TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
QID: P901

Which one of the following describes the function of a safety valve?

A. Provide overpressure protection to limit the internal pressure in vessels

B. Control pressure in a system to maintain optimum operational conditions

C. Sound a warning by lifting at a predetermined value slightly higher than operating pressure

D. Modulate open as necessary to maintain system pressure and/or temperature within normal limits

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
QID: P1802 (B1701)

A vertical safety valve has a compressed spring assembly that is applying 1,200 lbf to the top of the valve disk in opposition to system pressure. System pressure is being exerted on the underside of the valve disk that is 3 inches in diameter.

Which one of the following is the approximate system pressure at which the safety valve will open? (Ignore any effects from atmospheric pressure.)

A. 44 psi

B. 64 psi

C. 128 psi

D. 170 psi

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
QID: P1903 (B2003)

A vertical safety valve with a 3-inch diameter disk has a compressed spring applying 1,000 lbf to the top of the valve disk in opposition to system pressure. Which one of the following is the approximate system pressure at which the safety valve will open? (Neglect the effect of atmospheric pressure.)

A. 35 psi

B. 111 psi

C. 142 psi

D. 444 psi

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
QID: P2101 (B2103)

Refer to the drawing of a typical safety valve (see figure below).

The component indicated by the solid arrow is used when necessary to manually...

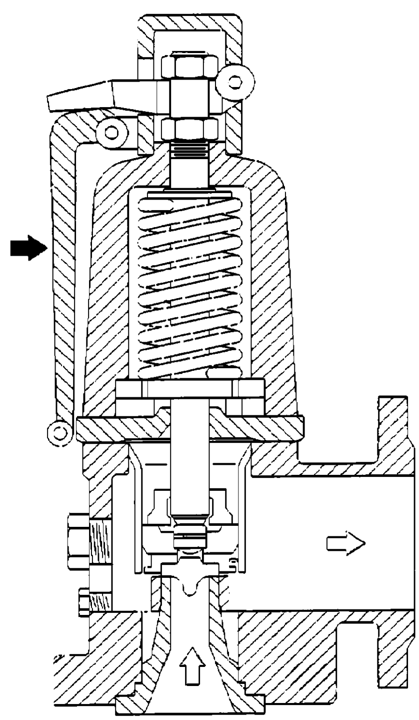
A. rachet open the safety valve.

B. pop open the safety valve.

C. gag shut the safety valve.

D. determine the position of the safety valve.

ANSWER: B.



SAFETY VALVE

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
QID: P2301 (B2301)

A vertical safety valve has a compressed spring assembly that is applying 2,500 lbf to the top of the valve disk in opposition to system pressure. System pressure is being exerted on the underside of the valve disk that is 5 inches in diameter.

Which one of the following is the approximate system pressure at which the safety valve will open? (Neglect the effect of atmospheric pressure.)

A. 32 psi

B. 127 psi

C. 159 psi

D. 500 psi

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
QID: P2801 (B2803)

A vertical safety valve with a 2-inch diameter disk has a compressed spring applying 2,400 lbf to the top of the valve disk in opposition to system pressure. Which one of the following is the approximate system pressure at which the safety valve will open?

A. 95 psig

B. 191 psig

C. 382 psig

D. 764 psig

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
QID: P3401 (B3401)

Given the following pressure specifications for operation of a main steam safety valve (MSSV):

Setpoint pressure (MSSV starts to open):	1,200 psia
Maximum pressure (MSSV will be fully open):	1,230 psia
Reseat pressure (MSSV will be fully closed):	1,140 psia

Which one of the following is the percent blowdown for the MSSV?

A. 2.5%

B. 5.0%

C. 7.5%

D. 10.0%

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
K1.02 [3.0/3.3]
QID: P4201 (B4201)

A completely full water storage tank is being hydrostatically tested to 100 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 10 gpm. The tank is protected by a safety valve <u>and</u> a relief valve; both valves will discharge to the atmosphere. Each valve has an opening setpoint of 105 psig and a maximum rated discharge flow rate of 6 gpm. The PDP is inadvertently left running when tank pressure reaches 100 psig.

With the PDP still running, tank pressure will stabilize _______ 105 psig; the greater mass flow rate will be coming from the _________ valve.

A. at; safety

B. above; safety

C. at; relief

D. above; relief

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
QID: P4401 (B4401)

Given the following pressure specifications for a main steam safety valve (MSSV):

Setpoint pressure (MSSV will start to open):	1,200 psia
Maximum pressure (MSSV will be fully open):	1,242 psia
Reseat pressure (MSSV will be fully closed):	1,152 psia

Which one of the following is the percent accumulation for this MSSV?

A. 2.5%

B. 3.0%

C. 3.5%

D. 4.0%

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
K1.02 [3.0/3.3]
QID: P4701 (B4701)

A completely full water storage tank is being hydrostatically tested to 200 psig using a positive displacement pump (PDP) with a smooth and constant discharge flow rate of 8 gpm. The tank is protected by a relief valve <u>and</u> a safety valve; both valves discharge to the atmosphere. Each valve has an opening setpoint of 205 psig and a maximum rated discharge flow rate of 6 gpm. The PDP is inadvertently left running when tank pressure reaches 200 psig.

With the PDP still running, when conditions stabilize the relief valve will be __________ open; and the safety valve will be discharging approximately _________ to atmosphere.

A. partially; 6 gpm

B. partially; 2 gpm

C. fully; 6 gpm

D. fully; 2 gpm

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.01 [3.3/3.4]
K1.02 [3.0/3.3]
QID: P5201 (B5201)

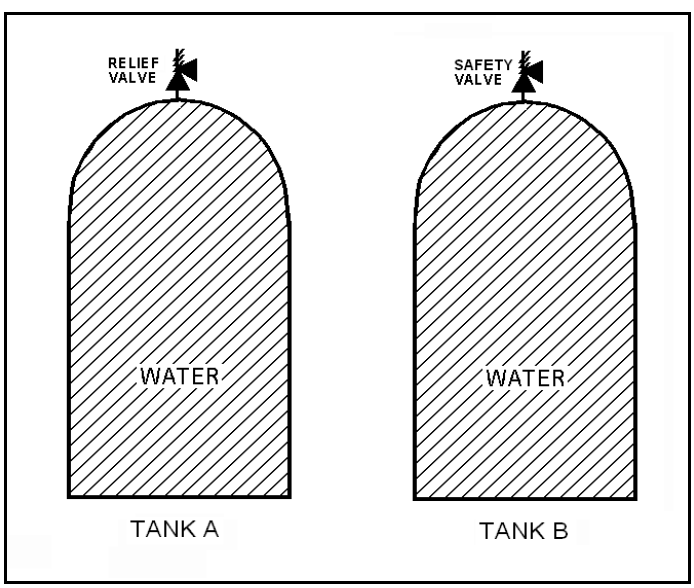
Refer to the drawing of two identical water storage tanks (see figure below). Tank A is protected by a relief valve and Tank B is protected by a safety valve. Each valve has an opening setpoint of 205 psig and a maximum rated discharge flow rate of 8 gpm.

The tanks are being hydrostatically tested to 200 psig. Each tank is being supplied with a smooth and constant flow rate of 2 gpm from separate positive displacement pumps (PDPs). Both PDPs are inadvertently left running when tank pressures reach 200 psig.

With the PDPs running continuously, what will be the resulting status of the relief and safety valves?

	Relief Valve Status	Safety Valve Status
A.	Partially open	Partially open
B.	Partially open	Cycling between fully open and fully closed
C.	Cycling between fully open and fully closed	Partially open
D.	Cycling between fully open and fully closed	Cycling between fully open and fully closed

ANSWER: B.



TOPIC: 191001
KNOWLEDGE: K1.02 [3.3/3.4]
QID: P1

The primary purpose of a pressure relief valve is to...

A. reduce system energy.

B. reduce system pressure.

C. maintain system integrity.

D. maintain system mass.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.02 [3.0/3.3]
QID: P202 (B301)

The difference between the set point pressure at which a safety valve opens and the pressure at which it closes is called...

A. blowdown.

B. accumulation.

C. set point tolerance.

D. set point deviation.

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.02 [3.0/3.3]
QID: P501 (B201)

The difference between the setpoint pressure at which a relief valve begins to open and the pressure at which it is fully open is called...

A. setpoint deviation.

B. setpoint tolerance.

C. accumulation.

D. blowdown.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.02 [3.0/3.3]
QID: P1504 (B1801)

Which one of the following is a difference between a typical relief valve and a typical safety valve?

A. The actuator closing spring on a relief valve is in a compressed state whereas the actuator closing spring on a safety valve acts in tension.

B. A relief valve gradually opens as pressure increases above the setpoint pressure whereas a safety valve fully opens at the setpoint pressure.

C. Relief valves are capable of being gagged whereas safety valves are not.

D. The blowdown of a relief valve is greater than the blowdown of a safety valve.

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.02 [3.0/3.3]
QID: P1801 (B1301)

Refer to the drawing of two identical pressure vessels with identical relief valve protection (see figure below).

Both vessels have been pressurized to 50 psig and then isolated. Vessel A is completely filled with water at 150°F. Vessel B is in a saturated condition with one-half steam (100% quality) and one-half water (0% quality) by volume.

If both relief valves fully open simultaneously, the faster pressure reduction will occur in vessel ________; and if both relief valves close at 40 psig, the greater mass loss will have occurred in vessel ________.

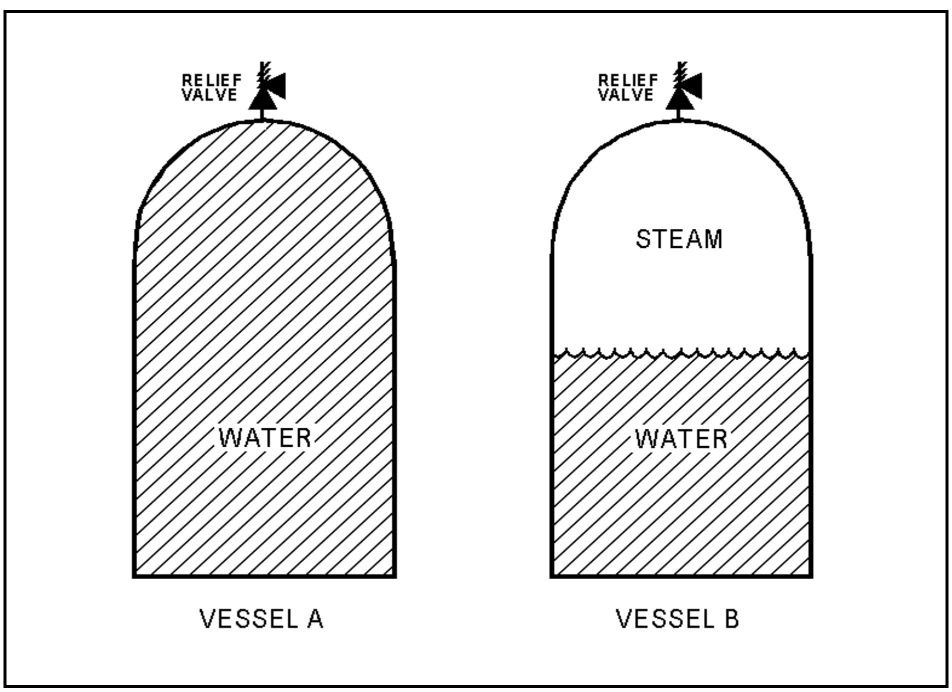
A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: B.



TOPIC: 191001
KNOWLEDGE: K1.02 [3.0/3.3]
QID: P2501 (B2501)

Water storage tanks A and B are identical except that tank A receives overpressure protection from an installed relief valve, whereas tank B has an installed safety valve. The relief valve and safety valve have the same pressure setpoint and design flow rate.

Water is continuously added to each tank at the same rate (50% of the design flow rate of the relief/safety valve). After the tanks are completely full, tank A pressure will _________; and tank B pressure will ________.

A. stabilize slightly above the pressure setpoint; stabilize slightly above the pressure setpoint

B. stabilize slightly above the pressure setpoint; fluctuate within a few percent of the pressure setpoint

C. fluctuate within a few percent of the pressure setpoint; stabilize slightly above the pressure setpoint

D. fluctuate within a few percent of the pressure setpoint; fluctuate within a few percent of the pressure setpoint

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.02 [3.0/3.3]
QID: P2701 (B2701)

Vessels A and B are identical except that vessel A receives overpressure protection from an installed safety valve. Vessel B has an installed relief valve. The safety and relief valves have the same pressure setpoint and design flow rate.

Water is continuously added to each vessel at the same rate (50% of the design flow rate of the safety and relief valves). After vessel pressure reaches the setpoint for each valve, vessel A pressure will _________ and vessel B pressure will _________.

A. stabilize slightly above the pressure setpoint; stabilize slightly above the pressure setpoint

B. stabilize slightly above the pressure setpoint; fluctuate within a few percent of the pressure setpoint

C. fluctuate within a few percent of the pressure setpoint; stabilize slightly above the pressure setpoint

D. fluctuate within a few percent of the pressure setpoint; fluctuate within a few percent of the pressure setpoint

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.02 [3.4/3.6]
QID: P3302 (B2)

Refer to the drawing of two identical pressure vessels with identical relief valve protection (see figure below).

Vessel A is completely filled with subcooled water at 80°F and vessel B is in a saturated, two-phase condition. Both vessels are currently pressurized to 50 psig and isolated.

If both relief valves fully open simultaneously, the faster pressure reduction will initially occur in vessel ________ and the faster mass loss will initially occur in vessel ________.

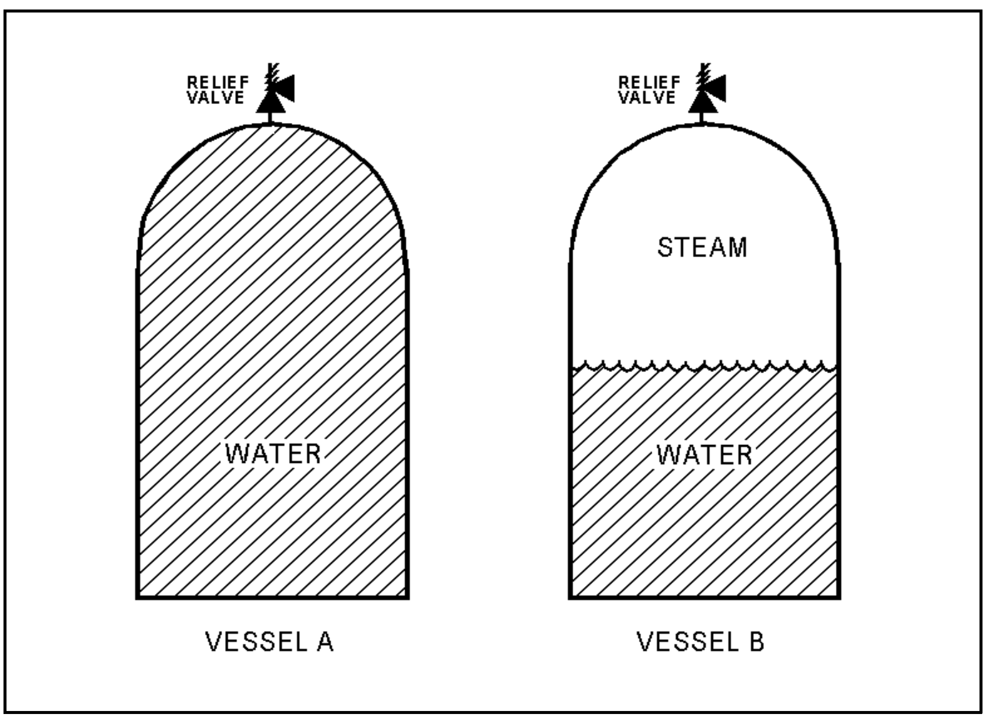
A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: A.



TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P2

When a discharge valve is opened to atmosphere, the pressure on the upstream side of the valve will...

A. remain the same, and the pressure on the downstream side will increase.

B. increase, and the pressure on the downstream side will remain the same.

C. remain the same, and the pressure on the downstream side will decrease.

D. decrease, and the pressure on the downstream side will remain the same.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P602 (B2005)

When comparing a globe valve and a gate valve in the same application, the gate valve has a _____________ pressure drop when fully open and is the _____________ choice for throttling.

A. higher; better

B. lower; better

C. higher; poorer

D. lower; poorer

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P1201 (B2101)

Refer to the drawing of a lube oil heat exchanger (see figure below).

If a cooling water outlet valve is partially closed from the full open position, heat exchanger cooling water pressure upstream of the valve will ____________ and the temperature of the lube oil exiting the heat exchanger will ____________.

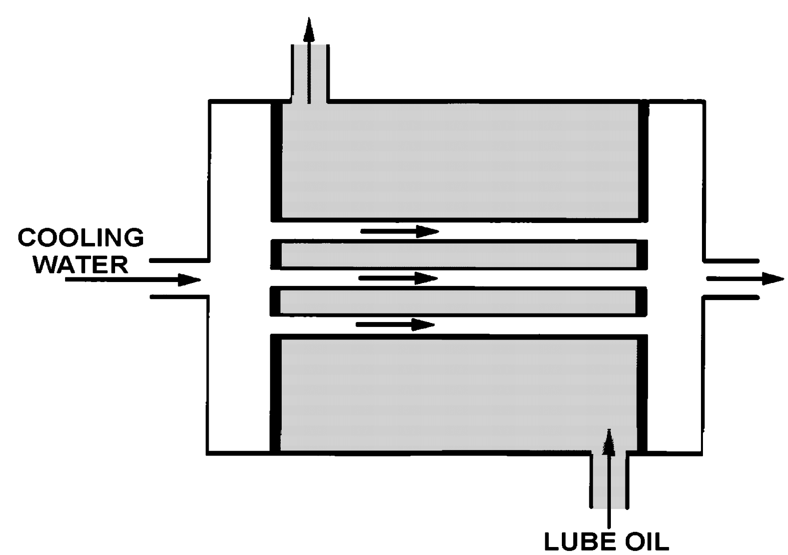
A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P1302 (B1505)

When comparing a 3-inch gate valve to a 3-inch globe valve in the same application in an operating cooling water system, if both valves are fully open, the gate valve produces the ____________ head loss and the ____________ flow rate.

A. smaller; larger

B. smaller; smaller

C. larger; larger

D. larger; smaller

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P2102 (B2101)

Which one of the following statements describes the flow rate characteristics of a typical gate valve in an operating water system?

A. The first 25% of valve disk travel in the open direction will produce a smaller change in flow rate than the last 25% of valve disk travel.

B. The first 25% of valve disk travel in the open direction will produce a greater change in flow rate than the last 25% of valve disk travel.

C. The first 25% of valve disk travel in the open direction will produce approximately the same change in flow rate as the last 25% of valve disk travel.

D. A gate valve that has been opened to 25% of valve disk travel will result in approximately 25% of full flow rate.

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P2302 (B2601)

Which one of the following statements describes the flow rate characteristics of a typical globe valve in an operating water system?

A. The first 25% of valve disk travel in the open direction will produce a smaller change in flow rate than the last 25% of valve disk travel.

B. The first 25% of valve disk travel in the open direction will produce a greater change in flow rate than the last 25% of valve disk travel.

C. The first 25% of valve disk travel in the open direction will produce approximately the same change in flow rate as the last 25% of valve disk travel.

D. A globe valve that has been opened to 25% of valve disk travel will result in approximately 25% of full flow rate.

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P2303 (B2303)

A control valve is most likely to experience cavitation when the valve is almost fully ________ because of a relatively __________ pressure drop across the valve seat.

A. open; large

B. open; small

C. closed; large

D. closed; small

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P3001 (B3002)

Which one of the following statements describes the throttling characteristics of a typical globe valve?

A. The first third of valve disk travel in the open direction will result in approximately one-third of full flow rate.

B. The first third of valve disk travel in the open direction will produce a smaller increase in flow rate than the last third of valve disk travel.

C. The first third of valve disk travel in the open direction will produce a greater increase in flow rate than the last third of valve disk travel.

D. The first two-thirds of valve disk travel in the open direction will produce approximately the same increase in flow rate as the last third of valve disk travel.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P3901 (B3902)

Refer to the drawing of a cooling water system in which both centrifugal pumps A and B are operating (see figure below).

An operator stops pump B, but the pump B check valve fails to close. In comparison to normal operation with only pump A running, operation with the failed pump B check valve will result in pump A flow rate being ________ than normal; and heat exchanger flow rate being _________ than normal.

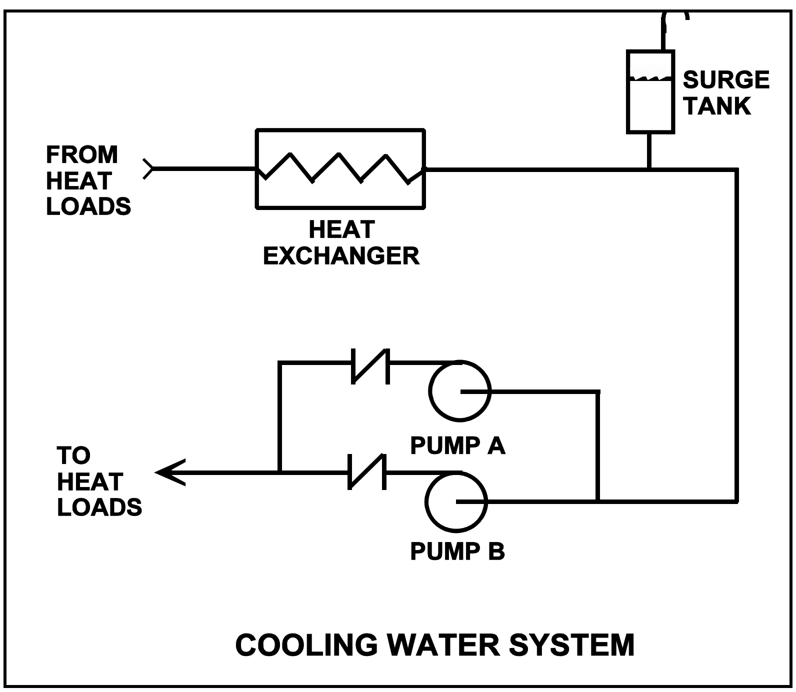
A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

ANSWER: A.



TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P4101 (B4103)

Which one of the following types of similarly sized valves in an operating water system produces the least frictional head loss when fully open?

A. Ball

B. Globe

C. Butterfly

D. Swing check

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P4801 (B4802)

Refer to the centrifugal pump operating curve with two system head loss curves (see figure below). The curves apply to an open cooling water system using one single-speed centrifugal pump discharging through a typical flow control valve. The valve is located on the discharge piping of the pump.

One of the system curves shows system head loss with the flow control valve 25% open. The other system curve shows system head loss with the flow control valve 100% open. The pump is operating and the valve is initially 25% open, resulting in a pump flow rate of 800 gpm.

If the flow control valve is subsequently fully opened, pump flow rate through the valve will be approximately...

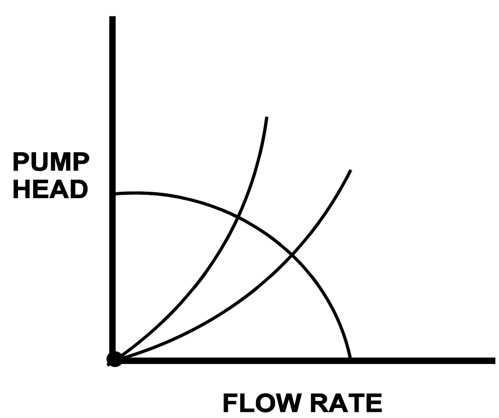
A. 400 gpm.

B. 1,200 gpm.

C. 1,600 gpm.

D. 3,200 gpm.

ANSWER: B.



CENTRIFUGAL PUMP CURVE

TOPIC: 191001
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P4901 (B4901)

Consider a 6-inch globe valve and a 6-inch gate valve in the same water system application. Typically, the valve that requires the most linear disk travel from fully closed to fully open is the ___________ valve; and the valve that produces the smallest pressure drop when fully open is the ___________ valve.

A. gate; gate

B. gate; globe

C. globe; gate

D. globe; globe

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
QID: P101 (B1903)

Refer to the drawing of a spring-loaded air-operated valve (see figure below).

Upon a loss of air pressure, this valve will...

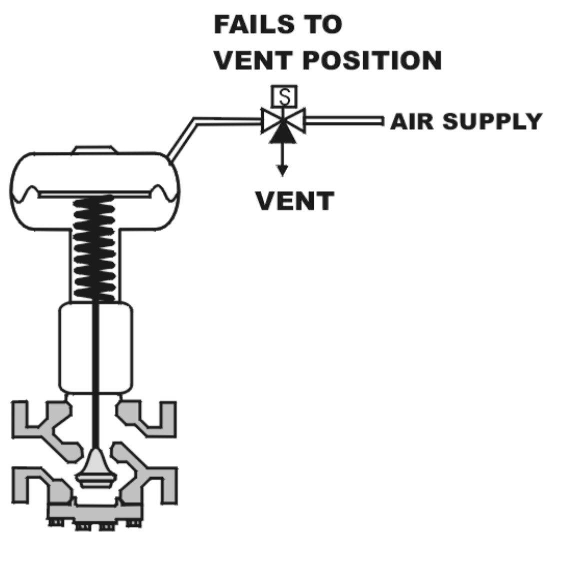
A. go to the fully open position.

B. remain at the current position.

C. go to the fully closed position.

D. go to the midposition.

ANSWER: C.



SPRING-LOADED AIR-OPERATED VALVE

TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
QID: P112 (B1401)

Using the drawing of an air-operated valve (see figure below), identify the valve position following a loss of electrical power.

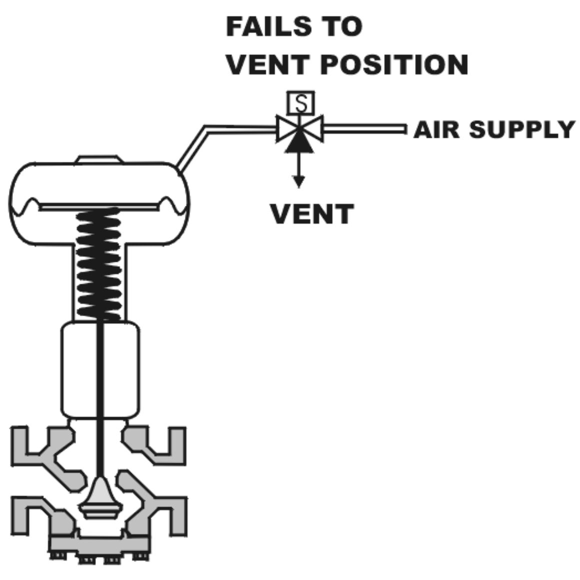
A. Midposition

B. Closed

C. As is

D. Open

ANSWER: B.



SPRING-LOADED AIR-OPERATED VALVE

TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
QID: P203 (B502)

Refer to the drawing of a hydraulically-operated valve that is shown in a throttled position (see figure below).

Select the position of this valve following a loss of hydraulic system pressure.

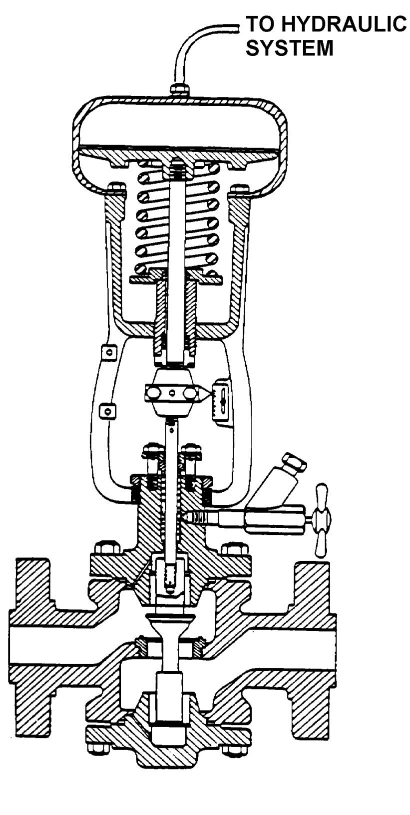
A. Fully open

B. As is

C. Fully closed

D. Midposition

ANSWER: A.



HYDRAULICALLY - OPERATED VALVE

TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
QID: P1101 (B1109)

Refer to the drawing of a spring-loaded air-operated valve shown in a throttled position (see figure below).

The figure currently depicts normal air supply pressure and an energized solenoid. What will be the valve position following a loss of electrical power to the solenoid?

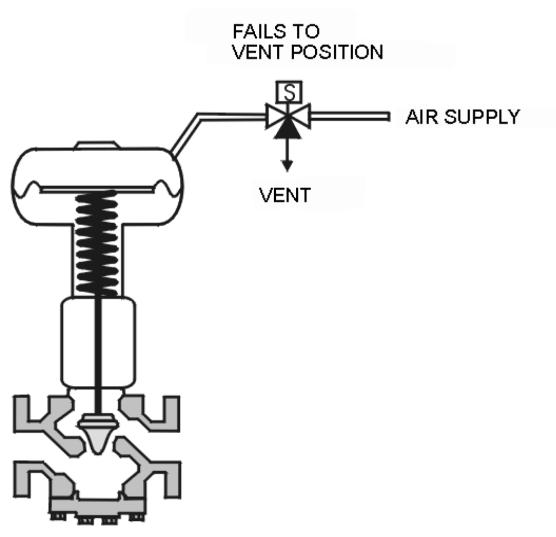
A. As is

B. More open

C. More closed

D. Varies with system flow

ANSWER: B.



SPRING-LOADED AIR-OPERATED VALVE

TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
QID: P1202 (B602)

How will a typical motor-operated valve respond to a loss of electrical power to the valve actuator?

A. Open fully

B. Close fully

C. Remain as is

D. Move to 50% open

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
QID: P2104 (B1002)

Refer to the drawing of a spring-loaded air-operated valve shown in a throttled position (see figure below).

Which one of the following will be the valve position following a reduction in air pressure to the valve actuator caused by a leaking air connection at the valve?

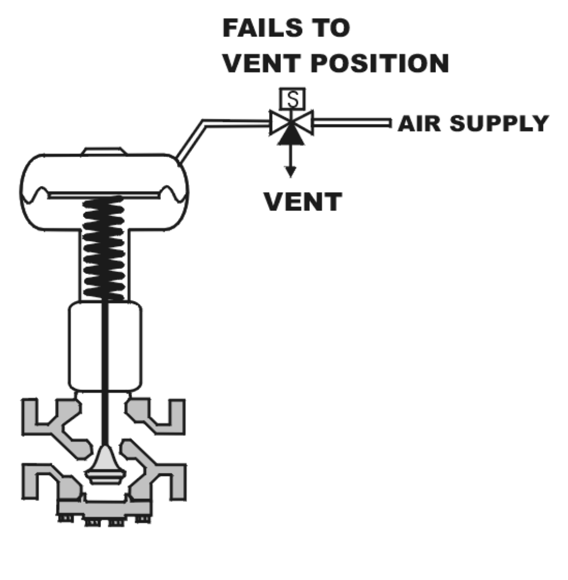
A. Original position

B. More closed

C. More open

D. Varies with system flow

ANSWER: B.



SPRING-LOADED AIR-OPERATED VALVE

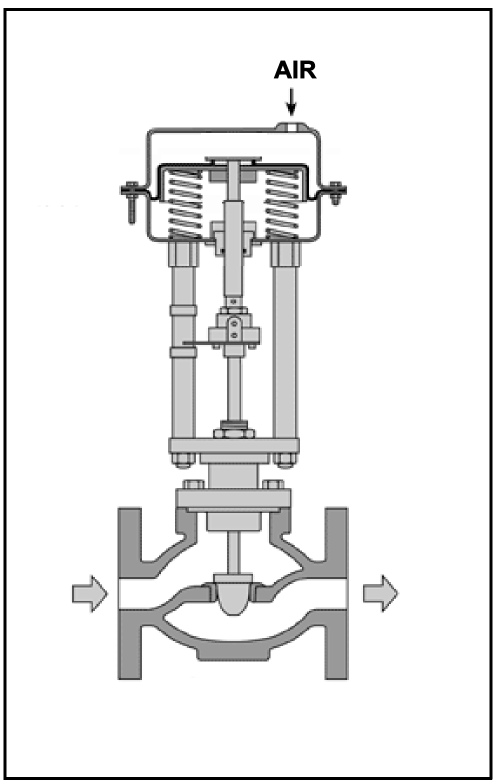
TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
K1.08 [3.4/3.4]
QID: P5002 (B5002)

Refer to the drawing of a pneumatically-operated valve (see figure below). The valve actuator may be shown with or without air pressure applied to it.

Which one of the following describes the type of valve shown, and the fail position on loss of air to the actuator?

	Valve Type	Fail Position
A.	Gate	Open
B.	Gate	Closed
C.	Globe	Open
D.	Globe	Closed

ANSWER: C.



TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P5302 (B5301)

Refer to the drawing of four air-operated valves (see figure below). **Note:** The valve actuators may be shown with or without air pressure applied.

Given:

- The direction of system flow is from left to right when the valves are open.
- The internal components for each valve are identical except for the orientation of the valve disk and seat.
- The valve actuators exert the same force on the attached valve stem for a given applied air pressure.

If each actuator is vented, which valve disk will remain closed with the most force?

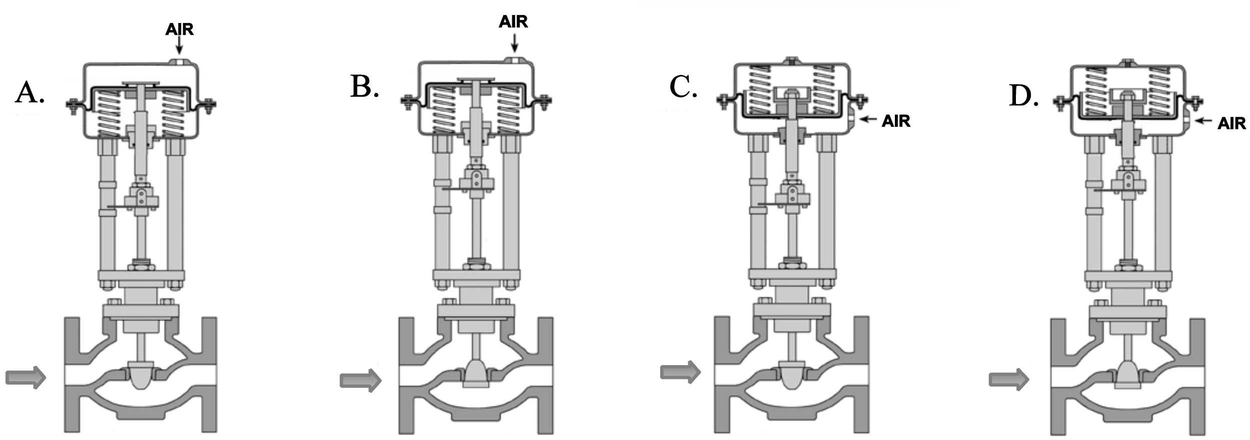
A. A.

B. B.

C. C.

D. D.

ANSWER: C.



TOPIC: 191001
KNOWLEDGE: K1.04 [2.8/3.2]
QID: P5502 (B5502)

Refer to the drawing of four air-operated valves (see figure below). **Note:** The valve actuators may be shown with or without air pressure applied.

Which valves are currently shown in their failed (i.e., no air pressure applied to the actuator) positions?

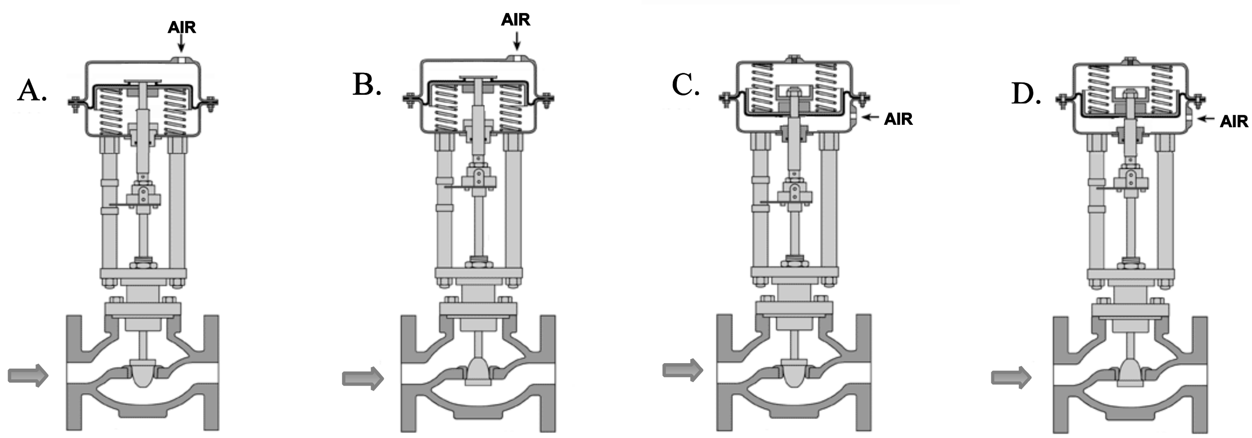
A. A and B

B. B and C

C. C and D

D. D and A

ANSWER: B.



TOPIC: 191001
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P201 (B206)

An operator attempts to close a fully-open upright manual gate valve to isolate a pump in a cooling water system that has been cooled down for maintenance. However, the operator is unable to rotate the handwheel in the close direction.

Which one of the following could cause this condition?

A. A hydraulic lock has developed under the valve disk.

B. A hydraulic lock has developed in the valve bonnet between the valve disk and the packing gland.

C. The two halves of the valve disk have expanded and are jammed against the valve seats.

D. The valve disk has jammed against its backseat by the difference in the thermal contraction of the stem and the bonnet.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P403 (B108)

When manually positioning a motor-operated valve, why must the operator avoid using excessive valve seating/backseating force?

A. The valve may bind during subsequent operation.

B. Valve stem limit switch settings may become inaccurate.

C. The clutch may not reengage the valve motor when required.

D. Stem position may no longer be an accurate indicator of valve position.

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1303 (B2802)

After an adjustment of the packing gland on a valve that had a minor packing leak, the operator attempts to operate the valve but finds that the valve is stuck. What is the most probable cause?

A. The disk separated from the valve stem as a result of overtightening the packing.

B. The operator placed the valve in the wrong position while adjusting the packing.

C. Adjusting the packing overtorqued the valve in the closed direction.

D. The operator overtightened the packing, causing the stem to bind.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1603 (B1003)

An adjustment has just been completed on the packing gland of an automatic valve to stop a minor stem leak. Which one of the following can occur if the technician overtightened the packing gland?

A. Decreased cooling flow to the valve internals

B. Separation of the valve disk from the valve stem

C. Misalignment of the valve position limit switches

D. Increased stroke time from fully open to fully closed

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1902 (B6)

Which one of the following describes the function and use of the backseat on a manual valve?

A. Removes pressure from the packing/stuffing box and is typically used to isolate the stuffing box for valve repacking.

B. Removes pressure from the packing/stuffing box and is typically used when needed to isolate packing leakage.

C. Acts as a backup in case the primary seat leaks and is typically used during system isolation for personnel protection.

D. Acts as a backup in case the primary seat leaks and is typically used when needed to prevent the primary seat from leaking excessively.

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P2503 (B2603)

When manually closing a motor-operated valve, why must the operator avoid using excessive valve seating force?

A. The valve may bind and cause the valve motor to trip on overload during subsequent remote operation.

B. The valve actuator clutch may be damaged and disable subsequent automatic operation.

C. The valve stem limit switches may be damaged and cause inaccurate remote valve position indication.

D. The valve actuator position indicator may be damaged and cause inaccurate local valve position indication.

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P3503 (B3503)

Refer to the drawing of a water supply pump with two suction sources (see figure below). All motor-operated valves (MOVs) are currently closed.

Which one of the following MOV interlocks will permit the pump to take a suction on either the building sump or the water storage tank, while preventing the two sources from being cross-connected?

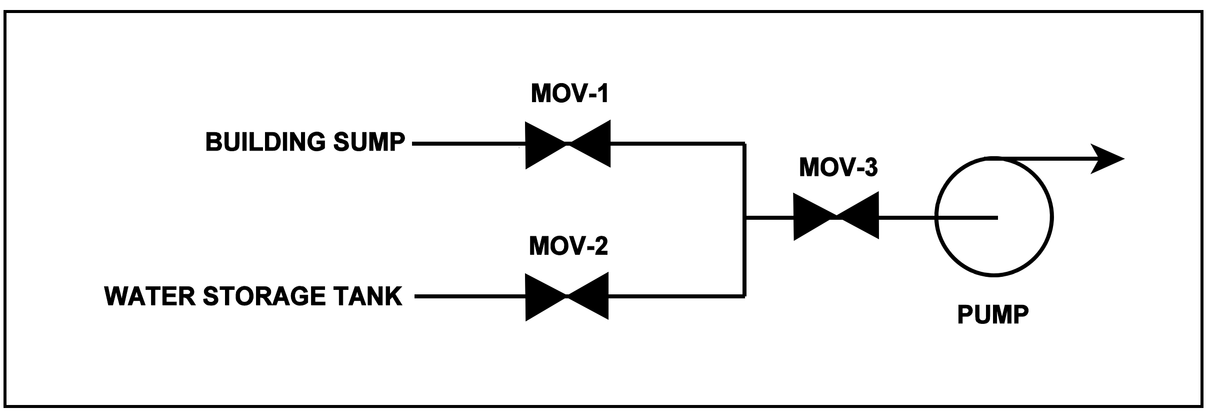
A. Neither MOV-1 nor MOV-2 can be opened unless MOV-3 is fully closed.

B. None of the MOVs can be opened unless at least one MOV remains fully closed.

C. None of the MOVs can be opened unless at least two MOVs remain fully closed.

D. Neither MOV-1 nor MOV-2 can be opened unless the other source MOV is fully closed.

ANSWER: D.



TOPIC: 191001
KNOWLEDGE: K1.06 [3.3/3.7]
QID: P4

After manually positioning a motor-operated valve, the valve actuator is reengaged by actuation of the...

A. manual declutch lever to the disengage position.

B. manual declutch lever to the engage position.

C. racked in limit switch when the actuator motor breaker is racked in.

D. valve actuator motor in the open direction.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.06 [3.3/3.7]
QID: P204 (B204)

Operation of the manual declutch lever (initially in the normal position) of a motor-operated valve _______________ the motor and _______________ the handwheel.

A. disengages; engages

B. deenergizes; engages

C. engages; disengages

D. reenergizes; disengages

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.06 [3.3/3.7]
QID: P1702 (B1605)

A typical Limitorque® motor-operated valve is installed in an emergency core cooling system (ECCS) application. The ECCS actuation signal is designed to energize the valve motor and open the valve. The valve is currently open, but being manually/locally closed by a technician as required by a surveillance test procedure. The declutch lever has been operated and released, and the valve is being closed by operation of the valve handwheel.

If an ECCS actuation signal is received, how will the valve be affected?

A. The handwheel will disengage and the valve will automatically open.

B. The handwheel will disengage and the valve will remain in the current position.

C. The handwheel will remain engaged and the valve will automatically open.

D. The handwheel will remain engaged and the technician can continue to close the valve.

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.06 [3.3/3.7]
QID: P2003 (B2004)

A surveillance test procedure is being performed on a typical Limitorque® motor-operated valve (MOV) used in an emergency core cooling system (ECCS) application. The declutch lever has been operated and released and the valve is being manually/locally opened by a technician. The MOV breaker is closed as required by the surveillance test procedure. During operation of the valve handwheel an ECCS actuation signal is received that normally energizes the valve motor and closes the valve.

How will the valve be affected by the actuation signal?

A. The handwheel will disengage and the valve will automatically close.

B. The handwheel will disengage and the valve will remain in the current position.

C. The handwheel will remain engaged and the valve will automatically close.

D. The handwheel will remain engaged and the technician can continue to open the valve.

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.06 [3.3/3.7]
QID: P2703 (B2704)

A typical motor-operated valve (MOV) has just been opened from the main control room, and the breaker for the MOV has been opened. A plant operator has been directed to close the MOV locally for a surveillance test.

If the operator attempts to turn the MOV handwheel in the clockwise direction without first operating the clutch lever, which one of the following will occur?

A. The handwheel will <u>not</u> turn, and the valve stem will <u>not</u> move.

B. The handwheel will turn, but the valve stem will <u>not</u> move.

C. The handwheel will turn, and the valve stem will move toward the closed position because the clutch is automatically engaged when the handwheel is turned.

D. The handwheel will turn, and the valve stem will move toward the closed position because the clutch is automatically engaged when the breaker is opened.

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.06 [3.3/3.7]
QID: P4002 (B4003)

Which one of the following types of similarly sized valves requires the <u>most</u> manual valve stem rotation to move the valve from fully open to fully closed? (Assume that each valve has a non-rising stem.)

A. Ball

B. Gate

C. Plug

D. Butterfly

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.07 [2.5/2.8]
QID: P303 (B302)

A stop check valve is a type of check valve that...

A. cannot be shut remotely.

B. can be used to prevent flow in both directions.

C. can be opened manually to allow flow in both directions.

D. contains both a gate valve disk and a check valve disk.

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.07 [2.5/2.8]
QID: P503

Which one of the following valves is used to control the direction of fluid flow and prevent backflow in a system?

A. Safety valve

B. Relief valve

C. Divert valve

D. Check valve

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.07 [2.5/2.8]
QID: P802 (B2204)

Two common types of check valves used in nuclear power plants are...

A. globe and gate.

B. ball and plug.

C. swing and lift.

D. needle and angle.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.07 [2.5/2.8]
QID: P1003 (B2903)

A typical check valve is designed to...

A. permit flow in only one direction.

B. prevent system overpressure.

C. isolate system components.

D. perform automatic pump venting.

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.07 [2.5/2.8]
QID: P1503 (B205)

Check valves are normally used to prevent...

A. overpressurization of nonoperating system piping and components.

B. backflow through nonoperating components or flowpaths.

C. pump runout by providing a constant backpressure.

D. pump cavitation by keeping nonoperating systems filled.

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.07 [2.5/2.8]
QID: P2202 (B1102)

Which one of the following valves is used to control the direction of fluid flow and prevent backflow in a system?

A. Gate valve

B. Relief valve

C. Globe valve

D. Check valve

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P5 (B402)

To verify a manual valve in an operating system is <u>closed</u>, the operator should operate the valve handwheel in the...

A. open direction until the valve is fully open, then close it using normal force.

B. open direction until flow sounds are heard, then close the valve using normal force.

C. close direction using normal force and verify there is no substantial handwheel movement.

D. close direction until it stops, then close it an additional one-half turn using additional force if necessary.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P205 (B503)

To verify the position of a <u>fully</u> <u>open</u> manual valve in an operating system, the operator should operate the valve handwheel...

A. in the open direction until the valve is backseated one-half turn.

B. to fully close the valve, then open the valve to the fully open position.

C. in the closed direction, then open the valve to its previously open position.

D. to open the valve until it touches the backseat, then close the valve to the desired position.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P405 (B2205)

A comparison of the characteristics of gate valves and globe valves in an operating system indicates a globe valve generally has a _____________ pressure drop when fully open, and is ___________ commonly used for throttling system flow.

A. smaller; less

B. larger; more

C. smaller; more

D. larger; less

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P1104 (B504)

Gate valves generally are not used to throttle fluid flow because...

A. gate valves introduce a large system head loss when fully open.

B. all gate valves will experience stem leakage when partially open.

C. the turbulent flow created by a partially opened gate valve would cause damage to the valve.

D. the large size of the valve disk would require an oversized actuator to position the valve accurately.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P1405 (B1705)

Refer to the cutaway-view drawing of a valve (see figure below).

Which one of the following describes the type of valve shown?

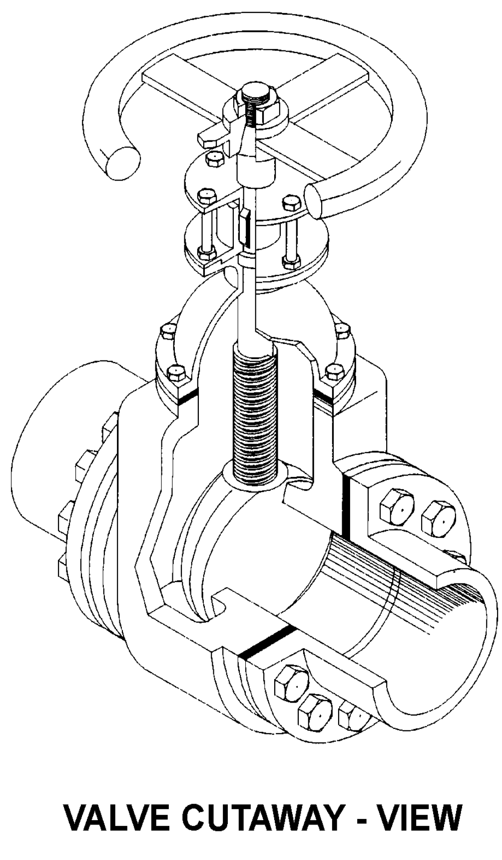
A. Rising-stem gate valve

B. Nonrising-stem gate valve

C. Rising-stem globe valve

D. Nonrising-stem globe valve

ANSWER: B.



VALVE CUTAWAY - VIEW

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P1501 (B1805)

When comparing a 3-inch gate valve to a 3-inch globe valve in the same application in an operating cooling water system, if both valves are fully open, the globe valve produces the ____________ head loss and the ____________ flow rate.

A. larger; larger

B. larger; smaller

C. smaller; larger

D. smaller; smaller

ANSWER: B.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P1602 (B1404)

Which one of the following is a generally accepted method for locally verifying that a manual valve is fully closed in a depressurized static piping system?

A. Check a downstream flow gauge to be indicating zero flow

B. Visually observe the valve rising-stem threads to be fully exposed

C. Attempt to turn the valve handwheel in the close direction and verify no movement

D. Attempt to turn the valve handwheel in the open direction and verify valve opens

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P1604 (B1604)

Compare a typical gate valve to a typical globe valve in the same application in an operating high-pressure cooling water system. If both valves are fully open, the gate valve will have a ____________ pressure drop and is the better choice for ____________ flow.

A. higher; throttling

B. higher; isolating

C. lower; throttling

D. lower; isolating

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P1704 (B1802)

To verify a manual valve in an operating system is <u>closed</u>, the operator should observe valve position indication and operate the valve handwheel in the...

A. open direction at least one full rotation, then close the valve using normal force.

B. open direction until system flow is observed, then close the valve using normal force.

C. close direction using normal force and verify there is no substantial handwheel movement.

D. close direction using normal force, then operate the valve handwheel an additional one-quarter turn in the close direction.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P1901 (B1305)

Which one of the following is a disadvantage associated with using a gate valve, versus a globe valve, to throttle flow in a cooling water system?

A. The tortuous flow path through a throttled gate valve body makes flow control difficult.

B. A gate valve will experience stem leakage unless it is fully opened and backseated.

C. The turbulent flow created by a throttled gate valve will cause erosion damage to the valve seat.

D. A fully open gate valve will produce a greater system head loss than a fully open globe valve.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2004 (B1205)

After an adjustment of the packing gland on a valve that had a minor packing leak, the operator attempts to operate the valve but finds that the valve is stuck. What is the most probable cause?

A. The disk separated from the valve stem as a result of overtightening the packing gland.

B. The operator placed the valve in the wrong position for adjusting the packing gland.

C. The valve was overtorqued in the closed direction during the packing gland adjustment.

D. The maintenance technician overtightened the packing gland, causing the stem to bind.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2103 (B203)

Which one of the following is <u>not</u> a generally accepted method for locally verifying that a valve is open?

A. Observe local flow rate instrumentation.

B. Check the local valve position indicator indicates "open."

C. Turn the valve operator in the "close" direction and verify that some movement occurs.

D. Attempt to turn the valve operator in the "open" direction and verify that no movement occurs.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2204 (B2605)

Gate valves generally are <u>not</u> used to throttle water flow because...

A. rapid changes in flow direction through the valve cause a large unrecoverable system head loss.

B. gate valves experience stem leakage unless they are fully open or fully closed.

C. the turbulent flow created by a partially opened gate valve causes excessive seat and disk wear.

D. Flow rate through a gate valve is <u>not</u> proportional to the differential pressure across the valve.

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2304 (B2305)

When comparing globe valves to gate valves, globe valves...

A. are less effective at throttling flow.

B. are less effective as pressure regulating valves.

C. produce a smaller pressure decrease when fully open.

D. require less force to open against large differential pressures.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2404 (B905)

When comparing gate valves to globe valves, gate valves...

A. are more effective at throttling flow.

B. are more effective as pressure regulating valves.

C. produce a larger pressure decrease when fully open.

D. require more force to open against large differential pressures.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2504 (B2504)

In a comparison of butterfly valves with ball valves, ___________ valves are generally more leak tight in high pressure applications; and ___________ valves generally exhibit the lower system pressure drop when fully open.

A. ball; ball

B. ball; butterfly

C. butterfly; ball

D. butterfly; butterfly

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2604 (B805)

A gate valve is generally a poor choice for throttling liquid flow because...

A. the turbulent flow created by a partially opened gate valve can cause extensive damage to the valve.

B. the tortuous path through a gate valve body can make flow control difficult.

C. excessive stem leakage will occur unless the gate valve is kept fully open or fully closed.

D. the head loss from a throttled gate valve causes an unacceptable reduction in system flow rate.

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2804 (B1604)

In a comparison between a typical gate valve and a typical globe valve in the same application with both valves fully open, the gate valve has a ____________ pressure drop and is normally used in ____________ flow applications.

A. larger; throttling

B. larger; on/off

C. smaller; throttling

D. smaller; on/off

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P2903 (B2904)

In a comparison between ball valves and butterfly valves in the same liquid process system application, the valves that typically would allow more leakage when fully closed and under high differential pressure are ______ valves, and the valves that typically would cause the higher system pressure drop when fully open are ________ valves.

A. ball; butterfly

B. ball; ball

C. butterfly; butterfly

D. butterfly; ball

ANSWER: C.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P3304 (B3304)

A typical motor-operated valve has been returned to service following a complete maintenance overhaul of the valve and actuator. The valve was remotely opened and closed to verify operability. The measured valve stroke time in each direction was 15 seconds, which is 25% longer than normal.

Which one of the following could have caused the increased stroke time?

A. The valve position limit switches were removed and were not reinstalled.

B. The valve torque limit switches were misadjusted to open at half their normal setpoints.

C. The valve was packed with improved packing material having a lower friction coefficient.

D. The valve stem packing gland was overtightened after the packing material was replaced.

ANSWER: D.

TOPIC: 191001
KNOWLEDGE: K1.08 [3.4/3.4]
QID: P3804 (B3804)

In a comparison between ball valves and butterfly valves in the same liquid process system application, the valves that typically are more leak-tight when fully closed and under high differential pressure are __________ valves; and the valves that typically result in the higher system pressure drop when fully open are __________ valves.

A. ball; butterfly

B. ball; ball

C. butterfly; butterfly

D. butterfly; ball

ANSWER: A.

TOPIC: 191001
KNOWLEDGE: K1.11 [3.2/3.2]
QID: P3804 (B3804)

In a comparison between ball valves and butterfly valves in the same liquid process system application, the valves that typically are more leak-tight when fully closed and under high differential pressure are ______ valves; and the valves that typically result in the higher system pressure drop when fully open are ________ valves.

A. ball; butterfly

B. ball; ball

C. butterfly; butterfly

D. butterfly; ball

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P6 (B1806)

Density input is normally used in steam flow instruments to convert _______________ into _______________.

A. mass flow rate; volumetric flow rate

B. volumetric flow rate; mass flow rate

C. mass flow rate; differential pressure

D. differential pressure; volumetric flow rate

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P305 (B2906)

If the steam pressure input to a density-compensated steam flow instrument fails high, the associated flow rate indication will...

A. decrease, because the density input has decreased.

B. increase, because the density input has decreased.

C. decrease, because the density input has increased.

D. increase, because the density input has increased.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P406 (B1606)

The density compensating input to a steam flow instrument is used to convert volumetric flow rate to...

A. velocity flow rate.

B. gallons per minute.

C. mass flow rate.

D. differential flow rate.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P705 (B708)

A steam flow measuring instrument uses density compensation and square root compensation to convert the differential pressure across the flow element to flow rate in lbm/hr.

The purpose of square root compensation in this flow measuring instrument is to convert _______________ to _______________.

A. volumetric flow rate; mass flow rate

B. volumetric flow rate; differential pressure

C. differential pressure; mass flow rate

D. differential pressure; volumetric flow rate

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P1212

If the steam pressure input to a density-compensated steam flow instrument fails low, the indicated flow rate will...

A. increase, because the density input has increased.

B. decrease, because the density input has increased.

C. increase, because the density input has decreased.

D. decrease, because the density input has decreased.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P2505 (B2506)

A main steam flow rate measuring instrument uses a steam pressure input to produce main steam flow rate indication in lbm/hr. Assuming volumetric steam flow rate does <u>not</u> change, a steam pressure decrease will cause indicated steam flow rate to...

A. decrease because the density of the main steam has decreased.

B. increase because the specific volume of the main steam has increased.

C. remain the same because steam pressure does <u>not</u> affect the mass flow rate of main steam.

D. remain the same because the steam pressure input compensates for changes in steam pressure.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P3605 (B3608)

A steam flow measuring instrument uses density compensation and square root extraction to convert the differential pressure across the flow element to flow rate in lbm/hr.

The purpose of density compensation in this flow measuring instrument is to convert _______________ to _______________.

A. volumetric flow rate; mass flow rate

B. volumetric flow rate; differential pressure

C. differential pressure; mass flow rate

D. differential pressure; volumetric flow rate

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P4603 (B4604)

A main steam flow rate differential pressure detector was properly calibrated to produce a main steam flow rate indication of 500,000 lbm/hr with the following initial input conditions:

Detector high pressure input:	1,000 psia
Detector low pressure input:	950 psia

The current detector input conditions are as follows:

Detector high pressure input:	985 psia
Detector low pressure input:	935 psia

Assume that the detector and associated circuitry do not have steam density compensation. Also assume that the main steam quality and volumetric flow rate do not change.

The current main steam flow rate indication is ______________ 500,000 lbm/hr; and the current main steam flow rate is ______________ 500,000 lbm/hr.

A. equal to; greater than

B. less than; greater than

C. equal to; less than

D. greater than; less than

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.02 [2.7/2.9]
QID: P4703 (B4704)

A nuclear power plant is initially operating with the following main steam parameter values:

Main steam pressure: 1,000 psia
Main steam flow rate: 500,000 lbm/hr

Main steam pressure decreases and stabilizes at 950 psia.

Assume 100% quality saturated steam and that main steam volumetric flow rate is the same before and after the pressure change.

Which one of the following is the approximate mass flow rate of main steam after the pressure change?

A. 528,000 lbm/hr

B. 500,000 lbm/hr

C. 472,000 lbm/hr

D. 444,000 lbm/hr

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P206

The most probable cause for fluctuating indication from a liquid flow rate differential pressure detector is...

A. gas or steam being trapped in the liquid.

B. unequal temperature gradients in the liquid.

C. vortexing of the liquid passing through the flow device.

D. the valve on the high pressure sensing line being partially closed.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.03 [2.7/2.9]
QID: P905

A properly calibrated water flow detector is located several feet below a horizontal pipe containing the detector's sensing element. The detector is removed for inspection and then reconnected to the sensing element with its low-pressure sensing line filled with air and its high-pressure sensing line filled with water.

If the water system is operating, indicated flow rate will be...

A. zero.

B. equal to actual flow rate but greater than zero.

C. lower than actual flow rate.

D. higher than actual flow rate.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P8 (B607)

If the equalizing valve for a differential pressure flow detector is opened in an operating system, the associated flow indication will...

A. increase by 50%.

B. decrease by 50%.

C. increase to maximum.

D. decrease to minimum.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P307 (B307)

Which one of the following will cause indicated volumetric flow rate to be lower than actual volumetric flow rate using a differential pressure flow detector that is connected to a calibrated orifice?

A. System pressure decreases.

B. The orifice erodes over time.

C. Debris becomes lodged in the orifice.

D. A leak develops in the low pressure sensing line.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P706 (B707)

Flow rate is being measured using a differential pressure flow detector and a calibrated orifice. If actual flow rate remains constant, which one of the following will cause indicated flow rate to be higher than actual flow rate?

A. The flow detector equalizing valve is inadvertently opened.

B. A leak develops in the high pressure sensing line.

C. Debris becomes lodged in the orifice.

D. The orifice erodes over time.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P1007 (B1907)

Refer to the drawing of a pipe elbow used for flow measurement in a cooling water system (see figure below).

A differential pressure (D/P) flow detector is connected to instrument lines A and B.

If instrument line A develops a leak, indicated flow rate will _______________ due to a _______________ measured D/P.

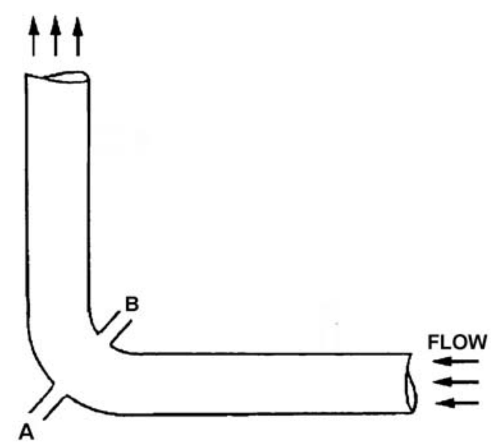
A. increase; larger

B. increase; smaller

C. decrease; larger

D. decrease; smaller

ANSWER: D.



PIPE ELBOW - TOP VIEW

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P1205 (B1506)

If the orifice in a differential pressure (D/P) flow sensor erodes such that the orifice opening becomes larger, indicated flow rate will ____________ due to a ____________ D/P across the orifice.

A. increase; larger

B. increase; smaller

C. decrease; larger

D. decrease; smaller

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P1608 (B1608)

Refer to the drawing of a horizontal pipe elbow (top view) in an operating water system (see figure below).

Three separate bellows differential pressure flow detectors are connected to taps A, B, C, and D as follows:

DETECTOR	TAPS
X	A and D
Y	B and D
Z	C and D

Assuming zero head loss in this section of pipe, how will the detectors be affected if tap D ruptures?

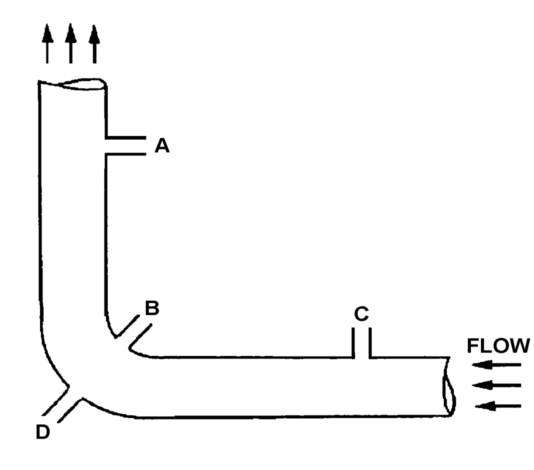
A. All detectors will fail low.

B. All detectors will fail high.

C. Two detectors will fail low and one will fail high.

D. Two detectors will fail high and one will fail low.

ANSWER: A.



PIPE ELBOW - TOP VIEW

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P2107 (B2209)

Refer to the drawing of a pipe elbow used for flow measurement in a cooling water system (see figure below).

A differential pressure (D/P) flow detector is connected to instrument lines A and B.

If instrument line B develops a leak, indicated flow rate will _______________ due to a _______________ measured D/P.

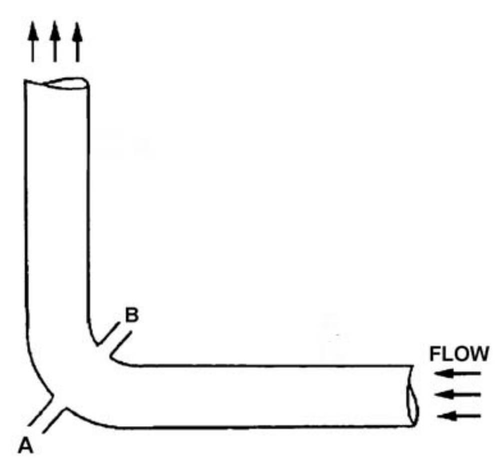
A. increase; larger

B. increase; smaller

C. decrease; larger

D. decrease; smaller

ANSWER: A.



PIPE ELBOW - TOP VIEW

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P2305 (B2310)

An orifice is being used in an operating cooling water system to measure flow rate. Which one of the following will cause the differential pressure sensed across the orifice to decrease?

A. System pressure decreases.

B. System flow rate decreases.

C. Debris becomes lodged in the orifice.

D. A leak develops in the low pressure sensing line.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P2307 (B2307)

Refer to the drawing of a horizontal pipe elbow (top view) in an operating water system (see figure below).

Three separate bellows differential pressure flow detectors are connected to taps A, B, C, and D as follows:

DETECTOR	TAPS
X	A and D
Y	B and D
Z	C and D

Assume that water is incompressible and there is no head loss in this section of pipe. How will the detectors be affected if system flow rate remains the same while system pressure increases from 1000 psig to 1200 psig?

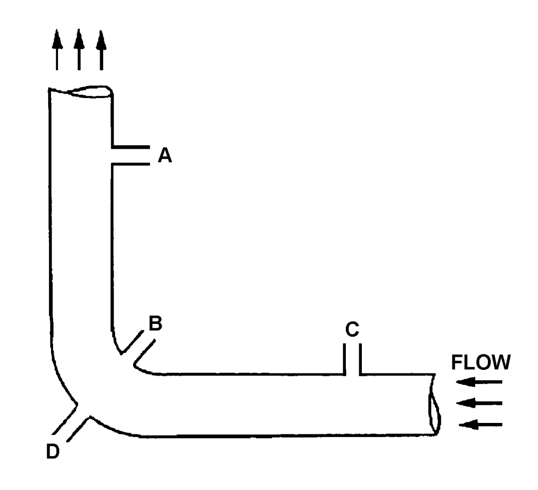
A. All detectors will indicate higher flow.

B. Only two detectors will indicate higher flow.

C. Only one detector will indicate higher flow.

D. Detector indication will not change.

ANSWER: D.



PIPE ELBOW - TOP VIEW

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P2807 (B1007)

Refer to the drawing of a pipe elbow used for flow measurement (see figure below).

At which one of the following locations is the highest pressure sensed? (Assume a constant pipe diameter and zero head loss in this section of pipe.)

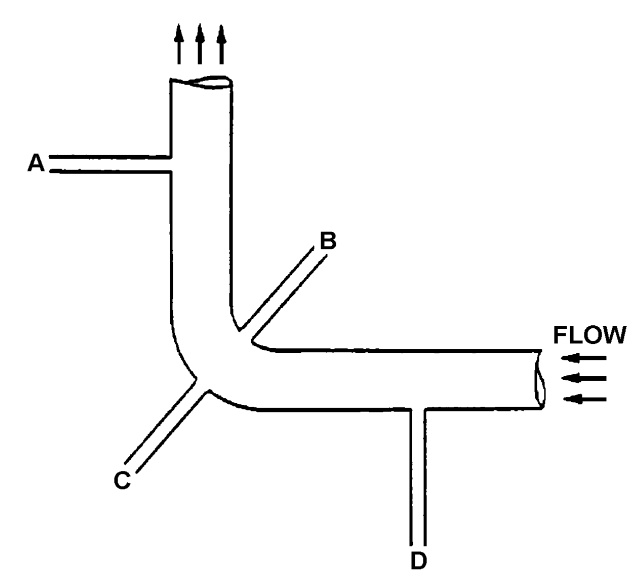
A. Point A

B. Point B

C. Point C

D. Point D

ANSWER: C.



PIPE ELBOW

TOPIC: 191002
KNOWLEDGE: K1.04 [2.7/2.7]
QID: P2905 (B3108)

Refer to the drawing of a horizontal pipe elbow (top view) in an operating water system (see figure below).

Three separate bellows-type differential pressure flow detectors are connected to taps A, B, C, and D as follows:

DETECTOR	TAPS
X	A and D
Y	B and D
Z	C and D

Assuming zero head loss in this section of pipe, how will the detectors be affected if tap B experiences a significant leak? (Assume water system pressure does not change.)

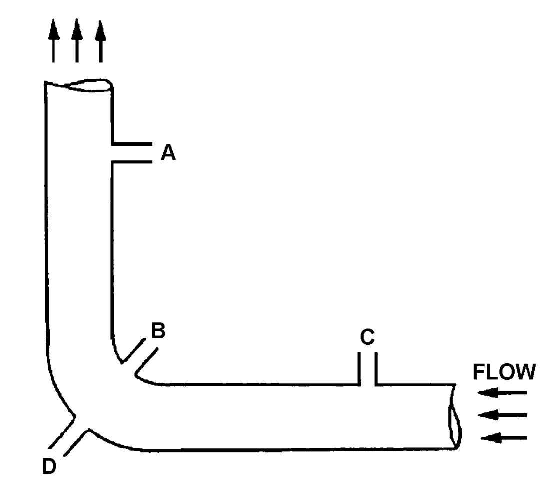
A. All detectors will fail low.

B. All detectors will fail high.

C. Only one detector will fail, and it will fail low.

D. Only one detector will fail, and it will fail high.

ANSWER: D.



PIPE ELBOW - TOP VIEW

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P9

Flow detectors (such as an orifice, flow nozzle, and venturi tube) measure flow rate using the principle that flow rate is...

A. directly proportional to the differential pressure (D/P) squared.

B. inversely proportional to the D/P squared.

C. directly proportional to the square root of the D/P.

D. inversely proportional to the square root of the D/P.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P308 (B305)

A cooling water system is operating at steady-state conditions indicating 900 gpm with 60 psid across the flow transmitter venturi. If cooling water flow rate is increased to 1800 gpm, flow transmitter venturi delta-P will be approximately...

A. 85 psid.

B. 120 psid.

C. 175 psid.

D. 240 psid.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P607 (B608)

The flow rate of a fluid passing through a venturi can be determined by measuring the:

A. change in the pressure of the fluid as it passes through the venturi.

B. change in the density of the fluid as it passes through the venturi.

C. linear displacement of a metering plug installed in the throat of the venturi.

D. rotation of a paddle wheel type device installed in the throat of the venturi.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P707 (B706)

A cooling water system is operating at a steady-state flow rate of 700 gpm with 60 psid across the flow transmitter venturi. If cooling water flow rate is increased to 1000 gpm, differential pressure across the flow transmitter venturi will be approximately...

A. 85.7 psid.

B. 122.4 psid.

C. 171.4 psid.

D. 244.8 psid.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P807 (B807)

Refer to the drawing of a venturi flow element (see figure below) with direction of fluid flow indicated by the arrow.

Where should the high pressure tap of a differential pressure flow detector be connected?

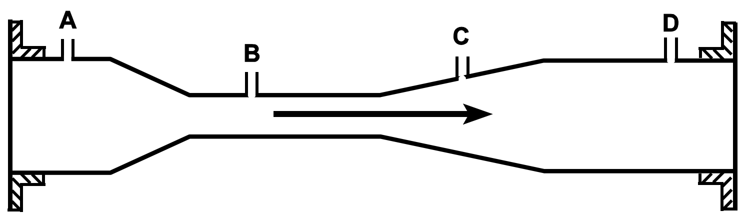
A. Point A

B. Point B

C. Point C

D. Point D

ANSWER: A.



VENTURI FLOW ELEMENT

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P907 (B1905)

A differential (D/P) detector is being used to measure main steam flow rate. At a steam flow rate of 5×10^6 lbm/hr measured D/P is 40 psid.

If steam flow changes such that current D/P is 30 psid, what is the approximate current steam flow rate?

A. 2.1×10^6 lbm/hr

B. 3.5×10^6 lbm/hr

C. 3.7×10^6 lbm/hr

D. 4.3×10^6 lbm/hr

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P908 (B2106)

Which one of the following flow measuring elements produces the largest unrecoverable head loss when used in an operating fluid system?

A. Venturi

B. Flow nozzle

C. Pipe elbow

D. Orifice

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1106 B3306)

Refer to the drawing of a venturi flow element in an operating cooling water system (see figure below).

At what point does the lowest pressure exist?

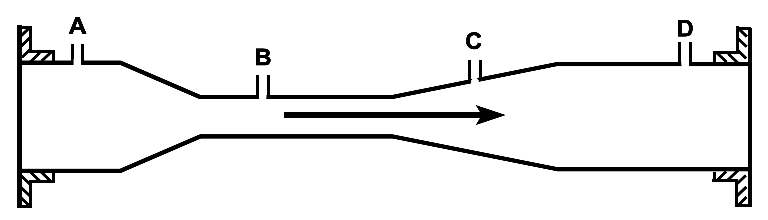
A. Point A

B. Point B

C. Point C

D. Point D

ANSWER: B.



VENTURI FLOW ELEMENT

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1308 (B907)

Refer to the drawing of a venturi flow element for an operating cooling water system (see figure below).

The greatest differential pressure (D/P) will be sensed by a D/P flow detector if the low pressure sensing line is connected at _____ and the high pressure sensing line is connected at _____.

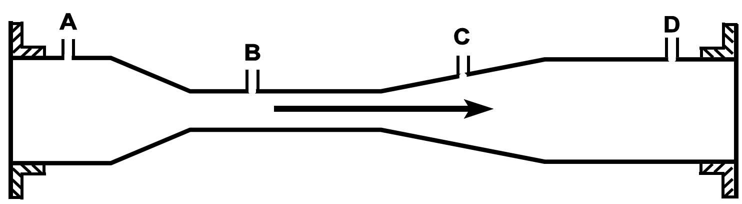
A. B; A

B. B; C

C. D; A

D. D; C

ANSWER: A.



VENTURI FLOW ELEMENT

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1407

A cooling water system is operating at a steady-state flow rate of 500 gpm with 60 psid across the flow transmitter venturi. If cooling water flow rate is increased to 1000 gpm, differential pressure across the flow transmitter venturi will be approximately...

A. 85 psid.

B. 120 psid.

C. 240 psid.

D. 480 psid.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1606 (B407)

Refer to the drawing in which subcooled water is flowing through a convergent-divergent venturi (see figure below). The pipe diameters at P1 and P2 are equal.

Compared to the conditions at the inlet of the venturi (P1), the pressure at the outlet of the venturi (P2) has ____________ and the mass flow rate of the water at the outlet of the venturi has ______________. (Assume "real" conditions.)

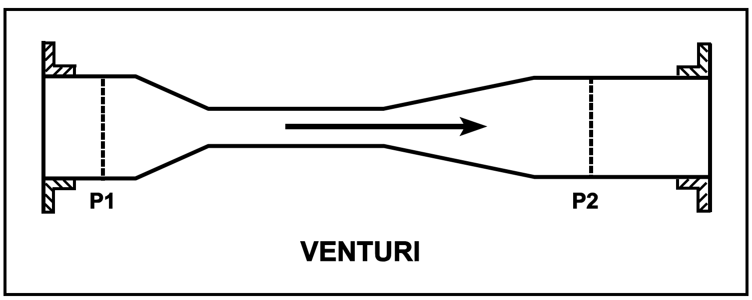
A. remained the same; remained the same

B. remained the same; decreased slightly

C. decreased slightly; remained the same

D. decreased slightly; decreased slightly

ANSWER: C.



TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1808

Subcooled water is flowing through a venturi flow element. When the water reaches the throat of the venturi, the __________ water pressure and the __________ water velocity occurs.

A. highest; highest

B. lowest; lowest

C. lowest; highest

D. highest; lowest

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1873 (B1773)

Subcooled water is flowing through each of the following devices. Which one of the devices will produce an outlet pressure that is greater than the inlet pressure?

A. Convergent nozzle

B. Divergent nozzle

C. Orifice

D. Flow restrictor

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P1906 (B1408)

Refer to the drawing of a pipe elbow used for flow measurement (see figure below).

At which one of the following pairs of connection points will the greatest differential pressure be sensed? (Assume ideal fluid flow conditions.)

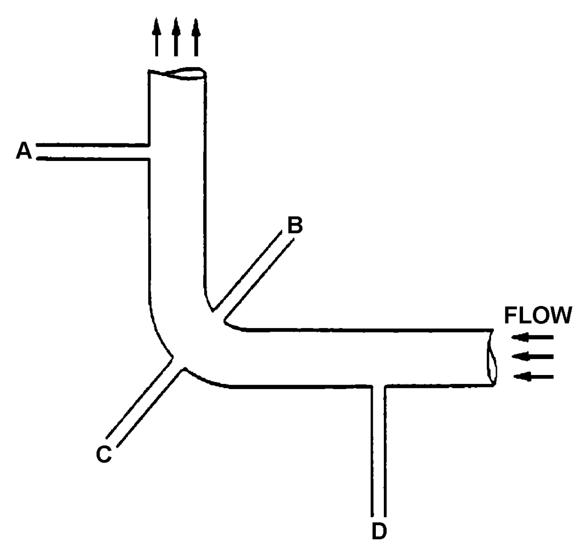
A. Points A and B

B. Points B and C

C. Points C and D

D. Points D and A

ANSWER: B.



PIPE ELBOW

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P2306 (B2306)

A venturi is used to measure flow rate in a cooling water system. As the water flows from the throat to the discharge of the venturi, water pressure will ____________ and volumetric flow rate will ____________. (Assume water is incompressible.)

A. increase; remain the same

B. increase; increase

C. decrease; remain the same

D. decrease; decrease

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P2406 (B2206)

A cooling water system is operating at a steady-state flow rate of 700 gpm with 60 psid across a flow transmitter venturi. If cooling water flow rate is increased to 900 gpm, differential pressure across the flow transmitter venturi will be approximately...

A. 68 psid.

B. 77 psid.

C. 99 psid.

D. 127 psid.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P2506 (B2606)

A venturi is being used to measure flow rate in a cooling water system. As the cooling water flows from the inlet to the throat of the venturi, water pressure will ____________ and volumetric flow rate will ____________. (Assume water is incompressible.)

A. increase; remain the same

B. increase; increase

C. decrease; remain the same

D. decrease; increase

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P2507 (B2508)

A differential pressure detector is being used with an orifice plate to measure water flow rate through a pipe. When the flow detector was last calibrated, the following parameters were observed:

Upstream Pressure:	125 psig	Actual Flow Rate:	100 gpm
Downstream Pressure:	116 psig	Indicated Flow Rate:	100 gpm

Significant erosion of the orifice has occurred since the calibration such that actual flow rate through the orifice has increased to 120 gpm while the upstream and downstream pressures have changed to 110 psig and 106 psig respectively.

What is the approximate flow rate that is currently indicated?

A. 44 gpm

B. 67 gpm

C. 81 gpm

D. 120 gpm

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P2606

A cooling water system is operating at steady-state conditions at 900 gpm with 64 psid across the flow transmitter venturi. Cooling water flow rate changes such that venturi differential pressure decreases to 36 psid.

Which one of the following is the new system flow rate?

A. 506 gpm

B. 576 gpm

C. 675 gpm

D. 745 gpm

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P2808 (B2806)

A differential pressure detector is being used with an orifice plate to measure water flow rate through a pipe. When the flow detector was last calibrated, the following parameters were observed:

Upstream Pressure: 135 psig
Downstream Pressure: 120 psig

Actual Flow Rate: 100 gpm
Indicated Flow Rate: 100 gpm

Significant erosion of the orifice plate opening has occurred since the last calibration such that actual flow rate through the orifice has increased to 120 gpm while the upstream and downstream pressures have changed to 124 psig and 109 psig respectively.

What is the approximate currently indicated flow rate?

A. 44 gpm

B. 67 gpm

C. 100 gpm

D. 120 gpm

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P3207 (B3206)

A cooling water system uses a horizontal venturi with a differential pressure flow detector to provide cooling water flow rate indication. Water enters and leaves the venturi at 70°F, 120 psig and 20 ft/sec. Water velocity at the throat of the venturi is 45 ft/sec. Assume water is incompressible and the venturi experiences no unrecoverable head loss.

What is the approximate pressure of the water at the throat of the venturi?

A. 109 psig

B. 98 psig

C. 86 psig

D. 71 psig

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P3306 (B2010)

A cooling water system is operating at steady-state conditions. A calibrated system flow meter indicates 600 gpm with 50 psid across the flow transmitter venturi.

If cooling water flow rate is increased to 900 gpm, differential pressure across the flow transmitter venturi will be approximately...

A. 63 psid.

B. 75 psid.

C. 97 psid.

D. 112 psid.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P3706 (B3706)

The following is the current calibration data for an orifice plate that is being used for water flow rate measurement:

Upstream Pressure: 135 psig
Downstream Pressure: 120 psig
Flow Rate: 100 gpm

During a surveillance the following pressures are observed across the orifice plate:

Upstream Pressure: 124 psig
Downstream Pressure: 117 psig

What is the approximate water flow rate through the orifice plate?

A. 47 gpm

B. 57 gpm

C. 68 gpm

D. 78 gpm

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P3807 (B3807)

Refer to the drawing of a differential pressure manometer (see figure below).

The manometer is filled with water and installed across an orifice in a ventilation duct to determine the rate of air flow. The manometer is currently indicating a water level difference of 16 inches at an air flow rate of 300 ft^3/min.

Which one of the following will be the approximate rate of air flow when the manometer indicates a water level difference of 4 inches?

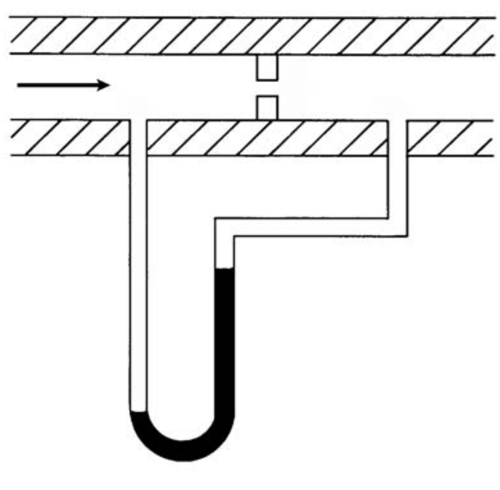
A. 75 ft^3/min.

B. 125 ft^3/min.

C. 150 ft^3/min.

D. 175 ft^3/min.

ANSWER: C.



DIFFERENTIAL PRESSURE MANOMETER

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P4003 (B4005)

A differential pressure detector is being used with an orifice plate to measure water flow rate through a pipe. When the flow instrument was last calibrated, the following parameters were observed:

Upstream Pressure:	125 psig	Actual Flow Rate:	100 gpm
Downstream Pressure:	116 psig	Indicated Flow Rate:	100 gpm

Since the calibration, debris has collected in the orifice such that the actual flow rate through the orifice has decreased to 80 gpm while the upstream and downstream pressures have changed to 135 psig and 110 psig, respectively.

What is the approximate flow rate that is currently indicated by the flow instrument?

A. 125 gpm

B. 133 gpm

C. 156 gpm

D. 167 gpm

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P4604 (B4605)

Refer to the drawing of a differential pressure manometer (see figure below).

The manometer is filled with water and installed across an orifice in a ventilation duct to determine the rate of air flow. The manometer is currently indicating a water level difference of 8 inches at an air flow rate of 300 cubic feet per minute (ft^3/min).

Which one of the following will be the approximate air flow rate when the manometer indicates a water level difference of 4 inches?

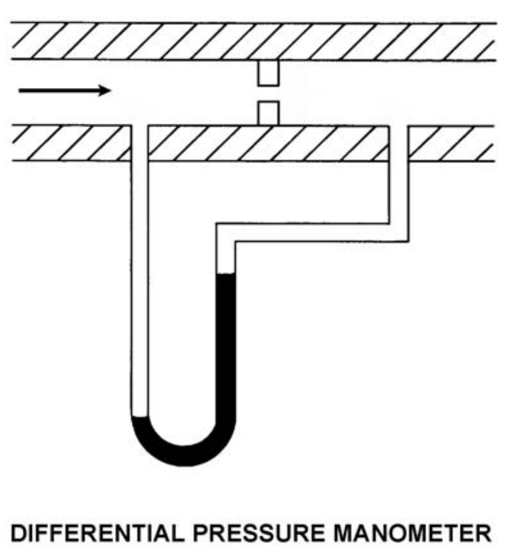
A. 75 ft^3/min

B. 150 ft^3/min

C. 188 ft^3/min

D. 212 ft^3/min

ANSWER: D.



DIFFERENTIAL PRESSURE MANOMETER

TOPIC: 191002
KNOWLEDGE: K1.05 [2.6/2.8]
QID: P4804 (B4804)

A cooling water system uses a horizontal venturi with a differential pressure flow detector to provide cooling water flow rate indication. Water enters and leaves the venturi at 70°F, 100 psig and 24 ft/sec. Water velocity at the throat of the venturi is 50 ft/sec. Assume water is incompressible and the venturi experiences no unrecoverable head loss.

What is the approximate pressure of the water at the throat of the venturi?

A. 98 psig

B. 94 psig

C. 87 psig

D. 74 psig

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P208 (B909)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

The associated level instrument was calibrated with the water in the storage tank at 100°F. If mass in the tank remains constant and the water temperature increases to 120°F, the <u>indicated</u> level will...

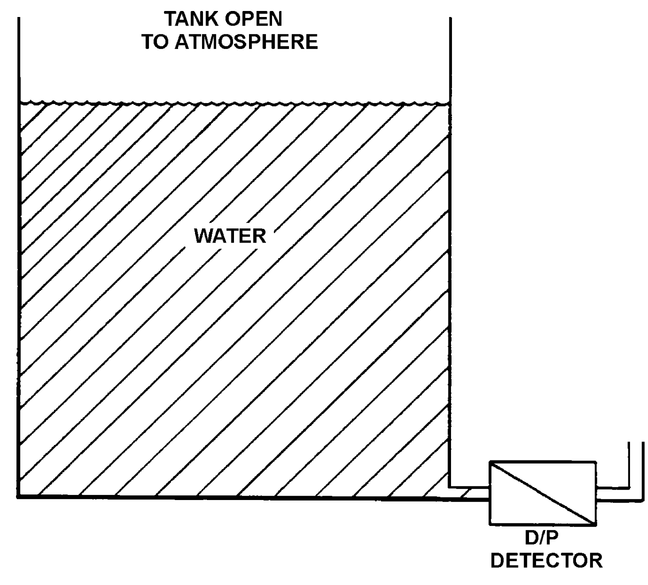
A. increase in direct proportion to the temperature rise.

B. increase but remain less than actual level.

C. decrease in direct proportion to the temperature rise.

D. remain the same although actual level increases.

ANSWER: D.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P411

Refer to the drawing of a pressurizer differential pressure (D/P) level detection system (see figure below).

With the nuclear power plant at normal operating conditions, a pressurizer level D/P instrument, that had been calibrated while the plant was in a cold condition, would indicate ______________ than actual level because of a ______________ D/P sensed by the D/P detector at normal operating conditions.

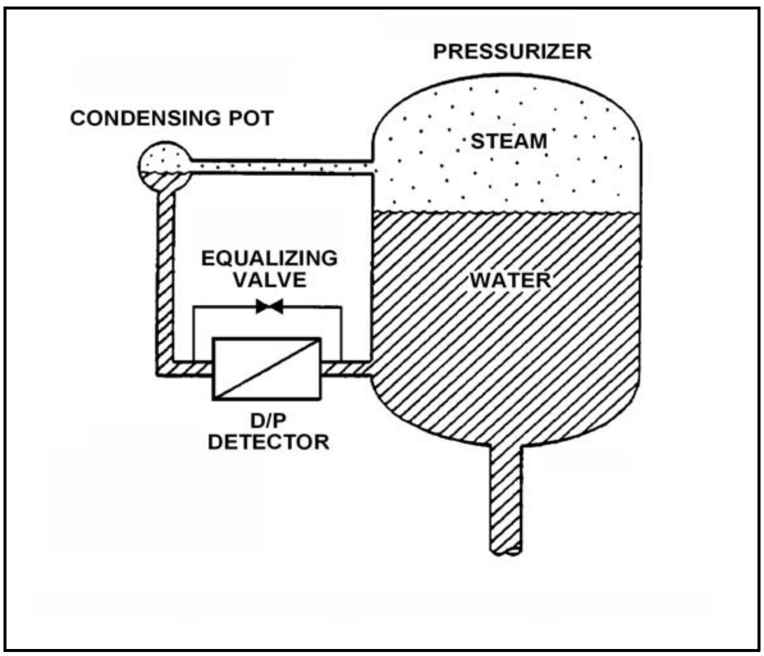
A. higher; smaller

B. higher; larger

C. lower; smaller

D. lower; larger

ANSWER: D.



TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P507

Refer to the drawing of a tank differential pressure level detector that was recently calibrated at a tank water temperature of 80°F (see figure below).

If the mass of the water in the tank remains the same while the tank water temperature is raised from 80°F to 150°F, the <u>indicated</u> level will...

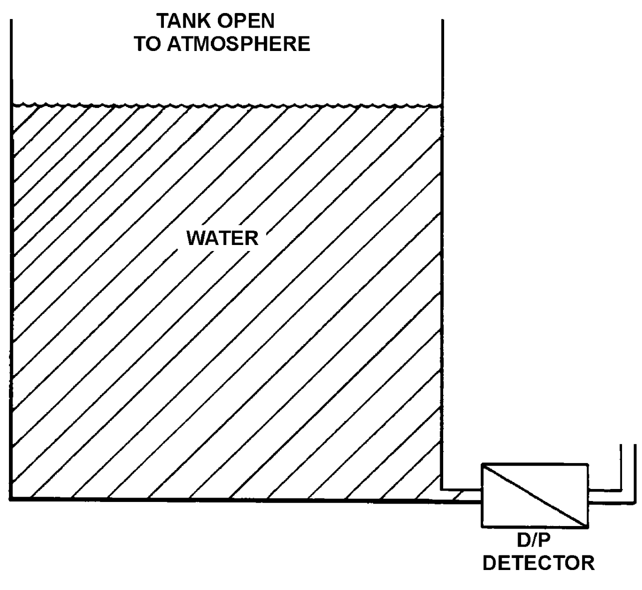
A. remain equal to actual level.

B. increase due to the expansion of the water.

C. remain the same.

D. decrease due to the expansion of the water.

ANSWER: C.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P608

Refer to the drawing of two tank differential pressure (D/P) level indicators (see figure below).

Two D/P level indicators are installed on a large water storage tank. Indicator 1 was calibrated at 100°F water temperature and indicator 2 was calibrated at 200°F water temperature.

Assuming both indicators are on scale, which one will indicate the higher level?

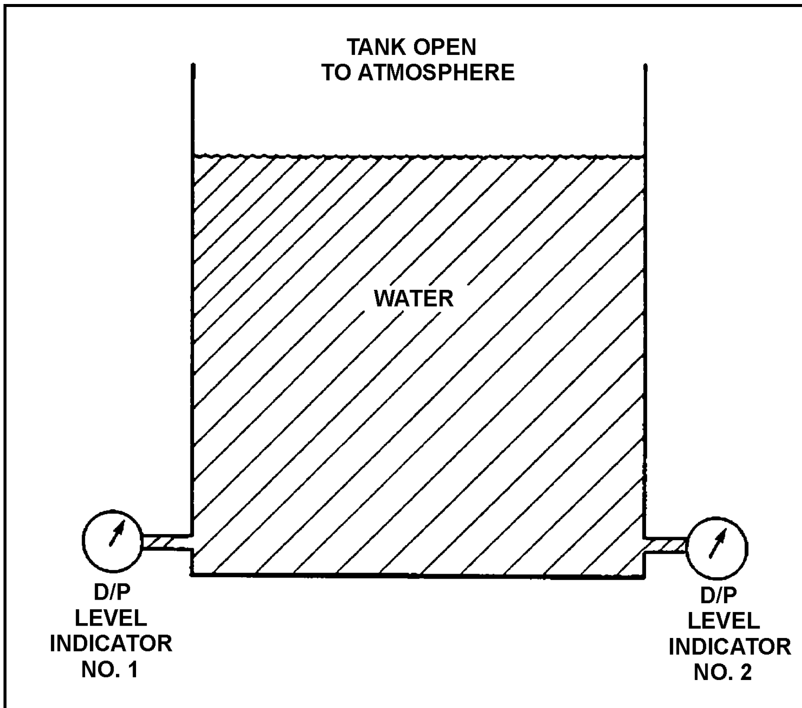
A. Indicator 1 at all water temperatures

B. Indicator 2 at all water temperatures

C. Indicator 1 below 150°F, indicator 2 above 150°F

D. Indicator 2 below 150°F, indicator 1 above 150°F

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P808 (B809)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

The D/P level detector is being used in a level control system that is calibrated to maintain tank level at 80% at the current tank temperature of 100°F. If tank temperature gradually increases and stabilizes at 150°F, actual tank level will...

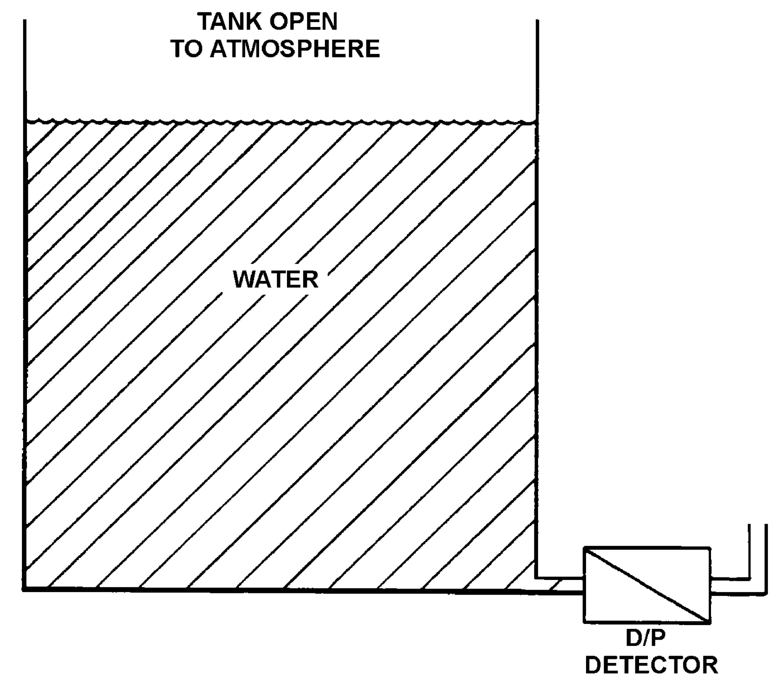
A. remain at 80%.

B. increase and stabilize above 80%.

C. oscillate around 80%.

D. decrease and stabilize below 80%.

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P1107 (B1507)

Refer to the drawing of two tank differential pressure (D/P) level indicators (see figure below).

Two D/P level indicators are installed on a large water storage tank. Indicator 1 was calibrated at 100°F water temperature and indicator 2 was calibrated at 200°F water temperature.

Assuming both indicators are on scale, which indicator will indicate the lower level?

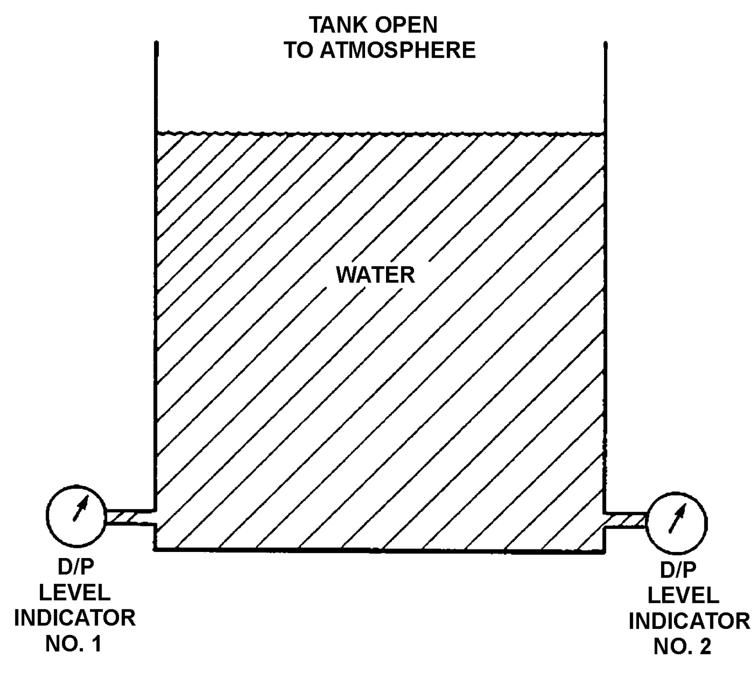
A. Indicator 1 at all water temperatures

B. Indicator 2 at all water temperatures

C. Indicator 1 below 150°F, indicator 2 above 150°F

D. Indicator 2 below 150°F, indicator 1 above 150°F

ANSWER: A.



TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P1706 (B1706)

Refer to the drawing of two tank differential pressure (D/P) level indicators (see figure below).

Two D/P level indicators are installed on a large water storage tank. Indicator No. 1 was calibrated at 200°F water temperature and indicator No. 2 was calibrated at 100°F water temperature.

Assuming both indicators are on scale, which indicator will indicate the lower level?

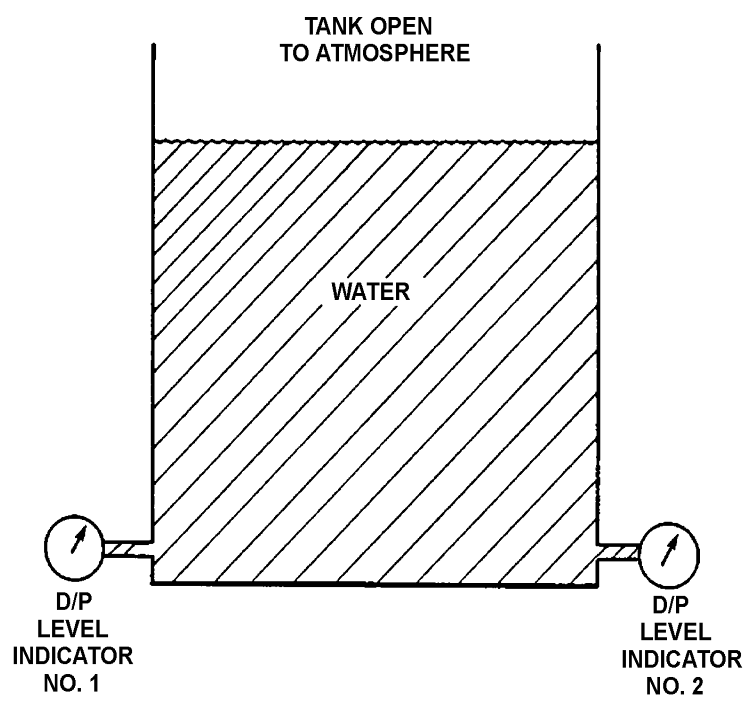
A. Indicator 1 at all water temperatures

B. Indicator 2 at all water temperatures

C. Indicator 1 below 150°F, indicator 2 above 150°F

D. Indicator 2 below 150°F, indicator 1 above 150°F

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P1907

Refer to the drawing of a water storage tank with two differential pressure (D/P) level indicators (see figure below).

Indicator 1 was calibrated at 120°F and indicator 2 was calibrated at 180°F. If tank water temperature is 150°F, then indicator...

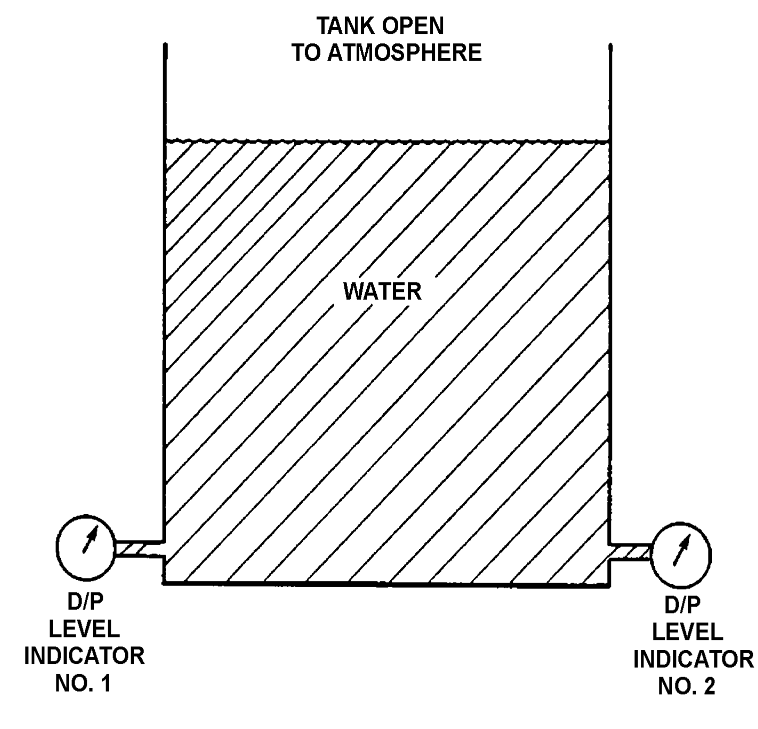
A. 1 will read greater than indicator 2 and greater than actual level.

B. 1 will read greater than indicator 2 and less than actual level.

C. 2 will read greater than indicator 1 and greater than actual level.

D. 2 will read greater than indicator 1 and less than actual level.

ANSWER: C.



TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P2108 (B2408)

Refer to the drawing of a water storage tank with two differential pressure (D/P) level indicators (see figure below).

Indicator 1 was calibrated at 180°F and indicator 2 was calibrated at 120°F. If current tank water temperature is 150°F, then indicator...

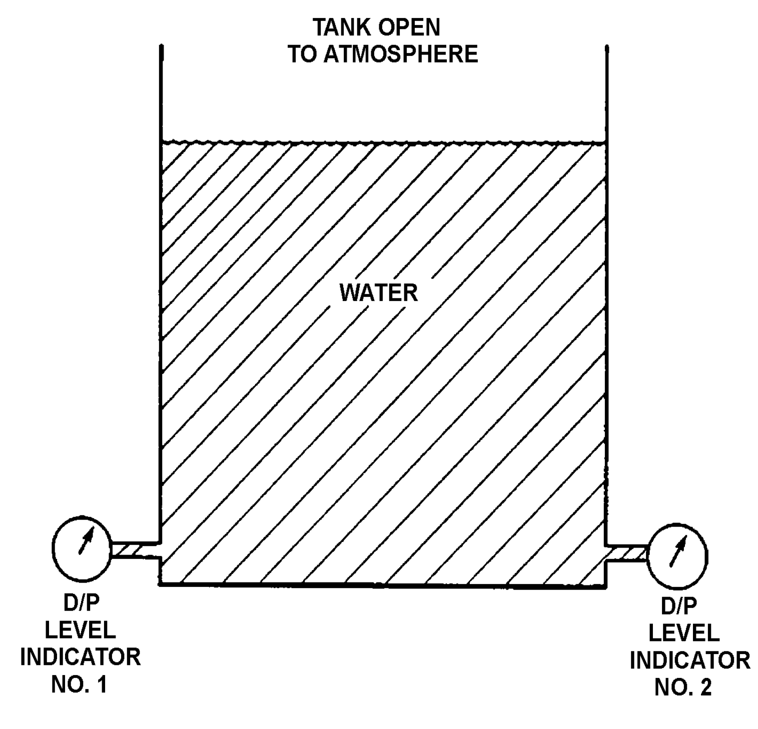
A. 1 will read greater than indicator 2 and greater than actual water level.

B. 1 will read greater than indicator 2 and less than actual water level.

C. 2 will read greater than indicator 1 and greater than actual water level.

D. 2 will read greater than indicator 1 and less than actual water level.

ANSWER: A.



TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P2308 (B2308)

Refer to the drawing of a steam generator differential pressure (D/P) level detection system that was calibrated at normal operating conditions (see figure below).

A reactor coolant system cooldown has resulted in a decrease in steam generator pressure from 900 psia to 400 psia. Without density compensation of the level instrumentation, at the end of the cooldown, steam generator level indication would indicate _________ than actual level because the density of the water in the _____________ has changed significantly.

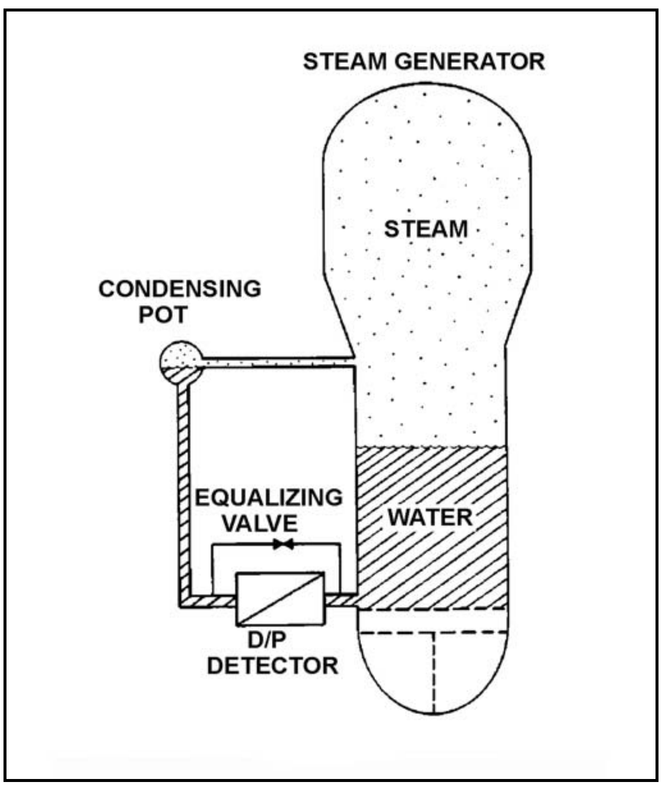
A. lower; reference leg

B. lower; steam generator

C. higher; reference leg

D. higher; steam generator

ANSWER: D.



TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P2509

Refer to the drawing of a steam generator (S/G) differential pressure (D/P) level detection system (see figure below) that has been calibrated at the current S/G pressure of 400 psia.

A reactor coolant system heatup has resulted in an increase in S/G pressure from 400 psia to 900 psia over 4 hours. The ambient air temperature surrounding the S/G has remained constant.

Without density compensation of the level instrumentation, at the end of the heatup S/G level indication would indicate _________ than actual level because the density of the water in the _____________ has changed significantly.

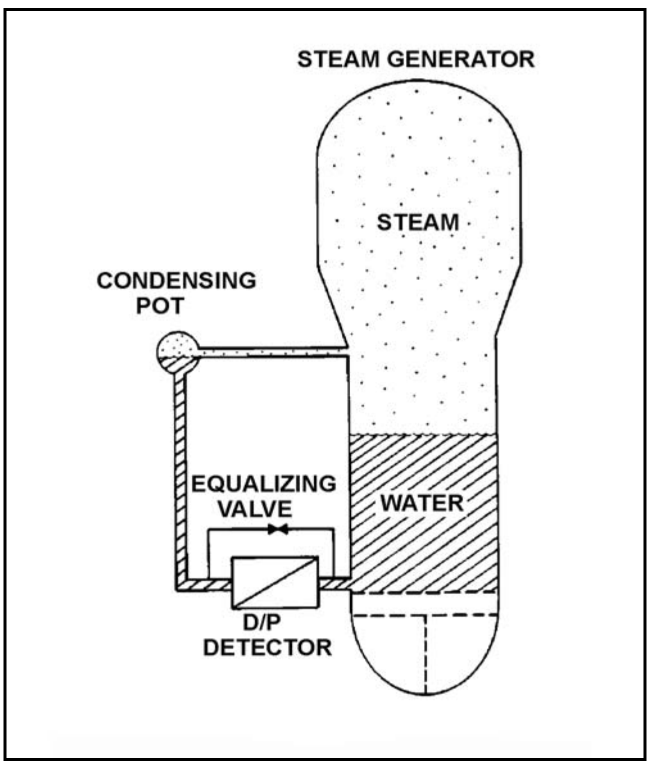
A. higher; steam generator

B. higher; reference leg

C. lower; steam generator

D. lower; reference leg

ANSWER: C.



TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P3208

A nuclear reactor is currently shut down at 140°F and 150 psig. Pressurizer level is being monitored using a normal at-power pressurizer level instrument that was calibrated at normal plant operating conditions.

The pressurizer level instrument indicates _________ than actual pressurizer level because, compared to the calibration conditions, there has been a significant change in the density of the fluid in the ____________.

A. lower; reference leg

B. lower; pressurizer

C. higher; reference leg

D. higher; pressurizer

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P4104

Refer to the drawing of a pressurizer and differential pressure (D/P) level detection system that was recently calibrated at normal operating conditions (see figure below). Assume that the associated pressurizer level instrument does not use density compensation.

With the nuclear power plant shut down at reduced reactor coolant system temperature and pressure, the pressurizer level instrument will indicate _______________ than actual water level because the D/P currently sensed by the D/P detector is_____________ than the D/P for the same pressurizer water level at normal operating conditions.

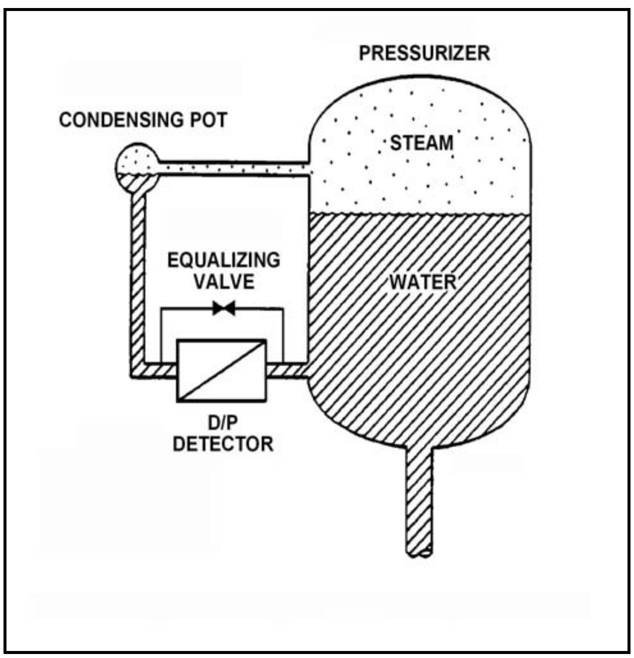
A. lower; smaller

B. lower; larger

C. higher; smaller

D. higher; larger

ANSWER: C.



TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P4204 (B4205)

Refer to the drawing of a water storage tank with two differential pressure (D/P) level indicators (see figure below).

Indicator 1 was calibrated at a tank water temperature of 120°F and indicator 2 was calibrated at 180°F. If tank water temperature is currently 150°F, then indicator...

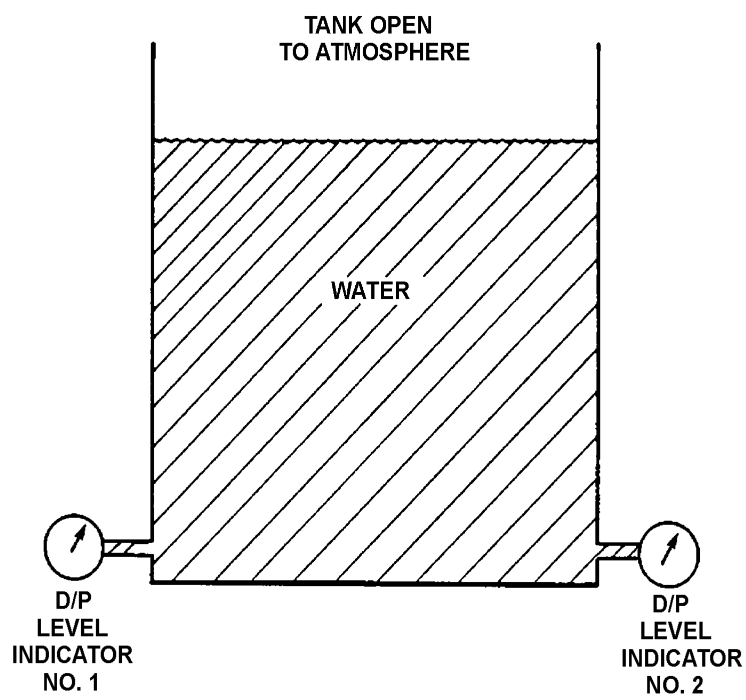
A. 1 will read greater than indicator 2, and indicator 1 will read greater than actual water level.

B. 1 will read greater than indicator 2, and indicator 1 will read less than actual water level.

C. 2 will read greater than indicator 1, and indicator 2 will read greater than actual water level.

D. 2 will read greater than indicator 1, and indicator 2 will read less than actual water level.

ANSWER: C.



TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P4404

Refer to the drawing of a pressurizer differential pressure (D/P) level detection system (see figure below).

The associated pressurizer level instrument was recently calibrated with the nuclear power plant at normal operating conditions. Assume that the level instrument does <u>not</u> use density compensation.

If the plant is currently shut down at reduced reactor coolant system temperatures and pressure, pressurizer water level will currently indicate _______________ than actual water level because, for a given pressurizer water level, the D/P sensed by the D/P detector is currently _____________.

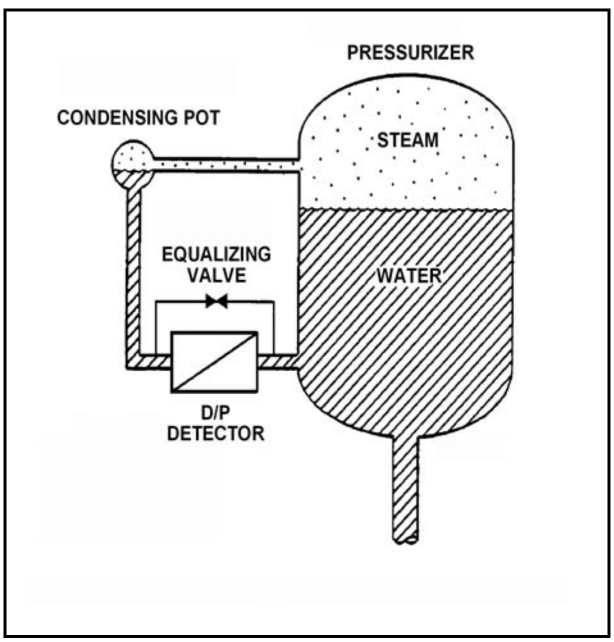
A. higher; smaller

B. higher; larger

C. lower; smaller

D. lower; larger

ANSWER: A.



TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P4504

Refer to the drawing of a differential pressure (D/P) level detection system for a pressurizer at normal operating temperature and pressure (see figure below).

A nuclear power plant uses several differential pressure detectors like the one below to provide multiple channels of pressurizer water level indication. A hot channel was calibrated when the pressurizer was at normal operating temperature. A cold channel was calibrated when the pressurizer was at 160°F.

How will the level indications on the two channels compare when the pressurizer is at normal operating temperature?

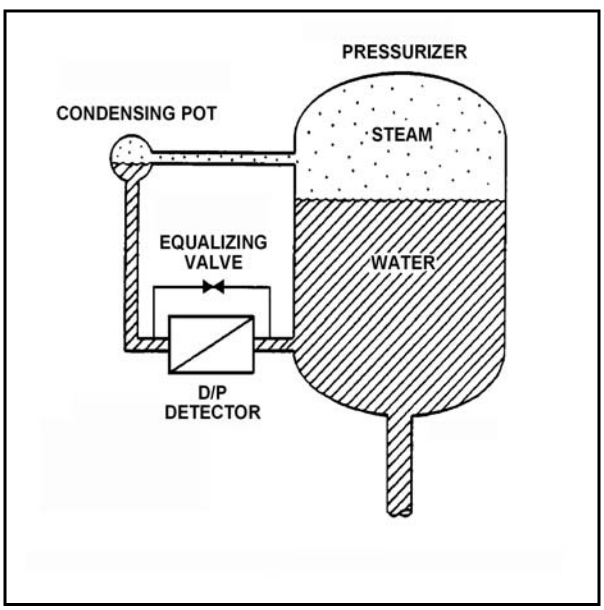
A. The cold channel will indicate higher than the hot channel due to the difference in reference leg water density at the two calibration temperatures.

B. The cold channel will indicate lower than the hot channel due to the difference in reference leg water density at the two calibration temperatures.

C. The cold channel will indicate higher than the hot channel due to the difference in pressurizer water density at the two calibration temperatures.

D. The cold channel will indicate lower than the hot channel due to the difference in pressurizer water density at the two calibration temperatures.

ANSWER: D.



TOPIC: 191002
KNOWLEDGE: K1.06 [2.5/2.6]
QID: P5103

Refer to the drawing of a differential pressure (D/P) level detection system for a pressurizer at normal operating temperature and pressure (see figure below).

A nuclear power plant uses several differential pressure detectors like the one below to provide multiple channels of pressurizer water level indication. A hot channel was calibrated when the pressurizer was at normal operating temperature. A cold channel was calibrated when the pressurizer was at 160°F.

How will the level indications on the two channels compare when the pressurizer is at 160°F?

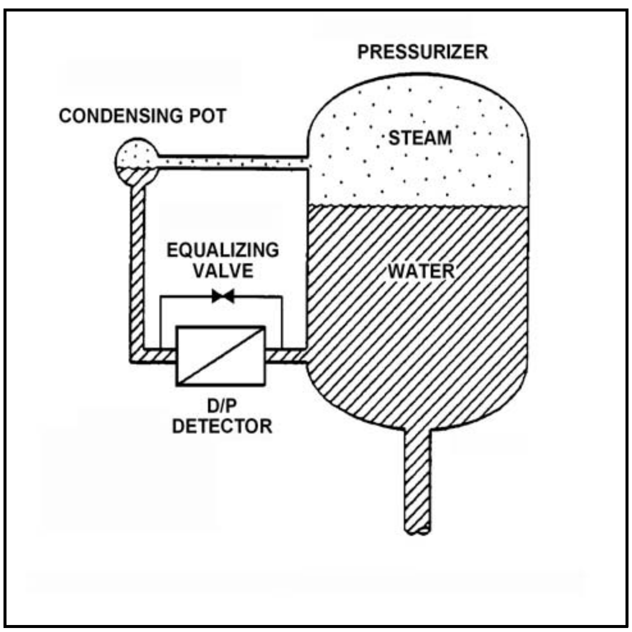
A. The cold channel will indicate higher than the hot channel due to the difference in reference leg water density at the two calibration temperatures.

B. The cold channel will indicate lower than the hot channel due to the difference in reference leg water density at the two calibration temperatures.

C. The cold channel will indicate higher than the hot channel due to the difference in pressurizer water density at the two calibration temperatures.

D. The cold channel will indicate lower than the hot channel due to the difference in pressurizer water density at the two calibration temperatures.

ANSWER: D.



TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P410

Refer to the drawing of a tank differential pressure level detector (see figure below).

If the differential pressure detector equalizing valve is opened, level indication will:

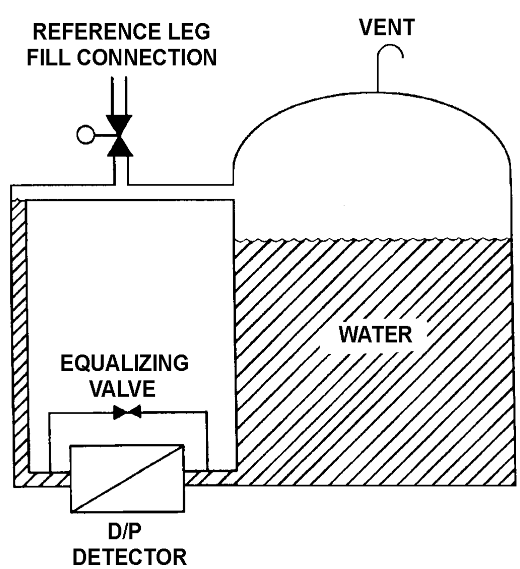
A. decrease and stabilize below actual level.

B. increase and stabilize above actual level.

C. oscillate above and below actual level.

D. remain constant at the current level.

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P708 (B2609)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

The level detector is being used in a level control system that is calibrated to maintain tank level at 75% at the current water temperature of 90°F. If water temperature gradually increases and stabilizes at 120°F, the level control system will cause actual tank level to...

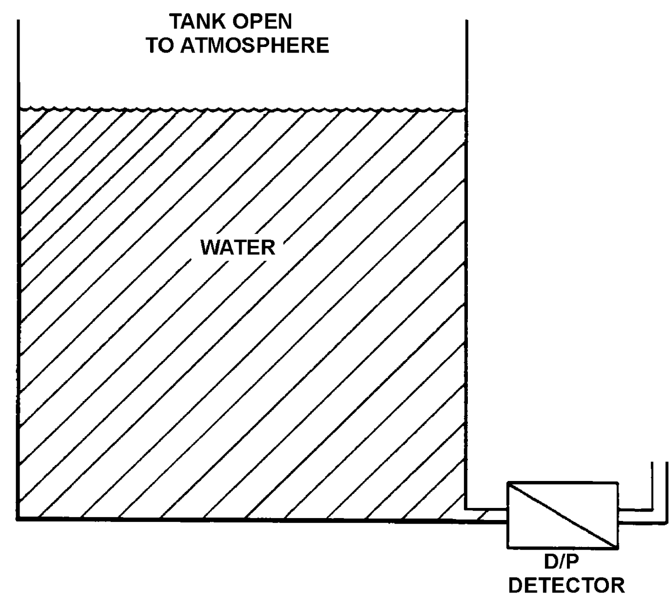
A. remain at 75%.

B. increase and stabilize above 75%.

C. oscillate around 75%.

D. decrease and stabilize below 75%.

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P910 (B910)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

The D/P sensed by the detector varies in the __________ direction as the temperature of the water in the tank if the __________ of the tank water is constant. (Assume reference leg and tank water temperatures are initially the same.)

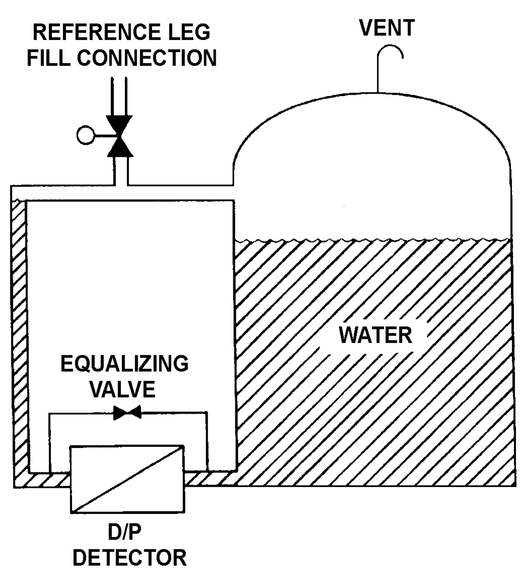
A. same; level

B. inverse; level

C. same; mass

D. inverse; mass

ANSWER: A.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P1008 (B1909)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

The level detector is being used in a level control system that is calibrated to maintain tank level at 75% at the current water temperature of 120°F. If water temperature gradually decreases and stabilizes at 90°F, actual tank level will...

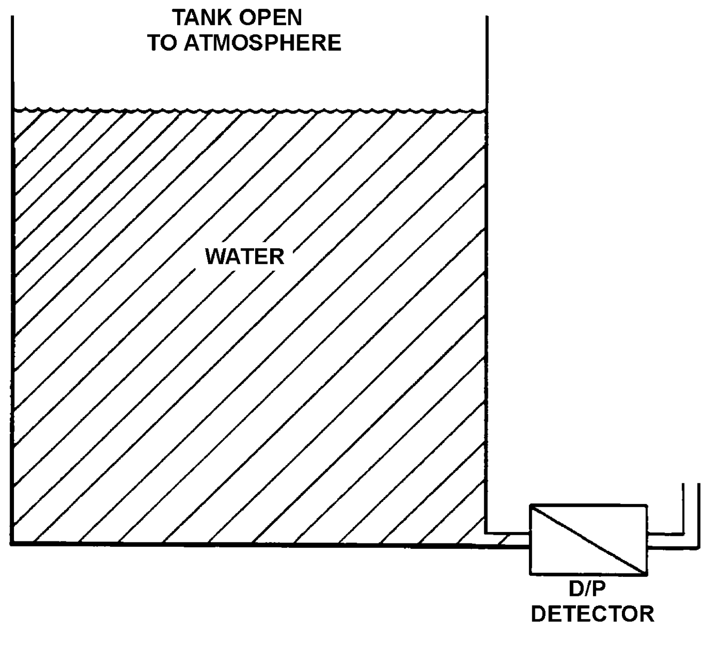
A. remain at 75%.

B. increase and stabilize above 75%.

C. oscillate around 75%.

D. decrease and stabilize below 75%.

ANSWER: D.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P1807 (B1211)

A cooling water system is cooling a lube oil heat exchanger. Cooling water system surge tank level is being measured using a differential pressure level detector that has been calibrated at the current water temperature in the tank. A leak in the heat exchanger results in lube oil collecting in the surge tank.

Assuming that the temperature of the contents in the surge tank does not change, indicated tank level will be ____________ than actual tank level because lube oil is ____________ than water.

A. higher; more dense

B. higher; less dense

C. lower; more dense

D. lower; less dense

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P2009

Many steam generator water level instruments are designed with a condensing chamber in the reference leg. The purpose of the condensing chamber is to...

A. maintain a constant water level in the reference leg during normal operations.

B. provide reference leg compensation for the steam generator pressure exerted on the variable leg.

C. prevent reference leg flashing during a rapid depressurization of the steam generator.

D. ensure the reference leg temperature remains close to the temperature of the variable leg.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P3008 (B3010)

Refer to the drawing of a tank with a differential pressure (D/P) level detection system (see figure below).

Assume the initial temperature of the reference leg and the water in the tank is 100°F, and that reference leg temperature does not change.

If the temperature of the water in the tank increases by 20°F, the D/P sensed by the detector will __________ as long as the water __________ is maintained constant.

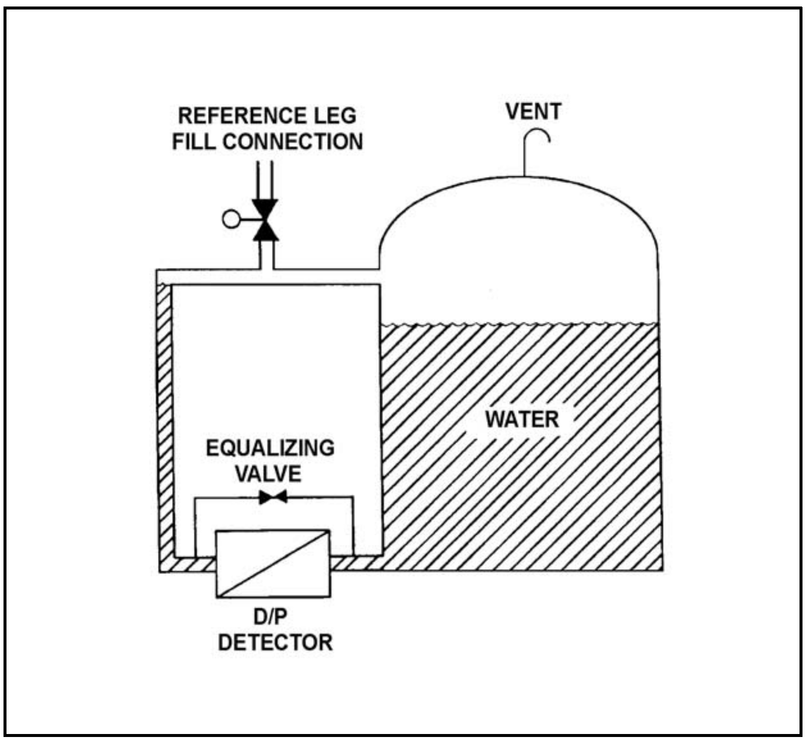
A. increase; level

B. decrease; level

C. increase; mass

D. decrease; mass

ANSWER: A.



TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P3407 (B3408)

Refer to the drawing of a tank with a differential pressure (D/P) level detector (see figure below). Assume that the initial temperature of the reference leg and the water in the tank are the same, and that reference leg temperature and level do not change.

The level detector is being used in a level control system (not shown) that is calibrated to maintain tank level at 75% at the current tank water temperature (70°F) and pressure (5 psig).

If the tank water temperature remains constant, but the tank pressure is increased by 10 psig, the level control system will cause actual tank level to...

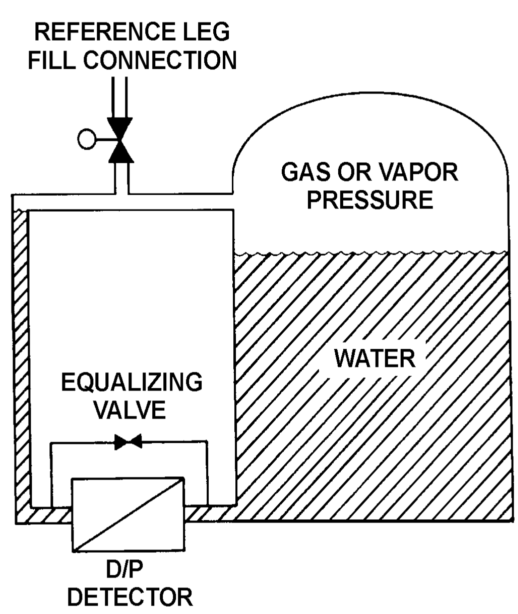
A. remain at 75%.

B. increase and stabilize above 75%.

C. oscillate around 75%.

D. decrease and stabilize below 75%.

ANSWER: A.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P5003

The downcomer region of a steam generator contains 40 feet of saturated water at 536°F. A steam generator water level detector has a pressure tap located at the bottom of the downcomer region. Approximately how much of the total pressure at the pressure tap is caused by the downcomer water?

A. 0.6 psi

B. 13.0 psi

C. 27.7 psi

D. 156.0 psi

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.07 [2.5/2.6]
QID: P5204

Refer to the drawing of a differential pressure (D/P) level detection system (see figure below) for a pressurizer at normal operating temperature and pressure. The level detector has just been calibrated.

The high pressure side of the detector is connected to the __________; and if the equalizing valve is opened the indicated pressurizer level will be ___________ than the actual level.

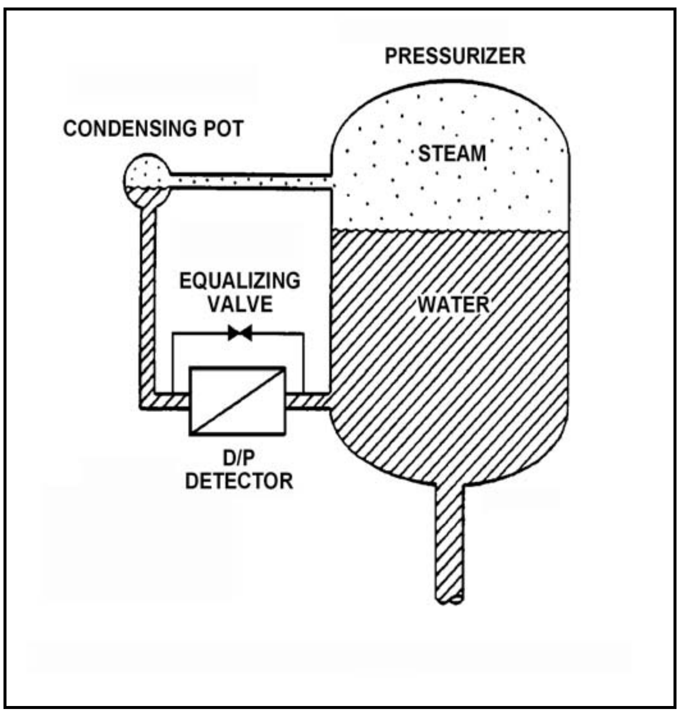
A. condensing pot; lower

B. condensing pot; higher

C. pressurizer; lower

D. pressurizer; higher

ANSWER: B.



TOPIC: 191002
KNOWLEDGE: K1.08 [2.8/3.1]
QID: P11

Refer to the drawing of a water storage tank with a differential pressure (D/P) level detector (see figure below).

The level instrument has just been calibrated to read actual tank water level. If the reference leg subsequently experiences high ambient temperature, indicated level will...

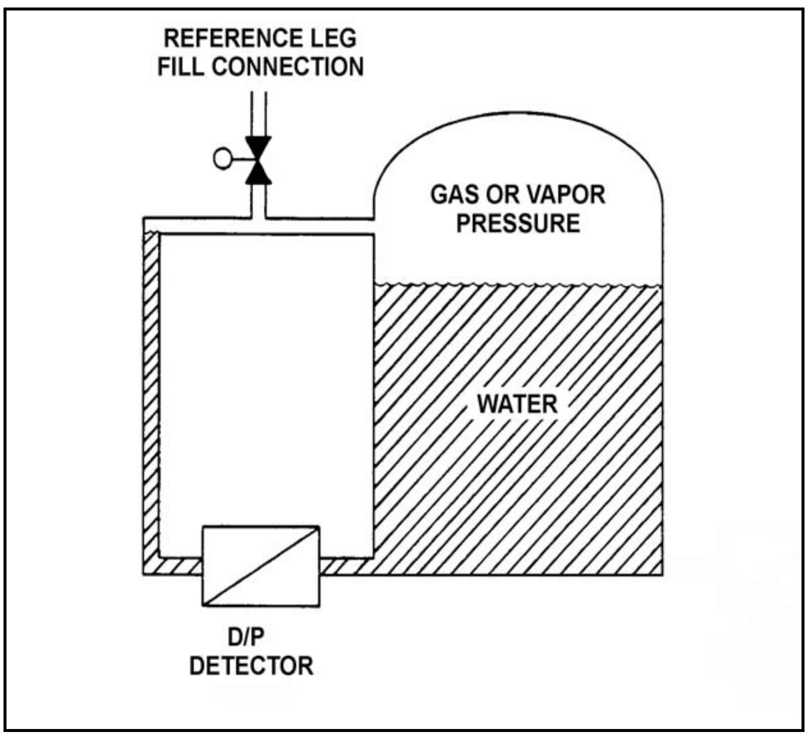
A. equal the actual level.

B. read less than the actual level.

C. read greater than the actual level.

D. drift above and below the actual level.

ANSWER: C.



TOPIC: 191002
KNOWLEDGE: K1.08 [2.8/3.1]
QID: P14 (B510)

Refer to the drawing of a water storage tank with two differential pressure level indicators (see figure below).

Indicator 1 was calibrated at 200°F and indicator 2 was calibrated at 100°F. If tank water temperature is 150°F, then...

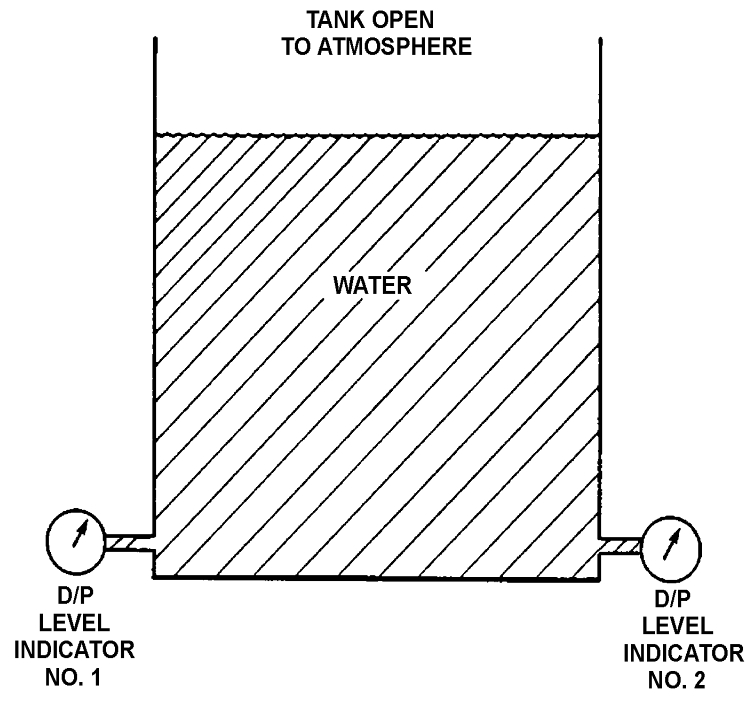
A. indicator 1 will read greater than indicator 2.

B. indicator 2 will read greater than indicator 1.

C. indicator 1 and 2 will read the same.

D. both indicators will be inaccurate, but it is impossible to predict which indicator will read greater.

ANSWER: A.



TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

TOPIC: 191002
KNOWLEDGE: K1.08 [2.8/3.1]
QID: P609 (B12)

Refer to the drawing of four tank differential pressure (D/P) level detectors (see figure below).

The tanks are identical with equal water levels and both are pressurized to 20 psig. All detectors were calibrated at the current water temperature and 70°F external (ambient) temperature.

Which detectors will provide the most accurate level indication following an increase in external (ambient) temperature from 70°F to 100°F? (Assume tank contents temperatures and external pressure do not change.)

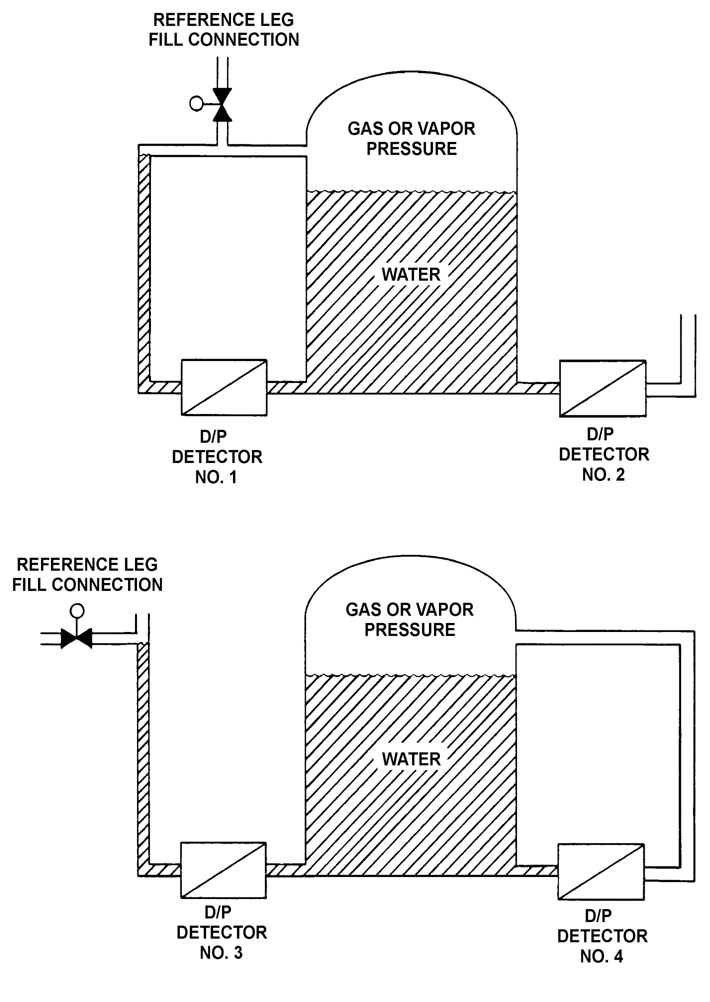
A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 2 and 3

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

TOPIC: 191002
KNOWLEDGE: K1.08 [2.8/3.1]
QID: P1108 (B1609)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

A calibrated D/P level detector is being used to measure level in a vented tank inside the auxiliary building. If building pressure increases with no change in temperature, the associated level indication will...

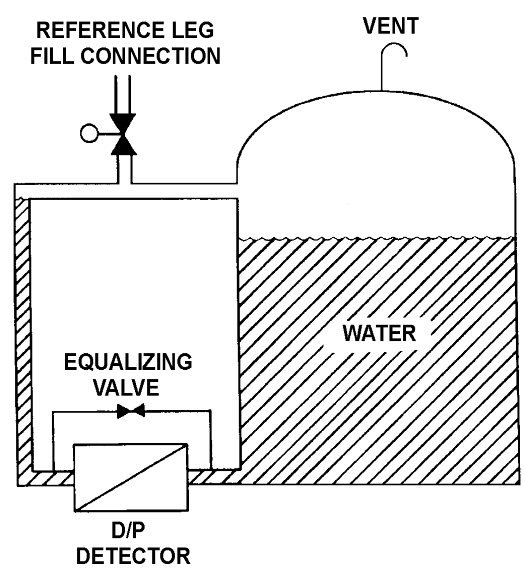
A. decrease, then increase and stabilize at the actual level.

B. decrease and stabilize below the actual level.

C. increase and stabilize above the actual level.

D. remain at the actual level.

ANSWER: D.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.08 [2.8/3.1]
QID: P1411

Refer to the drawing of a pressurizer differential pressure (D/P) level detection system (see figure below).

With the nuclear power plant in cold shutdown conditions, a pressurizer level D/P instrument, which was calibrated while the plant was at normal operating conditions, will indicate _______________ than actual level because the D/P sensed by the detector at cold shutdown conditions will be _____________ than at normal operating conditions. (Assume actual pressurizer level has not changed.)

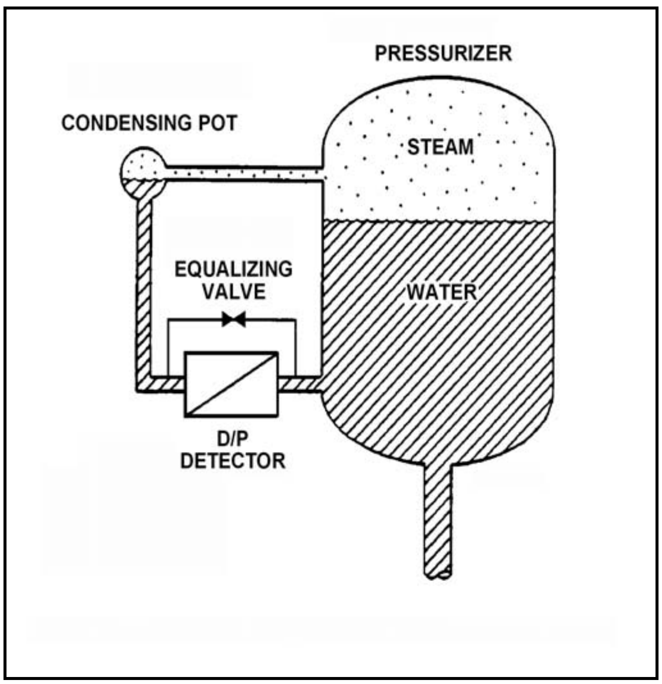
A. lower; larger

B. lower; smaller

C. higher; larger

D. higher; smaller

ANSWER: D.



TOPIC: 191002
KNOWLEDGE: K1.08 [2.8/3.1]
QID: P1607 (B1409)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

The associated level instrument was calibrated with the water in the tank at 120°F. If the mass of water in the tank remains constant and the water temperature decreases to 100°F, the indicated level will...

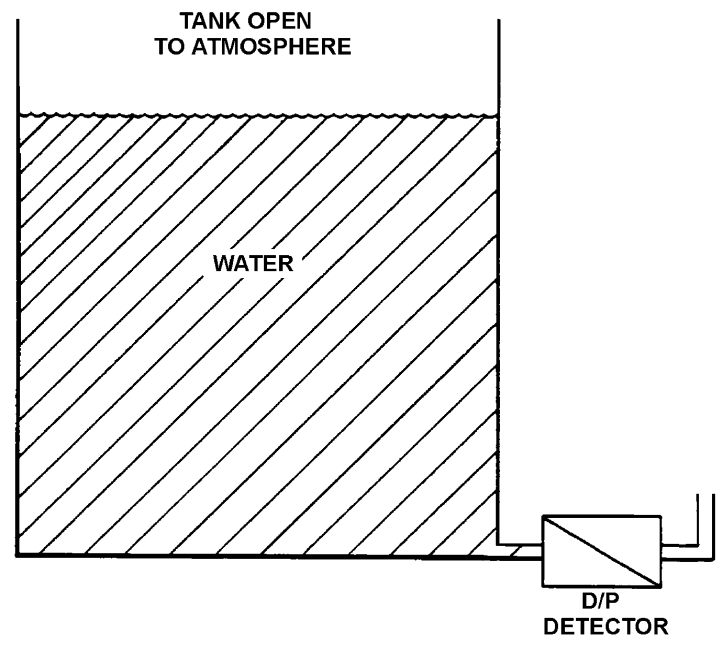
A. remain the same although actual level increases.

B. remain the same although actual level decreases.

C. increase in direct proportion to the temperature decrease.

D. decrease in direct proportion to the temperature decrease.

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.08 [2.8/3.1]
QID: P2810 (B2808)

Refer to the drawing of a pressurizer level detection system (see figure below). The differential pressure (D/P) detector was calibrated while the nuclear power plant was at normal operating conditions.

With the plant initially at normal operating conditions, a pressurizer steam space leak occurred. The pressurizer pressure decreased by 300 psia, and the ambient air temperature surrounding the reference leg increased by 80°F, where these parameters stabilized.

If the actual pressurizer water level is 60%, the reduced pressurizer pressure will tend to make the indicated pressurizer level read ______ than actual; and the increased reference leg temperature will tend to make the indicated pressurizer level read ______ than actual.

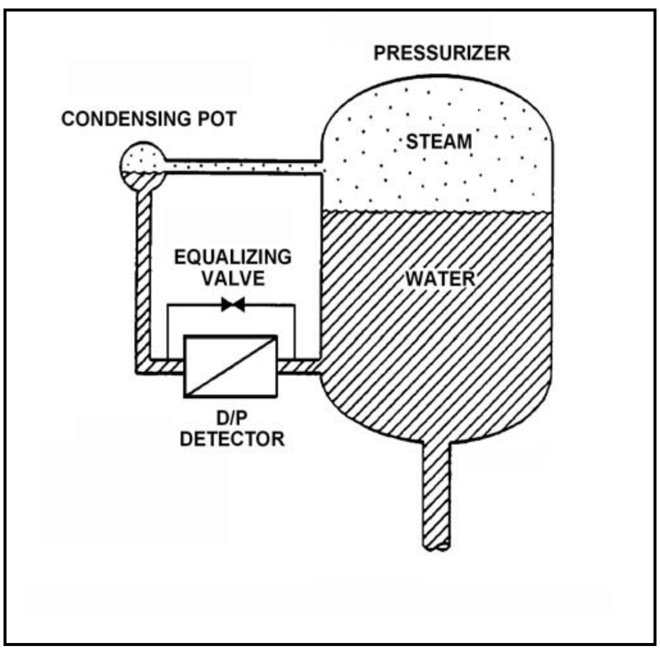
A. higher; higher

B. higher; lower

C. lower; higher

D. lower; lower

ANSWER: A.



TOPIC: 191002
KNOWLEDGE: K1.08 [2.8/3.1]
QID: P4004 (B4006)

Refer to the drawing of an open water storage tank with a differential pressure (D/P) level detector (see figure below).

The level instrument has just been calibrated to indicate actual tank water level. Assume that tank water temperature and level remain constant. If the reference leg temperature increases by 20°F, indicated tank water level will...

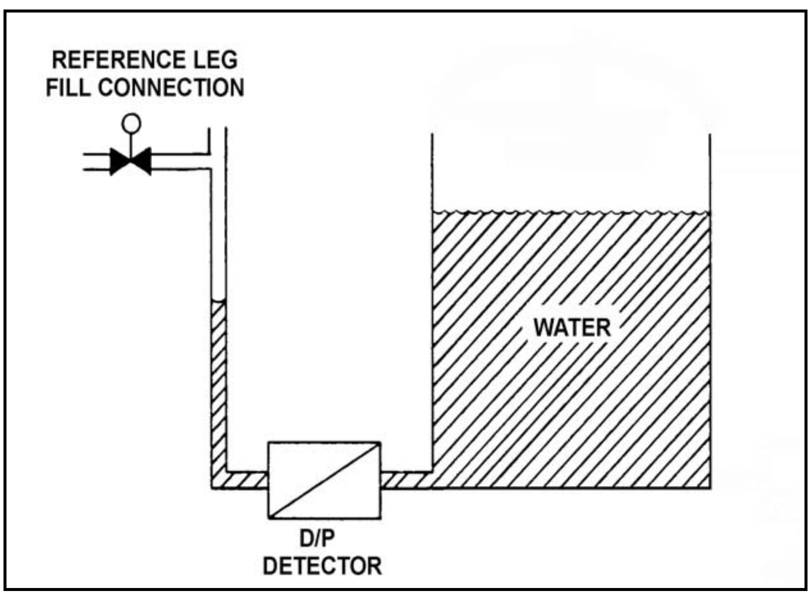
A. be unpredictable.

B. equal the actual level.

C. read less than the actual level.

D. read greater than the actual level.

ANSWER: B.



TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P12

The level indication for a reference leg differential pressure (D/P) level instrument will fail low as a result of...

A. a break on the reference leg.

B. a rupture of the diaphragm in the D/P cell.

C. the reference leg flashing to steam.

D. a break on the variable leg.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P209 (B1010)

Refer to the drawing of a steam generator differential pressure (D/P) level detection system (see figure below).

Which one of the following failures will cause the associated steam generator level indicator to indicate the <u>lowest</u> level?

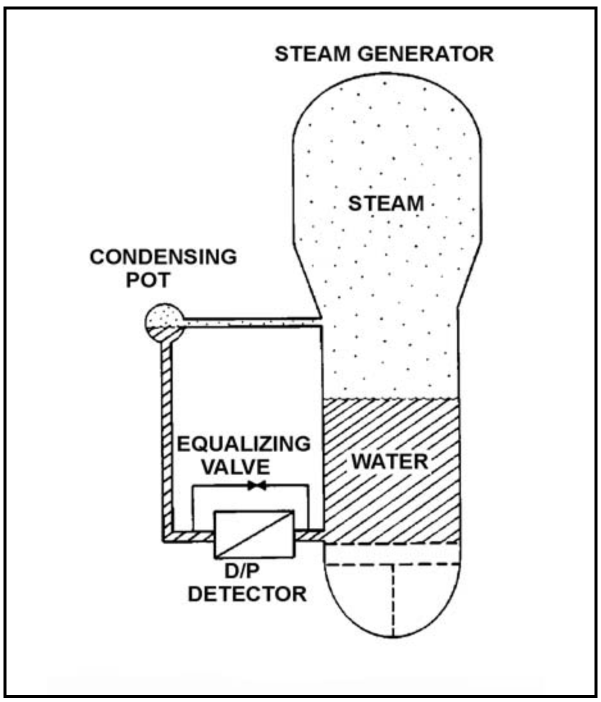
A. The D/P detector diaphragm ruptures.

B. The reference leg ruptures.

C. The variable leg ruptures.

D. The equalizing valve is opened.

ANSWER: C.



TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P309 (B308)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

Tank water level indication will be lower than actual level when reference leg temperature is ___________ than calibration conditions or when there is a break in the ___________ leg of the D/P cell.

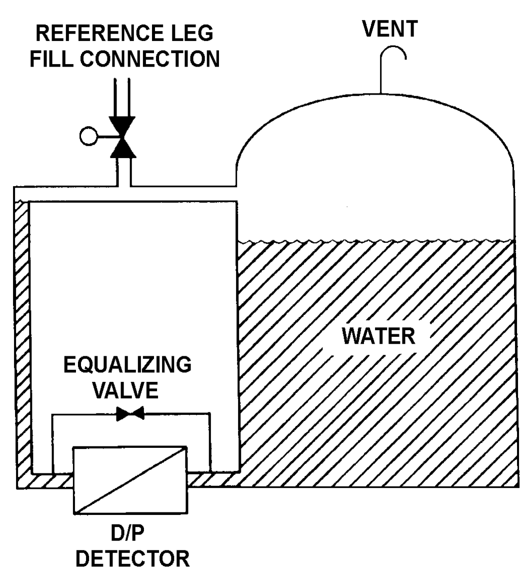
A. less; reference

B. less; variable

C. greater; reference

D. greater; variable

ANSWER: B.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P911 (B3508)

Refer to the drawing of a steam generator (S/G) differential pressure level detection system (see figure below) that was recently calibrated at normal operating conditions.

With the nuclear reactor shut down, S/G pressures were inadvertently decreased from 900 psig to 700 psig in 5 minutes due to operator error. S/G pressures were stabilized at 700 psig, but during the pressure decrease a small amount of water in the condensing pot flashed to steam. Assume the reference leg water remains subcooled, except for the small amount of water that flashes to steam in the condensing chamber.

As a result of the small loss of condensing pot water, S/G level will indicate ________ than actual level; and as the condensing pot refills, indicated level will __________.

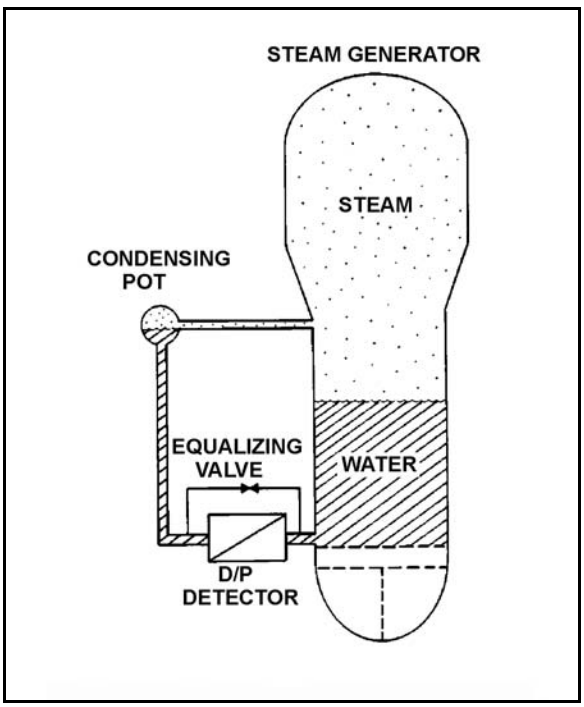
A. higher; decrease and stabilize above the actual level

B. higher; decrease and stabilize below the actual level

C. lower; increase and stabilize above the actual level

D. lower; increase and stabilize below the actual level

ANSWER: A.



TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P2408 (B1212)

Refer to the drawing of a steam generator (S/G) with a differential pressure (D/P) level detection system (see figure below).

Which one of the following events will result in a steam generator level indication that is greater than actual level?

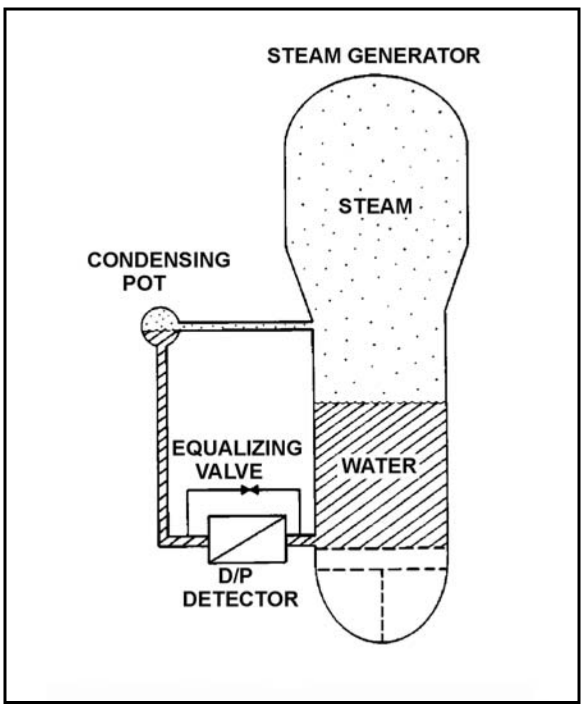
A. The S/G pressure increases by 50 psia.

B. The variable leg breaks and completely drains.

C. A portion of the reference leg water flashes to steam.

D. The temperature surrounding the S/G and reference leg decreases by 30°F.

ANSWER: C.



TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P2609

Refer to the drawing of a steam generator (S/G) differential pressure (D/P) level detection system (see figure below).

The S/G is at normal operating temperature and pressure with accurate level indication. Which one of the following events will result in a S/G level indication that is greater than actual level?

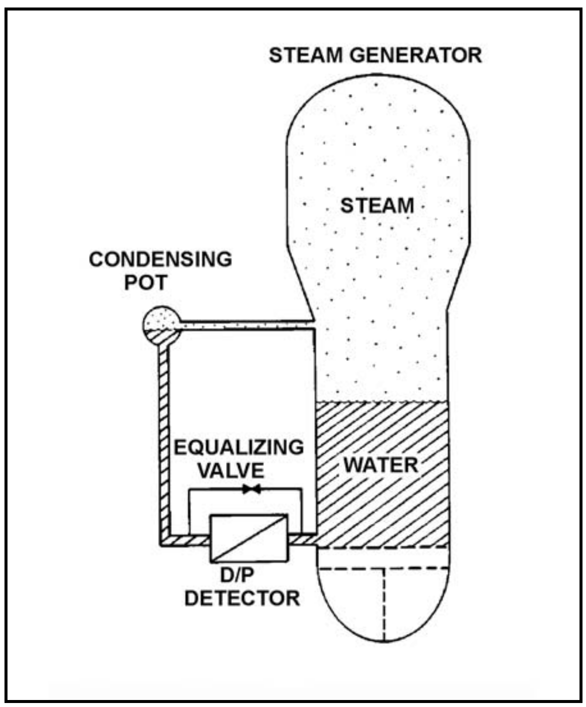
A. The external pressure surrounding the D/P detector increases by 2 psi.

B. S/G pressure increases by 50 psi with no change in actual water level.

C. Actual S/G level increases by 6 inches.

D. The temperature of the reference leg increases by 20°F.

ANSWER: D.



TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P2708

Refer to the drawing of a steam generator (S/G) differential pressure (D/P) level detection system (see figure below).

The S/G is supplying steam at normal operating temperature and pressure and the level instrumentation has just been calibrated. Which one of the following events will result in a S/G level indication that is less than actual level?

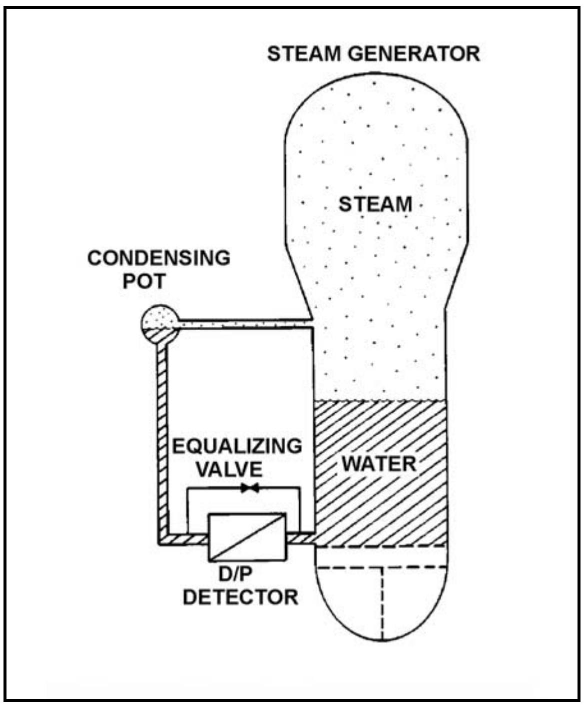
A. S/G pressure increases by 50 psi.

B. Actual S/G water level decreases by 6 inches.

C. The external pressure surrounding the D/P detector decreases by 2 psi.

D. The temperature surrounding the reference leg increases by 20°F.

ANSWER: A.



TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P2907 (B1410)

Refer to the drawing of a steam generator (S/G) differential pressure (D/P) level detection system (see figure below).

The S/G is at normal operating temperature and pressure with accurate level indication. Which one of the following events will result in a S/G level indication that is lower than actual level?

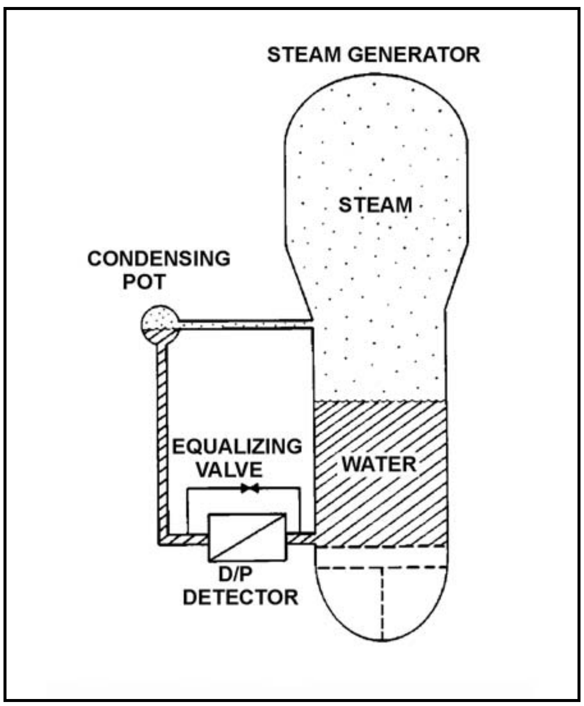
A. Actual S/G level decreases by 6 inches.

B. The temperature surrounding the reference leg decreases by 20°F.

C. The external pressure surrounding the D/P detector decreases by 2 psi.

D. S/G pressure decreases by 50 psi with no change in actual water level.

ANSWER: B.



TOPIC: 191002
KNOWLEDGE: K1.09 [2.9/3.0]
QID: P3808

Refer to the drawing of a pressurizer differential pressure (D/P) level detection system (see figure below).

A nuclear reactor is shutdown with the reactor coolant system being maintained at 100 psia. The level detector has just been calibrated. Suddenly a rupture in the condensing pot of the level detector results in a rapid drop of the condensing pot pressure to atmospheric pressure.

Given the following current conditions:

- The condensing pot is at atmospheric pressure.
- Pressurizer pressure is 98 psia and slowly decreasing.
- Bulk reference leg temperature is 120°F.
- Actual pressurizer level has not changed significantly.

Which one of the following describes the current pressurizer level indication from the detector?

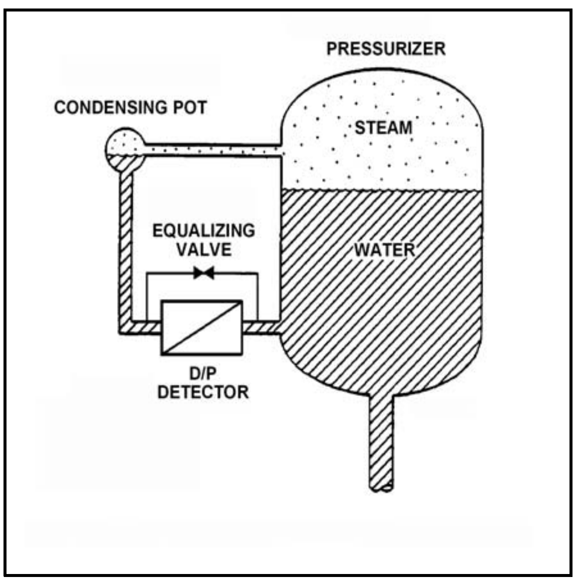
A. Offscale low because the bulk of the water in the reference leg has flashed to steam.

B. Offscale high because the bulk of the water in the reference leg has flashed to steam.

C. Offscale low because the static pressure on the reference leg is much less than the static pressure in the pressurizer.

D. Offscale high because the static pressure on the reference leg is much less than the static pressure in the pressurizer.

ANSWER: D.



TOPIC: 191002
KNOWLEDGE: K1.10 [2.3/2.5]
QID: P310

Semiconductor strain gages are often used in transmitters for...

A. reactor coolant pressure instruments.

B. reactor coolant temperature instruments.

C. control rod position instruments.

D. steam generator level instruments.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.10 [2.3/2.5]
QID: P413 (B410)

If the pressure sensed by a bourdon tube increases, the curvature of the detector will ____________ because the greater force is being applied to the ____________ curve of the detector.

A. increase; outer

B. increase; inner

C. decrease; outer

D. decrease; inner

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.10 [2.3/2.5]
QID: P810

In a diaphragm type pressure detector, pressure is measured using the __________ of the diaphragm.

A. rotational movement

B. axial deflection

C. change in circumference

D. change in diameter

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.10 [2.3/2.5]
QID: P1508 (B1011)

A bourdon tube works on the principle that when the pressure inside the tube decreases, the tube tends to: (Assume detected pressure remains above atmospheric pressure.)

A. coil due to an increased pressure-induced force on the outside of the tube.

B. straighten due to an increased pressure-induced force on the outside of the tube.

C. coil due to the spring action of the metal overcoming the pressure-induced force on the inside of the tube.

D. straighten due to the spring action of the metal overcoming the pressure-induced force on the inside of the tube.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.10 [2.3/2.5]
QID: P2109 (B2109)

A centrifugal pump is taking suction from the bottom of a vented cylindrical storage tank that contains 100,000 gallons of water at 60°F. A pressure gauge at the inlet to the pump indicates 40 psig. Over the next several days storage tank temperature increases to 90°F with <u>no</u> change in tank water level and <u>no</u> change in head loss in the pump suction line.

Which one of the following is the current pressure at the inlet to the pump?

A. 39.8 psig

B. 37.4 psig

C. 34.6 psig

D. 31.2 psig

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.11 [2.7/3.0]
QID: P210 (B210)

A simple bellows pressure detector is connected to a cooling water system. The detector is located in the reactor containment and has its low pressure side vented to the containment atmosphere. Current system pressure indication is 100 psig.

If a main steam line break raises containment pressure by 40 psig, the system pressure indication will: (Disregard any temperature effect on the pressure detector.)

A. increase by 40 psig.

B. increase by the square root of 40 psig.

C. decrease by 40 psig.

D. decrease by the square root of 40 psig.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.11 [2.7/3.0]
QID: P509 (B1310)

A cooling water system bourdon tube pressure detector is located inside a sealed building and system pressure currently indicates 50 psig. A building ambient temperature increase of 100°F will cause a ____________ change in indicated system pressure, and a building pressure increase of 20 psig will cause a ____________ change in indicated system pressure.

A. significant; significant

B. negligible; significant

C. significant; negligible

D. negligible; negligible

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.11 [2.7/3.0]
QID: P611

A bellows pressure transmitter with its low-pressure side vented to containment atmosphere is being used to measure reactor coolant system (RCS) pressure. A decrease in the associated pressure indication could be caused by either a containment pressure ____________ or a RCS pressure ____________.

A. decrease; decrease

B. increase; increase

C. decrease; increase

D. increase; decrease

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.11 [2.7/3.0]
QID: P710 (B711)

Cooling water system pressure is being monitored by a simple diaphragm pressure detector with its low pressure side vented to the containment. If a main steamline rupture raises containment pressure by 20 psi, cooling water system pressure indication will: (Disregard any temperature effect on the detector.)

A. increase by 20 psi.

B. decrease by 20 psi.

C. increase by the square root of 20 psi.

D. decrease by the square root of 20 psi.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.11 [2.7/3.0]
QID: P3509 (B2912)

The pressure within a cooling water system is 100 psig, as indicated by a bourdon tube pressure detector. The cooling water system and the detector are located inside a reactor containment building. The pressure detector case is vented to the containment building, which is currently at atmospheric pressure.

If a steam line rupture raises the containment building pressure by 20 psi, the cooling water system pressure indication will: (Disregard any temperature effect on the detector.)

A. increase to 120 psig.

B. increase by a small, but indeterminate amount.

C. decrease by a small, but indeterminate amount.

D. decrease to 80 psig.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.12 [2.8/2.9]
QID: P211 (B212)

A bourdon-tube pressure detector was indicating 50% of scale when it was suddenly exposed to a high-pressure transient that caused permanent strain to the bourdon tube. The detector remained intact and actual pressure was restored to its original value.

During the pressure transient, the affected pressure indication initially went off-scale high. After the original pressure was restored, the indication was...

A. unpredictable.

B. less than 50% of scale.

C. 50% of scale.

D. greater than 50% of scale.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.12 [2.8/2.9]
QID: P510 (B1610)

Refer to the drawing of a bellows-type differential pressure (D/P) detector (see figure below).

The spring in this detector (shown in a compressed state) has weakened from long-term use. If the actual D/P is constant, how will indicated D/P respond as the spring weakens?

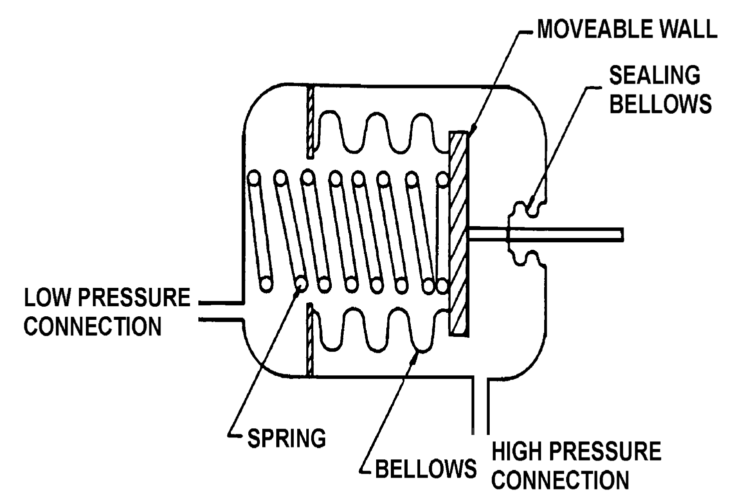
A. Increase, because the spring will expand more.

B. Decrease, because the spring will expand more.

C. Increase, because the spring will compress more.

D. Decrease, because the spring will compress more.

ANSWER: C.



BELLOWS - TYPE DIFFERENTIAL PRESSURE DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.12 [2.8/2.9]
QID: P511

If a bourdon tube pressure detector is over-ranged sufficiently to permanently distort the bourdon tube, subsequent pressure measurement will be inaccurate because the _____________ of the detector tube will be inaccurate.

A. distance moved by the tip

B. change in the length

C. expansion of the cross-sectional area

D. change in the volume

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.12 [2.8/2.9]
QID: P1011 (B2910)

A properly calibrated 0 to 100 psia diaphragm pressure detector is connected to a pressurized system; the low pressure side of the detector is vented to the atmosphere. The detector is currently producing a system pressure indication of 75 psia.

If the detector diaphragm ruptures, indicated pressure will be approximately...

A. 0 psia.

B. 15 psia.

C. 60 psia.

D. 90 psia.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.12 [2.8/2.9]
QID: P2211 (B1908)

Refer to the drawing of a bellows-type pressure detector (see figure below).

A bellows-type pressure detector with its low-pressure side vented to containment atmosphere is being used to measure pressurizer pressure. A decrease in the associated pressure indication will be caused by either a containment pressure ____________ or a ____________.

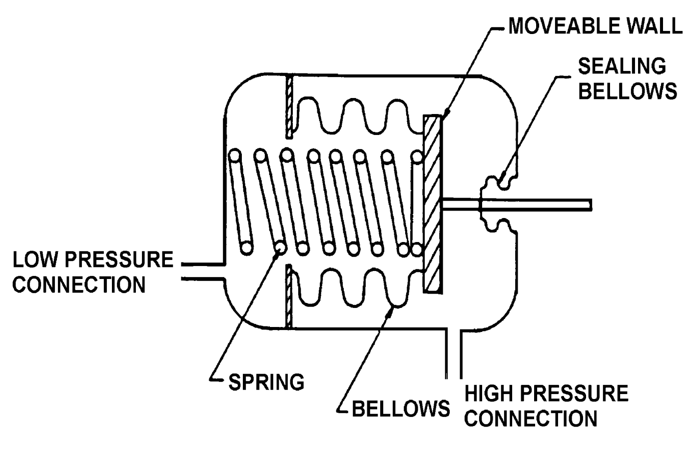
A. increase; ruptured bellows

B. increase; broken spring

C. decrease; ruptured bellows

D. decrease; broken spring

ANSWER: A.



BELLOWS - TYPE PRESSURE DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.12 [2.8/2.9]
QID: P2610 (B610)

Refer to the drawing of a bellows-type differential pressure (D/P) detector (see figure below).

The spring in this detector (shown in a compressed state) has weakened from long-term use. If the actual D/P is constant, how will indicated D/P respond as the spring weakens?

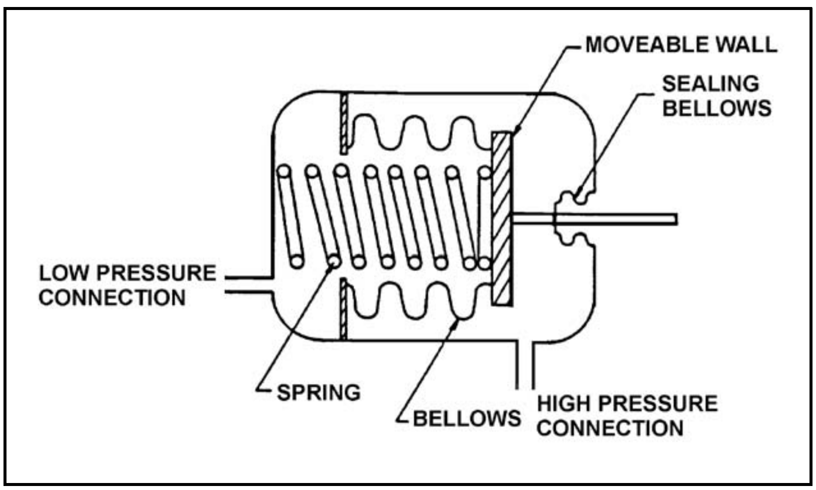
A. Decrease, because the high pressure will compress the spring more

B. Increase, because the high pressure will compress the spring more

C. Decrease, because the spring will expand more

D. Increase, because the spring will expand more

ANSWER: B.



TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P13

A resistance temperature detector operates on the principle that the change in electrical resistance of...

A. two dissimilar metals is directly proportional to the temperature change measured at their junction.

B. two dissimilar metals is inversely proportional to the temperature change measured at their junction.

C. a metal is directly proportional to its change in temperature.

D. a metal is inversely proportional to its change in temperature.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P212

A resistance temperature detector operates on the principle that the change in metal resistance is ____________ proportional to the change in ____________.

A. inversely; metal temperature

B. inversely; metal temperature squared

C. directly; metal temperature

D. directly; metal temperature squared

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P311

When comparing a thermocouple to a resistance temperature detector, the thermocouple...

A. measures temperature less accurately.

B. requires an external power supply to produce an electrical output.

C. is unable to withstand high temperatures.

D. responds much slower to a temperature change.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P812

If the reference junction temperature of a thermocouple remains constant, the output voltage of the thermocouple is __________ proportional to the __________.

A. directly; measuring junction temperature

B. directly; square root of the measuring junction temperature

C. inversely; measuring junction temperature

D. inversely; square root of the measuring junction temperature

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P1209 (B1314)

Refer to the drawing of a simple thermocouple circuit (see figure below).

Thermocouple temperature indication is currently 350°F. A small steam leak occurs that raises reference (cold) junction temperature by 20°F. Assume measuring junction temperature remains constant. Without temperature compensation for the reference junction, the new temperature indication will be...

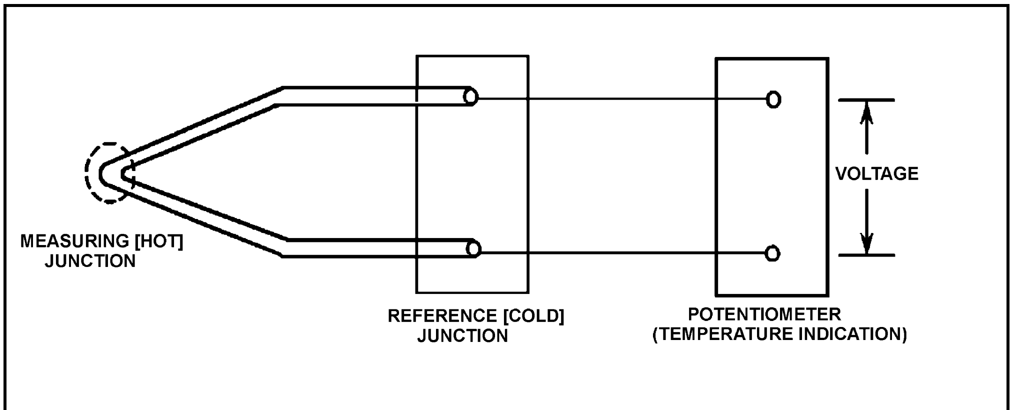
A. 310°F.

B. 330°F.

C. 370°F.

D. 390°F.

ANSWER: B.



SIMPLE THERMOCOUPLE CIRCUIT

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P1311

A thermocouple operates on the principle that a measurable voltage will be produced when two...

A. similar metals form two junctions at the same temperature.

B. similar metals form two junctions at different temperatures.

C. dissimilar metals form two junctions at the same temperature.

D. dissimilar metals form two junctions at different temperatures.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P1412 (B2911)

Refer to the drawing of a simple thermocouple circuit (see figure below).

Thermocouple temperature indication is currently 390°F. A small steam leak occurs that raises reference (cold) junction temperature by 20°F. Assume measuring junction temperature remains constant. Without temperature compensation for the reference junction, the new temperature indication will be...

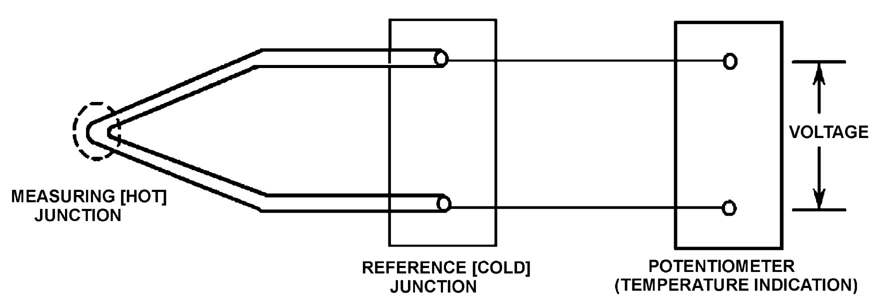
A. 370°F.

B. 390°F.

C. 400°F.

D. 410°F.

ANSWER: A.



SIMPLE THERMOCOUPLE CIRCUIT

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P1510 (B309)

In contrast to a thermocouple, a resistance temperature detector...

A. is used in high temperature applications.

B. does <u>not</u> require an external power supply for temperature indication.

C. uses a single type of metal or alloy in the sensing element.

D. is commonly placed in direct contact with the monitored substance.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P1710 (B1710)

Refer to the drawing of a simple thermocouple circuit (see figure below).

Thermocouple temperature indication is currently 150°F. A small steam leak occurs that raises both the measuring (hot) junction and reference (cold) junction temperatures by 20°F. Without temperature compensation for the reference junction, the new temperature indication will be...

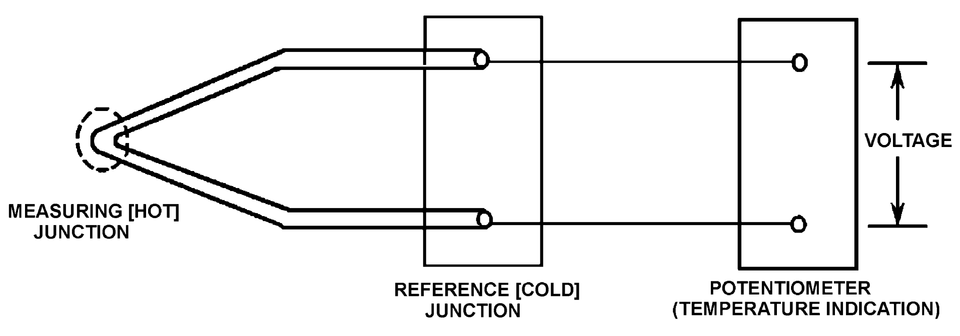
A. 130°F.

B. 150°F.

C. 170°F.

D. 190°F.

ANSWER: B.



SIMPLE THERMOCOUPLE CIRCUIT

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P2212 (B1510)

Refer to the drawing of a simple thermocouple circuit (see figure below).

Circuit temperature indication is currently 350°F. The reference (cold) junction temperature decreases by 10°F. Assume the measuring junction temperature remains constant. Without temperature compensation for the reference junction, the new temperature indication will be...

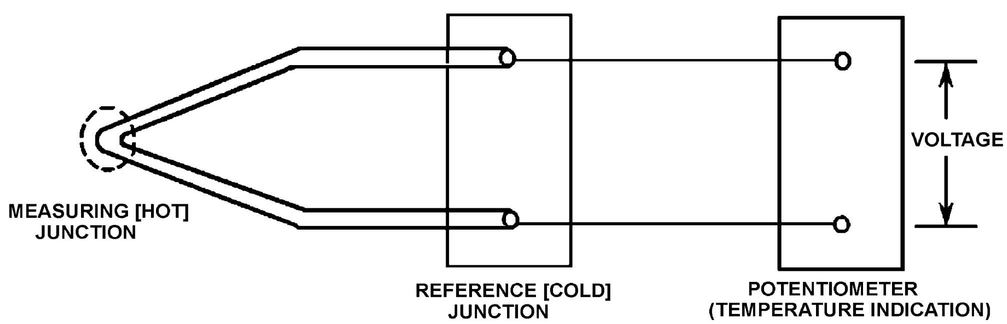
A. 340°F.

B. 350°F.

C. 360°F.

D. 370°F.

ANSWER: C.



SIMPLE THERMOCOUPLE CIRCUIT

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P2409 (B2412)

What is the purpose of the reference junction panel that is provided with many thermocouple circuits?

A. Ensures that thermocouple output is amplified sufficiently for use by temperature indication devices.

B. Ensures that temperature changes away from the thermocouple measuring junction do <u>not</u> affect thermocouple temperature indication.

C. Ensures that electrical noise in the thermocouple extension wires does <u>not</u> affect thermocouple temperature indication.

D. Ensures that different lengths of thermocouple extension wires do <u>not</u> affect thermocouple temperature indication.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P2711 (B2712)

<u>Unlike</u> a resistance temperature detector, a typical thermocouple...

A. uses a single type of metal in the sensing element

B. requires a temperature-controlled reference junction.

C. can provide temperature input to a valve controller in a cooling water system.

D. requires an external power supply to provide indication of temperature.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P3011 (B3013)

Refer to the drawing of a simple thermocouple circuit (see figure below).

Thermocouple temperature indication is 410°F with the reference (cold) junction at 125°F. An ambient temperature decrease lowers reference junction temperature to 110°F. Assume the measuring junction temperature remains constant. Without temperature compensation for the reference junction, the new thermocouple temperature indication will be...

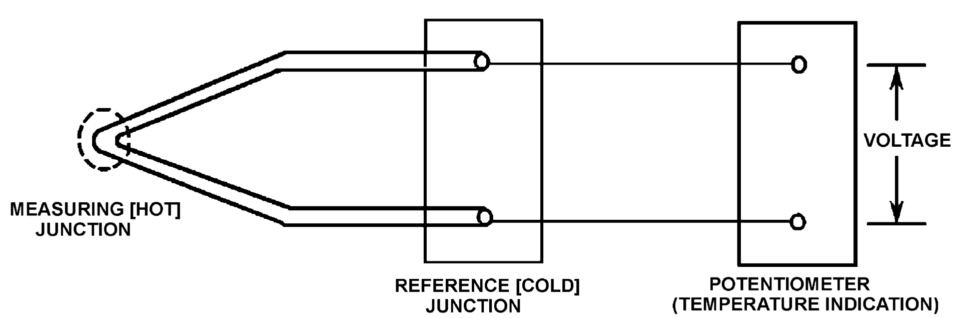
A. 380°F.

B. 395°F.

C. 410°F.

D. 425°F.

ANSWER: D.



SIMPLE THERMOCOUPLE CIRCUIT

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P4206 (B4206)

Refer to the drawing of a simple thermocouple circuit (see figure below).

Given that the temperatures at the measuring and reference junctions remain constant, if a ventilation system malfunction causes the temperature of the temperature indication panel to increase by 10°F, indicated temperature will...

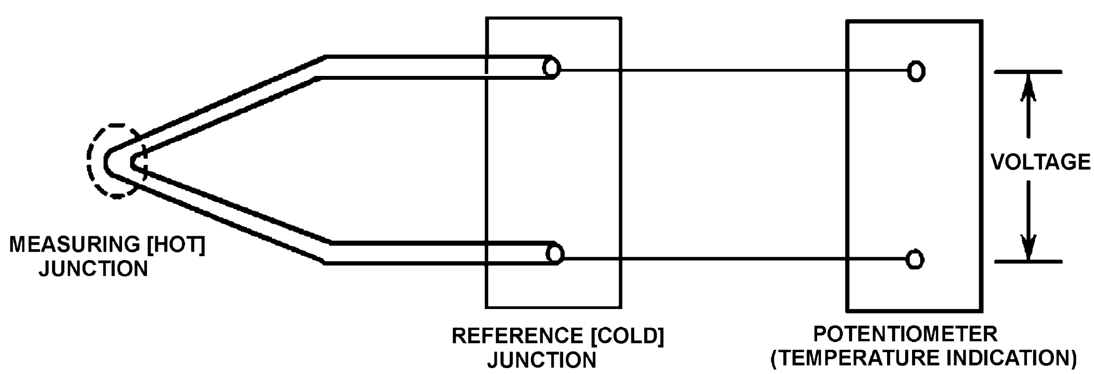
A. not be affected.

B. increase by 10°F.

C. decrease by 10°F.

D. change in an unpredictable manner.

ANSWER: A.



SIMPLE THERMOCOUPLE CIRCUIT

TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P5305 (B5305)

Refer to the drawing of a simple thermocouple circuit (see figure below).

The measuring and reference junctions are located inside the reactor containment building while the potentiometer is located in a remote location outside the containment building. Thermocouple temperature indication is initially 500°F.

An ambient temperature decrease outside the containment building lowers the temperature of the potentiometer by 10°F while the measuring and reference junction temperatures remain constant. Thermocouple temperature indication at the lower ambient temperature will be...

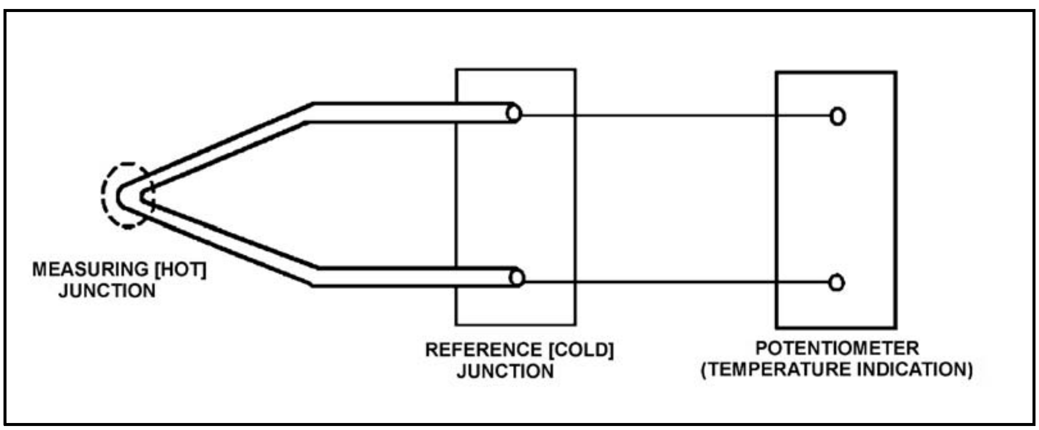
A. 490°F.

B. 500°F.

C. 510°F.

D. unpredictable.

ANSWER: B.



TOPIC: 191002
KNOWLEDGE: K1.13 [2.6/2.8]
QID: P5505 (B5507)

Refer to the drawing of a Chromel-Alumel thermocouple circuit (see figure below).

What is the effect on the thermocouple reference junctions if the chromel and alumel extension wires from the thermocouple connection head to the reference junction panel are replaced with copper wires?

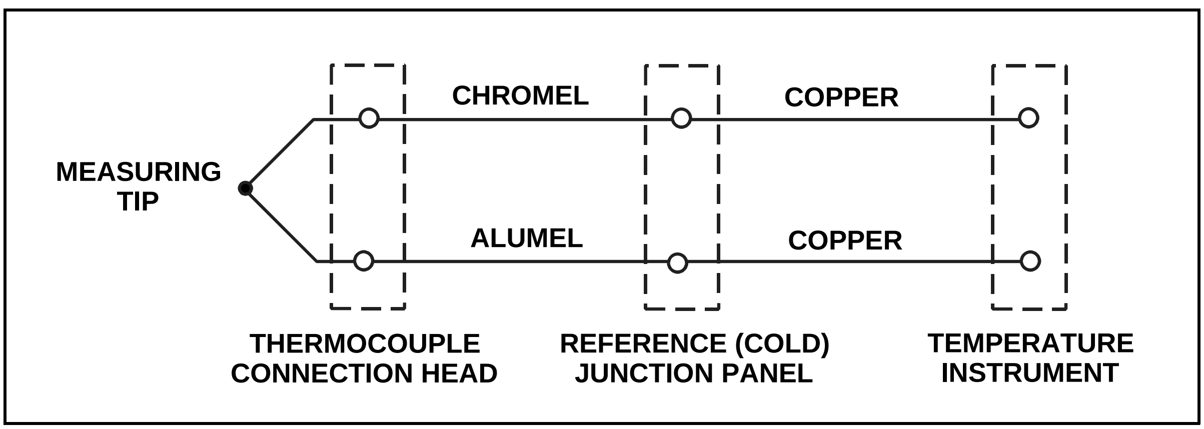
A. The reference junctions will be located in the thermocouple connection head.

B. The reference junctions will still be located in the reference junction panel.

C. The reference junctions will be located in the temperature instrument.

D. There will no longer be any reference junctions.

ANSWER: A.



TOPIC: 191002
KNOWLEDGE: K1.14 [2.8/2.9]
QID: P213

An open circuit in a thermocouple detector causes the affected temperature indication to fail...

A. high.

B. low.

C. to reference junction temperature.

D. as is.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.14 [2.8/2.9]
QID: P312 (B310)

If shorting occurs within a resistance temperature detector, the associated indication will fail...

A. low.

B. high.

C. as is.

D. to midscale.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.14 [2.8/2.9]
QID: P414 (B208)

If a resistance temperature detector develops an <u>open</u> circuit (bridge circuit remains intact), indication will fail...

A. high.

B. low.

C. as is.

D. to midscale.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.14 [2.8/2.9]
QID: P2011 (B2009)

Refer to the drawing of a simple thermocouple circuit (see figure below).

Thermocouple temperature indication is currently 150°F. Reference junction temperature is currently 90°F. Indicator range is from 0°F to 2000°F.

If one of the thermocouple extension wires loosens and becomes dislodged from its terminal in the reference junction panel, which one of the following temperature indications will occur?

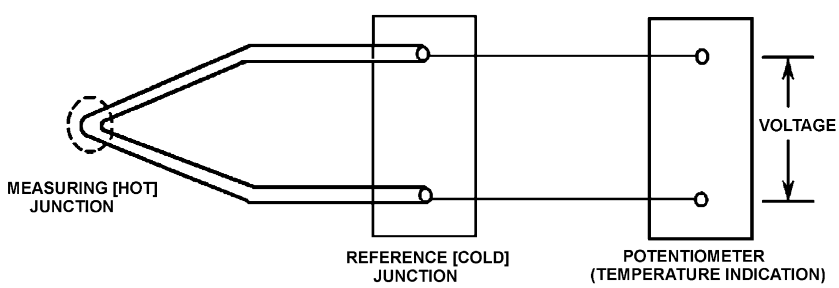
A. Minimum instrument reading (0°F)

B. 60°F

C. 90°F

D. Maximum instrument reading (2000°F)

ANSWER: A.



SIMPLE THERMOCOUPLE CIRCUIT

TOPIC: 191002
KNOWLEDGE: K1.16 [2.3/2.7]
QID: P813 (B812)

What is the most common type of sensor used to provide remote position indication of a valve that is normally either fully open or fully closed?

A. Limit switch

B. Reed switch

C. Servo transmitter

D. Linear variable differential transformer

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.16 [2.3/2.7]
QID: P1313 (B1712)

Which one of the following devices is capable of providing remote indication of valve position on an analog meter in units of "percent of full open"?

A. Reed switch

B. Limit switch

C. Resistance temperature detector

D. Linear variable differential transformer

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.16 [2.3/2.7]
QID: P2611

Refer to the simplified drawing of a control rod position detector (see figure below).

Coils of wire connected to an ac power supply are being used to monitor the position of a control rod in a nuclear reactor. The coils are mounted in a column outside the reactor vessel head such that the steel control rod drive shaft passes upward through the coils as the control rod is withdrawn. Currently, the top of a control rod drive shaft is located between coils A and B as shown. The control rod is to be withdrawn until the top of the control rod drive shaft is located just below coil C.

Compared to the initial coil output currents, after the control rod is withdrawn the output current of coil A will be _______; and the output current of coil B will be _______.

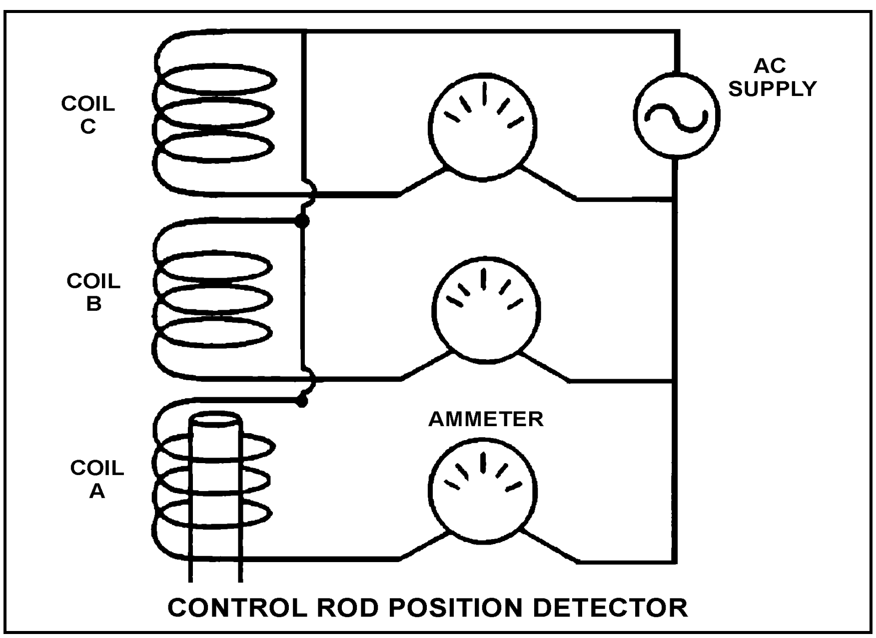
A. higher; higher

B. higher; lower

C. the same; higher

D. the same; lower

ANSWER: D.



TOPIC: 191002
KNOWLEDGE: K1.16 [2.3/2.7]
QID: P2813 (B2811)

Refer to the simplified drawing of a control rod position detector circuit (see figure below).

A magnet on the control rod extension (or drive) shaft sequentially closes individual reed switches mounted vertically adjacent to the control rod drive housing. A constant +5 dc volts is supplied to the input of the resistor network at resistor R_1.

A control rod is initially fully inserted such that all reed switch contacts are open; then the rod is withdrawn until reed switch contact S_1 is closed. Compared to the initial circuit currents, the current through resistor R_5 after the rod withdrawal will be _________, and the output current of the resistor network to the amplifier will be _________.

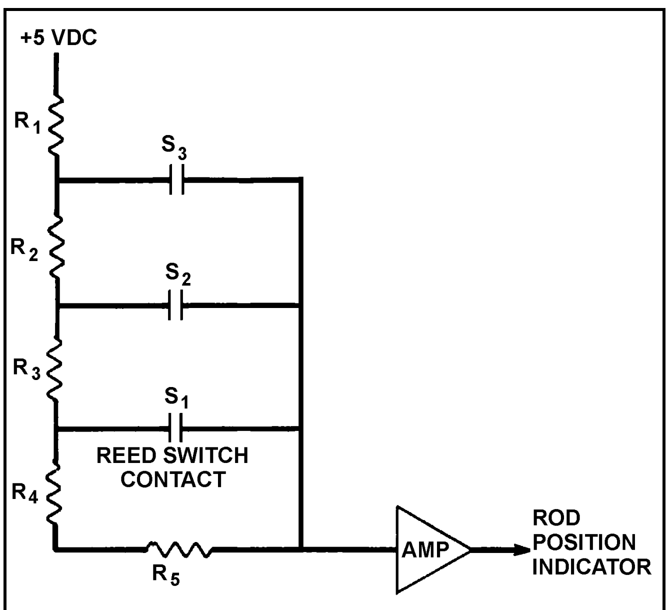
A. lower, higher

B. lower, lower

C. higher, higher

D. higher, lower

ANSWER: A.



CONTROL ROD POSITION DETECTOR

TOPIC: 191002
KNOWLEDGE: K1.16 [2.3/2.7]
QID: P2911

Reed switches are being used in an electrical measuring circuit to monitor the position of a control rod in a nuclear reactor. The reed switches are mounted in a column above the reactor vessel such that the control rod drive shaft passes by the reed switches as the control rod is withdrawn.

Which one of the following describes the action that causes the electrical output of the measuring circuit to change as the control rod is withdrawn?

A. An ac coil on the control rod drive shaft induces a voltage into each reed switch as the drive shaft passes by.

B. A metal tab on the control rod drive shaft mechanically closes each reed switch as the drive shaft passes by.

C. The primary and secondary coils of each reed switch attain maximum magnetic coupling as the drive shaft passes by.

D. A permanent magnet on the control rod drive shaft attracts the movable contact arm of each reed switch as the drive shaft passes by.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P415

A nuclear power plant has experienced a loss of coolant accident with degraded emergency core cooling flow. Core voiding is homogeneous and the core void fraction is currently 20%.

Which one of the following describes excore source/startup range neutron level indication as homogeneous core voiding increases from 20% to 100% of the core? (Assume the neutron detectors are located adjacent to the bottom portion of the core.)

A. Decreases continuously.

B. Decreases, then increases.

C. Increases continuously.

D. Increases, then decreases.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P1312

A nuclear reactor is shut down at 100 cps in the source/startup range when a loss of coolant accident occurs. How will excore source/startup range neutron level indication change as homogeneous core voiding increases from 20% to 100% in a shutdown reactor?

A. Increases because more neutron leakage occurs and then continues to increase because more neutrons are available for subcritical multiplication.

B. Increases because more neutron leakage occurs and then decreases because fewer neutrons are available for subcritical multiplication.

C. Decreases because less neutron leakage occurs and then increases because more neutrons are available for subcritical multiplication.

D. Decreases because fewer neutrons are available for subcritical multiplication and then increases because more neutron leakage occurs.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P1612

A nuclear reactor is shut down at 100 cps in the source/startup range when a loss of coolant accident occurs. Which one of the following describes excore source/startup range neutron level indication as homogeneous core voiding increases from 20% to 40%?

A. Increases because more neutron leakage is occurring

B. Decreases because less neutron leakage is occurring

C. Increases because K_{eff} is increasing

D. Decreases because K_{eff} is decreasing

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P1811

A nuclear reactor is shut down at 100 counts per second in the source range when a loss of coolant accident occurs. How will excore source range neutron level indication change as homogeneous core voiding increases from 80% to 100%?

A. Decreases because K_{eff} is decreasing.

B. Increases because K_{eff} is increasing.

C. Decreases because a smaller fraction of the core neutron population is leaking out of the core.

D. Increases because a larger fraction of the core neutron population is leaking out of the core.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P1910

During a nuclear reactor refueling, the fuel assemblies were reconfigured to reduce the power being produced at the center of the core while maintaining the same rated thermal power. No maintenance or adjustments have been performed on the power range detectors.

How will reactor power level indication compare to actual reactor power when power is stabilized at 50% power?

A. Indication will be higher than actual power due to increased neutron leakage.

B. Indication will be higher than actual power due to decreased neutron leakage.

C. Indication will be lower than actual power due to decreased neutron leakage.

D. Indication will be lower than actual power due to increased neutron leakage.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P2513

A nuclear power plant startup is in progress immediately following a reactor refueling outage. The external nuclear instrumentation (NI) was calibrated at 90% power just prior to the refueling outage and has not been readjusted.

If actual reactor power level is increased to 90% and stabilized, NI power level will be _________ than actual reactor power level because, when compared to pre-outage 90% power level operation, _________.

A higher; the total core fission rate has increased

B. lower; the total core fission rate has decreased

C. higher; the fission rate in the outer portion of the core has increased

D. lower; the fission rate in the outer portion of the core has decreased

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P2713

During a nuclear reactor refueling outage, the fuel assemblies were reconfigured to reduce the radial power peak at the center of the core while maintaining the same rated thermal power. Excore power range detectors were calibrated at 50% of rated power just prior to the outage.

How will actual reactor power compare to indicated reactor power when the nuclear power plant is stabilized at 50% power following the outage?

A. Actual reactor power will be higher than indicated reactor power due to increased core neutron leakage.

B. Actual reactor power will be higher than indicated reactor power due to decreased core neutron leakage.

C. Actual reactor power will be lower than indicated reactor power due to decreased core neutron leakage.

D. Actual reactor power will be lower than indicated reactor power due to increased core neutron leakage.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P2812

A nuclear power plant has experienced a loss of coolant accident combined with a loss of emergency coolant injection flow. Homogeneous core voiding has occurred, with the void fraction currently nearing 100%. Now, emergency coolant injection flow is restored, which causes a steady reduction in the core void fraction as the core is refilled.

Which one of the following describes the expected trend in excore source/startup range neutron level indication as the homogeneous core void fraction decreases from 100% to 20% in the core and downcomer? (Assume the source/startup range neutron detectors are located adjacent to the bottom one-third of the core.)

A. Increases, then decreases

B. Increases continuously

C. Decreases, then increases

D. Decreases continuously

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.17 [3.3/3.5]
QID: P3112

Given:

- The nuclear reactor is shut down.
- The reactor coolant system is at normal operating pressure and temperature.
- The BF_3 source/startup range detectors are properly positioned outside the reactor vessel and adjacent to the lower portion of the core.
- All BF_3 source/startup range detectors are indicating approximately 100 cps.
- A sudden loss of coolant pressure accident occurs that causes bulk boiling and homogeneous core voiding in the reactor vessel.

How and why will source/startup range detector outputs change as homogeneous core voiding increases from 0% to 50%?

A. Increase, because the detectors will experience a higher rate of neutron interactions due to the axial power distribution shifting toward the lower portion of the core.

B. Increase, because the detectors will experience a higher rate of neutron interactions due to increasing neutron leakage from the core.

C. Decrease, because the detectors will experience a lower rate of neutron interactions due to a decreasing subcritical multiplication neutron level.

D. Decrease, because the detectors will experience a lower rate of gamma interactions due to decreasing reactor coolant attenuation.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P15 (B314)

Scintillation detectors convert radiation energy into light by a process known as...

A. gas amplification.

B. space charge effect.

C. luminescence.

D. photoionization.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P16

A BF_3 proportional counter is being used to measure neutron level during a reactor startup. Which of the following describes the method used to ensure that neutron indication is not being affected by gamma reactions in the detector?

A. Two counters are used, one sensitive to neutron and gamma and the other sensitive to gamma only. The outputs are electrically opposed to cancel the gamma-induced currents.

B. The BF3 proportional counter measures neutron flux of sufficient intensity that the gamma signal is insignificant compared to the neutron signal.

C. In a proportional counter gamma-induced pulses are of insufficient duration to generate a significant log-level amplifier output. Only neutron pulses have sufficient duration to be counted by the detector instrumentation.

D. In a proportional counter neutron-induced pulses are significantly larger than gamma pulses. The detector instrumentation filters out the smaller gamma pulses.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P214 (B213)

Most of the electrons collected in a fission chamber are released as a result of ionizations caused directly by...

A. fission betas.

B. fission gammas.

C. fission neutrons.

D. fission fragments.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P215

Which one of the following describes the reason for the high sensitivity of a Geiger-Mueller tube radiation detector?

A. Changes in applied detector voltage have little effect on detector output.

B. Geiger-Mueller tubes are thinner than other radiation detector types.

C. Any incident radiation event causing primary ionization results in ionization of the entire detector gas volume.

D. Geiger-Mueller tubes are operated at relatively low detector voltages, allowing detection of low energy radiation.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P314

A gas-filled radiation detector that is operating in the ionization region is exposed to a gamma radiation field. If the gamma radiation field is constant and the applied voltage is increased but maintained within the ionization region, the detector output will:

A. increase, because of an increase in secondary ionizations.

B remain the same, because detector output is not affected by a change in voltage in this region.

C increase, because of a decrease in recombination of primary ions.

D remain the same, because the detector is already producing its maximum output.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P316

Which one of the following materials is installed inside an ion chamber that is typically used for thermal neutron detection and reactor power indication?

A. Polyethylene

B. Boron-10

C. Uranium-238

D. Rhodium-103

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P614

Refer to the drawing of a gas-filled detector characteristic curve (see figure below).

In a gas-filled radiation detector, operating in the "proportional" region, essentially _____ of the ions caused by incident radiation are collected and the number of ions collected from secondary ionizations is __________________ applied voltage.

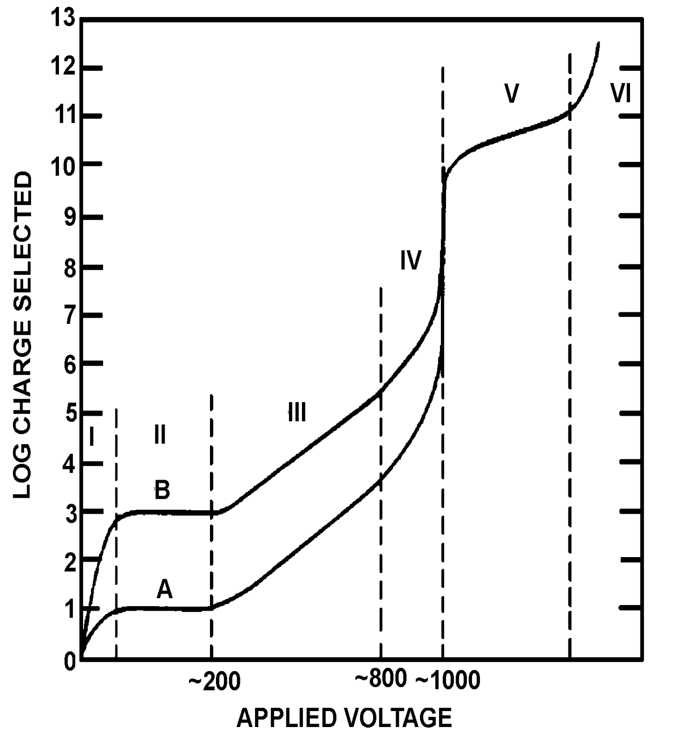
A. all; independent of

B. none; related to

C. all; related to

D. none; independent of

ANSWER: C.



GAS-FILLED DETECTOR CURVE

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1013

A gas-filled radiation detector that is used to measure thermal neutron flux requires a special feature because thermal neutrons are not directly ionizing particles. Which one of the following will allow thermal neutron detection in a gas-filled detector?

A. Encapsulate the detector with polyethylene

B. Encapsulate the detector with boron-10

C. Line the inside of the detector with polyethylene

D. Line the inside of the detector with boron-10

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1112

Which one of the following is a characteristic of Geiger-Mueller tube radiation detectors?

A. They can discriminate between neutron and gamma radiation.

B. They can discriminate between gammas of differing energies in the MeV range.

C. They provide an output that is inversely proportional to the applied voltage within the Geiger-Mueller region.

D. They undergo maximum gas amplification whenever an ion is formed in the tube.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1213

Which one of the following describes why a BF_3 proportional counter can be used in the source range to measure neutron radiation in a radiation field that also contains gamma radiation?

A. Neutrons directly ionize the BF_3 gas, producing larger pulses than gammas.

B. Neutrons interacting with the BF_3 gas result in the release of alpha particles which produce larger pulses than gammas.

C. Neutrons are captured by boron-10 and produce additional neutrons that completely ionize the fill gas in the detector.

D. The gamma radiation field is insignificant when compared to the neutron field.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1314

Which one of the following types of radiation will produce the greatest number of ions while passing through 1 centimeter of air? (Assume the same kinetic energy for each.)

A. Alpha

B. Beta

C. Gamma

D. Neutron

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1513 (B1514)

Which one of the following lists the two types of gas-filled radiation detectors whose outputs will be least affected by a small variation ($\pm$ 10 volts) in the voltage applied to the detectors? (Assume voltage remains within normal range.)

A. Geiger Mueller and ion chamber

B. Proportional and limited proportional

C. Ion chamber and proportional

D. Limited proportional and Geiger Mueller

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1613 (B913)

Which one of the following describes a characteristic of a gas-filled radiation detector operating in the Geiger-Mueller region?

A. Radiation types can be identified by pulse height.

B. Specific radionuclides can be identified by energy level.

C. Small variations in applied voltage will result in large changes in detector output.

D. Any type of radiation that ionizes the detector gas will produce the same magnitude detector output pulse.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1713 (B1714)

A Geiger-Mueller radiation detector is located in a radiation field consisting of beta, gamma, and fast neutron radiation. Assuming each type of radiation enters the detector gas chamber and ionizes the detector gas, which one of the following describes the resulting detector pulse sizes?

A. Beta radiation will produce a larger pulse size than either gamma or fast neutron radiation.

B. Gamma radiation will produce a larger pulse size than either beta or fast neutron radiation.

C. Fast neutron radiation will produce a larger pulse size than either beta or gamma radiation.

D. Beta, gamma, and fast neutron radiation will produce pulse sizes that are equal in magnitude.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1812 (B814)

A gas-filled radiation detector operating in the proportional region is exposed to a constant gamma radiation field. If the applied voltage is increased but maintained within the proportional region, the rate of ion collection will...

A. stay approximately the same because all of the primary ions were already being collected at the lower voltage.

B. stay approximately the same because the ion chamber is operating at saturated conditions.

C. increase because fewer primary ions are recombining in the detector prior to reaching the electrodes.

D. increase because more secondary ionizations are occurring in the detector.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P1909 (B1113)

Which one of the following is the function of the positive electrode in an ion chamber?

A. Produces ions when exposed to a radiation field

B. Releases electrons to combine with positive ions

C. Performs gas quenching to maximize detector sensitivity

D. Collects electrons released during gas ionization

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P2013 (B313)

An ion chamber radiation detector is exposed to a constant gamma radiation field. If the applied voltage is increased but maintained within the ion chamber region, the rate of ion collection will...

A. increase with voltage because more secondary ionizations are occurring in the detector.

B. increase with voltage because less primary ions are recombining in the detector prior to reaching the electrodes.

C. stay approximately the same because all of the primary ions were already being collected at the lower voltage.

D. stay approximately the same because the ion chamber is operating at saturated conditions.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P2014 (B2413)

What is the effect on a proportional neutron detector if the detector operating voltage is increased such that the detector operates near the high end of the true proportional region on the gas-filled detector characteristic curve?

A. Neutron-induced pulses will become so large that gamma pulse discrimination is no longer needed, yielding a more accurate neutron count rate.

B. The positive space charge effect will increase and prevent collection of both gamma- and neutron-induced pulses, yielding a less accurate neutron count rate.

C. A high rate of incident gamma radiation will result in the combination of multiple small gamma-induced pulses into larger pulses. The larger combined pulses will be counted as neutron-induced pulses, yielding a less accurate neutron count rate.

D. Detection of any single ionizing event will result in ionizing nearly the entire detector gas volume. The resulting large pulses will prevent the detector from differentiating between radiation types, yielding a less accurate neutron count rate.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P2313 (B2613)

A gas-filled radiation detector operating in the proportional region is exposed to a constant gamma radiation field. If the applied voltage is decreased but maintained within the proportional region, the rate of ion collection will...

A. stay approximately the same because all of the primary ions were already being collected at the higher voltage.

B. stay approximately the same because the ion chamber is still operating at saturated conditions.

C. decrease because more primary ions are recombining in the detector prior to reaching the electrodes.

D. decrease because fewer secondary ionizations are occurring in the detector.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P2413 (B2414)

A gas-filled radiation detector operating in the ionization chamber (IC) region is being exposed to a constant gamma radiation field. If the applied voltage is decreased but maintained within the IC region, the rate of ion collection will...

A. stay approximately the same because all of the primary ions continue to be collected and essentially no secondary ionizations are occurring.

B. stay approximately the same because detector operation in the ionization chamber region is characterized by complete ionization of the detector gas.

C. decrease because fewer primary ionizations are occurring in the detector as detector voltage decreases.

D. decrease because fewer secondary ionizations are occurring in the detector as detector voltage decreases.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P2613 (B1114)

Which one of the following describes the reason for the high sensitivity of a gas-filled ion chamber operating in the Geiger-Mueller region?

A. Any radiation-induced ionization results in a large detector output pulse.

B. Geiger-Mueller detectors are longer than other types of radiation detectors, resulting in greater detector surface area.

C. The detector output is directly proportional to the applied voltage within the Geiger-Mueller region.

D. The high detector voltage allows differentiation between the various radiation types.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P2913 (B414)

Refer to the drawing of a gas-filled radiation detector characteristic curve (see figure below).

Which one of the following statements describes how a gas-filled radiation detector, operating in the "proportional" region, functions?

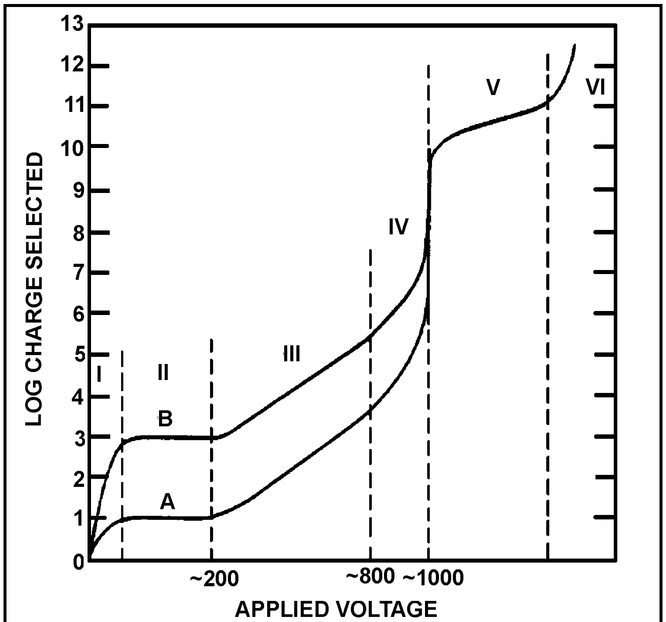
A. Essentially all of the ions from primary ionizations are collected; the number of ions collected from secondary ionizations are independent of the applied voltage on a logarithmic scale.

B. The number of ions collected from both primary and secondary ionizations vary directly with the applied voltage on a logarithmic scale.

C. Essentially all of the ions from primary ionizations are collected; the number of ions collected from secondary ionizations vary directly with the applied voltage on a logarithmic scale.

D. The number of ions collected from both primary and secondary ionizations are independent of the applied voltage on a logarithmic scale.

ANSWER: C.



GAS-FILLED DETECTOR CURVE

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P3413

A boron trifluoride (BF_3) detector (proportional counter) is normally used to monitor only source range core neutron level. How will the detector and source range count rate indication be affected if normal detector high voltage is inadvertently applied during nuclear reactor operation in the power range?

A. The BF_3 gas will become completely ionized and source range indication will stabilize at a constant low value.

B. The BF_3 gas will become completely ionized and source range indication will stabilize at a constant high value.

C. The detector electrodes will become exposed to an extremely high neutron flux and cause a false high reading on the source range indication.

D. The detector electrodes will become exposed to an extremely high gamma flux and cause a false high reading on the source range indication.

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P3906 (B3907)

A beta particle and an alpha particle enter and cause ionization in a gas-filled radiation detector operating in the Geiger-Mueller region. Which one of the following accurately compares the amplitude of the detector pulses caused by each type of radiation?

A. The beta particle pulse will be larger in amplitude.

B. The alpha particle pulse will be larger in amplitude.

C. The pulses will be identical for both types of radiation.

D. Cannot be determined without particle kinetic energy information.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P4506 (B4507)

A nuclear power plant has been shutdown for one month. A portable gas-filled radiation detector is needed to monitor shutdown reactor core neutron level from a location outside the reactor vessel. The detector must be able to distinguish between ionizations caused by gamma and neutron radiation.

Which region(s) of the gas-filled detector characteristic curve is/are acceptable for operation of the detector?

A. Geiger-Mueller, Ionization, and Proportional regions are all acceptable.

B. Proportional region is acceptable, and Ionization region also may be usable.

C. Ionization region is acceptable, and Geiger-Mueller region also may be usable.

D. Geiger-Mueller region is acceptable, and Proportional region also may be usable.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P4806 (B4807)

Select the option that correctly fills in the blanks.

Quench gases are added to gas-filled radiation detectors that operate in the ______________ region; the quench gases prevent a single ionization event from causing ______________ in the detector gas volume.

A. ion chamber; multiple discharges

B. ion chamber; secondary ionizations

C. Geiger-Mueller; multiple discharges

D. Geiger-Mueller; secondary ionizations

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P4906 (B4907)

Which one of the following contains the pair of radiation detector types that are the most sensitive to low-energy beta and/or gamma radiation?

A. Geiger-Mueller and scintillation

B. Geiger-Mueller and ion chamber

C. Ion chamber and scintillation

D. Ion chamber and proportional

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P5206 (B5207)

A beta particle and an alpha particle with equal kinetic energies cause ionization in a gas-filled radiation detector. The detector is operating in the ion chamber region of the gas ionization curve. Which one of the following describes the amplitudes of the detector pulses caused by each type of radiation?

A. The beta particle pulse will be larger in amplitude.

B. The alpha particle pulse will be larger in amplitude.

C. The amplitudes of both pulses will be approximately equal for all detector voltages in the ion chamber region.

D. The amplitudes of both pulses will be approximately equal for all detector voltages in the ion chamber region, as well as all detector voltages outside the ion chamber region.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P5306 (B5307)

Which one of the following types of radiation detectors is generally not used for measuring a high-intensity beta and gamma radiation field because of a relatively long detector recovery time, or dead time, following each ionization event.

A. Geiger-Mueller

B. Ion chamber

C. Proportional

D. Scintillation

ANSWER: A.

TOPIC: 191002
KNOWLEDGE: K1.18 [2.6/2.8]
QID: P5606 (B5607)

A proportional detector with pulse height discrimination circuitry is being used in a constant field of neutron and gamma radiation to provide source range neutron count rate indication. Assume that the pulse height discrimination setpoint does not change.

If the detector's operating voltage is increased but maintained within the true proportional operating region, count rate indication will increase because...

A. a single neutron- or gamma- induced ionizing event will result in multiple pulses inside the detector.

B. the ratio of the number of neutron-induced pulses to gamma-induced pulses inside the detector will increase.

C. the positive space charge effect will increase and promote the collection of both gamma- and neutron-induced pulses.

D. all detector pulses will increase in amplitude and previously uncounted gamma pulses will be added to the total count rate.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.19 [3.1/3.3]
QID: P216 (B214)

Which one of the following describes a characteristic of a self-reading pocket dosimeter (SRPD)?

A. The output of an SRPD is a dose rate in mR/hr.

B. SRPDs are primarily sensitive to beta radiation.

C. SRPD readings must be considered inaccurate when they are dropped.

D. SRPDs hold their charge indefinitely when removed from a radiation field.

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.19 [3.1/3.3]
QID: P714 (B714)

Which one of the following types of radiation is the major contributor to the dose indication on a self-reading pocket dosimeter (SRPD)? (also called SRD, PIC, and direct reading dosimeter)

A. Alpha

B. Beta

C. Gamma

D. Neutron

ANSWER: C.

TOPIC: 191002
KNOWLEDGE: K1.20 [2.5/2.7]
QID: P1114

Which one of the following describes the ion collection that occurs in a proportional counter, such as a BF_3 detector?

A. A fraction of the ions created by primary ionizations are collected. No secondary ionizations take place.

B. Virtually all of the ions created by primary ionizations are collected. No secondary ionizations take place.

C. Virtually all of the ions created by primary ionizations along with a fraction of the ions created by secondary ionizations are collected.

D. Virtually all of the ions created by primary and secondary ionizations are collected.

ANSWER: D.

TOPIC: 191002
KNOWLEDGE: K1.20 [2.5/2.7]
QID: P1514 (B511)

A BF_3 gas-filled detector, operating in the proportional region, is being used to monitor reactor power while shut down. If a complete loss of detector gas pressure occurs, the instrument indication will fail...

A. upscale.

B. downscale.

C. as is.

D. to midscale.

ANSWER: B.

TOPIC: 191002
KNOWLEDGE: K1.20 [2.5/2.7]]
QID: P3714 (B3714)

During reactor power operation, a reactor coolant sample is taken and analyzed. Which one of the following lists three radionuclides that are all indicative of a fuel cladding failure if detected in elevated concentrations in the reactor coolant sample?

A. Lithium-6, cobalt-60, and argon-41

B. Iodine-131, cesium-138, and strontium-89

C. Nitrogen-16, xenon-135, and manganese-56

D. Hydrogen-2 (deuterium), hydrogen-3 (tritium), and oxygen-18

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.01 [3.1/3.2]
QID: P17 (B15/B1414)

The difference between the setpoint in an automatic controller and the steady-state value of the controlled parameter is called...

A. offset.

B. gain.

C. deadband.

D. feedback.

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.01 [3.1/3.2]
QID: P217 (B215)

In an automatic flow controller, the range of values around the set point of a measured variable where <u>no</u> <u>action</u> occurs is called...

A. bias.

B. error.

C. deadband.

D. deviation.

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.01 [3.1/3.2]
QID: P715 (B1817)

An automatic flow controller is being used to position a valve in a cooling water system. The controller develops a flow error signal and then increases the magnitude of the signal to drive the valve operator.

The factor by which the magnitude of the flow error signal is increased is referred to as...

A. bias.

B. gain.

C. feedback.

D. offset.

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.01
QID: P1115

A typical flow controller uses the ____________ method of control.

A. open-loop

B. on-off

C. closed-loop

D. external regulating

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.01 [3.1/3.2]
QID: P1518 (B1616)

Which one of the following terms is used to describe the delay between a process parameter change and the sensing of that change by the process controller?

A. Offset

B. Gain

C. Dead time

D. Feedback

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.01 [3.1/3.2]
QID: P1615 (B715)

An automatic flow controller is being used to position a valve in a cooling water system. A signal from the valve, which is proportional to valve position, is returned to the controller. This signal is referred to as...

A. gain.

B. bias.

C. feedback.

D. error.

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.01 [3.1/3.2]
QID: P3715 (B3715)

A flow controller has proportional, integral, and derivative control features. Which one of the following lists the effect on the control features when the controller is switched from the automatic mode to the manual mode?

A. Only the derivative feature will be lost.

B. Only the integral and derivative features will be lost.

C. All proportional, integral, and derivative features will be lost.

D. All control features will continue to influence the controller output.

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.01 [3.1/3.2]
QID: P5607 (B5608)

Consider a direct-acting proportional flow controller that is maintaining flow rate at a value that is offset from the controller setpoint. If the controller's gain is increased, the controller's offset will __________ and the controller's proportional band will __________.

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.02 [2.6/2.7]
QID: P218 (B3115)

An emergency diesel generator (D/G) is operating as the only power source connected to an emergency bus. The governor of the D/G is directly sensing D/G __________ and will directly adjust D/G __________ flow to maintain a relatively constant D/G frequency.

A. speed; fuel

B. speed; air

C. load; fuel

D. load; air

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.02 [2.6/2.7]
QID: P417 (B417)

If the turbine shaft speed signal received by a typical turbine governor control system fails low during turbine startup, the turbine governor will cause turbine speed to...

A. decrease to a minimum speed setpoint.

B. increase, until the mismatch with demanded turbine speed is nulled.

C. decrease, until the mismatch with demanded turbine speed is nulled.

D. increase, until an upper limit is reached or the turbine trips on overspeed.

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.02 [2.6/2.7]
QID: P1316

An emergency diesel generator (D/G) is the only power source connected to an emergency bus. The governor of the D/G directly senses D/G ____________ and adjusts D/G fuel flow to maintain a relatively constant D/G ____________.

A. voltage; voltage

B. voltage; frequency

C. speed; voltage

D. speed; frequency

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.02 [2.6/2.7]
QID: P1815 (B1016)

If the turbine shaft speed signal received by a typical turbine governor control system fails <u>high</u> during turbine startup, the turbine governor will cause turbine speed to...

A. increase, until an upper limit is reached or the turbine trips on overspeed.

B. decrease, until the mismatch with the turbine speed demand signal is nulled.

C. increase, until the mismatch with the turbine speed demand signal is nulled.

D. decrease, until a lower limit is reached or turbine steam flow is isolated.

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.03 [3.1/3.1]
QID: P616

Refer to the drawing of a pneumatic control system (see figure below).

An increasing steam generator (S/G) level will decrease the S/G level control signal and reduce the control air pressure applied to the feed control valve which reduces feedwater flow to the S/G.

If the level control signal is manually increased, how will the pneumatic control system affect steam generator level?

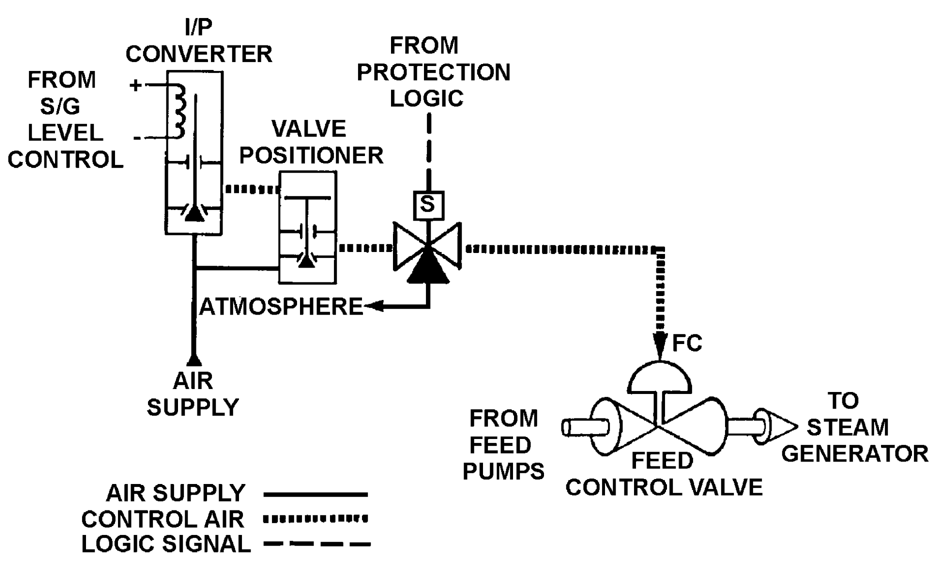
A. Level will increase because the valve positioner will close more.

B. Level will decrease because the valve positioner will close more.

C. Level will increase because the valve positioner will open more.

D. Level will decrease because the valve positioner will open more.

ANSWER: C.



PNEUMATIC CONTROL SYSTEM - PWR

TOPIC: 191003
KNOWLEDGE: K1.03 [3.1/3.1]
QID: P2117

Refer to the drawing of a pneumatic control system (see figure below).

An increasing steam generator (S/G) water level will decrease the S/G level control signal and reduce the control air pressure applied to the actuator of the feed control valve.

If the level control signal fails high, S/G water level will __________ because the control air pressure to the valve positioner will __________.

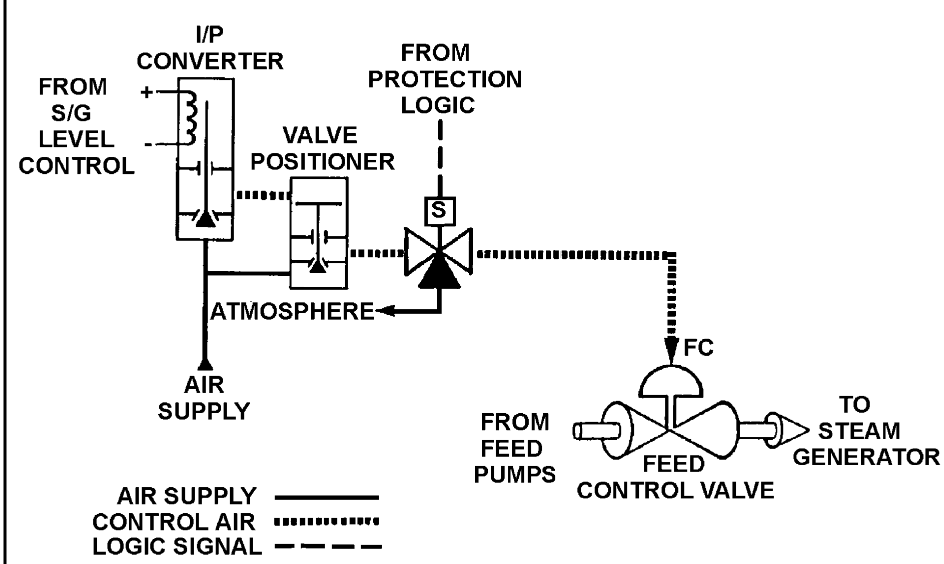
A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: D.



PNEUMATIC CONTROL SYSTEM - PWR

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P617 (B516)

Refer to the drawing of a lube oil temperature control system (see figure below).

If the temperature transmitter fails high (high temperature output signal), the temperature controller will ________ the temperature control valve, causing the actual heat exchanger lube oil outlet temperature to ________.

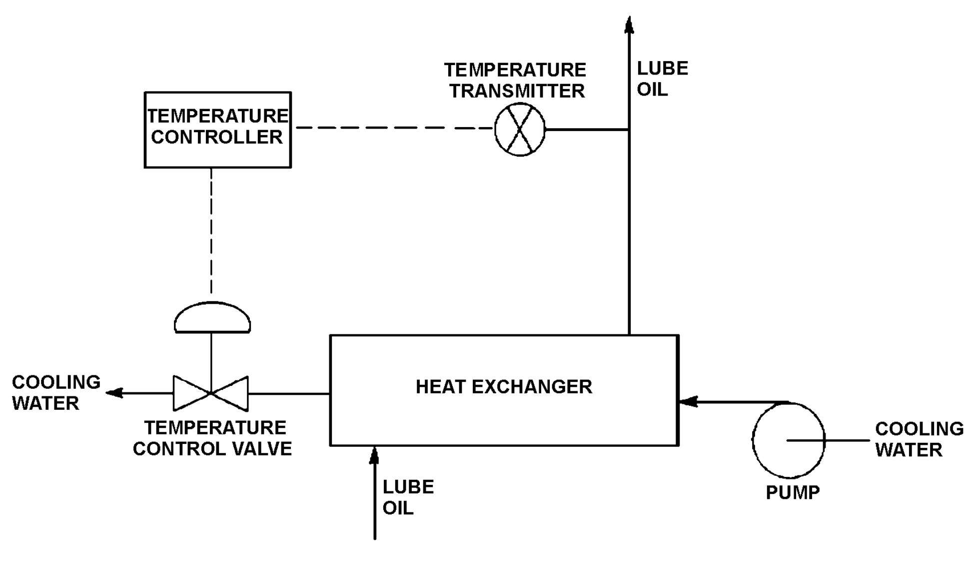
A. open; decrease

B. open; increase

C. close; decrease

D. close; increase

ANSWER: A.



LUBE OIL TEMPERATURE CONTROL SYSTEM

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P1216

If a typical flow controller is in manual control, the output of the flow controller is determined by the...

A. operator.

B. system feedback.

C. plant computer.

D. flow error signal.

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P1315 (B917)

Refer to the drawing of a lube oil temperature control system (see figure below).

If the temperature transmitter fails low (low temperature output signal), the temperature controller will throttle the temperature control valve ________, causing the actual heat exchanger lube oil outlet temperature to ________.

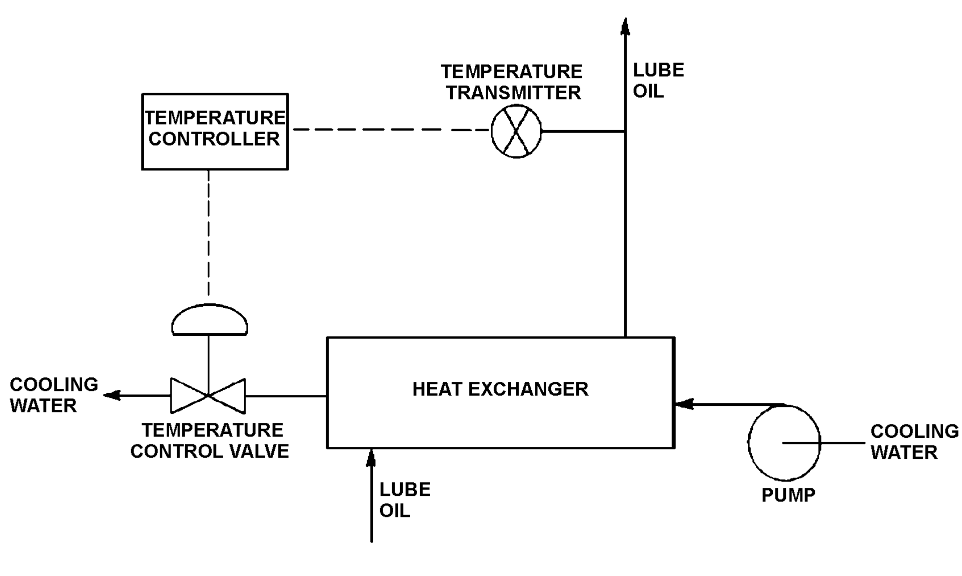
A. closed; decrease

B. closed; increase

C. open; decrease

D. open; increase

ANSWER: B.



LUBE OIL TEMPERATURE CONTROL SYSTEM

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P1715 (B1914)

Refer to the drawing of a lube oil temperature control system (see figure below).

Which one of the following describes the type of control used in the lube oil temperature control system?

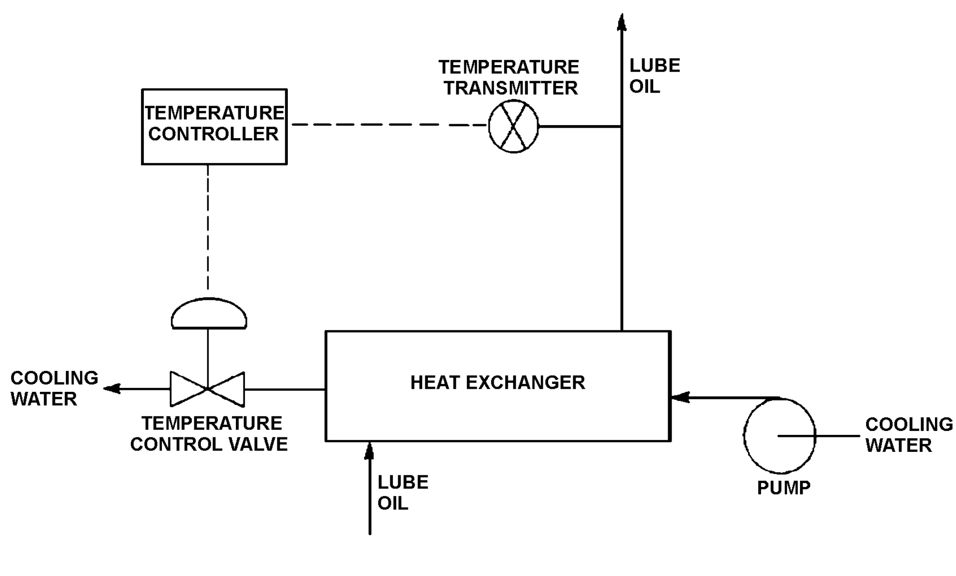
A. Open loop, because lube oil temperature feedback is being provided to the controller from the lube oil temperature transmitter

B. Open loop, because lube oil temperature is being controlled by positioning a flow control valve in a separate system

C. Closed loop, because lube oil temperature feedback is being provided to the controller from the lube oil temperature transmitter

D. Closed loop, because lube oil temperature is being controlled by positioning a flow control valve in a separate system

ANSWER: C.



LUBE OIL TEMPERATURE CONTROL SYSTEM

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P2016 (B2016)

Refer to the drawing of a lube oil temperature control system (see figure below). The temperature control valve is currently 50% open.

If the cooling water inlet temperature decreases, the temperature controller will position the temperature control valve more ________, causing cooling water differential temperature through the heat exchanger to ________.

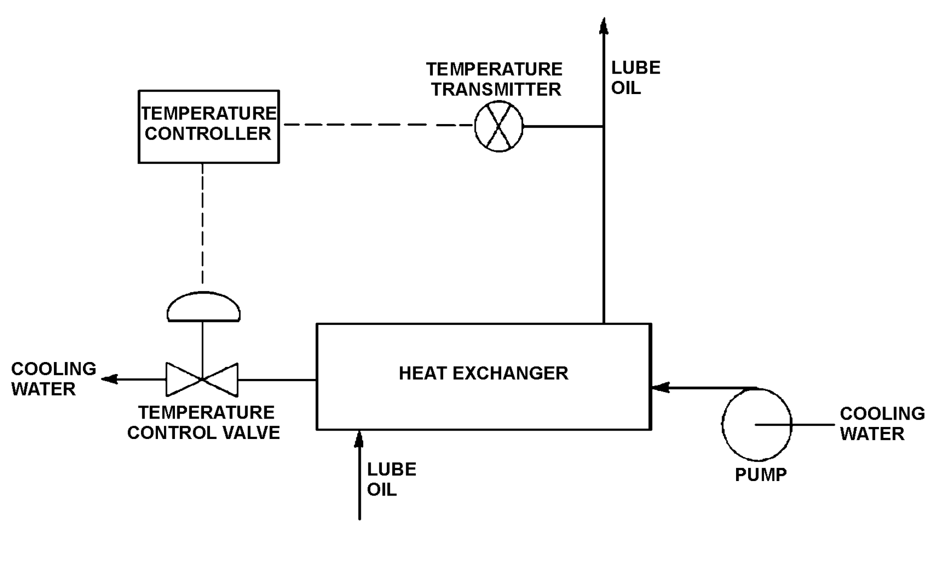
A. closed; increase

B. closed; decrease

C. open; increase

D. open; decrease

ANSWER: A.



LUBE OIL TEMPERATURE CONTROL SYSTEM

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P3015 (B3016)

Refer to the drawing of a pressure bistable in an alarm circuit (see figure below).

The orientation of the bistable symbol indicates the characteristics of the bistable, as is normal for a control circuit diagram. The bistable turns on to actuate an alarm at a system pressure of 100 psig. The bistable has a 5 psig dead band, or neutral zone.

If current system pressure is 90 psig, which one of the following describes the alarm response as system pressure is slowly increased to 110 psig?

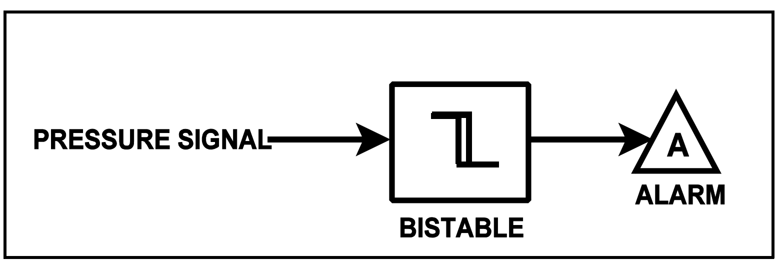
A. The alarm is currently actuated and will turn off at 95 psig.

B. The alarm will actuate at 100 psig and will <u>not</u> turn off.

C. The alarm is currently actuated and will turn off at 105 psig.

D. The alarm will actuate at 100 psig and will turn off at 105 psig.

ANSWER: C.



TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P3215 (B3216)

Refer to the drawing of a pressure bistable in an alarm circuit (see figure below).

The orientation of the bistable symbol indicates the characteristics of the bistable, as is normal for a control circuit diagram. The bistable turns on to actuate an alarm at a system pressure of 100 psig. The bistable has a 5 psig dead band, or neutral zone.

If current system pressure is 90 psig, which one of the following describes the alarm response as system pressure is slowly increased to 110 psig?

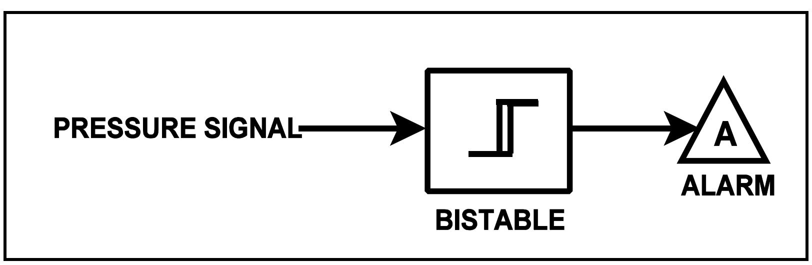
A. The alarm is currently actuated and will turn off at 95 psig.

B. The alarm will actuate at 100 psig and will not turn off.

C. The alarm is currently actuated and will turn off at 105 psig.

D. The alarm will actuate at 100 psig and will turn off at 105 psig.

ANSWER: B.



TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P3516

Refer to the drawing of a pressure bistable in an alarm circuit (see figure below).

The orientation of the bistable symbol indicates the characteristics of the bistable, as is normal for a control circuit diagram. The bistable turns on to actuate an alarm at a system pressure of 100 psig. The bistable has a 5 psig dead band, or neutral zone.

If system pressure is currently 110 psig, which one of the following describes the alarm circuit response as system pressure slowly decreases to 90 psig?

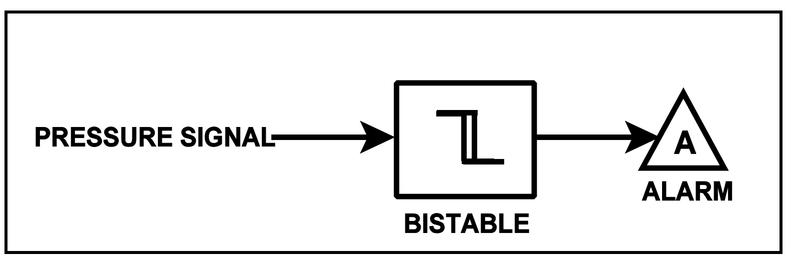
A. The alarm will actuate at 100 psig and will not turn off.

B. The alarm will actuate at 100 psig and will turn off at 95 psig.

C. The alarm is currently actuated and will not turn off.

D. The alarm is currently actuated and will turn off at 95 psig.

ANSWER: A.



TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P3816 (B3817)

Refer to the drawing of four bistable symbols (see figure below).

A temperature controller uses a bistable that turns on to actuate a warning light when the controlled temperature reaches a low setpoint. The warning light extinguishes immediately after the temperature increases above the low setpoint.

Which one of the following bistable symbols indicates the characteristics of the bistable?

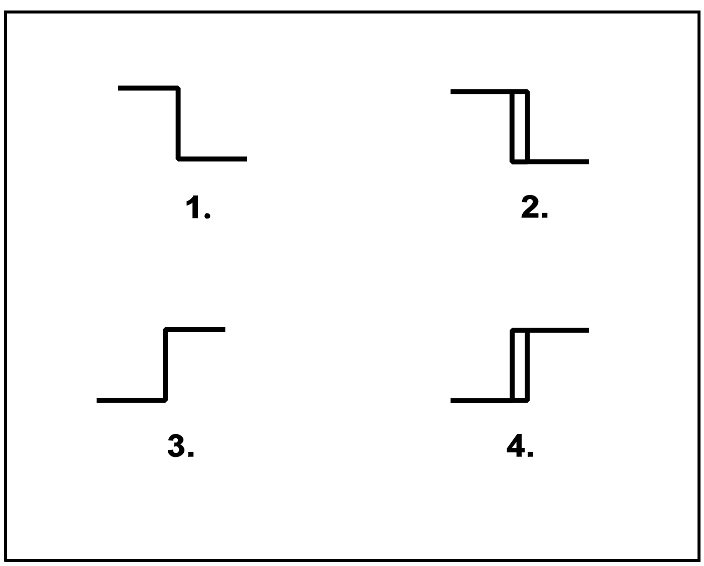
A. 1.

B. 2.

C. 3.

D 4.

ANSWER: A.



TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P4508 (B4509)

Refer to the drawing of four bistable symbols (see figure below).

A temperature controller uses a bistable that turns on to actuate a warning light when the controlled temperature reaches a high setpoint. The bistable turns off to extinguish the warning light when the temperature decreases to 5°F below the high setpoint.

Which one of the following bistable symbols indicates the characteristics of the bistable?

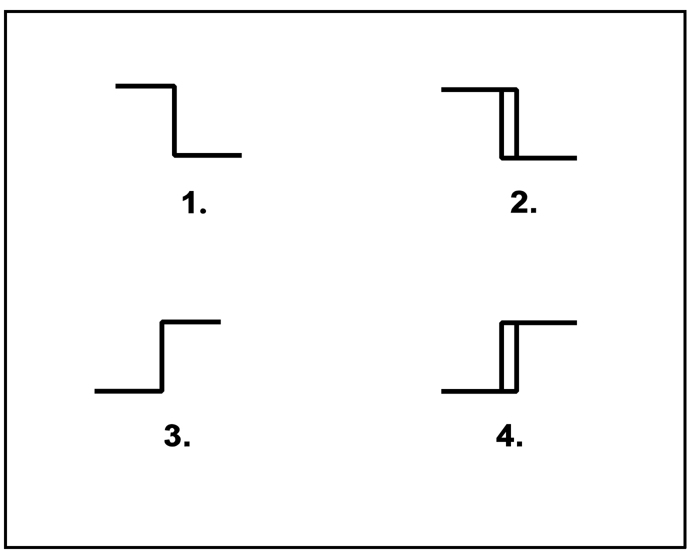
A. 1.

B. 2.

C. 3.

D 4.

ANSWER: D.



TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P4607 (B4609)

Refer to the drawing of a temperature bistable in a bistable alarm circuit (see figure below).

The orientation of the bistable symbol indicates the characteristics of the bistable, as is normal for a control circuit diagram. The bistable turns on to actuate an alarm at a temperature of 130°F. The bistable has a 5°F dead band, or neutral zone.

If the current temperature is 150°F, which one of the following describes the alarm response as temperature slowly decreases to 110°F?

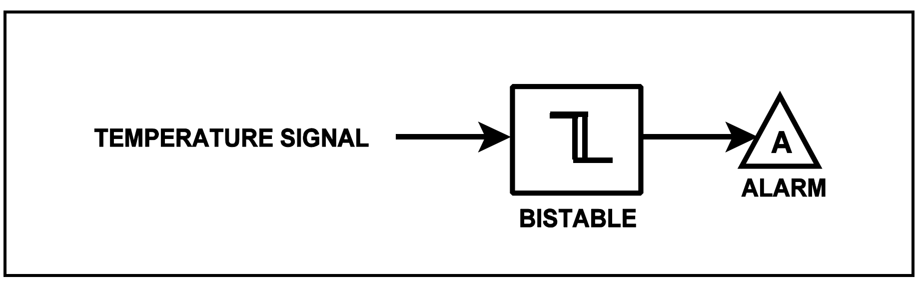
A. The alarm is currently actuated and will <u>not</u> turn off.

B. The alarm will actuate at 130°F and will <u>not</u> turn off.

C. The alarm is currently actuated and will turn off at 125°F.

D. The alarm will actuate at 130°F and will turn off at 125°F.

ANSWER: B.



TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P5107 (B5109)

Refer to the drawing of a lube oil temperature control system (see figure below).

The temperature controller is a direct-acting proportional controller with a gain of 1.0. Which one of the following describes the effect of changing the gain to 2.0?

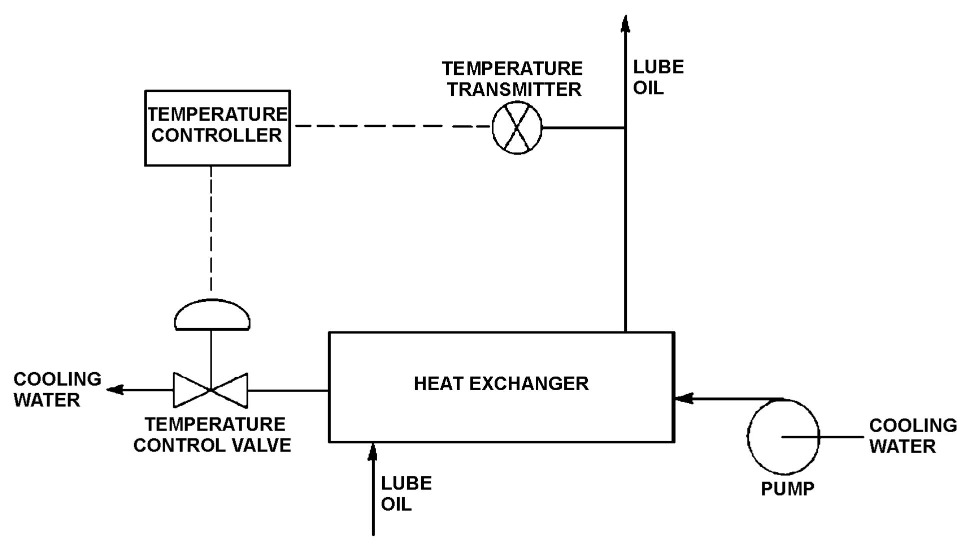
A. Half the temperature deviation from setpoint will produce a given controller output.

B. Twice the temperature deviation from setpoint will produce a given controller output.

C. The temperature control valve will move half as far for a given change in controller output.

D. The temperature control valve will move twice as far for a given change in controller output.

ANSWER: A.



LUBE OIL TEMPERATURE CONTROL SYSTEM

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P5308 (B5309)

A direct-acting proportional controller is being used to control the temperature of lube oil exiting a heat exchanger. The controller's proportional band is 70°F to 120°F.

Which one of the following will be the controller output percentage when the measured lube oil temperature is 83°F?

A. 13%

B. 26%

C. 37%

D. 74%

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P5508 (B5509)

A reverse-acting proportional controller is being used to control the temperature of lube oil exiting a heat exchanger. The controller's proportional band is 70°F to 120°F.

Which one of the following will be the controller output when the measured lube oil temperature is 83°F?

A. 13%

B. 26%

C. 74%

D. 87%

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.04 [2.8/3.0]
QID: P5608 (B5609)

The temperature of the water in a storage tank is monitored by a bistable alarm circuit. If water temperature decreases to 50°F a bistable turns on to actuate an alarm indicator. As soon as the water temperature exceeds 50°F the bistable turns off to clear the alarm.

Which one of the following bistable symbols indicates the characteristics of the bistable used in the alarm circuit?

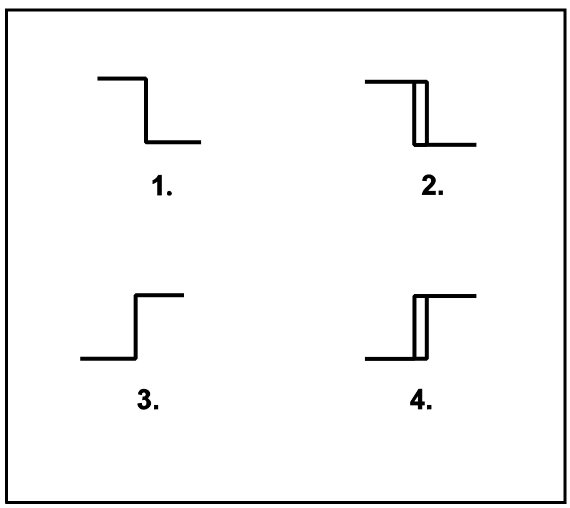
A. 1.

B. 2.

C. 3.

D 4.

ANSWER: A.



TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P18 (B816/B217)

The output pressure of a pneumatic controller is typically insufficient to drive a valve actuator accurately. To overcome this problem, a valve operating control loop would normally employ a...

A. valve actuating lead/lag unit.

B. pressure regulator.

C. valve positioner.

D. pressure modulator.

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P318 (B317)

Refer to the drawing of a pneumatic control system (see figure below).

The purpose of the valve positioner is to convert...

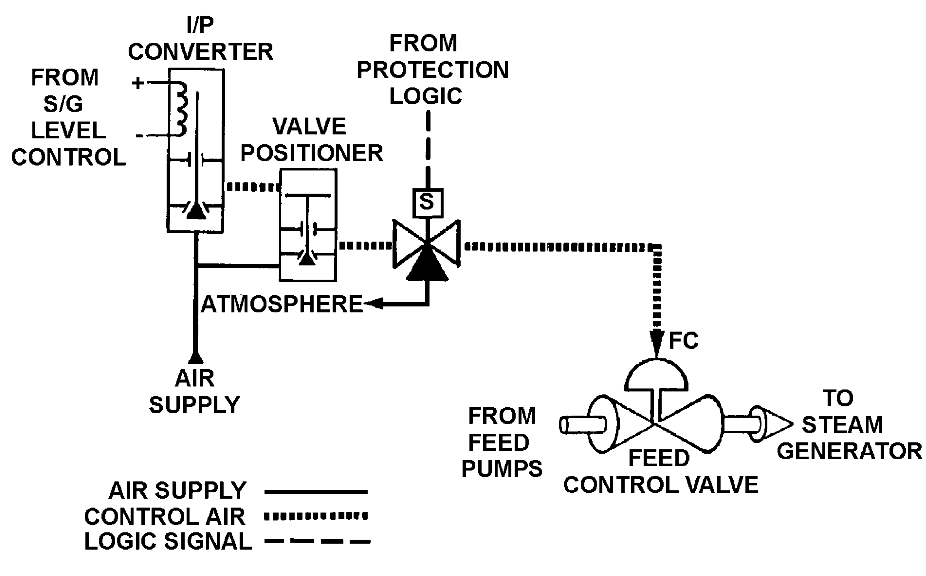
A. a small control air pressure into a proportionally larger air pressure to adjust valve position.

B. a large control air pressure into a proportionally smaller air pressure to adjust valve position.

C. pneumatic force into mechanical force to adjust valve position.

D. mechanical force into pneumatic force to adjust valve position.

ANSWER: A.



PNEUMATIC CONTROL SYSTEM - PWR

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P1116 (B2816)

Which one of the following describes a characteristic of pneumatic valve positioners?

A. They provide auto and manual demand signals to valve controllers and valve actuators.

B. They supply air pressure to valve actuators in response to a control signal to regulate valve position.

C. They can either receive or supply air to/from valve controllers, depending on the direction of valve travel.

D. They act independently of the valve controller, in order to prevent pressure transients on the actuator diaphragm.

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P1117 (B1116)

An air-operated isolation valve requires 4,800 pounds-force (lbf) from its diaphragm actuator and 4 inches of stem travel for proper operation. The air supply system can provide a nominal 80 psig of air pressure to the actuator.

What is the minimum surface area of the actuator diaphragm required for proper valve operation?

A. 15 square inches

B. 60 square inches

C. 120 square inches

D. 240 square inches

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P1217 (B1416)

The purpose of a typical valve positioner in a pneumatic control system is to...

A. provide actual valve position feedback to the valve controller.

B. position the solenoid valve that supplies air to the valve actuator.

C. compare valve controller output signal to setpoint error and adjust valve actuator air supply pressure to position the valve.

D. compare valve controller output signal to valve position, and adjust valve actuator air supply pressure to position the valve.

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P1516 (B1517)

An air-operated isolation valve requires 3,200 pounds-force (lbf) from its diaphragm actuator and 4 inches of stem travel for proper operation. The area of the actuator diaphragm is 80 square inches.

What is the minimum air pressure (rounded to the nearest psig) required for proper valve operation?

A. 10 psig

B. 25 psig

C. 40 psig

D. 55 psig

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P1618 (B1617)

An air-operated isolation valve requires 3,600 pounds-force (lbf) from its diaphragm actuator and 4 inches of stem travel for proper operation. The valve positioner can supply a nominal 120 psig of air pressure to the actuator.

What is the minimum surface area of the actuator diaphragm required for proper valve operation?

A. 30 square inches

B. 60 square inches

C. 90 square inches

D. 120 square inches

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P1716

Refer to the drawing of an air-operated isolation valve (see figure below).

The valve requires 2,400 lbf applied to the top of the actuator diaphragm to open. The actuator diaphragm has a surface area of 60 square inches and the valve stem travels 2 inches from fully open to fully closed.

If control air pressure to the valve actuator begins to increase from 0 psig, which one of the following is the minimum air pressure required to open the valve?

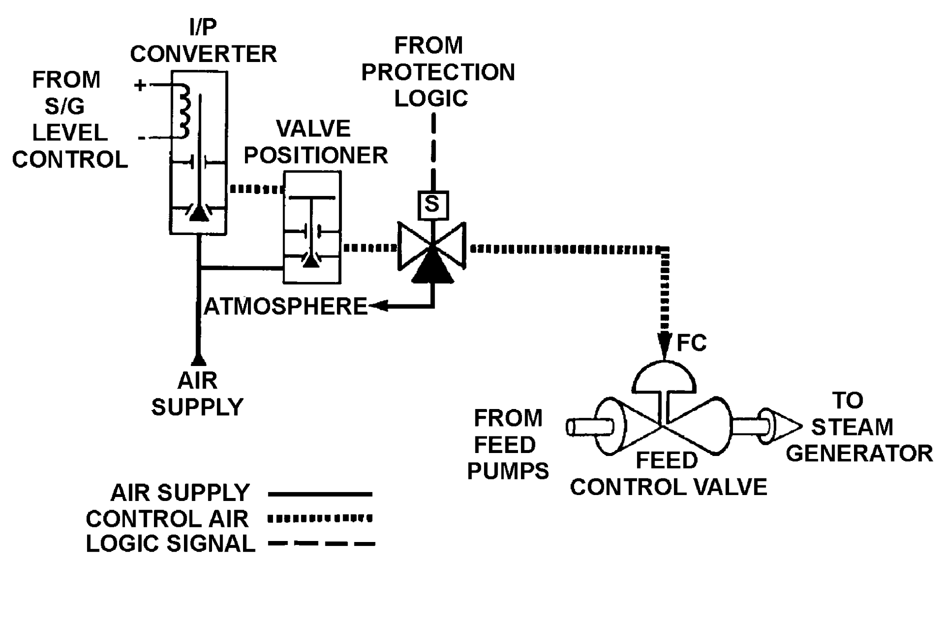
A. 10 psig

B. 20 psig

C. 30 psig

D. 40 psig

ANSWER: D.



PNEUMATIC CONTROL SYSTEM - PWR

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P2116 (B2117)

An air-operated isolation valve requires 3,200 pounds-force from its pneumatic actuator and 4 inches of stem travel for proper operation. The area of the actuator diaphragm is 160 square inches.

What is the minimum air pressure (rounded to the nearest psig) required for proper valve operation?

A. 20 psig

B. 40 psig

C. 60 psig

D. 80 psig

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P2216 (B3317)

An air-operated isolation valve requires 2,800 pounds-force (lbf) from its diaphragm actuator and 4 inches of stem travel for proper operation. The valve positioner can supply a nominal 117 psig of air pressure to the actuator.

What is the minimum surface area of the actuator diaphragm required for proper valve operation? (Answer options are rounded to the nearest square inch.)

A. 24 square inches

B. 48 square inches

C. 94 square inches

D. 138 square inches

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P2416 (B2917)

Which one of the following describes the operation of a typical pneumatic valve positioner?

A. Compares the valve controller demand signal with actual valve position and sends an error signal to the valve controller for adjustment of the demand signal.

B. Compares the valve controller automatic and manual setpoints and sends an error signal to the valve controller to ensure the manual demand signal is tracking the automatic demand signal.

C. Receives a valve position error signal from the valve controller and positions the valve as necessary to null the valve position error signal.

D. Receives a demand signal from the valve controller and supplies the appropriate air pressure to the valve actuator to move the valve to the demanded position.

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P2417 (B2416)

An air-operated isolation valve requires 3,600 lbf applied to the top of the actuator diaphragm to open. The actuator diaphragm has a diameter of 9 inches.

If control air pressure to the valve actuator begins to increase from 0 psig, which one of the following is the approximate air pressure at which the valve will begin to open?

A. 14 psig

B. 57 psig

C. 81 psig

D. 127 psig

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P2517 (2516)

An air-operated isolation valve requires 2,400 lbf applied to the top of the actuator diaphragm to open. The actuator diaphragm has a diameter of 12 inches.

If control air pressure to the valve actuator begins to increase from 0 psig, which one of the following is the approximate air pressure at which the valve will begin to open?

A. 21 psig

B. 34 psig

C. 43 psig

D. 64 psig

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P2617 (B2216)

Which one of the following describes a characteristic of pneumatic valve positioners?

A. They can provide automatic and manual demand signals to pneumatic controllers and valve actuators.

B. They can increase or decrease air pressure to valve actuators to obtain the proper valve response.

C. They can either supply or receive air to/from pneumatic controllers, depending on the direction of valve travel.

D. They can increase air pressure to valve actuators above existing main air header pressure.

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P2716 (B2716)

An air-operated isolation valve requires 3,600 lbf applied to the top of the actuator diaphragm to open. The actuator diaphragm has a diameter of 8 inches.

If control air pressure to the valve actuator begins to increase from 0 psig, which one of the following is the approximate air pressure at which the valve will begin to open?

A. 32 psig

B. 45 psig

C. 56 psig

D. 72 psig

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.05 [2.5/2.8]
QID: P2917 (B2915)

An air-operated isolation valve requires 2,400 lbf applied to the top of the actuator diaphragm to open against spring pressure. The actuator diaphragm has a diameter of 12 inches.

If control air pressure to the valve actuator begins to decrease from 100 psig, which one of the following is the approximate air pressure at which the valve will begin to close?

A. 5.3 psig

B. 16.7 psig

C. 21.2 psig

D. 66.7 psig

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P419 (B1316)

Refer to the drawing of a flyball-weight mechanical speed governor (see figure below).

In a flyball-weight mechanical speed governor, the purpose of the spring on the flyball mechanism is to ____________ centrifugal force by driving the flyballs ___________.

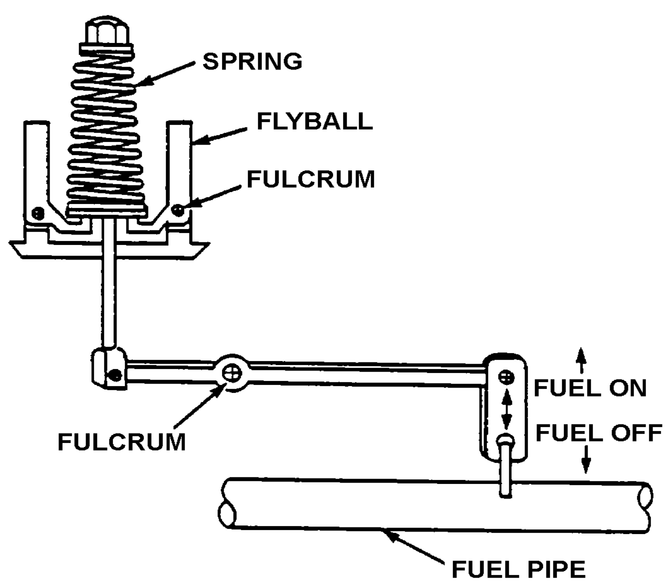
A. counteract; apart

B. aid; together

C. counteract; together

D. aid; apart

ANSWER: C.



FLYBALL-WEIGHT MECHANICAL SPEED GOVERNOR

TOPIC: 191003
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P1818 (B1815)

A diesel generator is supplying an isolated electrical bus with the governor operating in the isochronous mode. If a large electrical load is started on the bus, generator frequency will...

A. initially decrease, then increase and stabilize below the initial value.

B. initially decrease, then increase and stabilize at the initial value.

C. initially decrease, then increase and stabilize above the initial value.

D. remain constant during and after the load start.

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2018 (B2015)

A diesel generator is supplying an isolated electrical bus with the governor operating in the isochronous mode. If a large electrical bus load trips, generator frequency will...

A. initially increase, then decrease and stabilize below the initial value.

B. initially increase, then decrease and stabilize at the initial value.

C. initially increase, then decrease and stabilize above the initial value.

D. remain constant during and after the load trip.

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2818 (B2817)

A diesel generator (DG) is supplying an isolated electrical bus with the DG governor operating in the speed droop mode. Assuming the DG does not trip, if a large electrical bus load trips, bus frequency will initially...

A. increase, then decrease and stabilize below the initial value.

B. increase, then decrease and stabilize above the initial value.

C. decrease, then increase and stabilize below the initial value.

D. decrease, then increase and stabilize above the initial value.

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.07 [2.3/2.6]
QID: P1019

Which one of the following refers to the transfer of controller modes from automatic-to-manual or manual-to-automatic without causing a system perturbation?

A. A direct transfer

B. A deadband transfer

C. An analog-to-digital transfer

D. A bumpless transfer

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.08 [2.1/2.6]
QID: P3617 (B3616)

Refer to the drawing of a water storage tank with an automatic level control system (see figure below).

Given:

- The drain valve fails open on loss of controller output signal.
- The level sensor output signal changes directly with tank water level.

For proper automatic control of tank water level, the controller must be ____________; and the control loop must be __________.

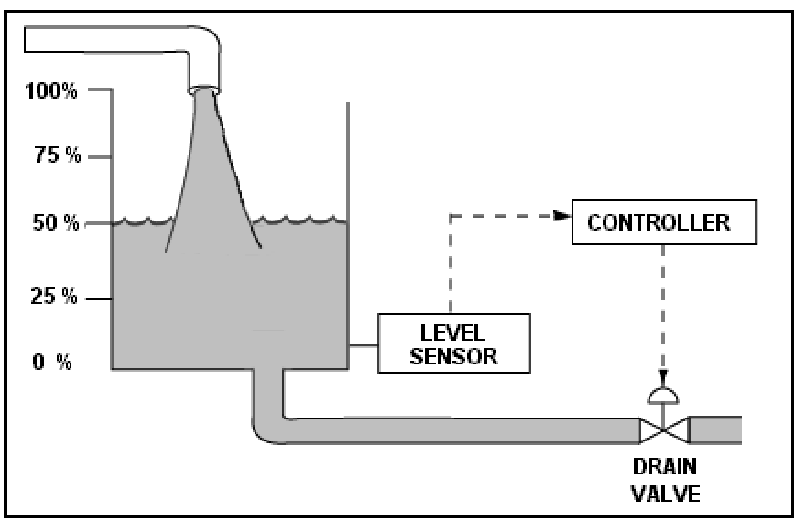
A. direct-acting; open

B. direct-acting; closed

C. reverse-acting; open

D. reverse-acting; closed

ANSWER: D.



TOPIC: 191003
KNOWLEDGE: K1.08 [2.1/2.6]
QID: P4109 (B4108)

Refer to the drawing of a water storage tank with an automatic level control system (see figure below).

Given:

- The drain valve fails closed on loss of controller output signal.
- The level sensor output signal changes directly with tank water level.

For proper automatic control of tank water level, the controller must be ____________; and the control loop must be __________.

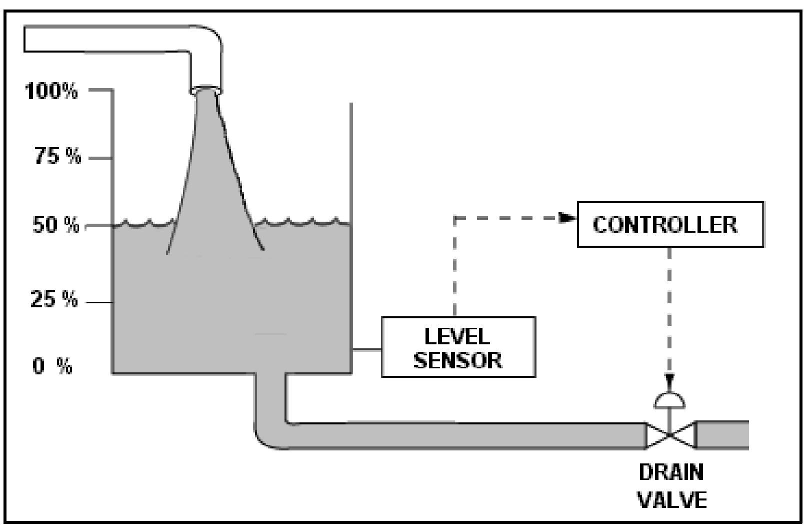
A. direct-acting; open

B. direct-acting; closed

C. reverse-acting; open

D. reverse-acting; closed

ANSWER: B.



TOPIC: 191003
KNOWLEDGE: K1.08 [2.1/2.6]
QID: P4408 (B4408)

The water level in a water storage tank is being controlled by an automatic bistable level controller. If water level increases to 70%, the controller bistable turns on to open a tank drain valve. When water level decreases to 60%, the controller bistable turns off to close the drain valve.

Which one of the following bistable symbols indicates the characteristics of the bistable used in the level controller?

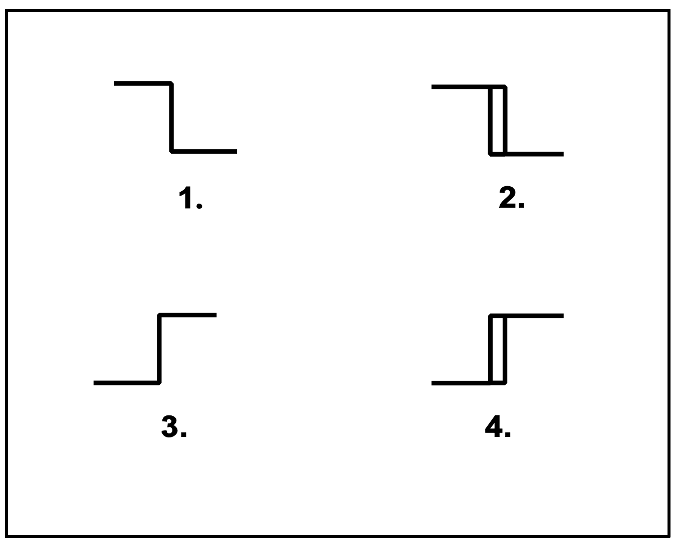
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: D.



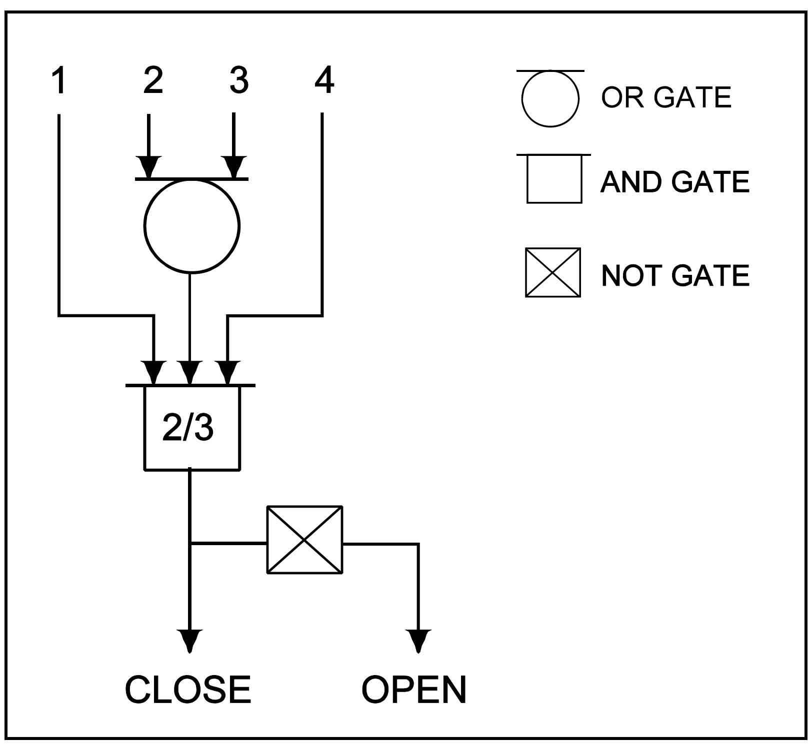
TOPIC: 191003
KNOWLEDGE: K1.08 [2.1/2.6]
QID: P4707 (B4708)

Refer to the valve controller logic diagram (see figure below).

Which one of the following combinations of inputs will result in the valve receiving an open signal?

	INPUTS			
	1.	2.	3.	4.
A.	On	Off	Off	On
B.	Off	On	On	Off
C.	On	Off	On	Off
D.	Off	On	Off	On

ANSWER: B.



TOPIC: 191003
KNOWLEDGE: K1.08 [2.1/2.6]
QID: P4909 (B4908)

The water level in a water storage tank is being controlled by an automatic bistable level controller. If water level increases to 70%, the controller bistable turns off to open a tank drain valve. When water level decreases to 60%, the controller bistable turns on to close the drain valve.

Which one of the following bistable symbols indicates the characteristics of the bistable used in the level controller?

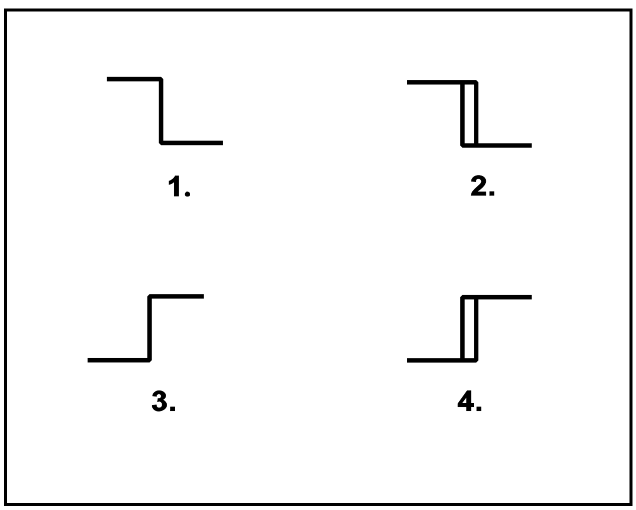
A. 1.

B. 2.

C. 3.

D 4.

ANSWER: B.



TOPIC: 191003
KNOWLEDGE: K1.08 [2.1/2.6]
QID: P5009 (B5009)

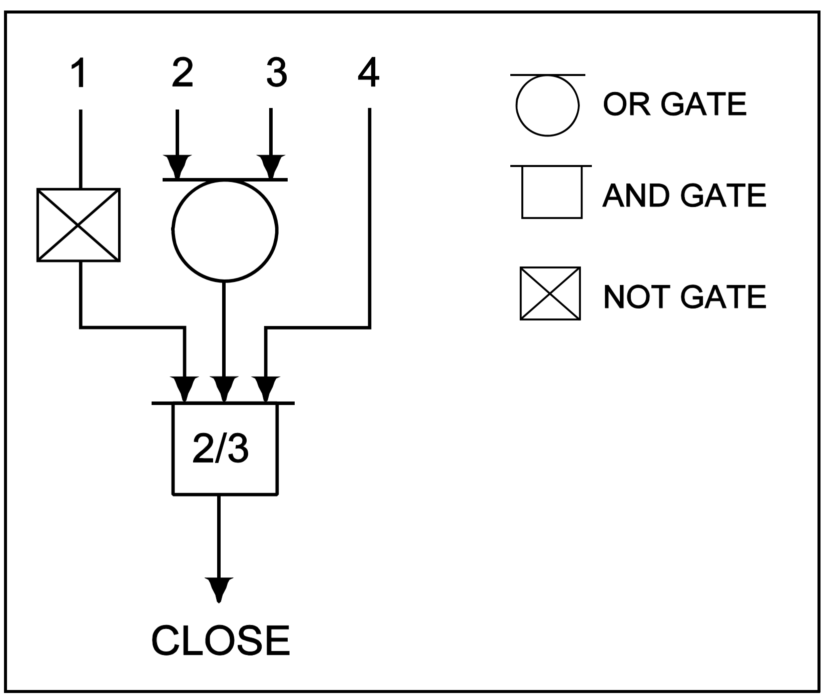
Refer to the valve controller logic diagram (see figure below).

Which one of the following combinations of inputs will result in the valve receiving a close signal?

INPUTS

	1.	2.	3.	4.
A.	On	On	Off	Off
B.	Off	Off	On	Off
C.	On	Off	Off	On
D.	On	On	On	Off

ANSWER: B.



TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
KNOWLEDGE: K1.08 [2.1/2.6]
QID: P319 (B316)

Which one of the following describes the response of a direct acting proportional-integral controller, operating in automatic mode, to an increase in the controlled parameter above the controller set point?

A. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller set point, at which time the output signal stops increasing.

B. The controller will develop an output signal that will remain directly proportional to the difference between the controlled parameter and the controller set point.

C. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller set point, at which time the output signal becomes zero.

D. The controller will develop an output signal that will remain directly proportional to the rate of change of the controlled parameter.

ANSWER: A.

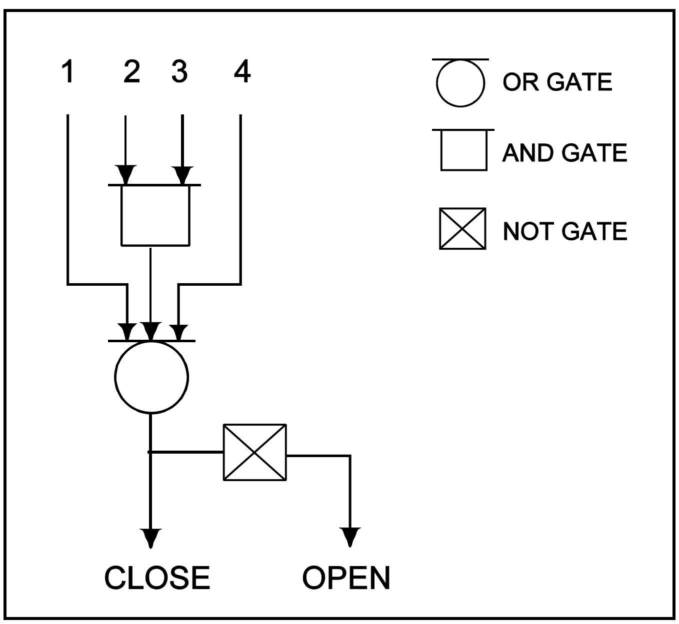
TOPIC: 191003
KNOWLEDGE: K1.08 [2.1/2.6]
QID: P5409 (B5408)

Refer to the valve controller logic diagram (see figure below).

Which one of the following combinations of inputs will result in the valve receiving an open signal?

	INPUTS			
	1.	2.	3.	4.
A.	On	Off	On	On
B.	Off	On	Off	Off
C.	On	Off	Off	On
D.	Off	On	On	Off

ANSWER: B.



TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P818 (B1317)

The water level in a tank is being controlled by an automatic level controller and is initially at the controller setpoint. A drain valve is then opened, causing tank level to decrease. The decreasing level causes the controller to begin to open a makeup water supply valve. After a few minutes, a new steady-state tank level below the original level is established, with the supply rate equal to the drain rate.

The controller in this system uses __________ control.

A. proportional integral, and derivative

B. proportional and integral

C. proportional only

D. bistable

ANSWER: C.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P917 (B1015)

A proportional-derivative controller senses an increase in the controlled parameter above the controller set point. The derivative function causes the controller output signal to...

A. increase until the controlled parameter equals the controller set point, at which time the output signal becomes constant.

B. remain directly proportional to the difference between the controlled parameter and the controller set point.

C. increase until the controlled parameter equals the controller set point, at which time the output signal becomes zero.

D. change at a rate that is directly proportional to the rate of change of the controlled parameter.

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P918 (B2615)

In a proportional controller, the term "offset" refers to the difference between the...

A. control point and set point.

B. control point and proportional band.

C. deadband and set point.

D. deadband and proportional band.

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P1016 (B1915)

The level in a tank is controlled by an automatic control system. Level is initially at its setpoint. A drain valve is then opened, causing tank level to begin to decrease. The decreasing level causes the controller to begin to open a makeup supply valve. After a few minutes, with the drain valve still open, level is again constant at the setpoint.

The controller in this system uses primarily ______________ control.

A. integral

B. on-off

C. derivative

D. proportional

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P1219 (B1516)

The level in a tank is controlled by an automatic level controller. Level is initially at the setpoint when a drain valve opens. When level decreases to 5% below setpoint the level controller opens a makeup supply valve. After a few minutes level is 5% above setpoint and the makeup valve closes. With the drain valve still open, level continues to oscillate 5% above and below the setpoint.

The controller in this system uses primarily ____________ control.

A. integral

B. bistable

C. derivative

D. proportional

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P1417 (B2215)

Which one of the following controller types is designed to maintain the measured parameter at the controller set point?

A. Integral

B. Proportional

C. On-Off

D. Derivative

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P2319 (B2315)

The level in a drain collection tank is being controlled by an automatic level controller and is initially at the controller set point. Flow rate into the tank increases, causing tank level to increase. The increasing level causes the controller to throttle open a tank drain valve. After a few minutes, a new, steady-state tank level above the original level is established, with the drain flow rate equal to the supply flow rate.

The controller in this system uses __________ control.

A. on-off

B. proportional

C. proportional plus integral

D. proportional plus integral plus derivative

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P2419 (B2415)

The level in a drain collection tank is being controlled by an automatic level controller and level is initially at the controller set point. Flow rate into the tank causes tank level to increase. The increasing level causes the controller to fully open a tank drain valve. When level decreases below the setpoint, the controller closes the drain valve. Tank level continues to be controlled in this manner within a narrow band above and below the setpoint.

The controller in this system uses __________ control.

A. on-off

B. proportional

C. proportional plus integral

D. proportional plus integral plus derivative

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P2519 (B2515)

The temperature of the water in a small outside storage tank is controlled by a set of heaters submerged in the tank. The heaters energize at a water temperature of 40°F and deenergize at 48°F. When the heater set is energized, the tank heatup rate averages 2°F/minute in the operating range between 40°F and 48°F.

Which one of the following types of control devices is used in the heater control circuit to produce these characteristics?

A. Bistable

B. Proportional

C. Proportional Integral

D. Proportional Derivative

ANSWER: A.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P2819 (B2815)

The level in a drain collection tank is being controlled by an automatic level controller and is initially at the controller set point. Flow rate into the tank increases, slowly at first, and then faster until a stable higher flow rate is attained.

As tank level increases, the controller slowly opens a tank drain valve. The level controller output signal increases both as the tank level increases and as the rate of tank level change quickens. After a few minutes, a new, steady-state tank level above the original level is established, with the drain flow rate equal to the supply flow rate.

The controller in this system uses __________ control.

A. proportional only

B. proportional plus derivative

C. proportional plus integral

D. proportional plus integral plus derivative

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P2919 (B3116)

The level in a drain collection tank is being controlled by an automatic level controller and is initially at the controller set point. Flow rate into the tank increases, slowly at first, and then faster until a stable high flow rate is attained.

As tank level increases, the controller slowly opens a tank drain valve. The level controller output signal increases both as the tank level increases and as the rate of tank level change quickens. After a few minutes, tank level returns to and remains at the original level with the drain flow rate equal to the supply flow rate.

The controller in this system uses __________ control.

A. proportional only

B. proportional plus derivative only

C. proportional plus integral only

D. proportional plus integral plus derivative

ANSWER: D.

TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P3319 (B3316)

Refer to the drawing of a water storage tank with a level control system (see figure below). The tank water level is being automatically controlled at 50% by a proportional-integral (PI) controller that positions the drain valve. Tank water level is currently stable with 500 gpm entering the tank and the drain valve 50% open.

Tank inlet flow rate suddenly increases to 700 gpm and remains constant. When tank water level stabilizes, level will be ____________, and the drain valve position will be ____________.

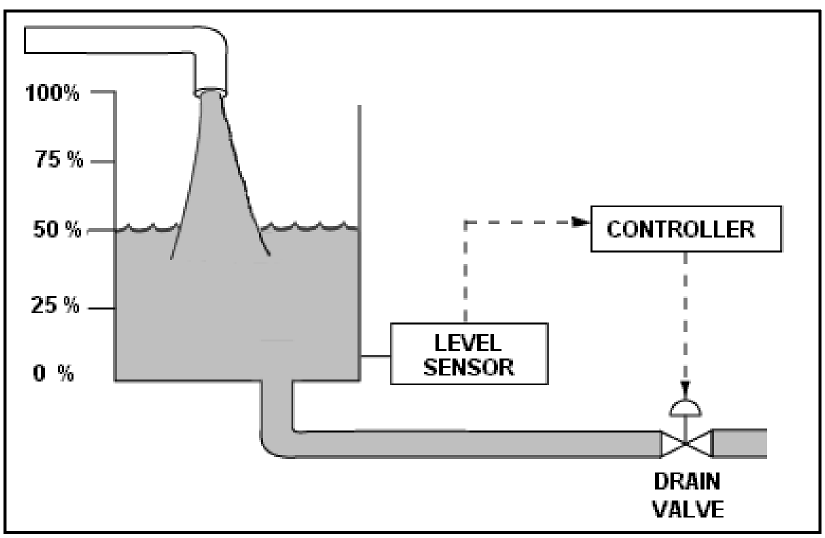
A. higher than 50%; more open

B. higher than 50%; the same

C. 50%; more open

D. 50%; the same

ANSWER: C.



TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P3419 (B3415)

Refer to the drawing of a water storage tank with a level control system (see figure below). The tank water level is being automatically controlled at 50% by a proportional-integral (PI) controller that positions the drain valve. Tank water level is currently stable with 500 gpm entering the tank and the drain valve 50% open.

The tank suddenly develops a constant 200 gpm leak, while the input flow rate remains constant at 500 gpm. When tank water level stabilizes, level will be ____________, and the drain valve position will be ____________.

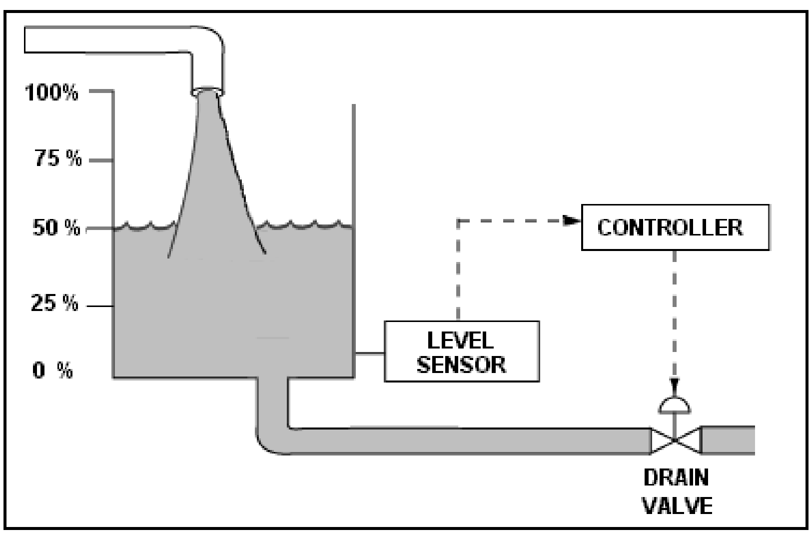
A. 50%; more open

B. 50%; more closed

C. lower than 50%; more open

D. lower than 50%; more closed

ANSWER: B.



TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P3519 (B3515)

Refer to the drawing of a water storage tank with a level control system (see figure below).

The tank water level is being automatically controlled by a proportional-only controller with a setpoint of 50%. Tank water level is currently stable at 50% with 500 gpm entering the tank and the drain valve 50% open.

The tank suddenly develops a constant 200 gpm leak, while the input flow rate remains constant at 500 gpm. After the tank water level stabilizes, level will be ____________, and the drain valve position will be ____________.

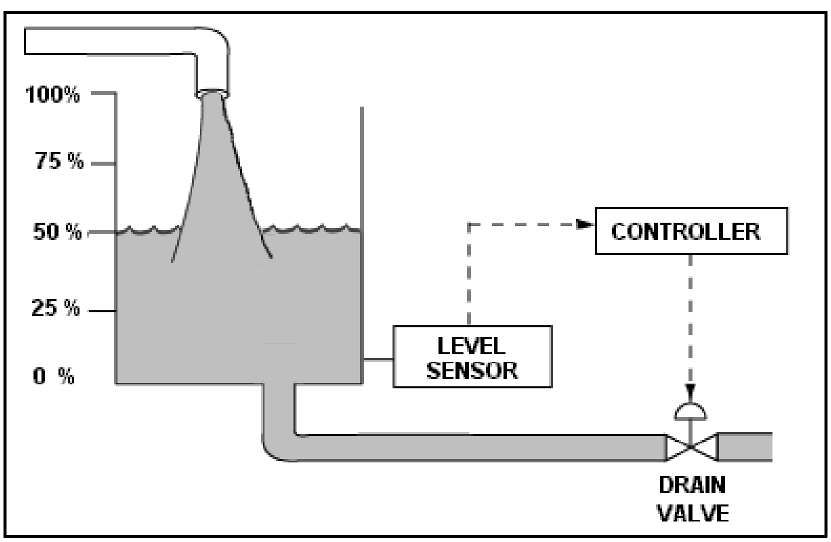
A. 50%; more than 50% open

B. 50%; less than 50% open

C. below 50%; more than 50% open

D. below 50%; less than 50% open

ANSWER: D.



TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P3818 (B3816)

Refer to the drawing of a water storage tank with a level control system (see figure below).

The tank water level is being automatically controlled by a proportional-only controller with a level setpoint of 50%. Tank water level is currently stable at 50% with 500 gpm entering the tank and the drain valve 50% open.

The tank input flow rate suddenly increases to 700 gpm. After the tank water level stabilizes, level will be ____________; and the drain valve position will be ____________.

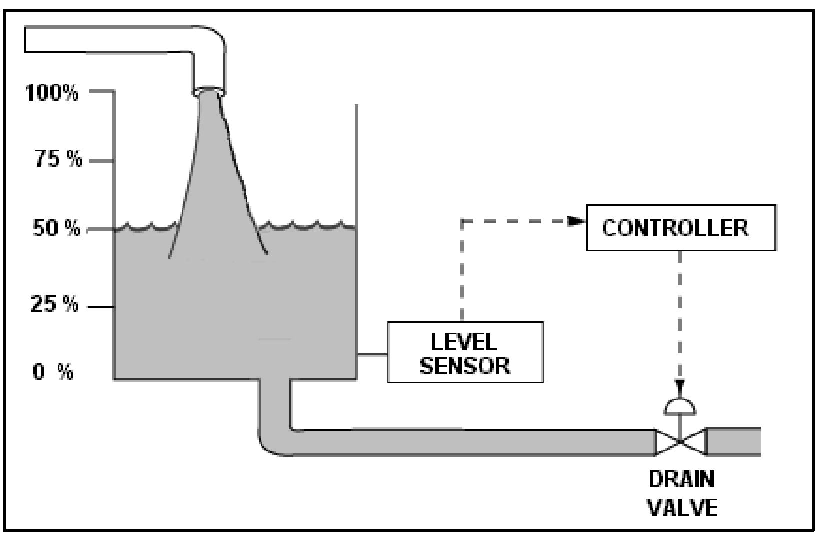
A. 50%; more than 50% open

B. 50%; 50% open

C. above 50%; more than 50% open

D. above 50%; 50% open

ANSWER: C.



TOPIC: 191003
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P4008

A system pressure controller has the following features:

- The controller output signal is null when the differential pressure (ΔP) between the pressure setpoint and the actual system pressure is zero.
- The controller output signal increases linearly with the ΔP.
- The controller output signal is <u>not</u> affected by the rate of change of the ΔP.
- The controller output signal is <u>not</u> affected by the length of time the ΔP exists.

Which one of the following lists the type(s) of control used by the controller described above?

A. Bistable only

B. Proportional only

C. Proportional plus integral

D. Proportional plus derivative

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.11 [2.8/2.9]
QID: P20

What precaution must be observed when transferring a valve controller from the automatic mode to the manual mode of control?

A. Ensure that a substantial deviation is established between the automatic and manual valve controller outputs.

B. Ensure that the automatic and manual valve controller outputs are matched.

C. Ensure that the automatic valve controller output is increasing before transferring to the manual mode of control.

D. Ensure that the automatic valve controller output is decreasing before transferring to the manual mode of control.

ANSWER: B.

TOPIC: 191003
KNOWLEDGE: K1.11 [2.8/2.9]
QID: P220 (B1502)

Prior to shifting a valve controller from automatic to manual control, why should the automatic and manual controller output signals be matched?

A. To ensure the valve will operate in manual control upon demand.

B. To ensure valve position indication is accurate in manual control.

C. To move the valve to the new position prior to the transfer.

D. To prevent a sudden valve repositioning during the transfer.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P21

Which one of the following contains indications of cavitation for an operating centrifugal pump?

A. Low flow rate with low discharge pressure

B. Low flow rate with high discharge pressure

C. High motor amps with low discharge pressure

D. High motor amps with high discharge pressure

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P221 (B218)

Which of the following changes in pump operating parameters will <u>directly</u> lead to pump cavitation in a centrifugal pump that is operating at rated conditions in an open system?

A. Steadily increasing pump inlet temperature

B. Steadily decreasing pump speed

C. Steadily increasing pump suction pressure

D. Steadily decreasing pump recirculation flow

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P421

Pump cavitation occurs when vapor bubbles are formed at the eye of a pump impeller...

A. when the localized flow velocity exceeds sonic velocity for the existing fluid temperature.

B. when the localized pressure exceeds the vapor pressure for the existing fluid temperature.

C. and enter a high pressure region of the pump where they collapse, causing damaging pressure pulsations.

D. and are discharged from the pump where they collapse in downstream piping, causing damaging pressure pulsations.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P524

Which one of the following is a symptom associated with cavitation of a centrifugal pump?

A. Decreased motor current and pump speed

B. Decreased pump and motor temperature

C. Steadily increasing discharge pressure

D. Increased noise and vibration

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P1021

Which one of the following will result in immediate cavitation of a centrifugal pump that is initially operating at normal rated flow?

A. Recirculation flow path is aligned.

B. Recirculation flow path is isolated.

C. Pump suction valve is fully closed.

D. Pump discharge valve is fully closed.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P1220 (B1218)

Which one of the following describes pump cavitation?

A. Vapor bubbles are formed when the enthalpy difference between pump discharge and pump suction exceeds the latent heat of vaporization.

B. Vapor bubbles are formed in the eye of the pump impeller and collapse as they enter higher pressure regions of the pump.

C. Vapor bubbles are produced when the localized pressure exceeds the vapor pressure at the existing temperature.

D. Vapor bubbles are discharged from the pump where they collapse on downstream piping and cause localized water hammers.

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P1321

Which one of the following is an indication of pump cavitation?

A. Pump motor amps are pegged high.

B. Pump discharge pressure indicates zero.

C. Pump motor amps are fluctuating.

D. Pump discharge pressure indicates shut-off head.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P1520 (B1018)

If a centrifugal pump is started with the discharge valve fully open, versus throttled, the possibility of pump runout will _________ and the possibility of pump cavitation will _________.

A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.01 [3.3/3.5]
QID: P1820 (B1718)

By starting a centrifugal pump with the discharge valve throttled versus fully open, the possibility of pump runout is _______________ , and the possibility of pump cavitation is _______________ .

A. increased; decreased

B. increased; increased

C. decreased; decreased

D. decreased; increased

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.02 [3.1/3.4]
QID: P106

A centrifugal pump is started and the following indications are observed:

Oscillating flow
Oscillating discharge pressure
Oscillating amps

These indications are symptoms that the pump is experiencing...

A. excessive thrust.

B. cavitation.

C. runout.

D. wear ring failure.

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.02 [3.1/3.4]
QID: P222

The presence of air in a pump casing may result in ________when the pump is started.

A. vortexing

B. pump runout

C. pump overspeed

D. gas binding

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.02 [3.1/3.4]
QID: P920

Which one of the following contains indications of a gas/vapor bound motor-operated centrifugal pump that is operating in a cooling water system?

A. Fluctuating pump discharge pressure, reduced system flow rate, and increased pump motor current

B. Reduced system flow rate, increased pump motor current, and increased pump noise level

C. Increased pump motor current, increased pump noise level, and fluctuating pump discharge pressure

D. Increased pump noise level, fluctuating pump discharge pressure, and reduced system flow rate

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.03 [3.1/3.3]
QID: P1927 (B1821)

Which one of the following is an effective method for ensuring that a centrifugal pump remains primed and does not become gas bound during operation and after shutdown?

A. Install an orifice plate in the discharge piping of the pump.

B. Install a pump recirculation line from the pump discharge piping to the pump supply piping.

C. Install the pump below the level of the suction supply.

D. Install a check valve in the discharge piping of the pump.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P23 (B423)

A motor-driven centrifugal pump is operating under no flow conditions. Which one of the following damaging conditions will <u>first</u> occur during pump operation with no flow?

A. Pump failure from overspeed

B. Pump failure from overheating

C. Motor failure from overspeed

D. Motor failure from overheating

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P109 (B1823)

When a centrifugal pump is operating at shutoff head, it is pumping at ___________ capacity and ___________ discharge head.

A. maximum; maximum

B. maximum; minimum

C. minimum; maximum

D. minimum; minimum

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P119 (B1319)

Refer to the drawing of a centrifugal pump operating curve (see figure below).

Which point represents pump operation at shutoff head?

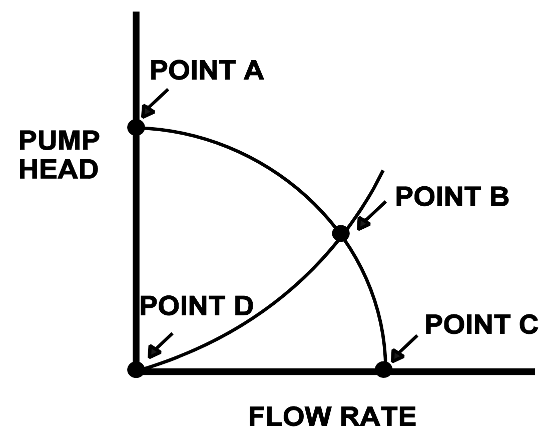
A. Point A

B. Point B

C. Point C

D. Point D

ANSWER: A.



CENTRIFUGAL PUMP CURVE

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P223

Operating a centrifugal pump at shutoff head without recirculation flow can directly result in...

A. discharge piping overpressure.

B. suction piping overpressure.

C. excessive pump leakoff.

D. pump overheating.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P321 (B319)

A motor-driven centrifugal pump with no recirculation flow path must be stopped when discharge pressure reaches the pump shutoff head to prevent...

A. overheating of the pump.

B. overheating of the motor.

C. bursting of the pump casing.

D. water hammer in downstream lines.

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P1222 (B1181)

A nuclear power plant is operating at full power when a 200 gpm reactor coolant leak occurs, which results in a reactor trip and initiation of emergency coolant injection. Reactor coolant system pressure stabilizes at 1,000 psia and all injection pumps are operating with their pump recirculation lines isolated. The shutoff heads for the pumps are as follows:

High pressure injection (HPI) pumps: 2,500 psia
Low pressure injection (LPI) pumps: 200 psia

Which pumps must be stopped quickly and why?

A. HPI pumps to prevent pump overheating caused by low flow.

B. LPI pumps to prevent pump overheating caused by low flow.

C. HPI pumps to prevent motor overheating caused by high flow.

D. LPI pumps to prevent motor overheating caused by high flow.

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P1320 (B1917)

Refer to the drawing of a pump with recirculation line (see figure below).

The flowpath through valve A is designed to...

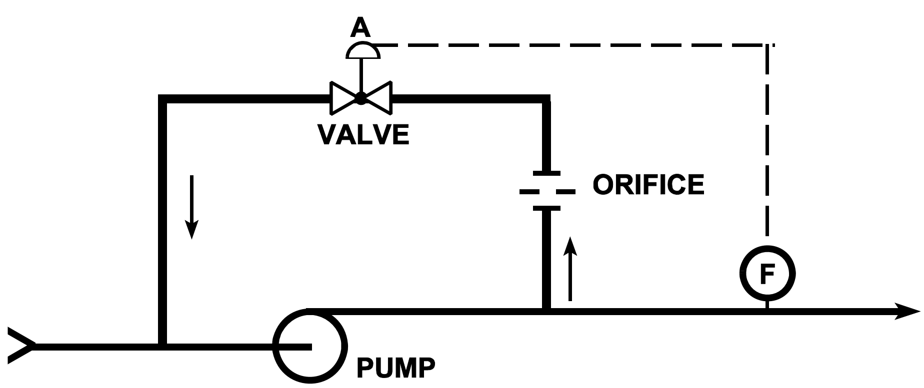
A. prevent pump runout by creating a recirculation flowpath.

B. provide a small flow rate through the pump during shutoff head conditions.

C. direct a small amount of water to the pump suction to raise available net positive suction head.

D. prevent the discharge piping from exceeding design pressure during no-flow conditions.

ANSWER: B.



PUMP WITH RECIRCULATION LINE

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P1423

Which one of the following is at a relatively high value when a centrifugal pump is operating at shutoff head?

A. Pump motor current

B. Pump volumetric flow rate

C. Available net positive suction head

D. Required net positive suction head

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P1523

Which one of the following describes centrifugal pump operating parameters at shutoff head?

A. High discharge pressure, low flow, low power demand

B. High discharge pressure, high flow, low power demand

C. Low discharge pressure, low flow, high power demand

D. Low discharge pressure, high flow, high power demand

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P1621

Which one of the following conditions applies to a centrifugal pump running at shutoff head?

A. The volumetric flow rate for the pump has been maximized.

B. Cavitation will occur immediately upon reaching shutoff head.

C. Available net positive suction head is at a maximum value for the existing fluid conditions.

D. Pump differential pressure is at a minimum value.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P1922

Which one of the following would result from operating a motor-driven centrifugal pump for extended periods of time with the discharge valve shut and no recirculation flow?

A. No motor damage, but the pump will overheat and may be damaged.

B. No motor damage, but the pump will overspeed and may be damaged.

C. No pump damage, but the motor will overspeed and the motor bearings may fail.

D. No pump damage, but the motor windings will draw excessive current and may fail.

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P2019 (B2017)

Refer to the drawing of a pump with recirculation line (see figure below).

Which one of the following describes the response of the pump if a complete flow blockage occurs in the discharge line just downstream of the flow transmitter?

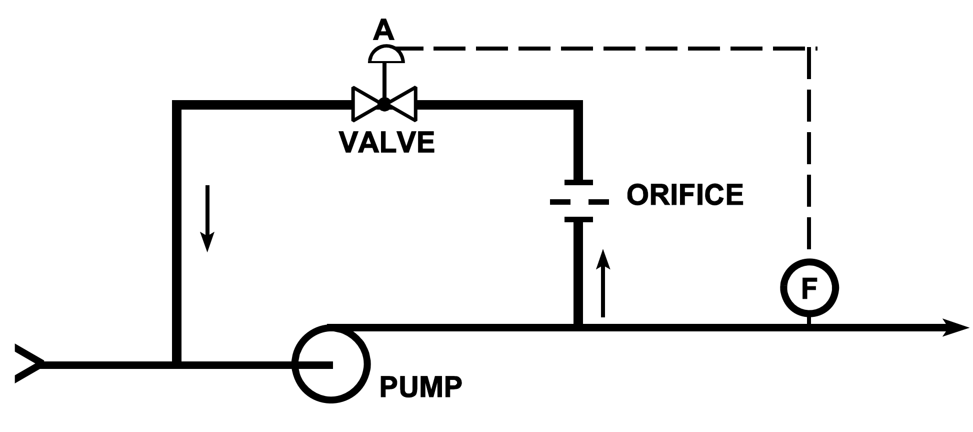
A. The pump will overheat after a relatively short period of time due to a loss of both main flow and recirculation flow.

B. The pump will overheat after a relatively long period of time due to a loss of main flow only.

C. The pump will overheat after a relatively long period of time due to a loss of recirculation flow only.

D. The pump will be able to operate under these conditions indefinitely due to sustained main flow.

ANSWER: B.



PUMP WITH RECIRCULATION LINE

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P2022 (B2018)

A variable-speed centrifugal fire water pump is taking a suction on an open storage tank and discharging through a 4-inch diameter fire hose and through a nozzle located 50 feet above the pump.

Which one of the following will cause the pump to operate at shutoff head?

A. The fire hose is replaced with a 6-inch diameter fire hose.

B. The fire hose is replaced with a 2-inch diameter fire hose.

C. Pump speed is increased until steam formation at the eye of the impeller prevents pump flow.

D. Pump speed is decreased until pump discharge pressure is insufficient to cause flow.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P2221 (B1219)

Refer to the drawing of a pump with a recirculation line (see figure below).

Valve "A" will open when pump...

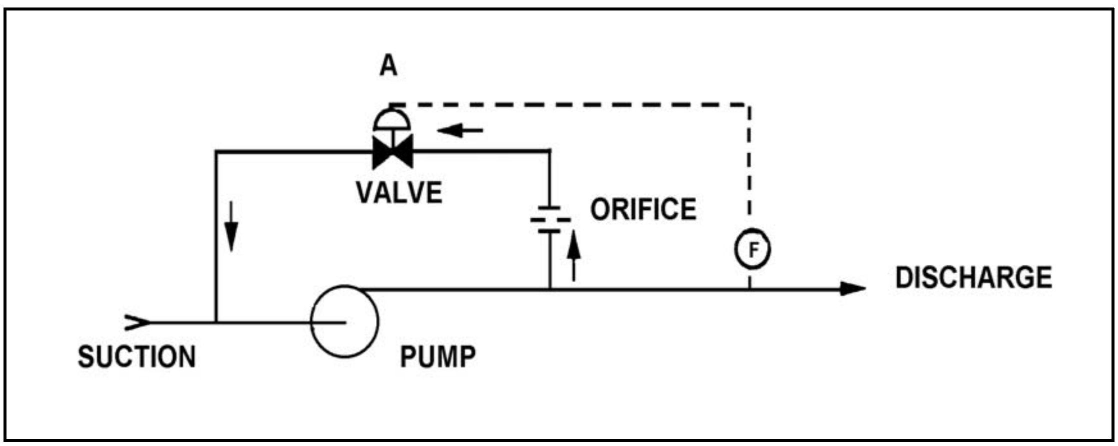
A. discharge pressure increases above a setpoint.

B. discharge pressure decreases below a setpoint.

C. flow rate increases above a setpoint.

D. flow rate decreases below a setpoint.

ANSWER: D.



TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P2322 (B520)

A centrifugal fire water pump takes a suction on an open storage tank and discharges through a fire hose. Which one of the following will cause the pump to operate at shutoff head?

A. Suction temperature is increased to the point that gas binding occurs.

B. Suction pressure is adjusted until available net positive suction head is reduced to zero feet.

C. Pump speed is adjusted to the value at which cavitation occurs.

D. The fire hose nozzle is raised to an elevation that prevents any flow.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P2721 (B2721)

A centrifugal fire water pump takes a suction on an open storage tank and discharges through a fire hose. Which one of the following will cause the pump to operate at shutoff head?

A. A firefighter inadvertently severs the fire hose.

B. The fire hose becomes completely crimped in a fire door.

C. Fire water storage tank level drops below the pump suction tap.

D. A firefighter adjusts the fire hose nozzle spray pattern from “deluge” to “fog.”

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P2820 (B3320)

A centrifugal fire water pump takes a suction on an open storage tank and discharges through a fire hose. Which one of the following will cause the pump to operate at shutoff head?

A. A firefighter inadvertently severs the fire hose.

B. The fire hose becomes partially crimped in a fire door.

C. Fire water storage tank level drops below the pump suction tap.

D. A firefighter adjusts the fire hose nozzle spray pattern from “deluge” to “off”.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.04 [3.3/3.4]
QID: P3122 (B2225)

Refer to the drawing of a pump with a recirculation line (see figure below).

Valve "A" will close when pump...

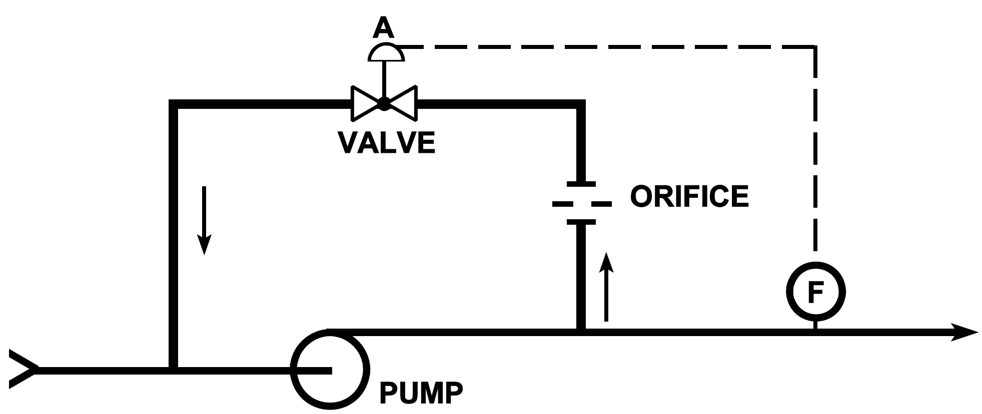
A. discharge pressure increases above a setpoint.

B. discharge pressure decreases below a setpoint.

C. flow rate increases above a setpoint.

D. flow rate decreases below a setpoint.

ANSWER: C.



PUMP WITH RECIRCULATION LINE

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P322 (B324)

The available net positive suction head for a pump may be expressed as...

A. suction pressure minus saturation pressure of the fluid being pumped.

B. suction pressure plus discharge pressure.

C. discharge pressure minus saturation pressure of the fluid being pumped.

D. discharge pressure minus suction pressure.

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P1120 (B121)

Which one of the following operations will cause a decrease in available net positive suction head for an operating centrifugal pump?

A. Decreasing the inlet fluid temperature

B. Increasing the pump discharge pressure

C. Increasing the pump suction pressure

D. Throttling open the pump discharge valve

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P1221 (B1621)

Refer to the drawing of a cooling water system (see figure below).

The available net positive suction head for the centrifugal pump will be increased by...

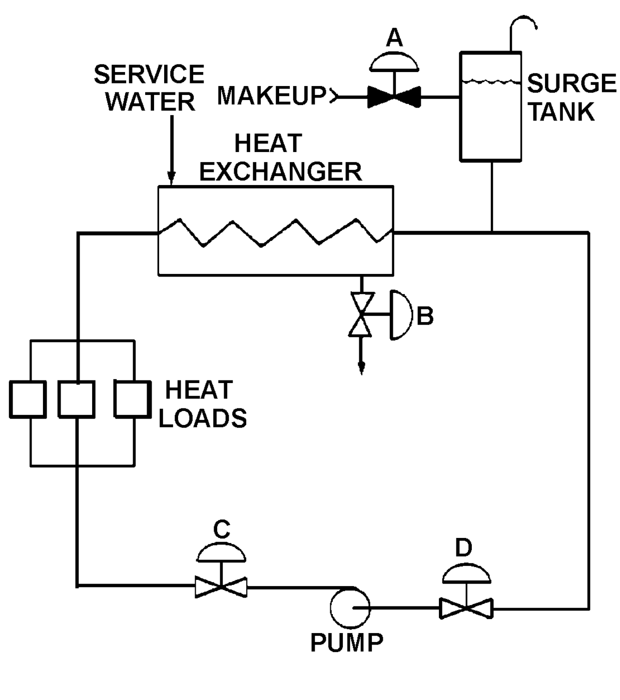
A. opening surge tank makeup valve "A" to raise tank level.

B. throttling heat exchanger service water valve "B" more closed.

C. throttling pump discharge valve "C" more open.

D. throttling pump suction valve "D" more closed.

ANSWER: A.



COOLING WATER SYSTEM

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P1521 (B1918)

Refer to the drawing of a cooling water system (see figure below).

The available net positive suction head for the centrifugal pump will be decreased by...

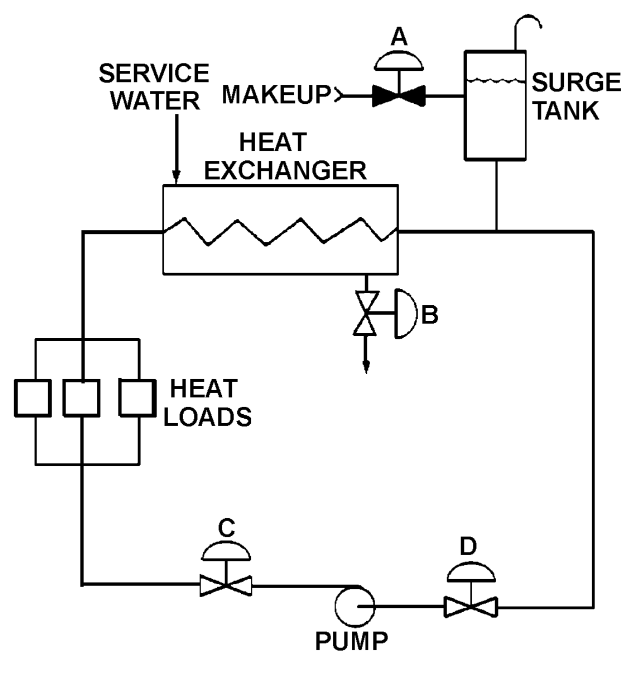
A. opening surge tank makeup valve "A" to raise tank level.

B. throttling heat exchanger service water valve "B" more open.

C. throttling pump discharge valve "C" more open.

D. reducing the heat load on the cooling water system.

ANSWER: C.



COOLING WATER SYSTEM

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P1822 (B2119)

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following will increase available net positive suction head for the centrifugal pump?

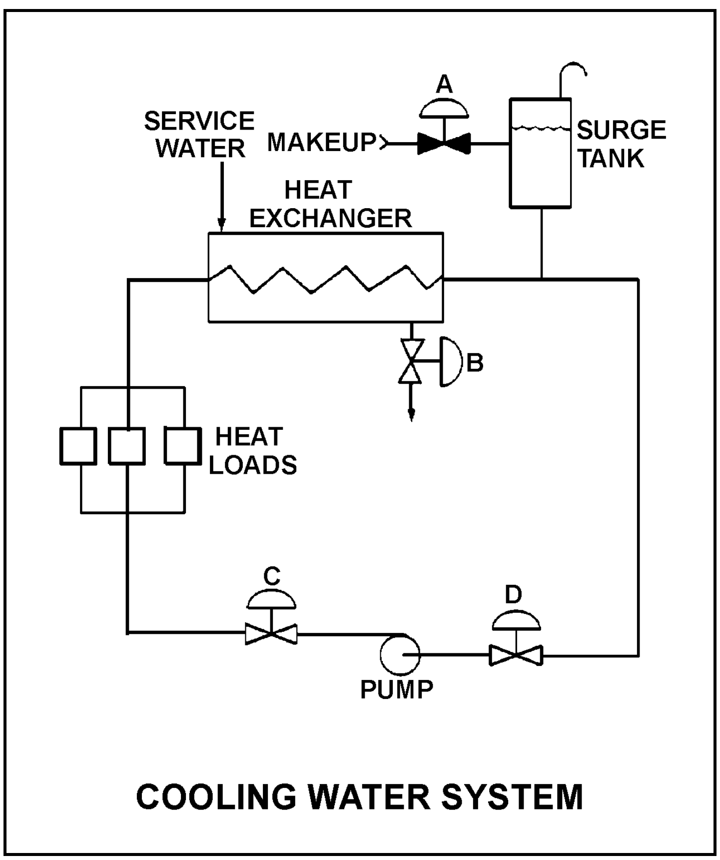
A. Draining the surge tank to decrease level by 10%.

B. Positioning heat exchanger service water valve "B" more closed.

C. Positioning pump discharge valve "C" more closed.

D. Positioning pump suction valve "D" more closed.

ANSWER: C.



TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P2222 (B2518)

Refer to the drawing of a cooling water system (see figure below).

The available net positive suction head for the centrifugal pump will be decreased by...

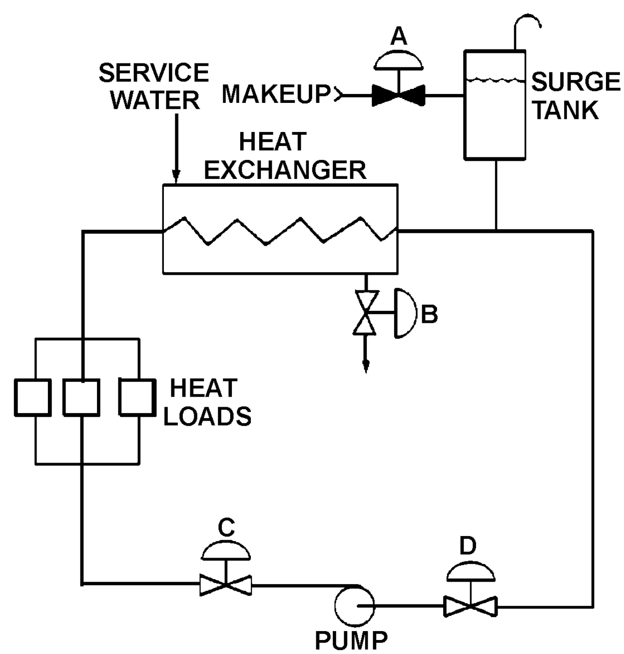
A. increasing surge tank level by 5 percent.

B. throttling heat exchanger service water valve "B" more open.

C. throttling pump discharge valve "C" more closed.

D. increasing the heat loads on the cooling water system.

ANSWER: D.



COOLING WATER SYSTEM

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P2323 (B2319)

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following will decrease available net positive suction head for the centrifugal pump?

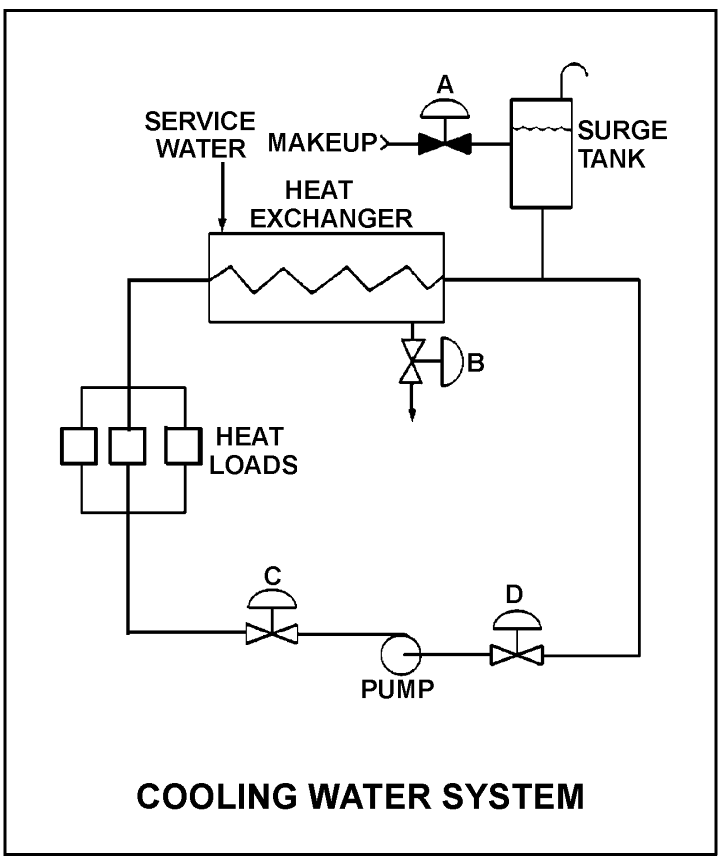
A. Adding water to the surge tank to raise level by 10%.

B. Positioning heat exchanger service water valve "B" more open.

C. Positioning pump discharge valve "C" more open.

D. Reducing heat loads on the cooling water system by 10%.

ANSWER: C.



TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P2621 (B2621)

A cooling water pump is operating with the following pump suction parameters:

Suction Temperature: 124°F
Suction Pressure: 11.7 psia

What is the approximate available net positive suction head (NPSH) for the pump? (Neglect the contribution of the suction fluid velocity to NPSH.)

A. 23 feet

B. 27 feet

C. 31 feet

D. 35 feet

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P2722 (B2722)

A centrifugal pump is operating at maximum design flow rate, taking suction on a vented water storage tank and discharging through two parallel valves. Valve "A" is fully open and valve "B" is half open.

Which one of the following will occur if valve "B" is fully closed?

A. The pump will operate at shutoff head.

B. The pump will operate at runout conditions.

C. The pump available net positive suction head will increase.

D. The pump required net positive suction head will increase.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P2921 (B2920)

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following will increase the available net positive suction head for the centrifugal pump?

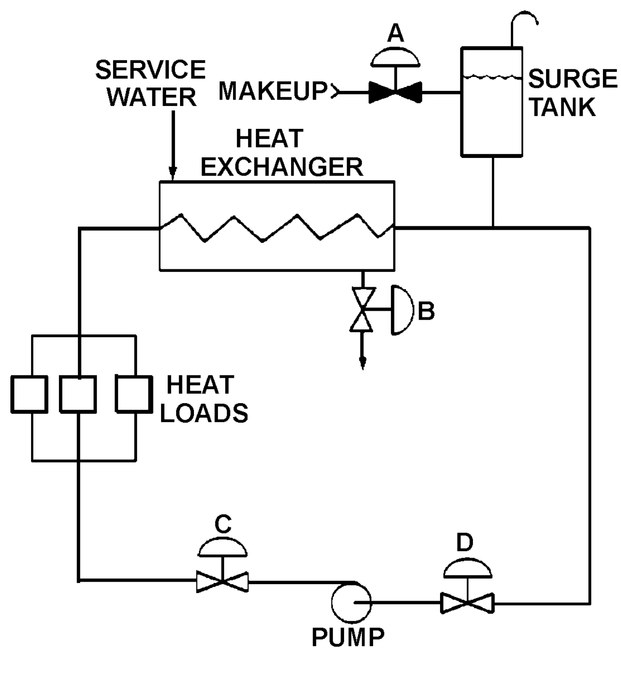
A. Draining the surge tank to decrease level by 10%.

B. Positioning the service water valve “B” more closed.

C. Positioning the pump discharge valve “C” more open.

D. Reducing the heat loads on the cooling water system.

ANSWER: D.



COOLING WATER SYSTEM

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P3020 (B3022)

A centrifugal pump is needed to take suction on a hot water storage tank and deliver high pressure hot water to a water spray system. To minimize axial thrust on the pump shaft, the pump should have __________ stage(s); and to maximize the available NPSH at the impeller inlet, the pump should be __________ suction.

A. a single; single

B. a single; double

C. multiple opposed; single

D. multiple opposed; double

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P3221 (B3219)

A centrifugal pump is taking suction on an open storage tank that has been filled to a level of 40 feet with 10,000 gallons of 60°F water. The pump is located at the base of the tank, takes a suction from the bottom of the tank, and discharges through a fire hose.

Given:

- The pump is currently operating at its design flow rate of 200 gpm and a total developed head of 150 feet.
- The pump requires 4 feet of net positive suction head (NPSH).

How will the centrifugal pump flow rate be affected as the water storage tank level decreases?

A. Flow rate will remain constant until the pump begins to cavitate at a tank level of about 4 feet.

B. Flow rate will remain constant until the pump becomes air bound when the tank empties.

C. Flow rate will gradually decrease until the pump begins to cavitate at a tank level of about 4 feet.

D. Flow rate will gradually decrease until the pump becomes air bound when the tank empties.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P4010 (B4011)

Refer to the drawing below of a centrifugal pump taking suction from the bottom of an open storage tank containing water at 66°F. Pump and water level elevations are indicated in the figure. Assume standard atmospheric pressure.

Assuming that pump suction fluid velocity head loss is negligible, what is the approximate value of net positive suction head available to the pump.

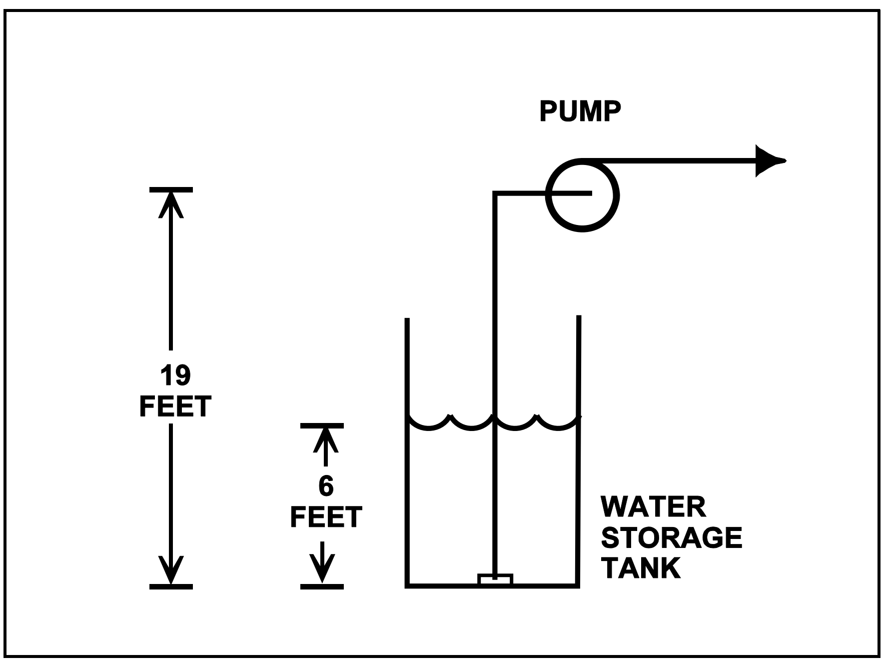
A. 6 feet

B. 13 feet

C. 20 feet

D. 25 feet

ANSWER: C.



TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P4110 (B4113)

Refer to the drawing of an elevated centrifugal pump taking suction from the bottom of an open storage tank containing water at 66°F (see figure below). Assume standard atmospheric pressure.

The pump requires 4.0 ft-lbf/lbm of net positive suction head (NPSH). Assume that pump suction fluid velocity head loss is negligible.

If tank water level is allowed to decrease continuously, at what approximate water level will the pump begin to cavitate?

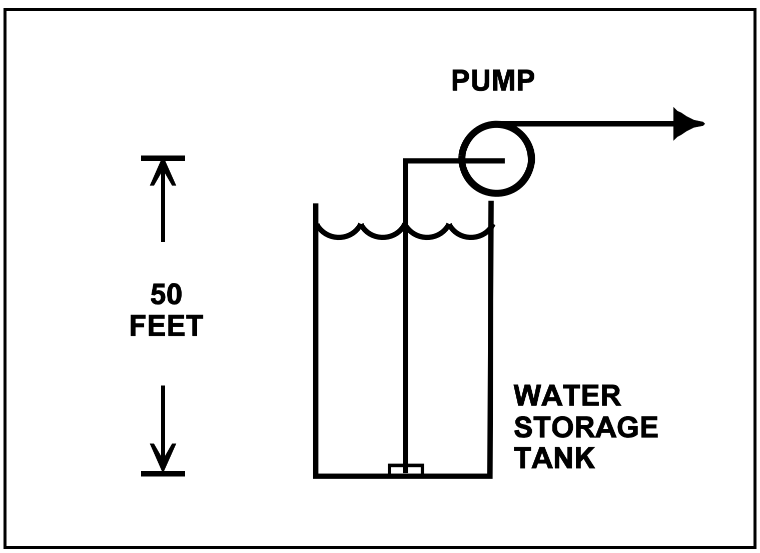
A. 34 feet

B. 29 feet

C. 21 feet

D. 16 feet

ANSWER: C.



TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P4410 (B4410)

Refer to the drawing below of a centrifugal pump taking suction from the bottom of an open storage tank containing water at 66°F. Pump and water level elevations are indicated in the figure. Assume standard atmospheric pressure.

Assuming that pump suction fluid velocity head loss is negligible, what is the approximate value of net positive suction head available to the pump.

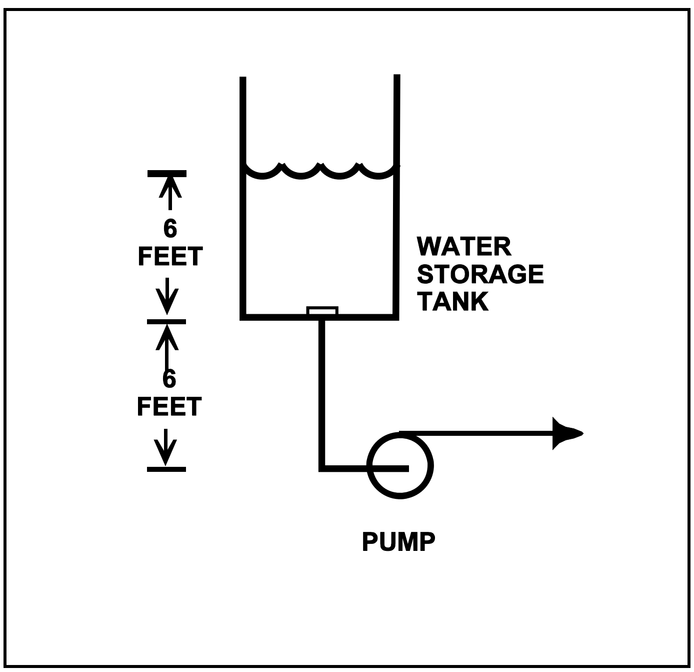
A. 6 feet

B. 12 feet

C. 39 feet

D. 45 feet

ANSWER: D.



TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P5211 (B5210)

Consider a centrifugal pump that is taking suction from the bottom of an open water storage tank. (See figure below.)

Given:

The tank contains 60°F water.
The eye of the pump impeller is located 50 feet above the bottom of the tank.
The pump requires a minimum net positive suction head of 4 feet.

Which one of the following describes the effect on pump operation if tank water level is allowed to continuously decrease?

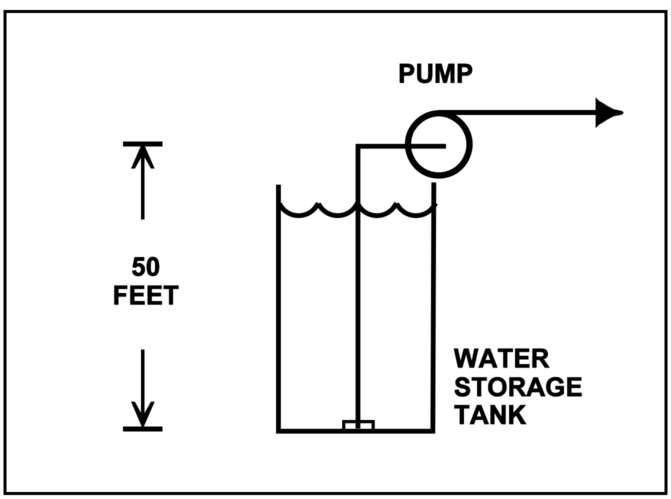
A. The pump will operate normally until tank water level decreases below approximately 20 feet, at which time the pump will cavitate.

B. The pump will operate normally until tank water level decreases below approximately 16 feet, at which time the pump will cavitate.

C. The pump will operate normally until the pump suction becomes uncovered, at which time the pump will cavitate.

D. The pump will operate normally until the pump suction becomes uncovered, at which time the pump will become air bound.

ANSWER: A.



TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P5511 (B5510)

Refer to the drawing of a steam condenser, hotwell, and condensate pump (see figure below).

Given the following:

- The eye of the pump impeller is located 6.0 feet below the bottom of the hotwell.
- The pump requires 10.0 ft-lbf/lbm of net positive suction head (NPSH).
- Condenser pressure is 1.2 psia.
- Hotwell water temperature is 90°F.
- Fluid velocity and friction head losses are zero.

What is the minimum hotwell water level necessary to provide the required NPSH?

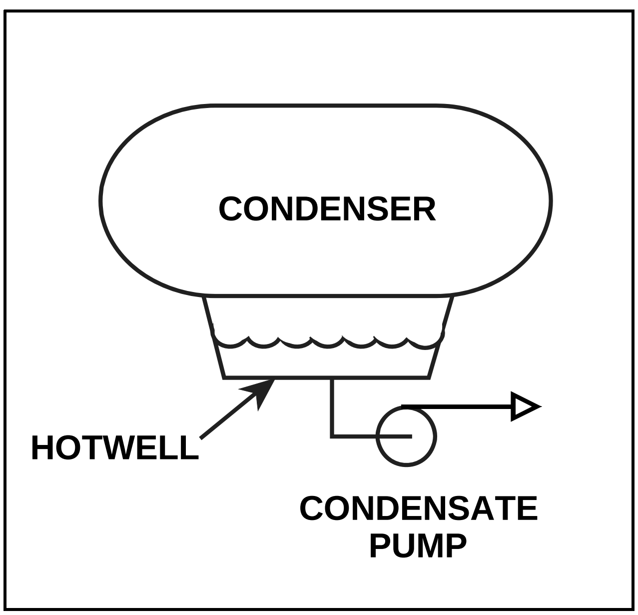
A. 1.2 feet

B. 2.8 feet

C. 4.0 feet

D. 5.2 feet

ANSWER: B.



TOPIC: 191004
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P5611 (B5610)

A centrifugal pump is taking suction on a water storage tank and delivering the makeup water to a cooling water system. The pump will have the lowest net positive suction head requirement if the pump is operated at a relatively __________ speed with a __________ discharge flow control valve.

A. high; fully open

B. high; throttled

C. low; fully open

D. low; throttled

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P24

Shutting the discharge valve on an operating centrifugal pump will cause the motor amps to ______________ and the pump discharge pressure to _______________.

A. increase, increase

B. decrease, increase

C. increase, decrease

D. decrease, decrease

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P117

When starting an ac motor-driven centrifugal pump, the response of motor current will be...

A. low starting amps, increasing to a higher equilibrium running amperage.

B. low starting amps, remaining at a low equilibrium running amperage.

C. high starting amps, decreasing to a lower equilibrium running amperage.

D. high starting amps, remaining at a high equilibrium running amperage.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P224

A constant-speed radial-flow centrifugal pump motor draws the <u>least</u> current when the pump is...

A. at runout conditions.

B. at operating conditions.

C. accelerating to normal speed during start.

D. at shutoff head.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P424

A centrifugal pump is circulating water at 100°F in a cooling water system. After several hours the water temperature has increased to 150°F. Assuming system flow rate (gpm) is constant, pump motor amps will have _______________ because _______________.

A. decreased; water density has decreased

B. decreased; water volume has increased

C. increased; water density has decreased

D. increased; water volume has increased

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P821

Refer to the drawing of an operating cooling water system (see figure below).

The pump is circulating 200°F water. Several hours later, after system cooldown and no lineup changes, the pump is circulating 120°F water.

During the system cooldown, pump motor current has...

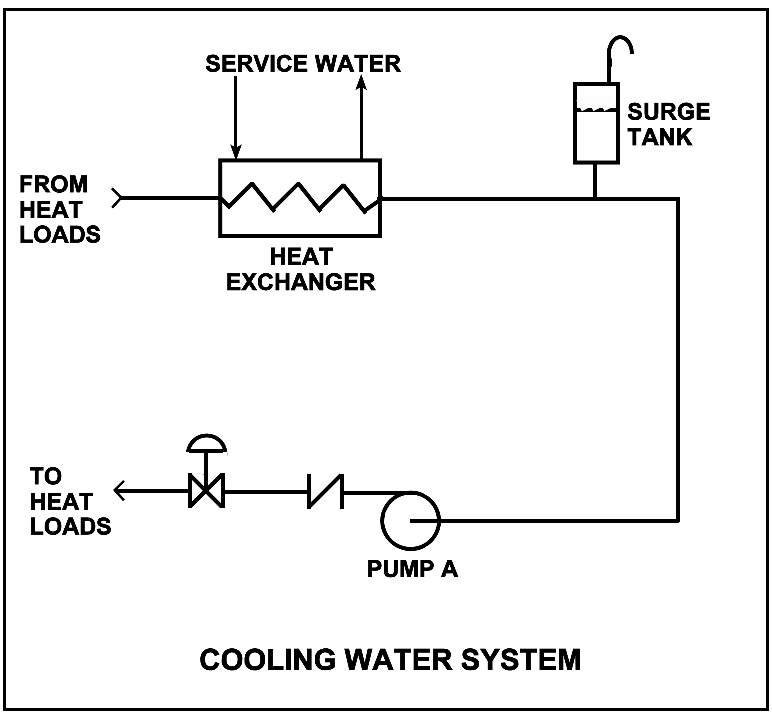
A. decreased because water density has increased.

B. increased because water density has increased.

C. decreased because pump motor efficiency has decreased.

D. increased because pump motor efficiency has decreased.

ANSWER: B.



TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P923

A centrifugal pump is operating in a closed system with all valves fully open. If the pump discharge valve is throttled 75% closed, pump motor current will...

A. increase and stabilize at a higher value.

B. decrease and stabilize at a lower value.

C. increase briefly, then return to original value.

D. decrease briefly, then return to original value.

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P1223

Which one of the following centrifugal pump operating conditions will result in the most current being drawn by the pump ac motor?

A. Pump discharge head is at shutoff head.

B. The pump is operating at minimum flow.

C. Pump discharge head is at design head.

D. The pump is operating at runout.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P1420 (B2219)

A centrifugal pump is circulating water at 150°F in a cooling water system. After several hours the water temperature has decreased to 100°F. Assuming system flow rate (gpm) is constant, pump motor amps will have _______________ because _______________ has increased.

A. increased; water density

B. decreased; water density

C. increased; motor efficiency

D. decreased; motor efficiency

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P1622 (B922)

An ac induction motor-driven centrifugal pump is circulating water at 180°F with a motor current of 100 amps. After several hours, system temperature has changed such that the water density has increased by 4%.

Assuming pump head and volumetric flow rate do not change, which one of the following is the new pump motor current?

A. 84 amps

B. 96 amps

C. 104 amps

D. 116 amps

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P1824 (B419)

Refer to the drawing of a cooling water system (see figure below).

The centrifugal pump is circulating water at 100°F. After several hours the water temperature has increased to 200°F. Assuming system flow rate (gpm) is constant, pump motor amps will have _______________ because _______________.

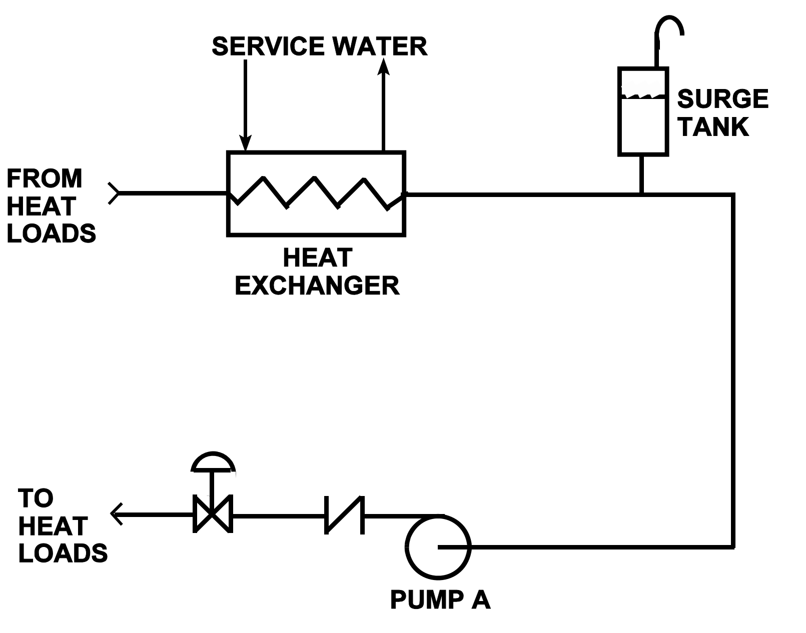
A. decreased; water density has decreased

B increased; water density has decreased

C. decreased; pump efficiency has increased

D. increased; pump efficiency has increased

ANSWER: A.



COOLING WATER SYSTEM

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P1924 (B115)

A constant-speed radial-flow centrifugal pump motor draws the <u>least</u> current when the pump is...

A. at maximum rated flow conditions.

B. operating on recirculation flow only.

C. accelerating to normal speed during start.

D. at shutoff head with no recirculation flow.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P2023 (B2020)

A reactor coolant pump (RCP) is circulating reactor coolant at 100°F. After several hours the reactor coolant temperature has increased to 150°F.

Assuming coolant flow rate (gpm) is constant, RCP motor amps will have _______________ because _______________.

A. decreased; coolant density has decreased

B. decreased; system head losses have increased

C. increased; coolant density has increased

D. increased; system head losses have decreased

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P2123 (B622)

A typical radial-flow centrifugal pump is operating at rated conditions in an open system with all valves fully open. If the pump discharge valve is throttled to 50% closed, pump discharge pressure will __________ and pump motor current will __________.

A. decrease; decrease

B. decrease; increase

C. increase; increase

D. increase; decrease

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P2124 (B2423)

A centrifugal pump in a cooling water system is circulating water at 180°F with a motor current of 200 amps. After several hours, system temperature has changed such that the water density has increased by 3%.

Assuming pump head remains the same, which one of the following is the new pump motor current?

A. 203 amps

B. 206 amps

C. 218 amps

D. 236 amps

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P2520 (B2520)

A constant-speed centrifugal pump motor draws the most current when the pump is...

A. at maximum rated flow conditions.

B. operating at runout flow.

C. accelerating to normal speed during start.

D. at shutoff head with no recirculation flow.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P2821 (B2822)

An ac motor-driven centrifugal pump was just started. During the start, motor current remained peaked for 6 seconds before decreasing to standard running current. Normally, the starting current peak lasts about 4 seconds.

Which one of the following could have caused the extended starting current peak?

A. The pump shaft was seized and did not turn.

B. The pump was initially rotating slowly in the reverse direction.

C. The pump discharge check valve was stuck closed and did not open.

D. The pump was initially air bound, and then primed itself after 6 seconds of operation.

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P2925 (B2921)

A centrifugal pump is circulating water at 180°F with a pump motor current of 200 amps. After several hours, system temperature has changed such that the water density has increased by 6%.

Assuming pump head and volumetric flow rate do not change, which one of the following is the new pump motor current?

A. 203 amps

B. 206 amps

C. 212 amps

D. 224 amps

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P3822 (B3820)

An ac motor-driven centrifugal water pump was just started. During the start, motor current remained peaked for 2 seconds, and then decreased and stabilized at about one-fifth the standard running current. Normally, the starting current peak lasts about 4 seconds.

Which one of the following could have caused the abnormal start indications above?

A. The pump shaft was initially seized and the motor breaker opened.

B. The pump was initially rotating slowly in the reverse direction.

C. The pump was initially air bound, and then primed itself after 2 seconds of operation.

D. The coupling between the motor and pump shafts was left unfastened after maintenance.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P4811 (B4811)

A centrifugal cooling water pump is driven by an ac induction motor. The pump can supply cooling water to several heat loads, all of which are in parallel alignment. The following pump conditions initially exist:

Pump motor current:	100 amps
Pump flow rate:	400 gpm
Pump suction temperature:	70°F

Four hours later, the motor is drawing 95 amps. Which one of the following could be responsible for the observed decrease in motor amps?

A. The temperature of the cooling water being pumped decreased to 60°F with <u>no</u> change in pump flow rate.

B. The temperature of the cooling water being pumped increased to 80°F with <u>no</u> change in pump flow rate.

C. Cooling water flow was established to an additional heat load with <u>no</u> change in the temperature of the cooling water being pumped.

D. Cooling water flow was isolated from an out-of-service heat load with <u>no</u> change in the temperature of the cooling water being pumped.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.08 [2.4/2.6]
QID: P225

Many larger centrifugal pumps are started with their discharge valves <u>closed</u> to prevent...

A. cavitation in the pump.

B. lifting the discharge relief valve.

C. loss of recirculation (miniflow).

D. excessive current in the pump motor.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.08 [2.4/2.6]
QID: P1325 (B1822)

Some large centrifugal pumps are interlocked so that the pump will not start unless its discharge valve is at least 90% fully closed. This interlock is provided to minimize the...

A. pump discharge pressure.

B. heating of the pumped fluid.

C. cavitation at the pump suction.

D. duration of the pump motor starting current.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.08 [2.4/2.6]
QID: P2622 (B821)

Which one of the following contains two reasons for starting a typical radial-flow centrifugal pump with the discharge piping full of water and the discharge valve shut?

A. Prevent pump runout and prevent motor overspeed

B. Prevent pump runout and ensure lubrication of pump seals

C. Prevent water hammer and ensure adequate pump recirculation flow

D. Prevent water hammer and prevent excessive starting current

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P323

Refer to the drawing of a cooling water system and the associated centrifugal pump operating curve (see figure below) in which pumps A and B are identical single-speed centrifugal pumps and only pump A is operating.

If pump B is started, system flow rate will be __________ and common pump discharge pressure will be __________.

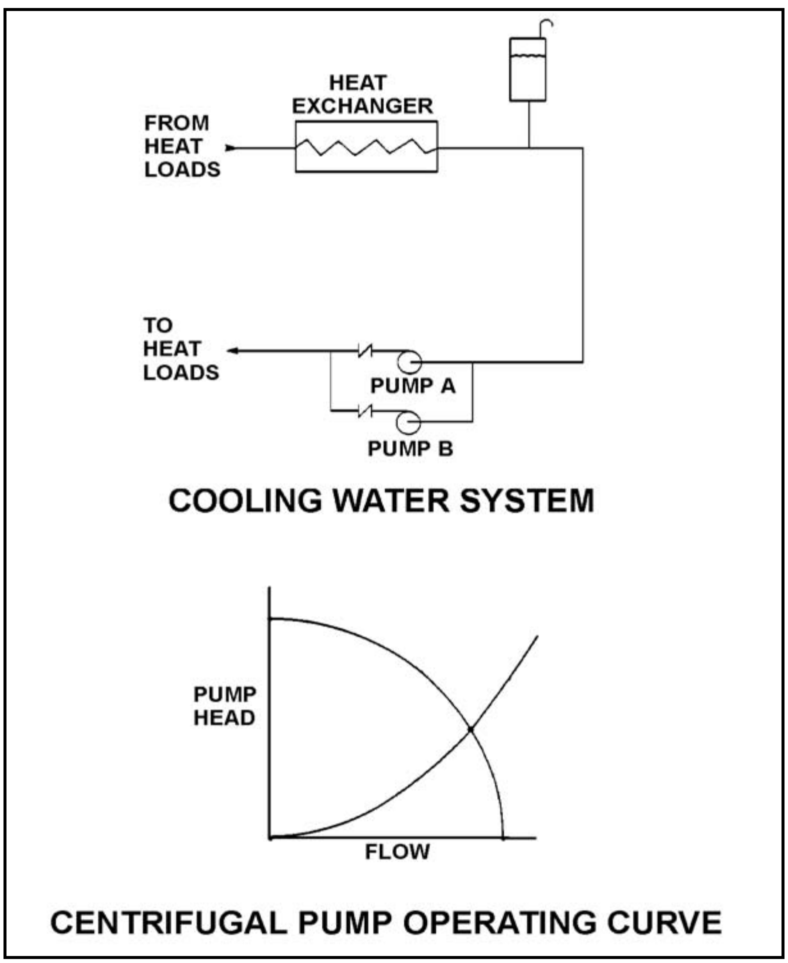
A. the same; higher

B. higher; the same

C. the same; the same

D. higher; higher

ANSWER: D.



TOPIC: 191004
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P1823

Refer to the drawing of a cooling water system and the associated centrifugal pump operating curve (see figure below).

Pumps A and B are identical single-speed centrifugal pumps, and only pump A is operating. If pump B is started, after the system stabilizes system flow rate will be...

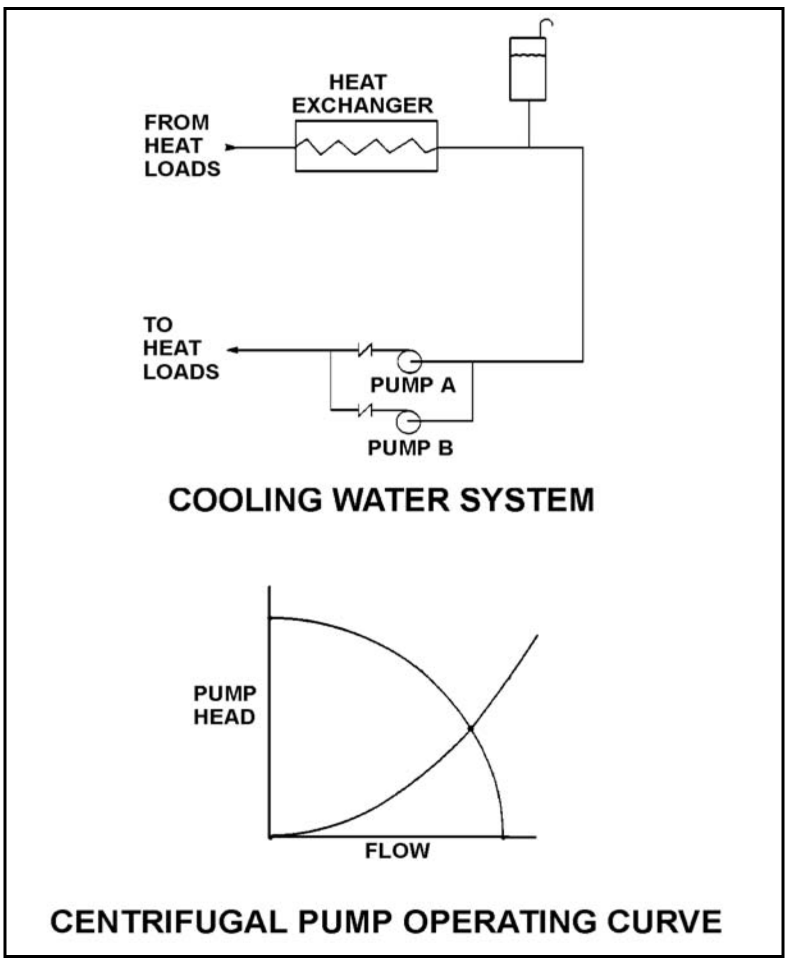
A. twice the original flow.

B. the same as the original flow.

C. less than twice the original flow.

D. more than twice the original flow.

ANSWER: C.



TOPIC: 191004
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P2223

A centrifugal pump is operating in parallel with a positive displacement pump in an open water system. Each pump has the same maximum design pressure.

If pump discharge pressure increases to the maximum design pressure of each pump, the centrifugal pump will be operating at _______________ flow and the positive displacement pump will be operating near _______________ flow.

A. minimum; minimum

B. minimum; maximum rated

C. maximum rated; minimum

D. maximum rated; maximum rated

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.09 [2.4/2.5]
QID: P2324

Refer to the drawing of a cooling water system (see figure below).

Pumps A and B are identical single-speed centrifugal pumps and both pumps are operating. If pump B trips, after the system stabilizes, system flow rate will be...

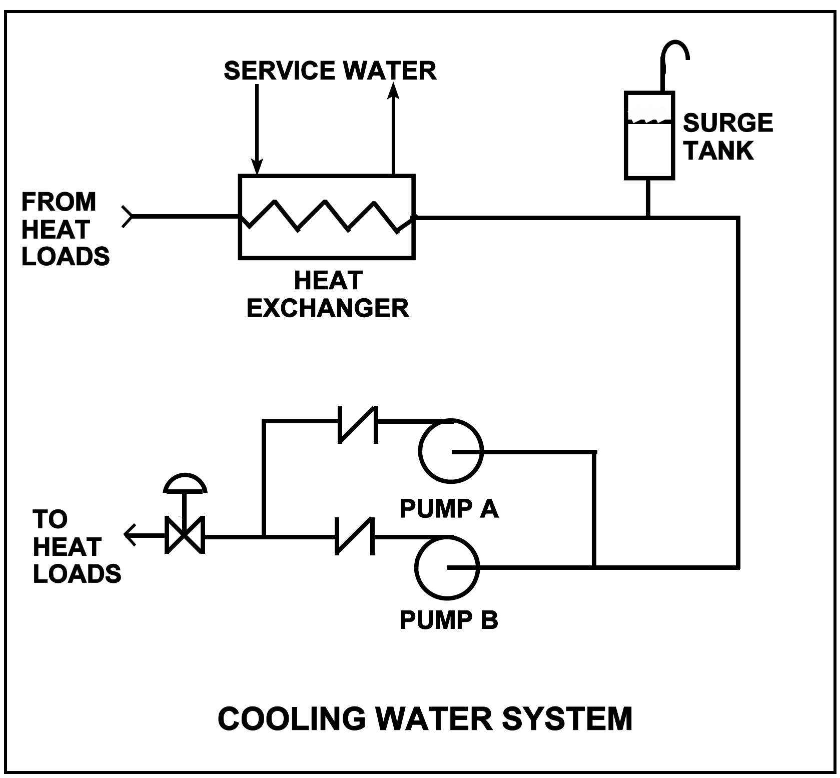
A. more than one-half the original flow.

B. one-half the original flow.

C. the same; only the pump head will change.

D. less than one-half the original flow.

ANSWER: A.



TOPIC: 191004
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P324

Which one of the following is an indication of pump runout?

A. Low pump flow rate

B. High pump vibration

C. Low pump motor current

D. High pump discharge pressure

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P823

Which one of the following is an indication of pump runout?

A. High discharge pressure

B. Low pump motor current

C. High pump flow rate

D. Pump flow reversal

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P1123 (B1920)

Which one of the following describes typical radial-flow centrifugal pump runout conditions?

A. High discharge pressure, low flow, high power demand

B. High discharge pressure, high flow, low power demand

C. Low discharge pressure, low flow, low power demand

D. Low discharge pressure, high flow, high power demand

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P1623 (B1323)

A centrifugal pump is operating at its maximum design flow rate, delivering water through two parallel valves. Valve "A" is half open, and valve "B" is one quarter open.

Which one of the following will occur if both valves are fully opened?

A. The pump will operate at shutoff head.

B. The pump available net positive suction head will increase.

C. The pump required net positive suction head will decrease.

D. The pump will operate at runout conditions.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P1721 (B1024)

Refer to the drawing of a centrifugal pump operating curve (see figure below).

Which point represents pump operation at runout conditions?

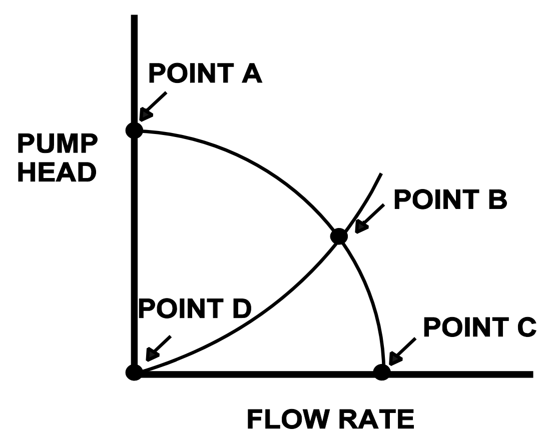
A. Point A

B. Point B

C. Point C

D. Point D

ANSWER: C.



CENTRIFUGAL PUMP CURVE

TOPIC: 191004
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P3910 (B3910)

Refer to the drawing of a cooling water system in which only centrifugal pump A is operating and the common pump discharge valve is currently 90% open (see figure below).

An abnormal total heat load on the cooling water system is causing pump A to approach operation at runout conditions. Which one of the following will cause pump A to operate farther away from runout conditions? (Assume that satisfactory available net positive suction head is maintained at all times.)

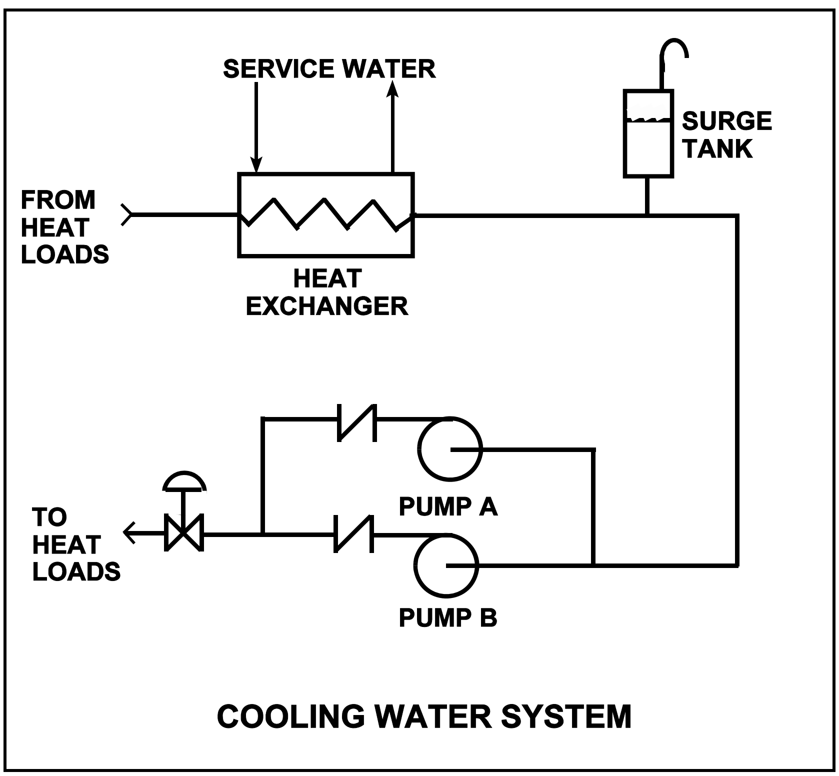
A. Starting pump B.

B. Positioning the discharge valve to 100% open.

C. Raising the water level in the surge tank by 2 feet.

D. Decreasing heat exchanger service water flow rate by 10%.

ANSWER: A.



TOPIC: 191004
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P5111 (B5111)

A flow-limiting venturi in the discharge piping of a centrifugal pump decreases the potential for the pump to experience...

A. runout

B. reverse flow

C. shutoff head

D. water hammer

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P623 (B1423)

Refer to the drawing of a lube oil temperature control system and the associated centrifugal pump operating curve (see figure on the following page).

If the pump is operating at point B on the operating curve, how will the operating point change if the temperature control valve modulates farther open?

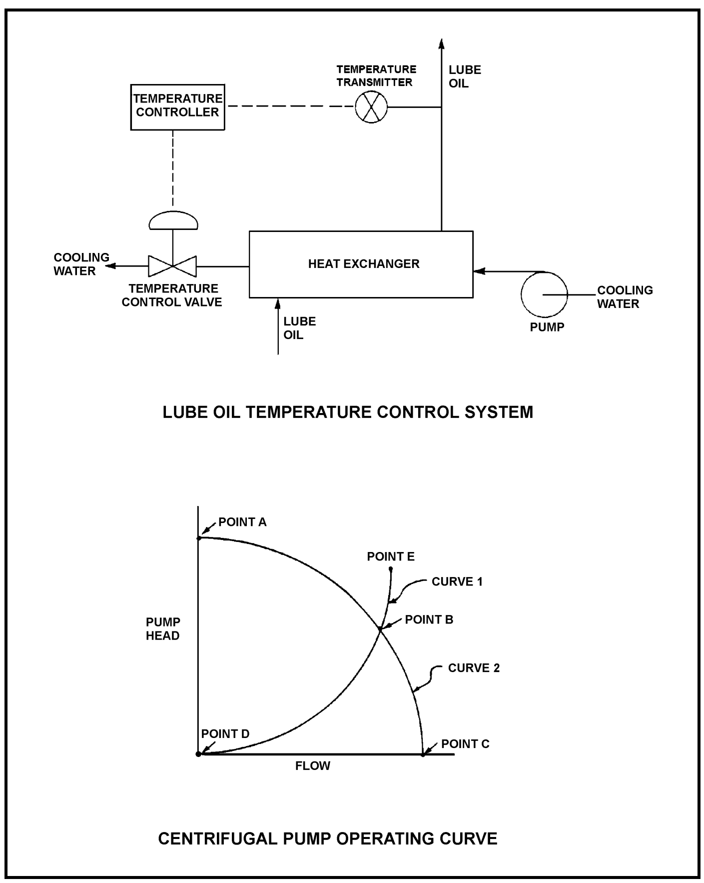
A. Operating point B will be located on curve 1 closer to point E.

B. Operating point B will be located on curve 1 closer to point D.

C. Operating point B will be located on curve 2 closer to point A.

D. Operating point B will be located on curve 2 closer to point C.

ANSWER: D.



TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P723 (B722)

Refer to the drawing of a lube oil temperature control system and the associated centrifugal pump operating curve (see figure below).

The pump is operating at point B on the operating curve. If the temperature control valve modulates farther closed, operating point B will be located on curve __________, closer to point ___________. (The options below assume that curves 1 and 2 are exactly as shown in the figure.)

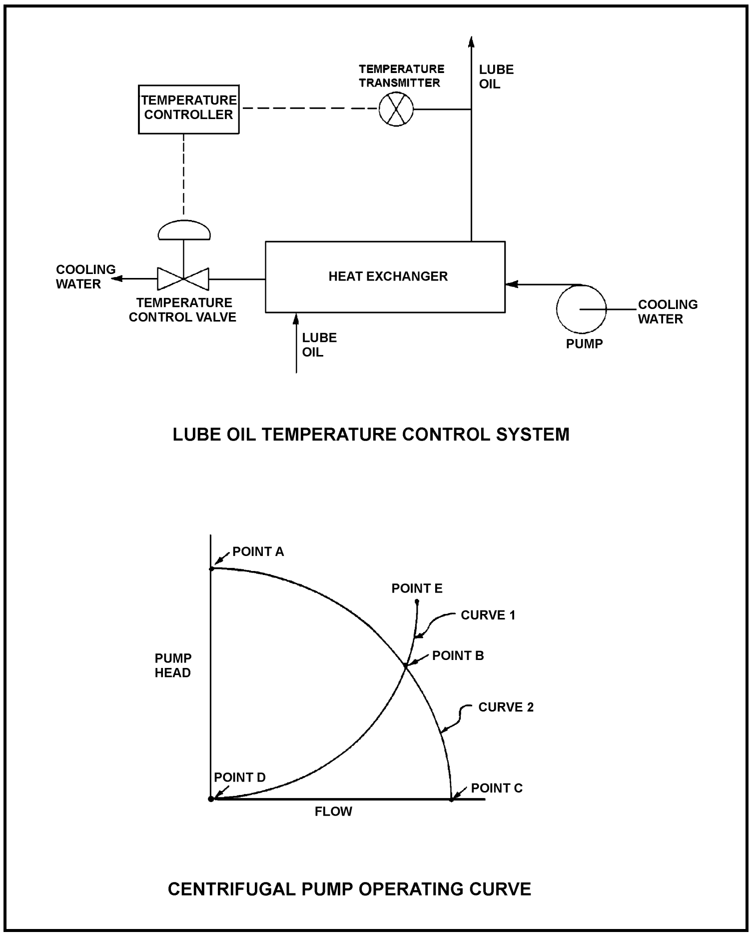
A. 1; D

B. 2; A

C. 1; E

D. 2; C

ANSWER: B.



LUBE OIL TEMPERATURE CONTROL SYSTEM

CENTRIFUGAL PUMP OPERATING CURVE

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P824

Refer to the drawing of four centrifugal pump operating curves (see figure below).

A centrifugal pump in a closed system is operating with a partially open discharge valve. The discharge valve is then opened fully. Which set of curves illustrates the initial and final operating conditions?

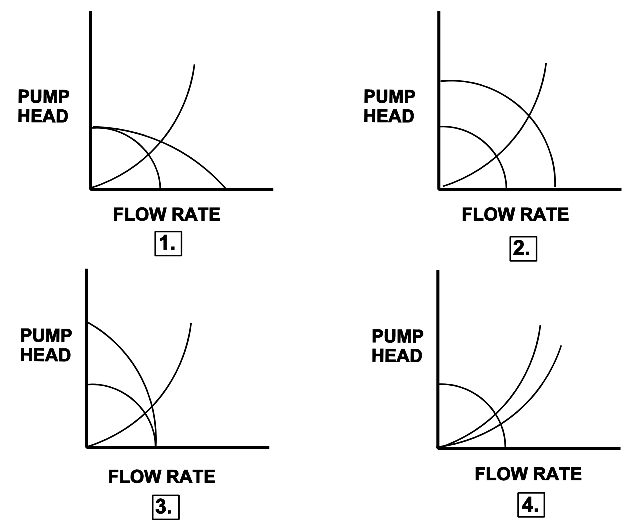
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: D.



CENTRIFUGAL PUMP CURVES

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P926 (B1578)

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows the combination of two pump/system operating conditions.

Two identical constant-speed centrifugal pumps are operating in series in an open system when one pump trips.

Which set of operating curves depicts the "before" and "after" conditions described above?

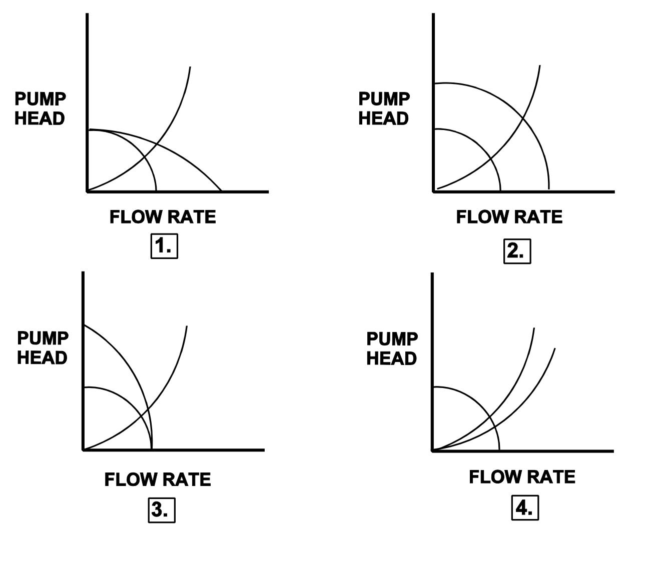
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: C.



CENTRIFUGAL PUMP CURVES

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P1324 (B2179)

Refer to the drawing of four centrifugal pump operating curves (see figure below).

A centrifugal pump is operating in a cooling water system. Another identical centrifugal pump is started in series with the first. Which set of curves illustrates the resulting change in system parameters?

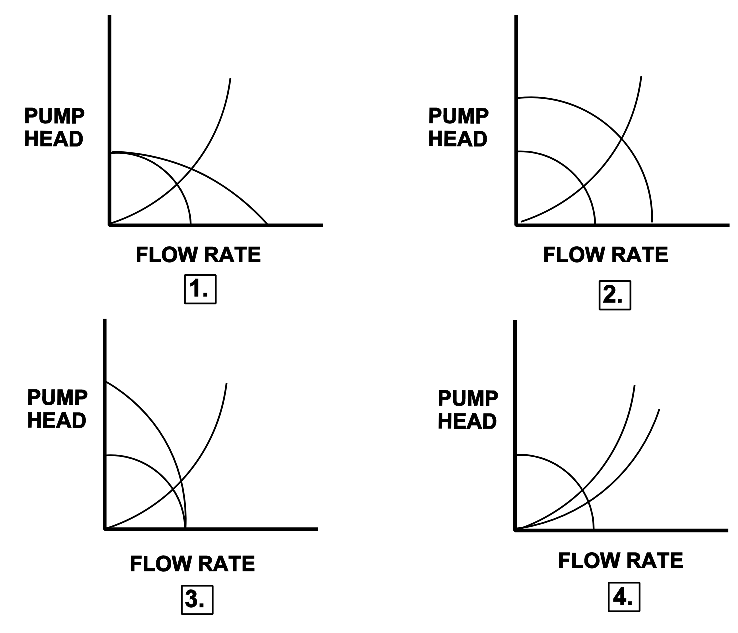
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: C.



CENTRIFUGAL PUMP CURVES

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P1524 (B2480)

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows the results of a change in pump/system operating conditions.

Two identical constant-speed centrifugal pumps are operating in parallel in an open system when one pump trips.

Which set of operating curves depicts the "before" and "after" conditions described above?

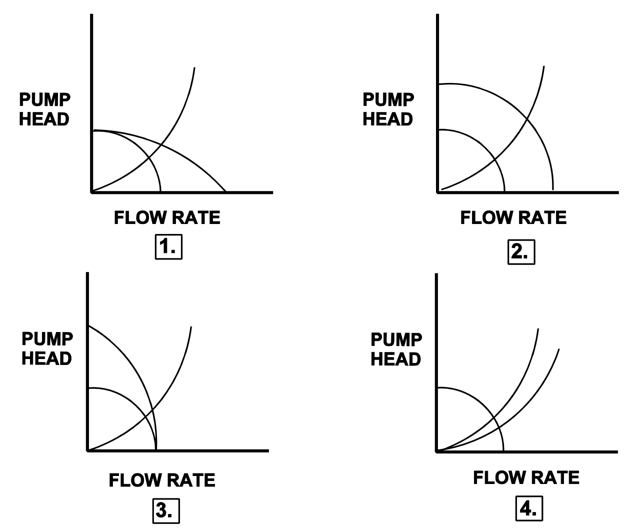
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: A.



CENTRIFUGAL PUMP CURVES

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P1624 (B2279)

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows the results of a change in pump/system operating conditions.

One constant-speed centrifugal pump is operating in an open system when a second identical centrifugal pump is started in parallel.

Which set of operating curves depicts the "before" and "after" conditions described above?

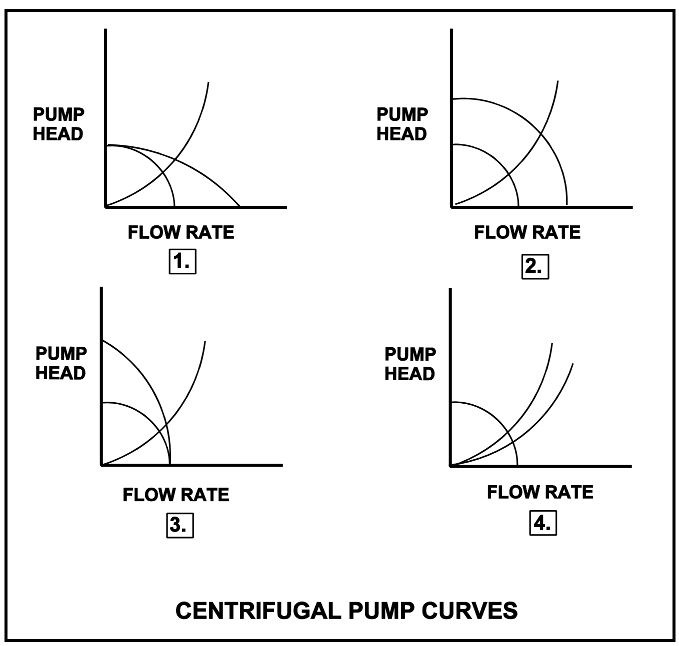
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: A.



TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P1724 (B1780)

Refer to the drawing of four centrifugal pump operating curves (see figure below).

A centrifugal pump is initially operating in a closed water system and discharging through a heat exchanger. A second heat exchanger, in parallel with the first, is then placed in service.

Which set of curves illustrates the initial and final operating conditions?

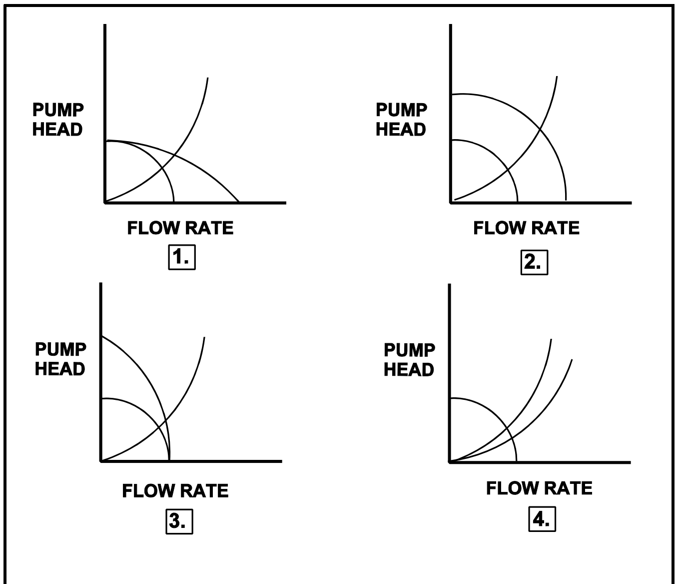
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: D.



CENTRIFUGAL PUMP CURVES

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P1921 (B925)

Refer to the drawing of a centrifugal pump operating curve and system curve (see figure below).

Which one of the following determines the general shape of the curve from point C to point D?

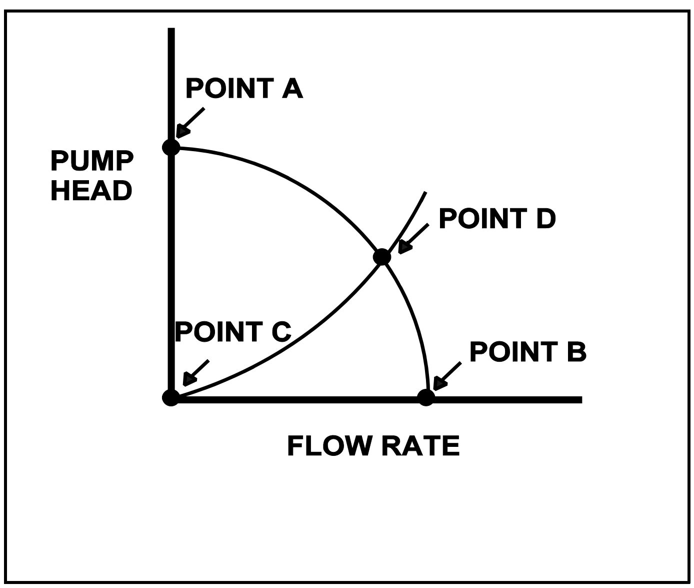
A. The pump flow losses due to the decrease in available net positive suction head as the system flow rate increases.

B. The pump flow losses due to back leakage through the clearances between the pump impeller and casing as the D/P across the pump increases.

C. The frictional and throttling losses in the piping system as the system flow rate increases.

D. The frictional losses between the pump impeller and its casing as the differential pressure (D/P) across the pump increases.

ANSWER: C.



TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P2325 (B2323)

Refer to the drawing of a centrifugal pump operating curve (see figure below).

A centrifugal pump is currently operating at point B. If the pump speed is reduced by one-half, the new operating point will be located on curve __________, closer to point ___________. (Assume that no other changes occur in the system.)

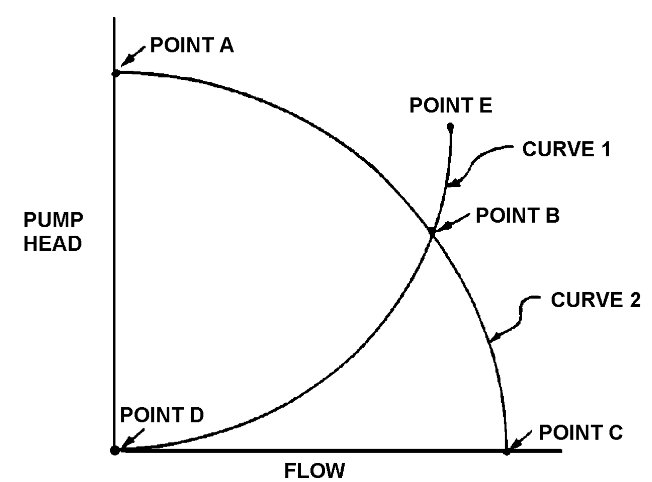
A. 1; D

B. 2; A

C. 1; E

D. 2; C

ANSWER: A.



CENTRIFUGAL PUMP OPERATING CURVE

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P2422 (B2422)

Refer to the drawing of a lube oil temperature control system (see figure below).

The pump is operating with the temperature control valve one-half open. If the temperature control valve modulates farther closed, system head loss will _________ and pump head will _________.

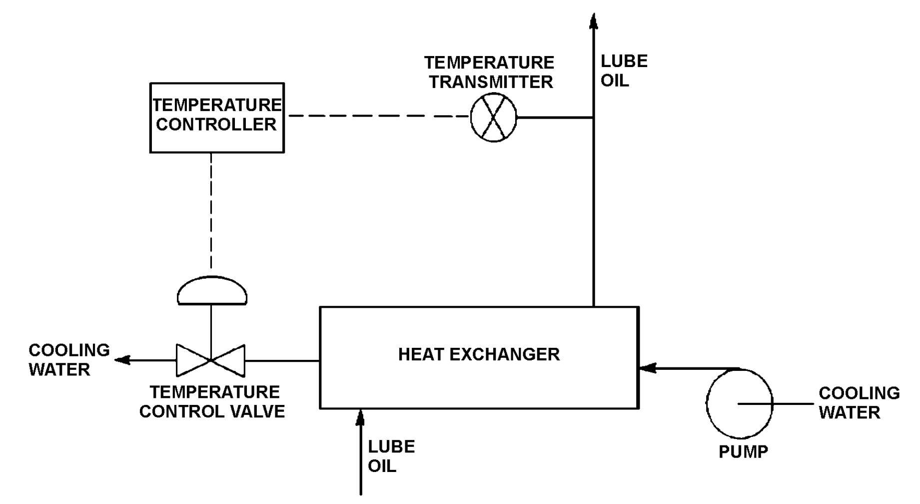
A. increase, decrease

B. increase, increase

C. decrease, decrease

D. decrease, increase

ANSWER: B.



LUBE OIL TEMPERATURE CONTROL SYSTEM

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P2523 (B2524)

Refer to the drawing of a lube oil temperature control system and the associated centrifugal pump operating curve (see figure below).

If the pump is operating at point B on the operating curve, how will the operating point change if the temperature controller setpoint is decreased by 10°F?

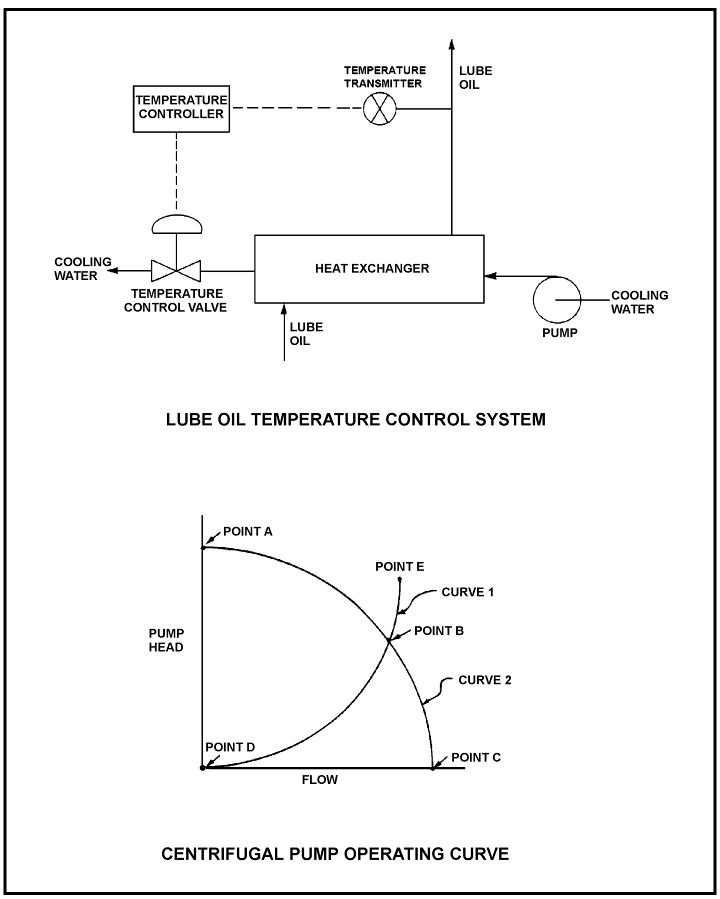
A. Operating point B will be located on curve 1 closer to point E.

B. Operating point B will be located on curve 1 closer to point D.

C. Operating point B will be located on curve 2 closer to point A.

D. Operating point B will be located on curve 2 closer to point C.

ANSWER: D.



TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P2723 (B2718)

Refer to the drawing showing two operating points for the same centrifugal pump (see figure below).

Operating point A was generated from pump performance data taken six months ago. Current pump performance data was used to generate operating point B. Which one of the following would cause the observed difference between operating points A and B?

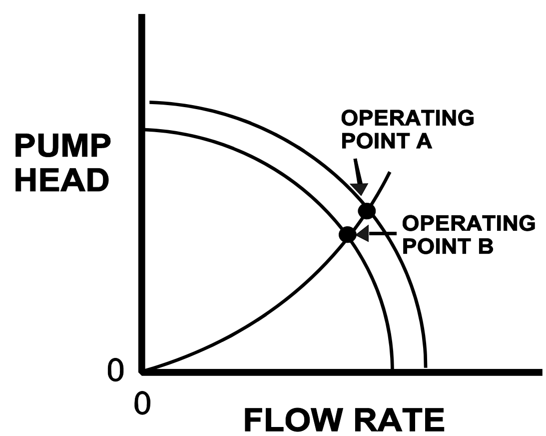
A. The pump discharge valve was more open when data was collected for operating point A.

B. The pump discharge valve was more closed when data was collected for operating point A.

C. The pump internal components have worn since data was collected for operating point A.

D. The system piping head loss has increased since data was collected for operating point A.

ANSWER: C.



CENTRIFUGAL PUMP OPERATING POINTS

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P2823 (B2879)

Refer to the drawing of four centrifugal pump operating curves (see figure below).

A two-speed centrifugal pump is operating in low speed in a cooling water system and discharging through a heat exchanger. The pump is then switched to high speed.

Which set of curves illustrates the initial and final operating conditions?

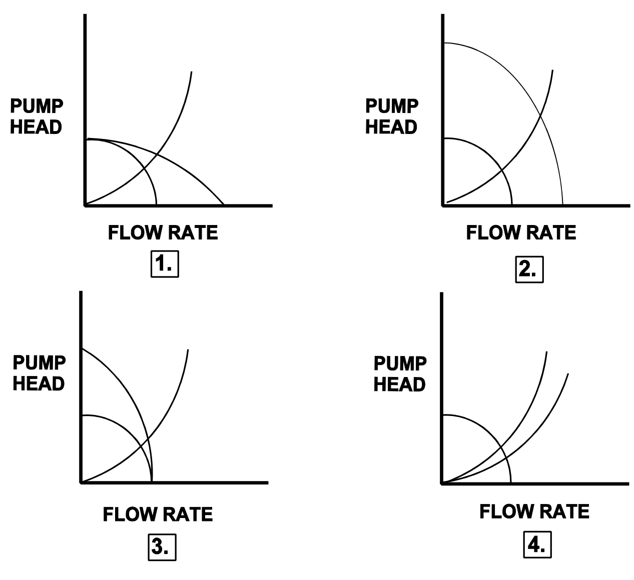
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: B.



CENTRIFUGAL PUMP CURVES

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P2923 (B3579)

Refer to the drawing of four centrifugal pump operating curves (see figure below).

A two-speed centrifugal pump is operating at fast speed in a cooling water system and discharging through a heat exchanger. The pump is then switched to slow speed.

Which set of curves illustrates the initial and final operating conditions?

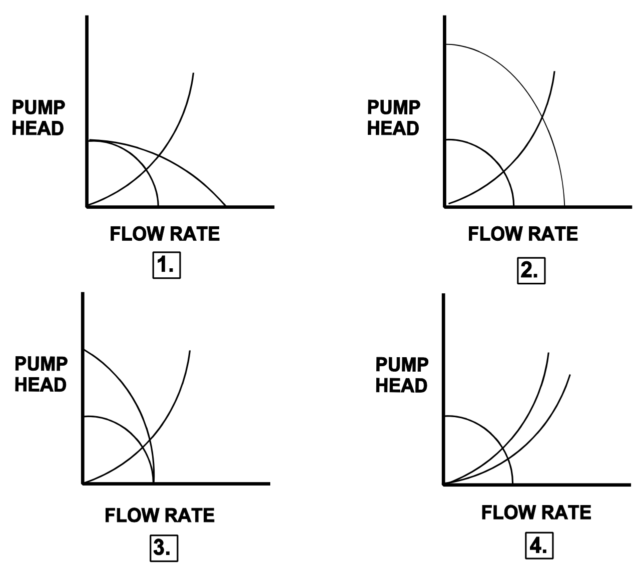
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: B.



CENTRIFUGAL PUMP CURVES

TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P3323 (B1020)

Refer to the drawing of a cooling water system and the associated centrifugal pump operating curve (see figure below). Pumps A and B are identical single-speed centrifugal pumps and initially only pump A is operating.

Pump B is then started. After the system stabilizes, system flow rate will be...

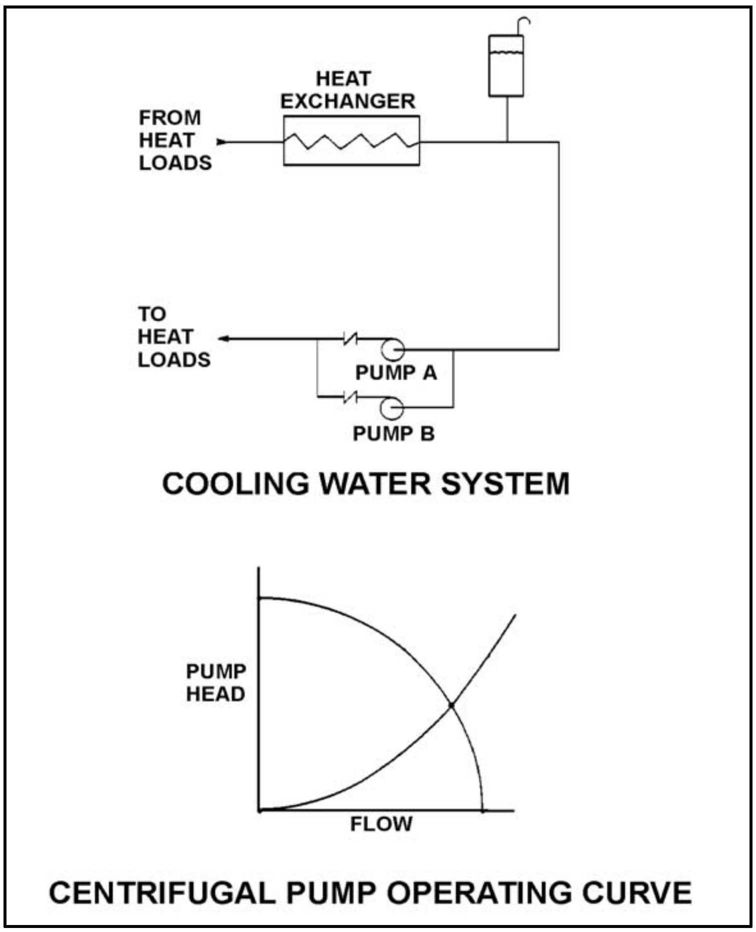
A. the same as the initial flow rate.

B. less than twice the initial flow rate.

C. twice the initial flow rate.

D. more than twice the initial flow rate.

ANSWER: B.



TOPIC: 191004
KNOWLEDGE: K1.14 [2.4/2.5]
QID: P4211 (B4211)

Refer to the drawing of an operating cooling water system (see figure below). As depicted in the drawing, only two of the three system heat loads are currently in service.

Which one of the following changes to the cooling water system will result in a higher cooling water pump flow rate <u>and</u> a reduced pump discharge head?

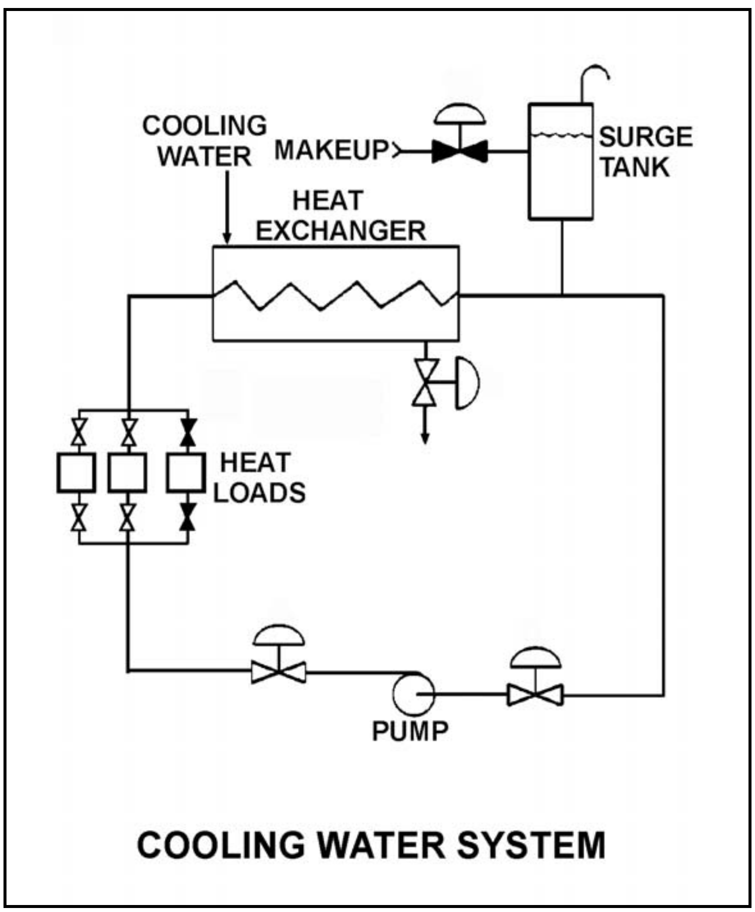
A. Increase pump speed by 20%.

B. Decrease pump speed by 20%.

C. Isolate one of the two in-service heat loads.

D. Place the third system heat load in service.

ANSWER: D.



TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P114 (B2223)

A motor-driven centrifugal pump is operating in an open system with its discharge valve throttled to 50% open. If the discharge valve is fully opened, available net positive suction head (NPSH) will ___________ and required NPSH will ___________.

A. remain the same; increase

B. remain the same; remain the same

C. decrease; increase

D. decrease; remain the same

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P325 (B322)

Increasing the flow rate through a centrifugal pump by throttling open the discharge valve will cause pump head to...

A. increase and stabilize at a higher value.

B. decrease and stabilize at a lower value.

C. remain constant.

D increase, then decrease following the pump's efficiency curve.

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.15
QID: P724 (B723)

A centrifugal pump is operating at rated conditions in an open system. If the pump recirculation valve is opened farther, pump discharge pressure will ____________ and pump flow rate will ____________.

A. increase; decrease

B. decrease; increase

C. increase; increase

D. decrease; decrease

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P1421 (B1421)

A centrifugal pump is operating at rated conditions in an open system with all valves fully open. If the pump discharge valve is throttled to 50%, pump suction pressure will ___________ and pump discharge pressure will ____________.

A. increase; decrease

B. decrease; increase

C. increase; increase

D. decrease; decrease

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P2025 (B2019)

A variable-speed centrifugal pump is operating at rated speed in an open system. If the pump speed is decreased by 50%, available net positive suction head (NPSH) will ________ and required NPSH will _________.

A. increase; decrease

B. increase; remain the same

C. decrease; decrease

D. decrease; remain the same

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P2224 (B521)

A motor-driven centrifugal pump is operating in an open system with its discharge valve throttled to 50%. How will the pump be affected if the discharge valve is fully opened?

A. Total developed head decreases, and motor current decreases.

B. Total developed head increases, and available net positive suction head decreases.

C. The potential for pump cavitation decreases, and pump differential pressure decreases.

D. Available net positive suction head decreases, and pump differential pressure decreases.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P2424 (B2420)

A variable speed motor-driven centrifugal pump is operating at 50% speed in an open system. If the pump speed is increased to 100%, available net positive suction head (NPSH) will ________ and required NPSH will _________.

A. increase; remain the same

B. increase; increase

C. decrease; remain the same

D. decrease; increase

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P2624 (B2622)

Which one of the following describes a reason for designing centrifugal pumps with suction nozzles that are larger than their discharge nozzles?

A. Increases total pump head by increasing the velocity head at the suction of the pump.

B. Increases the differential pressure across the pump by decreasing pump head loss.

C. Increases pump available net positive suction head by decreasing head loss at the pump suction.

D. Increases pump capacity by decreasing turbulence at the suction of the pump.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.6/2.8]
QID: P3623 (B3623)

A centrifugal firewater pump is operating to pressurize a fire main. The pump takes suction on a water reservoir. The reservoir water level and the eye of the pump impeller are both at sea level.

Given:

- The pump has a design shutoff head of 100 feet.
- The required net positive suction head (NPSH) for the pump is 15 feet.
- The reservoir water temperature is 60°F.
- A fire hose connected to the fire main is being used to suppress an elevated fire.

At which one of the following elevations (referenced to sea level) will the fire hose spray nozzle first be unable to provide flow? (Disregard head loss in the fire main and fire hose.)

A. 86 feet

B. 101 feet

C. 116 feet

D. 135 feet

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P3912 (B3911)

A centrifugal firewater pump is operating to pressurize a fire main. The pump takes suction from a water reservoir. A fire hose connected to the fire main is being used to suppress an elevated fire.

Given:

- The eye of the pump impeller is located 5 feet above the reservoir water level.
- The pump has a design shutoff head of 120 feet.
- The required net positive suction head (NPSH) for the pump is 15 feet.
- The reservoir water temperature is 60°F.

At which one of the following elevations above the eye of the pump impeller will the fire hose spray nozzle first be unable to provide flow? (Disregard all sources of system frictional head loss.)

A. 111 feet

B. 116 feet

C. 121 feet

D. 126 feet

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P4313 (B4312)

A centrifugal firewater pump is operating to pressurize a fire main. The pump takes suction from a vented water storage tank. A fire hose connected to the fire main is being used to suppress an elevated fire.

Given:

- The eye of the pump impeller is located 30 feet below the tank water level.
- The pump has a design shutoff head of 120 feet.
- The required net positive suction head (NPSH) for the pump is 15 feet.
- The tank water temperature is 60°F.

At which one of the following elevations above the eye of the pump impeller will the fire hose spray nozzle first be unable to provide flow? (Disregard all sources of system frictional head loss.)

A. 106 feet

B. 121 feet

C. 136 feet

D. 151 feet

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P4712 (B4710)

A motor-driven centrifugal cooling water pump is operating in an open system with its discharge valve fully open. If the discharge valve is repositioned to 50% open, the pump's available net positive suction head (NPSH) will ___________ and the pump's required NPSH will ___________.

A. remain the same; decrease

B. remain the same; remain the same

C. increase; decrease

D. increase; remain the same

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P4912 (B4911)

A centrifugal firewater pump is operating to pressurize a fire main. The pump takes suction from a water reservoir. A fire hose connected to the fire main is being used to suppress an elevated fire.

Given:

- The eye of the pump impeller is located 15 feet below the reservoir water level.
- The pump has a design shutoff head of 120 feet.
- The required net positive suction head (NPSH) for the pump is 15 feet.
- The reservoir water temperature is 60°F.

At which one of the following elevations above the reservoir water level will the fire hose spray nozzle first be <u>unable</u> to provide flow? (Disregard all sources of system frictional head loss.)

A. 91 feet

B. 106 feet

C. 121 feet

D. 136 feet

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.15 [2.5/2.8]
QID: P5412 (B5412)

A motor-driven centrifugal pump is operating in a closed-loop cooling water system and is unable to achieve its rated volumetric flow rate due to cavitation. Which one of the following will enable the pump to achieve a higher volumetric flow rate before cavitation occurs?

A. Operate the system at a higher pressure.

B. Operate the system at a higher temperature.

C. Remove the existing pump motor and install a motor with a higher horsepower rating.

D. Remove the existing pump and install a same-capacity pump with a higher minimum required net positive suction head rating.

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.16 [2.8/2.9]
QID: P624

Which one of the following specifies the proper pump discharge valve position and the basis for that position when starting a large radial-flow centrifugal pump?

A. Discharge valve fully open to reduce motor power requirements

B. Discharge valve throttled to reduce motor power requirements

C. Discharge valve fully open to ensure adequate pump net positive suction head

D. Discharge valve throttled to ensure adequate pump net positive suction head

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.16 [2.8/2.9]
QID: P1725 (B1722)

A typical single-stage radial-flow centrifugal pump is being returned to service following maintenance on its three-phase ac induction motor. Which one of the following will occur when the pump is started if two of the three motor power leads were inadvertently swapped during restoration?

A. The motor breaker will trip on instantaneous overcurrent.

B. The motor will not turn and will emit a humming sound.

C. The pump will rotate in the reverse direction with reduced or no flow rate.

D. The pump will rotate in the normal direction with reduced flow rate.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.20 [2.8/2.8]
QID: P25

If the speed of a positive displacement pump is increased, the available net positive suction head will __________ and the probability of cavitation will __________.

A increase; increase

B. decrease; decrease

C. increase; decrease

D. decrease; increase

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.20 [2.8/2.8]
QID: P226

An increase in positive displacement pump speed will cause the available net positive suction head for the pump to...

A. decrease due to the increase in fluid flow.

B. decrease due to the increase in fluid discharge pressure.

C. increase due to the increase in fluid discharge pressure.

D. increase due to the increase in fluid flow.

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.20 [2.8/2.8]
QID: P1025

The minimum required net positive suction head for a typical positive displacement pump will increase the most if the pump...

A. motor speed increases from 1,200 rpm to 1,600 rpm.

B. discharge pressure decreases from 100 psig to 50 psig.

C. suction temperature increases from 75°F to 85°F.

D. discharge valve is positioned from 90% open to fully open.

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.21 [3.0/3.1]
QID: P1425 (B1125)

Which one of the following describes the proper location for a relief valve that will be used to prevent exceeding the design pressure of a positive displacement pump and associated piping?

A. On the pump suction piping upstream of the suction isolation valve.

B. On the pump suction piping downstream of the suction isolation valve.

C. On the pump discharge piping upstream of the discharge isolation valve.

D. On the pump discharge piping downstream of the discharge isolation valve.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P326 (B323)

A positive displacement pump (PDP) is operating in an open system. PDP parameters are as follows:

PDP speed	= 1,000 rpm
PDP discharge pressure	= 2,000 psig
PDP suction pressure	= 50 psig
PDP flow rate	= 150 gpm

Which one of the following changes will cause PDP flow rate to exceed 200 gpm?

A. A second identical discharge path is opened.

B. PDP speed is increased to 1,500 rpm.

C. PDP suction pressure is increased to 120 psig.

D. Downstream system pressure is decreased to 1,000 psig.

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P826 (B1123)

If the fully-open discharge valve of a reciprocating positive displacement pump is throttled closed approximately 10%, pump flow rate will __________ and pump head will __________. (Assume "ideal" pump response.)

A. decrease; increase

B. remain constant; increase

C. decrease; remain constant

D. remain constant; remain constant

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P925

A variable-speed positive displacement pump is operating at 100 rpm with a flow rate of 60 gpm in an open system. To decrease pump flow rate to 30 gpm, pump speed must be decreased to approximately...

A. 25 rpm.

B. 35 rpm.

C. 50 rpm.

D. 71 rpm.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P1026

Which one of the following conditions will result in the greatest increase in volumetric flow rate through a positive displacement pump?

A. Doubling the pump speed

B. Doubling pump net positive suction head

C. Reducing downstream system pressure by one-half

D. Positioning the discharge valve from half open to full open

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P1126

Which one of the following describes single-speed pump operating characteristics?

A. Centrifugal pumps deliver a variety of flow rates at a constant head.

B. Centrifugal pumps deliver a constant head over a variety of flow rates.

C. Positive displacement pumps deliver a variety of flow rates at a constant head.

D. Positive displacement pumps deliver a constant flow rate over a variety of heads.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P1526 (B1525)

A positive displacement pump (PDP) is operating in an open system. PDP parameters are as follows:

PDP speed	= 480 rpm
PDP discharge pressure	= 1,000 psig
PDP suction pressure	= 10 psig
PDP flow rate	= 60 gpm

Which one of the following changes will cause PDP flow rate to exceed 100 gpm?

A. PDP speed is increased to 900 rpm.

B. A second identical discharge path is opened.

C. PDP suction pressure is increased to 40 psig.

D. Downstream system pressure is decreased to 500 psig.

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P1726 (B1919)

An ideal (no slip) reciprocating positive displacement pump is operating to provide makeup water to a reactor coolant system that is being maintained at 2,200 psig. The discharge valve of the pump was found to be throttled to 80% open.

If the valve is subsequently fully opened, pump flow rate will __________ and pump head will __________.

A. increase; decrease

B. remain constant; decrease

C. increase; remain constant

D. remain constant; remain constant

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P2126 (B1824)

A variable-speed positive displacement pump is operating at 100 rpm with a flow rate of 60 gpm in an open system. To decrease pump flow rate to 25 gpm, pump speed must be decreased to approximately...

A. 17 rpm.

B. 33 rpm.

C. 42 rpm.

D. 64 rpm.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P2526 (B2525)

Which one of the following conditions will result in the greatest increase in volumetric flow rate in a water system with one positive displacement pump operating at 400 rpm and a discharge pressure of 100 psig?

A. Increasing pump speed to 700 rpm.

B. Decreasing pump discharge pressure to 40 psig.

C. Starting a second identical positive displacement pump in series with the first.

D. Starting a second identical positive displacement pump in parallel with the first.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P2626 (B2624)

A section of reactor coolant piping is being hydrostatically tested to 2,900 psig using a positive displacement pump. The operating characteristics of the positive displacement pump are shown below, identifying ideal, expected, and actual pump performance.

Which one of the following could cause the observed difference between the expected and the actual pump performance?

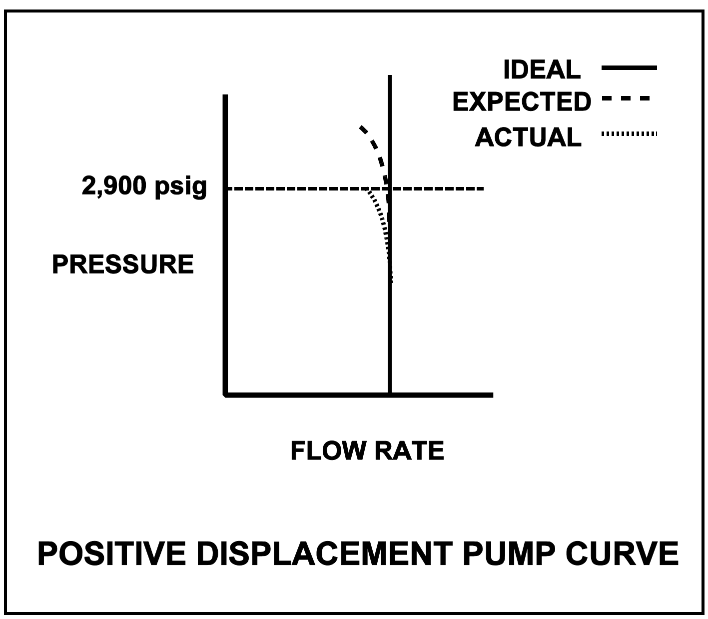
A. Pump internal leakage is greater than expected.

B. Reactor coolant piping boundary valve leakage is greater than expected.

C. Available NPSH has decreased more than expected, but remains slightly above required NPSH.

D. A relief valve on the pump discharge piping has opened prior to its setpoint of 2,900 psig.

ANSWER: A.



TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P2726 (B2724)

Which one of the following conditions will result in the greatest increase in volumetric flow rate from a positive displacement pump operating at 300 rpm and a discharge pressure of 100 psig?

A. Increasing pump speed to 700 rpm

B. Decreasing pump discharge pressure to 40 psig

C. Starting a second identical positive displacement pump in series with the first

D. Starting a second identical positive displacement pump in parallel with the first

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P2926 (B2925)

An ideal (no slip) reciprocating positive displacement pump is operating in an open system to provide makeup water to a coolant system that is being maintained at 800 psig. The discharge valve of the pump is full open.

If the pump discharge valve is subsequently throttled to 80% open, pump flow rate will __________ and pump head will __________.

A. decrease; increase

B. decrease; remain constant

C. remain constant; increase

D. remain constant; remain constant

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P3024 (B3025)

A pump is needed to supply fuel oil from a day tank to a diesel engine fuel injection system. The pump must maintain a nearly constant flow rate with a minimum of discharge pressure fluctuations as system pressure varies between 200 psig and 1,900 psig.

Which one of the following types of pumps would typically be used in this application?

A. Axial flow centrifugal

B. Radial flow centrifugal

C. Rotary positive displacement

D. Reciprocating positive displacement

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P3525 (B1680)

An ideal positive displacement pump is pumping to a system operating at 100 psig. Assume pump speed is constant, zero pump slip, and pump backpressure remains within normal pump operating limits.

If system pressure increases to 200 psig, the pump head will ________; and pump flow rate will ________.

A. increase; remain the same

B. increase; decrease

C. remain the same; remain the same

D. remain the same; decrease

ANSWER: A.

TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P5012 (B5013)

Use the following drawing of system and pump operating curves for a positive displacement pump with discharge relief valve protection to answer the following question.

A positive displacement pump is initially supplying water at 40 gpm with a pump discharge pressure of 400 psia. Then, pump speed is increased until pump flow rate is 80 gpm. What is the pump discharge pressure at the new pump flow rate of 80 gpm?

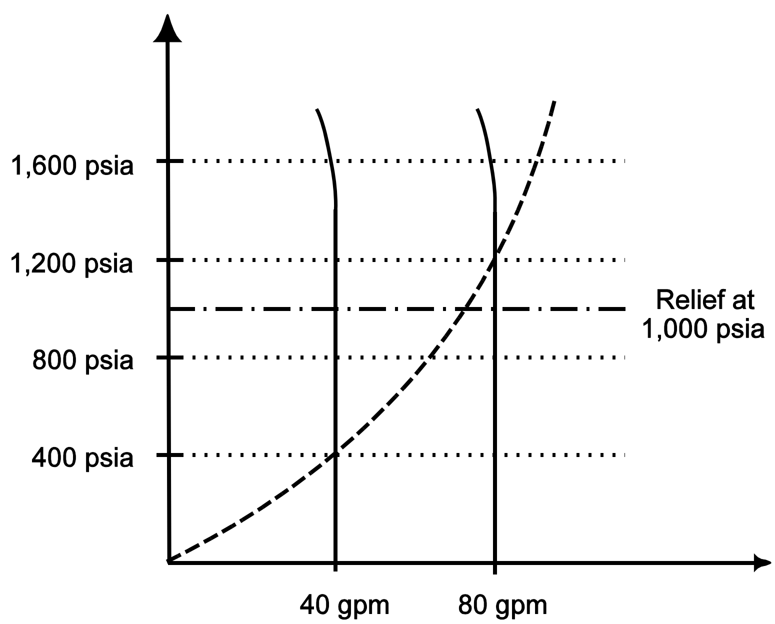
A. 800 psia

B. 1,000 psia

C. 1,200 psia

D. 1,600 psia

ANSWER: B.



TOPIC: 191004
KNOWLEDGE: K1.22 [2.3/2.5]
QID: P5313 (B5313)

Use the following drawing of system and pump operating curves for an operating positive displacement pump with relief valve protection to answer the following question.

A positive displacement pump is initially supplying water at 40 gpm with a pump discharge pressure of 200 psia. Then, pump speed is increased until pump flow rate is 80 gpm. What is the pump discharge pressure at the new pump flow rate of 80 gpm?

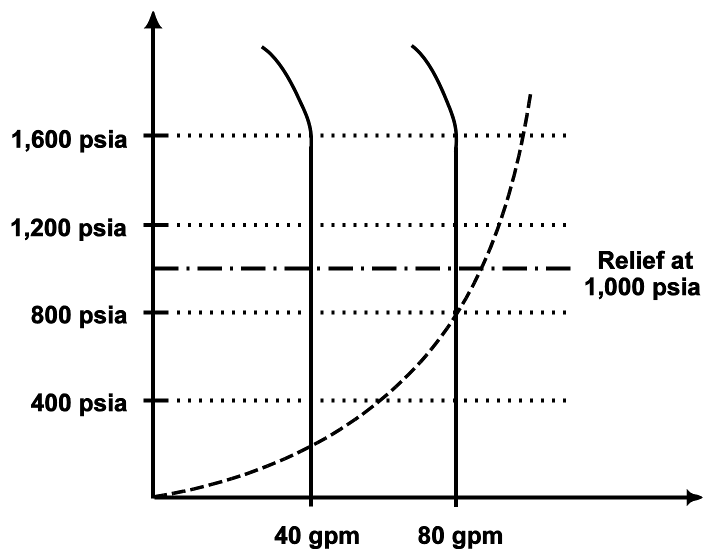
A. 400 psia

B. 800 psia

C. 1,000 psia

D. 1,600 psia

ANSWER: B.



TOPIC: 191004
KNOWLEDGE: K1.23 [2.8/2.9]
QID: P526

When starting a positive displacement pump, why must the pump discharge valve be fully open?

A. Prevents pump cavitation.

B. Reduces motor starting current.

C. Minimizes the potential for water hammer.

D. Ensures integrity of the pump and system piping.

ANSWER: D.

TOPIC: 191004
KNOWLEDGE: K1.24 [3.0/3.1]
QID: P626 (B2425)

What is the purpose of the safety/relief valve located between the pump outlet and the discharge isolation valve of most positive displacement pumps?

A. Protect the pump and suction piping from overpressure if the discharge valve is open during system startup.

B. Protect the pump and suction piping from overpressure if the suction valve is closed during pump operation.

C. Protect the pump and discharge piping from overpressure if the discharge valve is closed during pump operation.

D. Protect the pump and discharge piping from overpressure due to thermal expansion of pump contents when the pump is stopped with its suction valve closed.

ANSWER: C.

TOPIC: 191004
KNOWLEDGE: K1.24 [3.0/3.1]
QID: P1722 (B1724)

A positive displacement pump should be started with its suction valve ________ and its discharge valve ________.

A. fully open; throttled

B. fully open; fully open

C. throttled; throttled

D. throttled; fully open

ANSWER: B.

TOPIC: 191004
KNOWLEDGE: K1.24 [3.0/3.1]
QID: P1923 (B525)

A positive displacement pump should be started with its suction valve ________ and its discharge valve ________.

A. open; open

B. open; closed

C. closed; open

D. closed; closed

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.01 [2.8/3.1]
QID: P26

Reactor coolant pump motor amps will ____________ if the rotor is <u>locked</u> and the motor speed will ____________ if the rotor <u>shears</u>.

A. increase, increase

B. increase, decrease

C. decrease, increase

D. decrease, decrease

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.01 [2.8/3.1]
QID: P227

A nuclear power plant is operating normally at 80% power when a reactor coolant pump (RCP) shaft seizes. Which one of the following indications would <u>not</u> accompany the seized shaft?

A. Reactor coolant system pressure transient.

B. Decreased flow rate in the associated reactor coolant loop.

C. Decreased flow rate in the remaining reactor coolant loop(s).

D. Increased current to the affected RCP with possible breaker trip.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.01 [2.8/3.1]
QID: P327

A nuclear power plant is operating at 100% power when a reactor coolant pump (RCP) malfunction occurs. Thirty seconds after the malfunction, which one of the following can be used by an operator to determine whether the malfunction is a locked RCP rotor or a sheared RCP rotor? (Assume no operator action is taken.)

A. Reactor trip status

B. Loop flow indications

C. RCP ammeter indications

D. Loop differential temperature indications

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.01 [2.8/3.1]
QID: P1127

During a locked reactor coolant pump (RCP) rotor event, RCP current will...

A. increase due to the increased rotor torque.

B. increase due to the increased stator counter electromotive force (CEMF).

C. decrease due to the decreased pump flow.

D. decrease due to the increased rotor CEMF.

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.01 [2.8/3.1]
QID: P1427 (B2626)

A nuclear power plant is operating at full power when a reactor coolant pump experiences a locked rotor. How will pump ammeter indication respond?

A. Decreases immediately to zero due to breaker trip

B. Decreases immediately to no-load motor amps

C. Increases immediately to many times running current, then decreases to no-load motor amps

D. Increases immediately to many times running current, then decreases to zero upon breaker trip

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.01 [2.8/3.1]
QID: P2127 (B1326)

A cooling water pump is being driven by an ac induction motor. Which one of the following describes how and why pump motor current will change if the pump shaft seizes?

A. Decreases due to decreased pump flow

B. Decreases due to increased counter electromotive force

C. Increases due to decreased pump flow

D. Increases due to decreased counter electromotive force

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.01 [2.8/3.1]
QID: P2827 (B1726)

A cooling water pump is being driven by an ac induction motor. Which one of the following describes how and why pump motor current will change if the pump shaft shears?

A. Decreases due to decreased pump work

B. Decreases due to decreased counter electromotive force

C. Increases due to increased pump work

D. Increases due to increased counter electromotive force

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.01 [2.8/3.1]
QID: P3127 (B2826)

A motor-driven centrifugal pump exhibits indications of pump failure while being started in an idle cooling water system. Assuming the pump motor breaker does not trip, which one of the following pairs of indications would be observed if the pump failure is a locked impeller shaft?

A. Lower than normal running current with zero system flow rate

B. Lower than normal running current with a fraction of normal system flow rate

C. Excessive duration of starting current peak with zero system flow rate

D. Excessive duration of starting current peak with a fraction of normal system flow rate

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P27

If the generator bearings on a motor-generator begin to overheat from excessive friction, which one of the following will occur next?

A. Generator current will begin to increase.

B. Generator windings will begin to heat up.

C. Motor current will begin to decrease.

D. Motor windings will begin to heat up.

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P344 (B340)

A thermal overload device for a large motor protects the motor from...

A. sustained overcurrent by opening the motor breaker or motor line contacts.

B. sustained overcurrent by opening contacts in the motor windings.

C. instantaneous overcurrent by opening the motor breaker or motor line contacts.

D. instantaneous overcurrent by opening contacts in the motor windings.

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P528 (B1927)

Which one of the following will provide the initial motor protection against electrical damage caused by gradual bearing failure?

A. Thermal overload device

B. Overcurrent trip relay

C. Underfrequency relay

D. Undervoltage device

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P1028 (B1526)

Which one of the following will result from prolonged operation of an ac motor with excessively high stator temperatures?

A. Decreased electrical current demand due to reduced counter electromotive force

B. Increased electrical current demand due to reduced counter electromotive force

C. Decreased electrical resistance to ground due to breakdown of winding insulation

D. Increased electrical resistance to ground due to breakdown of winding insulation

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P1528 (B1126)

Continuous operation of a motor at rated load with a loss of required cooling to the motor windings will eventually result in...

A. cavitation of the pumped fluid.

B. failure of the motor overcurrent protection devices.

C. breakdown of the motor insulation.

D. phase current imbalance in the motor and overspeed trip actuation.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P2644 (B2242)

Thermal overload devices will provide the first electrical protection for a pump motor in the event of...

A. a locked rotor upon starting.

B. an electrical short circuit.

C. gradual motor bearing damage.

D. a sheared shaft during operation.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P2927

Which one of the following breaker trip signals will trip the associated motor breaker if a motor bearing seizes while the motor is running?

A. Undervoltage

B. Underfrequency

C. Time-delayed overcurrent

D. Instantaneous overcurrent

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P115 (B120)

A main generator that is connected to an infinite power grid has the following initial indications:

100 MW
0 MVAR
2,900 amps
20,000 VAC

If main generator excitation is reduced slightly, amps will __________ and MW will ___________.

A. increase; decrease

B. decrease; decrease

C. increase; remain the same

D. decrease; remain the same

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P229

Excessive current will be drawn by an ac induction motor that is operating...

A. completely unloaded.

B. at full load.

C. with open-circuited stator windings.

D. with short-circuited stator windings.

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P529

A main generator that is connected to an infinite power grid has the following indications:

500 Mw
300 MVAR (out)
2,800 amps

If main generator excitation is reduced slightly, amps will __________ and Mw will ___________.

A. increase; decrease

B. increase; remain the same

C. decrease; decrease

D. decrease; remain the same

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P928

A main generator is operating in parallel with an infinite power grid. If the voltage supplied to the generator field is slowly and continuously decreased, the generator will experience high current due to... (Assume <u>no</u> generator protective actuations occur.)

A. excessive generator MW.

B. excessive generator MVAR (VARs out).

C. excessive generator MVAR (VARs in).

D. generator reverse power.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P1128 (B2228)

An ac generator is supplying an isolated electrical system with a power factor of 1.0. If generator voltage is held constant while real load (KW) increases, the current supplied by the generator will increase in direct proportion to the ____________ of the change in real load. (Assume the generator power factor remains constant at 1.0.)

A. cube

B. square

C. amount

D. square root

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P1428 (B1830)

A main generator that is connected to an infinite power grid has the following indications:

600 MW
100 MVAR (in)
13,800 amps
25,000 volts

If main generator excitation is increased slightly, amps will __________ and MW will ___________.

A. decrease; increase

B. increase; increase

C. decrease; remain the same

D. increase; remain the same

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P1728 (B1729)

A main generator that is connected to an infinite power grid has the following indications:

600 MW
100 MVAR (in)
13,800 amps
25,000 volts

If main generator excitation is decreased slightly, amps will __________ and MVAR will ___________.

A. decrease; increase

B. increase; increase

C. decrease; decrease

D. increase; decrease

ANSWER: B.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P1928 (B226)

A main generator is connected to an infinite power grid. Which one of the following conditions will exist on the generator if it is operating underexcited?

A. Negative MVAR (VARs in) and a leading power factor

B. Positive MVAR (VARs out) and a leading power factor

C. Positive MVAR (VARs out) and a lagging power factor

D. Negative MVAR (VARs in) and a lagging power factor

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P2027 (B2028)

A diesel generator (D/G) is supplying both KW and kVAR to an electrical bus that is connected to an infinite power grid. Assuming D/G and bus voltage do not change, if the D/G voltage regulator set point is increased slightly, then D/G KW will ________ and D/G amps will ________.

A. remain the same; increase

B. remain the same; remain the same

C. increase; increase

D. increase; remain the same

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P2228

A diesel generator (D/G) is supplying an electrical bus that is connected to an infinite power grid. Assuming D/G terminal voltage and bus frequency do not change, if the D/G governor set point is increased from 60.0 Hz to 60.1 Hz, D/G kVAR load will ________ and D/G amps will ________.

A. increase; increase

B. increase; remain the same

C. remain the same; increase

D. remain the same; remain the same

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P2328 (B2330)

A main generator that is connected to an infinite power grid has the following indications:

600 MW
100 MVAR (out)
13,800 amps
25,000 volts

If main generator excitation is decreased, amps will initially __________ and MVAR will initially ___________.

A. decrease; increase

B. increase; increase

C. decrease; decrease

D. increase; decrease

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P2528 (B2530)

A diesel generator (D/G) is supplying both KW and KVAR to an electrical bus that is connected to an infinite power grid. Assuming bus voltage does <u>not</u> change, if the D/G voltage regulator set point is decreased slightly, then D/G KW will ________ and D/G amps will ________.

A. remain the same; decrease

B. remain the same; remain the same

C. decrease; decrease

D. decrease; remain the same

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P2628 (B1532)

A main generator that is connected to an infinite power grid has the following indications:

100 MW
0 MVAR
2,900 amps
20,000 volts

If main generator excitation is increased, amps will __________ and MW will ___________.

A. remain the same; increase

B. increase; increase

C. remain the same; remain the same

D. increase; remain the same

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P2728 (B2729)

A main generator is operating in parallel with an infinite power grid. If the voltage supplied to the generator field is slowly and continuously increased, the generator will experience high current due to: (Assume no generator protective actuations occur.)

A. generator reverse power.

B. excessive generator MW.

C. excessive generator MVAR (VARs in).

D. excessive generator MVAR (VARs out).

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P2838 (B3543)

Two identical 1,000 MW electrical generators are operating in parallel supplying the same isolated electrical bus. The generator output breakers provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
22 KV	22 KV
60.2 Hertz	60.2 Hertz
800 MW	800 MW
50 MVAR (out)	25 MVAR (in)

A malfunction causes the voltage regulator for generator B to slowly and continuously increase the terminal voltage for generator B. If no operator action is taken, generator B output current will...

A. increase continuously until the output breaker for generator A trips on overcurrent.

B. increase continuously until the output breaker for generator B trips on overcurrent.

C. initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

D. initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P3229 (B3227)

A cooling water system is being returned to service following maintenance on the two identical centrifugal cooling water pumps. The two pumps (see figure below) take suction from a common suction header and discharge to a common discharge header. Each pump is driven by a three-phase ac induction motor.

Pump A was started five minutes ago to initiate flow in the cooling water system. Pump B is about to be started.

When pump B is started, which one of the following would cause the ammeter for pump B to remain off-scale high for several seconds longer than usual before returning to normal running current indication?

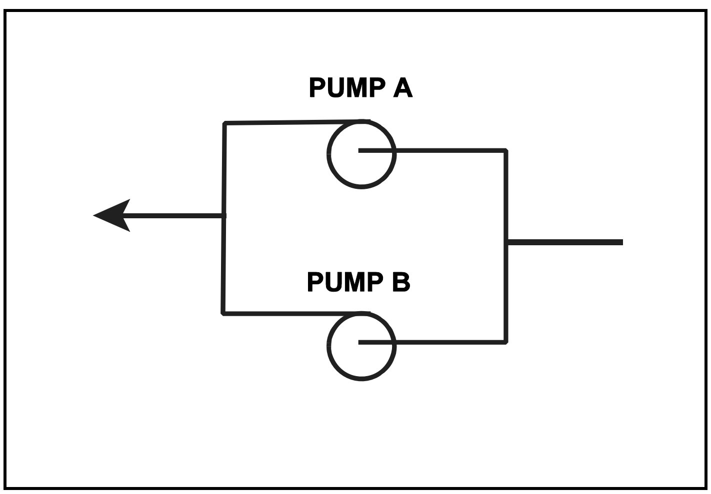
A. The pump packing was removed and <u>not</u> reinstalled.

B. The pump was initially rotating in the reverse direction.

C. Two phases of the motor windings were electrically switched.

D. The coupling between the motor and the pump was removed and <u>not</u> reinstalled.

ANSWER: B.



TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P3629 (B3629)

A main turbine-generator is operating in parallel with an infinite power grid. If the turbine control valves (or throttle valves) slowly fail open, the generator will experience high current primarily due to... (Assume no generator protective actuations occur.)

A. excessive generator MW.

B. excessive generator VARs (out).

C. excessive generator VARs (in).

D. generator reverse power.

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
KNOWLEDGE: K1.09 [2.3/2.6]
QID: P4115 (B4115)

A main generator is operating and connected to an infinite power grid. Elevated main generator winding temperature requires a reduction in reactive load from 200 MVAR (out) to 150 MVAR (out). To accomplish the reactive load reduction, the operator must ____________ the generator field current; when generator reactive load equals 150 MVAR (out) the generator power factor will be ___________than the initial power factor.

A. increase; larger

B. increase; smaller

C. decrease; larger

D. decrease; smaller

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P4315

A main generator is operating and connected to an infinite power grid with the following initial generator parameters:

Terminal Voltage:	22 KV
Frequency:	60 Hertz
Load--Real:	575 MW
Load--Reactive:	100 MVAR (in)
Power Factor:	0.985

Which one of the following contains a combination of manual adjustments to the main generator voltage regulator and speed control setpoints such that each adjustment will initially result in an increase in main generator amps?

	VOLTAGE SETPOINT	SPEED SETPOINT
A.	Increase	Increase
B.	Increase	Decrease
C.	Decrease	Increase
D.	Decrease	Decrease

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P4714 (B4714)

A nuclear power plant startup is in progress. The main generator has just been connected to the power grid with the following generator indications:

10 MW
0 MVAR
288 amps
20,000 volts

The operator suspects that the main generator is operating under reverse power conditions and attempts to increase generator load (MW) normally. If the main generator is operating under reverse power conditions when the operator attempts to increase generator load, generator MW will initially ____________; and generator amps will initially ____________.

A decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P4814 (B4815)

A main generator is operating and is connected to an infinite power grid with the following initial generator parameters:

Terminal Voltage:	22 KV
Frequency:	60 Hertz
Load--Real:	575 MW
Load--Reactive:	100 MVAR (in)
Power Factor:	0.985

Which one of the following contains a combination of manual adjustments to the main generator voltage regulator and speed control setpoints such that each adjustment will initially result in a decrease in main generator amps?

	VOLTAGE SETPOINT	SPEED SETPOINT
A.	Increase	Increase
B.	Increase	Decrease
C.	Decrease	Increase
D.	Decrease	Decrease

ANSWER: B.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P5014

A main generator is connected to an infinite power grid with the following initial generator parameters:

Voltage:	22 KV
Frequency:	60 Hertz
Load--Real:	600 MW
Load--Reactive:	100 MVAR (out)
Power Factor:	0.986

Which one of the following contains a combination of manual adjustments to the main generator voltage regulator and speed control setpoints such that each adjustment will initially result in an increase in main generator amps?

	Voltage Setpoint	Speed Setpoint
A.	Increase	Increase
B.	Increase	Decrease
C.	Decrease	Increase
D.	Decrease	Decrease

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P5414 (B5415)

A main generator is connected to an infinite power grid. Which one of the following pairs of main generator output parameters places the generator in the closest proximity to slipping a pole.

A. 800 MW; 200 MVAR (in)

B. 800 MW; 600 MVAR (in)

C. 400 MW; 200 MVAR (out)

D. 400 MW; 600 MVAR (out)

ANSWER: B.

TOPIC: 191005
KNOWLEDGE: K1.03 [2.7/2.8]
QID: P5514

A main generator is connected to an infinite power grid with the following initial generator parameters:

Voltage:	22 KV
Frequency:	60 Hertz
Load--Real:	600 MW
Load--Reactive:	100 MVAR (out)
Power Factor:	0.986

Which one of the following contains a combination of manual adjustments to the main generator voltage regulator and speed control setpoints such that each adjustment will initially result in a decrease in main generator amps?

	Voltage Setpoint	Speed Setpoint
A.	Increase	Increase
B.	Increase	Decrease
C.	Decrease	Increase
D.	Decrease	Decrease

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P28

If the speed of a variable speed centrifugal pump is increased to cause pump flow rate to double, pump motor current will...

A. remain constant.

B. increase two-fold (double).

C. increase four-fold.

D. increase eight-fold.

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P120

A centrifugal pump is operating with the following parameters:

Pump speed = 1800 rpm
Pump head = 100 psid
Motor current = 10 amps

What will be the new value of pump head if the speed is increased such that the current requirements are now 640 amps?

A. 400 psid

B. 800 psid

C. 1200 psid

D. 1600 psid

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P228 (B227)

A centrifugal pump has a flow rate of 3,000 gpm and a current requirement of 200 amps. If the pump speed is reduced such that the flow rate is 2,000 gpm, what is the final current requirement at the new lower speed? (Assume a constant motor voltage.)

A. 59 amps

B. 89 amps

C. 133 amps

D. 150 amps

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P328 (B326)

A centrifugal pump is operating with the following parameters:

Speed	= 1,800 rpm
Current	= 40 amps
Pump head	= 20 psi
Pump flow rate	= 400 gpm

Which one of the following will be the new value of pump head and current if the speed is increased to 2,000 rpm?

A. 22 psi, 49 amps

B. 22 psi, 55 amps

C. 25 psi, 49 amps

D. 25 psi, 55 amps

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P428

A centrifugal pump is operating at 600 rpm with the following parameters:

Current	= 10 amps
Pump head	= 50 psi
Pump flow rate	= 200 gpm

What will be the new value of pump head if the flow is increased such that the current requirements are now 640 amps?

A. 400 psi

B. 600 psi

C. 800 psi

D. 1,200 psi

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P630

A motor-driven centrifugal pump is operating at a low flow condition in an open system. The throttled discharge valve is then fully opened to increase system flow rate.

Which one of the following will increase?

A. Pump discharge pressure

B. Available net positive suction head

C. Motor amps

D. Pump speed

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P1329

A centrifugal pump is operating with the following parameters:

Speed	= 3,600 rpm
Current	= 100 amps
Pump head	= 50 psi
Pump flow rate	= 400 gpm

What will be the new value of pump head and current if the speed is decreased to 2,000 rpm?

A. 8.6 psi, 30.1 amps

B. 8.6 psi, 17.1 amps

C. 15.4 psi, 30.1 amps

D. 15.4 psi, 17.1 amps

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P1429

A two-speed centrifugal pump is driven by an ac motor with the following initial conditions:

Pump speed	= 400 rpm
Motor current	= 40 amps
Pump head	= 60 psid

If pump speed is increased to 1600 rpm what will be the new pump head?

A. 240 psid

B. 480 psid

C. 960 psid

D 3,840 psid

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P1530 (B2126)

A centrifugal pump is operating with the following parameters:

Speed	= 1,200 rpm
Current	= 40 amps
Pump head	= 20 psi
Pump flow rate	= 400 gpm

What will be the approximate value of pump head and current if pump speed is increased to 1,600 rpm?

A. 25 psi, 55 amps

B. 25 psi, 95 amps

C. 36 psi, 55 amps

D. 36 psi, 95 amps

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P1629

A centrifugal pump is operating with the following parameters:

Speed	= 1,200 rpm
Current	= 40 amps
Pump head	= 20 psi
Pump flow rate	= 400 gpm

What will be the approximate value of pump head and current if pump speed is increased to 1,800 rpm?

A. 36 psi, 95 amps

B. 36 psi, 135 amps

C. 45 psi, 95 amps

D. 45 psi, 135 amps

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P1729 (B1719)

A centrifugal pump is operating with the following parameters:

Speed	= 1,800 rpm
Current	= 40 amps
Pump head	= 20 psi
Pump flow rate	= 400 gpm

What will be the approximate value of pump head and current if pump speed is decreased to 1,200 rpm?

A. 13 psi, 18 amps

B. 13 psi, 12 amps

C. 9 psi, 18 amps

D. 9 psi, 12 amps

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P1828 (B2627)

An ac motor-driven centrifugal pump is operating with a flow rate of 3,000 gpm and a motor current of 150 amps. If the pump speed is reduced such that the flow rate is 2,000 gpm, what is the approximate final motor current at the new lower speed? (Assume a constant motor voltage.)

A. 44 amps

B. 59 amps

C. 67 amps

D. 100 amps

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P2130 (B2229)

A centrifugal pump is operating at 600 rpm with the following parameters:

Motor current = 100 amps
Pump head = 50 psid
Pump flow rate = 880 gpm

Which one of the following will be the approximate value of pump head if pump speed is increased to 1200 rpm?

A. 71 psid

B. 126 psid

C. 172 psid

D. 200 psid

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P2329 (B2321)

A multi-speed centrifugal pump is operating at 3,600 rpm with a flow rate of 3,000 gpm. Which one of the following approximates the new flow rate if the speed is decreased to 3,000 rpm?

A. 1,000 gpm

B. 1,500 gpm

C. 2,000 gpm

D. 2,500 gpm

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P2529 (B2527)

A multispeed centrifugal pump is operating with a flow rate of 1800 gpm at a speed of 3600 rpm. Which one of the following approximates the new flow rate if the pump speed is decreased to 2400 rpm?

A. 900 gpm

B. 1050 gpm

C. 1200 gpm

D. 1350 gpm

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P3129 (B1626)

A multi-speed motor-driven centrifugal pump is operating with the following parameters:

Motor current = 27 amps
Pump head = 50 psi
Pump flow rate = 880 gpm

Which one of the following will be the approximate new value of pump head if pump speed is increased such that the motor current is now 64 amps?

A. 89 psi

B. 119 psi

C. 211 psi

D. 281 psi

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P3130 (B3127)

Which one of the following describes the relationship between the current supplied to an ac induction motor and the amount of heat generated in the motor windings?

A. Heat generation is directly proportional to the current.

B. Heat generation is proportional to the cube of the current.

C. Heat generation is proportional to the square of the current.

D. Heat generation is proportional to the square root of the current.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P3430 (B1228)

A centrifugal pump is operating at 600 rpm with the following parameters:

Current	= 100 amps
Pump head	= 50 psid
Pump flow rate	= 880 gpm

What will be the approximate value of pump head if pump speed is increased such that the pump now draws 640 amps?

A. 93 psid

B. 126 psid

C. 173 psid

D. 320 psid

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P3730 (B3722)

A rotary positive displacement pump (PDP) is being used to supply water to a piping system. The PDP is driven by an ac induction motor. The initial parameters are:

System pressure:	500 psig
PDP flow rate:	50 gpm
PDP motor current:	40 amps

After several hours, the PDP motor speed is increased such that the new PDP flow rate is 100 gpm. If system pressure does not change, what is the approximate value of the PDP motor current at the 100 gpm flow rate?

A. 80 amps

B. 160 amps

C. 320 amps

D. 640 amps

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.04 [2.7/2.8]
QID: P4515 (B4515)

Refer to the pump performance curves for a centrifugal cooling water pump (see figure below). The pump is being driven by a single-speed ac induction motor. Pump flow rate is being controlled by a throttled discharge flow control valve.

The following initial pump conditions exist:

Pump motor current: 50 amps
Pump flow rate: 400 gpm
Pump suction temperature: 70°F

If the flow control valve is repositioned such that pump flow rate is now 800 gpm, what will be the approximate new pump motor current?

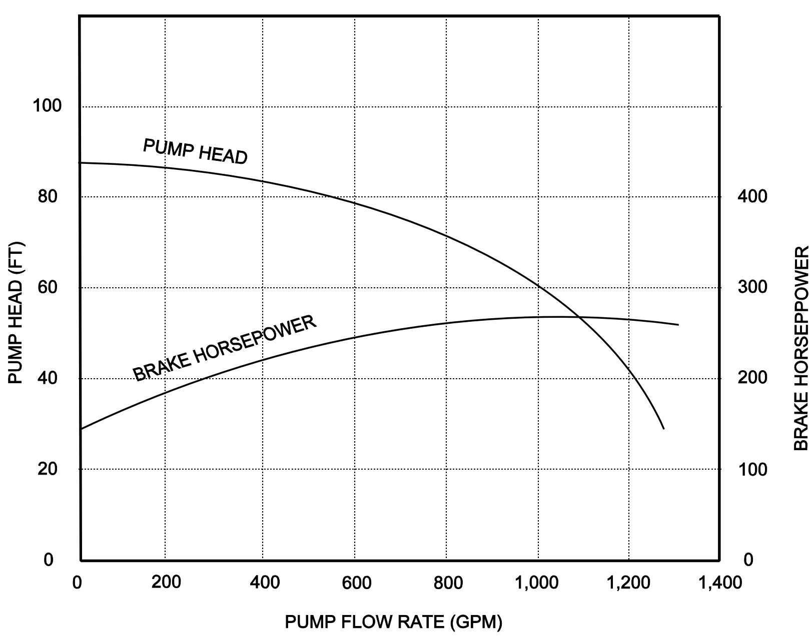
A. Less than 100 amps

B. 200 amps

C. 400 amps

D. More than 500 amps

ANSWER: A.



TOPIC:	191005
KNOWLEDGE:	K1.04 [2.7/2.8]
QID:	P4915 (B4914)

Consider two identical single-speed ac induction motors, one of which is connected to a radial-flow centrifugal pump and the other to a reciprocating-type positive displacement pump (PDP). Both pumps are taking suction at the same elevation from a vented water storage tank.

Each pump has a maximum design backpressure of 800 psig, and each is operating with the following initial conditions:

Flow rate:	200 gpm
Backpressure:	400 psig
Motor current:	100 amps

If the backpressure for each pump increases to 600 psig, the centrifugal pump will have a ___________ flow rate than the PDP; and the centrifugal pump will have a ___________ motor current than the PDP.

A. lower; higher

B. lower; lower

C. higher; higher

D. higher; lower

ANSWER: B.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P29 (B2127)

The starting current in a typical ac induction motor is significantly higher than the full-load running current because...

A. starting torque is lower than running torque.

B. starting torque is higher than running torque.

C. rotor speed during start is too low to generate sufficient counter electromotive force (CEMF) in the stator.

D. rotor current during start is too low to generate sufficient CEMF in the stator.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P108 (B105)

The average starting current for an ac motor is approximately...

A. the same as its normal running current.

B. two to three times its normal running current.

C. five to seven times its normal running current.

D. ten to fifteen times its normal running current.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P230

Which one of the following describes the motor current indications that would be observed during the start of a large ac motor connected to a load?

A. Amps slowly increase to the normal operating value over a period of five time constants.

B. Amps immediately increase to the normal operating value and stabilize.

C. Amps immediately increase to many times the normal operating value and then decrease to the normal operating value.

D. Amps immediately increase to the full-scale value and then decrease rapidly to zero due to overload protection.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P429

If the discharge valve of a large motor-driven centrifugal pump is kept closed during a normal pump start, the amps indication for the ac induction motor will rise to...

A. several times the full-load current value and then decrease to the no-load current value.

B. approximately the full-load current value and then decrease to the no-load current value.

C. several times the full-load current value and then decrease to the full-load value.

D. approximately the full-load current value and then stabilize at the full-load current value.

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P930 (B2928)

Which one of the following causes starting current to be greater than running current for a typical ac induction motor?

A. The rotor does not develop maximum induced current flow until it has achieved synchronous speed.

B. After the motor starts, resistors are added to the electrical circuit to limit the running current.

C. A large amount of starting current is required to initially establish the rotating magnetic field.

D. The rotor field induces an opposing voltage in the stator that is proportional to rotor speed.

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P1230

The starting current in an ac motor is significantly higher than the full-load running current because...

A. little counter electromotive force is induced onto the rotor during motor start.

B. motor torque production is highest during motor start.

C. little counter electromotive force is induced onto the stator during motor start.

D. work performed by the motor is highest during motor start.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P1330

Starting current in an ac induction motor is typically ____________ times full-load rated current.

A. 1/4 to ½

B. 2 to 3

C. 5 to 6

D. 10 to 12

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P1827 (B1327)

Which one of the following describes the motor current during the start of a typical ac motor-driven centrifugal pump with a closed discharge valve? (Assume the pump does <u>not</u> trip.)

A. Current immediately increases to the full-load value and then gradually decreases to the no-load value.

B. Current immediately increases to the full-load value and then stabilizes at the full-load value.

C. Current immediately increases to many times the full-load value and then rapidly decreases to the no-load value after several seconds and then stabilizes.

D. Current immediately increases to many times the full-load value and then rapidly decreases to the full-load value after several seconds and then stabilizes.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P1929 (B1428)

Which one of the following describes the typical ammeter response during a normal start of a large ac motor-driven centrifugal pump with a closed discharge valve?

A. Indication will approach full scale and then return to the full-load value.

B. Indication will go off scale high and then return to the no-load value.

C. Indication will approach full scale and then return to the no-load value.

D. Indication will go off scale high and then return to the full-load value.

ANSWER: B.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P2229 (B28)

Which one of the following describes the motor current indications that would be observed during the start of a large ac motor-driven centrifugal pump with a closed discharge valve?

A. Current immediately increases to the full-load value and then gradually decreases to the no-load value over several minutes.

B. Current immediately increases to the no-load value and then stabilizes.

C. Current immediately increases to many times the no-load value and then rapidly decreases to the no-load value after several seconds.

D. Current immediately increases to many times the no-load value and then gradually decreases to the no-load value after several minutes.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P2230 (B2227)

Two identical 4,160 VAC induction motors are connected to identical centrifugal pumps being used to provide cooling water flow in separate systems in a nuclear power plant. Each motor is rated at 1000 hp. The discharge valve for pump A is fully open and the discharge valve for pump B is fully shut.

If each motor is then started, the longest time period required to stabilize motor current will be experienced by motor ___________ and the higher stable motor current will be experienced by motor ________.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P2430 (B2428)

Which one of the following describes when the highest stator current will be experienced by an ac induction motor?

A. During motor operation at full load

B. During motor operation at zero load

C. Immediately after energizing the motor

D. Immediately after deenergizing the motor

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P2730 (B2727)

Two identical 4,160 VAC induction motors are connected to identical centrifugal pumps in identical but separate cooling water systems. Each motor is rated at 200 hp. The discharge valve for pump A is fully shut and the discharge valve for pump B is fully open.

If each motor is then started, the longest time period required to stabilize motor current will be experienced by motor ___________ and the higher stable motor current will be experienced by motor ________.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P2830 (B2828)

Two identical 4,160 VAC induction motors are connected to identical centrifugal pumps. The pumps are used to provide flow in two separate but identical cooling water systems in a nuclear power plant. Each motor is rated at 400 hp. The discharge valve for pump A is fully shut and the discharge valve for pump B is fully open.

If each motor is then started, the longer time period required to stabilize motor current will be experienced by motor ___________ and the higher stable motor current will be experienced by motor ________.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P2931 (B3529)

Two identical 4,160 VAC induction motors are connected to identical centrifugal pumps in identical but separate cooling water systems. Each motor is rated at 200 hp. The discharge valve for pump A is fully shut and the discharge valve for pump B is fully open.

When the motors are started under these conditions, the shorter time period required to reach a stable running current will be experienced by motor ___________, and the higher stable running current will be experienced by motor ________.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: B.

TOPIC: 191005
KNOWLEDGE: K1.05 [2.8/2.7]
QID: P4615 (B4614)

Select the option that correctly fills in the blanks.

To minimize the adverse effects of starting current, an ac induction motor should be started ____________ to ___________ the stator counter electromotive force (CEMF).

A. unloaded; quickly establish

B. unloaded; delay

C. partially loaded; quickly establish

D. partially loaded; delay

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.06 [3.0/3.1]
QID: P30 (B1826)

What is the primary reason for limiting the number of starts for an electric motor in a given period of time?

A. Prevent overheating of the windings due to high starting currents.

B. Prevent overheating of the windings due to shorting within the stator.

C. Prevent rotor damage due to excessive cyclic stresses on the shaft.

D. Prevent rotor damage due to excessive axial displacement of the shaft.

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.06 [3.0/3.1]
QID: P231 (B328)

Which one of the following is the basis for restricting the number of starts that a large ac motor may be subjected to within a one-hour period?

A. Prevent excessive torsional stresses on the motor shaft

B. Prevent excessive arcing and degradation of motor breaker contacts

C. Prevent excessive heat buildup within the motor windings

D. Prevent excessive wear of motor thrust bearings

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.06 [3.0/3.1]
QID: P1031

The number of starts for an electric motor in a given period of time should be limited because overheating of the _______________ can occur due to the _______________ counter electromotive force produced at low rotor speeds.

A. windings; low

B. windings; high

C. commutator and/or slip rings; low

D. commutator and/or slip rings; high

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.06 [3.0/3.1]
QID: P1131

The frequency of start/stop cycles for an electrical motor is limited to prevent...

A. overheating the motor windings.

B. overheating the motor supply bus.

C. excessive shaft torsional stresses.

D. excessive cycling of the motor breaker.

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.06 [3.0/3.1]
QID: P1331 (B1128)

Frequent start/stop cycling of large ac motors is prohibited to prevent...

A. excessive bearing wear.

B. motor shaft imbalance.

C. overloading electrical buswork.

D. overheating motor windings.

ANSWER: D.

TOPIC: 191005
KNOWLEDGE: K1.06 [3.0/3.1]
QID: P2531 (B2528)

Frequent starts of large motors will result in overheating of the motor windings due to high current flow caused by...

A. low electrical resistance of the motor windings.

B. an electrical short circuit between the rotor and stator.

C. high counter electromotive force at low rotor speeds.

D. windage losses between the rotor and stator.

ANSWER: A.

TOPIC: 191005
KNOWLEDGE: K1.06 [3.0/3.1]
QID: P2631 (B228)

Which one of the following is the primary reason for limiting the number of motor starts in a given time period?

A. Minimizes pitting of contacts in the motor breaker.

B. Prevents excessive torsional stresses on motor shaft.

C. Prevents overheating of motor windings.

D. Minimizes axial stresses on motor bearings.

ANSWER: C.

TOPIC: 191005
KNOWLEDGE: K1.06 [3.0/3.1]
QID: P3331 (B3327)

A large centrifugal pump is driven by a 200 horsepower 4.16 kV ac motor. The motor breaker control circuit contains the following protection devices: instantaneous overcurrent relay, motor thermal overload relay, control power fuses, and an anti-pumping device.

The pump had been manually started and stopped several times during a 5-minute period when the motor breaker unexpectedly tripped. In this situation, which one of the following is the most likely cause of the breaker trip?

A. Instantaneous overcurrent

B. Motor thermal overload

C. Blown control power fuse

D. Anti-pumping device actuation

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P104 (B231)

Refer to the drawing of an operating water cleanup system. All valves are identical and are initially 50% open (see figure below).

To lower the temperature at point 7, the operator should adjust valve __________ in the open direction.

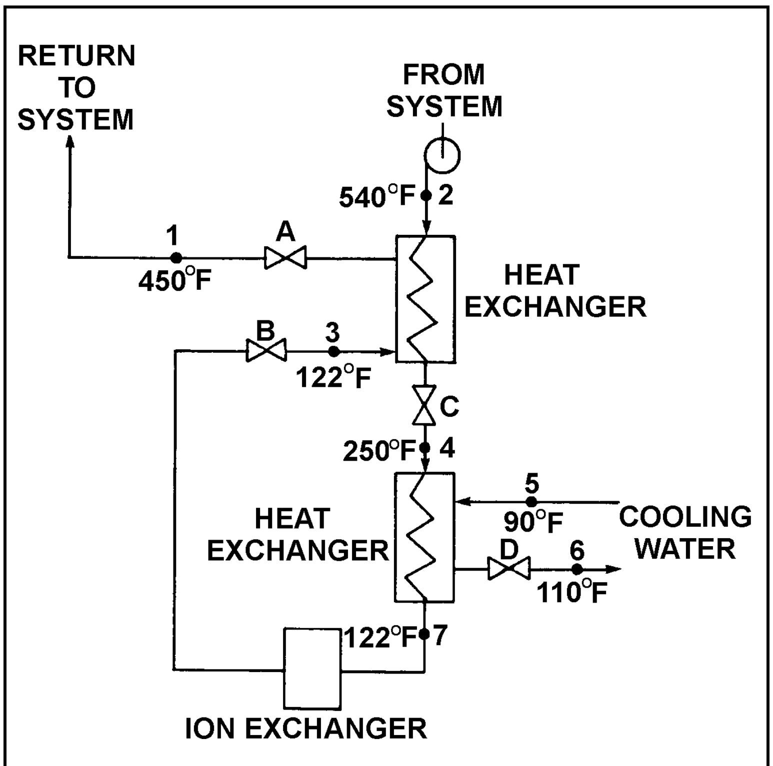
A. A

B. B

C. C

D. D

ANSWER: D.



WATER CLEANUP SYSTEM

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P534 (B331)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Increasing the oil flow rate through the heat exchanger will cause the oil outlet temperature to _________ and the cooling water outlet temperature to __________. (Assume cooling water flow rate remains the same.)

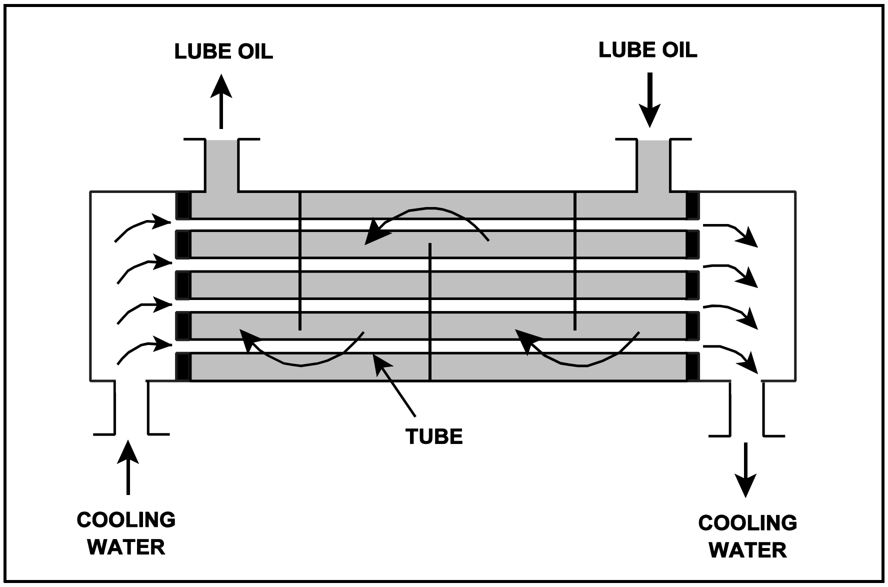
A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P632 (B431)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Assume that the inlet lube oil and inlet cooling water temperatures are constant and cooling water flow rate remains the same. Decreasing the oil flow rate through the heat exchanger will cause the oil outlet temperature to _________ and the cooling water outlet temperature to _________.

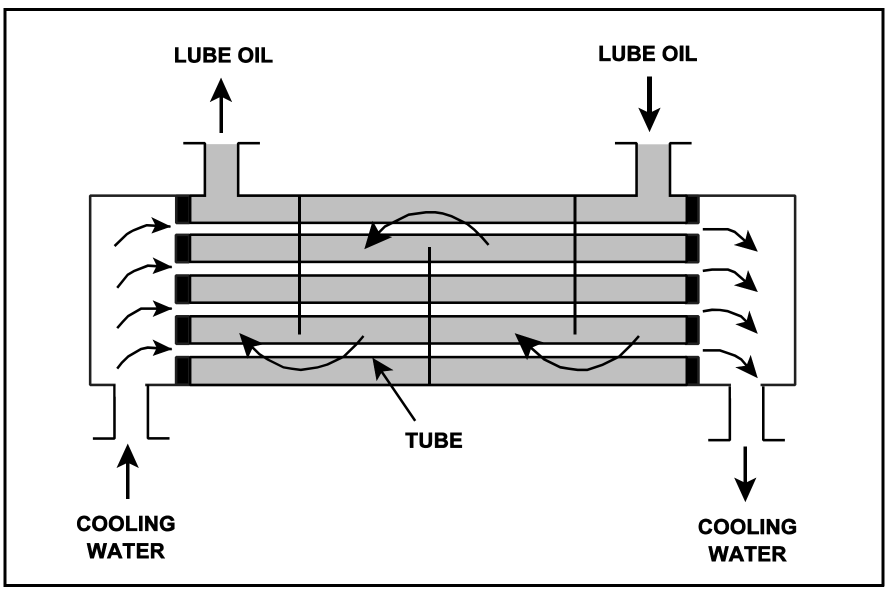
A. increase, increase

B. increase, decrease

C. decrease, increase

D. decrease, decrease

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P732 (B1834)

Refer to the drawing of an operating water cleanup system (see figure below).

Valves A, B, and C are fully open. Valve D is 80% open. All temperatures are as shown. If valve D is then throttled to 50%, the temperature at point...

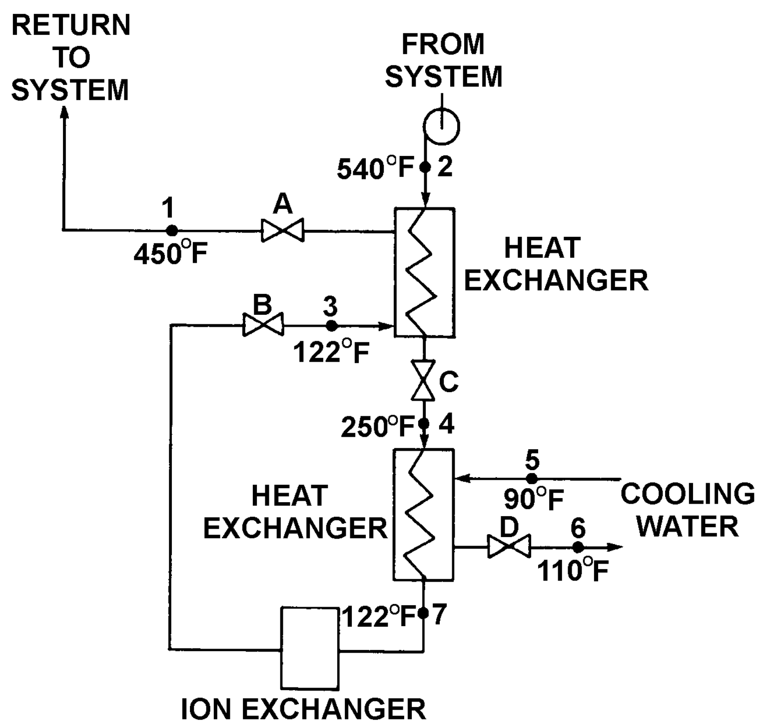
A. 3 will decrease.

B. 4 will increase.

C. 5 will increase.

D. 6 will decrease.

ANSWER: B.



WATER CLEANUP SYSTEM

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1032 (B1031)

Refer to the drawing of an operating water cleanup system (see figure below).

Valves A, B, and C are fully open. Valve D is 20% open. All temperatures are as shown. Valve D is then quickly opened to 100%.

The temperature at point...

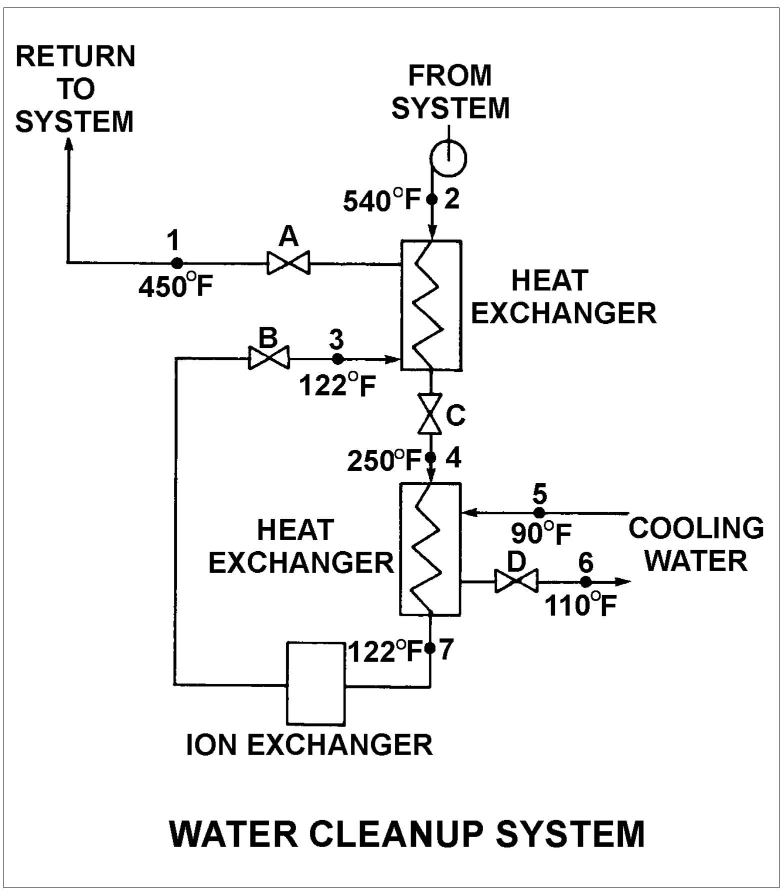
A. 3 will increase.

B. 4 will decrease.

C. 5 will decrease.

D. 7 will increase.

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1231 (B1231)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50% open. To lower the temperature at point 4, the operator can adjust valve ______ in the ______ direction.

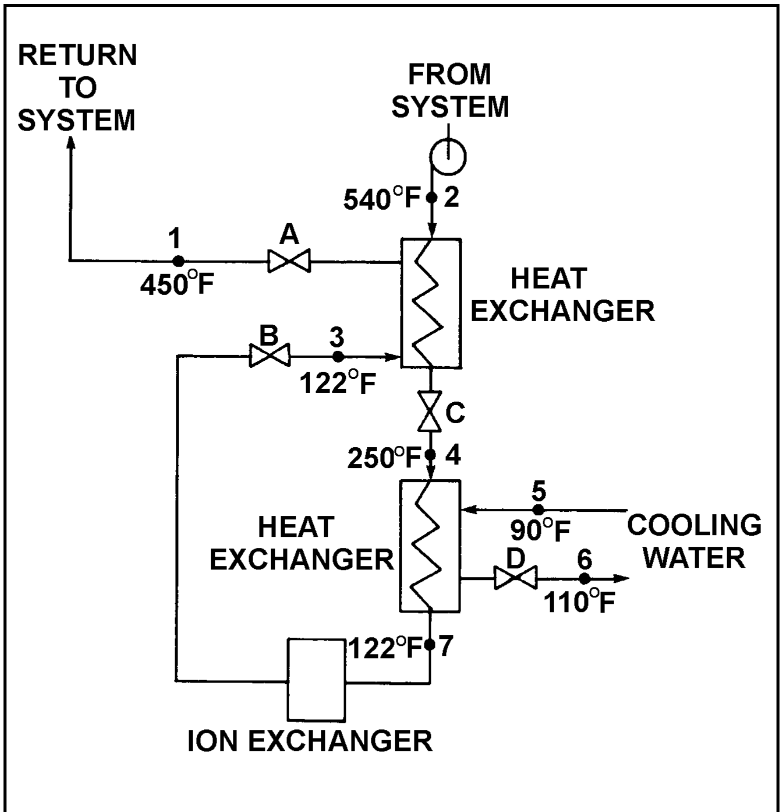
A. A; open

B. B; shut

C. C; open

D. D; shut

ANSWER: B.



WATER CLEANUP SYSTEM

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1432 (B1432)

The rate of heat transfer between two liquids in a heat exchanger will be increased if the: (Assume single-phase conditions and a constant specific heat.)

A. temperature of the hotter liquid is decreased by 20°F.

B. temperature of the colder liquid is increased by 20°F.

C. flow rates of both liquids are decreased by 10%.

D. flow rates of both liquids are increased by 10%.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1533 (B1531)

Refer to the drawing of a lube oil heat exchanger (see figure below).

The heat exchanger is operating with the following parameters:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$\dot{m}_{oil}$ = 4.0×10^4 lbm/hr
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$\dot{m}_{water}$ = ?

What is the mass flow rate of the cooling water?

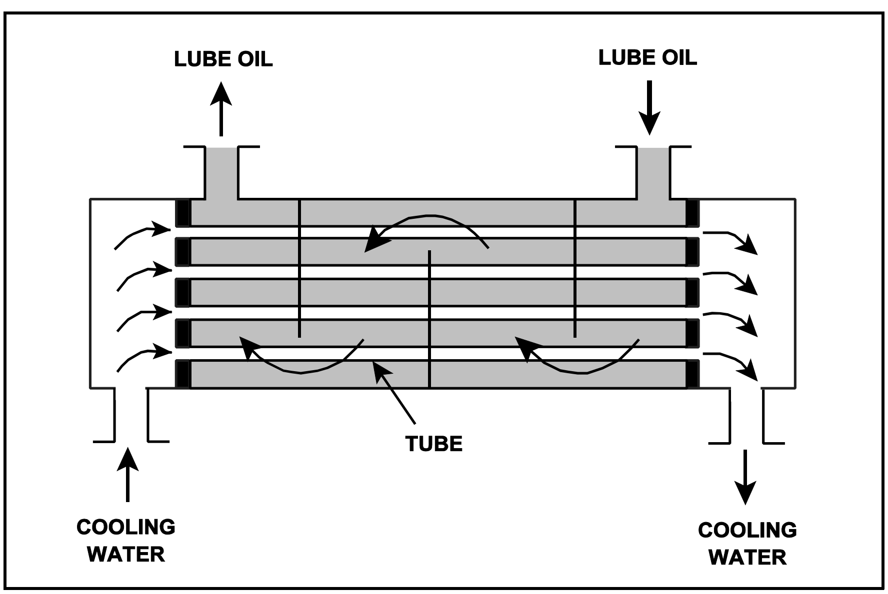
A. 8.8×10^4 lbm/hr

B. 7.3×10^4 lbm/hr

C. 2.2×10^4 lbm/hr

D. 1.8×10^4 lbm/hr

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1632 (B832)

A liquid-to-liquid counterflow heat exchanger is operating with single-phase conditions and a constant specific heat for each liquid. Which one of the following will decrease the heat transfer between the two liquids?

A. The temperature of both liquids is increased by 20°F.

B. The temperature of both liquids is decreased by 20°F.

C. The flow rate of the hotter liquid is increased by 10%.

D. The flow rate of the colder liquid is decreased by 10%.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1634 (B1631)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information, which one of the following is the temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

$\dot{m}_{oil}$ = 2.0×10^4 lbm/hr
$\dot{m}_{water}$ = 3.0×10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 92°F
$T_{cw\text{-}out}$ = 125°F
$T_{oil\text{-}in}$ = 180°F
$T_{oil\text{-}out}$ = ?

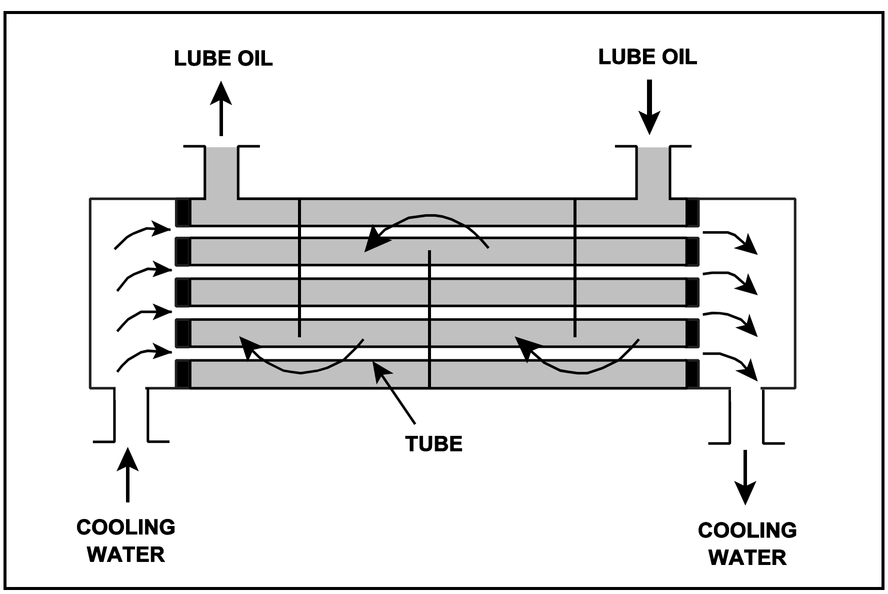
A. 135°F

B. 140°F

C. 145°F

D. 150°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1732 (B1732)

Which one of the following will reduce the rate of heat transfer between two liquids in a heat exchanger? (Assume single-phase conditions and a constant specific heat for both liquids.)

A. The inlet temperatures of both liquids are decreased by 20°F.

B. The inlet temperatures of both liquids are increased by 20°F.

C. The inlet temperature of the hotter liquid is increased by 20°F.

D. The inlet temperature of the colder liquid is increased by 20°F.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1832 (B631)

The rate of heat transfer between two liquids in a heat exchanger will be increased if the: (Assume single-phase conditions and a constant specific heat capacity.)

A. temperature of both liquids is decreased by 20°F.

B. temperature of both liquids is increased by 20°F.

C. flow rate of the colder liquid is decreased by 10%.

D. flow rate of the hotter liquid is increased by 10%.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P1934 (B1933)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information, which one of the following is the temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

$\dot{m}_{oil}$ = 1.5 x 10^4 lbm/hr
$\dot{m}_{water}$ = 2.5 x 10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 92°F
$T_{cw\text{-}out}$ = 125°F
$T_{oil\text{-}in}$ = 160°F
$T_{oil\text{-}out}$ = ?

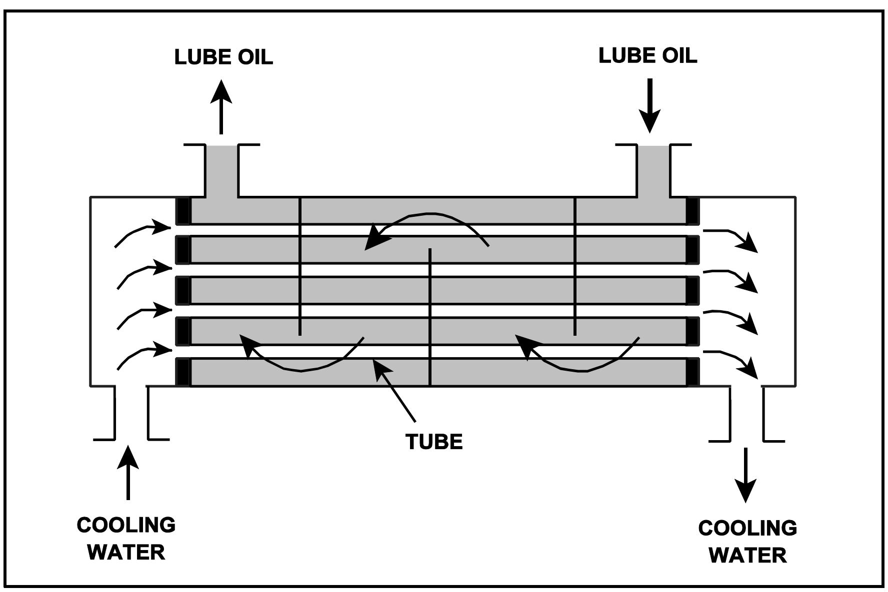
A. 110°F

B. 127°F

C. 135°F

D. 147°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2034 (B834)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following existing conditions:

$c_{p\text{-oil}}$ = 1.1 Btu/lbm-°F
$c_{p\text{-water}}$ = 1.0 Btu/lbm-°F
$\dot{m}_{oil}$ = 1.2 x 10^4 lbm/hr
$\dot{m}_{water}$ = 1.61 x 10^4 lbm/hr
$T_{oil\ in}$ = 170°F
$T_{oil\ out}$ = 120°F
$T_{water\ out}$ = 110°F
$T_{water\ in}$ = ?

Which one of the following is the approximate cooling water inlet temperature ($T_{water\ in}$) in this heat exchanger?

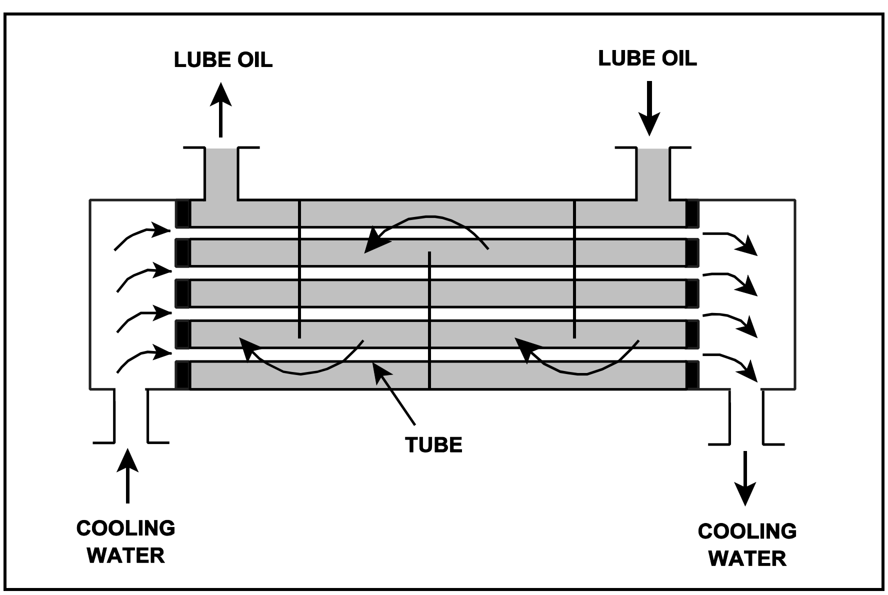
A. 65°F

B. 69°F

C. 73°F

D. 77°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2133 (B2132)

Refer to the drawing of a lube oil heat exchanger (see figure below).

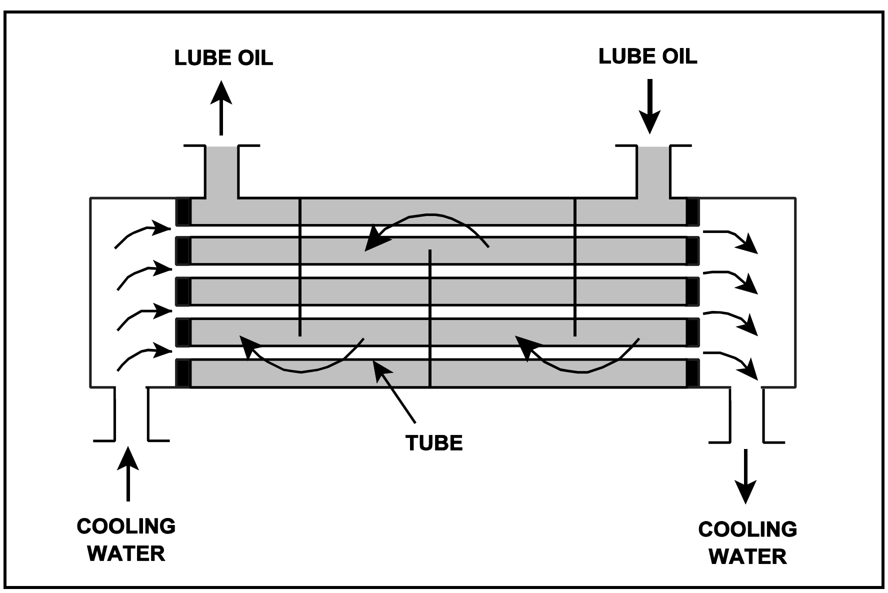
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 120°F
Cooling water inlet temperature: 60°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Assume both fluids have the same c_p.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	100°F
B.	90°F	90°F
C.	80°F	80°F
D.	80°F	100°F

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2232 (B1435)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following existing conditions:

$\dot{m}_{oil}$ = 1.8 x 10^4 lbm/hr
$\dot{m}_{water}$ = 3.3 x 10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 90°F
$T_{cw\text{-}out}$ = 120°F
$T_{oil\text{-}in}$ = 190°F
$T_{oil\text{-}out}$ = ?

Which one of the following is the temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

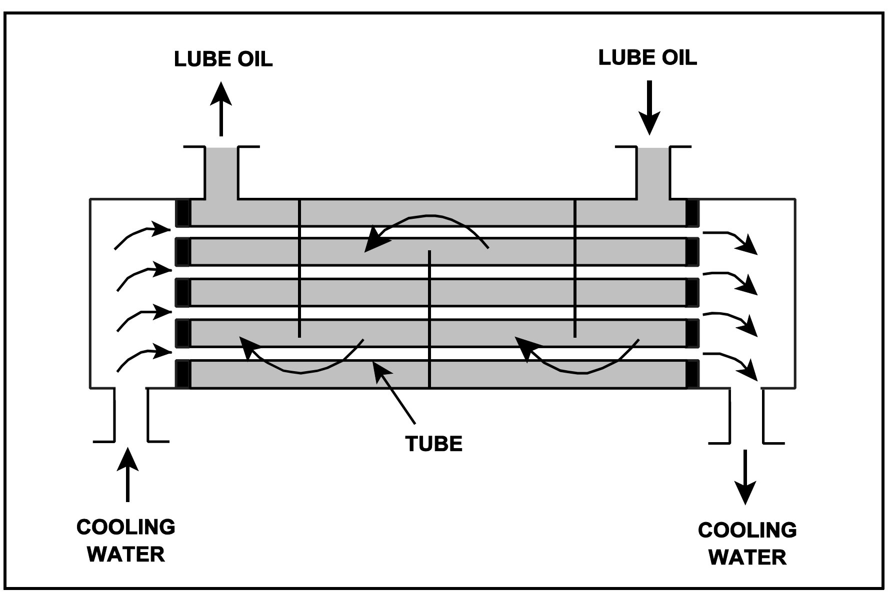
A. 110°F

B. 120°F

C. 130°F

D. 140°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2434 (B2233)

Refer to the drawing of a lube oil heat exchanger (see figure below).

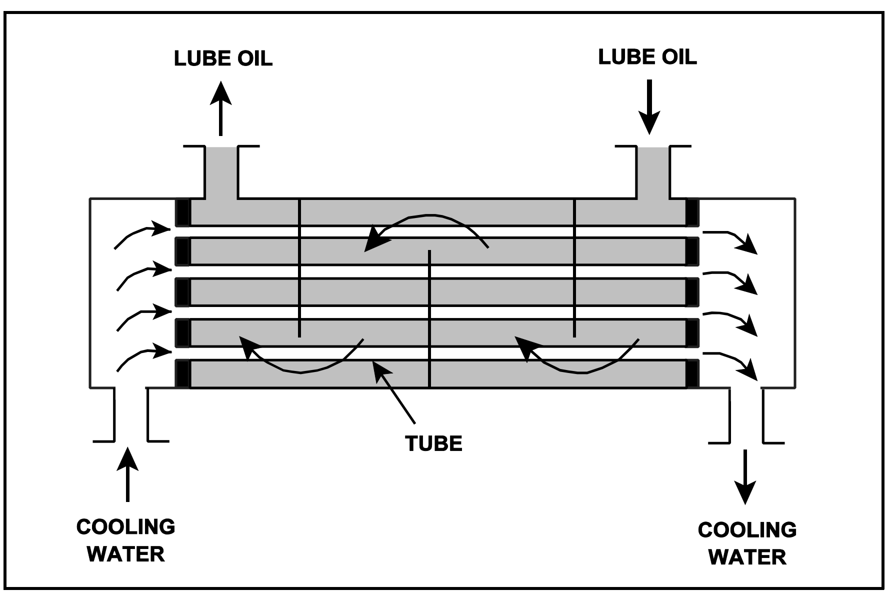
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Neglect any difference between fluid specific heat.)

	Lube Oil <u>Outlet Temp</u>	Cooling Water <u>Outlet Temp</u>
A.	90°F	100°F
B.	90°F	110°F
C.	100°F	100°F
D.	100°F	110°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2532 (B2534)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information, which one of the following is the temperature of the cooling water exiting the heat exchanger ($T_{cw\text{-}out}$)?

$\dot{m}_{oil}$ = 1.5×10^4 lbm/hr
$\dot{m}_{water}$ = 2.5×10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{oil\text{-}in}$ = 160°F
$T_{oil\text{-}out}$ = 110°F
$T_{cw\text{-}in}$ = 92°F
$T_{cw\text{-}out}$ = ?

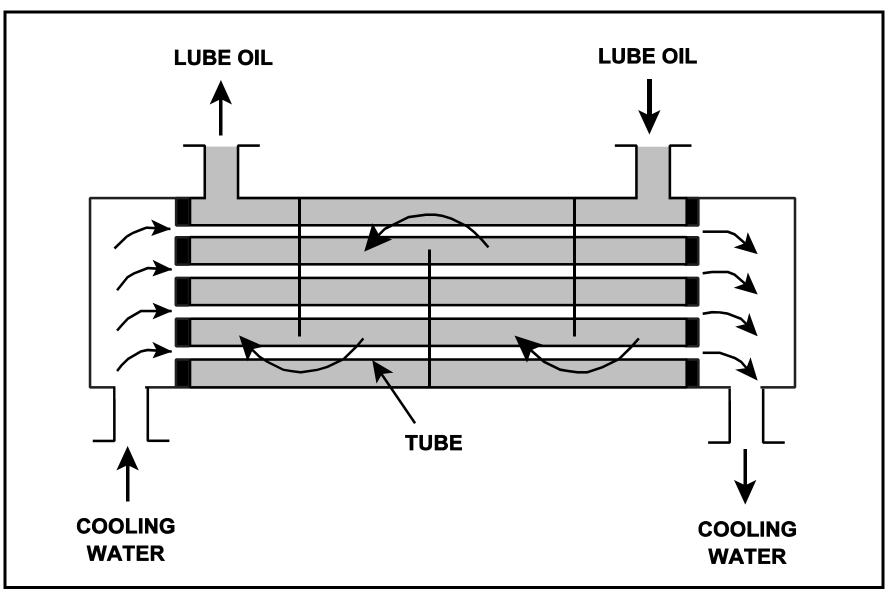
A. 110°F

B. 115°F

C. 120°F

D. 125°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2632 (B2531)

The rate of heat transfer between two liquids in a heat exchanger will be decreased if the: (Assume single-phase conditions and a constant specific heat for both liquids.)

A. inlet temperature of the hotter liquid is increased by 20°F.

B. inlet temperature of the colder liquid is decreased by 20°F.

C. flow rates of both liquids are decreased by 10%.

D. flow rates of both liquids are increased by 10%.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2633 (B2632)

Refer to the drawing of a lube oil heat exchanger (see figure below).

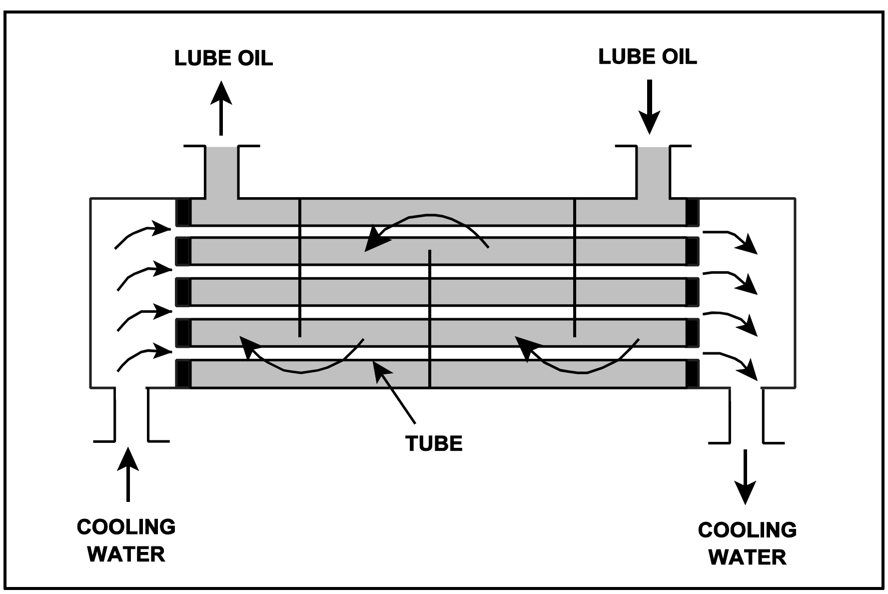
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 110°F
Cooling water inlet temperature: 75°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Neglect any difference between fluid specific heats.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	100°F
B.	100°F	90°F
C.	90°F	100°F
D.	90°F	90°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2732 (B2732)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50% open. To raise the temperature at point 4, the operator can adjust valve ______ in the ______ direction.

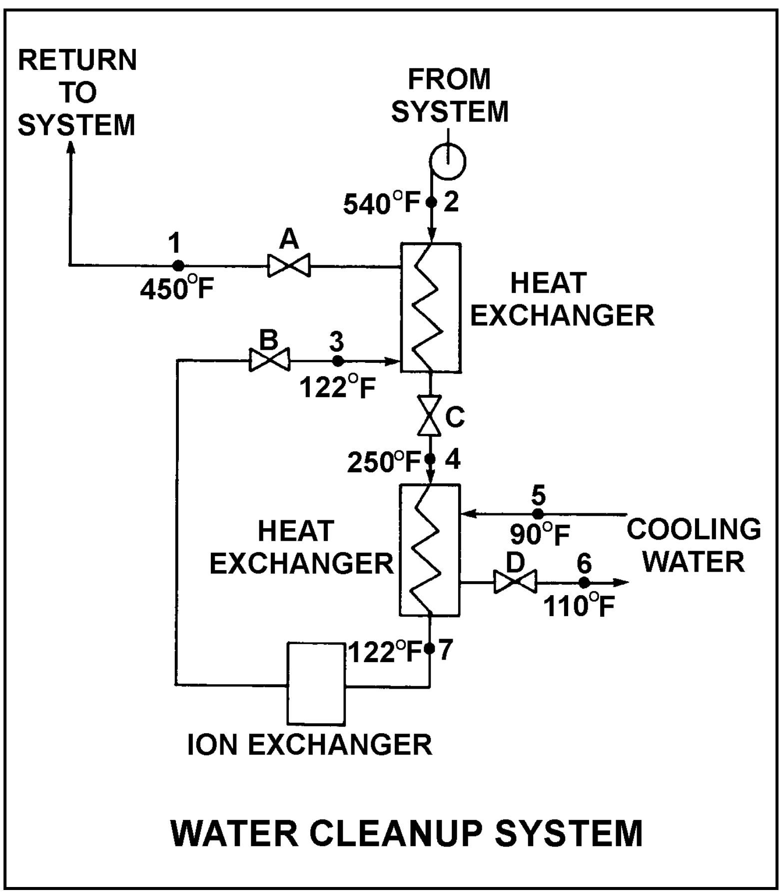
A. A; shut

B. B; shut

C. C; open

D. D; open

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2733 (B2733)

Refer to the drawing of a lube oil heat exchanger (see figure below).

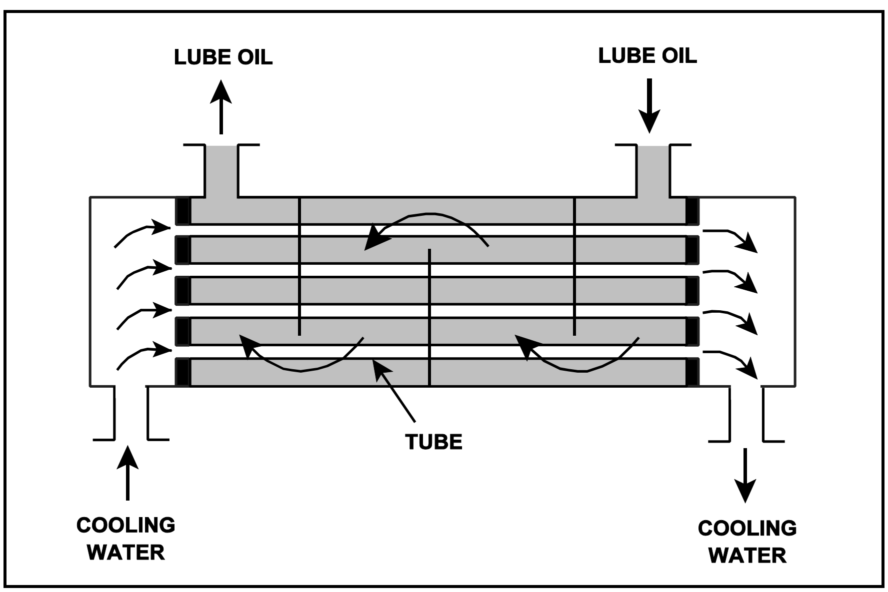
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is <u>not</u> possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	86°F
B.	100°F	85°F
C.	110°F	84°F
D.	120°F	83°F

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P2934 (B2933)

Refer to the drawing of a lube oil heat exchanger (see figure below).

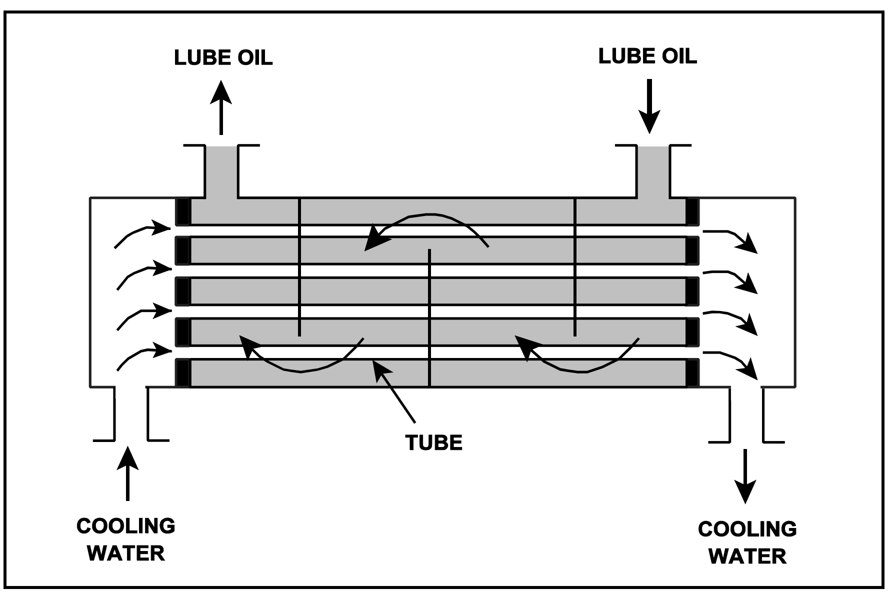
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assuming that cooling water flow rate is significantly larger than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	90°F
B.	100°F	100°F
C.	110°F	90°F
D.	110°F	100°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P3034 (B3082)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following lube oil cooling system conditions:

The lube oil flow rate in the lube oil heat exchanger is 200 lbm/min.
The lube oil enters the heat exchanger at 140°F.
The lube oil leaves the heat exchanger at 100°F.
The specific heat of the lube oil is 0.8 Btu/lbm-°F.
The cooling water flow rate is 400 lbm/min.
The cooling water enters the lube oil heat exchanger at 60°F.
The specific heat of the cooling water is 1.0 Btu/lbm-°F.

What is the approximate temperature of the cooling water leaving the lube oil heat exchanger?

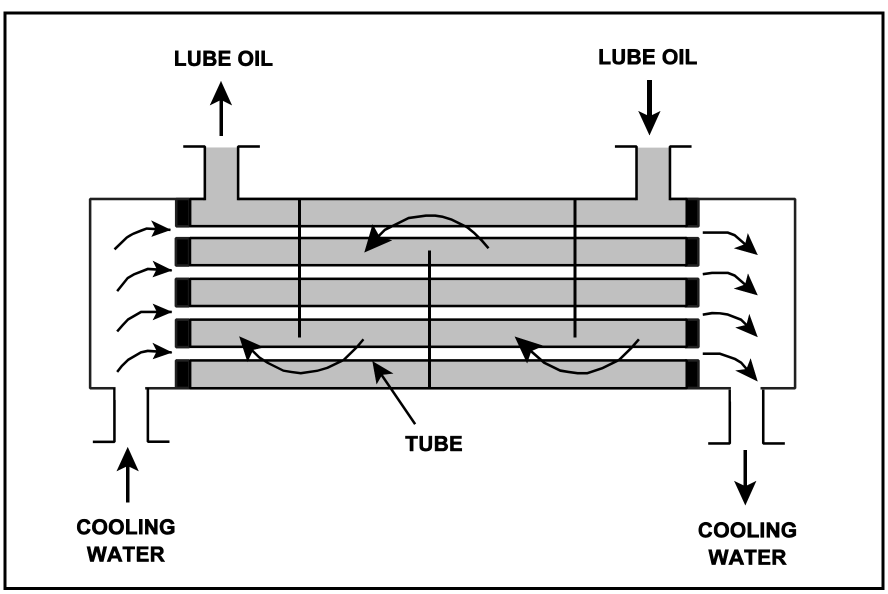
A. 76°F

B. 85°F

C. 92°F

D. 124°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P3132 (B934)

Refer to the drawing of a lube oil heat exchanger (see figure below).

The heat exchanger is operating with the following parameters:

$\dot{Q}_{oil}$ = 1.0×10^7 Btu/hr
$T_{oil\ in}$ = 170°F
$T_{oil\ out}$ = 134°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 112°F
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$\dot{m}_{water}$ = ?

Which one of the following is the mass flow rate of the cooling water?

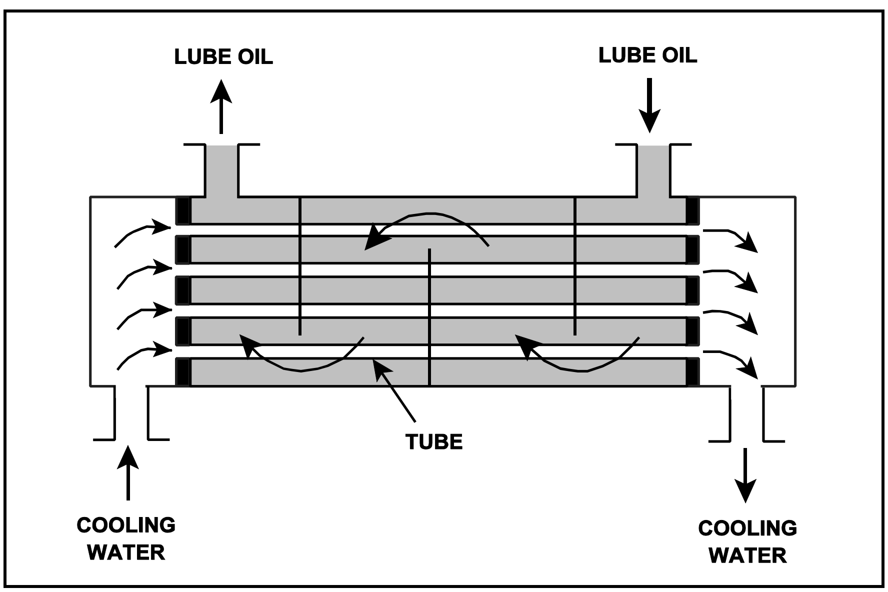
A. 4.5×10^5 lbm/hr

B. 3.7×10^5 lbm/hr

C. 2.5×10^5 lbm/hr

D. 1.2×10^5 lbm/hr

ANSWER: B.



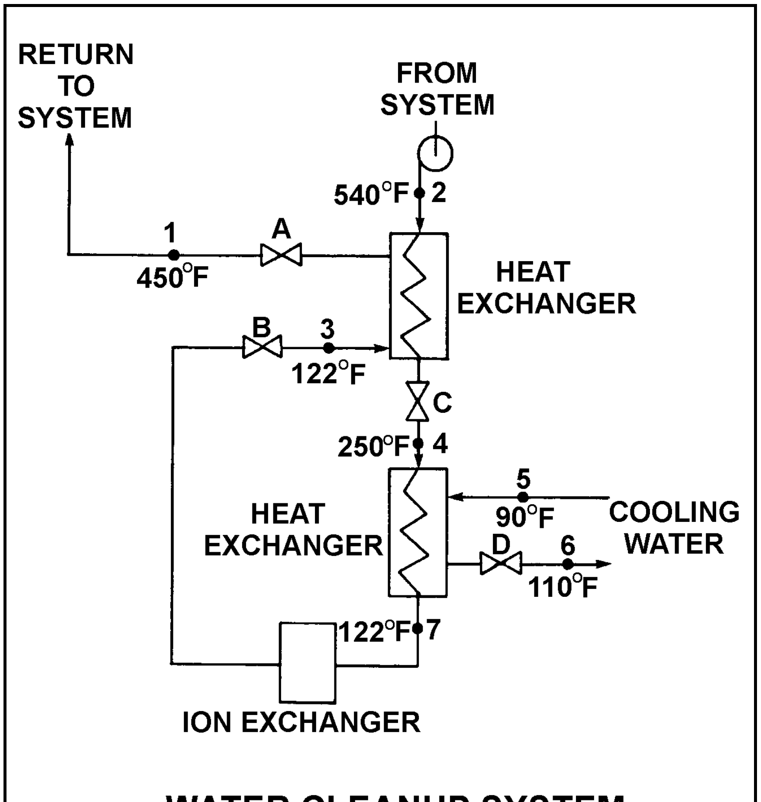
TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P3232 (B632)

Refer to the drawing of an operating water cleanup system (see figure below). Valves A, B, and D are fully open and valve C is 50% open.

If valve C is opened to 100%, how will the temperatures at points 3 and 6 be affected?

	Point 3	Point 6
A.	Decrease	Decrease
B.	Decrease	Increase
C.	Increase	Decrease
D.	Increase	Increase

ANSWER: D.



WATER CLEANUP SYSTEM

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P3332 (B1930)

Refer to the drawing of an operating water cleanup system (see figure below). All valves are identical and are initially 50% open.

To raise the temperature at point 7, the operator should adjust valve __________ in the close direction.

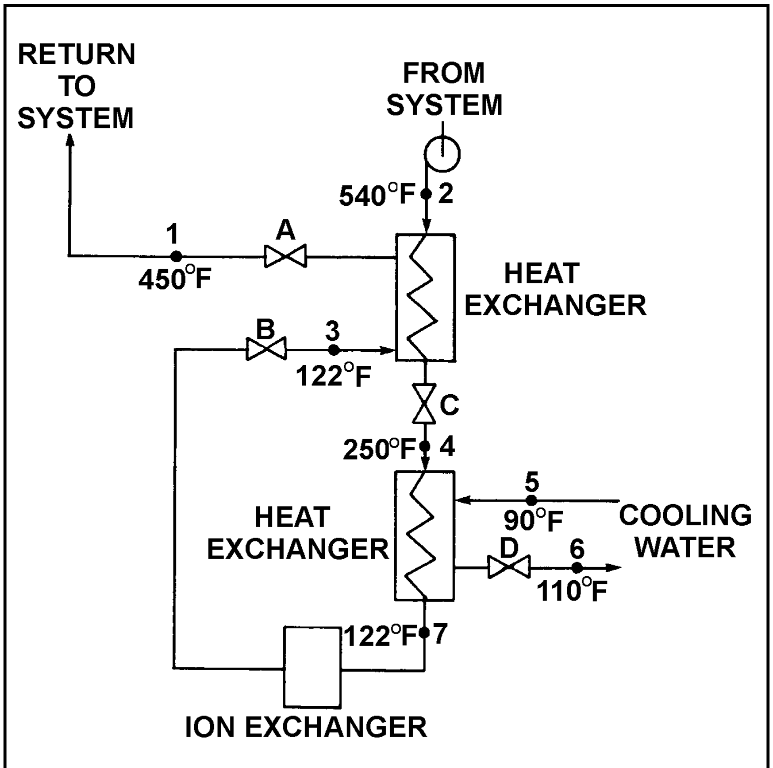
A. A

B. B

C. C

D. D

ANSWER: D.



WATER CLEANUP SYSTEM

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P3432 (B1435)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following existing conditions:

$\dot{m}_{oil}$ = 1.8×10^4 lbm/hr
$\dot{m}_{water}$ = 3.3×10^4 lbm/hr
$c_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$c_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 90°F
$T_{cw\text{-}out}$ = 120°F
$T_{oil\text{-}in}$ = 170°F
$T_{oil\text{-}out}$ = ?

What is the approximate temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

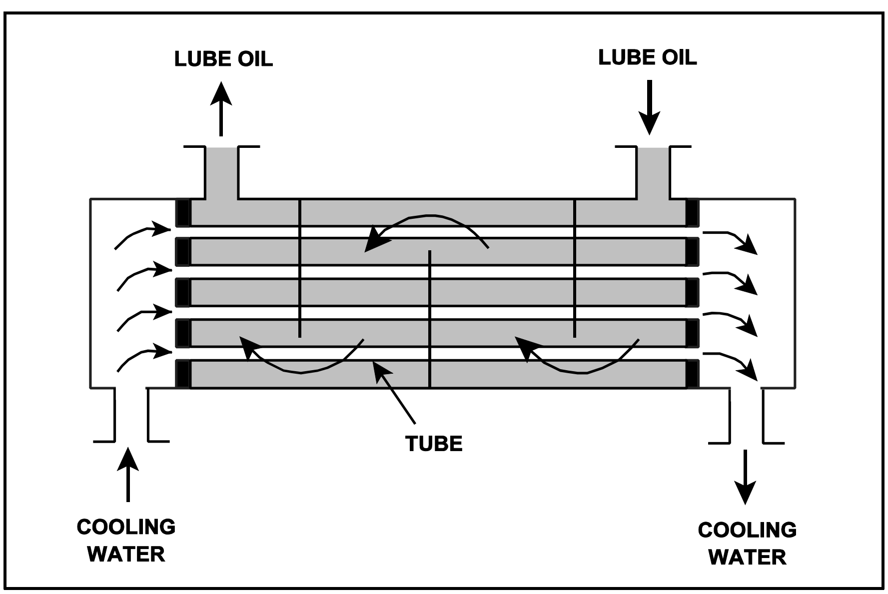
A. 110°F

B. 120°F

C. 130°F

D. 140°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P3632 (B3631)

Refer to the drawing of an operating water cleanup system (see figure below).

If cooling water flow rate is 1.0×10^6 lbm/hr, what is the approximate water flow rate in the cleanup system?

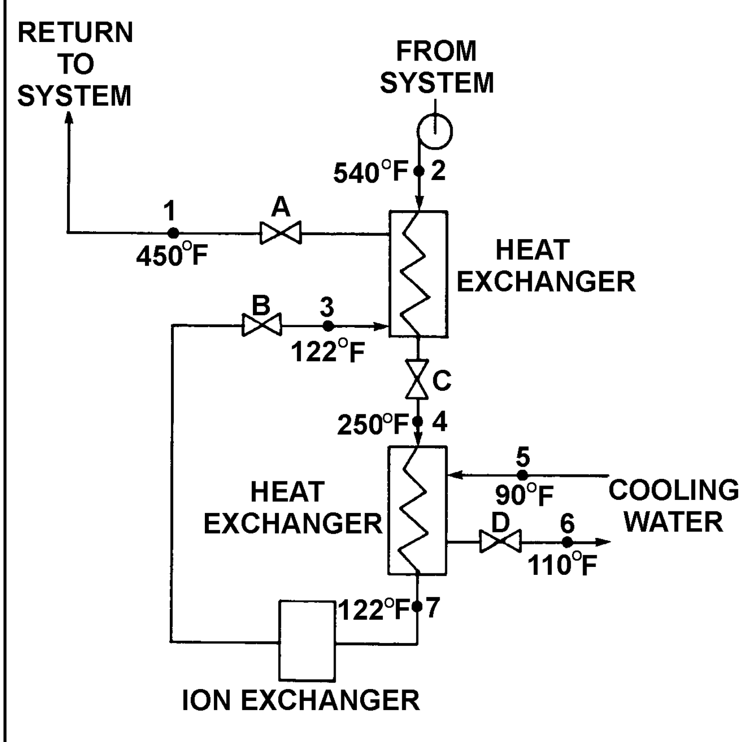
A. 1.6×10^5 lbm/hr

B. 3.2×10^5 lbm/hr

C. 1.6×10^6 lbm/hr

D. 3.2×10^6 lbm/hr

ANSWER: A.



WATER CLEANUP SYSTEM

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P3732 (B3732)

Refer to the drawing of a lube oil heat exchanger (see figure below).

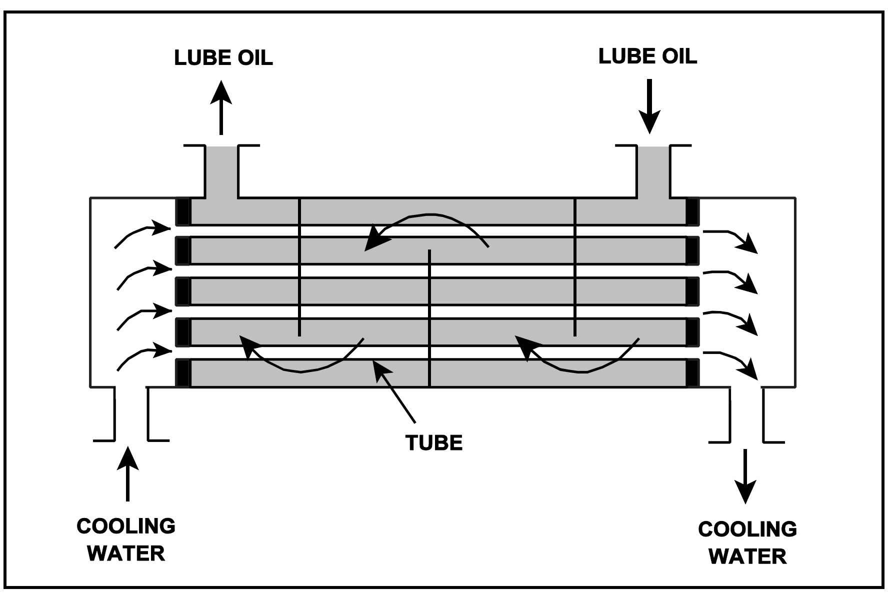
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assume that cooling water mass flow rate is less than lube oil mass flow rate, and that both fluids have the same specific heat. Which one of the following pairs of heat exchanger outlet temperatures is not possible?

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	105°F
B.	105°F	105°F
C.	110°F	90°F
D.	115°F	90°F

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.5/2.7]
QID: P3833 (B3832)

A main turbine-generator was operating at 80% load with the following initial steady-state lube oil and cooling water temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Six months later, the following current steady-state heat exchanger temperatures are observed:

$T_{oil\ in}$ = 177°F
$T_{oil\ out}$ = 111°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Assume that the total heat exchanger heat transfer coefficient and the cooling water mass flow rate do not change, and that the specific heat values for the cooling water and lube oil do not change. Also, assume that the lube oil system is a closed system.

Which one of the following could be responsible for the differences between the initial and current steady-state heat exchanger temperatures?

A. The current main turbine-generator load is lower than the initial load.

B. The current main turbine-generator load is higher than the initial load.

C. The current main turbine lube oil mass flow rate is less than the initial flow rate.

D. The current main turbine lube oil mass flow rate is greater than the initial flow rate.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P4416 (B4416)

Refer to the drawing of a lube oil heat exchanger (see figure below).

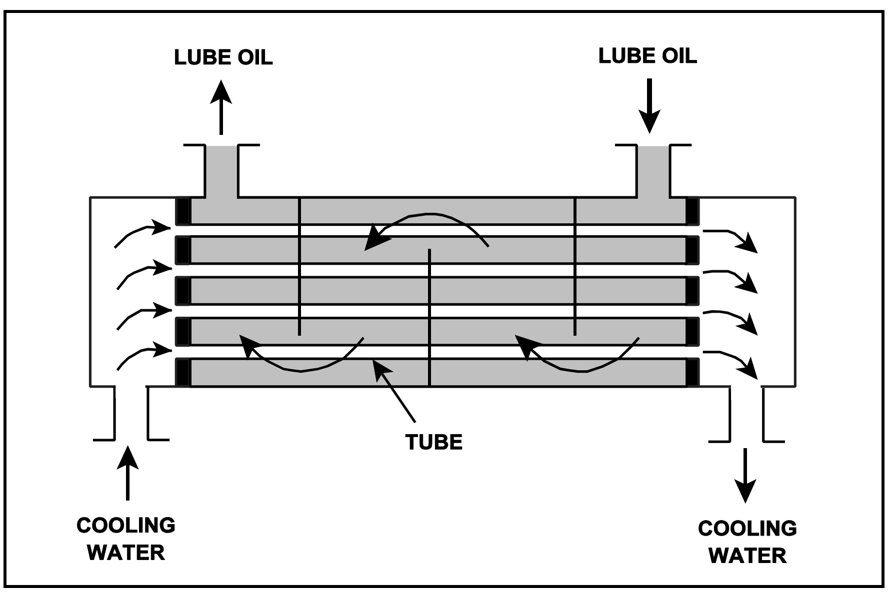
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 120°F
Cooling water inlet temperature: 60°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following sets of heat exchanger outlet temperatures is possible? (Neglect any difference between fluid specific heats.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	100°F
B.	90°F	85°F
C.	95°F	100°F
D.	95°F	85°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.5/2.7]
QID: P5316 (B5317)

A main turbine-generator was operating at 80% load with the following initial steady-state lube oil and cooling water temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Six months later, the current steady-state heat exchanger temperatures are:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 120°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 120°F

Assume that the lube oil mass flow rate does not change, and that the specific heat values for the cooling water and lube oil do not change. Also, assume that the main turbine lube oil system is a closed system.

The differences between the initial and current steady-state heat exchanger temperatures could be caused by the current main turbine-generator load being __________ with the current heat exchanger cooling water mass flow rate being ___________.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P5516 (B5517)

Refer to the drawing of a lube oil heat exchanger (see figure below).

The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Given that cooling water mass flow rate is greater than lube oil mass flow rate, which one of the following pairs of heat exchanger outlet temperatures is not possible? (Neglect any difference between the fluid specific heat capacities.)

Lube Oil Outlet Temp	Cooling Water Outlet Temp

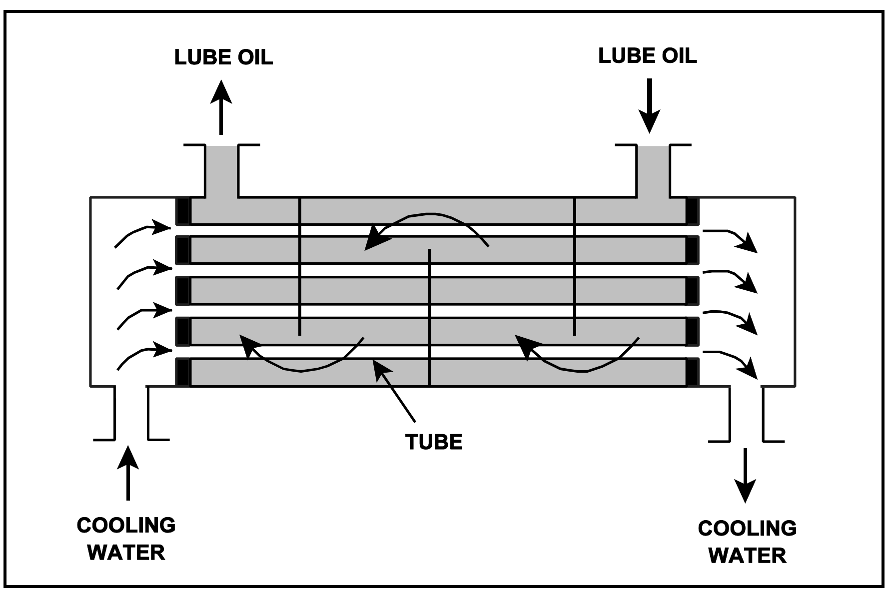
A. 90°F 105°F

B. 90°F 100°F

C. 110°F 95°F

D. 110°F 85°F

ANSWER: C.



TOPIC: 191006
KNOWLEDGE: K1.07 [2.4/2.6]
QID: P5616 (B5617)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Assume that the inlet lube oil and inlet cooling water temperatures are constant and the lube oil flow rate remains the same. If the cooling water flow rate increases, the lube oil outlet temperature will _________ and the cooling water outlet temperature will _________.

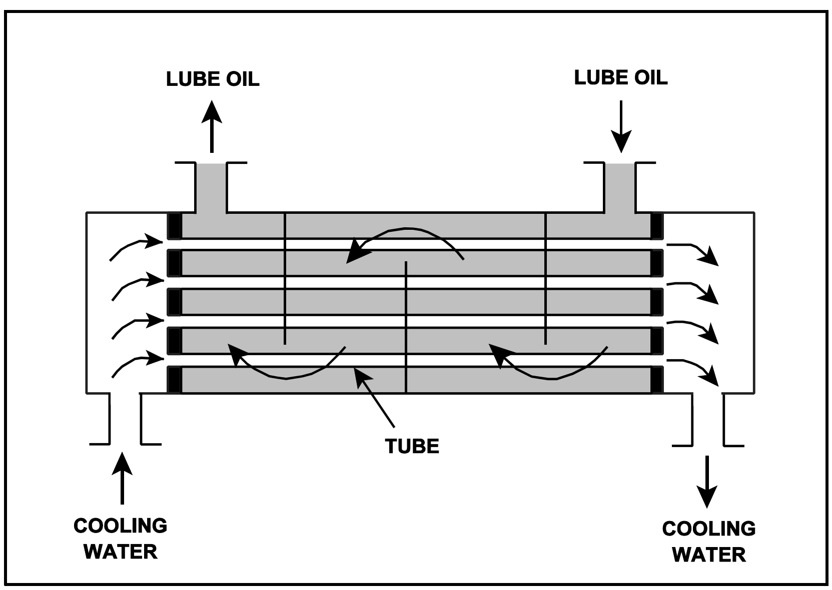
A. increase, increase

B. increase, decrease

C. decrease, increase

D. decrease, decrease

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.09 [2.8/2.8]
QID: P31

Severe stress in a mechanical component, induced by a sudden, unequally distributed temperature reduction is a description of...

A. fracture stress.

B. brittle fracture.

C. thermal shock.

D. pressurized thermal shock.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.09 [2.8/2.8]
QID: P233

The major thermodynamic concern resulting from rapidly cooling a reactor vessel is...

A. thermal shock.

B. stress corrosion.

C. loss of shutdown margin.

D. loss of subcooling margin.

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.09 [2.8/2.8]
QID: P2832 (B633)

Steam has been admitted to a main condenser for 25 minutes with no cooling water. Initiating full cooling water flow rate at this time will...

A. reduce the stress on the condenser shell by rapidly cooling the shell.

B. reduce the stress on the condenser tubes by rapidly cooling the tubes.

C. induce large thermal stresses on the condenser shell.

D. induce large thermal stresses on the junctions between the condenser tubes and the tubesheet.

ANSWER: D.

TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P32 (B1234)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

If scaling occurs inside the cooling water tubes, cooling water outlet temperature will __________ and lube oil outlet temperature will __________. (Assume oil and cooling water flow rates remain the same.)

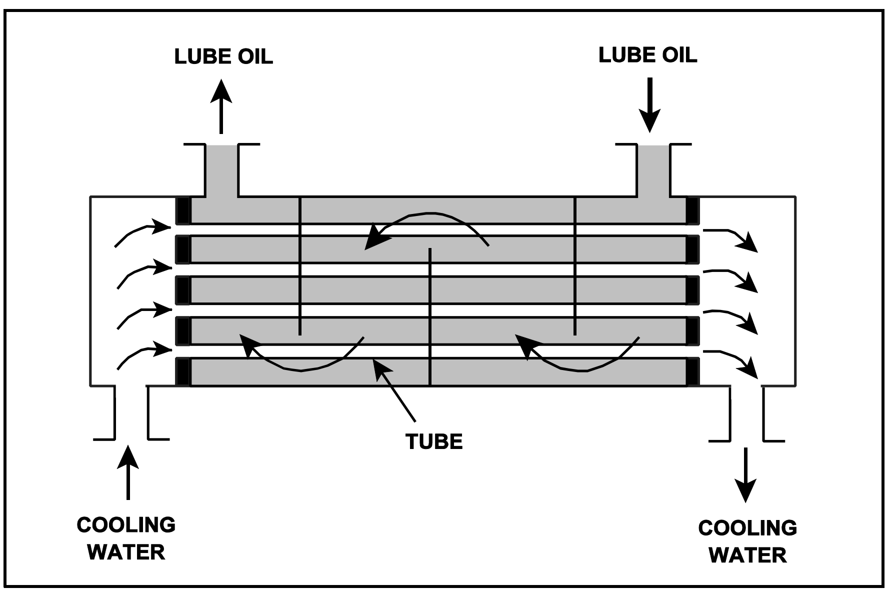
A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P105

Which one of the following will occur to reduce the heat transfer rate in a parallel-flow heat exchanger as scaling increases on the exterior surface of the tubes? (Assume no operator actions.)

A. Flow through the heat exchanger tubes will decrease.

B. Surface area of the tubes will decrease.

C. Thermal conductivity of the tubes will decrease.

D. Delta-T across the tubes will decrease.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P331 (B332)

A nuclear power plant is operating at steady-state conditions with the main generator supplying 1,000 MW to the power grid. Assume main generator load remains constant.

If 1% of the tubes in the main condenser become plugged, condenser absolute pressure will ___________; and condenser hotwell temperature will _________.

A. increase; increase

B. decrease; increase

C. increase; decrease

D. decrease; decrease

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P2233 (B1833)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

If deposits accumulate on the outside of the cooling water tubes, cooling water outlet temperature will __________ and oil outlet temperature will __________. (Assume oil and cooling water inlet temperatures and flow rates remain the same.)

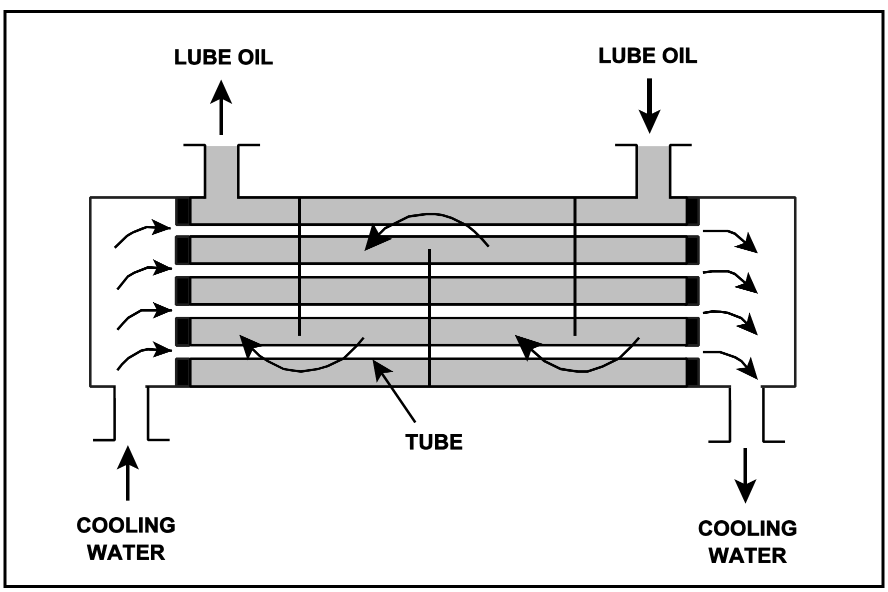
A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P3633 (B3635)

A main turbine-generator is operating at 80% load with the following initial steady-state temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

After six months of main turbine operation, the following final steady-state lube oil heat exchanger temperatures are observed:

$T_{oil\ in}$ = 179°F
$T_{oil\ out}$ = 119°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Assume that the final cooling water and lube oil flow rates are the same as the initial flow rates, and that the specific heat values for the cooling water and lube oil do not change.

Which one of the following could be responsible for the differences between the initial and final heat exchanger steady-state temperatures?

A. The heat exchanger tubes have become fouled with scale.

B. The temperature of the cooling water source has increased.

C. The final main turbine-generator load is higher than the initial load.

D. The final main turbine-generator load is lower than the initial load.

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P4617 (B4616)

Refer to the drawing of two system curves for a typical main condenser cooling water system (see figure below).

Which one of the following will cause the system curve to shift from the solid curve toward the dashed curve?

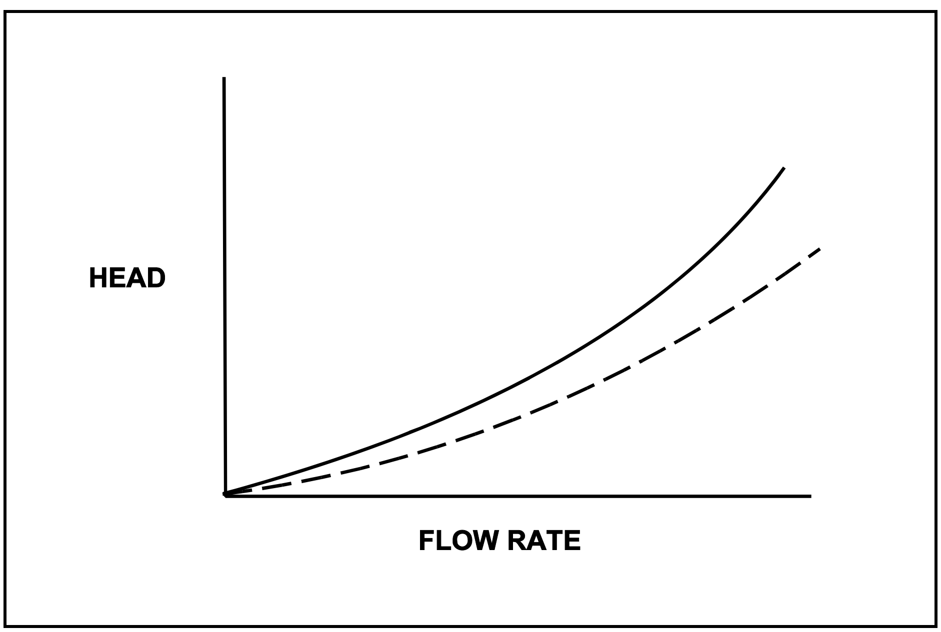
A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

C. Cooling water flow rate is increased by 25% by starting an additional cooling water pump.

D. Cooling water flow rate is decreased by 25% by stopping one of the operating cooling water pumps.

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.12 [2.5/2.7]
QID: P5116 (B5117)

Refer to the drawing of two system curves for a typical main condenser cooling water system (see figure below).

Which one of the following will result in the system curve shifting from the solid curve toward the dashed curve?

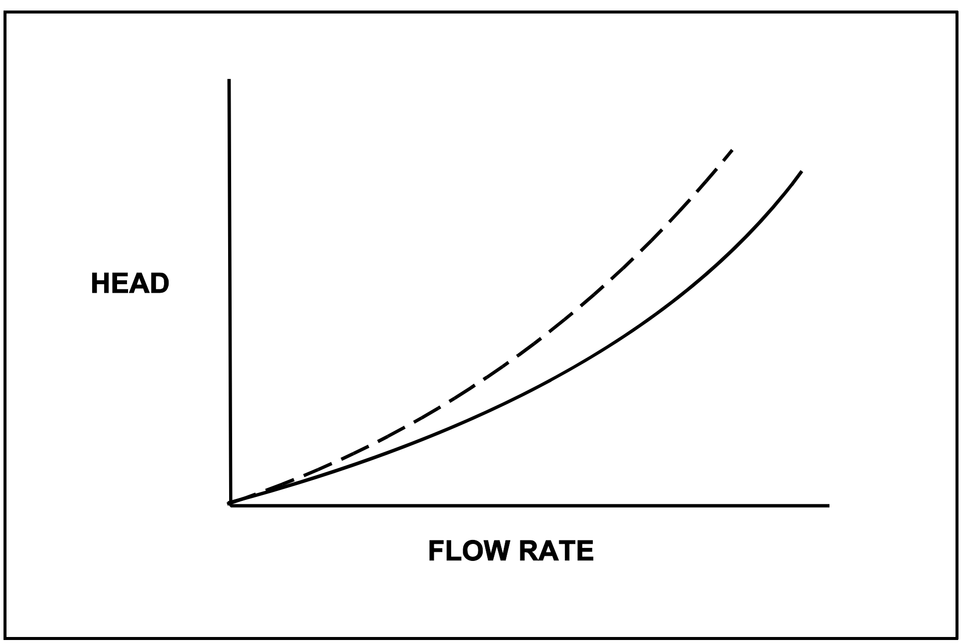
A. The main condenser tubes are cleaned.

B. The main condenser tubes become increasingly fouled.

C. Cooling water system flow rate is increased by 25% by starting an additional cooling water pump.

D. Cooling water system flow rate is decreased by 25% by stopping one of the operating cooling water pumps.

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P33

Borated water is flowing through the tubes of a heat exchanger being cooled by fresh water. The shell side pressure is less than tube side pressure. What will occur as a result of a tube failure?

A. Shell side pressure will increase and the borated water system will be diluted.

B. Shell side pressure will decrease and the borated water inventory will be depleted.

C. Shell side pressure will increase and the borated water inventory will be depleted.

D. Shell side pressure will decrease and the borated water system will be diluted.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P234 (B3535)

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following effects would occur as a result of the failed tube in the heat exchanger?

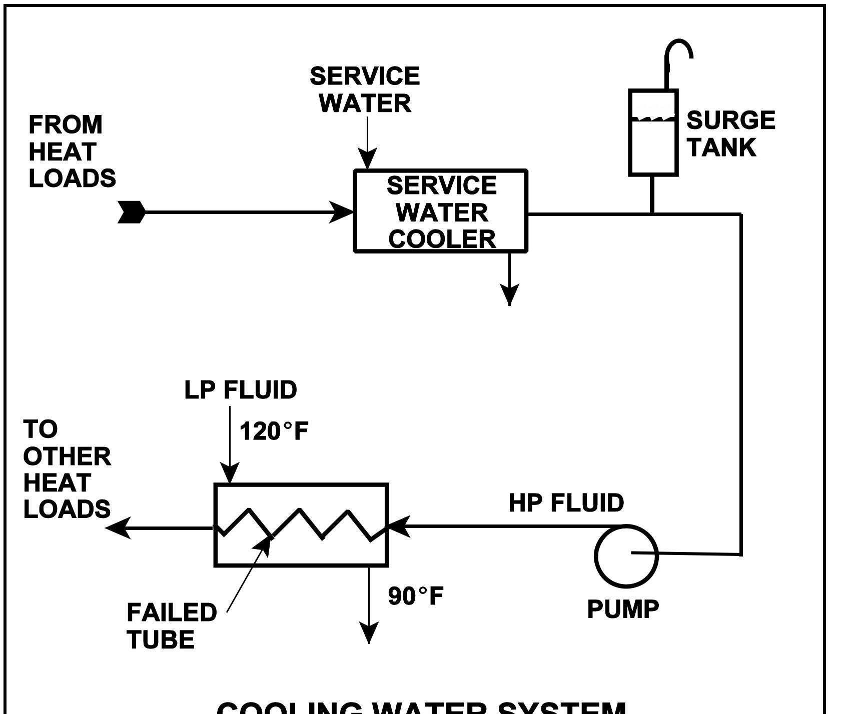
A. Level in the surge tank increases.

B. Flow in the low pressure system reverses.

C. Pressure in the low pressure system decreases.

D. Low pressure fluid heat exchanger outlet temperature decreases.

ANSWER: D.



COOLING WATER SYSTEM

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P333 (B333)

A nuclear power plant is operating normally at 50% power. Which one of the following will result from a cooling water tube rupture in the main condenser?

A. Increased condenser vacuum

B. Increased conductivity of the condensate

C. Decreased condensate pump net positive suction head

D. Decreased condensate pump flow rate

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P1134 (B1931)

Which one of the following effects will occur as a result of multiple tube failures (leaks) in the main condenser of a nuclear power plant at 50% power?

A. Condensate depression will decrease.

B. Condensate conductivity will increase.

C. Condensate oxygen concentration will decrease.

D. Condenser inlet cooling water flow rate will decrease.

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P1234 (B1535)

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following will occur as a result of the indicated tube failure in the heat exchanger?

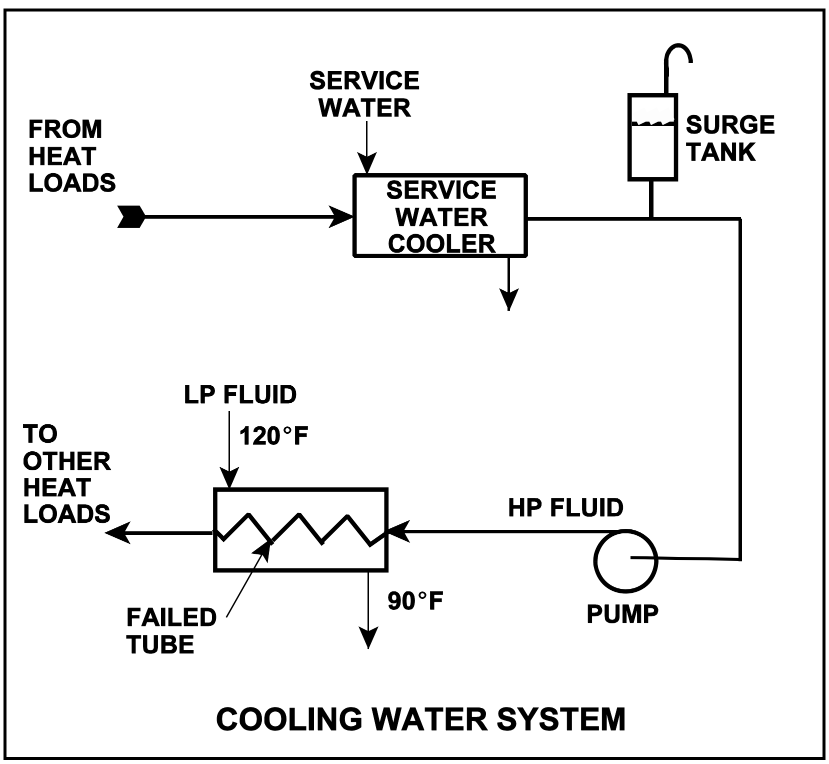
A. High pressure (HP) fluid inventory increases.

B. Pressure in the low pressure (LP) system decreases.

C. Temperature in the low pressure (LP) system increases.

D. Level in the surge tank decreases.

ANSWER: D.



TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P2984 (B2084)

The following 100% rated power conditions existed before a nuclear power plant outage:

Main condenser pressure:	1.20 psia
Cooling water inlet temperature:	60°F
Cooling water outlet temperature:	92°F

During the outage, 6% of the main condenser tubes were plugged. After the outage, the following 100% rated power conditions exist:

Main condenser pressure:	1.31 psia
Cooling water inlet temperature:	60°F
Cooling water outlet temperature:	?

Which one of the following is the approximate cooling water outlet temperature after the outage?

A. 92°F

B. 94°F

C. 96°F

D. 98°F

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.13 [2.8/2.9]
QID: P4917 (B4918)

A nuclear power plant was initially operating at steady-state 50% thermal power with 50 gpm of main condenser cooling water inleakage through a cooling water tube rupture. Thermal power was then increased and is currently stable at 60%.

Assume that the size of the cooling water tube rupture does not change, and that the main condenser cooling water inlet pressure and inlet temperature do not change.

When compared to the flow rate of main condenser cooling water inleakage at 50% power, the flow rate of main condenser cooling water inleakage at 60% power is ____________ because the main condenser pressure at 60% power is __________.

A. lower; lower

B. lower; higher

C. higher; lower

D. higher; higher

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P1834 (B111)

During normal nuclear power plant operation, a main condenser develops an air leak which decreases vacuum at a rate of 1 inch Hg/min. Which one of the following will <u>increase</u> because of this condition?

A. Extraction steam flow rate

B. Condenser hotwell temperature

C. Low pressure turbine exhaust steam moisture content

D. Steam cycle efficiency

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P1912 (B936)

During normal nuclear power plant operation, why does air entry into the main condenser reduce the thermodynamic efficiency of the steam cycle?

A. The rate of steam flow through the main turbine increases.

B. The condensate subcooling in the main condenser increases.

C. The enthalpy of the low pressure turbine exhaust increases.

D. The air mixes with the steam and enters the condensate.

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P2634 (B2633)

A nuclear power plant is operating at steady-state 100% power. Assuming that condenser cooling water inlet temperature and flow rate do <u>not</u> change, if condenser vacuum decreases, condensate temperature will...

A. increase because condensate subcooling has decreased.

B. increase because condenser saturation pressure has increased.

C. decrease because condensate subcooling has increased.

D. decrease because condenser saturation pressure has decreased.

ANSWER: B.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P3534 (B2736)

A nuclear power plant is operating at steady-state 100% power when air inleakage causes main condenser vacuum to decrease from 28 inches Hg to 27 inches Hg. Assume the steam inlet quality and mass flow rate of steam through the main turbine remain unchanged, and that condenser cooling water inlet temperature and flow rate do not change.

When the plant stabilizes, turbine exhaust quality will be_________ and turbine exhaust temperature will be _________.

A. higher; higher

B. higher; lower

C. lower; higher

D. lower; lower

ANSWER: A.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P3734 (B3777)

A nuclear power plant is operating near rated power with the following initial conditions:

Main steam pressure:	900 psia
Main steam quality:	100%, saturated vapor
Main condenser pressure:	1.0 psia

Air leakage into the main condenser results in the main condenser pressure increasing and stabilizing at 2.0 psia. Assume that all main steam parameters (e.g., pressure, quality, and mass flow rate) remain the same and that the main turbine efficiency remains at 100%.

Which one of the following is the approximate percent by which the main generator output will decrease as a result of the main condenser pressure increase?

A. 5.0%

B. 6.3%

C. 7.5%

D. 8.8%

ANSWER: C.

TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P4016 (B4018)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following initial parameters:

Cooling water inlet temperature (T_{cw-in}) = 75°F
Cooling water outlet temperature (T_{cw-out}) = 95°F
Oil inlet temperature (T_{oil-in}) = 150°F
Oil outlet temperature ($T_{oil-out}$) = 120°F

Air introduction to the heat exchanger results in some of the heat exchanger tubes becoming uncovered. As a result, T_{cw-out} decreases to 91°F. Assume the inlet temperatures, mass flow rates, and specific heats of both fluids remain the same.

Which one of the following will be the resulting temperature of the oil exiting the heat exchanger ($T_{oil-out}$)?

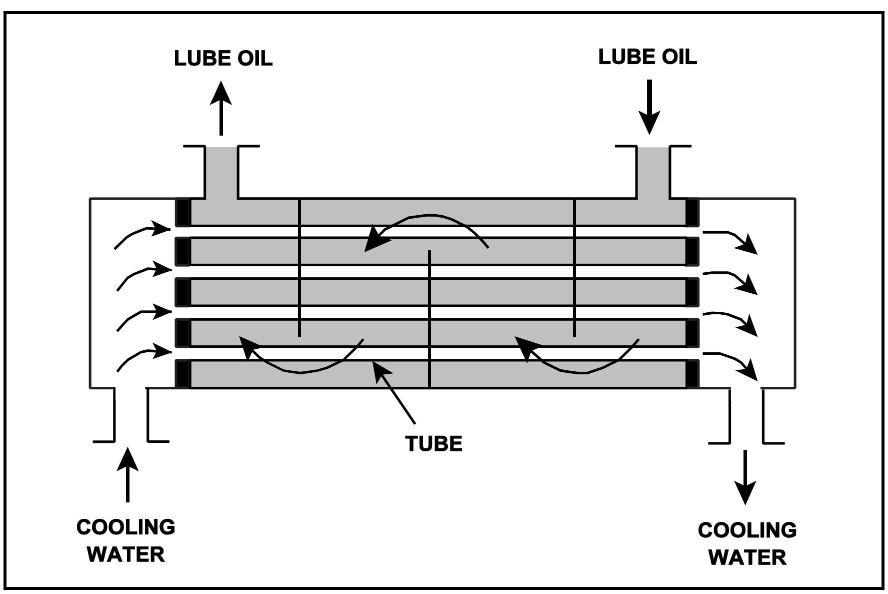
A. 126°F

B. 130°F

C. 134°F

D. 138°F

ANSWER: A.



TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P4517 (B2832)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following initial parameters:

Cooling water inlet temperature (T_{cw-in}) = 75°F
Cooling water outlet temperature (T_{cw-out}) = 105°F
Oil inlet temperature (T_{oil-in}) = 140°F
Oil outlet temperature ($T_{oil-out}$) = 100°F

Air introduction to the heat exchanger results in some of the heat exchanger tubes becoming uncovered. As a result, T_{cw-out} decreases to 99°F. Assume that the mass flow rate and specific heat of both fluids remain the same, and that Toil-in does not change. Which one of the following will be the approximate temperature of the oil exiting the heat exchanger ($T_{oil-out}$)?

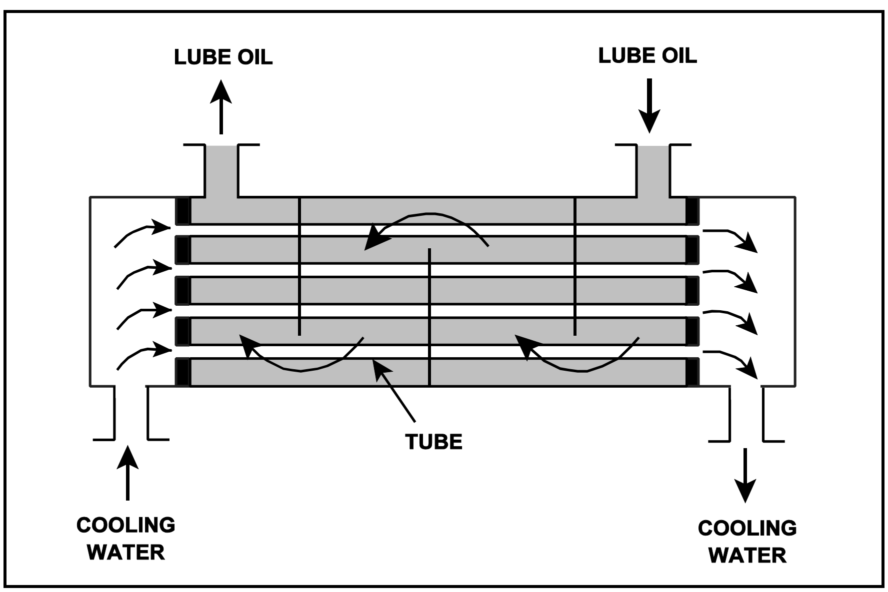
A. 99°F

B. 108°F

C. 116°F

D. 122°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P4816 (B4817)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 95°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 150°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 110°F

Air leakage into the heat exchanger causes some of the heat exchanger tubes to become uncovered. As a result, $T_{cw\text{-}out}$ decreases to 89°F. Assume the inlet temperatures, mass flow rates, and specific heats of both fluids remain the same.

Which one of the following will be the new approximate temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

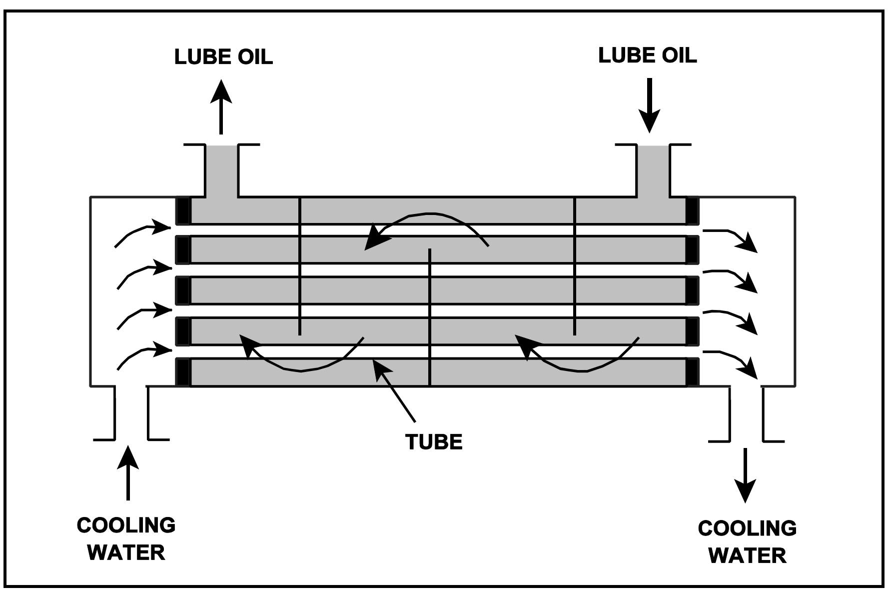
A. 116°F

B. 122°F

C. 130°F

D. 138°F

ANSWER: B.



TOPIC: 191006
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P5417 (B5418)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

The heat exchanger was operating with the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 71°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 91°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 175°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 125°F

The heat exchanger was vented, resulting in the following current parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 71°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 95°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 175°F
Oil outlet temperature ($T_{oil\text{-}out}$) = ?

Assume that the mass flow rates and specific heats of both fluids were unchanged.

Which one of the following is the current lube oil outlet temperature ($T_{oil\text{-}out}$)?

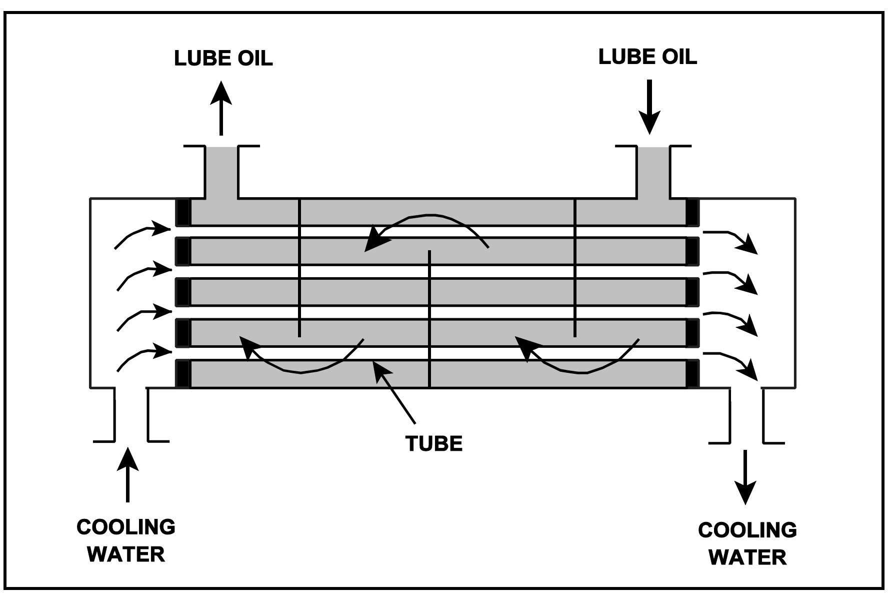
A. 115°F

B. 120°F

C. 130°F

D. 135°F

ANSWER: A.



TOPIC: 191007
KNOWLEDGE: K1.01 [2.3/2.5]
QID: P935 (B737)

A demineralizer is being used in a water purification system. How will accumulation of suspended solids in the demineralizer affect performance of the demineralizer?

A. The rate of resin depletion will increase.

B. The flow rate of water through the demineralizer will increase.

C. The differential pressure across the demineralizer will decrease.

D. The rate of unwanted ion removal from the system will decrease.

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.01 [2.3/2.5]
QID: P1035

A sudden increase in conductivity of water at the outlet of a demineralizer will result from...

A. increased demineralizer flow rate

B. reduced demineralizer inlet temperature

C. reduced demineralizer inlet conductivity

D. increased demineralizer effluent pressure

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.01 [2.3/2.5]
QID: P1535 (B1138)

A condensate demineralizer differential pressure (D/P) gauge indicates 4.0 psid at 50% flow rate. Over the next two days plant power changes have caused condensate flow rate to vary between 25% and 100%.

Which one of the following combinations of condensate flow rate and demineralizer D/P, observed during the power changes, indicates an increase in the accumulation of corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	100%	15.0
B.	75%	9.0
C.	60%	5.0
D.	25%	2.0

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.01 [2.3/2.5]
QID: P1736 (B1736)

A condensate demineralizer differential pressure (D/P) gauge indicates 6.0 psid at 50% flow rate. Which one of the following combinations of condensate flow rate and demineralizer D/P observed at various power levels over the next few days indicates an increase in the accumulation of insoluble corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	100%	23.5
B.	75%	16.5
C.	60%	8.5
D.	25%	1.5

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.01 [2.3/2.5]
QID: P2035 (B2039)

Which one of the following conditions will lead to channeling in a demineralizer?

A. Suspended solids and insoluble particles forming a mat on the surface of the resin bed.

B. A sudden 10°F decrease in the temperature of the influent to the demineralizer.

C. Exhaustion of the resin bed due to high conductivity of the demineralizer influent.

D. Operation of the demineralizer with influent flow rate at 10% below design flow rate.

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.01 [2.3/2.5]
QID: P2135 (B637)

High differential pressure in a demineralizer could be caused by all of the following <u>except</u>...

A. resin exhaustion.

B. resin overheating.

C. crud buildup.

D. high flow rate.

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.01 [2.3/2.5]
QID: P2235 (B2638)

A condensate demineralizer differential pressure (D/P) gauge indicates 4.0 psid at 50% flow rate. Which one of the following combinations of condensate flow and demineralizer D/P observed at various power levels over the next few days indicates an increase in the accumulation of insoluble corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	25%	0.9
B.	60%	6.3
C.	75%	8.7
D.	100%	15.6

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.01 [2.3/2.5]
QID: P2335 (B2338)

A condensate demineralizer differential pressure (D/P) gauge indicates 4.0 psid at 50% flow rate. Over the next two days plant power changes have caused condensate flow rate to vary between 25% and 100%.

Which one of the following combinations of condensate flow and demineralizer D/P, observed during the power changes, indicates an increased accumulation of corrosion products in the demineralizer?

	Condensate Flow Rate	Demineralizer D/P (psid)
A.	100%	15.0
B.	75%	9.0
C.	40%	3.0
D.	25%	1.0

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P535 (B39)

Which one of the following is an indication of resin exhaustion in a demineralizer:

A. An increase in suspended solids in the effluent

B. A decrease in the flow rate through the demineralizer

C. An increase in the conductivity of the effluent

D. An increase in the differential pressure across the demineralizer

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P835 (B839)

The demineralization factor of a demineralizer can be expressed as...

A. Inlet Conductivity minus Outlet Conductivity.

B. Outlet Conductivity minus Inlet Conductivity.

C. Inlet Conductivity divided by Outlet Conductivity.

D. Outlet Conductivity divided by Inlet Conductivity.

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P936

The ion exchange efficiency of a condensate demineralizer is determined by performing a calculation using the...

A. change in conductivity at the outlet of the demineralizer over a period of time.

B. change in pH at the outlet of the demineralizer over a period of time.

C. demineralizer inlet and outlet conductivity.

D. demineralizer inlet and outlet pH.

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P1735

Which one of the following will be caused by exhausted demineralizer resin?

A. Decreased demineralizer process water flow rate

B. Decreased demineralizer influent conductivity

C. Decreased demineralizer differential pressure

D. Decreased demineralizer decontamination factor

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P1835

The ion exchange efficiency of a condensate demineralizer can be calculated using the values for demineralizer inlet and outlet...

A. conductivity.

B. pH.

C. N-16 radioactivity.

D. pressure.

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P2236 (B1437)

To determine the demineralization factor for a demineralizer, the parameters that must be monitored are inlet and outlet:

A. pH

B. conductivity

C. suspended solids

D. pressure

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P2735 (B2737)

What percentage of impurities is being removed from the water passing through an ion exchanger if the ion exchanger has a decontamination factor of 25?

A. 99%

B. 96%

C. 88%

D. 75%

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P3235 (B3238)

What percentage of ionic impurities is being removed from the water passing through an ion exchanger if the ion exchanger has a decontamination factor of 50?

A. 98%

B. 96%

C. 75%

D. 50%

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P3435 (B3437)

The decontamination factor (also called the demineralization factor) of a condensate demineralizer has just been determined to be 50, based on conductivity measurements.

If condensate having a conductivity of 20 µmho/cm is flowing <u>into</u> this demineralizer, which one of the following is the conductivity of the condensate at the <u>outlet</u> of the demineralizer?

A. 0.4 µmho/cm

B. 1.0 µmho/cm

C. 4.0 µmho/cm

D. 10.0 µmho/cm

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P3636 (B3637)

The decontamination factor (or demineralization factor) of a condensate demineralizer has just been determined to be 10, based on conductivity measurements.

If condensate having a conductivity of 20 µmho/cm is flowing <u>into</u> this demineralizer, which one of the following is the conductivity of the condensate at the <u>outlet</u> of the demineralizer?

A. 0.5 µmho/cm

B. 2.0 µmho/cm

C. 5.0 µmho/cm

D. 10.0 µmho/cm

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P4219 (B4219)

The decontamination factor (or demineralization factor) of a condensate demineralizer has just been determined to be 5.0, based on conductivity measurements.

If condensate having a conductivity of 20 µmho/cm is flowing into this demineralizer, which one of the following is the conductivity of the condensate at the outlet of the demineralizer?

A. 0.4 µmho/cm

B. 4.0 µmho/cm

C. 10.0 µmho/cm

D. 100.0 µmho/cm

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
QID: P4718 (B4719)

What percentage of ionic impurities is being removed from the water passing through an ion exchanger if the ion exchanger has a decontamination factor of 1.0?

A. 100%

B. 99%

C. 1%

D. 0%

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.03 [2.2/2.5]
KNOWLEDGE: K1.06 [2.1/2.5]
QID: P5418

Two indications of channeling through an operating demineralizer are a _________-than-normal demineralizer differential pressure and a _________ -than-normal demineralization factor

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.06 [2.1/2.5]
QID: P635 (B2237)

How does demineralizer differential pressure indicate the condition of a demineralizer resin bed?

A. Low differential pressure indicates flow blockage in the demineralizer.

B. Low differential pressure indicates that the demineralizer resin bed is exhausted.

C. High differential pressure indicates flow blockage in the demineralizer.

D. High differential pressure indicates that the demineralizer resin bed is exhausted.

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.06 [2.1/2.5]
QID: P836 (B539)

A lower than expected differential pressure across a demineralizer is an indication of...

A. depletion of the cation exchange resin.

B. channeling through the resin bed.

C. improper resin regeneration.

D. excessive accumulation of suspended solids.

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.06 [2.1/2.5]
QID: P1036 (B639)

As the operating time of a demineralizer resin bed increases, the differential pressure across the bed...

A. increases due to depletion of resin sites.

B. increases due to trapping of suspended solids.

C. decreases due to gradual resin breakdown.

D. decreases due to erosion of the resin sites.

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.06 [2.1/2.5]
QID: P1136

Which one of the following will cause a large pressure drop across a demineralizer that is in operation?

A. Channeling of flow through the demineralizer

B. Depletion and resultant swelling of resin beads

C. Accumulation of suspended solids filtered by the resin beads

D. Improper demineralizer venting after resin fill

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.06 [2.1/2.5]
QID: P1236

An indication that a demineralizer resin bed is clogged is a...

A. large pressure drop across the bed.

B. high flow rate through the bed.

C. temperature rise in the effluent.

D. large conductivity increase across the bed.

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.06 [2.1/2.5]
QID: P1537 (B1539)

A higher- than-expected differential pressure across an operating mixed-resin demineralizer can be caused by...

A. exhaustion of the cation exchange resin.

B. channeling through the resin bed.

C. insufficient resin backwash.

D. decreased demineralizer inlet conductivity.

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.06 [2.1/2.5]
QID: P1836 (B337)

A demineralizer that is continuously exposed to flowing water with high concentrations of suspended solids will first develop an increase in the...

A. conductivity at the demineralizer outlet.

B. decontamination factor of the demineralizer.

C. differential pressure across the demineralizer.

D. pH at the demineralizer outlet.

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.08 [3.0/3.1]
QID: P1636 (B838)

Which one of the following, if processed through a demineralizer, will rapidly reduce the effectiveness of the demineralizer?

A. Condensate

B. Oily water

C. Radioactive water

D. Makeup water

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.08 [3.0/3.1]
QID: P2037

A nuclear power plant has been operating normally at 100% power for one month and with the same reactor coolant boron concentration for the last 24 hours.

Which one of the following changes associated with the in-service reactor coolant demineralizer will cause a reduction in reactor coolant boron concentration in the demineralizer effluent?

A. Increase the temperature of the reactor coolant being processed from 95°F to 105°F.

B. Decrease the temperature of the reactor coolant being processed from 105°F to 95°F.

C. Increase the flow rate of reactor coolant being processed from 75 gpm to 100 gpm.

D. Decrease the flow rate of reactor coolant being processed from 75 gpm to 50 gpm.

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.08 [3.0/3.1]
QID: P2837

A PWR nuclear power plant has two identical mixed resin reactor coolant ion exchangers, A and B, which operated in parallel service continuously for two weeks of power operation immediately after a refueling outage. Then, ion exchanger A was removed from service while ion exchanger B remained in service. After 10 months of continuous operation at full power, it is necessary to place ion exchanger A in service and remove ion exchanger B from service.

Which one of the following describes why the effluent from ion exchanger A initially will be drained to a collection facility prior to fully placing the ion exchanger in service?

A. To avoid an undesired increase in reactor coolant pH.

B. To avoid an undesired decrease in reactor coolant pH.

C. To avoid an undesired increase in reactor coolant boron concentration.

D. To avoid an undesired decrease in reactor coolant boron concentration.

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.08 [3.0/3.1]
QID: P2937

A nuclear power plant has been operating normally at 100% power for one month and with the same reactor coolant boron concentration for the last 24 hours.

Which one of the following changes associated with an in-service reactor coolant letdown demineralizer will cause an increase in reactor coolant boron concentration in the demineralizer effluent?

A. Increase the temperature of the reactor coolant being processed from 95°F to 105°F.

B. Decrease the temperature of the reactor coolant being processed from 105°F to 95°F.

C. Increase the flow rate of reactor coolant being processed from 75 gpm to 100 gpm.

D. Decrease the flow rate of reactor coolant being processed from 75 gpm to 50 gpm.

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.09 [2.5/2.7]
QID: P34

What is the reason for bypassing a demineralizer due to high temperature?

A. Resins expand and restrict flow through the demineralizer.

B. Resins decompose and restrict flow through the demineralizer.

C. Resins decompose and create preferential flowpaths through the demineralizer.

D. Resins decompose and contaminate the system.

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.09 [2.5/2.7]
QID: P235 (B1838)

When a mixed-bed demineralizer resin is exhausted, the resin should be replaced or regenerated because...

A. ions previously removed by the resin will be released into solution.

B. the resin will fracture and possibly escape through the retention screens.

C. particles previously filtered out of solution will be released.

D. the resin will physically bond together, thereby causing a flow blockage.

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.09 [2.5/2.7]
QID: P236

A demineralizer that has been exposed to ____________________ should be bypassed because the resin beads may release unwanted ions.

A. high flow

B. low flow

C. high temperature

D. low temperature

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.09 [2.5/2.7]
QID: P2637 (B239)

A result of proper demineralizer operation on water with ionic impurities is that the exiting water will always have a...

A. higher pH.

B. lower pH.

C. higher conductivity.

D. lower conductivity.

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.11 [2.5/2.8]
QID: P336

Prior to a scheduled nuclear power plant shutdown, the reactor coolant system was chemically shocked to induce a crud burst. What effect will this have on the letdown purification demineralizers?

A. Decreased radiation levels around the demineralizers

B. Increased flow rate through the demineralizers

C. Decreased demineralizer outlet conductivity

D. Increased pressure drop across the demineralizers

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.11 [2.5/2.8]
QID: P1436

Prior to a scheduled nuclear power plant shutdown, the reactor coolant system was chemically shocked to induce a crud burst. What effect will the crud burst have on the in-service reactor coolant letdown ion exchangers?

A. Decreased demineralizer outlet conductivity

B. Decreased pressure drop across the demineralizers

C. Increased flow rate through the demineralizers

D. Increased radiation levels around the demineralizers

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.11 [2.5/2.8]
QID: P2736

A nuclear power plant was operating at steady-state 100% power when the reactor coolant system experienced a large crud burst. After ten minutes, the operators began to record parameters for the in-service reactor coolant purification ion exchanger.

Assuming no additional operator actions, what trend will the recorded parameters show during the next few hours?

A. Increasing flow rate through the ion exchanger

B. Increasing pressure drop across the ion exchanger

C. Increasing ion exchanger inlet water conductivity

D. Increasing ion exchanger outlet water conductivity

ANSWER: B.

TOPIC: 191007
KNOWLEDGE: K1.11 [2.5/2.8]
QID: P3537

After 12 months of operation at 100% power, a nuclear reactor is shutdown with a plant cooldown in progress. An operator reports that the general area radiation levels around the operating shutdown cooling pumps have increased significantly since the cooldown started several hours ago.

Which one of the following is a typical cause of these indications, resulting from the cooldown?

A. Increased radioactive tritium in the reactor coolant.

B. Increased radioactive oxygen-16 dissolved in the reactor coolant.

C. Increased radioactive nitrogen-16 dissolved in the reactor coolant.

D. Increased radioactive corrosion products suspended in the reactor coolant.

ANSWER: D.

TOPIC: 191007
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P337

A nuclear power plant is operating at 70% steady-state power level when the temperature of the reactor coolant letdown passing through a boron-saturated mixed bed ion exchanger is decreased by 20°F.

As a result, the boron concentration in the effluent of the ion exchanger will _____________ because the affinity of the ion exchanger for boron atoms has ___________.

A. decrease; increased

B. decrease; decreased

C. increase; increased

D. increase; decreased

ANSWER: A.

TOPIC: 191007
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P1335

A nuclear power plant is operating at a stable 70% power level when the temperature of the reactor coolant letdown passing through a boron-saturated mixed bed ion exchanger increases by 20°F.

As a result, the boron concentration in the effluent of the ion exchanger will ____________ because the affinity of the ion exchanger for boron atoms has __________.

A. decrease; decreased

B. decrease; increased

C. increase; decreased

D. increase; increased

ANSWER: C.

TOPIC: 191007
KNOWLEDGE: K1.14 [2.4/2.6]
QID: P3337

Which one of the following <u>indicates</u> that a demineralizer receiving 75 gpm of reactor coolant is boron-saturated?

A. The decontamination factor of the demineralizer is less than 1.0.

B. The decontamination factor of the demineralizer is greater than 1.0.

C. Following a reactor coolant temperature increase, demineralizer effluent boron concentration exceeds influent boron concentration.

D. Following a reactor coolant temperature increase, demineralizer influent boron concentration exceeds effluent boron concentration.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.01 [2.6/2.8]
QID: P37

To completely deenergize an electrical component and its associated control and indication circuits, the component breaker should be...

A. open with the control switch in Pull-To-Lock.

B. open with the control switch tagged in the open position.

C. racked out and tagged in racked-out position.

D. racked out with control power fuses removed.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P838 (B1841)

Which one of the following describes the normal operation of a local breaker overcurrent trip flag indicator?

A. Actuates when no lockout is present; satisfies an electrical interlock to remotely close a breaker.

B. Actuates when a breaker overcurrent trip has occurred; can be manually reset when the overcurrent condition clears.

C. Actuates when a breaker has failed to trip on an overcurrent condition; can be manually reset when the overcurrent condition clears.

D. Actuates to cause a breaker trip when the overcurrent trip setpoint is reached; can be remotely reset when the overcurrent condition clears.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P4120 (B4121)

Given the following indications for an open 4,160 VAC breaker:

All phase overcurrent trip flags are reset.
The control power fuses indicate blown.
The line-side voltmeter indicates 4,160 VAC.
The load-side voltmeter indicates 0 volts.

Assuming no operator actions were taken since the breaker opened, which one of the following could have caused the breaker to open?

A. A ground fault caused an automatic breaker trip.

B. A loss of control power caused an automatic breaker trip.

C. An operator tripped the breaker manually at the breaker cabinet.

D. An operator tripped the breaker manually from a remote location.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.02 [2.8/2.9]
QID: P5020 (B1141)

Which one of the following describes the local overcurrent trip flag indicators for a breaker?

A. They actuate prior to breaker tripping to warn of imminent protective action.

B. When actuated, they indicate that the breaker overcurrent trip relay has been reset.

C. They indicate breaker overcurrent trip actuation during and after breaker trip actuation.

D. When actuated, they indicate that the associated breaker has failed to trip open.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.03 [2.9/3.1]
QID: P40 (B1943)

Loss of breaker control power will cause...

A. inability to operate the breaker locally and remotely.

B. breaker line voltage to indicate zero regardless of actual breaker position.

C. the remote breaker position to indicate open regardless of actual breaker position.

D. failure of the closing spring to charge following local closing of the breaker.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.03 [2.9/3.1]
QID: P118

Which one of the following results from a loss of control power to a breaker supplying a motor?

A. Motor ammeter indication will be zero regardless of actual breaker position.

B. Breaker position will remotely indicate closed regardless of actual position.

C. Breaker will trip open due to the actuation of its protective trip device.

D. Charging motor will <u>not</u> recharge the closing spring after the breaker closes.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.03 [2.9/3.1]
QID: P240

Which one of the following would cause a loss of ability to remotely trip a circuit breaker and a loss of remote breaker position indication?

A. Failure of the breaker control switch

B. Racking the breaker to the "test" position

C. Mechanical binding of the breaker tripping bar

D. Loss of control power for the breaker

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.03 [2.9/3.1]
QID: P338 (B40)

Which one of the following will cause a loss of indication from the remote breaker position indicating lights associated with a typical 480 VAC load supply breaker?

A. Loss of breaker line voltage

B. Locally opening the breaker

C. Burnout of the local breaker position indicating lights

D. Removing the breaker control power fuses

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.04 [2.9/3.0]
QID: P639

How is typical breaker operation affected when the associated breaker control power transfer switch is placed in the "Local" position?

A. Control power will be available to provide protective trips, and the breaker can be electrically operated only from the control room.

B. Control power will be removed from both the open and close circuits, and the breaker can be electrically operated only from the control room.

C. Control power will be available to provide protective trips, and the breaker can be electrically operated only from the breaker cabinet.

D. Control power will be removed from both the open and close circuits, and the breaker can be electrically operated only from the breaker cabinet.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.04 [2.9/3.0]
QID: P840 (B840)

A typical 120 VAC manual circuit breaker has tripped due to overload. To <u>close</u> this circuit breaker the breaker handle must be moved from the...

A. OFF position directly to the ON position; trip latch reset is not required.

B. OFF position to the midposition to reset the trip latch, and then to the ON position.

C. midposition directly to the ON position; trip latch reset is not required.

D. midposition to the OFF position to reset the trip latch, and then to the ON position.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.04 [2.9/3.0]
QID: P2041 (B3344)

Two identical 1,000 MW electrical generators are operating in parallel, supplying the same isolated electrical bus. The generator output breakers also provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
22.5 KV	22.5 KV
60.2 Hertz	60.2 Hertz
750 MW	750 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator for generator B to slowly and continuously increase the terminal voltage for generator B. If no operator action is taken, which one of the following describes the electrical current indications for generator A?

A. Current will decrease continuously until the output breaker for generator A trips on reverse power.

B. Current will decrease continuously until the output breaker for generator B trips on reverse power.

C. Current will initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

D. Current will initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.04 [2.9/3.0]
QID: P2439 (B2444)

Two identical 1,000 MW ac electrical generators are operating in parallel, supplying all the loads on a common electrical bus. The generator output breakers provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
28 KV	28 KV
60 Hertz	60 Hertz
150 MW	100 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator set point for generator B to slowly and continuously decrease. If no operator action is taken, the electrical current indication for generator B will...

A. initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

B. initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

C. decrease continuously until the output breaker for generator A trips on overcurrent.

D. decrease continuously until the output breaker for generator B trips on reverse power.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.04 [2.9/3.0]
QID: P2540 (B2543)

Two identical 1,000 MW electrical generators are operating in parallel supplying the same isolated electrical bus. The generator output breakers also provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
22 KV	22 KV
60.2 Hertz	60.2 Hertz
200 MW	200 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator setpoint for generator A to slowly increase continuously toward a maximum of 25 KV. If no operator action is taken, generator B output current will...

A. initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

B. initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

C. increase continuously until the output breaker for generator A trips on overcurrent.

D. increase continuously until the output breaker for generator B trips on overcurrent.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.04 [2.9/3.0]
QID: P2639

Two identical 1,000 MW electrical generators are operating in parallel supplying the same isolated electrical bus. The generator output breakers also provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
22 KV	22 KV
60.2 Hertz	60.2 Hertz
200 MW	200 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator setpoint for generator A to slowly and continuously decrease. If no operator action is taken, generator B output current will increase until...

A. the output breaker for generator A trips on overcurrent.

B. the output breaker for generator B trips on overcurrent.

C. the output breaker for generator A trips on reverse power.

D. the output breaker for generator B trips on reverse power.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.04 [2.9/3.0]
QID: P4620 (B4615)

Two identical 1,000 MW electrical generators are operating in parallel supplying the same isolated electrical bus. The generator output breakers provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B
22 KV	22 KV
60.2 Hertz	60.2 Hertz
200 MW	200 MW
25 MVAR (out)	50 MVAR (out)

A malfunction causes the voltage regulator setpoint for generator B to slowly increase continuously toward a maximum of 25 KV. If no operator action is taken, generator A output current will...

A. increase continuously until the output breaker for generator A trips on overcurrent.

B. decrease continuously until the output breaker for generator B trips on overcurrent.

C. initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

D. initially decrease, and then increase until the output breaker for generator B trips on overcurrent.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P540 (B541)

Refer to the drawing of a typical valve control circuit (see figure below).

What is the purpose of depressing the S1 pushbutton?

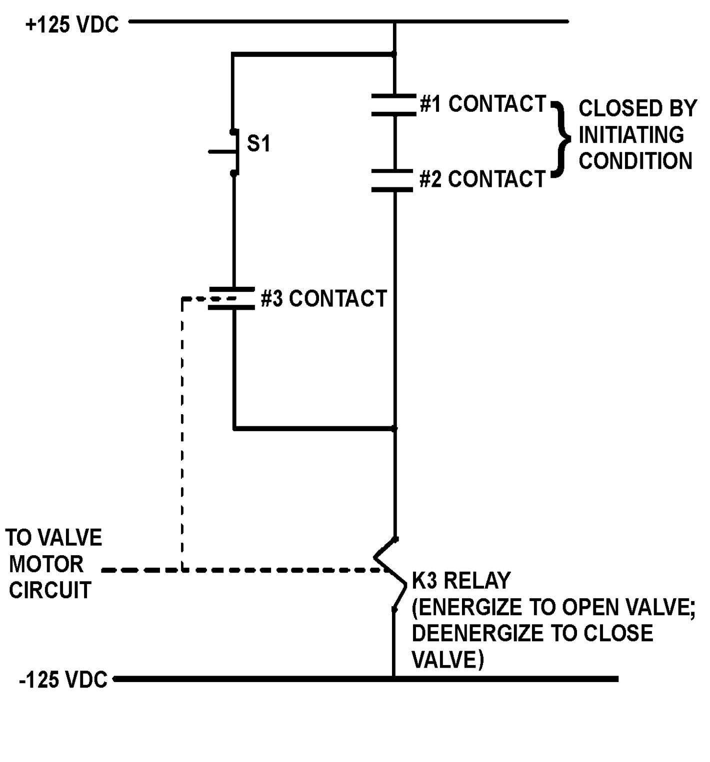
A. To deenergize the K3 relay after the initiating condition has cleared.

B. To prevent energizing the K3 relay when the initiating condition occurs.

C. To manually energize the K3 relay in the absence of the initiating condition.

D. To maintain the K3 relay energized after the initiating condition has cleared.

ANSWER: A.



TYPICAL VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P640 (B116)

Refer to the drawing of a typical valve control circuit (see figure below).

One purpose of the K3 relay is to...

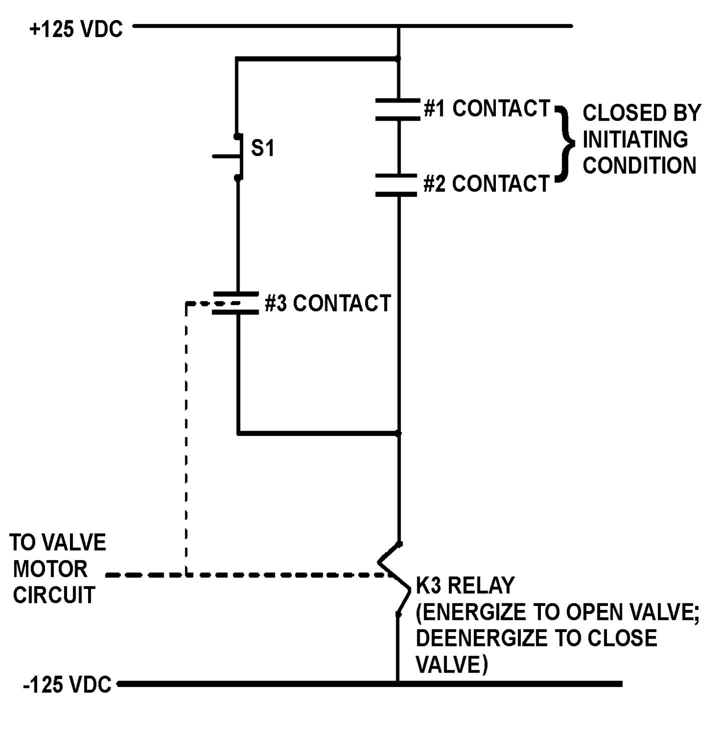
A. hold the valve open after one or both of the initiating conditions have cleared, even if the reset pushbutton (S1) is depressed.

B. hold the valve open even if one or both of the initiating conditions have cleared.

C. close the valve as soon as either initiating condition has cleared.

D. close the valve as soon as both initiating conditions have cleared.

ANSWER: B.



TYPICAL VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P742 (B742)

Refer to the drawing of a typical valve control circuit for a 480 VAC motor-operated valve (see figure below).

The valve is currently open with the contact configuration as shown. If the S1 pushbutton is depressed, the valve will ____________ and when the S1 pushbutton is subsequently released, the valve will ____________.

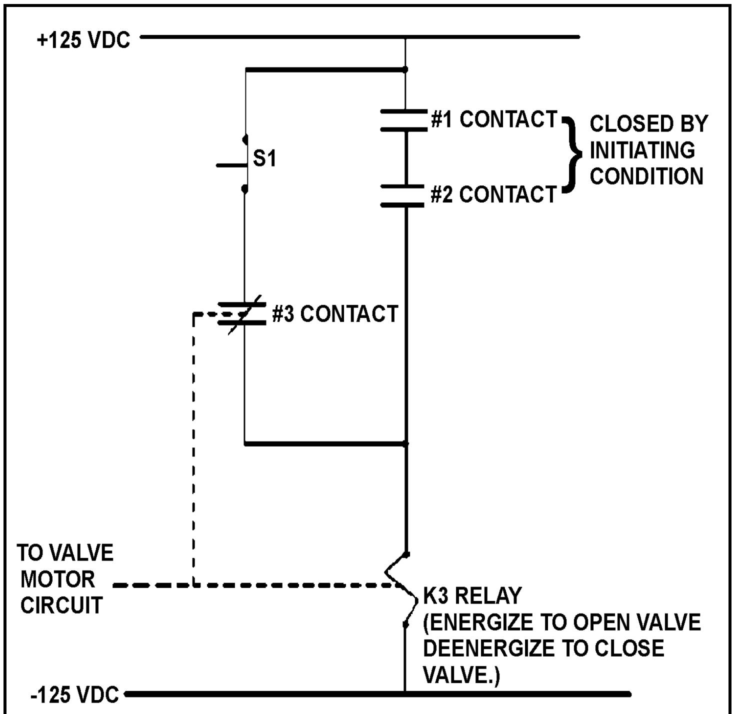
A. remain open; remain open

B. close; remain closed

C. remain open; close

D. close; open

ANSWER: B.



TYPICAL VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P941 (B942)

Refer to the drawing of a typical valve control circuit (see figure below).

Which one of the following describes the function of the #3 contact?

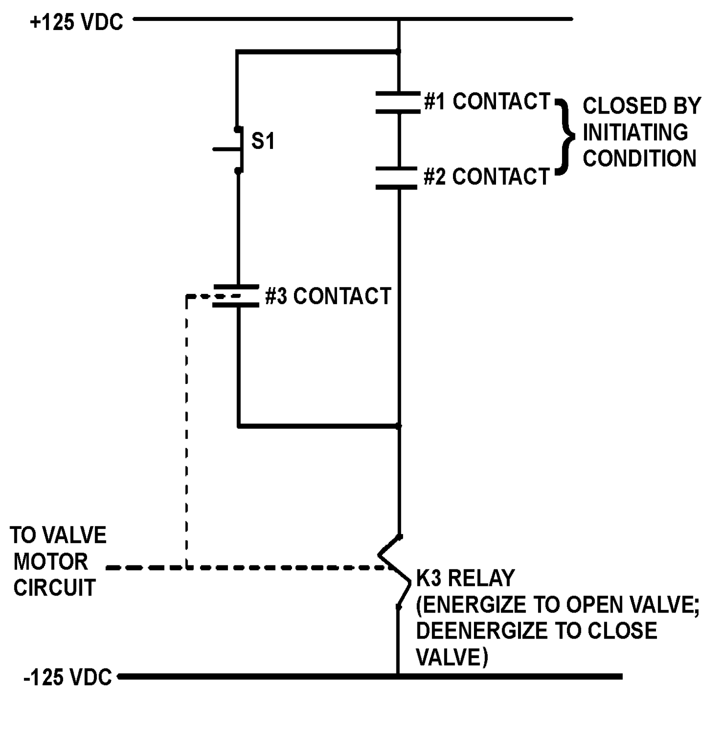
A. To keep the K-3 relay energized after the initiating condition clears

B. To provide a method for manually energizing the K-3 relay

C. To increase circuit reliability because any one of three contacts can energize the K-3 relay

D. To ensure the K-3 relay can always be deenergized even with the initiating condition present

ANSWER: A.



TYPICAL VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P1040 (B1042)

Refer to the drawing of a typical valve control circuit (see figure below).

The initiating condition occurs and closes the #1 and #2 contacts to energize the K-3 relay and open the valve. Which one of the following will close the valve?

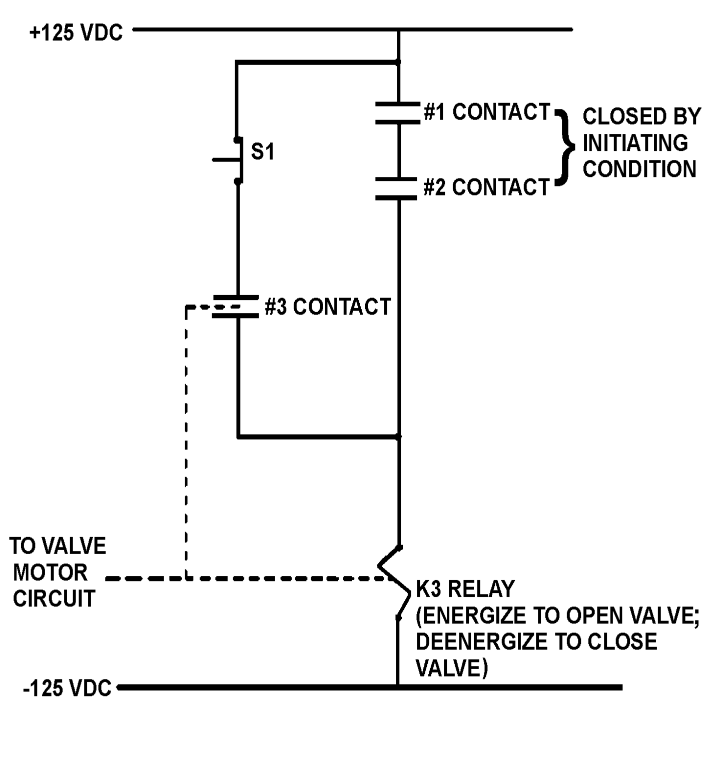
A. Loss of 125 VDC

B. Both #1 and #2 contacts open

C. Either #1 or #2 contact opens

D. Depressing the S1 pushbutton with the initiating condition present

ANSWER: A.



TYPICAL VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P1239 (B5022)

Refer to the drawing of a valve control circuit (see figure below).

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

If the valve is presently closed, when will the alarm actuate?

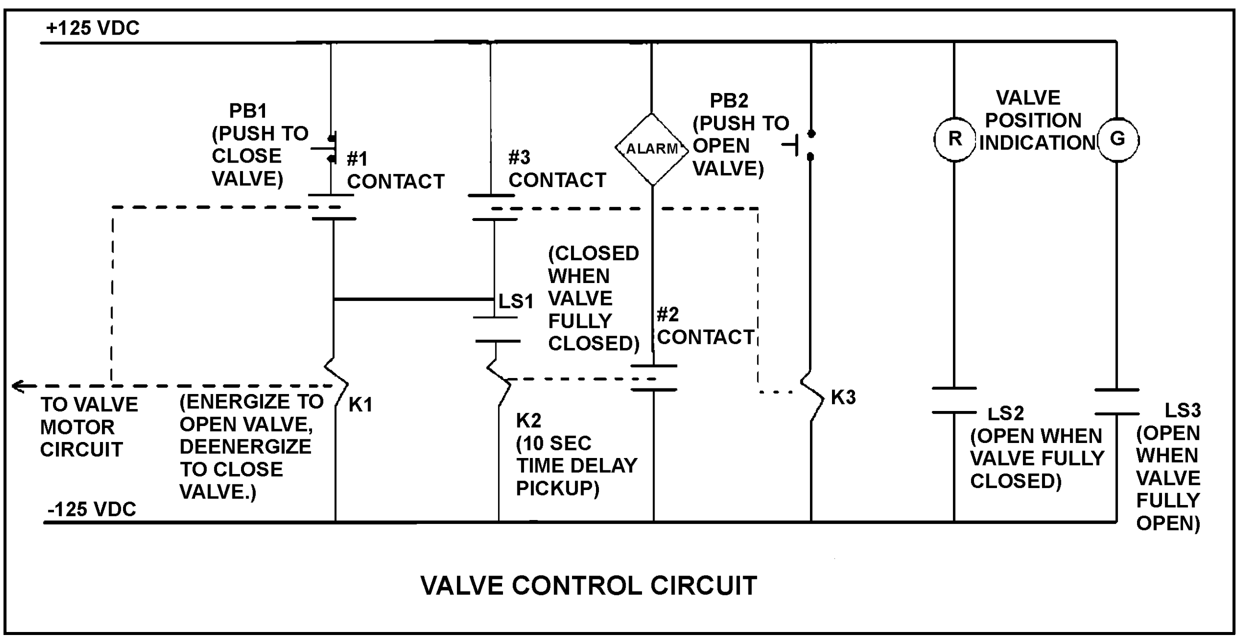
A. As soon as PB2 is pushed.

B. Ten seconds after PB2 is pushed if the valve is still closed.

C. Immediately upon pushing PB2 and for the next 10 seconds if the valve remains closed.

D. Ten seconds after PB2 is pushed if the valve is still stroking open.

ANSWER: B.



TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P1340 (B1341)

Refer to the drawing of a valve control circuit for a valve that is initially fully closed (see figure below).

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following describes when the motor-operated valve will begin to stroke open?

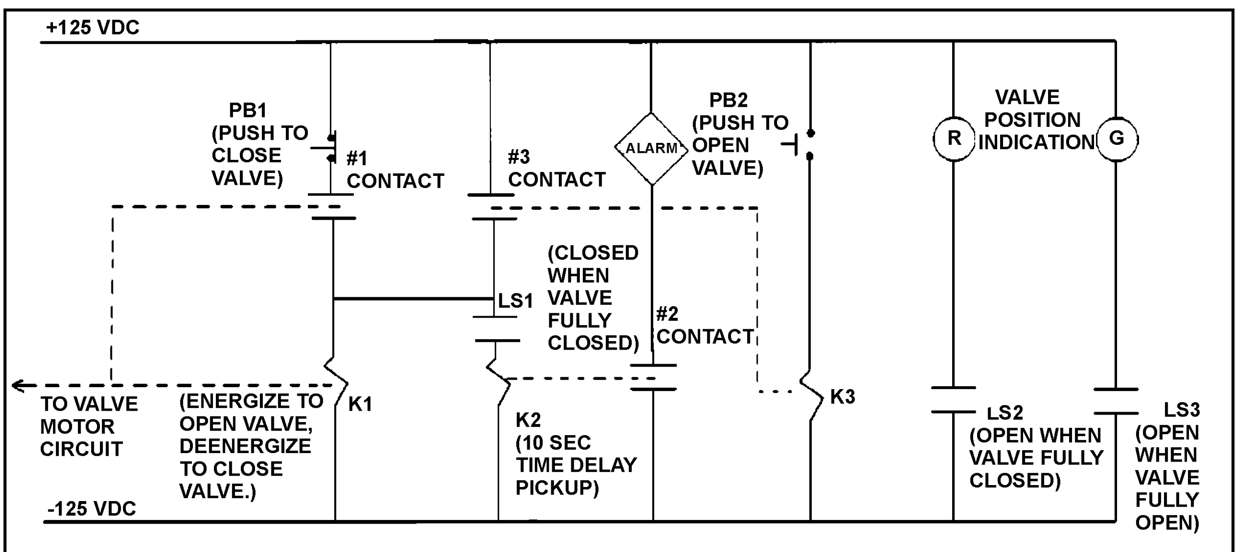
A. At the same time the alarm actuates

B. 10 seconds after PB2 is depressed

C. Immediately after PB2 is depressed

D. Immediately after PB1 is depressed if contact #1 is closed

ANSWER: C.



VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P1440 (B1441)

Refer to the drawing of a valve control circuit (see figure below).

Pushbutton PB2 was depressed to open the valve, and the current contact/pushbutton status is as shown with the following exceptions:

LS1 is closed.
LS3 is closed.
#1 contact is closed.
#2 contact is closed.

Which one of the following describes the condition of the valve and its control circuit?

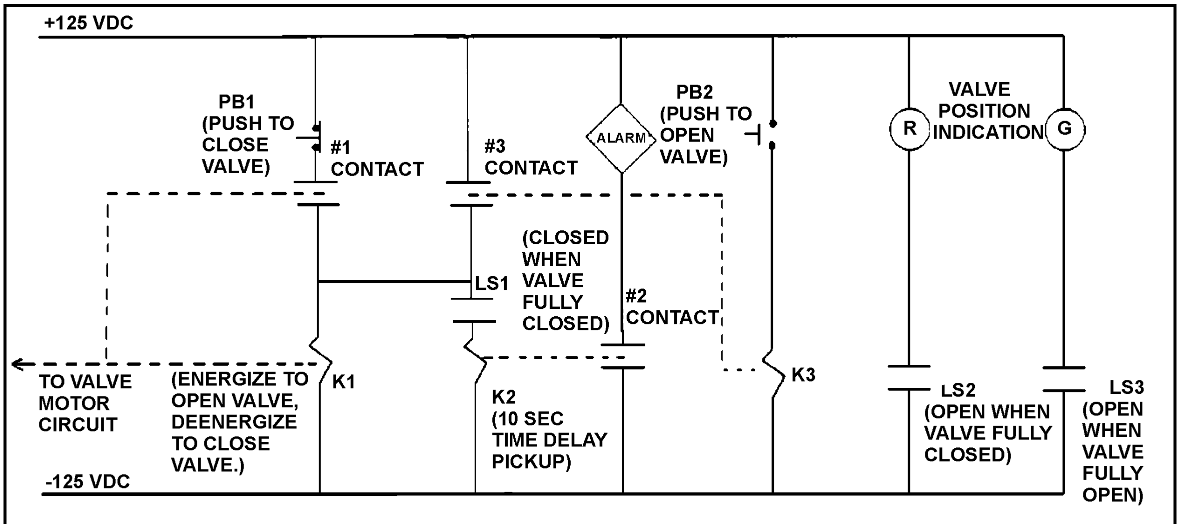
A. The valve is closed and the valve motor circuit has just been energized to open the valve.

B. The valve is closed and an open demand signal has existed for at least 10 seconds.

C. The valve is partially open and the valve motor circuit is deenergized as PB2 was prematurely released.

D. The valve is partially open and an open demand signal has existed for at least 10 seconds.

ANSWER: B.



VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P1540 (B1542)

Refer to the drawing of a valve control circuit (see figure below).

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following describes the purpose of the alarm?

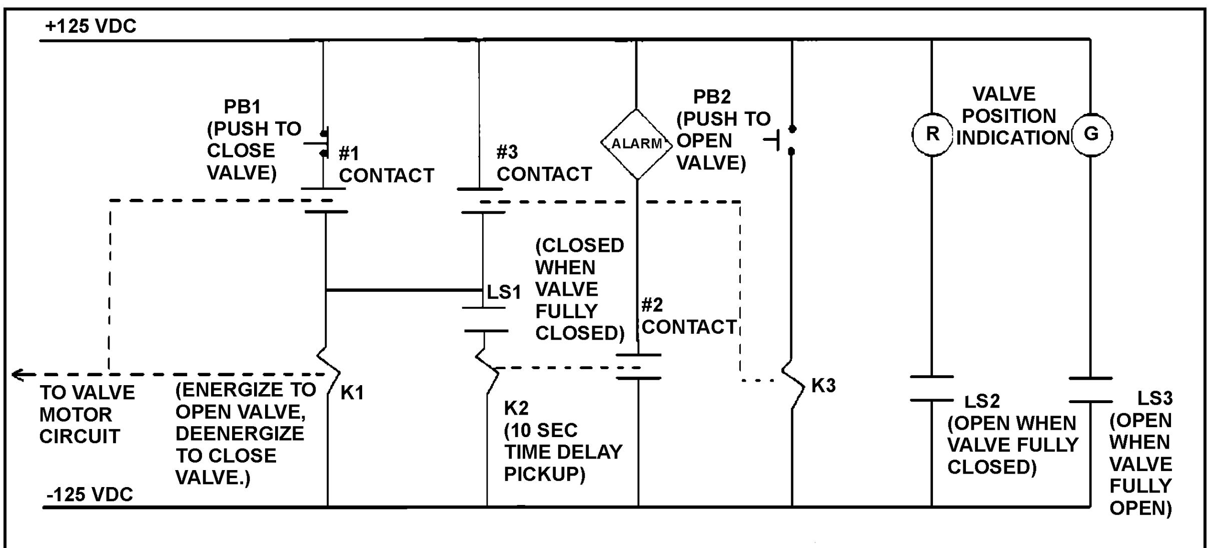
A. Alert the operator when the valve motor circuit has been energized for 10 seconds after pushbutton PB2 is depressed

B. Alert the operator when the valve has not moved off its closed seat within 10 seconds of depressing pushbutton PB2

C. Alert the operator that the valve is opening by sounding the alarm for 10 seconds after PB2 is depressed

D. Alert the operator if the valve has not reached full open within 10 seconds of depressing pushbutton PB2

ANSWER: B.



VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P1640 (B1644)

Refer to the drawing of a valve control circuit (see figure below).

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

The valve is half open and moving to the open position. Which one of the following describes the current condition of the valve position indicating lights?

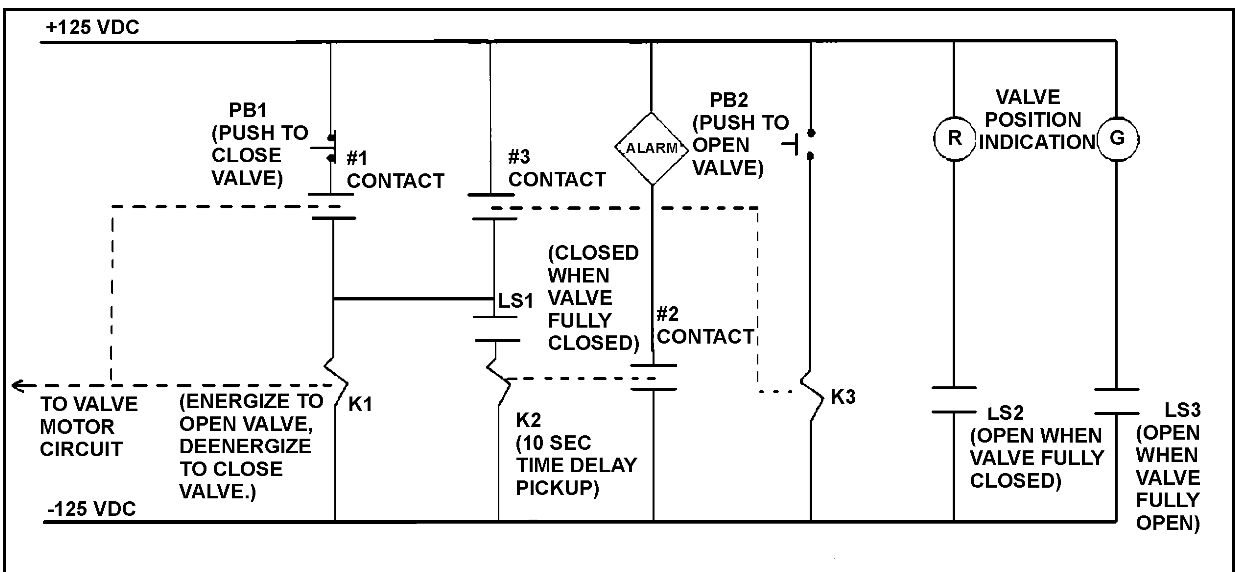
A. Red light on, green light off

B. Red light off, green light on

C. Red light off, green light off

D. Red light on, green light on

ANSWER: D.



VALVE CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P1739 (B1742)

Refer to the drawing of a valve control circuit (see figure below).

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Pushbutton PB2 has been momentarily depressed and then released, and the valve is currently at mid-stroke and moving to the open position. Under these conditions, which one of the following describes the position of contacts #1, #2, and #3?

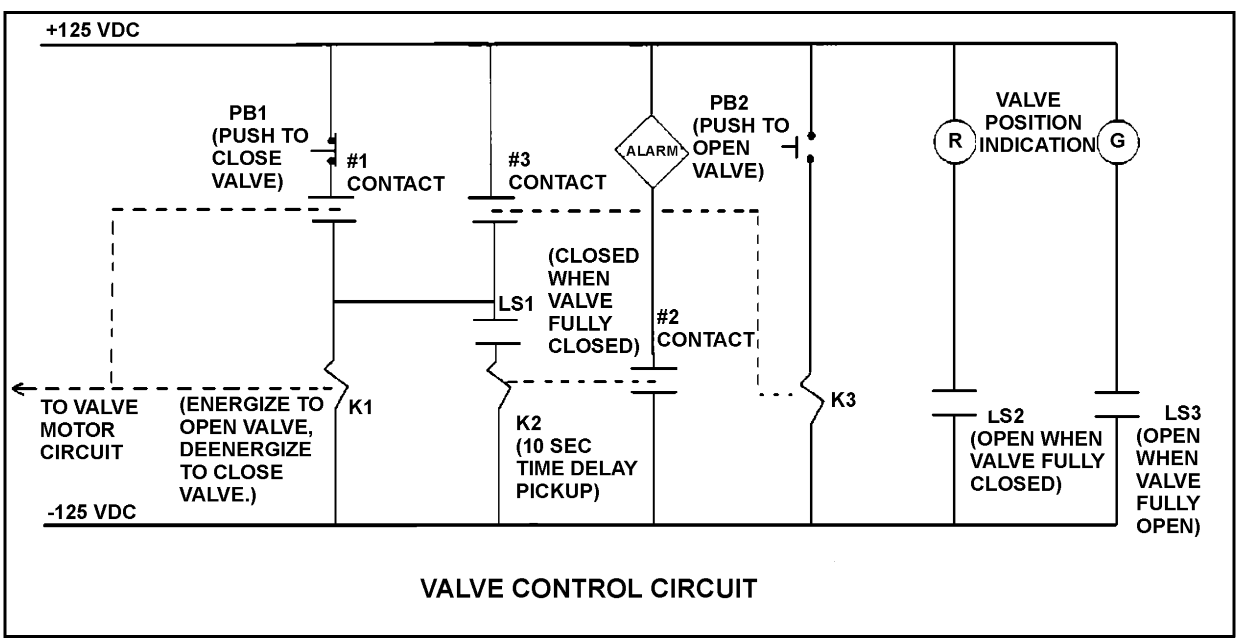
A. #1 closed; #2 open; #3 open

B. #1 open; #2 closed; #3 closed

C. #1 open; #2 open; #3 open

D. #1 closed; #2 closed; #3 closed

ANSWER: A.



TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2239 (B2341)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following describes the valve response if the control switch is taken to the "Close" position for two seconds and then released?

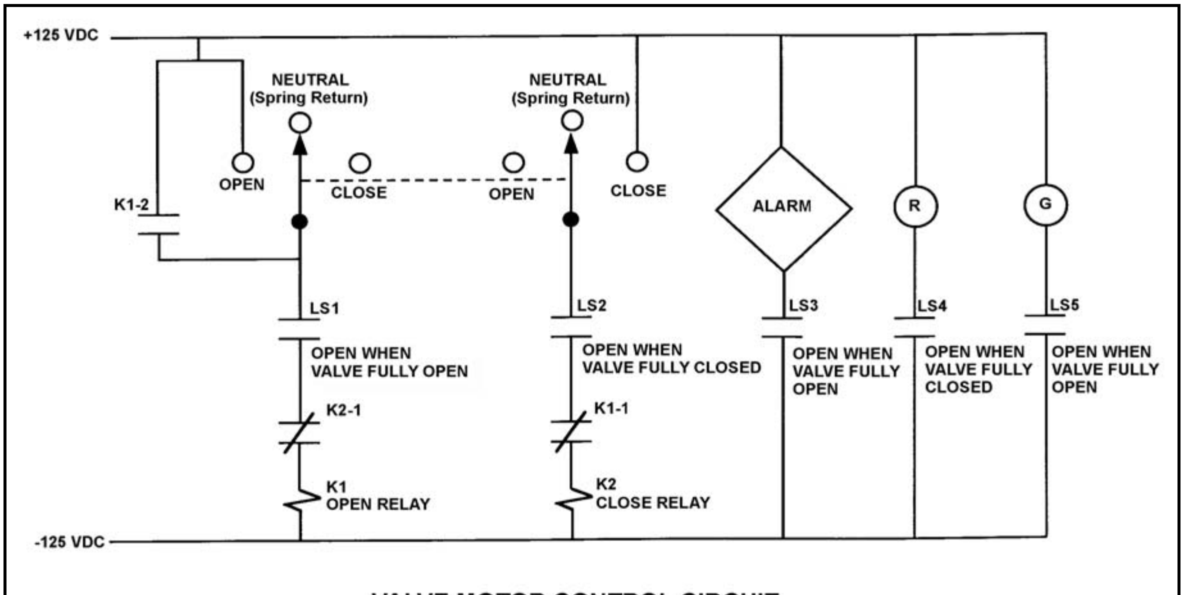
A. The valve will not move.

B. The valve will close fully.

C. The valve will begin to close and then stop moving.

D. The valve will begin to close and then open fully.

ANSWER: C.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2341 (B2442)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following describes the valve response if the control switch is taken to the "Open" position for two seconds and then released?

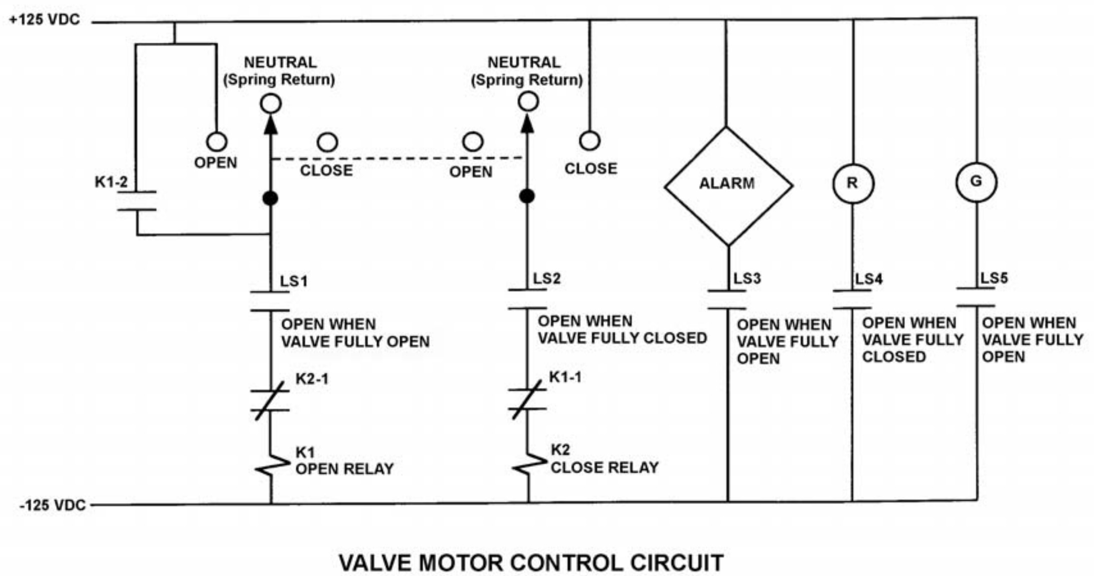
A. The valve will not move.

B. The valve will open fully.

C. The valve will begin to open and then stop moving.

D. The valve will begin to open and then close fully.

ANSWER: B.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2539 (B2542)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open and has a 10-second stroke time. Limit switch LS2 has failed open.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following describes the valve response if the control switch is taken to the "Close" position for 2 seconds and then released?

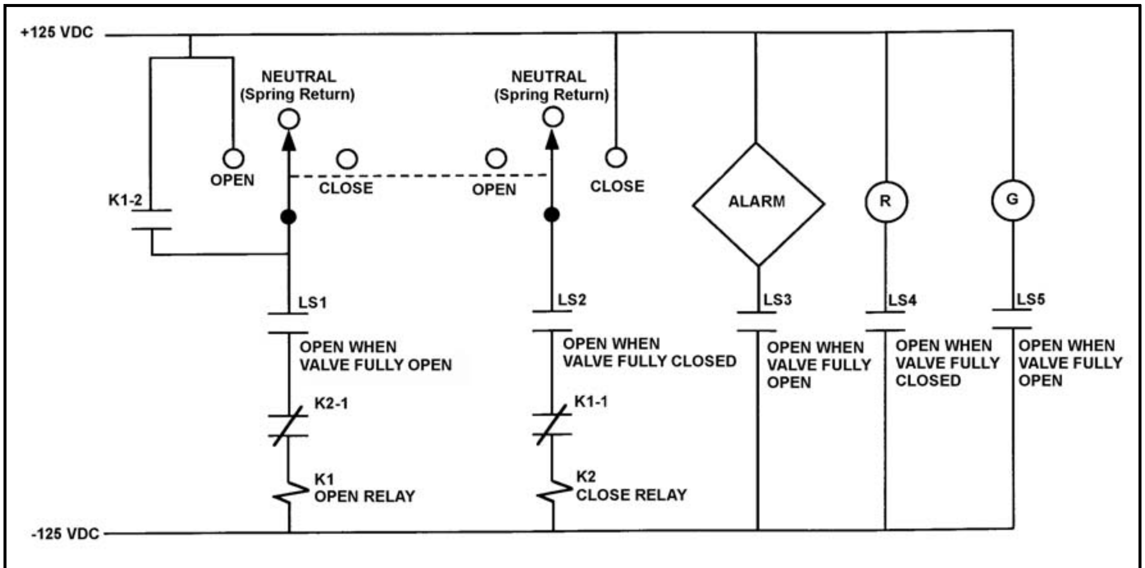
A. The valve will not move.

B. The valve will close fully.

C. The valve will begin to close and then stop moving.

D. The valve will begin to close and then open fully.

ANSWER: A.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2640 (B2841)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

The operator takes the control switch to "Open" momentarily and the valve begins to open. Five seconds later, the operator takes the switch to "Close" momentarily and then releases the switch. Which one of the following describes the valve response after the switch is released?

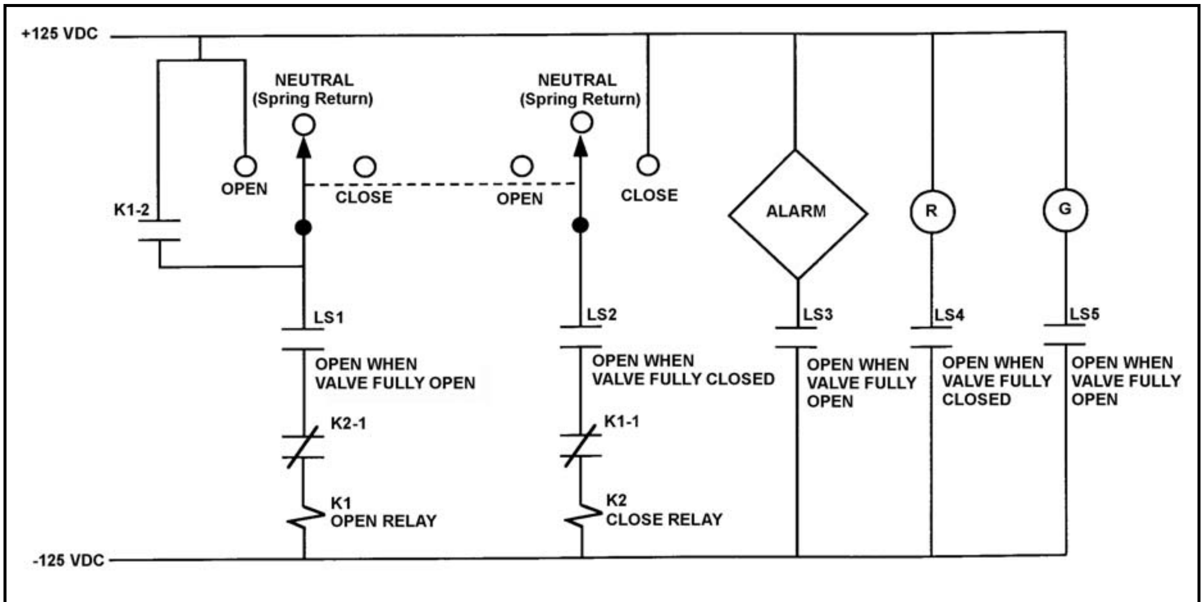
A. The valve will stop opening and remain partially open.

B. The valve will stop opening and then go fully closed.

C. The valve will open fully and remain fully open.

D. The valve will open fully and then go fully closed.

ANSWER: C.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2739 (B2741)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

An operator takes the control switch to "Open" momentarily and the valve begins to open. Five seconds later, the operator places and holds the switch in the "Close" position. Which one of the following describes the valve response with the switch held in the "Close" position?

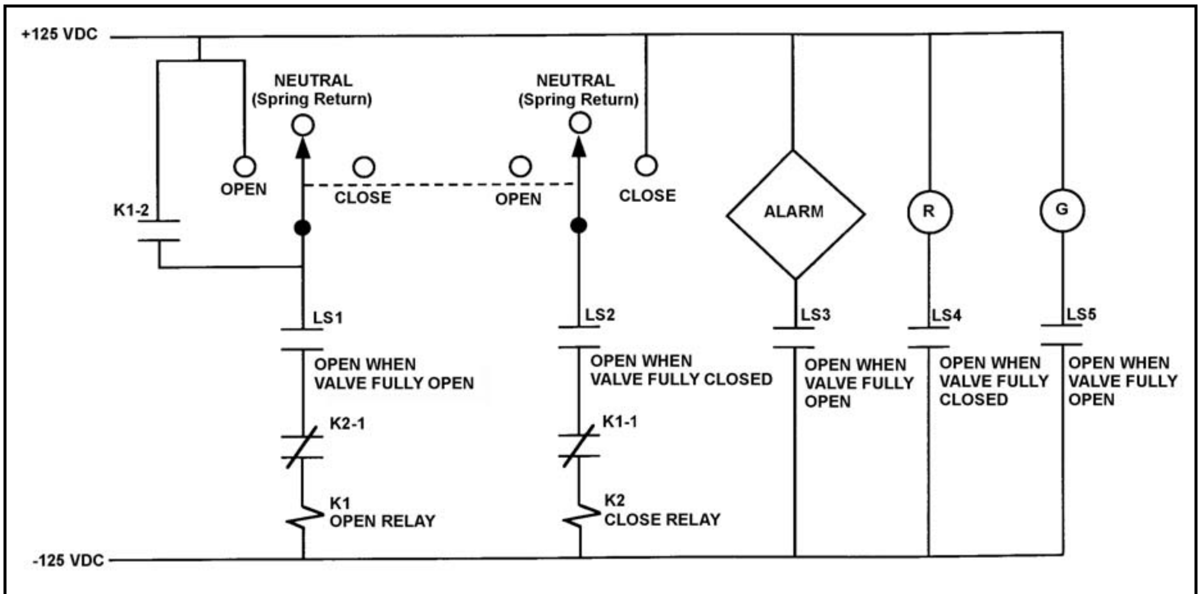
A. The valve will stop opening and remain partially open.

B. The valve will stop opening and then go fully closed.

C. The valve will open fully and remain fully open.

D. The valve will open fully and then go fully closed.

ANSWER: D.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2839

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

The operator takes the control switch to "Open". Two seconds later, after verifying the valve is opening, the operator releases the control switch. Which one of the following describes the valve motor control circuit alarm response after the switch is released?

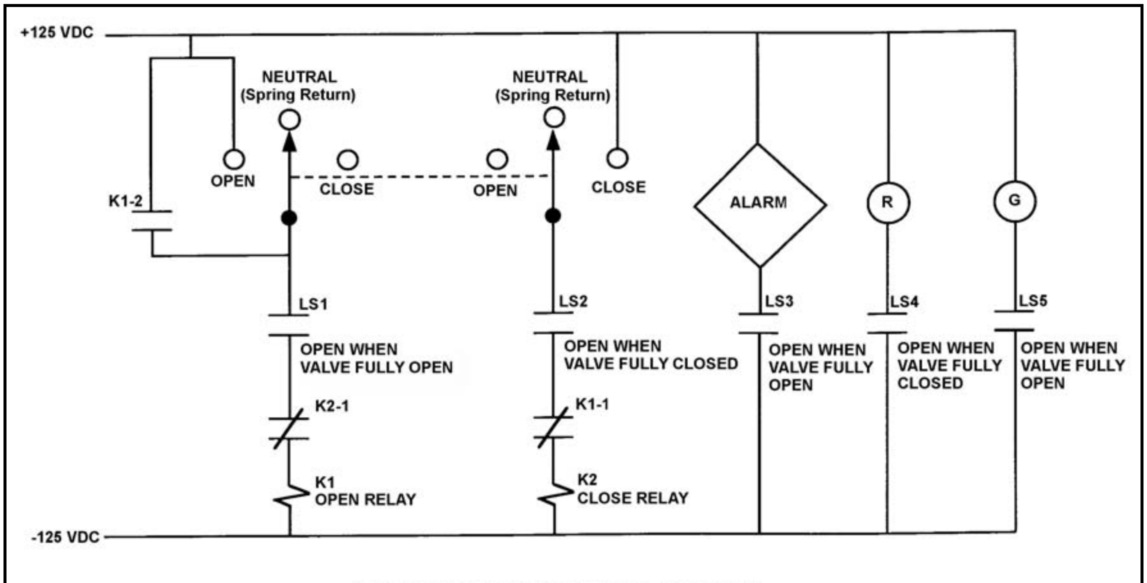
A. The alarm will continue to actuate for approximately 8 seconds.

B. The alarm will continue to actuate until additional operator action is taken.

C. The alarm will actuate after approximately 8 seconds.

D. The alarm will <u>not</u> actuate until additional operator action is taken.

ANSWER: A.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P2942 (B2940)

Refer to the drawing of a motor controller circuit (see figure below).

Note: Relay contacts are shown open/closed according to the standard convention for control circuit drawings.

What is the purpose of the Time Delay Coil (TD) in the motor controller circuit?

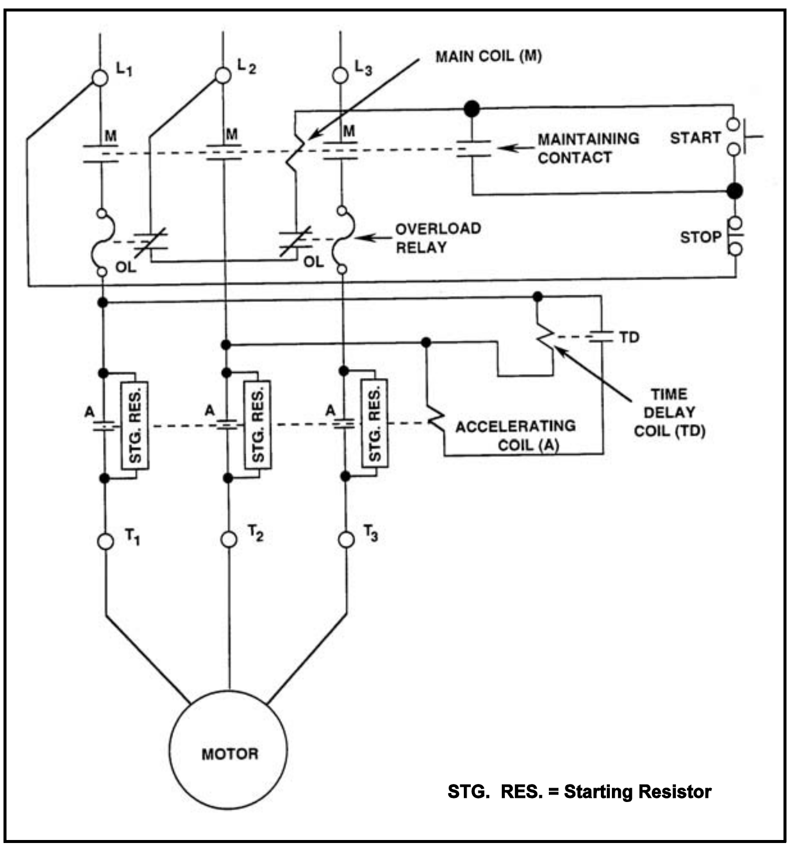
A. Ensures the motor cannot be started until the overload relays are reset.

B. Ensures the motor cannot be started until the accelerating coil is energized.

C. Allows the motor to come up to speed before bypassing the starting resistors.

D. Allows the motor to come up to speed before placing the starting resistors in the circuit.

ANSWER: C.



TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P3640 (B3641)

Refer to the drawing of a motor controller circuit for a three-phase ac motor (see figure below).

Note: Relay contacts are shown open/closed according to the standard convention for control circuit drawings.

The motor receives overload protection from _________ overload (OL) relays, and _________ OL relay(s) must actuate to deenergize the motor.

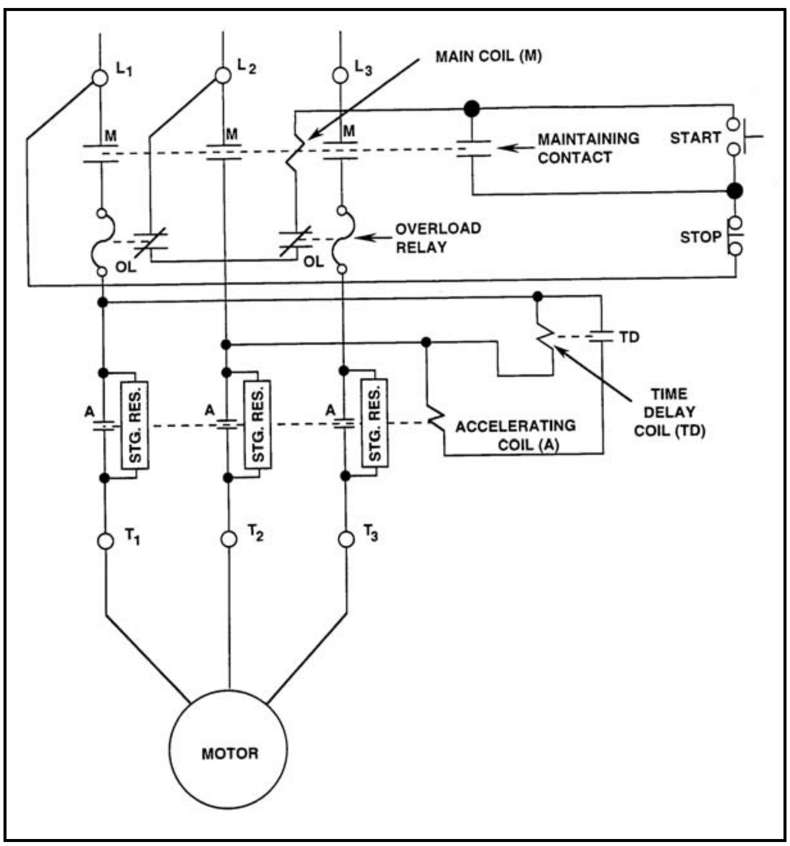
A. two; one

B. two; two

C. three; one

D. three; two

ANSWER: A.



TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P3921 (B3921)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

The operator takes the control switch to “Open” for 5 seconds and then releases the switch. After one minute the operator takes the control switch to “Close” for 5 seconds and then releases the switch. Which one of the following describes the valve position immediately after the control switch is released the second time?

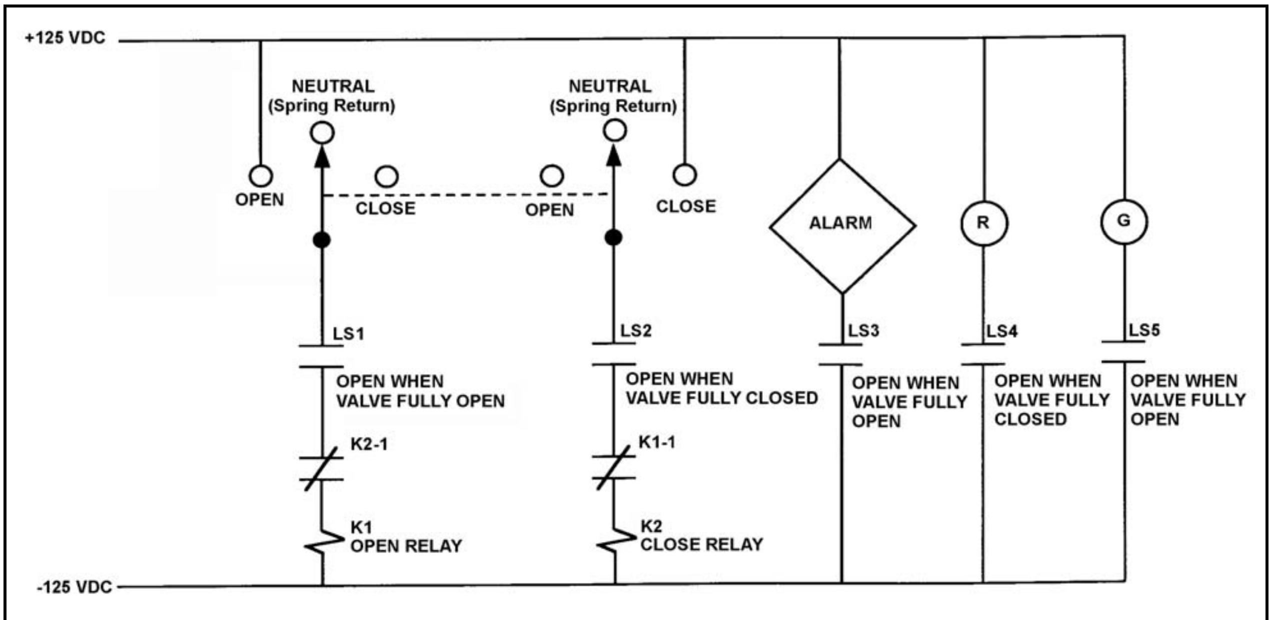
A. Approximately fully open.

B. Approximately fully closed.

C. Approximately 50% open.

D. Cannot be determined without additional information.

ANSWER: B.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P4221 (B4221)

Refer to the drawing of a motor and its control circuit (see figure below).

Note: Relay contacts are shown open/closed according to the standard convention for control circuit drawings.

How are the starting resistors employed before and after the motor is energized?

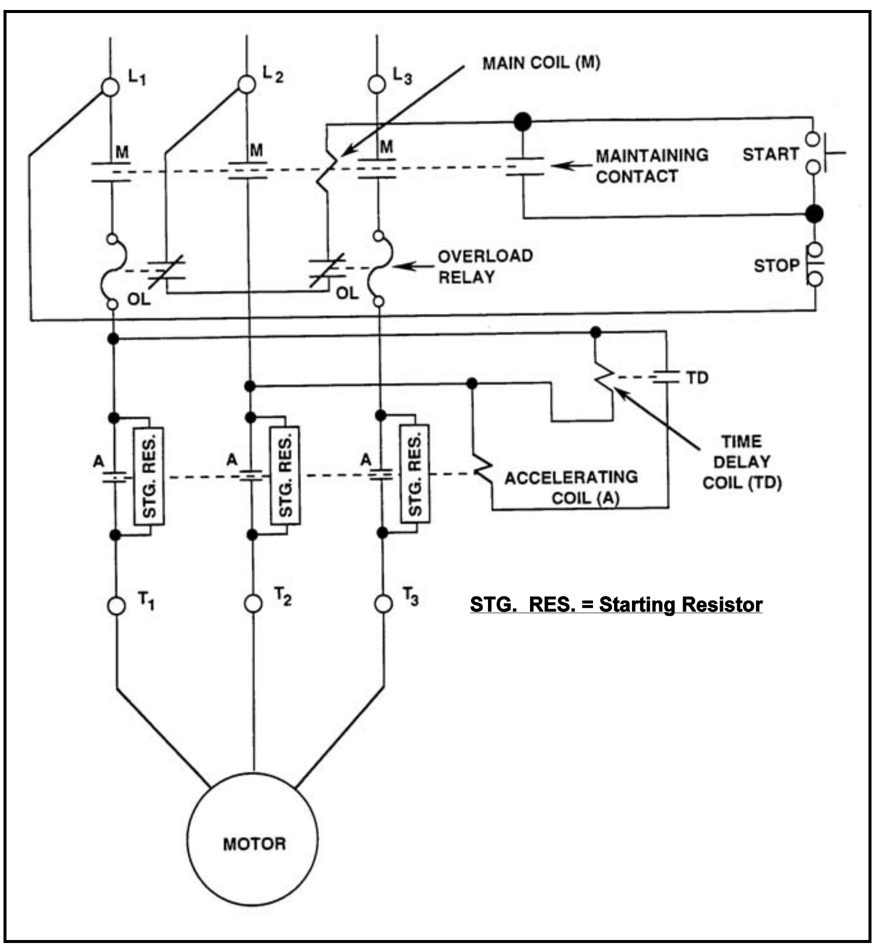
A. Inserted before the motor is energized; simultaneously bypassed after the motor gains speed.

B. Inserted before the motor is energized; sequentially bypassed as the motor gains speed.

C. Bypassed before the motor is energized; simultaneously inserted after the motor gains speed.

D. Bypassed before the motor is energized; sequentially inserted as the motor gains speed.

ANSWER: A.



TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P4421 (B4421)

Refer to the drawing of a motor and its control circuit (see figure below).

Note: Relay contacts are shown open/closed according to the standard convention for control circuit drawings.

The motor has been operating for several hours when it is decided to stop the motor. What is the status of the starting resistors before and after the motor STOP pushbutton is depressed?

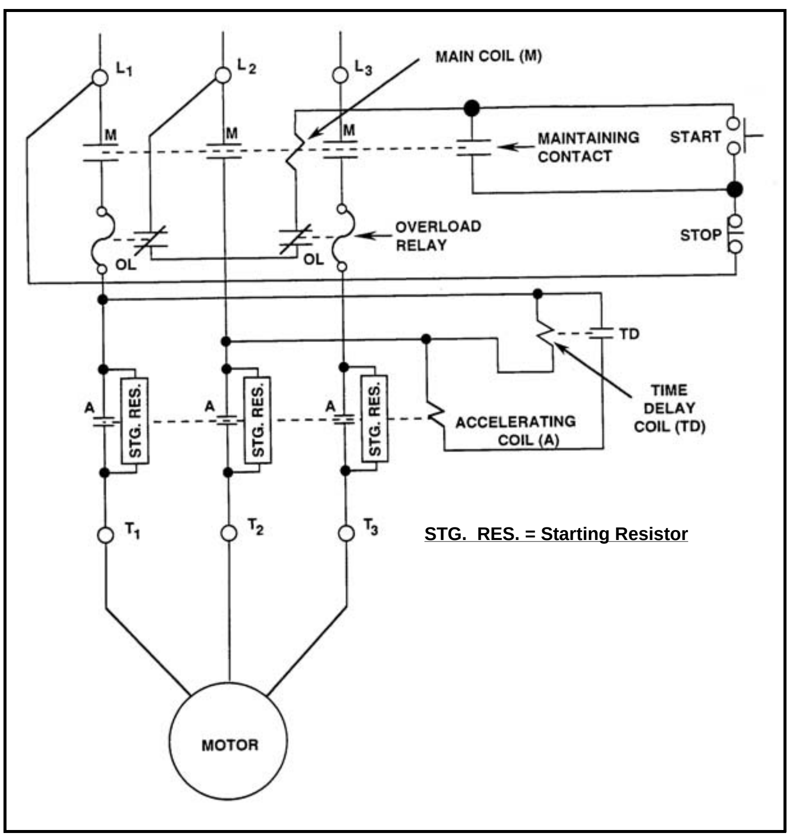
A. Initially inserted in the motor circuit; bypassed immediately after the STOP pushbutton is depressed.

B. Initially inserted in the motor circuit; bypassed following a preset time delay after the STOP pushbutton is depressed.

C. Initially bypassed; bypass is removed immediately after the STOP pushbutton is depressed.

D. Initially bypassed; bypass is removed following a preset time delay after the STOP pushbutton is depressed.

ANSWER: C.



TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P4521 (B4521)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully closed and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following describes the valve response if the control switch is taken to the "Open" position for two seconds and then released?

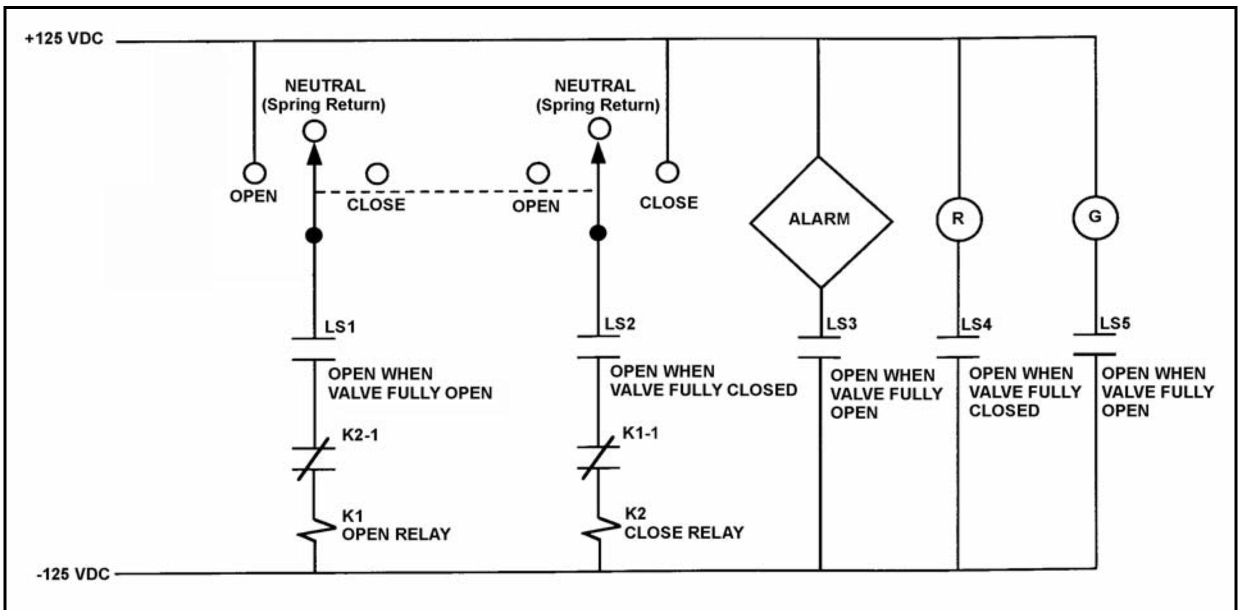
A. The valve will <u>not</u> move.

B. The valve will open fully.

C. The valve will begin to open and then close fully.

D. The valve will begin to open and then stop moving.

ANSWER: D.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P5120 (B5121)

Refer to the drawing of a motor and its control circuit (see figure below).

Note: Relay contacts are shown open/closed according to the standard convention for control circuit drawings.

The motor has been idle for several days when it is decided to start the motor. What is the status of the starting resistors before and after the motor START pushbutton is depressed?

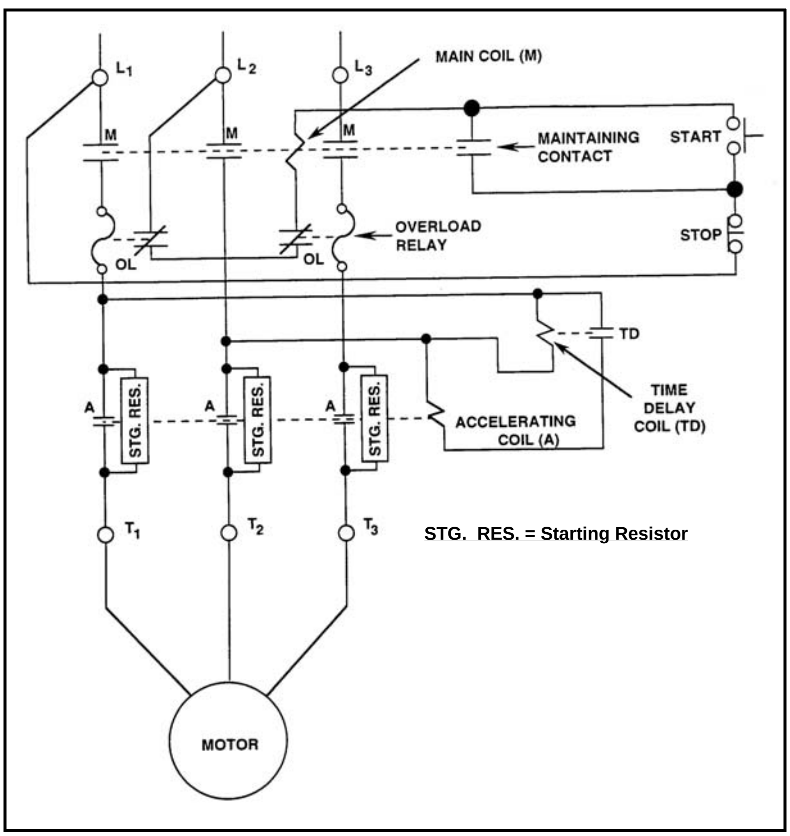
A. Initially bypassed; bypass is removed immediately after the START pushbutton is depressed.

B. Initially bypassed; bypass is removed following a preset time delay after the START pushbutton is depressed.

C. Initially inserted in the motor circuit; bypassed immediately after the START pushbutton is depressed.

D. Initially inserted in the motor circuit; bypassed following a preset time delay after the START pushbutton is depressed.

ANSWER: D.



TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P5221 (B5222)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open and has a 10-second stroke time.

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

The operator takes the control switch to "Close". Two seconds later, after verifying the valve is closing, the operator releases the control switch. Which one of the following describes the valve motor control circuit alarm response after the switch is released?

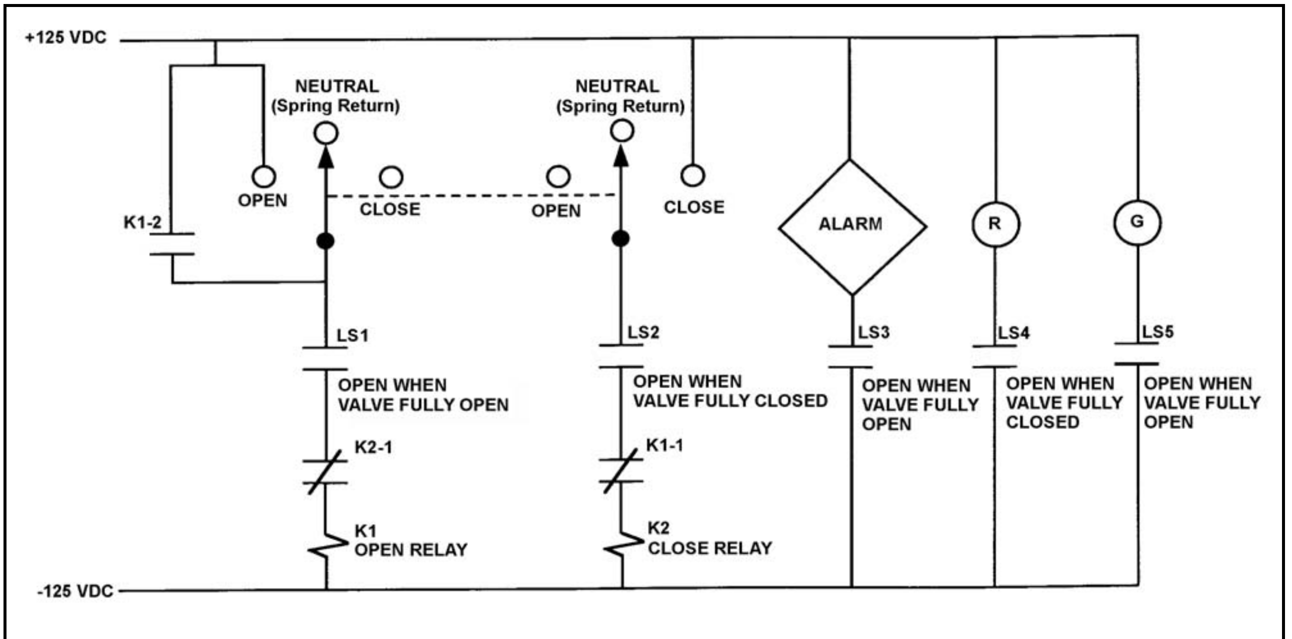
A. The alarm will continue to actuate for approximately 8 seconds.

B. The alarm will continue to actuate until additional operator action is taken.

C. The alarm will actuate after approximately 8 seconds.

D. The alarm will not actuate until additional operator action is taken.

ANSWER: B.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.06 [2.3/2.6]
QID: P5421 (B5421)

Refer to the drawing of a valve control circuit (see figure below).

Note: Limit switch (LS) contacts are shown open regardless of valve position, but relay contacts are shown open/closed according to the standard convention for control circuit drawings.

Which one of the following conditions will actuate the alarm?

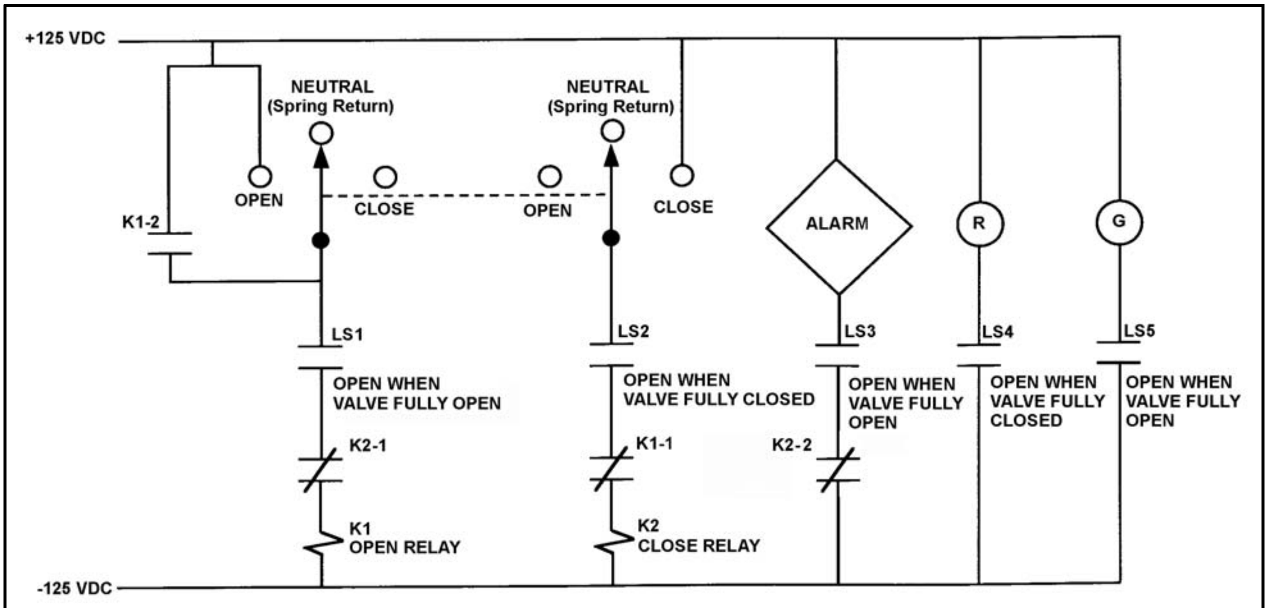
A. The valve is partially closed with the control switch in the CLOSE position.

B. The valve is fully open with the control switch in the CLOSE position.

C. The valve is partially closed with the control switch in the OPEN position.

D. The valve is fully open with the control switch in the OPEN position.

ANSWER: C.



VALVE MOTOR CONTROL CIRCUIT

TOPIC: 191008
KNOWLEDGE: K1.07 [3.0/3.3]
QID: P1141 (B1142)

Which one of the following is an unsafe practice if performed when working on or near energized electrical equipment?

A. Cover exposed energized circuits with insulating material to prevent inadvertent contact.

B. Have a person standing by to deenergize the equipment in the event of an emergency.

C. Use two hands for balance and to prevent dropping tools onto energized equipment.

D. Stand on insulating rubber material to prevent yourself from being grounded.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.07 [3.0/3.3]
QID: P1241 (B842)

A 480 VAC motor is supplied power via an electrical disconnect in series with a circuit breaker. Which one of the following describes the proper operation to isolate power to the load?

A. Open the disconnect first, then the breaker.

B. Open the breaker first, then the disconnect.

C. Open the breaker and disconnect at the same time.

D. Sequence is not important as long as motor is operating.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.07 [3.0/3.3]
QID: P2940 (B3141)

Which one of the following is an unsafe practice if performed when working on or near energized electrical equipment?

A. Use insulated tools to prevent inadvertent contact with adjacent equipment.

B. Cover exposed energized circuits with insulating material to prevent inadvertent contact.

C. Attach a metal strap from your body to a nearby neutral ground to ensure that you are grounded.

D. Have a person standing by with the ability to remove you from the equipment in the event of an emergency.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P41 (B342)

The primary reason for isolating emergency electrical loads from their power supply bus prior to energizing the bus via the emergency diesel generator is to prevent an...

A. overcurrent condition on the generator.

B. overcurrent condition on the loads.

C. underfrequency condition on the generator.

D. underfrequency condition on the loads.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P43 (B1941)

A main generator is being connected to an infinite power grid that is operating at 60 Hz. Generator output voltage is equal to the grid voltage but generator frequency is at 57 Hz.

Which one of the following generator conditions is most likely to occur if the generator output breaker is closed with voltages in phase (synchronized) but with the existing frequency difference? (Assume <u>no</u> generator breaker protective trip occurs.)

A. Reverse power

B. Underfrequency

C. Undervoltage

D. Overspeed

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P107 (B122)

Closing the output breaker of a three-phase generator onto a deenergized bus can result in...

A. an overvoltage condition on the bus.

B. an overcurrent condition on the generator if the bus was not first unloaded.

C. a reverse power trip of the generator circuit breaker if generator frequency is low.

D. a large reactive current in the generator.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P241 (B1843)

A main generator is being paralleled to an infinite power grid. Closing the output breaker of the generator with the frequency of the generator 0.1 Hz <u>higher</u> than grid frequency will result in the generator...

A. supplying a portion of the grid reactive load (MVAR).

B. supplying a portion of the grid real load (MW).

C. behaving as a reactive load to the grid.

D. behaving as a real load to the grid.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P242 (B243)

Which one of the following generator conditions is <u>most</u> <u>likely</u> to cause generator damage because of high current?

A. Tripping the output breaker under full-load conditions

B. Tripping the generator prime mover under full-load conditions

C. Closing the output breaker on a bus that has an open-circuit fault

D. Closing the output circuit breaker on a bus that has a short-circuit fault

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P340

A main generator is about to be connected to an infinite power grid. Closing the generator output breaker with the generator voltage slightly lower than grid voltage and with generator frequency slightly higher than grid frequency will initially result in: (Assume no generator breaker protective trip occurs.)

A. the generator supplying reactive power to the grid.

B. the generator attaining a leading power factor.

C. the generator acting as a real load to the grid.

D. motoring of the generator.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P341 (B343)

A main generator is being paralleled to the power grid. Generator voltage has been properly adjusted and the synchroscope is rotating slowly in the clockwise direction.

The generator breaker must be closed just as the synchroscope pointer reaches the 12 o'clock position to prevent...

A. motoring of the generator due to unequal frequencies.

B. excessive MW load transfer to the generator due to unequal frequencies.

C. excessive MW load transfer to the generator due to out-of-phase voltages.

D. excessive arcing within the generator output breaker due to out-of-phase voltages.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P441 (B440)

During paralleling operations of the main generator to an infinite power grid, closing the generator output breaker with the frequency of the generator at 61 hertz and the grid frequency at 60 hertz will...

A. cause the generator to immediately increase load.

B. trip open the generator breaker on reverse power.

C. cause the generator voltage to increase.

D. cause the generator current to decrease.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P743 (B743)

Which one of the following evolutions will draw the highest current from the main generator during operation of the output breaker?

A. Opening the output breaker under full-load conditions

B. Opening the output breaker under no-load conditions

C. Closing the output breaker with voltages out of phase

D. Closing the output breaker with voltages in phase

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P940

Under which one of the following preexisting conditions will closing a circuit breaker between two electrical generators cause a sudden large and possibly damaging mechanical torque to be exerted on both of the generators?

A. One generator is supplying a 3% higher voltage than the other.

B. One generator is supplying a 3% higher frequency than the other.

C. The voltage of one generator is out of phase with the other by 30°.

D. The capacity of one generator is twice that of the other generator.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1143 (B1143)

A main generator is about to be connected to an infinite power grid with the following conditions:

Generator frequency:	59.5 Hz
Grid frequency:	59.8 Hz
Generator voltage:	115.1 KV
Grid voltage:	114.8 KV

When the generator output breaker is closed the generator will...

A. acquire real load and reactive load.

B. acquire real load but become a reactive load to the grid.

C. become a real load to the grid but acquire reactive load.

D. become a real load and a reactive load to the grid.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1242

A main generator is about to be connected to an infinite power grid. Closing the generator output breaker with generator and grid voltages matched, but with generator frequency lower than grid frequency will initially result in the generator...

A. picking up a portion of the grid real load.

B. picking up a portion of the grid reactive load.

C. experiencing reverse power conditions.

D. experiencing overspeed conditions.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1342

A main generator is about to be connected to an infinite power grid. Closing the generator output breaker with the _____________ of the generator higher than that of the grid will initially result in generator real load _____________.

A. frequency; decreasing

B. frequency; increasing

C. voltage; decreasing

D. voltage; increasing

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1542

A main generator is about to be connected to an infinite power grid. Closing the generator output breaker with generator and grid voltages matched, but with generator frequency 0.1 Hz higher than grid frequency will initially result in the generator...

A. picking up a portion of the grid real load.

B. picking up a portion of the grid reactive load.

C. experiencing reverse power conditions.

D. experiencing overspeed conditions.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1642

A main generator is about to be connected to an infinite power grid with the following conditions:

Generator frequency	= 59.8 Hz
Grid frequency	= 59.5 Hz
Generator voltage	= 114.8 kV
Grid voltage	= 115.1 kV

When the generator output breaker is closed, the generator will initially...

A. acquire real load and reactive load.

B. acquire real load, but become a reactive load to the grid.

C. become a real load to the grid, but acquire reactive load.

D. become a real load and a reactive load to the grid.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1741 (B1744)

A main generator is being paralleled to an infinite power grid. Generator voltage has been properly adjusted and the synchroscope is rotating slowly in the counterclockwise direction.

If the generator breaker is closed just prior to the synchroscope pointer reaching the 12 o'clock position, which one of the following will occur?

A. The breaker will close and the generator will supply MW to the grid.

B. The breaker will close and the generator will supply MW and MVAR to the grid.

C. The breaker will close and then open due to overcurrent.

D. The breaker will close and then open due to reverse power.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1839 (B43)

A main generator is being connected to an infinite power grid. Which one of the following will occur if the generator output breaker is closed with generator frequency 0.1 Hz lower than power grid frequency? (Assume that no generator protection relay actuates.)

A. The generator will motorize.

B. The generator will accept too much load.

C. The voltage of the generator will decrease to compensate for the lower frequency.

D. The entire connected system will operate at the frequency of the lowest frequency (the oncoming) generator.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1842 (B1240)

A main generator is being prepared for paralleling with an infinite power grid. Which one of the following indicates that the main generator and the grid are in phase?

A. The synchroscope pointer is at the 12 o'clock position.

B. The frequency of the generator is equal to the frequency of the grid.

C. The synchroscope pointer is turning slowly in the clockwise direction.

D. The synchroscope pointer is turning slowly in the counterclockwise direction.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P1940 (B341)

Closing a circuit breaker between two electrical generators that are out of phase will cause...

A. one generator to become a motor and the other generator to supply the motoring current.

B. a voltage reduction in both generators until normal voltage is manually restored.

C. a sudden large mechanical torque to be exerted on both of the generators.

D. a frequency reduction in both generators until normal frequency is manually restored.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2040 (B2042)

A main generator is being prepared for paralleling with an infinite power grid. Which one of the following conditions will cause the main generator to immediately supply reactive power (MVAR) to the grid when the generator output breaker is closed?

A. Generator voltage is 1% higher than grid voltage.

B. Generator voltage is 1% lower than grid voltage.

C. The synchroscope is turning slowly in the clockwise direction.

D. The synchroscope is turning slowly in the counterclockwise direction.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2044 (B2043)

Two identical 1,000 MW electrical generators are being connected to the same electrical bus. Generator A is currently supplying the bus. Generator A and B output indications are as follows:

Generator A	Generator B
4,160 Volts	4,140 Volts
60.2 Hertz	60.8 Hertz
25 MW	0 MW
10 MVAR	0 MVAR

When the output breaker for generator B is closed, which generator is more likely to trip on reverse power?

A. Generator A due to the higher initial voltage

B. Generator A due to the lower initial frequency

C. Generator B due to the lower initial voltage

D. Generator B due to the higher initial frequency

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2143 (B2044)

A main generator is about to be connected to an infinite power grid. Generator voltage equals grid voltage and the synchroscope is rotating slowly in the clockwise direction. The generator breaker is closed just prior to the synchroscope pointer reaching the 12 o'clock position.

Which one of the following will occur after the breaker is closed?

A. The breaker will remain closed and the generator will supply only MW to the grid.

B. The breaker will remain closed and the generator will supply both MW and MVAR to the grid.

C. The breaker will remain closed and the generator will become an electrical load on the grid.

D. The breaker will open due to reverse power.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2240

A main generator is being prepared for paralleling with an infinite power grid. Which one of the following indicates that the generator and grid voltages are in phase?

A. The voltage of the generator is equal to the voltage of the grid.

B. The frequency of the generator is equal to the frequency of the grid.

C. The synchroscope pointer is turning slowly in the clockwise direction.

D. The synchroscope pointer is passing through the 12 o’clock position.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2244

An isolated electrical bus is being supplied by generator A. Generator B is about to be connected to the same electrical bus. Generators A and B are both rated at 1,000 MW. Generator A and B output indications are as follows:

Generator A	Generator B
4,140 Volts	4,160 Volts
60.8 Hertz	60.2 Hertz
25 MW	0 MW
10 MVAR	0 MVAR

When the output breaker for generator B is closed, which generator is more likely to trip on reverse power?

A. Generator A due to the lower initial voltage

B. Generator A due to the higher initial frequency

C. Generator B due to the higher initial voltage

D. Generator B due to the lower initial frequency

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2343 (B2343)

A main generator is about to be connected to an infinite power grid. Generator voltage is slightly higher than grid voltage and the synchroscope is rotating slowly in the clockwise direction. The generator breaker is closed just as the synchroscope pointer reaches the 12 o'clock position.

Which one of the following will occur after the breaker is closed?

A. The breaker will remain closed and the generator will supply only MW to the grid.

B. The breaker will remain closed and the generator will supply both MW and MVAR to the grid.

C. The breaker will open due to overcurrent.

D. The breaker will open due to reverse power.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2440 (B2643)

A main generator is being prepared for paralleling with an infinite power grid. If the synchroscope pointer is stopped, at which one of the following positions is the main generator output voltage the farthest out of phase with the grid voltage?

A. 3 o’clock

B. 6 o’clock

C. 9 o’clock

D. 12 o’clock

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2441 (B2443)

A main generator is about to be connected to an infinite power grid. Generator voltage is equal to grid voltage and the synchroscope is rotating slowly in the <u>counterclockwise</u> direction. The generator breaker is closed just prior to the synchroscope pointer reaching the 12 o'clock position.

Which one of the following will most likely occur after the breaker is closed?

A. If the breaker remains closed, the generator will supply only MW to the grid.

B. If the breaker remains closed, the generator will supply both MW and MVAR to the grid.

C. The breaker will open due to overcurrent.

D. The breaker will open due to reverse power.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2642

A main generator is about to be connected to an infinite power grid. Generator voltage is slightly higher than grid voltage and the synchroscope is rotating slowly in the <u>clockwise</u> direction. The generator breaker is closed just as the synchroscope pointer reaches the 3 o'clock position.

Which one of the following will occur after the breaker is closed?

A. The breaker will remain closed and the generator will supply only MW to the grid.

B. The breaker will remain closed and the generator will supply both MW and MVAR to the grid.

C. The breaker will open due to overcurrent.

D. The breaker will open due to reverse power.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2743 (B2742)

A main generator is about to be connected to an infinite power grid with the following conditions:

Generator frequency:	59.9 Hz
Grid frequency:	60.1 Hz
Generator voltage:	114.8 kV
Grid voltage:	115.1 kV

When the generator output breaker is closed, the generator will...

A. acquire real load and reactive load.

B. acquire real load, but become a reactive load to the grid.

C. become a real load to the grid, but acquire reactive load.

D. become a real load and a reactive load to the grid.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P2943

A main generator is about to be connected to an infinite power grid with the following conditions:

Generator frequency:	60.1 Hz
Grid frequency:	59.9 Hz
Generator voltage:	115.1 kV
Grid voltage:	114.8 kV

When the generator output breaker is closed, the generator will...

A. acquire real load and reactive load.

B. acquire real load, but become a reactive load to the grid.

C. become a real load to the grid, but acquire reactive load.

D. become a real load and a reactive load to the grid.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P3142 (B3130)

A nuclear power plant is operating at 80% power in the middle of a fuel cycle. The main generator is connected to an infinite power grid with the following initial main generator output parameters:

Frequency:	60 Hz
Voltage:	25 KV
Reactive Load:	300 MVAR (out)
Real Load:	800 MW

A hydraulic oil system malfunction causes the main turbine steam inlet valves to begin to slowly drift closed. Over the next 10 minutes, the main generator real load decreases to 600 MW. Assuming no operator actions were taken during the above 10 minutes, how have the following main generator output parameters been affected?

	Frequency	Voltage	Reactive Load
A.	Decreased	Decreased	No change
B.	Decreased	No change	Decreased
C.	No change	No change	No change
D.	No change	Decreased	Decreased

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P3841 (B3842)

Which one of the following will cause the most damage to the contact surfaces of a main generator output breaker?

A. An operator attempts to close the main generator breaker with the generator and power grid frequencies matched but with voltages 180 degrees out of phase.

B. An operator attempts to close the main generator breaker with the generator and power grid voltages in phase but with generator frequency 0.5% higher than power grid frequency.

C. The main generator breaker automatically trips open on a loss of offsite power while the main generator is operating at its minimum rated load.

D. The main generator breaker automatically trips open on a loss of offsite power while the main generator is operating at its maximum rated load.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P4321 (B4321)

A main generator is about to be connected to an infinite power grid. The main generator has the following initial conditions:

Generator frequency:	59.9 Hz	Generator voltage:	115.1 kV
Grid frequency:	60.1 Hz	Grid voltage:	114.8 kV

When the generator output breaker is closed, the generator will...

A. acquire real load and reactive load.

B. acquire real load, but become a reactive load to the grid.

C. become a real load and a reactive load to the grid.

D. become a real load to the grid, but acquire reactive load.

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P4322 (B4322)

During a routine inspection of a main generator output breaker, a technician discovers severely damaged main contact surfaces. Which one of the following is the most likely cause of the damaged contact surfaces?

A. The main generator breaker automatically tripped open after it was closed with the generator and power grid voltages 60 degrees out of phase.

B. The main generator breaker automatically tripped open due to a faulty trip relay actuation while the main generator was operating unloaded.

C. The main generator breaker automatically tripped open on a loss of offsite power while the main generator was operating at its maximum rated load.

D. The main generator breaker automatically tripped open after it was closed with the generator and power grid voltages in phase but with generator frequency 0.2 Hz lower than power grid frequency.

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P5121 (B5122)

A main generator is about to be connected to an infinite power grid. Generator output frequency is slightly higher than grid frequency and generator output voltage is equal to grid voltage.

Which one of the following situations will exist when the main generator electrical conditions stabilize immediately after the generator output breaker is closed? (Assume no additional operator actions are taken.)

A. Generator output current will be 0.

B. Generator power factor will be 0.

C. Generator output MVAR will be 0.

D. Generator output MW will be 0.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.08 [3.3/3.5]
QID: P5620 (B5621)

A main generator is being connected to an infinite power grid. The following frequencies exist just prior to closing the generator output breaker:

Generator frequency: 59.9 Hz
Grid frequency: 60.1 Hz

When conditions stabilize just after the generator output breaker is closed, the generator frequency will be _________ and the grid frequency will be _________.

A. 59.9 Hz; 59.9 Hz

B. 59.9 Hz; 60.1 Hz

C. 60.0 Hz; 60.0 Hz

D. 60.1 Hz; 60.1 Hz

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.09 [2.8/3.1]
QID: P642 (B44)

When a typical 4,160 volt breaker is racked to the "test" position, control power is __________ the breaker and the breaker is __________ the load.

A. available to; connected to

B. available to; isolated from

C. removed from; connected to

D. removed from; isolated from

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.09 [2.8/3.1]
QID: P938

Which one of the following functions or capabilities would remain following a loss of control power to a typical 480 VAC bus feeder breaker?

A. Remote breaker control capability

B. Breaker closing spring automatic recharging capability

C. Remote bus voltage indication

D. Remote breaker position indication

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P42

Which one of the following statements describes the use of high-voltage disconnects?

A. Disconnects should be limited to normal load current interruption.

B. Disconnects may be used to isolate transformers in an unloaded network.

C. Disconnects trip open like circuit breakers, but must be manually closed.

D. Disconnects must be closed with caution when under load because of possible arcing.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P243 (B1842)

The function of high voltage electrical disconnects is to provide__________ electrical isolation of equipment during __________ conditions.

A. manual; no-load

B. manual; overload

C. automatic; no-load

D. automatic; overload

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P844 (B644)

High voltage electrical disconnects are used to...

A. adjust the output voltage range from a main power transformer.

B. protect bus feeder breakers by opening upon bus short-circuit faults.

C. provide equipment isolation under no-load conditions.

D. bypass and isolate an electrical bus while maintaining the downstream buses energized.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P943 (B2244)

What is an advantage of using high voltage electrical disconnects instead of breakers to isolate main power transformers?

A. Disconnects can be operated either locally or remotely.

B. Disconnects provide direct visual indication that the circuit is broken.

C. Disconnects are cheaper and provide the same automatic protection as a breaker.

D. Disconnects are capable of interrupting a higher current flow with less heating than a breaker.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P1043

Which one of the following describes a characteristic of high voltage electrical disconnects?

A. They close automatically requiring no operator action.

B. They should not be used to interrupt a circuit under load.

C. They require a remote means of indication to determine actual position.

D. They should be connected so that they ground the supply bus prior to opening a circuit.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P1343

Typical high voltage electrical disconnects are designed to...

A. protect circuits during overcurrent conditions.

B. automatically trip open to protect breakers.

C. isolate equipment electrically during no-load conditions.

D. interrupt circuits under load.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P1840 (B1544)

Typical main transformer high voltage electrical disconnects are designed to...

A. automatically protect the transformer from overcurrent conditions.

B. automatically trip open prior to transformer output breaker trip.

C. manually isolate the transformer during no-load conditions.

D. manually interrupt the transformer output circuit under load when grounds are detected.

ANSWER: C.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P2742 (B2744)

Refer to the simplified drawing of an electrical distribution system (see figure below).

The high voltage side of each step-down transformer has a remote-operated disconnect to allow transformer maintenance while keeping the other transformers in service. The control circuit for each disconnect is position-interlocked with the associated MCC feeder breaker.

Which one of the following describes the purpose served by the interlock?

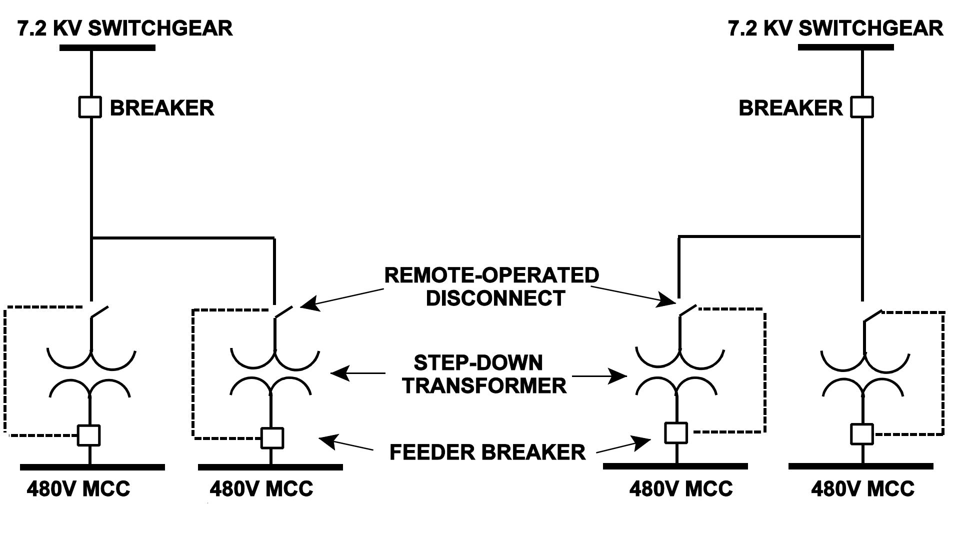
A. Prevent damage to the disconnect.

B. Prevent damage to the transformer.

C. Prevent damage to the feeder breaker.

D. Prevent damage to the 480V MCC.

ANSWER: A.



SIMPLIFIED ELECTRICAL DISTRIBUTION SYSTEM

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P2944 (B2944)

A 480 VAC motor control center supplies a load through a breaker and a manual disconnect. If both isolation devices are operated to isolate the load, which one of the following sequences will provide the greatest level of personnel safety when deenergizing the load for maintenance and when reenergizing the load after the maintenance?

	DEENERGIZING	REENERGIZING
A.	Open breaker first	Shut breaker first
B.	Open breaker first	Shut disconnect first
C.	Open disconnect first	Shut breaker first
D.	Open disconnect first	Shut disconnect first

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.10 [2.7/3.1]
QID: P3744 (B3744)

Refer to the simplified drawing of an electrical distribution system showing 7.2 KV switchgear, step-down transformers, and 480 V motor control centers (MCCs) (see figure below). The high voltage side of each step-down transformer has a remote-operated disconnect. The control circuit for each disconnect is position-interlocked with the associated MCC feeder breaker.

Which one of the following describes the interlock operating scheme that will provide the greatest protection for the disconnect?

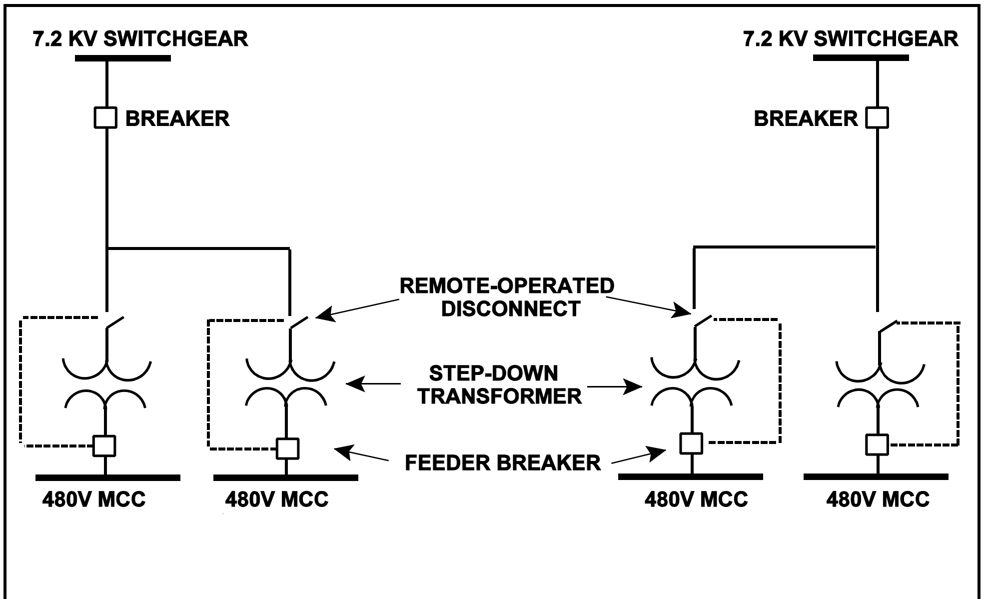
A. Permits opening the feeder breaker only if the disconnect is closed.

B. Permits opening the feeder breaker only if the disconnect is open.

C. Permits opening the disconnect only if the feeder breaker is closed.

D. Permits opening the disconnect only if the feeder breaker is open.

ANSWER: D.



SIMPLIFIED ELECTRICAL DISTRIBUTION SYSTEM

TOPIC: 191008
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P239

The following remote indications are observed for a 480 VAC load center supply breaker. (The breaker is normally open.)

Red indicating light is on.
Green indicating light is off.
Load center voltage indicates 0 volts.
Breaker incoming voltage indicates 480 volts.

What is the condition of the breaker?

A. Open and racked in

B. Closed and racked in

C. Open and racked to "test" position

D. Closed and racked to "test" position

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P244

The following indications are observed for a motor breaker in the control room:

Red position indicating light is off.
Green position indicating light is off.
Load amps indicate normal load current.

Assuming one of the indicating lights is burned out, what is the condition of the breaker?

A. Closed and racked in

B. Open and racked in

C. Closed and racked to "test" position

D. Open and racked to "test" position

ANSWER: A.

TOPIC: 191008
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P1044

The following indications are observed in the control room for a normally-open motor control center (MCC) breaker that directly starts/stops a 480 VAC motor:

Red position indicating light is on.
Green position indicating light is off.
Motor load current indicates 0 amps.
MCC voltage indicates 480 volts.

What is the condition of the breaker?

A. Open and racked in

B. Closed and racked in

C. Open and racked to "test" position

D. Closed and racked to "test" position

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P1140

The following indications are observed in the control room for a normally-open breaker that directly starts/stops a 480 VAC motor:

Red position indicating light is on.
Green position indicating light is off.
Load current indicates 50 amps.
Supply voltage indicates 480 volts.

What is the condition of the breaker?

A. Open and racked to "test" position

B. Closed and racked to "test" position

C. Open and racked in

D. Closed and racked in

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P1438 (B1440)

While remotely investigating the condition of a normally-open motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is out.
Red breaker position indicating light is lit.
MCC voltmeter indicates normal voltage.
MCC ammeter indicates zero amperes.

Based on these indications, the operator should report that the circuit breaker is __________ and racked __________.

A. open; in

B. closed; in

C. open; out

D. closed; out

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P1838 (B2143)

While remotely investigating the condition of a typical normally-open motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is lit.
Red breaker position indicating light is out.
MCC voltmeter indicates zero volts.
MCC ammeter indicates zero amperes.

Based on these indications, the operator can accurately report that the breaker is open and racked to __________ position.

A. the OUT

B. the IN

C. the TEST

D. an unknown

ANSWER: D.

TOPIC: 191008
KNOWLEDGE: K1.11 [3.1/3.3]
QID: P1932 (B2640)

While remotely investigating the condition of a normally-open 480 VAC motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is out.
Red breaker position indicating light is lit.
MCC voltmeter indicates 480 VAC.
MCC ammeter indicates zero amperes.

Based on these indications, the operator should report that the feeder breaker is __________ and racked __________.

A. open; in

B. closed; in

C. open; to the test position

D. closed; to the test position

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.12 [2.9/2.9]
QID: P1444 (B2240)

Breaker local overcurrent trip flag indicators, when actuated, indicate that...

A. a breaker trip will occur unless current is reduced.

B. a breaker overcurrent condition is responsible for a breaker trip.

C. an overcurrent condition has cleared and the breaker can be closed.

D. the associated breaker has failed to trip open during an overcurrent condition.

ANSWER: B.

TOPIC: 191008
KNOWLEDGE: K1.12 [2.9/2.9]
QID: P3444 (B3440)

Given the following indications for an open 4,160 VAC breaker:

- The local OPEN/CLOSED mechanical flag indicates open
- A breaker overcurrent trip flag is actuated on one phase
- The line-side voltmeter indicates 4,160 VAC
- The load-side voltmeter indicates 0 volts

Assuming no operator actions were taken since the breaker opened, which one of the following could have caused the breaker to open?

A. A ground fault caused an automatic breaker trip.

B. A loss of control power caused an automatic breaker trip.

C. An operator opened the breaker locally.

D. An operator opened the breaker from a remote location.

ANSWER: A.