BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Metal Construction Skills

Session: 2021-22 (Summer Semester)

B. Voc. Program, V Semester,

1st In-Sem. Examination

Course Code: MCS1503 **Time: 1 Hour**

Course Name: Welded Construction & Design **Max. Marks: 20**

Instruction:

1. Attempt all questions.
2. Use of Calculator is allowed.
3. Section A contains 05 Questions. Each question carries 1 Marks.
4. Section B contains 03 Questions. Each question carries 2 Marks.
5. Section C contains 03 Questions. Each question carries 3 Marks.

Section – A

05X01 = 05 Marks

Q.1 All welding processes require pressure along with heat.

a) Yes
b) No, fusion doesn't require
c) Can't be stated
d) None of the listed

Q.2 Rails in the field are generally welded by using

a) Thermit welding
b) Gas welding
c) Electric arc welding
d) Forge welding

Q.3 Among gas and electric arc welding, which has the higher rate of heating?

a) Gas welding
b) Electric arc welding
c) Gas welding and electric arc welding have equal rate of heating
d) Cannot be determined

Q4. The effective throat thickness is K times the size of weld. What is the value of K when angle between fusion faces is 80°?

a) 0.5
b) 0.65
c) 0.7
d) 1

Q.5 Which of the following is not true regarding effective throat thickness of weld?

a) Effective throat thickness should not be less than 3mm.
b) It should not exceed 0.7t or 1t, where 't' is thickness of thinner plate of elements being welded.
c) Effective throat thickness = K x size of weld, where K is a constant.
d) Effective throat thickness = K x (size of weld)^2, where K is a constant.

Section – B

03X02 = 06 Marks

Q.6 What do you mean by tack welding?

Q7 Why we use Tack welding?

Q8 What is effective throat thickness?

Section – C

03X03 = 09 Marks

Q.9 Two plates 16 mm thick are joined by

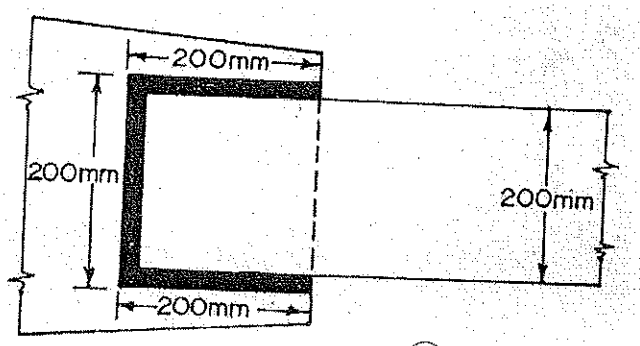
I) a double U butt weld,

II) A single U butt weld.

Determine the strength of the welded joint in tension in each case. Effective length of weld is 150 mm. Allowable stress in butt weld in tension is 142 N/mm^2.

Q.10 What do you mean by welding distortion? And how you can minimize the distortion?

Q.11 In a truss girder of a bridge, a tie as shown in Fig. 7.18 is connected to the gusset plate by fillet weld. Determine the strength of the weld. The size of the weld in the fillet weld is 6 mm. permissible load is 110 N/mm^2



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Answer key

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Section – B

03X02 = 06 Marks

Q.6 What do you mean by tack welding?

Ans: Tack welding is a process in which you set your welding material in place by applying short welds or tack welds that act as fixtures or joints. These welds are placed along the metals being soldered together before making the initial and final root pass.

Q.7 Why we use Tack welding?

Ans: There are several reasons why the use of proper tack welding is important. It helps to ensure proper alignment of the material. If your welds are placed at appropriate intervals, it also aids in preventing the metal from warping out of place during the welding process. It also allows the welder to set the joint gap. With your tack weld acting as a fixture, it allows you to reduce workplace clutter or can even be used to help reinforce fixtures for added security against misalignment or distortion. They are also easily disassembled to allow for realignment if the weld happens to be incorrect. For such a small step, the benefits of properly applying a tack weld have an impact on the entire process and the quality of the finished product. Not only can it help to eliminate unnecessary equipment from the work area by acting as a fixture but it has the ability to strengthen or weaken a weld.

Q.8 What is effective throat thickness?

Ans: Effective throat thickness is the shortest distance from the root of fillet weld to face of diagrammatic weld (line joining the toes). The effective throat thickness should not be less than 3mm and it should not exceed 0.7t or 1t, where t is thickness of thinner plate of elements being welded. Effective throat thickness = K x size of weld, where K is a constant which depends on angle between fusion faces.

Section – C

03X03 = 09 Marks

Q.9 Two plates 16 mm thick are joined by i. a double U butt weld, ii. A single U butt weld. Determine the strength of the welded joint in tension in each case. Effective length of weld is 150 mm. Allowable stress in butt weld in tension is 142 N/mm^2.

Ans:

i.In case of double U but weld, complete penetration of weld takes place

Effective throat thickness of weld = 16 mm

Effective length of weld = 150 mm

Strength of single U butt weld = throat thickness x length of weld x permissible shear stress

= (16 x 150 x 142/1000) = 340.8 kN

ii. In case of single U butt weld, incomplete penetration of butt weld takes place

Effective throat thickness = 5/8 x 16 = 10 mm

Effective length of weld = 150 mm

Strength of single U butt weld = (10 x 150 x 142/1000) = 213.0 kN

Q.10 What do you mean by welding distortion? And how you can minimize the distortion?

Ans: Distortion:

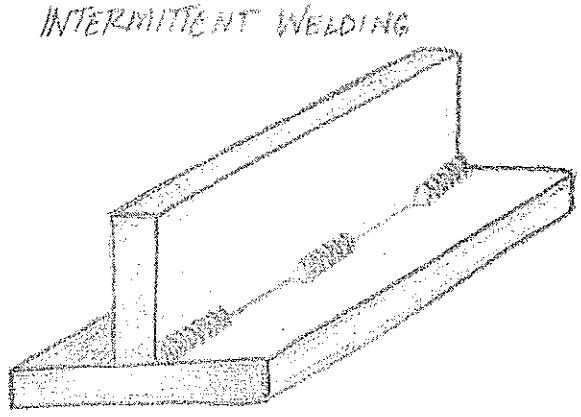
Weld shrinkage plagues experienced and amateur welders alike. Shrinkage causes distortion of the weldment. Warping of the base plate is caused by heat from the welding arc. Distortion results from the expansion and contraction of the weld metal and adjacent base metal during the welding process.

1. Don't over-weld

The greater the amount of metal in a joint, the greater the shrinkage forces. Reducing the amount of weld saves metal, saves time, and protects the weld from distortion. If the metal plate is thicker than 0.25", beveling can help ward off distortion.

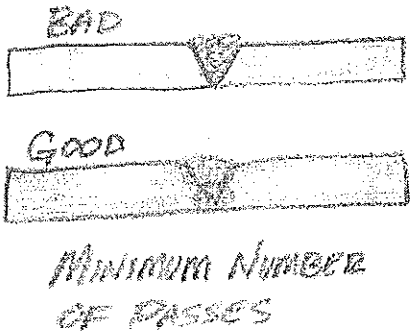
2. Use intermittent welding

Using intermittent welding, rather than continuous welding, where possible greatly decreases distortion. Even though weld metal and heat transfer are reduced by as much as 75%, the strength of the weld remains relatively uncompromised.



3. Use as few weld passes as possible

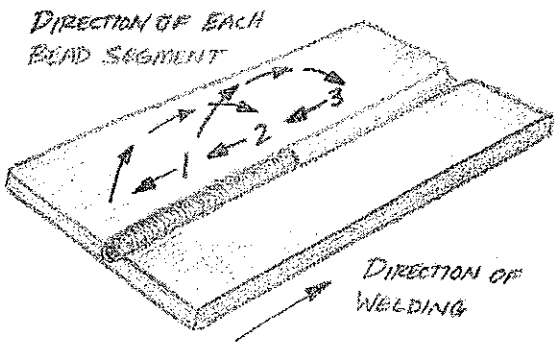
Fewer passes with a larger electrode are preferable to many passes with smaller electrodes when transverse distortion could be a problem. Shrinkage is cumulative with each pass. More passes lead to more shrinkage.



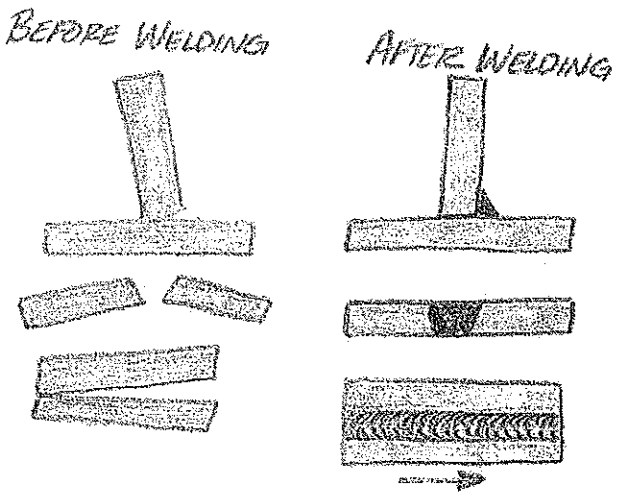
4. Place welds near the neutral axis
Providing a smaller leverage for shrinkage forces to pull the places out of alignment by placing welds near the neutral axis minimizes distortion.

5. Balance welds around the neutral axis
Offset one shrinkage force with another to effectively minimize distortion. The design of the assembly and sequence of welding are both important factors to consider.

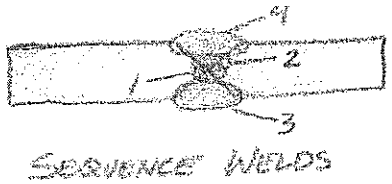
6. Use backstep welding
The general progression of the weld may be, for example, left to right, but each sequential bead segment is placed right to left. After placement of each bead, the heated edges expand on the far side of the weld. Once the heat spreads across the plate, expansion on the opposite edge brings the plates back together. This process greatly reduces distortion.

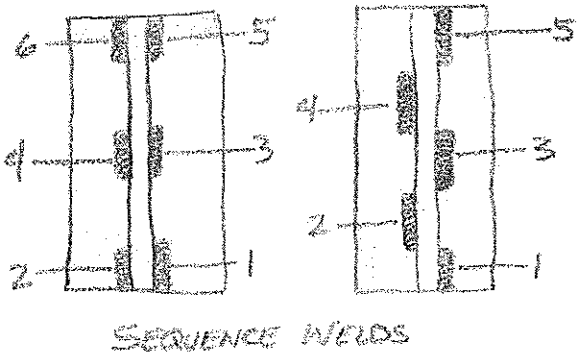


7. Anticipate the shrinkage forces
Presetting the parts before welding can make shrinkage perform constructive work. Presetting, prebending, or prespringing the parts to weld uses opposing mechanical forces to counteract distortion. For example, lengthening the top of a weld groove when presetting the plates can help reduce distortion. The resulting weld is slightly longer than it would have been on a flat plate. After removal of the clamps, the final weld relieves its longitudinal shrinkage stresses by shortening to a straight line. This process results in a flat plate. Another technique balances shrinkage by positioning identical weldments back-to-back and clamping them tightly together. Welds are placed on both assemblies and allowed to cool before removing clamps. Combining this process with prebending can further prevent distortion. A diagram would help



8. Planning the weld sequence
The proper weld sequence involves placing weld metal at different points of the assembly so that shrinkage occurs in just one place at a time and is counteracted by sequential welds. Alternating welds on both sides of the neutral axis is especially useful in complete joint penetration groove welds. In fillet welds, intermittent welds alternating down weldment balance shrinkage.

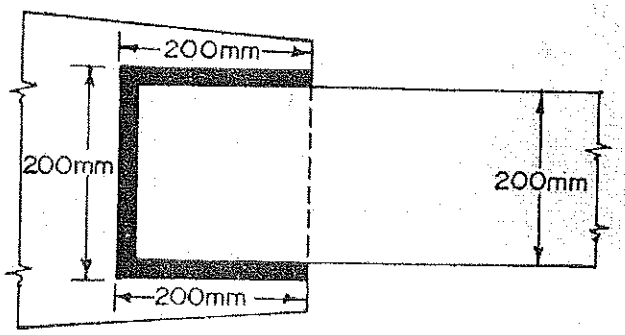




9. Remove shrinkage forces after welding
Peening counteracts the shrinkage forces of a weld bead as it cools. Peening stretches the bead and makes it thinner, thus relieving the stresses induced by contraction as the metal cools. This process requires caution; peening is inapplicable on a root bead or on a final pass as the process could conceal or cause cracks. Another technique is thermal stress relieving. Thermal stress relieving involves controlled heating of the weldment followed by controlled cooling to removed weld-introduced stresses.

10. Minimize welding time
Minimizing time while welding minimized the amount of metal heated. Reducing heat reduces shrinkage and thus distortion.

Q.11 In a truss girder of a bridge, a tie as shown in Fig. 7.18 is connected to the gusset plate by fillet weld. Determine the strength of the weld. The size of the weld in the fillet weld is 6 mm. permissible load is 110 N/mm^2



Solution

Size of weld	= 6 mm
Effective throat thickness	= 0.7 x 6 = 4.2 mm
Effective length of fillet weld	= 200 + 200+ 200 = 600 mm
Strength of fillet weld	= (4.2 x 600 x 110/1000) = 277.2 kN