TOPIC: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B15   (P17)

The difference between the setpoint and the measured parameter in an automatic flow controller is called...

A. gain.

B. bias.

C. error.

D. feedback.

ANSWER: C.

TOPIC: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B215   (P217)

The range of values around the set point of a measured variable where <u>no</u> <u>action</u> occurs in an automatic flow controller is called...

A. deviation.

B. error.

C. deadband.

D. bias.

ANSWER: C.

TOPIC: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B715   (P1615)

An automatic flow controller is being used to position a valve in a cooling water system. A signal from the valve, that 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: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B1414   (P17)

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: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B1516 (P1219)

The level in a tank is controlled by an automatic level controller. Level is initially at 50% when the tank develops a leak. When level decreases to 45% the level controller opens a makeup supply valve. After a few minutes level is 55% and the makeup valve closes. With the leak still in progress, level continuously oscillates between 45% and 55% as the makeup valve opens and closes.

The controller in this system uses primarily _____ control.

A. bistable

B. proportional

C. integral

D. derivative

ANSWER: A.

TOPIC: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B1616 (P1518)

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. Time constant

ANSWER: C.

TOPIC: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B1817 (P715)

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: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B2115 (P918)

In a proportional controller, the term "offset" refers to the difference between the...

A. control point and setpoint.

B. control point and proportional band.

C. deadband and setpoint.

D. deadband and proportional band.

ANSWER: A.

TOPIC: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B3715 (P3715)

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: 291003
KNOWLEDGE: K1.01   [3.5/3.7]
QID: B5608 (P5607)

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: 291003
KNOWLEDGE: K1.02   [3.5/3.6]
QID: B3115 (P218)

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 <u>directly</u> sensing D/G _____ and will <u>directly</u> adjust D/G _____ flow to maintain a relatively constant D/G frequency.

A. speed; air

B. speed; fuel

C. load; air

D. load; fuel

ANSWER: B.

TOPIC: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B1317 (P818)

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: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B2215 (P1417)

Which one of the following controller types is designed to control the measured parameter at the controller set point?

A. Integral

B. Proportional

C. On-Off

D. Derivative

ANSWER: A.

TOPIC: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B2315 (P2319)

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: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B2415   (P2419)

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 set point, the controller closes the drain valve. Tank level continues to be controlled in this manner within a narrow band above and below the set point.

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: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B2815 (P2819)

The water level in a water collection tank is being controlled by an automatic level controller that positions a tank drain valve. Tank water level is initially at the controller set point. Flow rate into the tank increases, slowly at first, and then faster until a stable flow rate is attained.

When tank level increases, the controller begins to open the tank drain valve farther. 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: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B3116 (P2919)

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 begins to increase, the level 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.
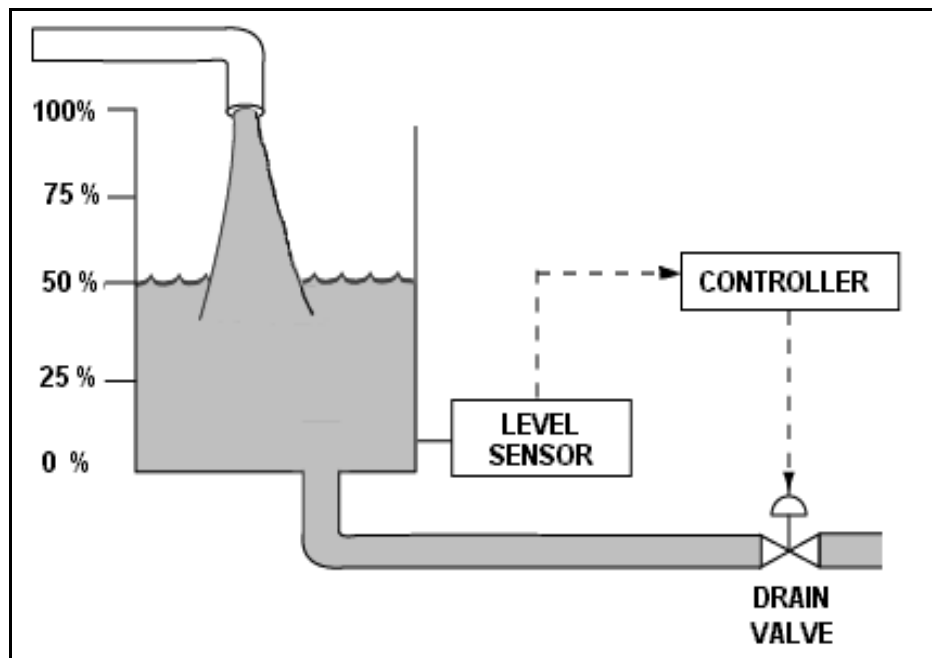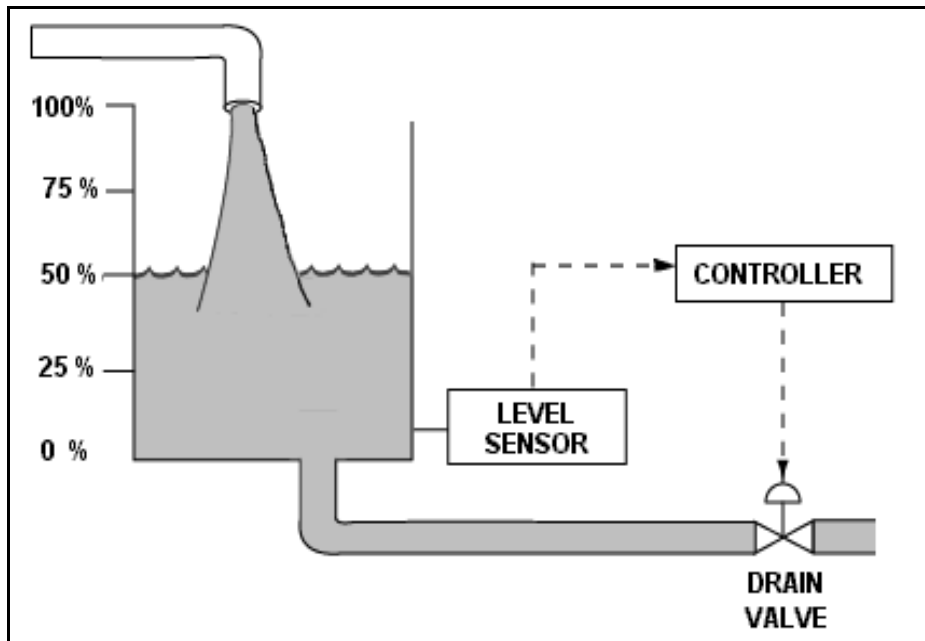
TOPIC: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B3316   (P3319)

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: 291003
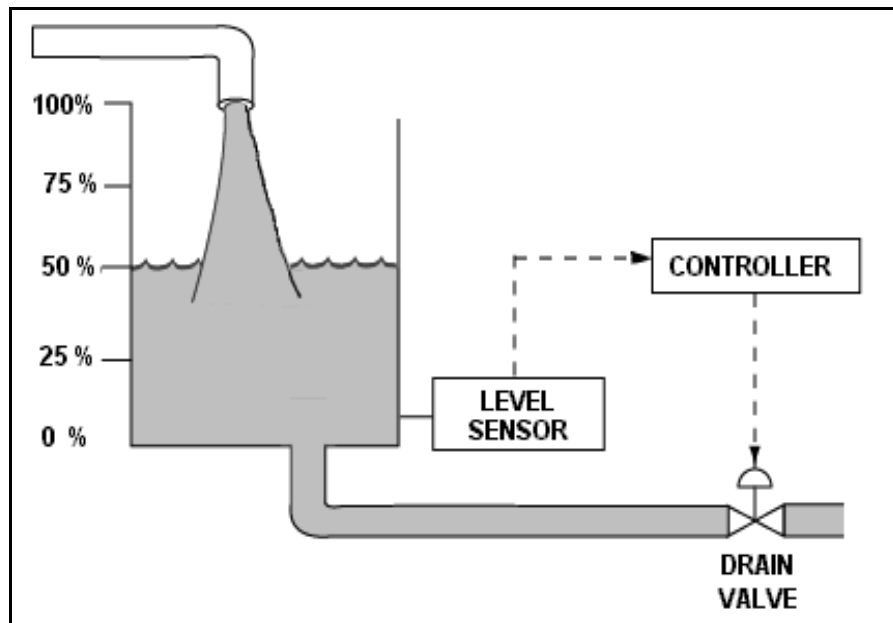KNOWLEDGE: K1.03   [3.3/3.4]
QID: B3415 (P3419)

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: 291003
KNOWLEDGE: K1.03 [3.3/3.4]
QID: B3515 (P3519)

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: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B3616 (P3617)

Refer to the drawing of a water storage tank with an automatic level control system (see figure below).
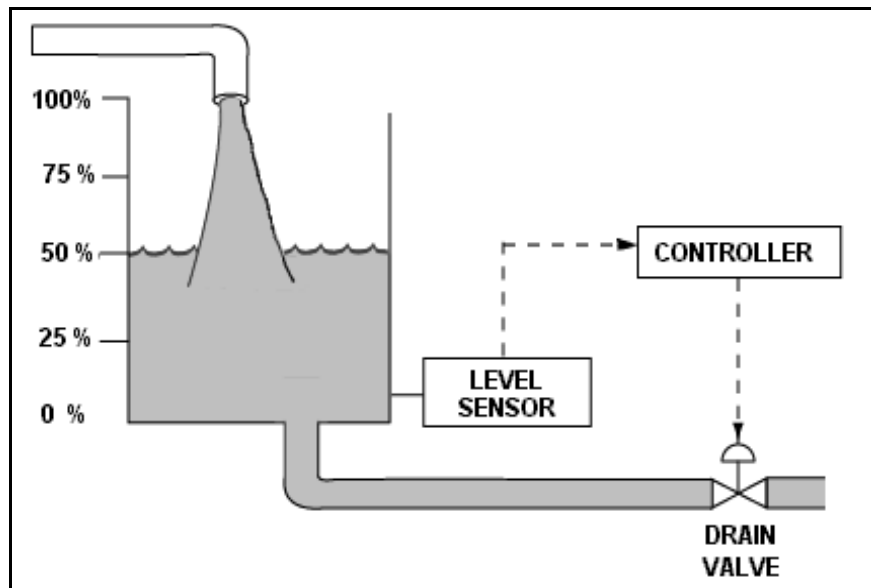
Given:

*   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: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B3816 (P3818)

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.
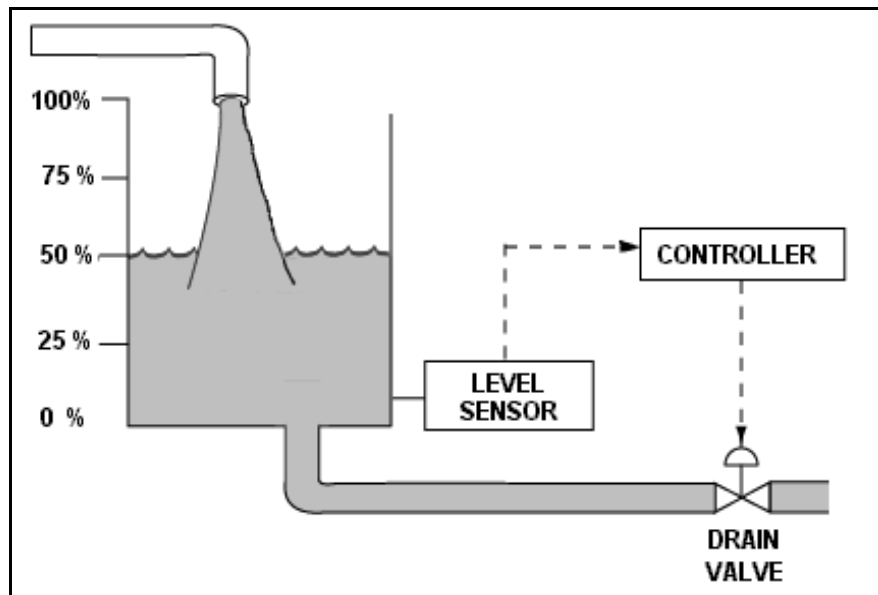
TOPIC: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B4108   (P4109)

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
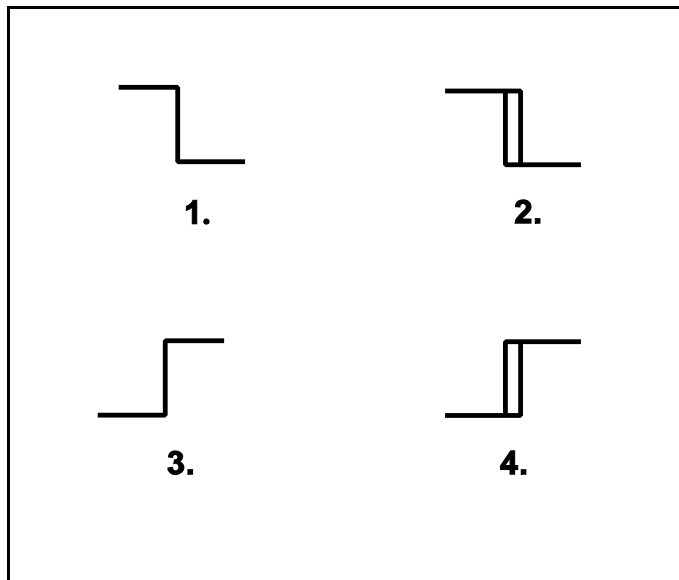
ANSWER: B.
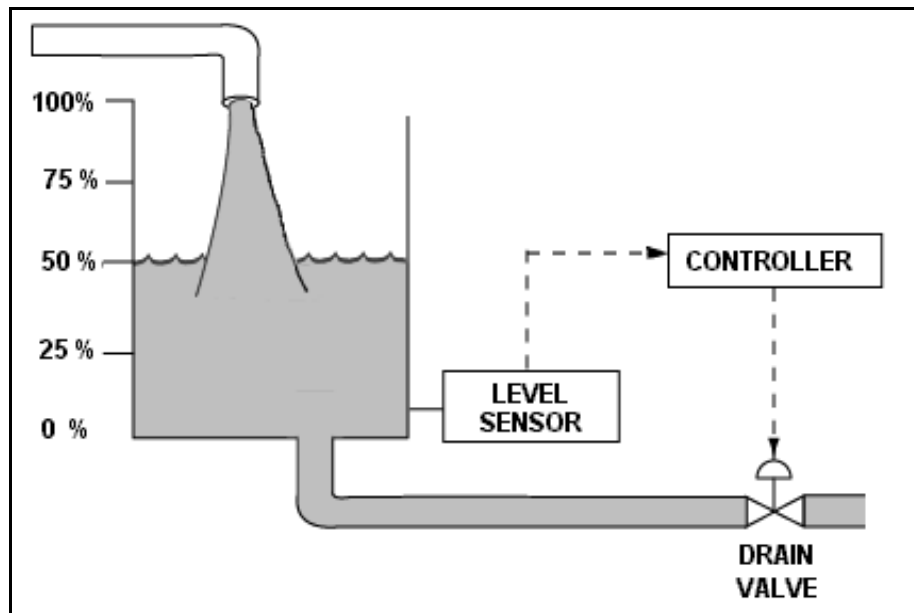
TOPIC: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B4408   (P4408)

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.

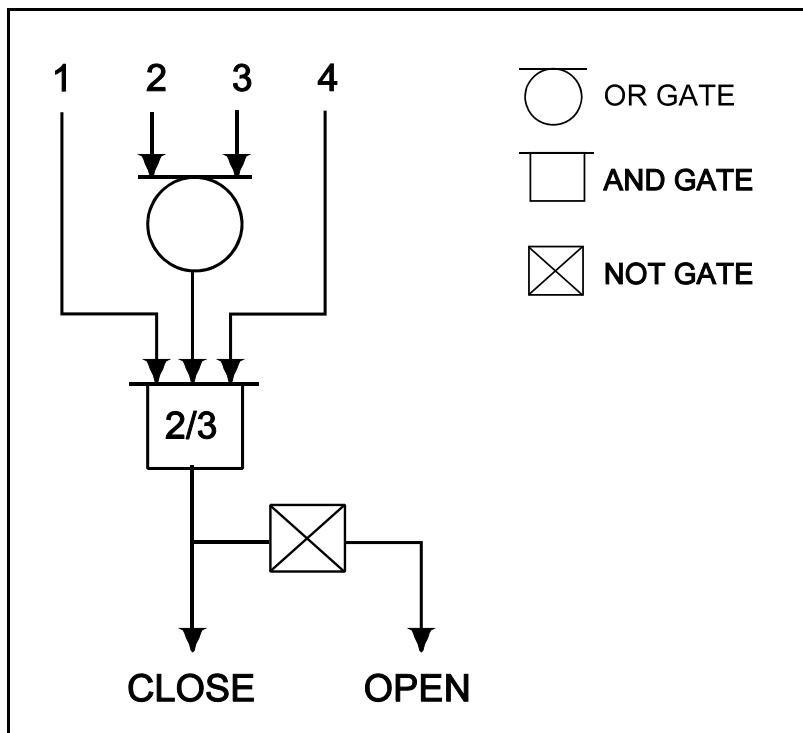ANSWER: D.

TOPIC: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B4708   (P4707)

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: 291003
KNOWLEDGE: K1.03   [3.3/3.4]
QID: B4908 (P4909)

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.
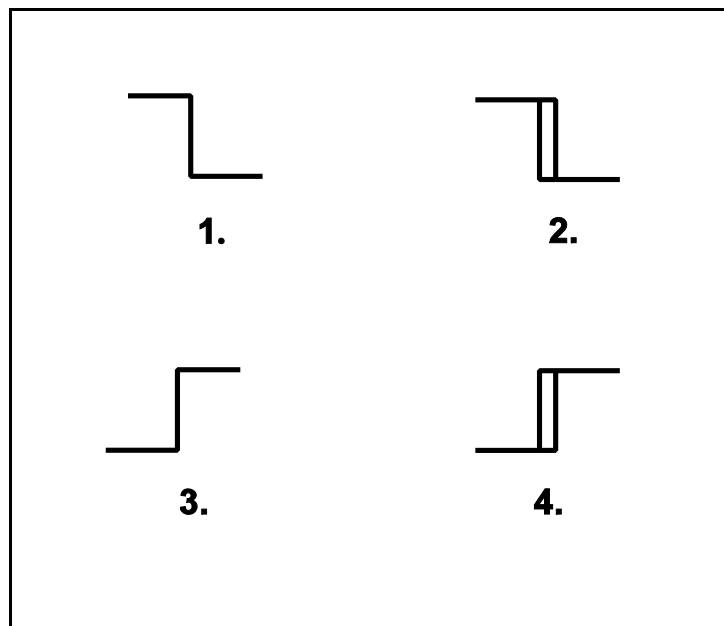
TOPIC: 291003
KNOWLEDGE: K1.03 [3.3/3.4]
QID: B5009 (P5009)

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: 291003
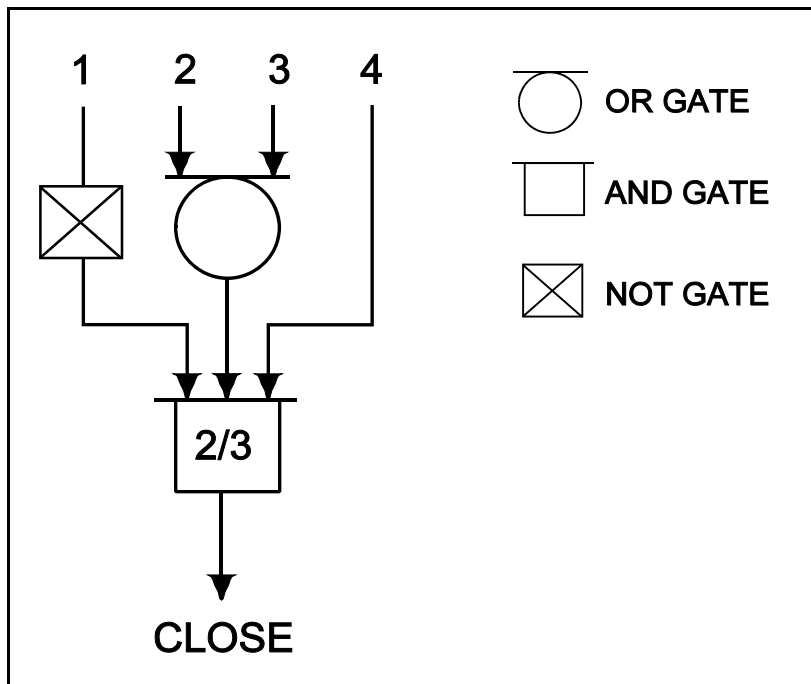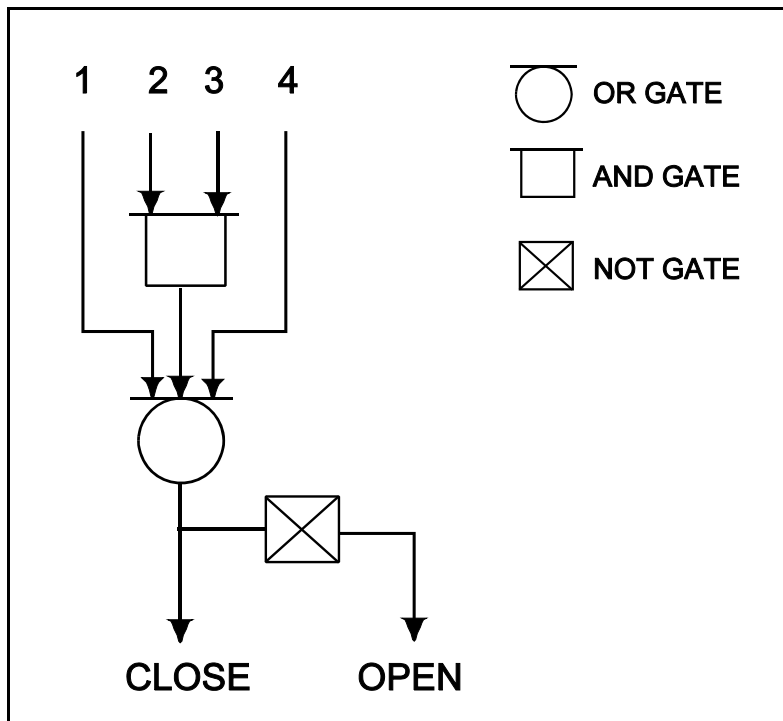KNOWLEDGE: K1.03 [3.3/3.4]
QID: B5408 (P5409)

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.

Controllers and Positioners

TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B316   (P319)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B516   (P617)

Refer to the drawing of a lube oil temperature control system (see figure below).

If the temperature transmitter fails <u>high</u> (high temperature output signal), the temperature controller will _____ the temperature control valve, causing the actual heat exchanger lube oil outlet temperature to _____.

A. close; increase

B. close; decrease

C. open; increase

D. open; decrease

ANSWER: D.

LUBE OIL TEMPERATURE CONTROL SYSTEM
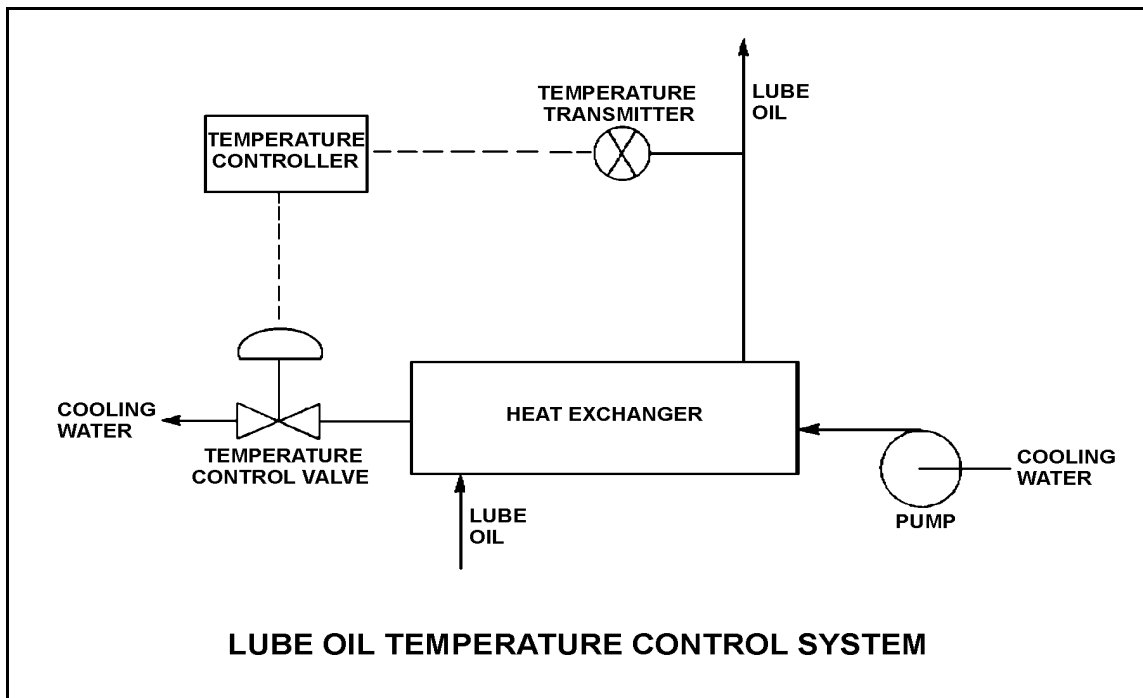
TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B917   (P1315)

Refer to the drawing of a lube oil temperature control system (see figure below).

If the temperature transmitter fails <u>low</u> (low temperature output signal), the temperature controller will position the temperature control valve in the _____ direction, causing the actual heat exchanger lube oil outlet temperature to _____.

A. close; increase

B. close; decrease

C. open; increase

D. open; decrease

ANSWER: A.

LUBE OIL TEMPERATURE CONTROL SYSTEM

TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B1015 (P917)

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.

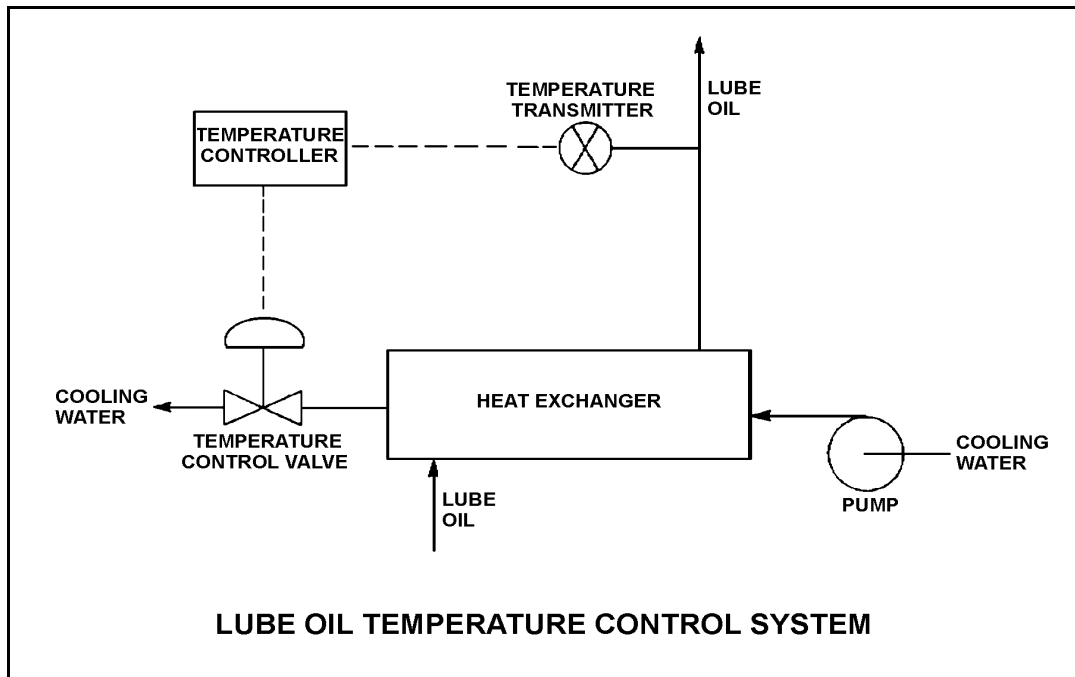ANSWER: D.

TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B1914 (P1715)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B1915 (P1016)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B2016   (P2016)

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
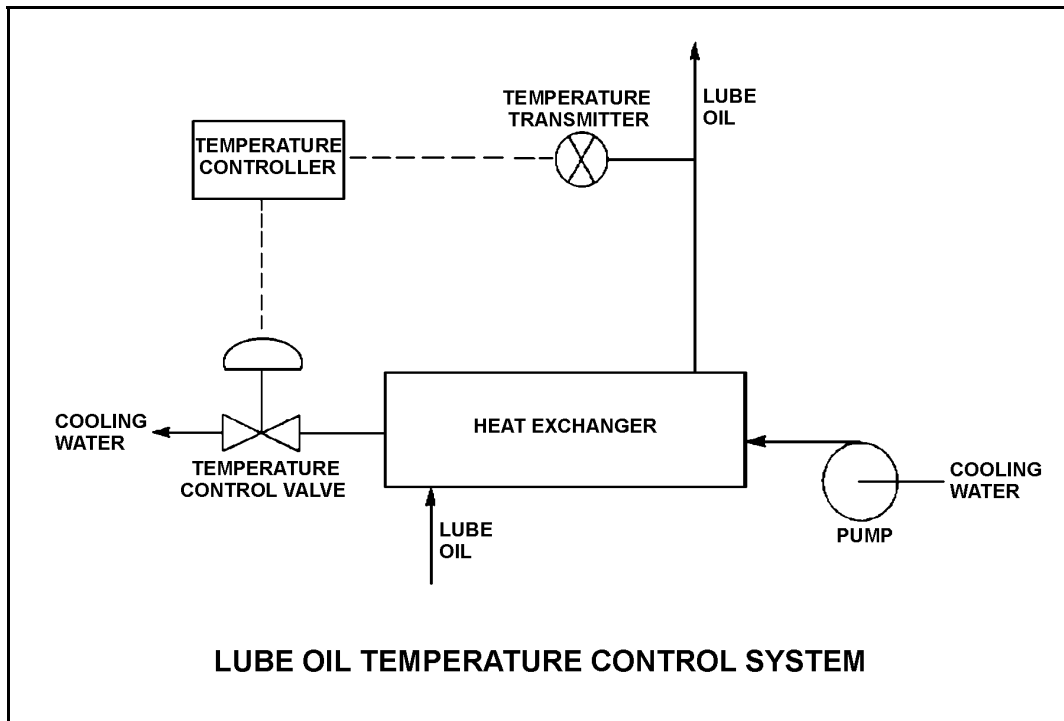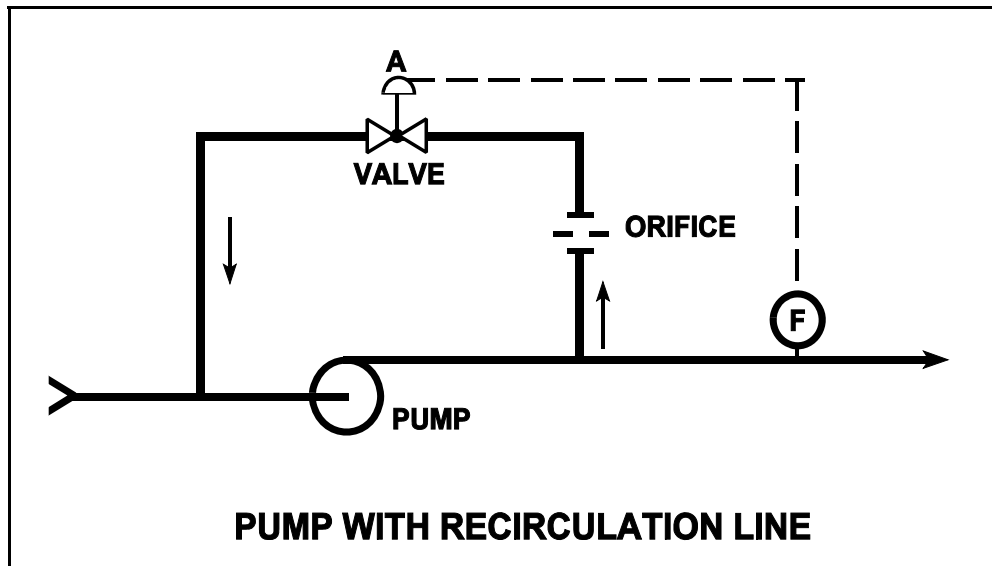
TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B2017   (P2019)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B2515 (P2519)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
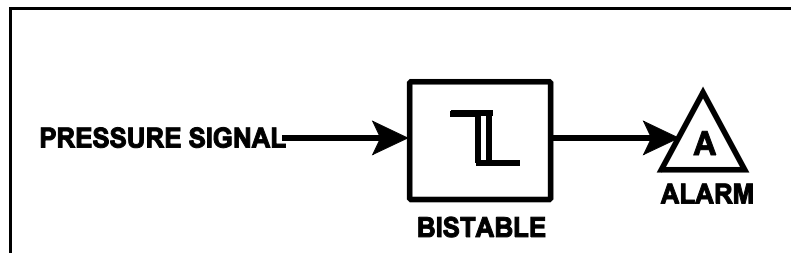QID: B3016   (P3015)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
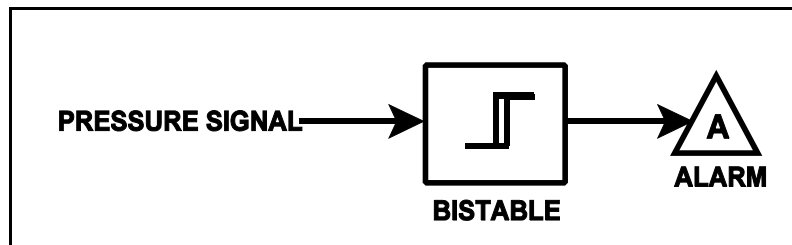QID: B3216 (P3215)

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: B.

TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B3817 (P3816)

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.
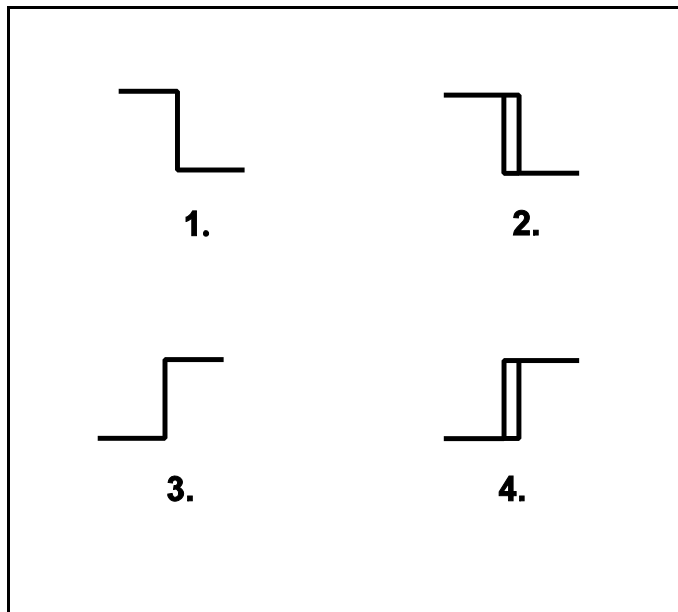
TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
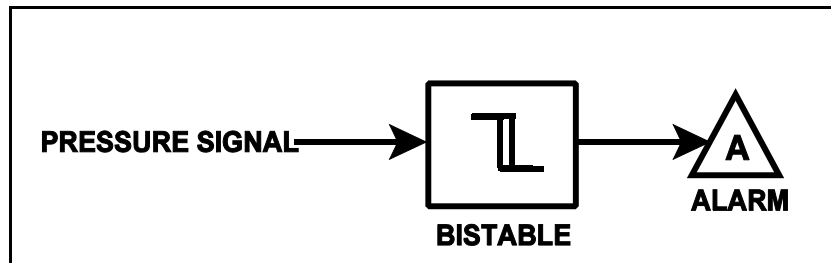QID: B3909   (P3516)

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 <u>not</u> 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 <u>not</u> turn off.

D. The alarm is currently actuated and will turn off at 95 psig.

ANSWER: A.

TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B4509 (P4508)

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.
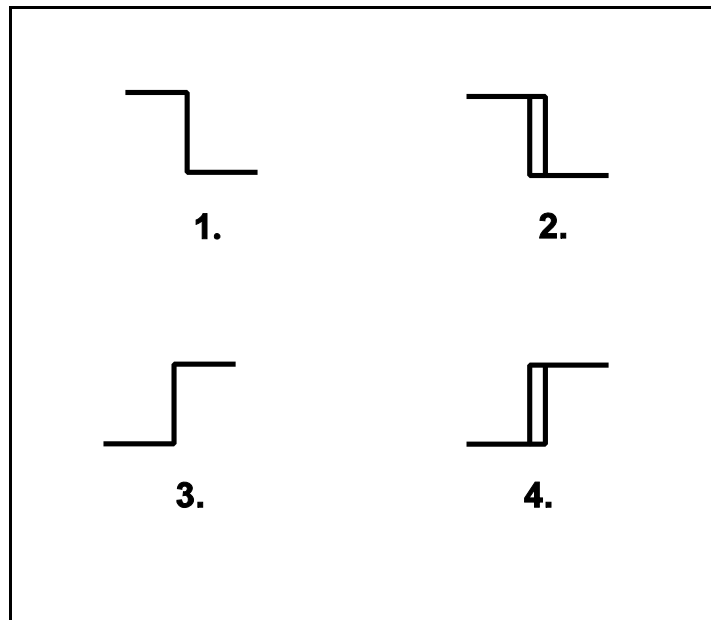
TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B4609   (P4607)

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.

TEMPERATURE SIGNAL ⟶ BISTABLE ⟶ A ALARM
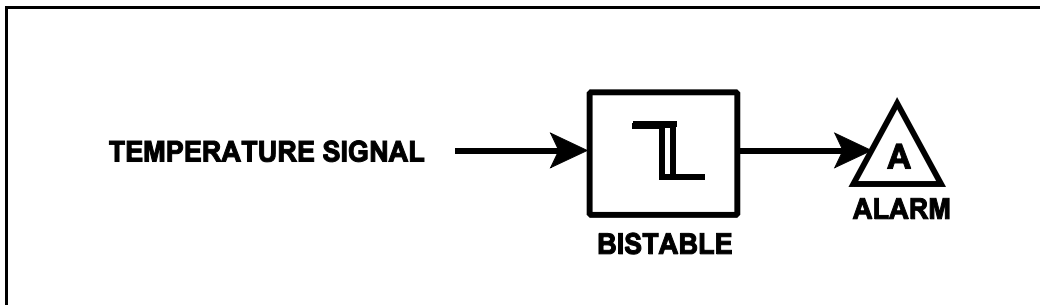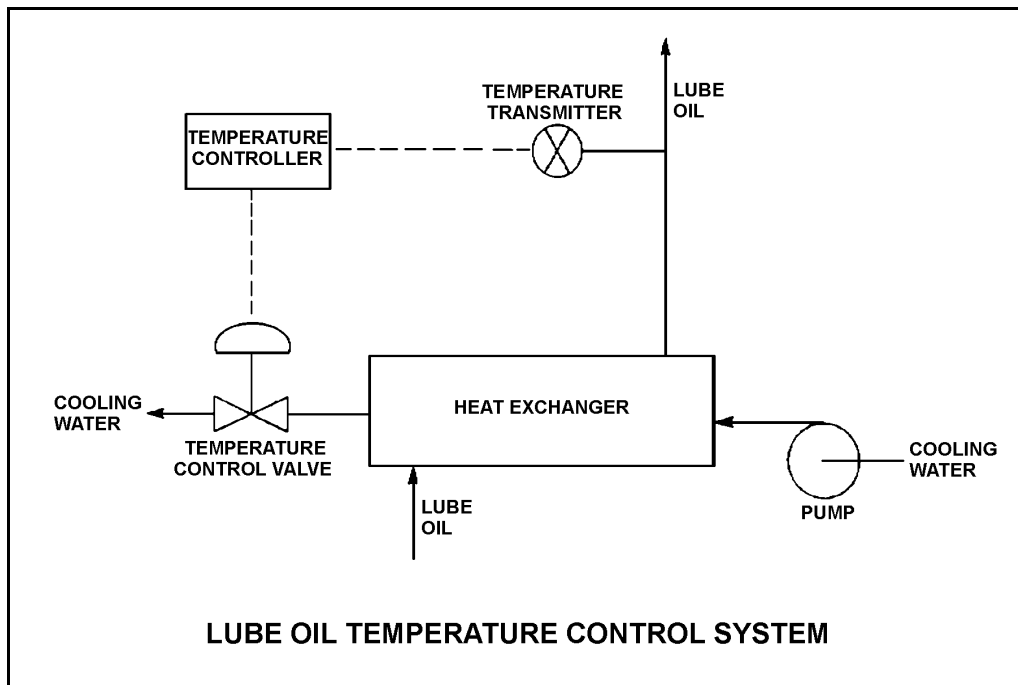
TOPIC: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B5109 (P5107)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B5309 (P5308)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B5509 (P5508)

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: 291003
KNOWLEDGE: K1.04   [3.3/3.3]
QID: B5609   (P5608)

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.
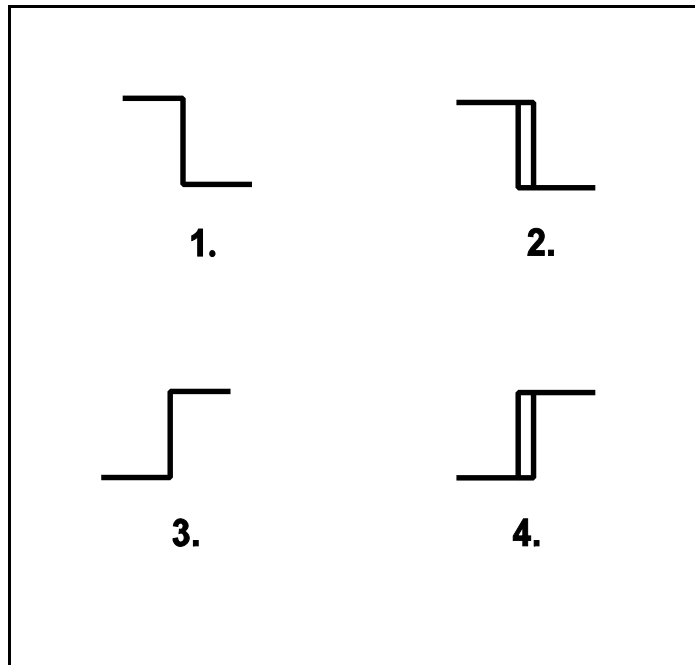
TOPIC: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B217   (P18)

The output pressure of a pneumatic controller is typically insufficient to drive a valve actuator accurately. To overcome this problem, a pneumatic control system will <u>normally</u> employ a/an...

A. valve actuating lead/lag unit.

B. air pressure regulator.

C. valve positioner.

D. air accumulator.

ANSWER: C.

TOPIC: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B317   (P318)

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 - BWR
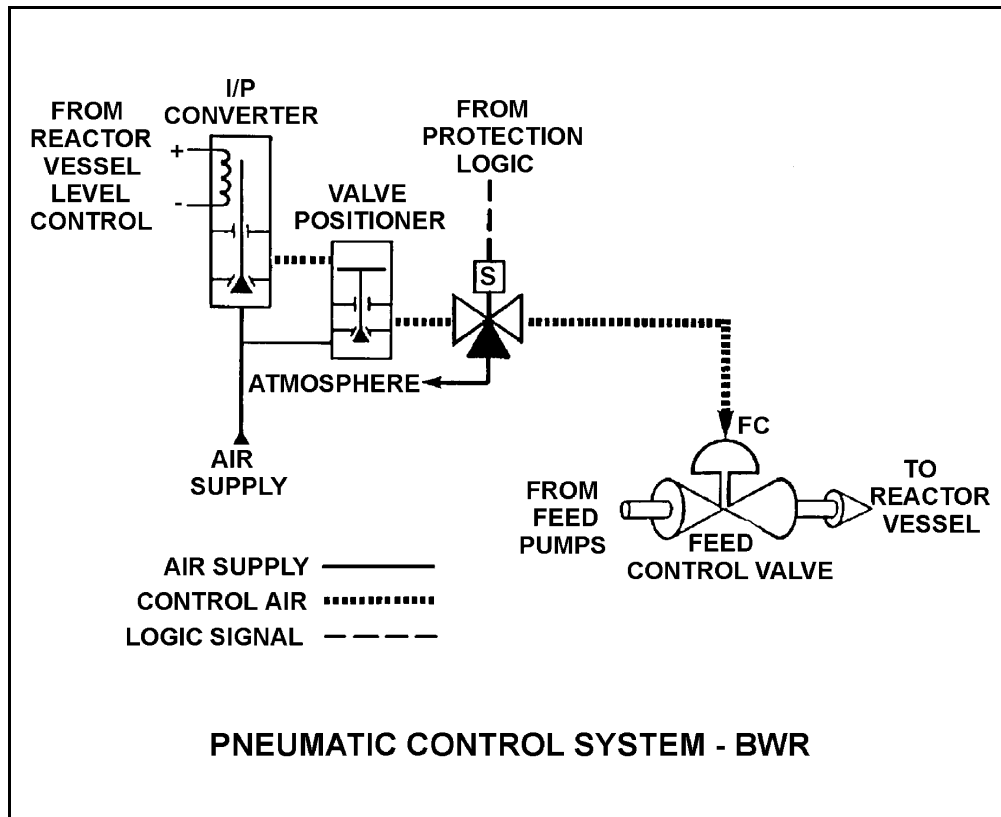
TOPIC: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B816   (P18)

The output pressure of a pneumatic controller is typically insufficient to drive a valve actuator accurately. To overcome this problem, a pneumatic control system will <u>normally</u> employ a...

A. diaphragm operator.

B. pneumatic clutch.

C. torque converter.

D. valve positioner.

ANSWER: D.

TOPIC: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B1116   (P1117)

An air-operated isolation valve requires 4,800 lbf from its diaphragm actuator and 4 inches of stem travel for proper operation. The valve positioner can supply up to 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: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B1416 (P1217)

The purpose of a valve positioner in a typical pneumatic control system is to...

A. convert the valve controller pneumatic output signal to a mechanical force to position the valve.

B. convert the valve controller pneumatic output signal to an electrical output to position the valve.

C. compare valve controller pneumatic output signal to setpoint error, and adjust valve actuator air supply pressure to position the valve.

D. compare valve controller pneumatic output signal to valve position, and adjust valve actuator air supply pressure to position the valve.

ANSWER: D.

TOPIC: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B1517 (P1516)

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: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B1617   (P1618)

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 up to 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: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B2117   (P2116)

An air-operated isolation valve requires 3,200 pounds-force from its diaphragm 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: 291003
KNOWLEDGE: K1.05 [2.8/2.8]
QID: B2216 (P2617)

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: 291003
KNOWLEDGE: K1.05 [2.8/2.8]
QID: B2416 (P2417)

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 and the valve stem travels 3 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 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: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B2516 (P2517)

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: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B2716 (P2716)

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: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B2816   (P116)

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 valve actuator diaphragm.

ANSWER: B.

TOPIC: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B2915   (P2917)

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: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B2917 (P2416)

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: 291003
KNOWLEDGE: K1.05   [2.8/2.8]
QID: B3317 (P2216)

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: 291003
KNOWLEDGE: K1.06 [2.5/2.6]
QID: B417   (P417)

If the turbine shaft speed signal received by a typical turbine governor control system fails <u>low</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 demanded turbine speed is nulled.

C. increase, until the mismatch with demanded turbine speed is nulled.

D. decrease to a minimum speed set point.

ANSWER: A.

TOPIC: 291003
KNOWLEDGE: K1.06 [2.5/2.6]
QID: B1016 (P1815)

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: 291003
KNOWLEDGE: K1.06   [2.5/2.6]
QID: B1316 (P419)

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; outward

B. aid; inward

C. counteract; inward

D. aid; outward

ANSWER: C.

FLYBALL-WEIGHT MECHANICAL SPEED GOVERNOR
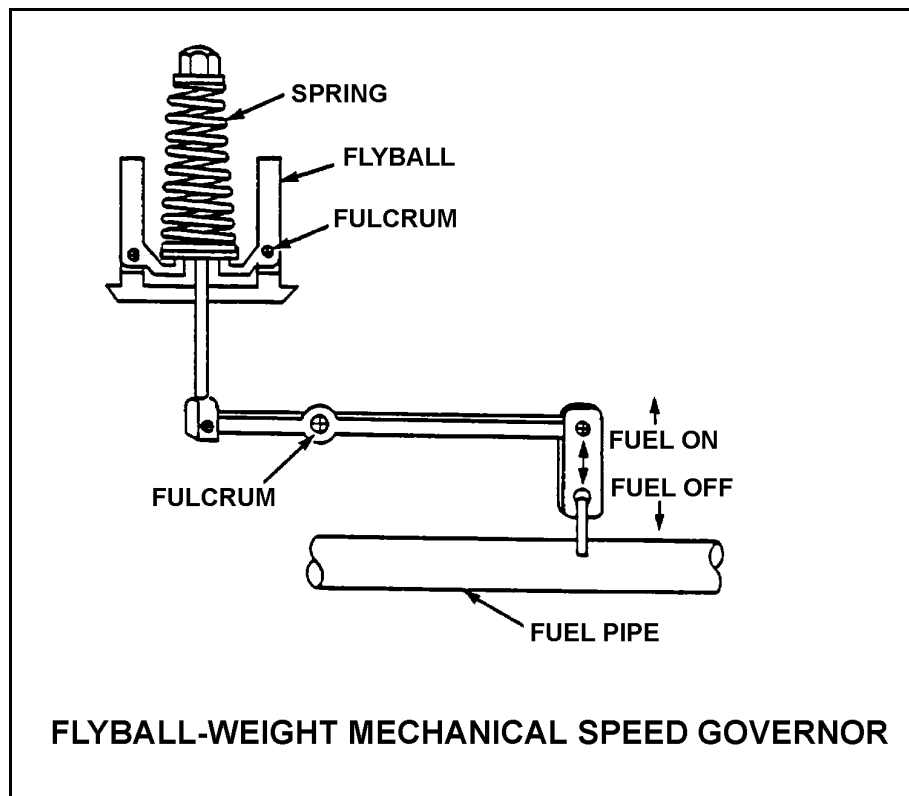
TOPIC: 291003
KNOWLEDGE: K1.06   [2.5/2.6]
QID: B1815 (P1818)

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: 291003
KNOWLEDGE: K1.06   [2.5/2.6]
QID: B2015 (P2018)

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.

NRC Generic Fundamentals Examination Question Bank--BWR
August 2008

TOPIC: 291003
KNOWLEDGE: K1.06   [2.5/2.6]
QID: B2817 (P2818)

A diesel generator (DG) is supplying an isolated electrical bus with the DG governor operating in the speed droop mode. Assuming the DG does <u>not</u> 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.

-52-   *Controllers and Positioners*