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"Evaluation of Bend test performance on MIG welded mildsteel plates"

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ABSTRACT

The influence of the welding process, i.e. choice of the metal plate welding technology, on mechanical and its properties, is thoroughly examined based on several aspects, which completely describe the behavior of the base metal and welded joint components. This paper is providing a detailed overview of the technological bend testing of the steel IS2062 E250 Br.This study evaluates the bend test performance of mild steel plates which are welded by the Metal Inert Gas (MIG) welding process across different plate thicknesses (8 mm, and 12 mm). The bend test is conducted to evaluate the ductility, flexibility, and weld integrity of the joints under deformation. Specimens are tested for both face and root bends, focusing on the effects of thickness variations on weld quality and its mechanical properties. Results highlight the influence of metal plate thickness on bend performance, which include defect occurrence, such as cracks or lack of fusion, and the metalplate's ability to withstand plastic deformation. This investigation provides valuable insights into optimizing welding parameters and material selection for structural applications involving MIG-welded mild steel plates. Based on given test results and the analysis, we can conclude that chosen welding technique is good for edgeprepared mildsteel plates of 8mm and 12mm , and the test results of the delivered steel plates IS 2062 are satisfactory .

Keywords:-Welded joint, welding technique, bending, face weld, root bend, crack

1. Introduction

Welded joint as a complex and heterogeneous structure presents a most critical point in the welding of metalplates. Therefore, in most cases, the satisfactory of the welding construction is evaluated based on weld joint properties as whole, and the properties of its components [1]. The influence of the welding process, is based on the choice of the plate welding technology, on mechanical and exploitation properties, is thoroughly examined based on several aspects, which fully describe the behaviour of the metal selected to weld i.e base material, welded joint, and welded joint components. The design of nearly every component and structure relay on minimum tensile properties. As welded joints contain metallurgical and often compositional differences that result from the welding process, the effects of these changes on the mechanical properties of the weldment must be assessed. One of these examinations is bend testing as per Standard IS 3600 P5 1983 [3]. Edge preparation is a critical factor that influences the quality and strength of the welded joint. The effect of root gap on mechanical properties and crossectional charateristics of MIG butt weld determines the effect of root gap on the geometry and the mechanical properties of weld metal.The depth of penetration of the weld bead is of high importance because it has a direct influence on weld strength[3] .This paper is providing a detailed overview of the Bend test of the mildsteel IS2062 E250 butt welded joint with V-groove and U-groove configuration, with the function of determination of mildsteel plates tensile strength around welded joint. Study of the technological bend testing of the butt welded joint was performed in order to determine the ability of the mildsteel plate to bend around the welded joint. The study

procedure, as well as test specimen used for bend testing of the butt welded joints, are defined by the Standard IS 3600 P5(Specifies root bend and face bend of butt joints in metallic materials - Bend test) [3].

2. Experimental

2.1 Materials

For the present work ,mild steel plate of Indian Standard IS 2062 E250 BR is selected to carry out the research work .IS 2062 E250BR is an Indian standard of structural steel. E250br Plate is designed with an excellent composition allowing it to withstand a range of corrosive environments. The Mild Steel Plate is a low carbon grade having a maximum carbon content of 0.41%. The content of carbon gives the IS 2062 E250BR Plates excellent strength in various structural systems. The high yield strength coupled with enhanced tensile strength allows the Hot Rolled IS 2062 E250BR Structural Plate to perform well in stress-induced systems.The below table shows the chemical composition (table 1) and material property in table 2.

Chemical Composition

Grade	C	Mn	P	S	Si	Carbon Equivalent (CE), Max
E250br Steel Plates	0.22	1.50	0.045	0.0450.40	0.40	0.41

Table 1: Chemical Composition of IS 2062 E250BR Mild Steel Plates

Mechanical Properties

Grade	Yield strength N/mm2	Tensile strength N/mm2	Elongation (%)
E250br Steel Plates	250 min	410 min	23

Table 2: Mechanical Properties of IS 2062 E250BR Plate

2.2. Bend Test study

Study of the technological bend testing of the butt welded joint of mild steel plate was performed in order to determine the ability of the mildsteel to bend around the welded joint. The study procedure, as well as specimen used for bend testing of the butt welded joints, are defined as per Standard. The bend testing samples are prepared from the welded specimens and the face bend and root bend tests are carried out in accordance IS – 3600 – P5 -1983 test method on Universal testing machine fig 2 and fig 3. Bend Test in Welding plays important role to determine the soundness and ductility of welds.The outer portion of the bend test takes the maximum expansion by plastic deformation under tensile stresses.The bend test is a qualitative destructive test as we except whether the result is acceptable or not. The main objectives of the bend tests are: 1.Check the weld soundness. 2.Check the weld joint ductility for welding procedure qualification. In my present investigation bend test is evaluated using Face bend: When the load is applied on the root side so that the weld face will be in the tension. Root Bend: Here load is applied on the face side so that the weld root will be in the tension.As shown in figure 1

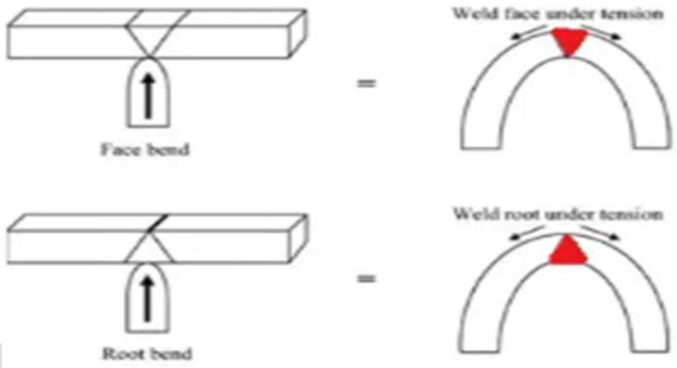

Figure 1. location of bend test

Figure 2. Universal Testing Machine

Figure 3.Specimen mounted on UTM

3. Result and discussion

Bend testing of butt welded joint of the edge prepared mildsteel plates was performed around weld face and weld root on universal testing machine. The results are tabulated below

Plate thickness	***Test parameter***	***Bending angle aound weld face***
8mm	***Face bend S1***	*Cracks were observed*
	Face bend S2	*180 no cracks*
	Face bend S3	*180 no cracks*
	Face bend S4	*180 no cracks*
		Bending angle aound root face
	Root bend S5	*180 No cracks*
	Root bend S6	*180 no cracks*
	Root bend S7	*180 no cracks*
		Bending angle aound weld face
12mm	***Face bend S1***	*Cracks were observed*
	Face bend S2	*180 no cracks*
	Face bend S3	*180 no cracks*
	Face bend S4	*180 no cracks*
		Bending angle aound root face
	Root bend S5	*180 No cracks*
	Root bend S6	*180 no cracks*
	Root bend S7	*180 no cracks*

Table 3: Test result as a function of different edge preparations of 8mm and 12mm mildsteel plates

Test specimen bend testing results extracted from the welded plates, indicate that.The specimen S1 of both 8mm and 12mm mildsteel plates, with no edge preparations, cracks were observed before reaching the bend angle, which indicated lack of fusion due to poor penetrations of weld metal. Without edgepreparation, the weld metal is not fully penetrated or fuse with the plates leads to weak joint. The weld metal has not reached the root of the joint leaving unfilled gaps leading to incomplete penetration. With no proper root gaps welding materials were trapped within the weld leading to inclusions and showed crack.

4. Conclusions

All the specimen with 12mm thickness and 8mm thickness which are edge prepared showed no cracks upon reaching bend angle of 180° there were no signs of cracks. Based on test results and their analysis, we can conclude that the chosen welding process and the selected edge preparations for 8mm and 12mm wild steel plates are good, and Cracks were not observed, hence weld bend test was satisfactory.The root gap plays a major role in welding as it enhance the mechanical property of the weld metal. Which provides good weld penetration and weld bead geometry.

5. References

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