

U.S.C.G. Merchant Marine Exam  
Third Assistant Engineer, Unlimited  
Q531 Motor Plants I  
(Sample Examination)

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

1. The purpose of the engine-driven hydraulic pump in an auxiliary diesel engine hydraulic starting system is to \_\_\_\_\_.
- (A) restore hydraulic pressure in the accumulator after starting
  - (B) engage the starter motor with the flywheel
  - (C) fill the sump and prevent low level in the system
  - (D) bypass the hydraulic motor when the engine is running

*If choice A is selected set score to 1.*

2. If point #1 in the diagram shown is the beginning of gas compression, which of the cycles listed is being illustrated? Illustration MO-0036
- (A) Otto
  - (B) Diesel
  - (C) Gas Turbine
  - (D) Rankine

*If choice B is selected set score to 1.*

3. The use of push rods becomes necessary in a diesel engine when \_\_\_\_\_.
- (A) the camshaft is located some distance below the valve gear
  - (B) the rocker arms are pivoted near their centers
  - (C) two or more valves must be opened and closed at the same time
  - (D) hydraulic valve lash adjusters are used

*If choice A is selected set score to 1.*

4. 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"

*If choice A is selected set score to 1.*

5. Which of the routine maintenance procedures listed is required for starting air receivers?
- (A) Frequent draining of accumulated moisture.
  - (B) Frequent testing of relief valves.
  - (C) A close watch on temperature to prevent fluctuations in pressure.
  - (D) Frequent cleaning to remove oil and foreign matter.

*If choice A is selected set score to 1.*

6. 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) For a constant operating temperature, the greater the specific gravity of the oil the larger the regulating ring.
  - (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) The larger sized regulating rings are designed to be used with oils of lower specific gravities.

*If choice D is selected set score to 1.*

7. The diesel engine connecting rod shown in the illustration is classified as a/an \_\_\_\_\_. Illustration MO-0010
- (A) primary type rod
  - (B) articulated type rod
  - (C) fork-and-blade type rod
  - (D) marine-type rod

*If choice C is selected set score to 1.*

8. Which of the following statements is true concerning the cetane number of diesel fuel?
- (A) The cetane number affects the amount of injection lag.
  - (B) The cetane number is an indication of the fuel's viscosity.
  - (C) Ignition lag is reduced with fuels having a high cetane number.
  - (D) The cetane number is of little significance in the combustion process.

*If choice C is selected set score to 1.*

9. The degree of fuel atomization in a diesel engine cylinder depends primarily on \_\_\_\_\_.
- (A) the size of the holes in the fuel nozzle
  - (B) timing of the pump
  - (C) supply pressure to the pump
  - (D) shape of the combustion chamber

*If choice A is selected set score to 1.*

**10.** Which of the following statements represents the function of the plunger flange labeled "A" shown in the illustration? Illustration MO-0061

- (A) It limits the actual stroke of the plunger.
- (B) It prevents the plunger from rotating in the barrel.
- (C) It transmits the control rack setting to the plunger.
- (D) It takes the plunger off stroke when injection is completed.

*If choice C is selected set score to 1.*

**11.** 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

*If choice D is selected set score to 1.*

**12.** Heavy fuel oil used in the system shown in the illustration will have the lowest viscosity \_\_\_\_\_.  
Illustration MO-0058

- (A) in the settling tank
- (B) at the transfer pump discharge
- (C) at the main engine fuel oil header
- (D) in the three-way valve

*If choice C is selected set score to 1.*

**13.** 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

*If choice D is selected set score to 1.*

**14.** An individual fuel injection pump is designed for variable beginning and constant ending of injection. For diesel engines operating a generator at constant speeds, the start of injection will \_\_\_\_\_.

- (A) advance as the load increases
- (B) retard as the load increases
- (C) remain unchanged regardless of load
- (D) always occur at top dead center

*If choice A is selected set score to 1.*

**15.** Starting aids such as glow plugs are installed on \_\_\_\_\_.

- (A) large, direct drive diesel engines
- (B) diesel engines designed to burn residual fuels
- (C) medium-speed, four-stroke cycle diesel engines
- (D) small diesel engines utilizing electric starting equipment

*If choice D is selected set score to 1.*

**16.** In order to reverse the rotation of a two-stroke cycle loop scavenged, direct reversing, propulsion diesel engine, the cam positions must be changed for the \_\_\_\_\_.

- (A) starting air and fuel pumps
- (B) piston cooling pumps
- (C) exhaust valves
- (D) all of the above

*If choice A is selected set score to 1.*

**17.** The component shown in the illustration would be identified as a/an \_\_\_\_\_. Illustration MO-0097

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

*If choice B is selected set score to 1.*

**18.** For a continuous operation diesel engine, a duplex filter unit would be the best arrangement because \_\_\_\_\_.

- (A) changing filter elements would not interrupt engine operation
- (B) filtering occurs twice in each pass of oil through the system
- (C) clogging will not occur
- (D) dropping pressure is half of that through a single filter unit

*If choice A is selected set score to 1.*

**19.** Integral cylinder liners constructed as part of the cylinder block, are characterized by which of the following disadvantages?

- (A) They conduct heat poorly.
- (B) They must operate with lower mean effective pressures.
- (C) They cannot be replaced.
- (D) They require special tools for removal.

*If choice C is selected set score to 1.*

**20.** Crankcase explosions in propulsion diesel engines result from \_\_\_\_\_.

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

*If choice D is selected set score to 1.*

**21.** Which lubricating oil additive is used in diesel engines to reduce the tendency for sludge and varnish to form on the engine parts?

- (A) Flash point improvers
- (B) Pour point improvers
- (C) Inhibitors
- (D) Foam suppressors

*If choice C is selected set score to 1.*

**22.** 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

*If choice D is selected set score to 1.*

**23.** Which factor determines the size of the ring dam for a fuel oil centrifugal purifier?

- (A) Viscosity of the fuel.
- (B) Quantity of water to be removed from the fuel.
- (C) Specific gravity of the fuel.
- (D) Quantity of dirt to be removed from the fuel.

*If choice C is selected set score to 1.*

**24.** Fuel combustion in a diesel engine cylinder should begin just before the piston reaches top dead center and should \_\_\_\_\_.

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

*If choice C is selected set score to 1.*

**25.** Which letter represents the top deck (valve) cover of the engine shown in the illustration? Illustration MO-0122

- (A) "A"
- (B) "H"
- (C) "8"
- (D) None of the above are correct.

*If choice A is selected set score to 1.*

**26.** Which of the following is an example of a solid bearing?

- (A) Thrust bearing
- (B) Spring bearing
- (C) Piston pin bushing
- (D) Turbo-generator turbine bearing

*If choice C is selected set score to 1.*

**27.** The upper piston rings in large, slow-speed, two-stroke cycle diesel engines are most effectively lubricated by oil \_\_\_\_\_.

- (A) fed from mechanical lubricators
- (B) thrown off from the main bearings
- (C) supplied from wick fed drip lubricators
- (D) flow from a centrifugal or banjo oiler

*If choice A is selected set score to 1.*

**28.** In a large slow-speed propulsion diesel engine, the side thrust on the crosshead is the direct result of \_\_\_\_\_.

- (A) the piston rod acting against the crosshead during the power stroke
- (B) the angularity of the connecting rod against the crosshead during the power stroke
- (C) the velocity of the crank pin during the power stroke
- (D) cylinder pressure acting against the piston crown

*If choice B is selected set score to 1.*

**29.** The arrangement and shape of the cams on a diesel engine camshaft directly control which of the listed groups of operating conditions?

- (A) Speed, torque, and horsepower production
- (B) Firing order, valve timing, and valve lift
- (C) Fuel consumption, efficiency, and cylinder pressure
- (D) Scavenge pressure, compression ratio, and exhaust pressure

*If choice B is selected set score to 1.*

**30.** Which of the following statements is accurate concerning the vibration sensing device used with the separator shown in the illustration? Illustration MO-0127

- (A) Vibration sensors are not used with centrifuges currently installed on diesel vessels due to excessive vibrations developed by the main propulsion units.
- (B) The vibration switch is sensitive to vibration in a direction horizontal to its mounting base and is normally installed low on the separator where movement is magnified.
- (C) The detector mechanism consists of an armature suspended on a flexure pivot and restrained from motion by a permanent magnet acting through a small air gap.
- (D) The detector is so arranged to prevent abnormal harmonic frequencies from being developed while the separator is passing through its critical speed range.

*If choice C is selected set score to 1.*

**31.** The replacement piping for diesel engine high-pressure fuel systems must be the same length and diameter as the original piping to \_\_\_\_\_.

- (A) avoid unnecessary parts inventory
- (B) keep torsional vibration constant
- (C) use existing supports and braces
- (D) maintain specified injection characteristics

*If choice D is selected set score to 1.*

**32.** What is the function of a diesel engine's stationary parts?

- (A) To add power to the engine.
- (B) To keep the engine firmly attached to its auxiliary pumps.
- (C) To maintain the engine's moving parts in their proper relative positions.
- (D) To rotate the crankshaft.

*If choice C is selected set score to 1.*

**33.** The #3 piston shown in the illustration is on the \_\_\_\_\_. Illustration MO-0038

- (A) intake stroke
- (B) exhaust stroke
- (C) compression stroke
- (D) power stroke

*If choice A is selected set score to 1.*

**34.** A decrease in the flash point of diesel engine lube oil indicates the lube oil has become \_\_\_\_\_.

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

*If choice C is selected set score to 1.*

**35.** The function of the piston compression rings used in a diesel engine is to \_\_\_\_\_.

- (A) seal the space between the piston and liner
- (B) reduce the amount of combustion gas blow-by
- (C) transmit heat from the piston to the cylinder liner
- (D) all of the above

*If choice D is selected set score to 1.*

**36.** The fuel injector shown in the illustration is opened by fuel pressure acting upward on \_\_\_\_\_.  
Illustration MO-0059

- (A) part 33
- (B) part 36
- (C) the needle valve
- (D) the plunger

*If choice C is selected set score to 1.*

**37.** The ignition quality of diesel fuel becomes LESS critical as \_\_\_\_\_.

- (A) lube oil additives are increased
- (B) designed piston speeds are increased
- (C) designed injection pressures are decreased
- (D) designed engine speeds are decreased

*If choice D is selected set score to 1.*

**38.** The control rack to a unit injector regulates fuel delivery by \_\_\_\_\_.

- (A) altering spring tension on the plunger
- (B) rotating the plunger and position of the helix
- (C) regulating the lift of the check valve
- (D) altering the actual length of the plunger stroke

*If choice B is selected set score to 1.*

**39.** The diesel engine connecting rods shown in the illustration are distinctively named \_\_\_\_\_.  
Illustration MO-0122

- (A) male and female
- (B) hook and nail
- (C) fork and blade
- (D) left hand and right hand

*If choice C is selected set score to 1.*

**40.** The diesel engine rocker arms shown in the illustration serve to \_\_\_\_\_. Illustration MO-0122

- (A) convert rotational energy to reciprocating pressures
- (B) operate the exhaust and starting valves
- (C) open the exhaust valves and operate the unit injectors
- (D) open the intake and exhaust valves

*If choice C is selected set score to 1.*

**41.** The pilot valves in an air pilot starting system for a two-stroke cycle, direct reversing, main propulsion diesel engine are operated by either a ported distributor disc or a/an \_\_\_\_\_.

- (A) regulator valve
- (B) quick opening main air valve
- (C) pilot air start check valve
- (D) individual cam for each pilot valve

*If choice D is selected set score to 1.*

**42.** The illustrated device is used to \_\_\_\_\_. Illustration MO-0050

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

*If choice A is selected set score to 1.*

**43.** In the pressure-volume diagram shown in the illustration, the atmospheric pressure line is indicated by line \_\_\_\_\_. Illustration MO-0035

- (A) A
- (B) B
- (C) C
- (D) de

*If choice C is selected set score to 1.*

**44.** The cylinders labeled "B" and "C" in the illustration are used to \_\_\_\_\_. Illustration MO-0125

- (A) provide oil to lubricate component "F"
- (B) supply a specific volume of oil to the engine governor
- (C) provide the required quantity of grease at specified maintenance intervals
- (D) supply the force required to shift the engine camshafts axially to reverse engine rotation

*If choice D is selected set score to 1.*

**45.** The illustration is of a/an \_\_\_\_\_. Illustration MO-0044

- (A) air driven starter motor assembly
- (B) power take-off driven, vane type, air compressor
- (C) air driven DC generator
- (D) battery powered, electric motor driven vane type, hydraulic pump

*If choice A is selected set score to 1.*

**46.** Which of the listed types of precombustion chambers is used in the diesel engine shown in the illustration? Illustration MO-0007

- (A) Turbulence chamber
- (B) Energy cell
- (C) Common rail
- (D) Open type

*If choice A is selected set score to 1.*

**47.** Bearing "crush" as applied to diesel engine main bearings, will result in \_\_\_\_\_.

- (A) positive seating of the bearings in their housings
- (B) above normal operating temperatures
- (C) damage to the journals
- (D) damage to the bearings

*If choice A is selected set score to 1.*

**48.** Regarding the fuel injector shown in the illustration, the purpose of piece #38 is to \_\_\_\_\_.  
Illustration MO-0059

- (A) adjust the fuel rack spring tension
- (B) filter the fuel
- (C) maintain fuel pressure at a preset level
- (D) relieve excess fuel pressure to the suction side of the pump

*If choice B is selected set score to 1.*

**49.** In a diesel engine, after ignition of the fuel occurs, but before the piston reaches TDC, there is little change in the cylinder \_\_\_\_\_.

- (A) temperature
- (B) pressure
- (C) energy
- (D) volume

*If choice D is selected set score to 1.*

**50.** The average pressure exerted on a piston during each power stroke is termed \_\_\_\_\_.

- (A) indicated horsepower
- (B) mean effective pressure
- (C) exhaust back pressure
- (D) compression pressure

*If choice B is selected set score to 1.*

**51.** Auxiliary diesel engines can be automatically shut down as a result of \_\_\_\_\_.

- (A) low lube oil temperature
- (B) low lube oil pressure
- (C) high exhaust temperature
- (D) high cooling water pressure

*If choice B is selected set score to 1.*

**52.** In a medium-speed marine propulsion engine equipped with direct admission air starting valves, the cylinders without air starting valves fire first because the \_\_\_\_\_.

- (A) operation is under higher compression
- (B) fuel is admitted only to these cylinders during cranking
- (C) compression is released during starting by opening the exhaust valve
- (D) cylinders are not chilled by the expansion of the starting air

*If choice D is selected set score to 1.*

**53.** As shown in the illustration of the fuel injection pump, the section designated as "M" is referred to as the \_\_\_\_\_. Illustration MO-0061

- (A) plunger relief shoulder
- (B) plunger helix
- (C) plunger control tab
- (D) plunger sleeve

*If choice B is selected set score to 1.*

**54.** The intake ports of a two-stroke cycle diesel engine are opened and closed by the action of the \_\_\_\_\_.

- (A) camshaft
- (B) piston movement
- (C) exhaust valves
- (D) vertical drive

*If choice B is selected set score to 1.*

**55.** In describing engine operation, what does the term "cycle" mean?

- (A) One stroke of a piston.
- (B) The sequence of events that produce a power pulse.
- (C) One rotation of the engine crankshaft.
- (D) All of the above.

*If choice B is selected set score to 1.*

**56.** Heat for igniting the fuel oil in the cylinder of a diesel engine is generated by the \_\_\_\_\_.

- (A) electronic ignition system
- (B) compression of air by the piston
- (C) friction in the fuel injector
- (D) fuel oil heating system

*If choice B is selected set score to 1.*

**57.** Which of the following statements is true concerning a main diesel engine oil cooler?

- (A) The oil temperature is less than the cooling water temperature.
- (B) The oil pressure is less than the cooling water pressure.
- (C) The oil pressure is greater than the cooling water pressure.
- (D) The oil flow control valve is always installed in the oil input line.

*If choice C is selected set score to 1.*

**58.** Where would a coarse screen wire mesh strainer normally be found on a diesel engine lubrication system?

- (A) pump discharge line
- (B) gravity tank inlet line
- (C) filter bypass return line
- (D) pump suction line

*If choice D is selected set score to 1.*

**59.** A diesel engine exposed to widely varying ambient temperatures should use a lubricating oil with \_\_\_\_\_.

- (A) a high viscosity index
- (B) a low viscosity index
- (C) extreme pressure additives
- (D) no additives

*If choice A is selected set score to 1.*

**60.** Starting air check valves are held firmly on their seats by \_\_\_\_\_.

- (A) cam rollers on the camshaft
- (B) spring force
- (C) air pressure on top of the valve differential piston
- (D) air pressure on the bottom of the valve differential piston

*If choice B is selected set score to 1.*

**61.** The diesel engine component labeled "3", shown in the illustration is called the \_\_\_\_\_.  
Illustration MO-0122

- (A) scavenging air space
- (B) cylinder liner
- (C) head valve assembly
- (D) cylinder head

*If choice D is selected set score to 1.*

**62.** Whether using a centrifuge or a simple filter, oil cleaning and filtration will be the most effective when the oil is at a \_\_\_\_\_.

- (A) high temperature and a high viscosity
- (B) high temperature and a low viscosity
- (C) low temperature and a high viscosity
- (D) low temperature and a low viscosity

*If choice B is selected set score to 1.*

**63.** Maintaining the proper fuel oil temperature will result in \_\_\_\_\_.

- (A) the elimination of valve wear
- (B) improved atomization
- (C) a decrease in cylinder blow-by
- (D) a decrease in cylinder mean effective pressure

*If choice B is selected set score to 1.*

**64.** The purpose of an oil mist detector in a main propulsion diesel engine is to warn of \_\_\_\_\_.

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

*If choice A is selected set score to 1.*

**65.** For a given fuel, a change in the compression ratio will affect the ignition lag by which of the listed means?

- (A) An increase in compression ratio will increase the ignition lag.
- (B) An increase in compression ratio will decrease the ignition lag.
- (C) A decrease in compression ratio will decrease the ignition lag.
- (D) A decrease in compression ratio will increase the ignition lag.

*If choice B is selected set score to 1.*

**66.** Item labeled "R" as shown in section 6 of the illustration is identified as the \_\_\_\_\_. Illustration MO-0025

- (A) air filter
- (B) exhaust manifold
- (C) non-return scavenge valve
- (D) after cooler

*If choice D is selected set score to 1.*

**67.** 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

*If choice C is selected set score to 1.*

**68.** The rocker arms of the diesel engine shown in the illustration are indicated by \_\_\_\_\_.  
Illustration MO-0122

- (A) "C" and "Y"
- (B) "B"
- (C) "C"
- (D) "D"

*If choice A is selected set score to 1.*

**69.** In a bypass type lubrication system for a diesel engine, the dirty oil line to the centrifuge should be taken from the \_\_\_\_\_.

- (A) lube oil pump suction line
- (B) lube oil pump discharge line
- (C) bottom of the lube oil sump
- (D) outlet from the lube oil header

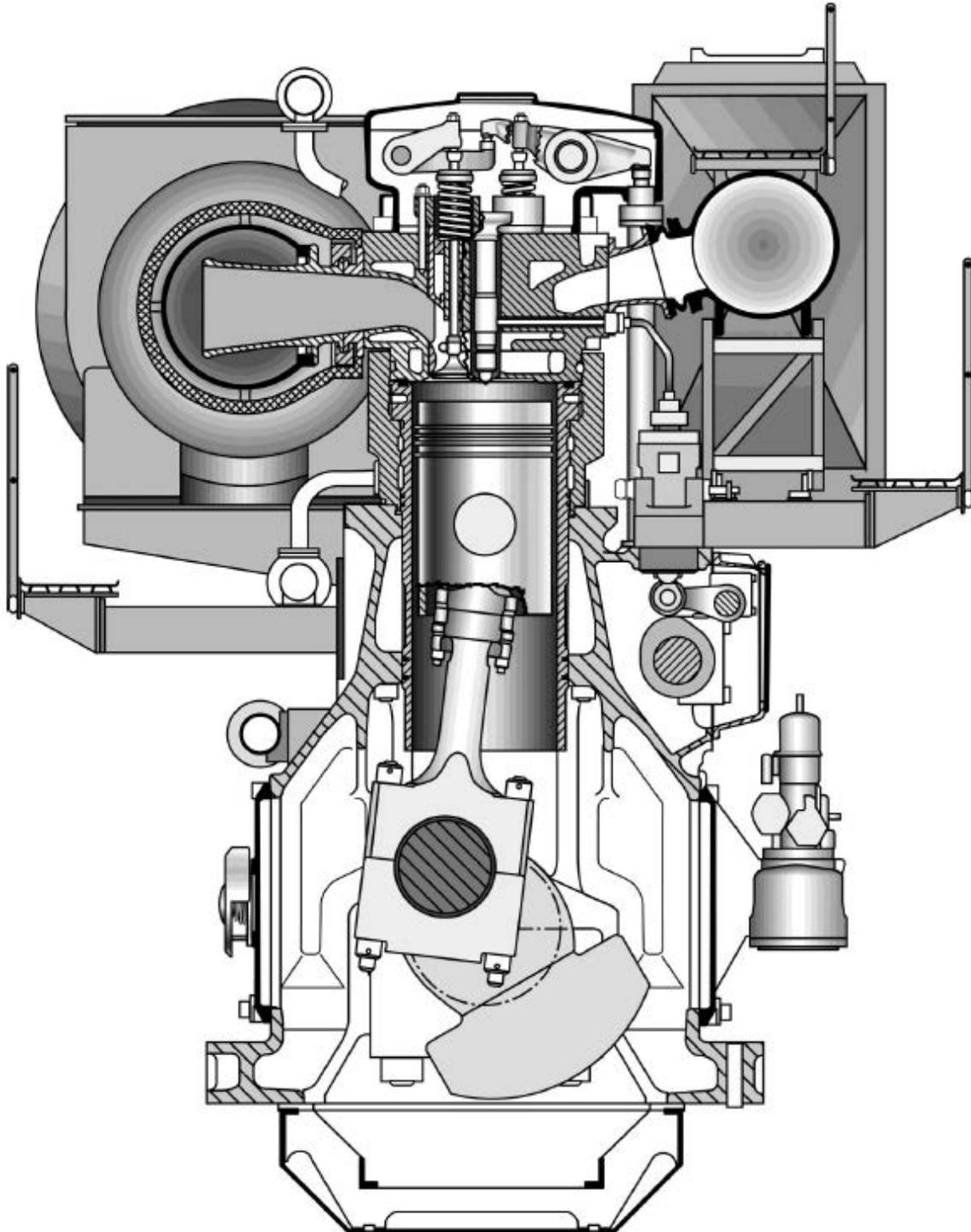
*If choice C is selected set score to 1.*

**70.** The component labeled as part No.20 in the illustration is used to \_\_\_\_\_. Illustration MO-0050

- (A) meter the amount of oil flow to the cylinder lubricating quill
- (B) adjust the timing of the cylinder lubricating oil to the cylinder
- (C) indicate the quantity of oil flow to the cylinder
- (D) prevent the backflow of oil and combustion gases

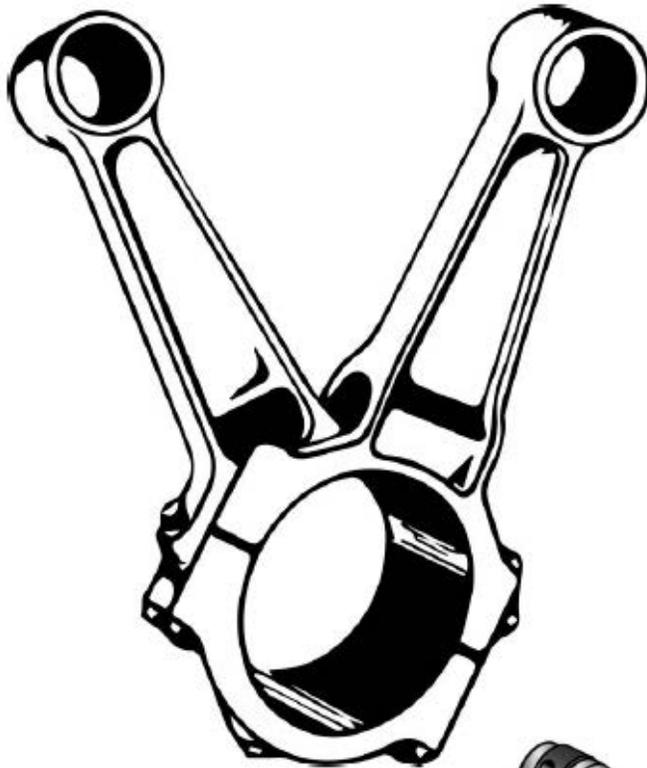
*If choice C is selected set score to 1.*

## MO-0007

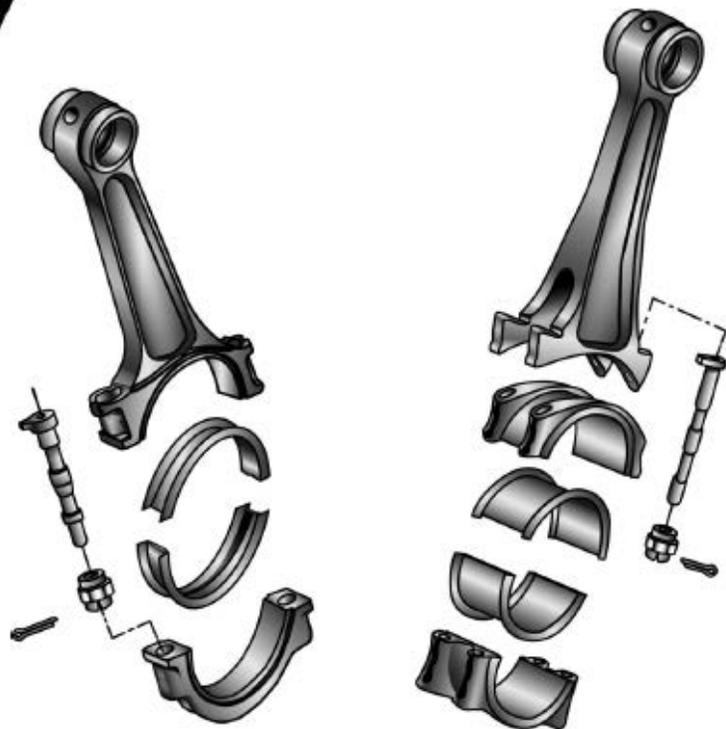


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## MO-0010

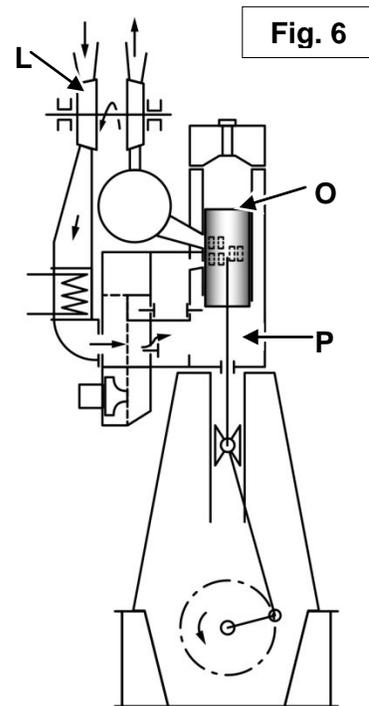
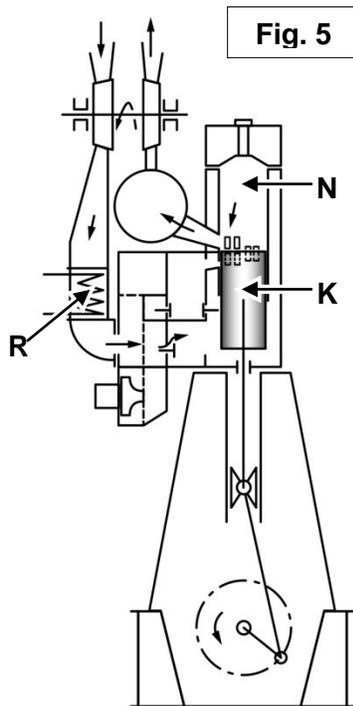
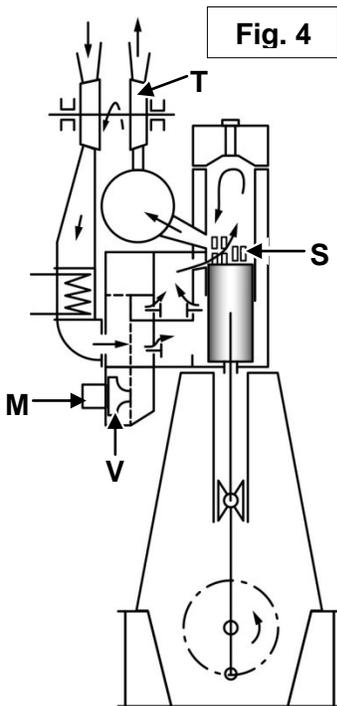
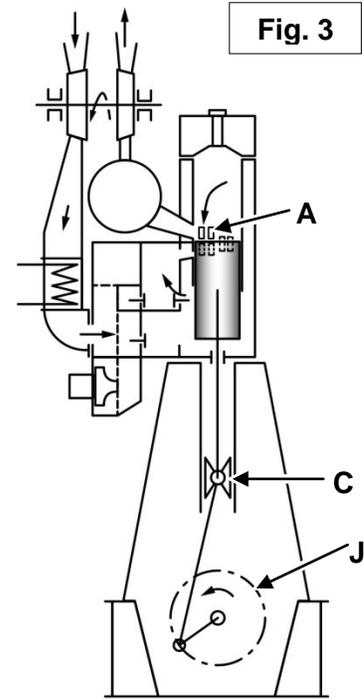
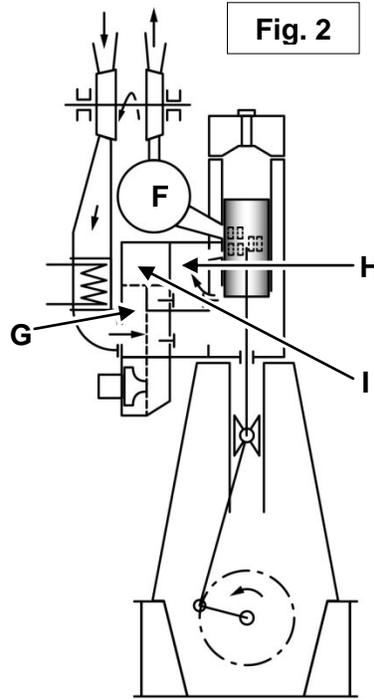
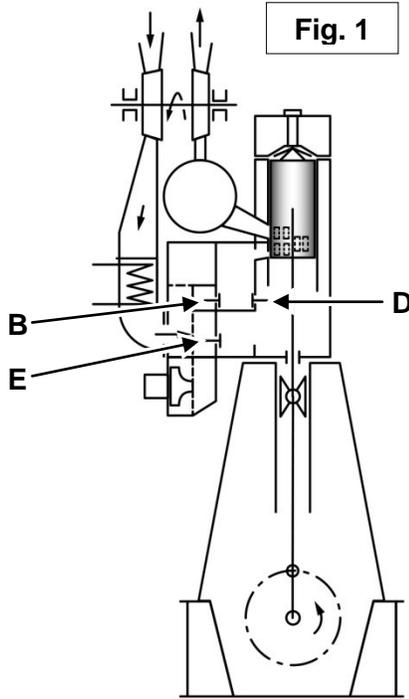


Exploded View



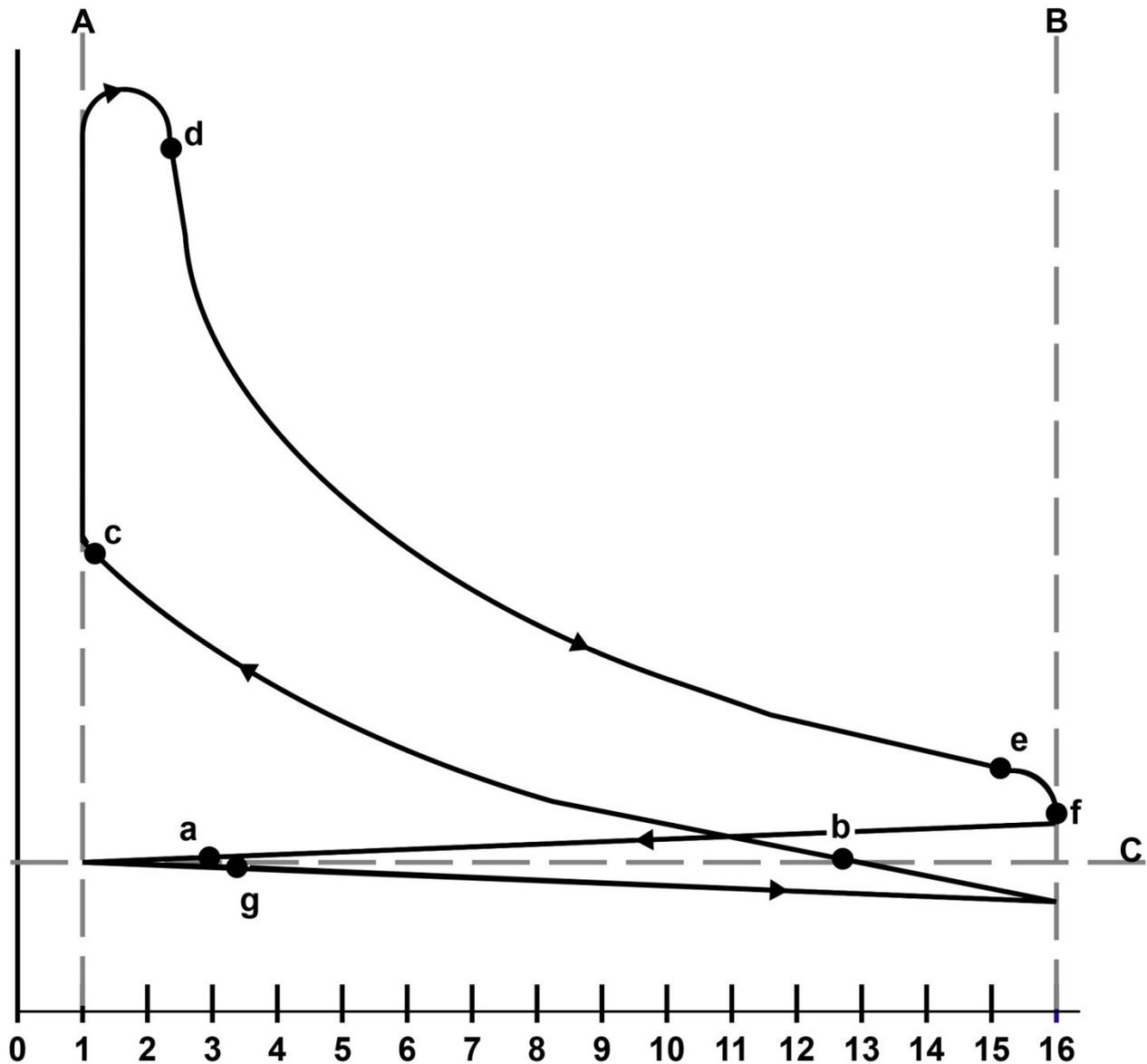
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## MO-0025

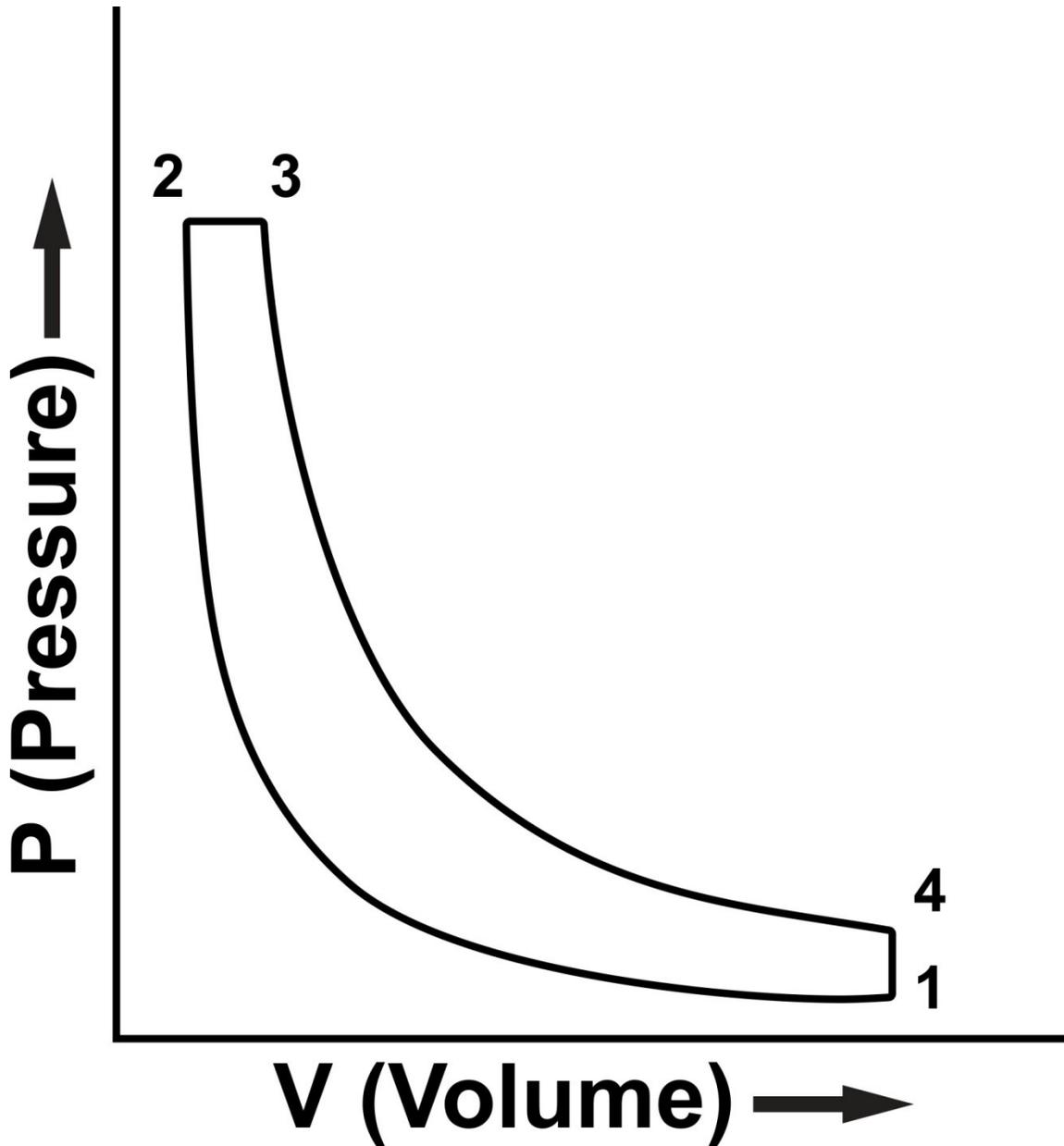


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## MO-0035



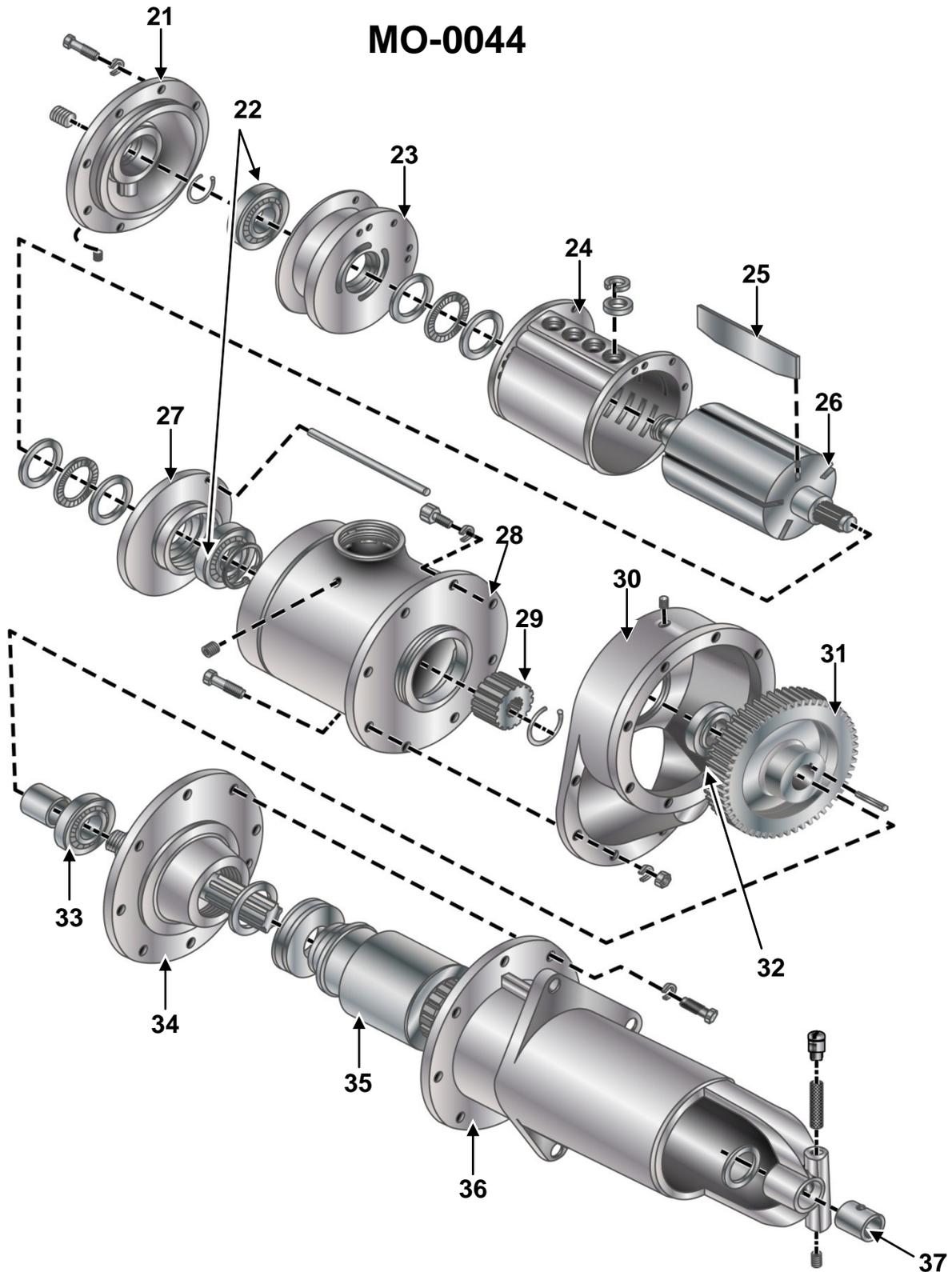
## MO-0036



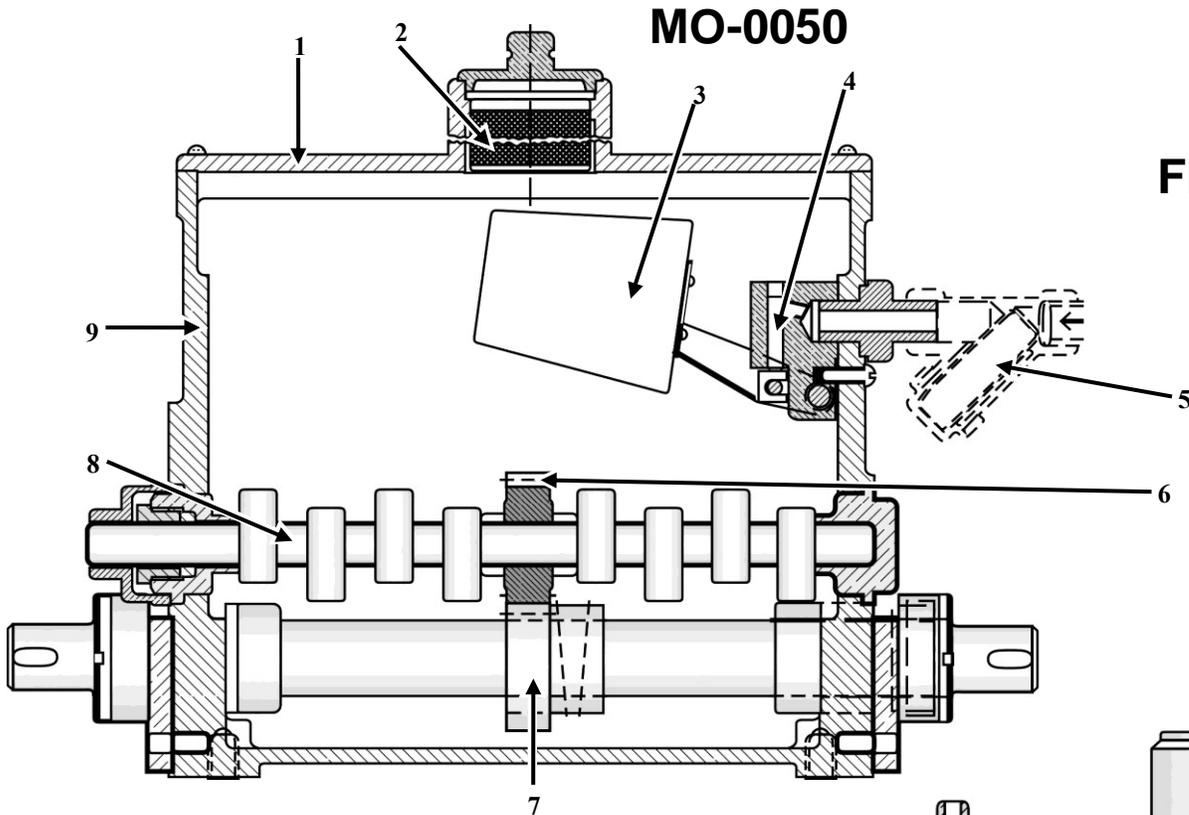
## MO-0038

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>0</b>	<b>120</b>	<b>240</b>	<b>60</b>	<b>300</b>	<b>180</b>

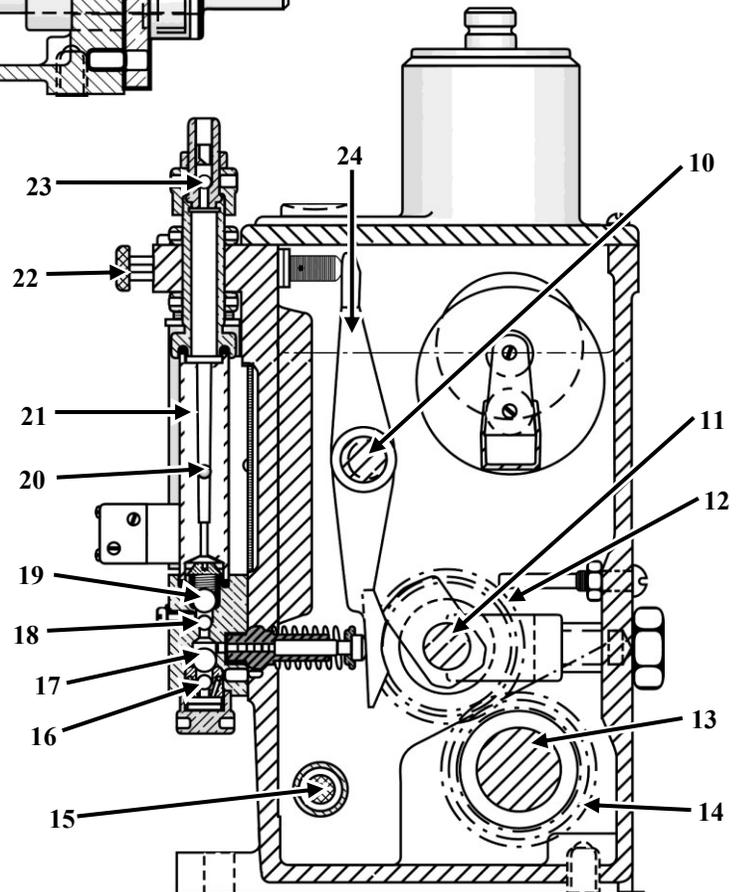
This chart gives the relative positions of fuel injection cam noses on a six cylinder auxiliary diesel engine with a right hand rotation. At the moment indicated, #1 cylinder is at top dead center and combustion is taking place.



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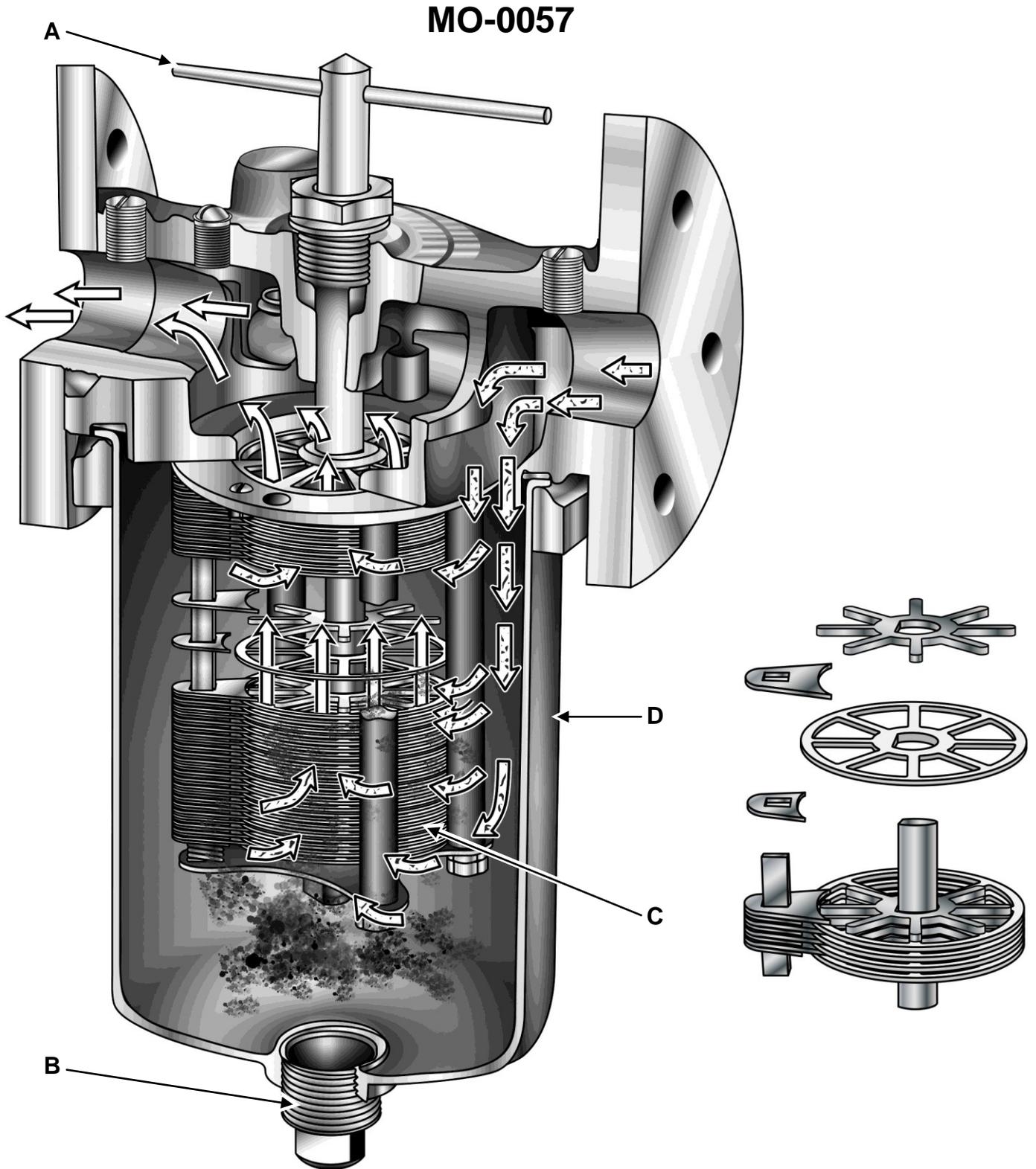


**Figure B**



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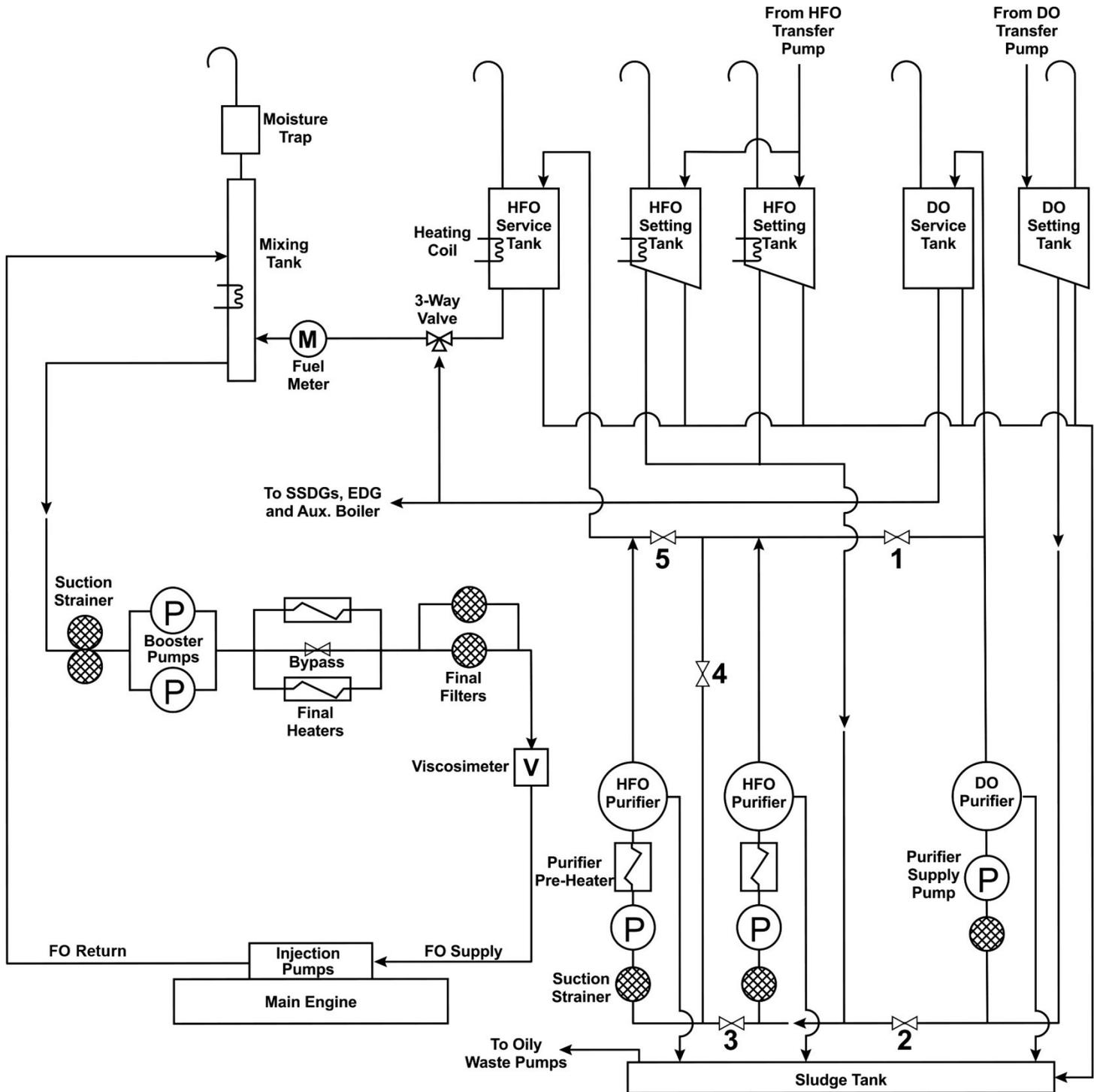


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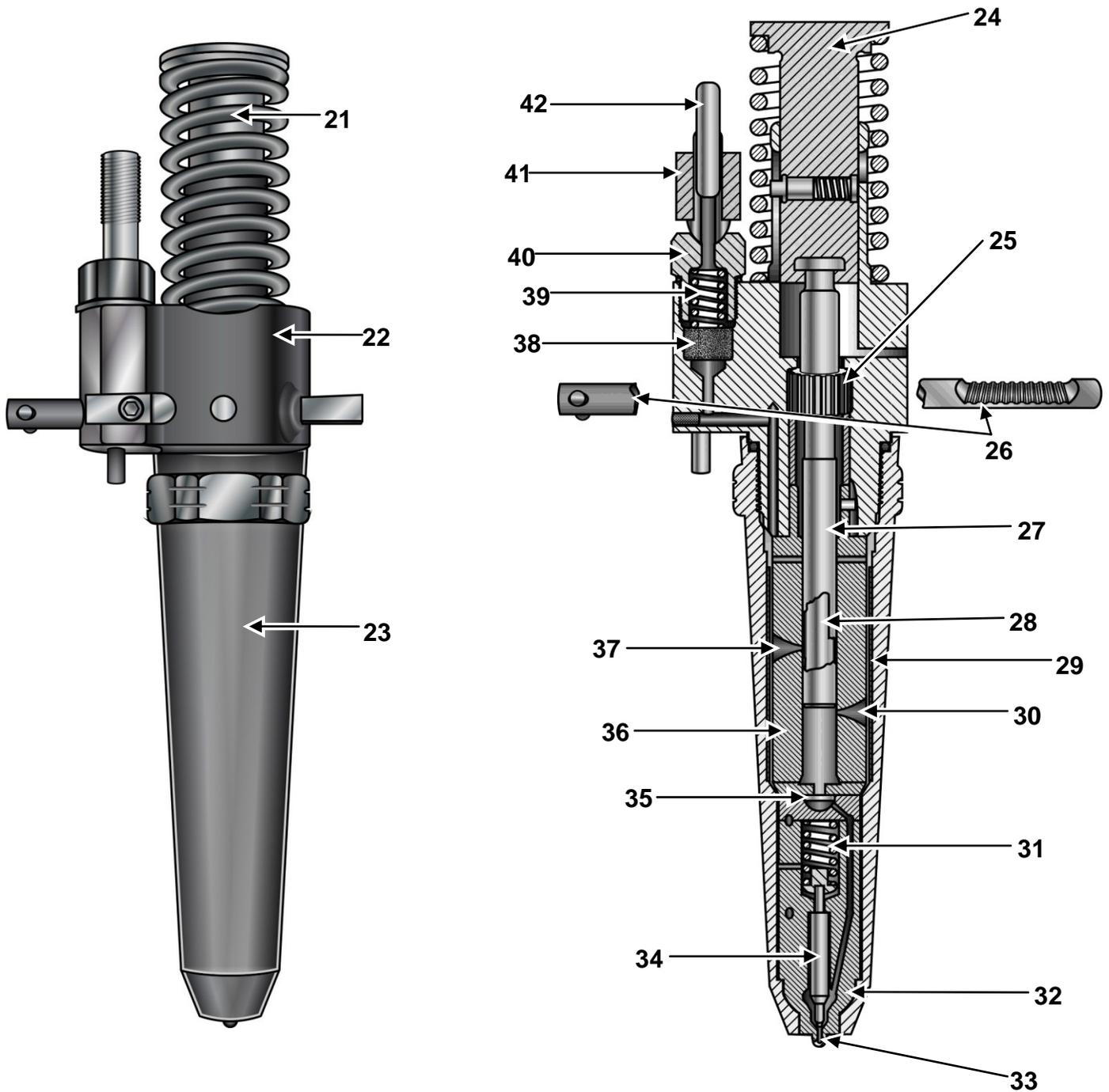
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## MO-0058



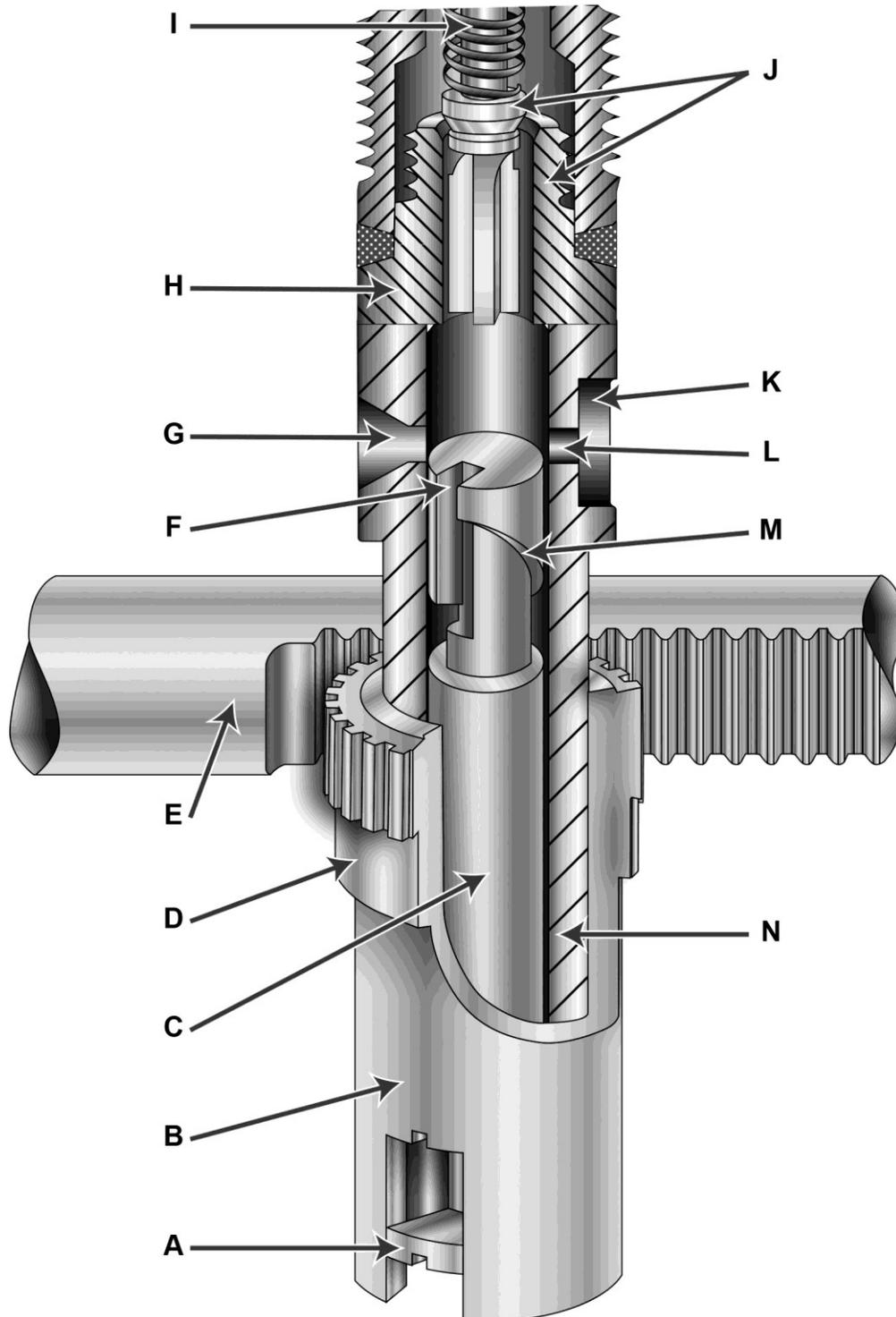
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## MO-0059



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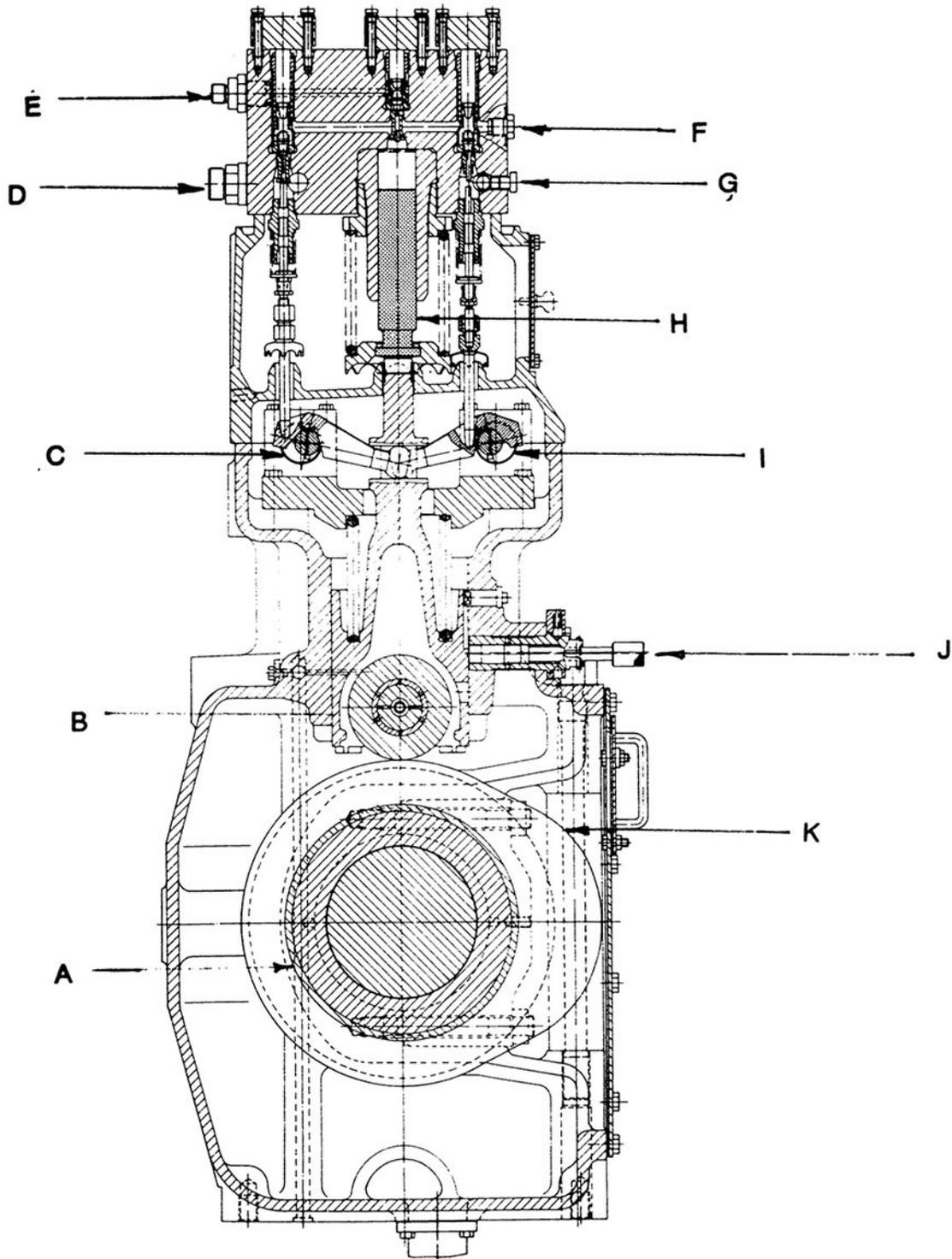
## MO-0061



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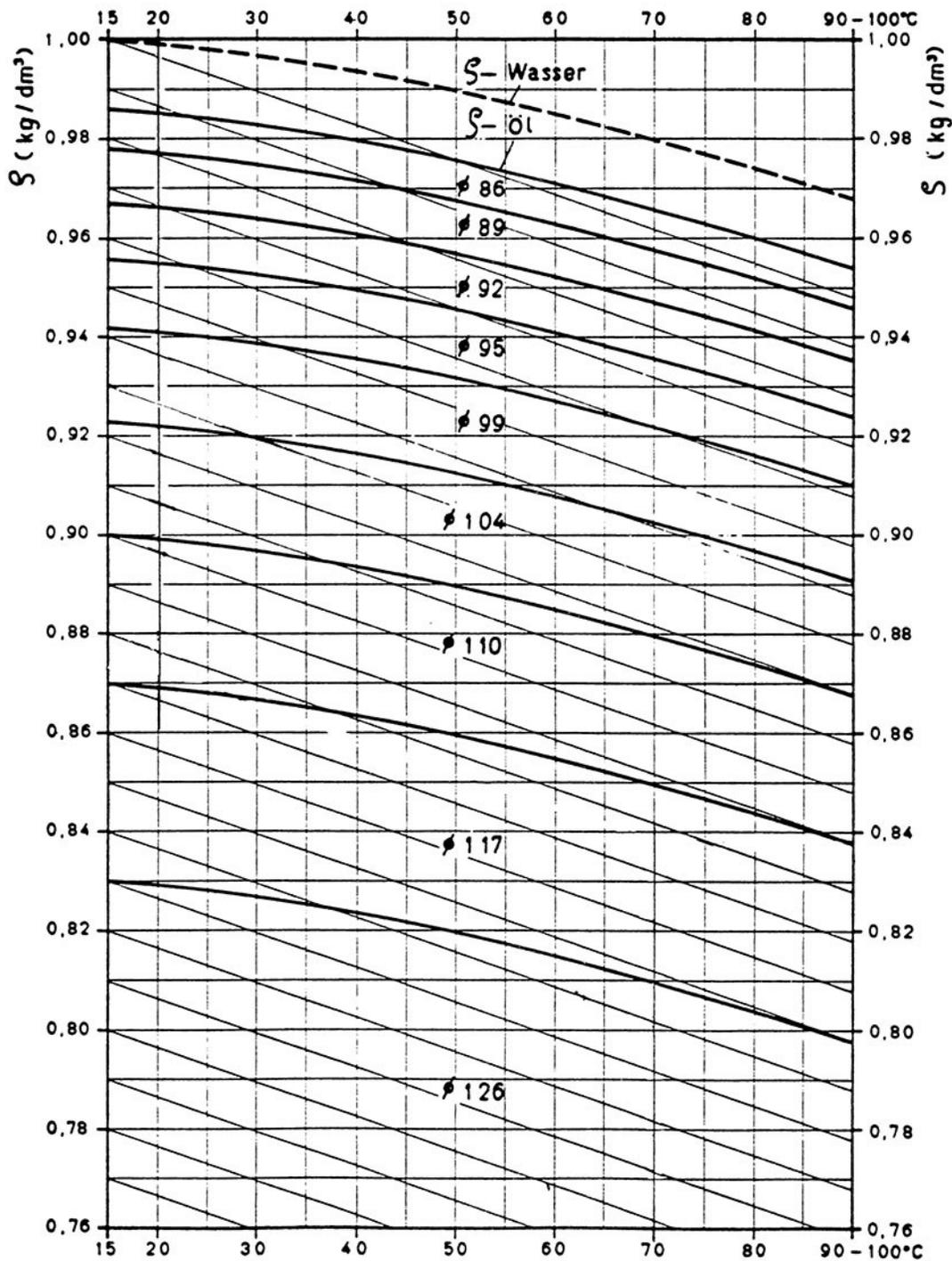
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## MO-0113



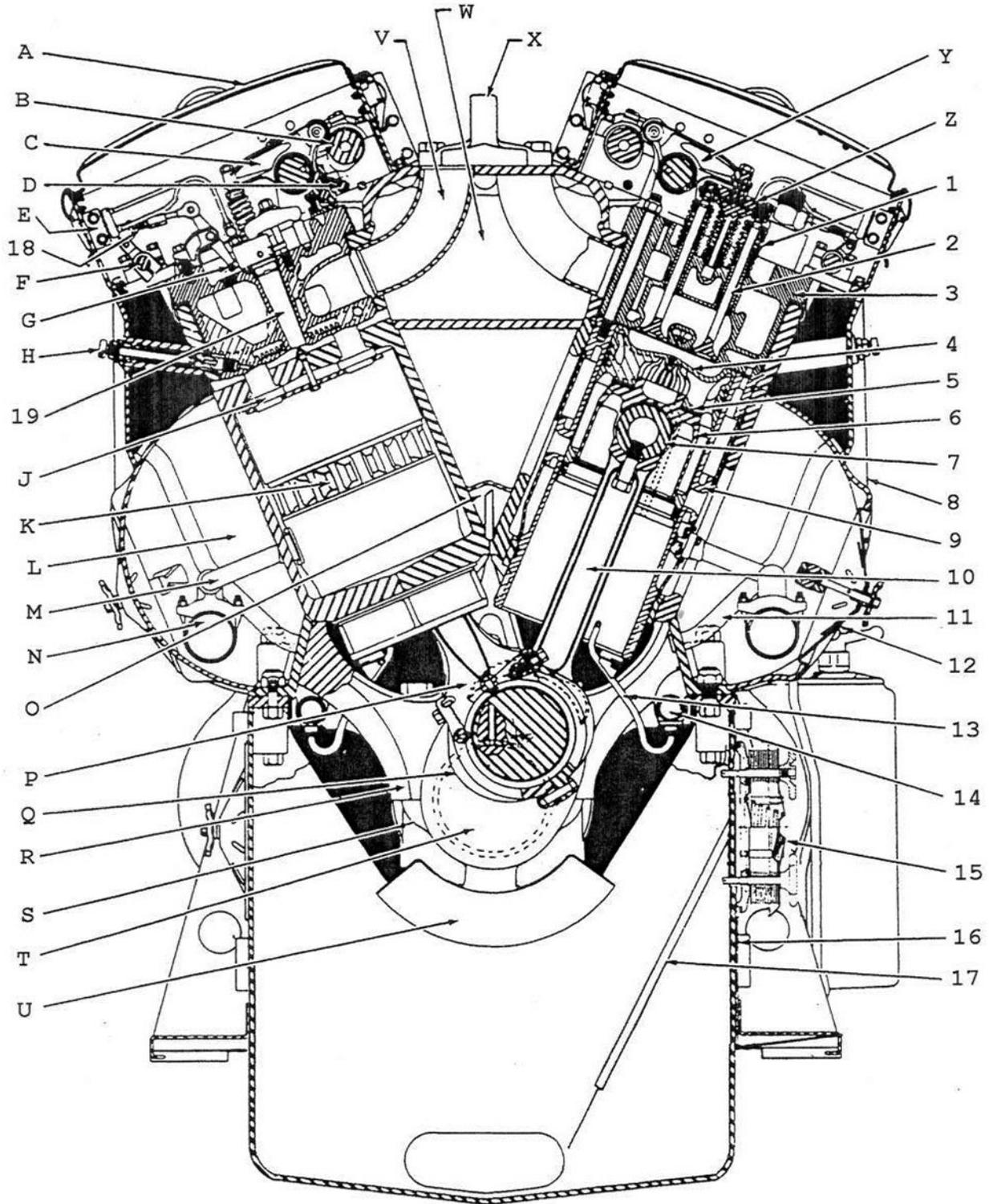
Separating temperature

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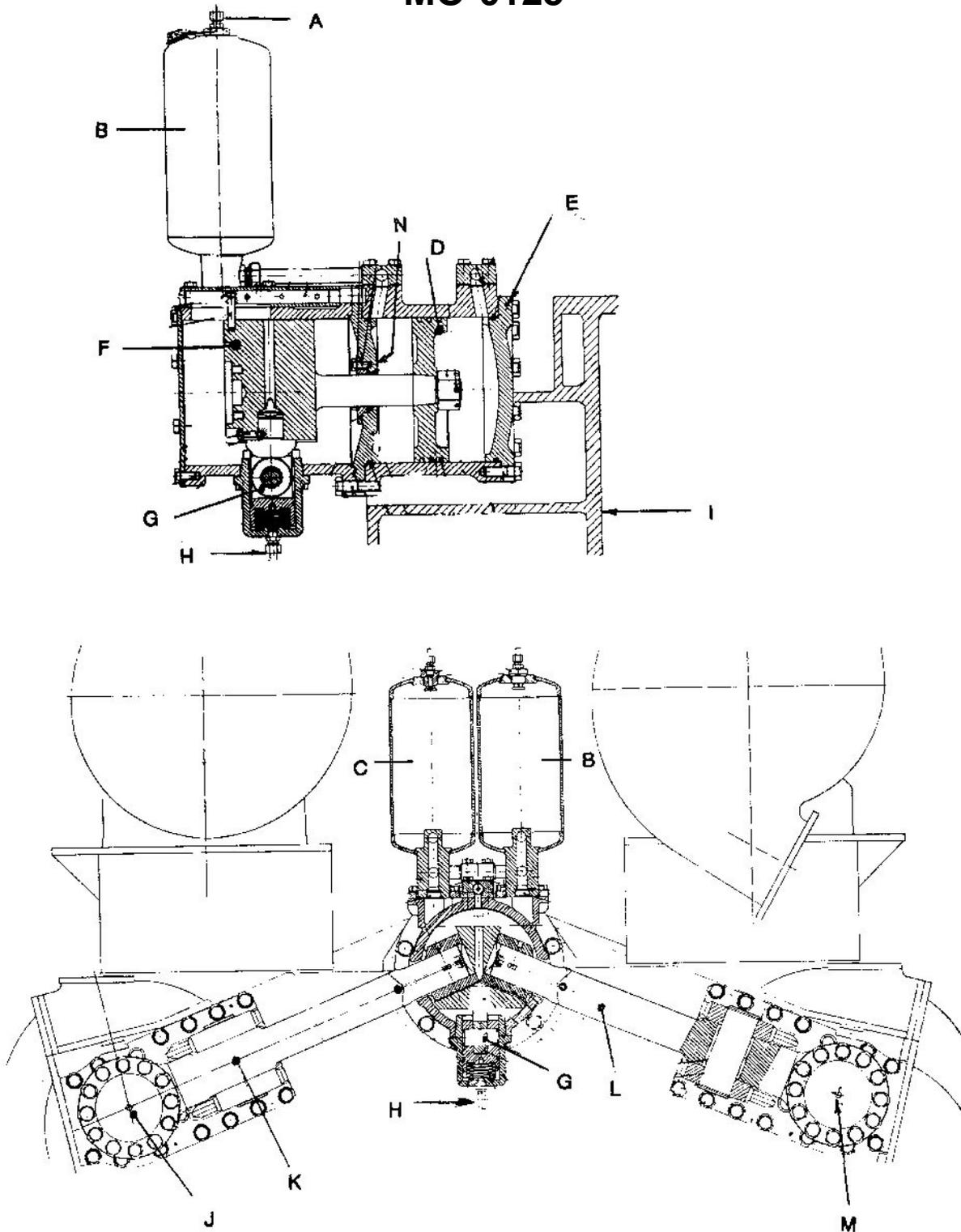
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## MO-0122

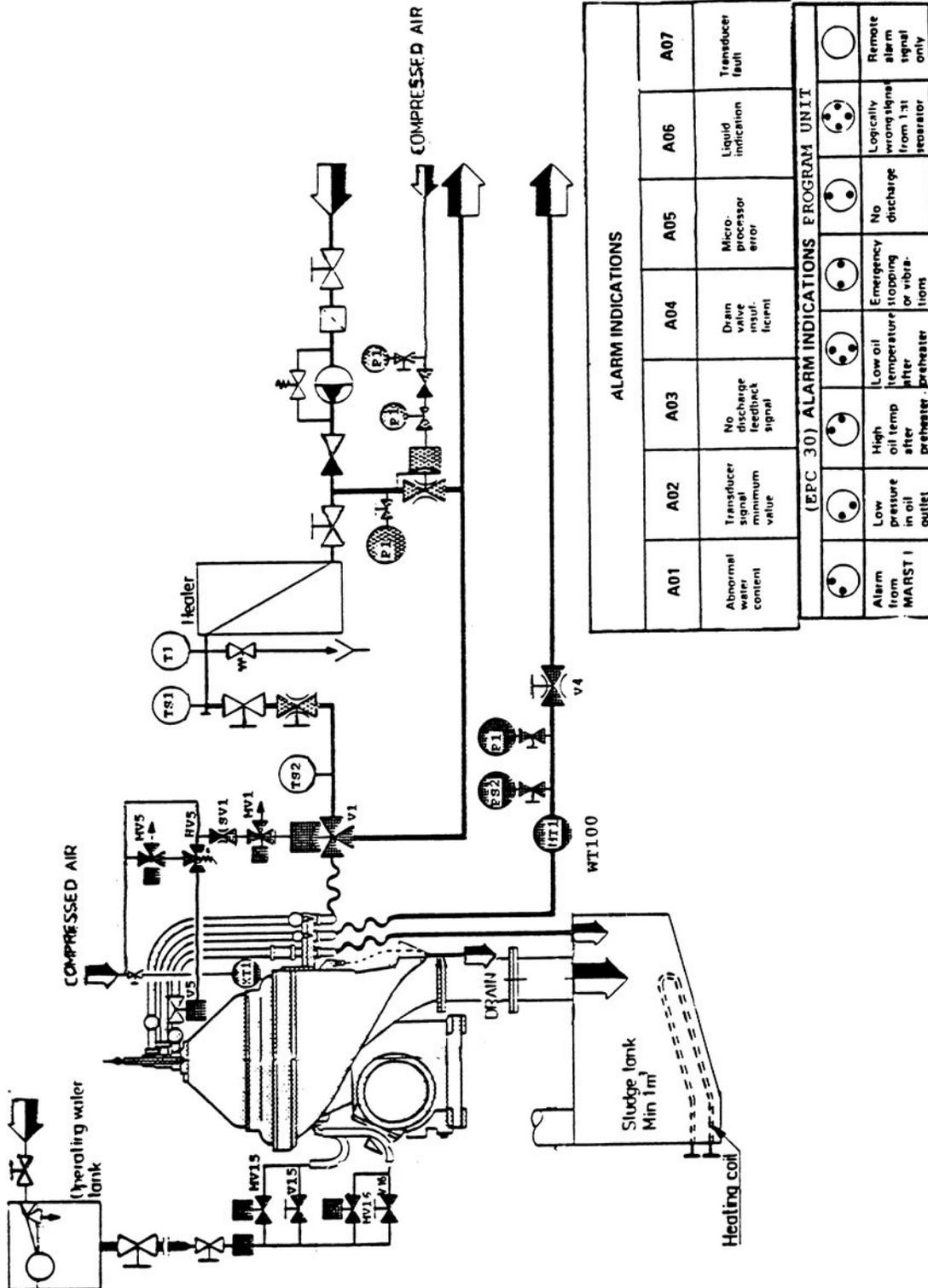


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## MO-0125



## MO-0127



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