

Chapter 12

Narrow Gap Welding Principle

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ABSTRACT

The effectiveness of the welding process depends on some attributes, such as costs, the production time, and the quality of welding joints. This matter is more vital when dealing with the thick plates of steel for special structures in industry. To provide the quality when joining thick plates, especially with narrow gap and small chamfer angle, it is necessary to design the progressive process focusing on the main parameters, including the arc power, the translational velocity, and the rotational velocity of the tip. To evaluate the stability and the reliability of this technique, it must also perform the microstructure analysis in different zones of welding joint. In this chapter, previous publications related to this topic were gathered and analyzed. Particularly, several findings in recent studies for improving this progressive technology in the manufacturing area were discussed in detail.

INTRODUCTION

Narrow gap welding has found wide applications in many industries such as nuclear, aerospace, shipbuilding, petroleum and automotive industries, especially in fabrication of heavy construction from thick steel plate. The high productivity can be achieved using narrow gap welding (NGW). In welding the thick steel plate, there is the challenge with shrinkage of construction due to additional time of welding and residual stress. The one pass conventional large heat input welding or low heat input multi-layer welding by Gas Metal Arc Welding (GMAW) are not a reasonable solution in this context. In shipbuilding and container industry for transportation of long-distance cargo, it is necessary to design construction reaching 100 mm in thickness of high-strength steel. From the other aspect, the added time of welding makes the production cost higher. Due to these conditions, the development of the new improved welding technology is prevailed (Sumi et al., 2015; Uchino et al., 2020; Murayama et al., 2015).

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DEFINITIONS

The formulation of this phenomenon is defined by the American Welding Society (AWS) as follows: a variation of a multiple pass welding process with filler metal, using a small root opening and V-groove with a small groove angle". Another significant feature yields a weld joint with a high ratio of depth to width.

Narrow Gap Welding (NGW) refers to narrow groove weld between two thick plates, applying to butt welding Type I or X groove. Normally, butt weld is considered NGW when the chamfer angle is typically in ranges 2-20°. Accordingly, the thickness of plates can reach 50 – 100 mm (see Figure 1, 2, 3). This requires less weld metal and less heat input in comparison with traditional welding technologies.

Figure 1. Narrow Gap Welding Joint

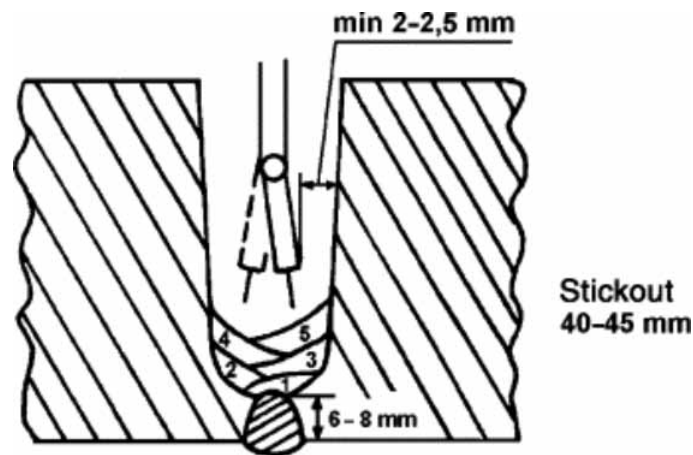
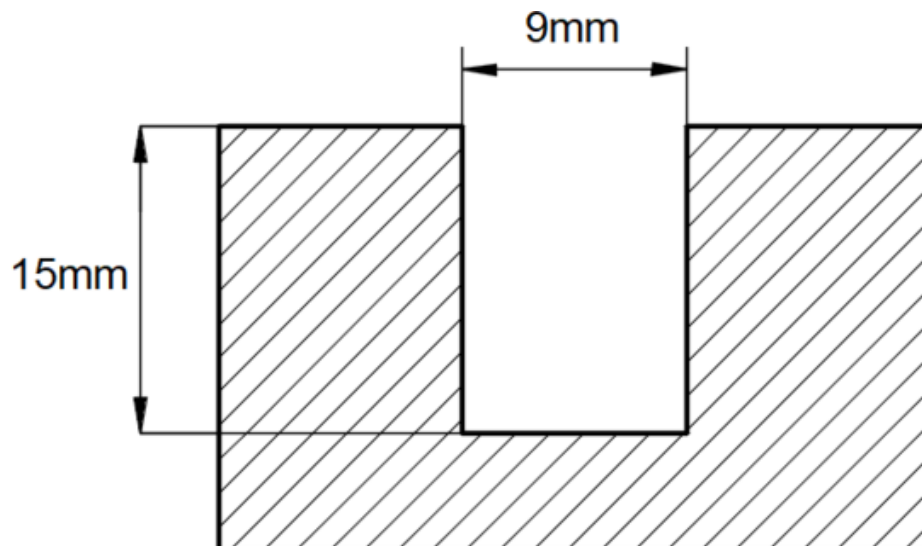


Figure 2. Narrow- groove welding



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