

## U.S.C.G. Merchant Marine Exam

UFIV - Assistant Engineer

Q693 General Subjects

(Sample Examination)

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

1. Which of the following bilge pumping applications would most likely use a non-automated centrifugal pump under manual supervision?
- (A) Engine room bilges
  - (B) Dry cargo-hold bilges
  - (C) Shaft alley bilges
  - (D) Machinery space bilges

*If choice B is selected set score to 1.*

2. Which of the listed valve types is typically used for the low-pressure stage of a reciprocating air compressor?
- (A) Strip-type
  - (B) Ring-plate
  - (C) Sliding
  - (D) Rotary

*If choice A is selected set score to 1.*

3. Which of the following illustrations represents the proper method of circuit grounding for a low level analog signal cable? Illustration EL-0124
- (A) A
  - (B) B
  - (C) C
  - (D) D

*If choice A is selected set score to 1.*

4. In a closed-loop process control system, what statement concerning feedback is true as it relates to stability and the direction of error displacement?
- (A) Negative feedback is used to minimize instability by pushing the system in the same direction as the error displacement.
  - (B) Positive feedback is used to minimize instability by pushing the system in the same direction as the error displacement.
  - (C) Positive feedback is used to minimize instability by pushing the system in the opposite direction as the error displacement.
  - (D) Negative feedback is used to minimize instability by pushing the system in the opposite direction as the error displacement.

*If choice D is selected set score to 1.*

5. With respect to shaft bearing load absorption capability in terms of direction, what is meant by a radial load?
- (A) A radial load is a load applied tangent to the circumference of the shaft.
  - (B) A radial load is a load applied perpendicular to the axis of the shaft.
  - (C) A radial load is a load applied perpendicular and parallel to the axis of the shaft.
  - (D) A radial load is a load applied parallel to the axis of the shaft.

*If choice B is selected set score to 1.*

6. What is the primary purpose of the lead-lag arrangement of the two potable water pumps supporting a typical potable water system?
- (A) Enabling the lag pump to cycle on and off during periods of relatively low demand and the lead pump to assist the lag pump only when the demand is high.
  - (B) Enabling the lead pump to pump against a shut-off head during periods of relatively low demand and the lag pump to recirculate when the demand is high.
  - (C) Enabling the lead pump to cycle on and off during periods of relatively low demand and the lag pump to assist the lead pump only when the demand is high.
  - (D) Enabling both potable water pumps to cycle on and off together in response to system demand changes.

*If choice C is selected set score to 1.*

7. What is meant by the term "deadband" as it applies to prime mover speed control governors?
- (A) Deadband is the repeated variation of speed due to under-control by the governor and a lack of governor power.
  - (B) Deadband is the change in speed required before the governor will initiate a corrective action as the result of a load change.
  - (C) Deadband is the result of transient speed changes of a prime mover as the governor responds to load changes.
  - (D) Deadband is the repeated and sometimes rhythmic variation of speed due to over-control by the governor.

*If choice B is selected set score to 1.*

8. With regard to the number of passes through the tubes of shell-and-tube heat exchangers, what statement is true?
- (A) In two-pass and four-pass heat exchangers, the inlet and outlet tube-side fluid connections are at the same end.
  - (B) In single-pass and two-pass heat exchangers, the inlet and outlet tube-side fluid connections are at the same end.
  - (C) In two-pass and four-pass heat exchangers, the inlet and outlet tube-side fluid connections are at opposite ends.
  - (D) In single-pass and two-pass heat exchangers, the inlet and outlet tube-side fluid connections are at opposite ends.

*If choice A is selected set score to 1.*

9. Energy losses occurring in a hydraulic system are ultimately absorbed by the \_\_\_\_\_.

- (A) fluid as friction
- (B) hydraulic piping flexibility
- (C) atmosphere as heat
- (D) reservoir expansion chamber

*If choice C is selected set score to 1.*

10. With an increase in temperature, the volume of hydraulic fluid \_\_\_\_\_.

- (A) increases
- (B) remains the same
- (C) contracts
- (D) remains constant if pressure decreases

*If choice A is selected set score to 1.*

11. Which of the listed components of a hydraulic system would enable the pump to be temporarily shut down, and yet still provide an instantaneous source of hydraulic force?

- (A) Sump actuator
- (B) Accumulator
- (C) Pressure compensator valve
- (D) Modulator

*If choice B is selected set score to 1.*

12. Which statement is true concerning alkaline reserve as it applies to a lubricating oil?

- (A) Alkaline reserve represents the ability of an oil to maintain the oil in an acidic condition.
- (B) Alkaline reserve represents the ability of an oil to maintain the oil in an alkaline condition.
- (C) Alkaline reserve represents the ability of an oil to neutralize bases as they are formed.
- (D) Alkaline reserve represents the ability of an oil to neutralize acids as they are formed.

*If choice D is selected set score to 1.*

13. A typical oily-water separator has three stages of separation. Which statement represents the correct sequential order of the stages?

- (A) First stage: polishing filter coalescer. Second stage: inclined plate coalescer. Third stage: gravimetric.
- (B) First stage: gravimetric. Second stage: polishing filter coalescer. Third stage: inclined plate coalescer.
- (C) First stage: gravimetric. Second stage: inclined plate coalescer. Third stage: polishing filter coalescer.
- (D) First stage: inclined plate coalescer. Second stage: polishing filter coalescer. Third stage: gravimetric.

*If choice C is selected set score to 1.*

**14.** The shaft sleeve for the pump shown in the illustration is identified by which item number?  
Illustration GS-0143

- (A) 9
- (B) 2
- (C) 3
- (D) 7

*If choice D is selected set score to 1.*

**15.** Concerning the operating mechanism of a controllable-pitch propeller, what statement is true?

- (A) If the hydraulic actuator is inboard or outboard, hydraulic oil pipes are located within the propeller shaft in either case.
- (B) If the hydraulic actuator is inboard or outboard, the blade rotating mechanism is actuated by a mechanical pull-push rod located within the propeller shaft.
- (C) If the hydraulic actuator is inboard, a mechanical pull-push rod is located within the propeller shaft. If the hydraulic actuator is outboard, hydraulic oil pipes are located within the propeller shaft.
- (D) If the hydraulic actuator is outboard, a mechanical pull-push rod is located within the propeller shaft. If the hydraulic actuator is inboard, hydraulic oil pipes are located within the propeller shaft.

*If choice C is selected set score to 1.*

**16.** Referring to the illustrated motorship fresh water cooling system drawing, which set of cooling water pumps would MOST likely require a priming maintenance system or the use of deep-well pumps?  
Illustration MO-0212

- (A) The main engine jacket cooling fresh water pumps.
- (B) The main engine piston cooling fresh water pumps.
- (C) The ship's service diesel-generator fresh water cooling pumps.
- (D) The main engine injector cooling fresh water pumps.

*If choice B is selected set score to 1.*

**17.** The "tare weight" of a refrigerant storage cylinder refers to what weight?

- (A) the total weight of a fully charged cylinder
- (B) the weight of an empty cylinder
- (C) the maximum weight of the refrigerant allowed
- (D) the weight of a cylinder AND its current contents

*If choice B is selected set score to 1.*

**18.** What is the pressure and condition of the refrigerant entering the receiver of a refrigeration system?

- (A) superheated high-pressure vapor
- (B) superheated low-pressure vapor
- (C) subcooled high-pressure liquid
- (D) subcooled low-pressure liquid

*If choice C is selected set score to 1.*

**19.** In the illustrated refrigeration system, what is the proper name for the component labeled "A"?  
Illustration RA-0012

- (A) condenser
- (B) compressor
- (C) filter drier
- (D) accumulator

*If choice B is selected set score to 1.*

**20.** During operating periods of a multi-box refrigeration system using a capacity-controlled compressor, when all of the evaporators of a four-box plant are actively being fed with liquid refrigerant, the control oil pressure acting on the hydraulic relay piston shown in the illustration will be at what value? Illustration RA-0013

- (A) the lowest
- (B) at its mid-range
- (C) the highest
- (D) of no consequence as the lube oil is not used in the operation of the unloader

*If choice C is selected set score to 1.*

**21.** Refrigerant flow through a thermostatic expansion valve is greatest under what conditions?

- (A) just before the evaporator stops feeding at relatively low box temperature
- (B) when the evaporator has just begun feeding at relatively high box temperature
- (C) when the low side and high side pressures are equal
- (D) when the low side pressure and the bulb pressure are equal

*If choice B is selected set score to 1.*

**22.** As shown in figure "B" of the illustrated self-contained recovery unit connection diagrams, what is the recovery method supported by the connection scheme? Illustration RA-0033

- (A) liquid recovery/push-pull
- (B) vapor recovery/push-pull
- (C) direct vapor recovery
- (D) direct liquid recovery

*If choice C is selected set score to 1.*

**23.** The amount of HCFC-123 in a storage cylinder is measured by what means?

- (A) weight
- (B) saturation pressure
- (C) volume
- (D) saturation temperature

*If choice A is selected set score to 1.*

**24.** Spring reinforced oil seals are generally installed with the tail or lip of the seal facing \_\_\_\_\_.  
Illustration GS-0152

- (A) toward the bearing preload washer
- (B) toward the oil pressure being sealed
- (C) away from the oil pressure being sealed
- (D) away from the bearing housing recess

*If choice B is selected set score to 1.*

**25.** What type of pump is shown in the illustration? Illustration GS-0144

- (A) Deep well centrifugal pump
- (B) Simplex reciprocating pump
- (C) Double screw rotary pump
- (D) Triple screw rotary pump

*If choice D is selected set score to 1.*

**26.** Which of the listed temperature measuring devices installed on a large turbo-electric alternating current propulsion generator would be the most reliable for monitoring generator temperatures to avoid premature winding insulation failure?

- (A) Temperature sensors measuring the temperature of the cooling air associated with the generator air cooler.
- (B) Temperature sensors inserted in the stator slots for measuring stator winding temperature.
- (C) Temperature sensors measuring the temperature of the cooling water associated with the generator air cooler.
- (D) Current transformers are the most reliable means of monitoring generator temperatures.

*If choice B is selected set score to 1.*

**27.** Ships requiring extremely rapid maneuvering response using propeller shaft speed and direction as the sole means of controlling propeller thrust are most likely to use what type of drive system?

- (A) Diesel-electric drive
- (B) Direct or geared diesel drive
- (C) Steam turbine geared drive
- (D) Gas turbine geared drive

*If choice A is selected set score to 1.*

**28.** In accordance with 33 CFR Subchapter O (Pollution), which type of Marine Sanitation Device (MSD) is used solely for the storage of sewage and flush water at ambient air pressure and temperature?

- (A) Type I
- (B) Type II
- (C) Type III
- (D) Type IV

*If choice C is selected set score to 1.*

**29.** The rudder torque capacity of the four ram steering gear illustrated, is rated at 44,210,000 inch-pounds with one power unit in operation. If the four ram system was able to be operated as a two ram system with both power units on line, what would be the available torque? Illustration GS-0067

- (A) 11,052,500 inch-pounds
- (B) 22,105,000 inch-pounds
- (C) 44,210,000 inch-pounds
- (D) 88,420,000 inch-pounds

*If choice B is selected set score to 1.*

**30.** How would you prevent the rudder from moving while a repair is made on the steering system using the illustrated actuator? Illustration GS-0116

- (A) screw in the locking pin, item "J"
- (B) tighten the locking screws in item "S"
- (C) tighten the locking pins, item "H" at each position of item "I" to keep the rudder from swinging
- (D) secure the valves in the supply and return lines

*If choice D is selected set score to 1.*

**31.** Four incandescent lamps are connected in series in a single circuit. If one of the lamp filaments burns out, what will happen to the other lamps?

- (A) all go out
- (B) become dimmer
- (C) no change in brightness
- (D) become brighter

*If choice A is selected set score to 1.*

**32.** No two drills from differing drill sets are of the exact same size, with the exception of the drills measured as 0.25 inch. These two drills are the 1/4 inch and the \_\_\_\_\_.

- (A) "A" drill
- (B) "E" drill
- (C) No.1 drill
- (D) No.80 drill

*If choice B is selected set score to 1.*



**33.** What class of screw thread is indicated with a machine screw described as 1/2-13 NC-2?

- (A) 1/2
- (B) 13
- (C) NC
- (D) 2

*If choice D is selected set score to 1.*

**34.** Suppose the illustrated pneumatically operated diaphragm actuated control valve is used to control the fuel oil outlet temperature of a steam-heated heavy fuel oil heater by controlling the steam flow. What would be the result if there was a complete loss of pilot air being delivered to the valve actuator? Illustration GS-0051

- (A) The valve would fail in the fully closed position, most likely resulting in a low fuel oil temperature alarm condition.
- (B) The valve would fail in the exact position just before the loss of pilot air. The fuel temperature will fluctuate with changes in fuel demand.
- (C) The valve would fail in the fully open position, most likely resulting in a high fuel oil temperature alarm condition.
- (D) It is not possible to predict how the valve would respond to a loss of pilot air.

*If choice C is selected set score to 1.*

**35.** As shown in the illustration, if figure "21" indicates the "TOP VIEW" of an orthographic projection, and figure "11" indicates the "FRONT VIEW", which figure would best represent the correct "RIGHT SIDE VIEW"? Illustration GS-0165

- (A) Figure "2"
- (B) Figure "8"
- (C) Figure "10"
- (D) Figure "15"

*If choice C is selected set score to 1.*

**36.** The term, whole depth of the gear, shown in the illustration, is equal to \_\_\_\_\_. Illustration GS-0111

- (A) A + D
- (B) B + D
- (C) C + A
- (D) C + D

*If choice D is selected set score to 1.*

**37.** Suppose the illustrated self-contained, internal-pilot, piston-operated temperature control valve is part of the temperature control system for a steam-heated heavy fuel oil service heater for a steam boiler. If there was an increase in demand for fuel by the boiler, what statement correctly represents how the valve would initially respond? Illustration GS-0045

- (A) The fuel oil heater fuel outlet temperature would decrease, causing the remote bulb pressure to decrease and the thermostatic diaphragm to flex upward and through lever action, further open the pilot valve.
- (B) The fuel oil heater fuel outlet temperature would increase, causing the remote bulb pressure to increase and the thermostatic diaphragm to flex downward and through lever action, further close the pilot valve.
- (C) The fuel oil heater fuel outlet temperature would decrease, causing the remote bulb pressure to decrease and the thermostatic diaphragm to flex downward and through lever action, further close the pilot valve.
- (D) The fuel oil heater fuel outlet temperature would increase, causing the remote bulb pressure to increase and the thermostatic diaphragm to flex upward and through lever action, further open the pilot valve.

*If choice A is selected set score to 1.*

**38.** The best tool to use to measure the number of threads per inch on a bolt is a \_\_\_\_\_.

- (A) Tap
- (B) Screw pitch gauge
- (C) Pair of outside calipers
- (D) Micrometer

*If choice B is selected set score to 1.*

**39.** To measure the circumference of a piece of pipe, you should use a \_\_\_\_\_.

- (A) hook rule
- (B) flexible steel rule
- (C) machinist's steel rule
- (D) folding rule

*If choice B is selected set score to 1.*

**40.** As shown in figure "A" of the illustration, with the switch closed what statement is true if "R<sub>1</sub>" and "R<sub>2</sub>" have unequal resistance values? Illustration EL-0019

- (A) The voltage drop across "R<sub>1</sub>" will not be equal to the voltage drop across "R<sub>2</sub>".
- (B) The current flow through "R<sub>1</sub>" will equal the current flow through "R<sub>2</sub>".
- (C) The current flow through "R<sub>1</sub>" will differ from the current flow through "R<sub>2</sub>".
- (D) The energy dissipated in "R<sub>1</sub>" will be the same as the energy dissipated in "R<sub>2</sub>".

*If choice C is selected set score to 1.*

**41.** Periodic testing using a special sensing device may be performed to detect potentially dangerous loose or corroded bus bar and controller connections. What is the name of this testing technology?

- (A) visual pyrotronics
- (B) infra-red thermography
- (C) corrosion electrolysis
- (D) electric vibro-analysis

*If choice B is selected set score to 1.*

**42.** Which line in figure "B" shown in the illustration represents the trailing edge of the wave? Illustration EL-0088

- (A) 3
- (B) 4
- (C) 5
- (D) 6

*If choice B is selected set score to 1.*

**43.** A silicon controlled rectifier (SCR) is a solid state device used for what functional purpose?

- (A) triggering the operation of a switching function
- (B) attenuating of voltage, current, and/or power
- (C) automatic impedance matching function
- (D) amplifying voltage, current, and/or power

*If choice A is selected set score to 1.*

**44.** What is the nominal output voltage of a 6 cell lead-acid battery?

- (A) 6 volts
- (B) 7.5 volts
- (C) 12 volts
- (D) 18 volts

*If choice C is selected set score to 1.*

**45.** The nominal voltage of one cell of a wet cell nickel-cadmium battery is approximately how many volts?

- (A) 1.2 volts
- (B) 1.5 volts
- (C) 2.0 volts
- (D) 3.0 volts

*If choice A is selected set score to 1.*

**46.** Which of the following motors has a frame configuration for solid base mounting only? Illustration EL-0184

- (A) A
- (B) B
- (C) C
- (D) D

*If choice A is selected set score to 1.*

**47.** What is the name of the type of motor control circuit that will not permit automatic restarting after power is restored, following a power failure?

- (A) reduced voltage restart
- (B) low voltage protection
- (C) low voltage release
- (D) overload lockout

*If choice B is selected set score to 1.*

**48.** The arc resulting from the tripping of a circuit breaker is prevented from damaging the contacts. How is this done?

- (A) instantaneous magnetic trip for overload currents
- (B) designing the contacts to open slowly
- (C) extinguishing the arc by means of an arc chute
- (D) an inverse timed thermal trip for short circuit currents

*If choice C is selected set score to 1.*

**49.** A grinding wheel is trued with a \_\_\_\_\_.

- (A) lathe tool
- (B) dressing tool
- (C) round file
- (D) garnet stone

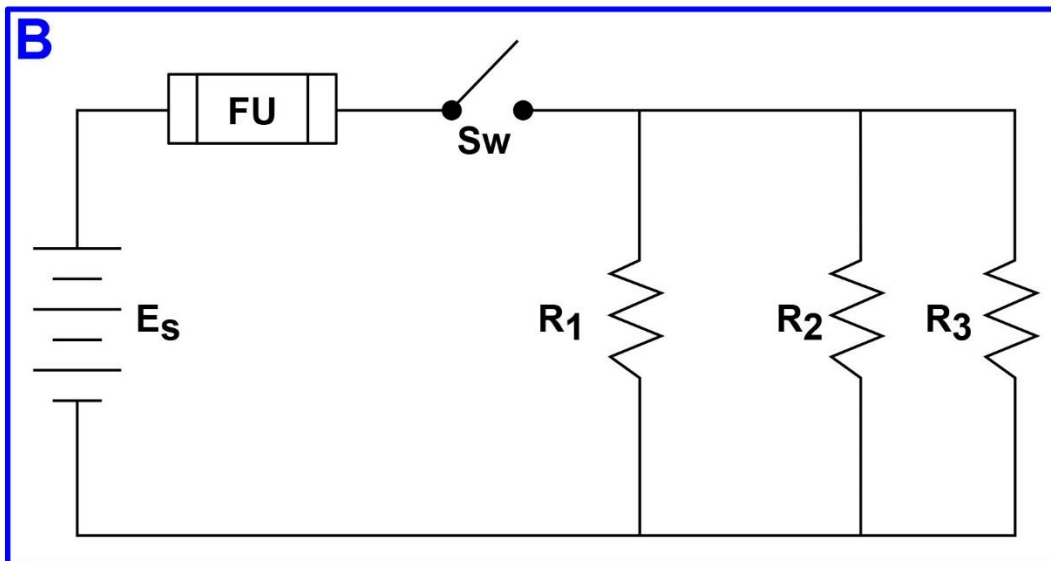
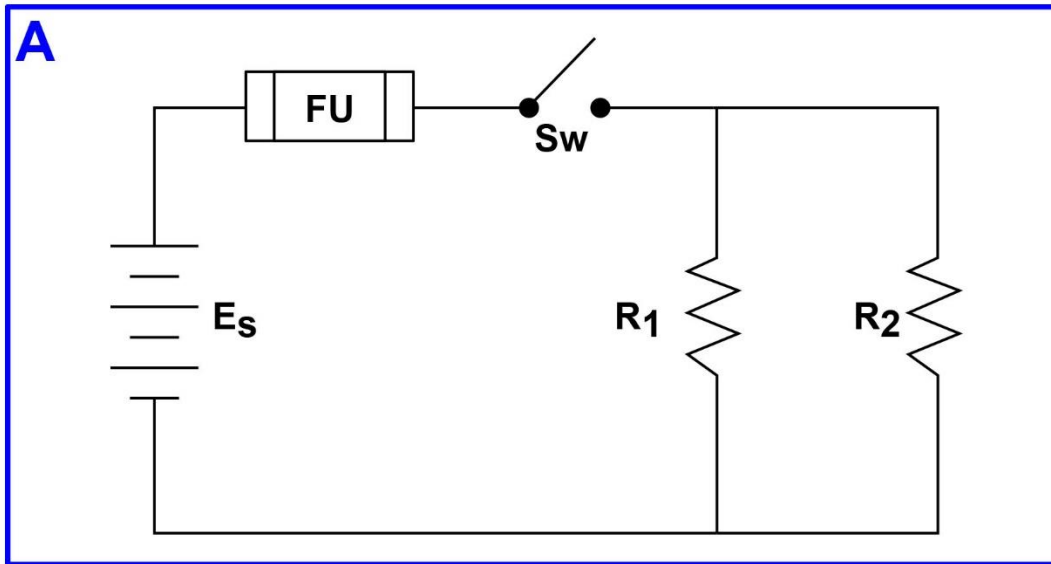
*If choice B is selected set score to 1.*

**50.** Which of the listed temperature sensors consists of finely coiled wire, such as platinum, where the resistance varies directly with temperature?

- (A) Thermocouple
- (B) Thermistor
- (C) Resistance temperature detector
- (D) Bimetallic device

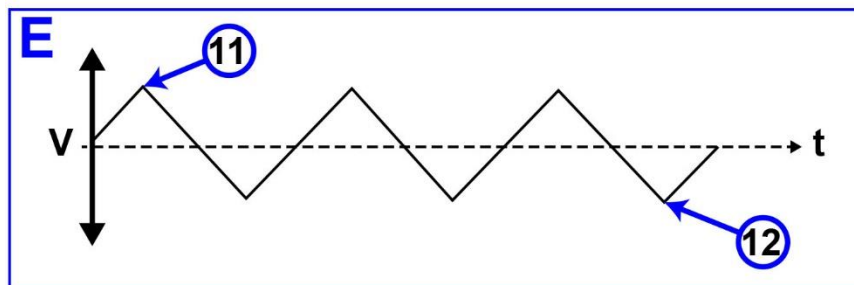
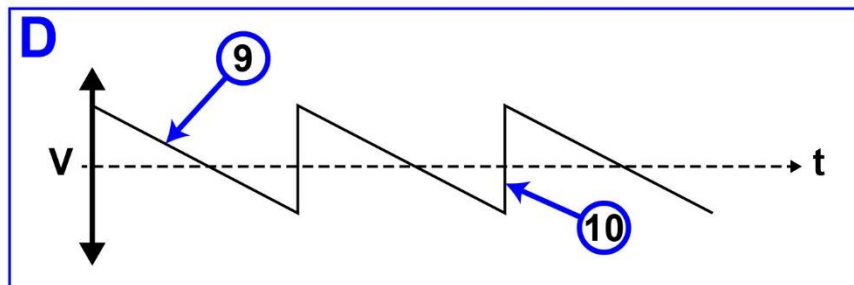
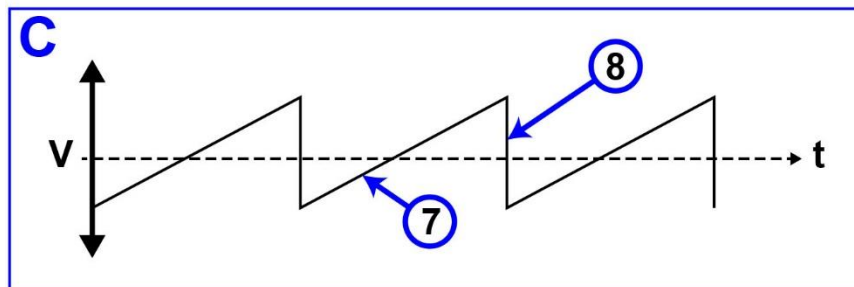
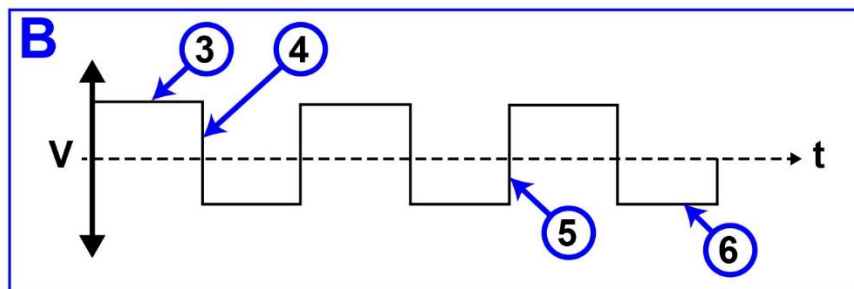
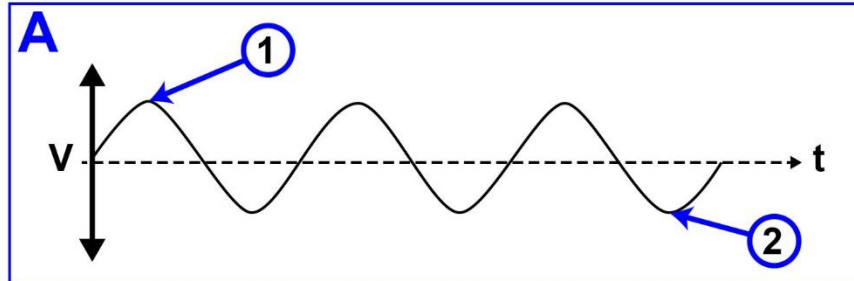
*If choice C is selected set score to 1.*

## EL-0019

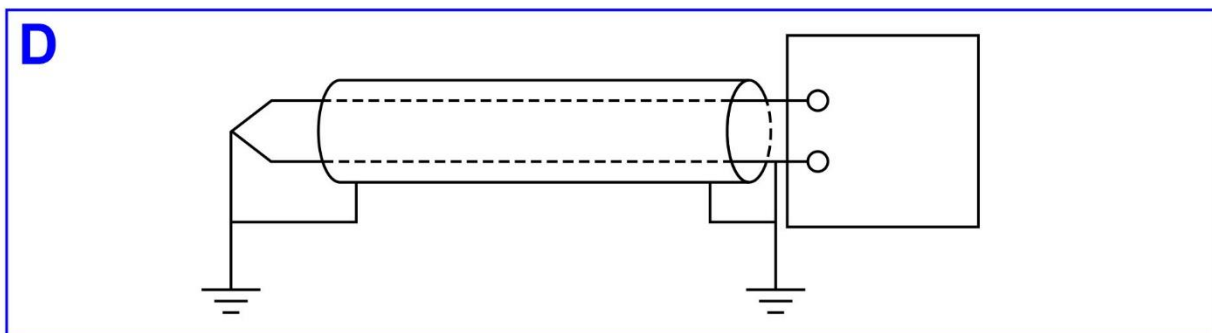
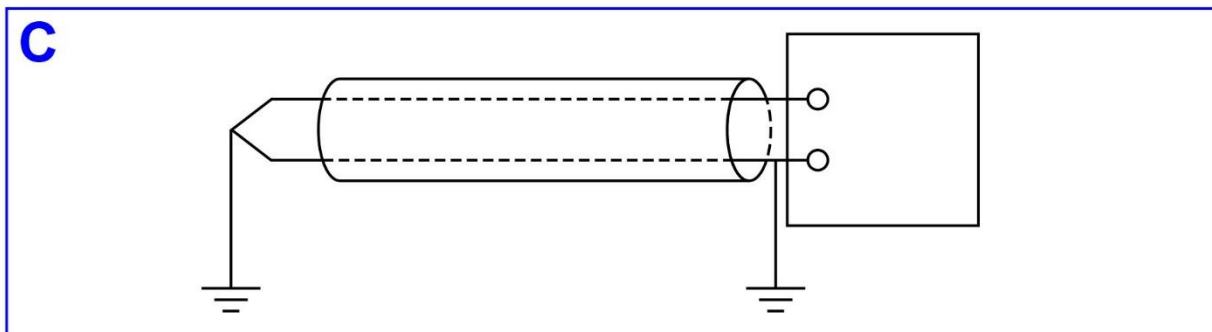
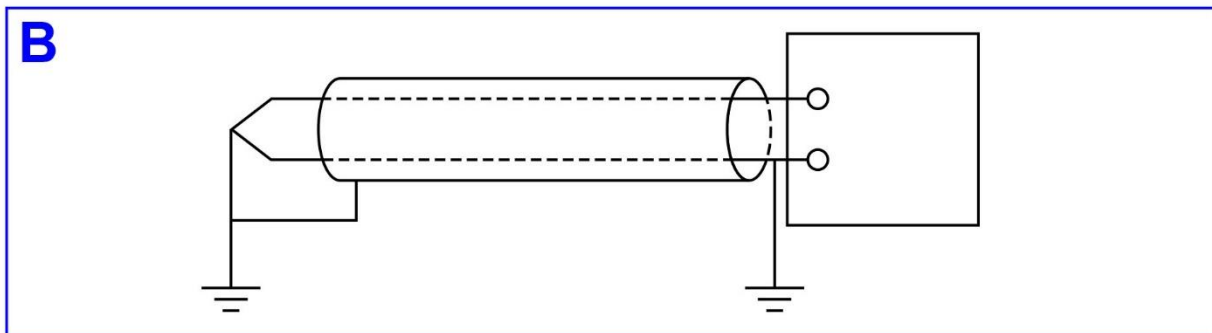
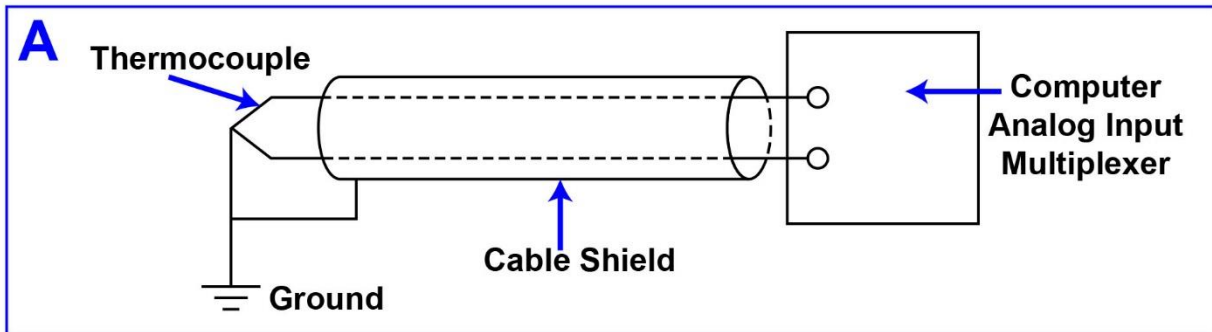


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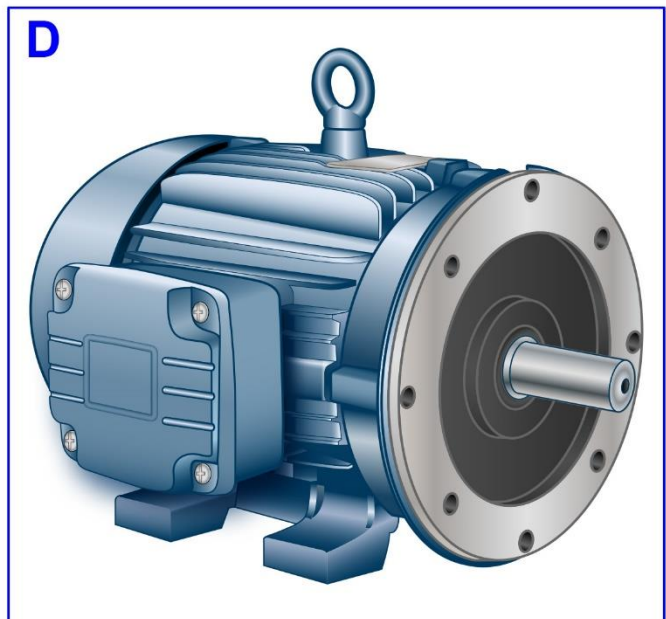
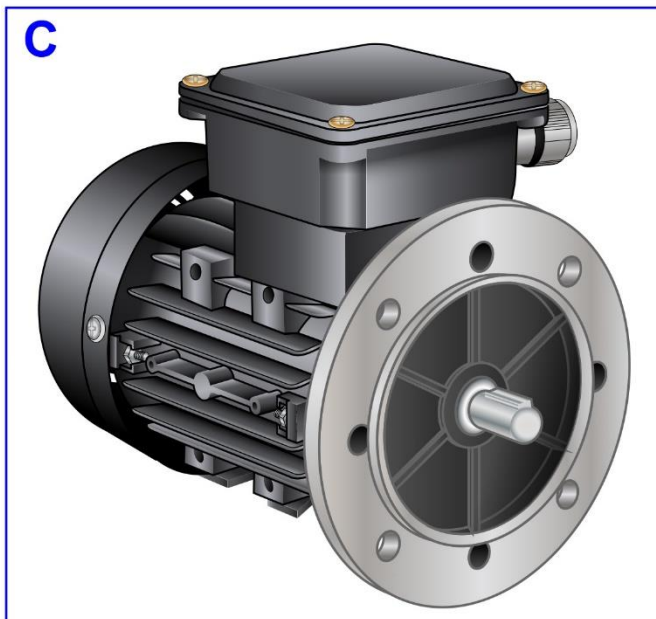
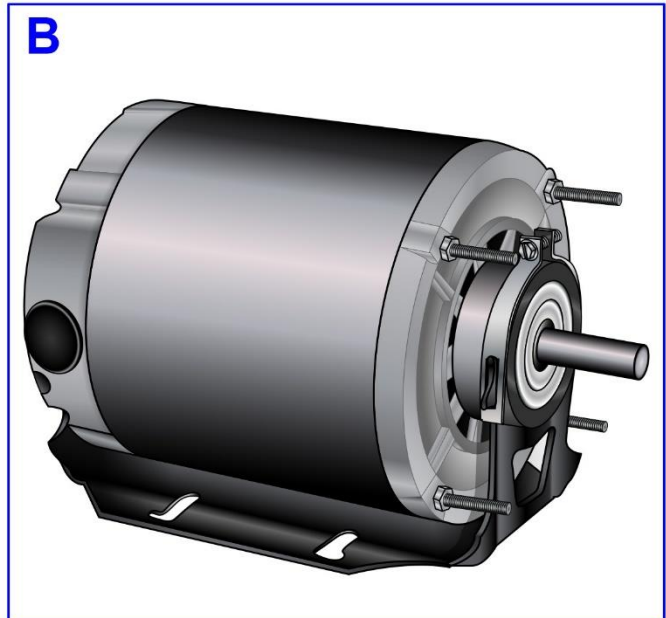
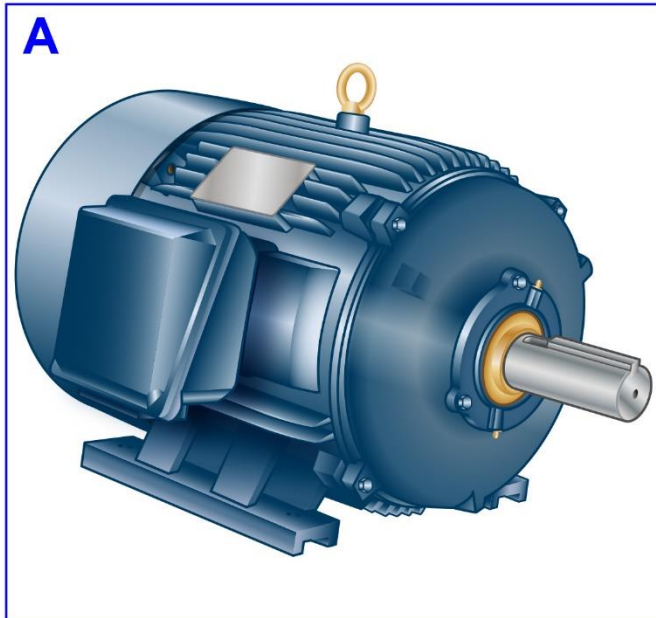
## EL-0088



## EL-0124 Signal Cabling Circuit

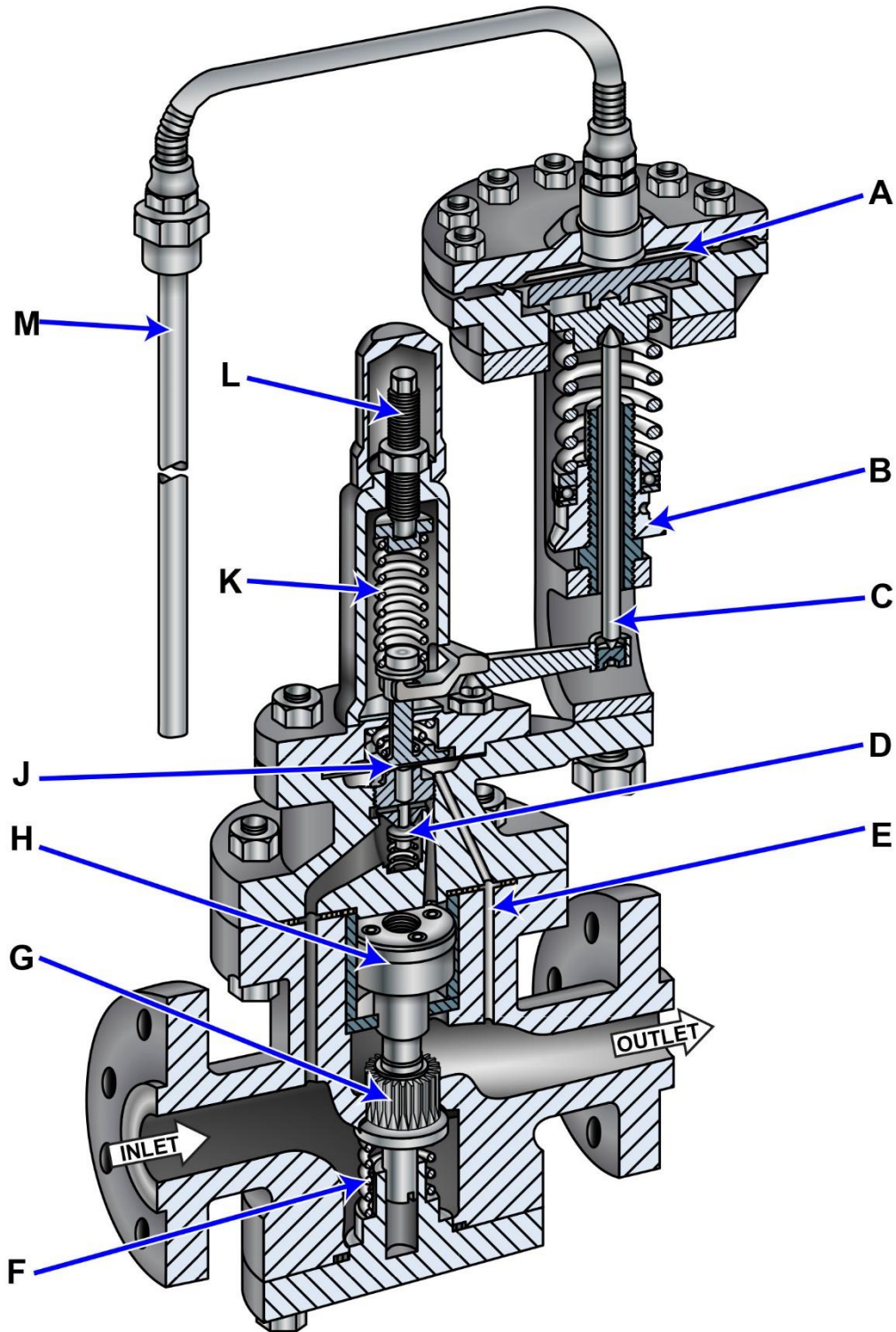


## EL-0184





## GS-0045

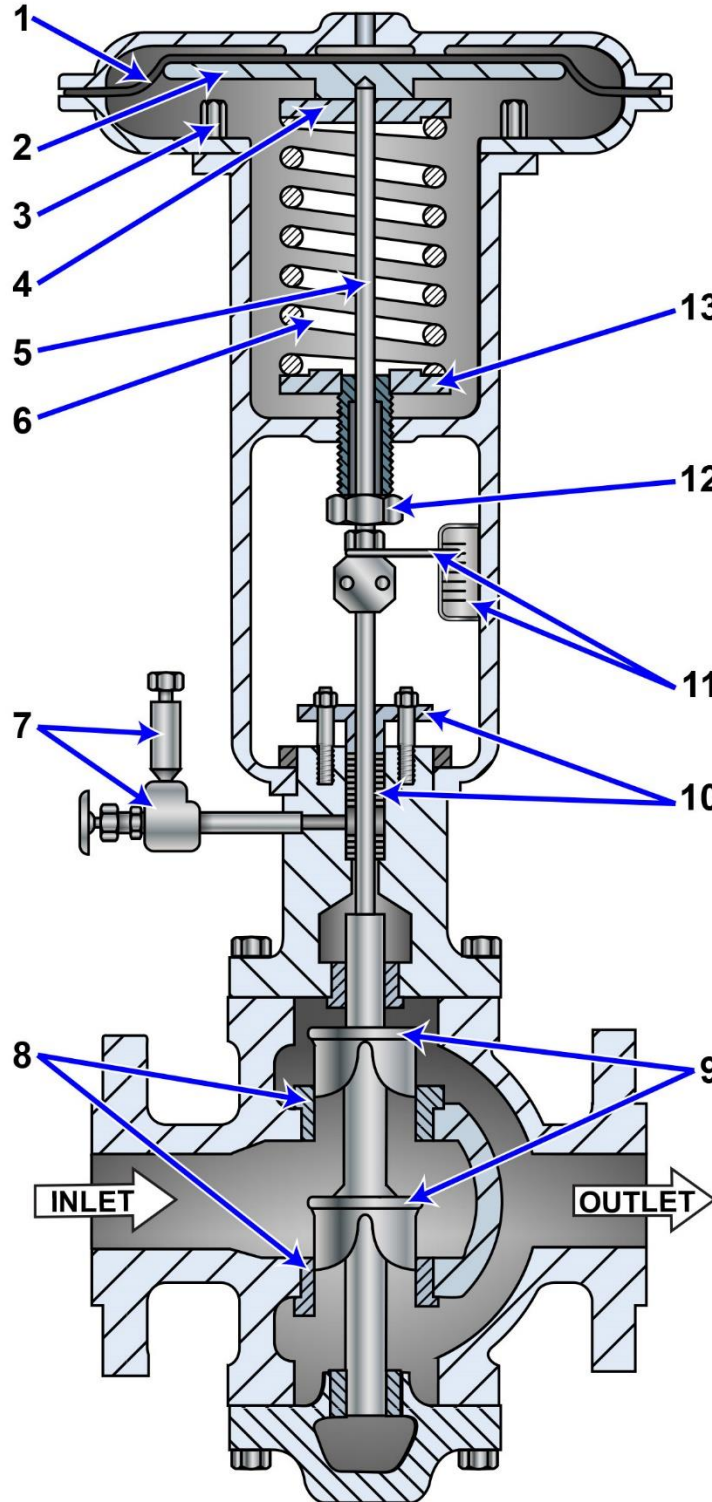


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## GS-0051



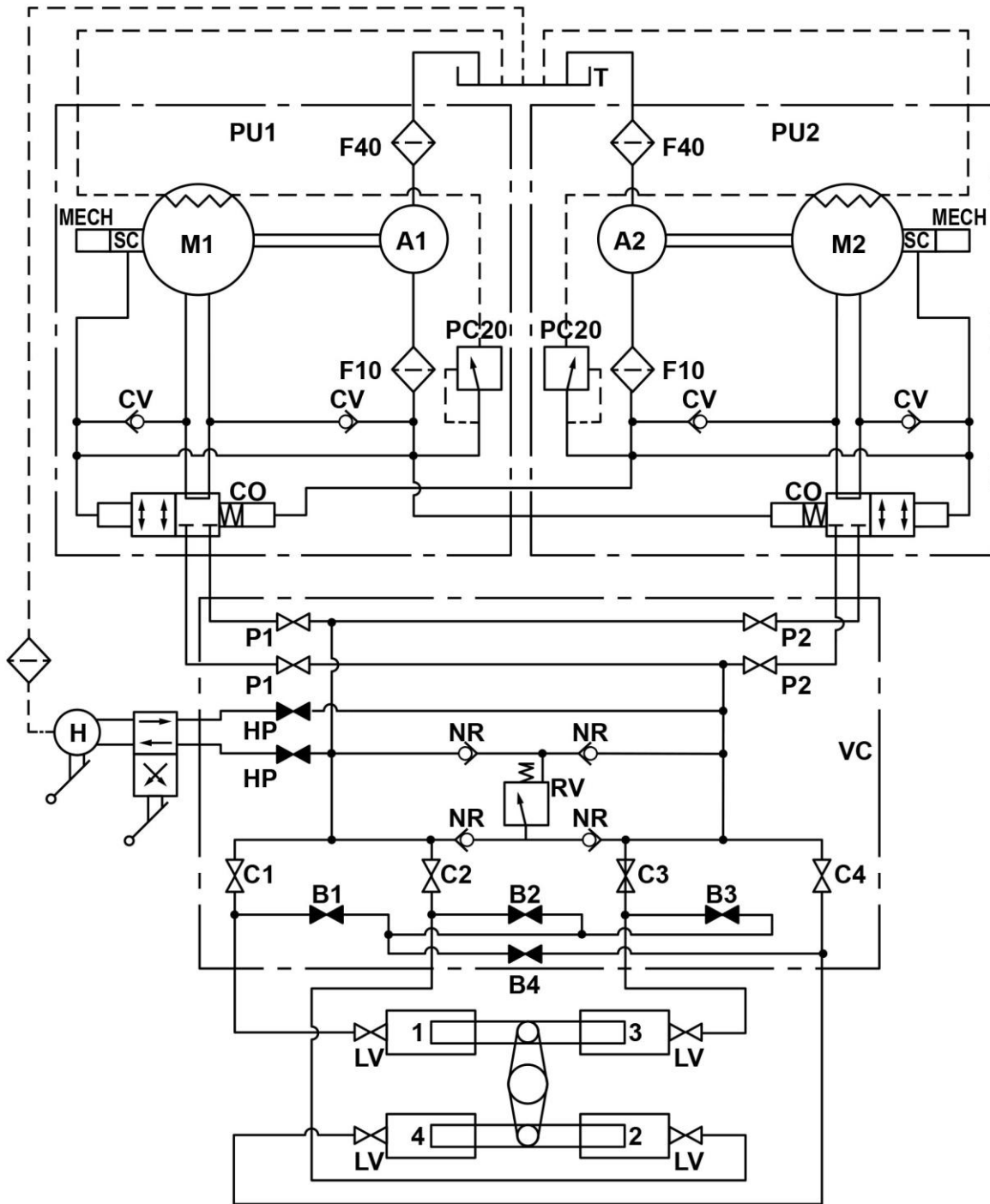
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## GS-0067

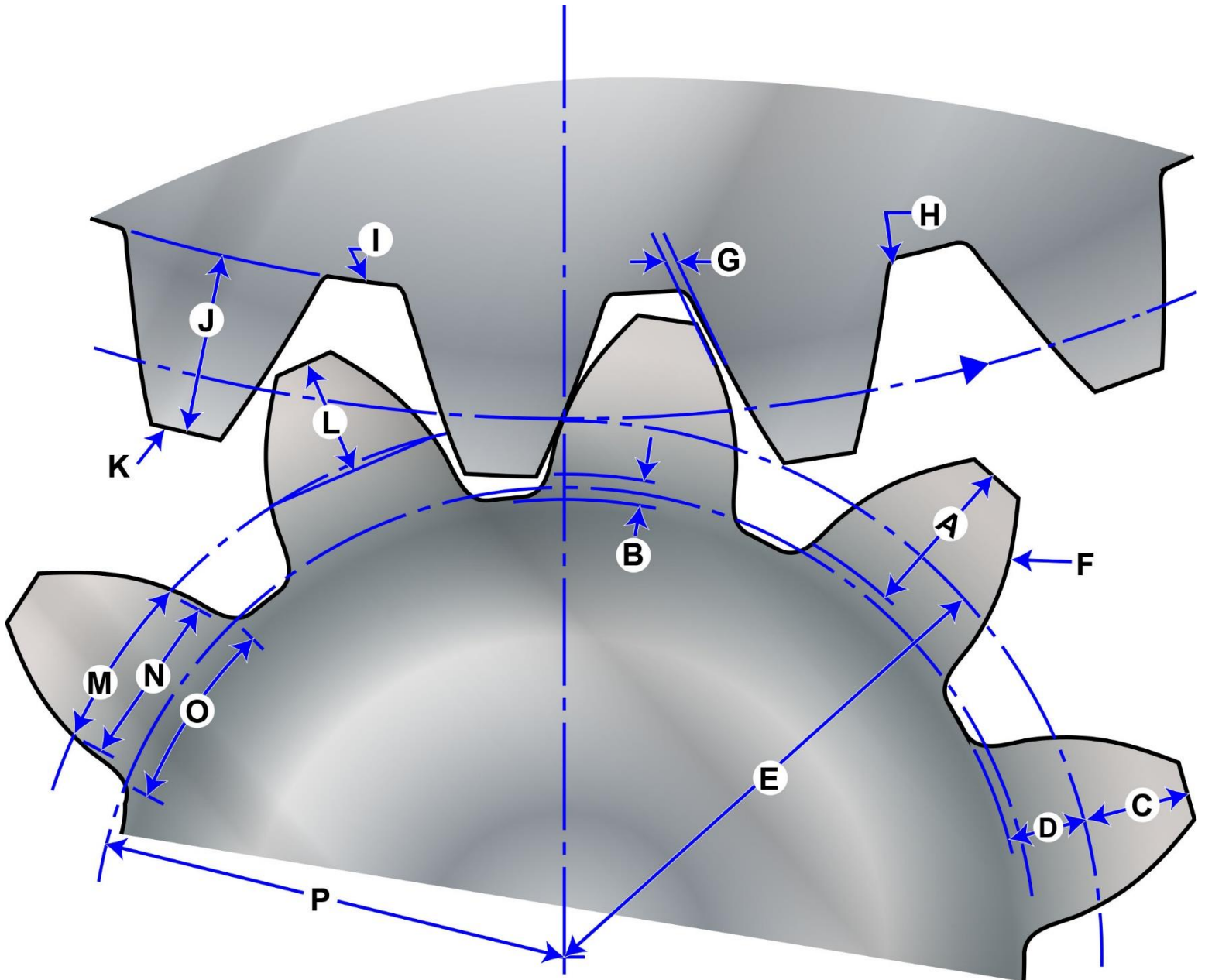


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## GS-0111



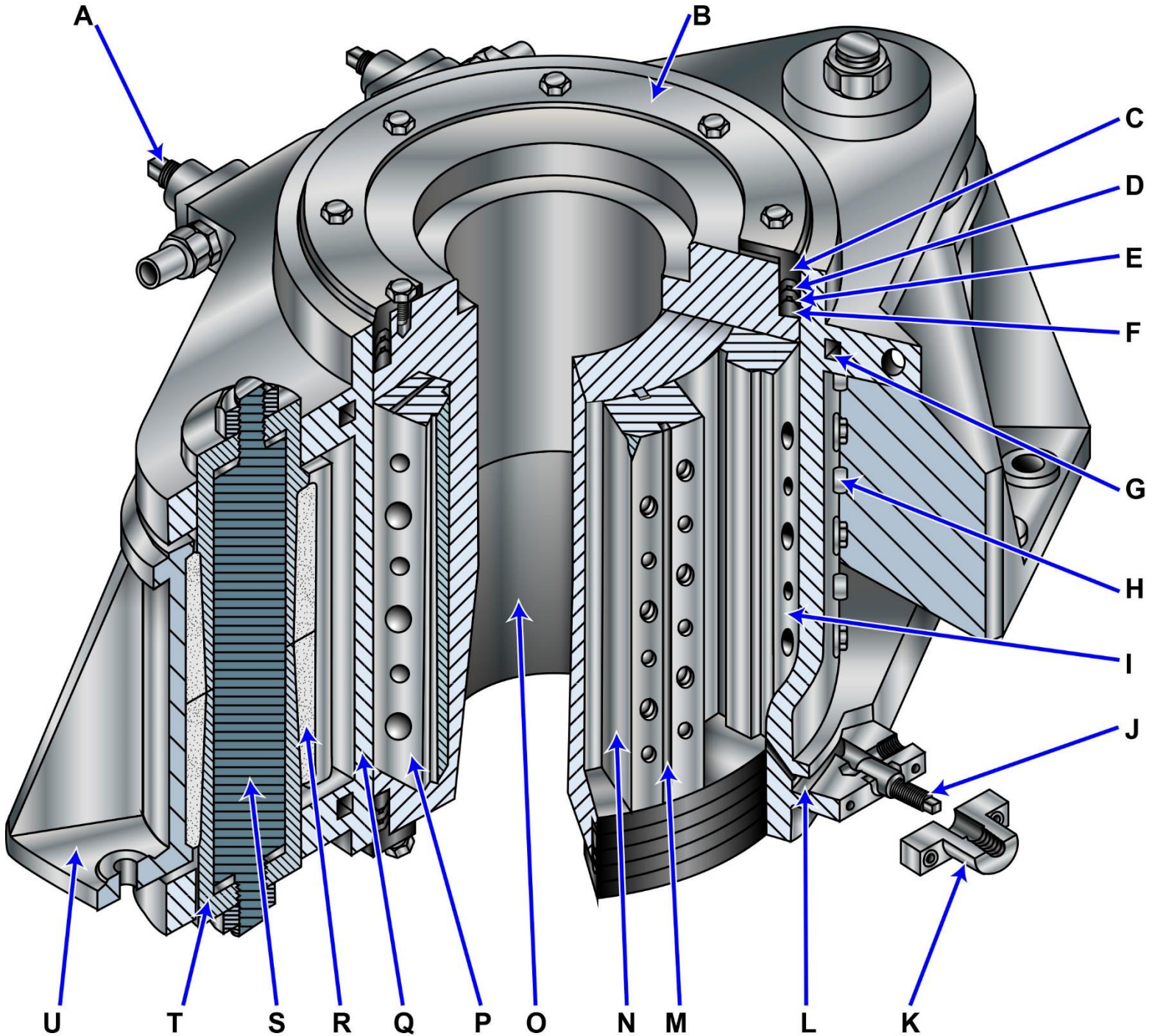
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## GS-0116

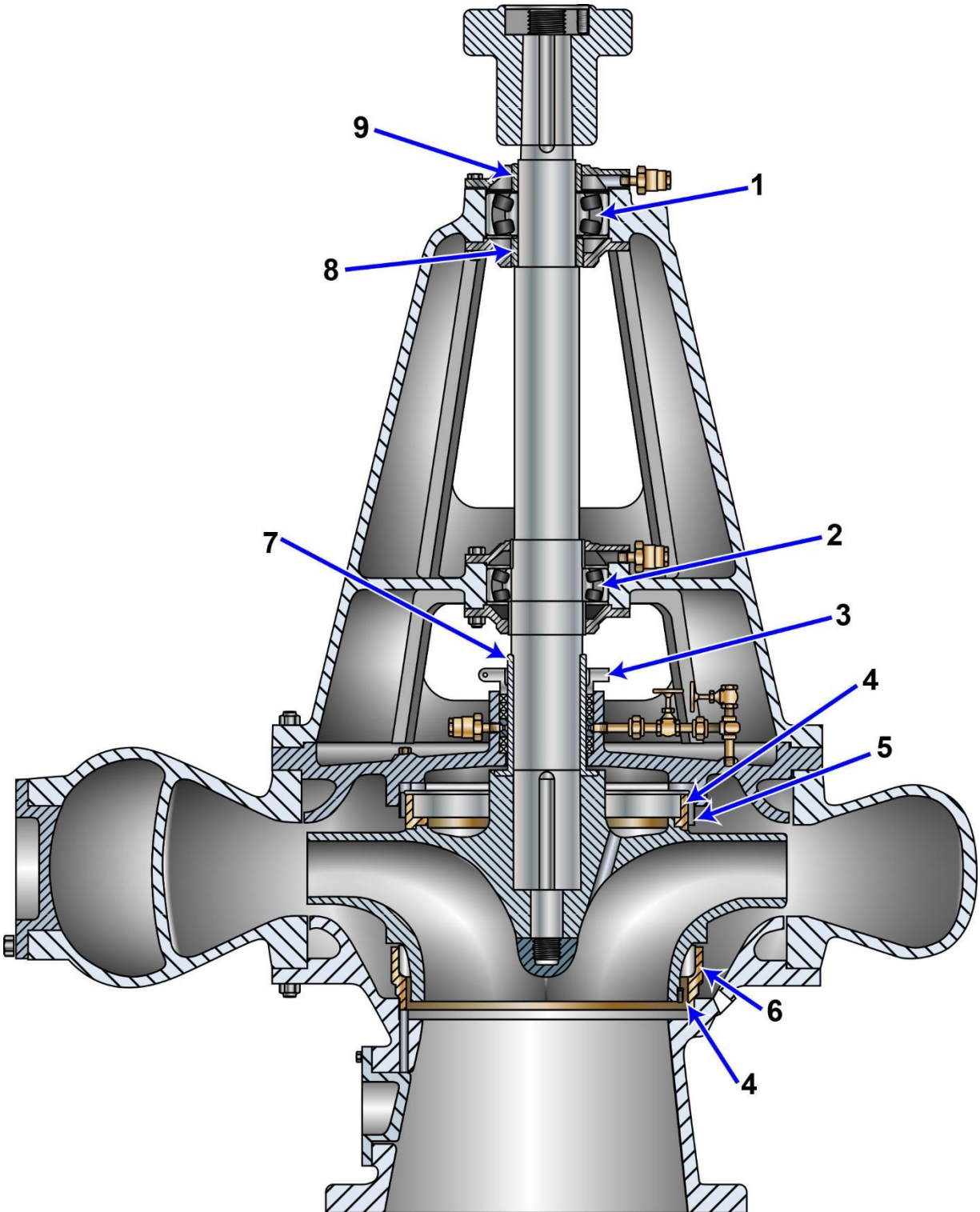


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## GS-0143



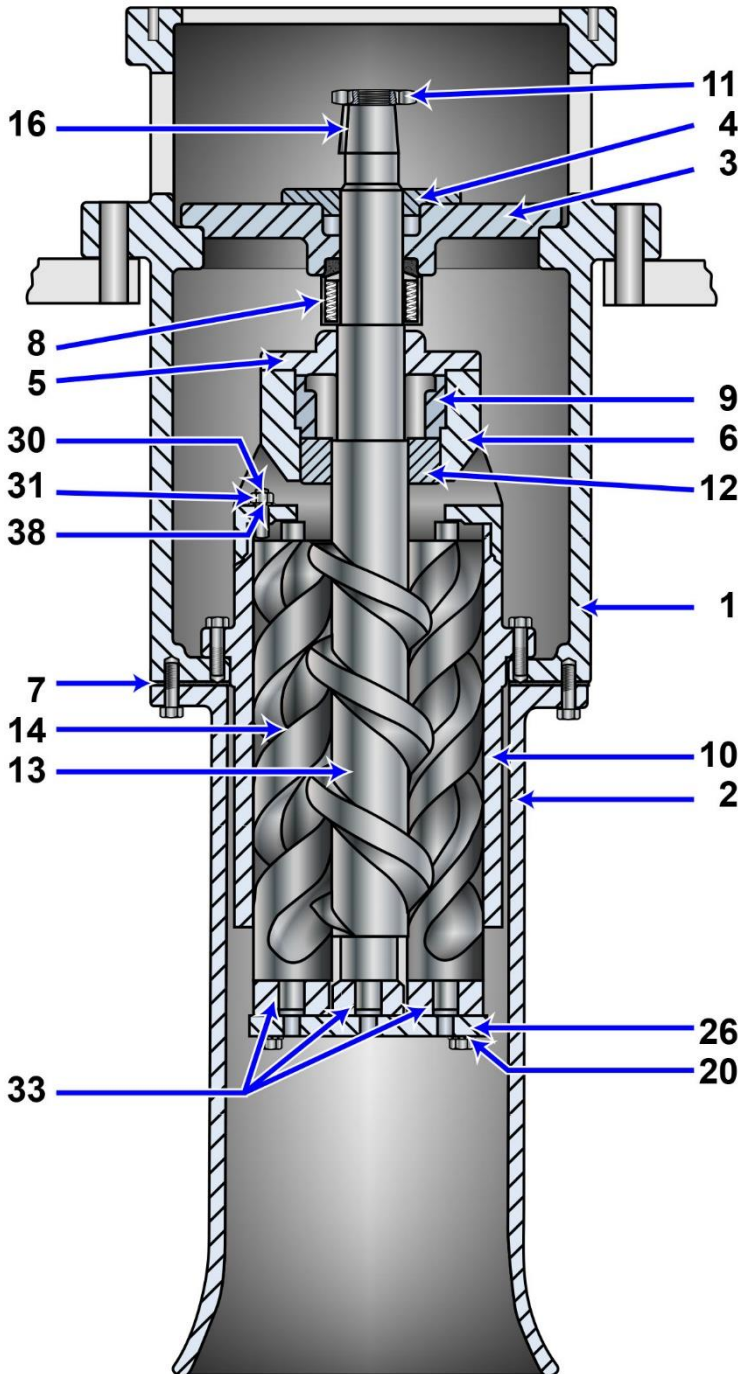
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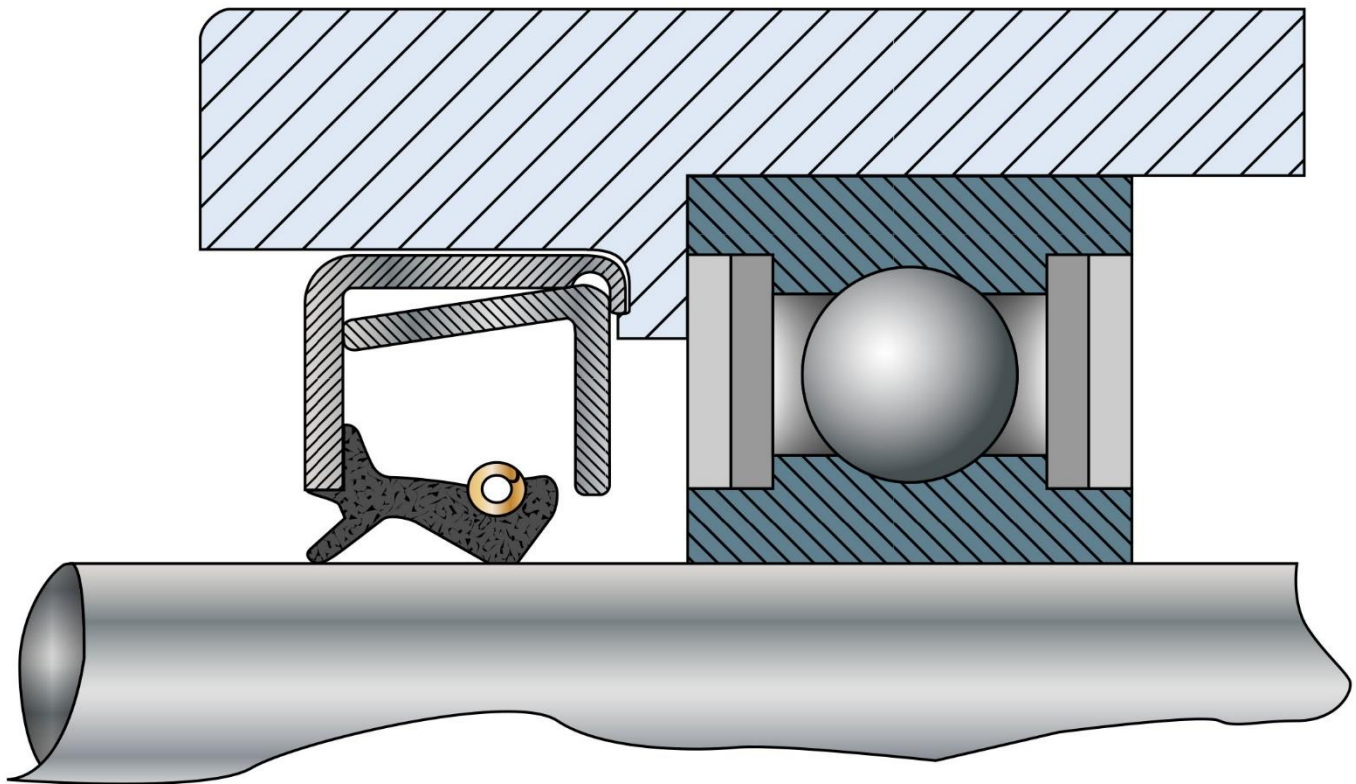


## GS-0144



PC NO.	NAME	Material
1	Pump Case	Cast Steel
2	Inlet Bell	Cast Steel
3	Seal Housing	Cast Steel
4	Packing Gland	Gun Metal
5	Bearing Retainer	Bearing Bronze
6	Balance Rotor Housing	Bearing Bronze
7	Gasket	Plant Fiber
8	Mechanical Seal for 2, 3, 8" Dia. Shaft	Steel & Syn. Rubber
9	Spacer	Bearing Bronze
10	Rotor Housing	Bearing Bronze
11	Check Nut	Steel
12	Balance Piston	Steel
13	Power Rotor	Steel
14	Idler Rotor	Steel
15	Socket Head Set Screw 1/4 - 20 x 7/16" long	Steel
16	Key	Steel
17	Bolt 3/8" - 16 x 1" long	Steel
18	Bolt 3/8" - 16 x 1 1/4" long	Steel
19	External Tooth Lockwasher	Steel
20	External Tooth Lockwasher	Steel
21	Bolt 1/4" - 13 x 1 1/4" Long	Steel
22	Socket Head Pipe Plug - 1/8" Size	Brass
23	Inlet Bell	Cast Steel
24	Bolt 1/2" - 13 x 1 1/2" Long	Steel
25	Spacer	Steel Pipe
26	Thrust Plate	Steel
27	Gasket	Plant Fiber
28	Oil Balance Tube	Steel
29	O Ring	Syn. Rubber
30	Stud 5/8" - 11" x 3 1/4" Long	Steel
31	Nut 5/8" - 11" THDS.	Steel
32	Bolt 1/2" - 13 x 4 1/2" Long	Steel
33	Thrust Shoe	Bearing Bronze
34	Lacing Wire 1/16" Dia. x 16 ft. Lg. (Cut to Suit)	Monel
35	Pkg. Ring for 2 3/8" Dia. Shaft 1/4" SQ	Symbol 430
36	Bolt 3/8" - 16" x 1 3/4" Long	Steel
37	Stud 3/4" - 10 x 3" Long	Steel
38	External Tooth Lockwasher	Steel
39	Spring Pin 3/32" x 3/8" Long	Steel
40	Name Plate (Serial)	Brass Sheet
41	Name Plate (Caution)	Brass Sheet
42	Name Plate (Rotation)	Brass Sheet

## GS-0152



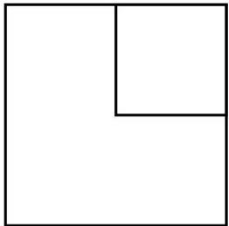
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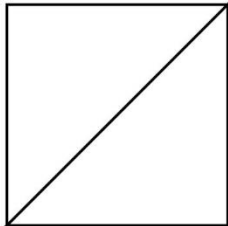
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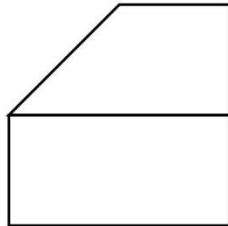
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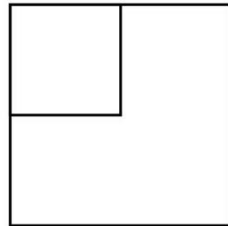
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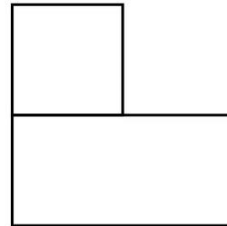
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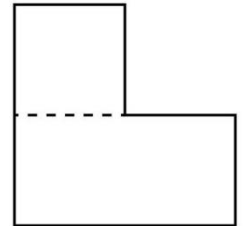
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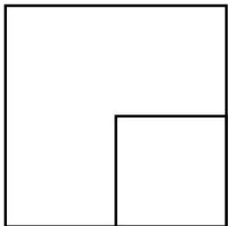
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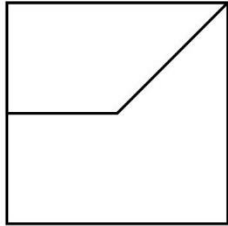
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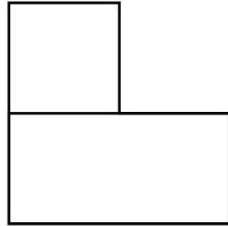
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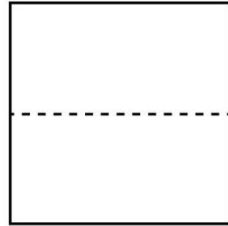
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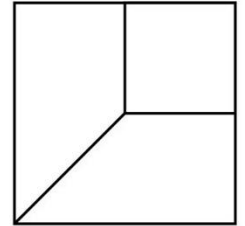
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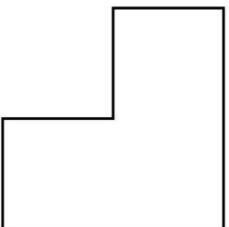
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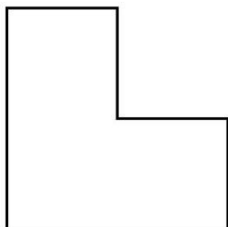
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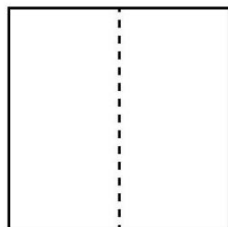
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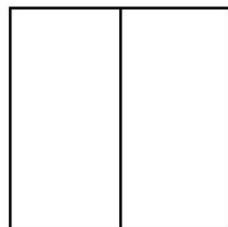
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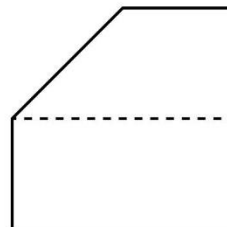
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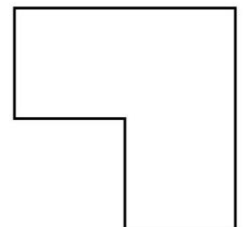
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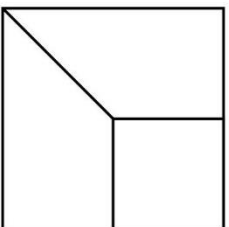
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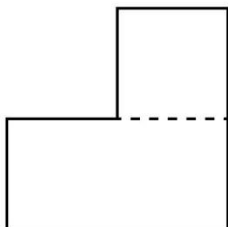
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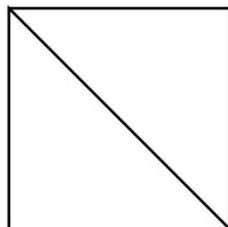
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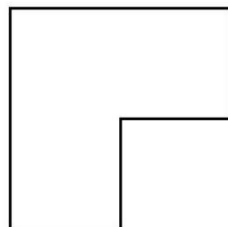
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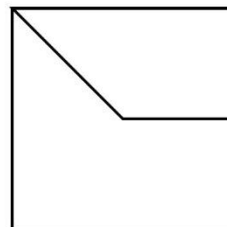
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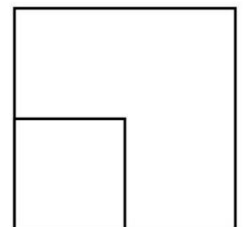
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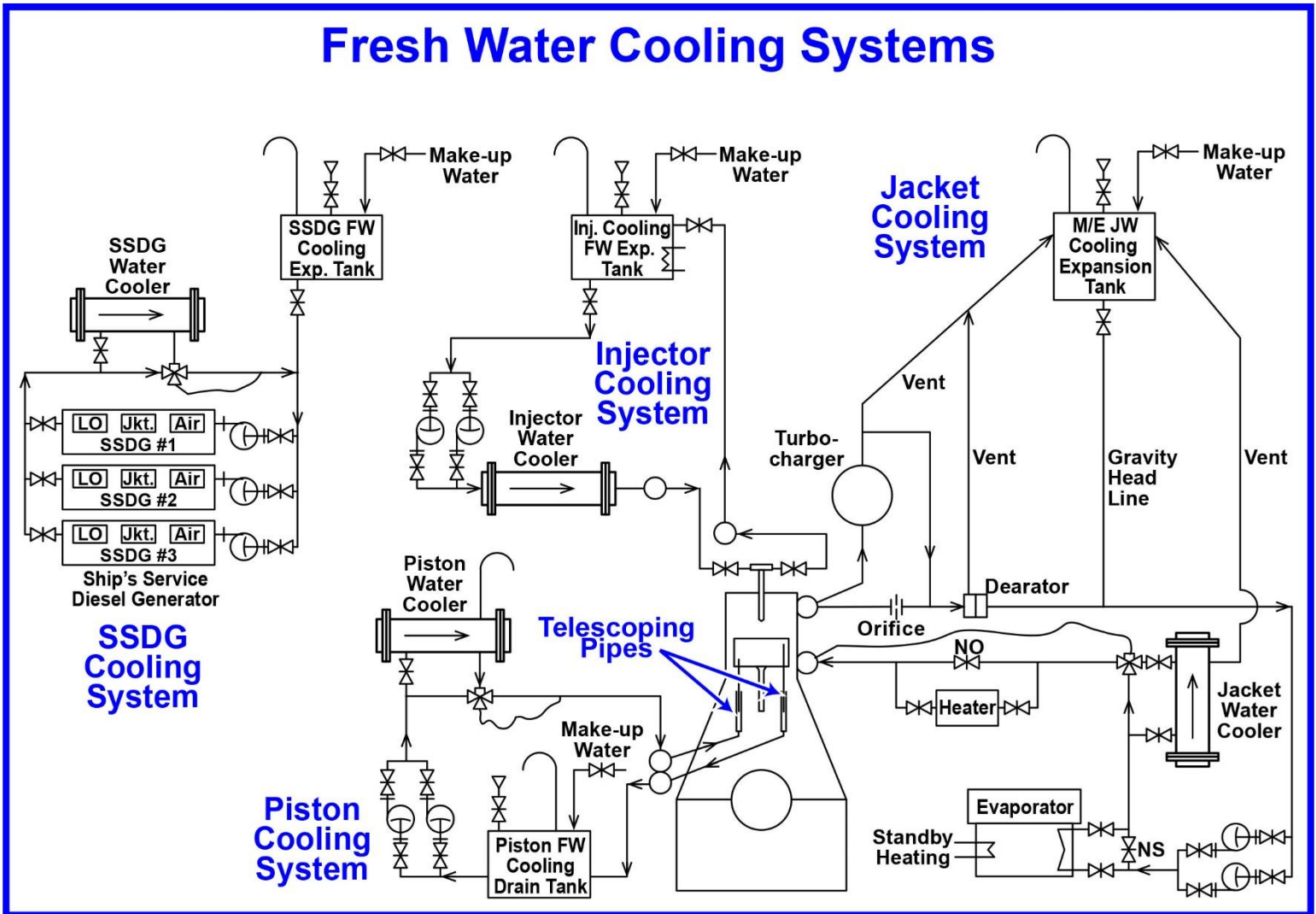
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## MO-0212

### Fresh Water Cooling Systems

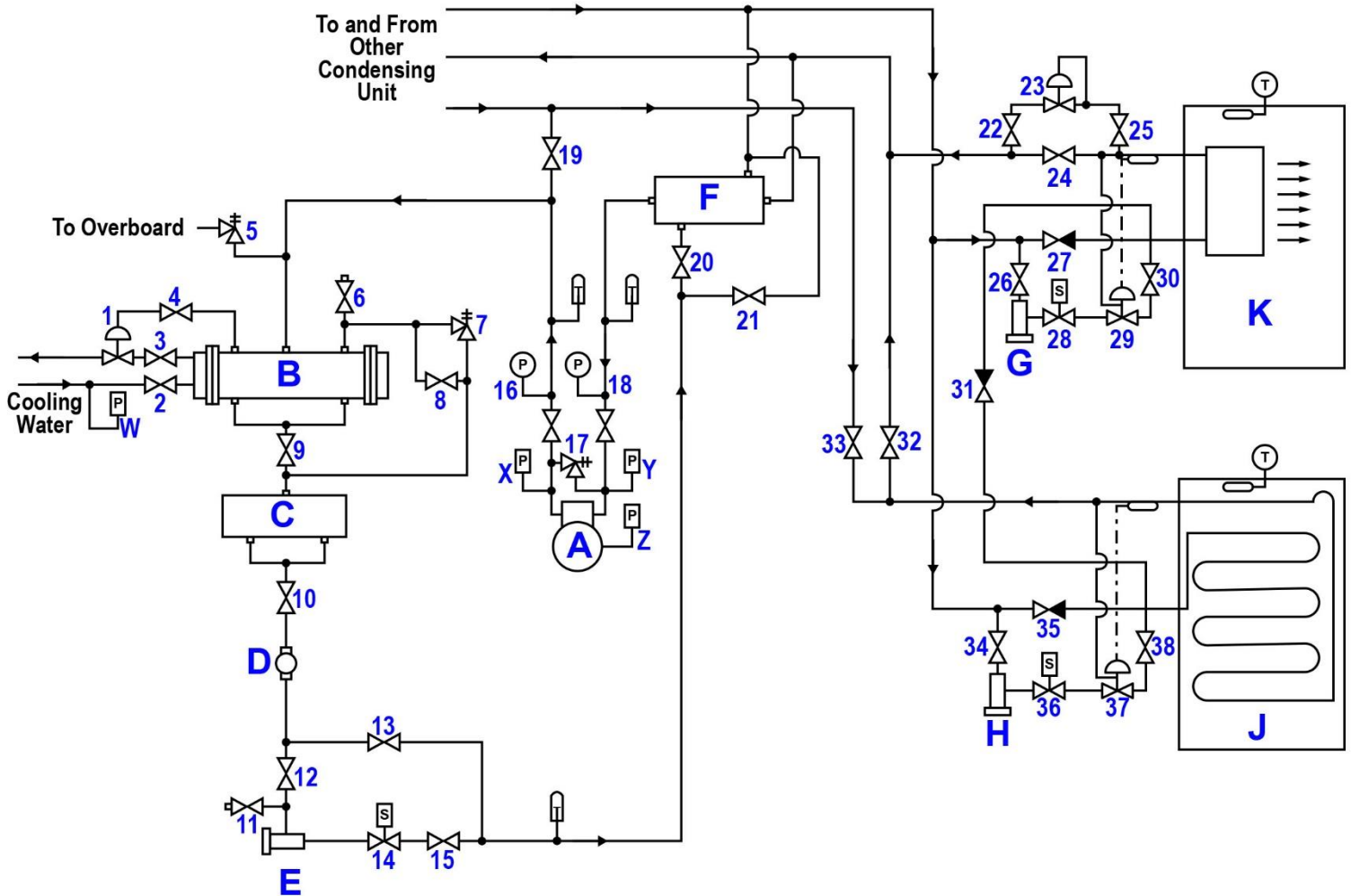


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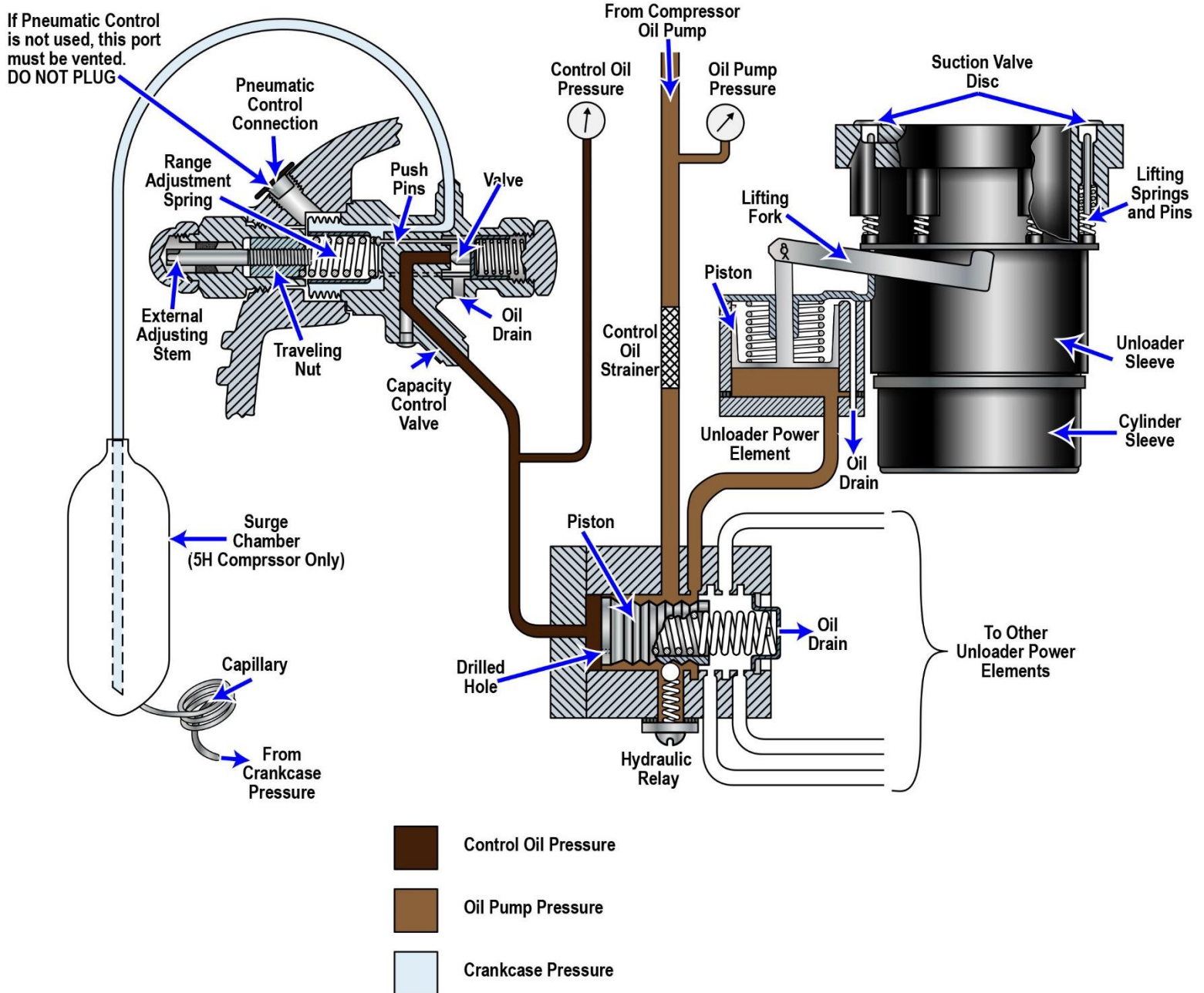
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## RA-0012



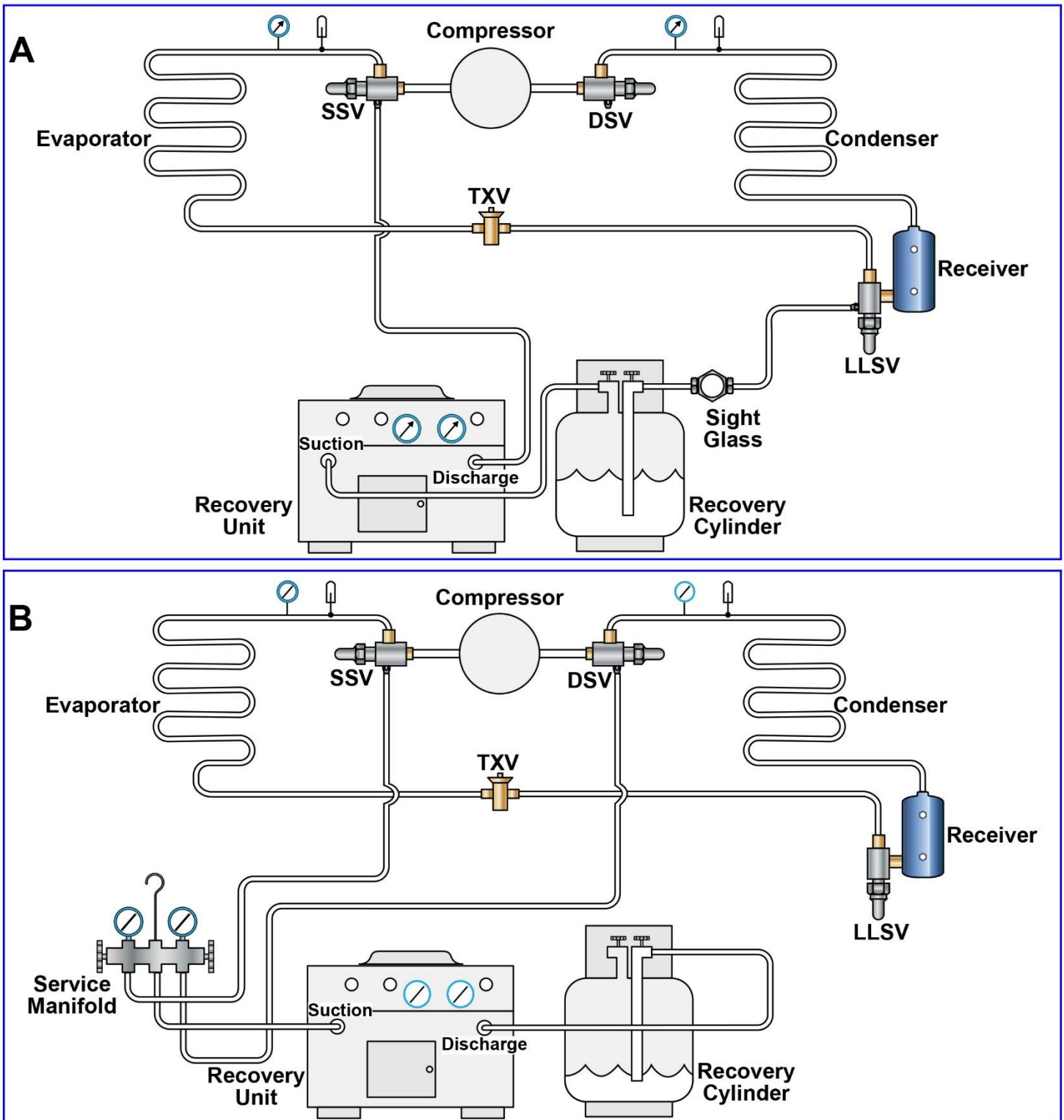
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