Hot Dip Galvanized Case Study No. 1
Blouwater substation

The Application

For many years, Eskom has used hot dip galvanizing as their corrosion protection system for transmission towers and the exterior sub-station steelwork. This equipment is distributed throughout Southern Africa and consequently many varied and differing environments are encountered.

Environmental Conditions

The environmental condition selected is that of the Cape West coast, approximately 130 kms north west of Cape Town. The area is routinely subjected to early morning mists that last well into the mid-morning. The location of the site selected is well within 20 kms of the coast with the prevailing winds being either South Easterly or North Westerly.
Steel structures in the environmental conditions are therefore exposed to high levels of moisture as well as coastal saline atmospheres.

The Site

Eskom's Saldana Blouwater sub-station

Blouwater Substation lattice steel structures were examined in order to establish the condition of the hot dip galvanized coating after 34 years in service.

General view of a section of the Blouwater Substation that was inspected on 22 July 2004

Our Findings

In general, the coating is in remarkably good condition despite misleading surface contamination. Interestingly, some of the bolts and nuts showed signs of distress. This appeared to be limited to fastener assemblies underneath the lower end of the inverted diagonal angle bracings. The reason for this is due to an extended period of accumulated wetness and being shielded from the sunlight. The use of zinc-electroplated fasteners (electro-galvanizing) is unacceptable due to the extremely thin zinc coating obtained (normally < 10µM, compared to 55µM of hot dip galvanized fasteners). The following photographic analysis of the survey illustrates our findings.

Despite the apparent "rust" contamination of the galvanized surface, once removed the galvanized coating measured 126µm.

Condition of the "upper" and "lower" fastener assembly illustrating the differential rate of corrosion due to the "Time of Wetness"

Conclusion

After approximately 35 years of service, the hot dip galvanized coatings on steel components installed at the Blouwater sub-station will continue to provide adequate and effective corrosion protection for at least another 35 years.

There is no doubt that hot dip galvanizing can and does provide a cost effective solution to the vexed question of steel corrosion protection, not only within 20 kms of the coast, but also in the more aggressive areas experienced within Southern Africa.

For the more aggressive corrosive environments, the use of duplex protection systems (hot dip galvanizing plus a heavy duty organic paint) is recommended. Information in this regard is readily available from the Association.

PS. It is interesting to note that even where the hot dip galvanized steel appears to exhibit “red rust”, once the contaminated surface has been cleaned a substantial amount of zinc and zinc iron alloys remain. It is an establish fact that the zinc iron alloy layers provide approximately 30% greater corrosion protection than that of pure zinc on its own. However, as the zinc iron alloys corrode, speckles of red rust appear due to the iron content within the alloys. This is sometimes seen as representing a potential failure of the structure, but in reality the steel remains unaffected and capable of performing the functions for which it was originally designed.