U.S.C.G. Merchant Marine Exam

MODU – Chief Engineer

Q730 Motor Plants

(Sample Examination)

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

1. 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

   Correct Answer: B

2. 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

3. Why are some diesel engine cylinder liners plated on the wearing surface with porous chromium?

   A. The chromium will not wear out the piston rings.
   B. The chromium strengthens the liners in the way of the scavenging air ports.
   C. Chromium eliminates the need for oil scraper rings.
   D. Pores in the plating aid in maintaining the lube oil film.

   Correct Answer: D

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

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

   Correct Answer: B

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

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

   Correct Answer: D

6. The illustration shown describes a _____. Illustration MO-0069

   A. four-cycle opposed-piston diesel engine
   B. four-cycle opposed cylinder diesel engine
   C. two-cycle opposed-piston diesel engine
   D. two-cycle opposed cylinder diesel engine

   Correct Answer: C

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

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

   Correct Answer: A

8. 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

9. 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

   Correct Answer: B

10. Regularly taken indicator cards on a slow-speed diesel engine provides relative engine performance data allowing engineers to compare to previous data and manufacturer's design. What are the two most important parameters obtained from reading the indicator cards?

    A. Pcomp and injection timing
    B. Pmax and Pcomp
    C. Pmax and injection delay
    D. Pmax and scavenging air pressure

    Correct Answer: B

11. During main engine performance testing it is noticed that the firing pressure in one cylinder is lower than the average, but cylinder compression pressure and fuel pump delivery rate are normal. Which of the following would most likely be the cause?

    A. Low engine load
    B. Late fuel injection
    C. Worn piston rings
    D. Early fuel injection

    Correct Answer: B

12. 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

13. Worn cylinder head valve seats in a diesel engine will cause _____.

    A. less cold valve lash
    B. more cold valve lash
    C. excessive pressure in hydraulic valve lash adjusters
    D. broken valve springs

    Correct Answer: A

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

    Correct Answer: B

15. 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. Sulfur in exhaust gas mixing with water vapor condensation. Order cylinder oil of lower total base number.
    B. Vanadium from fuel melting in the exhaust gases. Maintain lower cooling water temperature to prevent vanadium from melting.
    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 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.

    Correct Answer: D

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

    A. a light load
    B. excessive compression pressure
    C. cold intake air
    D. excessive cylinder lubrication

    Correct Answer: D

17. In diesel engines, hydraulic valve lifters are used to _____.

    A. increase valve operating lash
    B. create longer valve duration
    C. reduce valve gear pounding
    D. obtain greater valve lift

    Correct Answer: C

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

    A. piston bushing
    B. connecting rod bushing
    C. connecting rod cap
    D. bearing shell

    Correct Answer: B

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

    A. spring force
    B. combustion pressure
    C. exhaust pressure
    D. push rod pressure

    Correct Answer: A

20. 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

    Correct Answer: B

21. 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. Exhaust valve open, intake valve closed
    B. Intake and exhaust valves open
    C. Intake and exhaust valves closed
    D. Intake valve open, exhaust closed

    Correct Answer: C

22. The service life of a worn aluminum piston for an auxiliary diesel, for which no spares are readily available, can be extended by _____.

    A. increasing the dimensions of the ring land grooves
    B. building up the piston skirt with a liquid epoxy material and then remachining
    C. turning down the piston skirt to concentric values
    D. knurling the piston skirt surface

    Correct Answer: D

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

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

    Correct Answer: A

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

    A. high cetane number
    B. insufficient compression
    C. high lube oil pressure
    D. low lube oil viscosity

    Correct Answer: B

25. 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. ring gear with broken teeth
    B. low compression pressure
    C. overheated motor windings
    D. low lube oil viscosity

    Correct Answer: C

26. High exhaust temperature and black smoke exhausting from an auxiliary diesel engine can be caused by _____.

    A. excessive compression pressure
    B. engine overload
    C. plugged fuel nozzle holes
    D. low combustion temperature

    Correct Answer: B

27. Which of the following operating characteristics of the Bendix drive friction clutch is associated with a Bendix drive starter?

    A. Engages the pinion with the air start distributor
    B. Helps absorb the shock when the pinion engages the flywheel ring gear
    C. Disengages the pinion from the flywheel ring gear
    D. Prevents the pinion starter from overrunning on the starter shaft

    Correct Answer: B

28. Auxiliary diesel engine electric starting motors use _____.

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

    Correct Answer: D

29. In a direct cylinder admission air starting system, once the engine begins to fire, the air starting check valve illustrated, is closed by _____. Illustration MO-0107

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

    Correct Answer: A

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

    Correct Answer: C

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

    A. centrifugal purifier system
    B. batch system
    C. shunt system
    D. bypass system

    Correct Answer: C

32. The device shown in the illustration is a _____. Illustration MO-0008

    A. comparator type mist detector for large low-speed, crosshead type engines
    B. rotary type mist detector, designed for use in four-stroke, high-speed diesel engines
    C. level type explosimeter, for small medium-speed, trunk type piston engines
    D. photoelectric, explosive gas indicator, for use in high-speed, two-stroke, trunk type piston engines

    Correct Answer: A

33. Which of the following problems could develop due to the accumulation of oil vapors in the crankcase of a diesel engine?

    A. Crankcase explosion
    B. Poor fuel economy
    C. Reduced lubrication
    D. Combustion knock

    Correct Answer: A

34. If the analysis of used lube oil indicates a high content of iron particles, this could indicate _____.

    A. excessive ring and liner wear
    B. excessive cooling of lubricating oil
    C. corrosive deterioration of a bearing
    D. inadequate air filtration

    Correct Answer: A

35. Which of the following test indicators should be considered the most significant factor in determining as to whether or not a diesel-generator's lube oil should be drained and renewed?

    A. An extremely low precipitation number
    B. An extremely high neutralization number
    C. The oil appears black in color
    D. An increase in flash point

    Correct Answer: B

36. Which of the following effects will excessively cold lube oil have on the operation of a diesel engine?

    A. The engine will crank slowly and may fail to start.
    B. The engine will overspeed when started.
    C. The cooling system will overheat causing the engine to stall.
    D. The fuel oil supply will become diluted resulting in rough running.

    Correct Answer: A

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

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

    Correct Answer: D

38. Both crosshead type and trunk type lubricating oil are received onboard a vessel. These two oils cannot be interchanged due to which of the following reasons?

    A. Crosshead type lubricating oil has a lower base number as it does not need to neutralize the combustion by-products
    B. Trunk type lubricating oil has a higher flash point
    C. Crosshead type lubricating oil has a lower pour point
    D. Crosshead type engine oil scraper rings are designed for a certain oil type

    Correct Answer: A

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

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

    Correct Answer: D

40. 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. exhaust and intake valves just closing
    B. fuel injection occurring at that point and combustion begins
    C. maximum compression pressure is just being attained
    D. expansion during the combustion process

    Correct Answer: D

41. 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. Fuel injectors and piston rings
    C. Fuel injectors and turbocharger blading
    D. High pressure fuel pumps and cylinder liners

    Correct Answer: A

42. 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.

    Correct Answer: C

43. While bunkering heavy fuel, what quick/easy test can one perform onboard to determine the compatibility of 'old' with 'new' fuel?

    A. Take equal samples of both fuels, elevate their temperature, and mix them vigorously. If no frothing occurs, they are compatible.
    B. 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.
    C. Perform a running viscosity test of both fuels, at the same temperature, if the viscosities are equal, they should be compatible.
    D. Mix two equal samples of the two fuels at elevated temperatures and determine if they become a homogeneous mixture.

    Correct Answer: B

44. On a diesel-propelled vessel operating with constant slip, what is the effect on fuel consumption with an increase in shaft RPM?

    A. fuel consumption varies as the cube of the shaft RPM
    B. fuel consumption varies inversely with the shaft RPM
    C. fuel consumption varies as the square of the shaft RPM
    D. fuel consumption varies directly proportional to the shaft RPM

    Correct Answer: A

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

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

    Correct Answer: A

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

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

    Correct Answer: A

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

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

    Correct Answer: C

48. Uneven bolt tightening during the installation of a fuel injection pump can result in _____.

    A. binding of pump moving parts
    B. improper pump-to-engine timing
    C. high torsional shock to fuel lines
    D. ignition delay

    Correct Answer: A

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

    A. Coated fuel lines
    B. Excessive vibration
    C. Air in the fuel system
    D. Improper lubrication

    Correct Answer: C

50. When a fuel injection nozzle overheats, which of the problems listed can be expected?

    A. Carbon formation will increase on nozzle tip
    B. The fuel metering will vary
    C. Power will be reduced
    D. All of the above

    Correct Answer: D

51. One cause of diesel engine surging can be a result of _____.

    A. solenoid stuck open
    B. injection pump fuel rack binding or sticking
    C. fuel booster pump pressure too high
    D. low compression

    Correct Answer: B

52. Problems with the diesel engine fuel injection pump are usually caused by _____.

    A. kinked fuel lines
    B. contaminated fuel
    C. improper adjustment
    D. excessive engine vibration

    Correct Answer: B

53. Heat damage to fuel injection nozzles can be prevented by avoiding _____.

    A. excessive fuel oil temperature
    B. metallic contact between nozzles and cylinder heads
    C. hard carbon deposit and varnish on the nozzles
    D. long periods of engine overload

    Correct Answer: D

54. In the common rail system, excessive pressure in the header may be caused by _____.

    A. improper adjustment of the bypass valve
    B. insufficient leakoff through injection nozzle packing
    C. a malfunctioning injection nozzle
    D. a dribble in the fuel injection nozzle

    Correct Answer: A

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

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

    Correct Answer: A

56. Which condition indicates the air side fouling of an aftercooler on a turbocharged diesel engine?

    A. A decrease in the air temperature differential between the cooler inlet and outlet.
    B. An increased air temperature differential between the cooler inlet and outlet
    C. A decrease in the air pressure differential across the cooler
    D. Excessive condensate forming in the air box

    Correct Answer: A

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. increase compression on spring #12
    B. decrease 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: A

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

    Correct Answer: C

59. 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

60. The gear drive, shown in the illustration, can have the backlash determined best by using a _____. Illustration MO-0091

    A. lash indicator
    B. lead wire
    C. red dye indicator
    D. feeler gauge

    Correct Answer: D

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

    Correct Answer: B

62. 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. bleed off all accumulator pressure in "E"
    B. drain the reservoir
    C. remove all plugs from the system
    D. ensure that the accumulator piston is in the charged position

    Correct Answer: A

63. 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

    Correct Answer: A

64. Which of the following oil mist to air ratios would most likely lead to the most severe crankcase explosion?

    A. 2-3% by volume
    B. 5-7% by volume
    C. 9-10% by volume
    D. 12-15% by volume

    Correct Answer: B

65. Which of the following statements is correct concerning the operating function of the governor shown in the illustration? Illustration MO-0096

    A. The dial type adjusting knob (B) is used for setting speed droop and damping out hunting.
    B. The compensating mechanism provides positive control to lower engine speed as load is increased.
    C. The speed droop lever spring prevents the engine from racing or hunting by arresting the movement of the power piston after a speed change.
    D. Excess oil under high-pressure is released from the spring-loaded accumulators to the sump.

    Correct Answer: D

66. Increasing the oil pressure acting on the power piston of the hydraulic governor shown in the illustration will _____. Illustration MO-0092

    A. increase the governor output power
    B. increase the speed droop
    C. require the overspeed trip setting to be adjusted
    D. decrease the speed droop

    Correct Answer: A

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

    Correct Answer: C

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

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

    Correct Answer: B

69. Governor hunting is caused by _____.

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

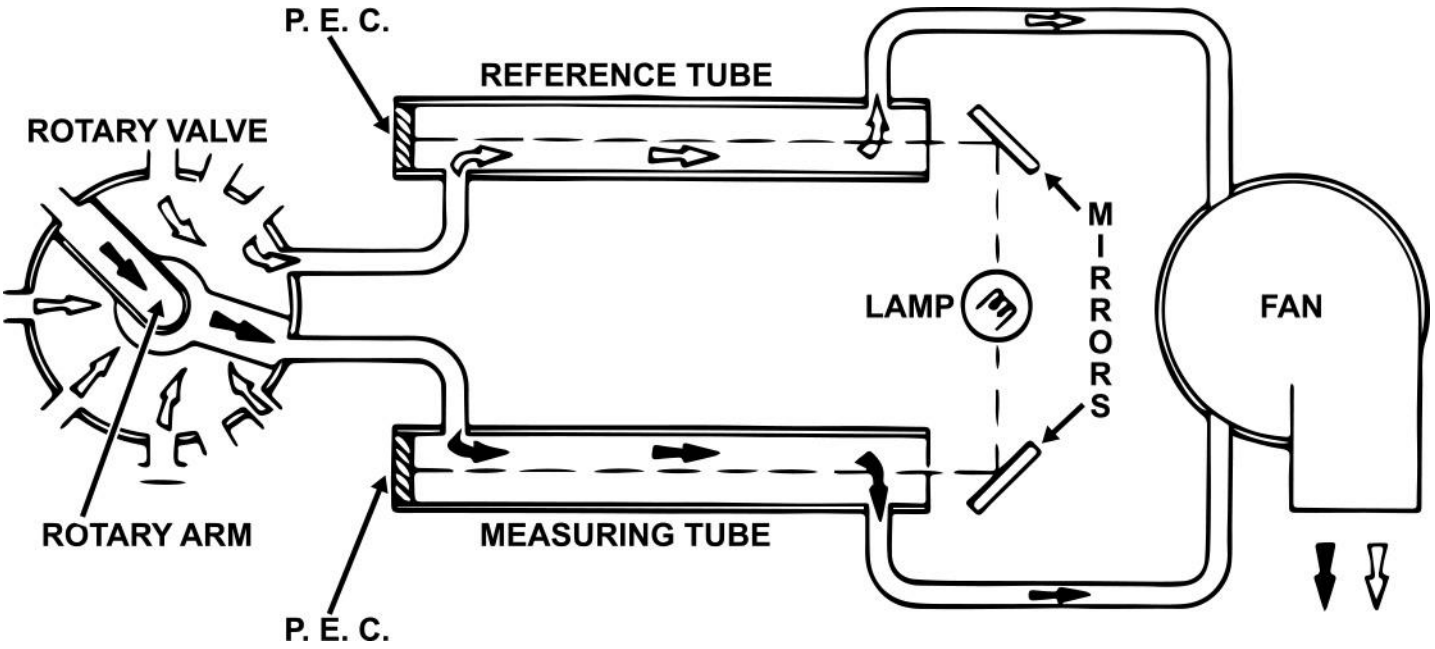
    Correct Answer: A

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

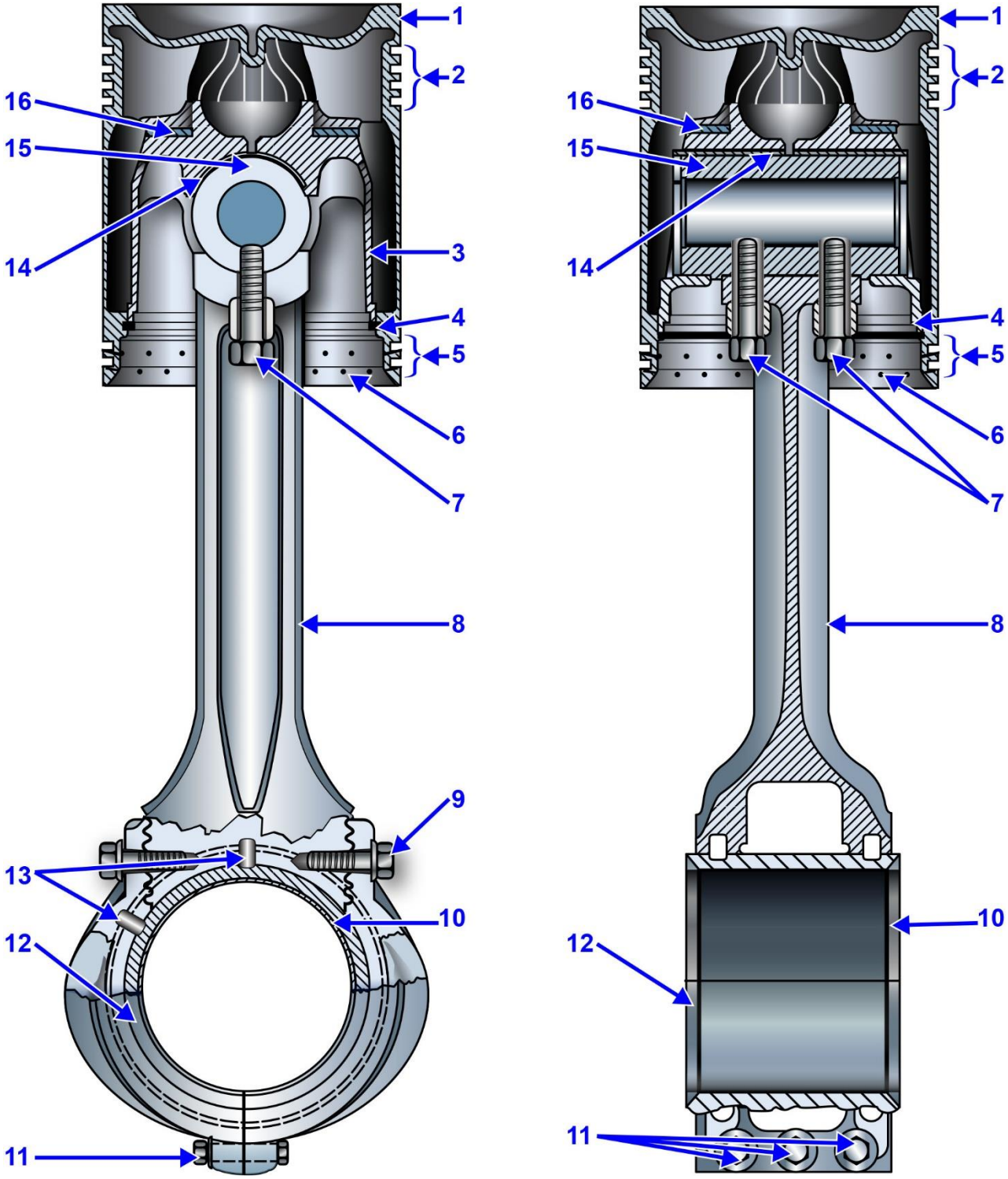
    A. clogged intake air intercooler
    B. malfunctioning governor
    C. control air leak
    D. leaking air starting valve

    Correct Answer: B

MO-0008



MO-0011



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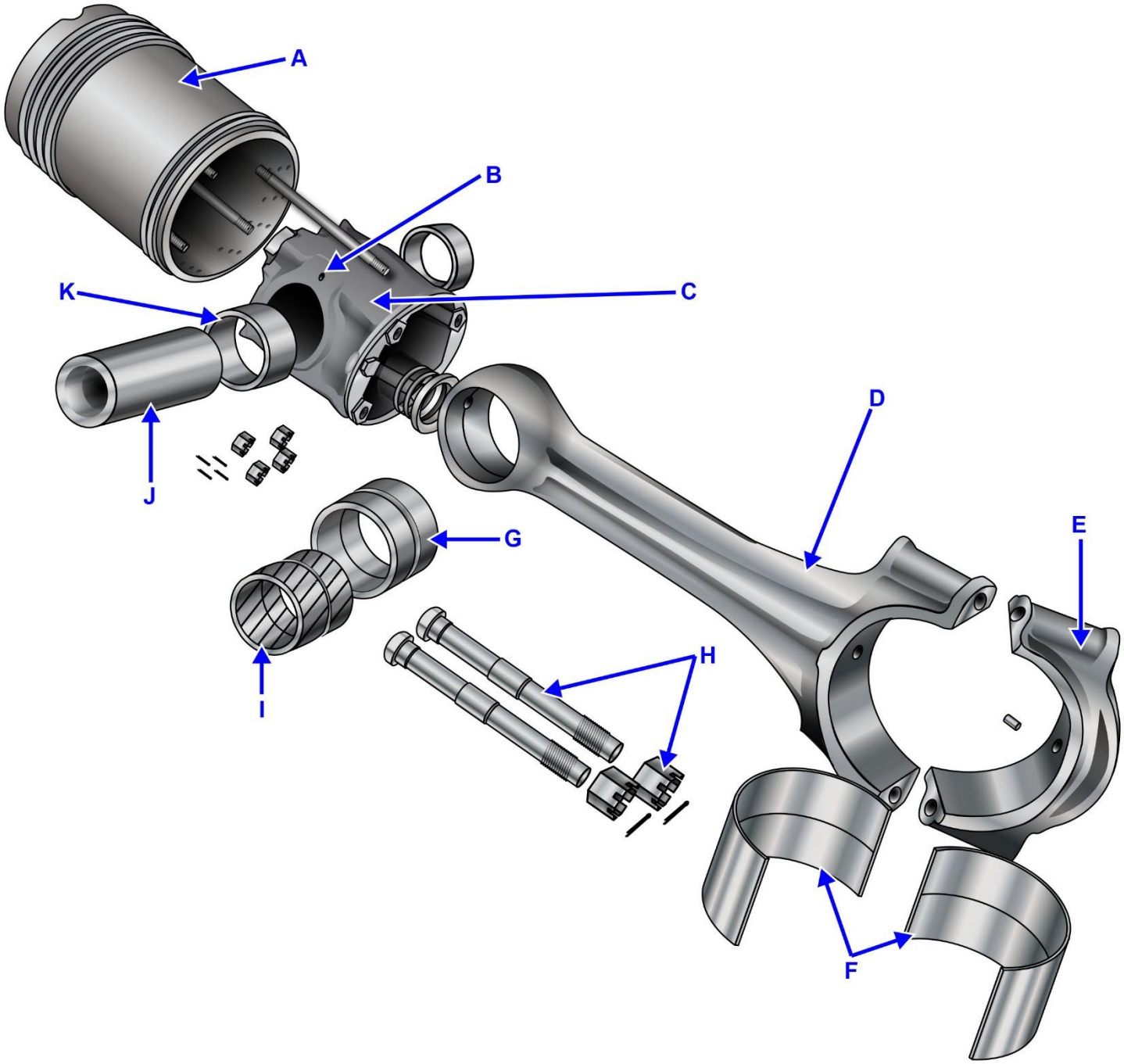

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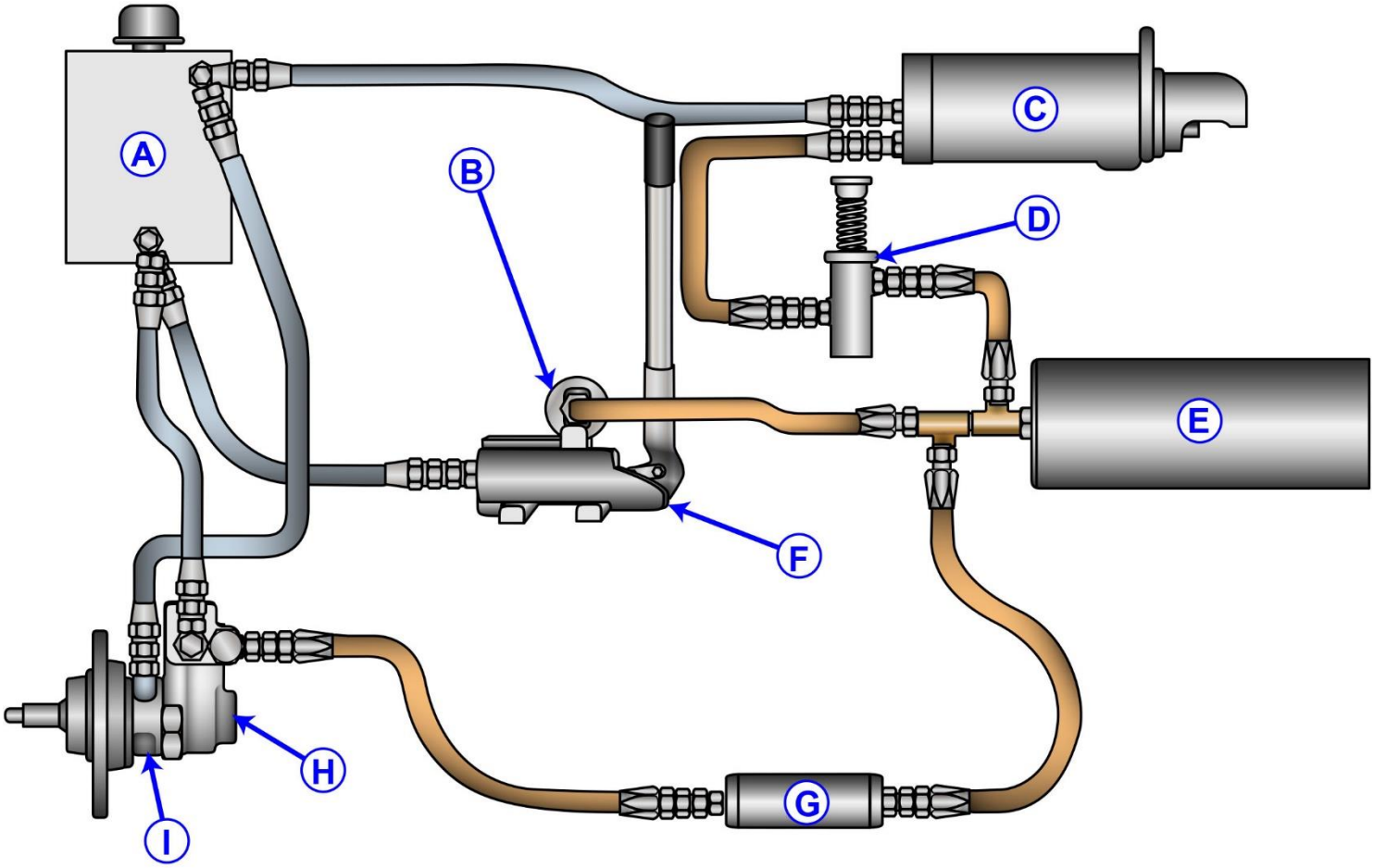

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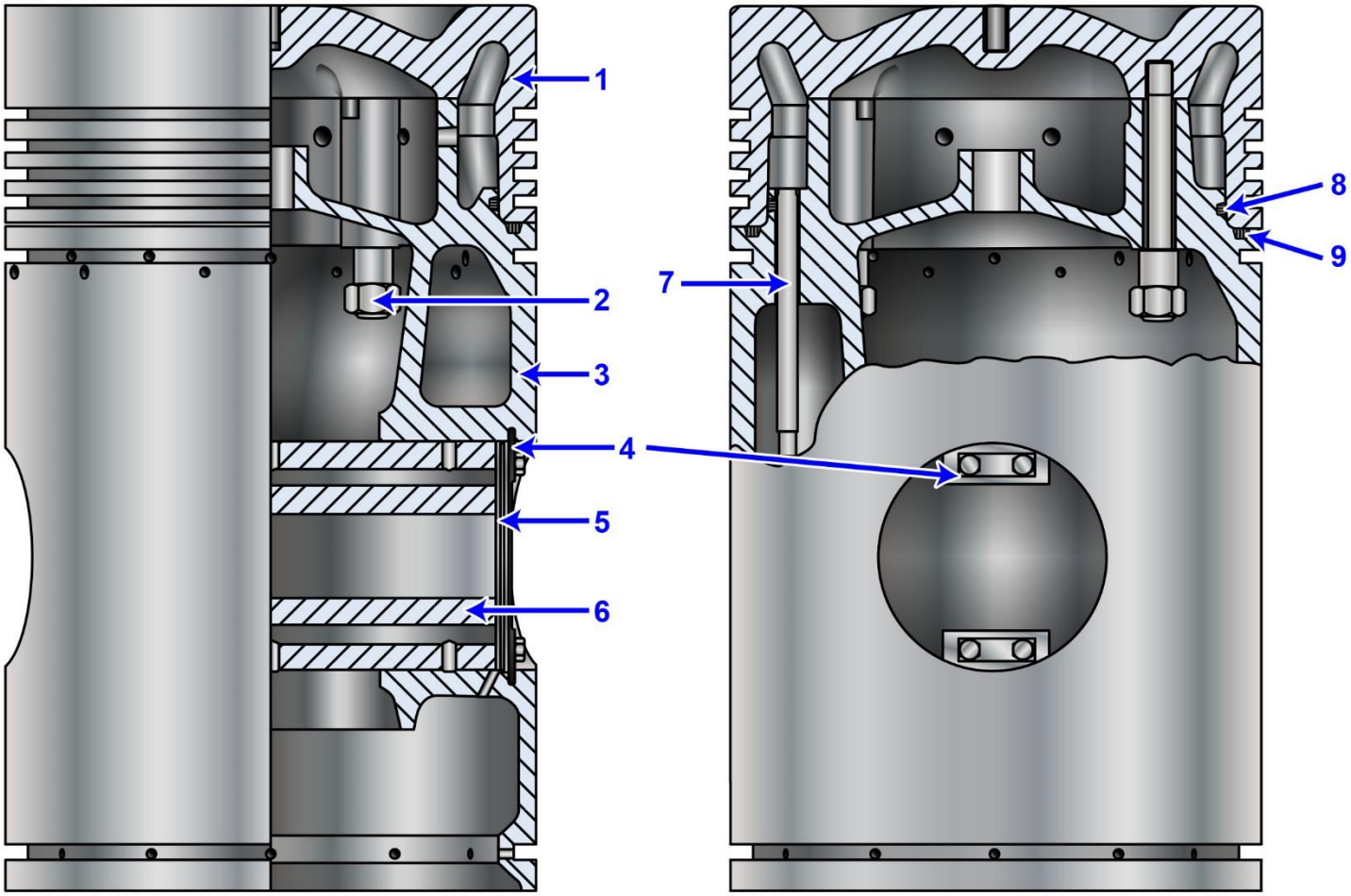

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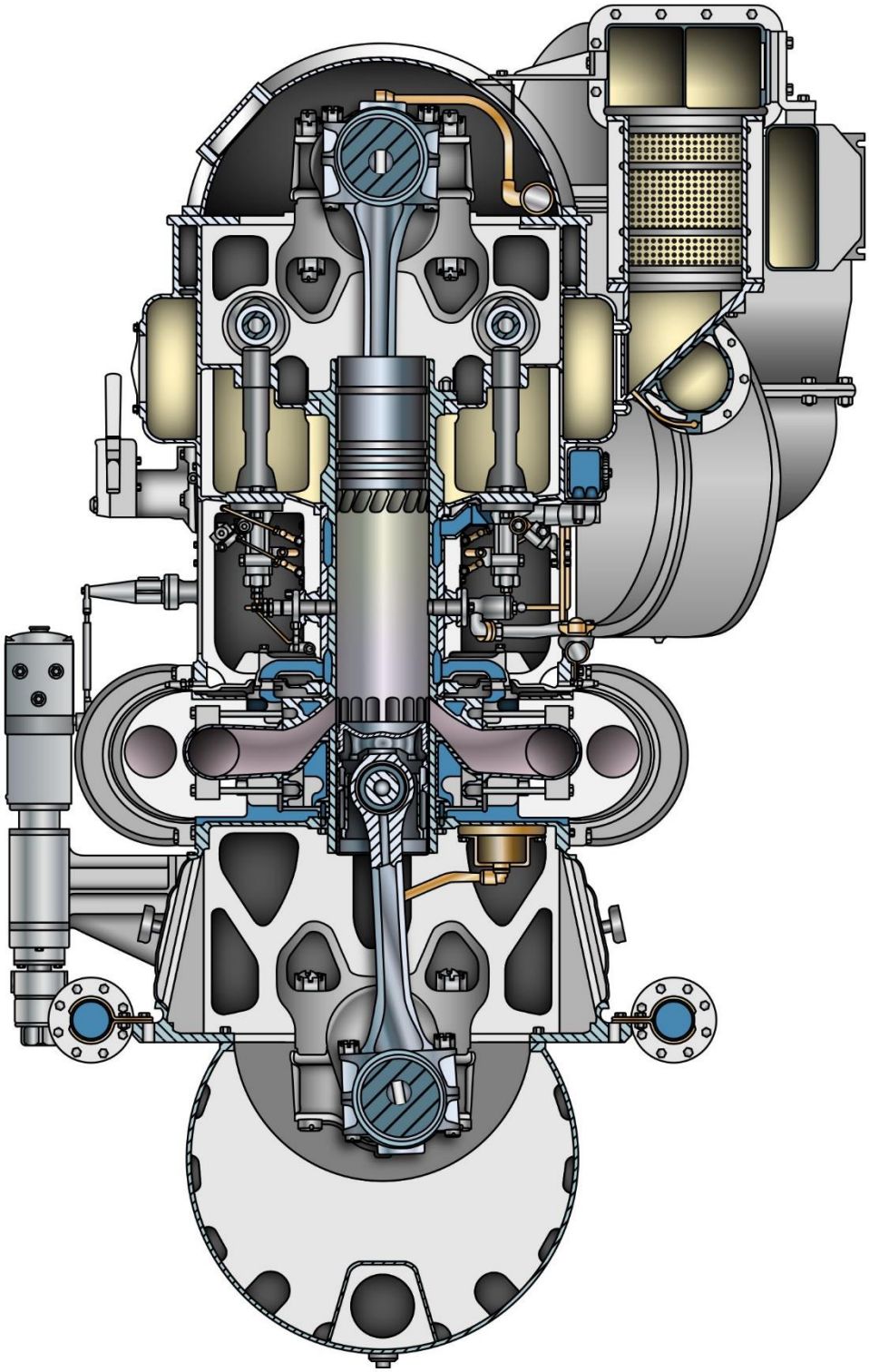

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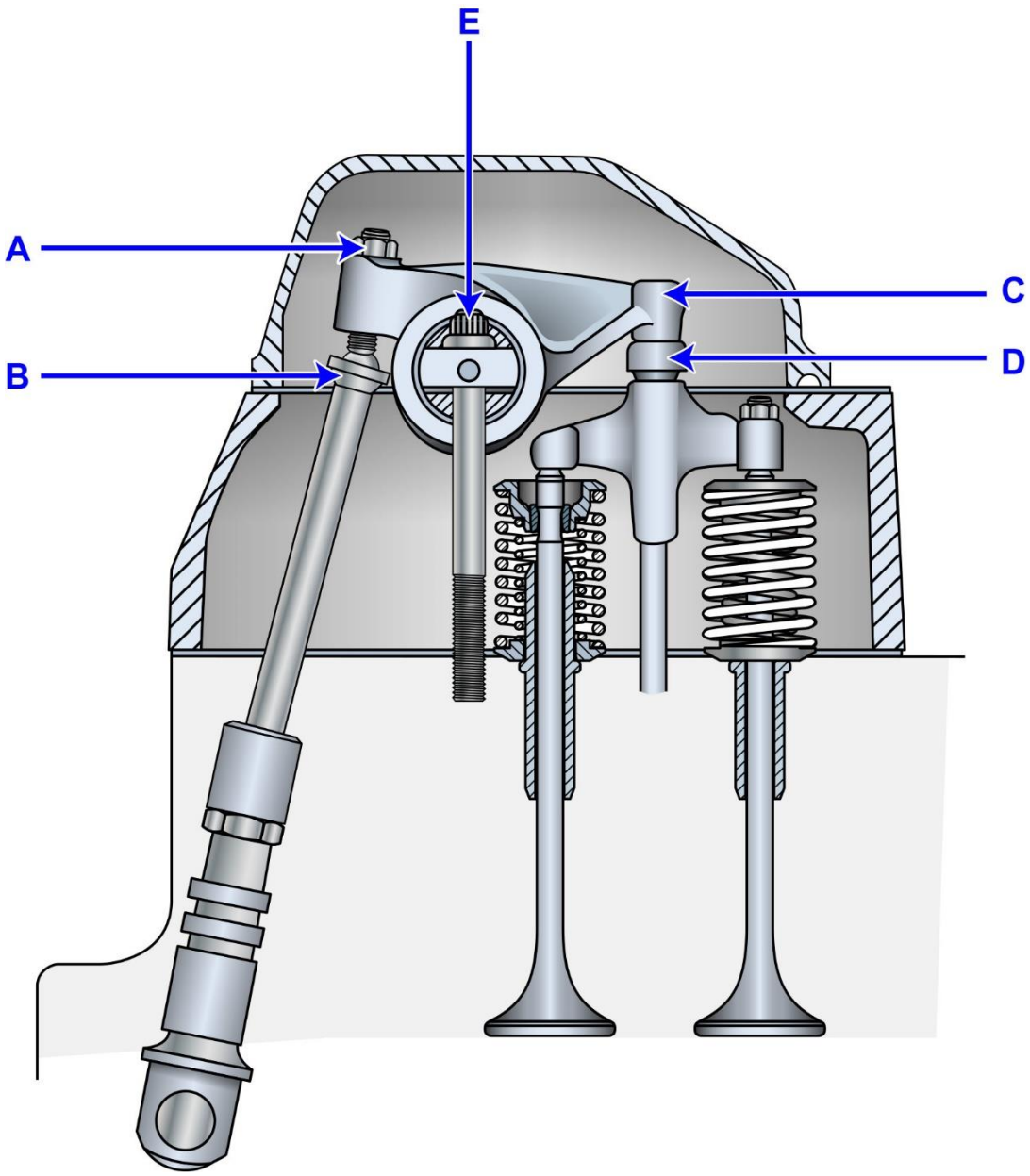

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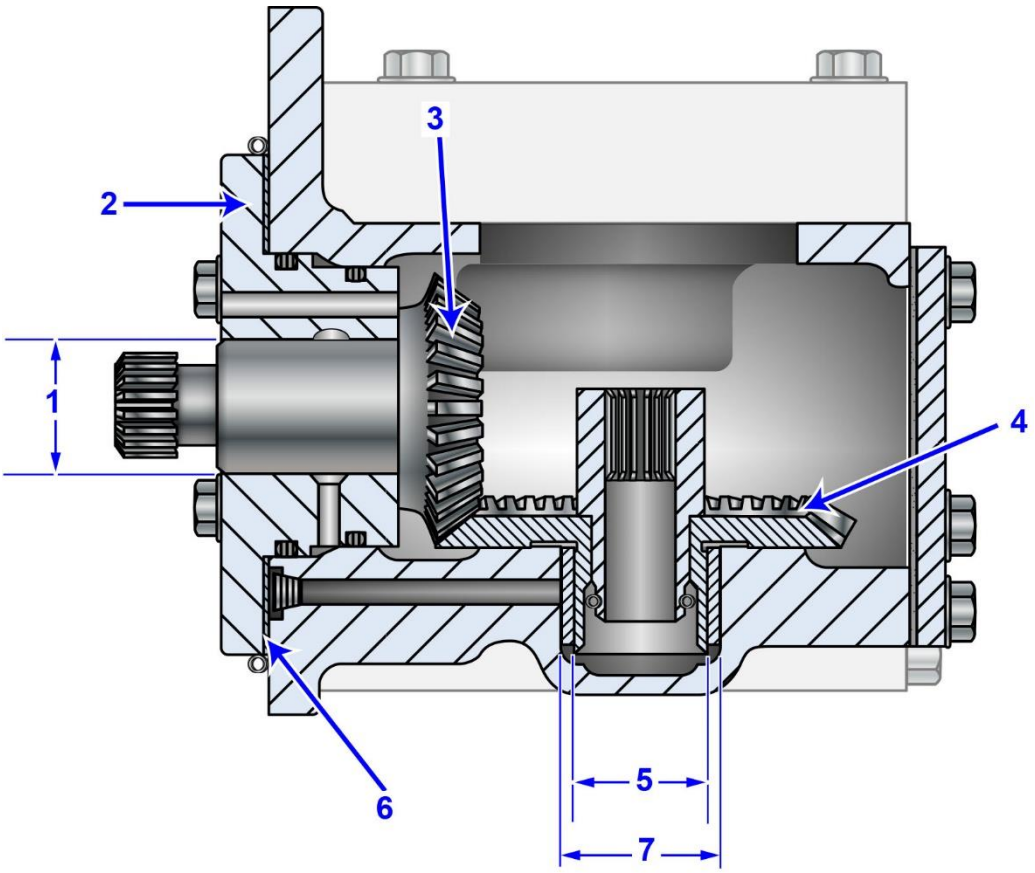
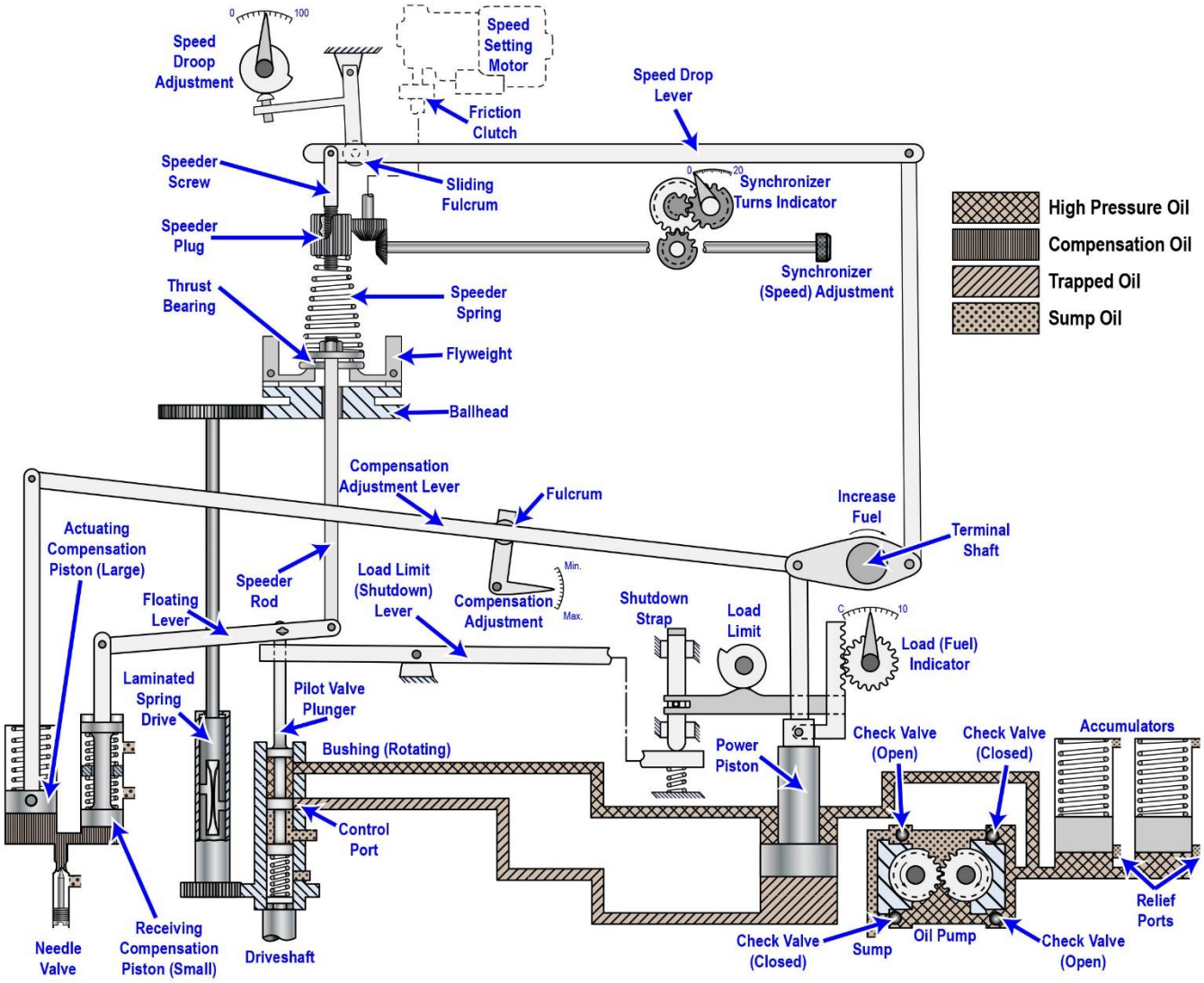


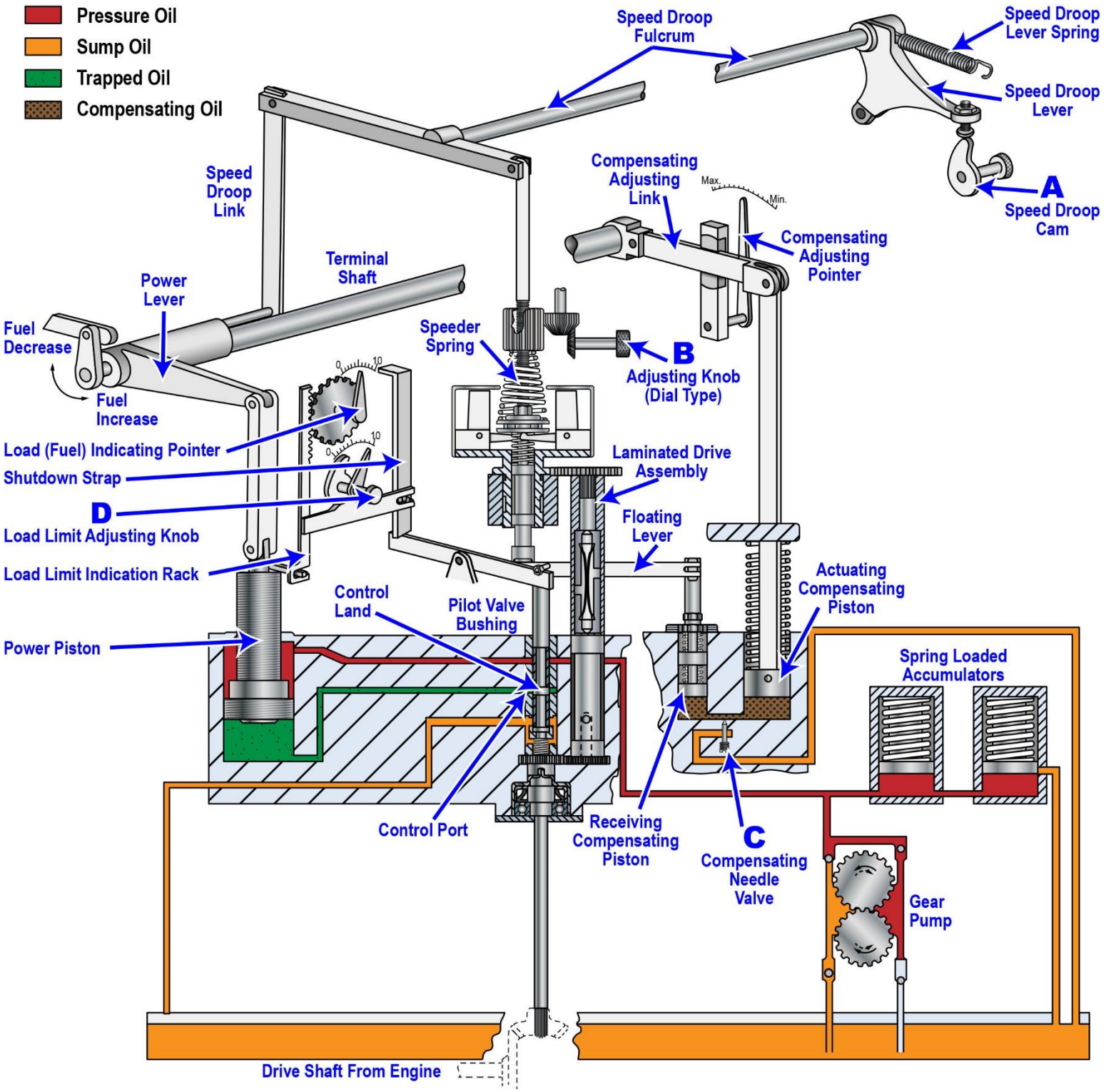
7N1889 & 8N9662 Drive Groups Used With UG8-L Woodward Governors
1W2135 Drive Group Used With Caterpillar 3161 Governors

1. Diameter of bore in adapter (2) ..... 34.072 ± 0.025 mm (1.3414 ± .0010 in.)
   Diameter of shaft on governor drive pinion (3) ..... 34.000 ± 0.013 mm (1.3386 ± .0005 in.)
2. Adaptor
3. Governor drive pinion
4. Bevel gear
5. Diameter of shaft on bevel gear (4)..... 34.000 ± 0.013 mm (1.3386 ± .0005 in.)
   Diameter of bore in bearing after assembly in drive housing ... 34.072 ± 0.039 mm (1.3414 ± .0015 in.)
6. Shims. Use as required to get a gear clearance (backlash)
   between pinion (3) and gear (4) of..... 0.100 + 0.050 or -0.025 mm (.0039 = 0.020 or - .0010 in.)
7. Diameter of bore in drive housing ..... 40.432 ± 0.025 mm (1.5918 ± .0010 in.)
   Diameter of bearing ..... 40.545 ± 0.013 mm (1.5963 ± .0005 in.)

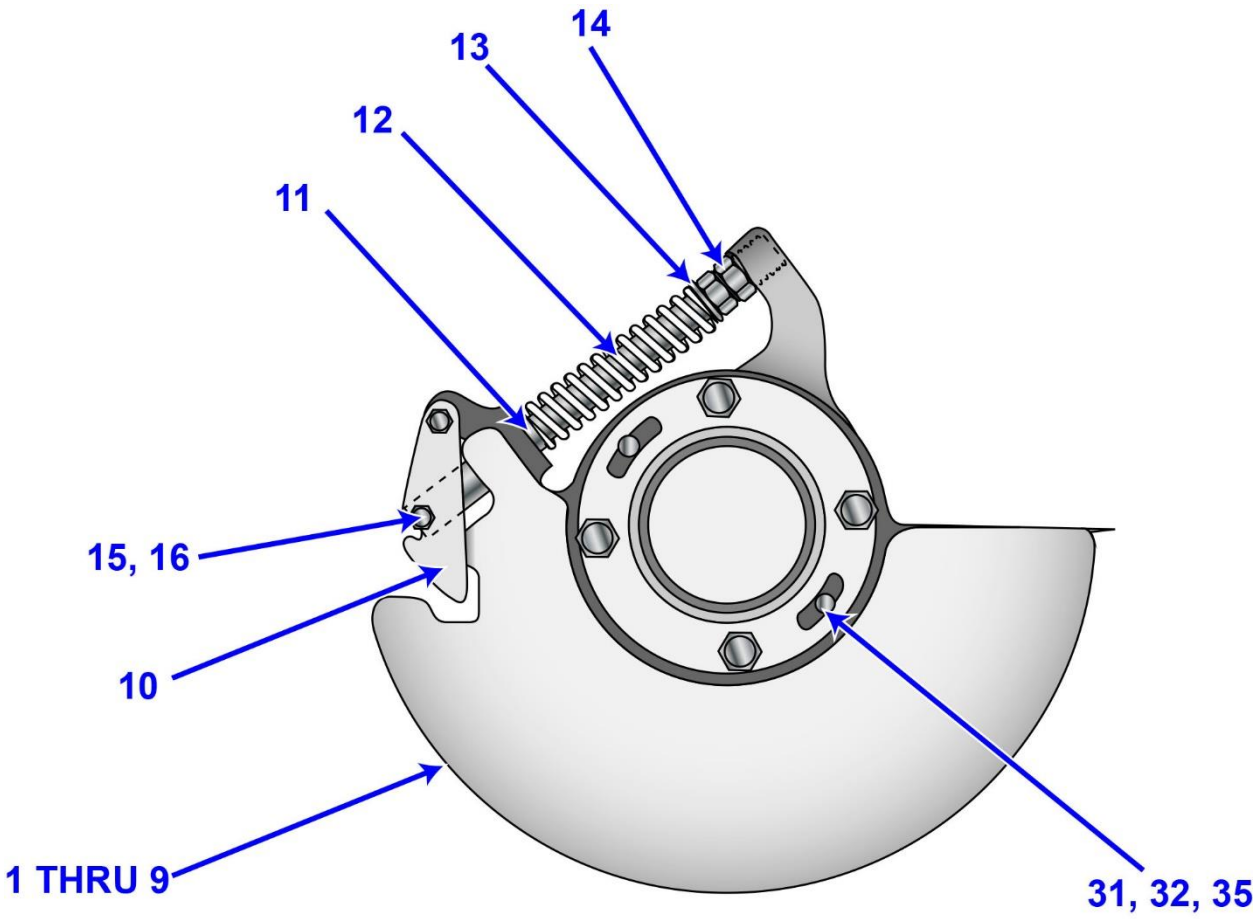
MO-0092



MO-0096



MO-0101



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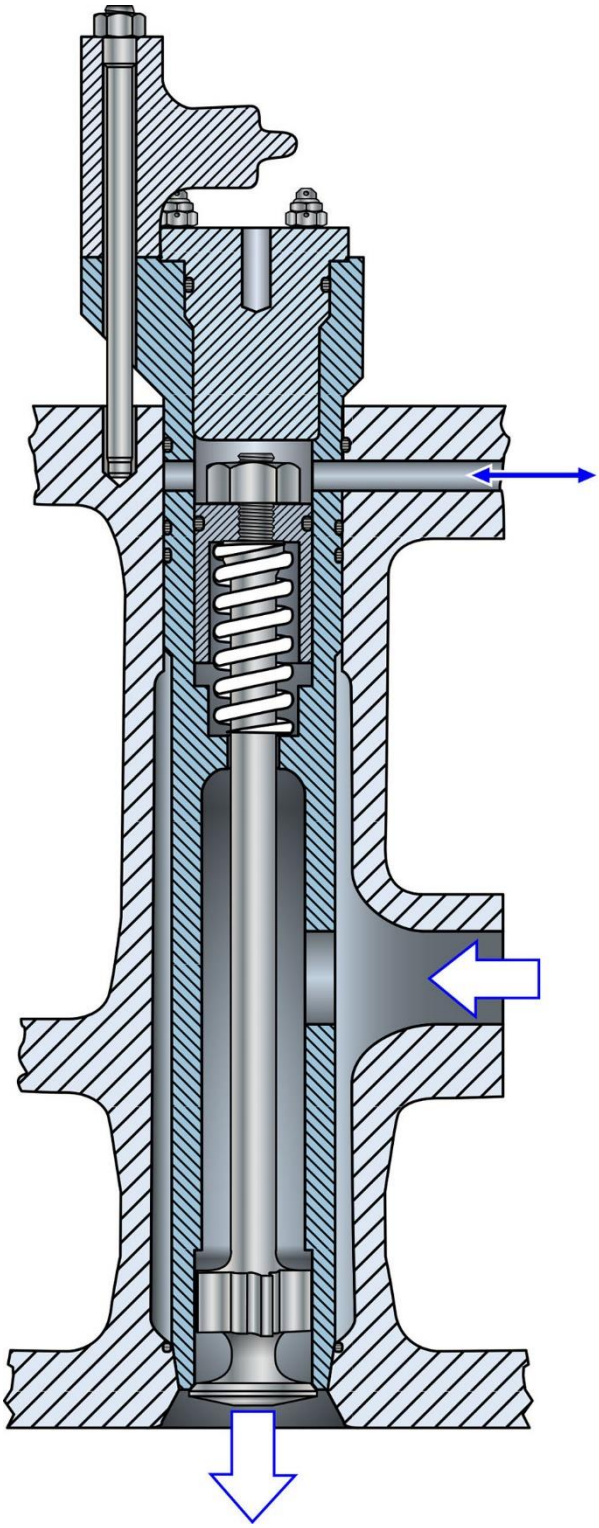
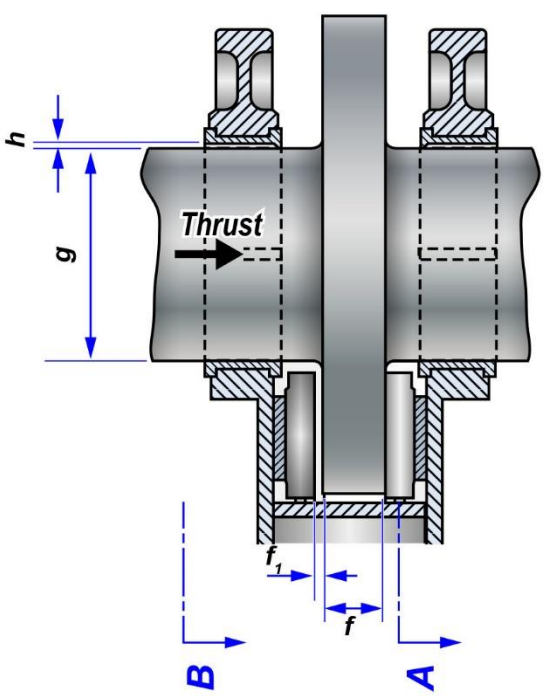
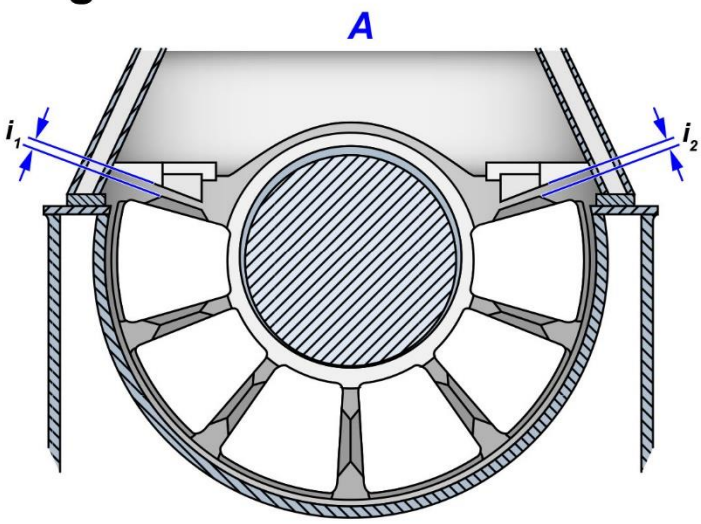
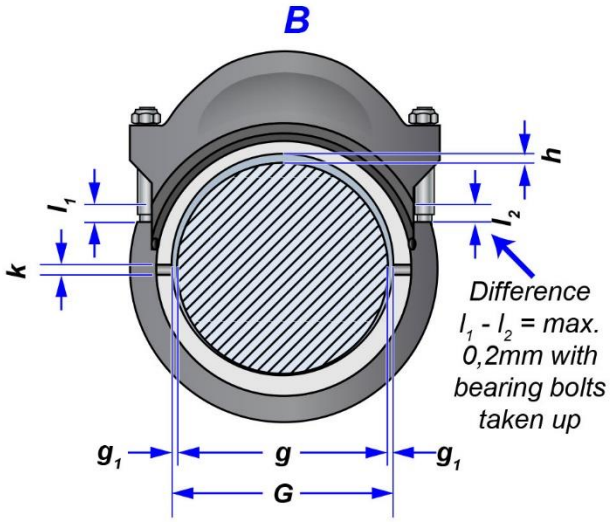


MO-0121

Thrust Bearing







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

RND 68	Principal Clearances Crankshaft and Thrust Bearing	All dimensions in mm	7 354 366 - E