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Material Matters

PVC linings provide better corrosion protection with improved welding technique



An operator uses a thermoplastic hot gas/hot air extrusion welding machine to join PVC lining sheets. Photo courtesy of Curtis Goad.

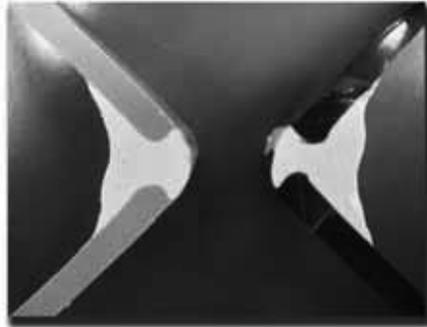
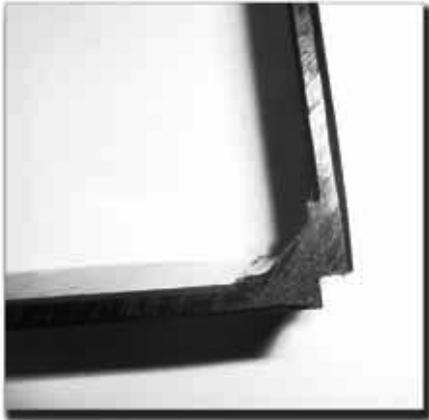
A welding technique developed by GOAD COMPANY (Ellisville, Missouri) improves the thermoplastic welding process for polyvinyl chloride (PVC) linings and helps prevent aggressive chemicals from seeping behind a plastic lining and attacking the underlying substrate.

In the process industry, such as metal finishing, PVC linings are commonly used as corrosion barriers to protect the interiors of steel tanks or concrete pits, which typically contain chemicals that are extremely corrosive, says NACE International member Curtis Goad, president and owner of GOAD COMPANY, a provider of custom-designed tank lining systems for the surface finishing and chemical processing industries. Open rectangular tanks and pits, as well as secondary containment areas, are typically used in surface processing such as electroplating, he says, and often are lined with high-performance plasticized (flexible) PVC sheets that are bonded with adhesive to side walls and bottoms and sealed at the seams and corners by thermoplastic welding.

The thermoplastic welding process melts the plastic welding material (rod or strip) to its molten state as well as preheats the PVC lining sheets, and applies pressure to both the welding material and the sheets to allow the molecules to fuse into a solid when cooled. Welding techniques for plastics include hot gas/hot air welding, where a hand-held welding device uses heated nitrogen gas or air to soften both the plastic welding rod or strip and the sheets to be joined while an operator moves the device along the seam.

In one method of hot gas/hot air welding, known as hand welding, an operator uses a welding gun to lay a bead of material along the seam where the base materials touch. The size and shape of the weld bead are determined by the tip on the welding gun nozzle, and the operator controls the preheat temperature, welding speed, and

Information on corrosion control and prevention



The photos show PVC lining sheets joined with thermoplastic welds made with (a) the hand welding technique and (b) the extrusion machine welding method.

Photo courtesy of Curtis Goad.

amount of pressure that is applied to the materials. For thicker gauge sheets, or joints with 90-degree angles and corners where two side walls meet the bottom, the operator can lay several beads of welding material on top of each other through multiple passes of the welding gun. One drawback with hand welding is that excessive stresses from alternating heating and cooling cycles can occur with multiple passes. Additionally, the quality of the hand weld directly depends on the skill of the operator.

Another hot gas/hot air welding method uses a hand-held machine that extrudes molten thermoplastic weld material through a polytetrafluoroethylene (PTFE) shoe that is shaped to fit the size of the desired weld. The melting chamber and base material preheat temperatures are set prior to welding and are digitally controlled and monitored by the machine, and the operator ensures the proper speed is maintained and adequate pressure is applied while moving the

machine along the seam. The weld is formed in a single pass, which eliminates the heat stresses associated with multiple passes.

Advances in tank linings have focused on machine welding, which provides a more consistent, higher-quality thermoplastic weld, says Goad, commenting that the welding parameters are more tightly controlled and the resulting welds are proven to be stronger and more tolerant of stresses. His company has developed a hot gas/hot air extrusion welding machine technique that overcomes disadvantages that are characteristic of hand welding, such as channels and gaps that can form behind welded seams and allow the solution in a tank or pit to flow behind the lining and corrode the substrate if a leak occurs.

This patent-pending technique modifies the preheating process and delivery of the weld material, Goad says. The welding machine extrudes a high-performance, plasticized PVC weld material that infuses into the sub-

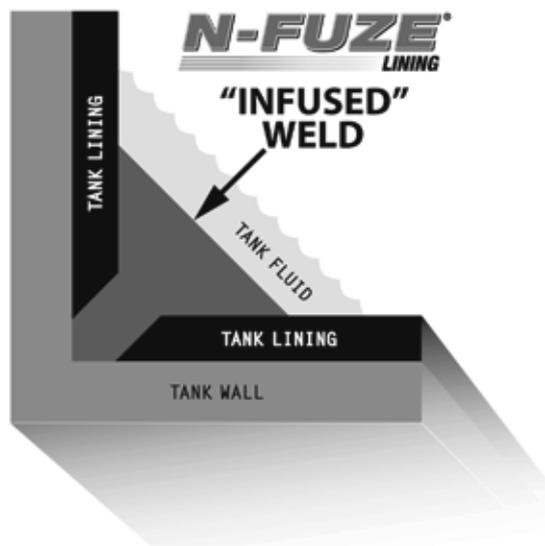
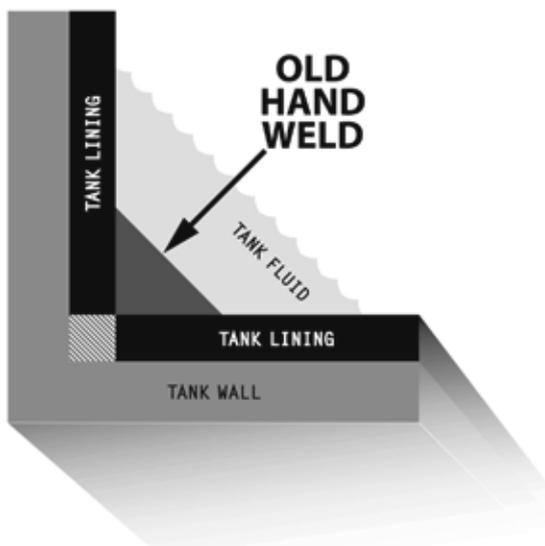
strate's pores and voids as well as joins the PVC sheet linings, he explains. Rather than extending the sheet linings on a side wall and bottom of a tank or pit so that they meet at the 90-degree joint, the sheet linings are shortened to leave a small gap at the joint. This allows the molten thermoplastic weld material to flow into and fill the gap between the lining sheets and penetrate the joint to the substrate. An infused weld area is created that eliminates channels behind the weld seams, reduces the probability of leaks, and increases the service life of the tank or pit. Should a leak happen, the weld blocks solution from flowing behind the lining.

Inner bottom corners, where three intersecting lining sheets must be joined, are typical problem areas and a frequent source of early leaks and premature lining failures, Goad says. "It is difficult to perform a high-quality weld in a corner. You need perfect speed, temperature, and pressure as you move the welding machine along the joint; but when you come to a corner, you can't preheat the lining sheets because the machine stops," he notes. To address this problem, the company has devised molded thermoplastic corner inserts that enable the machine to weld continuously in the corners.

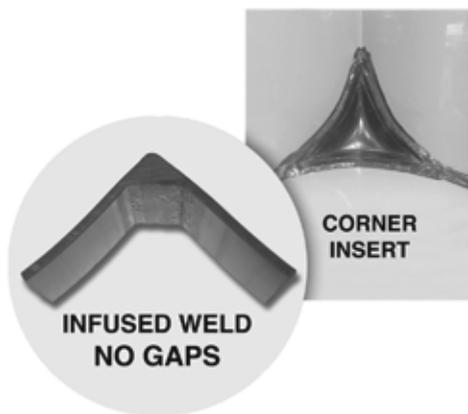
Goad comments that the extruded welding machine technique with plasticized PVC also can be used with rigid PVC and chlorinated PVC (CPVC) fabrications. Although steel and concrete are the major substrates used for processing tanks and pits, the PVC linings and machine welding technique can be used with wood, fiberglass, and other substrates that require corrosion protection.

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