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 directly 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?

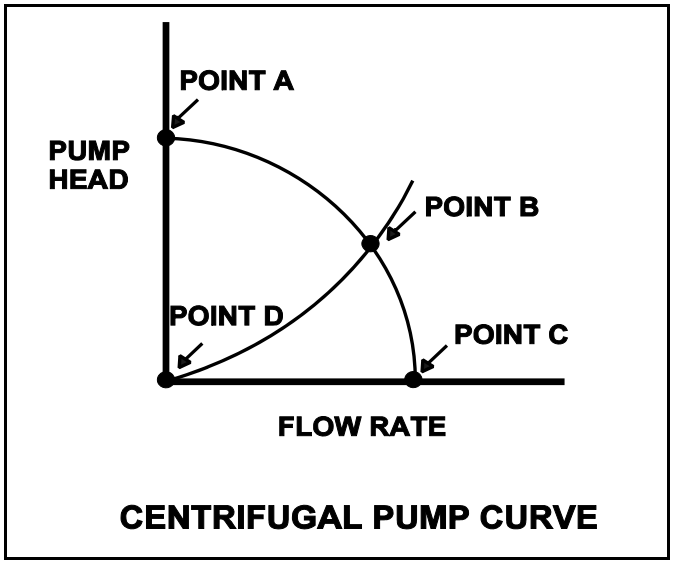
A. Point A

B. Point B

C. Point C

D. Point D

ANSWER: A.



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...

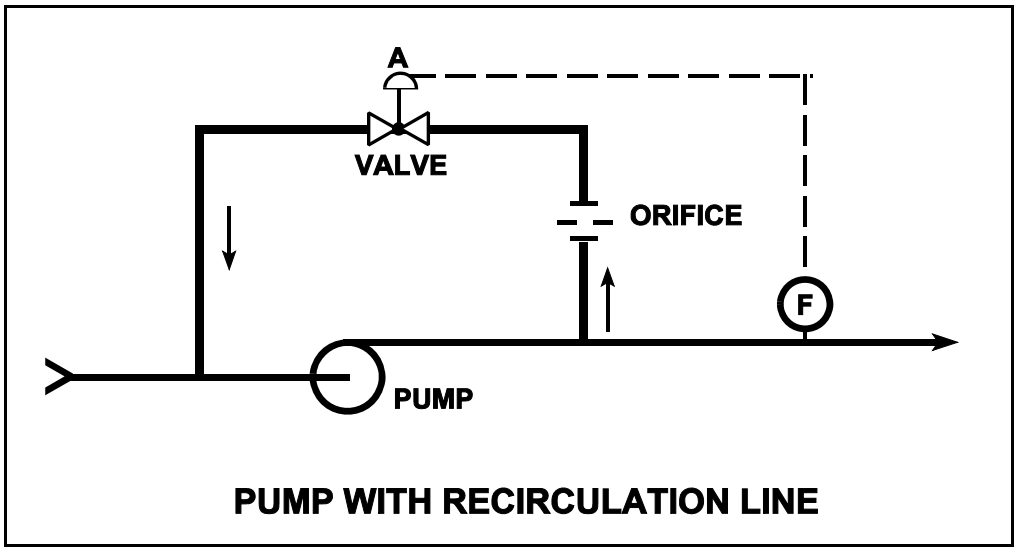
A. prevent pump runout by creating a recirculation flowpath.

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?

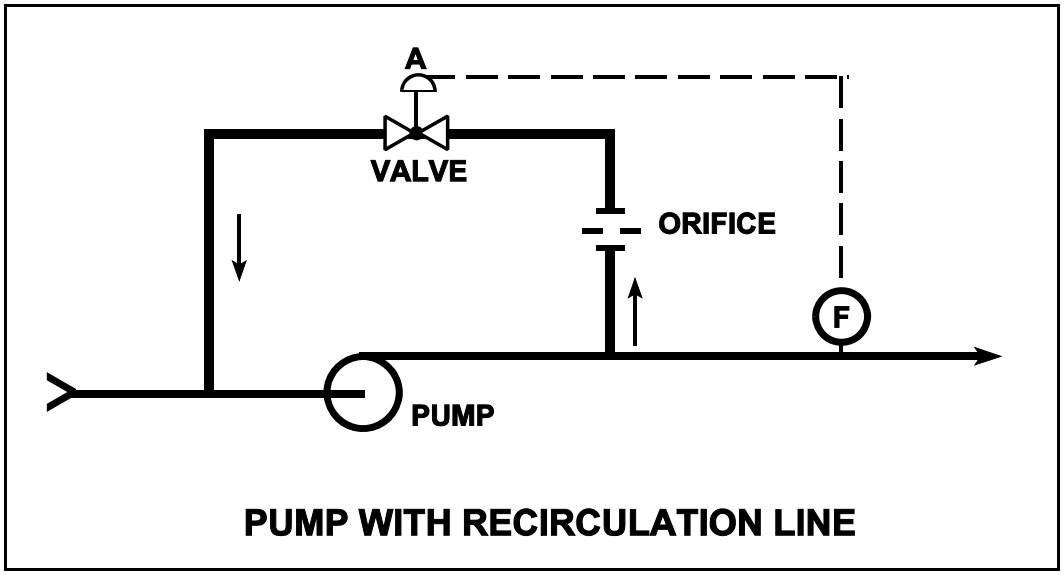
A. The pump will overheat after a relatively short period of time due to a loss of both main flow and recirculation flow.

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...

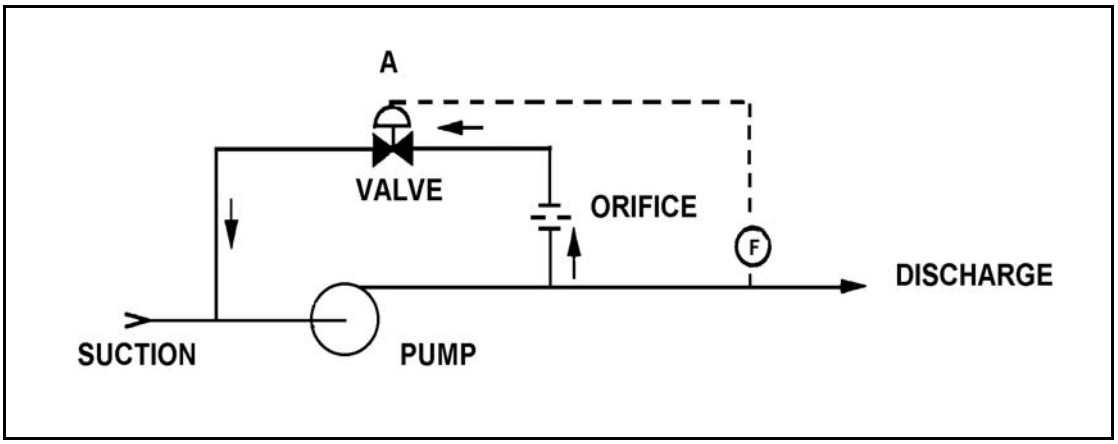
A. discharge pressure increases above a setpoint.

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...

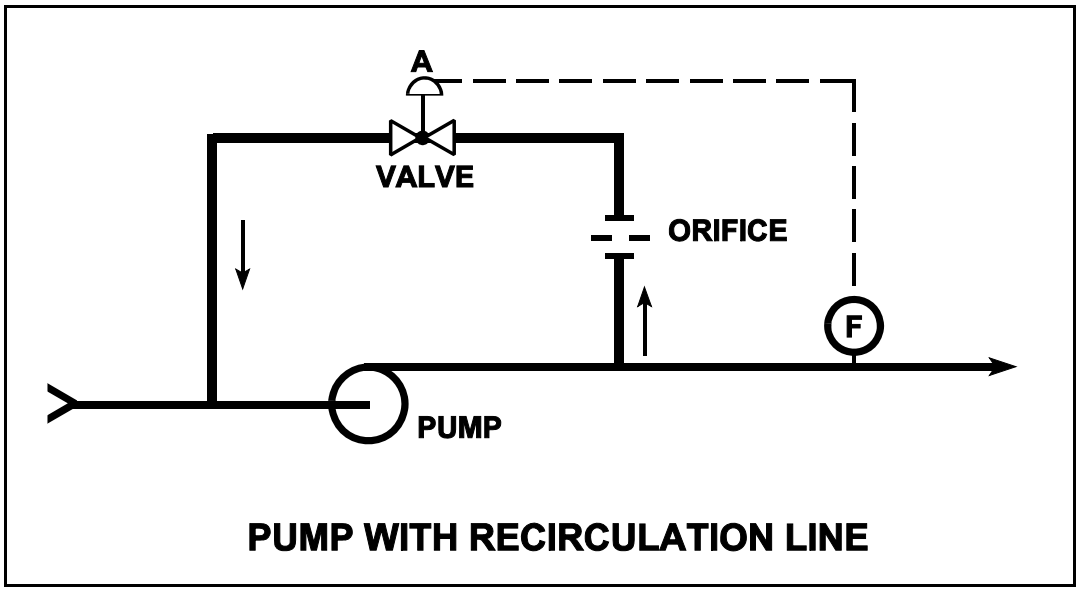
A. discharge pressure increases above a setpoint.

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...

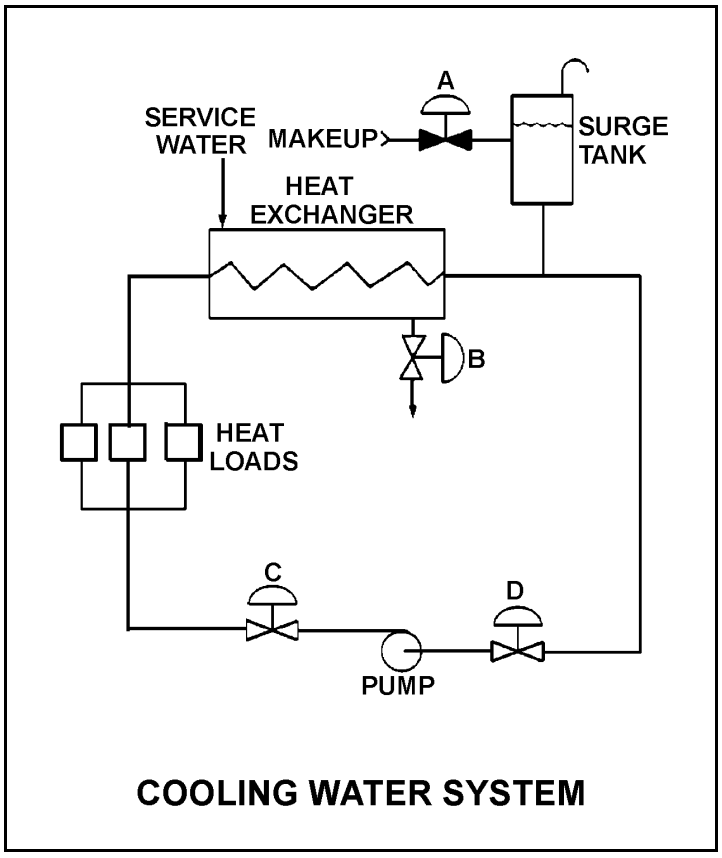
A. opening surge tank makeup valve "A" to raise tank level.

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.



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...

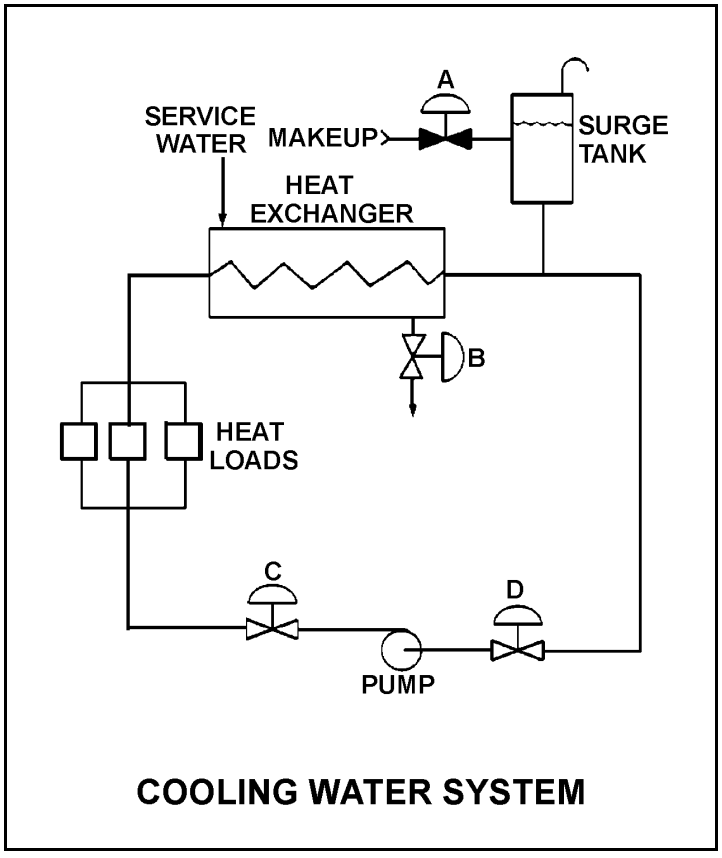
A. opening surge tank makeup valve "A" to raise tank level.

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.



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?

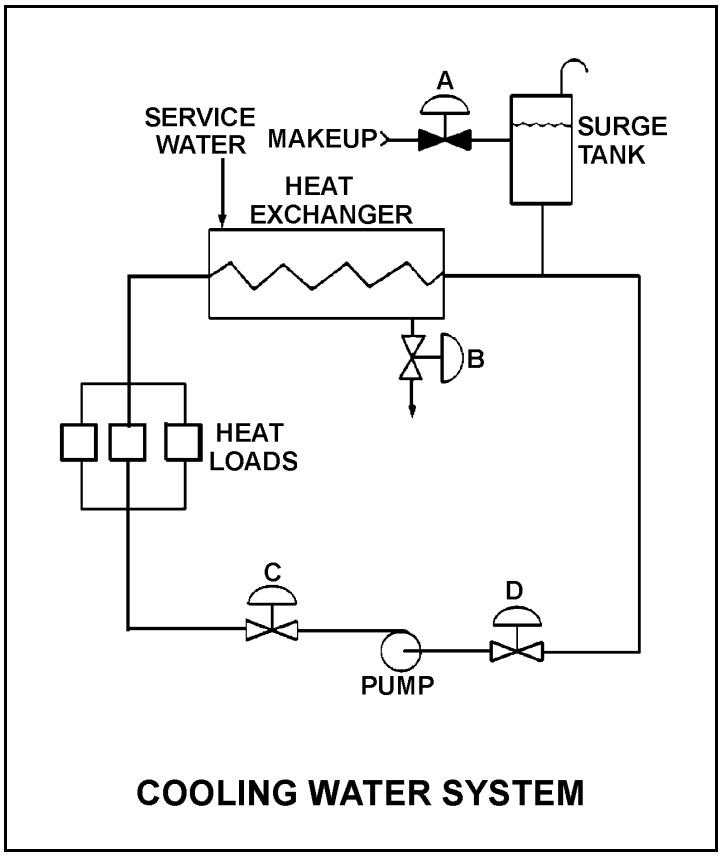
A. Draining the surge tank to decrease level by 10%.

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...

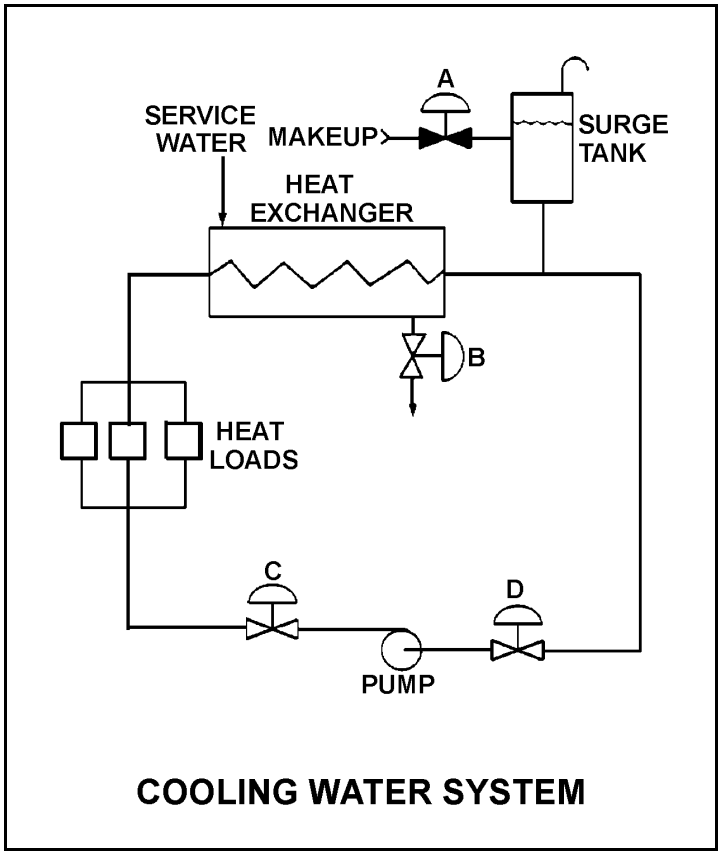
A. increasing surge tank level by 5 percent.

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.



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?

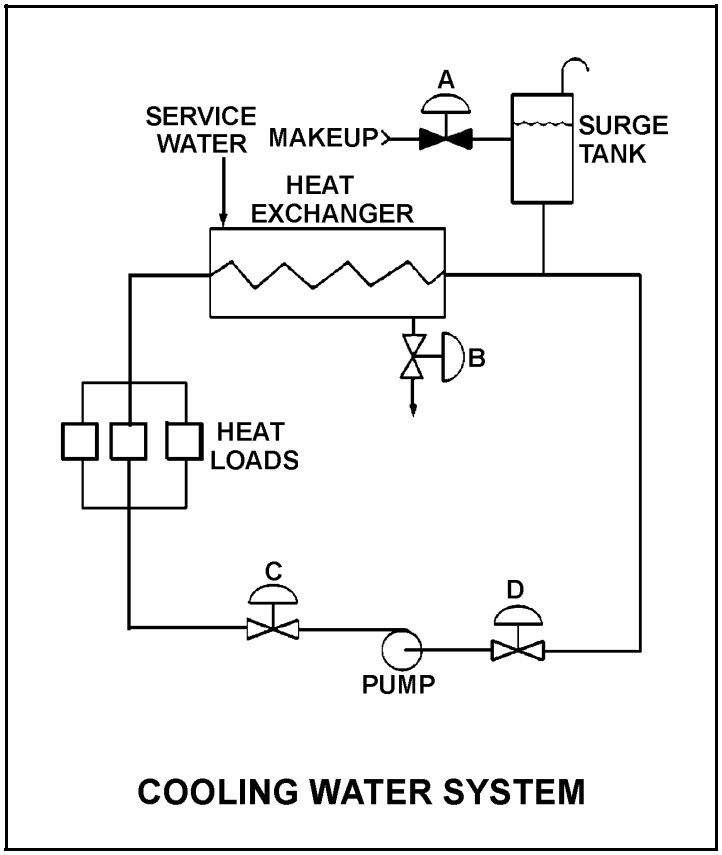
A. Adding water to the surge tank to raise level by 10%.

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?

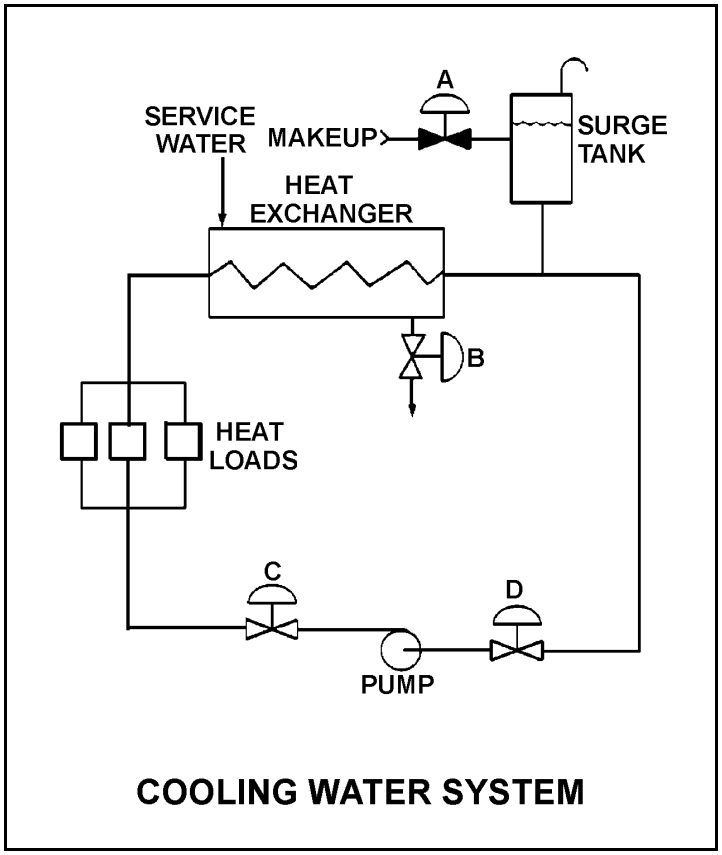
A. Draining the surge tank to decrease level by 10%.

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.



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.

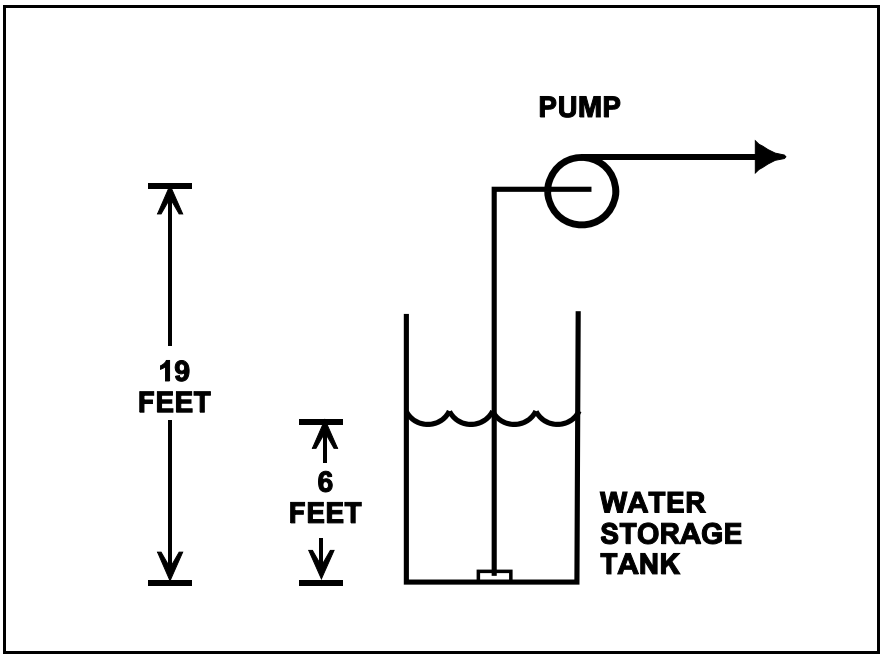
A. 6 feet

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?

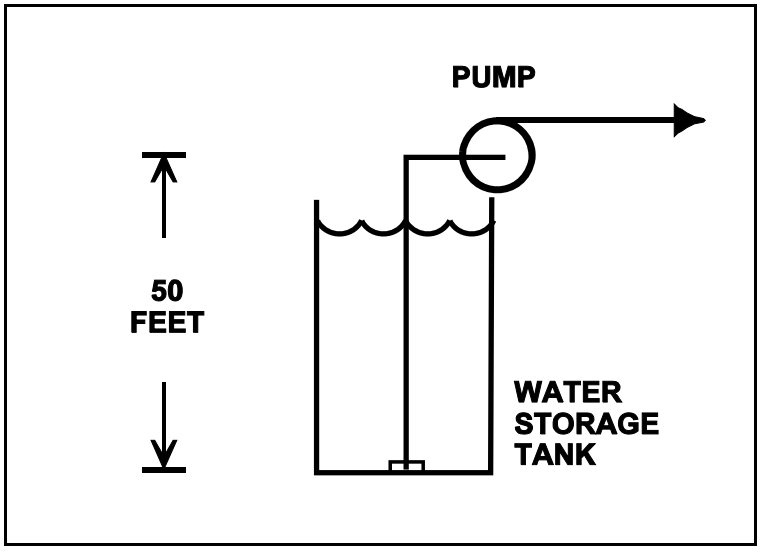
A. 34 feet

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.

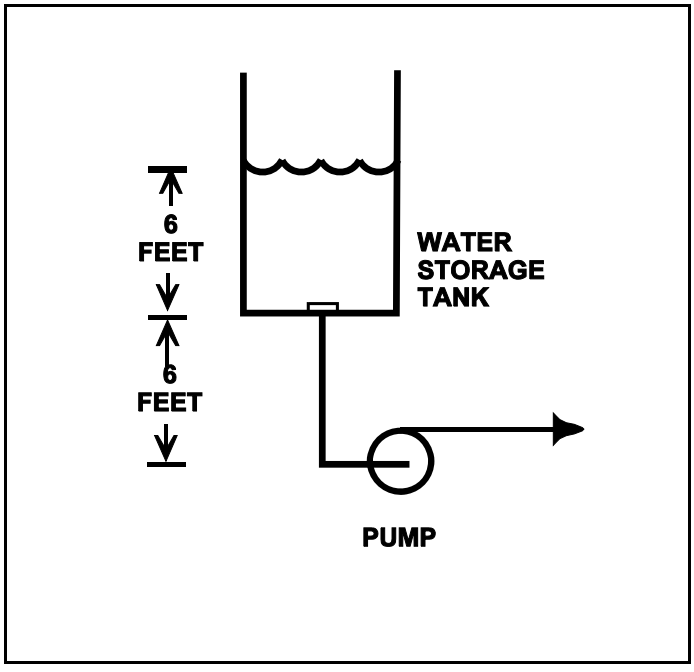
A. 6 feet

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?

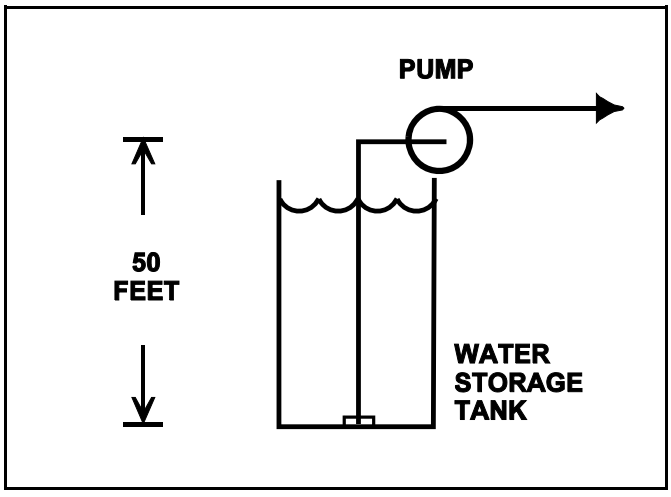
A. The pump will operate normally until tank water level decreases below approximately 20 feet, at which time the pump will cavitate.

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?

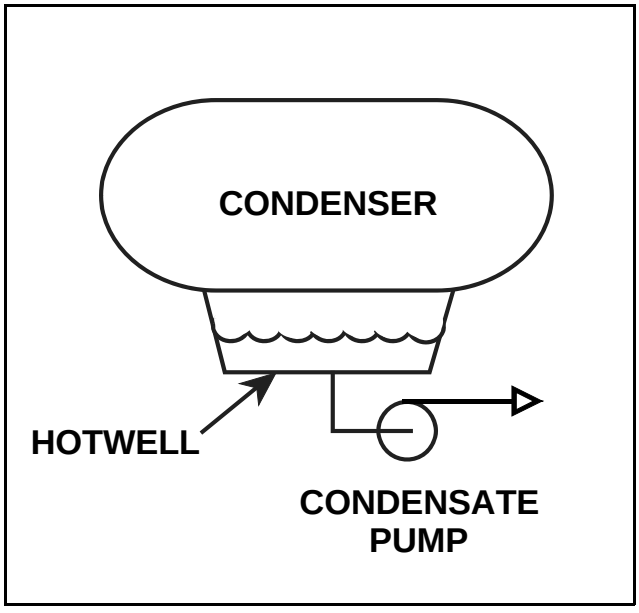
A. 1.2 feet

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...

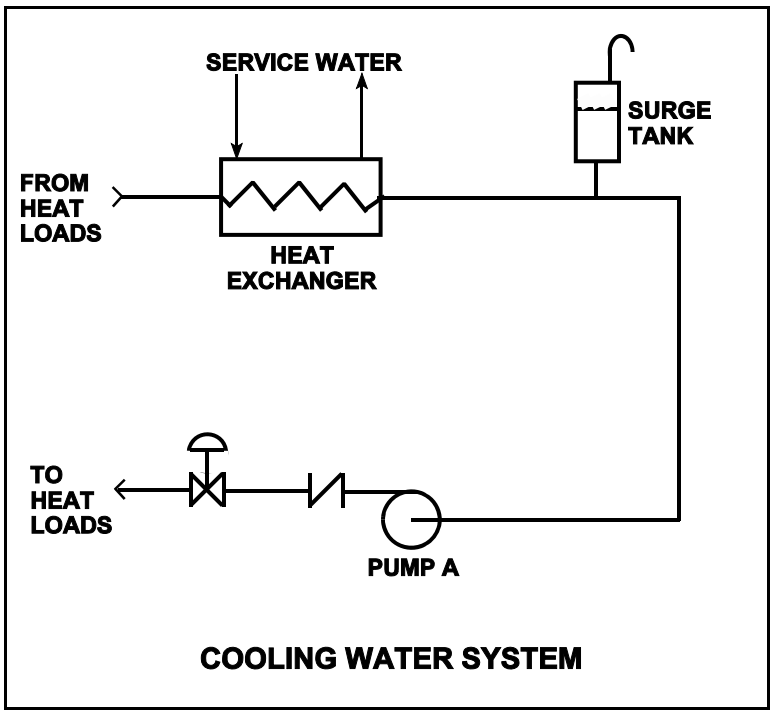
A. decreased because water density has increased.

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 _____.

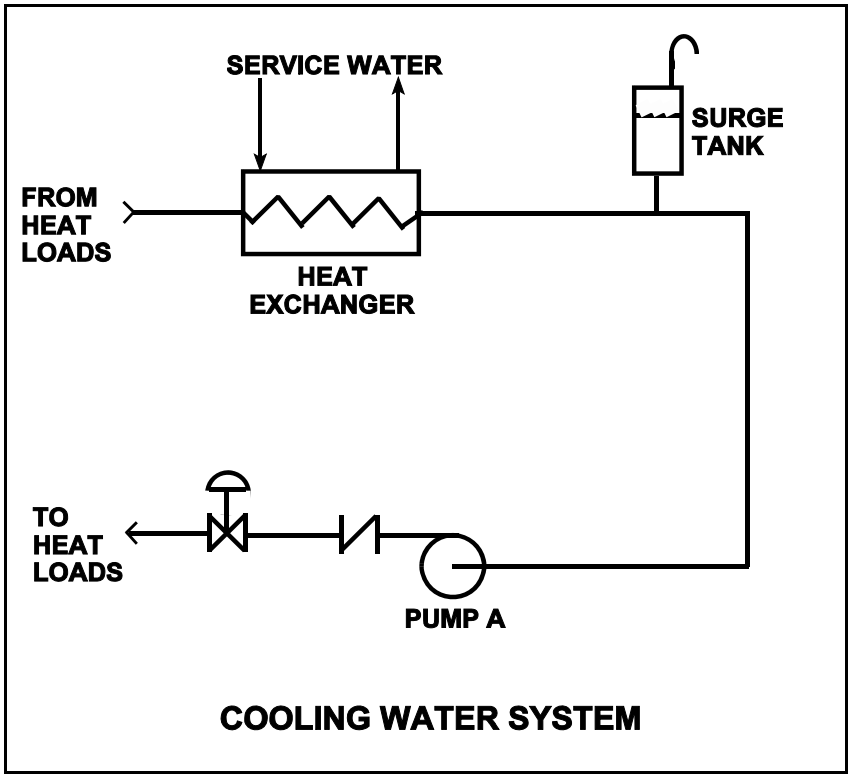
A. decreased; water density has decreased

B increased; water density has decreased

C. decreased; pump efficiency has increased

D. increased; pump efficiency has increased

ANSWER: A.



TOPIC: 191004
KNOWLEDGE: K1.07 [2.9/2.9]
QID: P1924 (B115)

A constant-speed radial-flow centrifugal pump motor draws the least 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 no change in pump flow rate.

B. The temperature of the cooling water being pumped increased to 80°F with no change in pump flow rate.

C. Cooling water flow was established to an additional heat load with no change in the temperature of the cooling water being pumped.

D. Cooling water flow was isolated from an out-of-service heat load with no 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 closed 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 _____.

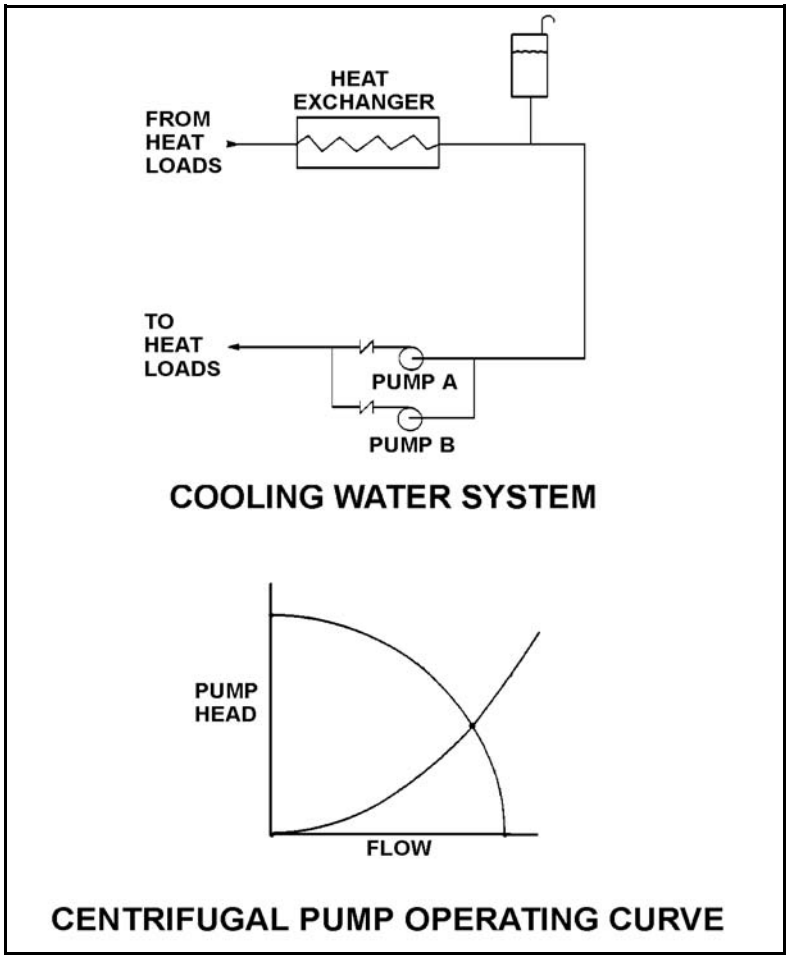
A. the same; higher

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...

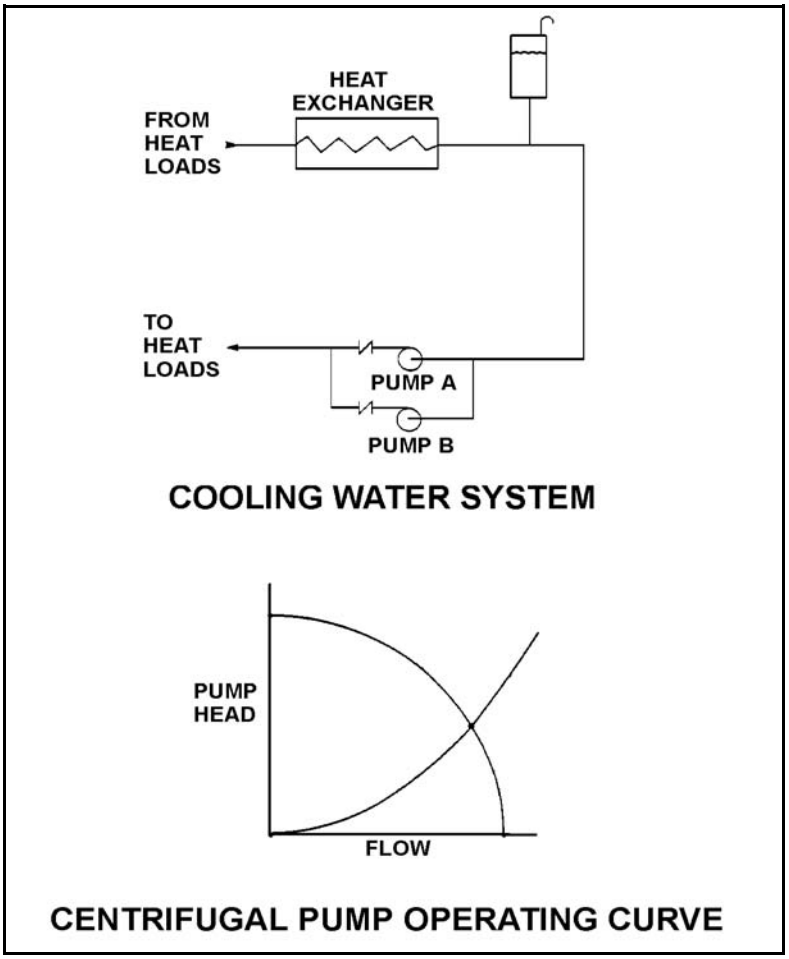
A. twice the original flow.

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...

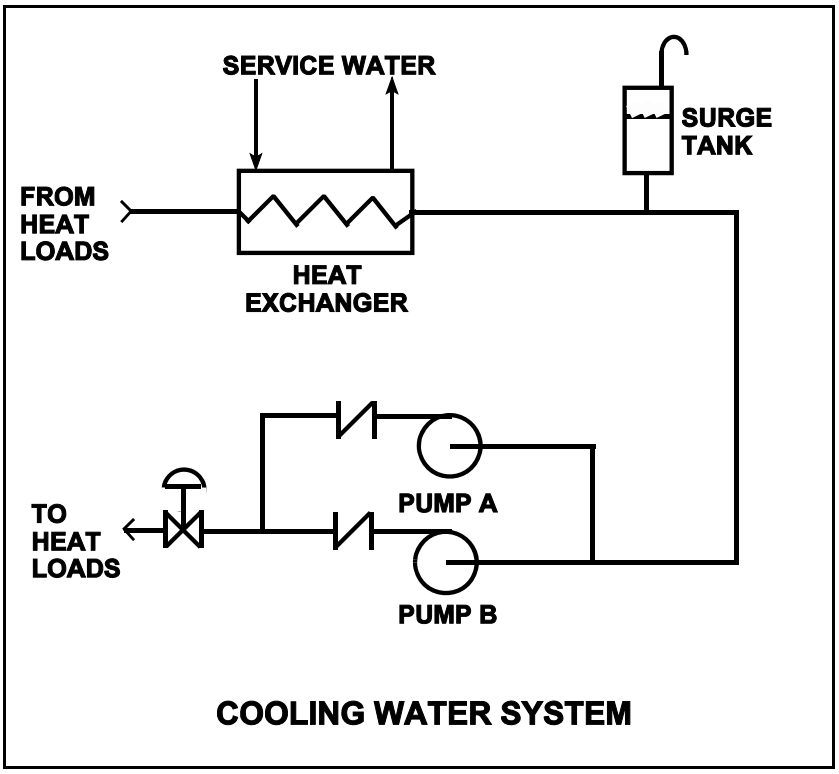
A. more than one-half the original flow.

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?

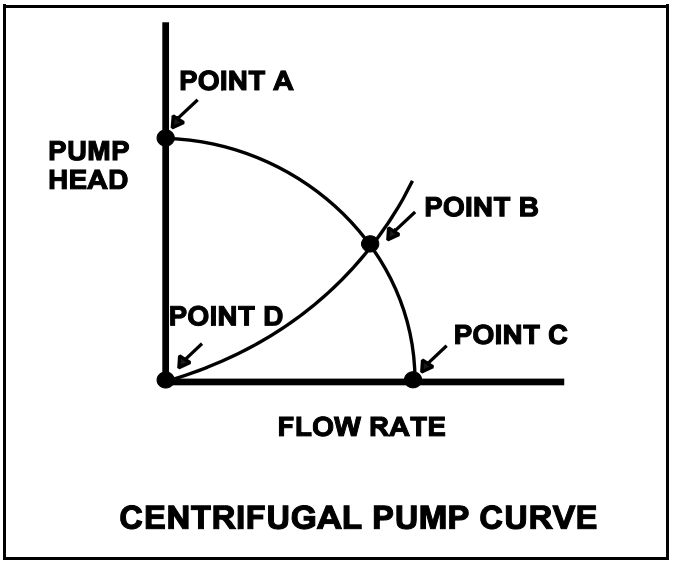
A. Point A

B. Point B

C. Point C

D. Point D

ANSWER: C.



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.)

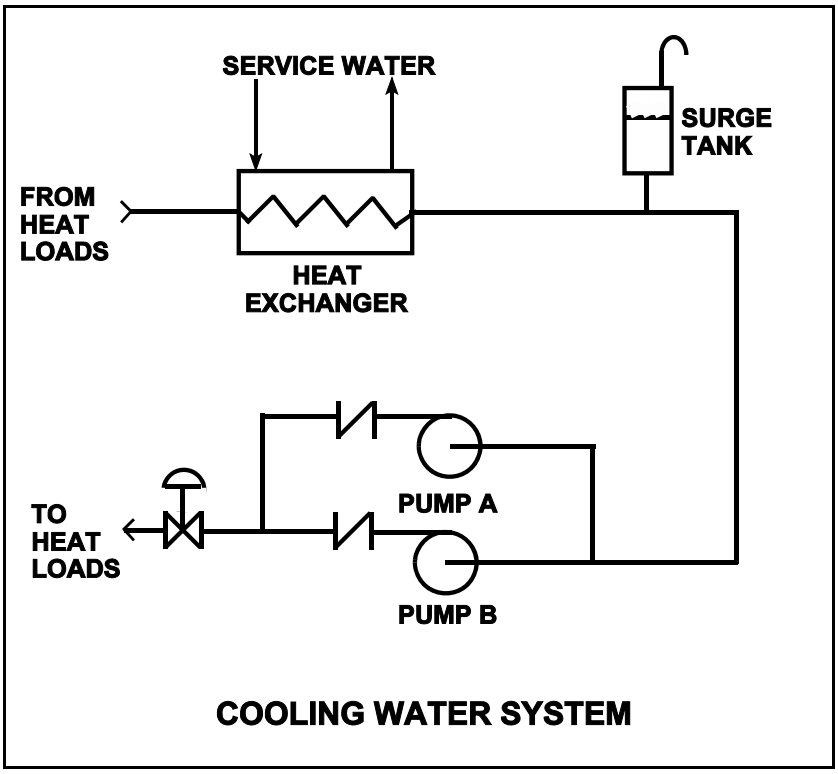
A. Starting pump B.

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?

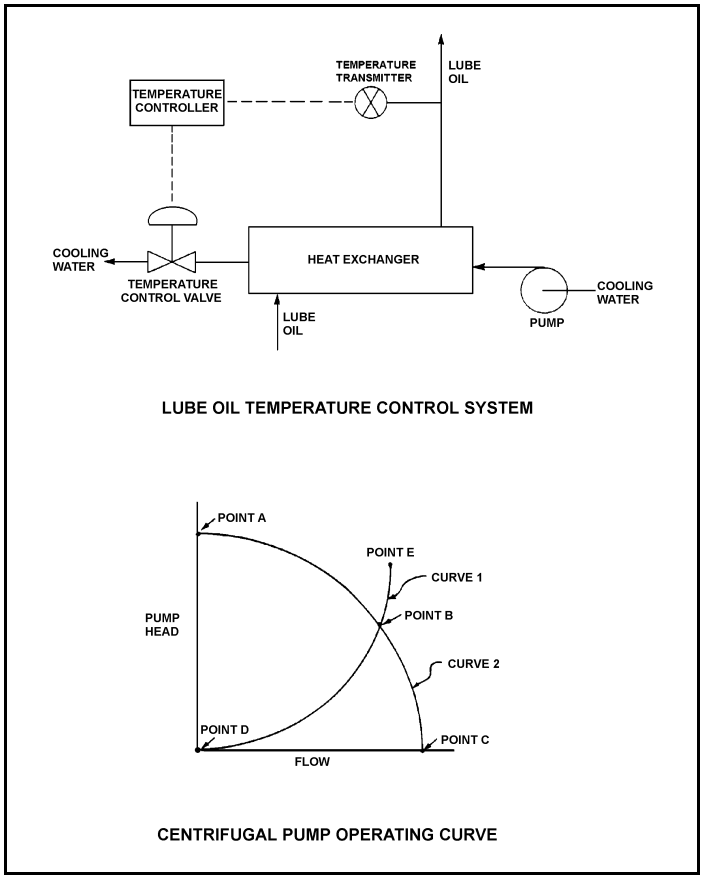
A. Operating point B will be located on curve 1 closer to point E.

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.)

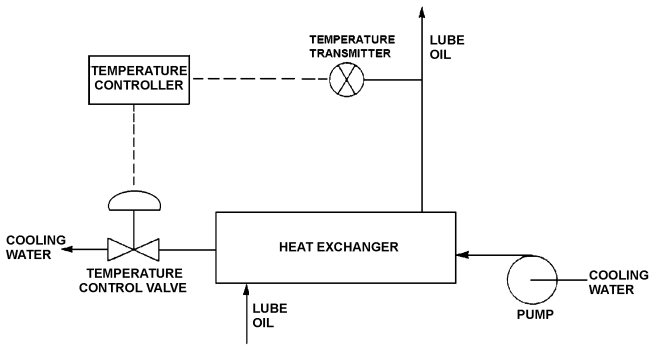
A. 1; D

B. 2; A

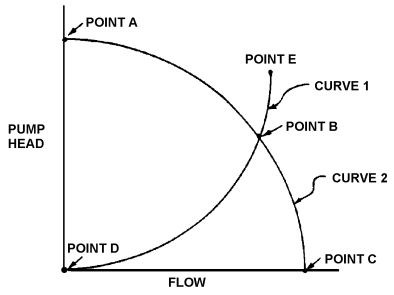
C. 1; E

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?

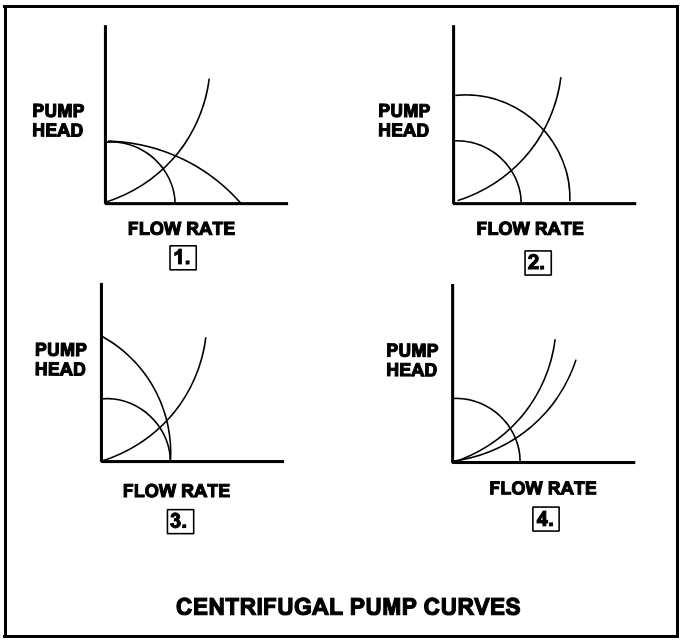
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: D.



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?

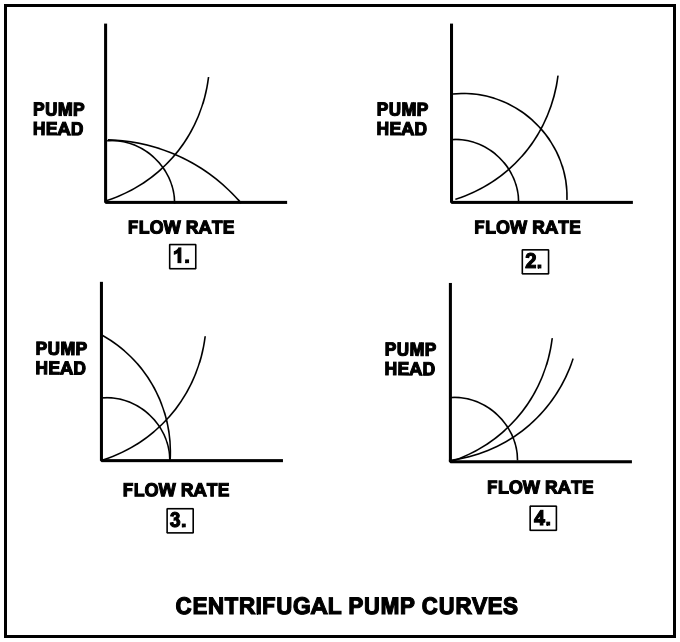
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: C.



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?

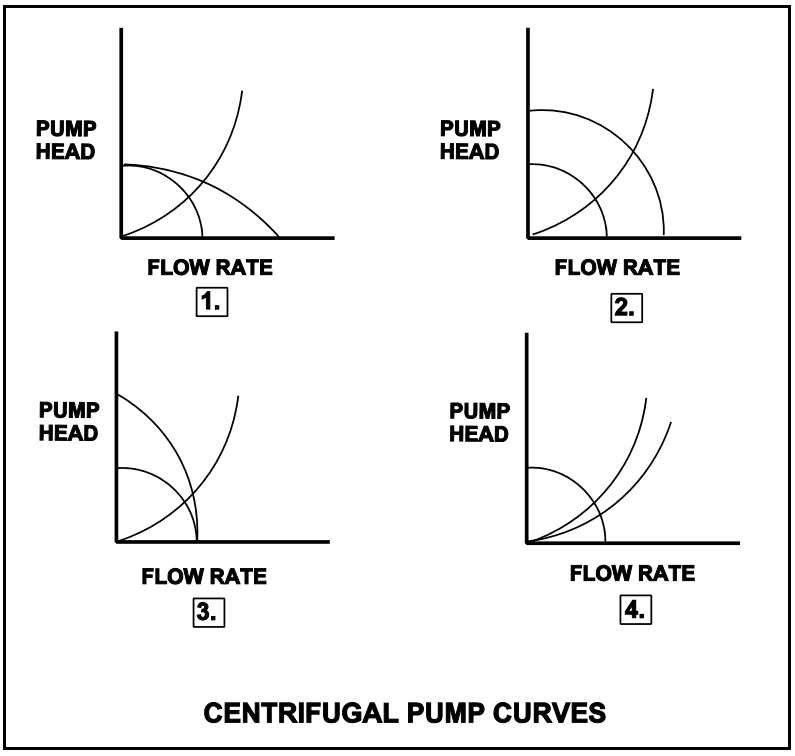
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: C.



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?

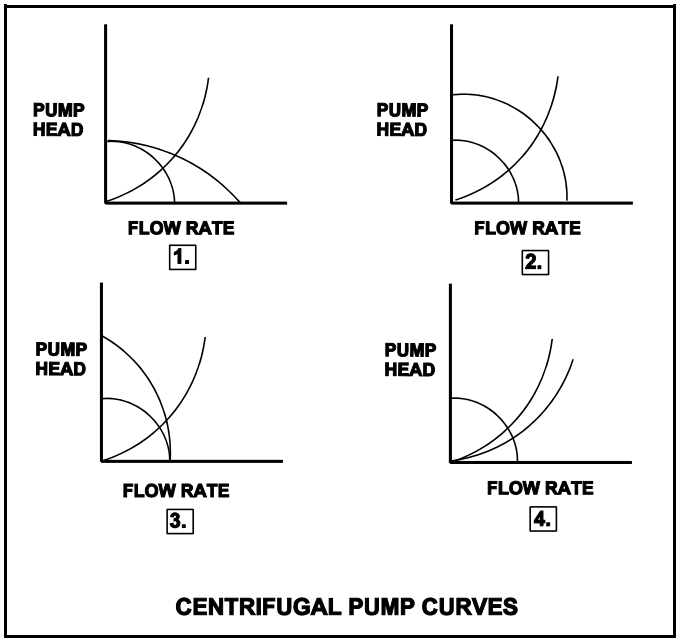
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: A.



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?

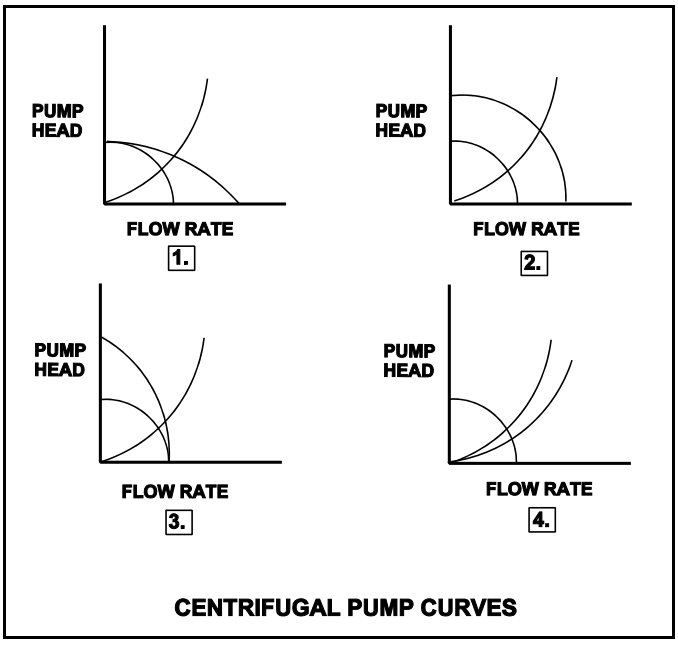
A. 1.

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?

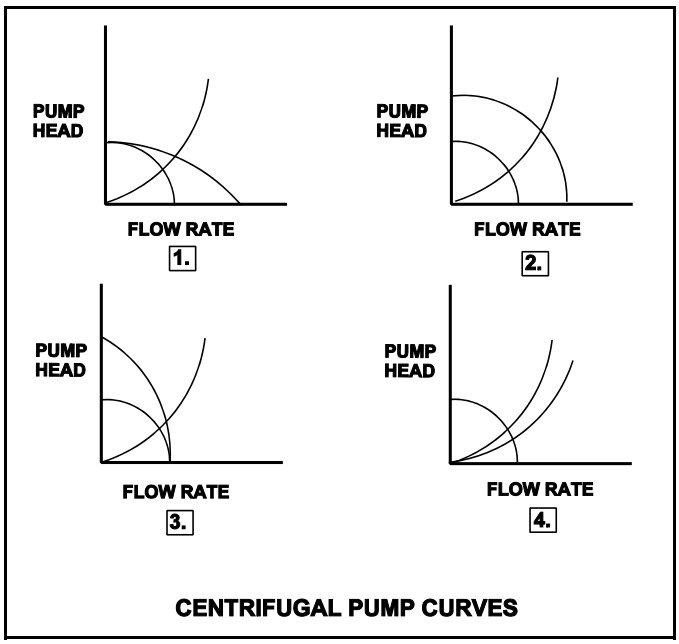
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: D.



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?

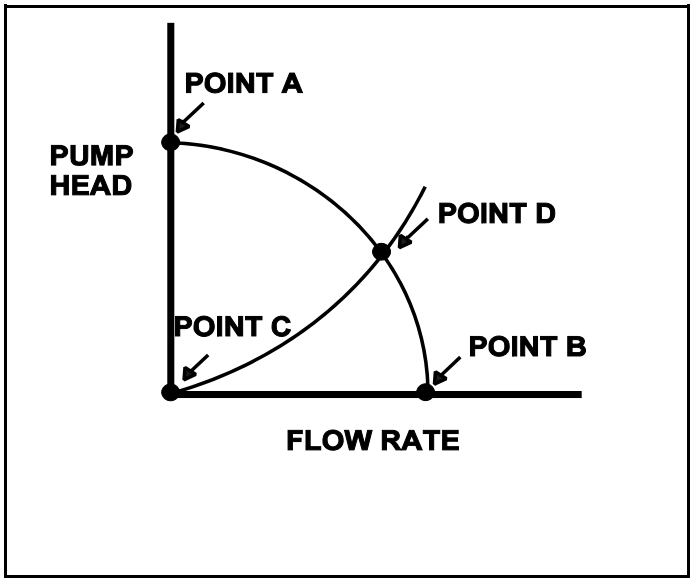
A. The pump flow losses due to the decrease in available net positive suction head as the system flow rate increases.

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.)

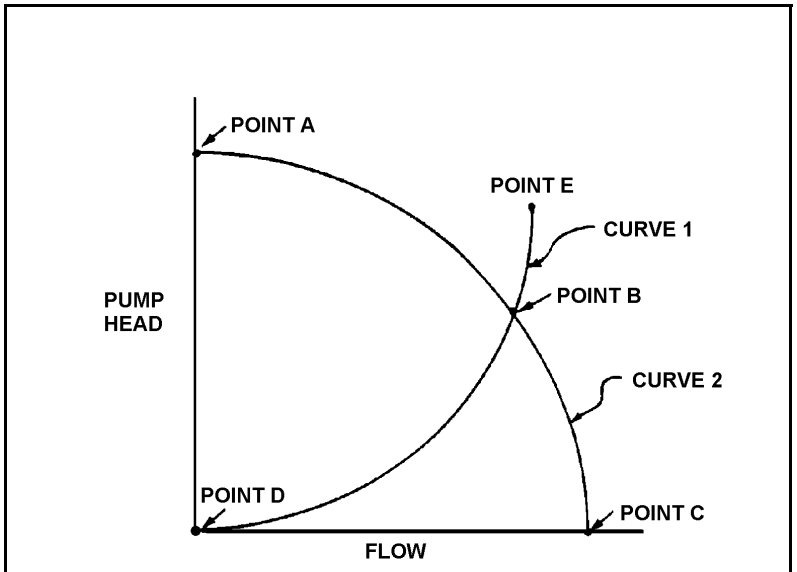
A. 1; D

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 _____.

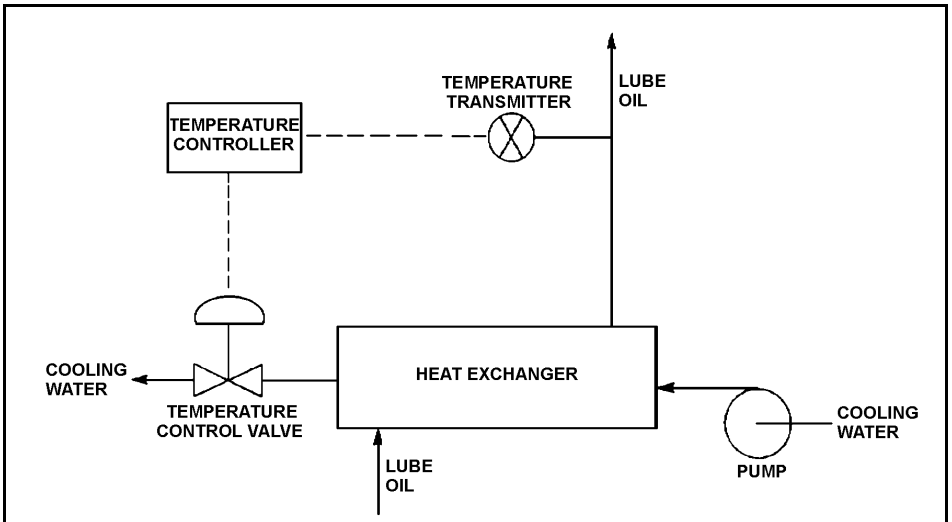
A. increase, decrease

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?

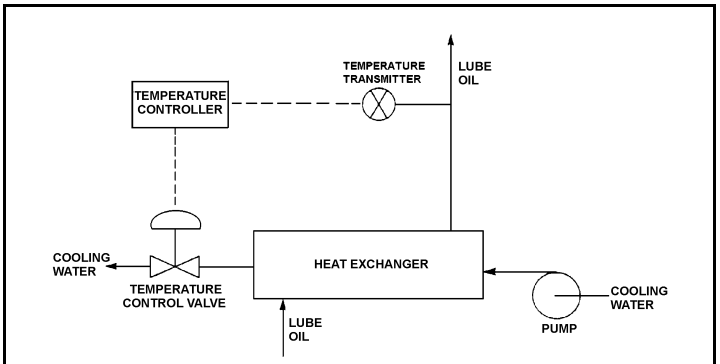
A. Operating point B will be located on curve 1 closer to point E.

B. Operating point B will be located on curve 1 closer to point D.

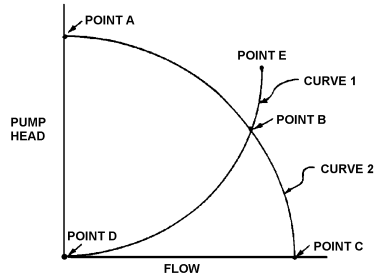
C. Operating point B will be located on curve 2 closer to point A.

D. Operating point B will be located on curve 2 closer to point C.

ANSWER: D.



LUBE OIL TEMPERATURE CONTROL SYSTEM



CENTRIFUGAL PUMP OPERATING CURVE

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?

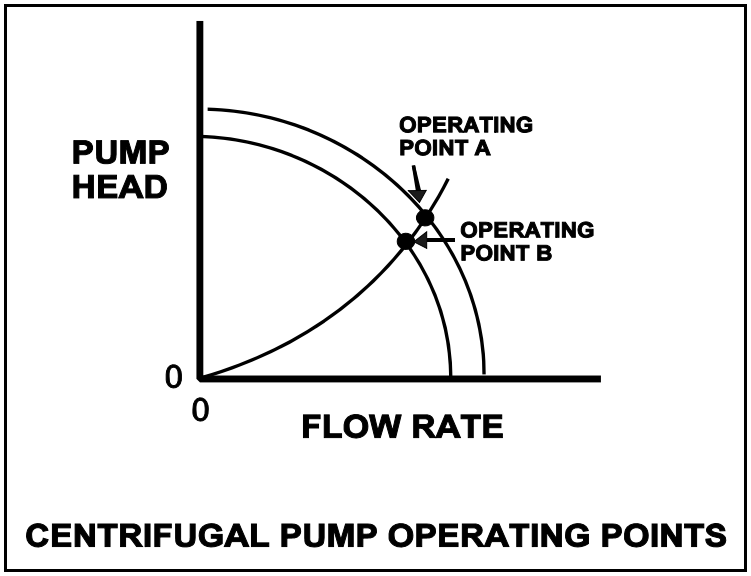
A. The pump discharge valve was more open when data was collected for operating point A.

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?

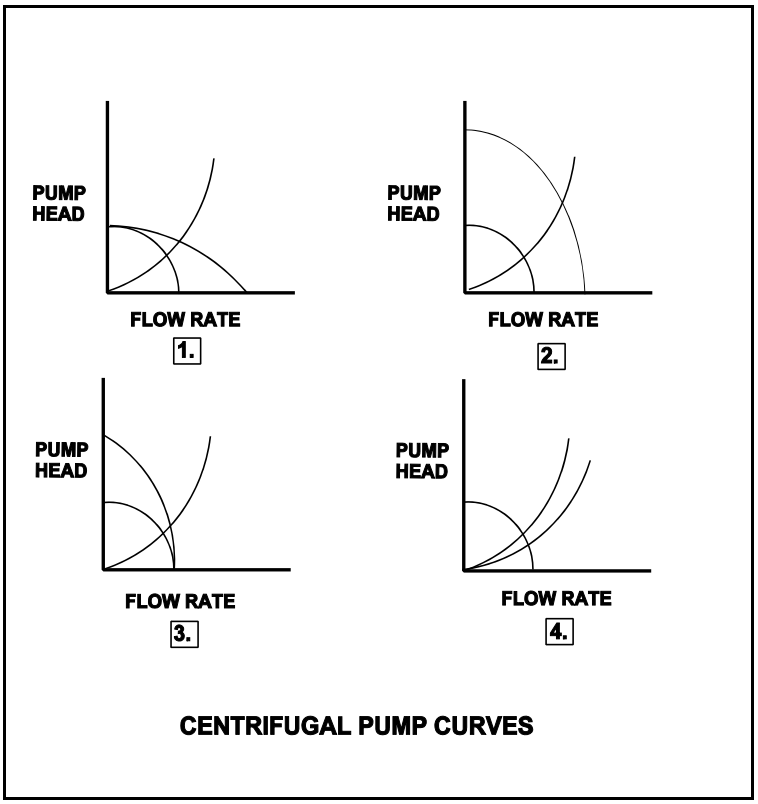
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: B.



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?

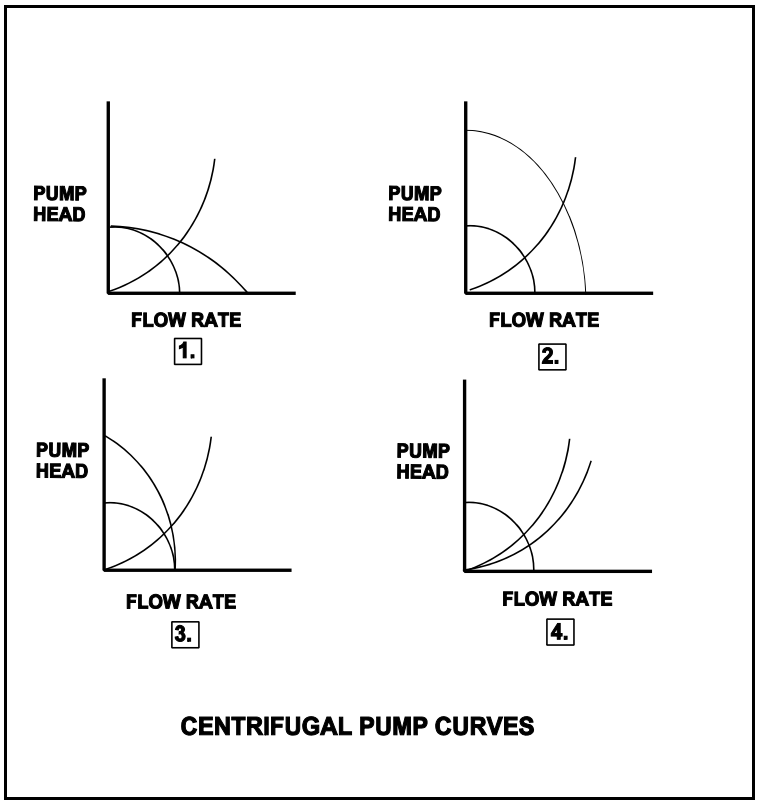
A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: B.



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...

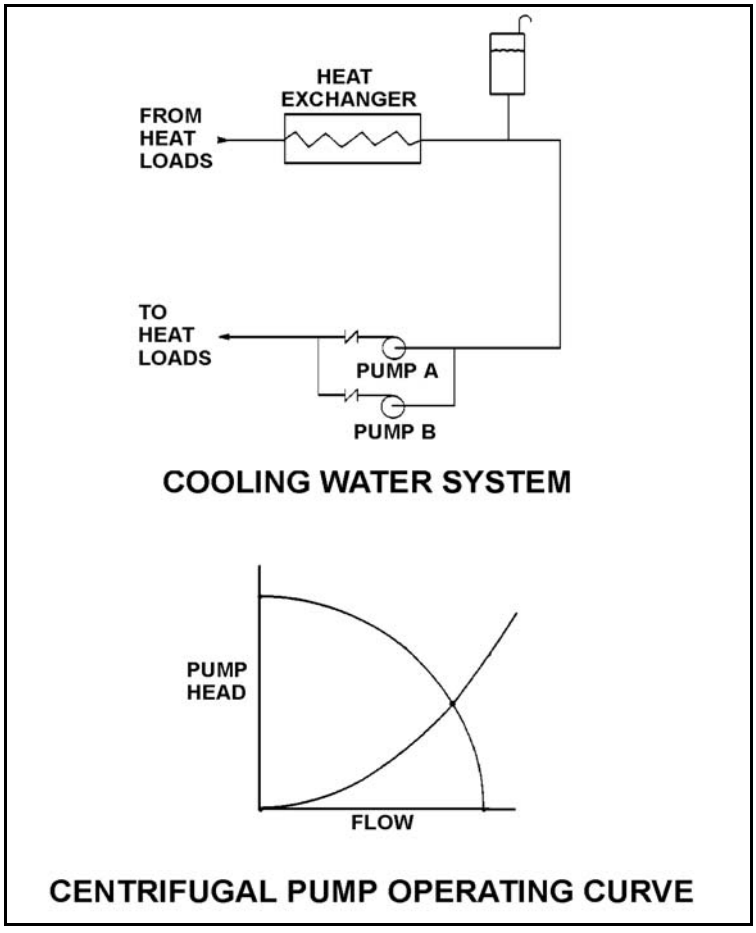
A. the same as the initial flow rate.

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 and a reduced pump discharge head?

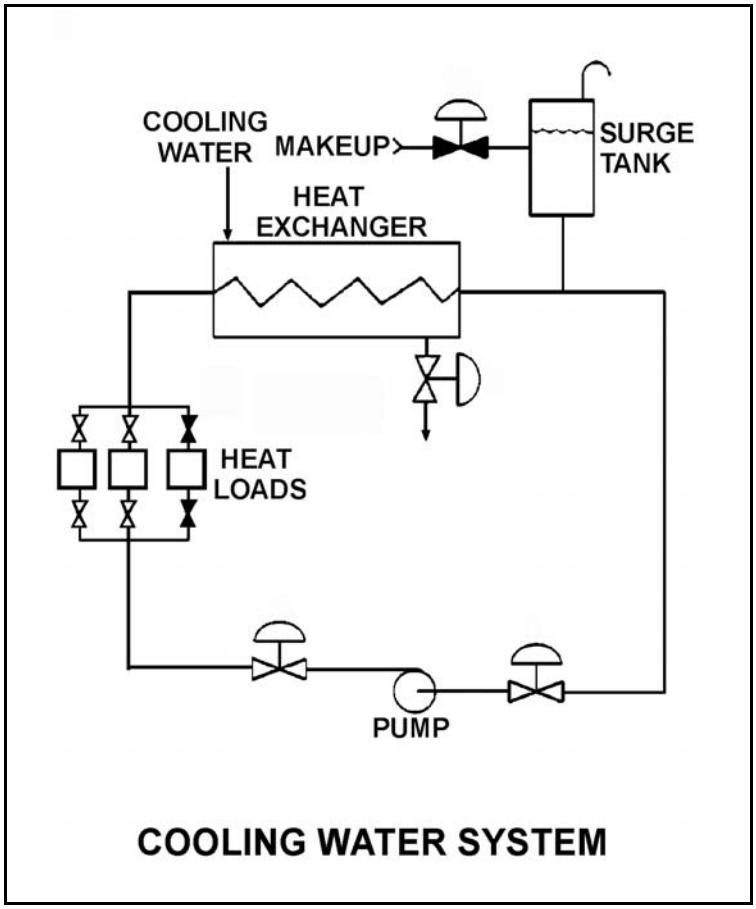
A. Increase pump speed by 20%.

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 unable 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?

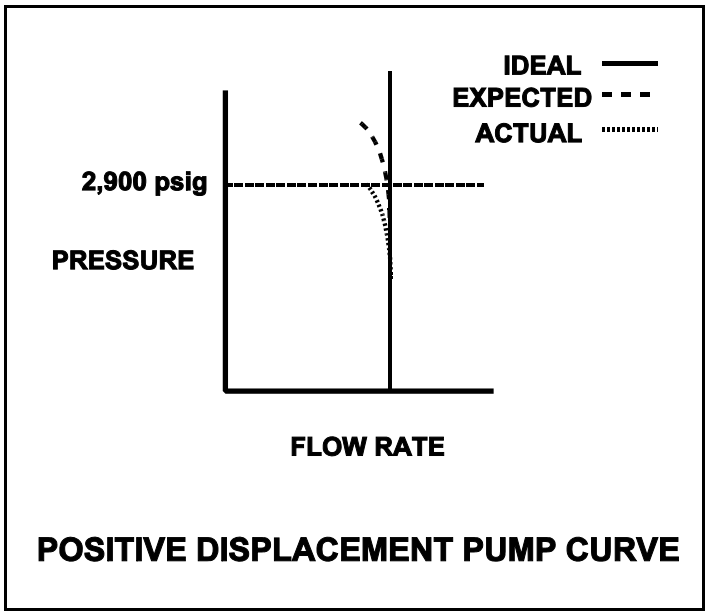
A. Pump internal leakage is greater than expected.

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?

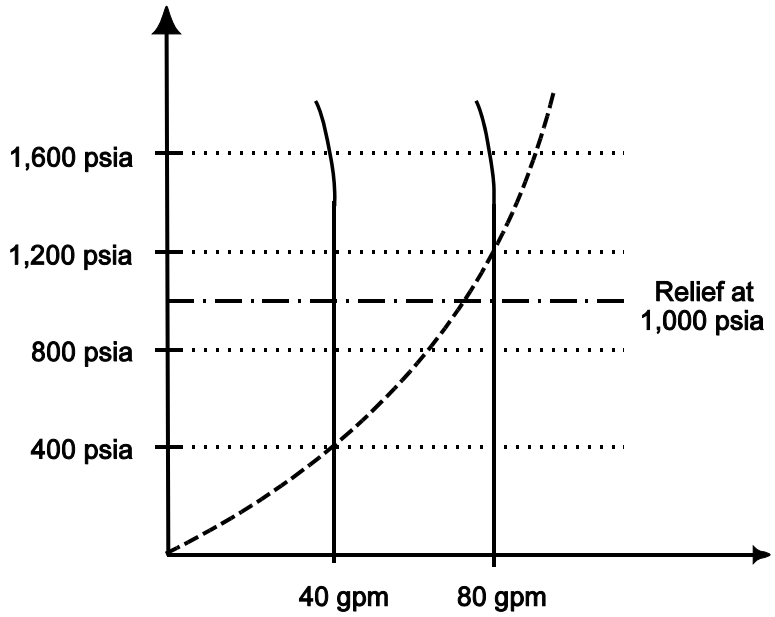
A. 800 psia

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?

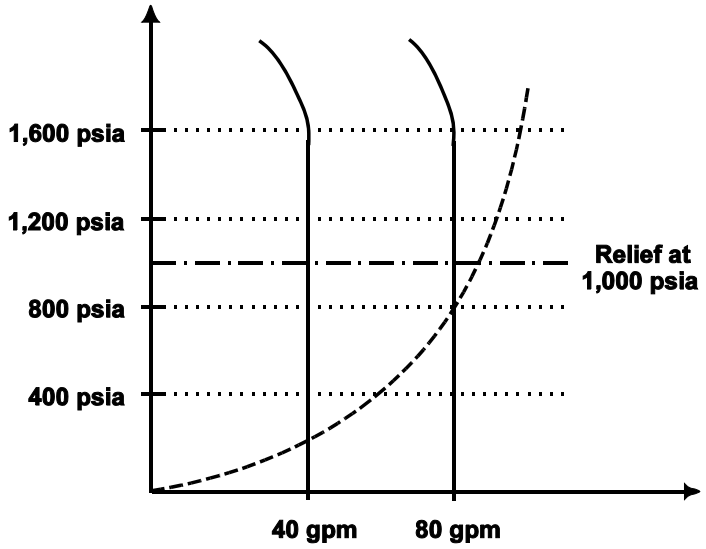
A. 400 psia

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.