

# Analysis of Two-Side Forming Technology for Single-Side Welding of Manual Arc Welding

Wenxiang Chen<sup>1, a</sup>, Jinyu Ren<sup>1, b</sup>

<sup>1</sup>Wuhan Technical College of Communications, Wuhan 430065, China.

<sup>a</sup>1104959422@qq.com, <sup>b</sup>308810953@qq.com

## Abstract

In the process of industrial construction, The welding position is limited by the space position, which required penetration and unable to remove the root and weld again on the back. Adopting one-sided welding and two-sided forming welding technology can effectively solve this difficult problem. Because it is not necessary to remove the root on the back of the weld and then welding, compared with the two-side welding, the production efficiency can be increased by 1 - 2 times. At the same time, it can also ensure that the welding root is completely permeated, avoided the welding defects of the weld root without penetration, cause the stress concentration of the weld and destroy the strength of the weld structure. Therefore, manual arc welding single-side welding and double-sided forming welding technology can effectively improve the working efficiency and ensure the welding quality of the structure.

## Keywords

Single-side welding two-side forming; welding process; operation technology.

## 1. INTRODUCTION

Welding is an important part of advanced manufacturing technology, which plays an irreplaceable role in the economic construction and social development of our country. Single-side welding and double-sided forming welding technology is a advantages of improving productivity, reducing the labor intensity of welders, ensuring welding quality and so on. It has been widely used in the construction of petrochemical, ship construction, lifting and hoisting equipment and steel structure engineering. The welding seam of steel structure is characterized by large quantity and complexity. For the welding position is good and easy to operate, the melting electrode gas shielded welding is generally adopted, which is beneficial to improve the welding efficiency. However, for the narrow space position, which is not conducive to the realization of melting electrode gas shielded welding technology, manual arc welding technology will be used. Based on the characteristics of the steel structure, the welding joint is welded with the bottom layer, and the welding technology of single-side welding and double-side welding of the manual arc welding is studied.

## 2. CHARACTERISTICS OF TWO-SIDE FORMING PROCESS FOR SINGLE-SIDE WELDING

The difficulty of the one-side welding two-side forming and welding process of the manual arc welding is reflected on the welding of the root of the bottom of the welding line, and the two-sided welding with the manual arc welding is different in that the conventional basic welding rod is connected with the arc welding, and the large-current arc-arc welding is adopted by the improvement of the novel process, Let the hot metal flow to the back of the weld

automatically, observe the temperature of the weld pool, the welding rod does instantaneous movement, the welder controls the welding speed and swing according to the size of the weld hole, and relies on the operation technology of controlling the molten pool metal at the seam gap to realize one-side welding, positive and reverse double-sided forming.

### **3. PREPARATION OF TWO-SIDE FORMING PROCESS FOR SINGLE-SIDE WELDING**

#### **3.1. The Groove Angle Should Be Appropriate and A Certain Blunt Edge Should Be Reserved**

When carrying out the single side welding and double side forming technology of manual arc welding, the necessary equipment should be prepared and the preparation work should be made. When welding, the V-shaped groove should be used, and the angle of the groove should be controlled at 60 °C -70 °C. A gas cutting and processing groove method is generally adopted, and the oxide scale on the surface of the workpiece is ground until the metallic luster is exposed, and slag clamping is avoided when the double-sided forming technology of one-side welding is carried out.

A 1-2 mm blunt edge shall be reserved for the general groove according to the thickness of the component, and the blunt edge shall be the end face part of the non-open groove in the thickness direction of the welding part. If the wall thickness is 3 mm, the blunt edge should be 0.5 mm, if the wall thickness is more than 12 mm, it should generally be 1.5 mm, the maximum should not exceed 2 mm, the blunt edge is too thick to appear the root is not welded through. It is too thin and easy to be broken through, and there are welding tumor defects on the back of the weld with large weld holes.

With blunt edges, it can withstand a large welding current, and there will be no phenomenon that the arc will break through the root as soon as it causes the arc to break through the root. It is easy to control the size of the molten pool with a blunt edge, which is beneficial to the penetration of the root, in particular to the position of the inverted welding, and a slightly larger welding current is required to ensure that the back surface of the welding seam is formed, otherwise, the process defects of air holes, slag clamping and the like can not be formed.

#### **3.2. Selection of Welding Material**

When the grade of the welding rod is selected, the matched welding rod shall be selected based on the material of the base material. The diameter of the selected electrode shall be selected according to the specific thickness of the structural member to be constructed, so that the electrode with smaller diameter is generally selected for operation, and it is generally preferable that the welding rod is 2.5 or equal to 3.2.2.

When using the electrode, be sure to do a good job of inspection to ensure the quality of each electrode, if the color of the electrode changes, corrosion or surface cracks, then can not be used. When drying the electrode, the corresponding temperature should be determined according to the nature of the electrode. For example, if the acid electrode is dried, the temperature should be controlled between 100 °C and 150 °C, and the constant temperature should be 1 hour. If the electrode is alkaline, the drying temperature should be controlled between 300 °C and 350 °C, and the constant temperature should be 1 °C for 2 hours. To avoid moisture when the electrode is used, place it in advance in the prepared heat preservation bucket.

#### **3.3. The Root Gap Assembly Clearance Shall Be Appropriate**

When the groove angle of the component is appropriate, there must be an appropriate gap at the root of the weld in order to ensure that the electrode is sent to the root and that the arc

permeates the root groove. In order to make the penetration of the back of the weld uniform, the diameter of the electrode used for the selection of the gap dimension of the root is preferably about 0.5 - 1 mm in diameter, and the deviation of the gap dimension shall be about 1-2 mm.

The size of the root gap is also related to many factors, combined with the actual situation to consider the choice:

3.3.1 Workpiece thickness: If the welding piece is thin, the heat dissipation is slow, the heat of the welding piece is not easy to dissipate, the root clearance can be smaller, and the thicker welding piece should be properly larger to facilitate the penetration of the root.

3.3.2 Process parameters: the welding current is small, the root gap should be slightly larger, When welders are used to using large current operations, the root gap should be reduced accordingly. The welding current of vertical welding and elevation welding is 10%-20% higher than that of flat welding.

3.3.3 Welding position: The root gap between the flat seam and the transverse seam is smaller, and the size of the gap is smaller than the diameter of the electrode used. For the back seam and vertical seam, the size of the gap is larger than the diameter of the electrode used.

3.3.4 Blunt size: The blunt edge is thick and the root space is appropriately larger; on the contrary, the root space is also appropriately smaller.

3.3.5 Welding sequence: Considering the factors such as thermal expansion and shrinkage, the clearance of the rear welding site should be slightly larger than that of the front welding site, the gap of the root should be welded first and the gap of the root should be welded after welding.

## **4. DOUBLE-SIDE FORMING OPERATION TECHNOLOGY FOR SINGLE-SIDE WELDING**

It is considered that the welder who can carry out the welding technology of single side welding and double side forming has a certain welding operation foundation, and realizes the purpose of one side welding and double side forming on the bottom welding of one side root. The welding operation technology and matters needing attention are as follows:

### **4.1. Arc-Arc Welding**

After the arc is drawn in the range of 10-15 mm, the electric arc is preheated, the penetration force of the arc is utilized, the blunt edge of the root of the breakdown is melted and broken, When the semi-molten state is reached, the arc is depressed so that a "melting hole" slightly larger than the corresponding gap occurs, When the semi-molten state is reached, the arc is depressed so that a "melting hole" slightly larger than the corresponding gap occurs, As the welding rod continues to melt, the penetration hole of the breakdown is welded, at this time, the appropriate arc-extinguishing method, the surface tension of the molten pool and the electromagnetic shrinkage force are taken, so that the welding seam is formed. Then break through, melt the blunt edge, then form the weld hole, and then weld back and forth to reach the back weld forming.

The formation of a weld hole means that the root has been welded through. the size of the weld hole size, that is, the size of the weld seam on the back of the logo. Generally control the diameter of the melt hole is about 1.5 times of the corresponding gap. The specific size should be adjusted according to the workpiece thickness, welding position, specification parameters, root clearance, steel type and other factors. Generally, the process test is carried out, and then the welding is carried out to ensure the welding quality.

#### 4.2. Accurate Arc Ignition and Decisive Arc Extinguishing

The arc ignition shall be carried out in the groove, and the arc shall not be scratched by the base metal. The arc shall be compressed to the lowest extent after starting the arc, and the transverse swing shall be carried out by the zigzag operation of the small tooth pitch at the welding point. The butt-welding part is used for heating, the "a hand" sound emitted by the arc penetrating groove is obtained, the metal starting to see the positioning welding line and the groove surface at the two sides of the connecting welding line is seen to melt, and the first molten pool is formed, so that the molten drop covers about half of the droplet before it is repeated until the root base weld is completed.

Because the welding cable and the welding tongs have a gravity on the wrist, the welding tongs of the welder are not easy to be stable, the arm should hold forceps hard, which is beneficial to the wrist to pick up slightly while the whole arm is not moving, so as to achieve the purpose of quickly and accurately igniting and decisively extinguishing the arc. Welders in the process of operation to relax, tension will be stiff hands, will act mechanically and jitter, easy to produce "stick" and welding deviation phenomenon.

#### 4.3. Remember the Three Basic Movements

When breaking arc welding is carried out, there are three actions: longitudinal movement and lateral swing along the direction of weld axis. Firstly, in order to ensure the stable combustion of the arc, the feeding effect in the axial direction of the welding rod is to ensure that the length of the arc is kept constant when the welding rod is continuously melted, therefore, the speed of feed should be equal to the melting speed of the welding core. Secondly, the longitudinal movement along the axis of the weld is to ensure the formation of a certain length, a certain size of the root weld, arc break welding, the root groove formation of a slightly larger than the gap of the hole; The purpose of the final lateral movement is to stir the bath so as to increase the width of the weld pool, the intermediate transition is slightly slower than the two ends of the fast groove, it is associated with the forward motion, and the change is much, depending on the shape of the bath and the amount of the molten metal. Only by organically combining the movement of the three operations can the weld forming quality on the back of the weld be ensured.

#### 4.4. Overcoming the Adverse Effect of Droplet Gravity on Weld Forming

First of all, we should choose the appropriate welding current, because of the gravity of the droplet, the root of the flat welding position is bottom welded, and the latter droplet covers 1/2 of the previous droplet. Welding current is 10 ≤ 15% lower than that of vertical, transverse and supine welding position. In the center of the molten pool, molten molten iron and slag are always vertically downward by gravity when welding at the root of the vertical and upward welding position. To this end, the welder is to use the angle of adjusting the welding rod, the arc striking end of the welding rod is directed to the position to be welded, the welding arc is pressed down at the temperature of between 70 and 80 DEG C with the work piece, and the melting hole is broken through the thrust of the arc. and the back-one droplet covers one third of the previous droplet when the back-welding position root base is used for backing down the through-hole welding; When the bottom penetration hole welding is carried out at the root of the vertical welding position, the latter droplet covers 1/2 of the previous droplet, and the arc is lowered or stayed at the front or upper part of the molten pool to overcome the adverse effects of gravity.

#### 4.5. If the Welding Rod Is to Be Replaced, the Joint Shall Be Accurate

The welding of the bottom weld at the root is completed by several electrodes. Because the welding length of one electrode is limited, it is necessary to replace the electrode in the middle. The welding rod is to be replaced quickly, and the joint should be accurate, that is, it is

still in the red heat state at the end of the welding seam of the front track, the return line distance is 10 to 20 mm, and the molten drop is right, so that the molten drop is easy to fuse before and after the welding, and the defects such as the air hole and the clamp slag can be effectively avoided, The quality of the joint will directly affect the overall quality of the weld.

## 5. CONCLUSION

To sum up, the welding technology of manual arc welding on one side and two sides is complex, the technical level of welder is high, and the operation is difficult, mainly because the back forming of weld is difficult to control. The paper mainly introduces the process technology of single-side welding on the root of the welding line, and provides a brand-new thinking for the welder in the practical work and the skill training. Pay attention to the acquisition of theoretical knowledge and strengthen the practical operation at the same time, only by combining theory with practice flexibly, can we constantly improve the skill level in welding field, so as to make it better serve the development of social industry.

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