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EFFECT OF PLATE THICKNESS AND CURRENT ON THE LONGITUDINAL SHRINKAGE IN MILD STEEL BUTT JOINTS

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Abstract - *Welding, as the name suggests is the way of joining of two metal parts by applying heat and filler material, by applying pressure or by applying both on the work piece. When the welding is done through the application of current, then it is termed as arc welding and when there is the application of pressure, then it is known as resistance welding [8]. In this report , we are performing a test in which , different plates of mild steel of different thicknesses (6mm , 7mm and 8mm) are being welded with a groove angle of 45^0. Now after this, we will calculate the longitudinal shrinkage in distortion of mild steel by applying different welding currents of 100 A, 150 A and 200 A.*

Key Words: Longitudinal shrinkage, Arc welding, Butt joint, HAZ, MS.

1. INTRODUCTION

Arc usage of electric arc welding in the various fields like automobile industries , industries which are based on building of ships , industries which are construction based .Due to the cost effective process , it is widely used in different industries In the electric arc welding process , we can vary the current according to the need[2].Distortion is a type of shortcoming in the welding process, in which , there is contraction in the length of the work piece after the welding process is being done. There are different types of distortions are there like, angular distortion, longitudinal distortion, transverse distortion etc. In this we will try to calculate the longitudinal distortion, which is parallel to the direction of welding. [5]

Different authors has experimented and calculated the value of distortion and calculated the welding process but Rarely any author has given the focus on varying the current and thickness simultaneously for calculating the distortion and thereafter analyzing different authors, there is a scope of calculating the longitudinal distortion by varying the thickness and current of mild steel plates.

2. EXPERIMENTAL SETUP

Mild steel plates of different thicknesses are being welded by giving groove angle of 45^0, the current is also varied to find the longitudinal shrinkage in distortion. The welding electrode E-6013 Is of size 3.15mm x450mm and the maker is unique wire industries ISO-9002, and the range of current is 100-200A.

2.1. PREPARATION OF THE PLATE OF WELD

In this , 6 plates of thicknesses 6mm and naming them as T1 ,T2 , T3 , T4 , T5 , T6 , similarly another 6 plates of thickness 7mm named as T7, T8 ,T9 ,T10 , T11 , T12 and then 6 plates of thickness 8mm named as T13 , T14,T15, T16 , T17 , T18 . The groove angle of 45^0 is being prepared with the help of bench vice and hand grinder. In this the work piece is fixed in the bench vice and after that, with the help of hand grinder, the grooves of 45^0 is made in each plate.

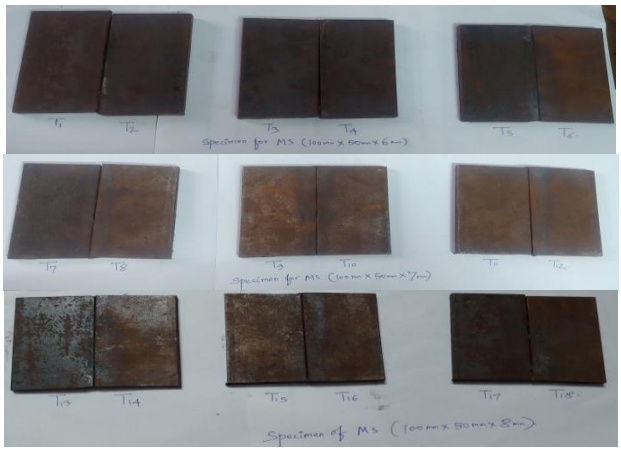

Fig -1: Mild steel plates before welding

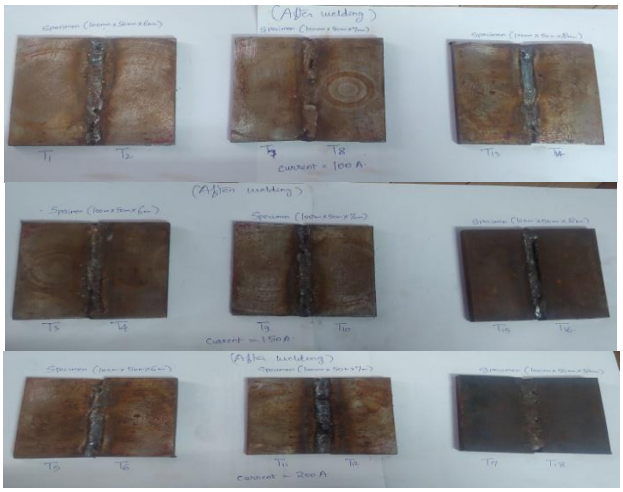

Fig -2: Mild steel plates after welding at different currents.

3. CALCULATION AND DISCUSSION

With the help of a scriber the gap in longitudinal axes is marked and then the welding is done, due to the Heat Affected Zone, there is contraction in the gaping in the longitudinal axes and hence, the change in gap is calculated with the help of a vernier caliper. This gives us the longitudinal shrinkage in the welding of mild steel.

Table -1: Calculation of longitudinal shrinkage

S. No	Plates	Thickness	Current Amp.	Groove Angle	Longitudinal Shrinkage
1	Z1	6mm	100 A	45^0	1.90
2	Z2	7mm	100 A	45^0	1.95
3	Z3	8mm	100 A	45^0	1.97
4	Z4	6mm	150 A	45^0	2.01
5	Z5	7mm	150 A	45^0	2.02
6	Z6	8mm	150 A	45^0	2.04
7	Z7	6mm	200 A	45^0	2.10
8	Z8	7mm	200 A	45^0	2.12
9	Z9	8mm	200 A	45^0	2.20

Here Z1, Z2, Z3, Z4, Z5, Z6, Z7, Z8. Z9 are Pair of, MIld steel plates of different thicknesses and different currents of 100 A, 150A 200A as shown in the table. The above table shows the longitudinal shrinkages of the different plate thicknesses of Mild steel with different current after the welding process is done. The groove angle taken here in each pair of plate is 45^0.

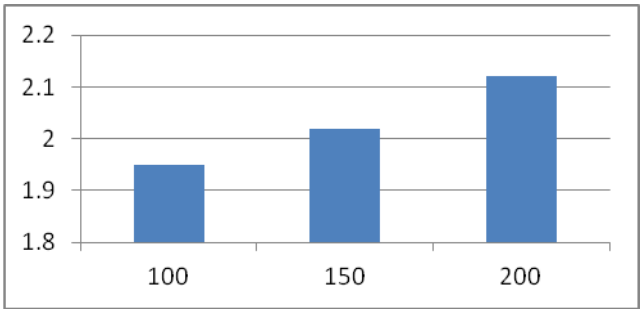

Chart -1: Longitudinal shrinkage at y axis and current at x axis of 6 mm thickness MS plate.

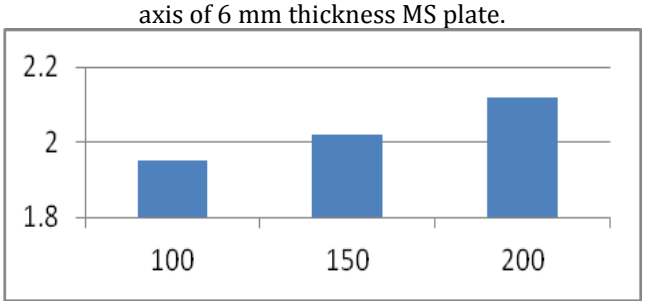

Chart -2: Longitudinal shrinkage at Y axis and current at x axis of 7 mm thickness of MS plate.

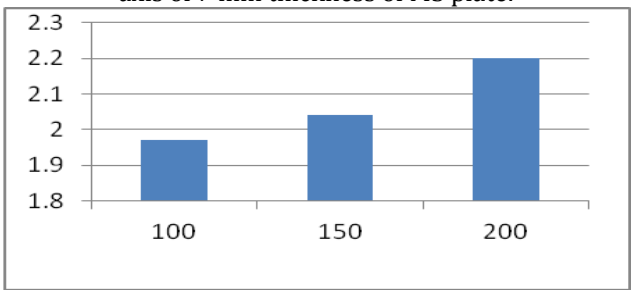

Chart -3: Longitudinal shrinkage at Y axis and current at x axis of 8 mm thickness of MS plate.

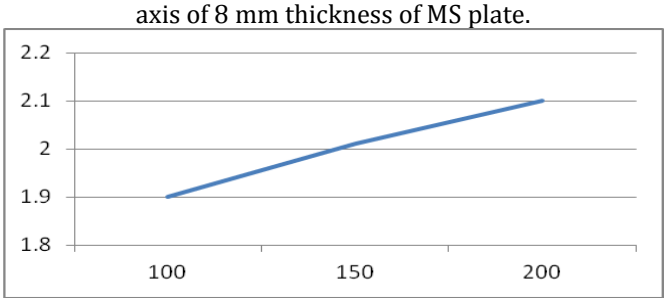

Chart -4: Line graph shows Longitudinal shrinkage at y axis and current at x axis of 6 mm thickness MS plate

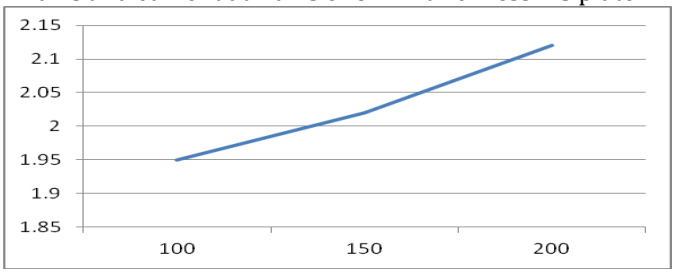

Chart -5: Line graph shows Longitudinal shrinkage at Y axis and current at x axis of 7 mm thickness of MS plate.

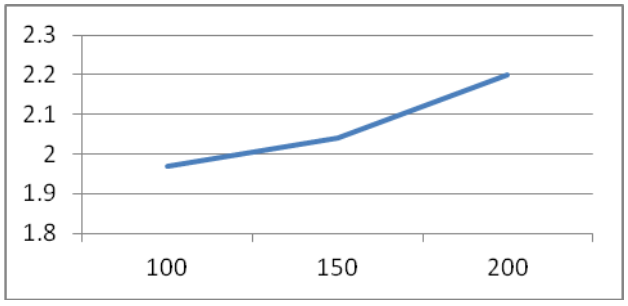

Chart -6: Line graph shows Longitudinal shrinkage at Y axis and current at x axis of 8 mm thickness of MS plate.

4. CONCLUSIONS

After the calculations are made in the MS plate of different thicknesses, following conclusions are being made,

1) As the thickness of mild steel plate increases, the longitudinal shrinkage in distortion also increases.
2) As the Welding current of the mild steel increases, the longitudinal shrinkage also increases means the longitudinal shrinkage is proportional to the welding current.
3) Resistance also affects the longitudinal shrinkage, as the resistance in current increases, heat will increase and hence HAZ will increase which will cause increase in longitudinal shrinkage in distortion.

From the above points it is concluded that, longitudinal shrinkage is minimum when current and plate thickness is less.

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