

U.S.C.G. Merchant Marine Exam

First Assistant Engineer

Q515 Gas Turbine Plants

(Sample Examination)

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

1. In general, diesel engine waste heat boiler construction is usually of the _____.

- A. dry back boiler type
- B. cyclone furnace boiler type
- C. water-tube type
- D. critical circulation boiler type

Correct answer: C

2. The pressuretrol which is installed on an auxiliary boiler senses steam pressure changes and _____.

- A. controls the flow of feedwater to the boiler
- B. monitors the boiler high water level
- C. secures the fires when a fusible plug burns out
- D. automatically regulates the quantity of oil and air flow to the burner

Correct answer: D

3. 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.

Correct answer: D

4. In comparing a centrifugal-type to an axial-type compressor, which of the following statements is true?

- A. Centrifugal compressors are more expensive to manufacture than an axial compressor.
- B. A centrifugal compressor has a lower resistance to FOD than an axial compressor.
- C. Centrifugal compressors have a higher compression ratio per stage than an axial flow compressor.
- D. Centrifugal compressors have a lower compression ratio per stage than an axial compressor.

Correct answer: C

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

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

Correct answer: C

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

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

Correct answer: C

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

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

Correct answer: B

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

Correct answer: C

9. 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 cause a velocity increase and a pressure decrease.
- 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 maintain a constant velocity and produce a pressure increase.

Correct answer: A

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

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

Correct answer: B

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

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

Correct answer: C

12. What is a compressor midspan shroud?

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

Correct answer: B

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

- A. can
- B. annular
- C. can-annular
- D. double-annular

Correct answer: A

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

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

Correct answer: C

15. 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

Correct answer: B

16. 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

Correct answer: B

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

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

Correct answer: A

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

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

Correct answer: B

19. 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. Nozzle assembly.
- B. Diffuser assembly.
- C. Rotor assembly.
- D. Compressor assembly.

Correct answer: A

20. What are the two principal functions of the turbine nozzle guide vanes?

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

Correct answer: D

21. 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.

Correct answer: D

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

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

Correct answer: B

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

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

Correct answer: B

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

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

Correct answer: D

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

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

Correct answer: D

26. When preparing to light off a cold boiler equipped with a return flow fuel oil system, the recirculating valve directs the flow of oil _____.

- A. directly to the fuel oil heater inlet for further warm-up
- B. back to the suction side of the service pump
- C. back to the fuel oil settler for further filtration
- D. directly to the deep tanks

Correct answer: B

27. 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

Correct answer: A

28. 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. Open cycle engine.
- B. Semi-open cycle engine.
- C. Closed cycle engine.
- D. Semi-closed cycle engine.

Correct answer: D

29. What type of gas turbine cycle configuration is shown in the illustration? Illustration GT-0026

- A. Intercooled type.
- B. Simple type.
- C. Recuperative type.
- D. Intercooled-recuperated type.

Correct answer: D

30. 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 compressor discharge air before it enters the combustor.
- C. Heat the intake air to the compressor.
- D. Heat the combustor discharge gas before entering the turbine.

Correct answer: B

31. To prevent overheating of the illustrated turbine blade, which of the following fluids is circulated through it via the shaped internal passages? Illustration GT-0029

- A. External compressed air.
- B. Bleed air.
- C. Cooling oil.
- D. Cooling water.

Correct answer: B

32. Assuming you maintain the same power output, how will a decrease in the compressor inlet air temperature effect a gas turbine engine's efficiency and fuel consumption?

- A. Efficiency will increase and fuel consumption will decrease.
- B. Efficiency will decrease and fuel consumption will increase.
- C. Efficiency and fuel consumption will not be effected by a change in inlet air temperature.
- D. Efficiency and fuel consumption will both increase.

Correct answer: A

33. On a gas turbine engine, a high outside air temperature can cause high turbine inlet temperature, low mass/weight of air flow through the turbine, and which of the following conditions?

- A. A requirement for more energy to achieve adequate compression
- B. Cooler exhaust gas temperature
- C. A requirement for less energy to achieve adequate compression
- D. None of the above

Correct answer: A

34. 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

Correct answer: C

35. 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

Correct answer: D

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

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

Correct answer: C

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

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

Correct answer: C

38. Which of the following is the most probable cause for the sump oil to be excessively aerated on an aeroderivative main propulsion gas turbine engine?

- A. The air oil separator is not functioning properly.
- B. Exhaust pressures are lower than normal.
- C. The compressor discharge pressure is lower than normal.
- D. Air inlet temperatures to the compressor are higher than normal.

Correct answer: A

39. 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. variable stator vane feedback lever
- B. deceleration schedule
- C. acceleration schedule
- D. all of the above

Correct answer: D

40. 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. Purge valve discharge.
- B. Booster pump discharge.
- C. Fuel oil day tank.
- D. Booster pump suction.

Correct answer: B

41. A fuel analysis report for a gas turbine propelled vessel indicates a calcium level in excess of 0.5 ppm. High calcium levels in distillate fuels for gas turbines can cause which of the following?

- A. Calcium deposits which can clog cooling holes in the turbine section.
- B. Clogged fuel filters in the fuel service system.
- C. Abrasive wear in the compressor section of the turbine.
- D. Corrosion in the combustor section of the turbine.

Correct answer: A

42. 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.
- C. Shaft will not rotate above 10 RPM.
- D. SSS clutch will not engage.

Correct answer: D

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

- A. To transfer high-speed gas turbine rotation to low-speed propeller rotation.
- B. To reduce gas turbine speed to engage the clutch.
- C. To increase gas turbine speed to engage the clutch.
- D. To transfer low-speed gas turbine rotation to high-speed propeller rotation.

Correct answer: A

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

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

Correct answer: A

45. Gear backlash is best described as which of the following?

- A. Clearance of the gears operating in parallel.
- B. Clearance of the gears that do not mesh.
- C. Radial play between the pinion teeth and bearings.
- D. Play between the surfaces of the teeth in mesh.

Correct answer: D

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

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

Correct answer: D

47. On a gas turbine powered vessel, what is the last step after an off-line water wash?

- A. Start the engine to dry it out.
- B. Open the variable stator vanes.
- C. Secure the starting system.
- D. Release the gas generator brake.

Correct answer: A

48. How do you gain access to the burner units of a can-annular combustor to perform maintenance?

- A. By sliding the can-annular case aside
- B. By disassembling the engine
- C. By removing the power turbine
- D. By removing the annular case

Correct answer: A

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

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

Correct answer: B

50. To manually rotate the GE LM2500 gas turbine engine, you should use which of the following tools?

- A. 18-inch long 3/4-inch drive socket wrench.
- B. A socket wrench with an 18-inch long 1/2-inch drive extension.
- C. 18-inch long 1/2-inch drive socket wrench.
- D. A socket wrench with an 18-inch long 3/4-inch drive extension.

Correct answer: D

51. 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.

Correct answer: A

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

Correct answer: C

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

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

Correct answer: B

54. A reddish-colored oxide usually forms on which of the following metals?

- A. Aluminum.
- B. Chromium.
- C. Magnesium.
- D. Steel.

Correct answer: D

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

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

Correct answer: A

56. 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.

Correct answer: A

57. Compressor tip clang can be usually attributed to which of the following operating conditions?

- A. Continuous high-power operation.
- B. Compressor stall.
- C. Overloading.
- D. Continuous low-power operation.

Correct answer: B

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

- A. Midspan damper.
- B. Tip clang.
- C. Blade root.
- D. Carbonyl pad.

Correct answer: C

59. When tip clang takes place on a gas turbine engine, the major damage occurs to what area of the blade?

- A. Root
- B. Tip
- C. Midspan
- D. Chord

Correct answer: A

60. 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 lift up 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 bend into the flow path.

Correct answer: C

61. While underway on a ship with gas turbine engines, the most likely indication of an engine stall is which of the following?

- A. Combustor temperature increases.
- B. Engine fails to accelerate.
- C. A loud bang is heard.
- D. All of the above.

Correct answer: D

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

- A. One
- B. Two
- C. Three
- D. Four

Correct answer: B

63. 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

Correct answer: B

64. The struts of the compressor front frame provide passages for all of the following mediums EXCEPT for which of the following?

- A. Scavenge oil
- B. Fuel oil
- C. Seal-pressurization air
- D. Lube oil

Correct answer: B

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

- A. cannular
- B. can-annular
- C. annular
- D. can

Correct answer: C

66. In order to get a ready indication for a normal start with a GE LM2500 marine gas turbine, what permissive(s) must be met?

- A. Gas generator speed must be less than 1200 RPM and all engine trips reset.
- B. Bleed air valve must be closed.
- C. Fuel supply pressure must be greater than 8 psig.
- D. All of the above.

Correct answer: D

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

Correct answer: D

68. 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. sump pressurization and cooling
- C. power turbine cooling
- D. power turbine balance piston cavity pressurization

Correct answer: A

69. 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. the GTM fire emergency shutdown switch located on the module is activated
- C. either the primary or reserve GTM CO2 system activates
- D. all of the above

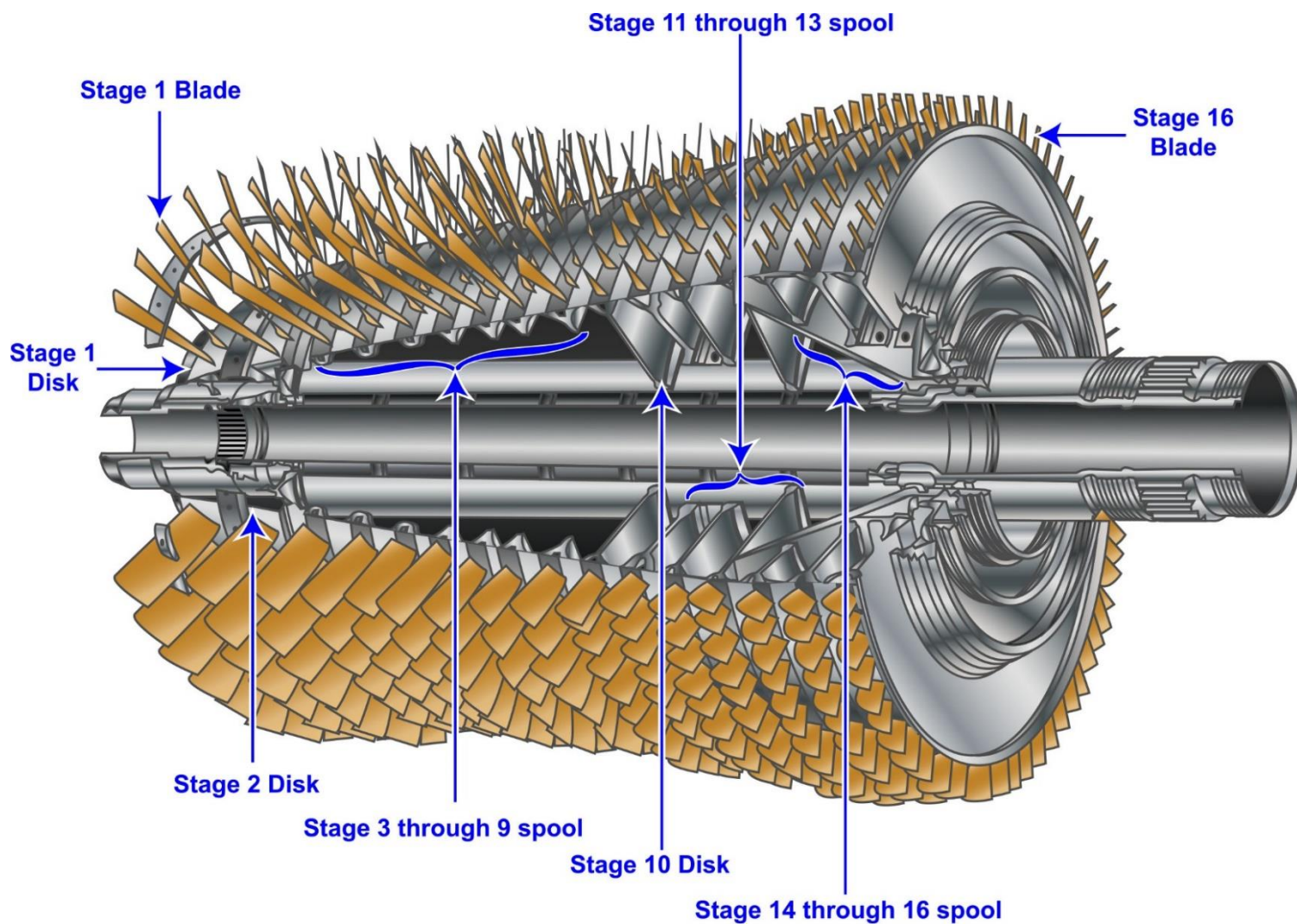
Correct answer: D

- 70.** Which of the following is the most likely cause for the main propulsion gas turbine engine tripping during start up?
- A. High oil filter differential pressure.
 - B. Low sump oil level.
 - C. Failure to achieve the minimum rpm in a certain period of time.
 - D. Inlet air ice detection.

Correct answer: C



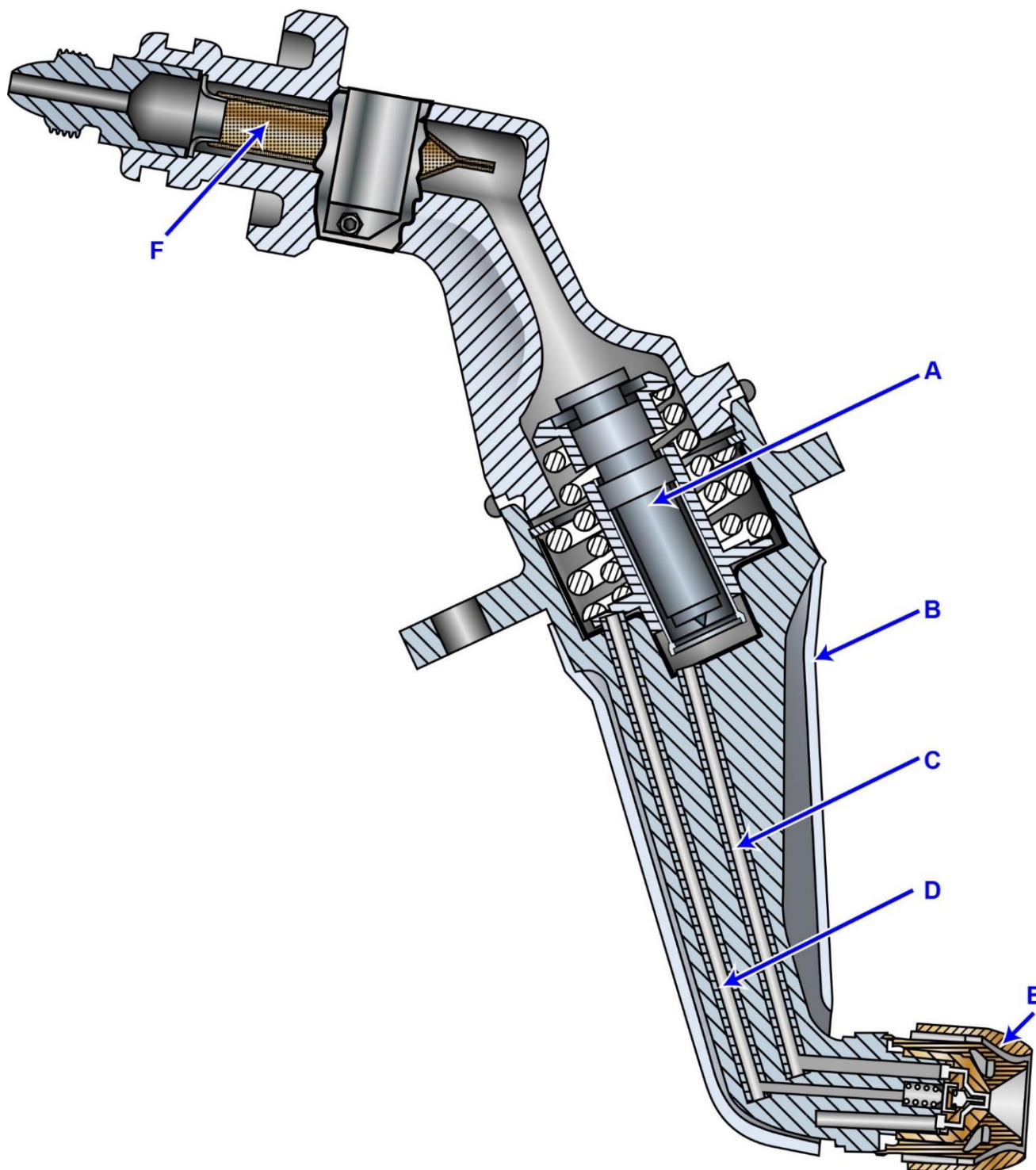
GT-0004



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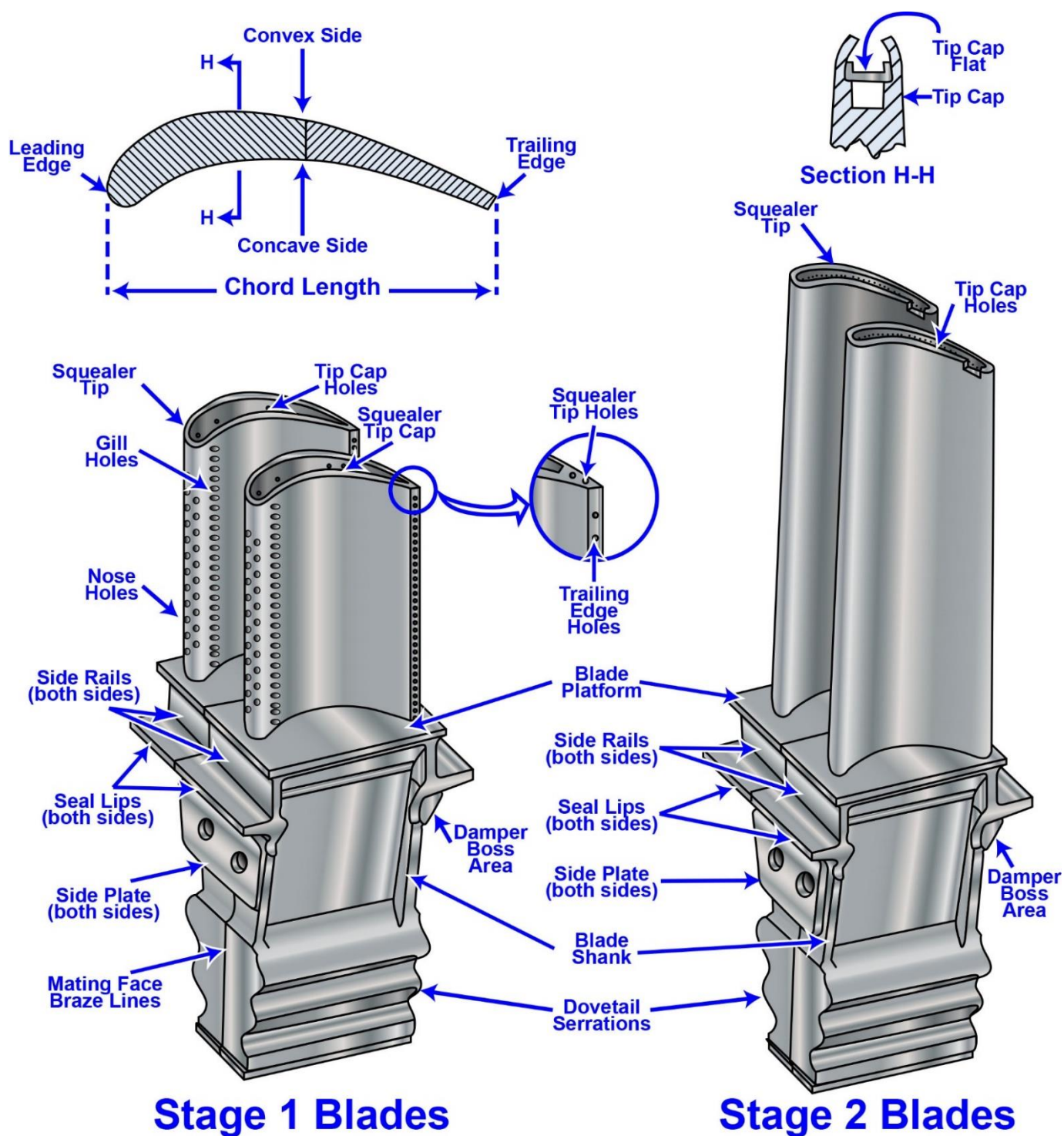
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GT-0011



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GT-0016

FUEL OIL

PUMP B FAULT	PUMP A FAULT	HEADER TEMP HI/LO
TANK B TEMP HI/LO	TANK A TEMP HI/LO	HEADER PRESS HI
		HEATER TEMP HI
SUCTION STR Δ P HI	DRAIN TANK LEVEL HI	FILTER WATER HI
		FILTER Δ P HI

TK B SUCT VALVE OPEN	TK A SUCT VALVE OPEN	
TK B RECIRC VALVE OPEN	TK A RECIRC VALVE OPEN	
TK B SUCT VALVE CL	TK A SUCT VALVE CL	FILTER A BLOCKED
TK B RECIRC VALVE CL	TK A RECIRC VALVE CL	FILTER B BLOCKED

HEADER

TEMP	PRESS
180	180
160	160
140	140
120	120
100	100
80	80
60	60
40	40
20	20
0	0

SERVICE TANK VALVES

B OPEN	A OPEN
B CLOSE	A CLOSE

EMERG TRIP

B	A
B	A

PUMP

B FAST	A FAST
B SLOW	A SLOW
B STOP	A STOP

PUMP MODE

MANUAL	
B LEAD	A LEAD

CONTROL TRANSFER

REMOTE	LOCAL
--------	-------

GTM B

FUEL TEMP LO	LUBO LEVEL HI	LUBO COOLER OUT TEMP HI	COOLING AIR OUT TEMP HI	
FUEL FILTER BLOCKED	LUBO SCAV FILTER BLK	LUBO SUPPLY FILTER BLK	CLUTCH FAIL TO DISENGAGE	CLUTCH FAIL TO ENGAGE
				FIRE DETECTOR FAIL

	NO. 1 FUEL VALVE OPEN	TACH NO. 1 LOSS	STARTER CUTOUT	BLEED AIR VALVE OPEN
	NO. 2 FUEL VALVE OPEN	TACH NO. 2 LOSS	WATER WASH HEATER ON	

WATER WASH

TANK EMPTY

OUT OF SERVICE

NORMAL

START COUNTER

START COUNTER

GTM TIMER

HOURS

MANUAL START

VENT DAMPER OPEN	COOLING FAN ON	BLEED VALVE OPEN	STARTER AIR ON	IGNITER ON	MAIN FUEL VALVE OPEN
VENT DAMPER CLOSE	COOLING FAN OFF	BLEED VALVE CLOSE			MAIN FUEL VALVE CLOSE
FUEL LOW TEMP OVRD	FUEL PURGE ON	CLUTCH ENGAGE	CLUTCH DISENGAGE	BRAKE ON	BRAKE OFF
COMPUTER TEST ON					
PT OVSP TRIP RESET					

SPEED

GG	PT
12	5
11	4
10	3
9	2
8	1
7	0
6	0
5	0
4	0
3	0
2	0
1	0
0	0

PT INLET

TEMP	PRESS
20	75
18	70
16	65
14	60
12	55
10	50
8	45
6	40
4	35
2	30
0	25
0	20
0	15
0	10
0	5
0	0

MAIN FUEL VALVE CHECK SWITCH

NO. 1	NO. 2

CONTROL TRANSFER

ENABLE	INHIBIT
--------	---------

EMERGENCY CONTROLS

FIRE SYS DISABLED PUSH TO RESTORE	CO2 RELEASE INHIBIT	BATTLE OVRD ON	EMERGENCY STOP
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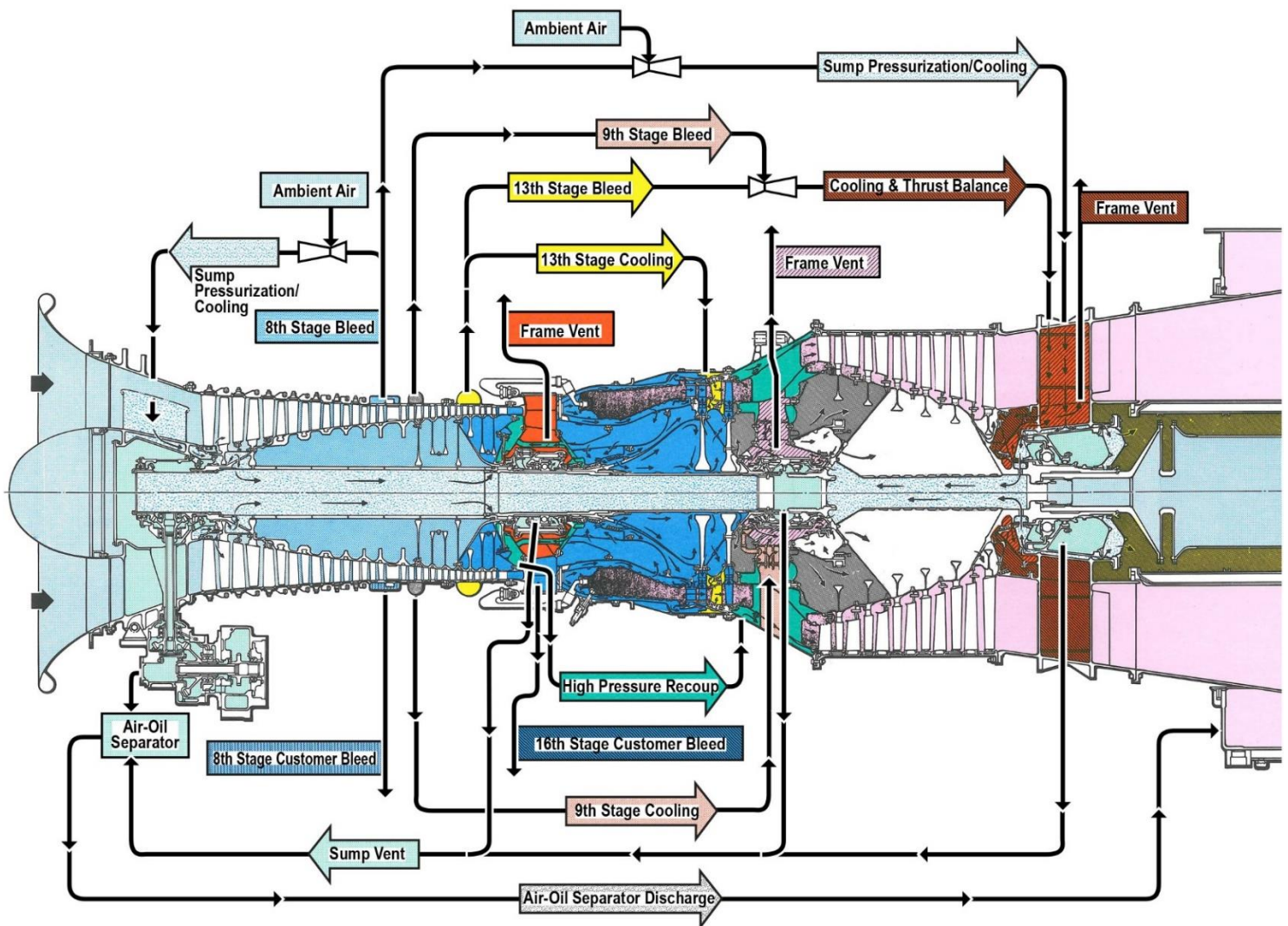
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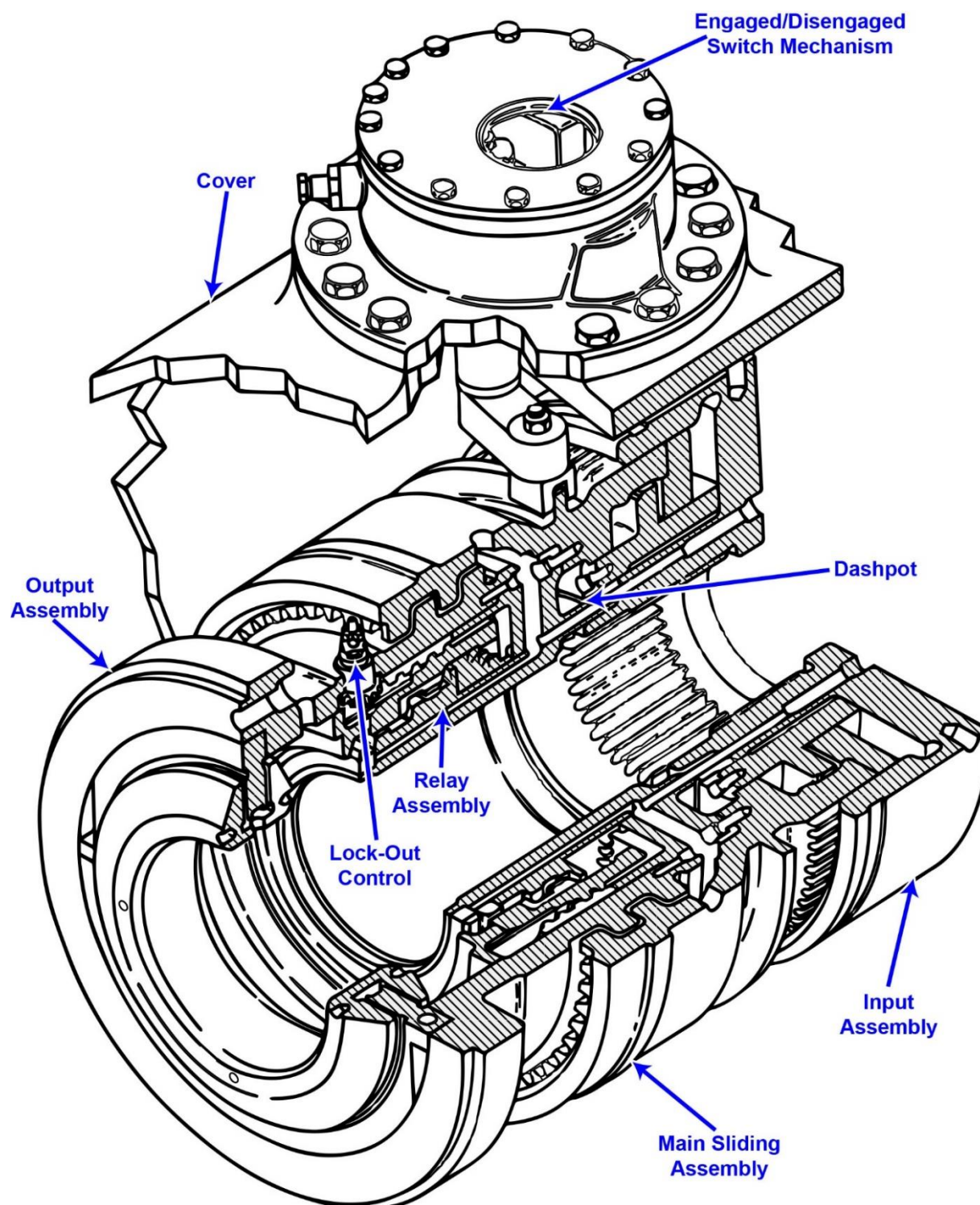
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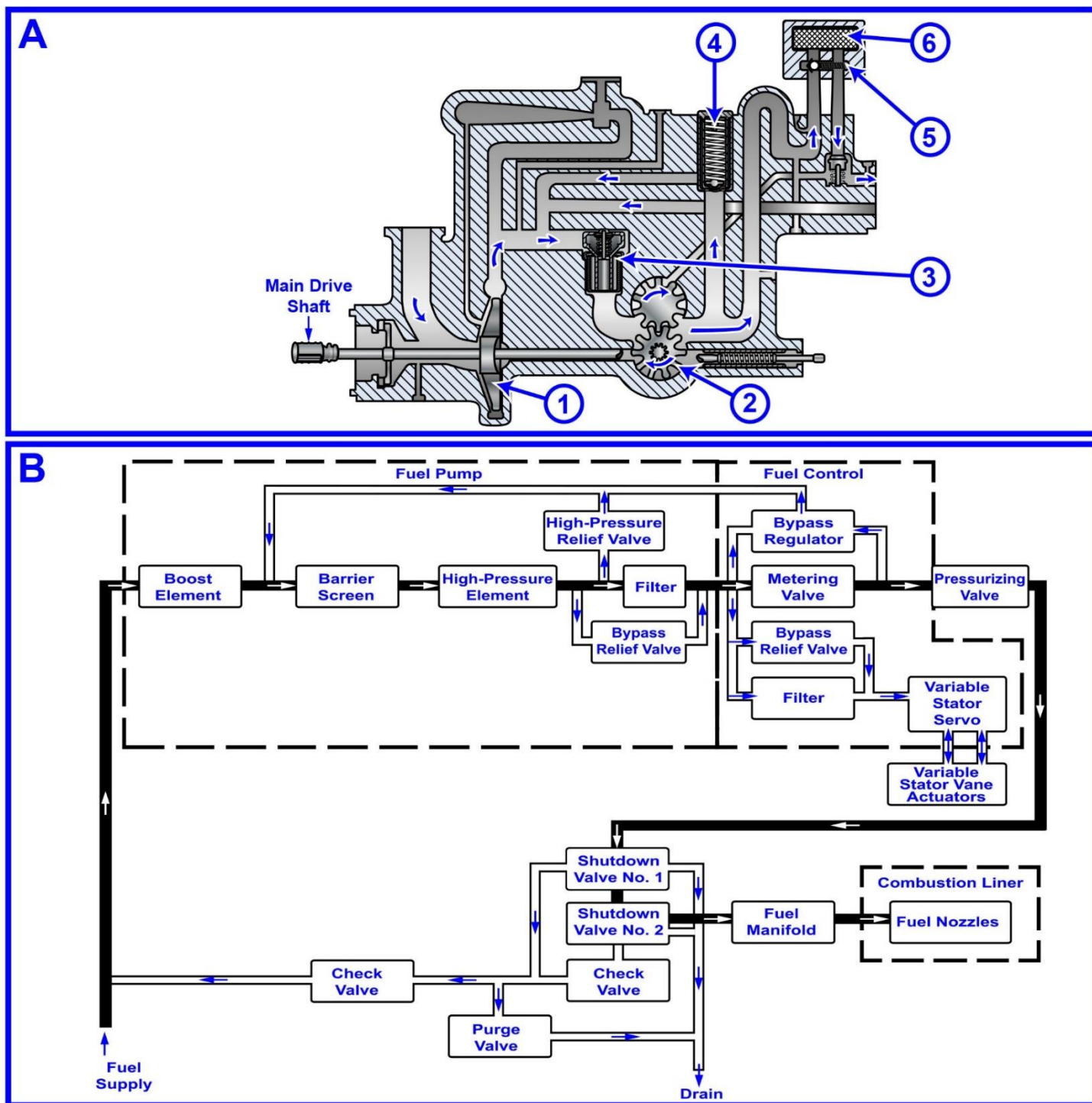
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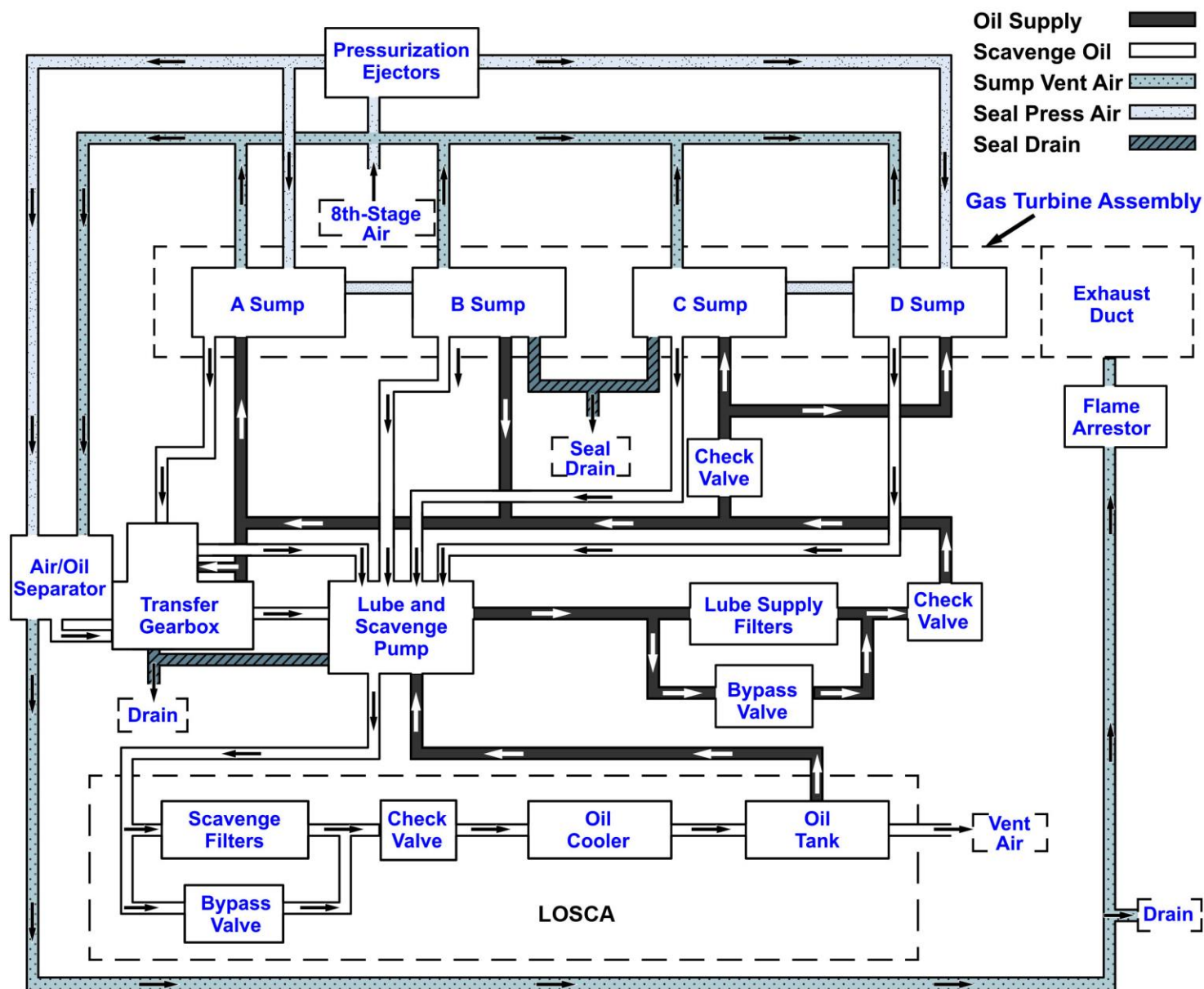
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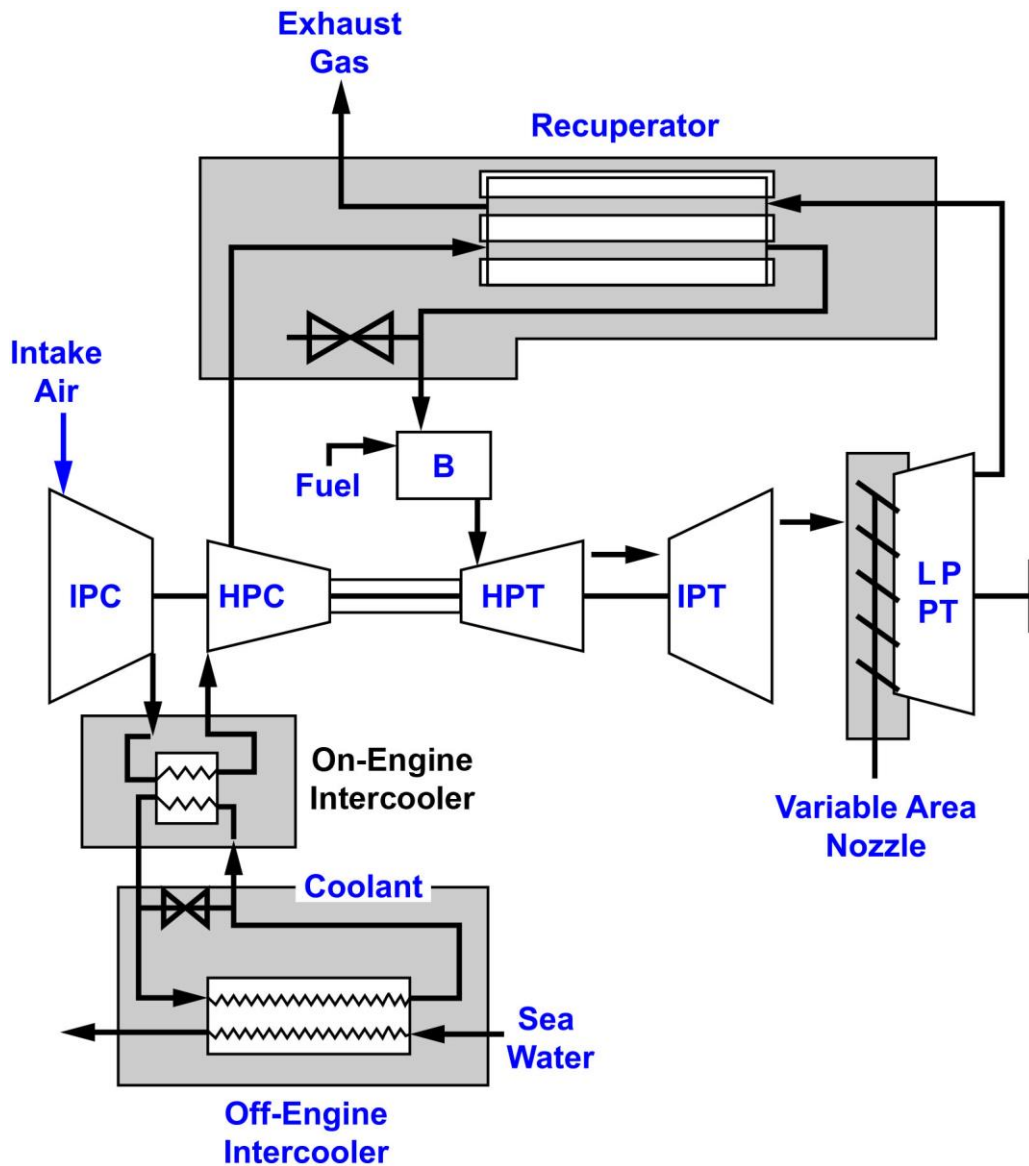
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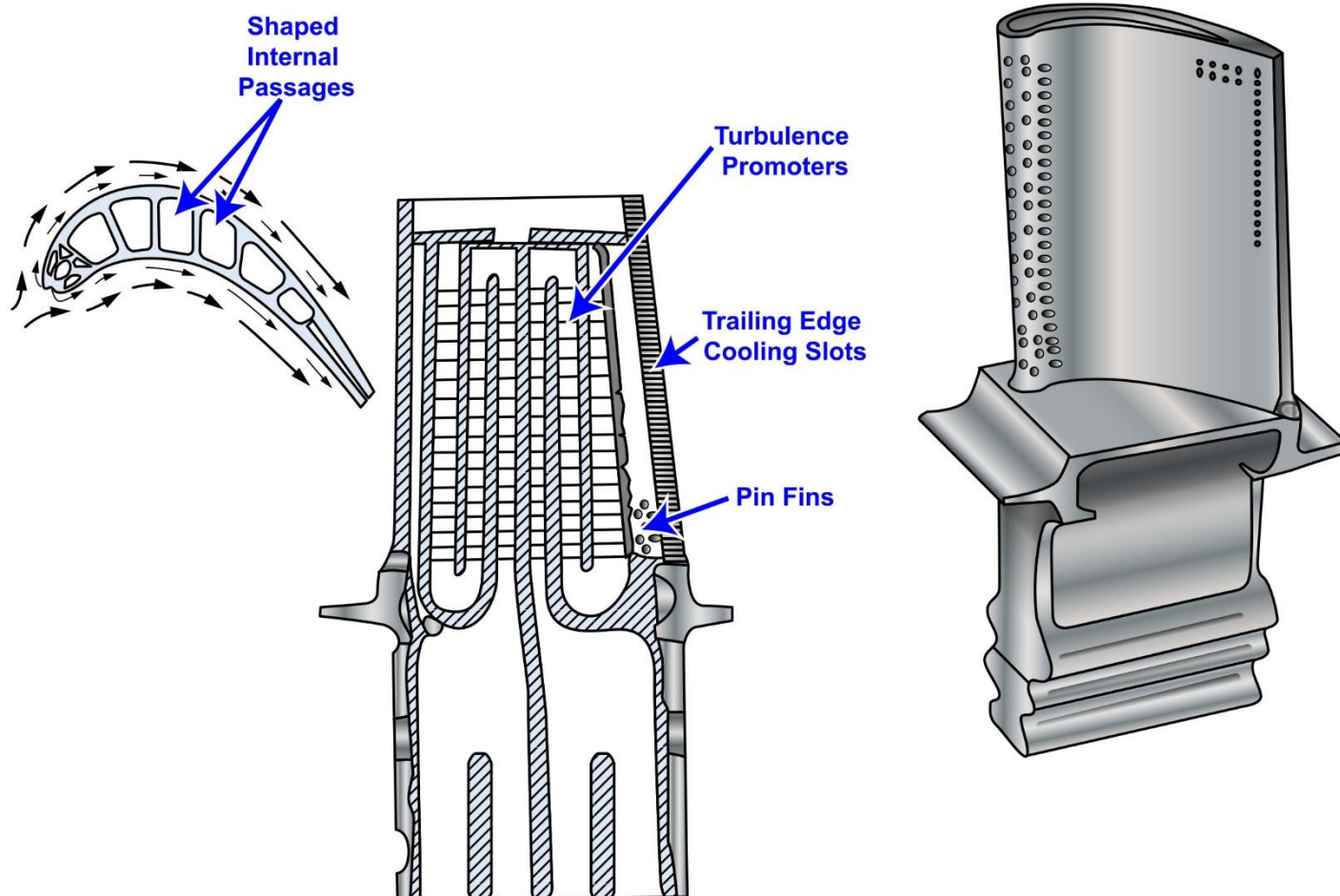
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GT-0029



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