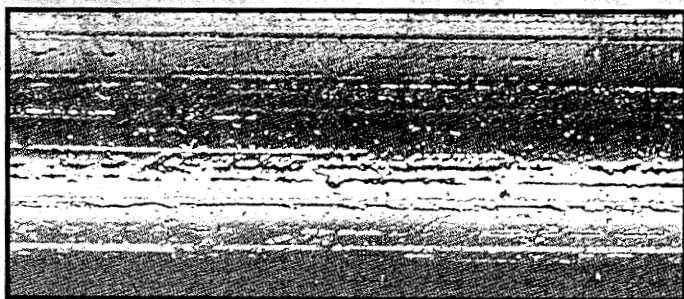


# Ask Dr. Galv

Dear Dr. Galv: I've been doing boat trailers or hand rails for a number of years and every once in a while the coating will come out looking very rough. Why is this happening and why does it happen in the center section of the part?

A. There are a couple of reasons that galvanizers may find a very rough coating on a part such as a boat trailer or a section of hand rail. The most obvious reason is the fabricator used a different piece of steel for one section of the assembly. The different piece of steel had high levels of silicon or phosphorous and was very reactive, causing the thick and rough coating. The rest of the assembly may be smooth and normal appearing galvanized coating. The inclusion of a reactive piece of steel in the assembly is apparent when the rough coating stops abruptly at a weld line or assembly joint. Sometimes it is an attached bracket or clip which has the rough coating. In the case of hand rail, this rough coating may be the cause for rejection of the assembly since the hand rail must be smooth for people to run their hands along.



A second, more subtle reason for the rough coating can be the steel chemistry of the steel tubing used to fabricate the assembly. The fabricator will often have specified a steel with a low silicon and phosphorous content. The steel manufacturer will furnish the mill certifications for the steel used to manufacture the tubing and the chemistry will appear to be low reactivity material as in the table below.

TABLE 1. TYPICAL HEAT CHEMISTRY FOR TUBULAR STEEL

C	Mn	P	S	Si	Cu	Sn	Ni
0.10	0.33	0.010	0.006	0.025	0.05	0.005	0.025

The two reactive elements, phosphorous and silicon, appear to be below the level where they cause thick and rough coatings. When the rough coating appears,

some galvanizers are suspicious of the steel chemistry despite what the heat chemistry shows. The galvanizers have taken samples of the actual steel tubing used in the assembly and the results of one example of this steel's chemistry is shown in the table below.

TABLE 2. ACTUAL STEEL TUBING CHEMISTRY

C	Mn	P	S	Si	Cu	Sn	Ni
0.09	0.30	0.011	0.007	0.06	0.07	0.004	0.03

The assembly with this steel chemistry showed rough coatings on some of the pieces. The picture shows the rough appearance of the coating. This looks like the typical example of high phosphorous steel but the actual reactive element is the silicon. The silicon level of 0.06 puts the steel on the leading edge of the Sandelin peak. Added factors such as cold working the tubes to form the shape of the boat trailer and the temperature cycle for the section of tubing in the center of the assembly add to the silicon reactivity. The silicon is on the edge of the reactivity curve and will cause problems on some pieces and not on others. This can be very difficult to diagnose.



These assemblies will provide adequate corrosion protection but may be difficult to deliver to a very particular customer because of the rough coating appearance. As a galvanizer, there is very little that can be done about this rough appearance because the problem is caused by the steel chemistry. Steel heat chemistries are an average of sample pieces and do not always reflect the actual chemistry of the tubing parts.