U.S.C.G. Merchant Marine Exam

Third Assistant Engineer

Q533 Gas Turbine Plants

(Sample Examination)

Q533 Gas Turbine Plants
U.S.C.G. Merchant Marine Exam
Third Assistant Engineer
Illustrations: 7

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

1. Which of the following drawbacks of a gas turbine engine provides the greatest potential for injury to personnel?

   A. High temperature of the exhaust gases
   B. Susceptibility to foreign object damage
   C. High pitched noise
   D. Mechanical stresses the engine is subject to

   Correct answer: C

2. An open cycle gas turbine engine is best described by which of the following statements?

   A. Working fluids are taken in, transformed, and then discarded.
   B. Energy is added externally.
   C. Energy is neither created nor destroyed and the cycle is therefore perpetual.
   D. Working fluids are taken in, transformed, and then recuperated.

   Correct answer: A

3. The thermal energy added to the gas as it flows through the combustion section has what effect on the gas?

   A. Increases pressure
   B. Decreases volume
   C. Increases volume
   D. Decreases pressure

   Correct answer: C

4. A gas turbine engine in which exhaust gas heat energy is added to the air charge between the compressor and combustion chamber is classified as which of the following?

   A. Closed cycle engine
   B. Open cycle engine
   C. Regenerative cycle engine
   D. Semi-open cycle engine

   Correct answer: C

5. The acronym FOD stands for which of the following?

   A. Fuel override demand
   B. Foreign object damage
   C. Flow offset design
   D. Fuel oil discharge

   Correct answer: B

6. What is the term given to a process that occurs without a loss or gain of heat?

   A. Isothermal
   B. Adiabatic
   C. Endothermic
   D. Exothermic

   Correct answer: B

7. A temperature of 69.5 degrees Fahrenheit converts to approximately what temperature in degrees Rankine?

   A. 590.5 degrees R.
   B. 529.5 degrees R.
   C. 342.5 degrees R.
   D. 203.5 degrees R.

   Correct answer: B

8. The term "divergent" is best described as which of the following?

   A. Moving away from each other, as the inner walls of a tube that flare outward.
   B. Approaching nearer together, as the inner walls of a tube that is constricted.
   C. Maintaining an equal distance between edges.
   D. Thermal and kinetic energy being converted to mechanical energy.

   Correct answer: A

9. The divergent area of the exhaust duct aids in what process?

   A. Increasing the pressure of the exhaust gases.
   B. Increasing the velocity of the exhaust gases.
   C. Decreasing the volume of the exhaust gases.
   D. Increasing the volume of the exhaust gases.

   Correct answer: D

10. The two basic types of compressors used in gas turbine engines are which of the following?

    A. Axial and lobe.
    B. Centrifugal and axial.
    C. Axial and reciprocating.
    D. Centrifugal and reciprocating.

    Correct answer: B

11. While air is being compressed in a centrifugal flow gas turbine, what happens to the direction of air flow?

    A. Changes at each separate component
    B. Changes only at the compressor inlet
    C. Changes only once from inlet to outlet
    D. Changes only at the compressor discharge

    Correct answer: A

12. A centrifugal compressor assembly consists of which of the following?

    A. Stationary vanes and rotating blades
    B. A stationary impeller and a rotating diffuser
    C. A rotating impeller and a stationary diffuser
    D. Rotating pistons and stationary liners

    Correct answer: C

13. Before combustion can occur, the combustion air must be delivered to the combustor at a high-pressure and low-velocity. High-velocity, low-pressure air is converted to high-pressure, low-velocity air at what part of a centrifugal type compressor?

    A. Turning vanes
    B. Diffuser
    C. Impeller
    D. Inlet plenum

    Correct answer: B

14. Which of the following is the main advantage of a split-axial compressor case?

    A. Easier to repair and inspect
    B. Cheaper to manufacture
    C. Stronger construction
    D. Simpler to disassemble

    Correct answer: A

15. Which of the following terms refers to axial compressor stator blades?

    A. Roots
    B. Vanes
    C. Nozzles
    D. Shrouds

    Correct answer: B

16. An axial compressor stator vane that is mechanically adjusted to provide optimum compressor performance over a wide operating range is referred to as which of the following?

    A. Static Guide Vane (SGV)
    B. Variable Guide Vane (VGV)
    C. Inlet Guide Vane (IGV)
    D. Variable Stator Vane (VSV)

    Correct answer: D

17. Which of the following statements is true concerning axial compressor disk-type rotors?

    A. Rotor discs are held together by through bolts.
    B. Rotor consists of rings that are flanged to fit one against the other.
    C. Rotor is only suitable for low-speed compressors.
    D. Rotor discs are shrunk fit onto a steel shaft.

    Correct answer: D

18. The primary function of an axial compressor rotor blade is which of the following?

    A. To impart acceleration to the air mass, resulting in an increase in velocity.
    B. To act as a diffuser to the air flow causing an increase in pressure with a resultant decrease in velocity.
    C. To use centrifugal force to increase the pressure of the air stream.
    D. To change the direction of the air flow.

    Correct answer: A

19. A centrifugal flow gas turbine uses what type of combustion chamber?

    A. Can-annular
    B. Can
    C. Annular
    D. Double-annular

    Correct answer: B

20. In a gas turbine engine, the majority of the energy is added to the working fluid in which of the following components?

    A. Compressor
    B. Combustor
    C. High-pressure turbine
    D. Power turbine

    Correct answer: B

21. The turbine nozzles convert heat and pressure energy to velocity energy by means of which of the following?

    A. Divergent process
    B. Deflection process
    C. Convergent-Divergent process
    D. Convergent process

    Correct answer: D

22. In the operation of a marine propulsion gas turbine, kinetic and thermal energy required to drive the main propeller shaft are extracted by which of the following?

    A. Combustor
    B. Exhaust gas
    C. Power turbine
    D. Multi-stage compressor

    Correct answer: C

23. The turbine nozzles function to direct the gases in what direction?

    A. Parallel to the turbine axis
    B. Radial to the turbine axis
    C. In the direction opposite of turbine rotation
    D. In the direction of turbine rotation

    Correct answer: D

24. The turbine nozzle blades convert the combustion gases heat and pressure energy into what form of energy?

    A. Kinetic
    B. Thermal
    C. Electrical
    D. Chemical

    Correct answer: A

25. HP turbine blades are generally cooled by which of the following methods?

    A. Compressed air entering the tip and exiting the root.
    B. Cooling water entering the root and exiting the tip.
    C. Compressed air entering the root and exiting the tip.
    D. Cooling water entering the tip and exiting the root.

    Correct answer: C

26. Which of the following designs is the most satisfactory method for attaching turbine blades to the rotor disk?

    A. Locking tab design
    B. Pinning design
    C. Fir-tree design
    D. Retaining ring design

    Correct answer: C

27. What are two common methods of power turbine blade retention?

    A. Bulb and bolting
    B. Fir-tree and bolting
    C. Riveting and fir-tree
    D. Bulb and dovetail

    Correct answer: D

28. Aboard ship, single-shaft gas turbines are used mostly as prime movers for which of the following applications?

    A. Single-screw ships
    B. Generators
    C. Multi-screw ships
    D. Auxiliary power units

    Correct answer: B

29. What is the purpose of the spring in a lip-type oil seal?

    A. To remove burrs and dirt from the shaft
    B. To keep the neoprene snugly fit around the shaft
    C. To seal against maximum fluid pressure
    D. To prevent air from entering the sump

    Correct answer: B

30. What type of seal is used in the gearbox of a gas turbine engine?

    A. Carbon ring
    B. Labyrinth-Windback
    C. Lip-type
    D. Fishmouth

    Correct answer: A

31. What type of starter is commonly used on smaller gas turbine engines?

    A. Hydraulic
    B. Pneumatic
    C. Air turbine
    D. Electric

    Correct answer: D

32. Accelerating the compressor to the self-sustaining speed of the engine is the function of which of the following components?

    A. Mechanical drive shaft
    B. PT shaft
    C. Compressor extension shaft
    D. Starter

    Correct answer: D

33. What is the power source for the ignition exciter of a gas turbine engine?

    A. Ship's 400 Hz system
    B. Four lead-acid batteries
    C. Ship's 115 volt AC system
    D. Ship's 28 volt DC system

    Correct answer: C

34. How is the lube oil supplied to each bearing in a gas turbine engine controlled?

    A. Calibrated orifice
    B. Flow divider
    C. Lube oil pump
    D. Regulating valve

    Correct answer: A

35. The electrostatic vent fog precipitator removes oil mist from which of the following areas?

    A. Gas turbine engine
    B. Synchronous self-shifting clutch
    C. Lube oil storage tank
    D. Main reduction gear

    Correct answer: D

36. As shown in the illustration, what is the purpose of pressurizing the main bearing lube oil sumps on a typical marine gas turbine? Illustration GT-0023

    A. Minimizes oil leakage from the rotor shaft
    B. Increases lube oil penetration
    C. Provides uniform lube oil distribution around the bearing
    D. Assists in cooling the lube oil

    Correct answer: A

37. The lube oil system shown in the illustration, is designed to lubricate the main bearings by what principle? Illustration GT-0023

    A. Self-contained partial oil bath
    B. Spray lubrication with dry sumps
    C. Splash lubrication
    D. Totally submerged oil bath

    Correct answer: B

38. Gas turbine fuel manifold pressure is established by which of the following actions?

    A. Closing the fuel recirculating valve
    B. Starting the fuel service pumps on high-speed
    C. Starting the fuel service pumps on low-speed
    D. Rotating the gas generator

    Correct answer: D

39. What is the approximate percentage of air extracted from the compressor that is mixed with fuel for combustion in a gas turbine?

    A. 12%
    B. 25%
    C. 50%
    D. 75%

    Correct answer: B

40. The term "lockout" on the synchronous self-shifting (SSS) clutch system means that the _____.

    A. shaft will not rotate above 10 RPM's
    B. reduction gear will not rotate
    C. shaft will not rotate
    D. SSS clutch will not engage

    Correct answer: D

41. How do you manually lockout an SSS clutch?

    A. Using air pressure
    B. Using the special wrench provided
    C. Calculate the engagement speed of the SSS clutch
    D. Remove the SSS clutch locking pawls

    Correct answer: B

42. How is the clutch shown in the attached illustration engaged? Illustration GT-0018

    A. Pneumatic pressure from the compressor engages the clutch.
    B. Clutch engages automatically once the output assembly begins rotating.
    C. Clutch is engaged manually prior to start up.
    D. Clutch engages automatically when input shaft flange is rotating faster than the output assembly.

    Correct answer: D

43. The purpose of the main reduction gear in a marine gas turbine propulsion installation is which of the following?

    A. Reduce gas turbine speed to engage the clutch.
    B. Increase gas turbine speed to engage the clutch.
    C. Transfer low-speed gas turbine rotation to high-speed propeller rotation.
    D. Transfer high-speed gas turbine rotation to low-speed propeller rotation.

    Correct answer: D

44. Rotation of the controllable-pitch propeller (CPP) blades is achieved through axial movement of what component in the hub body assembly?

    A. Crosshead
    B. Sliding block
    C. Crank pin ring
    D. Servomotor piston

    Correct answer: A

45. In a typical gas turbine propulsion plant, the main thrust bearing directly positions which part(s) of the main reduction gear?

    A. Low-speed gear
    B. High-speed gear
    C. Low-speed pinions
    D. High-speed pinions

    Correct answer: A

46. A magnet pickup typically produces what type of signal output?

    A. voltage pulse
    B. pure sine wave
    C. high current
    D. steady DC voltage

    Correct answer: A

47. When auto-starting a gas turbine engine similar to the one shown in the illustration, a "False Start" indication will initiate if which of the following conditions occurs? Illustration GT-0016

    A. Power turbine outlet temperature fails to reach a preset value.
    B. The power turbine fails to reach a preset RPM after the gas generator reaches a preset RPM.
    C. The gas generator rotor fails to reach a preset RPM after the starting motor has been energized for a preset interval.
    D. The gas generator rotor fails to reach a preset RPM after the power turbine begins to rotate.

    Correct answer: C

48. Compressor characteristics are normally summarized in the form of which of the following?

    A. Spread sheet
    B. Compressor map
    C. Venn diagram
    D. Straight line graph

    Correct answer: B

49. Accelerometers are generally used on gas turbine engines to sense which of the following?

    A. PLARA rate limited feedback to the FSEE
    B. High frequency vibration
    C. Gas generator speed with respect to power turbine speed
    D. Rate of rotor speed changes

    Correct answer: B

50. The only hand tools that should be used on gas turbine engines are chrome plated, nickel plated, or which of the following?

    A. Bronze plated
    B. Unplated
    C. Silver plated
    D. Cadmium plated

    Correct answer: B

51. Which of the following instruments is designed to help you when performing an internal inspection of the gas turbine engine?

    A. Stroboscope
    B. Borescope
    C. Telescope
    D. Oscilloscope

    Correct answer: B

52. When conducting a borescope inspection, you must be aware of all of the following factors EXCEPT which?

    A. The engineer’s experience
    B. The limitations of your equipment
    C. The internal reference points
    D. The inspection areas and ports

    Correct answer: A

53. Routine water washing of the gas turbine compressor shown in the illustration, is usually performed while operating under which of the following conditions? Illustration GT-0017

    A. At 25% power
    B. At 75% power
    C. At 100% power
    D. With the starter motor drive

    Correct answer: D

54. What is the term given to the condition in which cyclic pressure changes result in a repetitive failure and recovery of compressor air flow?

    A. Laminar
    B. Turbulence
    C. Surge
    D. Stall

    Correct answer: C

55. Which of the following could cause compressor stall?

    A. The angle at which the air strikes the compressor rotor blades is too high.
    B. The angle at which the hot gases strike the turbine rotor blades is too high.
    C. Air flow over the lower foil section becomes turbulent and destroys the pressure zone.
    D. The angle at which the air strikes the compressor rotor blades is too low.

    Correct answer: A

56. On a propulsion marine gas turbine, if full power temperatures become excessive, what action should the operator take?

    A. Water wash the engine
    B. Borescope the engine
    C. Reduce power to stay within limits
    D. No action is needed until auto shutdown occurs

    Correct answer: C

57. When working with gas turbine synthetic lube oil, which of the following safety measures should always be observed?

    A. wear eye protection and rubber gloves
    B. thoroughly wash any area of skin contact
    C. avoid prolonged inhaling of vapors
    D. All of the above

    Correct answer: D

58. Which of the following statements is true concerning the fuel oil ignition system of the gas turbine engine shown in the illustration? Illustration GT-0017

    A. The igniters will only energize if the exhaust gas temperature falls below a preset value.
    B. The igniters will de-energize when the gas generator exceeds a preset RPM.
    C. The igniters will de-energize when the power turbine exceeds a preset RPM.
    D. The igniters remain energized throughout the normal operation of the engine.

    Correct answer: B

59. How is the HP turbine rotor of the GE LM2500 gas turbine cooled?

    A. By synthetic lube oil
    B. By a continuous flow of compressor discharge air
    C. By an air-to-air heat exchanger
    D. By the ship's service sea water cooling system

    Correct answer: B

60. What is the primary purpose of the diffuser and distributor on the GE LM2500 gas turbine?

    A. To provide uniform air flow to the combustor
    B. To provide uniform air flow to the compressor
    C. To provide even temperature distribution at the compressor
    D. To provide uniform air flow to the turbine

    Correct answer: A

61. What type of combustor is used by the GE LM2500 gas turbine?

    A. Can-annular
    B. Cannular
    C. Can
    D. Annular

    Correct answer: D

62. Where are the carbon dioxide nozzles located in the GE LM2500 gas turbine enclosure?

    A. On either side of the power turbine
    B. Above the compressor
    C. On the cross beam under the compressor front frame
    D. Above and below the combustor section

    Correct answer: C

63. What is the primary function of the main fuel control on the GE LM2500 gas turbine engine?

    A. To control fuel temperature
    B. To control fuel pump inlet pressure
    C. To control stator vane angle and bleed air discharge
    D. To control stator vane angle and GG speed

    Correct answer: D

64. For the GE LM2500 gas turbine engine shown in the illustration, the HP turbine 2nd stage nozzle vanes are cooled by which of the following? Illustration GT-0020

    A. 9th stage compressor air
    B. 13th stage compressor air
    C. 16th stage compressor air
    D. Frame vent bleed air

    Correct answer: B

65. For the GE LM2500 gas turbine engine shown in the illustration, the HP turbine 1st stage nozzle vanes are cooled by which of the following? Illustration GT-0020

    A. 8th stage compressor air
    B. 9th stage compressor air
    C. 13th stage compressor air
    D. 16th stage compressor air

    Correct answer: D

66. On a GE LM2500 gas turbine powered vessel you are conducting a borescope inspection of the compressor. What is used on each compressor stage as a reference for indexing the blades?

    A. Witness marks center punched on the #1 nozzle and blade
    B. The IGV actuator
    C. Scribe marks located on the stator and rotor diaphragm
    D. The locking lug blades

    Correct answer: D

67. 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

68. The boiler shown in the illustration would be classed as _____. Illustration MO-0064

    A. single-pass, fire-tube, scotch marine
    B. two-pass, water-tube
    C. two-pass, scotch marine
    D. forced circulation, coil-type

    Correct answer: A

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

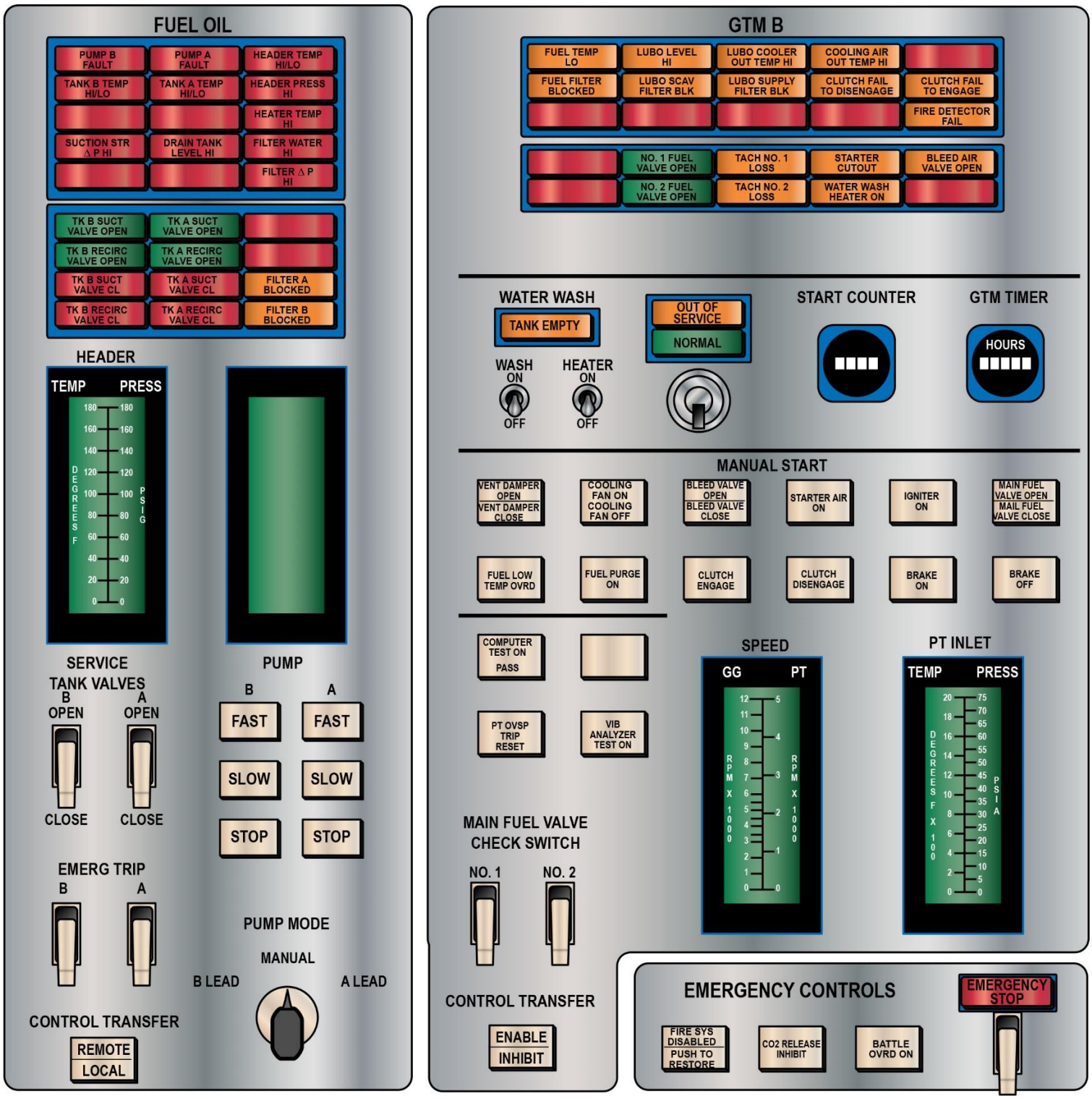
    Correct answer: C

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

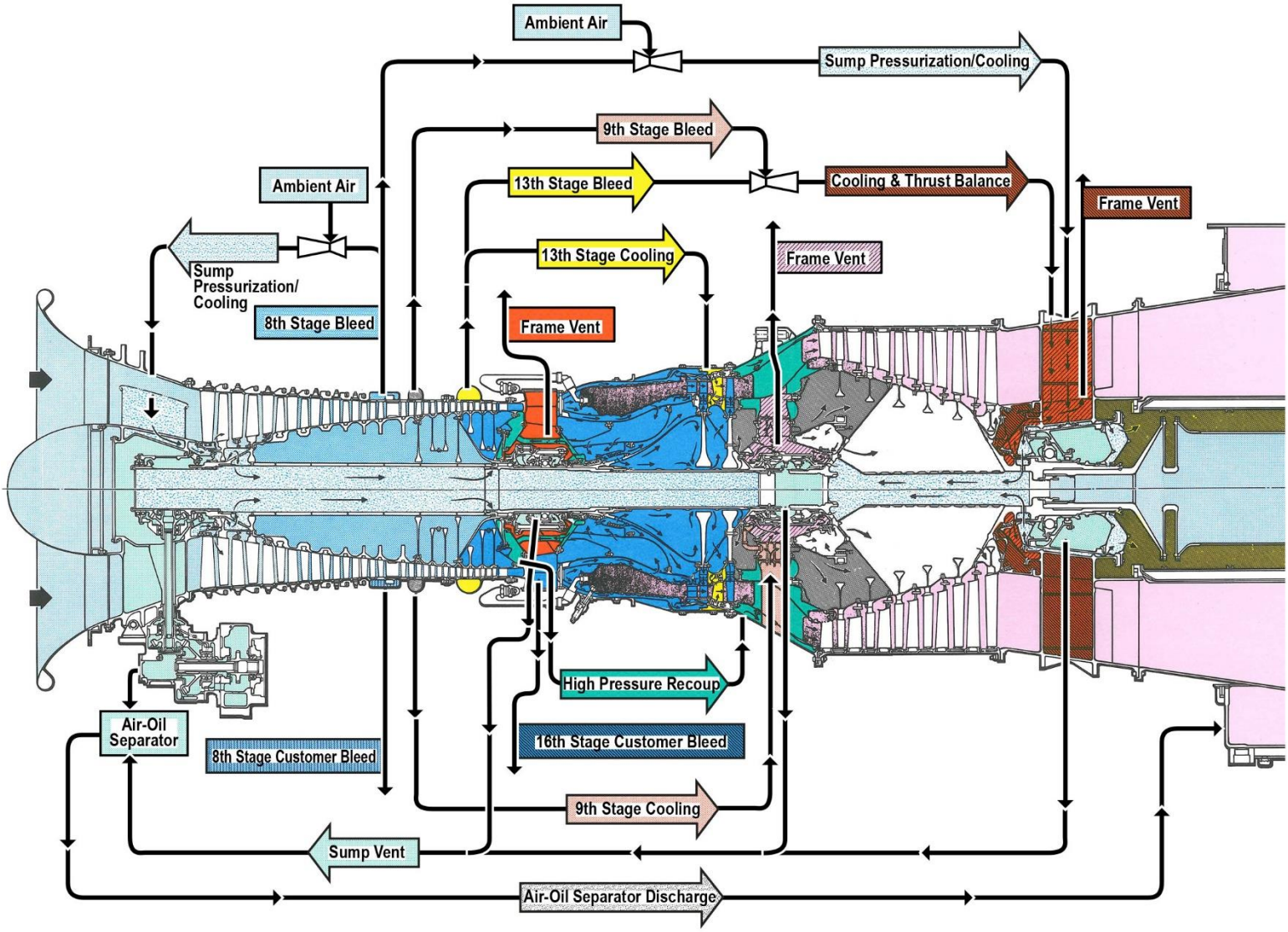
    A. maintain a constant fuel temperature
    B. provide a constant fuel return pressure
    C. provide a wide range of combustion
    D. maintain smokeless fuel oil atomization

    Correct answer: C

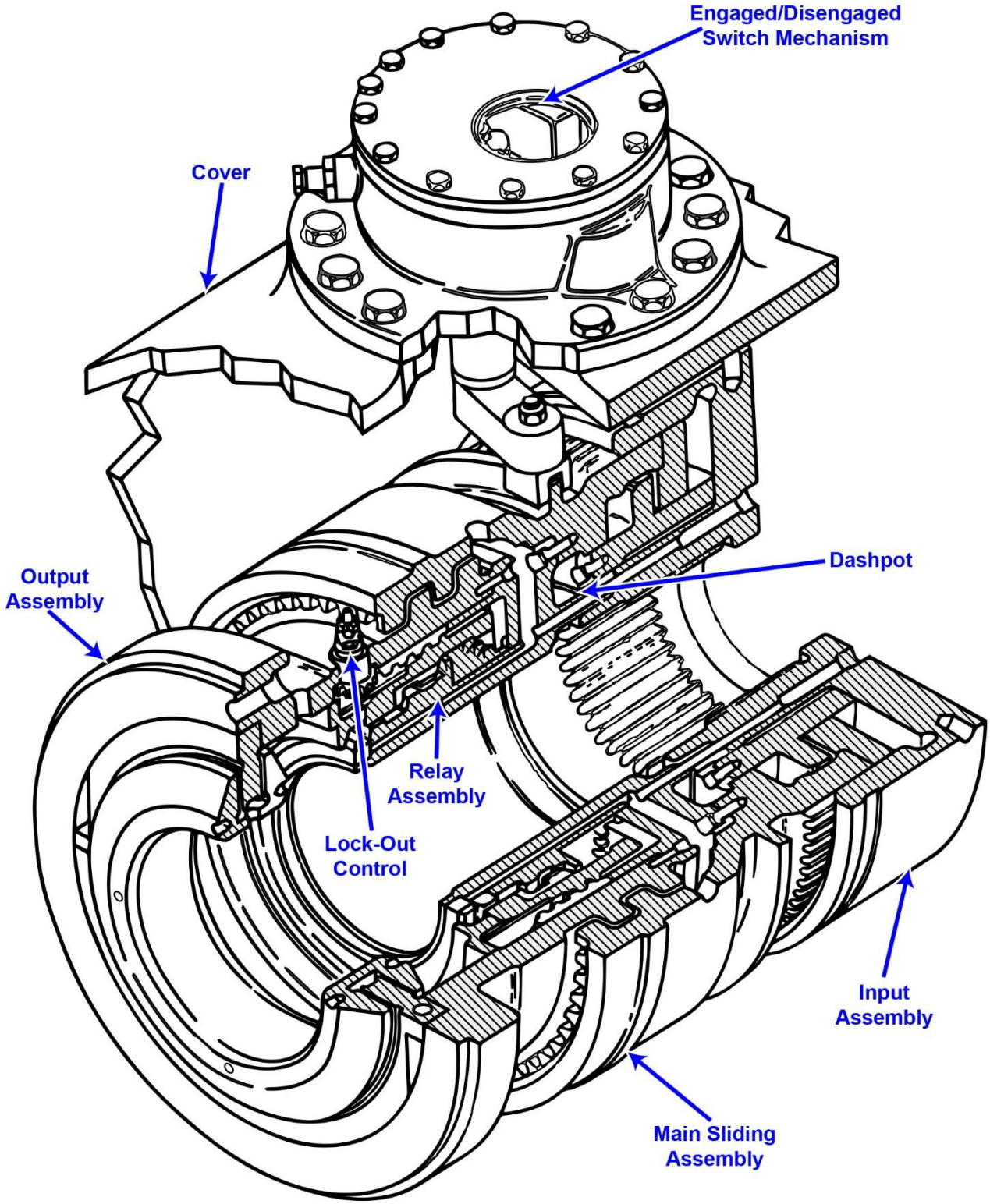
GT-0016



GT-0017

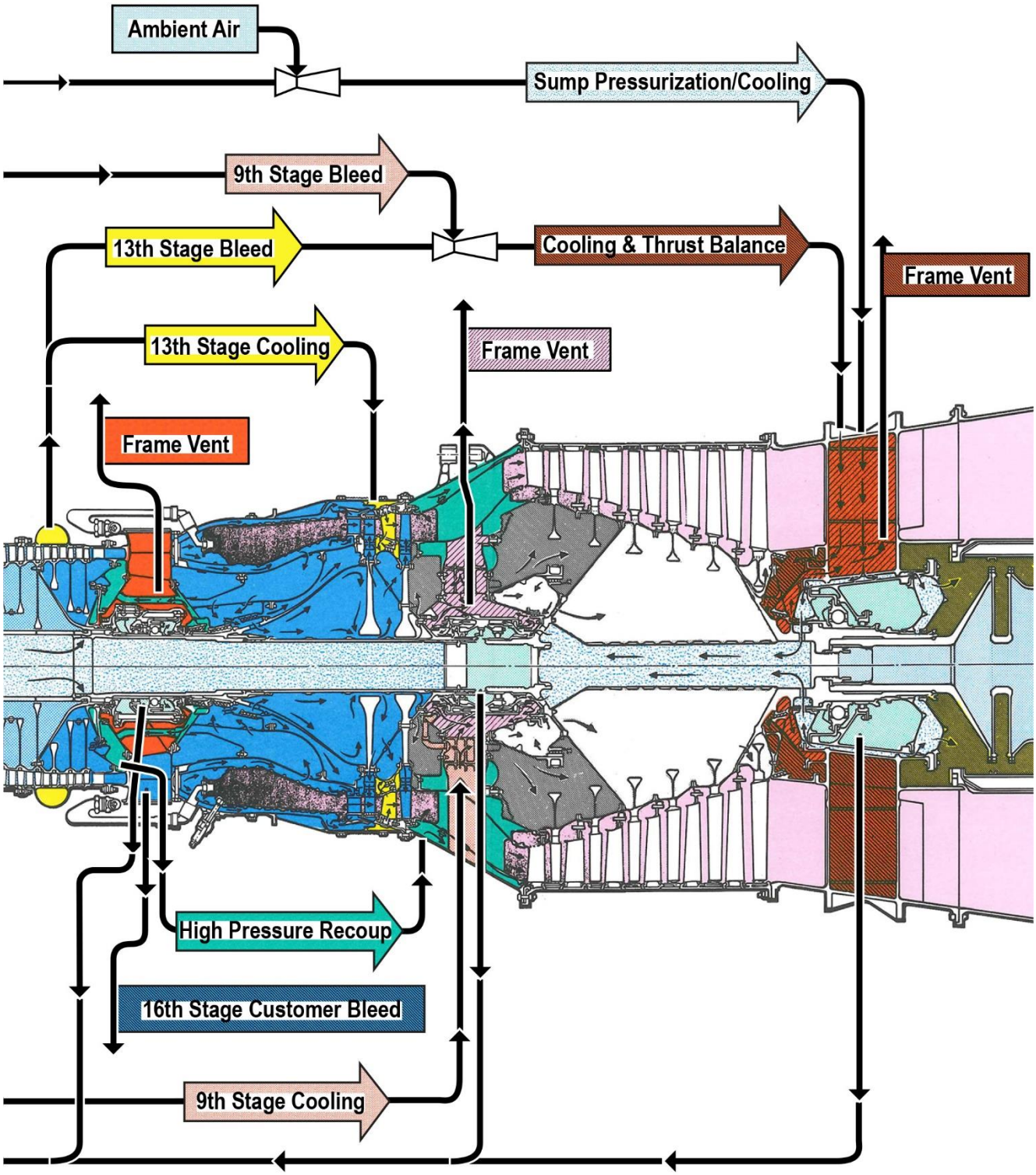


GT-0018

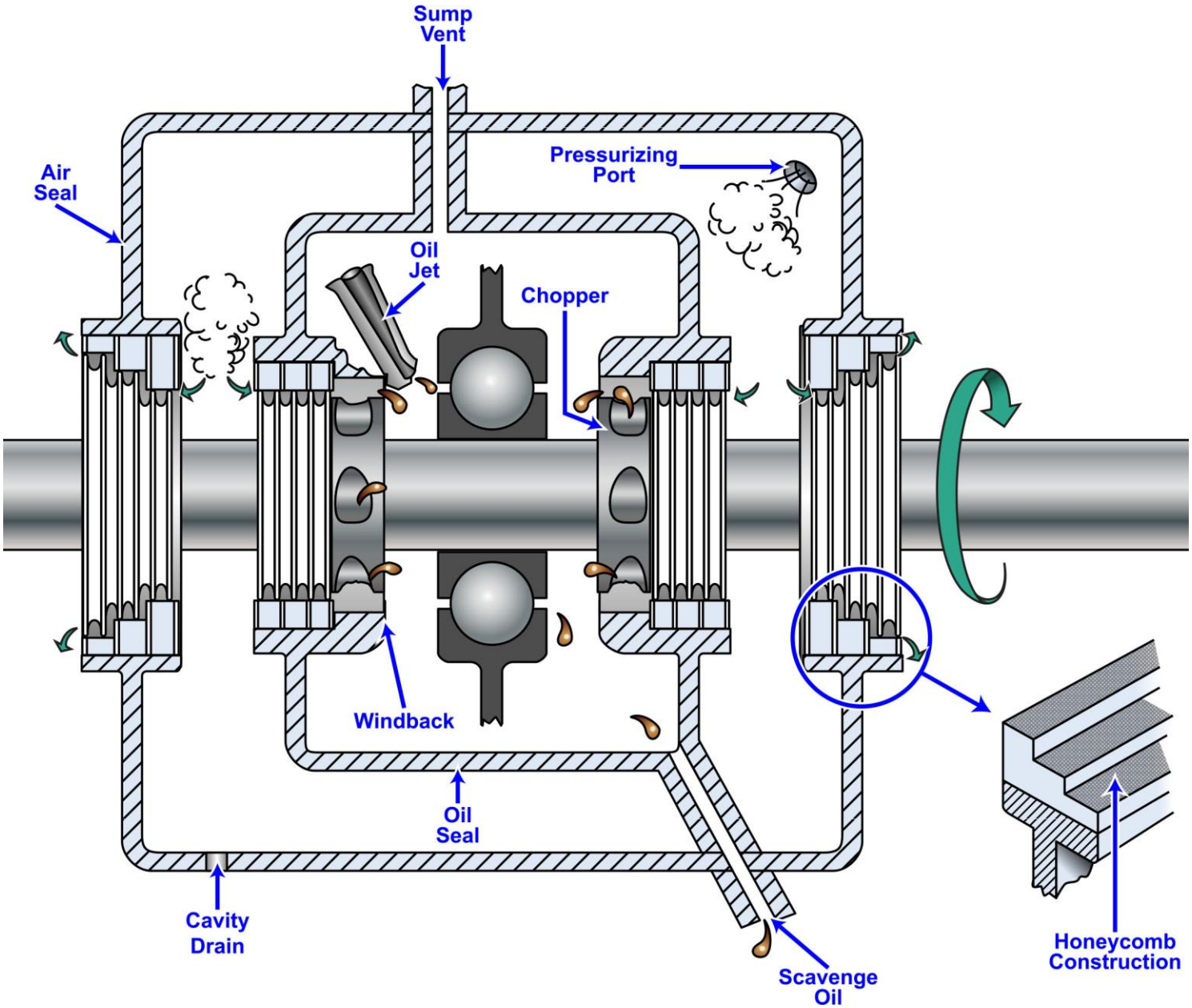


Adapted for testing purposes only from Gas Turbine Systems Technician (Electrical) 3/ Gas Turbine Systems Technician (Mechanical) 3, Volume 2
NAVEDTRA 14114

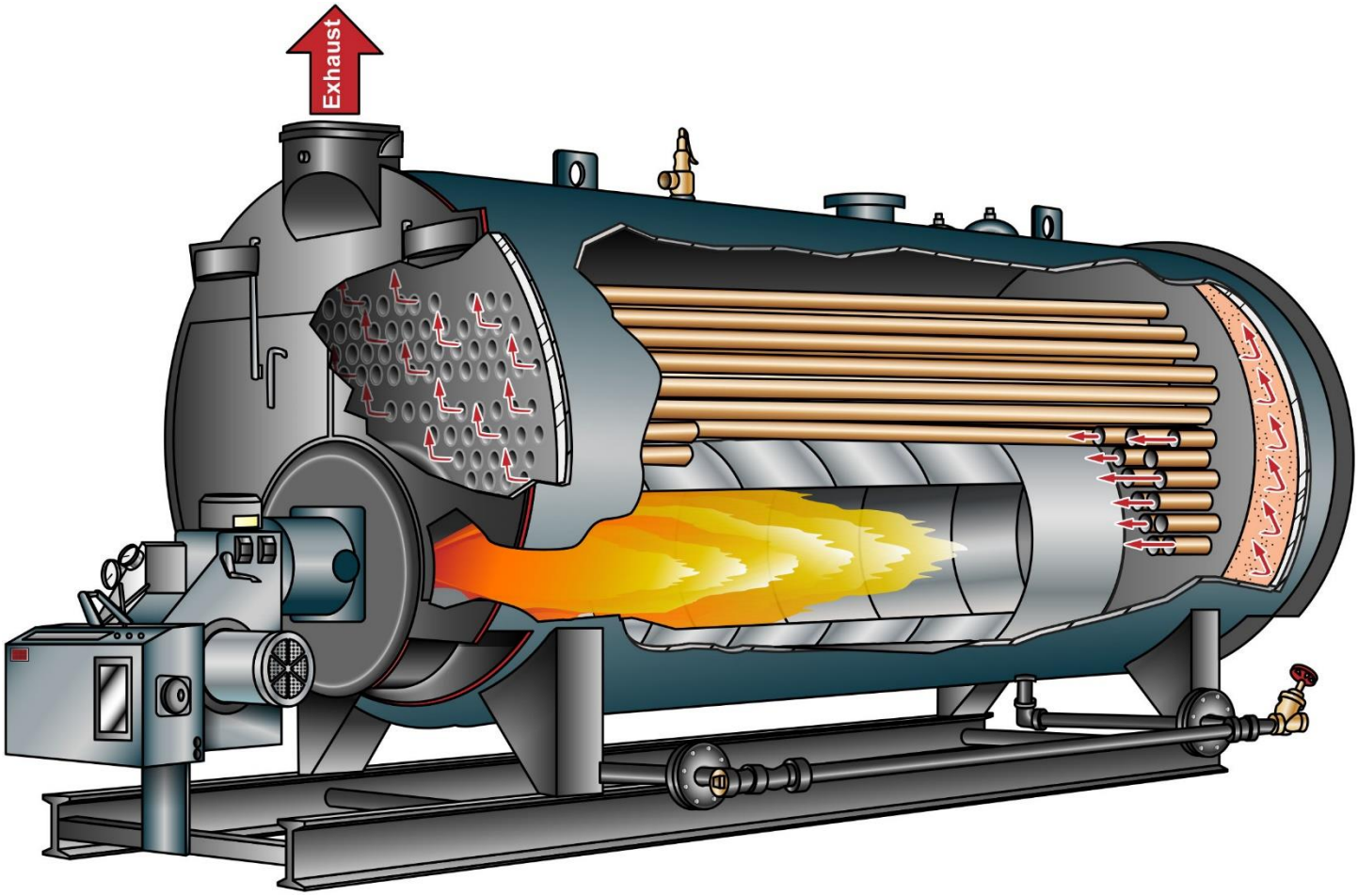
GT-0020



GT-0023



MO-0064



MO-0231