

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 the operation of a marine propulsion gas turbine, kinetic and thermal energy required to drive the main propeller shaft are extracted by the _____.
- A. power turbine
 - B. COWL diffuser
 - C. multi-stage compressor
 - D. Variable Stator Vane actuators

Correct answer: A

2. 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

Correct answer: D

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

Correct answer: D

4. In the marine 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. Frame vent bleed air
 - B. 9th stage compressor air
 - C. 13th stage compressor air
 - D. 16th stage compressor air

Correct answer: C

5. 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

6. 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

Correct answer: D

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

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

Correct answer: C

8. 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. Seal-pressurization air
- C. Fuel oil
- D. Lube oil

Correct answer: C

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

Correct answer: D

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

Correct answer: D

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

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

Correct answer: D

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

Correct answer: B

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

Correct answer: D

14. What design feature is incorporated into the main propulsion gas turbine to eliminate compressor surge?
- A. The governor maintains the compressor turbine speed constant.
 - B. The governor adjusts the fuel to maintain the turbine inlet temperature constant.
 - C. Fuel modulating function is incorporated into the governor control system.
 - D. Variable compressor stator vanes are used.

Correct answer: D

15. How is the lube oil supplied to each bearing in a gas turbine engine controlled?
- A. Flow divider
 - B. Calibrated orifice
 - C. Lube oil pump
 - D. Regulating valve

Correct answer: B

16. The electrostatic vent fog precipitator removes oil mist from which of the following areas?
- A. Lube oil storage tank
 - B. Gas turbine engine
 - C. Main reduction gear
 - D. Synchronous self-shifting clutch

Correct answer: C

17. A gas turbine engine's main lube oil system pump check valve serves to maintain system prime and perform what other function?
- A. To return oil to the main reduction gear sump
 - B. To increase system pressure
 - C. To prevent reverse flow of oil through a secured pump
 - D. None of the above

Correct answer: C

18. Your first step in response to a gas turbine engine high lube oil sump temperature alarm would be which of the following?
- A. Check the oil filter differential pressure.
 - B. De-couple the engine from the main reduction gear.
 - C. Check the oil pressure to the sump.
 - D. Reduce engine speed.

Correct answer: D

19. 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. Fuel oil day tank
 - C. Purge valve discharge
 - D. Booster pump discharge

Correct answer: D

20. The fuel purge valve on the marine gas turbine shown in the illustration, is opened _____. Illustration GT-0017
- A. prior to starting
 - B. automatically with auto sequencing
 - C. manually by the operator
 - D. all of the above

Correct answer: D

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

Correct answer: B

22. What does the term "lock-out" of a synchro-self-shifting (SSS) clutch system mean? Illustration GT-0018
- A. SSS clutch will not engage.
 - B. Shaft will not rotate.
 - C. Shaft will not rotate above 10 RPM.
 - D. Reduction gear will not rotate.

Correct answer: A

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

Correct answer: A

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

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

Correct answer: A

25. In cases where both the pinion and gear teeth of the main reduction gear have been slightly indented by foreign material, what action should you take?

- A. Both the pinion and gear should be relieved of all raised metal around the indentation.
- B. Remove the foreign material that caused the indentation and return the unit to service.
- C. Replace both the pinion and gear.
- D. Closely monitor the damage to see if it spreads.

Correct answer: A

26. 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 3/4-inch drive extension.
- C. 18-inch long 1/2-inch drive socket wrench.
- D. A socket wrench with an 18-inch long 1/2-inch drive extension.

Correct answer: B

27. Why is safety-wiring, or lock wiring of gas turbine parts required?

- A. Maintain lubrication
- B. Maintain fastener torque
- C. Prevent disengagement of parts
- D. Prevent corrosion

Correct answer: C

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

Correct answer: D

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

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

Correct answer: C

30. 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

Correct answer: D

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

Correct answer: D

32. 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

33. Zero reference for the GE LM2500 gas turbine engine is established by the use of which of the following engine components?

- A. Vane blades
- B. Vane shrouds
- C. Carboloy blade pads
- D. Locking lug blades

Correct answer: D

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

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

Correct answer: D

35. 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

Correct answer: C

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

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

Correct answer: D

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

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

Correct answer: A

38. 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

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

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

Correct answer: B

40. 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. Carboloy pad

Correct answer: C

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

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

Correct answer: A

42. Which of the following is the most probable cause if, while underway, the main propulsion gas turbine air intake blow-in doors open?

- A. Ice has formed on the air intakes.
- B. Exhaust pressures are higher than normal.
- C. Air inlet temperatures to the compressor are higher than normal.
- D. Air inlet pressures to the compressor are higher than normal.

Correct answer: A

43. Why should the main steam stop valve of an auxiliary boiler be eased off its seat and then gently closed before lighting off?

- A. To ensure that the valve will not be seized shut when hot
- B. To check for a tight bonnet seal
- C. To check the valve packing
- D. To examine the valve stem for scars or nicks

Correct answer: A

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

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

Correct answer: D

45. 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

46. 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

Correct answer: D

47. If after reducing power to a GTE in response to a high lube oil supply temperature alarm, the temperature continues to rise, your next step should be to _____.
- A. shutdown the engine
 - B. continue to reduce power
 - C. waterwash the engine
 - D. check oil consumption

Correct answer: A

48. In comparing a centrifugal-type to an axial-type compressor, which of the following statements is true?
- A. A centrifugal compressor has a lower resistance to FOD than an axial compressor.
 - B. Centrifugal compressors have a higher compression ratio per stage than an axial flow compressor.
 - C. Centrifugal compressors are more expensive to manufacture than an axial compressor.
 - D. Centrifugal compressors have a lower compression ratio per stage than an axial compressor.

Correct answer: B

49. 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

50. Each stage of an axial compressor of a gas turbine can compress the atmospheric air a total of how many times?
- A. 1.2 times
 - B. 2.2 times
 - C. 3.2 times
 - D. 4.2 times

Correct answer: A

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

Correct answer: D

52. Variable stator vanes give an axial gas turbine compressor which of the following capabilities?

- A. Efficiency at various speeds
- B. Ability to operate at constant speeds
- C. Increases pressure ratios
- D. Increased primary air flow

Correct answer: A

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

Correct answer: C

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

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

Correct answer: A

55. What is a compressor midspan shroud?

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

Correct answer: C

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

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

Correct answer: B

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

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

Correct answer: A

58. Most GTE fuel nozzles have passages for all of the following except _____.

- A. compressed air
- B. primary fuel flow
- C. cooling water
- D. secondary fuel flow

Correct answer: C

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

Correct answer: B

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

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

Correct answer: C

61. 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 vanes, one set of stationary blades.
- D. One set of rotating blades, one set of stationary vanes.

Correct answer: A

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

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

Correct answer: B

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

Correct answer: D

64. Turbine disks are commonly attached to the shaft by which of the following methods?

- A. Locking tabs or retaining rings
- B. Riveted or pinned
- C. Pinned or locking tabs
- D. Bolted or welded

Correct answer: D

65. 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

66. 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. Reversible
- D. Lower starting torque

Correct answer: B

67. What type of air seal is used in the combustor and turbine midframe of a gas turbine?

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

Correct answer: D

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

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

Correct answer: B

69. 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 at the compressor discharge
- D. Changes only once from inlet to outlet

Correct answer: A

70. 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. Inlet plenum
- B. Turning vanes
- C. Diffuser
- D. Impeller

Correct answer: C

GT-0016

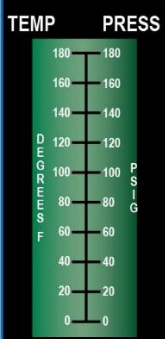
FUEL OIL

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



SERVICE


TANK VALVES

B OPEN




CLOSE

A OPEN




CLOSE

B



CLOSE

A



CLOSE

PUMP

B

FAST

SLOW

STOP

A

FAST


SLOW

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

WASH ON



OFF


HEATER ON



OFF

OUT OF SERVICE

NORMAL



START COUNTER

GTM TIMER

HOURS

MANUAL START

VENT DAMPER OPEN VENT DAMPER CLOSE	COOLING FAN ON COOLING FAN OFF	BLEED VALVE OPEN BLEED VALVE CLOSE	STARTER AIR ON	IGNITER ON	MAIN FUEL VALVE OPEN MAIL FUEL VALVE CLOSE
FUEL LOW TEMP OVRD	FUEL PURGE ON	CLUTCH ENGAGE	CLUTCH DISENGAGE	BRAKE ON	BRAKE OFF


COMPUTER TEST ON
PASS

PT OVSP TRIP RESET


VIB ANALYZER TEST ON

MAIN FUEL VALVE CHECK SWITCH

NO. 1

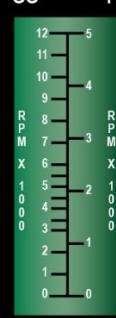


NO. 2




SPEED

GG

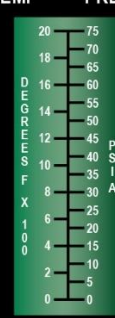


PT




PT INLET

TEMP



PRESS




EMERGENCY CONTROLS

FIRE SYS DISABLED
PUSH TO RESTORE

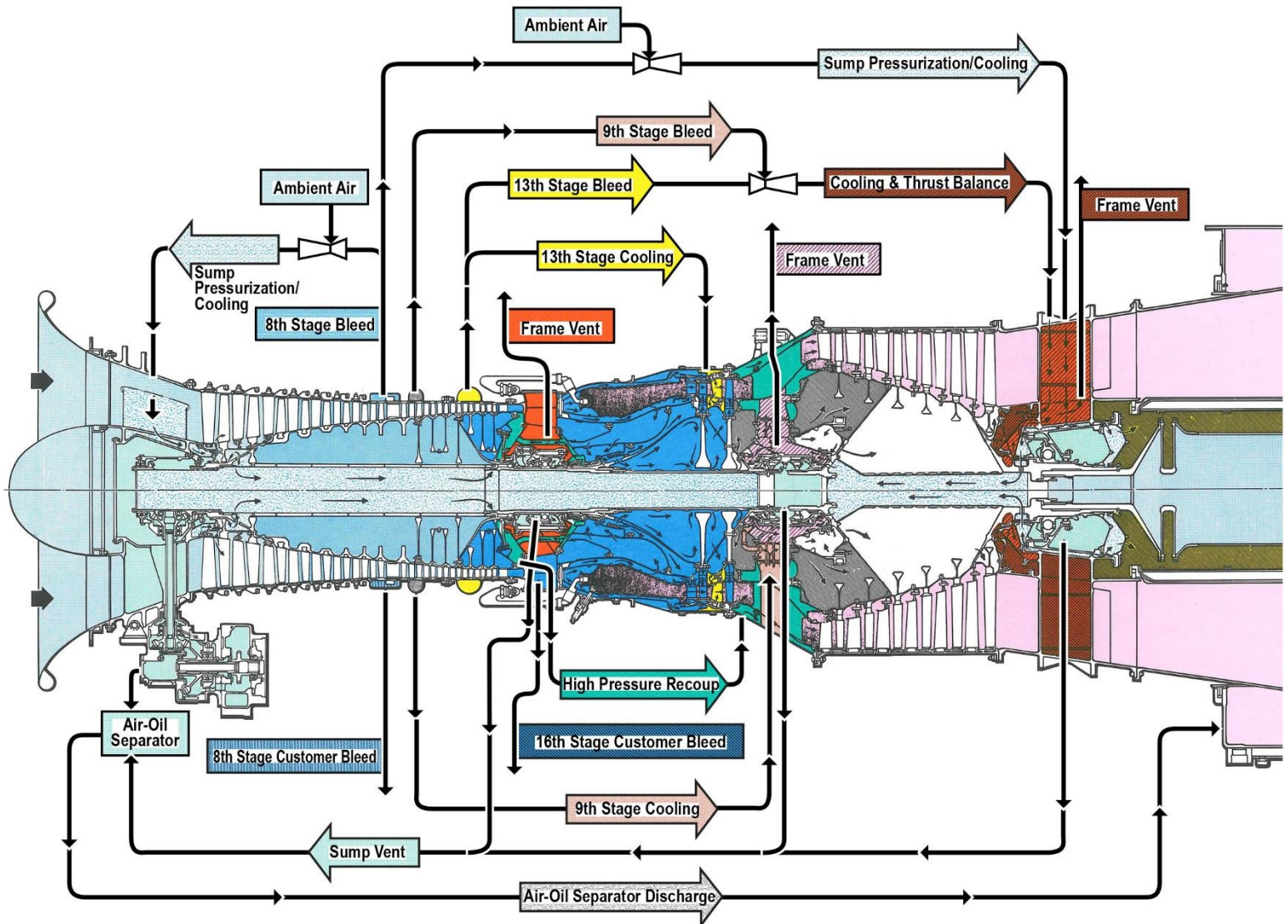
CO2 RELEASE INHIBIT

BATTLE OVRD ON

EMERGENCY STOP


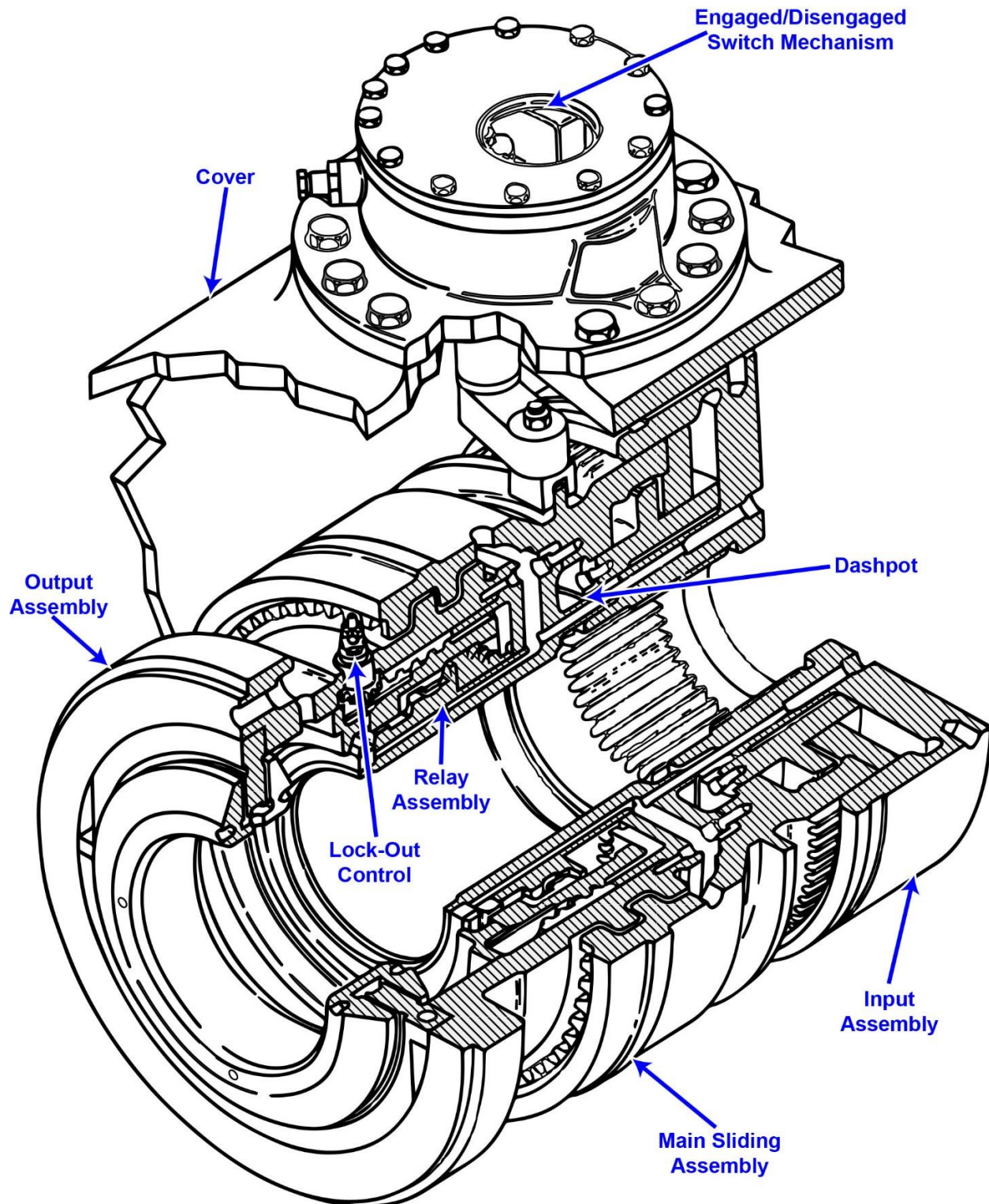
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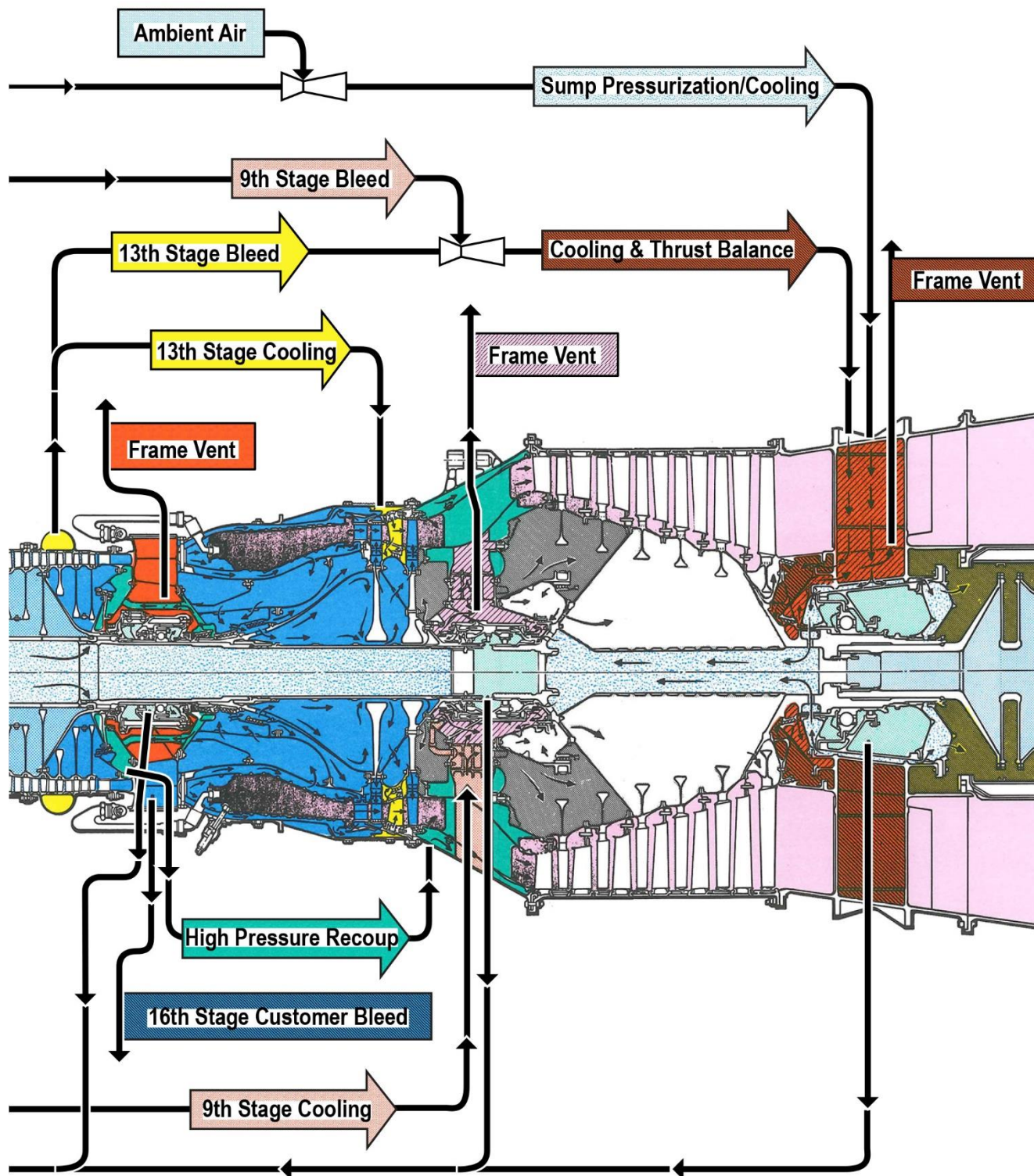
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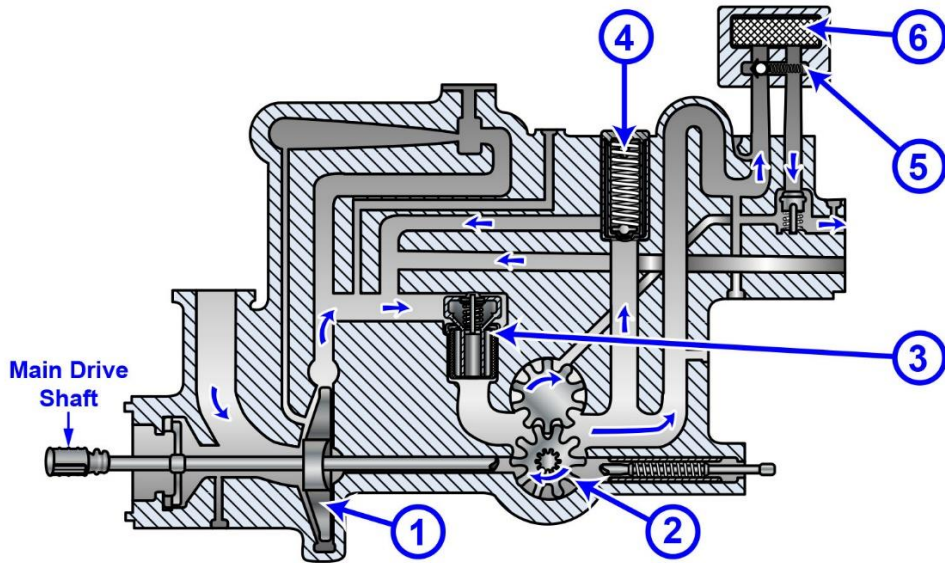
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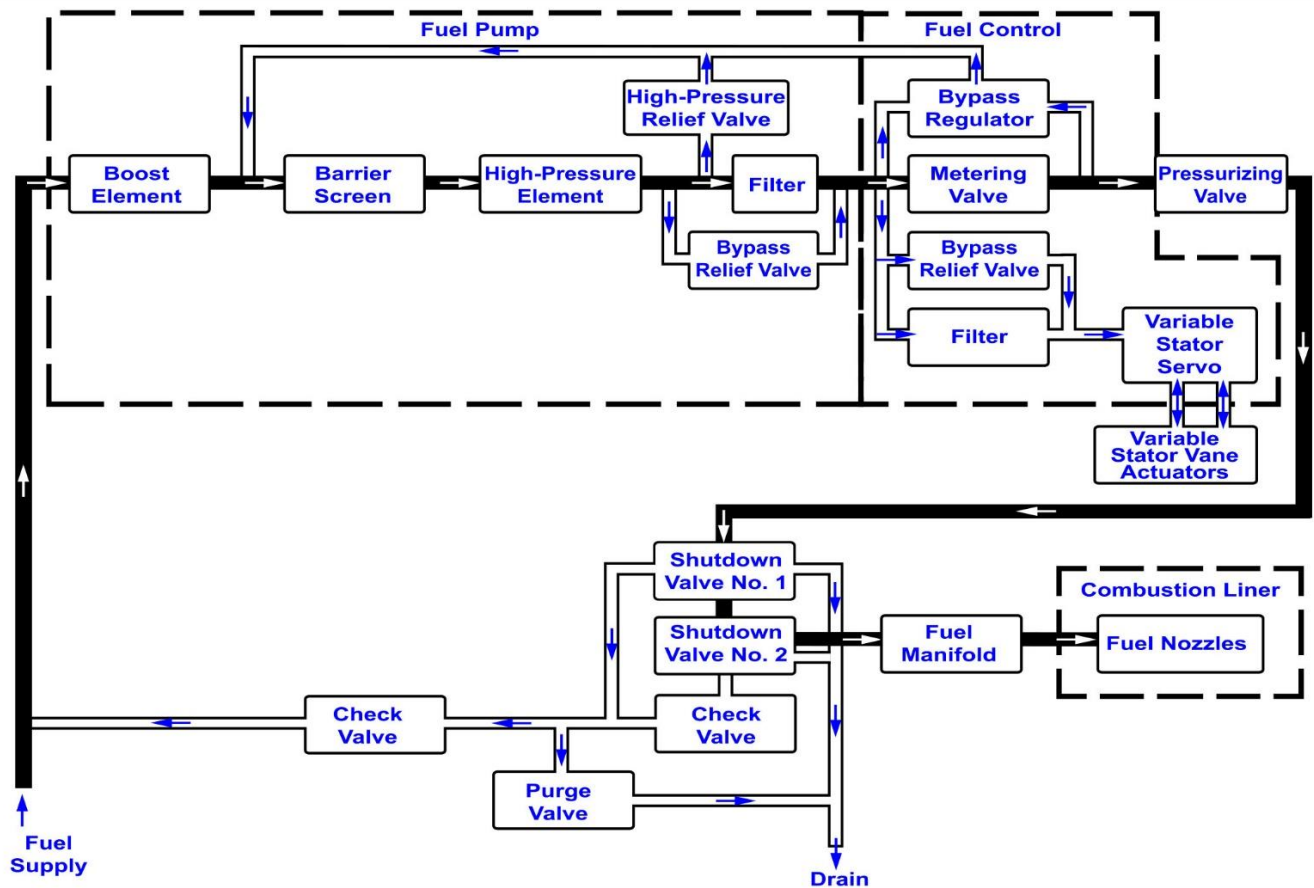
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GT-0021

A



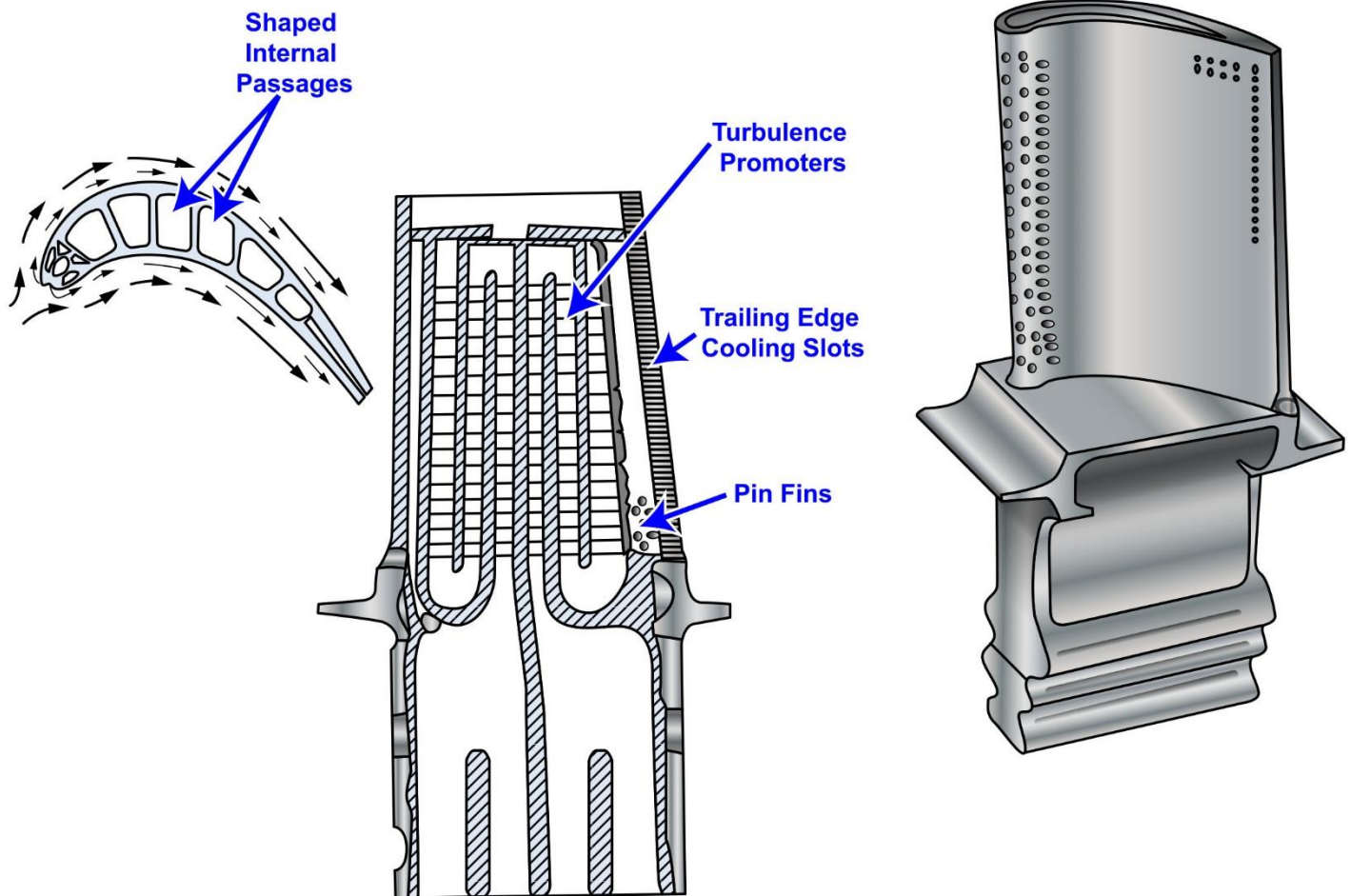
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