WELDING QUESTIONNAIR

1) What is HAZ ?
- Heat Affected Zone : Adjacent to weld metal where material has experienced a temp at about Transformation temp to melting temp.

2) Why is HAZ important ?
- The cooling rates are high.
- More brittle than weld metal and there by more prone to cracking. (Particularly Hydrogen induced).
- Prone to IGC in S.S.

3) What are main conditions, which determine the microstructure in weldment; and hence properties?
- Heat input.
- Preheat.
- Carbon equivalent.
- Cooling rate/Base metal thickness.

4) How do you calculate heat input ?

Heat input (KJ/mm) = $\frac{VI}{Smm/min} \times \frac{60}{1000}$

S = Speed

V. Volt Amp. X60 / Travel Speed

5) Why do we Pre-heat ?
- To reduce cooling rate and thereby reduce hard & brittle structure.
- To reduce cooling rate and reduce hardenability in HAZ. (HAZ will be wider in this case but softer compared to a case with no-preheat)
- To reduce residual stressers
- More time for Hydrogen and other gases to escape (Little amount of martensite is unavoidable)
- Less thermal shock, between cold base metal and not weld metal. better fusion.

6) What is Carbon equivalent ?
- It is empirically equivalent of all alloying elements contributing to hardening inform of Carbon percentage.

7) What is IIW Carbon Eq. Expression ?
- CE = %C+%Mn÷6+(%Cr+v%+Mo%)÷5+(Cu%+%N)÷15
- This is generally applicable for low alloy steels

8) What is the importance of CE ?
- It gives information regarding hardenability of the structure and also the necessity of taking preeaution for welding.

10) How do you utilise CE ?
- To determine Pre-heat.
- To limit material thicknen.

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- To select right consumables & process.

11) How to calculate Pre-heat ?

A) Upto 0.45 Optional. (but not less than 10°C)
0.45 to 0.60 100°c-200°c
>0.6% 200-350°c.

B) SAFERIAN METHOD : 1) Calculate CE as per IIW Equation.
2) CE Modified = CE(1+0.005t), t = thickness of material.
3) Preheat = $350\sqrt{CE_M - 0.25}$ °C

11) What are the Precaution to be taken during Pre-heat ?

- Heating shall be done uniformly and maintain throughout the cross section of the material.
- Take Temp measurement after a typical time of 10-15 Sec.
- Use right range of Temple stic/thermal chalk/Pyrometer

12) Where the temp. measurement should be taken to check pre-heat temperature?

- Opposite surface.

13) In case of flame heating (for preheating) which is the location on base material where flame should be directed ?

- 1" to 2" away from weld zone.

14) What are different methods of pre-heating ?

- Flame heating, Resistance heating, Induction heating

15) Which kind of flame is utilised for preheating?

- Neutral flame.

17) How to recognise a neutral flame?

18) Is preheating required for SS material (Austentic)?

- No.

19) Why no preheating is recommended in case of Austentic Stainless Steels?

- To avoid sensitisation.

20) What is inter pass temperature?

- It is the temperature to be maintained between the runs of welding.
- It is one of the parameter like Preheat-which gives desired mechanical properties.

21) Where do you specify inter pass temperature?

- For C.S. materials (depending on the composition) it is at any time min. Preheat and max as specified in approved W.P.S.
- Specified when Pre-heat is mandatory.

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- For C.S. : 300°C?
- For S.S. : 150°C?

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22)What is PWHT?

- It is heat application (Generally upto 550-650°c for C, C-M steels) to an assembly after welding for the purpose of
  a) Reducing of residual stressers.
  b) Hydrogen removal.
  c) Tempering

23)What are the important aspects of PWHT? & What are recommended values for C. S. materials?

a) Rate of heating— 100°C/hr.
b) Uniformity of heating— Temperature shall not vary by more than 140°C in any 450cm.Length of weld.
c) Peak temp. of heating — 700°C ±20°C
d) Soaking period— * Up to 25mm thick – 1hr.
   * >25mm and up to 125mm – 1hr+2.5min/mm (above 25 mm).
   * Temperature shall be uniform and variation shall not be more than 55°C.
e) Cooling rate — * 100°C/hr up to 450°C.

24)What is the use of covering in covered Arc electrodes?

- To displace O_2 & N_2 of the atmosphere and to maintain shielding gas aroun the arc and molten metal.
- To produce slag which protects molten metal from oxidations.
- To deoxidize and refine weld metal.
- Controls the operating characteristics of the electrode.-Burn off rate, Penetration.
- To provide cap around the upper position of arc and prevents air being dragged in
- Deposition efficiency (Iron Powder type)

25)What is Rutile electrode? (Ex.E 6012, 6013)

Majority i.e. @ 45% of covering is $Ti.O_2$ (Rutile)
General purpose structural electrode with medium penetration and smooth Arc, (Less spatter)

26)What are Cellulosic Electrodes ? (E 6010, 6011)

- Basic constituent of covering is cellulosic
- Deep penetration, forcefull arc, rapid burn off rate.
- Contain 4-6% moisture. No backing is required.

27)What is Basic type. (E7018, 7018 -1)

- Flux covering is high in Cal. Corbonate, Cal. Flouride.
- No combined water is available and hence no hydrogen pick up
- Good transfer efficiency of alloying elements from the coating to weld deposit.
- Smoother and quite arc, low spatter, adequate penetration.

- Good impact, low hygrogen, Crack resistance.
- High radiographic acceptance. (quality)

28)How do you take care of low hydrogen electrodes?
- Keep boxes in closed room with < 60%.RH.
- Only open those Boxes which are to be used.
- Bake the electrodes (250°c – 3hrs followed by 100°c – till use)
- Discard those which come in contact with water/rain.

29)What are generally used C.S. Covered electrodes?
- E 7018 SFA 5.1 F No. 4
- E 6013, 12 SFA 5.1 F No. 2
- E 6010, 6011 SFA 5.1 F.No. 3

30)What are generally used filler metals for Carbon Steel (GMAW)
- ER 70 S-2, ER70 S-6
- SFA Number : SFA 5.18 F. No : 6
- What is the shielding gas : Ar + Co2 /Co_2

- (Here filler is it self electrode)

31)What are general S.S. electrodes(GMAW) ?
- ER 308 L, 309L, ER 310, ER316L ER, 347
- SFA Number : SFA : 5.9 F. No. 6

32 What does -15,-16 suffix denotes in S.S. covered electrodes?
- -15- Lime type covering contain largely calcium minerals,(Alkaline).Generally used with DCEP.
- -16- Can have lime type or Titania Type (T102) Also these covering contain readily ionizing elements like pottatium for stabilized arc, can be used with DCEP or AC

32)What 'L' stands for in the above ?
- Low Carbon (< 0.03%)

33)What are general purpose/used C.S. filler in GTAW?
- ER 70 - S2, ER70 - S6
- SFA No. 5.18 F No: 6

34)What are generally used S.S. filler wire in GTAW (For S.S. welding & dissimilar welding)?
- ER 308L, ER309L, ER310, ER316L, ER347L
- SFA No : 5.9
- F.No. : 6

A. What are generally used covered electrodes in Austentitic Stainless Steels?
- E 308L-16, E 309L-16, E 310-16, E 316-L16 etc.
- SFA No: 5.4, F. No: 5.

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35) What are generally used SAW electrodes /flux ?
- F 6A0 – EL8, F7 A2 – EH14
- SFA No. : 5.17 F. No: 6.

36)Name different welding Processes.
- OFW, SMAW, PAW, RESISW , SAW, FCAW, GTAW, GHAW, Laser W, Electron, Beam W, etc.

37)What are the General deposition rates of different Processes say SMAW, GMAW, GTAW, SAW?
- Deposition rates are expressed as Kg. of weld metal deposits in 1hr Arc time. Arc time is generally ¼ of welder time.(i.e. In a working day of 8 hrs – 2hrs.will be Arc time).
- For SMAW – 3.5Kg/Arc hour.
- In a day – 7Kg/day (8hrs.)
  GMAW – 21/Kg/day
  GTAW – 1Kg/day
  SAW – 35Kg/day

38)What in the general Arc temperature in SMAW?
- 5000° FC. (2760°C)

39)What are the limitations of SMAW?
- It cannot weld highly reactive metals like Titanium and Zirconium.
- Skilled welders are needed.

40)What is A.C. & D.C.?
- Alternating Current : Changes direction 100 times/section (50HZ Supply)
- Direct Current : Does not change direction.
- Rectified Current : Full wave rectified, Half wave rectified.

41)What is Polarity in welding ?
- It is how Electrode and work piece are connected to the power source terminals i.e. Positive and Negative.(In case of D.C.)

42)What is straight Polarity and Reverse Polarity?
- Direct Current Straight Polarity (DCSP)

  or
- Direct Current Electrode negative (DCEN) is called Straight Polarity.
- DCRP or DCEP is called Reverse polarity.

43) What is the polarity used for E7018?
- DCEP Reverse polarity.

44)What is the importance of Polarity?
- It determines the concentration of heat and there by influences deposition rates and Penetration.

45)What are typical defects in SMAW?

- Burn through – High current at low speeds at root & improper shielding.
- Lack of fusion – Welders Performance & its fit up to some extent.
- Lack of Penetration – Joint preparation & welders skill.
- Excess penetration _ Performance of the welder.
- Under Cuts – High Current & skill.
- Gas Pore, Blow hole, porosity – Cleanliness of the joint, moisture.
- Cracks – Impurities, hydrogen, Restraints, material composition, cooling rates.
- Slag inclusions.

46) What are the general defects in SAW?

- Under cut, Porosity, L.F., Slag inclusions, L.P., Excess weld deposit etc.

47) What are the advantages of SAW?

- High deposition rates.
- Smooth weld profile.
- Reliable welds (Defect free)
- Semi Automatic to fully Automatic – Dependency on welders skill is eliminated.

48) What are the limitation of SAW?

- Can be welded in Position (1F & 2F & 1G only.)

49) What are the advantages of GATW?

- Inert gas provides Excellent Shielding and completely eliminates Hydrogen and there by Hydrogen induced cracking in HAZ.
- Clean and defect free welds.
- Gives better contour on weld bead.

50) Why DCEN in used in GATW?

- Electrode is not the consumable and so less heat is required at the electrode and more heat is applied on to base metal where filler wire is added for proper fusion and deposit.
- To avoid Tungsten melting.

51) What are the generally used Electrodes in GTAW?

- EWTh – 1 - Colour code Yellow.
- EWTh – 2 - Colour code Red.
- Pupose -→ Better Arc – Striking, Re-ignition, Arc Stability even at low currents.

52) What are the commonly used shielding gases in GTAW?

- ARGON, HELIUM
- ARGON – Heavier than air, and provides effective shielding. Smooth arc & quite arc with low ARC VOLTAGE.
- Helium – Lighter gas, hence requires higher flow rates for better shielding. It offers high ARC VOLTAGE than Argon and is useful in welding thick section.

53) what are the general defects found in GTAW?

- Tungsten inclusions.
- L.F.
- Under cut
- L.P.
- Burn through.
- E.P.
- Porosity.
- Root oxidation.
- Crack.

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54) What is GMAW? and What are its applications?

Gas Metal Arc welding is a semi automatic process where shielding is provided by Co_2, Argon or Helium, with consuming electrode for high rate of depositions.

- General selection of shielding gases.
- Co_2 - Carbon steels, low alloy steels.
- Argon + 5-25% Co_2 - Carbon steels, low alloy steels.
- Argon + 1-5% O_2 - S.S.
- 75% He + 25% Argon + Co_2 traces – Austentic S.S.

55) What kind of grinding wheels are used for S.S.?

- Aluminium oxide (A-24), Zirconium(Zircon/Zirconium)
  Why :- Other (SIC) wheels -→ Lead to Carbon pick up by base material.

56) Is it required to identify and separate tools used on C.S. & S.S. materials?

- Yes. Why -→ Iron particles/powder picked by tools of CS material will be transferred to S.S. material on base and lead to Iron contamination and further to corrosion.

57) What are the means and methods to avoid mix up of C.S. & S.S. tools?

1. Colour coding.
2. Separate storage area of tools.
3. Separate fabrication area for S.S. & C.S. fabrication works.
4. Imparting awareness of the seriousness to the technician.

58) What are the standard bevel angle of a piping butt weld joint? How to check the fit up?

(1) C.S. := 37.5° ±. 0.2.5° (2) S.S.: + 30° ±. 2.5°

Make different templates for different angles & Root gaps

59) How do you prepare fit up of a piping joint having ID mismatch ?

- Match I.D. of the thick section with thinner one, and merge the thick ness transition in 1:3 ratio.

60) What is most important in making Socket weld edge preparation/Fit up?

- Keep min 1.6 mm gap at socket face to pipe end face.

61) Where do you find more distortion? In S.S. or C.S. welding?
- More distortion is found in S.S. welds.
- S.S. have higher Coef. Of thermal expansion & lower conductivity.

62) What are important feature of a fit up for butt welded joint?
- Groove angle.
- Root gap.
- Root face.
- O.D. mismatch.
- I.D. mismatch.
- Axis off set.
- Cleanliness around joint
- Excessive air draft should not be there while welding.

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63) What is bolt Straddle in Flange joints?
- Placement of bolt holes on both sides of vertical axis when flanges are vertical.
- Similarly placement of bolts in both sides of in N-S direction when Flange is horizontal. (std. Practice to position valves etc.)

64) How do you check squareness of plate?
- Check two sides for dimensional equality.
- Check two diagonals for equality.

65) How do you check straightness of a member?
- Place two equal height blockes at both ends of the member and place a pianowire over the blocks. Stretch the wire tightly and take intermediate readings between member and wire if same, member is straight.
- Take readings on least in two perpendicular directions.

66) How do you check verticality?
- By dropping a plumb from top at a distance from member and taking readings between wire and member at different place.
- It readings are same, the member is vertical.

67) What is general Verticality limits?
- 1mm/1mtr limited to a max 10mm.

68) How do you mark 30° line on a plate?
- Mark the origin and base line.
- Mark perpendicular line to the base line at the origin point by try-square.

- Mark two equal length on these two line and joint those two points to term a line(L).
- Divide L into three equal parts and connect first points from base line to origin to get 30°line.

69) What is ovality?
- When circular object is having two different diameter at two mutually perpendicular directions, it is called ovality.

70) What are the precaution to be taken while marking identifications on plates, pipes etc?
- If the thickness is less than 6mm, vibro-etching method shall be used.
- If the thickness is more than 6mm, round nose low stress stamp can be used.

71) What are the check points to be taken while using consumables like paints, D.P.T. materials, Electrodes etc.
- Check for conformity to approvad brand name.
- Correlate batch number with manufactures certificates.
- Check for expiry date if applicable.

72)What are precautions to be taken while fabricating S.S. items?

- Area shall be identified, neat and clean.
- See that no Carbon Steel parts comes in direct contact with S.S. coponents.
- Use polyethylene sheets/Brass Shims while supporting.
- Wear clean hand glosses.
- Do not grind C.S. items near S.S. items/Grinding dust should not fall on S.S. items.
- Use identified tools (S.S. brushes, Alumina grinding wheels etc).

73) Why one should avoid touching S.S. items with bare hands?
- Human sweat contain halides (cl), whose presence is detrimental to S.S. components .
- Stress corrosion cracking can occur.

74) How do you find chloride contamination on S.S.?
- By using std. Procedures, using Ag NO3 (Silver Nitrate solution) & HNO_3 (Nitric acid)

75) How do you find Iron Contamination on S.S.?
- By using std. Procedure, using O_4So_4 solution on.
- By using std. Procedure, using K_3 F_e $(CN)_6$ Pottasium Ferri Cyanide solution.

76) What are the precautions to be taken while stopping the arc?
- Arc shall be drawn to side of the joint and stopped on the bevelled surface while extending the arc length.
- Current shall be gradually decreased.

77) What are the simple methods to control distortion in SS Welding?
- Use stringer beads
- Use back step welding
- Use sequential welding.

78) While welding CS. what shall be the maximum permitted width of bead w.r t diameter of electrode?
- 3 times the diameter of electrode/wire dia.

79) What care is to be exercised while making flame cut edges?
- Grind atleast 1.5 mm below the deepest cut mark/indentation.

80) Why excessive reinforcement (both inside and outside) in welded joints is not desirable?
- Unless specified this should be avoided. This cause sudden change in thickness and toe points become stress raisers and over the period joint may fail.

81) What care shall be taken while giving external reinforcement?
- Reinforcement shall not exceed 1.6 mm for thickness up to 12 mm and maximum up to 2.4 mm for thickness between 12 to 25 mm.
- Reinforcement shall be smooth curved and merged with base metal.
- While grinding care shall be taken not to reduce wall thickness at toe of the weld.

82) What shall be the governing maximum limits for root reinforcement?
- When welded without insert, it is 1.6 mm
- When welded with inserts, it is 0.8 mm

83) What care shall be taken while making fillet joints?
- Weld profile shall be slightly convex.
- Leg lengths shall be equal unless specified.
- Maintain correct leg lengths (Do not make higher sizes)
- In the fit up stage, see that both plates/parts are closely in contact. (If gap (up to 1.5mm) is unavoidable, increase the leg length by that much.)

84) What care shall be exercised w.r.t. temporary attachments to components? (Lifting lugs, cleats, stiffeners etc)
- Use as minimum number as possible.
- Do not knock off, while removing, but grind and remove

Or

- Flame cut carefully leaving atleast 3 mm on the parent surface and grind further.
- Conduct thorough visual examination followed by NDT as called for.

85) What are the features of flange alignment?

- Flange face shall be within ½° to pipe axis.
- Mating flanges shall not be offset by 1.6 mm
- Gap between the flanges shall not differ by more than 0.8 mm

86) What are the reasons for IGC in SS Welding?

- Carbon percentage more than 0.03%
- Slow cooling rate (particularly 400-800°C range)
- Corrosive environment

87) How can you avoid IGC in SS welding?

- Use L grade steels (Carbon less than 0.03%)
- Use stringer beads
- Use L grade electrodes/fillers
- Keep inter pass temperature less than 150°C. (Possibly keep at room temperature).
- Keep the surfaces neat and clean.
- Apply faster cooling methods after welding (Chills/ water soaked clothe etc)

88) What is the orientation of orifice plate?

- Sharp edge upstream side.

89) How do you locate diaphram valve?

- Lower side inlet
- Higher end – outlet.

- <u>Find the correct answer.</u>

90) Strectcher stains are?

- Surface marks
- Luder lines
- Grain boundry deformation
- Both surface marks and luder lines are correct

91) Low temperature heating giving rise to small readjustments in the position of the atoms is known as?

- Recristallisation

- Recovery .
- Grain growth
- Annealing

92) Segregation within an ingot may be detected by which of the following techniques?

- Ultrasonics /
- Sulphur printing.
- Visual examination
- All of the above

93) A segregation is associated with serious metallurgical defects including?

- Non metallic inclusions /
- Shrinkage cavities
- Hydrogen cracks
- Non metallic inclusions and shrinkage cavities
- Non metallic inclusions, shrinkage cavities and hydrogen cracks are correct.

94) If too greate a forging reduction is attempted in one operation which of the following may occur?

- Preferred orientation of the grains
- Inadequate grain growth
- Forging busts.
- Forging laps

95) Internal stress is associated with?

- High temperature gradients and rapid cooling /
- Low temperature gradients and rapid cooling
- High temperature gradients and slow cooling
- Low temperature gradients and slow cooling

96) Internal stress may lead to?

- Warping
- Hot cracking
- Cold cracking
- All of the above
- Warping and cold cracking.

97) Elements with completed outer electron shells are?

- Highly reactive
- Inert.
- Metallic in nature
- High melting point materials

98) The temperature at which bonds between atoms are broken and the atoms are free to move from their fixed positions known as?

- Liquidation temperature
- Latent heat of fusion
- Melting point
- Freezing point

99) Which of the following metallic structures exhibits good ductility and high electrical conductivity?

- Body centred cubic
- Face centred cubic.
- Close packed hexagonal
- Tetragonal

100) Which of the followings structures is considered to be tetragonal?

- Austenite
- Ferrite
- Pearlite
- Mertensite.

101) Which of the following atoms will form an interstitial solid solution?

- Aluminium
- Carbon.
- Tungsten
- Argon

102) Alloying of metals is carried out to?

- Reduce costs
- Improve mechanical properties.
- Eliminate the need for heat treatment
- None of the above.

103) The general term for a local variation in material continuity is called?

- A discontinuity
- A defect
- An indication
- A crack

104) Where an unacceptable condition occurs in a material, due to local variations in material continuity the term given specifically to this is?

- A discontinuity.
- A flaw
- A defect
- Any of the above

105) Which of the following could be considered a discontinuity?

- Crack
- Change of section
- Drilled holed
- All of the above.

106) Brittle fracture is most likely to occur?

- At high temperatures
- At low temperatures.
- Under cyclic loading
- In a corrosive environment

107) NDT is generally not carried out on cast irons because?

- Cast iron is inherently free from major defects
- Due to the high carbon content cast iron can withstand high tensile stresses
- It is generally used in applications where the loads are principally comprehensive.
- The low cost of cast iron cannot justify the high cost of NDT.

108) Which of the following could effect the properties of an engineering material?

- Compostion
- Heat treated condition
- Crystal structure
- Composition and heat treated condition
- Composition, heat treated condition and crystal structure.

109) Which of the following is classified as a chemical property?

- Electrical conductivity
- Thermal conductivity
- Corrosion resistance.
- Machine resistant

110) Which of the following is classified as Physical property?

- Density
- Conductivity
- Melting point
- All of the above.

111) A non-destructive test is usually classified as a?

- Indirect test.
- Direct test
- Destructive test
- Indirect and direct test.

112) If a material is loaded until its elastic limit is exceeded, what condition will occur?

- The material may fracture
- The material may be work hardened
- The material will show no harmful effects.
- The material may fracture and the material may be work hardened.

113) Which of the following materials exhibit better compressive strength than tensile strength?

- Cast iron
- Concrete
- Wood
- Concrete and wood
- All the above

114) When a metal is very brittle which test is used to replace the tensile test?

- The shear test
- The transverse rupture test.
- The compression test
- The endurance test

115) Fatigue failure may initiate from?

- An area of corrosion
- An internal flaw
- A surface notch
- All the above.

116) Which of the following is a Notched Bar test?

- Tensile impact test
- Charphy test
- Izod test
- Charpy test and izod test.
- All the above

117) Calculate the factor of safety given that a materials has a working stress of 15,000 lbs per square inch and an elastic limit of 60,000 lbs per square inch?

- 2
- 4.
- 6
- 8

118) To what angle should a bend test be normally bent?

- 180 degrees.
- 150 degrees
- 90 degrees
- None of the above.

119) Which of the following is a hardness test?

- Rockwell.
- Creep
- Charpy
- Izod

120) Stresses that act along or parallel to a plane are known as?

- Shear stresses
- Tensile stresses
- Compressive stresses
- All of the above.

121) A material that has high hardness and good electrical and thermal connectivity known as?

- A plastic material
- A ceramic material
- A metallic material.
- A liquid material

122) which of the following is a crystal lattice that has nine atoms, eight at each corner and one centrally between them?

- Hexagonal close packing
- Body centred cubic.
- Face centred cubic
- Body centred tetragonal

123) Which of the materials is Body centred cubic at room temperature?

- Copper
- Gold
- Iron.
- Nickel

124) A process used to decrease hardness, increase ductility and occasionally improve mechinability of high carbon steels is called?

- Annealing.
- Austenitization
- Spheroidizing
- Normalising

125) Localised corrosion causing deep extended holes is known as?

- Fissures
- Pitting.
- Worm holes
- None of the above.

126) During the hardening of steel which of the following quenching media will produce the severest quench?

- Water
- Brine.
- Oil
- Air

127) What is the approximate carbon content of Pig iron?

- 1-2%
- 2-3%
- 3-4%.
- 4-5%

128) When the carbon content of iron is reduced below 2% it is called?

- Steel.
- Gray iron
- White iron
- Ductile iron.

129) A Bessemer converter is?

- A method of producing cast iron
- A method of producing pig iron
- A method of producing wrought iron
- A method of producing steel.

130) The carbon content of low carbon steel is?

- 6-25 points of carbon
- 25-50 points of carbon
- 0.06%-0.25% of carbon
- 6-25 points and 0.06%-0.25% of carbon.

131) The carbon content of high carbon steel is?

- 6-25 points of carbon
- 25-50 points of carbon

- 50-160 points of carbon.
- Over 160 points of carbon

132) An alloy steel is a steel containing two or more?

- Elements
- Atoms
- Mixtures
- Components.

133) What do the letters AISI represent?

- American Institute of Steel Industries
- American Iron and Steel Industries
- American Industries of Steel Institutes
- American Iron and Steel Institute.

134) Austenitic stainless steel most typically contain?

- ✓ 18% Chromium 8% Nickel.
- 15% Chromium 10% Nickel
- 10% Chromium 15% Nickel
- 8% Chromium 18% Nickel

135) Which of the following metals can be magentised?.

- Martensitic stainless
- Ferritic stainless
- ✗ Austenitic stainless
- ✓ Martensitic stainless and Ferritic stainless
- None of the above.

136) Tool and die steels are classed as?

- Low carbon steels
- Medium carbon steels
- ✓ High carbon steels.

- Alloy steels.

137) Which of the following alloying additions are used to produce tools and die steels?

- Nickle
- Chromium
- Manganese
- All of the above
- Both Chromium and Manganese.

138) Of the following, which is considered the most important structural non-ferrous metal?

- Copper
- Zinc
- Tin
- Aluminium

139) Which below is considered a stress raisser?

- A notch
- A scratch
- A sudden change of section
- A notch and a scratch
- All of the above.

140) When a material is plated with zinc it is known as?

- Anodizing
- Wrapping
- Galvanising.
- Flashing.

141) Which solution is used for degalvanisation of a galvanised pipe end before welding?

- HCL

- NaOH
- H_2So_4 – 10%
- Concentrated HNO_3

142) HAZ starts away weld edge:- ?

- 25 mm
- 100 mm
- 10 mm

143) HAZ is less in:

- SMAW
- GTAW
- SAW
- All are equal.

144) While degalvanising pipe end pipe is kept:

- Horizontal
- Vertical
- Vertical but little inclined.

145) Degalvanising is done only:

- On OD
- On CD
- Both CD & OD

146) Mineral length of degalvanising is:

- 10 mm
- 50 mm
- 100 mm
- 25mm

MINIMUM LENGTH

147) That portion of the base metal affected by the welding process is known as?

- The weld zone
- The heat input zone
- The weld affect zone
- ✓ The heat affected zone.

148) What is required to form a fusion bond?

- ✓ Melting of parent metals
- A filler rod
- Pressure
- All of the above.

149) Flow bonding is a term used in the welding process which of the following would be classed as flow bonding?

- ✓ Brazing
- Braze welding
- Soldering
- All of the above.

150) In order to produce a fully homgenous structure after welding which of the following is required?

- Preheat
- ✓ Post heat treatment.
- Low heat input welding
- Fillers of different composition

151) In electric arc welding, a welding rod is one electrode, the other is?

- ✓ The work price/job
- The rod flux
- The earth
- The work material and the rod flux.

152) A typical temperature range to stress relieve ferritic steel is?

- 100-150 degrees celsius

- 250-300 degrees celsius
- 600-650 degrees celsius.
- 900-950 degrees celsius

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153) AWS categorise weld defects into three classes which of below is a dimensional defect?

- Slag
- Warping.
- Lack of fusion
- Porosity

154) Which of the following defects occur in the base metal?

- Lamination.
- Slag inclusion
- Lack of fusion
- Lack of penetration

155) Welds without preheat are said to have?

- Very low thermal gradients
- Low thermal gradients
- Medium thermal gradients
- High thermal gradients.

156) Which of the following is classified as an inert gas?

- Hydrogen
- Helium.
- Oxygen
- All of the above
- Hydrogen and helium only.

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157) Which weld process has a non-consumable electrode?

- Manual metal arc

- Metal inert gas
- Tungsten inert gas.
- Manual metal arc and metal inert gas.

158) Which of the following processes could be performed using oxyacetylene Equipment?

- Flame cutting
- Brazing
- Soldering
- Brazing and Soldering
- All of the above.

159) Mechanical properties are generally improved?
- In the direction of rolling
- 30 degrees to the direction of rolling
- 45 degrees to the direction of rolling
- 90 degrees to the direction of rolling.

160) Pipe and tube may be manufactured using which technique?
- Extruding
- Rolling
- Resistance welding
- Extruding and Rolling
- All of the above

161) The shearing operations has many forms – names- of those listed below which is a shearing within the material?
- Bending
- Drawing
- Forming
- Parting

162) During the bending process what stresses are produced within the material?
- Compressive
- Shear
- Tensile
- Compressive and tensile
- All of the above.

163) Which of the following may be used as a cutting tool material?

Ramchandran

- Diamonds
- Cast iron
- Cemented carbides
- Both diamonds and cemented
- carbides.

163) With which NDT method is surface cleanliness most important?
- UT
- PT
- RT.
- MT

164) Which of the following is a measuring device?
- Micrometer
- Vernier
- Steel rule
- All of the above.

165) The fundamental difference between macro examination and micro examination is?
- Micro examination can be regarded as the overall picture
- Macro examination is the detailed structure
- Micro structure examination are conducted at higher magnification
- Macro examination are conducted at higher magnification.

166) Which of the following hardness test measures depth of indentation to determine hardness?
- Brinell
- Rockwell
- Shore sclerescope
- Vickers

167) When carrying out a tensile test the maximum load to fracture is 3.2 tons and the test piece is 0.5 inches diameter. What is the tensile strengh?
- 6.4 tons per square inch
- 4.07 tons per square inch
- 16.29 tons per square inch
- 8.80 tons per square inch.

168) A localised extension which leads to reduction in cross section prior to fracture is termed?
- Necking
- Luder line formation
- Elastic limit
- Yielding.

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169) In steels that do not exhibit yield points, the stress at which plastic deformation begins corresponding to a small permanent strain is termed?
- Elastic limit
- Transition point
- Proof stress
- Younges modulus

170) Determine the percentage elongation if the guage length of the tensile specimen was 1.5 inches prior to fracture and 1.8 inches after fracture?
- 83%
- 16.6%
- 20%
- 80%

171) Least count of a measuring stape ?
- 0.1 mm
- 0.5 mm
- 1.0 mm
- 10 mm

172) Which of the following are possible initiation sites for fatigue?
- Sharp corners
- Poor surface finish
- Sub surface inclusion
- All of the above.

173) The effects of temperature, time and load are used in assessing?
- Fatigue limit
- Endurance limit
- Creep behaviour.
- Impact value

174) Which of the following defects is considered to be the most denimental?
- Surface porosity
- Surface cracks
- Subsurface non metallic inclusion
- Subsurface cracks

175) The microstructures if the weld metal can be considered to be similar to that of?
- The parent plate
- The heat affected zone
- The parent plate and the heat affected zone
- A casting.

176) Formation of martensite in a welded structure is?
- Desirable
- Inevitable
- Avoided if possible as martensite is prone to cracking.
- Avoided by the use of alloying elements

177) Hardenability increases as?
- Alloying elements increase
- Carbon equivalent increase
- Rate of cooling increase
- All of the above.

178) As the carbon equivalent increases the?
- Preheat temperature increases.
- Preheat temperature decreases
- Hardness of the weld decreases
- Hardenability decreases

179) Which of the following must be avoided to avoid cracking in a weldment?
- Stress
- Martensite
- Hydrogen
- All of the above.
- Martensite and hydrogen

- <u>Question and Answers</u> :-

180) What is ASME?
- American Society of Mechanical Engineers

181) What does ASME Sec IX deal with?
- Qualification standard for welding and Brazing procedures, Welders, Brazers and welding and Brazing operators

182) when to use ASME Sec IX?
- Section IX is a document referenced for qualification by various construction codes such as section I, III, IV and VIII etc. These construction codes may impose additional welding requirements or exemption to section IX qualifications
- When reffered by any other construction specification.

183) What is the purpose of WPS and PQR?
- The purpose of welding procedure specification and procedure qualification record is to determine that the weldment proposed for construction is capable

of having the required properties for its intended application. It is presupposed that the welder/operator performing the test in a skilled work man.

184) What are Groove weld positions as defined by Sec IX?
- Incase of plate welds : 1G, 2G, 3G, 4G.
- Incase of pipe welds : 1G, 2G, 5G, 6G.

185) What is the acceptance criteria for tension test as per Sec IX?
- The minimum specified tensile strength of the base metal.
- If the specimen breaks in the base metal out side of the weld or fusion line, strength below the specified value by 5% is acceptable.

186) As per Sec IX What for Tension Test is conducted ?
- To find out ultimate tensile strength of the groove welded joint.

187) As per Sec IX, what for Guided bend tests are conducted?
- The degree of soundness of the weld joint.
- Ductility of groove weld joint.

188) In fillet weld qualification tests, Sectioning and macro etching is conducted for?
- size, contour and degree of soundness of weld.

189) What are fillet weld positions as defined in Sec IX?
- Incase of plates joints : 1F, 2F, 3F, 4F.
- Incase of pipe joints : 1F, 2F/2FR, 4F, 4F&5F.

190) Up to what thickness limit, full thickness specimen shall be used for tension test and above which multiple specimen may be used as a set to represent a single test of the full plate thickness?
- Thickness up to and including 1 inch.

191) What are different types of Bend tests?
- Transverse side bend.
- Tranverse Face bend, Root bend
- Longitudinal Face bend and root bend.

192) When do you use longitudinal bends test?
- When bending properties are markedly different between
  a) Two base metals or
  b) The weld metal and the base metal.

193) What is the diameter of the plunger to be used in bend test of weld specimens as per sec IX?
- 4t (Max. thickness of coupan 3/8")
- This is not a applicable when materials are having less than 20% elongation. (Generally not encountered in our applications, however guidelines are given for these Cases also in sec IX.)

194) What is the acceptance criteria in bend test of weld specimen?

- The weld and HAZ of bend specimen shall be completely within bent portion after testing.
- Shall not have no open defect in weld or HAZ. Exceeding 1/8" measured in any direction.
- (Open defects occurring evidence that they are resulted from a weld defect.

195) How and when does Notch toughness test shall be conducted for Qualification as per Sec. IX?

- Charpy V-notch impact test shall be made when required by construction code.
- The procedure and Apparatus shall conform to SA 370/E208.
- Acceptance criteria shall be as per the construction code requirements
- Positions. Shall be 3Gor 5G or 6G. (Vertical uphill)

196) What is the acceptance criteria in macro examination of Fillet weld Tests as per sec. IX?

- Visual Examination of the cross section of the welds shall show complete fusion and freedom from cracks, except that linear indications at the root not exceeding 0.8 mm shall be acceptable.
- Weld shall not have Concavity or Convexity greated than 1.6 mm.
- Leg length shall not differ by 3.2 mm.

197) What are important features of Fracture test in Fillet weld tests?

- Root side shall be in tension while loading.
- The loading shall be continued till the specimen fractures or bends flat upon it self.
- If the specimen fractures, fractures surface shall show no evidence of (a) Cracks, (b) Incomplete root fusion, (c) Porosity and inclusions cumulative lengths, not more than 10mm in 100mm length of weld length.

198) What is a WPS?

- A WPS is a written Qualified welding procedure prepared to provide direction to the welder or welding operator for making production welds to code requirements
- The completed WPS shall describe all of the essential variable for each welding process used in the WPS
- The WPS shall reference the supporting Procedure Qualification Record .Changes may be made in the non-essential variables of WPS to suit production requirements without requalification by suitable amendment.
- Each manufacturer or contractor shall prepare a WPS and supporting PQR.

199) What is a PQR?

- A PQR is record of the welding data/variables used to weld a test coupon. It also contain the results of the tested specimen.
- A PQR shall document all essential variables and supplementary essential variables when required.
- Changes to PQR are not permitted except for editonal corrections.

200) What is a P. number?

- To reduce the number of welding procedure qualifications required, P-numbers are assigned to base metals dependent on characteristic such as-
    a) Chemical compostion
    b) Weldability
    c) Mechanical properties
- Group numbers are additionally assigned to P. numbers to classify the metals for the purpose of procedure qualification where toughness requirements are specified.

201) State whether Fillet weld procedure qualified by making Fillet weld test coupon can be used at all places where Fillet joint is specified?

- No, It can be used only where the fillet joints are made on non-pressure boundaries. Otherwise Fillet Procedure qualification shall be done by making groove weld specimen.

202) What is the limitation w.r.t size of the electrode that can be used in SMAW Process?
- A size more than 6mm is supplementary essential variable, when notch toughness is specified. However when PWHT is done (with qualified procedure), this limitation does not apply.

203) what can be the max thickness that can be deposited in single pass and its implications on Procedure qualification?
- (As such there is no limit in per pass weld deposit thickness but there is limit on weld deposit thickness i.e. 2t, where 't' is weld deposit in test coupon of procedure qualification.
- If thickness of weld deposit is more than 12.5mm in single pass, it limits the base metal thickness qualified range to 1.1 times that of Test coupon welded.

204) State whether PWHT is essential variable?
- Yes
- Separate qualification is required dependings on the type of PWHT. i.e PWHT below lower transition temperature (LTT), above UTT, between LTT and UTT etc
- If PWHT is above UTT, the max qualified thickness for production welds is 1.1 times the thickness of the test coupon.
- The procedure qualification test shall be subjected to PWHT essentially equivalent to that encountered is productions welds.

205) What are the qualification limits as Preheat?
- Preheat cannot be reduced by not more than 100°F than the preheat qualified (Approved PQR)
- Inter pass temperature cannot be increased by more than 100°F than the inter pass temperature qualified (APP-PQR) when supplementary essential vanables are applicable.

206) When impact requirements are specified, what are the limits on base metal thickness?

- The minimum base metal thickness qualified in the thickness of test coupon T or 16mm. which ever in less. However if T is less than 6 mm, the thickness qualified is ½ T.

207) State whether heat input & change in current polarity is essential variable?
- When suppllimentary variables apply or Notch toughness is specified. increase of heat input calls for requalification.
- Current type i.e. A.C.or D.C.. change of polarity is supplementary variable. i.e. change over the one qualified by PQR, needs requalifications when notch toughness requirements are called by construction code.

208) State whether change in Tungsten electrode or size of electrode calls for requalifications of procedure?
- No.

209) State whether change in range of amperage calls for requalification? (SMAW, GTAW, SAW)
- No. (Indirectly taken care by Heat input.)

210) State whether change from stringer bead to weave bead Technique & vice versa is essential variable? (i.e. calls for requalification?)
- No.
- However one can understand this indirectly effects travel speed and hence heat input, which is supplementary essential variable.
- Even though notch toughness is not specified by construction code general method of construction shall not to deteriorate it. Hence it is advisable to use stringer bead even in carbon steels. In S.S. (304/30L Grades) it is always recommended to use stringer bead to avoid sensitization

211) State while using SAW Process, when there is a change from multi pass per side to single pass per side calls for requalification?
- Yes, when notch toughness is specified.

212) What do you understand by notch toughness and What is its significance?
- It is generally calculated by charpy V.notch test. It is absorbed energy by the component before it break.
- It is dependent on temperature.
- When it is discussed w.r.t. weld joints, when welds are made by high heat input, impact values will come down because of coarse grain formation (slow cooling rate). Fastest cooling rates give higher impact values because of fine grain structure. However fast cooling rates can from brittle structure which are not desirable always. Depending on the material to be welded, Pre-heat & PWHT shall be properly selected to get good impact values & good mechanical properties.

213) What is peening? Is it a essential variable?
- It is not a essential variable as far as welding procedure qualification is concerned.

- Grains of single phase metals continue to grow without obstruction through each succeeding weld pass of multi pass welds, which leads to extreme anisotropy of mechanical properties.
- Peening or cold working of each pass prior to next pass helps to mitigate this problem.
- However peening is not recommended for the first and last passes because of the likely hood of fracturing the first layer and heavily distorting the surface of the last layer.

Note : In M.C.I.L specification peening is not permitted

214) what is welder performance or operater performance qualification?
- It is a test conducted to determine the ability of welders and welding operators to make sound welds.

215) What are the conditions for expiration and renewal of qualification?
- If a welder has not welded with a process during a period of 6 months, his qualification for that process shall expire.
- When there is a specific reason to question his ability to make welds to meat the requirements.

216) State whether P-number is a essential variable for welder performance qualification.
- Yes.
- But within P no 1 to 11, it is not essential variable.

217) State whether backing is essential variable for welders?
- Deletion of backing calls for requalification.
- Double V-joints are considered joints with backing.

218) State what are essential variables for welders?
- Backing.
- Diameter.
- Thickness of deposit
- Position.
- F-number.
- Change in direction. ( )
- Addition or deletion of inserts (In GTAW)
- Omission of inert backing (In GTAW)
- Change in polarity (In GTAW).

219) What is an essential variable?
- Procedure – A change in welding condition which will effect the mechanical properties of the weld joint.
- Performance – a change in welding condition which will effect the ability of the welder to deposit sound weld metal

220) What is supplementary essential variable?
- A change in welding condition which will effect the notch toughness properties of the weldment.

221) What is a non essential variable?

- A change in a welding condition which will not effect the mechanical properties of the weldment.

222) State whether requalification is required for a welder when groove design changed from V-groove (Qualified) to U-groove?

- No. (V-groove, U-groove, Single-bevel, double bevel etc. fall under groove welds Qualification)

223) What is P-number?

- To reduce the number of qualifications required, base metals have been assigned with P-numbers based on composition, weldability and mechanical properties. Based on impact properties, ferrous metals have been assigned with Group numbers within P-numbers.

224) What are S-numbers?

- Non-mandatory.
- S-numbers are a listing of materials which are acceptable for use by B-31 code but which are not included in ASME Sec II.

225) What is F-number?

- Electrodes and welding rods are assigned with F-numbers based on their weld ability characteristics which determine the ability of the welder to make satisfactory welds with a given filler metal.

226) what is A-number?

- It is grouping of weld metal compositions.
- This can be determined from chemical analysis of the weld deposit taken from the test coupon or it can be taken from the manufactures certificate of compliance.

227) what are thickness limits of base metal in procedure qualification?

- Test coupon thickness 'T' between 1.5 mm and 9.5 mm.
  Qualified range minimum 1.5 mm
  maximum 2T.
- Test Coupon thickness 'T' between 9.5 mm and less than 38 mm
  Qualified range minimum : 4.5 mm.
  maximum : 2T.
- Test coupon thickness 'T' more than 38 mm.
  Qualified range minimum : 4.5 mm
  maximum : 200 mm

228) What are thickness range of weld deposit Qualification?

- If weld deposit 't' is les than 19 mm then it is 2t.
- If weld deposit 't' is more than 19 mm it is same as base metal limits

229) How many specimens are required for mechanical testing in procedure qualification? (Groove welds)

- Tension test : 2 Nos.

- Root bend : 2 Nos.
- Face bend : 2 Nos.

230) Side bend test are used in place of face & root bend tests when thickness is more than?

- When thickness is more than 9.5 mm, 4 Nos side bend specimen can be made in lieo of Face & root bend & specimen.
- When thickness is more than 19 mm, side bend test shall be conducted.

231) If Fillet Test joint is made using 6 mm fillet what are the qualification range?

- All fillet sizes on all base metal thicknesses and all diameter.

232) If a groove weld procedure is qualified, what are limits of fillet weld qualification?

- All fillet sizes on all base metal thicknesses and all diameter.

233) In a Procedure qualification fillet weld test, how many sections are required for macro etching?

- 5 pieces of 2" width. (T joint, double fillet).
- 4 pieces in case for Pipe fillet.

234) For performance qualification of welder for but weld groove joint, what are the tests to be conducted and what are the limits?

- 2 Bend test (1 Face & 1 Root)
- This can be substituted by a radiography test.

Thickness range qualified : For t < 19 mm, 2t
(Where t = deposited weld thickness) : For t > 19 mm Maximum to be welded.

Limits on diameter -

Test coupon O. D.	< 1"	Range Qualified : Size welded.
	1" < O.D. < 2 7/8"	minimum : 1"
		maximum : Unlimited.
	>/ 2 7/8	minimum : 2 7/8"
		maximum : Unlimited.

(2 7/8" = NPS 2 1/2")

235) What are the fillet weld, Performance qualification Tests?

- 1 Macro etch Test.
- 1 Fracture Test.

236) Which combination of position on plate – groove qualification will qualify all position on plate (Performance)?

- 3 G And 4 G, 2G

241) Which Performance qualification position in groove welds will qualify all position in plate & pipe?

- 6 G

242) Which position in fillet weld performance qualification will qualify all position?

- 5 F.

For 4G

243) What is the diameter of pipe, for which a groove weld performance qualification made on plate can be used for making groove welds? For flat position in pipe position

- Over 24" O. D. Pipe.

244) When making specimen for tensile testing from Groove welded joint piece, State whether machining of the reinforcement of the weld flush with base metal is necessary or not ?

- Yes, it is to flush machined, care shall be taken to machine minimum possible to get parallel surfaces.

245) what shall be the thickness of bend test specimen?

- For base metal thickness more 9.5 mm, it is ~~base metal thickness~~ 9.5 mm
- For base metal thickness less than 9.5 mm, it is base metal thickness.
- (When thickness is more than 9.5 mm side bend can be conducted and above 19 mm, side bend shall be conducted. When thickness is more than 9.5 mm, when making specimen for Face bend specimen, all the machining shall be done on root side and only flushing of reinforcement shall be done on weld face. Similar principle applies for root bend specimen.)

246) what happens if a higher thickness specimen is used for Face & root bend without reducing thickness to the required?

- The percentage elongation imposed on the outer layer may exceed the base metal ductility and may give erroneous results

247) When impact requirements are specified, what is the position to be used while making procedure qualification test weld?

- 3 G (uphill progression) or 5 G or 6 G

248) Which solution is used in degalvanisation of G. I. Pipes?

- H_2SO_4 (10 %).

249) How do you position the Pipe while degalvanising?

- Vertical but little inclined.

250) What is minimum length of degalvanisation on pipe ends for making weld fit- up?

- Minimum 50 mm.

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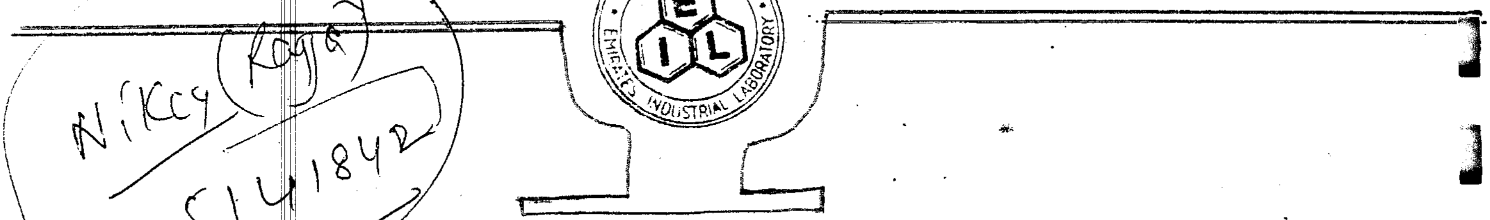
CLEVELAND BRIDGE ~~ENGG~~-ME
P.O. BOX # 16765, JEBAL ALI FZE
DUBAI, UAE
Fax: (009714) 8835416
e: contact@clevelandbridge.co.ae



Nikey (Raja)
514842

S. NAVANEETHAN
ASNT Level - II (UT, MT & PT)