U.S.C.G. Merchant Marine Exam

DDE – Unlimited HP

Q622 Gas Turbine Plants

(Sample Examination)

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Illustrations: 7

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

1. The gas generating sections of marine gas turbine engines are based on which of the following?

   A. Aircraft jet engines
   B. Radial piston engines
   C. Oil-fired auxiliary boilers
   D. Free piston engines

   Correct answer: A

2. The Brayton Cycle is a series of events best described by which of the following statements?

   A. Intake, pressurization, ignition, exhaust
   B. Intake, compression, combustion, expansion, exhaust
   C. Intake, decompression, combustion, expansion, exhaust
   D. Intake, compression, combustion, explosion, exhaust

   Correct answer: B

3. Why is the cycle efficiency higher in the intercooled-recuperated cycle as compared to a simple cycle gas turbine? Illustration GT-0026

   A. The intercooler serves to reduce the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to decrease turbine inlet temperature.
   B. The intercooler serves to reduce the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to decrease required fuel to achieve the turbine inlet temperature.
   C. The intercooler serves to increase the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to decrease turbine inlet temperature.
   D. The intercooler serves to increase the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to increase turbine inlet temperature.

   Correct answer: B

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

   A. Energy is added externally.
   B. Working fluids are taken in, transformed, and then discarded.
   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: B

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

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

   Correct answer: B

6. The acronym VSV represents which of the following?

   A. Variable stator vane
   B. Vibration stator vanes
   C. Variable speed valve
   D. Vibration shutdown valve

   Correct answer: A

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

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

   Correct answer: D

8. Which of the following terms refers to thermal energy in transition?

   A. Horsepower
   B. Power
   C. Heat
   D. Foot-Pound

   Correct answer: C

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

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

   Correct answer: D

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

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

    Correct answer: A

11. A compressor is operating at an inlet pressure of 14.7 (atmospheric pressure at the time of measurement) and a compressor discharge pressure of 123 psig. Calculate the absolute pressure ratio across the compressor.

    A. 8.2:1
    B. 8.4:1
    C. 9.4:1
    D. 10.5:1

    Correct answer: C

12. What is the disadvantage of a dual-entry centrifugal compressor compared to a single-entry centrifugal compressor?

    A. The dual-entry compressor utilizes a more complicated inlet ducting.
    B. The dual-entry compressor has a greater efficiency.
    C. The dual-entry compressor is larger in diameter.
    D. The dual-entry compressor rotates at slower speeds.

    Correct answer: A

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

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

    Correct answer: A

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

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

    Correct answer: C

15. The purpose of the metal spray rub coating on the rotor and stator casing of an axial type compressor is which of the following?

    A. Provide close vane to rotor and blade to stator case clearances
    B. Seal the circumferential dovetails
    C. Ensure protection for the gearbox adapter when removing or replacing the bearings
    D. Control air flow through the compressor

    Correct answer: A

16. What is the function of the stator in an axial gas turbine compressor?

    A. To provide velocity energy
    B. To increase volume
    C. To convert velocity to pressure
    D. To convert pressure to velocity

    Correct answer: C

17. What is the term used to describe the stationary vanes preceding the first stage of an axial compressor?

    A. Variable inlet vanes
    B. Variable stator vanes
    C. Inlet guide vanes
    D. First stage stator vanes

    Correct answer: C

18. Two functions of the compressor stator vanes include which of the following?

    A. Direct air flow to each rotor stage at the correct angle and deliver air to the combustor at the correct velocity and pressure.
    B. Direct air flow to rotor blades at the correct angle and are shaped to maintain a constant velocity and produce a pressure increase.
    C. Direct air flow to rotor blades at the correct angle and are shaped to produce a velocity increase and maintain a constant pressure.
    D. Direct air flow to rotor blades at the correct angle and are shaped to cause a velocity increase and a pressure decrease.

    Correct answer: A

19. Why are loose-fitting blades used on the first several stages of large axial compressors?

    A. To minimize vibration while the engine is passing through critical speed ranges
    B. To maintain close tolerances in the compressor
    C. To compensate for the abrasive action of the blade tips
    D. To compensate for a malfunctioning compressor support bearing

    Correct answer: A

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

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

    Correct answer: B

21. 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. Power turbine
    C. Combustor
    D. High-pressure turbine

    Correct answer: C

22. The three most common types of combustors used in gas turbine engines are which of the following?

    A. Can, annular, and can-annular.
    B. Can, derivative, and can-derivative.
    C. Can, vortex, and can-vortex.
    D. Can, angular, and can-angular.

    Correct answer: A

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

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

    Correct answer: A

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

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

    Correct answer: B

25. How do the high-velocity high-temperature gases cause the gas turbine rotor to rotate?

    A. By creating a low-pressure area before the rotor
    B. By increasing the velocity of the gases
    C. By converting the high-velocity gas to low-velocity gas
    D. By transferring velocity energy and thermal energy to the turbine blades

    Correct answer: D

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

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

    Correct answer: C

27. What method is utilized to allow turbine nozzle blades to withstand high inlet temperatures?

    A. Water cooling
    B. Laser cooling
    C. Thermoelectric cooling
    D. Air cooling

    Correct answer: D

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

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

    Correct answer: B

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

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

    Correct answer: B

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

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

    Correct answer: B

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

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

    Correct answer: C

32. What type of air seal is used in the sump and turbine areas of a gas turbine engine?

    A. Pneumatic carbon ring
    B. Lip-type
    C. Fishmouth
    D. Labyrinth-Honeycomb

    Correct answer: D

33. Which of the following components removes the oil from the transfer gearbox?

    A. Lube oil storage and conditioning assembly
    B. Air/Oil separator
    C. Lube and scavenge pump
    D. Duplex filter assembly

    Correct answer: C

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

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

    Correct answer: A

35. What is the most common type of spark igniter used on a gas turbine engine?

    A. Suppression gap
    B. Delayed gap
    C. Annular gap
    D. Resistive gap

    Correct answer: C

36. For the gas turbine engine lube oil system shown in the illustration, what is the purpose of the lube oil supply check valves? Illustration GT-0024

    A. keep the lube oil lines in the engine primed
    B. prevent the lube oil and scavenge pump from losing its prime
    C. prevent lube oil contained in the LO storage and conditioning tank from draining into gearboxes and sumps
    D. All of the above

    Correct answer: C

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

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

    Correct answer: B

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

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

    Correct answer: A

39. The main lubrication system utilized by the gas turbine engine shown in the illustration is what type? Illustration GT-0017

    A. Dry sump
    B. Wet sump
    C. Oil mist recovery sump
    D. Common drain sump

    Correct answer: A

40. The lube oil system shown in the illustration, consists of which of the following sub-systems? Illustration GT-0024

    A. Sump venting
    B. Lube oil supply
    C. Lube oil scavenging
    D. All of the above

    Correct answer: D

41. On the marine gas turbine engine shown in the illustration, the 8th stage bleed air is used for which of the following? Illustration GT-0017

    A. High-pressure turbine 2nd stage nozzle cooling
    B. Power turbine blade cooling
    C. Lube oil sump pressurization and cooling
    D. Power turbine balance piston cavity pressurization

    Correct answer: C

42. Air used to cool the combustion liners and turbine components is referred to as which of the following?

    A. Secondary air
    B. Primary air
    C. Control air
    D. None of the above

    Correct answer: A

43. The fuel oil system of a gas turbine engine provides all EXCEPT which of the following?

    A. Controls the angle of the variable stator vanes
    B. Acts as a cooling medium for the lube oil cooler
    C. Acts as a hydraulic medium to actuate the fuel control
    D. Provides accurately metered fuel for combustion

    Correct answer: B

44. Assuming at least a 500 rpm for the input shaft speed from the power turbine, as shown in the illustration, the synchronous self-shifting (SSS) clutch used on marine gas turbine main propulsion gears, requires which of the following inputs or conditions to make engagement possible? Illustration GT-0018

    A. Availability of low-pressure air to provide control air pressure for engagement
    B. Availability of high-pressure air to provide clutch air inflation pressure
    C. When the input shaft speed from the power turbine falls below the output shaft speed
    D. When the input shaft speed from the power turbine rises to the output shaft speed

    Correct answer: D

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

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

    Correct answer: C

46. What feature is commonly used on articulated reduction gear arrangements for the correction of misalignment between the 1st reduction gear and the 2nd reduction pinions?

    A. Quill shafts
    B. Fixed block pads
    C. Locked train shims
    D. Torsion pads

    Correct answer: A

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

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

    Correct answer: C

48. What is the purpose of the Controllable-Pitch Propeller (CPP) hydraulic oil power system?

    A. Supplies high-pressure oil for blade actuation and control oil for propeller pitch control
    B. Supplies low-pressure oil for both pitch control and stern tube sealing
    C. Supplies low-pressure oil for propeller blade actuation and control oil for propeller pitch control
    D. Supplies high-pressure oil for both propeller blade actuation and stern tube sealing

    Correct answer: A

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

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

    Correct answer: C

50. Which of the following conditions permits a gas turbine to produce 100% power?

    A. Minimum air inlet temperature
    B. Maximum fuel flow
    C. Maximum combustion temperature
    D. Minimum air mass/weight flow

    Correct answer: A

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

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

    Correct answer: B

52. Which of the following are the principle factors that affect the performance of a gas turbine compressor?

    A. Bleed pressure, fuel pressure, exhaust temperature
    B. Pressure ratio, air flow, rotational speed
    C. Fuel flow, air flow, exhaust temperature
    D. None of the above

    Correct answer: B

53. What are the two primary sources of deposits that build up on compressor blades?

    A. Lube oil mist and carbon residue
    B. Salt spray and carbon residue
    C. Lube oil mist and dry particulate matter
    D. Salt spray and lube oil mist

    Correct answer: D

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

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

    Correct answer: A

55. Which of the following wrenches should NOT be used while working on a gas turbine?

    A. Flare nut wrench
    B. Adjustable wrench
    C. Box wrench
    D. Crowfoot wrench

    Correct answer: B

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

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

    Correct answer: C

57. Which of the following could cause compressor stall?

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

    Correct answer: B

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

    Correct answer: A

59. Compressor surge is caused by which of the following factors?

    A. Increased demand for secondary air
    B. Interrupted air flow
    C. Maximum fuel pressure
    D. Low ambient air temperature

    Correct answer: B

60. While standing watch underway on a ship with the gas turbine shown in the illustration, a fire emergency stop is initiated when which of the following occurs? Illustration GT-0017

    A. One of the UV flame detectors is activated.
    B. The fire emergency shutdown switch located on the gas turbine module is activated.
    C. Either the primary or reserve gas turbine module CO2 system activates.
    D. All of the above

    Correct answer: D

61. When a compressor is in a stall condition, what will happen to the combustor and turbine temperatures?

    A. Slowly decrease
    B. Slowly increase
    C. Rapidly decrease
    D. Rapidly increase

    Correct answer: D

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

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

    Correct answer: D

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

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

    Correct answer: C

64. Which of the following components prevent(s) objects smaller than 1/4 inch from entering the GE LM2500 gas turbine?

    A. Inlet louvers
    B. Centerbody
    C. FOD screens
    D. Demister pads

    Correct answer: C

65. The gas generator section of the GE LM2500 gas turbine is composed of all of the following components EXCEPT which of the following?

    A. Bellmouth
    B. FOD screen
    C. Two-stage HP turbine
    D. Six-stage LP turbine

    Correct answer: D

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

    Correct answer: B

67. Marine GTE fuel oil systems, as shown in the illustration, require fuel oil shutdown valves to be _____. Illustration GT-0021

    A. manually operated from MPCMS
    B. piped in series
    C. piped in parallel
    D. piped in series-parallel

    Correct answer: B

68. 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

69. For the GE LM2500 gas turbine engine shown in the illustration, the 13th stage bleed air is used for which of the following? Illustration GT-0017

    A. High-pressure turbine 2nd stage nozzle cooling
    B. Power turbine balance piston cavity pressurization
    C. Power turbine cooling
    D. Sump pressurization and cooling

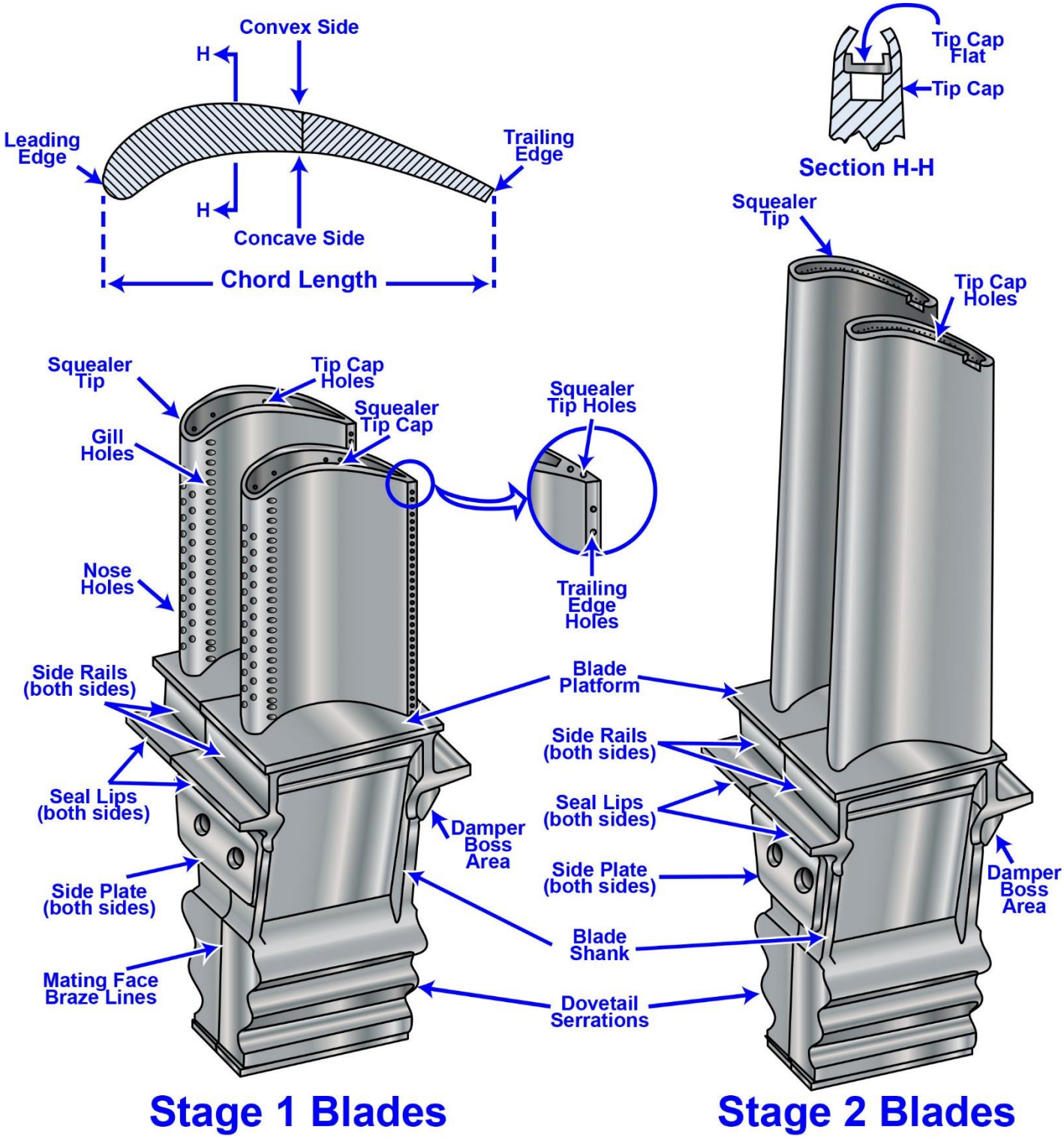
    Correct answer: A

70. For the GE LM2500 gas turbine engine shown in the illustration, the HP turbine 2nd stage blades are cooled by convection, with the cooling air being discharged where? Illustration GT-0011

    A. Trailing edge slots
    B. Nose holes on the leading edge
    C. Gill holes on the side
    D. Blade tips

    Correct answer: D

GT-0011



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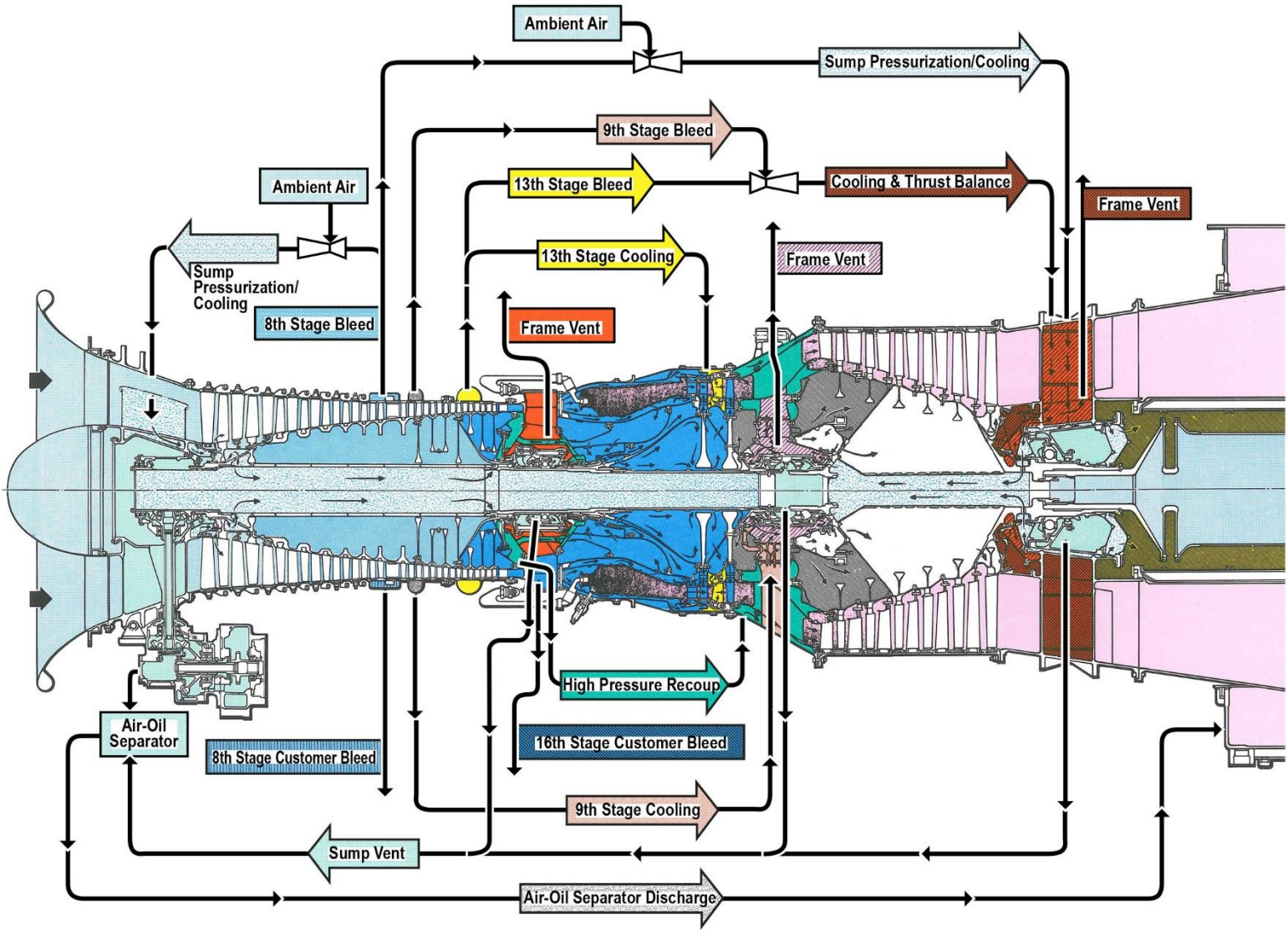

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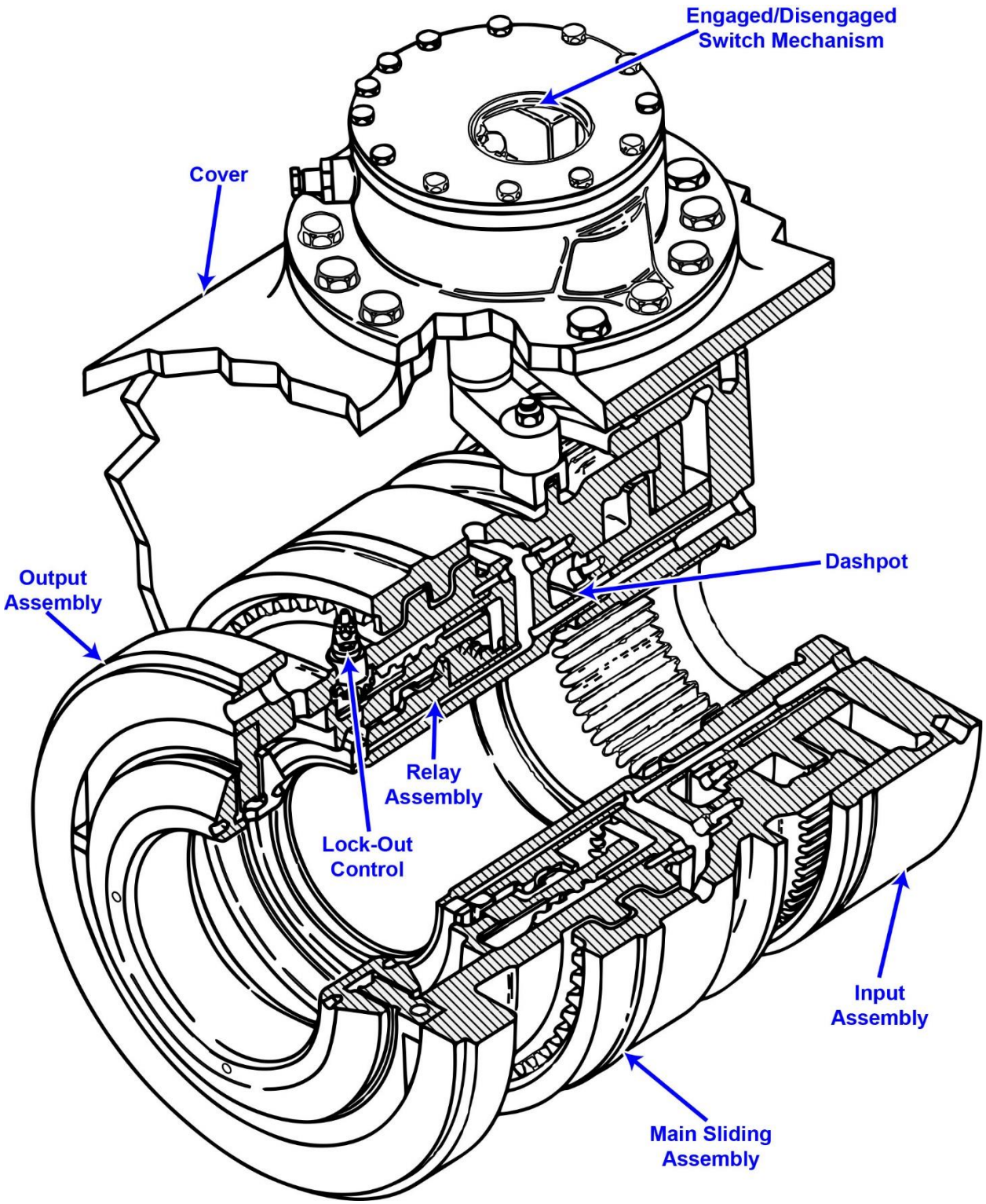

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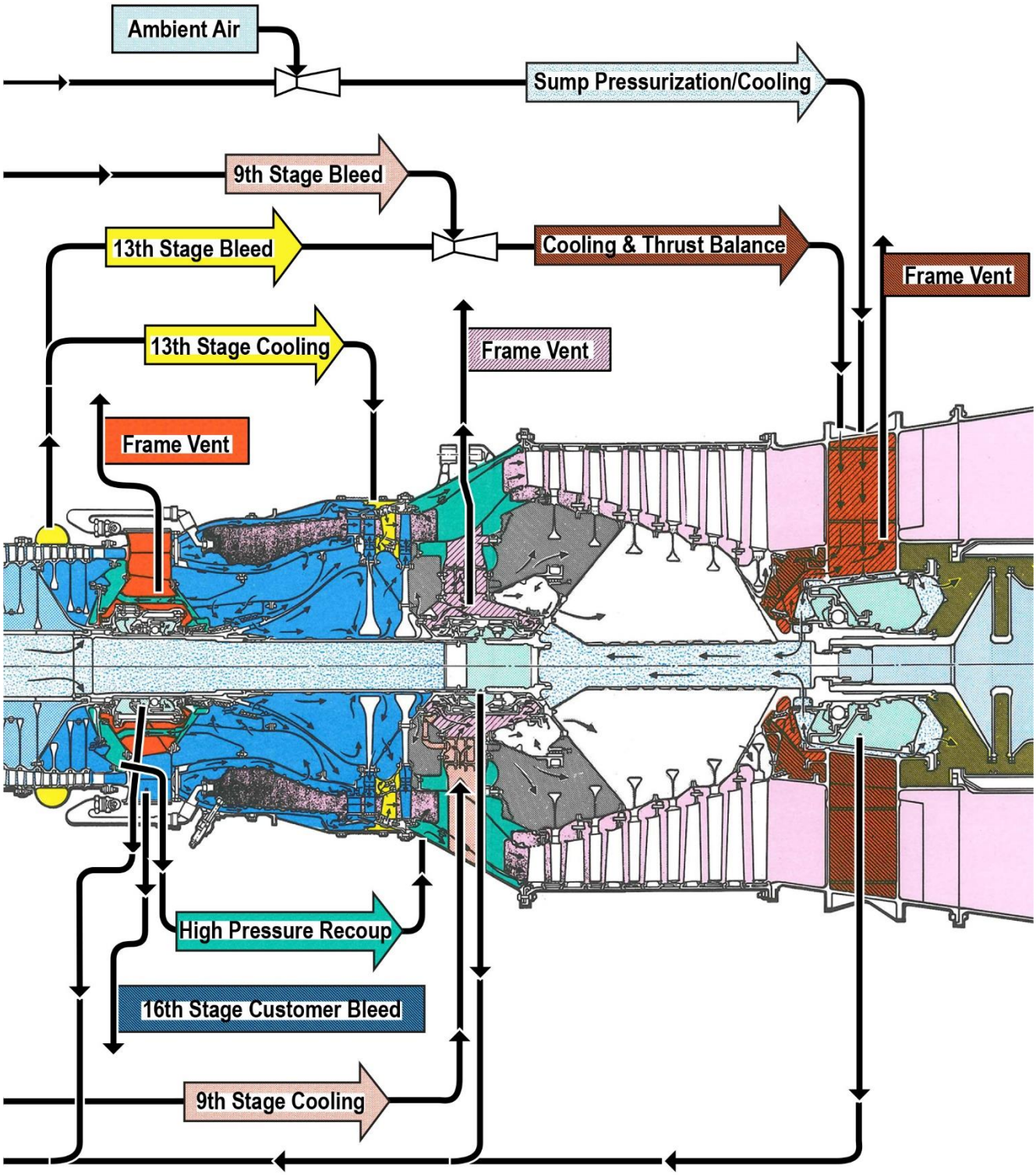

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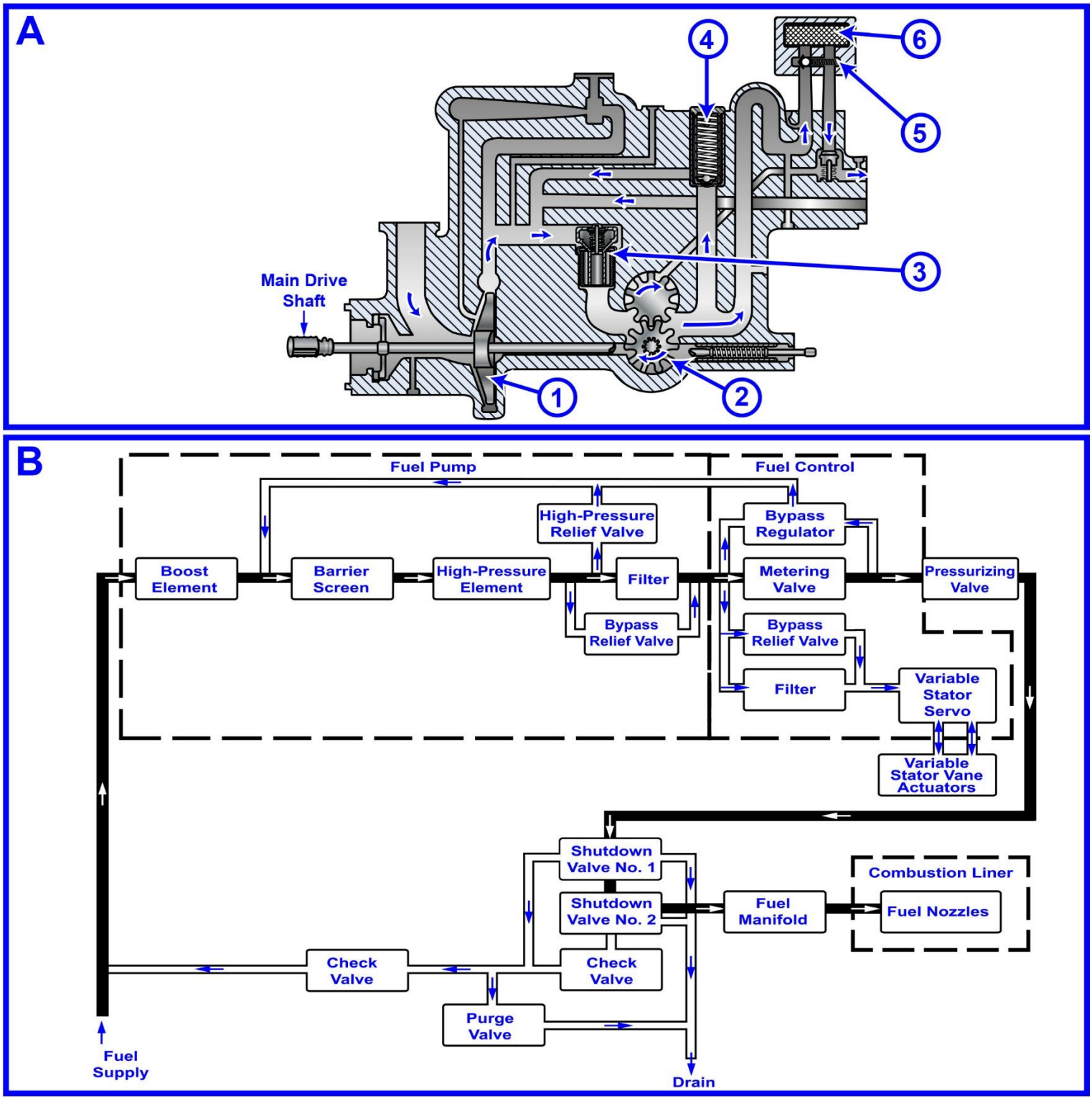

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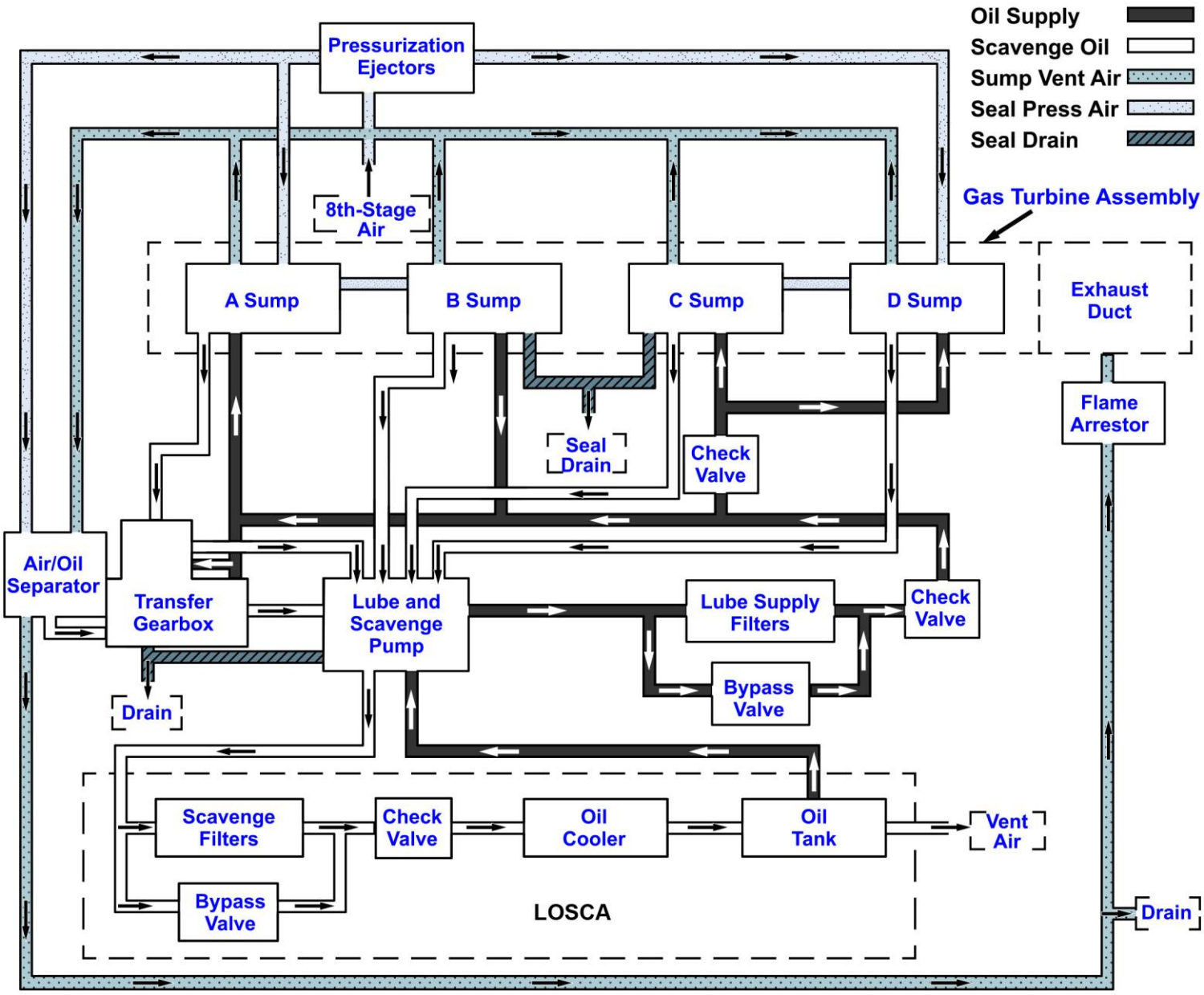

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