TECHNICAL BULLETIN

THE NECESSARY BUT UNDESIRABLE WELD JOINT

For years, J&L Wire has produced wire mesh decking using (pre-coated) hot-dipped galvanized wire and structural sheet steel. These components are then welded together using a resistance welding technique during manufacturing to provide the wire mesh decking commonly found in warehouses and stores around the country. Concern has been expressed on the weld zones and the effect they have on the protective zinc coating since some discoloration in these areas is common. To better understand the process, a further discussion is required.

HOT-DIPPED GALVANIZATION PROCESS

One of the best methods used to protect steel is by coating it with zinc using the hot-dipped galvanization process. Although there are other processes that can be used to apply zinc such as Electro-Galvanization, none compare with the hot-dipped process. The reaction of the molten zinc with the steel while in the kettle causes an iron-zinc bond to form at the surface. The result of this reaction is a metallurgical bond. Looking at a photomicrograph, various layers can be seen in the zinc layer, which are identified as follows: Base steel - Gamma, Delta, Zeta, and Eta. The percentage of iron is highest in the Gamma layer and diminishes in each successive layer until you reach the pure outer zinc (Eta) layer. Interestingly, the Gamma, Delta, and Zeta layers are typically harder, and therefore more durable and abrasion resistant than the base steel providing improved corrosion protection. The softer outer layer is more ductile and where the formation of protective oxides will form over time.

RESISTANCE WELDING PROCESS

The basic functions of resistance welding are pressure, current, and time, whereby electrical current is applied to heat the material until it reaches its plastic (molten) state. The two pieces of metal to be joined are squeezed together by electrodes to make good electrical contact, then current is passed through them until the metal begins to melt at the point of contact. The metal then flows together at the weld joint forming a weld nugget. The current is then turned off and the piece allowed to cool and solidify forming the weld nugget (and/or joint).

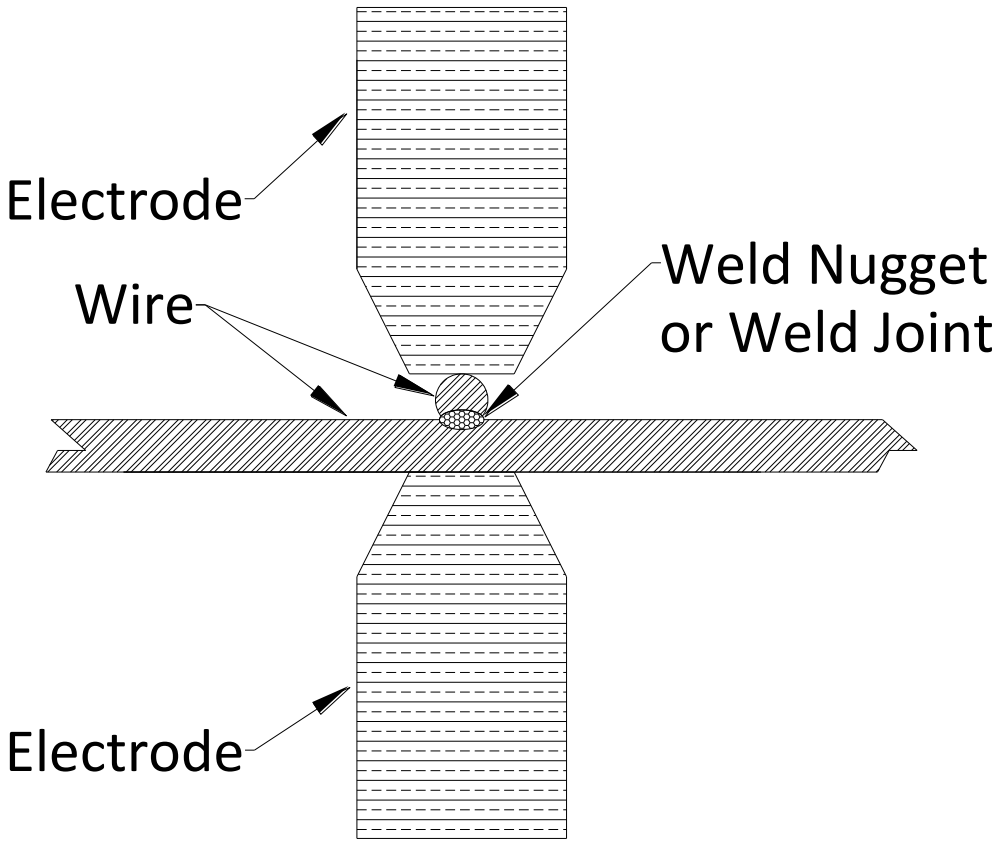
J&L MESH WELDING PROCESS

Resistance welding galvanized steel requires special attention to minimize the disturbance of the zinc layer since the melting temperature and boiling point of zinc is considerably lower than steel. To minimize the detrimental effect that welding may cause, typically the flashing of and/or evaporation of zinc due to excessive heat, J&L uses a resistance welding procedure that utilizes an up-slope process (the gradual ramping of weld energy). Controlling the weld current by automatically phase shifting each cycle of weld current from a low to a high preset level and minimizing the time at temperature, the disturbance to the zinc layer is minimal. The resulting weld joint, although discolored, still retains protective properties of the zinc.

SUMMARY

J&L Wire is aware of the challenges associated with welding galvanized steel and has established its procedures over decades of producing quality wire decks and flooring. Using a controlled welding

procedure and materials that are hot-dipped is extremely helpful in reducing the detrimental effect of the weld. Since the zinc forms a metallurgical (iron-zinc) bond, it becomes part of the steel at the surface and the corrosion benefits afforded by the zinc are present in the surrounding weld joint. Controlling the weld helps to minimize the displacement of zinc and improve the resistance to corrosion as the zinc solidifies adjacent to the joint. The resulting protective zinc oxide that forms around the joint serves to protect the area.



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