200+ Piping Interview Questions & Answers

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PIPING QUIZ & ANSWERS

1. What is the pipe size range, per Fluor Daniel standard, for pipe spools that are to be shop fabricated?

Ans: 3” diameter and larger <2.1/2” and larger>

2. What is the pipe size range, per Fluor Daniel standard, for pipe spools that are to be field fabricated?

Ans: 2” diameter and smaller

3. Define what piping is considered field assembly?

Ans: Off-the-shelf components that make-up a piping assembly and do not require cutting and / or welding
<If no field fabrication is required>

4. Define what piping is considered rack loaded, per Fluor Daniel standard, and what pipe size ranges is involved?

Ans: Piping in the PIPERACK that crosses two or more supports. 3” and larger

5. All shop fabricated piping spools (mark pieces) are shipped from the fabrication shop in a geometry that is defined by length, width, and height. Assuming it to be a box, there are two situations that you must avoid in regard to the box and the mark pieces within. Describe these two situations and describe the undesirable result if you do not avoid them?

Ans: Piece mark must fit within the shipping box otherwise it may not be transported. Skewed placement of the piece mark within the shipping box could result in crowding out other piece marks. <Press fit should be avoided to ensure piece mark fits shipping box>

6. Define a field weld (FW) and when it is used?

Ans: Field Weld is made somewhere other than the fabrication shop. Used to connect two mark pieces (or components) together

7. Describe three things you must consider when locating a field weld and why they must be considered?

Ans: Accessibility:

The weld must be in a place that is accessible to the welder

Constructability:

The weld must be placed so the constructors can position the piece mark prior to welding. Size of spool piece to ensure it fits shipping box and can be transported.

Economics:

Made in a location that would lessen or eliminate the need for additional scaffolding. Self-supporting so temporary supports are not required during construction. Made on the smaller side of a reducer; preferably made in the horizontal.

8. Describe a field fit-up weld (FFW) and when it is used?

Ans: Field Fit Weld is a weld made somewhere other than the fabrication shop. The fabrication shop adds additional length of material to the spool piece. This additional length gives the field variance for adjustment when the location of the connecting point is not known. <May require field alteration>

9. Per Fluor Daniel standard, what is the construction (fitting type) of:

Ans: Pipe size range 2 ½” and larger? Butt-weld

Pipe size range 2” and smaller? Socket Welded

Pipe size range 2” and smaller? Screwed or Threaded

10. What is the minimum (not absolute minimum) distance between welds that Fluor Daniel likes to use?

Ans: 3 inches

11. What is the absolute minimum distance between welds (used only as a last choice)?

Ans: Pipe Size (NPS) Min. distance b/w welds

1/8” 3/16

1 /4” 1/4

3/8" 5/16

1/2" 7/16

3/4" 1/2

1" 11/16

1 1/4" 13/16

1 1/2" 15/16

2" 1 3/16

2 1/2" 1 9/16

3" 1 3/4

3 1/2" 2

4" 2 1/4

5" 2 3/4

Half the outside diameter of pipe (6" and larger)

12. What do the letters HAZ mean?

Ans: Heat Affected Zone

13. What is the effect of the HAZ?

Ans: Weakens the material (pipe wall)

14. How far from the weld, is the HAZ?

Ans: ¼" or 1"

15. Why do piping designers care about the HAZ?

Ans: If two HAZ's overlap each other it may result in failure of the pipe

16. When is the HAZ considered in threaded construction?

Ans: When threaded connection is seal welded

17. What are the pressure ratings of forged steel Socket Weld Fittings?

Ans: 3000#

6000#

18. What are the pressure ratings of forged steel threaded fittings?

Ans: 2000#

3000#

6000#

19. What are the pressure ratings of malleable iron threaded Fittings?

Ans: 150#

300#

20. What are the pressure ratings of cast iron threaded fittings?

Ans: 125#

250#

21. List the wall thickness for pipe, starting with the thinnest wall to the heaviest wall:

Ans: Carbon Steel & Alloy steel (13 schedules)

Sch 10,

Sch 20,

Sch 30,

Sch 40,

Std Wt,

Sch 60,

Sch 80,

XS,
Sch 100,
Sch 120,
Sch 140,
Sch 160,
XXS

Stainless Steel (4 schedules)

Sch 5S,
Sch 10S,
Sch 40S,
Sch 80S

22. What is the technical term used for the sag in pipe caused by gravity and how does affect piping design?

Ans: Deflection; It govern the amount of pipe span
<Causes leakage at flanges>
<Causes stress on pipe>

23. If one 4" carbon steel pipe is schedule 40 and another 4" carbon steel pipe is schedule 80….? Which has the greater sag and why?

Ans: 4" sch. 40 has the greater sag because its wall thickness is less than the wall thickness of the sch. 80 - the thinner the wall, the shorter the length the line will span.

Which weighs more and why?

Ans; 4" sch. 80 because it's wall thickness is more than that of the sch. 40, more material = more weight.

Which requires fewer support point and why?

Ans: 4" sch. 80 because it's thicker wall allows it to span farther, reducing the number of times support is needed.
<More rigid / stiffer>

24. Pipeway/Piperack loading/stuffing drawings.

Which lines qualify for loading/stuffing?

Ans: Lines 3" and larger that cross two or more pipe supports.

Why is loading/stuffing done (the advantages)?

Ans: It provides an early start for construction. It reduces the amount of ground area taken by storage of pipe

25. Line size changes

When is swage used for a line size change?

Ans; When reducing from or to socket welded or threaded construction on at least one end.

When is a butt-weld reducer used for a line size change?

Ans: When reducing from or to butt welded construction on both ends.

When/where do you use eccentric, bottom flat swages or reducers and why?

Ans: In any horizontal run of pipe, that has two or more supports within that run.
To maintain a common bottom of pipe elevation for the two line sizes.

When/where do you use eccentric, top flat swages or reducers and why?

Ans: Used at the final reduction on a pump end suction line. To prevent cavitations of the pump

When/where do you use eccentric, side flat swages or reducers and why?

Ans: Used when two equipment connections are so close that the two connecting, adjacent lines interfere with each other after the line size change.
If they are side flat toward each other, the lines may clear.
<Used on vertical pipe to maintain common back of pipe>

When do you use butt-weld reducing 90 degree elbows and why?

Ans: Normally it is not FLUOR piping practice to use reducing butt-weld 90 degree reducing elbows.

If they are used, it will be where a size change is required and there is insufficient space available for an elbow and a reducer or an elbow and a reducing flange - or if the client requires it.

Why would a short radius butt-weld 90-degree elbow be used?

Ans: To adhere to FLUOR piping practice 000 250 2650 where it states 10" and larger elbows at a nozzle of a vertical vessel are short radius (decreases the "l" dimension so a standard vessel pipe support can be used).

<Space limitations>

Why would a short radius butt-weld 90-degree elbow not be used?

Ans: It is easy to "lose" a short radius elbow if shipped to the jobsite or fabrication shop with long radius elbows of the same size.

Additional tracking effort may result to keep the short radius elbow from being "lost" or used inadvertently where it was not intended to be used.

Often the use of a short radius elbow requires client approval, or process review, or stress approval - all taking time that would not be taken for a long radius elbow.

<when pressure drop is a concern – short radius elbow has more pressure drop.

26. What is a trimmed elbow and when is it used?

Ans: A trimmed elbow is a butt weld 90 degree long radius elbow that is cut and beveled to match the original bevel, the resulting change of direction is no longer 90 degrees but is a non-standard angle suited for the piping geometry requiring it.

Trimmed elbows are used when a line routing must have a change of direction that is not satisfied by a 90 or 45-degree elbow or by elbows being rolled or offset.

27. Describe a stub-on connection and when it is used?

Ans: A stub-on connection is a branch connection made to a header without the use of fittings - the connection is made from pipe. The branch pipe is contoured (fish-mouthed) to match the curvature of the header to which it will be connected (a fillet weld). A hole is made in the header that should match the inside diameter of the branch pipe. The stub-on connection is not the same construction as a stub-in connection - but the resulting geometry is the same as a stub-on. Stub-on connections are generally 90 degree, but can be other angles. Branch table

28. Describe a stub-in connection and when it is used?

Ans: Fluor piping does not use the stub-in construction. A stub-in connection is the same as a stub-on connection as far as the resulting geometry and material goes, but the construction is different. The branch pipe may or may not be contoured to match the inside diameter of the header - if it is not, then it is a straight cut. The header will have a hole cut in it that nearly matches the outside diameter of the branch pipe. The branch pipe is inserted into the hole in the header and is connected via a fillet weld. Like the stub-on, the stub-in is generally 90 degree and other angles are possible. Client request

29. Describe a reinforcing pad and when it is used?

Ans: Reinforcing pads are made from the same size, wall thickness and material as the pipe header to which they are welded. Reinforcing pads are used at stub-on and stub-in branch connections and occasionally at support trunnions when specified by the stress sketch, if required per the line list or if required per the branch chart in the piping material specification.

30. What document (name and 5-diget number) does a piping designer refer to determine what branch connection to use?

Ans: Piping material specification

31. What are the two documents (not specifications) that will tell a piping designer when branch reinforcement is required?

Ans: Stress sketch

Line list

<Branch chart>

32. What is the pipe size range in which all flanges are standard?

Ans: 24 inch and smaller

33. What is the pipe size range in which all flanges are not standard?

Ans: 26 inch and larger

34. List the information to be placed on the isometric that will fully describe a non-standard flange and what is the reason we would include this information?

Ans: Reason for including the information.

To guarantee, without failure, the flanges are compatible.

Information to be placed on ISOMETRICS?

ANSI number or other industry number (API, MSS)

Size

Rating

Facing

Outside diameter of flange

Bolt circle diameter

Bolt Hole diameter

Number of bolt holes

Flange bore

Material

Bolt hole orientation

Flange thickness

35. What facing is required on a steel flange that will be bolted to a cast iron flange and why?

Ans: Flat Face

There is a risk of breaking the cast iron flange if it is bolted to a raised face steel flange.

36. What are two pressure ratings of cast iron flanges and what are the ratings of compatible steel flanges?

Ans: 125# Cast iron to 150# steel,

250# cast iron to 300# steel

37. How is cast iron flange attached to steel pipe?

Ans: The flange is threaded on.

38. What are two reasons for using lap joint construction?

Ans: To reduce the cost of components - a less expensive carbon steel flange may be used in lieu of a stainless steel flange.

Flange can be rotated to aid in bolt-hole alignment.

39. What fitting (not flange) must be used in lap joint construction and what are the names of this two types of fittings?

Ans: Stub end <Lap joint stub end>

ANSI & MSS

40. What is the difference between a van stone flange and a slip on flange?

Ans: The shape of the contact point where the face of flange contacts the lip of the stub end is rounded on the van stone flange and is square on the slip on flange.

41. In lap joint construction, how many welds are on a slip flange?

Ans: Zero

42. In lap joint construction, how many welds are on a van stone flange?

Ans: Zero

43. List the types of steel flanges?

Ans: Weld neck

Slip on

Threaded

Socket welded

Van stone

Reducing

Expanding

Blind

<Lap joint>

<Orifice>

<Slip on reducing>

44. List the faces of steel flanges?

Ans: Raised face

Flat face

Ring joint

Tongue and groove

Male & Female

45. List the ratings of steel flanges?

Ans: 150#

300#

400#

600#

900#

1500#

2500#

46. How are flange bolt-holes oriented on flanges on vertical line?

Ans: Bolt-holes straddle the north-south-east-west flange centerlines

47. How are flange bolt-holes oriented on flanges on horizontal line?

Ans: Bolt-holes straddle the vertical and horizontal flange centerlines

48. Valves are used for three basic flow functions (not control valves or pressure safety valves). List three functions and the type of valve used for each function?

Ans: Function

BLOCK THROTTLE CHECK

<Start / stop> <prevent back flow>

Type

GATE/BALL/PLUG/BUTTERFLY <needle> – BLOCK

GLOBE <plug or butterfly or needle> – THROTTLE

CHECK – CHECK

49. What are the two styles of butterfly valves in flanged piping and their associated type of bolt?

Ans: A. WAFER - STUD BOLT/MACHINE BOLT

B. LUG TYPE - CAP SCREW

50. What are the two main styles of check valves in flanged piping and their associated type of bolt?

Ans: A. SWING - STUD BOLT/MACHINE BOLT

B. WAFER/SPLIT DISC - STUD BOLT/MACHINE BOLT

51. Not using a ladder or platform, how is a valve operated that is:

Ans: Too high - CHAIN OPERATOR

Too low - EXTENSION STEM

52. What is the minimum clearance between the outside diameter of a valve hand wheel and the next obstruction?

Ans: Three inches

53. If a valve hand wheel projects into an aisle way, to what elevation must the bottom of the hand wheel be raised above HPFS (High Point Finished Surface) or platform?

Ans: 6'-6" plus or minus 3" (6'-3" to 6'-9")

54. What manually operated item is added to a valve that is either to large or is too high a pressure to operate and how do you know it will be required (give the name of the specification)?

Ans: - A GEAR OPERATOR

- MATERIAL SPECIFICATION

55. If a pressure safety valve has a block vale upstream of it, what note must appear on the P&ID relating to this block valve and why?

Ans: • CSO (car sealed open) or LO (locked open).

• To help ensure that the valve is open during normal plant operation so that if a condition resulting in over pressurization occurs, the valve is open and the relief valve can function properly.

56. If a pressure safety valve downstream of it, what note must appear on the P&ID relating to this block valve and why?

Ans: • CSO (car sealed open) or LO (locked open)

• To help ensure that the valve is open during normal plant operation so that if a condition resulting in over pressurization occurs, the valve is open and the relief valve can function properly.

57. The piping downstream of a pressure safety valve that discharges to a closed system must be routed in a specific direction, what is this direction and why?

Ans: • Routed in such a manner as to free drain into the collection header.

So no liquid can collect and possibly obstruct the free release of pressure.

58. If a pressure safety valve has a downstream block valve, excluding accessibility, how is the vale hand wheel to be oriented and why?

Ans: • The hand wheel is to be located within the lower 180 degrees - horizontal to horizontal. <horizontal or downward>

• This is to prevent the disc falling into the port if the stem corrodes - thereby closing the valve and preventing the free release of pressure.

59. If a pressure safety valve has a rupture disc upstream, what is the purpose of the rupture disc?

Ans: The rupture disc isolates the relief valve from the potentially corrosive atmosphere of the system to be protected - protecting the stem from corrosion.

60. When a pressure safety valve discharges vertically to atmosphere, what must be added to the lowest part of the tail pipe, what size is it and why is it added?

Ans: • A weep hole.

• 1/4" diameter

• To drain the collection of rain water in the open tailpipe that if allowed to collect could obstruct the free release of pressure

61. What is the end preparation for the end tailpipe of a pressure safety valve discharging vertically to atmosphere and why?

Ans: • Square cut/plain end

• There is no need to bevel or 45-degree chamfer because it is unnecessary cost.

62. What is the formula for calculating the free standing (unguided) length of a tailpipe of a pressure safety valve discharging vertically to atmosphere?

Ans: 1.67 x outside diameter (in inches) of the Tail Pipe = the height in feet.

63. If a pressure safety valve has a small, valved and plugged connection in the area between the block valve and the pressure safety valve, describes the purpose and operation of this valve?

Ans: For bleeding pressure and venting any trapped commodity so, the relief valve can be safely removed for maintenance.

64. Per Fluor Daniel Standard, what is the rule for establishing the height of a tailpipe of a pressure safety valve that discharges to atmosphere?

Ans: The top of a tailpipe discharging to atmosphere must be a minimum of 8'-0" above any platform within a 25'-0" radius of the tailpipe.

65. The spring on a pressure safety valve must be oriented in which direction and why?

Ans: • Vertically upward, to keep the spring out of any liquid that could corrode the spring.

66. Cooling water piping at the channel side of a shell and tube heat exchanger that is located outside in the sunlight will typically have a THERMAL RELIEF VALVE located between the exchanger nozzle and the block valve. Why is this done?

Ans: To protect the tubes of exchanger from splitting due to over pressurization within the system when the valve's upstream and downstream of the exchanger are closed. Sunlight can cause a temperature rise of the trapped liquid, causing a rise in pressure.

67. What is the most common body style for control valves?

Ans: Globe Valve

68. In a control valve manifold with block valves upstream and downstream of the control valve, what is placed between the upstream block valve and the control valve and what is its purpose?

Ans: • 3/4" valve & plugged bleed valve.

• To drain and depressurize the volume of trapped liquid for the safe removal of the control valve for maintenance.

69. If a control valve manifold has a bypass line what is the distance between the bypass valve and the main line and why?

Ans: • Minimum distance.

• To prevent a dead leg in the bypass line.

70. What is the minimum clearance between the top of the diaphragm on a control valve and the nearest obstruction above it?

Ans: 1'-0" (12 inches)

71. In a control valve manifold with upstream and downstream block valves?

A. What is the breakout spool piece for?

Ans: Easy removal of the control valve

B. What is the preferred configuration of the breakout spool piece and why?

Ans: • Preferred configuration is with an elbow.

• It is easier to remove than a straight spool piece that requires a flange spreader. The "l" shape elbows gravity to aid in its removal.

72. Who determines the size of the control valve?

Ans: Process

73. Who determines the size of the bypass valve?

Ans: Process

74. Who determines the upstream and downstream block valves?

Ans: Process

75. If you are establishing the overall length of a control valve manifold for allocation of space and you do not have a vendor drawing giving the face-to-face dimension of the control valve, what valve will you use as a substitute face-to-face dimension (assume the control valve is 6"-300# RF)?

Ans: • A 6"-300# GLOBE VALVE OR PIPING PRACTICE 000 250 2701

• <17 ½ inches>

76. When a control valve and its downstream block valve are the same size and rating, they can be bolted together. What possible problem can occur when these two valves are bolted together?

Ans: The hand wheel of the block valve may interfere with the top works of the control valve.

Also give me two solutions that could correct the problem.

- If the bolt holes permit - rotate the block valve so the interference is gone.
- Add two flanges back-to-back, and, if necessary add a spool piece to give the necessary clearances. 0.
- <place valve in the vertical>

77. There are three things that establish the height of a valve drain (bottom of drain top of finished surface). One thing that sets this height is Fluor Daniel standard (6”), what are two others?

Ans:
- Clearance for rodding out the drain.
- Clearance required for the addition of a bucket to catch the liquid.

78. What are two industry terms when a threaded connection is also welded?

Ans: Seal welding

Back welding

79. What must be used on a threaded connection if it is to receive the weld referred into question 69, and why should it not be used?

Ans: • Thread compound or "pipe dope."

If thread compound/pipe dope is present and the connection is to be seal welded, the heat could cause a small explosion, injuring the welder.

80. What are the steps in selection of valve?

Ans : What to handle, liquid, gas or powder, fluid nature, function, construction material, disc type, stem type, how to operate, bonnet type,body ends, delivery time, cost, warranty.

81. What are functions of valves?

Ans: Isolation, regulation, non-return and special purposes.

82. What are isolating valves?

Ans: Gate, ball, plug, piston, diaphragm, butterfly, pinch.

83. What are regulation valves?

Ans: Globe, needle, butterfly, diaphragm, piston, pinch.

84. What are non-return valves?

Ans: check valve,

85. What are special valves?

Ans: multi-port, flush bottom, float, foot, pressure relief, breather.

86. What materials are used for construction of valves?

Ans: Cast iron, bronze, gun metal, carbon steel, stainless steel, alloy carbon steel, polypropylene and other plastics, special alloys.

87. What is trim?

Ans: Trim is composed of stem, seat surfaces, back seat bushing and other small internal parts that normally contact the surface fluid.

88. Which standard specifies trim numbers for valve?

Ans: API 600.

89. What are wetted parts of valve?

Ans: All parts that come in contact with surface fluid are called wetted parts.

90. What is wire drawing?
Ans : This term is used to indicate the premature erosion of the valve seat caused by excessive velocity between seat and seat disc, when valve is not closed tightly.

91. What is straight through valve?
Ans: Valve in which the closing operation of valve is achieved by 90 degrees turn of the closing element.

92. What pressure tests are carried out on valves?
Ans : Shell-hydrostatic, seat-hydrostatic, seat-pneumatic

93. What are available valve operators?
Ans: Hand lever, hand wheel, chain operator, gear operator, powered operator likes electric motor, solenoid, pneumatic and hydraulic operators, Quick acting operators for non-rotary valves (handle lift).

94. What are two types of ball valve?
Ans : Full port design and regular port design, according to type of seat, soft seat and metal seat.

95. What are ball valve body types?
Ans: Single piece, double piece, three piece, the short pattern, long pattern, sandwich and flush bottom design.

96. Why ball valves are normally flanged?
Ans: Because of soft seat PTFE which can damage during welding.

97. What are butterfly valve types?
Ans: Double flange type, wafer lug type and wafer type.

98. What are types of check valve?
Ans: Lift check valves and swing check valves.

99. What are non-slam check valves?
Ans: Swing check valve, conventional check valve, wafer check valve, tilting disc check valve, piston check valve, stop check valve, ball check valve.

100. Where stop check valve is used?
Ans: In stem generation by multiple boilers, where a valve is inserted between each boiler and the main stream header. It can be optionally closed automatically or normally.

101. Where diaphragm valves are used?
Ans: Used for low pressure corrosive services as shut off valves.

102. What is Barstock Valve?
Ans: Any valve having a body machined from solid metal (barstock). Usually needle or globe type.

103. What is BIBB Valve?
Ans: A small valve with turned down end, like a faucet.

104. What is Bleed Valve?
Ans: Small valve provided for drawing off liquid.

105. What is Blow down Valve?
Ans Refers to a plug type disc globe valve used for removing sludge and sedimentary matter from the bottom of boiler drums, vessels, drip-legs etc.,

106. What is Breather Valve?
Ans: A special self acting valve installed on storage tanks etc. to release vapor or gas on slight increase of internal pressure (in the region of ½ to 3 ounces per square inch).

107. What is Drip Valve?
Ans: A drain valve fitted to the bottom of a drip leg to permit blow down.

108. What is Flap Valve?
Ans: A non return valve having a hinged disc or rubber or leather flap used for low pressure lines.

109. What is Hose Valve?
Ans: A gate or globe valve having one of its ends externally threaded to one of the hose thread standards in use in the USA. These valves are used for vehicular and firewater connections.

110. What is Paper-Stock Valve?
Ans: A single disc single seat gate valve (Slide gate) with knife edged or notched discussed to regulate flow of paper slurry or other fibrous slurry.

32. What is Root Valve?
Ans: A valve used to isolate a pressure element or instrument from a line or vessel, or a valve placed at the beginning of a branch from the header.

33. What is Slurry valve?
Ans: A knife edge valve used to control flow of non-abrasive slurries.

34. What is Spiral sock valve?
Ans: A valve used to control flow of powders by means of a twistable fabric tube or sock.

114. What is Throttling valve?
Ans: Any valve used to closely regulate flow in the just-open position.

115. What is Vacuum breaker?
Ans: A special self-acting valve or nay valve suitable for vacuum service operated manually or automatically, installed to admit gas (usually atmospheric air) into a vacuum or low-pressure space. Such valves are installed on high points of piping or vessels to permit draining and sometimes to prevent siphoning.

116. What is Quick acting valve?
Ans: Any on/off valve rapidly operable, either by manual lever, spring or by piston, solenoid or lever with heat-fusible link releasing a weight which in falling operates the valve. Quick acting valves are desirable in lines conveying flammable liquids. Unsuitable for water or for liquid service in general without a cushioning device to protect piping from shock.

117. What is diverting valve?
Ans: This valve switches flow from one main line to two different outlets. WYE type and pneumatic control type with no moving part.

118. What is sampling valve?
Ans: Usually of needle or globe pattern, placed in branch line for the purpose of drawing all samples of process material thru the branch.

119. What are blow off valve?
Ans: It is a variety of globe valve confirming with boiler code requirements and specially designed for boiler blow-off service. WYE pattern and angle type, used to remove air and other gases from boilers etc.

120. What is relief valve?
Ans: Valve to relieve excess pressure in liquids in situations where full flow discharge is not required, when release of small volume of liquid would rapidly lower pressure.

121. What is safety valve?
Ans: Rapid opening(popping action) full flow valve for air and other gases.

122. What is foot valve?
Ans: Valve used to maintain a head of water on the suction side of sump pump, basically a lift check valve with integrated strainer.

123. What is float valve?
Ans: Used to control liquid level in tanks, operated by float, which rises with liquid level and opens the valve to control water level. It can also remove air from system, in which case, air flows out of system in valve open condition, but when water reaches valve, float inside valve raises to close the valve and stop flow of water. Used in drip legs.

124. What are flush bottom valves?
Ans: Special type of valves used to drain out the piping, reactors and vessels, attached on pad type nozzles.

125. What are types of flush bottom valves?
Ans: Valves with discs opening into the tank and valves with disks into the valve.

126. What are the uses of three-way valve?
Ans: Alternate connection of the two supply lines to a common delivery vice-versa, isolating one safety valve, division of flow with isolation facility.

127. What are uses of four way valve?
Ans: Reversal of pump suction and delivery, By pass of strainer or meter, reversal of flow through filter, heat exchanger or dryer.

128. What is metal seated lubricated plug valve?
Ans: A plug valve with no plastic material, where grease is applied to contacting surfaces for easy operation.

129. What are three patterns of plug valve design?
Ans : Regular pattern, short pattern and venture pattern.

130. What is regular pattern plug valve?
Ans: Rectangular port, area almost equal to pipe bore, smooth transition from round body to rectangular port, for min. pressure loss.

131. What are short pattern plug valve?
Ans: Valves with face to face dimension of gate valve, as a alternative to gate valve.

132. What are venture pattern plug valve?
Ans: Change of section through the body throat so graded to have venture effect, minimum pressure loss.

133. What are inverted plug design valve?
Ans: Plug valve with taper portion up of plug. For 8” and higher size

134. What is pressure balanced plug valve?
Ans: With holes in port top and bottom connecting two chambers on top and bottom of plug, to reduce turning effort.

135. What are Teflon sleeved plug valve?
Ans: PTFE sleeve between plug and body of valve, low turning effort, minimum friction, temperature limitation, anti static design possible.

136. What are permasil plug valve?
Ans: Plug valves with Teflon seat instead of sleeves, for on off applications, can handle clean viscous and corrosive liquids, Graphite seat for high temperature applications. Drip tight shut off not possible.

137. What are eccentric plug valve?
Ans: Off center plug, corrosive and abrasive service, on off action, moves into and away from seat eliminating abrasive wear.

138. What is dimensional standard for plug valve?
Ans: API 599.

139. What is pinch valve?
Ans: Similar to diaphragm valve, with sleeves of rubber or PTFE, which get squeezed to control or stop the flow, Cast iron body, for very low service pressures like isolation of hose connections, manufacture standard.

140. What is needle valve?
Ans: Full pyramid disc, same design as globe valve, smaller sizes, sw or threaded, flow control, disc can be integral with stem, inside screw, borged or barstock body and bonnet, manufacturers standard.

141. How to install a globe valve?
Ans: Globe valve should be installed such that the flow is from the underside of the disk, usually flow direction is marked on the globe valve.

142. What are globe valve port types?
Ans: Full port: More than 85% of bore size, Reducer port: One size less than the connected pipe.

143. What are globe valve disk types?
Ans: Flat faced type for positive shutoff, loose plug type for plug renewal or needle type for finer control.

144. What are characteristics of globe valve stem?
Ans: Always rising design, with disk nut at the lower end and handwheel at upper end.

145. What are types of globe valve?
Ans: Angle globe valve, plug type disc globe valve, wye-body globe valve, composite disc globe valve, double disc globe valve.

146. What is angle globe valve?
Ans: Ends at 90 degree to save elbow, higher pressure drop.

147. Where plug type disc globe valve is used?
Ans: For severe regulating service with gritty liquids such as boiler feed-water and for blow off service.

148. Where WYE body globe valve is used?
Ans: In line ports with stem emerging at 45 degree, for erosive fluids due to smoother flow pattern.

149. What is double disc globe valve?
Ans: Has two discs bearing on separate seats spaced apart, on a single shaft, for low torque, used for control valves.

150. What are port types for gate valves?
Ans: Full port and reduced port. Default is reduced bore. Full port has to be specified in BOM.

151. How to close a gate valve?
Ans: Turn the hand wheel in clockwise direction.

152. What is lantern ring?
Ans: It's a collection point to drain off any hazardous see pages or as a point where lubricant can be injected, it is in the middle of packing rings.

153. What are types of gate valves?
Ans: Solid plane wedge, solid flexible wedge, split wedge, double disc parallels seats, double disc wedge, single disc single seat gate or slide, single disc parallel seats, plug gate valve.

154. What are the types of bonnets?
Ans: Bolted bonnet, bellow sealed bonnet, screwed on bonnet, union bonnets, A U-bolt and clamp type bonnet, breechlock bonnet, pressure seal bonnet

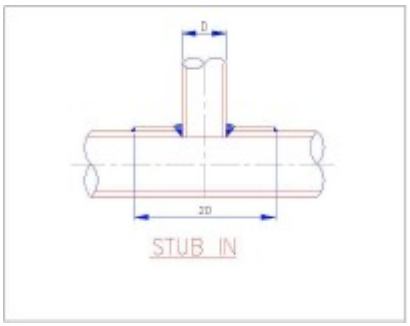
155. What is the ASME code followed for design of piping systems in Process piping (Refineries & Chemical Industries)?
(i) B31.1
(ii) B31.3
(iii) B31.5
(iv) B31.9
Answer (III)

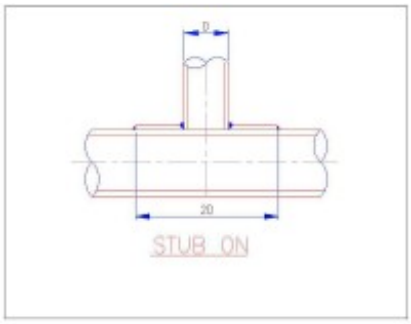
156. What do you mean by following items?
i.) ISLB-400 ii) ISMB-600 iii) ISHB-350 iv) ISMC-300 v) ISJB-150 vi) ISLB-200
vii) ISMB-450 viii) ISWB-400 ix) ISJC-200 x) ISLC-350 xii) ISMC-250
Answer:
i. Indian STD light weight beam, Web size – 400
ii. Indian STD medium weight beam, Web size – 600
iii. Indian STD 'H' beam, Web size – 350
iv. Indian STD medium weight channel, Web size –300
v. Indian STD junior beam, Web size – 150
vi. Indian STD light weight beam, Web size – 200
vii. Indian STD medium weight beam, Web size – 450
viii. Indian STD wide flange beam, Web size – 400
ix. Indian STD junior channel, Web size – 200
x. Indian STD light weight channel, Web size – 350

xi. Indian STD medium weight channel, Web size – 250

157. What is this item?
i) ISA-100X100X12 ii) ISA-80X50X10 iii) ISLT-100X100
Answer:
i. Equal angle size 100x12 THK
ii. Unequal angle size 80x50x10 THK
iii. Indian STD light weight tee bar size 100x100

158. What is the difference between stub in and stub on branches? Describe with Sketch? Which one is preferred?
Ans:





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For branching of one size lesser of run pipe, Stub On is preferred. For other branching less than one size of run pipe stub in is preferred. The Design is based on ANSI/ASME B 31.3

159. What is the difference between Pipe and Tube?
Ans: Pipe is identified by NB and thickness is defined by Schedule whereas Tube is identified by OD.

160. From which size onwards NB of pipe is equal to OD of Pipe?
Ans: From the size 14" and onwards NB = OD of pipe.

161. Write down the outside diameter of following pipe?
i. 3 inch ii) 6 inch iii) 10 inch iv) 14 inch
Answer:
i. 3 inch = 88.9mm ii) 6 inch = 168.28mm
iii) 10 inch = 273.06mm iv) 14 inch = 355 mm (OD= Size X 25.4)

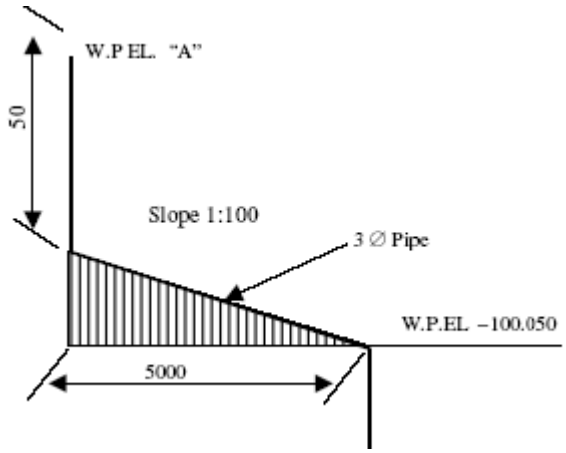
162. What is the difference between machine bolt and stud bolt?
Ans: Machine bolt has a head on one side and nut on other side but stud bolt have nuts on both sides.

163. What is soluble dam?
Ans: Soluble dam is a water-soluble material used for restricting the purging gas within the pipe.

164. While welding of pipe trunnion to pipe/reinforcement pad you have to put a hole or leave some portion of welding why?
Ans: For venting of hot gas which may get generated due to welding

165. What do you mean by following type of welding?
i) SMAW ii) TIG
Ans:
ii. SMAW = SHIELDED METAL ARC WELDING
iii. TIG = TUNGSTEN INTER GAS WELDING

166. Find out the elevation of marked point 'A'?
Ans:



Elevation of marked point 'A' is 100.050

167. What should be the radius of long radius elbow?
Ans: 1.5 x D (Where "D" is the diameter of the pipe)

168. Normally where do we use the following?
i) Eccentric reducer ii) Concentric reducer
Ans:
i. Eccentric reducers = Pump suction to avoid cavitations' to maintain elevation (BOP) in rack.
ii. Concentric reducers = Pump discharge, vertical pipeline etc.

169. Concentric reducer is used in pump suction. (Yes / No), Explain?
Ans: No. Air pockets may form if concentric reducer is used at pump suction, which results in cavitations', and cause damage to Pump. To avoid this problem, Eccentric Reducer with Flat Side Up (FSU)is used in Pump Suction.

170. What do you mean by Cavitations in Pump?
Ans: A pump is designed to handle liquid, not vapor. Vapor forms if the pressure in the pump falls below the liquid's vapor pressure. The vapor pressure occurs right at the impeller inlet where a sharp pressure drop occurs. The impeller rapidly builds up the pressure which collapses vapor bubbles causing cavitations' and damage. This is avoided by maintaining sufficient NPSH. (Cavitations imply cavities or holes in the fluid we are pumping. These holes can also be described as bubbles, so cavitations' is really about the formation of bubbles and their collapse. Bubbles form when ever liquid boils. It can be avoided by providing sufficient (NPSH).

171. What do you mean by NPSH? How do you calculate it?
Ans NPSH: Net Positive Suction Head (NPSH) is the pressure available at the pump suction after vapor pressure is subtracted. It is calculated as:
Static head + surface pressure head - the vapor pressure of your product - the friction losses in the piping, valves and fittings.
It thus reflects the amount of head loss that the pump can sustain internally before vapor pressure is reached.

172. What is the ASTM code for the following?
i) CS pipe ii) CS fittings iii) CS flanges iv) AS pipe P5/P11 v) Cast CS Valves
Ans:
i. CS pipe = A106 Gr. B
ii. CS fittings = A234 Gr.WPB/WPBW
iii. CS flanges = A105
iv. AS pipe = A335 Gr. P1/P11
v. Cast CS Valves = A216 Gr.WCB

173. What is the thumb rule to calculate spanner size for given bolt?
Ans: 1.5 x diameter of Bolt.

174. What is the thumb rule to calculate Current required for Welding?
Ans: Current (Amp) = [Diameter of Electrode (mm) X 40] ± 20

175. What is steam tracing? How do we decide the location of SSM & CRM?

Ans: Steam Tracing is a process which is used to prevent the fluid passing through a process line from freezing by keeping the temperature high enough for free flow of fluid and thus maintaining pump ability. SSM and CRM are generally located 38M max for open system and 24 M max for closed system when we use LP Steam up to 3.5 kg/sq cm. as a heating media.

176. Which piping items will you drop down before conducting Flushing and Hydro test?
Ans: Items like Control Valve, Orifice plates, Rotameters, safety valves; Thermowells are dropped or replaced with temporary spools before hydro test.

177. *Why do we provide a Dampner in the Piping of Reciprocating Pump?*
Ans: To take care of Pulsation.

178. Why do we provide Full Bore Valve in connecting pipeline of Launcher/Receiver?
Ans: For Pigging.

179. Which parameters will u check during checking Piping Isometrics?
Ans: Bill of Material, Pipe Routing w.r.t GAD, Supporting arrangement , details of insulation, hydro test pressure, painting specs and provision of Vent and Drains at appropriate locations.

180. What is the ANSI/ASME dimensional standard for steel flanges & fittings?
(i) B16.3
(ii) B16.5
(iii) B16.9
(iv) B16.10
Ans: (II)

181. How can flanges be classified based on facing?
Ans; a. Flat Face b. Raised Face c. Tongue and groove d. Ring type joint

182. What do you mean by AARH (Flange Finish)?
Ans: Arithmetic Average Roughness Height.

183. Which are the different types of Gaskets?
Ans: Full Face, Spiral Wound, Octagonal Ring Type, Metal Jacketed and Inside Bolt Circle.

184. What should be the relative hardness between the RTJ gasket and flange groove?
Ans: For a RTJ flange, the joint ring should have a 30-40 Vickers hardness less than that of the mating face of flange.(Brinnel hardness for RTJ groove shall be 20-50 BHN more than the corresponding gasket hardness)

185. From which side of pipe will you take a branch connection?
Ans: When Fluid is Gas, Air or Steam and Cryogenic Service – Topside. When Fluid is Liquid – Bottom Side

186. Why don't we take a branch for Cryogenic Service from bottom side though the fluid is in liquid state?
Ans: There is the chance of Ice formation during normal operation and since ice flows from the bottom of the pipe it will block the branch pipe connection.

187. Why do we provide Drip Leg in Steam Line?
Ans: To remove Condensate when there is a rise in the pipe along the flow direction. If we do not provide the drip leg in steam line, the condensate which forms inside the pipe will result in Water Hammer effect causing damage to piping system.

188. How do you support any small size HDPE/PVC (Plastic) pipe?
Ans: It should be supported continuously by using channel or Angle so that line should not Sag or fall from the sleeper/rack due to uneven expansion because of Hot Temp.

189. Why do we provide High Point Vent (HPV) and Low Point Drain (LPD) in piping?
Ans: HPV – for removing Air during Hydro-test. LPD – for draining water after conducting Hydro-test

190. Which standard and codes will you refer while designing the piping?
Ans: Following are the codes and standards –
· ASME SEC I : Rules for construction of Power Boilers.
· ASME SEC VIII : Rules for construction of Pressure Vessels.
· ASME B 31.1: Power Piping
· ASME B 31.3: Process Piping
· ASME B 31.4: Pipeline Transportation system for liquid hydrocarbon and Other liquids.
· API RP 520: Sizing selection and installation of Pressure Relieving

Devices in refineries
· API STD 610: Centrifugal Pumps for Petroleum, Heavy Duty Chemical and Gas Industry Services.
· ANSI/NEMA SM 23: Steam Turbines for Mechanical Drive Services.
· API Std 617: Centrifugal Compressor for Petroleum, Chemical and Gas Industry Service.
· EJMA: Expansion Joints Manufacturer's Association.
· OISD – 118: Layout for Oil and Gas Installations.
· IBR: Indian Boiler Regulations.
· NACE MR – 0175: Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment.
· NACE MR – 0284: Evaluation of Pipeline and Pressure Vessel Steel for Resistance to Hydrogen Induced Cracking.
· NACE TM – 0177: Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking in H2S Environment.

191. What do you mean by IBR and which lines comes under IBR purview?

Ans: IBR: Indian Boiler Regulation Act.
Steam lines with conditions listed bellow comes under IBR purview –
· Lines for which design pressure is 3.5 kg/sq cm and above.
· Line size above 10" having design pressure 1.0 kg/sq cm and above.
· Boiler feed water lines to steam generator, condensate lines to steam generator and flash drum.

192. What are Weldolet and Sockolet? And where they are used?

Ans: Weldolet and Sockolet are basically self reinforced fittings. Weldolet is used for Butt weld branch connection where standard tee is not available due to size restrictions and the piping is of critical / high pressure service. Sockolet is used for socket welding branch connection, which require reinforcing pad.

193. What is the MOC for Superheated high pressure Steam Lines?

Ans: A 335 Gr P I / P II
Composition: 0.5 Mo (P1) /1.25 % Cr-.5 Mo (P11)

194. What is the normal upstream and downstream straight length of orifice flow meter?

Ans: Upstream - 15D Downstream - 5D.

195. What are the essential data required for the preparation of equipment layout?

Ans: 1) PFD and P&ID 2) Project Design data 3) Equipment Sizes & Buildings

196. What are the various statutory requirements to be considered during layout?

Ans: State Industrial Development Corporation (SIDC)
Central / State Environmental Pollution Control Boards (PCBS)
Factory Inspectorate
State Electricity Boards
Chief Controller of Explosives (CCOE)
Static & Pressure Vessel Rules (SMPV)
Tariff Advisory Committee
Aviation Laws
Chief Inspector of Boilers (CIB)
Oil Industry Directorate (OISD)
Food and Drug Administration (FDA)
Ministry of Environment and Forest (MoEF)

197. What do you mean by Composite Flange?

Ans: The flange that is made up of more than one MOC is called a Composite flange.
a. Lap Joint Flanges
Insert Flanges are a specialty in the arena of pipe size flanges and consist of two parts - the insert and the flange ring. The flange ring is the outer part of the insert flange assembly, containing the bolt holes. The two piece construction of the insert flange also offers the economy of matching the insert material to the process pipe (usually some corrosion resistant alloy) while the outer flange ring may be manufactured from steel. When the environment requires the flange ring to be made of some alloy the rotating feature is still maintained.
b. RF flanges with Raised of one MOC and rest of the flange with different MOC
c. RF blind flange with an overlay of 90/10 Cuni for Sea water service.

198. What do you mean by Insulated Joint?

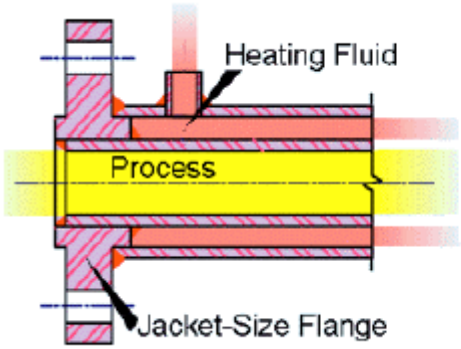
Ans: Insulating Joints are a prefabricated, non separable union used to isolate specific sections of Pipelines to prevent corrosion caused by stray electrical currents or interference from other pipelines and power transmission cables.

199. What are Insulating Gasket Kits?

Ans: Insulation gasket kits are designed to combat the effects of corrosion often found in flanged pipe systems. Galvanic corrosion between dissimilar metal flanges (flow of currents) , flange insulation associated with cathodic protection of underground piping are also the places where Insulating gasket kits are used. It consists of Gasket Neoprene faced Phenolic/Glass Reinforced Epoxy (G10) Insulation sleeve Reinforced Phenolic/Nylon/Polyethylene/(G10) Insulation washer Reinforced Phenolic/Nylon/Polyethylene/(G10) Plated Washer Electro plated steel washer.

200. What do you mean by Jacketed Piping?

Ans:



Piping which is recognized as providing the most uniform application of heat to the process, as well as maintaining the most uniform processing temperatures where steam tracing is not capable of maintaining the temperature of fluid constant. Usually used for molten sulphur, Polymers service.

201. What is the min. distance to be maintained between two welds in a pipe?

Ans: The rule of thumb is that the minimum distance between adjacent butt welds is 1D. If not, it is never closer than 1-1/2". This is supposedly to prevent the overlap of HAZ's. Minimum spacing of circumferential welds between centerlines shall not be less than 4 times the pipe wall thickness or 25 mm whichever is greater.

202. What are the different hardness tests carried out?

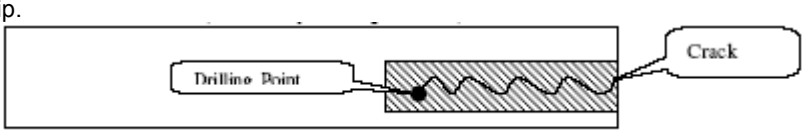
Ans: Brinell Hardness Test; Rockwell Hardness test; Vickers Hardness Test.

203. What is the relation between Brinell Hardness No and Rockwell Hardness No?

Ans: 22 HRC (Rockwell Hardness) = 238 BHN (Brinell Hardness No) Harder Piping which is recognized as providing the most uniform application of heat to the process, as well as maintaining the most uniform processing temperatures where steam tracing is not capable of maintaining the temperature of fluid constant. Usually used for molten sulphur, Polymers service.

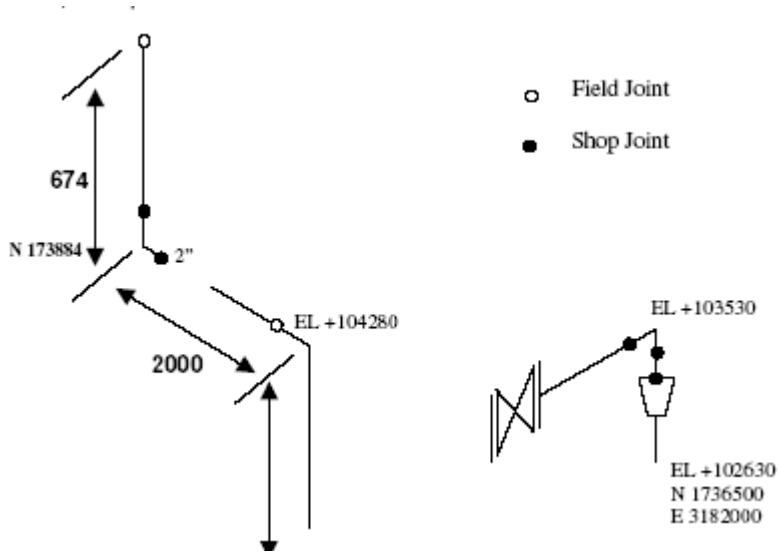
204. During fabrication you observed that one small crack has appeared on a fresh plate, what type of measure you will take to obtain desired quality with minimum wastage?

Ans: First identify the exact length of crack by DP test. Drill on the end point to resist further crack. Remove the crack portion by cutting the strip.

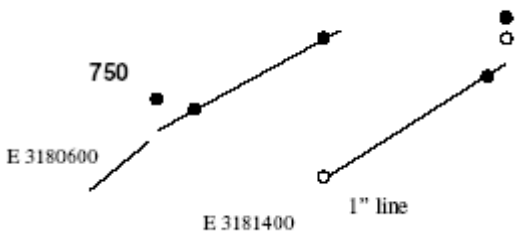


205. ISOMETRIC :-

Ans: i. What are the fittings required for fabrication of the isometric.
ii. Find out the length of pipe required.
iii. Do joint numbering and show the following things in the isometric.
a) Shop joint
b) Field joint
c) Spool no



674
2000
Drilling Point
Crack
N 173884
EL +104280
EL +103530
EL +102630
N 1736500
E 3182000
2”
Field Joint
Shop Joint
750



Answer:

· 2 INCH ELBOW – 4NOS

· 2 INCH WNRF FLANGE – 2NOS
· 2 INCH GATE VALVE – 1NO
· 2 x 1 INCH CONC. REDUCER – 1NO
· 1 INCH ELBOW 90 DEG – 1 NO
· 2 INCH PIPE - 4.210 MTRS
· 1 INCH PIPE – 1.424 MTRS

206. Describe different types of destructive and non-destructive tests?
Ans: DESTRUCTIVE TEST: Bend test, Tensile test, Impact test, and Hardness test.
NON-DESTRUCTIVE TEST: DPT, MPT*, Radiography and ultrasonic test*

207. What is mean by 'PWHT'? Why it is required?
Ans: "POST WELD HEAT TREATMENT" (PWHT) his is done to remove residual stress left in the joint which may cause brittle fracture.

208. What is the minimum thickness of pipe that requires stress relieving to be done as per B31.3?
Ans: 19 mm thickness.

209. What is the difference between Thermostatic and Thermodynamic Steam Trap?
Ans: Thermostatic Trap is actuated by Temp differential and is economic at steam pressure less than 6 PSI. It is operated by the movement of liquid filled bellows or by bimetal element which may get damaged by Water Hammer. Thermodynamic traps are most suited to applications where the pressure downstream of trap is always less than about ½ the upstream pressure. These are suitable for pressure higher than 8 PSI. Water hammer doesn't affect it.

210. What is the Code for Sour Service?
Ans: Code for Sour Service is NACE (NACE MR – 0175) **NACE:** National Association of Corrosion Engineers.

211. How much should be the pressure for Hydro-Test?
Ans: Hydro test pressure should be calculated as follow except as provided against point no-4.1. 1.5 x Design Pressure.
E 3180600
E 3181400
1" line
2. For a design temperature above the test temperature, minimum test pressure can be calculated as:
Pt = (1.5 X P X St) / S
Where:-
Pt: Minimum Test Pressure.
P: Internal design pressure.
St: Allowable stress at test temperature.
S: Allowable stress as design temperature.
(See SE in table A-1 or S in table B-1/2/3)
3. If a test pressure as per above would produce a stress in excess of the yield strength at test temp. The test pressure may be reduced to maximum pressure that will not exceed the yield strength at test temp. 4. If the test pressure of piping exceeds the vessel pressure and it is not considered practicable to isolate piping from vessel, the piping and vessel may be tested together at test pressure of the vessel when approved by owner and provided the test pressure for vessel is not less than 115% of piping design pressure adjusted for temperature as per point no 2.

212. How do you calculate the pipe spacing?
Ans: Pipe Spacing (mm) = (Do + Dt) / 2 + 25mm + Thickness of Insulation (mm)
Where: Do: OD of Small size Pipe (mm)
Dt: OD of Flange of Large size Pipe (mm).

213. How do you calculate the width of Pipe rack?
Ans: W = (f x n x s) + A + B.
Where: s=
f: Safety Factor
= 1.5 if pipes are counted from PFD
= 1.2 if pipes are counted from P&ID
n: number of lines in the densest area up to size 450
NB
= 300 mm (estimated average spacing)
= 225 mm (if lines are smaller than 250 NB)
A: Additional Width for –
· Lines larger than 450 NB.
· For instrument cable tray / duct.
· For Electrical cable tray.
s: 300 mm (estimated average spacing)
: 225 mm (if lines are smaller than 250 NB)

B: future provision
= 20% of (f X n X s) + A

214. Which fluid is used in Heat Exchanger in shell side and tube side?
Ans: Generally corrosive fluid is used from the tube side (as tube can be easily replaced) and cleaner fluid is used from shell side. Sometimes Hot fluid is also used from the shell side.

215. What is Reynold's number and what is the value of Reynold's number up to which the flow is laminar?
Ans: It's a dimensionless number to classify the nature of flow.

Re=□vd/□

Where: Re : Raynold's no.
□□□ass Density of fluid.
d : diameter of Pipe.
V : average velocity of fluid.
□□Viscocity of fluid.

Flow is laminar upto Re=2100

216. What are Glandless Piston Valves? Where these are used?
Ans: Glandless piston valves are maintenance free valves used in the steam service.

217. How do you carry out Estimation?
Ans:

1. Input from Bid:-
· P&Id, Line list, Temperature, Pressure.
· Overall Plant Layout and Piping corridor plan.
· Scope of work and the Specifications for the Job.
· Specifications for materials like PMS and VMS.
2. Value Addition:-
· Items like Valves, Flanges, Specialty items, Reducers can be estimated from P&ID.
· Length of Pipes, Elbows, width of Pipe Rack can be estimated by referring P&ID and Overall Plot Plan.
· No of Tires (on rack) can be estimated by referring the spacing required for pipes and also the space available.
· MTO for Steam Traps, Valves (for Vent and drain) can be calculated by using Thumb Rules.
3. Loads:-
· **Hydro Test Loads:** Can be estimated by assuming all the Pipes (on a grid) empty except some bigger size lines filled with Water.
· **Actual Operating Loads:** Gas lines to be considered as empty and rest of the lines to be considered as filled with the Fluid (which they are suppose to carry in operating condition).
The loads whichever is higher from above two cases should be referred for structural loading.

STRESS

218. What is the objective of stress analysis?
Ans:
1. To ensure that the stresses in piping components in the system are within allowable limits
2. To solve dynamic problems developed due to mechanical vibration, fluid hammer, pulsation, relief valves, etc
3. To solve problems associated due to higher or lower operating temperature such as a) Displacement stress range b) Nozzle loading on connected equipments c) Pipe displacements d) Loads & moments on supporting structure

219. What are the steps involved in stress analysis (or any stress package carries out)?
Ans:
1. Identify the potential loads that the piping system would encounter during the life of the plant
2. Relate each of these loads to the stresses and strains developed
3. Get the cumulative effect of the potential loads in the system
4. Decide the allowable limits the system can withstand without failure as per code
5. After the system is designed to ensure that the stresses are within safe limits

220. What are the different types of stresses that may get generated within pipe during normal operation?
Ans: Axial Stresses (Tensile / Compressive), Shear Stresses, Radial Stresses, Hoop's Stresses.

221. How are the loads classified in stress analysis package?
Ans: a. Sustained Loads 2. Occasional Loads 3. Displacement Loads (Self limiting stresses due to thermal effects) What are the Inputs for stress analysis of a piping system i) Pipe Size ii) Fluid Temperature iii) Pipe Material iv) Design pressure v)Insulation Thickness vi)Specific gravity vii)Friction coefficient viii) Model.

222. What are the sources of sustained loads generated in piping system?
Ans: a. Pressure b. Dead weight of Pipe and attachments Sustained load is calculated as Weight of Pipe with Fluid + Pressure load + Load due to springs W+P1.

223. How do you calculate the operating load?
Ans: W+P1+T1
T1 – Load due to thermal expansion.

224. Give some Examples for occasional Loads?
Ans: Wind, wave & earthquake.

225. Mention some of Primary Loads (Have their origin in force)?
Ans: Dead Weight, Pressure, forces due to relief or blow-down, force due to water hammer effects.

226. Mention some of secondary Loads (Have origin in displacement)?
Ans: Force on piping due to tank settlement
Vessel nozzle moving up due to expansion of vessel
Pipe expansion or contraction
Vibration due to rotational equipments

227. What is the failure theory subscribed under ASME B31.3?
(i) Maximum principal stress theory (Rankiness Theory)
(ii) Maximum Shear Theory
(iii) Tresca Thory
Ans: (I)

228. What are the types of failures encountered in Piping?
Ans: 1. Catastrophic Failure 2. Fatigue Failure

229. Select the failure stress range for fatigue failure due to thermal expansion as per B31.3
(i) (1.6Sc+1.6Sh)f
(ii) 0.78 Sh
(iii) (1.25 Sc+0.25Sh)f
(iv) Sc+Sh
Ans: (III)
Sc and Sh –Basic Allowable material stress in cold & hot conditions respectively.
f ---- is the stress range reduction factor(1 for 7000 cycles)

230. What is desired life cycle for Piping in operation?
Ans: Desired life cycle for Piping in operation is 20 Years (7000 Cycles). The normal no. of cycles for which the displacement or thermal stresses are designed is 7000 cycles.

231. How do you calculate the stress developed due to thermal expansion?
Ans: Stress developed = E x e/L
E – Young's Modulus
e- Increase in length due to thermal expansion
L – Original Length of the pipe
232. How do you calculate the thermal expansion in a pipe?
Ans:

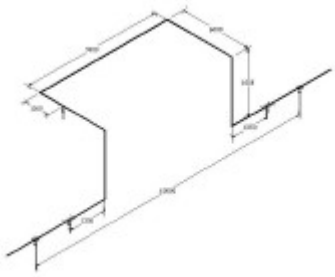
233. What do you mean by Stress Intensity Factor (SIF)? Give some examples?
Ans: Stress Intensity Factor (SIF) is the ratio of maximum stress intensity to normal stress. It is used as safe factor to account for the effect of localized stress on piping under respective loading. In piping it is applied to welds, fittings, branch connections etc where stress concentration and possible fatigue failure may occur. e.g., SIF for Reducer and Weldneck Flange: 1.0 SIF for socket weld flange: 1.3

234. Which is the Criteria for Pipe Supporting?
Ans: Following are the points which should be taken into account for proper supporting –
· Load of bare pipe + fluid + insulation (if any).
· Load of bare pipe + waterfill.
· Load of valves and online equipment and instrument.
· Thermal loads during operation.
· Steam out condition, if applicable.
· Wind loads for piping at higher elevation, if required.
· Forced vibration due to pulsating flow.
Bare pipe with size above 12" shall be supported with Pad or Shoe.

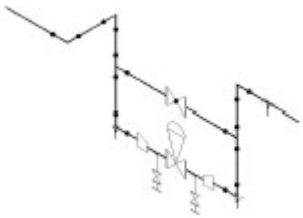
235. What is the basic span of supports for 2"/6"/10"/24" pipe?
Ans: Basic Span is 5.5m / 9m / 11.5m / 15m respectively.

236. How do we decide the anchor / cross guide and guide for offsite rack piping?
Ans: Anchor is provided to restrict all the axial and rotational movements of Pipe, whereas Cross Guide is provided to restrict displacements of Pipe along with the axis perpendicular to its centerline and Guide is provided to restrict the longitudinal movements of pipes along with its axis.

237. Define a typical 6D loop supporting details (Anchor/Guide)?
Ans:



238. Provision of anchor/cross guide for control valve?
Ans:



239. What are the things to be taken care of while doing pump piping?
Ans: Pipe strain may distort equipment alignment, so welding should be done in such a way that the tension in the equipment flange is minimized.

240. What is the Steam out condition?
Ans: Hydrocarbon lines are usually subjected to Steam Out condition and designed and analyzed at low pressure steam design temperature (should be minimum 180 degree C) or design temp. Whichever is more? Lines having negative design temp. Is analyzed for both conditions separately.

241. Where do you provide Anchor and Slotted Support of Heat Exchanger?
Ans: Anchor support of Heat exchanger is provided on the side from which Tube Bundle will be pulled out for the purpose of Maintenance work also it is based on the growth of the connecting piping as exchanger should grow with the piping.

242. What do you mean by Hoop Stresses and how do you calculate it?
Ans: Stresses which are generated circumferentially due to the action of Internal pressure of pipe are called as Hoop Stress. It is calculated by:
Hoop Stress (Sh) = P x do / 4t
Where P = Force Acting from Inside.
Do = OD of Pipe.
t= Pipe Thickness.

243. How does Hoop Stress affect the system?
Ans: As per membrane theory for pressure design of cylinder, as long as hoop stress is less than yield stress of Moc, the design is safe. Hoop stress induced by thermal pressure is twice the axial stress (SL). This is widely used for pressure thickness calculation for pressure vessel.

244. What is the design standard followed for the calculation of allowable forces/Moments in nozzles of centrifugal compressor & Steam turbines nozzle?

Ans: For strain sensitive equipment piping to be routed and supported to limit nozzle loadings and moments in equipment within allowable limits furnished by respective vendors or in absence of vendor data API 560/610/615/621/661 & NEMA SM23. NEMA – SM 23 (Referred by API 617) is used for compressor & steam turbine nozzle.

245. What is the mill tolerance to be considered for the thickness of pipe during stress analysis as per ASME B31?
(i) 1%
(ii) 2.5%
(iii) 7.5%
(iv) 12.5%
Ans: iv

246. What is the purpose of providing Graphite Pads in supports below shoes?
Ans: To reduce the friction factor. The co-efficient of friction for Graphite Pads is 0.1

247. How is piping to Tank inlet nozzle is supported and why?
Ans: Piping to Tank Nozzle is supported with Spring type support (first support from Nozzle) in order to make the Nozzle safe from the loads which occurs due to the displacement of pipe (thermal expansion of pipe / tank material, tank settlement etc).

248. What are the two types of flexible spring hangers?
Ans; 1. Constant Spring and 2. Variable Spring

249. What is the difference between Variable Spring Hanger and Constant Spring Hanger?
Ans: Variables use coiled springs to support a load and allow movement. The resistance of the coil to a load changes during compression, which is why these devices are called "variables". Constant Spring Hanger provides constant support force for pipes and equipment subjected to vertical movement due to thermal expansion at locations where maintaining a constant stress is critical. This constant resistance is achieved by having two moment arms pivoted about a common point. The load is suspended from one of these arms, and a spring is attached to the other. With an appropriate choice of moment arms and spring properties, a resisting force can be provided that is nearly independent of position. Constant support hangers are principally used to support pipes and equipment subjected to vertical movement due to thermal expansion at locations where transfer of stress to other supports or equipment can be critical. The maximum recommended variation according to MSS standard from the operating load is 25% for variable spring hangers. If the variation exceeds 25%, a constant support hanger should be used. The constant resistance to a load is achieved by combining a spring coil with a cam which rotates about a main pivot point. The cam is designed such that the distances from the main pivot changes to compensate for the variable resistance during compression of the coil. The MSS standard provides for a tolerance of 6% in the constant load through the travel range. Constant support hangers are designed per MSS, ANSI, and ASME standards. The sizing of constants primarily depends on the total travel and load.

250. How much should be the difference between the load which will be taken by Variable Spring Hanger during Cold and Hot condition of Pipe?
Ans: It should be Maximum 25% of Load for which spring is designed.

251. Differentiate between static load and dynamic load?
Ans: A piping system may respond far differently to a dynamic load than it would to a static load of the same magnitude. Static loads are those which are applied slowly enough that the system has time to react and internally distribute the loads, thus remaining in equilibrium. In equilibrium, all forces and moments are resolved (i.e., the sum of the forces and moments are zero), and the pipe does not move. With a dynamic load—a load which changes quickly with time—the piping system may not have time to internally distribute the loads, so forces and moments are not always resolved—resulting in unbalanced loads, and therefore pipe movement. Since the sum of forces and moments are not necessarily equal to zero, the internally induced loads can be different—either higher or lower—than the applied loads.

252. Give different types of dynamic loads with example?
Ans:
1. Random – Wind, Earthquake
2. Harmonic – Equipment Vibration, Pulsation, Acoustic Vibration
Impulse – Fluid Hammer, relief valve opening, slug flow

253. What is Dynamic Analysis and why it is used?
Ans: Dynamic analysis is performed for all two phase lines in order to ensure that the line supported is safe from vibrations loads which may occur during normal operation as well as in start up or any upset condition.(Diesel mixed with hydrogen in DHDT process)

254. What is WRC 107 / WRC 297?
Ans: Localised stresses at Nozzle to Shell are calculated by WRC 107 / 297 and these computed stress values shall be limited in accordance with ASME Sec VIII for Pressure Vessels.

255. How to get the Foundation Loads?

Ans: **1st CASE:**Foundation Loads for pipe rack should include the loads of Pipes, Cable Trays and Instrumentation duct at that location and also the design load for future tier shall be full load of the most heavily loaded tier in addition to all other wind/seismic/fraction and
piping thermal loads for future pipes. Load of pipes filled with water (Largest of **1st case** – During hydro-testing dead weight (wt/m X piperack spacing) of pipes + 2 –3 maximum size pipes filled with water.
2nd case – Actual commissioned condition except the gas lines) + Proportionate wt of
extra space required by client (normal 30%) + Load of 1 heavily loaded tier + Electrical cables + Instrument duct + Guide load for 50% of lines Guide Load = 0.3 x (Dead wt. of pipes at including water)
The maximum induced thermal loads on the Anchor at the battery limit shall be limited to
F in kg <= 150 X NB of pipe in inches (It should be <2 tonnes)
M in Kgm <=75 X NB of pipe in inches.
Horizontal Load = 0.3 X (Dead wt of pipes including water)
This load is used for designing of foundation bolts.
Foundation loads for any vessel having agitator mounted on top should contain weight of tank at operating or design condition (whichever is more) plus 20% of it for dynamic loading.

256. What is the maximum expansion absorbed in loops in normal design?

Ans: 10 Inches

257. What is the limiting factor in deciding the length of the spool in Jacketed piping?

Ans: Force exerted by dissimilar expansion of inner pipe = Force exerted by dissimilar expansion of jacket pipe. The stress developed due to this should be within limits as per ANSI B31.3 (Also fabrication constraints).

258. What is the factor to be checked concerning the expansion of header attached to air cooler piping?

Ans: Vendor drawing to be checked to see how much movement is permitted to compensate line expansion. To accommodate the diff. Expansion between inlet and outlet (The inlet temperature >The outlet temperature) offset can be built in to outlet piping to compensate for diff. expansion. Since the tubes are of floating design the nozzle flange is of 150# and loads transferred are to be kept min. Since the tubes are of floating design, the nozzle flange is 150#. Load of the nozzle to be kept min.

259. What is the maximum no. of cell nozzles connected to a single header of air cooler piping header in normal practice?

Ans: Six nos.

260. What is fluid hammer and how it is generated?

Ans: When the flow of fluid through a system is suddenly halted at one point, through valve closure or a pump trip, the fluid in the remainder of the system cannot be stopped instantaneously as well. As fluid continues to flow into the area of stoppage (upstream of the valve or pump), the fluid compresses, causing a high pressure situation at that point. Likewise, on the other side of the restriction, the fluid moves away from the stoppage point, creating a low pressure (vacuum) situation at that location. Fluid at the next elbow or closure along the pipeline is still at the original operating pressure, resulting in an unbalanced pressure force acting on the valve seat or the elbow. The fluid continues to flow, compressing (or decompressing) fluid further away from the point of flow stoppage, thus causing the leading edge of the pressure pulse to move through the line. As the pulse moves past the first elbow, the pressure is now equalized at each end of the pipe run, leading to a balanced (i.e., zero) pressure load on the first pipe leg. However the unbalanced pressure, by passing the elbow, has now shifted to the second leg. The unbalanced pressure load will continue to rise and fall in sequential legs as the pressure pulse travels back to the source (or forward to the sink). The ramp up time of the profile roughly coincides with the elapsed time from full flow to low flow, such as the closing time of the valve or trip time of the pump. Since the leading edge of the pressure pulse is not expected to change as the pulse travels through the system, the ramp down time is the same. The duration of the load from initiation through the beginning of the down ramp is equal to the time required for the pressure pulse to travel the length of the pipe leg.

261. What is the purpose of expansion bellows?

Ans: Expansion bellows are used absorb axial compression or extension, lateral shear or angular torsion developed in the pipes (specially near nozzles)

262. You have to connect a 20" pipe to a manhole of existing tank, how will you go about in carrying out the suitability of the manhole flange?

263. What should be the material of shoes for supporting AS pipes & why?

Ans: If CS shoes are used Pad in contact with the pipe to be of Alloy steel to avoid dissimilar welding at pipe. To avoid alloy steel welding and dissimilar welding fabricated clamps either of CS or SS can be used.

264. What is the allowable stress range for CS pipes?

Ans: 2070 kg/cm2

265. What are sway braces?

Ans: Sway Braces are essentially a double-acting spring, housed in a canister. Unlike variable effort supports, Sway Braces are not intended to carry the weight of pipe work; their purpose is to limit undesirable movement. Sway Braces act like a rigid strut until a small preload is reached, where after the restraining force increases in proportion to the applied deflection. *Fig. 1* Undesirable movement can occur due to many phenomena, such as wind loading, sympathetic vibration, rapid valve closure, relief valves opening, two phase flow or earthquake. It may be necessary to limit this type of deflection to prevent the generation of unacceptable stresses and equipment loadings. The Sway Brace is a cost-effective means of limiting pipe work deflection. It should be noted however that it does provide some resistance to the thermal movement of the pipe work and care should be taken when specifying to ensure that this is acceptable. Installation of Sway Braces will have the effect of raising the fundamental frequency of vibration of a pipe work system; this is likely to reduce undesirable deflections. Sway Braces are often used to solve unforeseen problems of resonant vibration. For situations where the resistance to thermal movement provided by Sway Braces is unacceptable, you are referred to Pipe Supports Limited's range of hydraulic snubbers and dampers.

266. Give a typical stress report including input and output and what is interpreted form the output?

267. For offshore structures what analysis is performed by Caesar?

268. In an offsite pipe rack change in direction during analysis it is found two adjacent pipes are having unequal expansion with the inner pipe having 50 cm thermal expansion. What can be done to eliminate collision during hot condition?

Ans: Use Cold Pull technique. Calculate the thermal expansion of the inside pipe, cut an equal length form the elbow joint and then re-weld with a shorter length to take care of expansion in hot condition.

269. What are the Insulation material used for piping systems?

Ans:

1. Fibrous – Rock & Glass Wool
2. Rigid - Calcium silicate, Polyisocyanurate, cellular Glass

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