U.S.C.G. Merchant Marine Exam

Third Assistant Engineer

Q532 Motor Plants II

(Sample Examination)

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

1. Compared to a naturally aspirated diesel engine, a supercharged diesel engine has _____.

   A. a cylinder air charge of higher pressure
   B. reduced cylinder mean effective pressure
   C. less valve overlap
   D. reduced blow-by

   Correct answer: A

2. An increase in the air inlet manifold pressure of a diesel engine will result in a/an _____.

   A. decrease in maximum cylinder pressure
   B. increase in ignition lag
   C. decrease in fuel consumption per horsepower-hour
   D. decrease in exhaust manifold pressure

   Correct answer: C

3. A naturally aspirated diesel engine at full throttle will have an intake manifold pressure _____.

   A. that is widely fluctuating
   B. slightly less than atmospheric pressure
   C. constantly decreasing as engine load increases
   D. approximately equal to exhaust manifold pressure at all times

   Correct answer: B

4. The vessel to which you are assigned has diesel generators fitted with intake and exhaust systems as shown in the illustration. What statement is true concerning the valves (items #1 and #9)? Illustration MO-0176

   A. Item #1 is an exhaust valve and item #9 is an intake valve.
   B. Both items #1 and #9 are intake valves.
   C. Both items #1 and #9 are exhaust valves.
   D. Item #1 is an intake valve and item #9 is an exhaust valve.

   Correct answer: D

5. In a diesel engine exhaust system, the cooling of the exhaust gases below their dew point, will result in _____.

   A. increased engine back pressure
   B. sulfuric acid corrosion
   C. surface pitting of the turbocharger compressor blades
   D. moisture impingement on the turbocharger compressor blading

   Correct answer: B

6. The diesel engine shown in the illustration can be fitted with a pyrometer at each exhaust elbow. If one of the cylinder pyrometers is reading significantly higher than the others, which of the following should be your FIRST action? Illustration MO-0005

   A. Check the pump rack setting
   B. Examine the water outlet header for evidence of blockage
   C. Replace the fuel injector nozzle
   D. Examine the exhaust valves for evidence of burning

   Correct answer: A

7. Excessive wear at part No.11, 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. The exhaust system for a turbocharged diesel engine functions to _____.

   A. power the aftercoolers
   B. power the turbocharger
   C. reduce the cylinder scavenge effect
   D. cool the turbocharger

   Correct answer: B

9. For corrosion to take place within the closed, re-circulating cooling water system of a marine diesel engine, an electro-chemical cell must exist where the cooling water is electrically conductive. Which of the following factors has the greatest influence on electrical conductivity?

   A. The amount of dissolved solids in the water
   B. The temperature of the water
   C. The amount of dissolved oxygen in the water
   D. The pH of the water

   Correct answer: A

10. Diesel engine closed, re-circulating cooling water systems are particularly prone to cavitation corrosion/erosion. Which of the listed cooling system/engine components has surfaces in contact with the coolant that are most susceptible to this type of corrosion and erosion?

    A. Wet-type cylinder liners
    B. Cylinder head cooling water passages
    C. Cylinder cooling water jackets
    D. Engine exhaust cooling water jackets

    Correct answer: A

11. In a diesel engine jacket water cooler, with sea water cooling the fresh water, the _____.

    A. Jacket water temperature must always be less than 60°F
    B. Sea water temperature must never be warmer than 40°F
    C. Jacket water pressure should always be greater than the sea water pressure
    D. Jacket water pressure must always be less than the sea water pressure

    Correct answer: C

12. What is the function of the device labeled "3" shown in the illustration? Illustration MO-0111

    A. The jacket water cooler is used to raise the temperature of the sea water flowing through it.
    B. The heat exchanger serves to heat the jacket water during cold water operation.
    C. The device specifically serves to remove the latent heat of vaporization from the jacket water.
    D. The cooler removes sensible heat from the jacket water.

    Correct answer: D

13. The operation of the lube oil cooler, shown in the illustration as item No.4, will be characterized by which of the following statements? Illustration MO-0111

    A. The pressure of the sea water to the lube oil cooler will increase with the distiller on line.
    B. The pressure of the lube oil to the cooler will increase whenever the distiller is on line.
    C. The temperature of the lube oil entering the cooler will decrease whenever the distiller is on line.
    D. The temperature of the sea water entering the cooler will be higher when operating with the distiller on line.

    Correct answer: D

14. Antifreeze solutions containing ethylene glycol should not be mixed with corrosion protection oils, as the resultant mixture _____.

    A. has a higher chloride content
    B. promotes scale buildup
    C. is dangerously flammable
    D. may cause frothing

    Correct answer: D

15. Which operating parameter may need to be decreased when running a large main propulsion diesel engine at low load conditions?

    A. Fuel injection pressure
    B. Cooling water flow through aftercoolers
    C. Lube oil temperature
    D. Control air supply pressure

    Correct answer: B

16. Ethylene glycol, when used as a coolant in a closed cooling system for a diesel engine, is more advantageous than untreated raw water because it _____.

    A. Provides a constant pH below 7
    B. Has a lower freezing point and higher boiling point
    C. Has a higher freezing point and a lower boiling point
    D. Provides better vapor-phase cooling

    Correct answer: B

17. What may cause a diesel engine cylinder head to crack?

    A. Heat transfer from exhaust valves
    B. A leaking oil control ring
    C. Overheated intake valves
    D. Scale on cooling passages

    Correct answer: D

18. Some diesel engines are fitted with a thermometer in the cooling water outlet from each cylinder. If the cooling water temperature from all cylinders begins to rise above normal, you should suspect _____.

    A. Insufficient fuel delivery to all cylinders
    B. Incomplete combustion in all cylinders
    C. Increased blow-by in all cylinders
    D. Overloading in all cylinders

    Correct answer: D

19. The process of scavenging a two-stroke cycle diesel engine serves to _____.

    A. Improve fuel flow volume
    B. Cool the exhaust valves
    C. Reduce the intake air charge density
    D. Increase the temperature of exhaust gases

    Correct answer: B

20. After cooling of a turbocharged diesel engine will result in _____.

    A. Higher torque but lower brake horsepower
    B. Lower torque but higher brake horsepower
    C. Higher torque and higher brake horsepower
    D. Lower torque and lower brake horsepower

    Correct answer: C

21. Which of the following statements is correct regarding a turbocharged four-stroke cycle diesel-generator?

    A. At zero load the intake manifold pressure is greater than the exhaust manifold pressure.
    B. At full load the intake manifold pressure and exhaust manifold pressure are equal.
    C. At full load the intake manifold pressure is less than the exhaust manifold pressure.
    D. At full load the intake manifold pressure is greater than the exhaust manifold pressure.

    Correct answer: D

22. Which of the turbocharging systems listed operates with the least average back pressure in the exhaust manifold?

    A. Constant volume
    B. Constant pressure
    C. Pulse pressure
    D. Radial flow

    Correct answer: C

23. In a Roots-type rotary blower, the volume of air delivered is directly proportional to _____.

    A. Engine speed
    B. Engine load
    C. Brake horsepower
    D. Brake specific fuel consumption

    Correct answer: A

24. A loop-scavenged engine utilizes the motion of its pistons and a turbocharger to provide scavenging air. Which of the listed mechanical designs prevents the air under the pistons from being pumped back through the scavenge ports during the piston power stroke?

    A. Masked intake ports
    B. Length of the piston skirt
    C. Positive pressure from the blower
    D. Lower liner seals

    Correct answer: B

25. What effect does nitrogen, as a volumetric component of a diesel engine's cylinder air charge, have on the ignition and combustion?

    A. Nitrogen advances fuel ignition.
    B. Nitrogen impedes fuel penetration.
    C. Nitrogen retards fuel ignition.
    D. Nitrogen has no effect on ignition and combustion.

    Correct answer: D

26. The power output of a turbo-charged diesel engine will drop if the cooling water flow through the after cooler is interrupted because the _____.

    A. Turbo-charger stalls
    B. Exhaust pressure increases
    C. Air charge density decreases
    D. Scavenge effect increases

    Correct answer: C

27. Clutching takes place nearest the bearing shown in the illustration, located at number _____. Illustration MO-0086

    A. 1
    B. 2
    C. 3
    D. 4

    Correct answer: A

28. Which of the types of reduction gearing listed is best suited for medium-speed main propulsion units?

    A. Hypoid
    B. Helical
    C. Cyclical
    D. Spur

    Correct answer: B

29. The main engine thrust bearing shown in the illustration contains how many thrust shoes? Illustration MO-0121

    A. 6
    B. 10
    C. 12
    D. 20

    Correct answer: C

30. 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 clearance on one side of the shaft at the axis will be one twentieth of a millimeter.
    C. The normal play on both sides of the shaft will be one tenth of a millimeter.
    D. The clearance is determined by the thickness of the hydrodynamic wedge formed and is not usually measured while underway.

    Correct answer: C

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

    A. Feeler gauge
    B. Red dye indicator
    C. Lead wire
    D. Lash indicator

    Correct answer: A

32. The pneumatic propulsion control system used on your vessel uses a diaphragm-operated relay valve as shown in the illustration. Periodically, the valve is to be disassembled for cleaning and inspection. What statement best describes the proper technique? Illustration MO-0052

    A. Rubber parts such as the diaphragm should be cleaned with non-flammable solvent, and metal parts such as the valve discs and seats should be washed with soap and water.
    B. Rubber parts such as the diaphragm should be washed with soap and water, and metal parts such as the valve discs and seats should be cleaned with non-flammable solvent.
    C. Rubber parts such as the diaphragm and metal parts such as the valve discs and seats should all be cleaned with non-flammable solvent.
    D. Rubber parts such as the diaphragm and metal parts such as the valve discs and seats should all be washed with soap and water.

    Correct answer: B

33. The vessel to which you are assigned is fitted with a totally pneumatic propulsion control system as shown in the illustration. If propulsion control functions perfectly from the engine room control station, but will not function at all from any of the remote stations, which of the following system faults best accounts for these symptoms? Illustration MO-0168

    A. The pilot house/remote transfer valve at the pilot house has a blocked remote port.
    B. The attendance valve at the pneumatic remote-control station has a blocked outlet port.
    C. The local/remote transfer valve at the engine room control station has a blocked local port.
    D. The local/remote transfer valve at the engine room control station has a blocked remote port.

    Correct answer: D

34. The direct acting mechanical governor used with some small diesel engines, controls fuel flow to the engine by _____.

    A. Governor flyweight action on a pilot valve which controls fuel injection
    B. Positioning a butterfly valve in the fuel delivery system
    C. Governor flyweight motion acting on fuel controls through suitable linkage
    D. Positioning a servomotor piston attached to the fuel controls

    Correct answer: C

35. The main engines on your vessel are fitted with speed control governors based on the operating principle shown in the illustration. What statement is true concerning the illustrated pressure-compensated governor? Illustration MO-0159

    A. With the speeder spring compression force and the flyweight centrifugal force in equilibrium, the flyweights are pivoted inward, and the pilot valve plunger will be in the raised position aligning the control port to the pressure port.
    B. With the speeder spring compression force and the flyweight centrifugal force in equilibrium, the flyweights are pivoted outward, and the pilot valve plunger will be in the lowered position aligning the control port to the drain port.
    C. With the speeder spring compression force and the flyweight centrifugal force in equilibrium, the flyweights are pivoted to vertical, and the pilot valve plunger can be positioned in any position.
    D. With the speeder spring compression force and the flyweight centrifugal force in equilibrium, the flyweights are pivoted to vertical, and the pilot valve plunger will be in the centered position blocking off the control port.

    Correct answer: D

36. If a hydraulic governor has been refilled with oil, the engine should be operated until it reaches normal temperature, then the air should be purged, and the _____.

    A. Rack position should be adjusted
    B. Compensating needle valve should be opened fully
    C. Compensating needle valve should be adjusted to stabilize operation
    D. Speed limiting device should be adjusted

    Correct answer: C

37. Using the oil chart provided in the illustration for guidance, which synthetic oil would be capable of providing adequate lubrication of the main engine speed control governor on your vessel, if the governor oil operating temperature shall be in the ideal operating range of 130oF to 205oF? Illustration MO-0161

    A. DN600 (Hydrocarbon)
    B. Amsoil 10W40 (Diester)
    C. All Proof 10W50 (Polyolester)
    D. Mobil 1 (Synthesized Hydrocarbon)

    Correct answer: C

38. In the illustrated auxiliary diesel engine governor, decreasing the distance between piece No.6 and piece No.10 will affect the engine by _____. Illustration MO-0094

    A. Decreasing the speed
    B. Increasing the speed droop setting
    C. Increasing the speed
    D. Decreasing the overspeed trip setting

    Correct answer: C

39. A main engine speed control governor for one of your vessel's main propulsion engines hunts, surges, or is sluggish to respond to load changes. Which of the following governor oil conditions would be the greatest single source of governor troubles?

    A. Foamy oil (air entrainment)
    B. Wrong type of oil (composition)
    C. Wrong grade of oil (viscosity)
    D. Dirty oil (solid contaminants)

    Correct answer: D

40. The governor utilized with the device shown in the illustration has become inoperative while the vessel is underway at sea. Which of the following statements describes what action should be taken? Illustration MO-0119

    A. It is necessary to disconnect the shuttle valve from the throttle lever horizontal bar, in order to effectively jump out the pneumatic engine enable control circuit.
    B. The governor should be replaced with one that has been proven to be useful in isochronous applications.
    C. The engine speed can be controlled using the fuel control lever without changing the position of the maximum fuel stop.
    D. The linkage to the shutdown servomotor and the governor output shaft must be disconnected in order to operate the engine via the fuel control lever.

    Correct answer: C

41. The hunting of a diesel engine may be caused by which of the following?

    A. Fluctuations in load
    B. Excessive governor control
    C. Excessive speed droop
    D. Poor quality fuel

    Correct answer: B

42. With reference to the chart, if a boiler generates saturated steam at 385.3 psig, how much heat per pound was required to change the water into steam if the feedwater temperature was initially 220°F? Illustration SG-0004

    A. 96.85 BTU
    B. 97.15 BTU
    C. 1016.40 BTU
    D. 1196.45 BTU

    Correct answer: C

43. At a given pressure, erosion of steam piping and machinery will be minimized by utilizing _____.

    A. desuperheated vapor
    B. saturated steam
    C. superheated steam
    D. wet steam

    Correct answer: C

44. According to the data given in illustration, which of the following would be the physical state of the fluid at a gauge vacuum of 28.09 inches Hg, and 117.99 degrees Fahrenheit? Illustration SG-0026

    A. Subcooled liquid
    B. Saturated liquid
    C. Mixture of saturated liquid and vapor
    D. Superheated vapor

    Correct answer: D

45. Large steam drums are not required in the design of a coil-type auxiliary water-tube boiler because _____.

    A. the steam-water mixture that exits the coils is separated in a flash chamber
    B. the heat of combustion is sufficient to remove all moisture from the steam
    C. automatic burner cycling controls steam volume and quality
    D. the volume of steam is small at low pressures

    Correct answer: A

46. In a coil-type forced circulation auxiliary water-tube boiler, _____.

    A. Steam is recirculated through heating coils in the boiler
    B. Unevaporated feedwater is discharged through the skim tube
    C. Steam demand response is comparatively rapid
    D. Steam demand response is slow

    Correct answer: C

47. The rate of heat transfer in a waste-heat boiler can be increased by _____.

    A. Operating the boiler at less than normal water level
    B. Increasing the amount of excess air to the burners
    C. Installing fins on the firesides of water-tubes
    D. Treating the boiler water with chemical oxygen scavengers

    Correct answer: C

48. Fusible plugs are installed in fire-tube boilers to _____.

    A. Provide a means of draining the boiler
    B. Cool the crown sheet at high firing rates
    C. Warn the engineer of low water level
    D. Open the burners' electrical firing circuits

    Correct answer: C

49. When the steam pressure drops below a set value on an automatically fired auxiliary boiler fitted with rotary cup atomizers, the combustion control system will _____.

    A. decrease the back pressure regulating valve opening
    B. increase the rotary cup speed
    C. increase the fuel oil control valve opening
    D. decrease the supply steam control valve opening

    Correct answer: C

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

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

    Correct answer: C

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

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

    Correct answer: C

52. Which of the following statements describes how the fuel oil enters the whirling chambers of the sprayer plates used in an auxiliary boiler return flow fuel oil system?

    A. Through the outer barrel tube
    B. Through the sprayer plate drilled passages
    C. Through tangential slots in the sprayer plate
    D. Through baffles in the orifice plate

    Correct answer: C

53. The auxiliary oil-fired water-tube steam boiler on your vessel is equipped with a water column similar to that shown in the illustration. Assuming that the water level is at the normal operating water level (NOWL) of the boiler, what would be the result of alternately opening and reclosing each of the water column tri-cocks? Illustration MO-0093

    A. Steam should issue from the uppermost tri-cock, and water should issue from lowermost tri-cock. Either steam or water could issue from the middle tri-cock.
    B. Water should issue from each of the uppermost, middle, and lowermost tri-cocks.
    C. Steam should issue from both the uppermost and middle tri-cocks, and water should issue from the lowermost tri-cock.
    D. Steam should issue from the uppermost tri-cock, and water should issue from both the middle and lowermost tri-cocks.

    Correct answer: A

54. If the water level as indicated by the gauge glass of an auxiliary boiler is in question, it should be blown down. Which of the following statements represents the proper procedure for performing a gauge glass blow down?

    A. The gauge glass should be blown down once with the lower cut-out valve open.
    B. The gauge glass should be blown down twice; first with the lower cut-out valve open and then with the upper cut-out valve open.
    C. The gauge glass should be blown down once with both the upper cut-out and lower cut-out valves open simultaneously.
    D. The gauge glass should be blown down twice; first with the upper cut-out valve open and then with the lower cut-out valve open.

    Correct answer: B

55. The water-tube natural-circulation steam boiler on your vessel is equipped with soot blowers for maintaining heat transfer efficiency. Which of the following statements best describes the conditions that must be met before tubes can be safely blown using the soot blowers?

    A. The boiler draft must be decreased AND the boiler fires must be lit before tubes can be safely blown.
    B. The boiler draft must be decreased AND the boiler fires must be secured before tubes can be safely blown.
    C. The boiler draft must be increased AND the boiler fires must be secured before tubes can be safely blown.
    D. The boiler draft must be increased AND the boiler fires must be lit before tubes can be safely blown.

    Correct answer: D

56. On a vessel fitted with a coil-type, forced-circulation, water-tube, oil-fired auxiliary boiler, what is the most practical way of determining if the inside surface of the coil is excessively scaled with hard scale deposits?

    A. Monitoring the circulating pump pressures
    B. Monitoring the feed pump pressures
    C. Measuring the coil inside diameter
    D. Performing a visual inspection

    Correct answer: A

57. Which statement most accurately represents the requirements for softening hard carbon deposits associated with the burner atomizers of an auxiliary boiler?

    A. Carbon should be softened by soaking in hot soapy water.
    B. Carbon should be softened by soaking in diesel fuel or kerosene.
    C. Carbon should be softened by blowing through with steam.
    D. Carbon should be softened by soaking in sulfamic or hydrochloric acid.

    Correct answer: B

58. Which of the following conditions could cause the feed pump for an auxiliary boiler to lose suction?

    A. Increased suction head pressure
    B. Decreased feedwater temperature
    C. Pump recirculating line being open too much
    D. Excessive feedwater temperature

    Correct answer: D

59. You are observing the flame condition on an oil-fired auxiliary boiler through an observation window peephole. The flame is a reddish color accompanied by a noticeably panting/pulsating furnace. What would be the correlating color of the gases exhausting from the stack under these conditions?

    A. White smoke
    B. Light brown haze
    C. Clear stack
    D. Dense black smoke

    Correct answer: D

60. As shown in the illustration, if the vessel was operating at full sea speed, the area labeled "L" would be used to _____. Illustration MO-0231

    A. Superheat the steam generated by the oil-fired mechanical burner
    B. Preheat the feedwater to the waste heat boiler
    C. Collect stack gas
    D. Collect steam and flash the heated water generated in area "B" into steam

    Correct answer: D

61. While preparing an engine for departure, the engineer notices water coming from both the waste heat boiler and turbocharger drains. Which of the following could be the cause?

    A. Leak from a cylinder exhaust valve cage
    B. Leak in a turbocharger exhaust casing
    C. Leak from a turbocharger inlet casing
    D. Leak in a waste heat boiler tube

    Correct answer: D

62. Casing drains may be required on a waste heat boiler gas passage side to _____.

    A. prevent an accumulation of boiler water entering gas passages as a result of a pinhole tube leak
    B. sample gases for testing
    C. drain off condensation
    D. release excess pressure

    Correct answer: C

63. The most common cause of scale formation in an auxiliary boiler is _____.

    A. Improper treatment of the feedwater with calcium sulfate
    B. Fuel oil in the feedwater
    C. Concentrations of calcium sulfate in the boiler water
    D. Excessive feedwater alkalinity

    Correct answer: C

64. The correct procedure for giving an auxiliary boiler a bottom blow, is to begin _____.

    A. when the boiler has been cooled to ambient temperature
    B. only after raising the water level to within 1/2 inch of the high-water cutout
    C. when the boiler has been secured long enough for most solids to settle
    D. only after bypassing the low-pressure pressuretrol

    Correct answer: C

65. The vessel to which you are assigned is gear-driven with one main propulsion diesel engine and a fixed-pitch propeller. While underway, the main engine becomes disabled, requiring your vessel to be towed back into port. If pressurized lubricating oil is not available to the reduction gear shaft bearings, what must be done during the towing operation?

    A. The reduction gear input shaft must be prevented from rotating by means of engaging the engine turning gear at the flywheel.
    B. The reduction gear input shaft must be prevented from rotating my means of engaging the propulsion clutch.
    C. The reduction gear input and output shafts must be prevented from rotating by means of blocking the gear teeth.
    D. The reduction gear output shaft must be prevented from rotating by means of locking the propeller shaft.

    Correct answer: D

66. Which of the listed conditions could result in the failure of an auxiliary diesel engine to stop running when a normal shutdown is attempted?

    A. Supplying high temperature inlet air
    B. Maintaining a high exhaust back pressure
    C. Lube oil entering in the air intake manifold
    D. Carbon buildup on the overspeed pawl

    Correct answer: C

67. If a tube ruptures in a water-tube auxiliary boiler due to low water, you should _____.

    A. Secure the fires and maintain feedwater to boiler to keep up the water level
    B. Not secure the fires until water level falls out of sight in the gauge glass
    C. Secure both the fires and the feed inlet valve
    D. Secure the fires when the pressure drops to 50% of the maximum allowable working pressure

    Correct answer: C

68. After a main diesel engine on your vessel has experienced a safety shutdown due to excessive crankcase pressure, why is it important to wait 2 hours before opening the crankcase to investigate the cause of the trip?

    A. Opening the crankcase before 2 hours has elapsed may result in crankshaft rotation.
    B. Opening the crankcase before 2 hours has elapsed may result in excessively rapid cooling.
    C. Opening the crankcase before 2 hours has elapsed may result in the engine spontaneously restarting.
    D. Opening the crankcase before 2 hours has elapsed may result in a crankcase explosion.

    Correct answer: D

69. A main diesel engine on your vessel has experienced a safety shutdown due to excessive crankcase pressure. What is the appropriate response?

    A. Immediately restart the engine and monitor the crankcase pressure to verify the cause of the shutdown.
    B. Allow 2 hours for the engine to cool before opening the crankcase and determine and correct the cause of the trip before attempting to restart the engine.
    C. Allow the engine to cool off for two minutes, then restart and monitor the crankcase pressure to verify the cause of the shutdown.
    D. Immediately open the crankcase to make the necessary inspections to determine the cause of the high crankcase pressure safety shutdown.

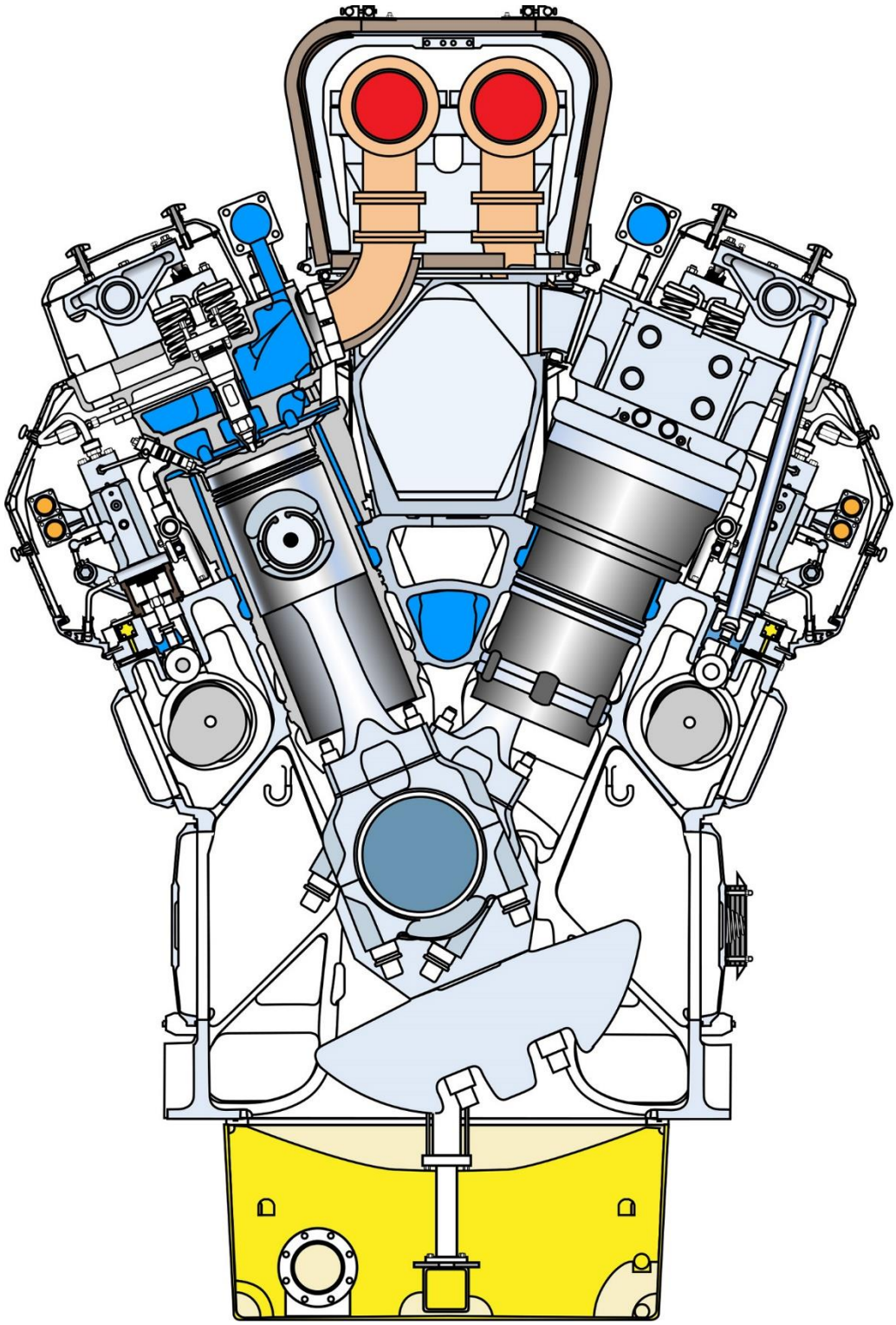
    Correct answer: B

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

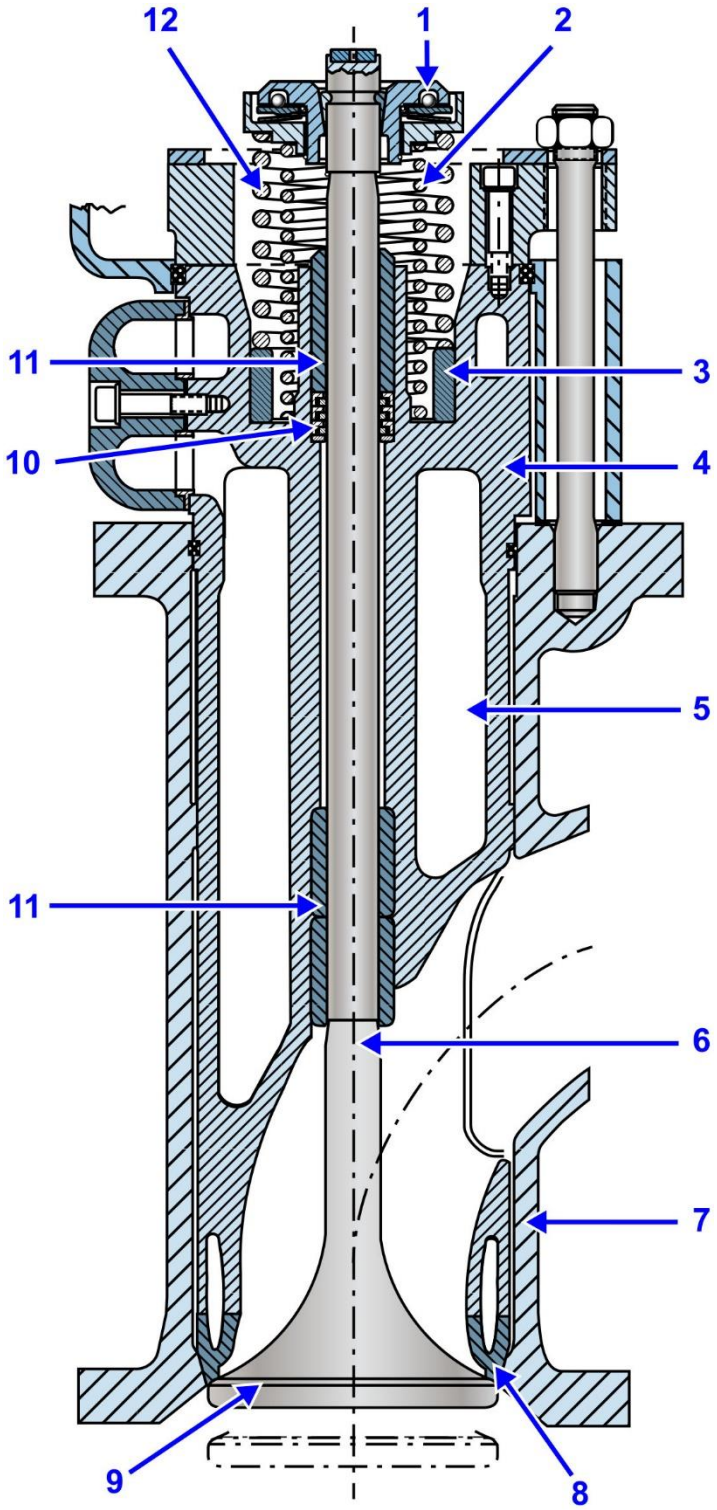
    A. Ventilation system should be continued in operation for one hour for cooling
    B. Scavenge pump should be immediately secured to prevent loss of lube oil
    C. Explosion covers should be opened slightly to provide extra ventilation
    D. Inspection covers should not be opened until the engine has cooled

    Correct answer: D

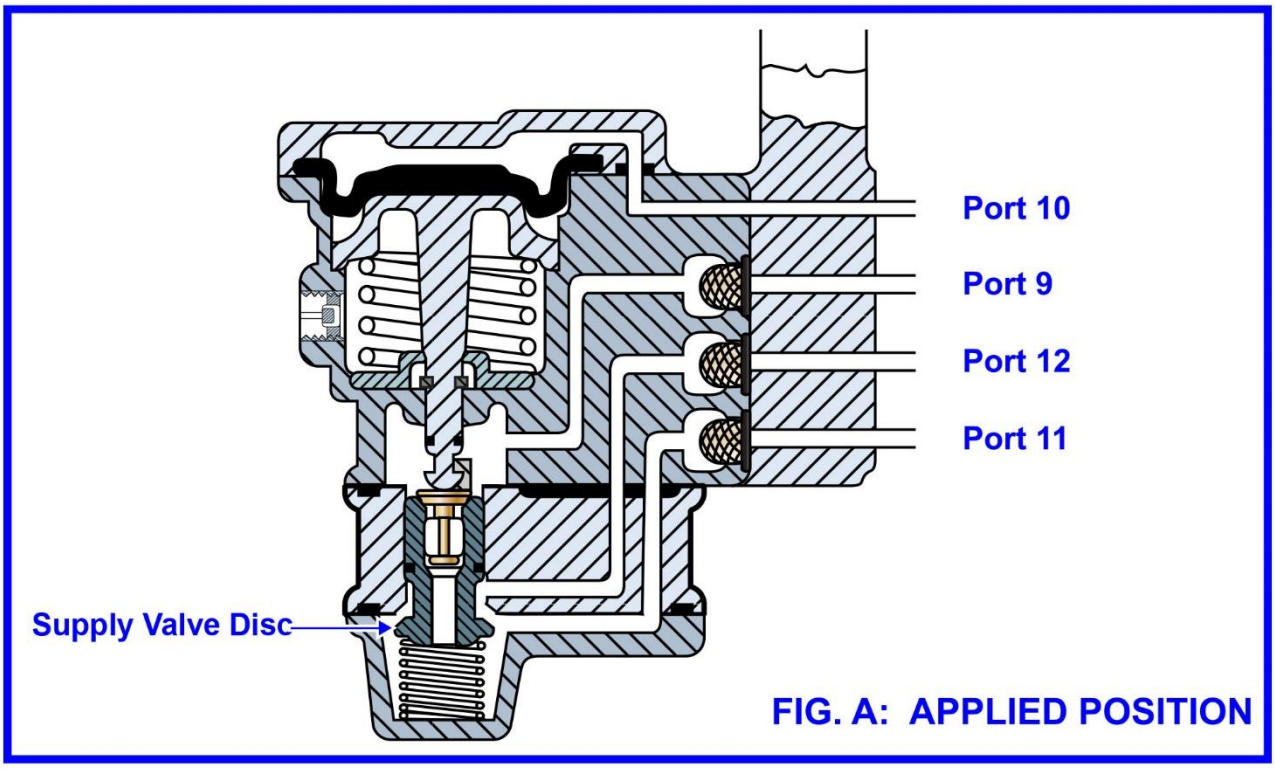
MO-0005

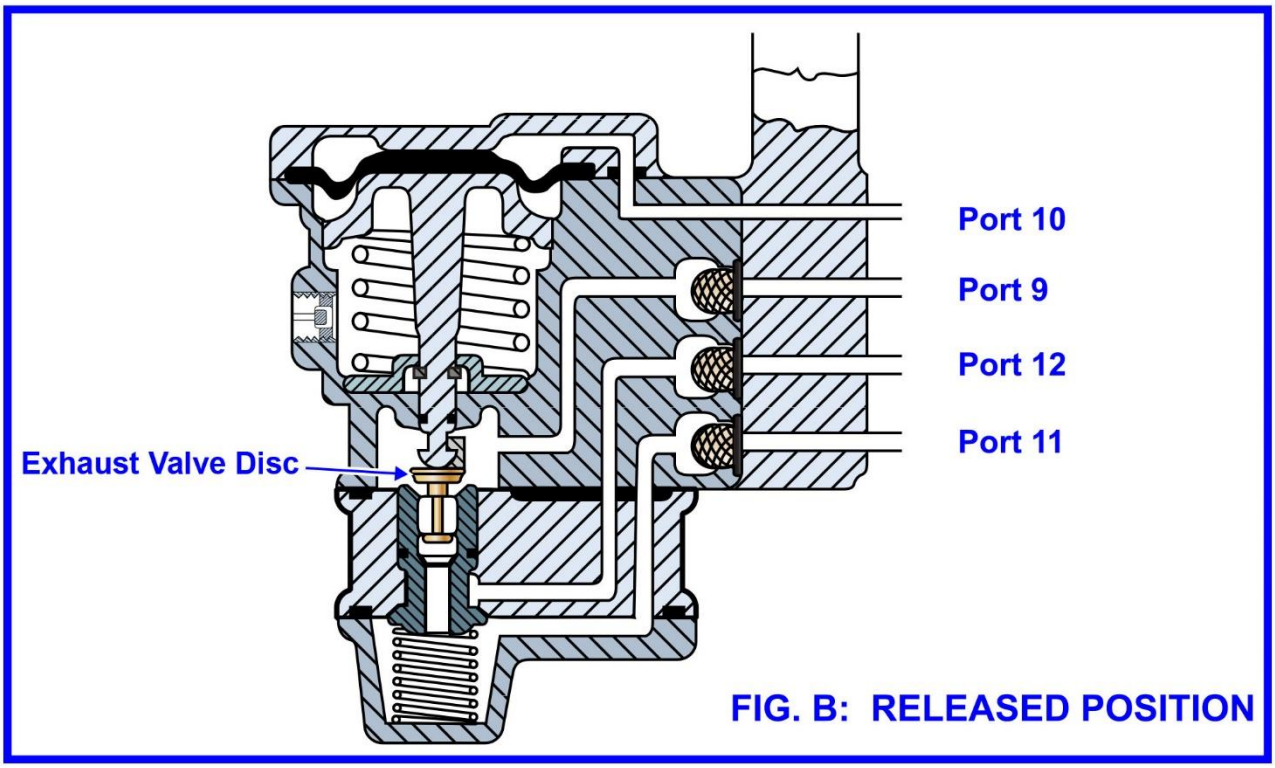


MO-0027

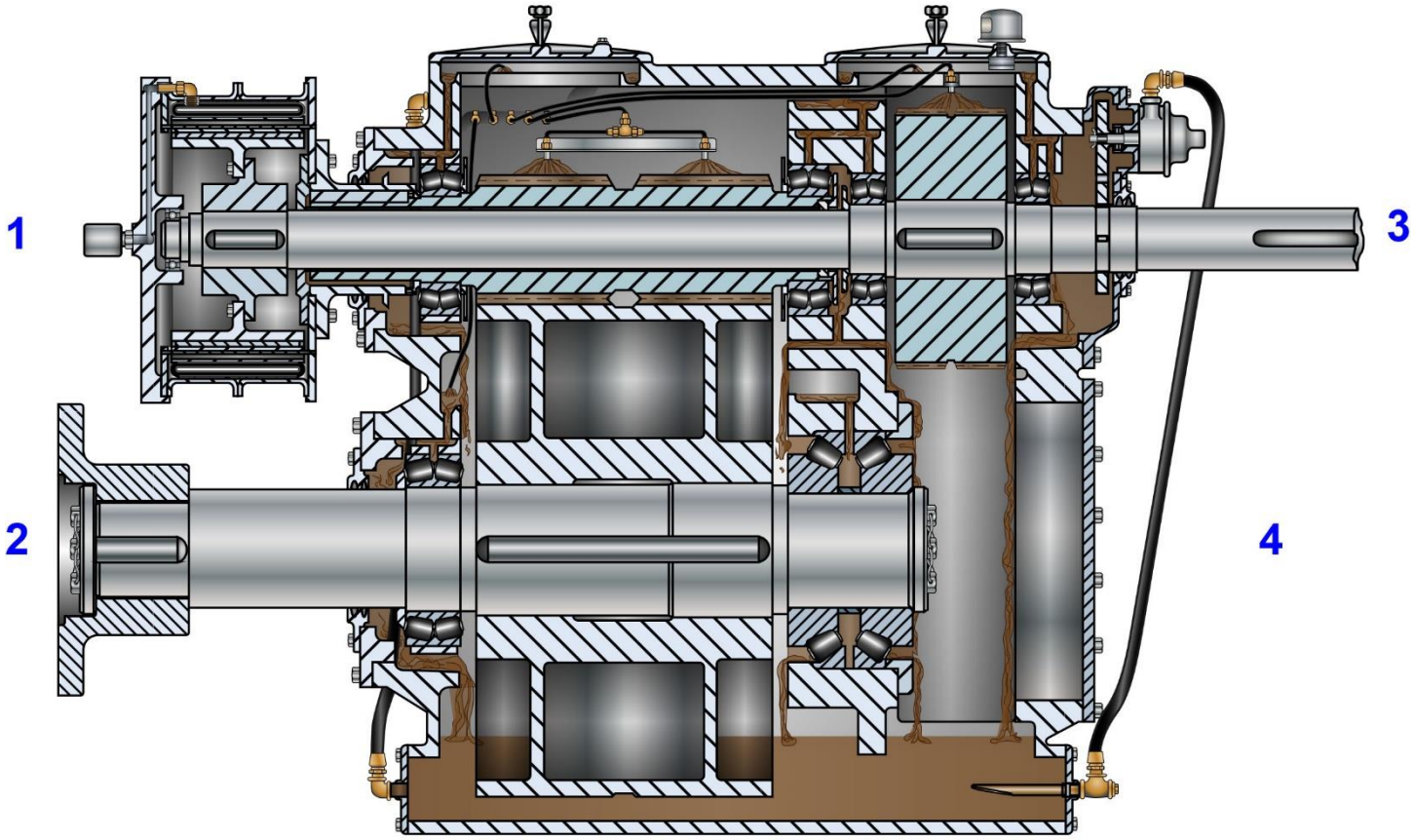


MO-0052

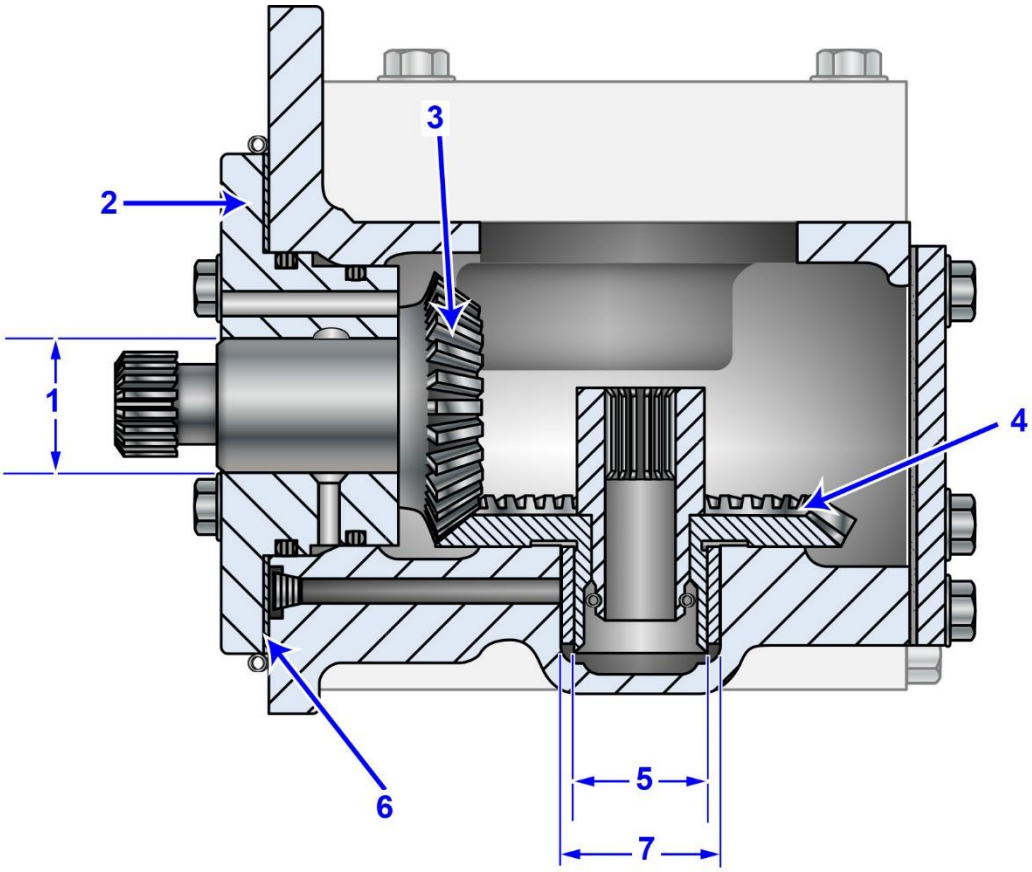




MO-0086



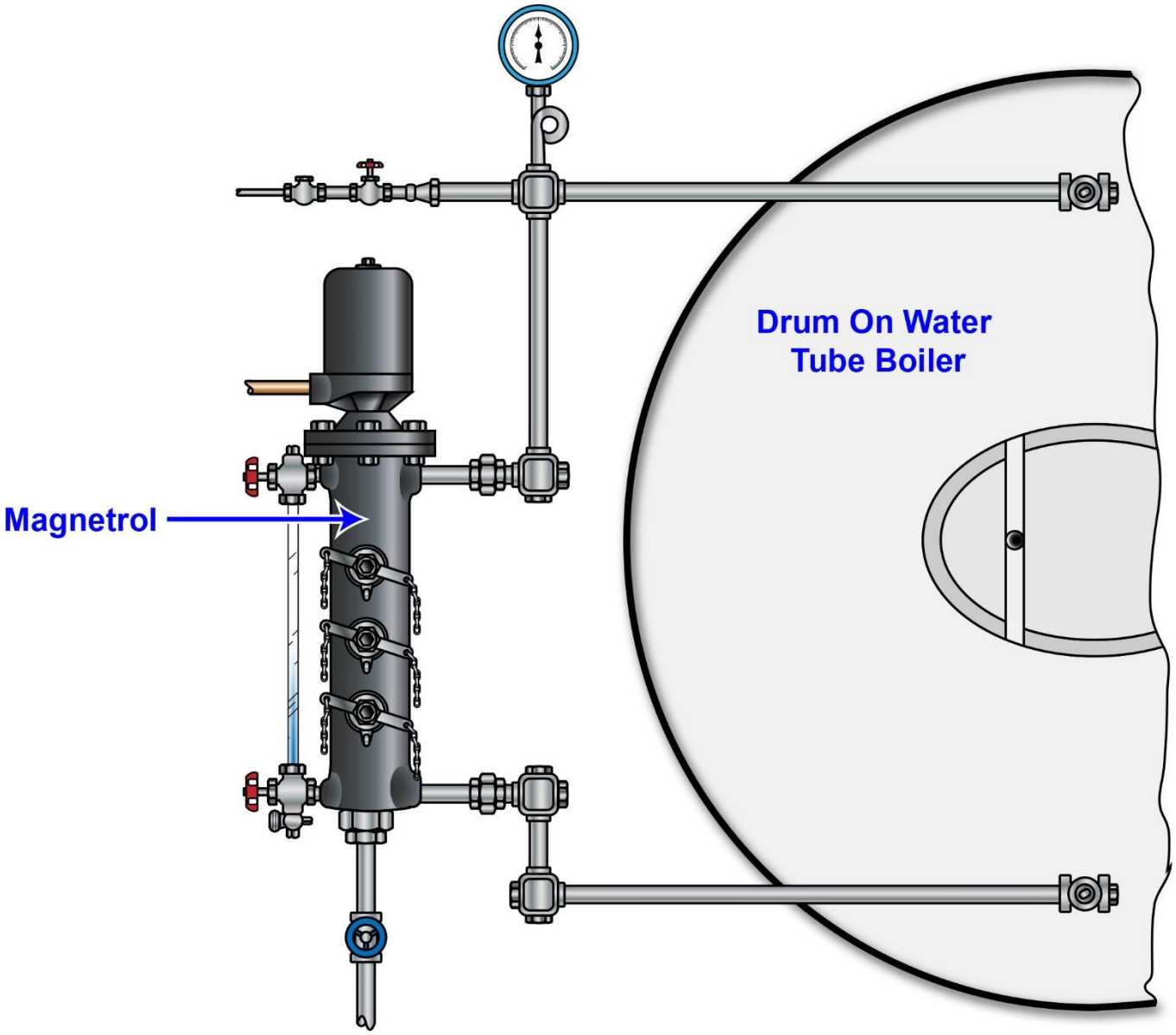
MO-0091



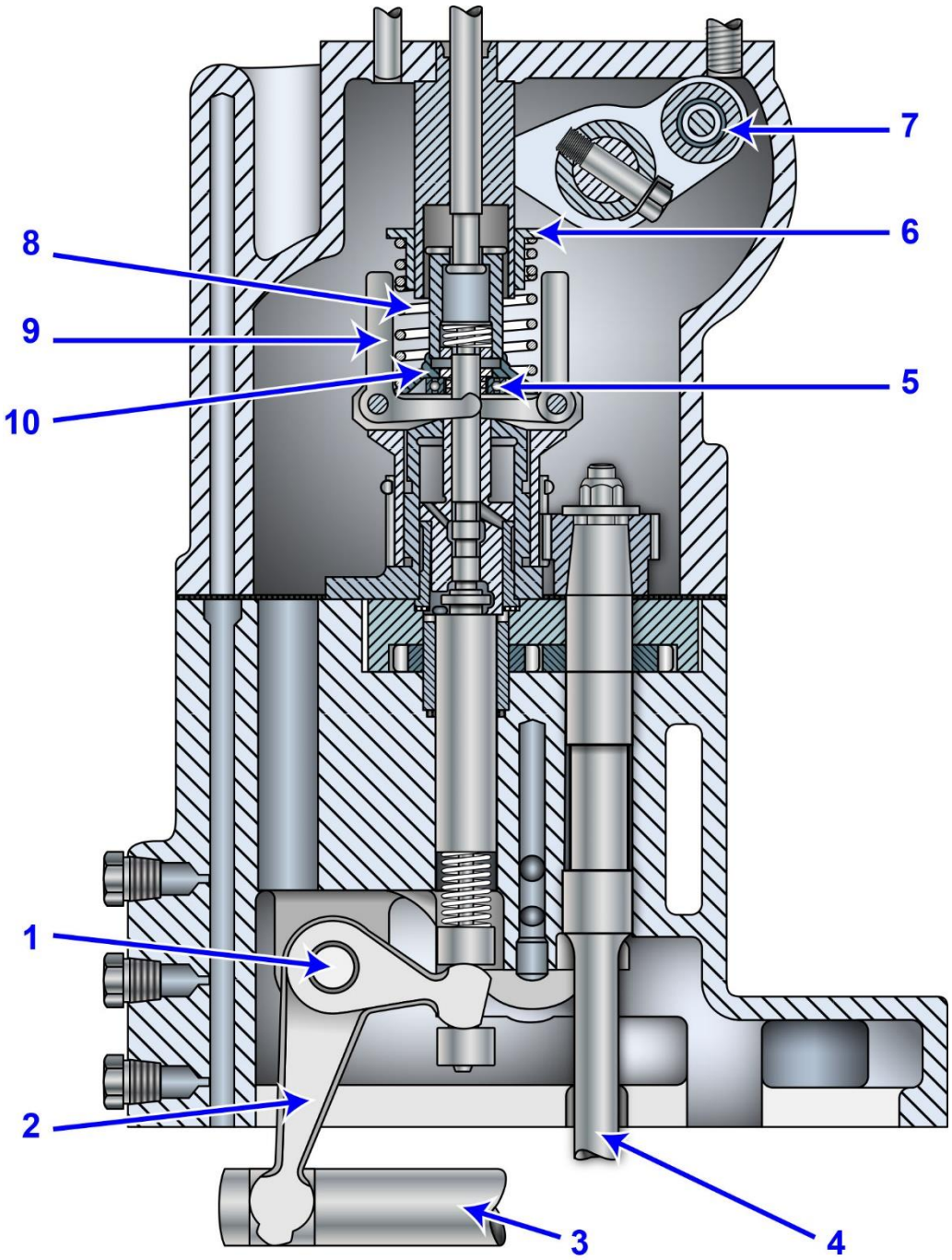
7N1889 & 8N9662 Drive Groups Used With UG8-L Woodward Governors
1W2135 Drive Group Used With Caterpillar 3161 Governors

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.)

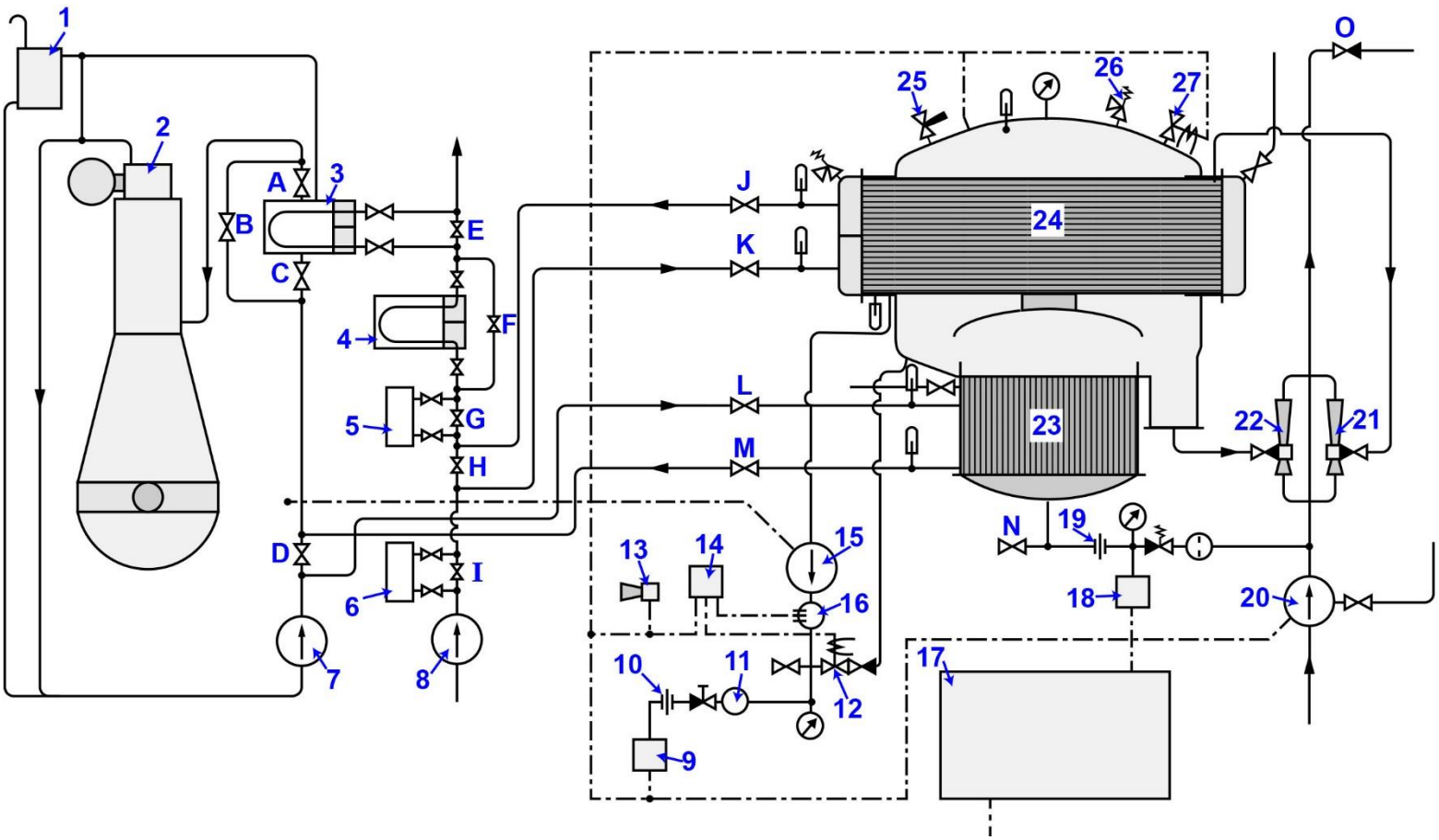
MO-0093



MO-0094

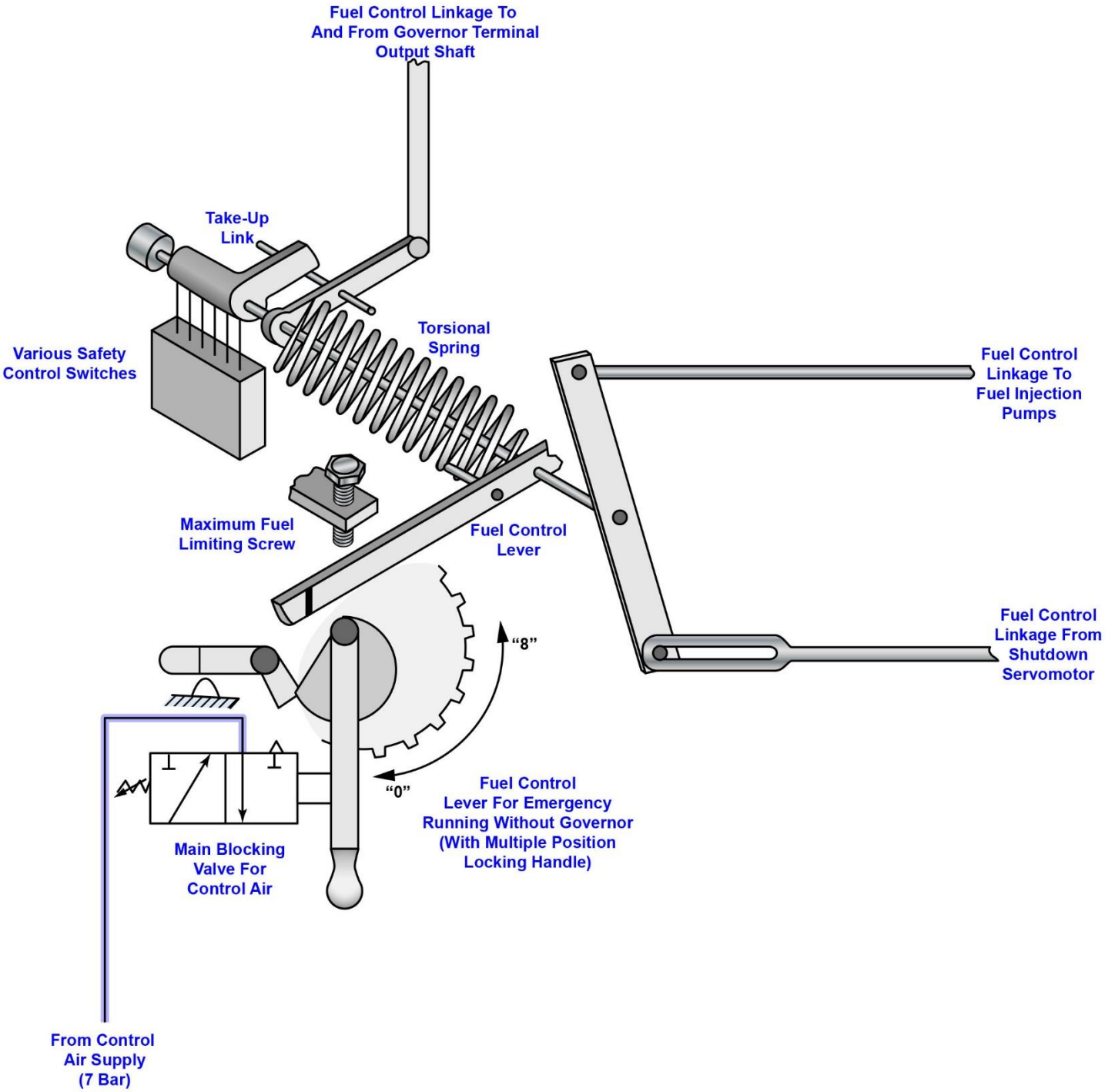


MO-0111



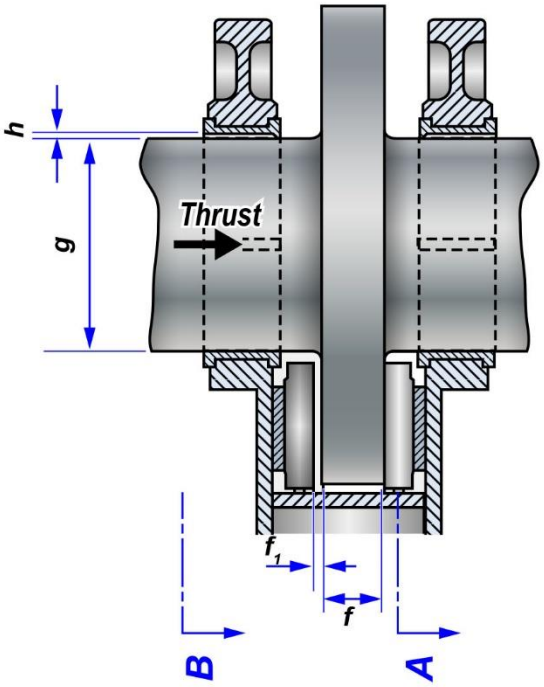
MO-0119

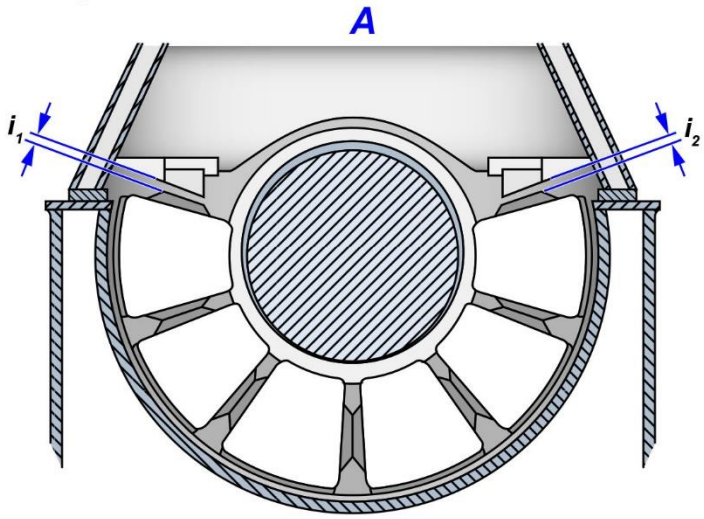
Fuel Control Linkage Arrangement

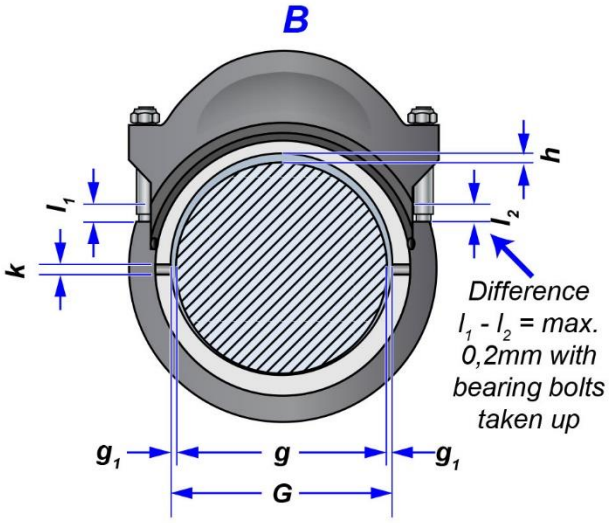


MO-0121

Thrust Bearing



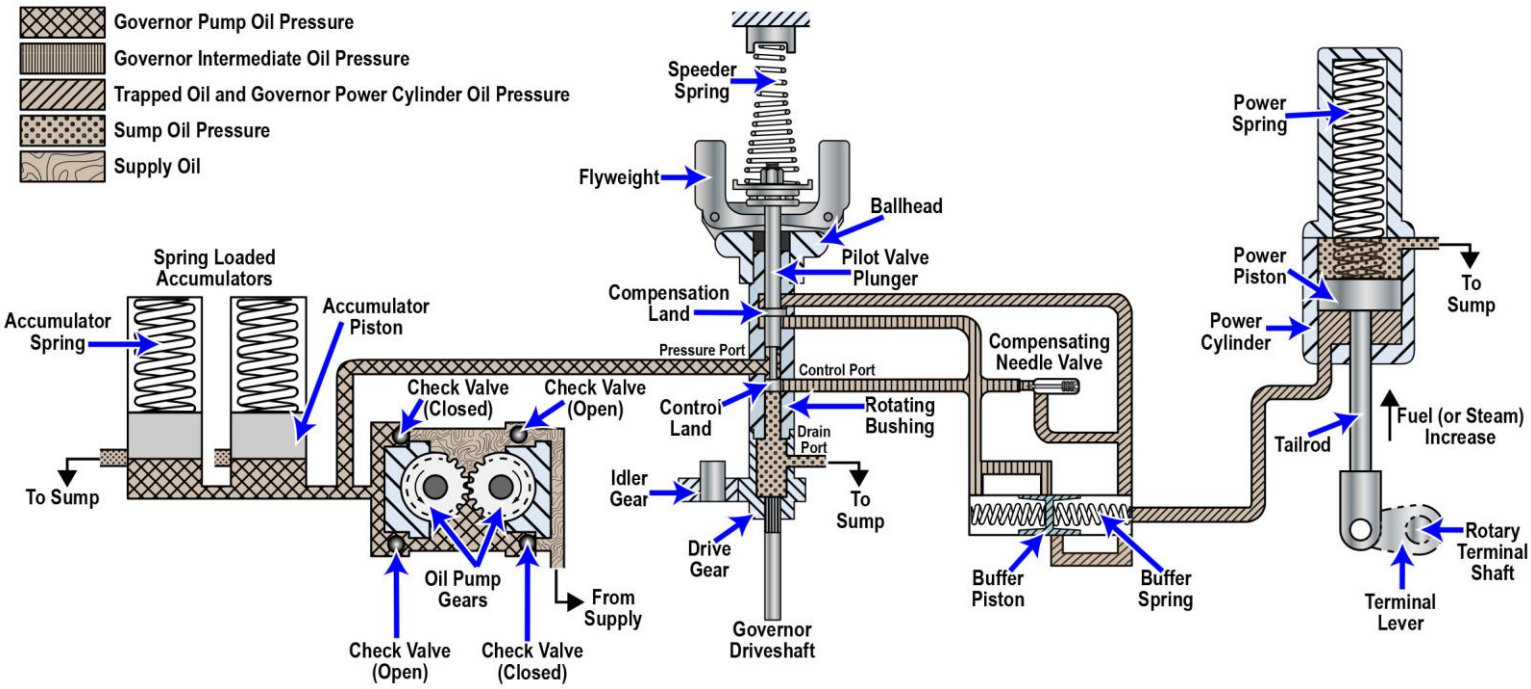




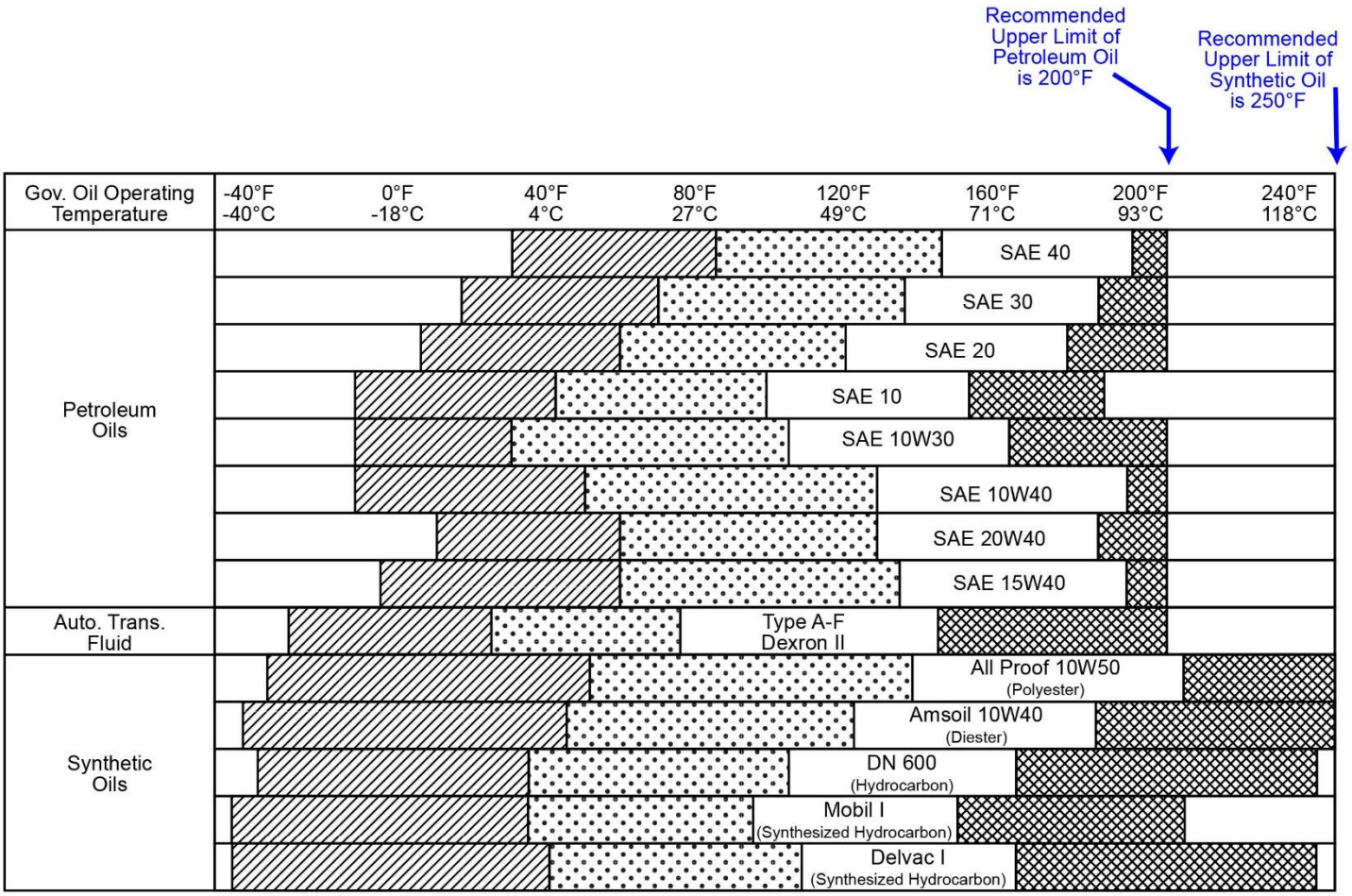
Nominal dimension	Normal play	Max. play (worn)
f = 200	f_1 = 1,0	2,0
g = 540 $^{+0}_{-0,08}$	g_1 = min. 0,10	
G = 540 $^{+0,38}_{+0,30}$	h = $^{+0,46}_{+0,30}$	0,8
	i_1,i_2 = 5	
k = 20		

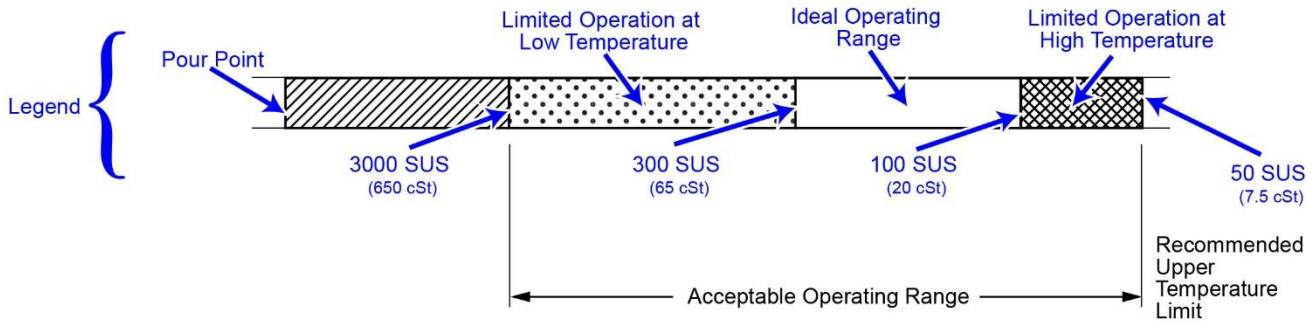
RND 68	Principal Clearances Crankshaft and Thrust Bearing	All dimensions in mm	7 354 366 - E

MO-0159
Basic Woodward Type PG Governor

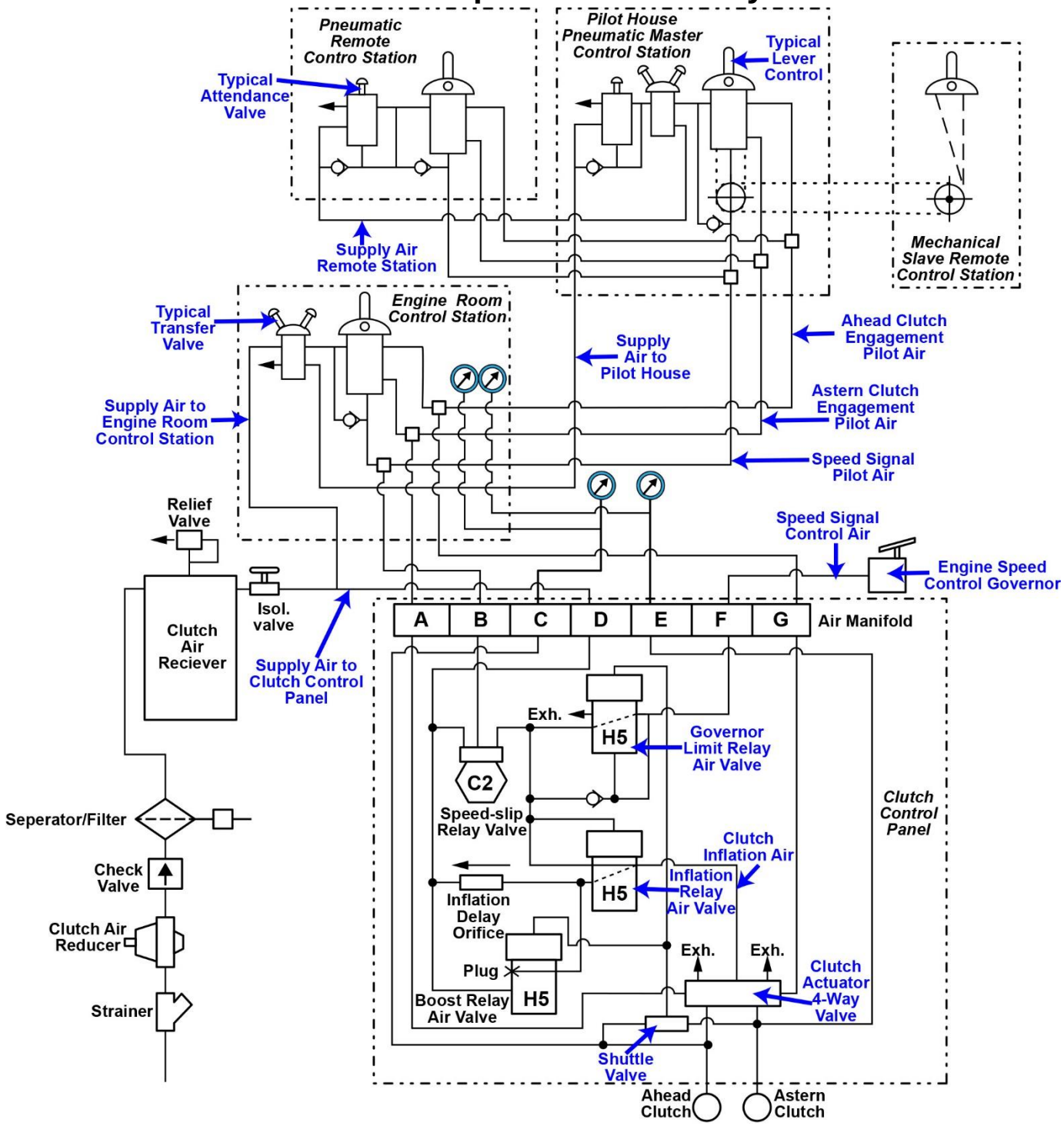


MO-0161
Oil Chart

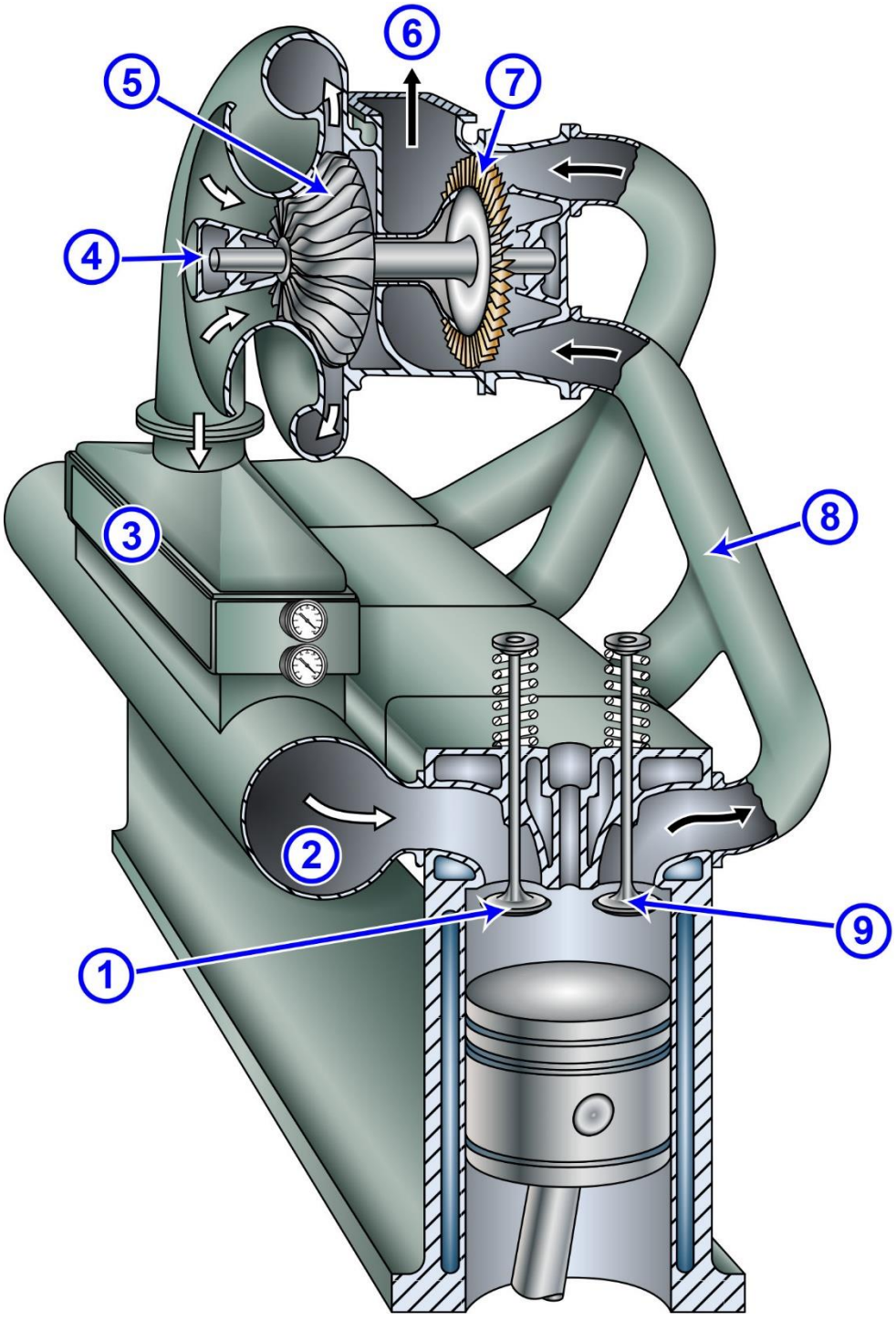




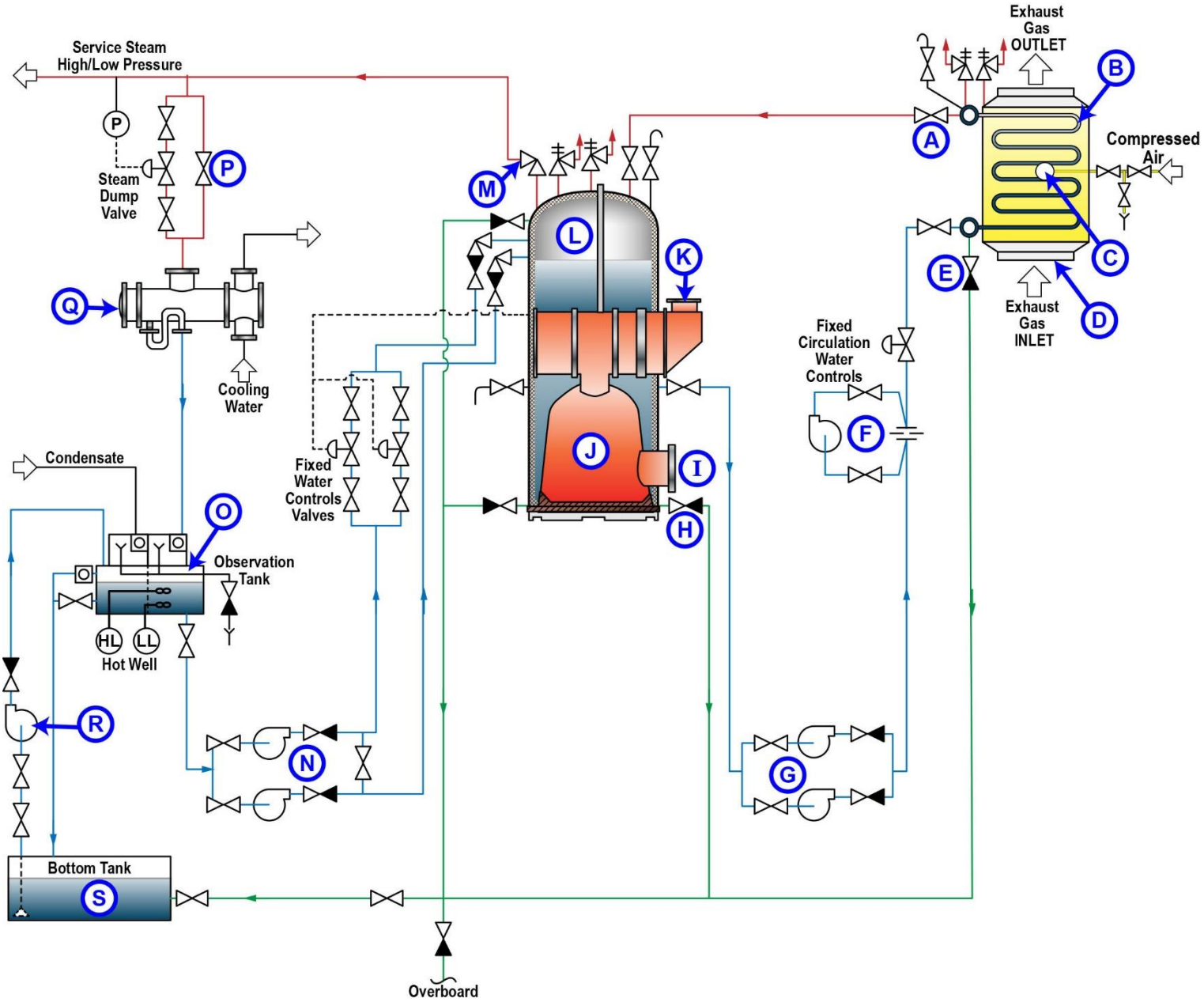
MO-0168
Pneumatic Propulsion Control System



MO-0176



MO-0231



SG-0004

Table 1
Thermodynamic Properties of Saturated Steam (Temperature)

Temp, °F	Absolute. Pressure, psi	Enthalpy (BTU/lb) of Liquid	Enthalpy (BTU/lb) of Evaporation	Enthalpy (BTU/lb) of vapor
32	0.08859	0.01	1075.5	1075.5
40	0.12170	8.05	1071.3	1079.3
50	0.17811	18.07	1065.6	1083.7
60	0.25630	28.06	1059.9	1088.0
70	0.36310	38.04	1054.3	1092.3
80	0.50690	43.02	1048.6	1096.6
90	0.69820	57.99	1042.9	1100.9
100	0.94920	67.97	1037.2	1105.2
110	1.27480	77.94	1031.6	1109.5
120	1.69240	87.92	1025.8	1113.7
130	2.22250	97.90	1020.0	1117.9
140	2.88860	107.90	1014.1	1122.0
150	3.71800	117.90	1008.2	1126.1
160	4.74100	127.90	1002.3	1130.2
170	5.99200	137.90	996.3	1134.2
180	7.51000	147.90	990.2	1138.1
190	9.33900	157.90	984.1	1142.0
200	11.52600	168.00	977.9	1145.9
212	14.69600	180.00	970.4	1150.4
220	17.18600	188.10	965.2	1153.4
240	24.96900	208.30	952.2	1160.5
280	49.20300	249.10	924.7	1173.8
300	67.01300	269.60	910.1	1179.7
340	118.01000	311.10	879.0	1190.1
380	195.77000	353.50	844.6	1198.1
400	247.31000	375.00	826.0	1201.0

Table 2
Thermodynamic Properties of Saturated Steam (Pressure)

Absolute. Pressure, psi	Temp, °F	Enthalpy (BTU/lb) of Liquid	Enthalpy (BTU/lb) of Evaporation	Enthalpy (BTU/lb) of vapor
0.5	79.58	47.6	1048.8	1096.4
1.0	101.74	69.7	1036.3	1106.0
5.0	162.24	130.1	1001.0	1131.1
10.0	193.21	161.2	982.1	1143.3
14.7	212.00	180.0	970.4	1150.4
15.0	213.03	181.1	969.7	1150.8
20.0	227.96	196.2	960.1	1156.3
25.0	240.07	208.5	952.1	1160.6
30.0	250.33	218.8	945.3	1164.1
40.0	267.25	236.0	933.7	1169.7
50.0	281.01	250.1	924.0	1174.1
60.0	292.71	262.1	915.5	1177.6
70.0	302.92	272.6	907.9	1180.6
80.0	312.03	282.0	901.1	1183.1
90.0	320.27	290.6	894.7	1185.3
100.0	327.81	298.4	888.8	1187.2
110.0	334.77	305.7	883.2	1188.9
120.0	341.25	312.4	877.9	1190.4
130.0	347.32	318.8	872.9	1191.7
140.0	353.02	324.8	868.2	1193.0
150.0	358.42	330.5	863.6	1194.1
200.0	381.79	355.4	843.0	1198.4
250.0	400.95	376.0	825.1	1201.1
300.0	417.33	393.8	809.0	1202.8
350.0	431.72	409.7	794.2	1203.9
400.0	444.59	424.0	780.5	1204.5

SG-0026

Properties of Saturated Steam

Vacuum Inches of Hg Gauge	Temperature °C	Temperature °F
29.51	11.74	53.14
29.41	15.17	59.30
29.31	18.04	64.47
29.21	20.52	68.93
29.11	22.70	72.86
29.00	24.66	76.38
28.90	26.43	79.58
28.70	29.56	85.21
28.49	32.27	90.08
28.29	34.66	94.38
28.09	36.80	98.24
27.88	38.74	101.74
27.48	42.18	107.92
27.06	45.14	113.26
26.66	47.77	117.99
26.26	50.13	122.23
25.85	52.27	126.08
25.44	54.23	129.62
25.03	56.05	132.89
24.63	57.74	135.94
24.22	59.33	138.79
23.81	60.82	141.48
22.79	64.21	147.57
21.78	67.21	152.97
20.76	69.91	157.83
19.74	72.36	162.24
18.72	74.61	166.30
17.70	76.70	170.06
16.69	78.64	173.56
15.67	80.47	176.85
14.65	82.14	179.86
13.63	83.81	182.86
12.61	85.36	185.64
11.60	86.82	188.28
10.58	88.22	190.80
9.56	89.57	193.21
7.52	92.08	197.75
5.49	94.42	201.96
3.45	96.60	205.88
1.42	98.64	209.56