Hot Dip Galvanized Case Study No. 21
Eskom Coastal Sub-station

The Application

Eskom have since the early seventies specified hot dip galvanizing for their electrical power distribution transmission lines throughout South Africa. Hot dip galvanizing has become the preferred method of corrosion control. Many of these installations are today still providing maintenance free service lives. Sub-stations follow the same trend.

In this case study the Duine sub-stations in the Western Cape was visited during February 2014 to evaluate the durability of the hot dip galvanized carbon steel structures.

The original steelwork for Duine sub-station was erected in September 1977. At the time of the site inspection the installation had been in service for the past 37 years being exposed in an aggressive marine environment adjacent to Koeberg Power Station.

Environmental Conditions

In terms of the environmental conditions reference to the ISO 9223 specification – Corrosion of Metals and Alloys – Corrosivity of Atmospheres – Classification is used , as a guide when determining an approximate service life of an installation.
Duine sub-station estimated corrosivity category is believed to meet the criteria of a C4 or worst case a C5 environment.

The description of a C4 environment is described as follows;

Temperate, subtropical to tropical, low to high pollution (SO2 30 to ≤ 90pg/m^3) or substantial chloride effect, e.g. < one kilometre of the ocean or within one hundred metres of sheltered coastal areas and outside the splash zone of salt water

Estimated corrosion rates for zinc in a C4 environment range between 2 to 4µm per year.

The Site

Duine sub station is located on the West coast approximately 50 kms from Cape Town and within one and half kilometres from the Atlantic Ocean.

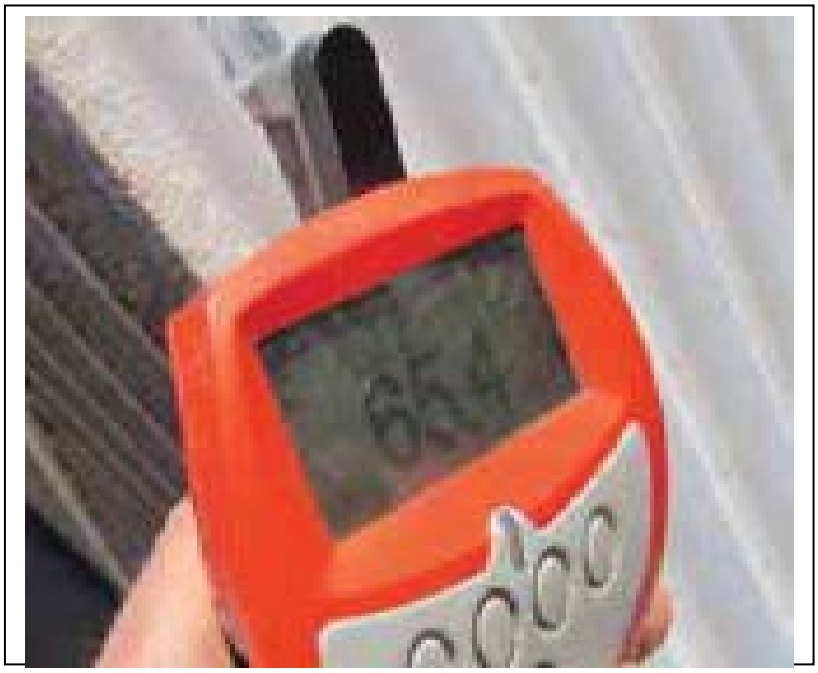
Hot dip galvanized power transformer radiators

Findings

The hot dip galvanizing is performing above expectation. Judging by the residual coating thickness on the structure as well as the holding down bolts and nuts, we predict the galvanizing will provide an excess of a further 30 years of service-free life.

Hot dip galvanized coating thicknesses on the transformer radiators were recorded in a range of 65 to 75µm.

Location the two cleaned area on the transformer radiator showing where residual coating thicknesses were taken



Typical coating thickness measurement being taken using an Elcometer 456 magnetic instrument

Zinc coating thickness on the Elcometer is 65µm

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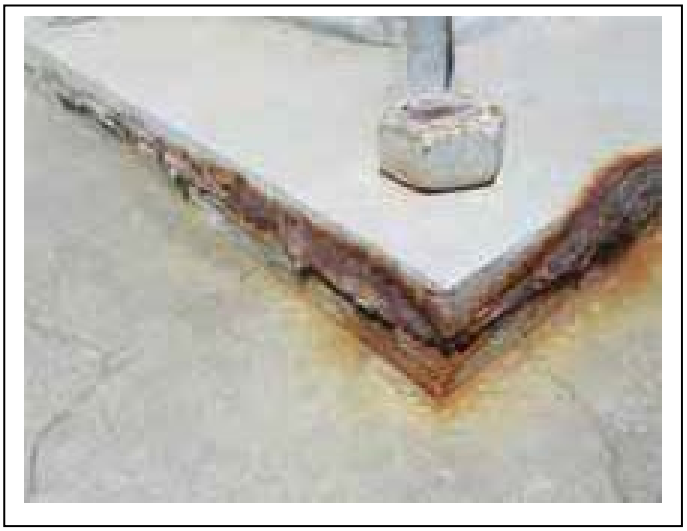
A galvanized steel component showing visible chloride salts

Removal of the surface contamination coating thickness readings of 124µm

All fasteners were found to be hot dip galvanized with recorded coatings of more than 70µm.



One base plate showed corrosion on the edge, indicating that crevice corrosion was active

Residual coating thickness readings of 140 and 165µm were taken adjacent to the corroded area

Remedial action would be to seal the crevice and prevent the ingress of moisture

HOT DIP GALVANIZERS ASSOCIATION SOUTHERN AFRICA

Conclusion

In spite of visible surface chlorides from the sea air, the hot dip galvanizing has performed admirably over the last 37 years in the West coast environment.

With the remaining zinc coating thicknesses in the order of 70 odd microns; corroding at an indicative corrosion rate of 3µm per year, the anticipated remaining service life would exceed a further 23 years to first 5% surface red rust.

Up the West Coast from Cape Town