International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

EXPERIMENTAL CALCULATION OF TRANSVERSE SHRINKAGE IN MILD STEEL BUTT WELDMENTS DUE TO VARIATION OF CURRENT AND PLATE THICKNESS

DEVENDRA SINGH[1], SHIV KUMAR[2]

[1]M.Tech. Research Scholar, GITM, Lucknow, UP, India
[2]Assistant Professor, Dept. of Mechanical Engineering, GITM, Lucknow, UP, India

---

Abstract - *The process of welding suggests that joining of two materials by applying heat or by the application of pressure or both on the work piece. Different types of welding include like gas welding, electric arc welding, resistance welding, thermo chemical welding etc. I am using electric arc welding in my work, when the work piece is heated distortion is occurs in different dimension which result a distortion in transverse direction called as transverse shrinkage.*

In this Report we are going to calculate the transverse shrinkage in welding process by the variation of current as 100 A , 150 A , 200 A and the variation of thicknesses as 6mm , 7mm and 8mm on the Mild Steel butt joint .Firstly we do welding after that we will calculate the change in dimensions in the perpendicular direction of the welding.[8]

Key Words: *Transverse shrinkage, Arc welding, Butt joint, Mild Steel.*

1. INTRODUCTION

The usage of welding is widely in the industries which are related to automobiles, also the industries which are related to the shipping industries, construction based industries. The most important feature of Arc welding is that we can vary the welding current according to the usage.[1]

Distortion, as the name suggests is a fault after the welding process is done, it signifies the change in the dimension of the workpiece. This defect hampers the Quality of the material to be welded and hence there is difference in the dimension of the workpiece as required for the work. Distortion types are angular, longitudinal and transverse etc. Transverse distortion is the distortion in the perpendicular direction of the direction of welding. [3]

Many authors have worked on the field of distortion of Mild Steel but its very rare that any author has change the current and thickness simultaneously to find the transverse distortion of the work piece. Hence, we can vary these properties to calculate the transverse distortion in Mild Steel after welding

1.1 EXPERIMENTAL ARRANGEMENT

In this, the Mild steel plates are being taken to welding while taking groove angle at 45^0. The current is also varied to calculate the transverse shrinkage in welding. The electrode used in welding is E-6013 and the size will be 3.15mm x 450mm, the unique wire industries has made it. And the current varies from 100 A to 200 A.

1.2. PREPARATION OF THE PLATE OF WELD

In this experimental setup six plates are being taken Of thicknesses 6mm, 7mm and 8mm each means total of 18 plates are being taken. The names given to the plates of 6mm are T1 , T2 , T3 , T4 , T5 , T6 and for 7mm , name given to plates are T7 , T8 , T8 , T9 , T10 , T11 , T12 and for 8mm plates named as T13 ,T14,T15, T16 , T17 , T18.

Bench vice is used for the preparation of grove angle which is 45^0, hand grinder is used for this purpose. Workpiece of Mild steel is attached to the bench vice and after that grinder is used for making groove angle of 45^0 for each plate.

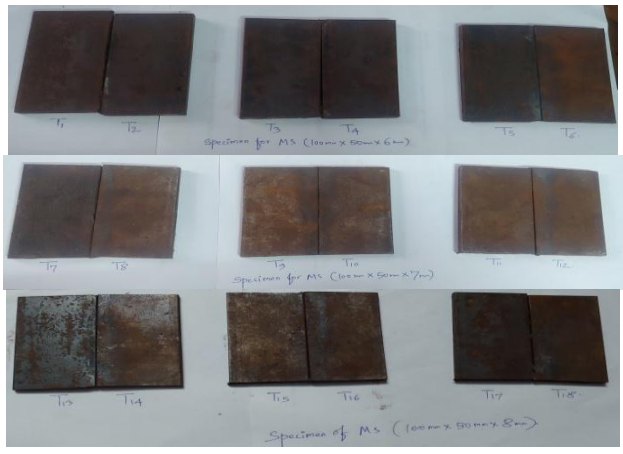

Fig -1.1: Mild steel plates before welding.

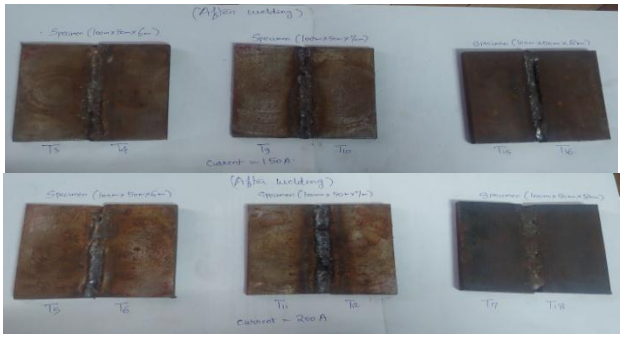

Fig -1.1: Mild steel plates after welding at different currents 100A, 150A. 200 A with groove angle 45^0.

2. EXPERIMENTAL CALCULATION

The mark on the workpiece is given with the help of scriber in transverse direction and after that welding is done. The change in gap is measured with the help of vernier caliper. This gives the transverse shrinkage in welding of mild steel.

Table -1: Transverse Shrinkages at different current and thickness

S.N	Plate	Thickness	Current	Groove Angle	Transverse Shrinkage
1	Z1	6mm	100 A	45^0	1.7
2	Z2	7mm	100 A	45^0	1.85
3	Z3	8mm	100 A	45^0	1.94
4	Z4	6mm	150 A	45^0	1.93
5	Z5	7mm	150 A	45^0	1.94
6	Z6	8mm	150 A	45^0	1.97
7	Z7	6mm	200 A	45^0	1.95
8	Z8	7mm	200 A	45^0	1.96
9	Z9	8mm	200 A	45^0	1.98

In the above table Z1 ,Z2 , Z3 , Z4 , Z5 , Z6 , Z7 , Z8 , Z9 indicates the pair of Mild steels in 6mm, 7mm and 8mm thicknesses and the current applied to them are 100A , 150 A , 200 A . The groove angle is taken as 45^0.

Table -2: Table of ANOVA for Transverse Shrinkages at different current and thickness

		Factor 1	Factor 2	Response 1
Std	Run	A:Plate thickness	B:current	TRANSVERSE SHRINKAGE
		MM	AMP	MM
1	2	6	100	1.7
2	8	8	100	1.94
3	3	6	200	1.95
4	7	8	200	1.98
5	4	6	150	1.93
6	6	8	150	1.97
7	9	7	100	1.85
8	5	7	200	1.96
9	1	7	150	1.94

Table -3: Table of F and P values for transverse shrinkage

S.N	Sum of Squares	Df	Mean Square	F-Value	P-Value	
1	1.77	3	0.5907	5.76	0.0057	significant
2	0.3361	1	0.3361	3.28	0.005	significant
3	1.00	1	1.00	9.75	0.0059	significant
4	0.4356	1	0.4356	4.25	0.0052	significant

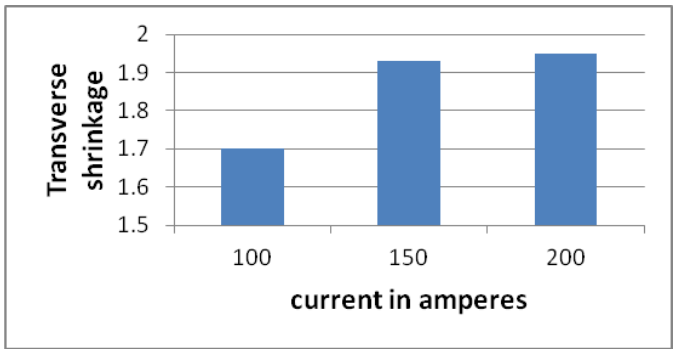

Chart -1: Transverse shrinkage at Y axis and current at x axis of 6 mm thickness of MS plate.

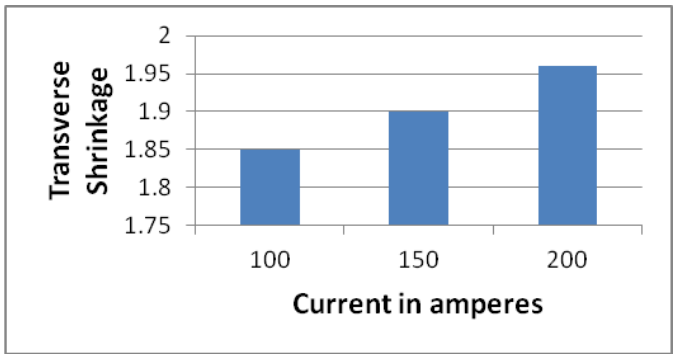

Chart -2: Transverse shrinkage at Y axis and current at x axis of 7mm thickness of MS plate.

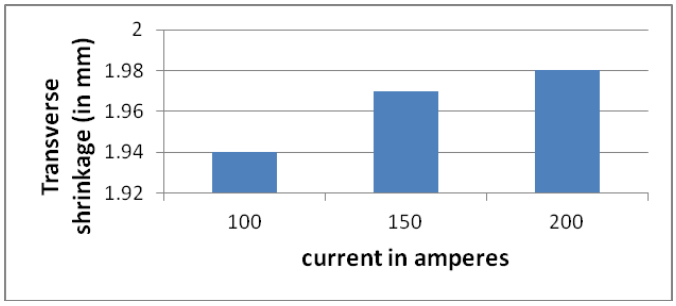

Chart -3: Transverse shrinkage at Y axis and current at x axis of 8 mm thickness of MS plate.

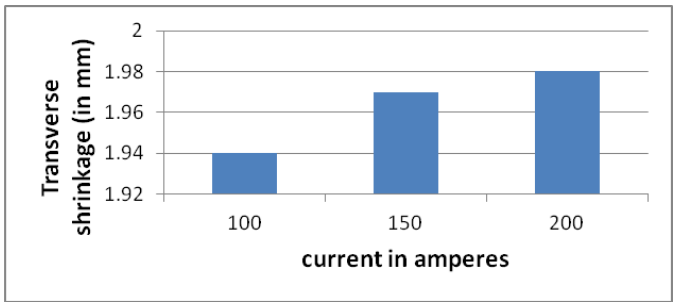

Chart -4: line graph shows Transverse shrinkage at y axis and current at x axis of 6 mm thickness MS plat

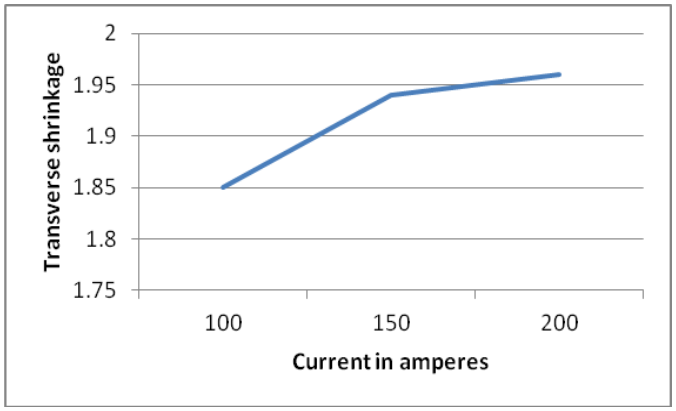

Chart -5: line graph shows Transverse shrinkage at Y axis and current at x axis of 7 mm thickness of MS plate.

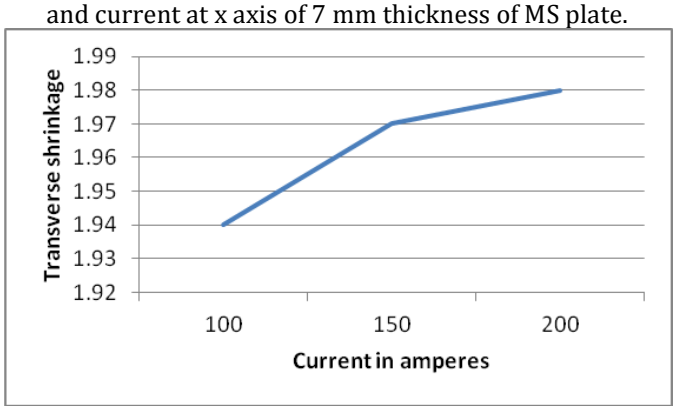

Chart -6: line graph shows Transverse shrinkage at Y axis and current at x axis of 8 mm thickness of MS plate.

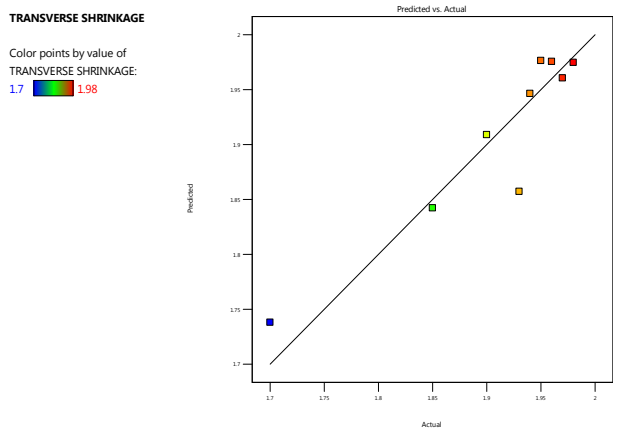

Chart -7: Graph For The Deflection In MS For Predicated Versus Actual for Transverse shrinkage

3. CONCLUSIONS

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

- The increase in thickness of mild steel effects directly to the transverse shrinkage means as the mild steel thickness increases transverse shrinkage also increases.
- The increase in welding current is also directly proportional to the transverse shrinkage
- HAZ also effects the transverse shrinkage means when there is welding takes place , then the part near to the heating zone of welding will be effected more and hence transverse shrinkage will also be high there

- Minimum shrinkage of distortion is achieve with minimum plate thickness and current.

From the Above discussion concludes that to avoid the transverse shrinkage, the thickness, current and HAZ should be less

REFERENCES

[1] P.C,Ikeagu,T.Waite, S. Williams, T. Nagy, Suder, Steuwer And Pirling Welding Process Impact On Residual Stress And Distortion. (2009)
[2] D.Deng Fem Prediction Of Welding Residual Stress And Distortion In Carbon Steel Considering Effects Of Transformation Of Phase. 2009
[3] L.Gannon , Y.Liu , N. Pegg, M Smith Effect Of Welding Sequence On Residual Stress And Distortion In Flat-Bar Stiffened Plates. (2010)
[4]. A.Damale1, Dr.K..Nandurkar Thermo-Mechanical Fea And Experimental Rationale Of Weld Incorporated Angular Distortion In MMAW Butt Welded Plates. (2012)

[5] H. Fisseha Nega1, Yang H, Gao Y Weld Design Of Vehicle Bodies And Analysis Of Welded Butt And T-Joints Using Simufact. (2013)
[6] Talabi, S, Owolabi,, Adebisi, Yahaya,. Effect Of Welding Variables On Mechanical Properties Of Low Carbon Steel Welded Joint. (2014)
[7] J. Kozak Prof, J. Kowalski Problems Of Determination Of Welding Angular Distortions Of T-Fillet Joints In Ship Hull Structures. (2015)
[8] A Course in workshop Technology by B.S . Raghuvanshi