pilot valve which controls fuel injection
 - (C) governor flyweight motion acting on fuel controls through suitable linkage
 - (D) positioning a butterfly valve in the fuel delivery system

If choice C is selected set score to 1.

- 57.** Trunk type diesel engine pistons are effectively cooled when heat is _____.
- (A) radiated through the engine block
 - (B) transferred to water cooled cylinder walls
 - (C) conducted through the piston crown
 - (D) transferred to escaping exhaust gases

If choice B is selected set score to 1.

- 58.** Uneven bolt tightening during the installation of a fuel injection pump can result in _____.
- (A) high torsional shock to fuel lines
 - (B) ignition delay
 - (C) binding of pump moving parts
 - (D) improper pump-to-engine timing

If choice C is selected set score to 1.

- 59.** 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 cylinder liners.
 - (B) Fuel injectors and piston rings.
 - (C) High pressure fuel pumps and fuel injectors.
 - (D) Fuel injectors and turbocharger blading.

If choice C is selected set score to 1.

- 60.** Because of the close tolerances used in diesel engine fuel oil pumps, a worn plunger requires _____.
- (A) replacing the plunger and the barrel
 - (B) highly polishing both the plunger and barrel
 - (C) grinding the spare plunger to the barrel
 - (D) replacing plunger only

If choice A is selected set score to 1.

61. The valve cam slope angle determines the _____.

- (A) engine fuel efficiency
- (B) acceleration rate of valve opening and closing
- (C) diameter of intake and exhaust valves
- (D) engine torque characteristics

If choice B is selected set score to 1.

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

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

If choice D is selected set score to 1.

63. What type of engine lubrication oil filter system sends filtered oil directly to the high-pressure supply gallery?

- (A) shunt system
- (B) batch system
- (C) centrifugal purifier system
- (D) bypass system

If choice A is selected set score to 1.

64. A four-stroke cycle auxiliary diesel engine fuel cam has shifted from its original position during maintenance. To ensure correct timing of the fuel pump, the intake and exhaust valves should be in what position when approaching top dead center for injection?

- (A) Intake and exhaust valves closed
- (B) Exhaust valve open, intake valve closed
- (C) Intake and exhaust valves open
- (D) Intake valve open, exhaust closed

If choice A is selected set score to 1.

65. 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) Early fuel injection
- (B) Low engine load
- (C) Worn piston rings
- (D) Late fuel injection

If choice C is selected set score to 1.

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

If choice A is selected set score to 1.

67. Which of the couplings listed is normally not repairable, and is usually replaced if completely damaged?

- (A) Flexible disk-ring coupling
- (B) Gear-type coupling
- (C) Block and jaw coupling
- (D) Grid spring coupling

If choice B is selected set score to 1.

68. A diesel engine emits blue exhaust smoke as a result of _____.

- (A) a light load
- (B) excessive compression pressure
- (C) excessive cylinder lubrication
- (D) cold intake air

If choice C is selected set score to 1.

69. If the compensating needle valve of a hydraulic governor is opened more than necessary the governor will _____.

- (A) produce excessive speed response to a load change
- (B) stabilize engine speed at the new governor setting
- (C) have a larger than normal dead band
- (D) respond slowly to any change in engine load

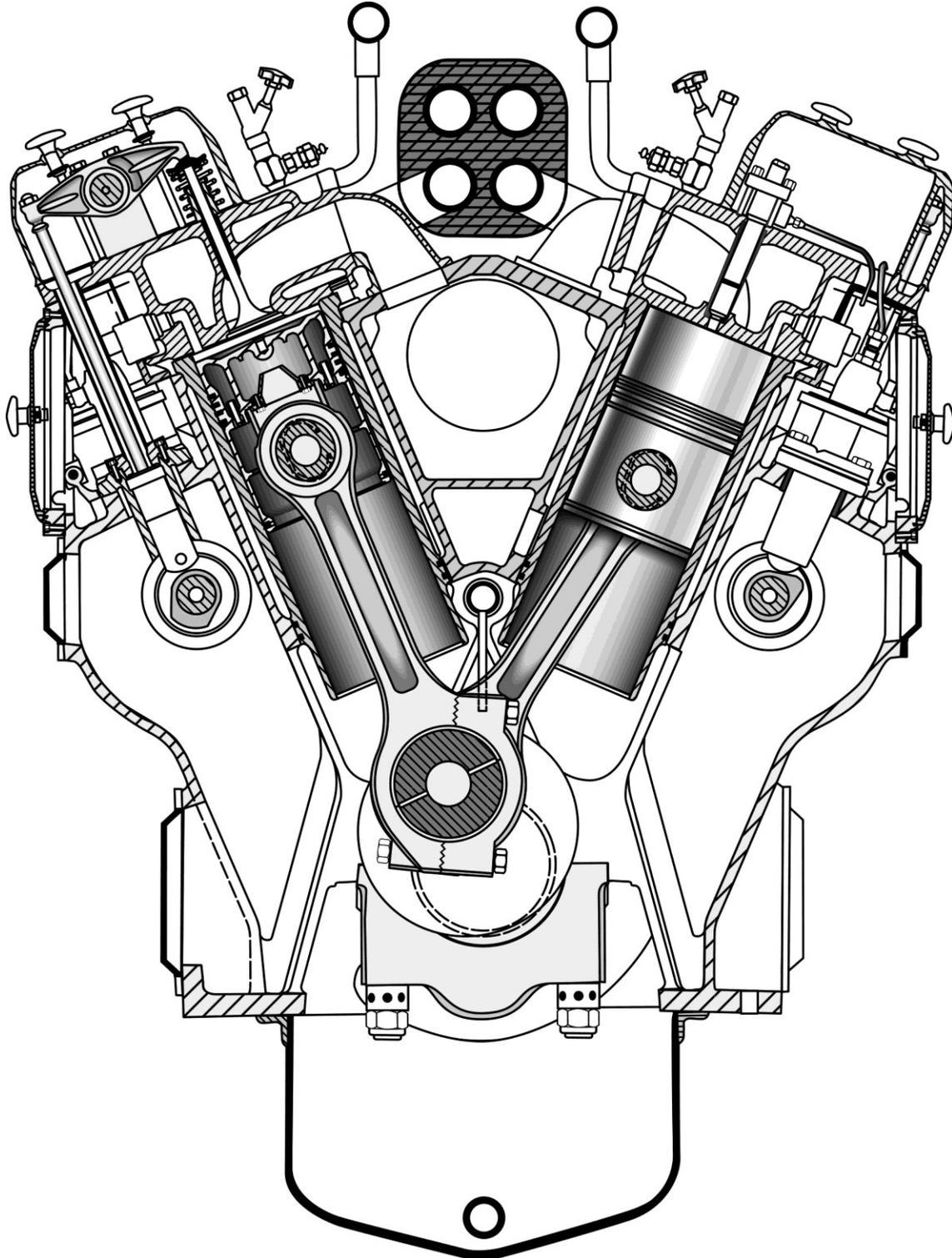
If choice A is selected set score to 1.

70. 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

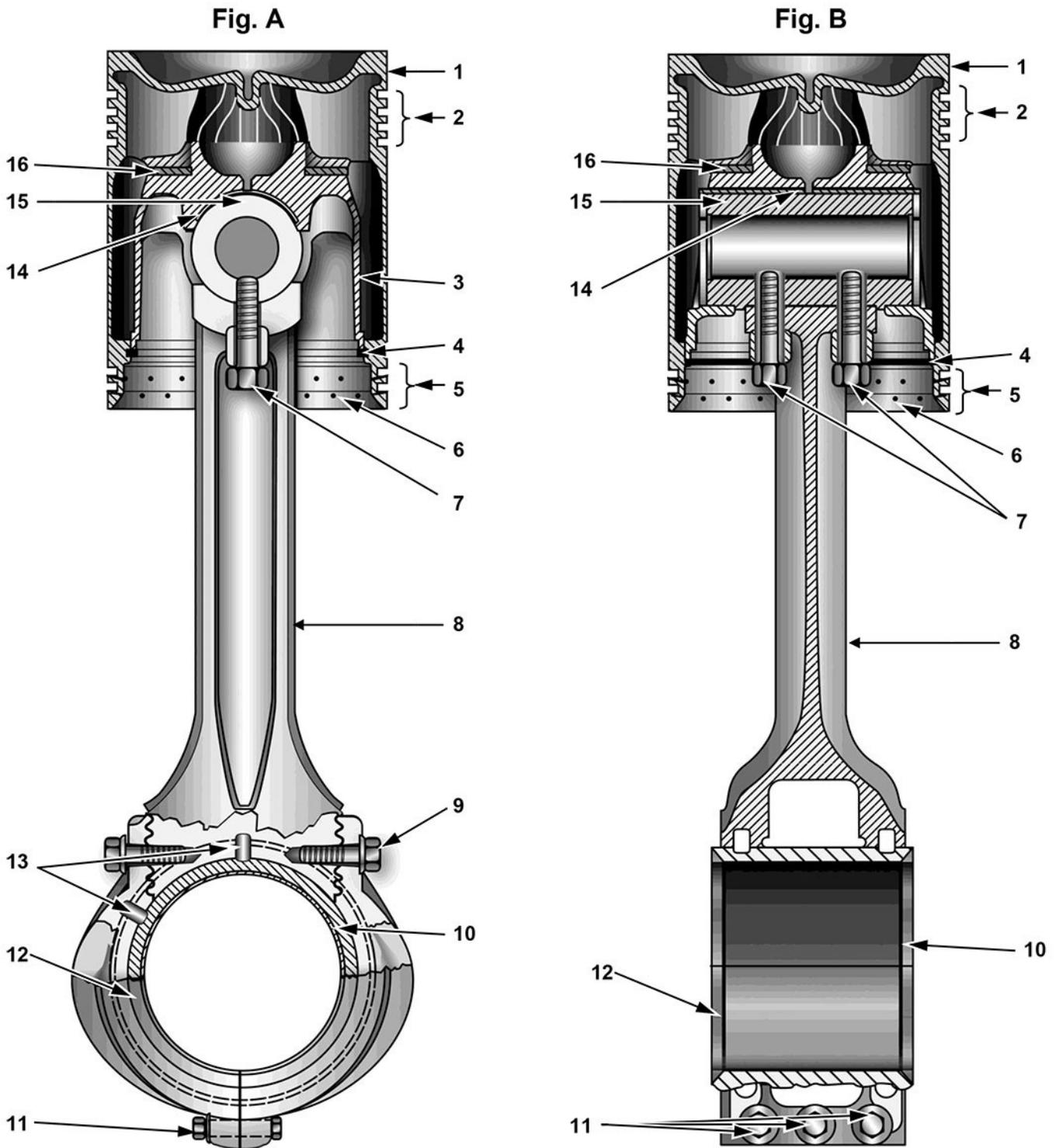
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MO-0006



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MO-0011



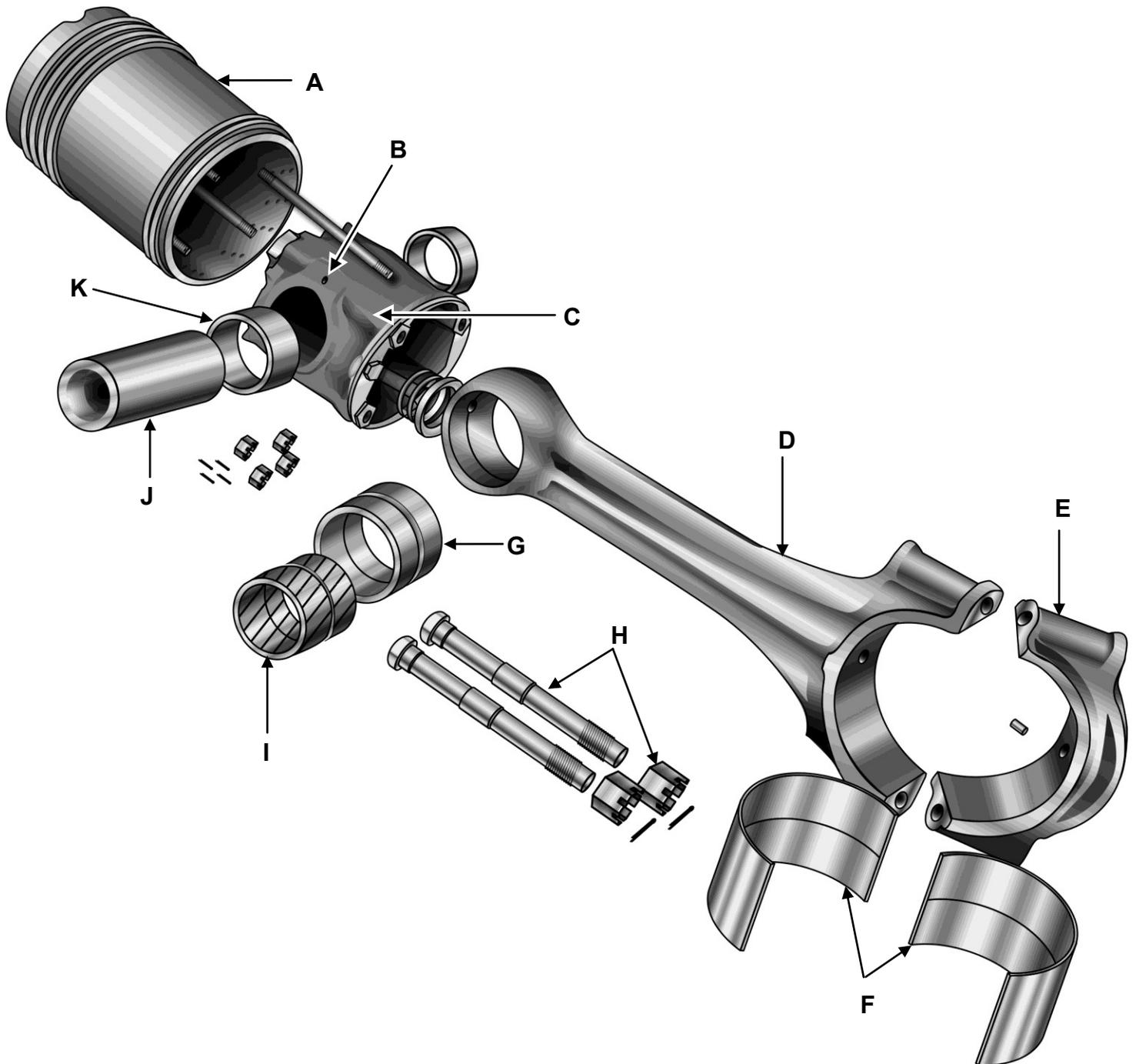
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MO-0039

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

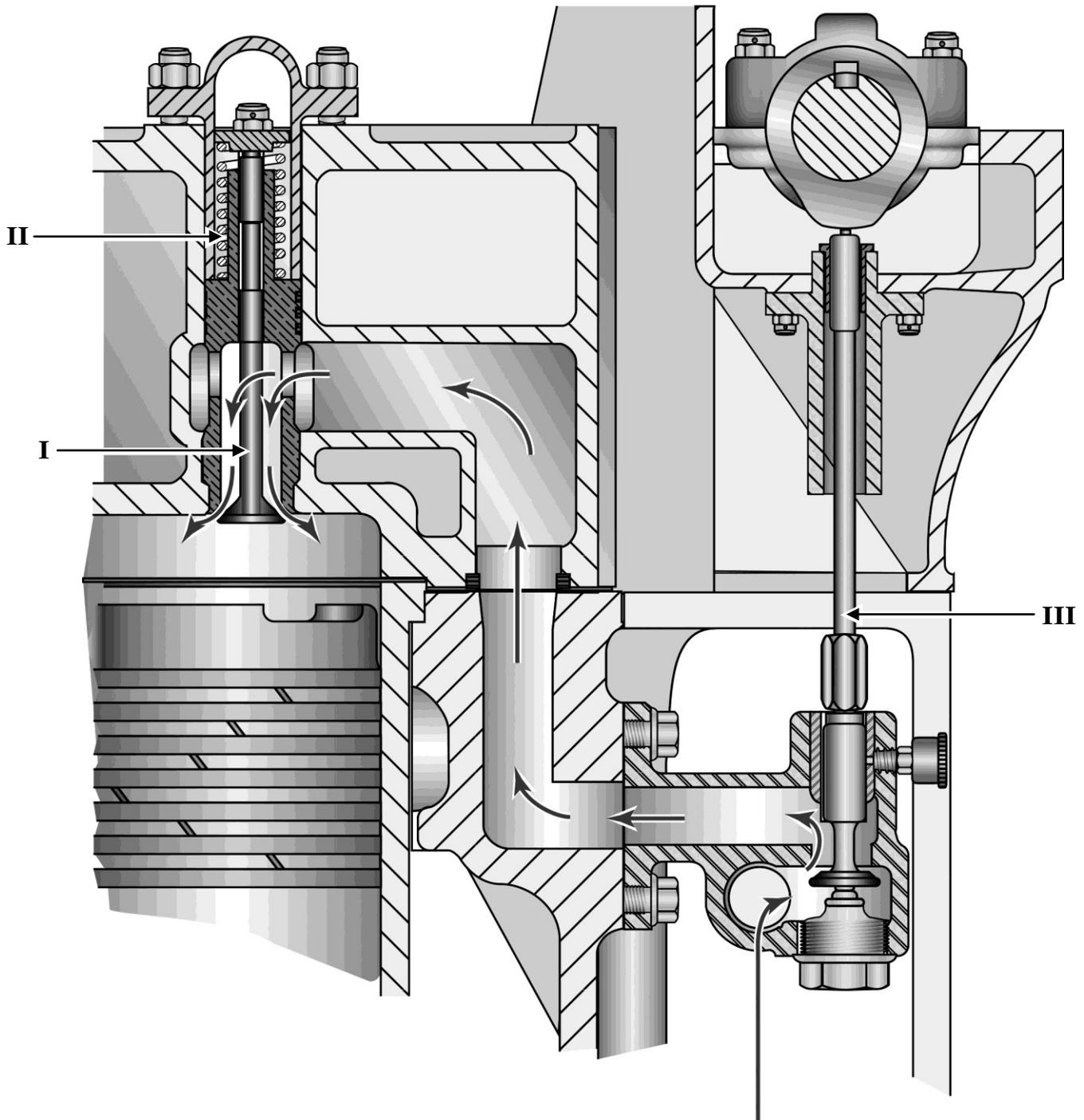
20-Cylinder	
Firing Order	Top Dead Center
1	0 DEGREES
14	27 “
9	36 “
16	63 ”
4	72 “
13	99 “
6	108 “
20	135 “
3	144 “
12	171 “
10	180 “
17	207 “
2	216 “
15	243 “
7	252 “
18	279 “
5	288 “
11	315 “
8	324 “
19	351 “

MO-0040



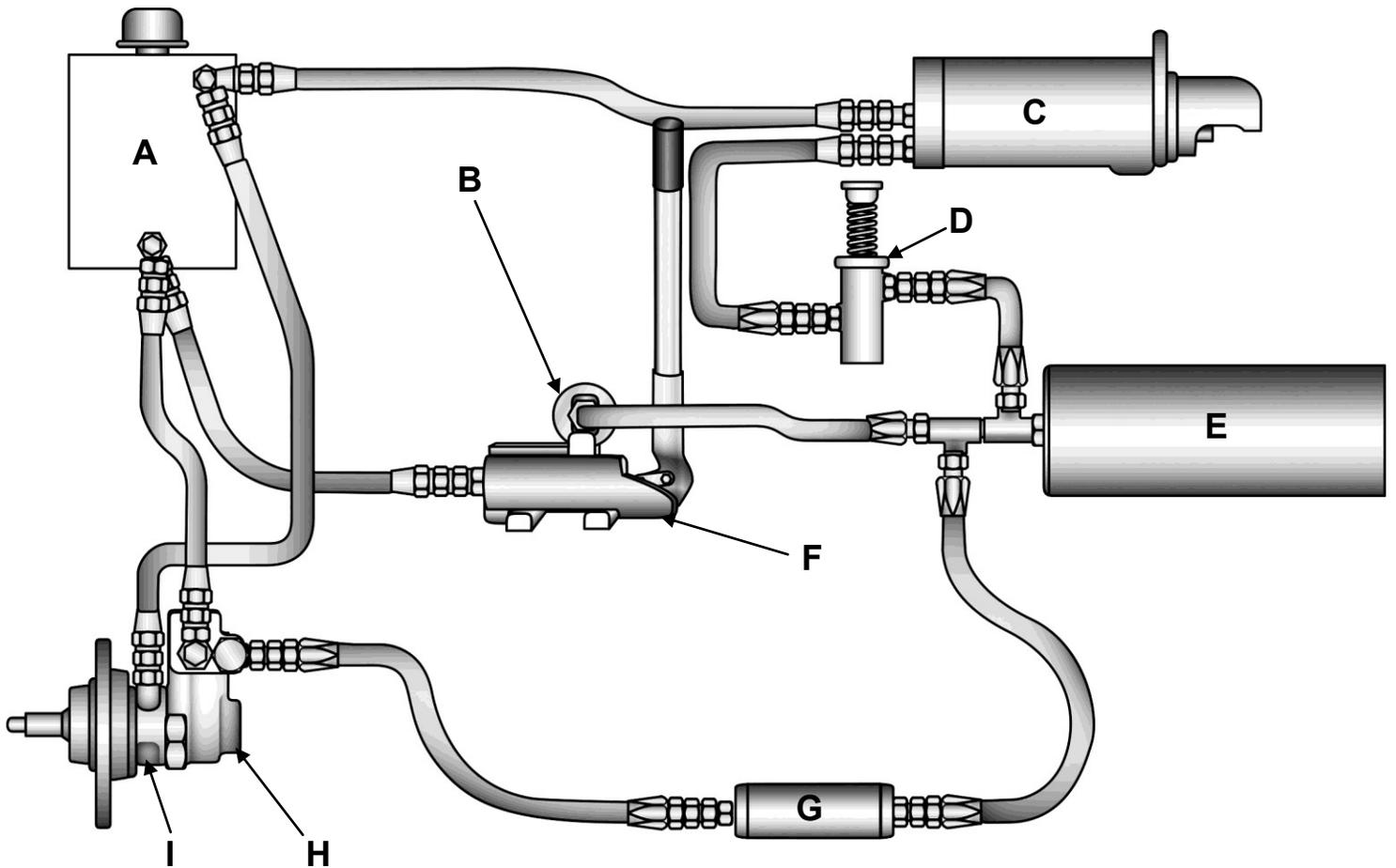
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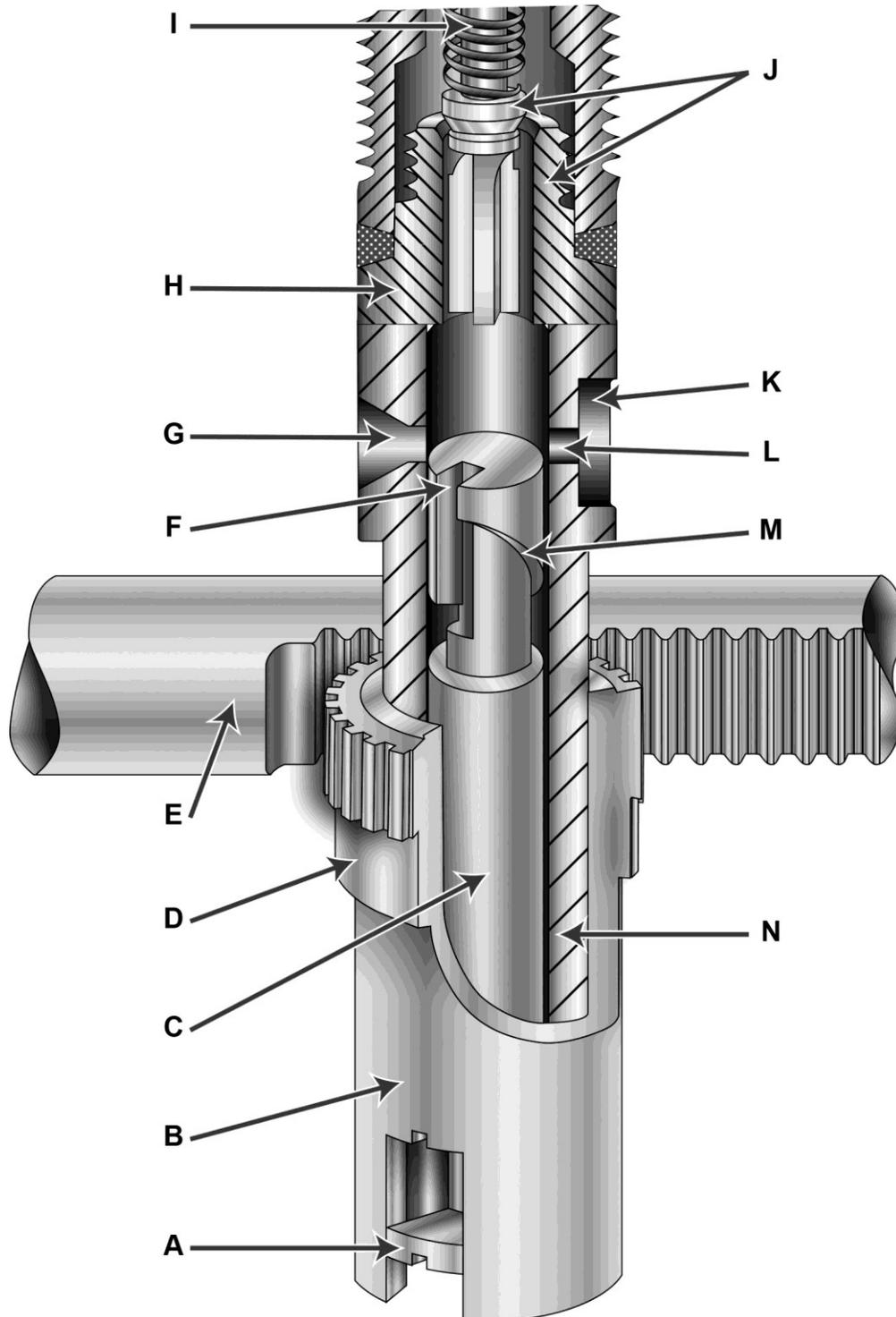
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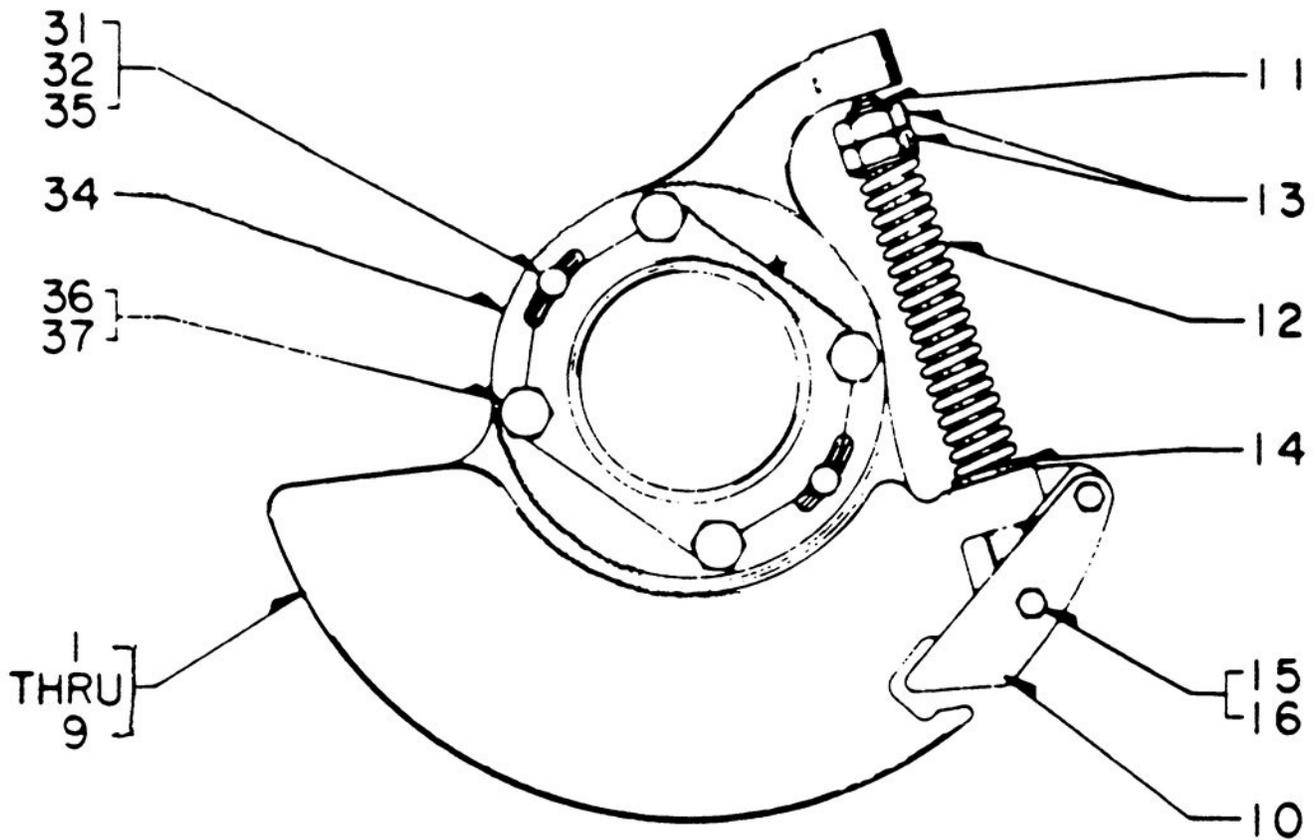
MO-0061



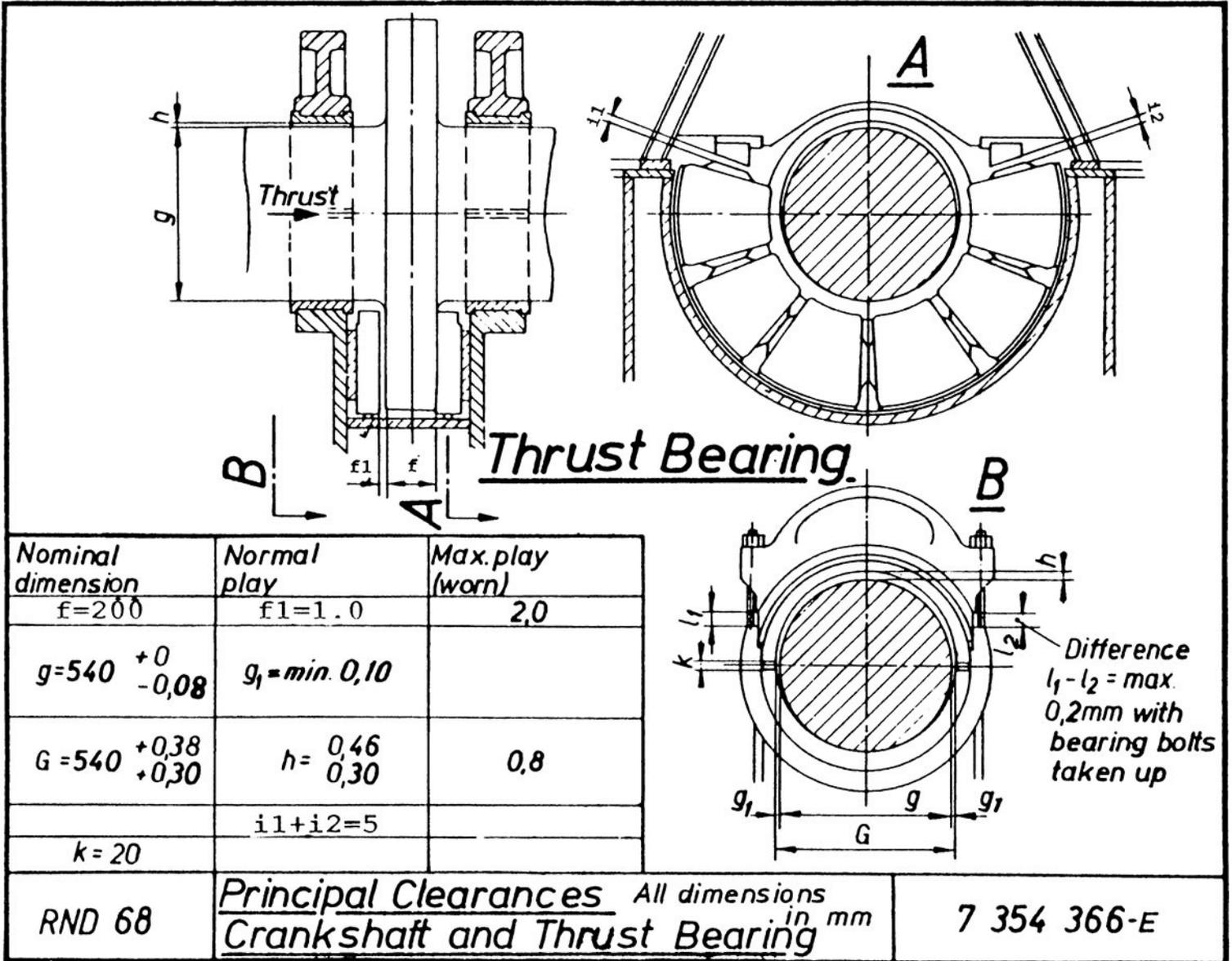
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