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Nova Pole
Attention: Ron

Dear Sir:

Subject: Comparison between Powder Coating versus Wet Spray Application Coatings on Traffic Poles previously Hot Dip Galvanized.

Limitation: This report deals only with traffic poles 300 to 2000 pounds in weight and may or may not apply to different products involving hot dip galvanizing. Please note that this report is also emphasizing the problem facing lower mainland area due to the weather conditions and equipment available by local coatings applicators.

Sources: American Galvanizers Association; Powder Manufacturers Technical Representatives; Wet Coatings Manufacturers Technical Representatives; personal experience (in powder and wet spray applications); job site visits and failure analysis; in shop tests; review of many specifications; Galvanizers Technical Representatives; many coating seminars organized by manufacturers of chemicals.

Assuming that we all know the benefit of Duplex System allows us to concentrate on comparing powder vs. wet spray in order to assist the customer to make the final determination on the system of choice. As it will become transparent later in this report my personal leaning is towards the wet coatings. Due to a much better ability to control the process consequently we get a more consistent and reliable final product.

Let us review the process from metal prep to final topcoat. Copy of most commonly used process description is attached to the last page of this report. They are all very similar and none of them are signed. I was unable to determine by whom they were prepared. Nevertheless the ~~reports~~ **PROCESS** present many different technical problems.

1. In order to ensure adhesion of powder to galvanized substrate sweep blast is mandatory. Some specs ask for profile .8 to 3 mill. 3 mill profile over galvanizing that is only 3.5 to 4 mill thick is effectively removing the galvanizing from the steel substrate. Even with the best efforts it is difficult to be consistent hour after hour and day after day. Over blasting is a real possibility. Even

if over blasting may be avoided de-lamination is another significant problem which may not be detected by the naked eye. De-lamination will become apparent only after a certain amount of time sometimes years, by causing accelerated corrosion and consequently system failure. Rough surface is desirable in powder applications to create mechanical bond. To the best of my knowledge there is no powder specifically formulated for galvanized substrate in order to create a chemical bond. In comparison there are many wet coating primers specifically designed for galvanized, edge primer and water born primers etc. These primers still demand oxide free substrate but they offer chemical bond in addition to mechanical bond. Being of the lower viscosity wet coatings will tend to develop better mechanical bond than powder by its ability to “wet the surface” better and “soaks” into all surface imperfection removing air bubble more effectively. Conclusion: Given the same substrate conditions there is no benefit to use powder with respect to adhesion. If sweep blast is insisted upon the risks greatly outweigh the benefits of this process. Corrosion protection is the main purpose of coatings aesthetics come second. Chemical cleaning is much safer and will not compromise corrosion protection provided by galvanizing.

2. **Color gloss and film retention:** Without going to too many different grades of powder that could be used the most commonly used is some type of polyester. That type of powder offers 18 months to 3 years (maybe 5 at low uv exposed sights) protection against chalk. After this time chalk is sure to accrue. Consequently color loss is imminent. Without looking too far you will find wet coatings offering 5 to 10 year life expectancy. For a premium there are wet coatings available that offer 25 years plus life expectancy. Conclusion: Today wet coatings greatly out perform powders. They have been used successfully for many years on monumental buildings. Powders offer greater film thickness (better hiding properties) but the benefit is quickly outweighed by faster film lost and degradation.
3. **There are many practical problems with powder process:** Out gassing – Very unpredictable, vary from job to job and from pole to pole. In order to minimize this phenomena specifications require up to one hour preheat time. This may in effect minimize the problem

but in my view is creating a much more severe problem. Mainly if not all ovens presently used are direct fire type (no heat exchanger, no condensers). By burning natural gas or propane large amounts of water is generated as by product. This water effectively condensates on the poles until the metal reaches 180 degrees F or so. This moisture in addition to elevated temperature (450 F) is promoting very rapid oxidation of the surface. This is precisely the condition we are trying to avoid and great efforts were spent to remove all the oxides from the surface. Wet coatings eliminate this condition entirely. Priming the Pole – With epoxy primer as required by spec is causing set of problems by itself. As previously mentioned preheating the pole is requested in order to minimize out gassing. Primer is applied to the hot pole (450 F or so). At this temperature primer will cure in 5 to 7 minutes. Topcoat will not adhere to fully cured primer. By letting the pole cool down the out gassing problem starts to persist. Not mentioning it takes a long time to heat the pole, cool it down and heat it again. For 2000 pound pole the process may take up to 3 hours. Distribution of steel also causes a problem. You have ¼ inch plate welded to a 2 inch plate some areas get over cured and some under cured. In addition energy consumption is astronomical comparing to different products. At the extreme you could bake 2000 square feet of metal per hour (in a form of 4X8 foot sheets) comparing to 100 to 200 square feet of surface in a form of poles. Giving the same temperatures and oven size. Giving the large amount of energy required per square foot of finished surface the benefit of using VOC free powder may be quickly outweighed by a large amount of CO2 in burning natural gas (Fossil fuel). This comparison should be made by architects or spec writers. The fact that today's wet coatings are 50 to 75% of solids and electrostatic application offers 75 to 80% transfer efficiency given their relatively small surface area of the pole the VOC issue may not be that significant.

4. Wet coatings offer also more practical properties. Touch up and repairs are much easier. Some paints offer excellent anti-graffiti properties. Color availability is unlimited and instant.

Over viewing the entire process I cannot find any significant benefits in choosing powder coating for the product in question. Giving many

technical uncertainties, difficulty in maintaining workmanship consistency even with great effort you may control the process 95% successfully the question remains whom will deal with remaining 5% of system failure that in my opinion is imminent. To underline again over blasting, delamination, out gassing, oxide build up in oven, over bake of primer, under or over cure of top coat, large energy consumption.

At this time I would ^{like} to thank you for reading this report. I tried to be as objective as possible and concentrate on the technical aspect of the process and ignoring other reasons that some manufacturers or coating applicators may have. Please do not hesitate to contact me if I may be of further assistance or elaborate further on the issue being raised.

Yours truly,

A handwritten signature in black ink, appearing to read 'Greg Palamarz', with a long horizontal flourish extending to the right.

Greg Palamarz, Eng., R & D