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Case Study - Controlling Distortion During Welding of a Composite Joint where Post Weld Machining is involved

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Abstract:

This is a short report on a case study where distortion could be controlled during welding of a complex composite joint of a big size structural component. In it, post weld machining was also involved.

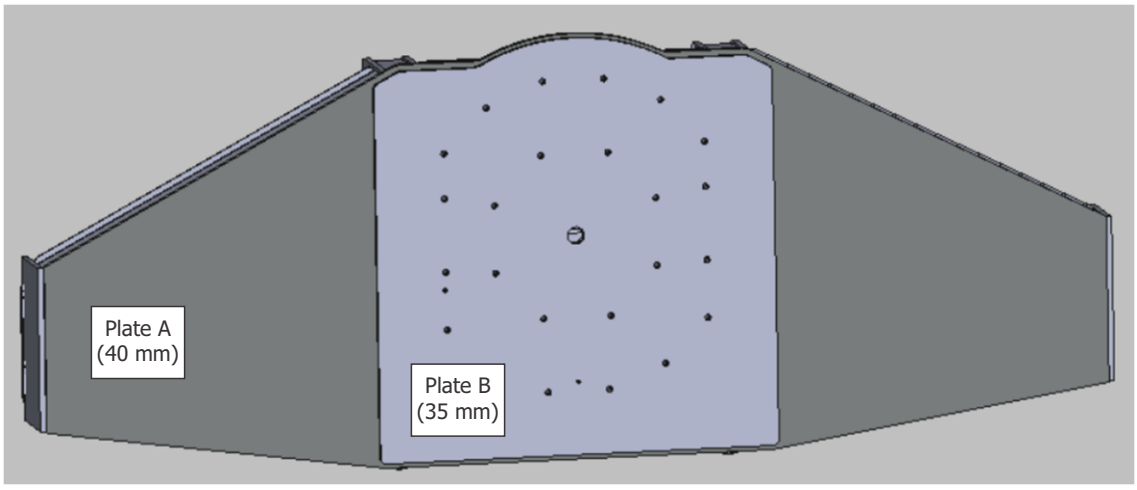
Description of the Task

This is a case study where two Steel Plates, A & B with thicknesses of 40mm & 35mm respectively are welded together to increase the thickness for machining. Referring the drawing below **Fig. 1**, a plate 'B' having dimension of 1605x1650 is being welded to the other plate 'A' having dimension of 4400x1650. The plate B at the bottom will have to be machined along with several through holes for the whole structure to be mounted to another pre-installed faceplate. Hence, the flatness of the plate B after welding is of great importance.

The Problem

When the Plate B was welded to Plate A along the side and the whole structure was sent for machining, it was observed that there was a bulging of 15 to 18 mm which originated from the centre of the fabricated structure. At this juncture, it is to be noted that the Plate had many other thicker steel plates welded at 90 to Plate A, which prevented the Plate to distort due to heat.

So, when machining was done, the thickness of the Plate B at the centre became almost 10 to 12mm due to machining while its edges remained 25 to 28mm. A Clear Gap of 5 to 8 mm between the Plate A and Plate B was created, which was not visible from the outside. In this state, the structure could not be mounted on the designated faceplate as it might bounce due to the gap created between the plates and also the alignment of the structure after tightening with the bolts would be disturbed and it would not be parallel to the mounting LM Rails fitted on the other side of the Plate A **(Fig. 2**).



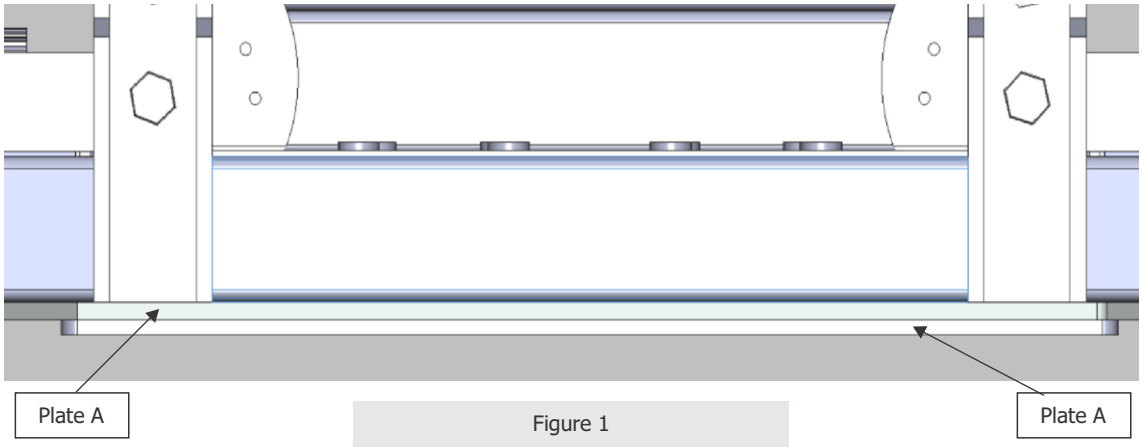


Figure 1

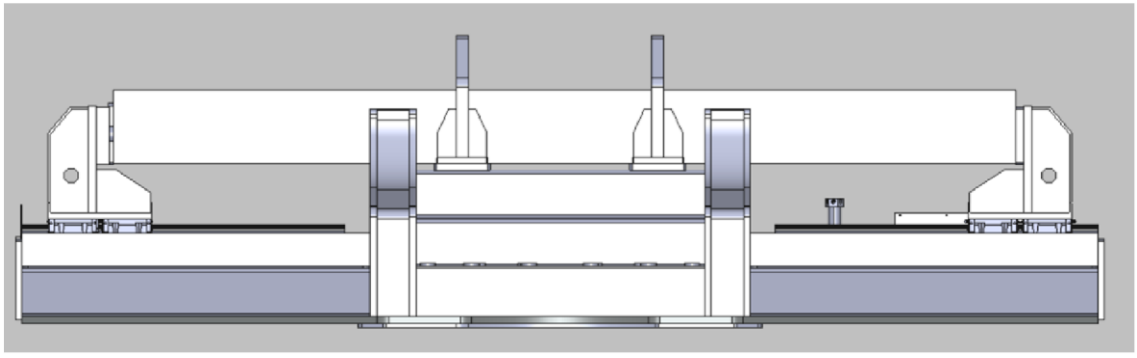


Figure 2

The Reason

During welding of the Plates A & B, there was enormous pressure generated between the plates, and the force was concentrated at the centre of the plates as a result of which the Plate B which was placed on Plate A, bulged due to heat distortion. The Plate A did not bend due to the other steel members placed at 90 to its base restricted it.

The Remedy

Before the Plate B is placed on top of Plate A, a centre hole of sufficient dia. e.g. 75mm, is to be cut in the Plate B. Then plate B is to be placed on Plate A and along the joint inside the centre circle, both the plates should be welded first. Thereafter, welding along the edges of the plates are to be done. Then the welded portion at the centre will restrict the plate B to bulge (**Fig. 3**). Secondly, the welding is preferred to be done by a process which can control / reduce the heat input to the parent material, eg. pulsed MIG.

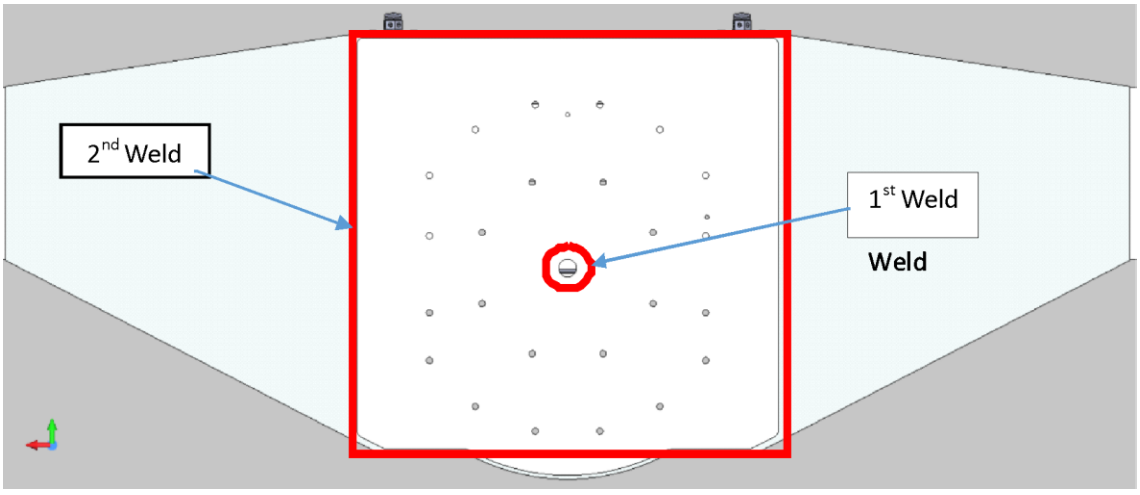


Figure 3