

Instructor Training Materials

ASSIGNMENTS & ANSWERS

pumps



for
**UNITED ASSOCIATION
JOURNEYWORKERS & APPRENTICES**

Instructor Training Materials

ASSIGNMENTS & ANSWERS

For

PUMPS



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ANSWERS TO ASSIGNMENTS

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CHAPTER 1: PUMP THEORY

For Instructor:

NAME _____

DATE _____

DATE _____

GRADE _____

Page 1 through Checkpoint 1 • Pages 1 thru 7

1. Theoretically, a pump can raise water by suction approximately _____ feet vertically.
2. A vented sump is an example of an _____ piping system.
3. See Fig. 1. The static suction lift is 8 feet and the static discharge head is 12 feet. What is the total static head?

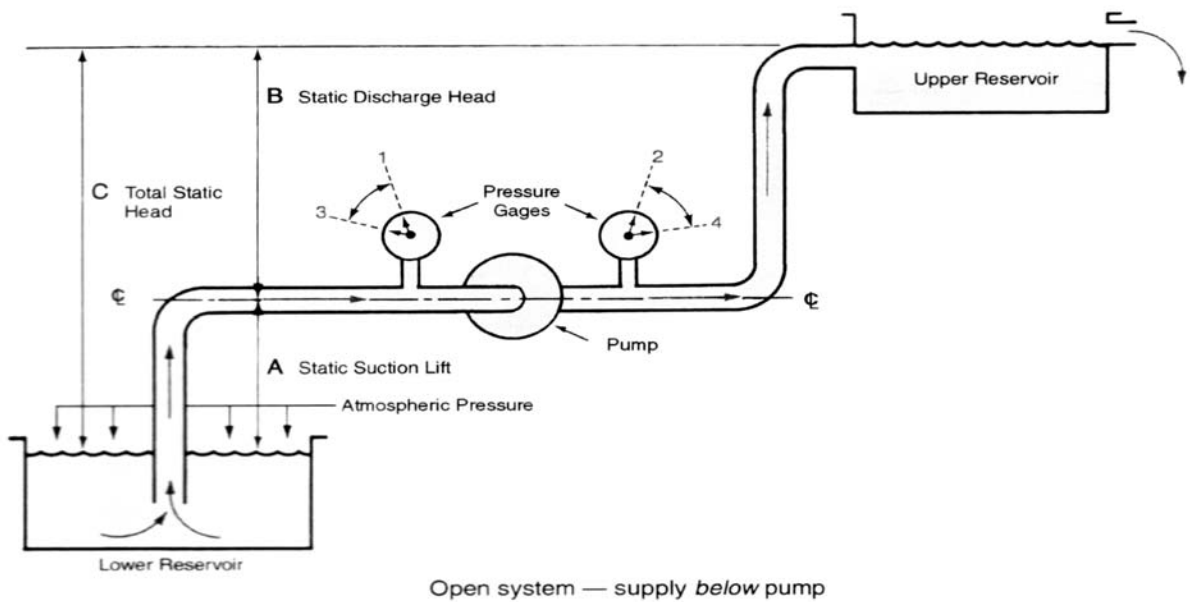


Fig. 1

CHAPTER 1: PUMP THEORY

NAME _____

(Continued)

DATE _____

4. See Fig. 2. The suction pressure gage reads 5 psig at position A, and the discharge pressure gage reads 30 psig at position B. What is the total static head in psig?

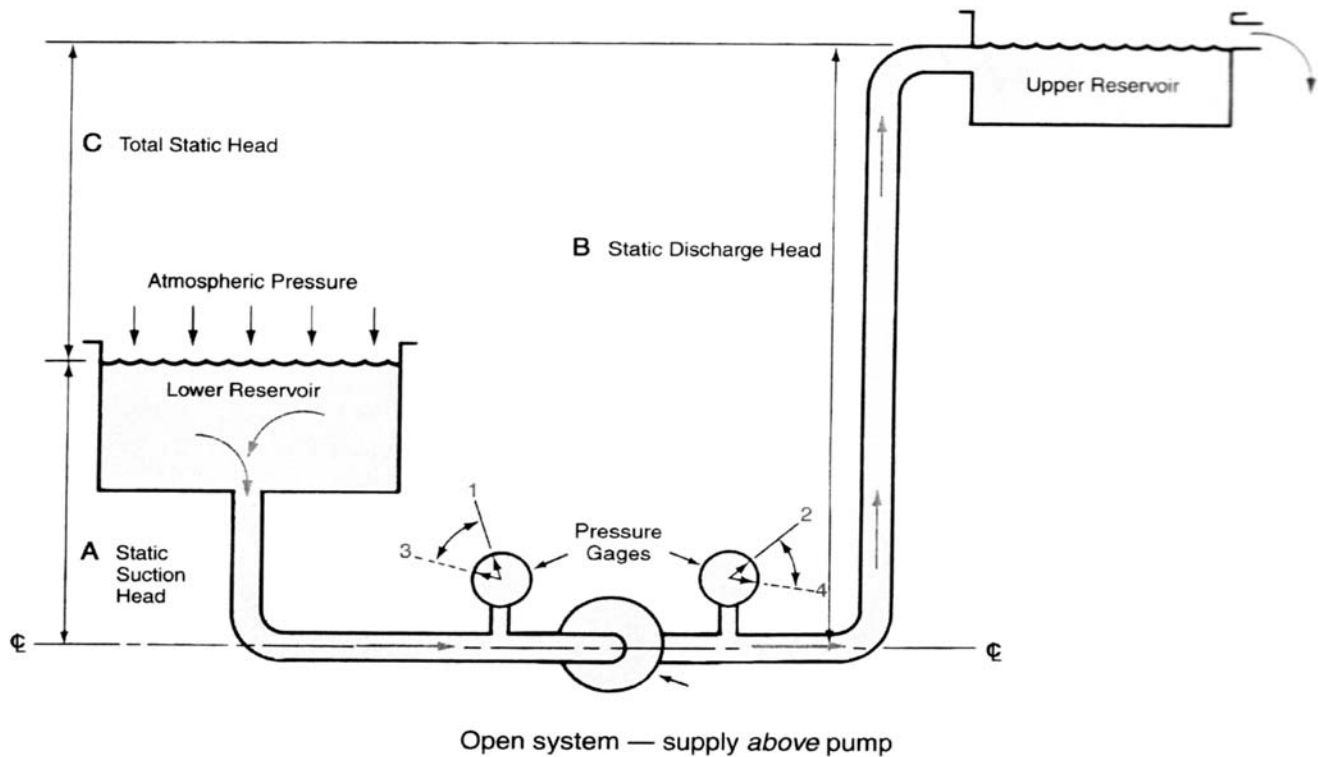


Fig. 2

5. What would the total static head be if expressed in feet of head as it relates to the correct answer in psig for question 4?

6. A pump is a device through which an external source of power is used to apply a force on a fluid.

T F

CHAPTER 1: PUMP THEORY

NAME _____

(Continued)

DATE _____

- | | | | |
|-----|---|---|---|
| 7. | Head in feet of water column can be converted to pounds per square inch (psig) by dividing the total static head by .433 psig/ft. | T | F |
| 8. | Static suction lift is the vertical distance the surface of the supply reservoir is above the bottom of the pump suction connection. | T | F |
| 9. | Total static head is the overall vertical distance a liquid is raised by a pump from the level of the supply (lower) reservoir to the level of the discharge (upper) reservoir. See Fig. 1. | T | F |
| 10. | See Fig. 2. Movement of the pressure gage reading from 1 to 3 on the suction gage and from 2 to 4 on the discharge gage is caused by the change from a static (no flow) system to a flowing system. | T | F |

NAME _____

DATE _____

DATE _____

GRADE _____

ASSIGNMENT 1

Page 9 through Checkpoint 1 • Page 1 thru 24

1. A piston pump which can discharge a fluid during both the primary stroke and the return stroke is known as a _____ - _____ pump.
2. A type of pump commonly used to supply oil at a stable high pressure to burner nozzles is a _____ pump.
3. The principle that causes the pumping action for an in-line circulating pump is known as _____.
4. The backward sloping vanes which rotate in a centrifugal pump are known as the _____.
5. The gradually expanding shape of the casing passage of a centrifugal pump is known as the _____.
6. A positive displacement pump discharges a definite quantity of liquid for each operating cycle. T F
7. A hydrostatic test pump is a form of reciprocating pump. T F
8. Both reciprocating and rotary pumps are grouped as non-positive displacement pumps. T F
9. Non-positive displacement pumps deliver uniform rates of discharge regardless of the pressure being pumped against. T F
10. The most frequently used pump found in piping systems installed by UA journeyworkers is the centrifugal pump. T F

NAME _____

DATE _____

DATE _____

GRADE _____

ASSIGNMENT 2

Checkpoint 1 through Checkpoint 3 • Pages 24 thru 35

1. Of the three types of impellers used in centrifugal pumps, enclosed, semi-open, and open, the most efficient is the _____ type.

2. Immersing the impeller in the liquid to remove the air from between the impeller blades is known as _____.

3. The entire body of a _____ pump, including the motor, is installed within the liquid it is pumping.

4. The fitting used in a deep well pump installation where water passes through a restriction into an expanding venturi fitting to raise the liquid is called a _____.

5. See Fig. 1. What is the ΔP if the suction gage reads 69.5 psig at position 3 and the discharge gage reads 100 psig at position 4?

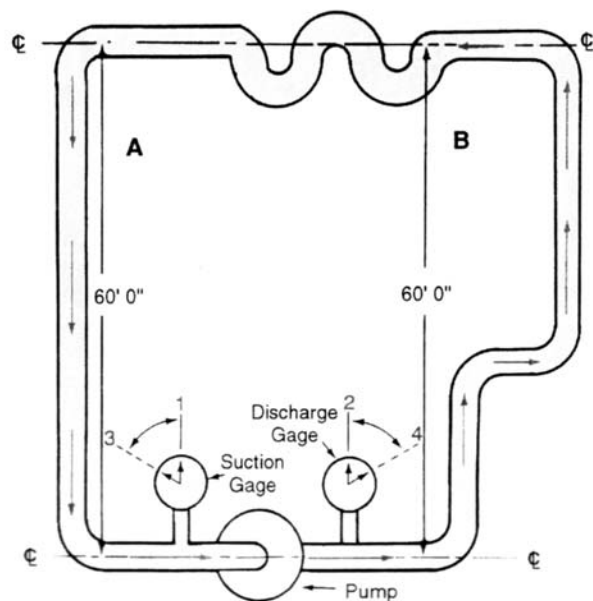


Fig. 1

CHAPTER 2: TYPES OF PUMPS

NAME _____

ASSIGNMENT 2 (Continued)

DATE _____

6. What is the ΔP of the pump in Question 5 expressed in feet of head?

7. Fig. 2 represents the pump curve for the pump shown in Fig. 1. What would be the flow rate of the pump in gpm if operating at an ΔP of 70.44 ft.

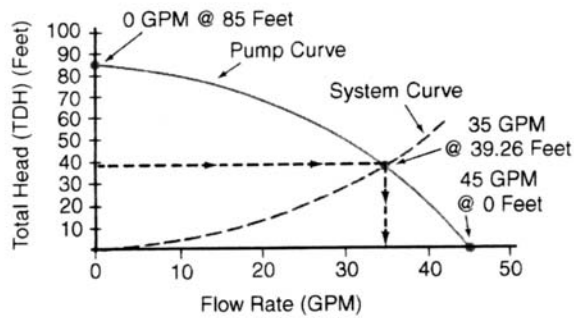


Fig. 2

8. Deep well pumps are designed to pump from wells where the water level is too far below the surface to be pumped by suction from ground level. T F

9. A multistage pump is used primarily to pump a greater volume at a low pressure. T F

10. When there is no flow in a piping system there is no friction loss. T F

CHAPTER 3: PUMP INSTALLATIONS

For Instructor:

NAME _____

DATE _____

DATE _____

GRADE _____

Page 37 through Checkpoint 1 • Pages 37 thru 51

1. The proper direction for pump rotation is usually indicated by an arrow on the pump casing. After priming, _____ the starting switch to determine proper rotation.

2. The violent flashing and collapsing of vapor bubbles in a centrifugal pump is called _____.

3. Before foundation bolts are fully tightened, _____ must set for a least _____ hours.

4. To check for angular alignment, use a _____ or _____ at four points.

5. The valve on the suction side of a pump should be fully opened. T F

6. Concrete foundations on a soil base are often used to absorb vibrations for large pumps. T F

7. Close alignment is not necessary for pumps which have flexible couplings between the motor shaft and the pump. T F

8. The bases of base mounted pumps should be strong enough to support the weight of the suction and discharge piping in addition to the weight of the pump and motor. T F

9. Concentric reducers are used in the suction inlet of a pump. T F

10. A small amount of leakage (steady drip) from packing type pump seals is allowable for cooling purposes. T F

CHAPTER 4: PUMPS IN SYSTEMS

For Instructor:

NAME _____

DATE _____

DATE _____

GRADE _____

ASSIGNMENT 1

Page 53 through Checkpoint 1 • Pages 53 thru 62

1. Before installing a well pump, the well should be _____ to prevent contamination and growth of bacteria.

2. A _____ unit, which forms an unbroken extension of a well, attaches to the _____ below the frost line.

3. Storage of water in an automatic water system is in a/an _____ tank.

4. A WELL-X-TROL operates on the principle of the separation of _____ and _____.

5. In a vacuum pump for steam heating systems, the smaller rectangular tank is called the _____.

6. Like air, water can be compressed into a smaller volume. T F

7. The drop pipe in a well is normally threaded galvanized steel or plastic. T F

8. Vacuum pumps used in steam heating systems normally maintain a vacuum on the return piping of 2" Hg to 10" Hg. T F

9. Sometimes a dielectric union is installed between the pump and the first section of galvanized pipe in a well. T F

10. An increase in velocity results in an increase in pressure. T F

CHAPTER 4: PUMPS IN SYSTEMS

For Instructor:

NAME _____

DATE _____

DATE _____

GRADE _____

ASSIGNMENT 2

Checkpoint 1 through Checkpoint 2 • Pages 62 thru 73

1. In both sump pumps and sewage ejectors, the type of pump generally used is the _____.
2. To prevent backflow into a sump pit, you should install a/an _____.
3. Boiler feed pumps are controlled by _____.
4. In a piston type reciprocating compressor, the downward stroke produces a/an _____.
5. The compressor used in medical air systems that insures 100% oil-free air is the _____ piston compressor.
6. Under normal conditions, both pumps in a duplex system operate simultaneously. T F
7. Float stops are permanently affixed to a float road by the manufacturer. T F
8. A sewer ejector must be installed in an enclosed pit with a gas-tight cover. T F
9. The air in a medical gas system is used solely for direct patient therapy. T F
10. The water in a liquid ring compressor is used for compression, cleaning and cooling. T F

CHAPTER 4: PUMPS IN SYSTEMS

For Instructor:

NAME _____

DATE _____

DATE _____

GRADE _____

ASSIGNMENT 3

Checkpoint 2 through Checkpoint 3 • Pages 73 thru 84

1. A gage on the supply side of a horizontal shaft fire pump will register:
 - a. negative pressure
 - b. positive pressure
 - c. both a and b
 - d. neither a or b

2. An eccentric tapered reducer is installed with the taper _____ when the suction pipe is not the same size as the pump suction flange.

3. The control valve in the suction piping to a fire pump must be an _____.

4. The control valve in the suction side of a fire-pump check valve may be either an indicator gate valve or a _____.

5. In an automatic controlled fire pump system, replenishing pressure loss due to leaks, requires the installation of a/an _____.

6. All fire pumps with adjustable-speed drivers do not require a pressure-relief valve. T F

7. The NFPA 20 definition of horizontal split-case pumps includes pumps which are installed with the shaft vertical. T F

8. Setting the impellers of a vertical-shaft pump is the responsibility of the installing contractor. T F

9. An ordinary swing check valve may be utilized as an automatic air-release valve in a vertical-shaft pump installation. T F

10. The shafts connecting a diesel engine and a right-angle gear drive must be perfectly aligned. T F

Page 1 through Checkpoint 1 • Pages 1 thru 7

1. Theoretically, a pump can raise water by suction approximately 34 feet vertically.
2. A vented sump is an example of an open piping system.
3. See Fig. 1. The static suction lift is 8 feet and the static discharge head is 12 feet. What is the total static head?

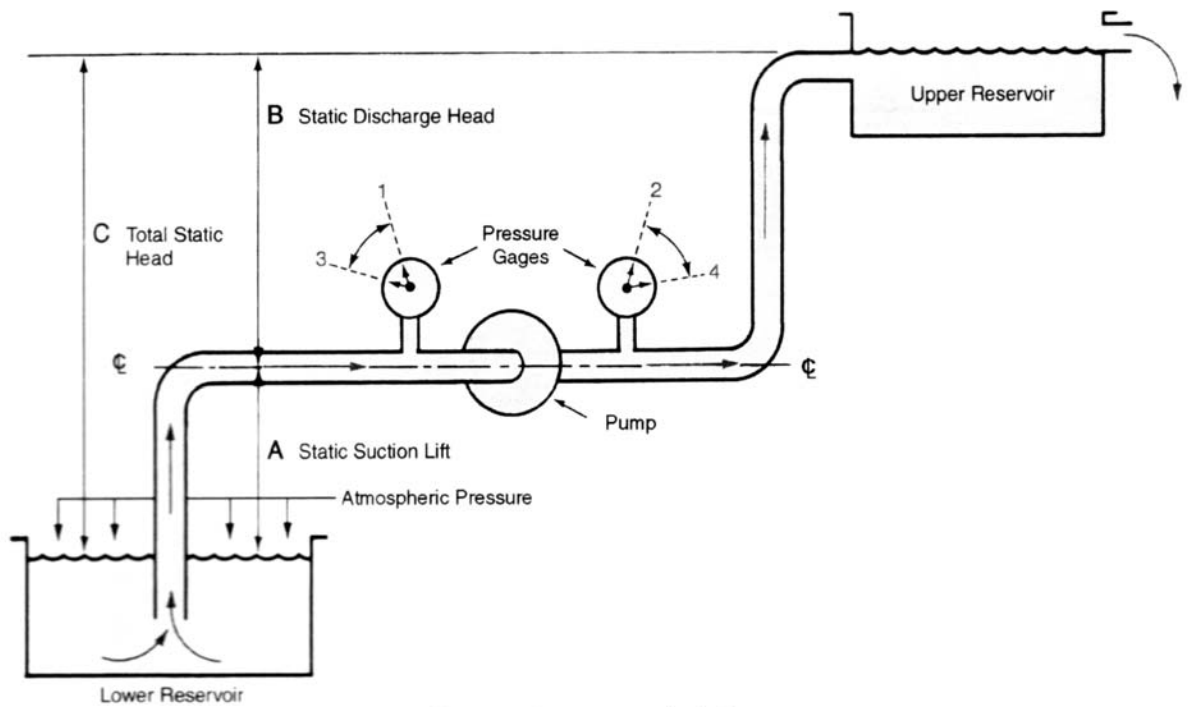
The total static head is 20 feet.

C (total static head) = A (static suction lift) + B (static discharge head)

$$C = A + B$$

$$C = 8' + 12'$$

$$C = 20'$$



Open system — supply below pump

Fig. 1

CHAPTER 1: PUMP THEORY

ANSWERS

(Continued)

4. See Fig. 2. The suction pressure gage reads 5 psig at position A, and the discharge pressure gage reads 30 psig at position B. What is the total static head in psig?

The total static head is 25 psig.

For an open system with supply reservoir above the pump, total static head $C =$ static discharge head $B -$ static suction head A .

$$C = B - A$$

$$C = 30 \text{ psig} - 5 \text{ psig}$$

$$C = 25 \text{ psig}$$

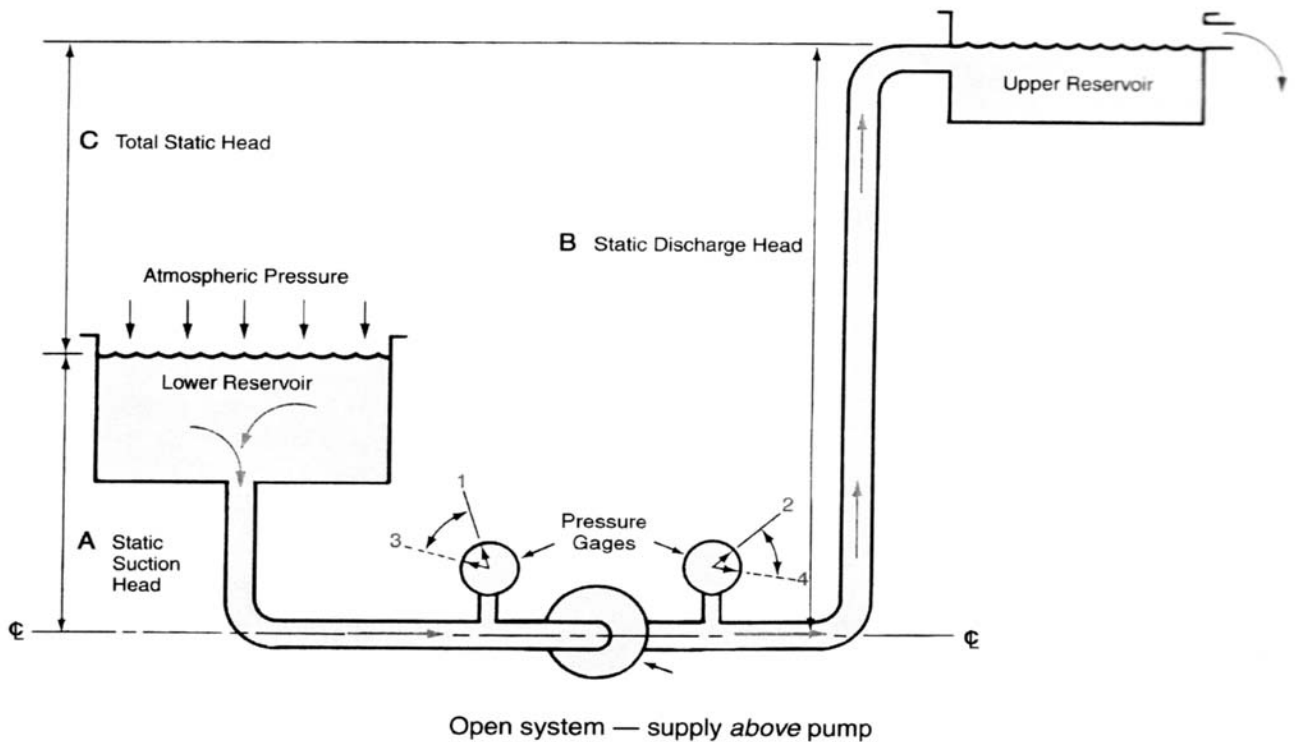


Fig. 2

5. What would the total static head be if expressed in feet of head as it relates to the correct answer in psig for question 4?

57.7 feet

$$25 \text{ psig} \div .433 \text{ psig/ft.} = 57.7 \text{ ft.}$$

6. A pump is a device through which an external source of power is used to apply a force on a fluid.

Ⓣ F

CHAPTER 1: PUMP THEORY

ANSWERS

(Continued)

- | | | | |
|-----|---|---|---|
| 7. | Head in feet of water column can be converted to pounds per square inch (psig) by dividing the total static head by .433 psig/ft. | T | Ⓣ |
| 8. | Static suction lift is the vertical distance the surface of the supply reservoir is above the bottom of the pump suction connection. | T | Ⓣ |
| 9. | Total static head is the overall vertical distance a liquid is raised by a pump from the level of the supply (lower) reservoir to the level of the discharge (upper) reservoir. See Fig. 1. | Ⓣ | F |
| 10. | See Fig. 2. Movement of the pressure gage reading from 1 to 3 on the suction gage and from 2 to 4 on the discharge gage is caused by the change from a static (no flow) system to a flowing system. | Ⓣ | F |

ASSIGNMENT 1

Page 9 through Checkpoint 1 • Page 9 thru 24

1. A piston pump which can discharge a fluid during both the primary stroke and the return stroke is known as a double - acting pump.
2. A type of pump commonly used to supply oil at a stable high pressure to burner nozzles is a rotary gear pump.
3. The principle that causes the pumping action for an in-line circulating pump is known as centrifugal force.
4. The backward sloping vanes which rotate in a centrifugal pump are known as the impeller.
5. The gradually expanding shape of the casing passage of a centrifugal pump is known as the volute.
6. A positive displacement pump discharges a definite quantity of liquid for each operating cycle. (T) F
7. A hydrostatic test pump is a form of reciprocating pump. (T) F
8. Both reciprocating and rotary pumps are grouped as non-positive displacement pumps. T (F)
9. Non-positive displacement pumps deliver uniform rates of discharge regardless of the pressure being pumped against. T (F)
10. The most frequently used pump found in piping systems installed by UA journeyworkers is the centrifugal pump. (T) F

ASSIGNMENT 2

Checkpoint 1 through Checkpoint 3 • Pages 24 thru 35

1. Of the three types of impellers used in centrifugal pumps, enclosed, semi-open, and open, the most efficient is the enclosed type.
2. Immersing the impeller in the liquid to remove the air from between the impeller blades is known as priming.
3. The entire body of a submersible pump, including the motor, is installed within the liquid it is pumping.
4. The fitting used in a deep well pump installation where water passes through a restriction into an expanding venturi fitting to raise the liquid is called a jet fitting.
5. See Fig. 1. What is the ΔP if the suction gage reads 69.5 psig at position 3 and the discharge gage reads 100 psig at position 4?

30.5 psig

$\Delta P = \text{discharge gage reading} - \text{suction gage reading}$

$\Delta P = 100 \text{ psig} - 69.5 \text{ psig}$

$\Delta P = 30.5 \text{ psig}$

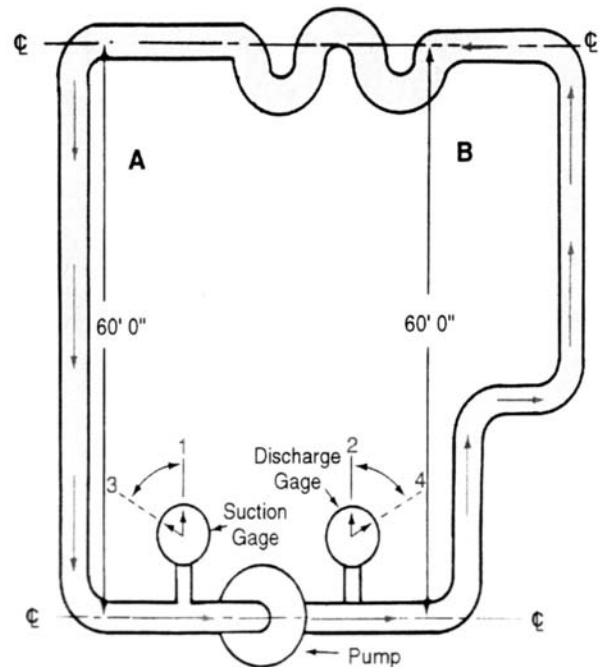


Fig. 1

CHAPTER 2: TYPES OF PUMPS

ANSWERS

(Continued)

6. What is the ΔP of the pump in Question 5 expressed in feet of head?

70.44 feet

$30.5 \text{ psig} \div .433 \text{ psig/ft.} = 70.44 \text{ ft.}$

7. Fig. 2 represents the pump curve for the pump shown in Fig. 1. What would be the flow rate of the pump in gpm if operating at an ΔP of 70.44 ft.

20 gpm (approximately)

Enter the pump curve at 70.44 ft. on the total head scale and read horizontally to the right to intersection with the pump curve. Then read down to the flow rate scale to read approximately 20 gpm.

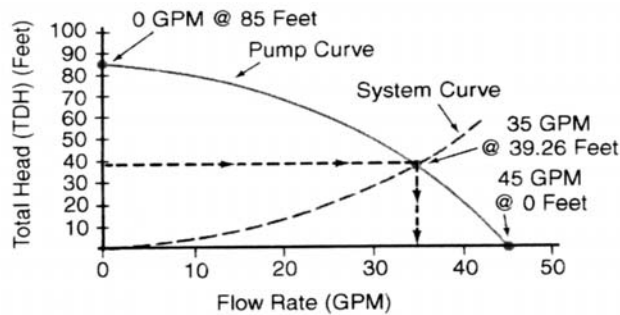


Fig. 2

8. Deep well pumps are designed to pump from wells where the water level is too far below the surface to be pumped by suction from ground level. Ⓣ F
9. A multistage pump is used primarily to pump a greater volume at a low pressure. T Ⓣ
10. When there is no flow in a piping system there is no friction loss. Ⓣ F

Page 37 through Checkpoint 1 • Pages 37 thru 51

1. The proper direction for pump rotation is usually indicated by an arrow on the pump casing. After priming, bump the starting switch to determine proper rotation.
2. The violent flashing and collapsing of vapor bubbles in a centrifugal pump is called cavitation.
3. Before foundation bolts are fully tightened, grout must set for a least 48 hours.
4. To check for angular alignment, use a taper gauge or feeler gauge at four points.
5. The valve on the suction side of a pump should be fully opened. Ⓣ F
6. Concrete foundations on a soil base are often used to absorb vibrations for large pumps. Ⓣ F
7. Close alignment is not necessary for pumps which have flexible couplings between the motor shaft and the pump. T Ⓣ
8. The bases of base mounted pumps should be strong enough to support the weight of the suction and discharge piping in addition to the weight of the pump and motor. T Ⓣ
9. Concentric reducers are used in the suction inlet of a pump. T Ⓣ
10. A small amount of leakage (steady drip) from packing type pump seals is allowable for cooling purposes. Ⓣ F

ASSIGNMENT 1

Page 53 through Checkpoint 1 • Pages 53 thru 62

1. Before installing a well pump, the well should be chlorinated to prevent contamination and growth of bacteria.
2. A pitless adapter unit, which forms an unbroken extension of a well, attaches to the well casing below the frost line.
3. Storage of water in an automatic water system is in a/an pressure tank.
4. A WELL-X-TROL operates on the principle of the separation of air and water.
5. In a vacuum pump for steam heating systems, the smaller rectangular tank is called the accumulator.
6. Like air, water can be compressed into a smaller volume. T F
7. The drop pipe in a well is normally threaded galvanized steel or plastic. T F
8. Vacuum pumps used in steam heating systems normally maintain a vacuum on the return piping of 2" Hg to 10" Hg. T F
9. Sometimes a dielectric union is installed between the pump and the first section of galvanized pipe in a well. T F
10. An increase in velocity results in an increase in pressure. T F

ASSIGNMENT 2

Checkpoint 1 through Checkpoint 2 • Pages 62 thru 73

1. In both sump pumps and sewage ejectors, the type of pump generally used is the centrifugal pump.
2. To prevent backflow into a sump pit, you should install a/an check valve.
3. Boiler feed pumps are controlled by level controls.
4. In a piston type reciprocating compressor, the downward stroke produces a/an partial vacuum.
5. The compressor used in medical air systems that insures 100% oil-free air is the oil-less piston compressor.
6. Under normal conditions, both pumps in a duplex system operate simultaneously. T (F)
7. Float stops are permanently affixed to a float road by the manufacturer. T (F)
8. A sewer ejector must be installed in an enclosed pit with a gas-tight cover. (T) F
9. The air in a medical gas system is used solely for direct patient therapy. (T) F
10. The water in a liquid ring compressor is used for compression, cleaning and cooling. (T) F

CHAPTER 4: PUMPS IN SYSTEMS

ANSWERS

ASSIGNMENT 3

Checkpoint 2 through Checkpoint 3 • Pages 73 thru 84

1. A gage on the supply side of a horizontal shaft fire pump will register:
 - a. negative pressure
 - b. positive pressure
 - Ⓒ both a and b
 - d. neither a or b

2. An eccentric tapered reducer is installed with the taper on the bottom when the suction pipe is not the same size as the pump suction flange.

3. The control valve in the suction piping to a fire pump must be an OS&Y valve.

4. The control valve in the suction side of a fire-pump check valve may be either an indicator gate valve or a butterfly valve.

5. In an automatic controlled fire pump system, replenishing pressure loss due to leaks, requires the installation of a/an jockey pump.

6. All fire pumps with adjustable-speed drivers do not require a pressure-relief valve. T Ⓕ

7. The NFPA 20 definition of horizontal split-case pumps includes pumps which are installed with the shaft vertical. Ⓕ F

8. Setting the impellers of a vertical-shaft pump is the responsibility of the installing contractor. T Ⓕ

9. An ordinary swing check valve may be utilized as an automatic air-release valve in a vertical-shaft pump installation. Ⓕ F

10. The shafts connecting a diesel engine and a right-angle gear drive must be perfectly aligned. T Ⓕ