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PUMPS AND MOTORS $200.00

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You will have 90 days from this date in order to complete this course

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DISCLAIMER NOTICE

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AFFIDAVIT OF EXAM COMPLETION

I affirm that I personally completed the entire text of the course. I also affirm that I completed the exam without assistance from any outside source. I understand that it is my responsibility to file or maintain my certificate of completion as required by the state or by the designation organization.

Grading Information

In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

For security purposes, please fax or e-mail a copy of your driver's license and always call us to confirm we've received your assignment and to confirm your identity.

Pumps and Motors Answer Key

Name_____

Phone _____

Please Circle, Bold, Underline or X, one answer per question.

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Please fax the answer key to TLC Western Campus Fax (928) 272-0747
Backup Fax (928) 468-0675 Always call us after faxing the paperwork to ensure that we've received it.

Rush Grading Service
If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of $50.00.

Please e-mail or fax this survey along with your final exam

PUMPS AND MOTORS CEU COURSE
CUSTOMER SERVICE RESPONSE CARD

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   Very Easy 0 1 2 3 4 5 Very Difficult

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Any other concerns or comments.

Pumps and Motors CEU Training Course Assignment

The Pumps and Motors CEU course assignment is available in Word on the Internet for your convenience, please visit www.ABCTLC.com and download the assignment and e-mail it back to TLC.

You will have 90 days from receipt of this manual to complete it in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % or better is necessary to pass this course. If you should need any assistance, please email or fax all concerns and the completed **ANSWER KEY** to info@tlch2o.com.

Select one answer per question. Please utilize the answer key. If you see (s) in the answer, this means the answer could be singular or plural.

Common Hydraulic Terms

1. A pressure applied to a confined fluid at rest is transmitted with equal intensity throughout the fluid.

A. Pressure, Absolute
B. Pressure
C. Hydraulics
D. Hydrokinetics
E. Pascal's Law
F. None of the Above

2. The application of continuous force by one body upon another that it is touching; compression. Force per unit area, usually expressed in pounds per square inch (Pascal or bar).

A. Pressure, Absolute
B. Pressure
C. Hydraulics
D. Hydrokinetics
E. Pascal's Law
F. None of the Above

3. Pressure exported by the atmosphere at any specific location. (Sea level pressure is approximately 14.7 pounds per square inch absolute, 1 bar = 14.5psi.)

A. Pressure, Atmospheric
B. Pressure, Static
C. Hydraulics
D. Pressure, Gauge
E. Pascal's Law
F. None of the Above

4. Pressure differential above or below ambient atmospheric pressure.

A. Pressure, Atmospheric
B. Pressure, Static
C. Hydraulics
D. Pressure, Gauge
E. Pascal's Law
F. None of the Above

5. The height of a column or body of fluid above a given point expressed in linear units. Head is often used to indicate gauge pressure. Pressure is equal to the height times the density of the liquid.

A. Head, Friction
B. Head, static
C. Head
D. Hydraulics
E. Hydrokinetics
F. None of the Above

6. The head required to overcome the friction at the interior surface of a conductor and between fluid particles in motion. It varies with flow, size, type, and conditions of conductors and fittings, and the fluid characteristics.

A. Head, Friction
B. Head, static
C. Head
D. Hydraulics
E. Hydrokinetics
F. None of the Above

7. The pressure in a fluid at rest.
A. Pressure, Atmospheric D. Pressure, Gauge
B. Pressure, Static E. Pascal's Law
C. Hydraulics F. None of the Above

8. The height of a column or body of fluid above a given point.
A. Head, Friction D. Hydraulics
B. Head, static E. Hydrokinetics
C. Head F. None of the Above

9. Engineering science pertaining to liquid pressure and flow.
A. Pressure, Absolute D. Hydrokinetics
B. Pressure E. Pascal's Law
C. Hydraulics F. None of the Above

10. Engineering science pertaining to the energy of liquid flow and pressure.
A. Pressure, Absolute D. Hydrokinetics
B. Pressure E. Pascal's Law
C. Hydraulics F. None of the Above

11. The pressure above zone absolute, i.e. the sum of atmospheric and gauge pressure. In vacuum related work it is usually expressed in millimeters of mercury. (mmHg).
A. Pressure, Absolute D. Hydrokinetics
B. Pressure E. Pascal's Law
C. Hydraulics F. None of the Above

General Pumping Fundamentals
Here are the important points to consider about suction piping when the liquid being pumped is below the level of the pump:

12. First, suction lift is when the level of water to be pumped is below the_____.
Sometimes suction lift is also referred to as 'negative suction head'.
A. Partial vacuum D. Centerline of the pump
B. Suction lift E. Negative suction head
C. Lift water F. None of the Above

13. The ability of the pump to _____ is the result of a partial vacuum created at the center of the pump.
A. Partial vacuum D. Atmospheric pressure
B. Suction lift E. Negative suction head
C. Lift water F. None of the Above

14. This works similar to sucking soda from a straw. As you gently suck on a straw, you are creating a vacuum or a_____.
A. Partial vacuum D. Pressure differential
B. Suction lift E. Negative suction head
C. Lift water F. None of the Above

15. Less pressure is exerted on the liquid inside the straw, so that the greater pressure is exerted on the liquid around the outside of the straw, causing the liquid in the straw to move up. By sucking on the straw, this allows atmospheric pressure to_____.
A. Partial vacuum D. Atmospheric pressure
B. Move the liquid E. Negative suction head
C. Lift water F. None of the Above

16. The suction side of pipe should be one diameter larger than the pump inlet. The required eccentric reducer _____so that the top is flat and the bottom tapered.

A. Partial vacuum
B. Suction lift
C. Lift water
D. Should be turned
E. Negative suction head
F. None of the Above

Pump Definitions

17. A barrier that separates stages of a multi-stage pump.

A. Gasket
B. Keyway
C. Kinetic energy
D. Inter-stage diaphragm
E. Energy
F. None of the Above

18. A rectangular piece of metal that prevents the impeller from rotating on the shaft.

A. Gasket
B. Key
C. Energy
D. Inter-stage diaphragm
E. Kinetic energy
F. None of the Above

19. The area on the shaft that accepts the key.

A. Gasket
B. Keyway
C. Energy
D. Inter-stage diaphragm
E. Kinetic energy
F. None of the Above

20. Any substance that can be pumped such as oil, water, refrigerant, or even air.

A. Fluid
B. Mixed flow pump
C. Kinetic energy
D. Mechanical seal
E. Mixed flow pump
F. None of the Above

21. A mechanical device that seals the pump stuffing box.

A. Fluid
B. Mixed flow pump
C. Kinetic energy
D. Mechanical seal
E. Mixed flow pump
F. None of the Above

22. A pump that uses both axial-flow and radial-flow components in one impeller.

A. Fluid
B. Mixed flow pump
C. Kinetic energy
D. Mechanical seal
E. Full flow pump
F. None of the Above

23. Flat material that is compressed between two flanges to form a seal.

A. Gasket
B. Keyway
C. Kinetic energy
D. Inter-stage diaphragm
E. Kinetic energy
F. None of the Above

24. A line that directs sealing fluid to the stuffing box.

A. Leak-off
B. Gland sealing line
C. Horizontal pumps
D. Lantern ring
E. Gland follower
F. None of the Above

25. The part of the pump that increases the speed of the fluid being handled.

A. Packing
B. Impeller
C. Inboard
D. Multi-stage pumps
E. Outboard
F. None of the Above

26. The end of the pump closest to the motor.

A. Packing
B. Impeller
C. Inboard
D. Multi-stage pumps
E. Outboard
F. None of the Above

27. Energy associated with motion.
A. Gasket D. Inter-stage diaphragm
B. Key E. Kinetic energy
C. Energy F. None of the Above

28. A bushing at the bottom of the stuffing box that prevents packing from being pushed out of the stuffing box into the suction eye of the impeller.
A. Strainer D. Stuffing box
B. Suction E. Throat bushing
C. Suction eye F. None of the Above

29. Force, usually along the center line of the pump.
A. Thrust D. Vertical pumps
B. Vanes E. Volute
C. Suction eye F. None of the Above

30. A metal ring located between rings of packing that distributes gland sealing fluid.
A. Leak-off D. Lantern ring
B. Gland sealing line E. Gland follower
C. Horizontal pumps F. None of the Above

31. Fluid that leaks from the stuffing box.
A. Leak-off D. Lantern ring
B. Gland sealing line E. Gland follower
C. Horizontal pumps F. None of the Above

32. A bushing used to compress the packing in the stuffing box and to control leakoff.
A. Leak-off D. Lantern ring
B. Gland sealing line E. Gland follower
C. Horizontal pumps F. None of the Above

33. Pumps in which the center line of the shaft runs vertically.
A. Thrust D. Vertical pumps
B. Vanes E. Volute
C. Suction eye F. None of the Above

34. A replaceable tubular covering on the shaft.
A. Slop drain D. Shaft sleeve
B. Shroud E. Stages
C. Slurry F. None of the Above

35. The metal covering over the vanes of an impeller.
A. Slop drain D. Shaft sleeve
B. Shroud E. Stages
C. Slurry F. None of the Above

36. The drain from the area that collects leak-off from the stuffing box.
A. Slop drain D. Shaft sleeve
B. Shroud E. Stages
C. Slurry F. None of the Above

37. The part of the pump that changes the speed of the fluid into pressure.
A. Thrust D. Vertical pumps
B. Vanes E. Volute
C. Suction eye F. None of the Above

38. Replaceable rings on the impeller or the casing that wear as the pump operates.
A. Thrust D. Vertical pumps
B. Vanes E. Wearing rings
C. Suction eye F. None of the Above

39. A nut that keeps the parts in place.
A. Radial flow D. Radial bearings
B. Rotor E. Retaining nut
C. Score F. None of the Above

40. The rotating parts, usually including the impeller, shaft, bearing housings, and all other parts included between the bearing housing and the impeller.
A. Radial flow D. Radial bearings
B. Rotor E. Retaining nut
C. Score F. None of the Above

41. To cause lines, grooves, or scratches.
A. Radial flow D. Radial bearings
B. Rotor E. Retaining nut
C. Score F. None of the Above

42. A cylindrical bar that transmits power from the driver to the pump impeller.
A. Radial flow D. Radial bearings
B. Shaft E. Retaining nut
C. Score F. None of the Above

43. The place where fluid enters the pump.
A. Strainer D. Stuffing box
B. Suction E. Throat bushing
C. Suction eye F. None of the Above

44. Bearings that prevent shaft movement in any direction outward from the center line of the pump.
A. Radial flow D. Radial bearings
B. Rotor E. Retaining nut
C. Score F. None of the Above

45. Flow at 90° to the center line of the shaft.
A. Radial flow D. Radial bearings
B. Rotor E. Retaining nut
C. Score F. None of the Above

46. A device that retains solid pieces while letting liquids through.
A. Strainer D. Stuffing box
B. Suction E. Throat bushing
C. Suction eye F. None of the Above

47. The area of the pump where the shaft penetrates the casing.
A. Strainer D. Stuffing box
B. Suction E. Throat bushing
C. Suction eye F. None of the Above

48. The place where fluid enters the pump impeller.
A. Strainer D. Stuffing box
B. Suction E. Throat bushing
C. Suction eye F. None of the Above

49. Pumps in which the center line of the shaft is horizontal.
A. Leak-off D. Lantern ring
B. Gland sealing line E. Gland follower
C. Horizontal pumps F. None of the Above

50. Bearings that prevent shaft movement back and forth in the same direction as the center line of the shaft.
A. Thrust D. Vertical pumps
B. Vanes E. Thrust bearings
C. Suction eye F. None of the Above

51. The parts of the impeller that push and increase the speed of the fluid in the pump.
A. Thrust D. Vertical pumps
B. Vanes E. Volute
C. Suction eye F. None of the Above

52. A thick, viscous fluid, usually containing small particles.
A. Slop drain D. Shaft sleeve
B. Shroud E. Stages
C. Slurry F. None of the Above

53. Impellers in a multi-stage pump.
A. Slop drain D. Shaft sleeve
B. Shroud E. Stages
C. Slurry F. None of the Above

54. A metal device that can amplify and pinpoint pump sounds.
A. Slop drain D. Shaft sleeve
B. Shroud E. Stages
C. Slurry F. None of the Above

55. Pumps with more than one impeller.
A. Packing D. Multi-stage pumps
B. Impeller E. Outboard
C. Inboard F. None of the Above

56. The end of the pump farthest from the motor.
A. Packing D. Multi-stage pumps
B. Impeller E. Outboard
C. Inboard F. None of the Above

57. Soft, pliable material that seals the stuffing box.
A. Packing D. Multi-stage pumps
B. Impeller E. Outboard
C. Inboard F. None of the Above

58. Pumps that move fluids by physically displacing the fluid inside the pump.
A. Packing D. Multi-stage pumps
B. Impeller E. Positive displacement pumps
C. Inboard F. None of the Above

Pumps

59. Pumps are used to move or raise fluids. They are not only very useful, but are excellent examples of _____.

A. Hydrostatics
B. Quasi-static
C. Oscillating diaphragm
D. Multi-stage pumps
E. Complicated part
F. None of the Above

60. Pumps are of two general types, _____ or positive displacement pumps, and pumps depending on dynamic forces, such as centrifugal pumps.

A. Hydrostatic
B. Quasi-static
C. Oscillating diaphragm
D. Hydrostatic considerations
E. Complicated part
F. None of the Above

61. We will only consider positive displacement pumps, which can be understood purely by _____. They have a piston (or equivalent) moving in a closely-fitting cylinder and forces are exerted on the fluid by motion of the piston.

A. Hydrostatics
B. Quasi-static
C. Oscillating diaphragm
D. Hydrostatic considerations
E. Complicated part
F. None of the Above

62. We have already seen an important example of this in the hydraulic lever or hydraulic press, which we have called _____.

A. Hydrostatics
B. Quasi-static
C. Oscillating diaphragm
D. Hydrostatic considerations
E. Complicated part
F. None of the Above

63. The simplest pump is the syringe, filled by withdrawing the _____ and emptied by pressing it back in, as its port is immersed in the fluid or removed from it.

A. Hydrostatics
B. Quasi-static
C. Oscillating diaphragm
D. Piston
E. Complicated part
F. None of the Above

64. More complicated pumps have valves allowing them to work repetitively. These are usually check valves that open to allow_____, and close automatically to prevent reverse flow.

A. Piston
B. Diaphragm
C. Discharged fluid
D. Passage in one direction
E. Lift pumps
F. None of the Above

65. There are many kinds of_____, and they are usually the most trouble-prone and complicated part of a pump.

A. Rotor
B. Force pump
C. Volume decreases
D. Air space
E. Valves
F. None of the Above

66. The force pump has _____in the cylinder, one for supply and the other for delivery.

A. Two check valves
B. Diaphragm
C. Discharged fluid
D. Cylinder
E. Lift pumps
F. None of the Above

67. The supply valve opens when the cylinder_____, the delivery valve when the cylinder volume decreases.

A. Rotor
B. Force pump
C. Volume decreases
D. Air space
E. Volume increases
F. None of the Above

68. The lift pump has a _____and a valve in the piston that allows the liquid to pass around it when the volume of the cylinder is reduced.
A. Supply valve D. Cylinder
B. Diaphragm E. Lift pumps
C. Discharged fluid F. None of the Above

69. The delivery in this case is from the upper part of the_____, which the piston does not enter.
A. Rotor D. Air space
B. Force pump E. Cylinder
C. Volume decreases F. None of the Above

70. Diaphragm pumps are force pumps in which the oscillating diaphragm takes the place of the piston. The _____ may be moved mechanically, or by the pressure of the fluid on one side of the diaphragm.
A. Piston D. Cylinder
B. Diaphragm E. Lift pumps
C. Discharged fluid F. None of the Above

71. The _____are typically used for water.
A. Rotor D. Force and lift pumps
B. Force pump E. Delivery
C. Volume decreases F. None of the Above

72. The force pump has two valves in the cylinder, while the lift pump has one valve in the cylinder and one in the piston. The maximum lift, or "_____," is determined by the atmospheric pressure, and either cylinder must be within this height of the free surface.
A. Suction D. Cylinder
B. Diaphragm E. Lift pumps
C. Discharged fluid F. None of the Above

73. The force pump, however, can give an arbitrarily large pressure to the _____, as in the case of a diesel engine injector.
A. Rotor D. Air space
B. Discharged fluid E. Delivery
C. Volume decreases F. None of the Above

74. A nozzle can be used to convert the_____, to produce a jet, as for firefighting. Fire fighting force pumps usually have two cylinders feeding one receiver alternately.
A. Piston D. Cylinder
B. Diaphragm E. Pressure to velocity
C. Discharged fluid F. None of the Above

75. The air space in the receiver helps to make the_____.
A. Rotor D. Air space
B. Water pressure uniform E. Delivery
C. Volume decreases F. None of the Above

76. The Roots blower has no valves, their place taken by the _____between the rotors and the housing.
A. Piston D. Cylinder
B. Diaphragm E. Sliding contact
C. Discharged fluid F. None of the Above

77. The Roots blower can either exhaust a receiver or provide _____under moderate pressure, in large volumes.
A. Air D. Discharge tube
B. Mixed flow E. Roots blower
C. Dynamic F. None of the Above

78. The Bellows is a very old device, requiring no accurate machining. The single valve is in one or both sides of the expandable _____.
A. Cylinder D. Cavity
B. Chamber E. Positive Displacement Pump(s)
C. Radial flow F. None of the Above

79. Another valve can be placed at the nozzle if required. The valve can be a piece of soft leather held close to holes in the_____.
A. Plunger pump D. Discharge tube
B. Mixed flow E. Chamber
C. Dynamic F. None of the Above

80. The _____uses the valve on the valve stem of the tire or inner tube to hold pressure in the tire.
A. Cylinder D. Bicycle pump
B. Chamber E. Positive Displacement Pump(s)
C. Radial flow F. None of the Above

81. The piston, which is attached to the discharge tube, has a _____that seals when the cylinder is moved to compress the air, but allows air to pass when the movement is reversed.
A. Plunger pump D. Discharge tube
B. Mixed flow E. Flexible seal
C. Dynamic F. None of the Above

82. Diaphragm and vane pumps act the same way by varying the volume of a chamber, and directing the flow with_____.
A. Cylinder D. Cavity
B. Check valves E. Positive Displacement Pump(s)
C. Radial flow F. None of the Above

Types of Pumps
83. The family of pumps comprises a large number of types based on application and capabilities. The two major groups of pumps are_____.
A. Plunger pump D. Discharge tube
B. Mixed flow E. Dynamic and positive displacement
C. Dynamic F. None of the Above

Centrifugal pumps are classified into three general categories:
84. A centrifugal pump in which the pressure is developed wholly by centrifugal force.
A. Cylinder D. Cavity
B. Chamber E. Positive Displacement Pump(s)
C. Radial flow F. None of the Above

85. A centrifugal pump in which the pressure is developed partly by centrifugal force and partly by the lift of the vanes of the impeller on the liquid.
A. Plunger pump D. Discharge tube
B. Mixed flow E. Roots blower
C. Dynamic F. None of the Above

86. A centrifugal pump in which the pressure is developed by the propelling or lifting action of the vanes of the impeller on the liquid.
A. Axial flow D. Cavity
B. Chamber E. Positive Displacement Pump(s)
C. Radial flow F. None of the Above

Positive Displacement Pumps
87. A Positive Displacement Pump has an expanding cavity on the _____of the pump and a decreasing cavity on the discharge side.
A. Plunger pump D. Discharge tube
B. Suction side E. Roots blower
C. Dynamic F. None of the Above

88. Liquid is allowed to flow into the pump as the cavity on the suction side expands and the liquid is forced out of the _____as the cavity collapses.
A. Cylinder D. Cavity
B. Chamber E. Discharge
C. Radial flow F. None of the Above

89. This principle applies to all types of Positive Displacement Pumps whether the pump is a rotary lobe, gear within a gear, piston, diaphragm, screw, _____, etc.
A. Plunger pump D. Progressing cavity
B. Mixed flow E. Roots blower
C. Dynamic F. None of the Above

90. A Positive Displacement Pump, unlike a Centrifugal Pump, will produce the same flow at a given RPM no matter what the discharge pressure is. A _____ cannot be operated against a closed valve on the discharge side of the pump, i.e. it does not have a shut-off head like a Centrifugal Pump does.
A. Cylinder D. Cavity
B. Chamber E. Positive Displacement Pump(s)
C. Radial flow F. None of the Above

91. If a Positive Displacement Pump is allowed to operate against a closed discharge valve it will continue to produce flow which will increase the pressure in the _____until either the line bursts or the pump is severely damaged or both.
A. Plunger pump D. Discharge tube
B. Mixed flow E. Discharge line
C. Dynamic F. None of the Above

Plunger Pump
92. The plunger pump is a positive displacement pump that uses a _____to force liquid from the suction side to the discharge side of the pump. It is used for heavy sludge.
A. Plunger pump D. Discharge tube
B. Mixed flow E. Plunger or piston
C. Dynamic F. None of the Above

93. The movement of the plunger or piston inside the pump creates pressure inside the pump, so you have to be careful that this kind of pump is never operated against any_____.
A. Inward force D. Closed discharge valve
B. Pump pushes E. Incompressible fluid
C. Viscous drag pump F. None of the Above

94. All _____must be open before the pump is started, to prevent any fast build-up of pressure that could damage the pump.
A. Inward force D. Center of the impeller
B. Discharge valves E. Incompressible fluid
C. Viscous drag pump F. None of the Above

Diaphragm Pumps
95. In this type of pump, a _____ provides the mechanical action used to force liquid from the suction to the discharge side of the pump.
A. Centrifugal pump(s) D. Diaphragm
B. Impeller blade(s) E. Cylindrical pump housing
C. Bernoulli's equation F. None of the Above

96. The advantage the _____has over the plunger is that the diaphragm pump does not come in contact with moving metal. This can be important when pumping abrasive or corrosive materials.
A. Diaphragm D. Center of the impeller
B. Pump pushes E. Incompressible fluid
C. Viscous drag pump F. None of the Above

Pump Categories
97. Let's cover the essentials first. The key to the whole operation is, of course, the pump. And regardless of what type it is (reciprocating piston, centrifugal, turbine or jet-ejector, for either shallow or deep well applications), its purpose is to move water and generate the _____ we call pressure.
A. Centrifugal pump(s) D. Diaphragm pump(s)
B. Impeller blade(s) E. Cylindrical pump housing
C. Delivery force F. None of the Above

98. Sometimes — with centrifugal pumps in particular — pressure is not referred to in pounds per square inch but rather as the equivalent in elevation, called_____. No matter; head in feet divided by 2.31 equals pressure, so it's simple enough to establish a common figure.
A. Inward force D. Center of the impeller
B. Head E. Incompressible fluid
C. Viscous drag pump F. None of the Above

99. Pumps may be classified on the basis of the application they serve. All pumps may be divided into two major categories: (1) dynamic, in which energy is continuously added to increase the fluid velocities within the machine, and (2)_____, in which the energy is periodically added by application of force.
A. Centrifugal pump(s) D. Diaphragm pump(s)
B. Impeller blade(s) E. Cylindrical pump housing
C. Displacement F. None of the Above

Basic Water Pump
100. The water pump commonly found in our systems is centrifugal pumps. These pumps work by spinning water around in a circle inside a_____.
A. Inward force D. Center of the impeller
B. Pump pushes E. Cylindrical pump housing
C. Viscous drag pump F. None of the Above

101. The pump makes the water spin by pushing it with an impeller. The blades of this impeller project outward from an axle like the arms of a turnstile and, as the _____, the water spins with it. As the water spins, the pressure near the outer edge of the pump housing becomes much higher than near the center of the impeller.

A. Centrifugal pump(s)
B. Impeller spins
C. Bernoulli's equation
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

102. Without such an inward force, an object will travel in a straight line and will not complete the _____.

A. Circle
B. Pump pushes
C. Viscous drag pump
D. Center of the impeller
E. Incompressible fluid
F. None of the Above

103. In a centrifugal pump, that inward force is provided by high-pressure water near the outer edge of the_____.

A. Centrifugal pump(s)
B. Impeller blade(s)
C. Pump housing
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

104. The water at the edge of the _____ inward on the water between the impeller blades and makes it possible for that water to travel in a circle.

A. Inward force
B. Pump pushes
C. Viscous drag pump
D. Center of the impeller
E. Incompressible fluid
F. None of the Above

105. The water pressure at the edge of the turning impeller rises until it is able to keep water circling with the _____.

A. Centrifugal pump(s)
B. Impeller blade(s)
C. Bernoulli's equation
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

106. You can also view the water as an incompressible fluid, one that obeys _____in the appropriate contexts.

A. Inward force
B. Pump pushes
C. Viscous drag pump
D. Center of the impeller
E. Bernoulli's equation
F. None of the Above

107. As water drifts outward between the _____ of the pump, it must move faster and faster because its circular path is getting larger and larger. The impeller blades cause the water to move faster and faster.

A. Centrifugal pump(s)
B. Impeller blade(s)
C. Bernoulli's equation
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

108. Here is where _____ figures in. As the water slows down and its kinetic energy decreases, that water's pressure potential energy increases (to conserve energy).

A. Centrifugal pump(s)
B. Impeller blade(s)
C. Bernoulli's equation
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

109. Thus, the slowing is accompanied by a pressure rise. That is why the water pressure at the outer edge of the _____is higher than the water pressure near the center of the impeller.

A. Inward force
B. Pump housing
C. Viscous drag pump
D. Center of the impeller
E. Incompressible fluid
F. None of the Above

110. When water is actively flowing through the pump, arriving through a hole near the center of the impeller and leaving through a _____near the outer edge of the pump housing, the pressure rise between center and edge of the pump is not as large.

A. Centrifugal pump(s)
B. Impeller blade(s)
C. Hole
D. Diaphragm pump(s)
E. Cylindrical pump housing
F. None of the Above

Venturi (Bernoulli's law):

111. A venturi is a pipe that has a gradual restriction that opens up into a gradual enlargement. The area of the restriction will have a _____than the enlarged area ahead of it. If the difference in diameters is large you can even produce a very high vacuum (-28 feet of water).

A. Inward force
B. Lower pressure
C. Viscous drag pump
D. Center of the impeller
E. Incompressible fluid
F. None of the Above

112. A pump whose impeller has no vanes but relies on fluid contact with a flat rotating plate turning at high speed to move the liquid.

A. Inward force
B. Pump pushes
C. Viscous drag pump
D. Center of the impeller
E. Incompressible fluid
F. None of the Above

Types of Water Pumps

113. The most common type of water pumps used for municipal and domestic water supplies are _____.

A. Spider bearing(s)
B. Horsepower
C. Impeller(s)
D. Turbine pump(s)
E. Variable displacement pumps
F. None of the Above

114. A _____will produce at different rates relative to the amount of pressure or lift the pump is working against.

A. Variable displacement pump
B. Drive shaft
C. Column pipe
D. Single or multiple bowls
E. Pump's lifting capacity
F. None of the Above

115. _____are variable displacement pumps that are by far used the most. The water production well industry almost exclusively uses Turbine pumps, which are a type of centrifugal pump.

A. Spider bearing(s)
B. Horsepower
C. Centrifugal pumps
D. Turbine pump(s)
E. Desired pumping rate
F. None of the Above

116. The turbine pump utilizes impellers enclosed in single or multiple bowls or stages to _____by centrifugal force. The impellers may be of either a semi-open or closed type.

A. Lift water
B. Drive shaft
C. Column pipe
D. Single or multiple bowls
E. Pump's lifting capacity
F. None of the Above

117. Impellers are rotated by the pump motor, which provides the _____ needed to overcome the pumping head.
A. Spider bearing(s) D. Turbine pump(s)
B. Horsepower E. Desired pumping rate
C. Impeller(s) F. None of the Above

118. The size and number of stages, horsepower of the motor and _____are the key components relating to the pump's lifting capacity.
A. Pumping head D. Single or multiple bowls
B. Drive shaft E. Pump's lifting capacity
C. Column pipe F. None of the Above

119. Vertical turbine pumps are commonly used in groundwater wells. These pumps are driven by a shaft rotated by a motor on the surface. The shaft turns the impellers within the pump housing while the_____.
A. Spider bearing(s) D. Water moves up the column
B. Horsepower E. Desired pumping rate
C. Impeller(s) F. None of the Above

120. This type of pumping system is also called a_____. The rotating shaft in a line shaft turbine is actually housed within the column pipe that delivers the water to the surface.
A. Line-shaft turbine D. Single or multiple bowls
B. Drive shaft E. Pump's lifting capacity
C. Column pipe F. None of the Above

121. The size of the _____are selected based on the desired pumping rate and lift requirements.
A. Spider bearing(s) D. Column, impeller, and bowls
B. Horsepower E. Desired pumping rate
C. Impeller(s) F. None of the Above

122. Column pipe sections can be threaded or coupled together while the drive shaft is coupled and suspended within the column by_____.
A. Oil tube D. Single or multiple bowls
B. Spider bearings E. Pump's lifting capacity
C. Column pipe F. None of the Above

123. The _____provide both a seal at the column pipe joints and keep the shaft aligned within the column. The water passing through the column pipe serves as the lubricant for the bearings.
A. Spider bearing(s) D. Turbine pump(s)
B. Horsepower E. Desired pumping rate
C. Impeller(s) F. None of the Above

124. Some vertical turbines are lubricated by oil rather than water. These pumps are essentially the same as_____; only the drive shaft is enclosed within an oil tube.
A. Oil tube D. Single or multiple bowls
B. Water lubricated units E. Pump's lifting capacity
C. Column pipe F. None of the Above

125. Food grade oil is supplied to the tube through a _____during operation.
A. Spider bearing(s) D. Turbine pump(s)
B. Horsepower E. Desired pumping rate
C. Gravity feed system F. None of the Above

126. The oil tube is suspended within the column by_____, while the line shaft is supported within the oil tube by brass or redwood bearings.
A. Oil tube D. Single or multiple bowls
B. Spider flanges E. Pump's lifting capacity
C. Column pipe F. None of the Above

127. A continuous supply of _____the drive shaft as it proceeds downward through the oil tube.
A. Spider bearing(s) D. Turbine pump(s)
B. Oil lubricates E. Desired pumping rate
C. Impeller(s) F. None of the Above

128. A small hole located at the top of the _____allows excess oil to enter the well. This results in the formation of an oil film on the water surface within oil-lubricated wells.
A. Pump bow unit D. Single or multiple bowls
B. Drive shaft E. Pump's lifting capacity
C. Column pipe F. None of the Above

129. Careful operation of oil lubricated turbines is needed to ensure that the pumping levels do not drop enough to allow oil to enter the pump. Both water and oil lubricated turbine pump units can be driven by_____.
A. Oil tube D. Electric or fuel powered motors
B. Drive shaft E. Pump's lifting capacity
C. Column pipe F. None of the Above

130. Most installations use an electric motor that is connected to the _____by a keyway and nut.
A. Drive shaft D. Keyway and nut
B. Diaphragm E. Time delay or ratchet assembly
C. Inertial cavitation F. None of the Above

131. Where electricity is not readily available, fuel powered engines may be connected to the drive shaft by a_____.
A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Right angle drive gear
C. Drive shaft F. None of the Above

132. Also, both oil and water lubricated systems will have a strainer attached to the _____to prevent sediment from entering the pump.
A. Intake D. Keyway and nut
B. Diaphragm E. Time delay or ratchet assembly
C. Inertial cavitation F. None of the Above

133. When the_____, water will flow back down the column, turning the impellers in a reverse direction.
A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Line shaft turbine is turned off
C. Drive shaft F. None of the Above

134. A pump and shaft can easily be broken if the motor were to turn on during this process. This is why a time delay or ratchet assembly is often installed on these motors to either prevent the motor from turning on before _____stops or simply not allow it to reverse at all.
A. Reverse rotation D. Keyway and nut
B. Diaphragm E. Time delay or ratchet assembly
C. Inertial cavitation F. None of the Above

There are three main types of diaphragm pumps:

135. In the first type, the _____with one side in the fluid to be pumped, and the other in air or hydraulic fluid.

A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Diaphragm is sealed
C. Drive shaft F. None of the Above

136. The diaphragm is flexed, causing the volume of the pump chamber to increase and decrease. A pair of _____prevents reverse flow of the fluid.

A. Strainer D. Non-return check valves
B. Diaphragm E. Time delay or ratchet assembly
C. Inertial cavitation F. None of the Above

137. The second type of diaphragm pump works with volumetric positive displacement, but differs in that the prime mover of the diaphragm is neither oil nor air; but is_____, working through a crank or geared motor drive.

A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Reverse direction
C. Electro-mechanical F. None of the Above

138. This method flexes the diaphragm through simple mechanical action, and one side of the _____ is open to air.

A. Strainer D. Keyway and nut
B. Diaphragm E. Time delay or ratchet assembly
C. Inertial cavitation F. None of the Above

139. The third type of diaphragm pump has one or more unsealed diaphragms with the fluid to be pumped on both sides. The _____again are flexed, causing the volume to change.

A. Diaphragm(s) D. Volumetric positive displacement
B. Chamber pressure E. Reverse direction
C. Drive shaft F. None of the Above

140. When the volume of a chamber of either type of pump is increased (the diaphragm moving up), the pressure decreases, and fluid is drawn into the_____.

A. Chamber D. Keyway and nut
B. Diaphragm E. Time delay or ratchet assembly
C. Inertial cavitation F. None of the Above

141. When the chamber pressure later increases from decreased volume (the diaphragm moving down), the _____in is forced out.

A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Fluid previously drawn
C. Drive shaft F. None of the Above

142. Finally, the diaphragm moving up once again draws fluid into the_____, completing the cycle. This action is similar to that of the cylinder in an internal combustion engine.

A. Chamber D. Keyway and nut
B. Diaphragm E. Time delay or ratchet assembly
C. Inertial cavitation F. None of the Above

Cavitation

143. Cavitation is defined as the phenomenon of formation of vapor bubbles of a flowing liquid in a region where the pressure of the liquid falls below its_____.

A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Vapor pressure
C. Drive shaft F. None of the Above

144. Cavitation is usually divided into two classes of behavior: inertial (or transient) cavitation and _____.

A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Non-inertial cavitation
C. Drive shaft F. None of the Above

145. _____is the process where a void or bubble in a liquid rapidly collapses, producing a shock wave.

A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Reverse direction
C. Inertial cavitation F. None of the Above

146. Such _____often occurs in pumps, propellers, impellers, and in the vascular tissues of plants.

A. Vapor bubbles D. Volumetric positive displacement
B. Chamber pressure E. Reverse direction
C. Cavitation F. None of the Above

147. _____is the process in which a bubble in a fluid is forced to oscillate in size or shape due to some form of energy input, such as an acoustic field.

A. Strainer D. Non-inertial cavitation
B. Diaphragm E. Time delay or ratchet assembly
C. Inertial cavitation F. None of the Above

148. Cavitation is, in many cases, an undesirable occurrence. In devices such as propellers and pumps, cavitation causes a great deal of_____, vibrations, and a loss of efficiency.

A. Cavitation D. Propellers and pumps
B. Turbulence E. Noise, damage to components
C. Driveshaft F. None of the Above

149. When the_____, they force liquid energy into very small volumes, thereby creating spots of high temperature and emitting shock waves, the latter of which are a source of noise.

A. Suction side D. Cavitation bubbles collapse
B. Residual stresses E. Collapse of cavities
C. Shock waves F. None of the Above

150. The noise created by _____ is a particular problem for military submarines, as it increases the chances of being detected by passive sonar.

A. Cavitation D. Propellers and pumps
B. Turbulence E. Center of rotation
C. Driveshaft F. None of the Above

151. Although the collapse of a cavity is a relatively low-energy event, highly localized collapses can_____, such as steel, over time. The pitting caused by the collapse of cavities produces great wear on components and can dramatically shorten a propeller's or pump's lifetime.

A. Suction side D. Erode metals
B. Residual stresses E. Collapse of cavities
C. Shock waves F. None of the Above

152. After a surface is initially affected by cavitation, it tends to erode at an accelerating pace. The cavitation pits increase the turbulence of the fluid flow and _____that act as nucleation sites for additional cavitation bubbles.

A. Cavitation D. Propellers and pumps
B. Turbulence E. Center of rotation
C. Create crevasses F. None of the Above

153. The pits also increase the component's surface area and leave behind_____. This makes the surface more prone to stress corrosion.

A. Suction side D. Residual stresses
B. Residual stresses E. Collapse of cavities
C. Shock waves F. None of the Above

Impeller

154. An _____is a rotating component of a centrifugal pump, usually made of iron, steel, aluminum or plastic, which transfers energy from the motor that drives the pump to the fluid being pumped by accelerating the fluid outwards from the center of rotation.

A. Cavitation D. Propellers and pumps
B. Turbulence E. Impeller
C. Driveshaft F. None of the Above

155. The velocity achieved by the _____when the outward movement of the fluid is confined by the pump casing.

A. Suction side D. Impeller transfers into pressure
B. Residual stresses E. Collapse of cavities
C. Shock waves F. None of the Above

156. Impellers are usually short cylinders with an open inlet (called an eye) to accept incoming fluid, vanes to push the fluid radically, and a splined center to accept a _____.

A. Cavitation D. Propellers and pumps
B. Turbulence E. Center of rotation
C. Driveshaft F. None of the Above

Progressing Cavity Pump

157. In this type of pump, components referred to as a rotor and an elastic stator provide the _____used to force liquid from the suction side to the discharge side of the pump.

A. Suction side D. Mechanical action
B. Residual stresses E. Collapse of cavities
C. Shock waves F. None of the Above

158. As the rotor turns within the stator, cavities are formed which progress from the suction to the _____, conveying the pumped material.

A. Cavitation D. Discharge end of the pump
B. Turbulence E. Center of rotation
C. Driveshaft F. None of the Above

159. The _____between the rotor and the stator helices keeps the fluid moving steadily at a fixed flow rate proportional to the pump's rotational speed.
A. Suction side D. Pump casing
B. Residual stresses E. Continuous seal
C. Shock waves F. None of the Above

160. _____are used to pump material very high in solids content. The progressive cavity pump must never be run dry, because the friction between the rotor and stator will quickly damage the pump.
A. Suction side D. Pump casing
B. Residual stresses E. Collapse of cavities
C. Progressing cavity pumps F. None of the Above

More on the Progressive Cavity Pump
161. A progressive cavity pump is also known as a progressing cavity pump, eccentric screw pump, or even just_____, and as is common in engineering generally, these pumps can often be referred to by using a generalized trademark.
A. Drag, or friction D. High pressure
B. Helical shaft E. Eccentric screw pump
C. Cavity pump F. None of the Above

162. This type of pump transfers fluid by means of the progress, through the pump, of a sequence of small, fixed shape, discrete cavities, as its_____.
A. Flow rate D. Rotor is turned
B. Hypocycloids E. Peristaltic pump(s)
C. Piston pump F. None of the Above

163. This leads to the _____being proportional to the rotation rate (bi-directionally) and to low levels of shearing being applied to the pumped fluid.
A. Drag, or friction D. High pressure
B. Volumetric flow rate E. Eccentric screw pump
C. Cavities F. None of the Above

164. These pumps have application in fluid metering and pumping of viscous or shear sensitive materials. It should be noted that the cavities taper down toward their ends and overlap with their neighbors, so that, in general, no flow pulsing is caused by the arrival of_____, other than that caused by compression of the fluid or pump components.
A. Flow rate D. Pump size
B. Hypocycloids E. Cavities at the outlet
C. Piston pump F. None of the Above

165. The principle of this _____is frequently misunderstood; often it is believed to occur due to a dynamic effect caused by drag, or friction against the moving teeth of the screw rotor.
A. Drag, or friction D. High pressure
B. Helical shaft E. Pumping technique
C. Cavities F. None of the Above

166. In reality it is due to sealed cavities, like a piston pump, and so has similar operational characteristics, such as being able to pump at extremely low rates, even to high pressure, revealing the effect to be purely_____.
A. Flow rate D. Pump size
B. Hypocycloids E. Positive displacement
C. Piston pump F. None of the Above

167. The mechanical layout that causes the cavities to, uniquely, be of fixed dimensions as they move through the pump, is hard to visualize (it's essentially 3D nature renders diagrams quite ineffective for explanation), but it is accomplished by the preservation in shape of the gap formed between a helical shaft and a two start, twice the wavelength and double the diameter, helical hole, as the shaft is "_____" around the inside surface of the hole.

A. Drag, or friction
B. Helical shaft
C. Rolled
D. High pressure
E. Eccentric screw pump
F. None of the Above

168. The motion of the rotor being the same as the smaller gears of a planetary gears system. This form of motion gives rise to the curves called _____.

A. Flow rate
B. Hypocycloids
C. Piston pump
D. Pump size
E. Peristaltic pump(s)
F. None of the Above

169. In order to produce a seal between cavities, the rotor requires a circular cross-section and the stator an oval one. The rotor so takes a form similar to a corkscrew, and this, combined with the off-center rotary motion, leads to the name; _____.

A. Drag, or friction
B. Helical shaft
C. Cavities
D. High pressure
E. Eccentric screw pump
F. None of the Above

170. Different rotor shapes and _____exist, but are specialized in that they don't generally allow complete sealing, so reducing low speed pressure and flow rate linearity, but improving actual flow rates, for a given pump size, and/or the pump's solids handling ability.

A. Flow rate
B. Hypocycloids
C. Piston pump
D. Pump size
E. Rotor/stator pitch ratios
F. None of the Above

171. At a high enough pressure the sliding seals between _____will leak some fluid rather than pumping it, so when pumping against high pressures a longer pump with more cavities is more effective, since each seal has only to deal with the pressure difference between adjacent cavities. Pumps with between two and a dozen or so cavities exist.

A. Drag, or friction
B. Helical shaft
C. Cavities
D. High pressure
E. Eccentric screw pump
F. None of the Above

172. In operation, progressive cavity pumps are fundamentally fixed flow rate pumps, like piston pumps and _____.

A. Flow rate
B. Hypocycloids
C. Piston pump
D. Pump size
E. Peristaltic pump(s)
F. None of the Above

173. This type of pump needs a fundamentally different understanding to the types of pumps to which people are more commonly first introduced, namely ones that can be thought of as generating a _____.

A. Drag, or friction
B. Helical shaft
C. Cavities
D. Pressure
E. Eccentric screw pump
F. None of the Above

174. This can lead to the mistaken assumption that all pumps can have their flow rates adjusted by using a valve attached to their_____, but with this type of pump this assumption is a problem, since such a valve will have practically no effect on the flow rate and completely closing it will involve very high, probably damaging, pressures being generated.

A. Flow rate
B. Outlet
C. Piston pump
D. Pump size
E. Peristaltic pump(s)
F. None of the Above

175. In order to prevent this, pumps are often fitted with cut-off pressure switches, burst disks (deliberately weak and easily replaced points), or a bypass pipe that allows a variable amount of a fluid to return to the inlet. With a_____, a fixed flow rate pump is effectively converted to a fixed pressure one.

A. Drag, or friction
B. Helical shaft
C. Bypass fitted
D. High pressure
E. Eccentric screw pump
F. None of the Above

176. At the points where the rotor touches the stator, the surfaces are generally traveling transversely, so small areas of sliding contact occur, these areas need to be lubricated by the fluid being pumped (_____), this can mean that more torque is required for starting, and if allowed to operate without fluid, called 'run dry', rapid deterioration of the stator can result.

A. Torque
B. Lubrication layer
C. Elastomer core
D. Hydrodynamic lubrication
E. Liquid's resistance to flow
F. None of the Above

177. While _____ offer long life and reliable service transporting thick or lumpy fluids, abrasive fluids will significantly shorten the life of the stator.

A. Elastomer
B. Rotor
C. Lubricated
D. Elastomer/pumped fluid compatibility
E. Progressive cavity pumps
F. None of the Above

178. Slurries (particulates in a medium) can be pumped reliably, as long as the _____ enough to maintain a lubrication layer around the particles and so provide protection to the stator.

A. Torque
B. Lubrication layer
C. Elastomer core
D. Medium is viscous
E. Liquid's resistance to flow
F. None of the Above

179. Specific designs involve the rotor of the pump being made of a steel, coated in a smooth hard surface, normally chromium, with the body (the stator) made of a molded elastomer inside a _____.

A. Elastomer
B. Rotor
C. Metal tube body
D. Elastomer/pumped fluid compatibility
E. Progressive cavity pumps
F. None of the Above

180. The _____ of the stator forms the required complex cavities. The rotor is held against the inside surface of the stator by angled link arms, bearings (which have to be within the fluid) allowing it to roll around the inner surface (un-driven).

A. Torque
B. Lubrication layer
C. Elastomer core
D. Distort under pressure
E. Liquid's resistance to flow
F. None of the Above

181. _____is used for the stator to simplify the creation of the complex internal shape, created by means of casting, and also improves the quality and longevity of the seals by progressively swelling due to absorption of water and/or other common constituents of pumped fluids.

A. Elastomer
B. Rotor
C. Lubricated
D. Elastomer/pumped fluid compatibility
E. Progressive cavity pumps
F. None of the Above

182. Elastomer/pumped _____will thus need to be taken into account.

A. Elastomer
B. Rotor
C. Lubricated
D. Pumped fluid compatibility
E. Progressive cavity pumps
F. None of the Above

183. Two common designs of stator are the "Equal-walled" and the "_____". The latter, having greater elastomer wall thickness at the peaks, allows larger-sized solids to pass through because of its increased ability to distort under pressure.

A. Unequal walled
B. Lubrication layer
C. Elastomer core
D. Distort under pressure
E. Liquid's resistance to flow
F. None of the Above

Key Pump Words

184. A measure of a liquid's resistance to flow. i.e.: how thick it is. The viscosity determines the type of pump used, the speed it can run at, and with gear pumps, the internal clearances required.

A. NPSH
B. Specific Speed
C. Viscosity
D. S.G.: Specific gravity
E. Vapor Pressure
F. None of the Above

185. The amount of pressure / head required to 'force' liquid through pipe and fittings.

A. NPSH
B. Specific Speed
C. Viscosity
D. Friction Loss
E. Vapor Pressure
F. None of the Above

186. Related to how much suction lift a pump can achieve by creating a partial vacuum. Atmospheric pressure then pushes liquid into the pump. A method of calculating if the pump will work or not.

A. NPSH
B. Specific Speed
C. Viscosity
D. S.G.: Specific gravity
E. Vapor Pressure
F. None of the Above

187. The weight of liquid in comparison to water at approx. 20 degrees C (SG = 1).

A. NPSH
B. Specific Speed
C. Viscosity
D. S.G.: Specific gravity
E. Vapor Pressure
F. None of the Above

188. A number which is the function of pump flow, head, efficiency etc. Not used in day to day pump selection, but very useful, as pumps with similar specific speed will have similar shaped curves, similar efficiency / NPSH / solids handling characteristics.

A. NPSH
B. Specific Speed
C. Viscosity
D. S.G.: Specific gravity
E. Vapor Pressure
F. None of the Above

189. If the _____ of a liquid is greater than the surrounding air pressure, the liquid will boil.

A. NPSH
B. Specific Speed
C. Viscosity
D. S.G.: Specific gravity
E. Vapor Pressure
F. None of the Above

Screw or Auger Pump

190. The machine consists of a screw inside a hollow pipe. Some attribute its invention to Archimedes in the 3rd century BC, while others attribute it to Nebuchadnezzar II in the 7th century BC. A screw can be thought of as _____(another simple machine) wrapped around a cylinder.

A. Casing
B. Screw
C. Suction side
D. An inclined plane
E. Spiral tube
F. None of the Above

191. The _____is turned (usually by a windmill or by manual labor). As the bottom end of the tube turns, it scoops up a volume of water.

A. Casing
B. Screw
C. Suction side
D. Equilibrium
E. Spiral tube
F. None of the Above

192. This amount of water will slide up in the spiral tube as the _____is turned, until it finally pours out from the top of the tube and feeds the irrigation system.

A. Casing
B. Screw
C. Suction side
D. Shaft
E. Spiral tube
F. None of the Above

193. The contact surface between the screw and the pipe does not need to be perfectly water-tight because of the relatively large amount of water being scooped at each turn with respect to the _____.

A. Casing
B. Screw
C. Suction side
D. Equilibrium
E. Angular speed of the screw
F. None of the Above

194. Water leaking from the top section of the _____ leaks into the previous one and so on. So a sort of equilibrium is achieved while using the machine, thus preventing a decrease in efficiency.

A. Casing
B. Screw
C. Suction side
D. Equilibrium
E. Spiral tube
F. None of the Above

195. The "_____" does not necessarily need to turn inside the casing, but can be allowed to turn with it in one piece.

A. Casing
B. Screw
C. Suction side
D. Equilibrium
E. Spiral tube
F. None of the Above

196. A screw could be sealed with pitch or some other adhesive to its casing, or, cast as a single piece in bronze, as some researchers have postulated as being the devices used to irrigate Nebuchadnezzar II's Hanging Gardens of Babylon. Depictions of Greek and Roman water screws show the screws being powered by a human treading on the outer casing to turn the entire apparatus as one piece, which would require that the casing be rigidly attached to the _____.

A. Casing
B. Screw
C. Suction side
D. Equilibrium
E. Spiral tube
F. None of the Above

197. In this type of pump, a large screw provides the mechanical action to move the liquid from the suction side to the_____.
A. Casing D. Discharge side of the pump
B. Screw E. Spiral tube
C. Suction side F. None of the Above

198. Most _____rotate in the 30 to 60 rpm range, although some screw pumps are faster.
A. Casing D. Equilibrium
B. Screw pumps E. Spiral tube
C. Suction side F. None of the Above

199. The slope of the _____ is normally either 30° or 38°.
A. Casing D. Equilibrium
B. Screw E. Spiral tube
C. Suction side F. None of the Above

200. The maximum lift for the larger diameter pumps is about 30 feet. The smaller diameter _____ have lower lift capabilities.
A. Casing D. Equilibrium
B. Screw E. Pumps
C. Suction side F. None of the Above

Submersible Pumps
201. Submersible pumps are in essence very similar to_____. They both use impellers rotated by a shaft within the bowls to pump water. However, the pump portion is directly connected to the motor.
A. Cased wells D. Pump bowl assembly
B. Turbine pumps E. VHS or VSS motors
C. Pump's intake F. None of the Above

202. The pump shaft has a keyway in which the splined motor end shaft inserts. The motor is bolted to the _____.
A. Motor D. Pump housing
B. Pump shrouds E. Number of stages
C. Canned configurations F. None of the Above

203. The pump's intake is located between the motor and the pump and is normally screened to prevent sediment from entering the pump and damaging the_____.
A. Impellers D. Pump bowl assembly
B. Shroud E. VHS or VSS motors
C. Pump's intake F. None of the Above

204. The efficient cooling of submersible motors is very important, so these types of pumps are often installed such that flow through the _____can occur upwards past the motor and into the intake.
A. Well screen D. Pump housing
B. Pump shrouds E. Number of stages
C. Canned configurations F. None of the Above

205. If the _____is inserted below the screened interval or below all productive portions of the aquifer, it will not be cooled, resulting in premature motor failure.
A. Cased wells D. Pump bowl assembly
B. Shroud E. Motor end
C. Pump's intake F. None of the Above

206. Some pumps may have _____ installed on them to force all the water to move past the motor to prevent overheating.
A. Motor D. Pump housing
B. Pump shrouds E. Number of stages
C. Canned configurations F. None of the Above

207. The _____is a piece of pipe that attaches to the pump housing with an open end below the motor.
A. Cased wells D. Pump bowl assembly
B. Shroud E. VHS or VSS motors
C. Pump's intake F. None of the Above

208. As with turbine pumps, the size of the bowls and impellers, number of stages, and horsepower of the motor are adjusted to achieve the desired production rate within the limitations of the_____.
A. Motor D. Pump housing
B. Pump shrouds E. Pumping head
C. Canned configurations F. None of the Above

Understanding the Operation of a Vertical Turbine Pump
209. _____are available in deep well, shallow well, or canned configurations. VHS or VSS motors will be provided to fulfill environmental requirements.
A. Cased wells D. Pump bowl assembly
B. Shroud E. Vertical turbine pumps
C. Pump's intake F. None of the Above

210. _____are also available. These pumps are also suitable industrial, municipal, commercial and agricultural applications.
A. Motor D. Submersible motors
B. Pump shrouds E. Number of stages
C. Canned configurations F. None of the Above

211. Deep well turbine pumps are adapted for use in cased wells or where the water surface is below the practical limits of a_____.
A. Cased wells D. Pump bowl assembly
B. Shroud E. Centrifugal pump
C. Pump's intake F. None of the Above

212. _____are also used with surface water systems. Since the intake for the turbine pump is continuously under water, priming is not a concern. Turbine pump efficiencies are comparable to or greater than most centrifugal pumps. They are usually more expensive than centrifugal pumps and more difficult to inspect and repair.
A. Turbine pumps D. Pump housing
B. Pump shrouds E. Number of stages
C. Canned configurations F. None of the Above

213. The turbine pump has three main parts: (1) the_____, (2) the shaft and column assembly and (3) the pump bowl assembly.
A. Head assembly D. Pump bowl assembly
B. Shroud E. VHS or VSS motors
C. Pump's intake F. None of the Above

214. The head is normally cast iron and designed to be installed on a foundation. It supports the column, shaft, and bowl assemblies, and provides a discharge for the water. It also will support either an electric motor, a _____or a belt drive.

A. Right angle gear drive
B. Pump shrouds
C. Canned configurations
D. Pump housing
E. Number of stages
F. None of the Above

Bowl Assembly

215. The _____is the heart of the vertical turbine pump. The impeller and diffuser type casing is designed to deliver the head and capacity that the system requires in the most efficient way.

A. Clutch assembly
B. Driver mounting base
C. Bowl assembly
D. Aligning the driver
E. Priming Capacity
F. None of the Above

216. Vertical turbine pumps can be_____, allowing maximum flexibility both in the initial pump selection and in the event that future system modifications require a change in the pump rating. The submerged impellers allow the pump to be started without priming.

A. Clutch assembly
B. Driver mounting base
C. Solid shaft drivers
D. Aligning the driver
E. Multi-staged
F. None of the Above

217. The _____changes the direction of flow from vertical to horizontal, and couples the pump to the system piping, in addition to supporting and aligning the driver.

A. Clutch assembly
B. Driver mounting base
C. Solid shaft drivers
D. Discharge head
E. Priming Capacity
F. None of the Above

Drivers

218. A variety of drivers may be used; however, electric motors are most common. For the purposes of this manual, all types of drivers can be grouped into two categories: _____ where the pump shaft extends through a tube in the center of the rotor and is connected to the driver by a clutch assembly at the top of the driver.

A. Clutch assembly
B. Driver mounting base
C. Solid shaft drivers
D. Aligning the driver
E. Hollow shaft drivers
F. None of the Above

219. Solid shaft drivers where the _____is solid and projects below the driver mounting base. This type of driver requires an adjustable flanged coupling for connecting to the pump.

A. Clutch assembly
B. Rotor shaft
C. Solid shaft drivers
D. Aligning the driver
E. Priming Capacity
F. None of the Above

Discharge Head Assembly

220. The discharge head supports the driver and bowl assembly as well as supplying a discharge connection (the "_____" type discharge connection which will be located on one of the column pipe sections below the discharge head).

A. NUF
B. Head and pump bowls
C. Discharge head
D. An open shaft
E. Several bowls are stacked in series
F. None of the Above

221. A shaft sealing arrangement is located in the discharge head to seal the shaft where it leaves the_____. The shaft seal will usually be either a mechanical seal assembly or stuffing box.

A. Single-stage pump
B. Line shaft
C. Liquid chamber
D. Semi-open or enclosed
E. Mechanical seal assembly
F. None of the Above

Column Assembly

222. The shaft and _____provides a connection between the head and pump bowls. The line shaft transfers the power from the motor to the impellers and the column carries the water to the surface.

A. Column assembly
B. Head and pump bowls
C. Discharge head
D. An open shaft
E. Several bowls are stacked in series
F. None of the Above

223. The _____ on a turbine pump may be either water lubricated or oil lubricated. The oil-lubricated pump has an enclosed shaft into which oil drips, lubricating the bearings.

A. Single-stage pump
B. Line shaft
C. Oil drips
D. Semi-open or enclosed
E. Mechanical seal assembly
F. None of the Above

224. The water-lubricated pump has_____. The bearings are lubricated by the pumped water.

A. 10-foot centers
B. Head and pump bowls
C. Discharge head
D. An open shaft
E. Bowls are stacked in series
F. None of the Above

225. If there is a possibility of fine sand being pumped, select the oil lubricated pump because it will keep the _____of the bearings. If the water is for domestic or livestock use, it must be free of oil and a water-lubricated pump must be used.

A. Single-stage pump
B. Line shaft
C. Sand out
D. Semi-open or enclosed
E. Mechanical seal assembly
F. None of the Above

226. Line shaft bearings are commonly placed on _____ for water-lubricated pumps operating at speeds under 2,200 RPM and at 5-foot centers for pumps operating at higher speeds.

A. 10-foot centers
B. Head and pump bowls
C. Discharge head
D. An open shaft
E. Several bowls are stacked in series
F. None of the Above

227. Oil-lubricated bearings are commonly placed on _____.

A. 10-foot centers
B. Head and pump bowls
C. Discharge head
D. An open shaft
E. 5-foot centers
F. None of the Above

228. A _____encloses the impeller. Due to its limited diameter, each impeller develops a relatively low head. In most deep well turbine installations, several bowls are stacked in series one above the other. This is called staging.

A. Pump bowl
B. Head and pump bowls
C. Discharge head
D. An open shaft
E. Several bowls are stacked in series
F. None of the Above

229. A _____contains four impellers; all attached to a common shaft and will operate at four times the discharge head of a single-stage pump.
A. Single-stage pump D. Semi-open or enclosed
B. Line shaft E. Four-stage bowl assembly
C. Fine sand F. None of the Above

230. _____used in turbine pumps may be either semi-open or enclosed.
A. Single-stage pump D. Semi-open or enclosed
B. Line shaft E. Mechanical seal assembly
C. Impellers F. None of the Above

231. The vanes on semi-open impellers are open on the bottom and they rotate with a close tolerance to the bottom of the_____.
A. Pump bowl D. Lineshaft bearings
B. Bowls E. Discharge head
C. Suction bell F. None of the Above

232. The _____ and must be adjusted when the pump is new. During the initial break-in period the line shaft couplings will tighten, therefore, after about 100 hours of operation, the impeller adjustments should be checked.
A. Pumping level D. Upward adjustment
B. Tolerance E. Utilizes the fluid
C. Discharge head F. None of the Above

233. After break-in, the tolerance must be checked and adjusted every _____ or more often if pumping sand.
A. Bowl shaft D. Lineshaft bearings
B. Bowls E. Discharge head
C. Suction bell F. None of the Above

234. Column assembly is of two basic types, either of which may be used:
Open _____construction utilizes the fluid being pumped to lubricate the lineshaft bearings.
A. Pumping level D. Upward adjustment
B. Lineshaft E. Utilizes the fluid
C. Discharge head F. None of the Above

235. Enclosed _____construction has an enclosing tube around the lineshaft and utilizes oil, grease, or injected liquid (usually clean water) to lubricate the lineshaft bearings.
A. Bowl shaft D. Lineshaft
B. Bowls E. Discharge head
C. Suction bell F. None of the Above

Column assembly will consist of:
236. Column pipe, which connects the _____to the discharge head,
A. Pumping level D. Upward adjustment
B. Bowl assembly E. Utilizes the fluid
C. Discharge head F. None of the Above

237. Shaft, connecting the bowl shaft to the _____and,
A. Bowl shaft D. Lineshaft bearings
B. Driver E. Discharge head
C. Suction bell F. None of the Above

238. May contain_____, if required, for the particular unit. Column pipe may be either threaded or flanged.
A. Line shaft D. Enclosed impellers
B. Bearings E. Suction bell
C. Column pipe F. None of the Above

239. Some units will not require_____, having the bowl assembly connected directly to the discharge head instead.
A. Bowl shaft D. Column assembly
B. Bowls E. Discharge head
C. Suction bell F. None of the Above

Bowl Assemblies
The bowl consists of:
240. Impellers rigidly mounted on the _____, which rotate and impart energy to the fluid,
A. Line shaft D. Enclosed impellers
B. Bowl shaft E. Suction bell
C. Column pipe F. None of the Above

241. _____ to contain the increased pressure and direct the fluid,
A. Bowl shaft D. Lineshaft bearings
B. Bowls E. Discharge head
C. Suction bell F. None of the Above

242. _____or case which directs the fluid into the first impeller, and
A. Line shaft D. Enclosed impellers
B. Bowl shaft E. Suction bell
C. Column pipe F. None of the Above

243. Bearings located in the suction bell (or case) and in each _____.
A. Bowl shaft D. Lineshaft bearings
B. Bowl E. Discharge head
C. Suction bell F. None of the Above

244. Both types of _____may cause inefficient pump operation if they are not properly adjusted.
A. Line shaft D. Enclosed impellers
B. Bowl shaft E. Impellers
C. Column pipe F. None of the Above

245. Mechanical damage will result if the semi-open impellers are set too low and the vanes rub against the bottom of the _____.
A. Bowl shaft D. Lineshaft bearings
B. Bowls E. Discharge head
C. Suction bell F. None of the Above

246. The adjustment of _____ is not as critical; however, they must still be checked and adjusted.
A. Line shaft D. Enclosed impellers
B. Bowl shaft E. Suction bell
C. Column pipe F. None of the Above

247. Impeller adjustments are made by tightening or loosening a nut on the top of the _____.
A. Line shaft D. Head assembly
B. Bowl shaft E. Suction bell
C. Column pipe F. None of the Above

248. _____are normally made by lowering the impellers to the bottom of the bowls and adjusting them upward.
A. Bowl shaft D. Lineshaft bearings
B. Bowls E. Impeller adjustments
C. Suction bell F. None of the Above

249. The amount of _____is determined by how much the line shaft will stretch during pumping.
A. Pumping level D. Upward adjustment
B. Tolerance E. Utilizes the fluid
C. Discharge head F. None of the Above

250. The adjustment must be made based on the lowest possible pumping level in the well. The proper adjustment procedure if often provided by the_____.
A. Pumping level D. Upward adjustment
B. Tolerance E. Pump manufacturer
C. Discharge head F. None of the Above

Stuffing Box Adjustment
251. On the initial starting it is very important that the packing gland not be tightened too much. New packing must be "_____" properly to prevent damage to the shaft and shortening of the packing life.
A. Packing gland D. Lineshaft bearings
B. Run in E. Variances
C. Impending trouble F. None of the Above

252. The stuffing box must be allowed to leak for_____. The proper amount of leakage can be determined by checking the temperature of the leakage; this should be cool or just lukewarm — NOT HOT.
A. Periodic inspection D. Any deviation in performance
B. Proper operation E. Gravity flow system
C. Correct alignment F. None of the Above

253. When adjusting the _____, bring both nuts down evenly and in small steps until the leakage is reduced as required.
A. Packing gland D. Lineshaft bearings
B. Oil reservoir E. Variances
C. Impending trouble F. None of the Above

254. The nuts should only be tightened about ½ turn at a time at 20 to 30 minute intervals to allow the packing to "_____".
A. Run in D. Any deviation in performance
B. Stuffing box E. Gravity flow system
C. Correct alignment F. None of the Above

255. Under proper operation, a set of packing will last a long time. Occasionally a new ring of packing will need to be added to keep the_____.
A. Packing gland D. Lineshaft bearings
B. Box full E. Variances
C. Impending trouble F. None of the Above

256. After adding two or three rings of packing, or when proper adjustment cannot be achieved, the _____should be cleaned completely of all old packing and re-packed.
A. Periodic inspection D. Any deviation in performance
B. Stuffing box E. Gravity flow system
C. Correct alignment F. None of the Above

Lineshaft Lubrication
257. Open _____ are lubricated by the pumped fluid and on close coupled units (less than 30' long), will usually not require pre or post lubrication.
A. Packing gland D. Lineshaft bearings
B. Oil reservoir E. Variances
C. Impending trouble F. None of the Above

258. Enclosed _____are lubricated by extraneous liquid (usually oil or clean water), which is fed to the tension nut by either a gravity flow system or pressure injection system. The gravity flow system utilizing oil is the most common arrangement.
A. Periodic inspection D. Any deviation in performance
B. Stuffing box E. Gravity flow system
C. Lineshaft bearings F. None of the Above

259. The oil reservoir must be kept filled with a good quality _____(about 150 SSU at operating temperature) and adjusted to feed 10 to 12 drops per minute plus one (1) drop per 100' of setting.
A. Packing gland D. Lineshaft bearings
B. Oil reservoir E. Light turbine oil
C. Impending trouble F. None of the Above

260. Injection systems are designed for each installation — injection pressure and quantity of lubricating liquid will vary. Refer to _____ for requirements when unit is designed for injection lubrication.
A. Packing gland D. Lineshaft bearings
B. Oil reservoir E. Variances
C. Impending trouble F. None of the Above

General Maintenance Section
261. A _____is recommended as the best means of preventing breakdown and keeping maintenance costs to a minimum.
A. Annual inspection D. Any deviation in performance
B. Stuffing box E. Periodic inspection
C. Correct alignment F. None of the Above

262. Maintenance personnel should look over the whole installation with a critical eye each time the pump is inspected — a change in noise level, amplitude or vibration, or performance can be _____.
A. Packing gland D. Lineshaft bearings
B. Oil reservoir E. Variances
C. Impending trouble F. None of the Above

263. _____ or operation from what is expected can be traced to some specific cause.
A. Periodic inspection D. Any deviation in performance
B. Stuffing box E. Gravity flow system
C. Correct alignment F. None of the Above

264. _____ or improper operation is essential to the correction of the trouble — whether the correction is done by the user, the dealer or reported back to the factory.
A. Packing gland D. Lineshaft bearings
B. Oil reservoir E. Variances
C. Impending trouble F. None of the Above

265. _____ from initial performance will indicate changing system conditions or wear or impending breakdown of unit.
A. Packing gland D. Lineshaft bearings
B. Oil reservoir E. Variances
C. Impending trouble F. None of the Above

266. Deep well turbine pumps must have _____ between the pump and the power unit.
A. Periodic inspection D. Any deviation in performance
B. Stuffing box E. Gravity flow system
C. Correct alignment F. None of the Above

267. _____is made easy by using a head assembly that matches the motor and column/pump assembly. It is very important that the well is straight and plumb.
A. Packing gland D. Correct alignment
B. Oil reservoir E. Variances
C. Impending trouble F. None of the Above

268. The _____must be vertically aligned so that no part touches the well casing.
A. Periodic inspection D. Pump column assembly
B. Stuffing box E. Gravity flow system
C. Correct alignment F. None of the Above

269. Spacers are usually attached to the pump column to prevent the pump assembly from touching the well casing. If the _____does touch the well casing, vibration will wear holes in the casing.
A. Packing gland D. Lineshaft bearings
B. Pump column E. Variances
C. Impending trouble F. None of the Above

270. A _____out of vertical alignment may also cause excessive bearing wear.
A. Periodic inspection D. Pump column
B. Stuffing box E. Gravity flow system
C. Correct alignment F. None of the Above

271. The _____must be mounted on a good foundation at least 12 inches above the ground surface. A foundation of concrete provides a permanent and trouble-free installation. The foundation must be large enough to allow the head assembly to be securely fastened.
A. Packing gland D. Lineshaft bearings
B. Oil reservoir E. Head assembly
C. Impending trouble F. None of the Above

272. The foundation should have at least 12 inches of bearing surface on all sides of the well. In the case of a gravel-packed well, the 12-inch clearance is measured from the outside edge of the _____.
A. Periodic inspection D. Gravel packing
B. Stuffing box E. Gravity flow system
C. Correct alignment F. None of the Above

Centrifugal Pump

273. By definition, a _____is a machine. More specifically, it is a machine that imparts energy to a fluid. This energy infusion can cause a liquid to flow, rise to a higher level, or both.

A. Web of the ring
B. Centrifugal pump
C. Pump shaft
D. Vapor bound
E. Single-stage pump
F. None of the Above

274. The centrifugal pump is an extremely simple machine. It is a member of a family known as rotary machines and consists of two basic parts: 1) the rotary element or impeller and 2) the stationary element or_____.

A. Staging
B. Eye
C. Pressure
D. Lantern ring spacer
E. Casing (volute)
F. None of the Above

275. In operation, a centrifugal pump "_____" liquid out of the impeller via centrifugal force. One fact that must always be remembered:

A. Web of the ring
B. Slings
C. Pump shaft
D. Vapor bound
E. Single-stage pump
F. None of the Above

276. A pump does not create pressure, it only provides flow. Pressure is just an indication of the amount of_____.

A. Staging
B. Eye
C. Pressure
D. Resistance to flow
E. Recirculation lines
F. None of the Above

277. Centrifugal pumps may be classified in several ways. For example, they may be either SINGLE STAGE or MULTI-STAGE. A _____ has only one impeller. A multi-stage pump has two or more impellers housed together in one casing.

A. Web of the ring
B. CLOSED or OPEN
C. Pump shaft
D. Vapor bound
E. Single-stage pump
F. None of the Above

278. As a rule, each impeller acts separately, discharging to the suction of the next stage impeller. This arrangement is called_____.

A. Staging
B. Series staging
C. Pressure
D. Lantern ring spacer
E. Recirculation lines
F. None of the Above

279. Centrifugal pumps are also classified as HORIZONTAL or VERTICAL, depending upon the position of the pump shaft. The impellers used on centrifugal pumps may be classified as _____.

A. Web of the ring
B. CLOSED or OPEN
C. Pump shaft
D. SINGLE SUCTION or DOUBLE SUCTION
E. Single-stage pump
F. None of the Above

280. The single-suction impeller allows liquid to enter the eye from one side only. The double-suction impeller allows liquid to enter the _____ from two directions.

A. Staging
B. Eye
C. Pressure
D. Lantern ring spacer
E. Recirculation lines
F. None of the Above

281. _____are also classified as CLOSED or OPEN.
A. Web of the ring D. Impellers
B. CLOSED or OPEN E. Single-stage pump
C. Pump shaft F. None of the Above

282. _____have side walls that extend from the eye to the outer edge of the vane tips.
A. Staging D. Closed impellers
B. Eye E. Recirculation lines
C. Pressure F. None of the Above

283. Open impellers do not have these side walls. Some small pumps with single-suction impellers have only a casing wearing ring and no_____. In this type of pump, the casing wearing ring is fitted into the end plate.
A. Staging D. Lantern ring spacer
B. Eye E. Recirculation lines
C. Impeller ring F. None of the Above

284. _____are installed on some centrifugal pumps to prevent the pumps from overheating and becoming vapor bound, in case the discharge is entirely shut off or the flow of fluid is stopped for extended periods.
A. Web of the ring D. Recirculation lines
B. CLOSED or OPEN E. Single-stage pump
C. Pump shaft F. None of the Above

285. _____is installed to cool the shaft and the packing, to lubricate the packing, and to seal the rotating joint between the shaft and the packing against air leakage.
A. Staging D. Lantern ring spacer
B. Eye E. Recirculation lines
C. Seal piping F. None of the Above

286. A _____is inserted between the rings of the packing in the stuffing box.
A. Web of the ring D. Vapor bound
B. Lantern ring spacer E. Single-stage pump
C. Pump shaft F. None of the Above

287. Seal piping leads the liquid from the discharge side of the pump to the annular space formed by the_____.
A. Staging D. Lantern ring spacer
B. Eye E. Recirculation lines
C. Lantern ring F. None of the Above

288. The web of the ring is perforated so that the water can flow in either direction along the shaft (between the_____).
A. Web of the ring D. Vapor bound
B. Shaft and the packing E. Single-stage pump
C. Pump shaft F. None of the Above

289. _____are fitted on the shaft between the packing gland and the pump bearing housing.
A. Staging D. Lantern ring spacer
B. Water flinger rings E. Recirculation lines
C. Pressure F. None of the Above

290. These flingers prevent water in the _____from flowing along the shaft and entering the bearing housing.

A. Web of the ring D. Vapor bound
B. Stuffing box E. Single-stage pump
C. Pump shaft F. None of the Above

Centrifugal Pump

291. As the impeller rotates, it sucks the liquid into the center of the pump and throws it out under pressure through the_____.
A. Web of the ring D. Vapor bound
B. Outlet E. Single-stage pump
C. Pump shaft F. None of the Above

292. The casing that houses the impeller is referred to as the_____, the impeller fits on the shaft inside. The volute has an inlet and outlet that carries the water as shown above.
A. Staging D. Lantern ring spacer
B. Eye E. Recirculation lines
C. Volute F. None of the Above

NPSH - Net Positive Suction Head

293. NPSH (a) must exceed NPSH(r) to allow pump operation without cavitation. (It is advisable to allow approximately 1 meter difference for most installations.) The other important fact to remember is that _____at much less than 100 degrees C if the pressure acting on it is less than its vapor pressure, i.e. water at 95 degrees C is just hot water at sea level, but at 1500m above sea level it is boiling water and vapor.
A. Pump suction D. Rotational speed
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

294. The vapor pressure of water at 95 degrees C is 84.53 kPa, there was enough atmospheric pressure at _____ to contain the vapor, but once the atmospheric pressure dropped at the higher elevation, the vapor was able to escape.
A. Centrifugal Pump D. Atmospheric pressure
B. Transmit tension E. Laws of Affinity
C. Most economical F. None of the Above

295. NPSH(r) is the Net Positive Suction Head Required by the pump, which is read from the_____. (Think of NPSH(r) as friction loss caused by the entry to the pump suction.)
A. Pump suction D. Pump performance curve
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

Affinity Laws

296. The Centrifugal Pump is a very capable and_____. Because of this it is unnecessary to design a separate pump for each job.
A. Centrifugal Pump D. Atmospheric pressure
B. Transmit tension E. Flexible machine
C. Most economical F. None of the Above

297. The performance of a centrifugal pump can be varied by changing the _____or its rotational speed.
A. Pump suction D. Rotational speed
B. Speed E. Impeller diameter
C. Suction conditions F. None of the Above

298. Either change produces approximately the same results. Reducing impeller diameter is probably the most common change and is usually the_____.
A. Most economical D. Atmospheric pressure
B. Transmit tension E. Laws of Affinity
C. Most economical F. None of the Above

299. The speed can be altered by changing _____or by changing the speed of the driver. In some cases both speed and impeller diameter are changed to obtain the desired results.
A. Pump suction D. Rotational speed
B. Pulley diameters E. Hydraulic efficiency
C. Suction conditions F. None of the Above

300. Whether it be a _____or change in impeller diameter, the Laws of Affinity give results that are approximate.
A. Centrifugal Pump D. Speed change
B. Transmit tension E. Laws of Affinity
C. Most economical F. None of the Above

301. The discrepancy between the _____and the actual values obtained in test are due to hydraulic efficiency changes that result from the modification.
A. Calculated values D. Rotational speed
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

302. The _____ give reasonably close results when the changes are not more than 50% of the original speed or 15% of the original diameter.
A. Centrifugal Pump D. Atmospheric pressure
B. Transmit tension E. Laws of Affinity
C. Most economical F. None of the Above

303. _____ are some of the most important factors affecting centrifugal pump operation. If they are ignored during the design or installation stages of an application, they will probably come back to haunt you.
A. Pump suction D. Rotational speed
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

Suction Lift
304. A pump cannot pull or "_____" a liquid up its suction pipe because liquids do not exhibit tensile strength. Therefore, they cannot transmit tension or be pulled.
A. Suck D. Atmospheric pressure
B. Transmit tension E. Laws of Affinity
C. Most economical F. None of the Above

305. When a pump creates a suction, it is simply reducing local pressure by creating a partial vacuum. _____or some other external pressure acting on the surface of the liquid pushes the liquid up the suction pipe into the pump.
A. Pump suction D. Rotational speed
B. Speed E. Atmospheric
C. Suction conditions F. None of the Above

306. Atmospheric pressure at sea level is called absolute pressure (PSIA) because it is a measurement using absolute zero (a perfect vacuum) as a base. If pressure is measured using atmospheric pressure as a base it is called _____.
A. Centrifugal Pump D. Atmospheric pressure
B. Transmit tension E. Laws of Affinity
C. Most economical F. None of the Above

307. Thus, 34 feet is the theoretical maximum suction lift for a pump pumping cold water at sea level. No pump can attain a suction lift of 34 ft; however, well designed ones can reach 25 ft quite easily. You will note, from the equation above, that _____can have a major effect on suction lift. For example, the theoretical maximum lift for brine (Specific Gravity = 1.2) at sea level is 28 ft..
A. Pump suction D. Rotational speed
B. Specific gravity E. Hydraulic efficiency
C. Suction conditions F. None of the Above

308. The realistic maximum is around 20ft. Remember to always factor in _____if the liquid being pumped is anything but clear, cold (68 degrees F) water.
A. Centrifugal Pump D. Atmospheric pressure
B. Specific gravity E. Laws of Affinity
C. Most economical F. None of the Above

309. In addition to pump design and_____, there are two physical properties of the liquid being pumped that affect suction lift.
A. Pump suction D. Suction piping
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

310. Maximum suction lift is dependent upon the pressure applied to the surface of the liquid at the suction source. _____decreases as pressure decreases.
A. Centrifugal Pump D. Atmospheric pressure
B. Transmit tension E. Laws of Affinity
C. Maximum suction lift F. None of the Above

311. _____is dependent upon the vapor pressure of the liquid being pumped. The vapor pressure of a liquid is the pressure necessary to keep the liquid from vaporizing (boiling) at a given temperature.
A. Pump suction D. Maximum suction lift
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

312. Vapor pressure increases as liquid temperature increases. _____decreases as vapor pressure rises.
A. Vapor pressure D. Rotational speed
B. Speed E. Maximum suction lift
C. Suction conditions F. None of the Above

313. It follows then, that the _____ of a centrifugal pump varies inversely with altitude. Conversely, maximum suction lift will increase as the external pressure on its source increases (for example: a closed pressure vessel).
A. Vapor pressure D. Rotational speed
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

Cavitation - Two Main Causes:
NPSH (r) EXCEEDS NPSH (a)
314. Due to low pressure the _____and higher pressure implodes into the vapor bubbles as they pass through the pump, causing reduced performance and potentially major damage.
A. Pump suction D. Water vaporizes (boils)
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

315. Suction or discharge recirculation. The pump is designed for a certain flow range, if there is not enough or too much flow going through the pump, the resulting _____can reduce performance and damage the pump.
A. Pump suction D. Turbulence and vortexes
B. Speed E. Hydraulic efficiency
C. Suction conditions F. None of the Above

Affinity Laws - Centrifugal Pumps
If the speed or impeller diameter of a pump changes, we can calculate the resulting performance change using:

Affinity laws
316. The flow changes proportionally to speed.
A. i.e.: double the speed / multiply the pressure by 4
B. i.e.: double the speed / double the flow
C. i.e.: double the speed / multiply the power by 8
D. None of the Above

317. The pressure changes by the square of the difference.
A. i.e.: double the speed / multiply the pressure by 4
B. i.e.: double the speed / double the flow
C. i.e.: double the speed / multiply the power by 8
D. None of the Above

318. The power changes by the cube of the difference.
A. i.e.: double the speed / multiply the pressure by 4
B. i.e.: double the speed / double the flow
C. i.e.: double the speed / multiply the power by 8
D. None of the Above

Pump Casing
319. There are many variations of centrifugal pumps. The most common type is an end suction pump. Another type of pump used is the split case. There are many variations of split case, such as; two-stage, single suction, and_____. Most of these pumps are horizontal.
A. Radial flow impellers D. Cupped vanes on blades
B. Double suction E. Shape of the vanes
C. Parallel to the shaft F. None of the Above

320. There are _____of vertical centrifugal pumps. The line shaft turbine is really a multistage centrifugal pump.

A. Shape of the vanes D. Critical distance of the impeller
B. Variations E. Discharge piping outlet
C. Parallel to the shaft F. None of the Above

Impeller

321. In most centrifugal pumps, the impeller looks like a number of cupped vanes on blades mounted on a_____.
A. Radial flow impellers D. Cupped vanes on blades
B. Axial flow impellers E. Disc or shaft
C. Parallel to the shaft F. None of the Above

322. The shape of the _____is important. As the water is being thrown out of the pump, this means you can run centrifugal pumps with the discharged valve closed for a SHORT period of time.
A. Shape of the vanes D. Critical distance of the impeller
B. Vanes of the impeller E. Discharge piping outlet
C. Parallel to the shaft F. None of the Above

323. The impellers all cause a flow from the eye of the impeller to the outside of the impeller. These impellers cause what is called_____, and they can be referred to as radial flow impellers.
A. Radial flow impellers D. Radial flow
B. Axial flow impellers E. Shape of the vanes
C. Parallel to the shaft F. None of the Above

324. The _____ of the impeller and how it is installed in the casing will determine if it is high volume / low pressure or the type of liquid that could be pumped.
A. Shape of the vanes D. Critical distance
B. Line shaft turbine E. Discharge piping outlet
C. Parallel to the shaft F. None of the Above

325. _____ look like a propeller and create a flow that is parallel to the shaft.
A. Radial flow impellers D. Cupped vanes on blades
B. Axial flow impellers E. Shape of the vanes
C. Parallel to the shaft F. None of the Above

Motor and Pump Calculations

326. The centrifugal pump pumps the difference between the suction and the discharge heads. There are three kinds of discharge head:
_____ The height we are pumping to, or the height to the discharge piping outlet that is filling the tank from the top. Note: that if you are filling the tank from the bottom, the static head will be constantly changing.
A. Static head D. System or dynamic head
B. Pump discharge head E. Negative suction head
C. Friction Loss F. None of the Above

327. _____ If we are pumping to a pressurized vessel (like a boiler) we must convert the pressure units (psi. or Kg.) to head units (feet or meters).
A. Positive suction head D. Negative suction head
B. Pressure head E. Total Dynamic Head (TDH)
C. Friction Loss F. None of the Above

328. _____ Caused by friction in the pipes, fittings, and system components. We get this number by making the calculations from published charts.
A. Static head D. System or dynamic head
B. Pump discharge head E. Negative suction head

C. Friction Loss F. None of the Above

Suction head is measured the same way.

329. If the liquid level is above the pump center line, that level is a positive suction head. If the pump is lifting a liquid level from below its center line, it is a _____.

A. Positive suction head D. Negative suction head
B. Friction E. Total Dynamic Head (TDH)
C. Friction Loss F. None of the Above

330. If the pump is pumping liquid from a pressurized vessel, you must convert this pressure to a positive suction head. A vacuum in the tank would be converted to a _____.

A. Static head D. System or dynamic head
B. Pump discharge head E. Negative suction head
C. Friction Loss F. None of the Above

331. Friction in the pipes, fittings, and associated hardware is a _____.

A. Positive suction head D. Negative suction head
B. Friction E. Total Dynamic Head (TDH)
C. Friction Loss F. None of the Above

332. Negative suction heads are added to the pump discharge head, positive suctions heads are subtracted from the_____.

A. Static head D. Pump discharge head
B. Pump discharge head E. Negative suction head
C. Friction Loss F. None of the Above

333. _____ is the total height that a fluid is to be pumped, taking into account friction losses in the pipe.

A. Positive suction head D. Negative suction head
B. Friction E. Total Dynamic Head (TDH)
C. Friction Loss F. None of the Above

334. _____is the head equivalent to the energy losses due to viscose drag of fluid flowing in the pipe (both on the suction and discharge sides of the pump). It is calculated via a formula or a chart, taking into account the pipe diameter and roughness and the fluid flow rate, density, and viscosity.

A. Static head D. System or dynamic head
B. Pump discharge head E. Negative suction head
C. Friction Loss F. None of the Above

Motor, Coupling and Bearing Section

335. The power source of the pump is usually an electric motor. The motor is connected by a coupling to the _____.

A. Static head D. System or dynamic head
B. Bearings E. Pump shaft
C. Pump assembly F. None of the Above

336. The purpose of the bearings is to hold the shaft firmly in place, yet allow it to rotate. The _____supports the bearings and provides a reservoir for the lubricant.
A. Static head D. System or dynamic head
B. Bearings E. Bearing house
C. Pump assembly F. None of the Above

337. An impeller is connected to the _____. The pump assembly can be a vertical or horizontal set-up; the components for both are basically the same.
A. Static head D. System or dynamic head
B. Bearings E. Shaft
C. Pump assembly F. None of the Above

Motors
338. The purpose of this discussion on _____is to identify and describe the main types of motors, starters, enclosures and motor controls, as well as to provide you with some basic maintenance and troubleshooting information. Although pumps could be driven by diesel or gasoline engines, pumps driven by electric motors are commonly used in our industry.
A. Heat generated D. Speed/torque characteristics
B. Synchronous type E. Full voltage or reduced voltage
C. Pump motors F. None of the Above

D-C Motors
339. The important characteristic of the D-C motor is that its speed will vary with the amount of current used. There are many different kinds of D-C motors, depending on how they are wound and their_____.
A. Bubbler pipe D. Totally enclosed motors
B. Manual pump controls E. Speed/torque characteristics
C. Wound rotor type F. None of the Above

A-C Motors
340. There are a number of different types of alternating current motors, such as Synchronous, Induction, wound rotor, and_____.
A. Bubbler pipe D. Totally enclosed motors
B. Manual pump controls E. Squirrel cage
C. Wound rotor type F. None of the Above

341. The _____ of A-C motor requires complex control equipment, since they use a combination of A-C and D-C. This also means that the synchronous type of A-C motor is used in large horsepower sizes, usually above 250 HP.
A. Heat generated D. Speed/torque characteristics
B. Synchronous type E. Full voltage or reduced voltage
C. Motor(s) F. None of the Above

342. The induction type motor uses only alternating current. The squirrel cage motor provides a relatively constant speed. The wound rotor type could be used as a_____.
A. Bubbler pipe D. Totally enclosed motor
B. Manual pump controls E. Reduced voltage starter
C. Variable speed motor F. None of the Above

Motor Starters

343. All electric motors, except very small ones such as chemical feed pumps, are equipped with starters, either full voltage or reduced voltage. This is because motors draw a much higher current when they are_____.

A. Heat generated
B. Synchronous type
C. Motor(s)
D. Starting and gaining speed
E. Full voltage or reduced voltage
F. None of the Above

344. The purpose of the _____is to prevent the load from coming on until the amperage is low enough.

A. Bubbler pipe
B. Manual pump controls
C. Reduced voltage starter
D. Totally enclosed motors
E. Reduced voltage starter
F. None of the Above

Motor Enclosures

345. Depending on the application, motors may need special protection. Some motors are referred to as open motors. They allow air to pass through to remove heat generated when current passes through the windings. Other motors use _____for special environments or safety protection.

A. Heat generated
B. Synchronous type
C. Motor(s)
D. Speed/torque characteristics
E. Full voltage or reduced voltage
F. None of the Above

346. Totally enclosed motors include dust-proof, water-proof and explosion-proof motors. An _____ must be provided on any motor where dangerous gases might accumulate.

A. Bubbler pipe
B. Manual pump controls
C. Explosion proof enclosure
D. Totally enclosed motors
E. Reduced voltage starter
F. None of the Above

Motor Controls

347. All _____are provided with some method of control, typically a combination of manual and automatic.

A. Heat generated
B. Synchronous type
C. Pump motors
D. Speed/torque characteristics
E. Full voltage or reduced voltage
F. None of the Above

348. _____ can be located at the central control panel at the pump or at the suction or discharge points of the liquid being pumped.

A. Bubbler pipe
B. Manual pump controls
C. Wound rotor type
D. Totally enclosed motors
E. Reduced voltage starter
F. None of the Above

349. Two typical level sensors are the float sensor and the bubble regulator. The _____is pear-shaped and hangs in the wet well. As the height increases, the float tilts, and the mercury in the glass tube flows toward the end of the tube that has two wires attached to it. When the mercury covers the wires, it closes the circuit.

A. Heat generated
B. Synchronous type
C. Float sensor
D. Speed/torque characteristics
E. Full voltage or reduced voltage
F. None of the Above

350. A low pressure air supply is allowed to escape from a _____ in the wet well. The back-pressure on the air supply will vary with the liquid level over the pipe. Sensitive air pressure switches will detect this change and use this information to control pump operation.

A. Bubbler pipe
B. Manual pump controls
C. Wound rotor type
D. Totally enclosed motors
E. Reduced voltage starter
F. None of the Above

Motor Maintenance

351. Motors should be kept clean, free of moisture, and lubricated properly. Dirt, dust, and grime will plug the _____and can actually form an insulating layer over the metal surface of the motor.

A. Heat generated
B. Synchronous type
C. Ventilating spaces
D. Speed/torque characteristics
E. Full voltage or reduced voltage
F. None of the Above

Moisture

352. Moisture harms the insulation on the windings to the point where they may no longer provide the required insulation for the _____applied to the motor. In addition, moisture on windings tend to absorb acid and alkali fumes, causing damage to both insulation and metals.

A. Bubbler pipe
B. Manual pump controls
C. Wound rotor type
D. Totally enclosed motors
E. Both insulation and metals
F. None of the Above

353. To reduce problems caused by moisture, the most suitable motor enclosure for the existing environment will normally be used. It is recommended to run stand by motors to dry up any _____ which accumulates in the motor.

A. Heat generated
B. Synchronous type
C. Condensation
D. Speed/torque characteristics
E. Full voltage or reduced voltage
F. None of the Above

Motor Lubrication

354. _____will cause wear in all moving parts, and lubrication is needed to reduce this friction. It is very important that all your manufacturer's recommended lubrication procedures are strictly followed. You have to be careful not to add too much grease or oil, as this could cause more friction and generate heat.

A. Bubbler pipe
B. Manual pump controls
C. Friction
D. Totally enclosed motors
E. Friction and generate heat
F. None of the Above

Review Statements

355. The speed at which the _____ rotates is called the motor's synchronous speed. It is expressed in revolutions per minute.

A. Two-pole motor
B. Lantern Ring
C. Axial-flow pump
D. Motor's synchronous speed
E. Magnetic field
F. None of the Above

356. For a motor that operates on an electric power system having a frequency of 60Hz, the maximum _____ is 3,600 rpm, or 60 revolutions per second.

A. Level sensors
B. High suction head
C. Synchronous speed
D. Suction areas
E. Backsiphonage
F. None of the Above

357. In other words, because the _____ changes its flow direction 60 times a second, the rotor can rotate 60 times per second. This speed is achieved by a two-pole motor.
A. Two-pole motor D. Motor's synchronous speed
B. Lantern Ring E. Electric current
C. Axial-flow pump F. None of the Above

358. _____ is a condition in which the pressure in the distribution system is less than atmospheric pressure. In other words, something is "sucked" into the system because the main is under a vacuum.
A. Level sensors D. Backpressure
B. High suction head E. Backsiphonage
C. Synchronous speed F. None of the Above

359. When a pump operates under suction, the impeller inlet is actually operating in a vacuum. Air will enter the water stream along the shaft if the packing does not provide an effective seal. It may be impossible to tighten the packing sufficiently to prevent air from entering without causing excessive heat and wear on the_____. To solve this problem, a Lantern Ring can be placed in the Stuffing Box.
A. Two-pole motor D. Packing and shaft or shaft sleeve
B. Lantern Ring E. Mechanical seals
C. Axial-flow pump F. None of the Above

360. If the pump must operate under high suction head, the suction pressure itself will compress the _____regardless of the operator's care.
A. Level sensors D. Suction areas
B. High suction head E. Packing rings
C. Synchronous speed F. None of the Above

361. _____will then require frequent replacement. Most manufactures recommend using mechanical seals for low-suction head conditions as well.
A. Two-pole motor D. Packing
B. Lantern Ring E. Mechanical seals
C. Axial-flow pump F. None of the Above

362. In general, any Centrifugal pump can be designed with a_____. Each stage requires an additional Impeller and casing chamber in order to develop increased pressure, which adds to the pressure developed by the preceding stage.
A. Level sensors D. Suction areas
B. High suction head E. Multistage configuration
C. Synchronous speed F. None of the Above

363. The axial-flow pump is often referred to as a_____.
A. Two-pole motor D. Motor's synchronous speed
B. Lantern Ring E. Mechanical seals
C. Propeller Pump F. None of the Above

364. In all centrifugal pumps, there must be a flow restriction between the _____and Suction areas that will prevent excessive circulation of water between the two parts.
A. Level sensors D. Suction areas
B. High suction head E. Impeller discharge
C. Synchronous speed F. None of the Above

365. _____ is designed to, 1. Prevent overflows from the storage tank or reservoir, or 2. Maintain a constant water level as long as water pressure in the distribution system is adequate.
A. Two-pole motor D. Motor's synchronous speed
B. Lantern Ring E. Mechanical seals
C. Axial-flow pump F. None of the Above

366. Float mechanisms, diaphragm elements, _____, and direct electronic sensors are common types of level sensors.
A. Level sensors D. Bubbler tubes
B. High suction head E. Backsiphonage
C. Synchronous speed F. None of the Above

367. The _____is designed so that it can be hydraulically balanced. The result is that the wearing force between the machined surfaces does not vary regardless of the suction head. Most seals have an operating life of 5,000 to 20,000 hours.
A. Suction pipe D. Split-phase motor
B. Mechanical seal E. Pressure-sensing device
C. Air relief valves F. None of the Above

368. _____is defined as the maximum momentary load placed on a water treatment plant, pumping station or distribution system.
A. Pump D. Partial demand
B. Vapor bubbles E. Peak demand
C. Blowoffs F. None of the Above

369. Concerning a single phase motor: If it is a split-phase motor, the motor will not have windings. A _____is very simple and less expensive than other single phase motors.
A. Suction pipe D. Split-phase motor
B. Cavitation E. Repulsion-induction motor
C. Air relief valves F. None of the Above

370. On most kilowatt meters, the current kilowatt load is indicated by _____on the meter.
A. Pump D. Partial vacuum
B. Vapor bubbles E. Disk revolutions
C. Blowoffs F. None of the Above

371. A _____is a check valve is located at the bottom end of the suction on a pump. This valve opens when the pump operates to allow water to enter the suction pipe but closes when the pump shuts off to prevent water from flowing out of the suction pipe.
A. Suction pipe D. Split-phase motor
B. Foot valve E. Pressure-sensing device
C. Air relief valves F. None of the Above

372. Distribution system water quality can be adversely affected by _____ or poorly located blowoffs of vacuum/air relief valves.
A. Pump D. Partial vacuum
B. Vapor bubbles E. Milky water
C. Blowoffs F. None of the Above

373. _____ in the distribution system lines must be placed in locations that cannot be flooded. This is to prevent water contamination.
A. Suction pipe D. Split-phase motor
B. Cavitation E. Pressure-sensing device
C. Air relief valves F. None of the Above

374. _____ is a common customer complaint is sometimes solved by the installation of air relief valves.
A. Pump D. Partial vacuum
B. Vapor bubbles E. Milky water
C. Blowoffs F. None of the Above

375. The most frequent problem that affects a _____is air accumulation at the sensor. The following are common pressure sensing devices: Helical Sensor, Bourdon Tube and Bellows Sensor.
A. Suction pipe D. Liquid pressure-sensing device
B. Cavitation E. Pressure-sensing device
C. Air relief valves F. None of the Above

Common Pump and Troubleshooting Questions
376. Cavitation is defined as the phenomenon of formation of _____of a flowing liquid in a region where the pressure of the liquid falls below its vapor pressure.
A. Vapor bubbles D. Turbulent flows
B. Vibration monitoring E. Low-pressure area
C. Suction nozzle F. None of the Above

377. One of the _____ an operator will encounter is cavitation. It can be identified by a noise that sounds like marbles or rocks are being pumped.
A. Suction pipe D. Split-phase motor
B. Cavitation E. Pressure-sensing device
C. Air relief valves F. None of the Above

378. The pump may also_____, to the point that piping is damaged, in some severe cases.
A. Vibrate and shake D. Partial vacuum
B. Vapor bubbles E. Milky water
C. Blowoffs F. None of the Above

379. Cavitation occurs when the pump starts discharging water at a rate faster than it can be _____.
A. Suction pipe D. Drawn into the pump
B. Cavitation E. Pressure-sensing device
C. Air relief valves F. None of the Above

380. This situation is normally caused by the loss of discharge head pressure or an obstruction in the suction line. When this happens, a _____ is created in the impeller causing the flow to become very erratic.
A. Pump D. Partial vacuum
B. Vapor bubbles E. Milky water
C. Blowoffs F. None of the Above

381. These _____are formed on the backside of the impeller vanes. When cavitation occurs, immediate action must be taken to prevent the impeller, pump and motor bearings, and piping from being damaged.

A. Suction pipe
B. Cavitation
C. Air relief valves
D. Vacuum-created cavities
E. Pressure-sensing device
F. None of the Above

382. _____can be temporarily corrected by throttling the discharge valve. This action prevents damage to the pump until the cause can be found and corrected. Remember that the discharge gate valve is there to isolate the pump, not control its flow.

A. Cavitation
B. Vapor bubbles
C. Blowoffs
D. Partial vacuum
E. Milky water
F. None of the Above

383. If it is left in a throttled position the valve face may become worn to the point that it won't _____ when the pump must be isolated for maintenance.

A. Pump
B. Vapor bubbles
C. Seal
D. Partial vacuum
E. Milky water
F. None of the Above

384. Butterfly valves can be throttled, but it is still not a good idea to _____with an isolation valve.

A. Force
B. Throttle a pump
C. Suction nozzle
D. Turbulent flows
E. Low-pressure area
F. None of the Above

385. Air and/or vacuum release valves are used to release trapped air or vacuums created in water pipelines. This unique structure allows the dynamic valves to discharge air from the water system in a controlled and gradual manner, preventing_____.

A. Sanitary seal
B. Sleeve bearing
C. Cavities
D. Trapped air or vacuums
E. Slam and local up-surges
F. None of the Above

386. When vacuum occurs, the _____will draw in large volumes of air into the water system, impeding down-surges and, consequently, all pressure surges in the line.

A. Force
B. Valves fast reaction
C. Suction nozzle
D. Turbulent flows
E. Low-pressure area
F. None of the Above

387. The _____ are normally closed when the line is not operating, thus preventing the infiltration of foreign particles and insects into the water system.

A. Sanitary seal
B. Sleeve bearing
C. Cavities
D. Trapped air or vacuums
E. Well Casing Perforations
F. None of the Above

388. A device placed into the topmost part of a well casing which, by means of an expanding gasket, excludes foreign material from entering the well and may be provided with a means for introducing disinfecting agents directly into the well, or a device producing an equivalent effect.

A. Force
B. Sanitary seal
C. Suction nozzle
D. Turbulent flows
E. Low-pressure area
F. None of the Above

389. _____ is used to maintain an open access in the earth while not allowing any entrance or leakage into the well from the surrounding formations. The most popular materials used for casing are black steel, galvanized steel, PVC pipe and concrete pipe.
A. Sanitary seal
B. Sleeve bearing
C. Cavities
D. Trapped air or vacuums
E. Well Casing
F. None of the Above

390. Is the process of creating holes in production casing to establish communication between the well and formation. Perforation holes are used to recover water from the ground.
A. Sanitary seal
B. Sleeve bearing
C. Cavities
D. Trapped air or vacuums
E. Well Casing Perforations
F. None of the Above

391. Perform _____ to detect failures or wait for excessive noise or heat. There are three types of bearings commonly used: ball bearings, roller bearings, and sleeve bearings.
A. Force
B. Vibration monitoring
C. Suction nozzle
D. Turbulent flows
E. Low-pressure area
F. None of the Above

392. Regardless of the particular type of bearings used within a system--whether it is ball bearings, a sleeve bearing, or a _____--the bearings are designed to carry the loads imposed on the shaft. Bearings must be lubricated.
A. Sanitary seal
B. Sleeve bearing
C. Cavities
D. Trapped air or vacuums
E. Roller bearing
F. None of the Above

393. Without proper lubrication, bearings will overheat and seize. Proper lubrication means using the correct type and the_____. Similar to motor bearings, shaft bearings can be lubricated either by oil or by grease.
A. Sanitary seal
B. Sleeve bearing
C. Cavities
D. Trapped air or vacuums
E. Correct amount of lubrication
F. None of the Above

394. The process liquid enters the suction nozzle and then into eye (center) of a revolving device known as an impeller.
A. Force
B. Vibration monitoring
C. Suction nozzle
D. Turbulent flows
E. Generation of Centrifugal Force
F. None of the Above

395. When the impeller rotates, it spins the liquid sitting in the cavities between the vanes outward and provides_____.
A. Sanitary seal
B. Sleeve bearing
C. Cavities
D. Trapped air or vacuums
E. Centrifugal acceleration
F. None of the Above

396. As liquid leaves the eye of the impeller a low-pressure area is created causing more liquid to flow toward the inlet. Because the_____, the fluid is pushed in a tangential and radial direction by the centrifugal force.
A. Force
B. Vibration monitoring
C. Impeller blades are curved
D. Turbulent flows
E. Low-pressure area
F. None of the Above

397. This _____ acting inside the pump is the same one that keeps water inside a bucket that is rotating at the end of a string.

A. Force
B. Vibration monitoring
C. Suction nozzle
D. Turbulent flows
E. Low-pressure area
F. None of the Above

398. _____caused by pump discharges, elbows and swedges upstream of a valve will also cause the discs to flutter excessively. Be careful not to create a water hammer.

A. Valve(s)
B. Foot valve
C. Suction nozzle
D. Pump discharges
E. Turbulent flows
F. None of the Above

Proper procedure for starting a pump.

399. Fill the pump with liquid, crack open the _____and start the motor. But, as you would guess, it is a little more complicated than that.

A. Valve(s)
B. Foot valve
C. Suction nozzle
D. Pump discharges
E. Discharge valve
F. None of the Above

400. We'll begin by making sure the pump is filled with liquid. There are several ways to do that: Install a _____ in the suction piping to insure the liquid will not drain from the pump casing and suction piping. Keep in mind that these valves have a nasty habit of leaking.

A. Valve(s)
B. Foot valve
C. Suction nozzle
D. Pump discharges
E. Fill the pump with liquid
F. None of the Above

You are finished with your assignment…. Please fax or e-mail the answer key and registration form and always call us to ensure we've received the paperwork.