

Ask Dr. Galv

Q: One of my customers called saying I didn't galvanize the whole part, and it was already starting to rust. What should I do about it?

A: The customer then described what he was seeing. Along the edge of a weld between a tube and a structural member, there was a trail of rust leaking down the tube. The galvanizer was finishing up the job, and the owner asked him why the parts were already starting to rust even before he was finished with the job.

This situation is very common due to a couple of decisions made by the fabricator and designer early in the design phase of the project, or due to a welding procedure that does not produce a full seal weld. The rust bleeding comes from the interaction of moisture, cleaning chemicals, and uncoated steel surfaces. When combined, these components will produce rust very quickly and the rust will then follow the path of gravity and cause iron oxide streaks down the sides of hot-dip galvanized surfaces.

The design decision causing the potential for this rust bleeding is welding parts together as the method of joining and leaving enclosed areas behind the welds. Sometimes this design decision can mean large areas of trapped air would be produced unless the enclosed area is vented properly per ASTM A 385. The venting of these large trapped areas then provides a route for the cleaning solutions to penetrate the area. Rinsing out the chemicals can be very difficult due to the orientation of the vent holes or the placement of the vent holes, and due to the thin gap between the steel pieces.

This will then result in some of the chemical solutions being left in the trapped area during the galvanizing process. The heat of the galvanizing kettle will cause the moisture in the cleaning solutions to evaporate and leave being dried cleaning compounds and salt crystals. The next step in the process may be to quench the galvanized parts, which will reintroduce moisture to the trapped area immediately. Some parts may be air cooled, and then the moisture is introduced over time as the part sees temperature fluctuations and the humidity of certain climates. Most venting holes will allow the cleaning solutions into the trapped area, but do not allow the flow of zinc metal into these areas.

The area between two steel parts can also collect salts and cleaning solution if the weld between the two parts is a stitch weld. The process of stitch welding leaves gaps along the edges being welded to allow air and cleaning solutions into the area between the parts. This serves the same purpose as a venting hole to allow trapped air and solutions to escape during galvanizing. Unless the two steel parts are separated



Rust bleeding results from the interaction of moisture, cleaning chemicals, and uncoated steel surfaces where a full seal weld was not achieved during the design/fabrication phase.

by a gap of 3/32 in. or more, the low viscosity of the zinc metal will not permit it to penetrate and fill the trapped area between the two steel pieces.

The situation is different for small areas formed between two parts when they are welded together. In this case the trapped area is completely seal welded on all sides. These areas do not need a vent hole to release the trapped air so the fabricator will weld the area on all sides to form a seal weld. If there is any pinhole in the welded joints, then the cleaning solutions can enter the trapped area through the pinhole. The weld pinholes will allow small amounts of cleaning solution into the seal welded area, and these solutions will not be rinsed out during cleaning. The seal welded area with a pinhole leak now can form rust that will seep out from the pinhole. Sometimes these seal welded areas begin showing signs of rust bleeding while the part is still at the galvanizing facility. Sometimes it will take a few months for the rusting to appear on the galvanized surfaces due to the slow build-up of moisture in the trapped areas.

Since the two reasons for rust bleeding lie with the designer and the fabricator, the galvanizer is not responsible for rust bleeding. This does not get him off the hook, as the old argument will be "it wasn't rusting before I sent it to you and now it is rusting." This does not make it the galvanizer's responsibility, as the cause for the trapped area rusting is either the poor welding procedure or the design including a large trapped area in need of venting.

What do you do about the rust bleeding? The best answer to this question is to first clean off the rust, and then to try to plug the vent or welding hole with some type of silicone material to prevent moisture from entering the trapped area. This is only a temporary fix, and the silicone material will need to be maintained over time to keep moisture out of the trapped area. The best solution is to plan on using a gap of 3/32 in. between two pieces to be welded before galvanizing, as this will allow zinc metal to fill the area between the pieces during galvanizing and produce an even better joint than welding alone.