

U.S.C.G. Merchant Marine Exam
First Assistant Engineer, Unlimited
Q515 Gas Turbine Plants
(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

1. Active corrosion on copper alloys is indicated by which of the following?

- (A) A white-gray powder formation.
- (B) A copper-oxide crust formation.
- (C) A gray-green patina formation.
- (D) A verdigris formation.

If choice C is selected set score to 1.

2. Provisions for avoiding the buildup of ice on the intake air surfaces of a gas turbine plant can be found where?

- (A) In the stack intake ducting.
- (B) In the inlet duct frame at the inlet to the engine.
- (C) In the exhaust and intake ducting.
- (D) Both A & B.

If choice D is selected set score to 1.

3. The dimples of a combustor dome band that has a low operating time will usually have what kind of damage?

- (A) Burn away.
- (B) Bowing.
- (C) Cracks.
- (D) Burn through.

If choice C is selected set score to 1.

4. Boyle's law can best be defined as _____.

- (A) the volume of an enclosed gas varies inversely with the applied pressure, provided the temperature remains constant
- (B) if the pressure is constant, the volume of an enclosed gas varies indirectly with absolute temperature
- (C) a body at rest tends to remain at rest
- (D) none of the above

If choice A is selected set score to 1.

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

- (A) can-annular
- (B) can
- (C) cannular
- (D) annular

If choice D is selected set score to 1.

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

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

If choice C is selected set score to 1.

7. For the same amount of available power, how does a low-speed two-stroke diesel engine compare to a recuperated gas turbine configuration?

- (A) The two-stroke diesel engine would burn more fuel and the particulate and nitrogen oxide (NO_x) levels in the exhaust would be higher than that of a recuperated gas turbine configuration
- (B) The two-stroke diesel engine would burn less fuel and the nitrogen oxide (NO_x) levels in the exhaust would be much lower than that of a recuperated gas turbine configuration.
- (C) The two-stroke diesel engine would burn more fuel than a recuperated gas turbine; however, the particulate and nitrogen oxide (NO_x) levels in the exhaust would be lower.
- (D) The two-stroke diesel engine would burn less fuel than a recuperated gas turbine; however, the levels of particulate and nitrogen oxide (NO_x) levels in the exhaust would be higher.

If choice D is selected set score to 1.

8. A gas turbine engine is experiencing a high rate of corrosion in the hot section of the engine. Which of the following fuel contamination issues could be associated with this problem?

- (A) High ash content in the fuel.
- (B) High particle content in the fuel.
- (C) Low pour point of the fuel.
- (D) High salt water content in the fuel.

If choice D is selected set score to 1.

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

- (A) Laser cooling
- (B) Air cooling
- (C) Water cooling
- (D) Thermoelectric cooling

If choice B is selected set score to 1.

10. 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.

If choice A is selected set score to 1.

11. In which of the following ways can compressor surge cause excessive temperatures in the turbine section?

- (A) By providing inadequate secondary air
- (B) By overloading the compressor
- (C) By providing excessive combustion air
- (D) All of the above

If choice A is selected set score to 1.

12. What are the two prime sources of deposits that build up on compressor blades?

- (A) Carbon residue and lube oil mist
- (B) Salt spray and carbon residue
- (C) Lube oil mist and fuel oil spray
- (D) Lube oil mist and salt spray

If choice D is selected set score to 1.

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

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

If choice C is selected set score to 1.

14. In the marine gas turbine engine shown in the illustration, the 13th stage bleed air is used for _____ . Illustration GT-0017

- (A) high-pressure turbine 2nd stage nozzle cooling
- (B) power turbine cooling
- (C) power turbine balance piston cavity pressurization
- (D) sump pressurization and cooling

If choice A is selected set score to 1.

15. In a regenerative or recuperative gas turbine cycle configuration, the heat of the turbine exhaust gas is used to do what?

- (A) Heat the LP compressor discharge air before entering the HP compressor inlet.
- (B) Heat the intake air to the compressor.
- (C) Heat the combustor discharge gas before entering the turbine.
- (D) Heat the compressor discharge air before it enters the combustor.

If choice D is selected set score to 1.

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

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

If choice D is selected set score to 1.

17. Why are the high-pressure turbine blades generally of the impulse/reaction type?

- (A) To evenly distribute the stress over the entire blade.
- (B) To keep the tip pressure higher than the root pressure thereby preventing air flow over the tip.
- (C) To keep the tip pressure lower than the root pressure thereby preventing air flow over the tip.
- (D) Both A and B.

If choice D is selected set score to 1.

18. When performing a static check to determine tooth contact, you should use which of the following compounds to coat the gear teeth?

- (A) Copper sulfate.
- (B) An indelible marker.
- (C) Prussian blue.
- (D) Persian blue.

If choice C is selected set score to 1.

- 19.** You are conducting a borescope inspection of the compressor section of a GE LM2500 gas turbine. In stage four, you see a slight tilt to one blade and the blade platform is raised higher than the other blades. What could be a cause of this condition and what would be your course of action?
- (A) Condition could be the result of blade root failure. Engine should be taken out of service until condition can be evaluated.
 - (B) FOD damage could cause this condition. Engine can be operated at full load until next scheduled maintenance.
 - (C) Metal fatigue could cause this condition. Engine can be operated but gas generator speed should be reduced.
 - (D) Ice damage could cause this condition. Blade tilt should be corrected using special tool provided, then engine will be safe to operate.

If choice A is selected set score to 1.

- 20.** The power turbine (PT) of the GE LM2500 gas turbine engine has a total of how many stages?
- (A) Four
 - (B) Six
 - (C) Seven
 - (D) Eight

If choice B is selected set score to 1.

- 21.** The main fuel control module used on a marine gas turbine engine as shown in the illustration, is responsible for managing which function(s)? Illustration GT-0021
- (A) deceleration schedule
 - (B) variable stator vane feedback lever
 - (C) acceleration schedule
 - (D) all of the above

If choice D is selected set score to 1.

- 22.** Most GTE fuel nozzles have passages for all of the following except _____.
- (A) cooling water
 - (B) secondary fuel flow
 - (C) primary fuel flow
 - (D) compressed air

If choice A is selected set score to 1.

23. Distortion of the combustor liner assembly is evident when you observe which of the following conditions?

- (A) The inner liner bends down into the flow path., and the outer liner lifts up into the flow path
- (B) Both the inner and outer liner bend into the flow path.
- (C) The inner liner lifts up into the flow path, and the outer liner bends down into the flow path.
- (D) Both the inner and outer liner lift up into the flow path.

If choice C is selected set score to 1.

24. 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 converting the high-velocity gas to low-velocity gas.
- (C) By increasing the velocity of the gases.
- (D) By transferring velocity energy and thermal energy to the turbine blades.

If choice D is selected set score to 1.

25. How many lube oil sumps are installed on the marine gas turbine engine shown in the illustration?
Illustration GT-0024

- (A) 1
- (B) 2
- (C) 3
- (D) 4

If choice D is selected set score to 1.

26. The fuel oil back pressure regulator on the fuel system shown in the illustration, returns fuel to which of the following? Illustration GT-0021

- (A) Booster pump suction.
- (B) Purge valve discharge.
- (C) Fuel oil day tank.
- (D) Booster pump discharge.

If choice D is selected set score to 1.

27. What is the designed compressor pressure ratio of the gas turbine compressor rotor shown in the illustration? Illustration GT-0004

- (A) 10 to 1
- (B) 12 to 1
- (C) 16 to 1
- (D) 20 to 1

If choice C is selected set score to 1.

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

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

If choice D is selected set score to 1.

29. What is the purpose of the GE LM2500 gas turbine enclosure heater?

- (A) To ensure enclosure temperature is maintained at 145 degrees F
- (B) To ensure fuel viscosity is maintained while the GTE is secured
- (C) To warm up the enclosure for maintenance personnel
- (D) To increase inlet air temperature

If choice B is selected set score to 1.

30. 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) Power turbine.
- (D) High-pressure turbine.

If choice B is selected set score to 1.

31. A compressor blade platform that is tilted or raised may indicate which of the following failures?

- (A) Blade root.
- (B) Carboloy pad.
- (C) Midspan damper.
- (D) Tip clang.

If choice A is selected set score to 1.

32. Lubricating oil contamination in a gas turbine bearing oil sump will most likely come from which of the following?

- (A) Failure of the lube oil pump.
- (B) Fuel oil contamination.
- (C) Failure of the scavenging pump.
- (D) Failure of seal pressurization air.

If choice D is selected set score to 1.

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

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

If choice A is selected set score to 1.

34. 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 once from inlet to outlet.
- (C) Changes only at the compressor discharge.
- (D) Changes only at the compressor inlet.

If choice A is selected set score to 1.

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

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

If choice A is selected set score to 1.

36. The main thrust bearing directly positions which part(s) of the main reduction gear?

- (A) Bull gear.
- (B) Low-speed pinion.
- (C) High-speed pinion.
- (D) High-speed gear.

If choice A is selected set score to 1.

37. On a gas turbine propulsion vessel, you notice a slow but steady increase in gas turbine vibration and specific fuel consumption as the voyage has progressed. What would be a good maintenance technique to use to correct these increases?

- (A) Secure the engine and water wash the compressor off-line.
- (B) Increase the Variable Stator Vane setting to supply more air to the combustor.
- (C) Water wash the power turbine on-line.
- (D) Increase gas generator RPM to a more efficient setting.

If choice A is selected set score to 1.

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

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

If choice B is selected set score to 1.

39. How many stages are in the HP turbine of the GE LM2500 gas turbine engine?

- (A) One
- (B) Two
- (C) Three
- (D) Four

If choice B is selected set score to 1.

40. Which of the following is the most likely cause for the main propulsion gas turbine engine tripping during start up?

- (A) Inlet air ice detection.
- (B) High oil filter differential pressure.
- (C) Low sump oil level.
- (D) Failure to achieve the minimum rpm in a certain period of time.

If choice D is selected set score to 1.

41. In the marine 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

If choice D is selected set score to 1.

42. Which of the following is an advantage of a single-shaft gas turbine engine compared to a split-shaft gas turbine engine?

- (A) Better fuel economy
- (B) Fewer moving parts
- (C) Lower starting torque
- (D) Reversible

If choice B is selected set score to 1.

43. What does the term "lock-out" of a synchro-self-shifting (SSS) clutch system mean? Illustration GT-0018

- (A) Reduction gear will not rotate.
- (B) Shaft will not rotate above 10 RPM.
- (C) SSS clutch will not engage.
- (D) Shaft will not rotate.

If choice C is selected set score to 1.

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

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

If choice D is selected set score to 1.

45. What type of metallurgical failure does Item B represent in the illustration? Illustration GT-0014

- (A) Circumferential cracking.
- (B) Axial cracking.
- (C) Weld cracking.
- (D) Radial cracking.

If choice B is selected set score to 1.

46. An axial compressor basically consists of which of the following?

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

If choice C is selected set score to 1.

47. Which of the following conditions will NOT be the result of a build-up of deposits in a gas turbine compressor?

- (A) Increased combustion gas temperatures.
- (B) Restricted air flow.
- (C) Reduced fuel consumption.
- (D) Turbine blade corrosion.

If choice C is selected set score to 1.

48. 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) seal the circumferential dovetails
- (B) provide close vane to rotor and blade to stator case clearances
- (C) control air flow through the compressor
- (D) ensure protection for the gearbox adapter when removing or replacing the bearings

If choice B is selected set score to 1.

49. You are preparing for a borescope inspection of an LM2500 gas turbine engine. You are reviewing the correct geometric orientation nomenclature which includes which of the following?

- (A) All references left, right, and radial are orientated as viewed from aft looking forward on the engine.
- (B) All references left, right, and radial are orientated as viewed from forward looking aft on the engine.
- (C) All references are made from the combustor section, forward to the HP turbine and aft to the power turbine.
- (D) All references are made from the combustor section, aft to the HP turbine and forward to the power turbine.

If choice A is selected set score to 1.

50. A turbine stage is represented by which of the following components and in which order?

- (A) One set of rotating blades, one set of stationary vanes.
- (B) Two sets of stationary vanes, one set of rotating blades.
- (C) One set of stationary vanes, one set of rotating blades.
- (D) One set of rotating vanes, one set of stationary blades.

If choice C is selected set score to 1.

51. What action should you take if full power vibration limits are exceeded on a gas turbine engine?

- (A) Reduce power to stay within limits.
- (B) Borescope the engine.
- (C) No action is needed.
- (D) Water wash the engine.

If choice A is selected set score to 1.

52. Cadmium and zinc coatings provide which of the following type of protection for the base metal?

- (A) Sealant.
- (B) Chemical.
- (C) Thermal.
- (D) Sacrificial.

If choice D is selected set score to 1.

53. A gas turbine that has a regenerator between the compression and combustion sections in which exhaust gas heat energy is added to the air charge is classified as what type of engine?

- (A) Semi-open cycle engine.
- (B) Closed cycle engine.
- (C) Open cycle engine.
- (D) Semi-closed cycle engine.

If choice D is selected set score to 1.

54. Once a compressor is broken in, which of the following factors will most likely cause blade tips to rub?

- (A) Sprayed material in the stator case
- (B) Elongation of the blade tips
- (C) Profiles on the blade tips
- (D) Failure of a rotor bearing

If choice D is selected set score to 1.

55. Assuming that the turbine inlet temperature of a gas turbine engine remains constant, which of the following operating parameter changes would be noted with an increase in the compressor inlet air temperature?

- (A) The mass air flow through the gas turbine would increase.
- (B) The power turbine output increases due to hot inlet air requiring less fuel to be heated to the same turbine inlet temperature.
- (C) The exhaust temperature would drop significantly.
- (D) The gas turbine power would drop due to reduced mass air flow.

If choice D is selected set score to 1.

56. As shown in the illustration, the HP turbine 2nd stage blades are cooled by convection, with the cooling air being discharged at which of the following? Illustration GT-0011

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

If choice B is selected set score to 1.

57. What type of main reduction gear arrangement prevents independent axial and rotational movement of the pinions?

- (A) Locked train
- (B) Hydraulic suspension
- (C) Unlocked train
- (D) Independent suspension

If choice A is selected set score to 1.

58. The buildup of contamination in a gas turbine will cause all of the following conditions EXCEPT which of the following?

- (A) Increased combustion gas temperatures
- (B) Restricted air flow
- (C) Reduced fuel consumption
- (D) Turbine blade corrosion

If choice C is selected set score to 1.

59. How many fuel igniters would be installed on the marine gas turbine engine shown in the illustration? Illustration GT-0017

- (A) 1
- (B) 2
- (C) 3
- (D) 4

If choice B is selected set score to 1.

60. When conducting a borescope inspection of the compressor, why can airfoil and tip cracks be difficult to detect?

- (A) Rotating the rotor too fast.
- (B) Borescope optics have deteriorated.
- (C) The cracks are generally tight and shallow in depth.
- (D) All of the above.

If choice D is selected set score to 1.

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

- (A) can-annular
- (B) annular
- (C) double-annular
- (D) can

If choice D is selected set score to 1.

62. What is a compressor midspan shroud?

- (A) The center of a two-piece rotor blade.
- (B) A method of securing stator blades.
- (C) A support for the tips of the stator blades.
- (D) A brace built into the middle of a rotor blade for damping.

If choice D is selected set score to 1.

63. On marine gas turbines equipped with fuel oil nozzles as shown in the illustration, the minimum fuel oil manifold pressure for proper operation should be _____. Illustration GT-0005

- (A) 40-80 psi
- (B) 80-200 psi
- (C) 200-300 psi
- (D) 300-500 psi

If choice B is selected set score to 1.

64. On a ship with a marine gas turbine as shown in the illustration, a fire emergency stop is initiated when _____. Illustration GT-0016

- (A) one of the UV flame detectors is activated
- (B) either the primary or reserve GTM CO₂ system activates
- (C) the GTM fire emergency shutdown switch located on the module is activated
- (D) all of the above

If choice D is selected set score to 1.

65. What are the two principle functions of the turbine nozzle guide vanes?

- (A) Convert the heat energy of the hot gases into kinetic energy and direct the flow of gases to the turbine rotor blades.
- (B) Convert the potential energy of the hot gases into heat energy and direct the flow of gases to the turbine rotor blades.
- (C) Convert the heat energy of the hot gases into potential energy and direct the flow of gases to the turbine rotor blades.
- (D) Convert the heat energy of the hot gases into potential energy and direct the flow of gases to the compressor rotor blades.

If choice A is selected set score to 1.

66. The circle of turbine stationary vanes that convert pressure and thermal energy to velocity energy and direct the combustion gases in the direction of turbine wheel rotation is referred to as what?

- (A) Diffuser assembly.
- (B) Rotor assembly.
- (C) Nozzle assembly.
- (D) Compressor assembly.

If choice C is selected set score to 1.

67. Which of the following statements is true regarding centrifugal compressors?

- (A) The efficiency of a centrifugal compressor is greater than that of an axial compressor.
- (B) Centrifugal compressors are complicated in design and heavy.
- (C) The impeller of a centrifugal compressor has a radial inlet and axial discharge.
- (D) The centrifugal compressor is frequently used on small, low power turbines.

If choice D is selected set score to 1.

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

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

If choice C is selected set score to 1.

69. You are preparing for a borescope inspection of a gas turbine engine. Prior to the inspection it is recommended that you do which of the following?

- (A) Water wash both the compressor and the power turbine.
- (B) Water wash the power turbine.
- (C) Water wash the compressor.
- (D) Not water wash the engine prior to the inspection.

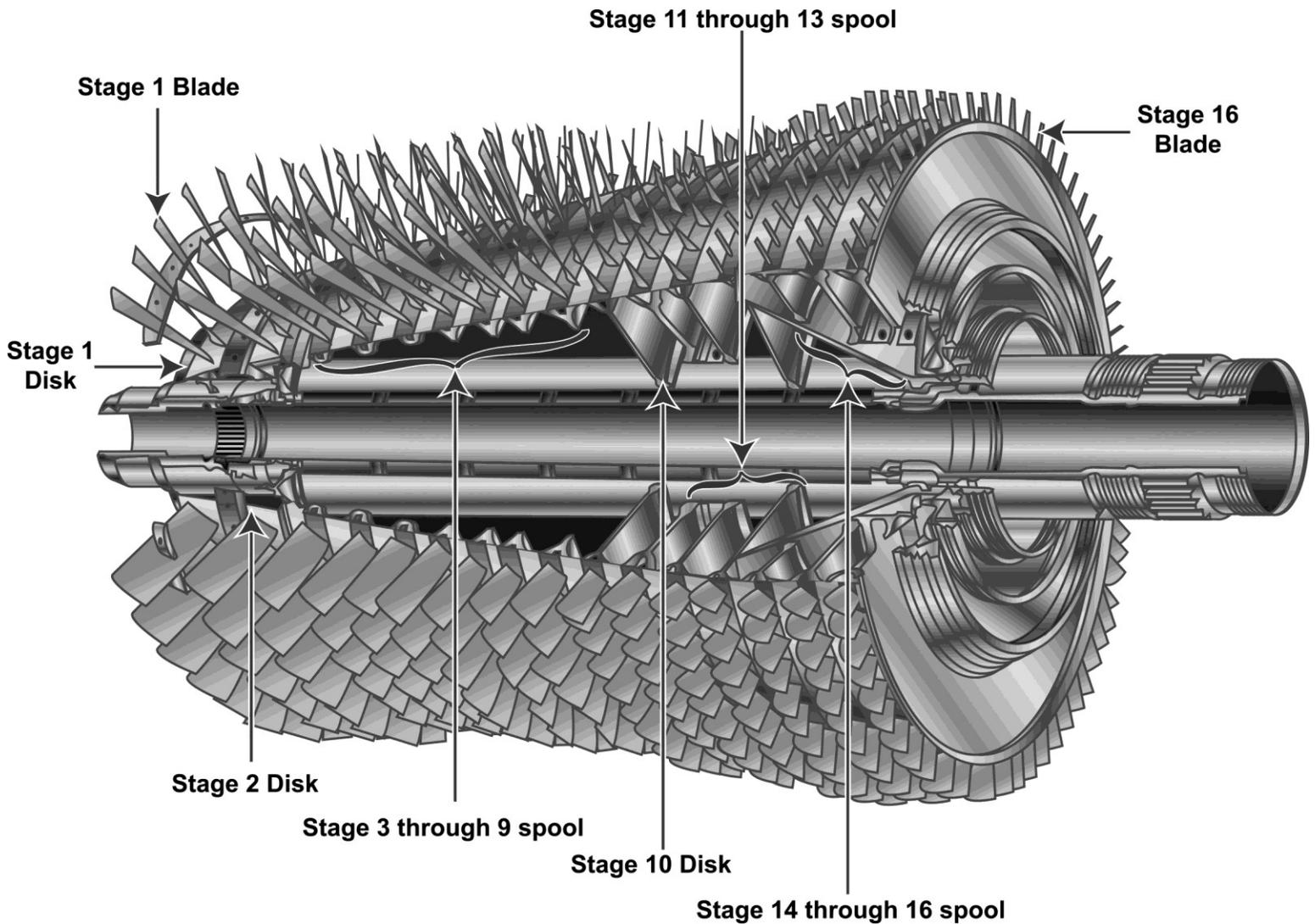
If choice C is selected set score to 1.

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

- (A) Centrifugal and axial.
- (B) Axial and lobe.
- (C) Axial and reciprocating.
- (D) Centrifugal and reciprocating.

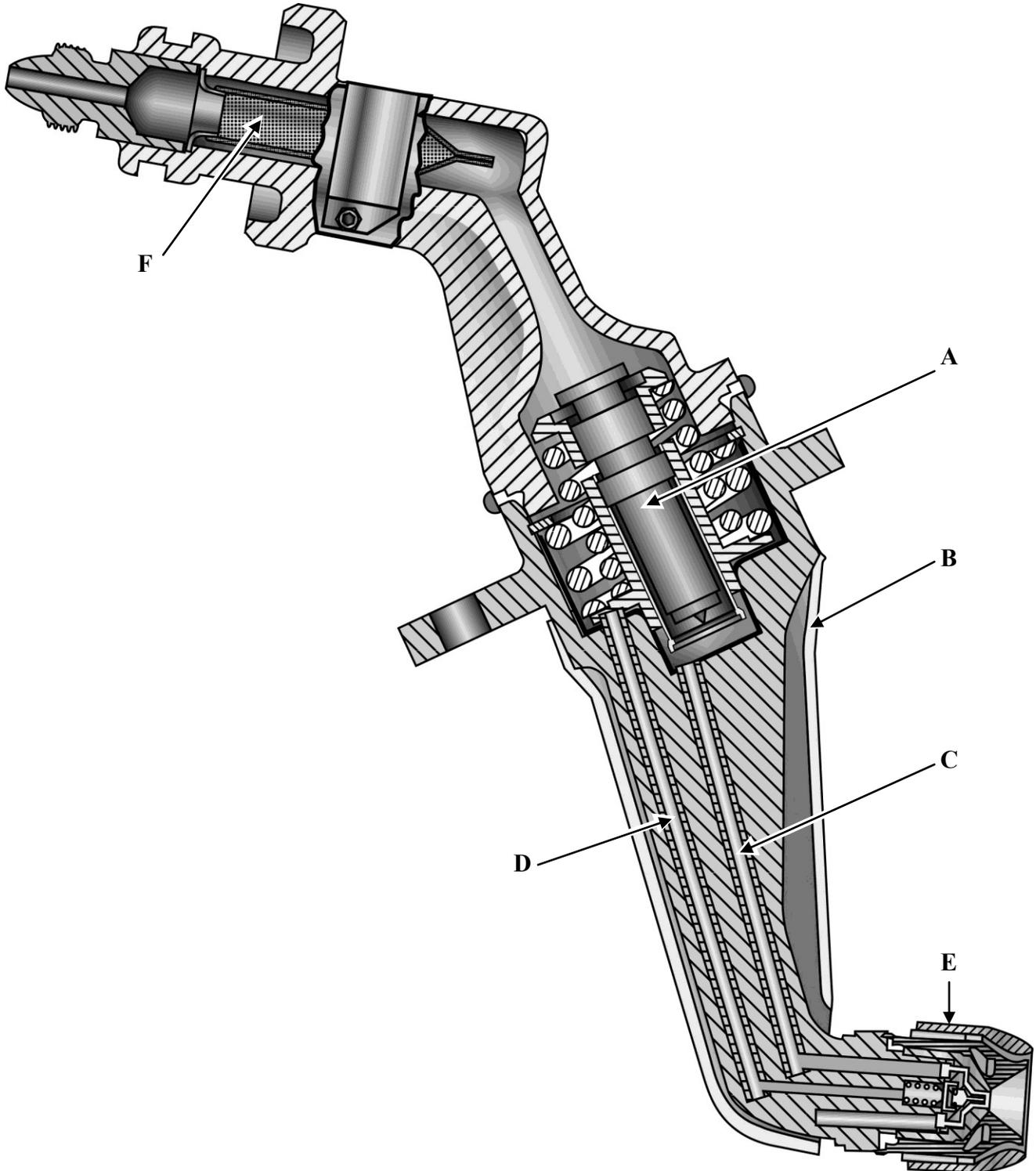
If choice A is selected set score to 1.

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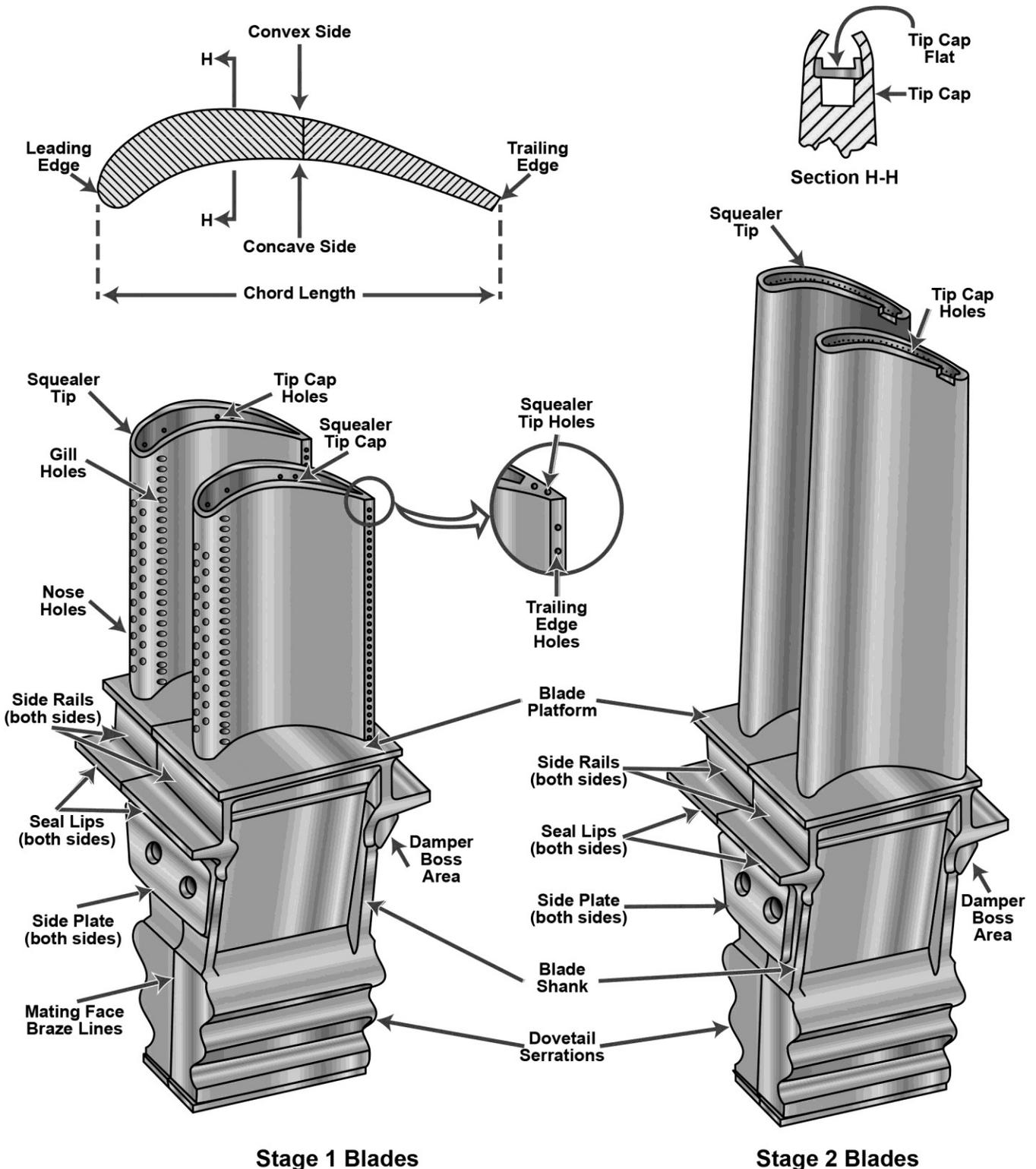
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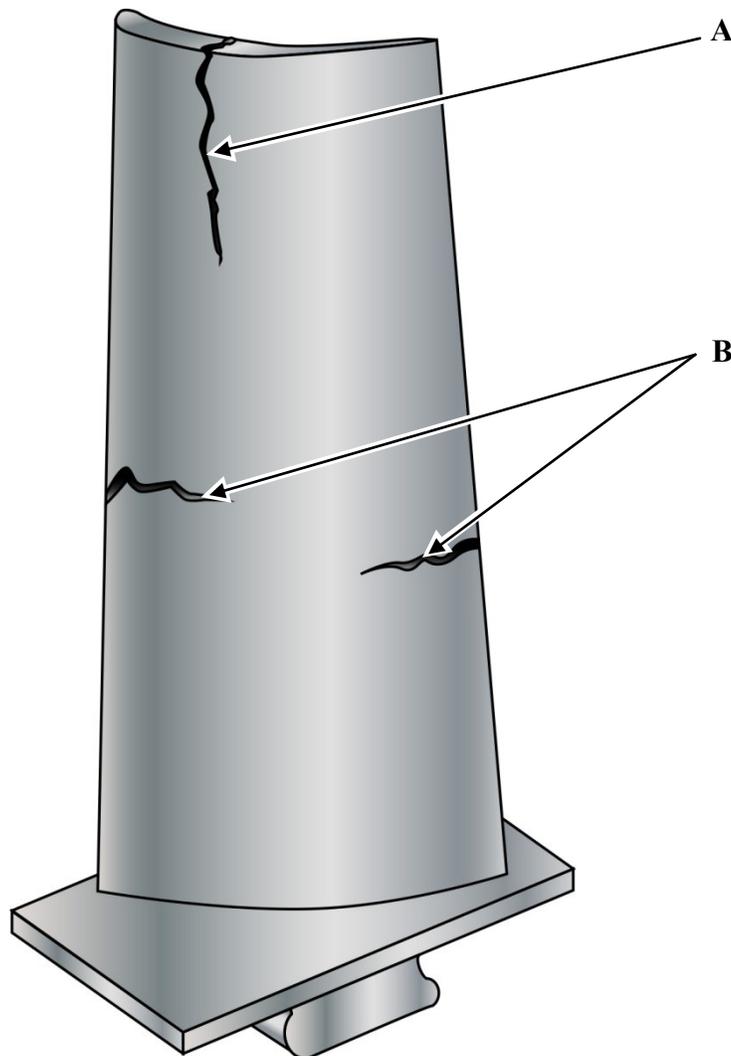
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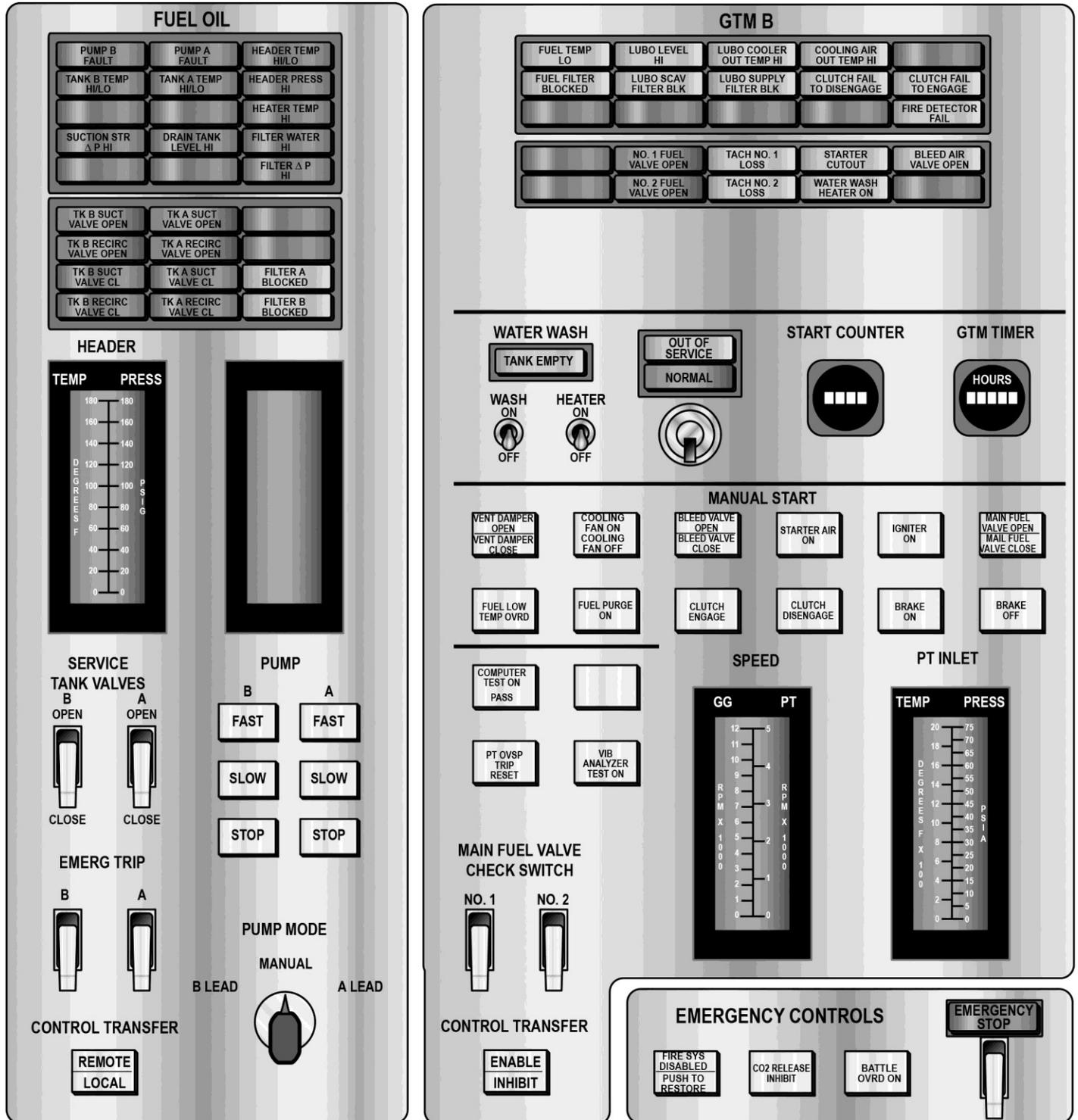
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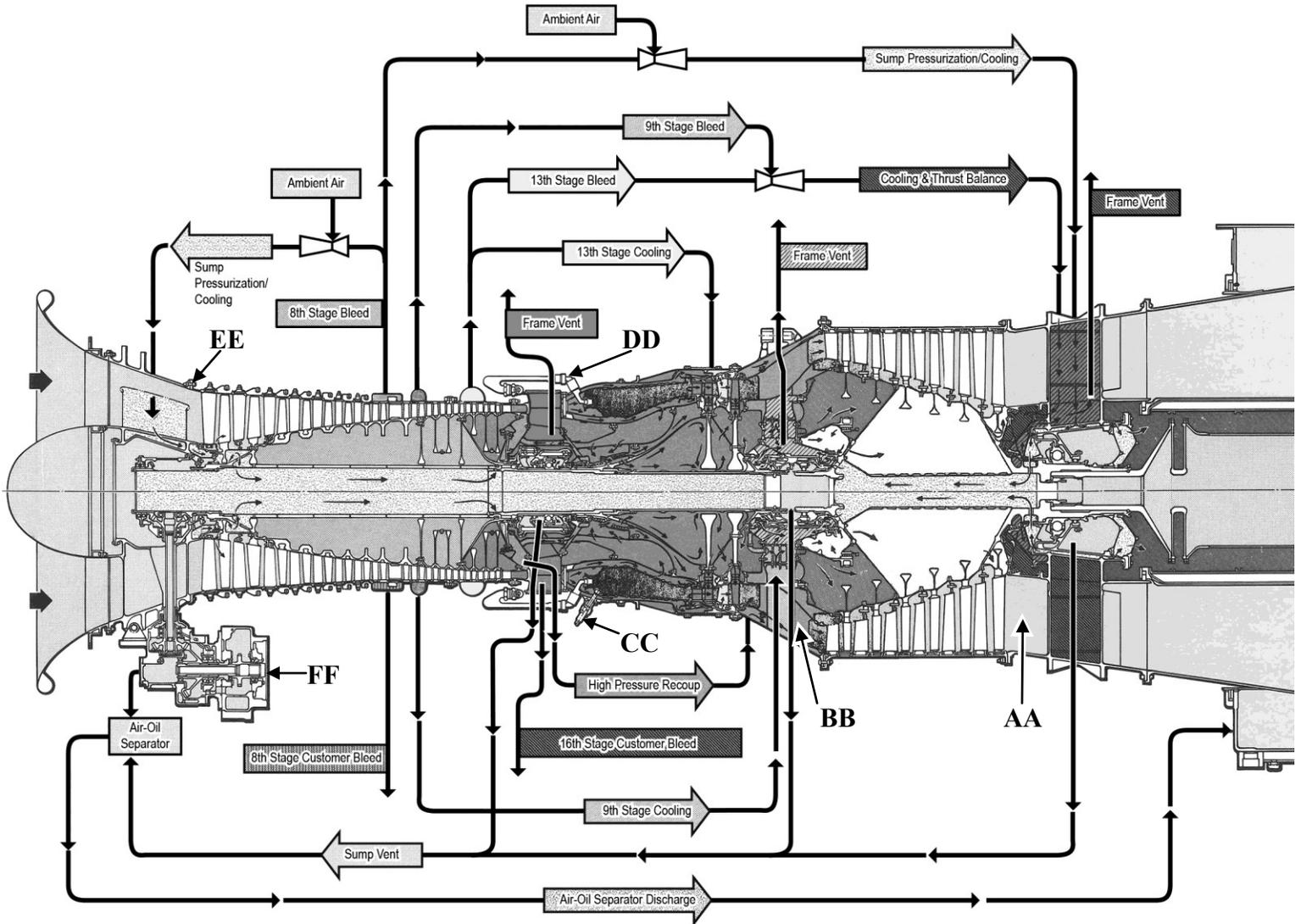
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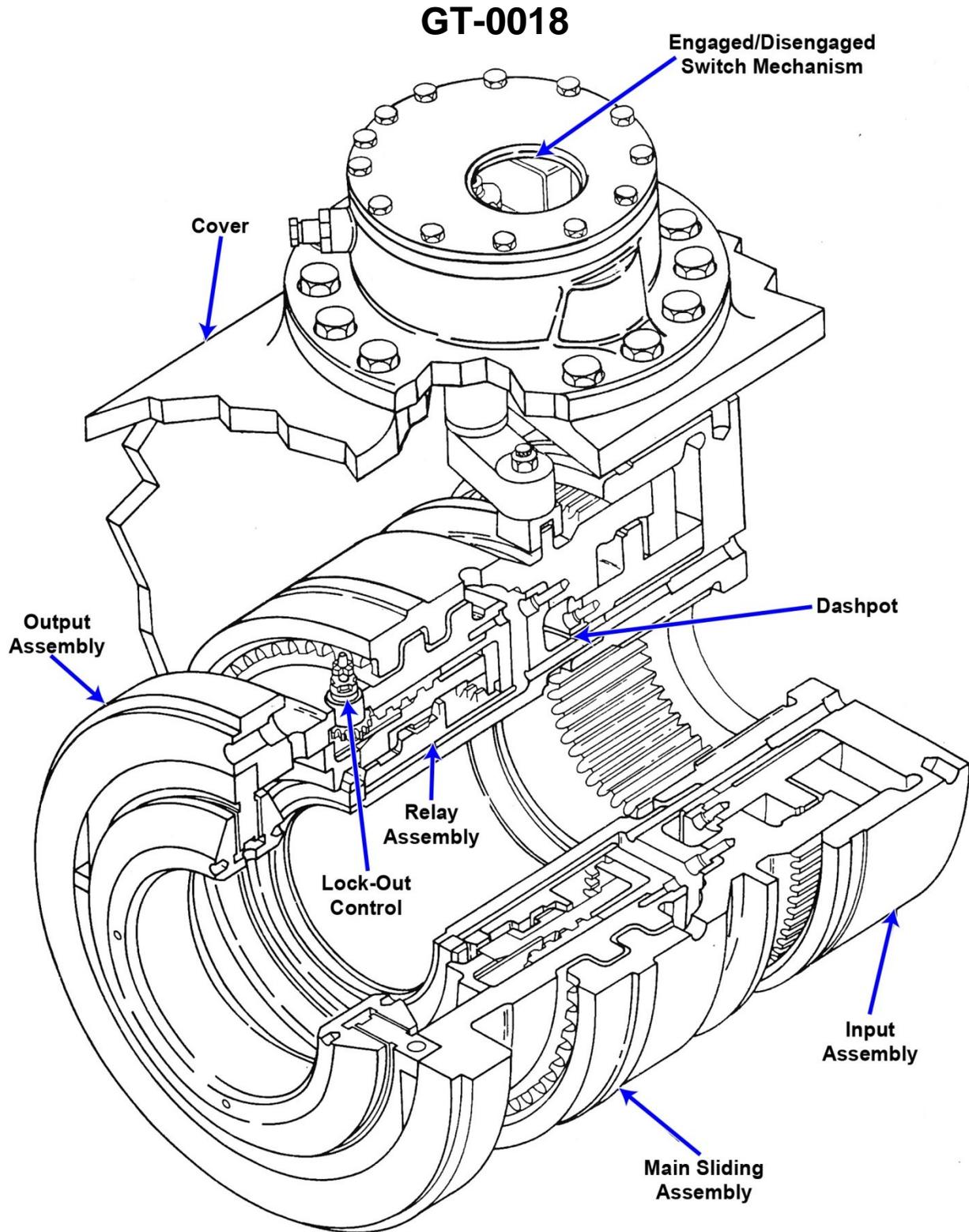


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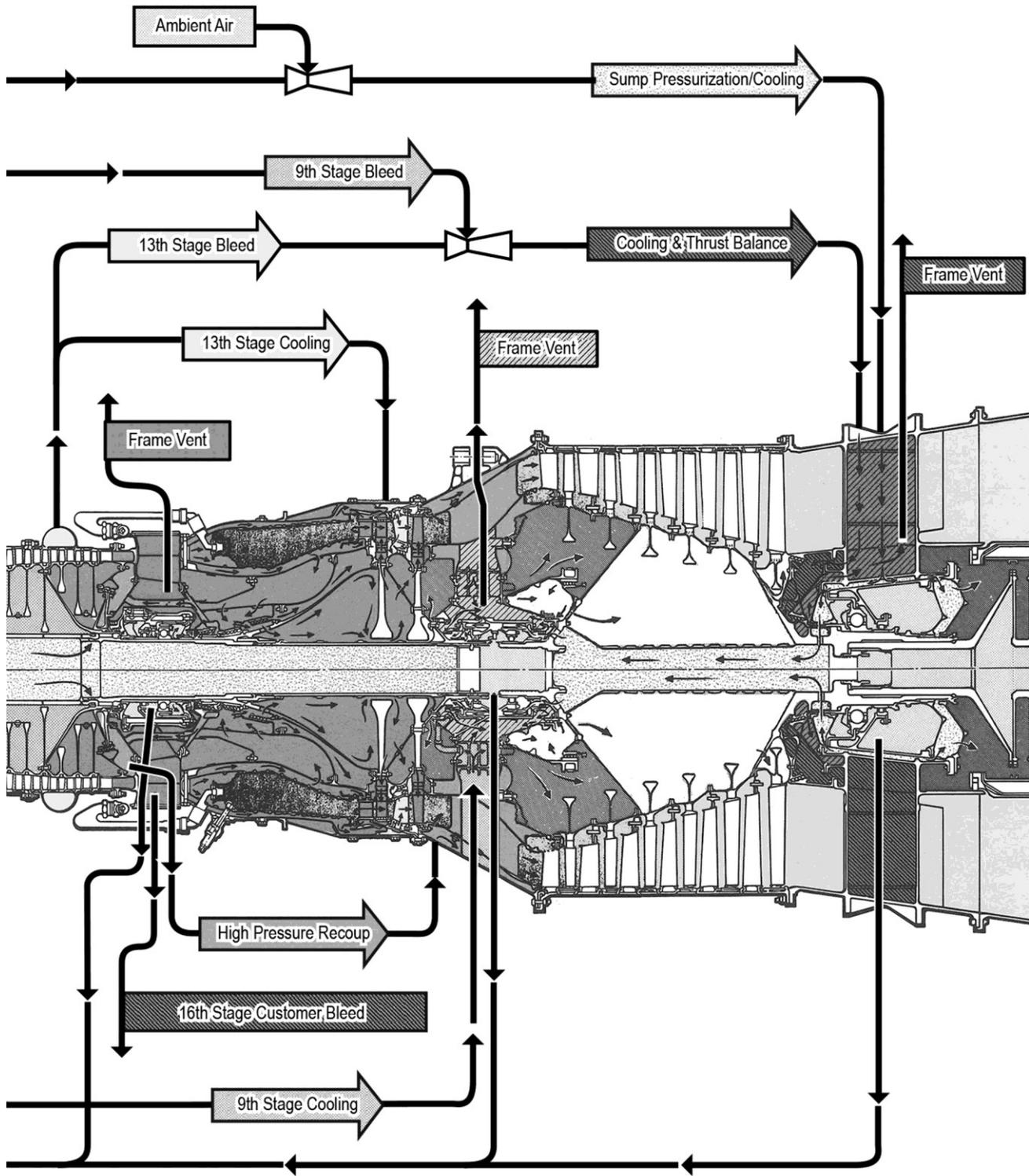


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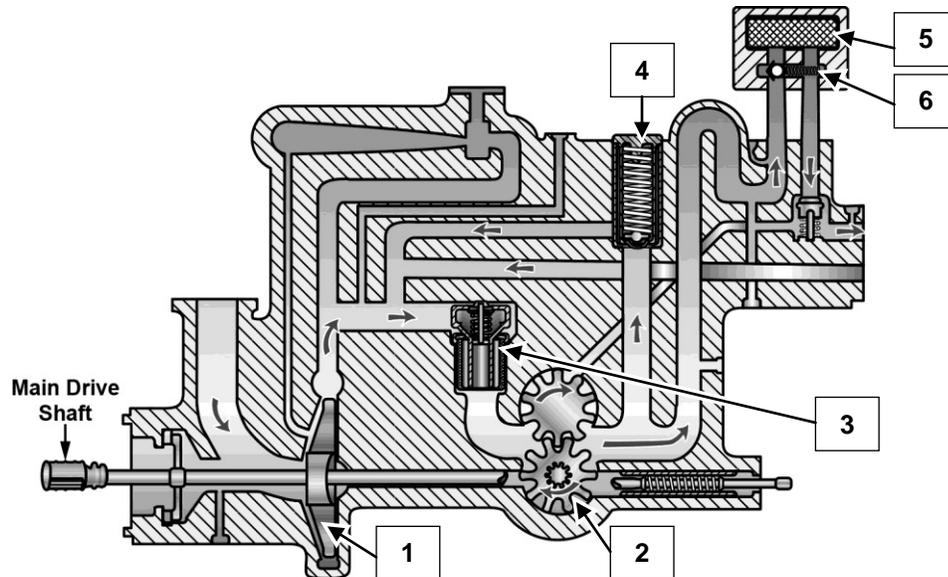
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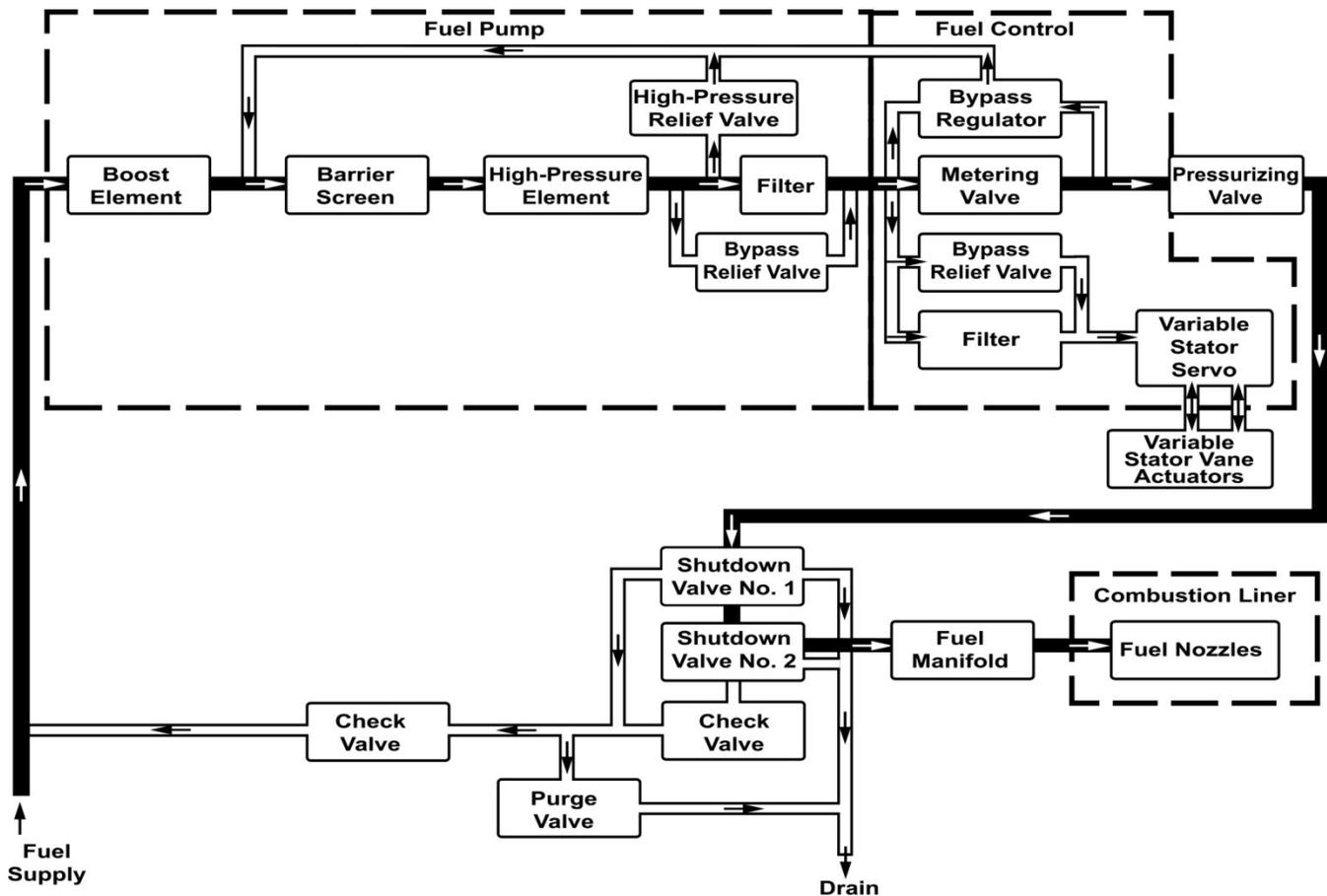
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A

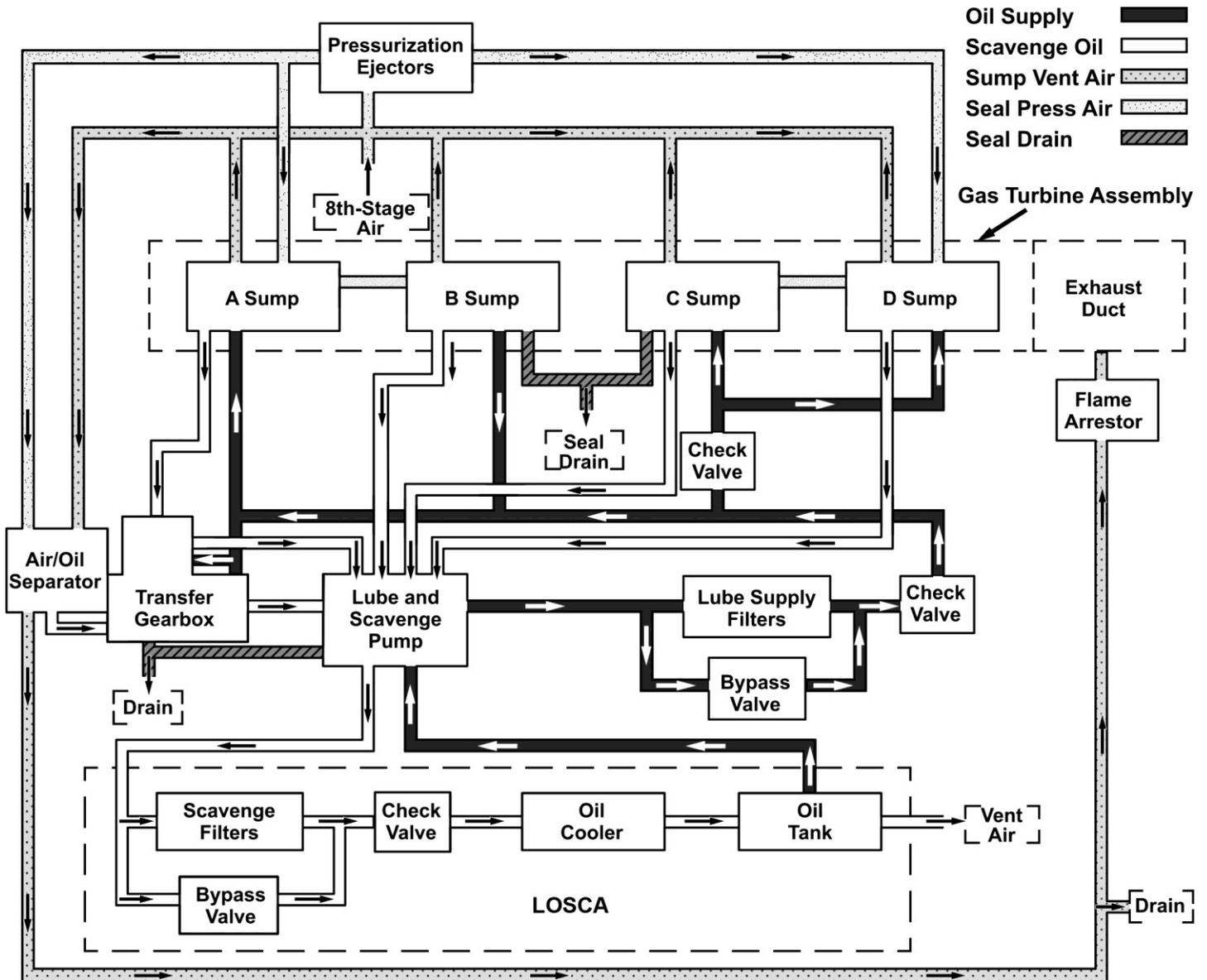


B



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