

U.S.C.G. Merchant Marine Exam

Chief Engineer – Limited

Q606 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 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

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

Correct answer: D

4. 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

5. 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

6. Which of the following components prevent(s) objects smaller than 1/4 inch from entering the engine?
- A. Centerbody
 - B. Demister pads
 - C. Inlet louvers
 - D. FOD screens

Correct answer: D

7. The term used to describe a gas turbine in which the turbine exhaust passes through a cooler and back to the compressor inlet is which of the following?
- A. Closed cycle
 - B. Twin cycle
 - C. Uni-cycle
 - D. Open cycle

Correct answer: A

8. 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 less fuel than a recuperated gas turbine; however, the levels of particulate and nitrogen oxide (NOx) levels in the exhaust would be higher.
 - C. 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
 - D. 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.

Correct answer: B

9. Which of the following statements about the intercooled-recuperated gas turbine cycle is true?
Illustration GT-0026
- A. 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.
 - B. 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.
 - C. 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.
 - D. 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.

Correct answer: C

10. 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 mass air flow through the gas turbine would increase.
 - C. The exhaust temperature would drop significantly.
 - D. The gas turbine power would drop due to reduced mass air flow.

Correct answer: D

11. 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. Water wash the engine
 - D. No action is needed

Correct answer: A

12. 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

13. The lube oil scavenge pressure on the gas turbine engine shown in the illustration is sensed by which of the following? Illustration GT-0017
- A. Transducer
 - B. Probe
 - C. RTD
 - D. Manometer

Correct answer: A

14. 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

15. 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. Failure of seal pressurization air
 - C. Failure of the scavenging pump
 - D. Fuel oil contamination

Correct answer: B

16. 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

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

Correct answer: A

18. 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 particle content in the fuel
 - B. Low pour point of the fuel
 - C. High ash content in the fuel
 - D. High saltwater content in the fuel

Correct answer: D

19. 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 above 10 RPM
 - C. Shaft will not rotate
 - D. Reduction gear will not rotate

Correct answer: A

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

- A. Unlocked train
- B. Locked train
- C. Hydraulic suspension
- D. Independent suspension

Correct answer: B

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

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

Correct answer: C

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

Correct answer: C

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

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

Correct answer: A

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

Correct answer: B

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

Correct answer: B

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

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

Correct answer: C

27. 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

Correct answer: D

28. 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

29. A white-gray powdery deposit can usually be found on which of the following metals?

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

Correct answer: A

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

- A. Rupture
- B. Radial cracking
- C. Axial cracking
- D. Creep

Correct answer: B

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

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

Correct answer: D

32. You are conducting a borescope inspection of the combustor section of a GE LM2500 gas turbine engine. You observe a one square inch hole in the combustor dome where burn through has removed the metal. What would be your course of action?

- A. Record the damage and continue to operate the engine while monitoring the high-pressure turbine temperatures and nozzle condition.
- B. Immediately take the engine out of service.
- C. Operate the engine only in an emergency and at reduced load.
- D. Make temporary repairs with onboard repair kit to patch hole.

Correct answer: A

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

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

Correct answer: D

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

Correct answer: D

35. Which of the listed problems will happen when the water level of a fire-tube type auxiliary boiler approaches the crown sheet?

- A. The furnace will explode
- B. Excess steam will be generated
- C. The fusible plugs will melt
- D. The furnace will overheat

Correct answer: C

36. With which of the following types of diesel engine arrangements is a waste heat boiler most likely to produce the maximum steam pressure, temperature, and flow conditions?
- A. Supercharged, four-stroke cycle diesel engine
 - B. Supercharged, loop scavenged diesel engine
 - C. Turbocharged, cross flow scavenged diesel engine
 - D. Turbocharged, return flow diesel engine

Correct answer: A

37. In general, diesel engine waste heat boiler construction is usually of the _____.
- A. dry back boiler type
 - B. cyclone furnace boiler type
 - C. critical circulation boiler type
 - D. water-tube type

Correct answer: D

38. During unsafe firing conditions in a large automatic auxiliary boiler, various control actuators are interlocked with the burner circuit to prevent start-up, in addition to safety shutdown. These controls are referred to as _____.
- A. limit controls
 - B. flame safeguard controls
 - C. combustion controls
 - D. programming controls

Correct answer: A

39. A photoelectric cell installed in an automatically fired auxiliary boiler burner management system _____.
- A. opens the burner circuit upon sensing a flame failure
 - B. detects a flame failure by monitoring radiant heat from glowing refractory
 - C. requires mechanical linkage to secure the burner fuel supply
 - D. must be bypassed at low firing rates

Correct answer: A

40. When the steam pressure drops below a set value on an automatically fired auxiliary boiler, fitted with rotary cup atomizers, the combustion control system will _____.
- A. increase the fuel oil control valve opening
 - B. increase the rotary cup speed
 - C. decrease the back pressure regulating valve opening
 - D. decrease the supply steam control valve opening

Correct answer: A

41. A variable capacity, pressure atomizing, fuel oil burner functions to _____.
- A. maintain a constant fuel temperature
 - B. provide a wide range of combustion
 - C. provide a constant fuel return pressure
 - D. maintain smokeless fuel oil atomization

Correct answer: B

42. In the water level electrode assembly, shown in the illustration, the feed pump should restart when the level of the water reaches the position indicated by arrow '_____'. Illustration MO-0047
- A. E
 - B. B
 - C. C
 - D. D

Correct answer: C

43. Burner ignition failure in an automatically fired auxiliary boiler would be caused by _____.
- A. a burned-out solenoid in the oil supply valve
 - B. high temperature excess air
 - C. incorrectly setting the hotwell dump valve
 - D. an incorrectly positioned burner snubber relay

Correct answer: A

44. A burner producing black smoke in an automatic auxiliary boiler, would be caused by a/an _____.
- A. incorrect electrode setting
 - B. defective solenoid valve
 - C. grounded high tension lead
 - D. incorrect primary air setting

Correct answer: D

45. A feed pump for an auxiliary boiler might lose suction if the _____.
- A. boiler water level is low
 - B. feedwater is too hot
 - C. boiler steam demand is low
 - D. feedwater is too cold

Correct answer: B

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. 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

47. During an operation of a main propulsion gas turbine, the engine shuts down. Which of the following is the most probable reason for the shutdown?
- A. Low fuel supply temperature
 - B. Low sump oil level
 - C. High lube oil temperature
 - D. High vibration on the gas generator

Correct answer: D

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

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

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

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

Correct answer: A

51. A pressure stage of an axial-type compressor consists of which of the following?

- A. Compressor rotor and a set of inlet guide vanes
- B. Set of stator blades
- C. Set of rotor blades
- D. Set of rotor blades and a set of stator blades

Correct answer: D

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

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

Correct answer: C

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

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

Correct answer: B

54. The primary function of an axial compressor rotor blade is which of the following?
- A. To act as a diffuser to the air flow causing an increase in pressure with a resultant decrease in velocity
 - B. To impart acceleration to the air mass, resulting in an increase in velocity
 - C. To change the direction of the air flow
 - D. To use centrifugal force to increase the pressure of the air stream

Correct answer: B

55. 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 discs are held together by through bolts.
 - C. Rotor consists of rings that are flanged to fit one against the other.
 - D. Rotor is only suitable for low-speed compressors.

Correct answer: A

56. A centrifugal flow gas turbine uses what type of combustion chamber?
- A. double-annular
 - B. annular
 - C. can
 - D. can-annular

Correct answer: C

57. 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, vortex, and can-vortex
 - C. can, annular, and can-annular
 - D. can, angular, and can-angular

Correct answer: C

58. The secondary passages on the gas turbine engine fuel nozzles shown in the illustration are designed to open at approximately what pressure? Illustration GT-0005
- A. 30 psig
 - B. 130 psig
 - C. 230 psig
 - D. 330 psig

Correct answer: D

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

Correct answer: A

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

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

Correct answer: A

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

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

Correct answer: A

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

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

Correct answer: D

64. To keep the exit pressures relatively constant across a HP turbine blade, which type of construction is generally utilized?

- A. Impulse
- B. Curtis
- C. Impulse-Reaction
- D. Rateau

Correct answer: C

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

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

Correct answer: D

66. In a single shaft, cold-end drive gas turbine, the power output speed has what relationship to the speed of the compressor?
- A. It is in an inverse relationship through reduction gears
 - B. It is the same or in a direct relationship through reduction gears
 - C. It varies independently of compressor speed
 - D. None of the above

Correct answer: B

67. What type of air seal is used in the sump and turbine areas of a gas turbine engine?
- A. Labyrinth-Honeycomb
 - B. Fishmouth
 - C. Pneumatic carbon ring
 - D. Lip-type

Correct answer: A

68. What type of seal is used in the gearbox of a gas turbine engine?
- A. Labyrinth-Windback
 - B. Carbon ring
 - C. Lip-type
 - D. Fishmouth

Correct answer: B

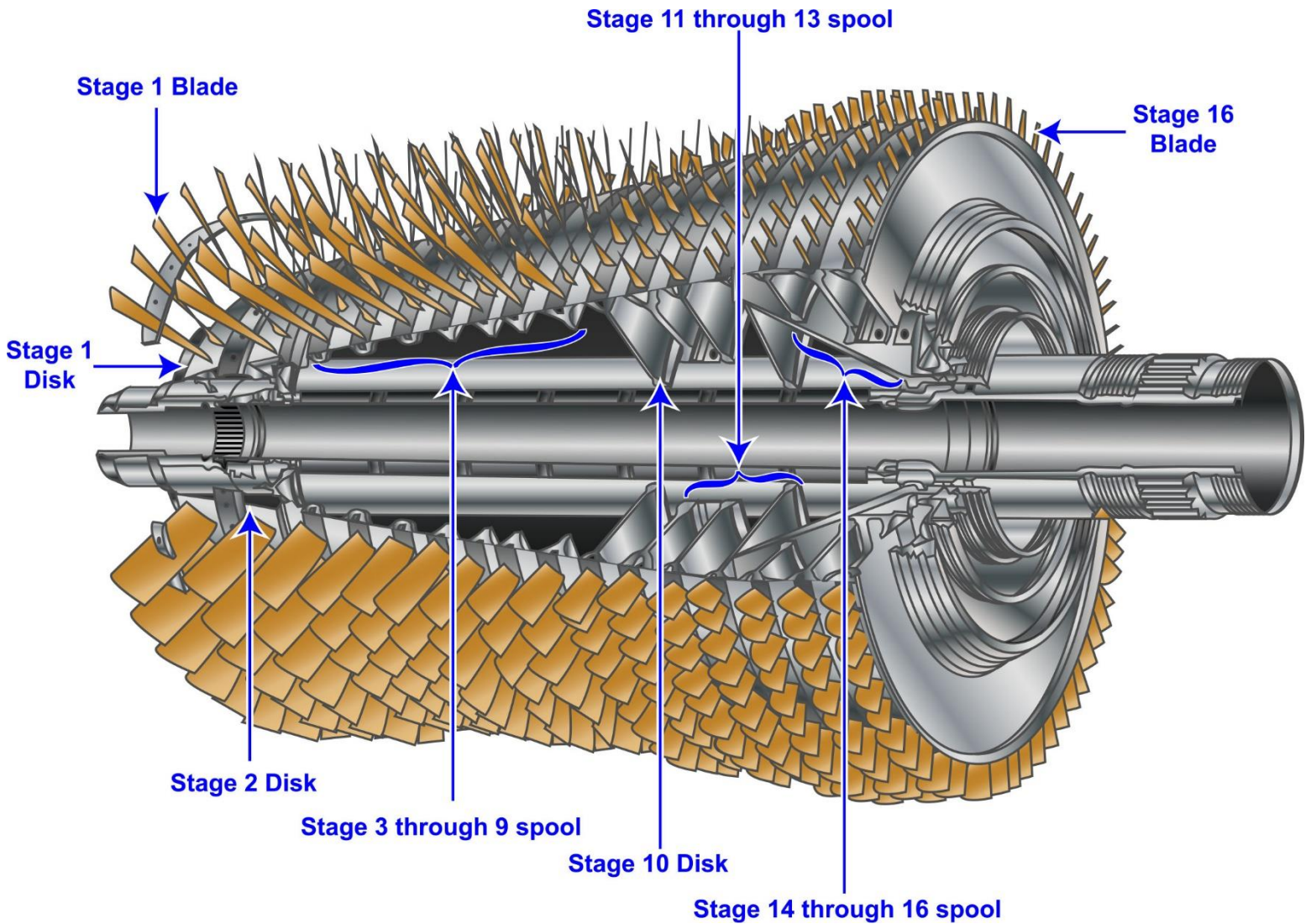
69. A centrifugal compressor assembly consists of which of the following?
- A. Rotating pistons and stationary liners
 - B. Stationary vanes and rotating blades
 - C. A stationary impeller and a rotating diffuser
 - D. A rotating impeller and a stationary diffuser

Correct answer: D

70. While air is being compressed in a centrifugal flow gas turbine, what happens to the direction of air flow?
- A. Changes only once from inlet to outlet
 - B. Changes only at the compressor inlet
 - C. Changes at each separate component
 - D. Changes only at the compressor discharge

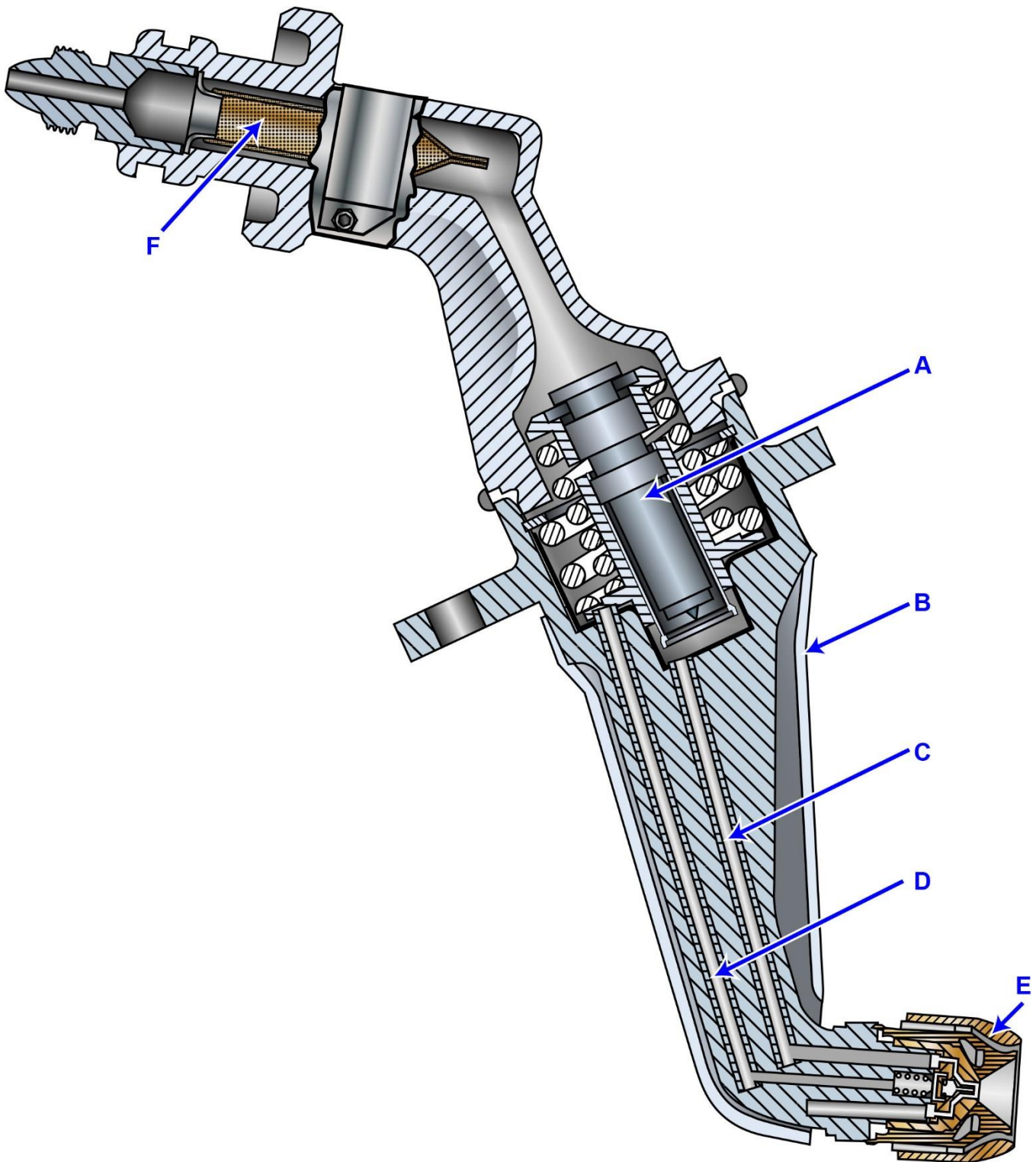
Correct answer: C

GT-0004



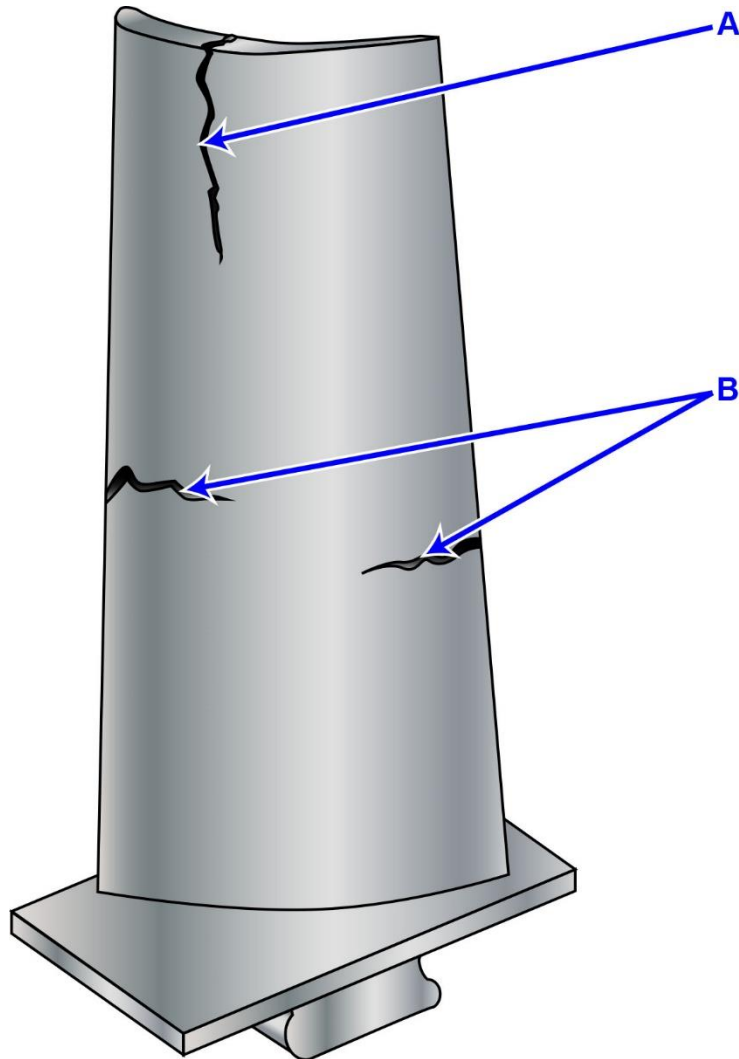
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GT-0005



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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

DEGREES F P S I G

SERVICE TANK VALVES

B OPEN A OPEN

B CLOSE A CLOSE

PUMP

B FAST A FAST

B SLOW A SLOW

B STOP A STOP

EMERG TRIP

B A

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

START COUNTER

OUT OF SERVICE / NORMAL

STARTER

GTM TIMER

HOURS

MANUAL START

VENT DAMPER OPEN / CLOSE COOLING FAN ON / OFF BLEED VALVE OPEN / CLOSE STARTER AIR ON IGNITER ON MAIN FUEL VALVE OPEN / 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

CONTROL TRANSFER

ENABLE INHIBIT

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

R P M R P M

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

DEGREES F P S I G

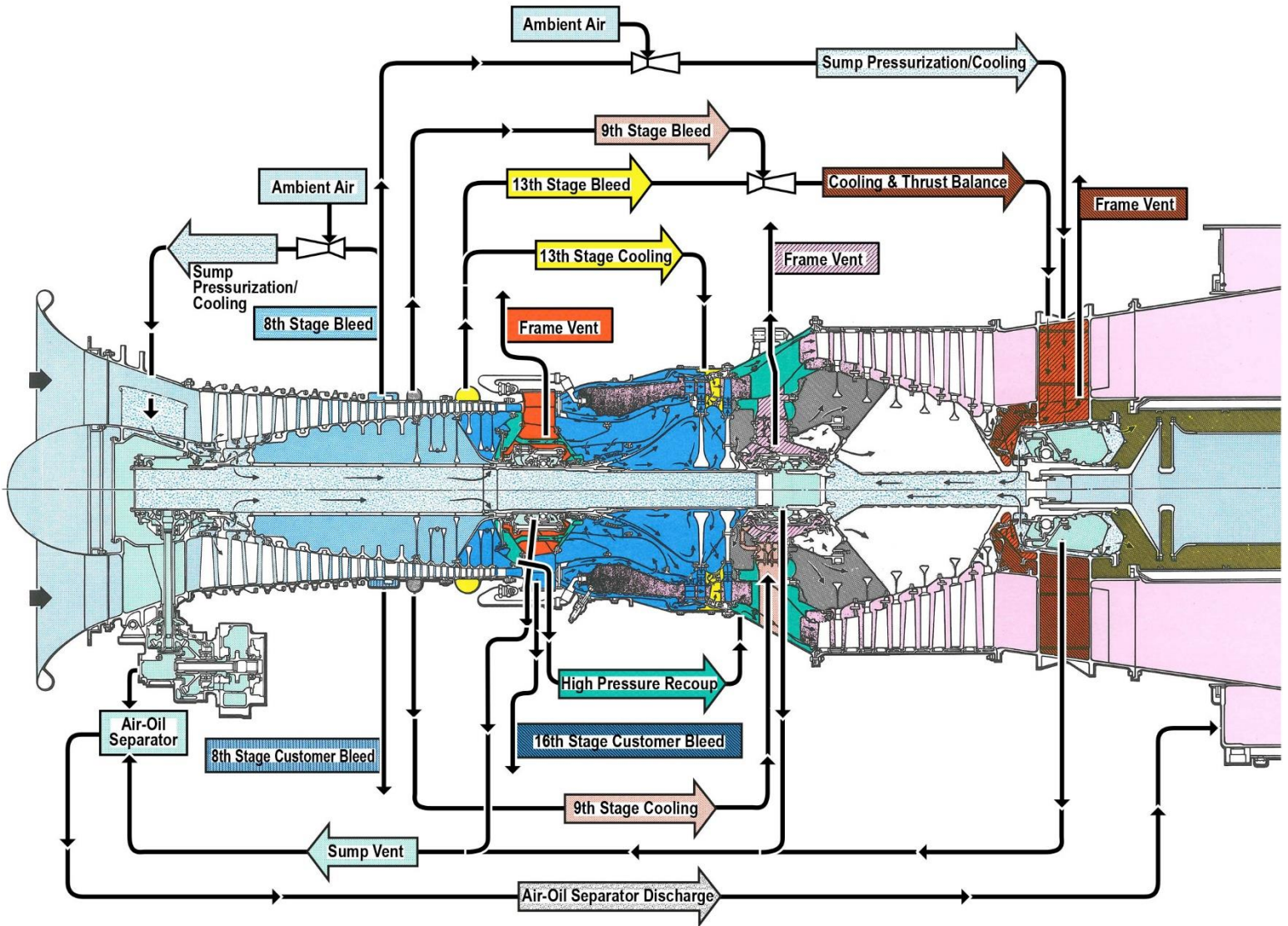
EMERGENCY CONTROLS

EMERGENCY STOP

FIRE SYS DISABLED PUSH TO RESTORE CO2 RELEASE INHIBIT BATTLE OVRD ON

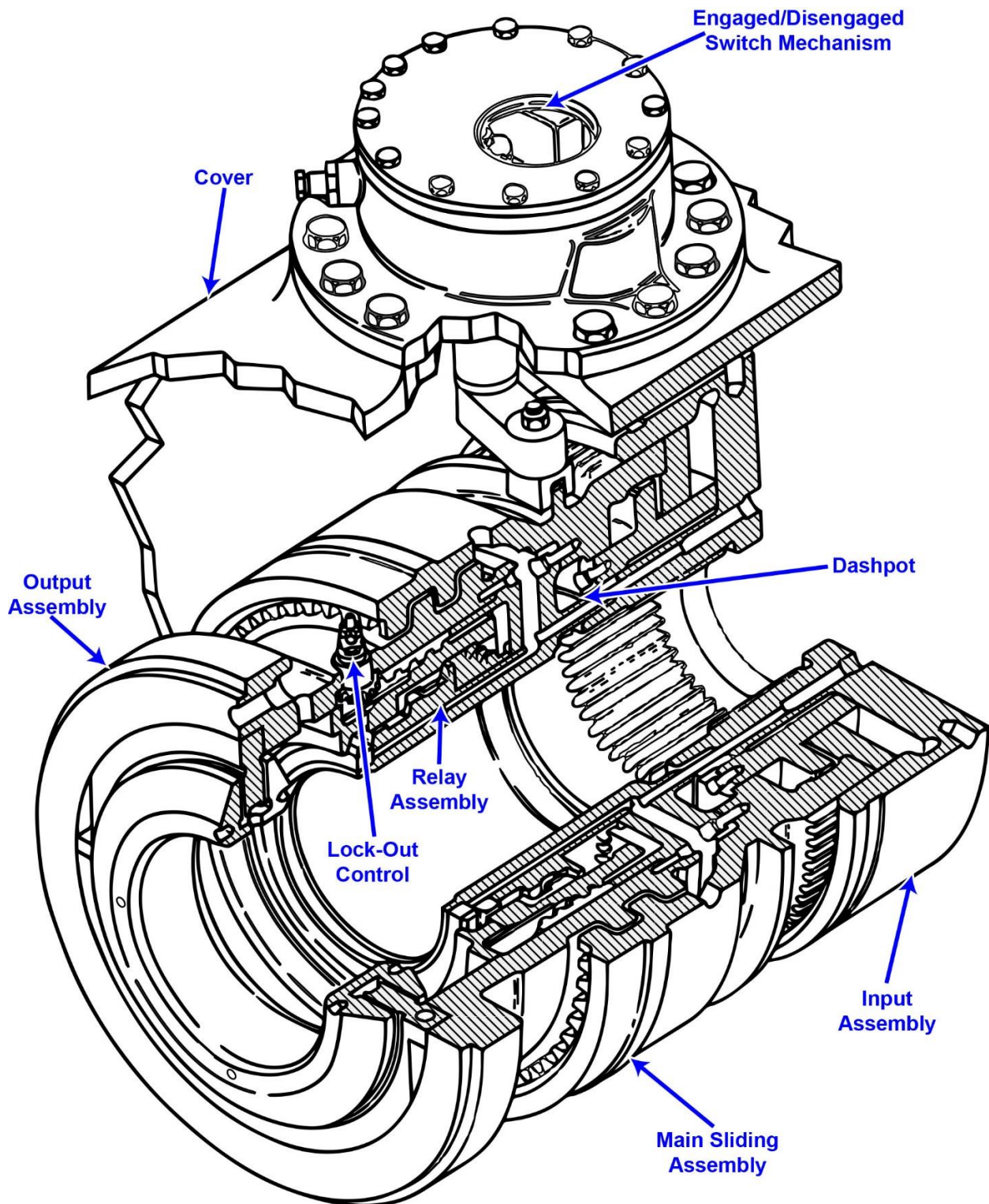
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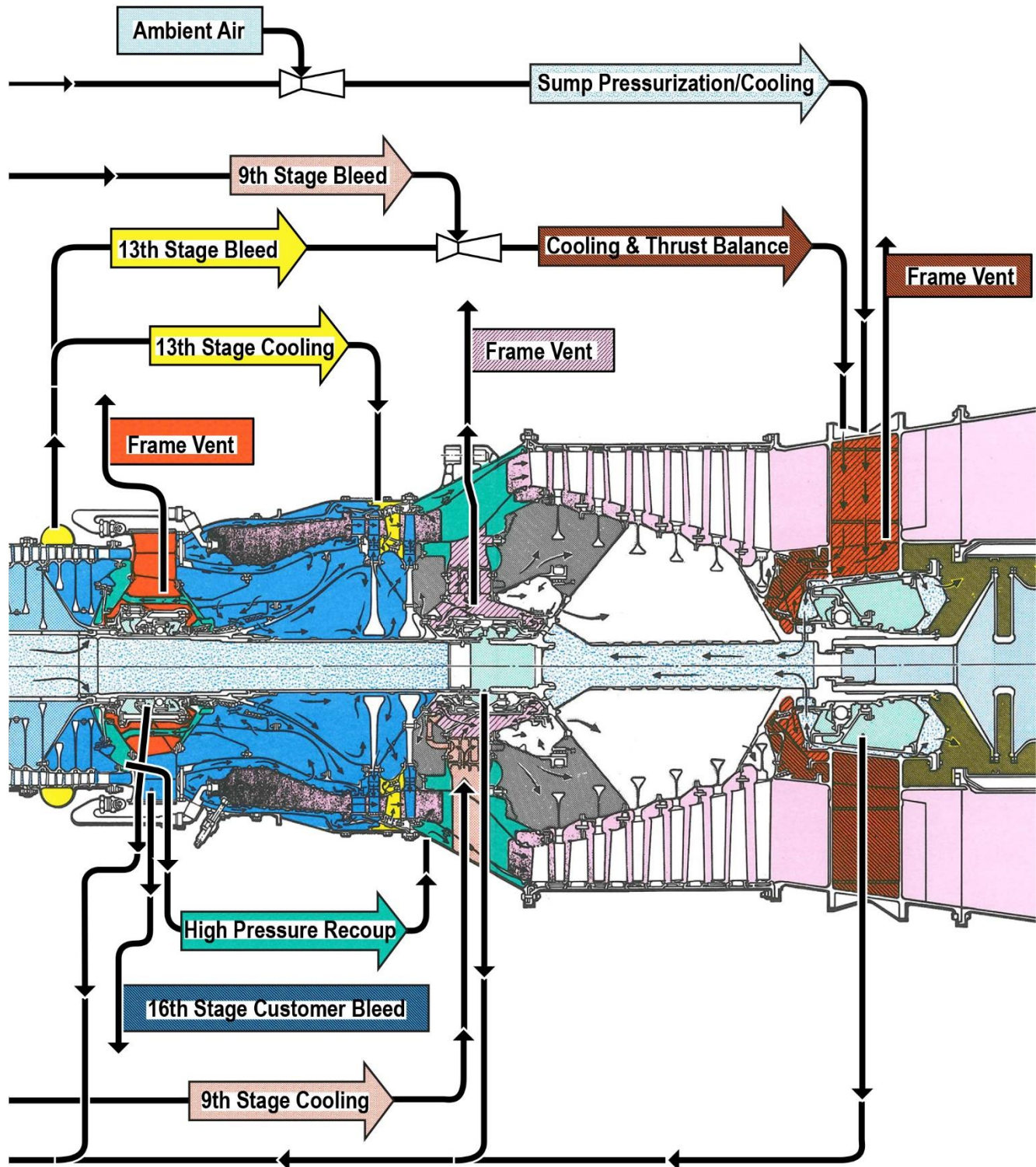
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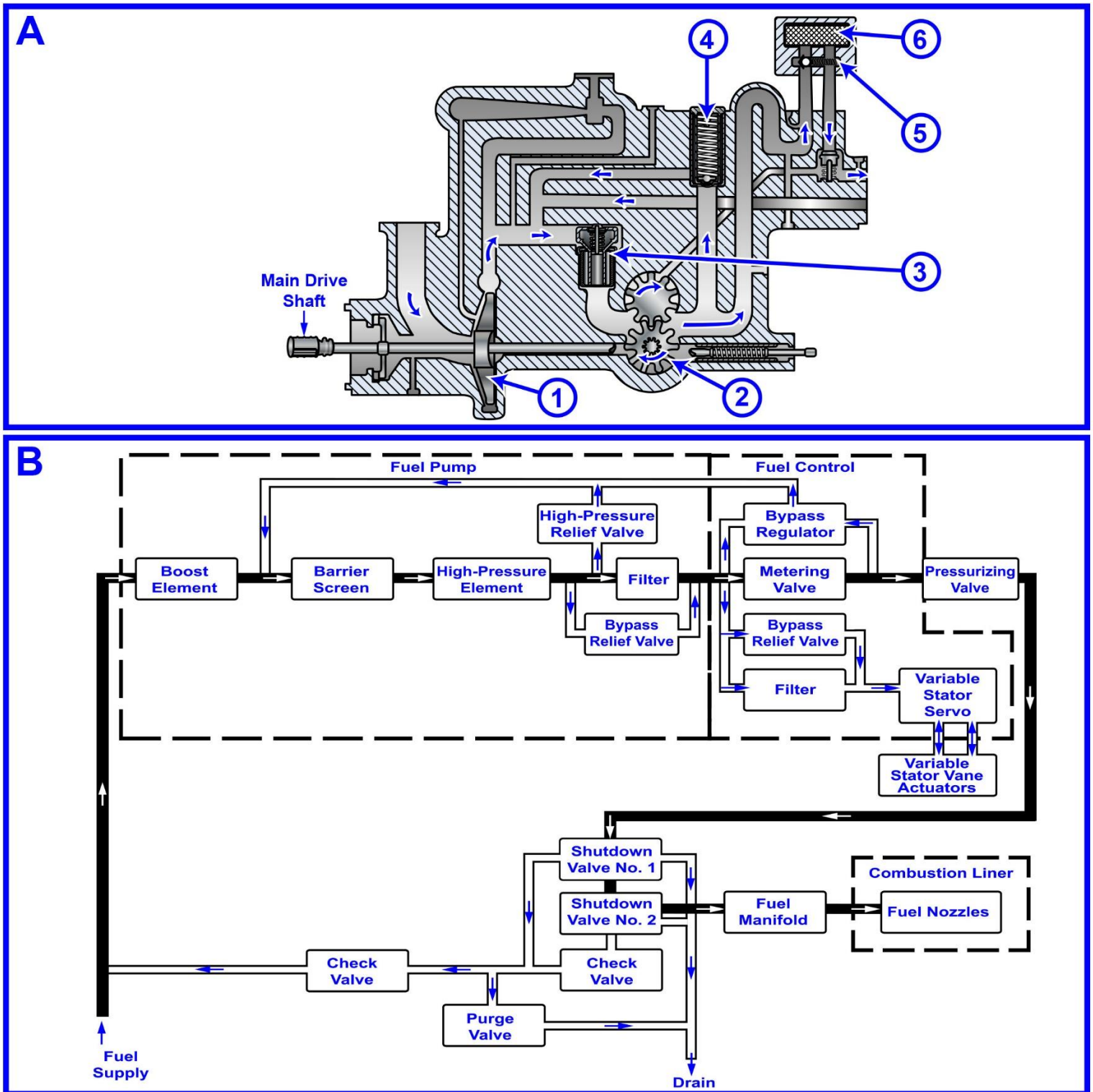
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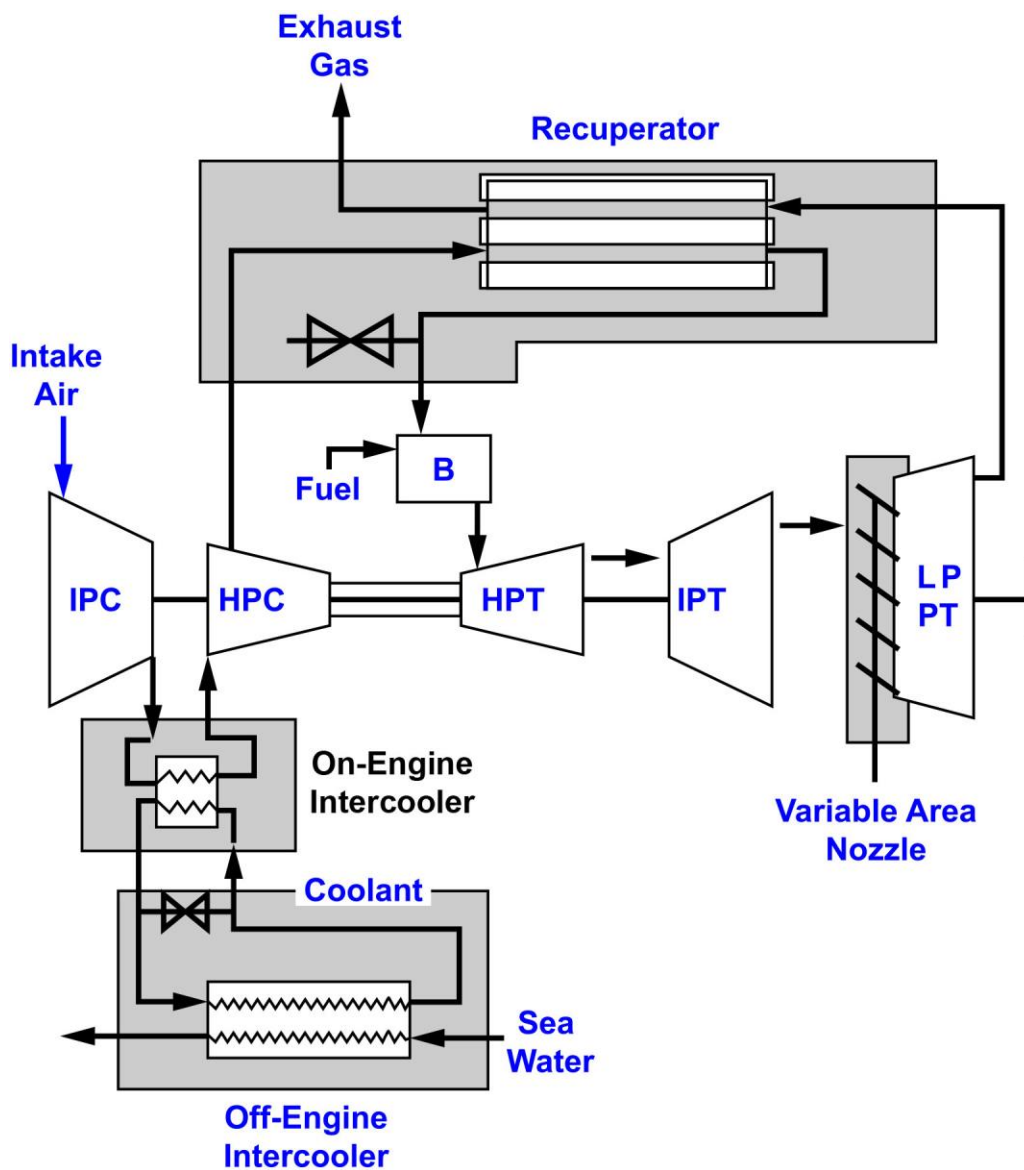
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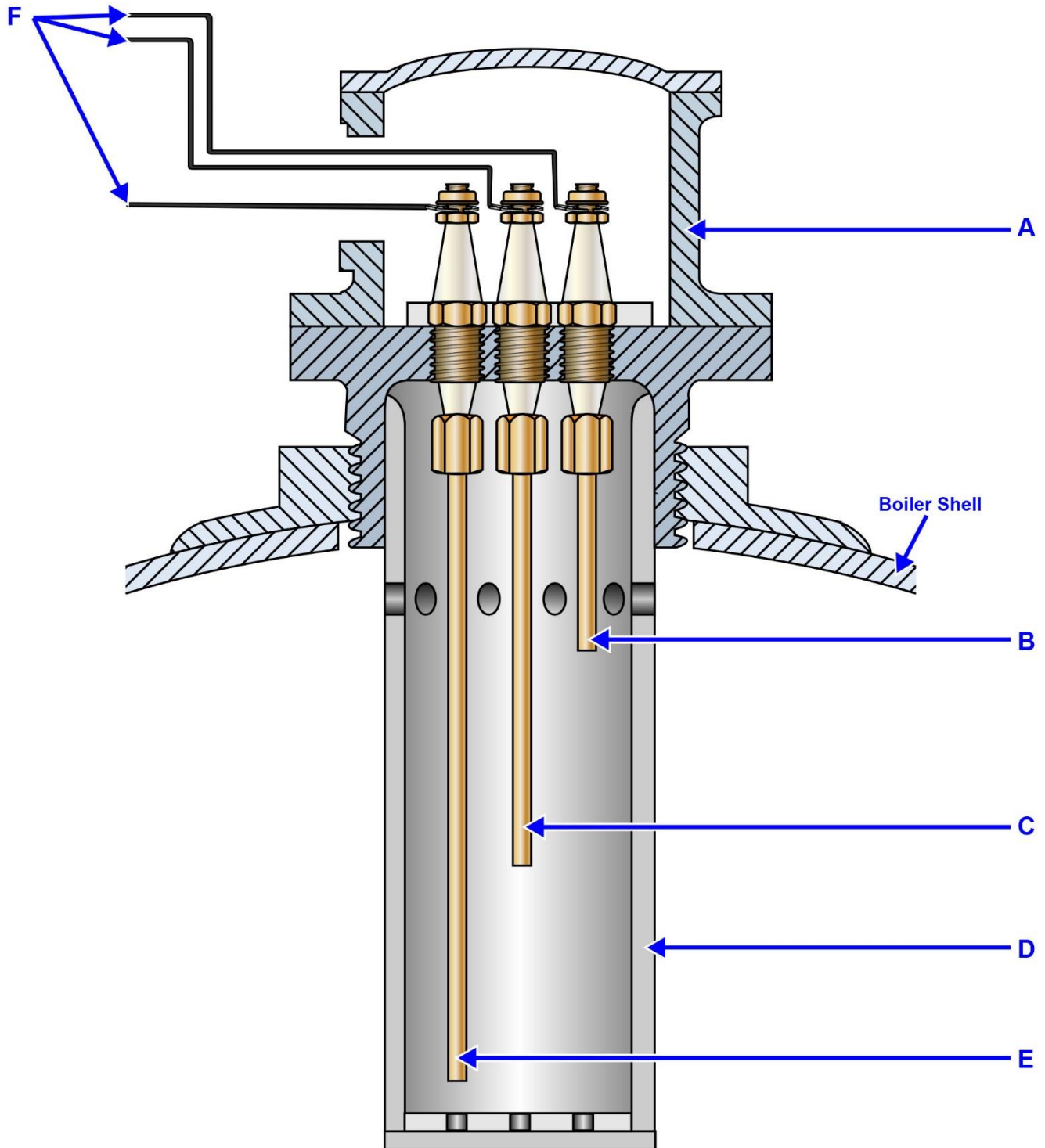
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GT-0026



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