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RUSTING PROBLEM

By Bob Cusumano

A recent inspection involved a 400 unit apartment complex in south Florida. The manager reported that many of the exterior door frames were showing signs of rusting less than one year after construction of the project was completed.

The project specifications indicated that the exterior hollow metal door frames were to receive a factory applied rust inhibitive primer at an approximate thickness of 1 mil. After installation, the painting contractor was to field apply a coat of rust inhibitive alkyd primer at a dry film thickness of 1.5 mils and two finish coats of exterior latex semi-gloss enamel, also at 1.5 mils DFT per coat.

A visual site inspection of the door frames confirmed that a majority of them exhibited varying degrees of rusting, with some being quite severe as shown in photos #1 and #2. Rusting was more severe on the exterior portions of the frame, although some corrosion was also observed on the interior side of these exterior door frames.

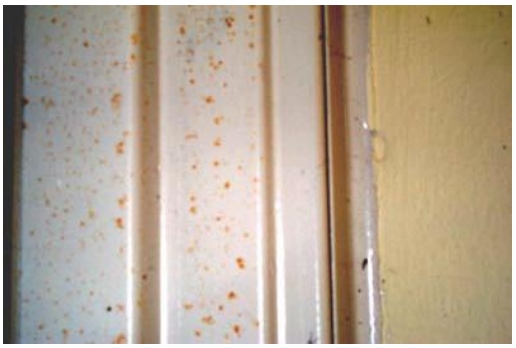

Photo 1

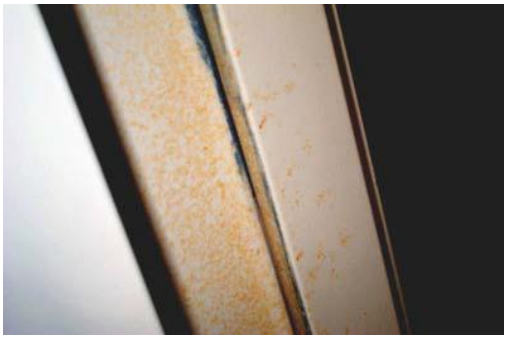

Photo 2

The total thickness of the paint coats that had been applied both in the shop and the field was measured using a ferrous metal mil gauge. The thickness was found to be in the proper range specified.

A portion of a rusting door frame was removed for testing. The paint was removed from the metal frame using a chemical paint stripper. Heavy rust was visible beneath the removed paint.

At this point, the questions that needed to be answered were "Did the corrosion develop as a result of defects in the field applied paint coats, thus being the responsibility of the painting contractor?" or "Was the rusting present as a result of improper surface preparation at the shop"? To answer these questions, several frames that did not exhibit visible rusting were selected for testing. The exposed surface of the paint was examined with a stereo zoom microscope and found to be relatively smooth and free of film defects as shown in photo #3.

Photo 3

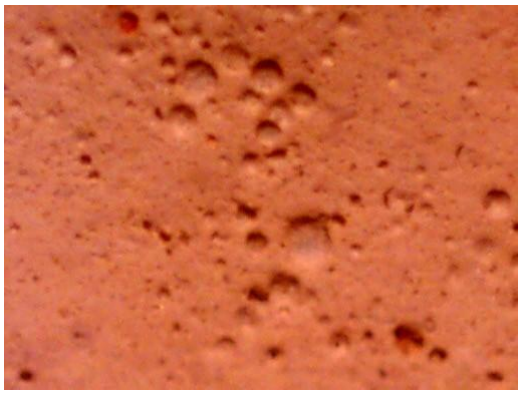

Photo 4

The top coats were then removed using denatured alcohol. This confirmed that the top coats were latex as specified. Alkyd paints and other resins like epoxies and urethane would be unaffected by exposure to denatured alcohol. The now exposed surface of the field applied rust inhibitive primer was found to have several craters, as shown in photo #4, but none of the pores penetrated entirely through that coat of paint. Denatured alcohol did not soften and remove this coat suggesting that it is indeed an alkyd as specified.

The red field applied primer and the gray factory applied primer were then carefully removed from the steel frame using a razor blade. On the rear of the paint sample, rust was attached to the gray factory primer as shown in photo #5.

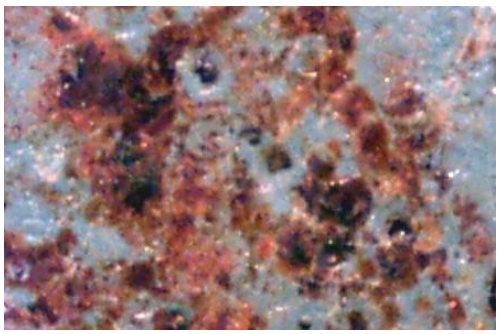

Photo 5

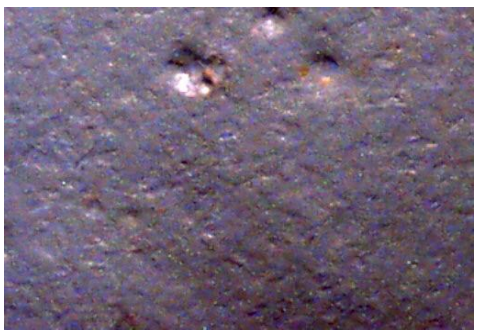

Photo 6

This rust was dissolved by placing dilute hydrochloric acid on the rear of the chip. This reacts with the iron oxide but does not affect the paint. The rear side of the factory primer was then re-examined under the microscope and found to be relatively rough as depicted in photo #6. This

indicates that the primer was applied over rust and mill scale rather than to a smooth surface. Test samples from other frames had similar results.

In summary, it was our opinion that the thickness of the factory and field applied paint coats was in the proper range according to the specifications of the various products. While there was found to be some variation in paint thickness from frame to frame, there was no correlation found between the paint thickness and whether or not that particular frame was rusting.

It was further our opinion that the painting contractor had applied all of the coats specified, that the paint applied was of the correct generic type specified, and that the paint coats that were field applied were free of defects that would have caused the premature rusting.

Based on our observations and testing, it was our opinion that the rust initiated beneath the coating rather than through pinholes or defects in the coating itself. This contention is based on the deformation at the back of the paint film noted above and the heavy rust found beneath the primer. Inconsistent surface preparation of the steel frames prior to the application of factory applied primer could account for the sporadic rusting noted.

It should be noted, however, that south Florida presents a challenging environment for exterior steel surfaces protected with traditional paints. For long term protection, the use of high performance coatings should have been considered.