

U.S.C.G. Merchant Marine Exam  
Third Assistant Engineer  
Q533 Gas Turbine Plants  
(Sample Examination)

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

1. Which of the following drawbacks of a gas turbine engine provides the greatest potential for injury to personnel?
- A. High pitched noise
  - B. Mechanical stresses the engine is subject to
  - C. High temperature of the exhaust gases
  - D. Susceptibility to foreign object damage

Correct answer: A

2. An open cycle gas turbine engine is best described by which of the following statements?
- A. Energy is neither created nor destroyed and the cycle is therefore perpetual.
  - B. Working fluids are taken in, transformed, and then recuperated.
  - C. Working fluids are taken in, transformed, and then discarded.
  - D. Energy is added externally.

Correct answer: C

3. Why is a gas turbine considered to operate on the Brayton cycle?
- A. Combustion causes no increase in volume.
  - B. Combustion causes an increase in total mass flow.
  - C. Combustion occurs with no increase in pressure.
  - D. Combustion causes large increase in pressure.

Correct answer: C

4. Why is the cycle efficiency higher in the intercooled-recuperated cycle as compared to a simple cycle gas turbine? Illustration GT-0026
- A. The intercooler serves to reduce the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to decrease required fuel to achieve the 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 increase 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 turbine inlet temperature.
  - D. The intercooler serves to increase the required high-pressure compressor power while the recuperator utilizes waste heat from the exhaust to decrease turbine inlet temperature.

Correct answer: A

5. The acronym CDP stands for which of the following?
- A. Compressor Discharge Pyrometer.
  - B. Choke Down Point.
  - C. Coupling Disassembly Point.
  - D. Compressor Discharge Pressure.

Correct answer: D

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

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

Correct answer: B

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

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

Correct answer: C

8. Which of the following statements concerning fluid flow is true?

- A. If a fluid flowing through a tube reaches a constriction or narrowing of the tube, the velocity of the fluid flowing through the restriction increases and the pressure increases.
- B. If a fluid flowing through a tube reaches a constriction or narrowing of the tube, the velocity of the fluid flowing through the restriction increases and the pressure decreases.
- C. If a fluid flowing through a tube reaches a constriction or narrowing of the tube, the velocity of the fluid flowing through the restriction decreases and the pressure increases.
- D. If a fluid flowing through a tube reaches a constriction or narrowing of the tube, the velocity of the fluid flowing through the restriction decreases and the pressure decreases.

Correct answer: B

9. The divergent area of the exhaust duct aids in what process?

- A. Increasing the volume of the exhaust gases.
- B. Increasing the pressure of the exhaust gases.
- C. Increasing the velocity of the exhaust gases.
- D. Decreasing the volume of the exhaust gases.

Correct answer: A

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

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

Correct answer: B

**11.** 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 at each separate component
- C. Changes only once from inlet to outlet
- D. Changes only at the compressor inlet

Correct answer: B

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

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

Correct answer: A

**13.** 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

**14.** An axial compressor 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. One set of rotating blades, two sets of stationary vanes.
- C. One set of rotating vanes, one set of stationary blades.
- D. One set of stationary vanes, one set of rotating blades.

Correct answer: A

**15.** 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 rotor blades at the correct angle and are shaped to cause a velocity increase and a pressure decrease.
- D. Direct air flow to each rotor stage at the correct angle and deliver air to the combustor at the correct velocity and pressure.

Correct answer: D

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

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

Correct answer: D

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

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

Correct answer: B

**18.** What is the primary function of an axial compressor rotor blade?

- A. To act as a diffuser to the air flow causing an increase in pressure with a resultant decrease in velocity.
- B. To use centrifugal force to increase the pressure of the air stream.
- C. To change the direction of the air flow.
- D. To impart acceleration to the air mass, resulting in an increase in velocity.

Correct answer: D

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

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

Correct answer: A

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

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

Correct answer: B

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

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

Correct answer: C

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

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

Correct answer: B

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

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

Correct answer: B

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

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

Correct answer: C

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

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

Correct answer: A

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

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

Correct answer: C

**27.** Which of the following is a feature of a power turbine blade that is not found on a high temperature turbine blade?

- A. Dovetail roots
- B. Interlocking shroud tips
- C. Bulb roots
- D. Solid blades

Correct answer: B

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

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

Correct answer: B

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

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

Correct answer: C

**30.** What is the purpose of the spring in a lip-type oil seal?

- A. To keep the neoprene snugly fit around the shaft
- B. To remove burrs and dirt from the shaft
- C. To seal against maximum fluid pressure
- D. To prevent air from entering the sump

Correct answer: A

**31.** What type of engine starter motor is commonly found on the marine gas turbine shown in the illustration?  
Illustration GT-0006

- A. AC synchronous motor
- B. AC induction motor
- C. Hydraulic motor
- D. DC series wound electric motor

Correct answer: C

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

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

Correct answer: B

**33.** What is the power source for the ignition exciter of a gas turbine engine?

- A. Four lead-acid batteries
- B. Ship's 400 Hz system
- C. Ship's 28 volt DC system
- D. Ship's 115 volt AC system

Correct answer: D

- 34.** 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. Manometer
  - B. RTD
  - C. Transducer
  - D. Probe

Correct answer: C

- 35.** For the gas turbine engine lube oil system shown in the illustration, what is the purpose of the lube oil supply check valves? Illustration GT-0024
- A. prevent the lube oil and scavenge pump from losing its prime
  - B. keep the lube oil lines in the engine primed
  - C. prevent lube oil contained in the LO storage and conditioning tank from draining into gearboxes and sumps
  - D. All of the above

Correct answer: C

- 36.** The main lubrication system utilized by the gas turbine engine shown in the illustration is what type? Illustration GT-0017
- A. Oil mist recovery sump
  - B. Dry sump
  - C. Common drain sump
  - D. Wet sump

Correct answer: B

- 37.** As shown in the illustration, what is the purpose of pressurizing the main bearing lube oil sumps on a typical marine gas turbine? Illustration GT-0023
- A. Assists in cooling the lube oil.
  - B. Minimizes oil leakage from the rotor shaft.
  - C. Increases lube oil penetration.
  - D. Provides uniform lube oil distribution around the bearing.

Correct answer: B

- 38.** The fuel oil system of a gas turbine engine provides all EXCEPT which of the following?
- A. Acts as a hydraulic medium to actuate the fuel control
  - B. Controls the angle of the variable stator vanes
  - C. Provides accurately metered fuel for combustion
  - D. Acts as a cooling medium for the lube oil cooler

Correct answer: D

**39.** What is the approximate percentage of air extracted from the compressor that is mixed with fuel for combustion in a gas turbine?

- A. 12%
- B. 25%
- C. 50%
- D. 75%

Correct answer: B

**40.** How do you manually lockout an SSS clutch?

- A. Using the special wrench provided
- B. Calculate the engagement speed of the SSS clutch
- C. Remove the SSS clutch locking pawls
- D. Using air pressure

Correct answer: A

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

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

Correct answer: B

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

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

Correct answer: D

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

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

Correct answer: D

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

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

Correct answer: C

**45.** In a typical gas turbine propulsion plant, the main thrust bearing directly positions which part(s) of the main reduction gear?

- A. Low-speed gear
- B. High-speed gear
- C. Low-speed pinions
- D. High-speed pinions

Correct answer: A

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

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

Correct answer: C

**47.** During an auto-start sequence on the marine gas turbine control console shown in the illustration, what would be the correct order of events required to occur after the start sequence begins? Illustration GT-0016

- A. NGG reaches ignition RPM, gas temperature greater than 400 degrees F, NGG reaches idle RPM.
- B. Power turbine reaches ignition RPM, gas temperature greater than 400 degrees F, power turbine reaches idle RPM.
- C. NGG reaches idle RPM, power turbine reaches ignition RPM, gas temperature greater than 400 degrees F.
- D. Power turbine reaches ignition RPM, gas temperature greater than 400 degrees F, NGG reaches idle RPM.

Correct answer: A

**48.** Compressor characteristics are normally summarized in the form of which of the following?

- A. Venn diagram
- B. Spread sheet
- C. Compressor map
- D. Straight line graph

Correct answer: C

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

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

Correct answer: A

**50.** Which of the following instruments is designed to help you when performing an internal inspection of the gas turbine engine?

- A. Telescope
- B. Oscilloscope
- C. Stroboscope
- D. Borescope

Correct answer: D

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

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

Correct answer: B

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

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

Correct answer: C

**53.** Routine water washing of the gas turbine compressor shown in the illustration, is usually performed while operating under which of the following conditions? Illustration GT-0017

- A. At 25% power
- B. At 75% power
- C. At 100% power
- D. With the starter motor drive

Correct answer: D

**54.** The two main types of compressor stall are known as what?

- A. Flame out and inlet temperature stall
- B. Rapid rise and temperature inversion
- C. Overspeed and overload stall
- D. Steady state and transient

Correct answer: D

**55.** What is the term given to the condition in which cyclic pressure changes result in a repetitive failure and recovery of compressor air flow?

- A. Stall
- B. Laminar
- C. Turbulence
- D. Surge

Correct answer: D

**56.** On a propulsion marine gas turbine, if full power temperatures become excessive, what action should the operator take?

- A. Water wash the engine
- B. Borescope the engine
- C. Reduce power to stay within limits
- D. No action is needed until auto shutdown occurs

Correct answer: C

**57.** When working with gas turbine synthetic lube oil, which of the following safety measures should always be observed?

- A. avoid prolonged inhaling of vapors
- B. thoroughly wash any area of skin contact
- C. wear eye protection and rubber gloves
- D. All of the above

Correct answer: D

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

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

Correct answer: B

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

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

Correct answer: D

**60.** Where are the carbon dioxide nozzles located in the GE LM2500 gas turbine enclosure?

- A. Above the compressor
- B. On either side of the power turbine
- C. On the cross beam under the compressor front frame
- D. Above and below the combustor section

Correct answer: C

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

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

Correct answer: B

**62.** Which of the following statements is true concerning the fuel oil ignition system of the gas turbine engine shown in the illustration? Illustration GT-0017

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

Correct answer: C

**63.** What is the primary function of the main fuel control on the GE LM2500 gas turbine engine?

- A. To control stator vane angle and bleed air discharge
- B. To control fuel temperature
- C. To control stator vane angle and GG speed
- D. To control fuel pump inlet pressure

Correct answer: C

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

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

Correct answer: D

- 65.** For the GE LM2500 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

- 66.** According to the gas turbine engine illustration shown, the areas labeled "14 thru 29" are locations for \_\_\_\_\_. Illustration GT-0006
- A. inspection ports
  - B. fuel nozzles
  - C. thermocouples
  - D. bell mouth strut cones

Correct answer: A

- 67.** The auxiliary steam boiler on your vessel is equipped with a gauge glass for local level indication. On which of the following auxiliary boiler types would this gauge glass be attached to a flash chamber also known as a steam accumulator or steam separator?
- A. Fire-tube steam boiler
  - B. Water-tube forced-circulation steam boiler
  - C. Electric steam boiler
  - D. Water-tube natural-circulation steam boiler

Correct answer: B

- 68.** The rate of heat transfer in a waste-heat boiler can be increased by \_\_\_\_\_.
- A. Operating the boiler at less than normal water level
  - B. Increasing the amount of excess air to the burners
  - C. Installing fins on the firesides of water-tubes
  - D. Treating the boiler water with chemical oxygen scavengers

Correct answer: C

- 69.** As shown in the illustration, if the vessel was operating at full sea speed, the area labeled "L" would be used to \_\_\_\_\_. Illustration MO-0231
- A. Preheat the feedwater to the waste heat boiler
  - B. Collect steam and flash the heated water generated in area "B" into steam
  - C. Superheat the steam generated by the oil-fired mechanical burner
  - D. Collect stack gas

Correct answer: B

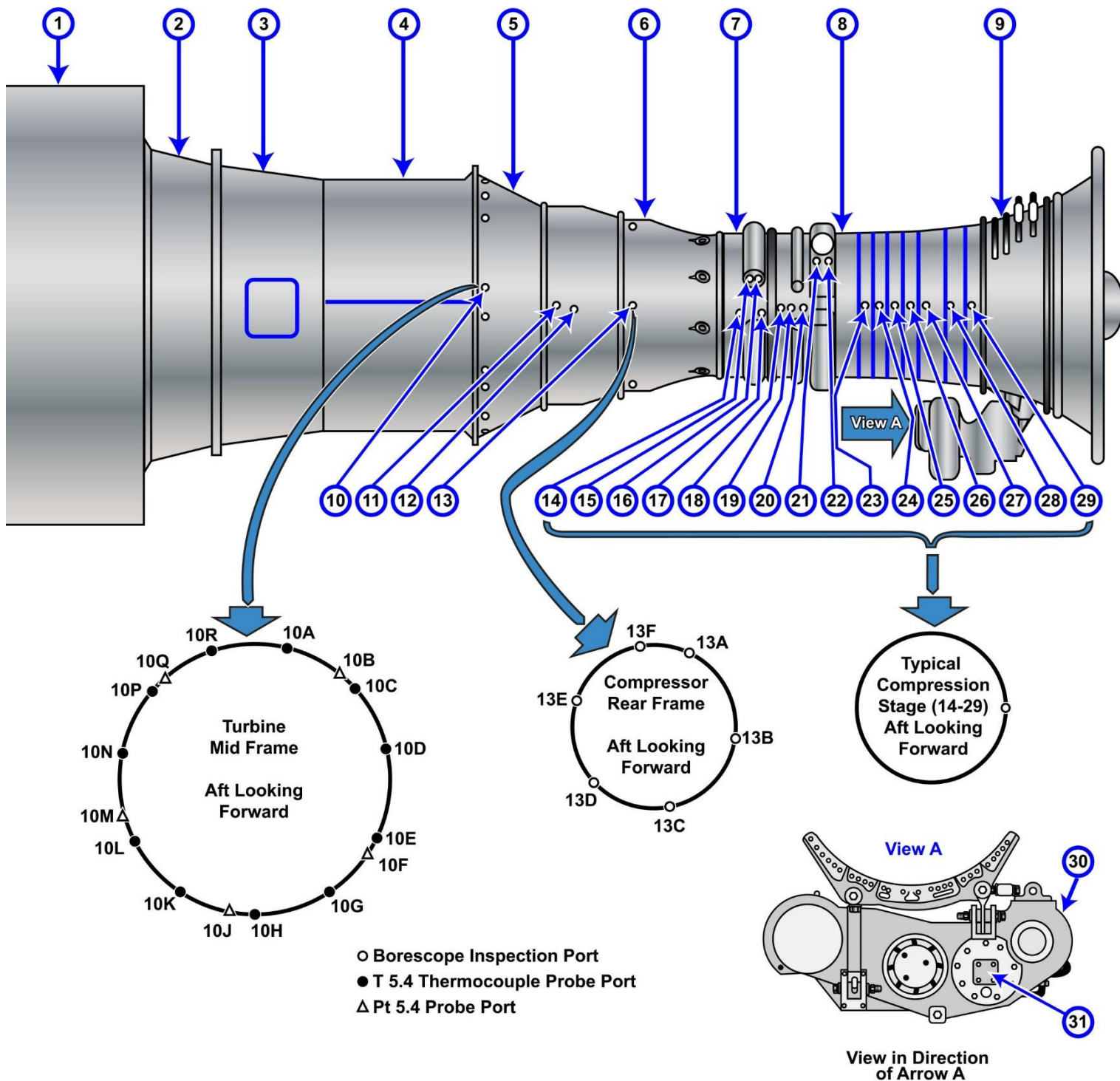
**70.** Control of the fuel oil metering valve in an automatically fired auxiliary boiler is accomplished by a \_\_\_\_\_.

- A. Pressure magnifying device in the steam coil outlet
- B. Metering device in the air supply line
- C. Steam pressure sensing device with linkage to the damper air vanes
- D. Signal from the feedwater electrode

Correct answer: C



## GT-0006



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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

CLOSE    CLOSE

### PUMP

B    A

FAST    FAST

SLOW    SLOW

STOP    STOP

### EMERG TRIP

B    A

### 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 CUTOFF	BLEED AIR VALVE OPEN
	NO. 2 FUEL VALVE OPEN	TACH NO. 2 LOSS	WATER WASH HEATER ON	

### WATER WASH

TANK EMPTY

WASH ON    HEATER ON

OFF    OFF

### OUT OF SERVICE

NORMAL

### 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			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
12	5
11	
10	4
9	
8	3
7	
6	2
5	
4	1
3	
2	0
1	
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
	20
	15
	10
	5
	0

### CONTROL TRANSFER

ENABLE    INHIBIT

### EMERGENCY CONTROLS

FIRE SYS DISABLED PUSH TO RESTORE

CO2 RELEASE INHIBIT

BATTLE OVRD ON

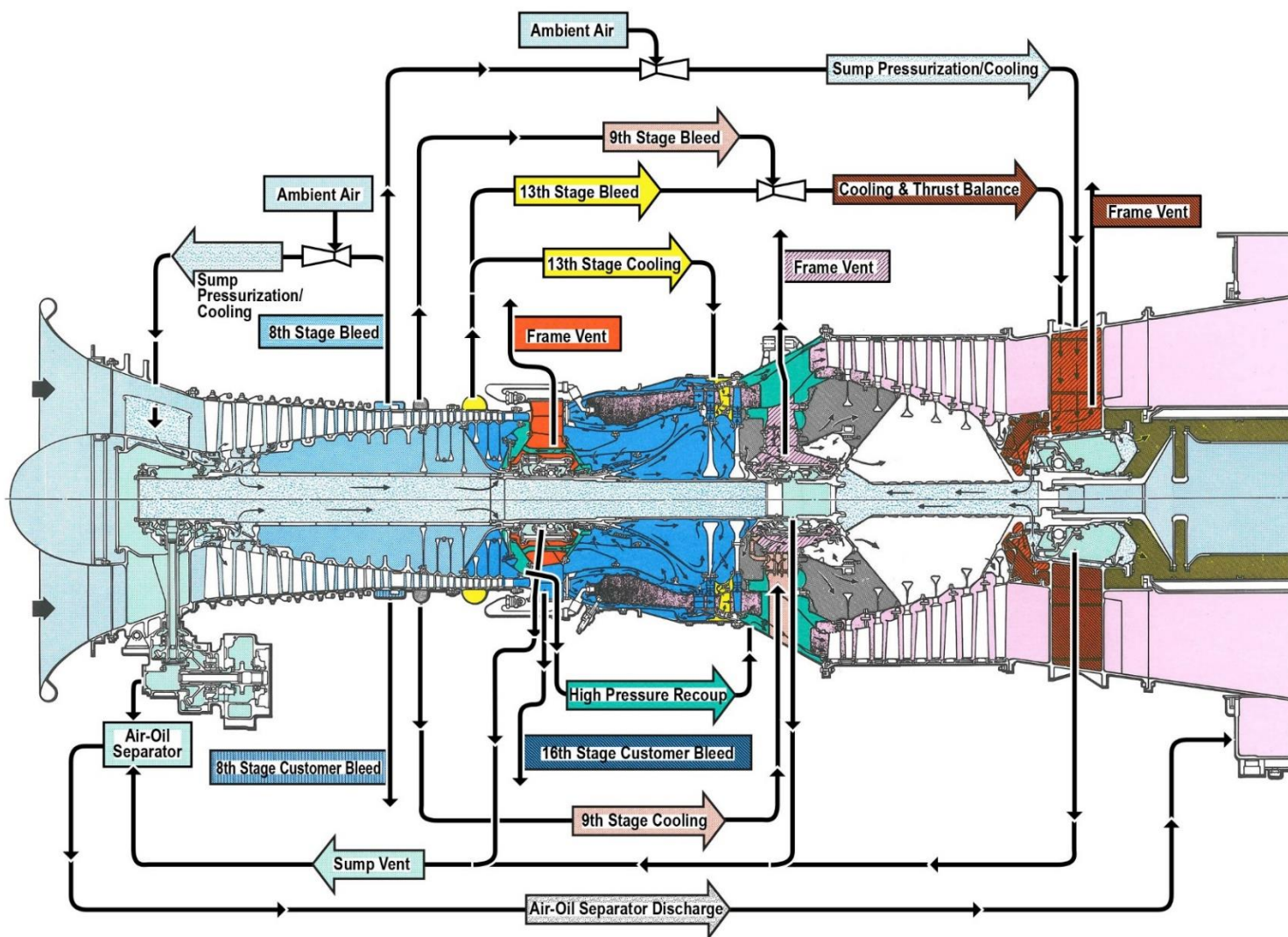
EMERGENCY STOP

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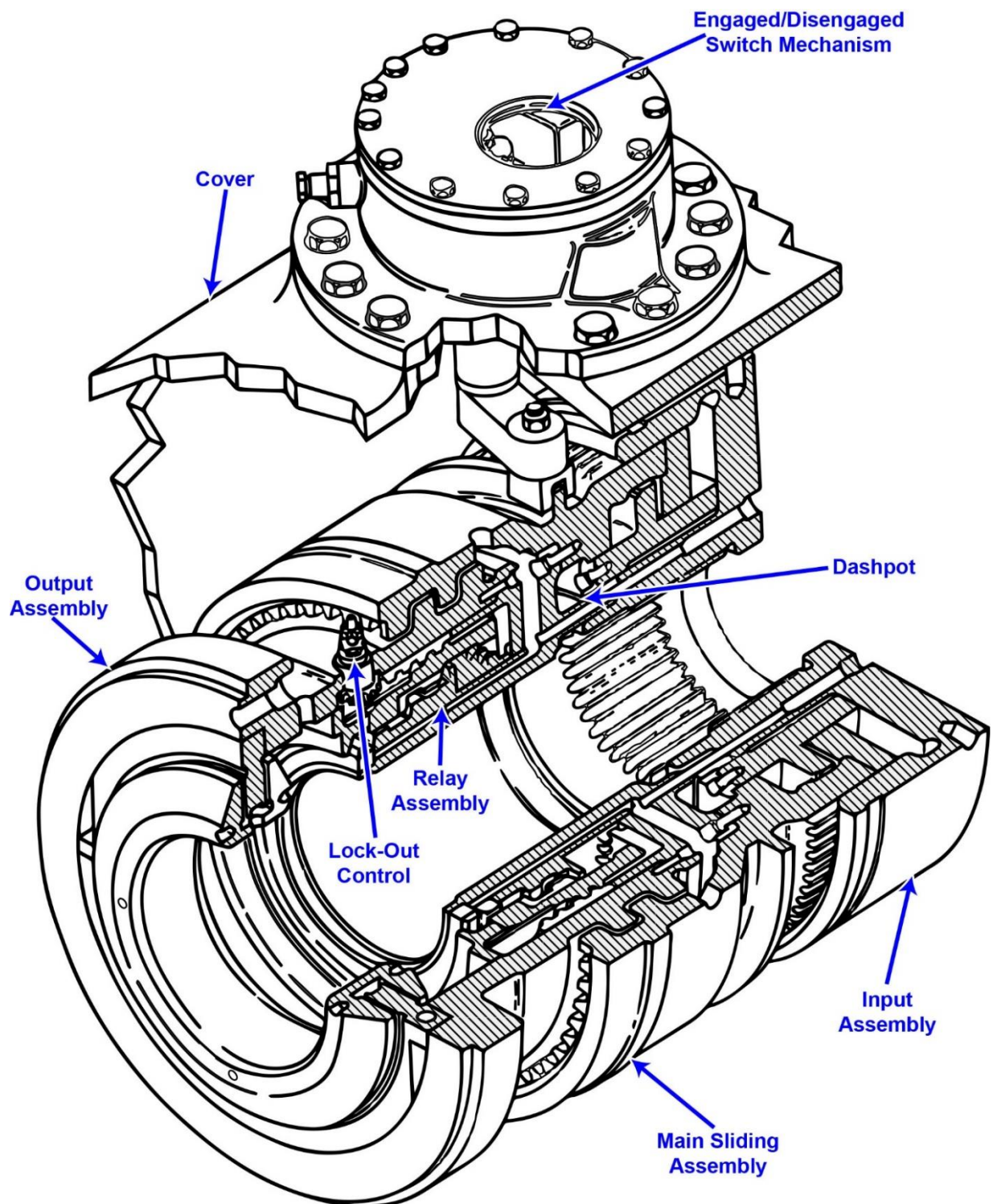
## GT-0017



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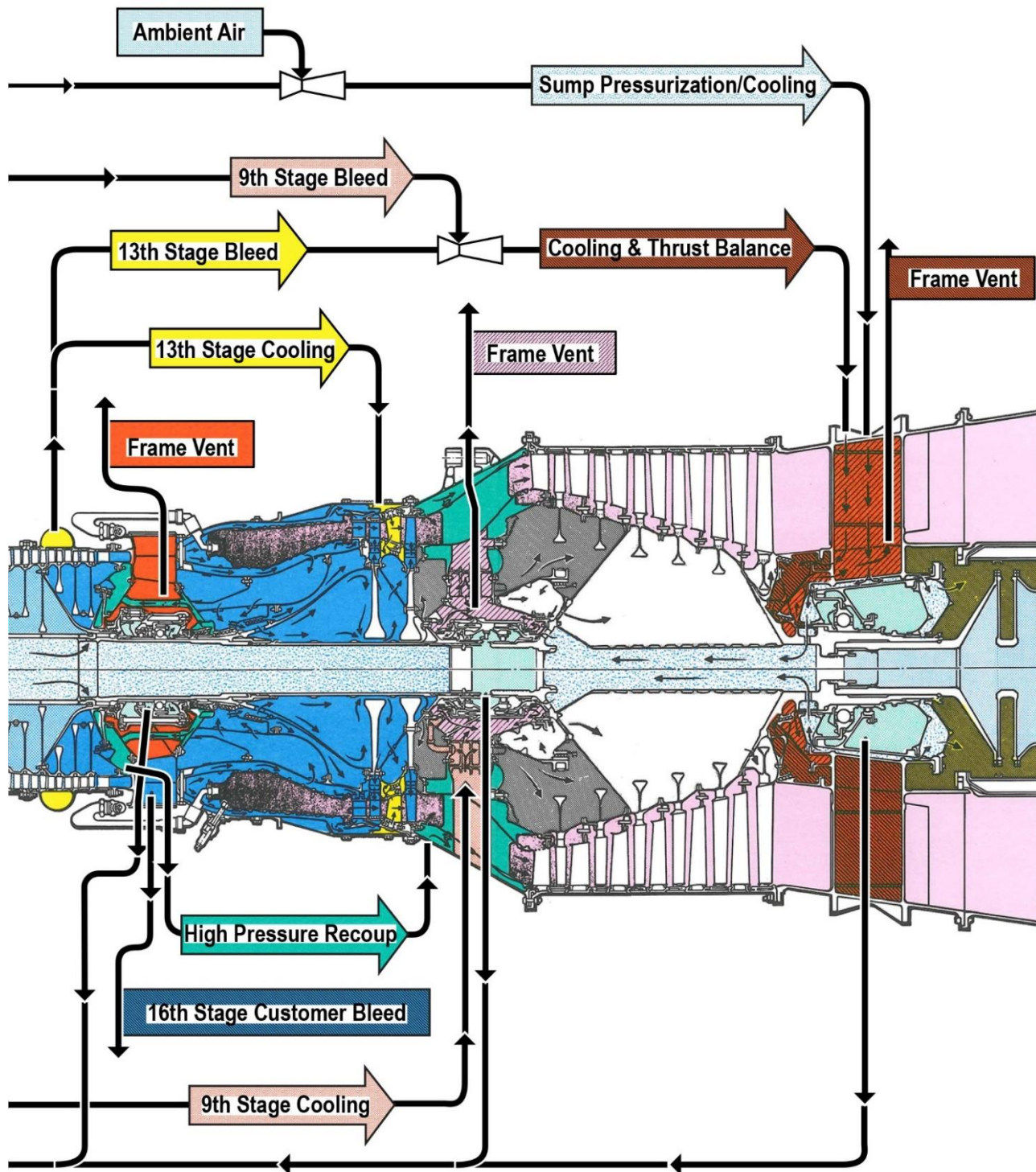
### GT-0018



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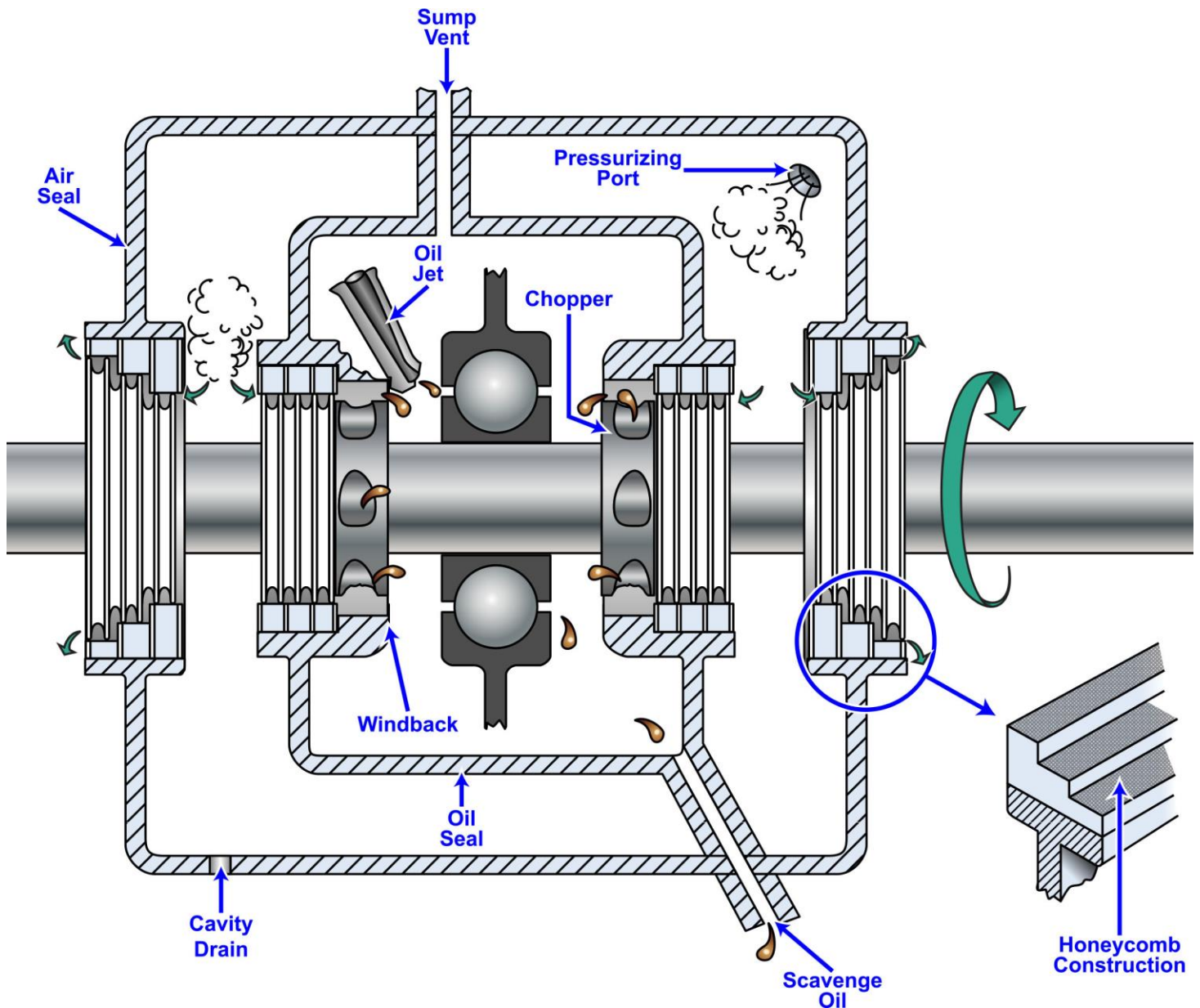
## GT-0020



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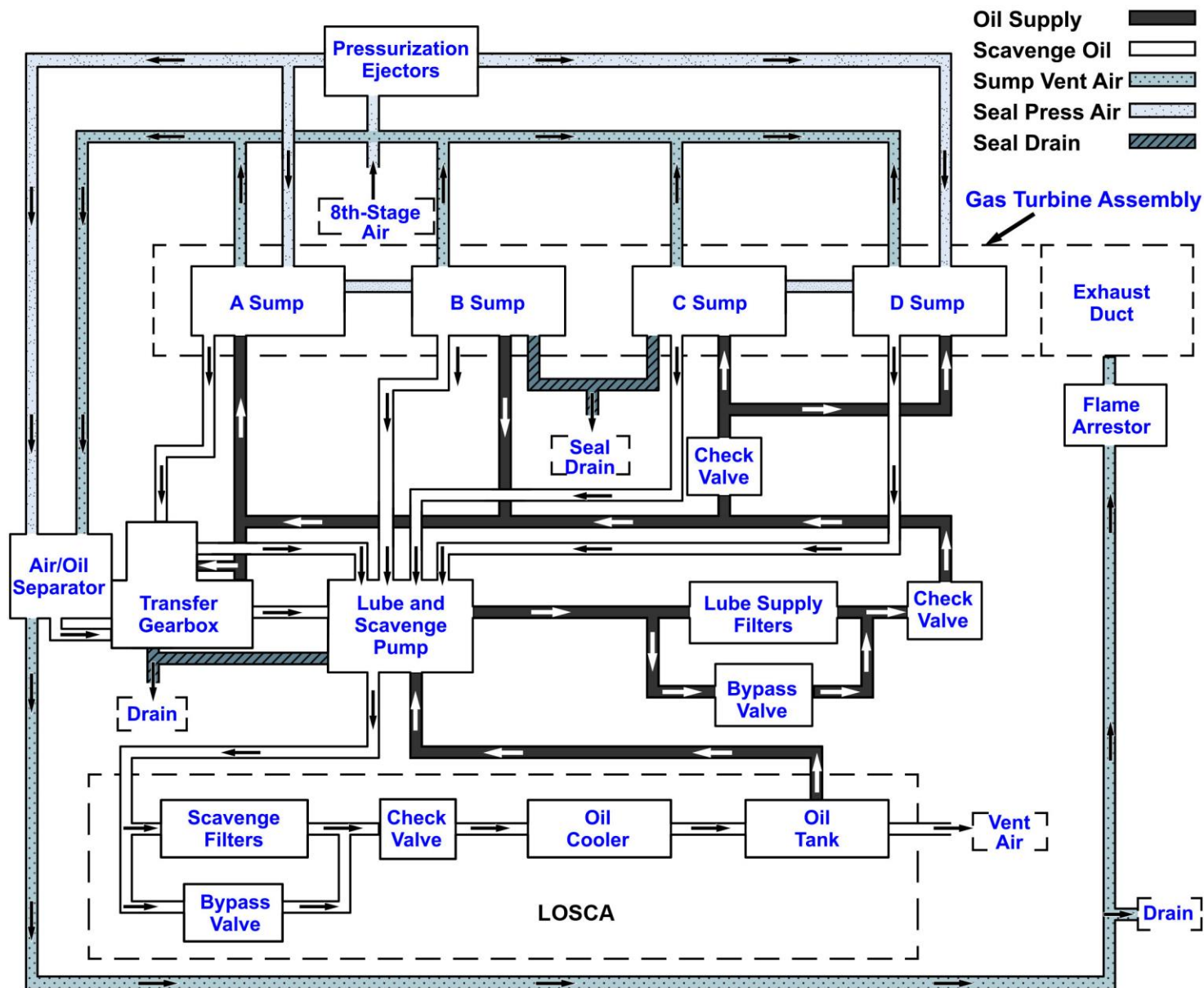
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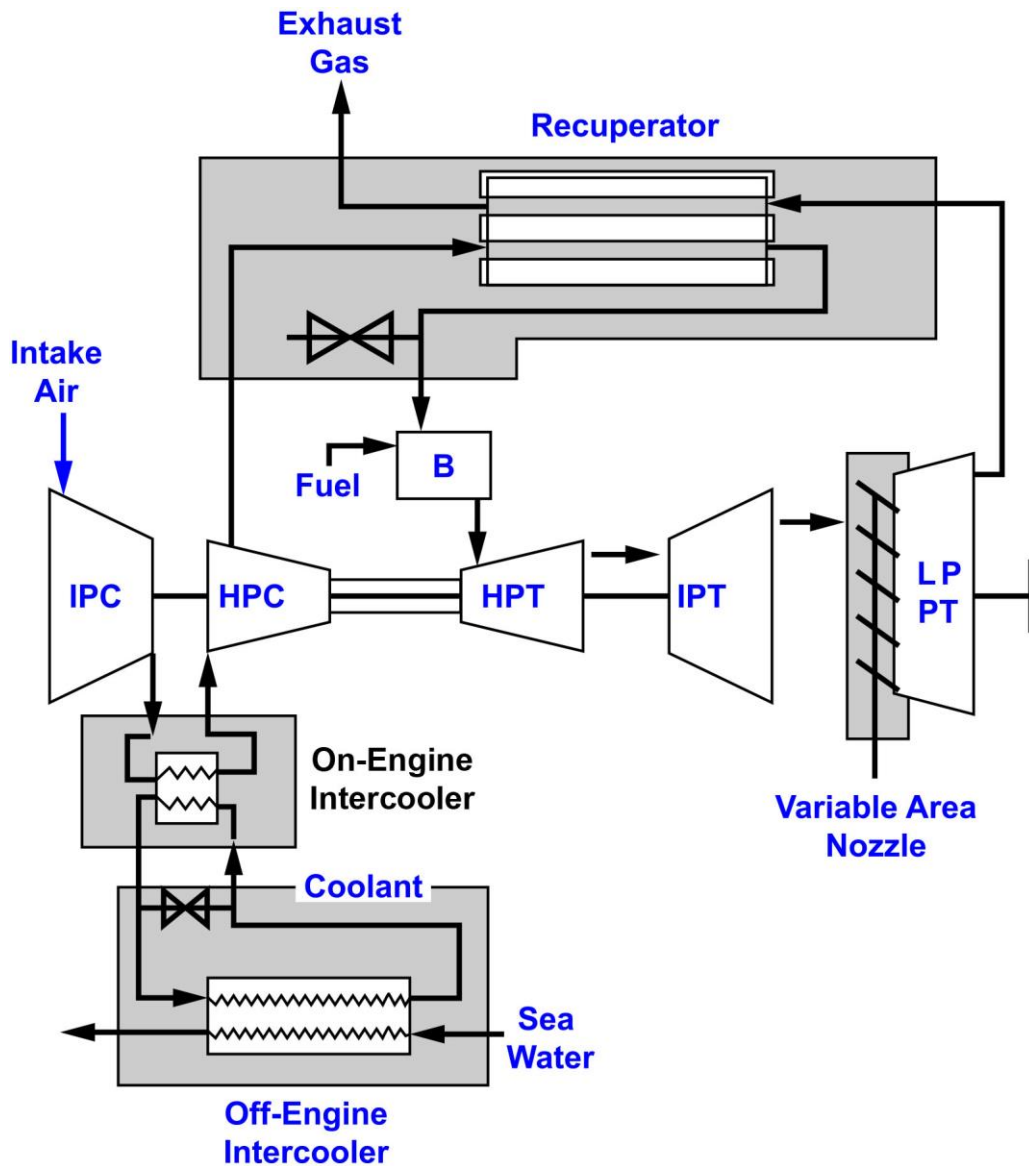


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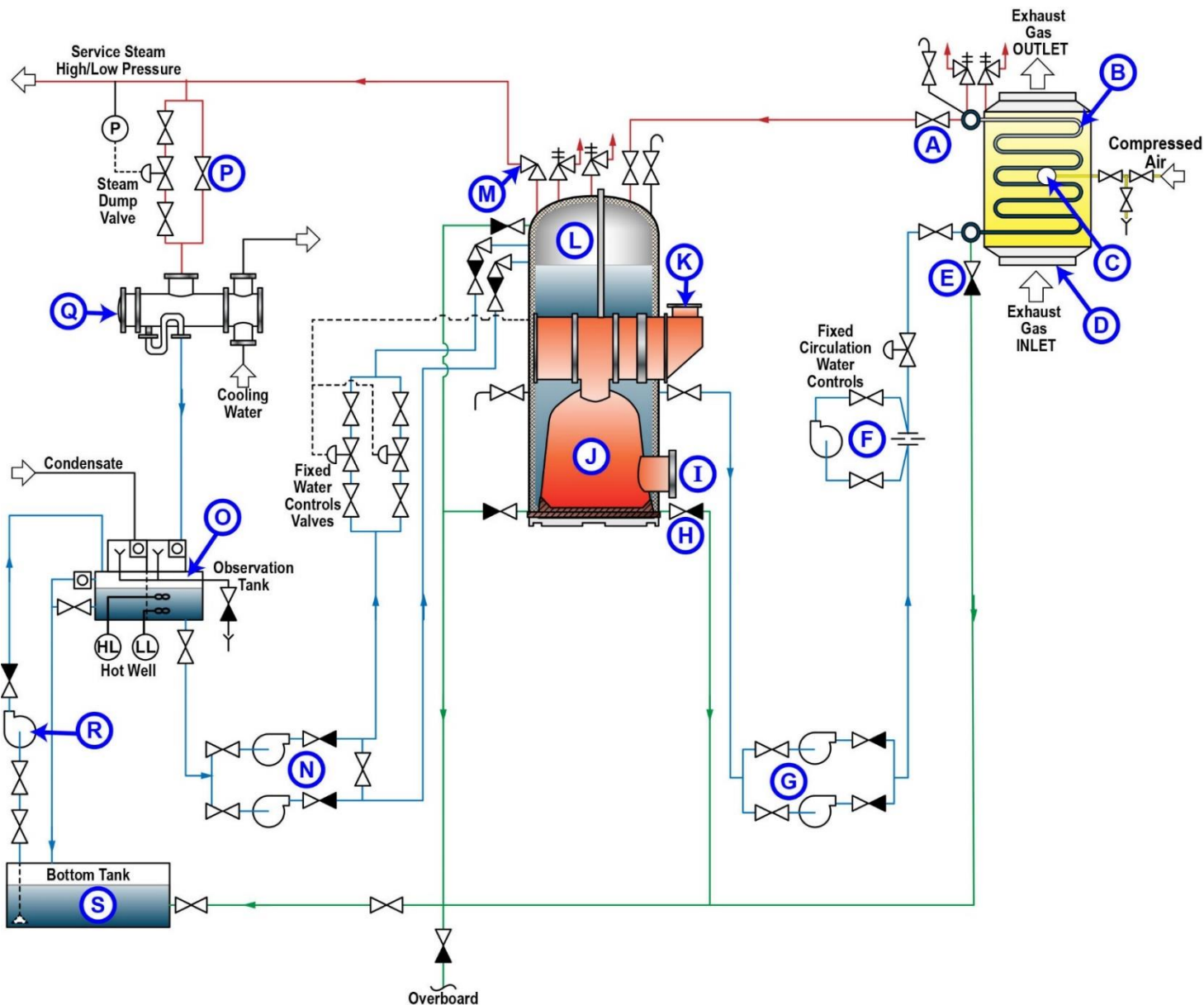
## GT-0026



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## MO-0231



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