CORROSION TECHNICAL BULLETIN 25

JUNE 2008 | Revision 0

This issue supersedes all previous issues

Inert Catchment

INTRODUCTION

Inert catchment, where the pH of rainwater or condensation is not changed by contact with the catchment material, can cause corrosion in materials downstream of the catchment, such as gutters and downpipes, if unsuitable materials are specified for these applications. Correct specification of materials can remove the risk of accelerated corrosion in these situations.

WHAT HAPPENS TO RAINWATER?

In general, unpolluted rainwater has a pH of less than 6, which is slightly acidic. This is due to naturally occurring carbon dioxide in the atmosphere reacting with the water vapour to lower the pH.

Rainwater can become more acidic when it is affected by certain atmospheric conditions, industrial fallout and even rainfall intensity and frequency. Acid rain, which can occur in industrial and heavily populated areas with fumes from motor vehicle exhausts, is more corrosive than unpolluted rainwater. Rainwater near the coast can pick up chlorides from salt air due to turbulence of the surf prior to precipitation, and overnight condensation can be similarly affected.

EFFECT OF CATCHMENT MATERIAL

When rain falls on a large catchment area, such as a roof, it is collected and directed in concentrated streams, following the roofing profile. If the materials at any point in the catchment system are susceptible to unpolluted rainwater or acid rain, corrosion is likely to occur. The material most commonly affected in such situations is unpainted galvanized steel, and this is of particular concern downstream from an inert catchment area.

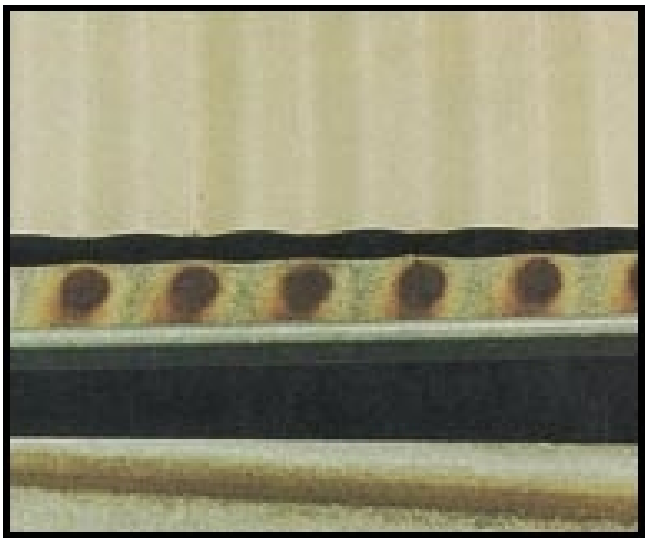
An “inert catchment” occurs where rainwater or condensation falls on materials that do not affect its corrosive properties in any way. This can allow for corrosion of materials downstream of the catchment, such as the gutter and downpipe.

Typical examples of inert catchments are COLORBOND® steel and ZINCALUME® steel, glazed terracotta tiles, fiberglass and aluminium decking. Concentrated streams of rainwater or condensation can then flow from these catchments onto localised areas of materials that are not themselves inert, which can lead to accelerated corrosion.

Catchments that alter the corrosive components of rain and condensate are unpainted zinc-coated materials and unglazed cement tiles. These materials counteract the acids and chlorides in rain or condensate to some extent, making it far less reactive by the time it leaves the catchment, although it is important to note that this is not a complete protection against corrosion.

Examples of common inert catchment situations include:

- COLORBOND® steel and ZINCALUME® steel roofing with galvanized steel gutters and downpipes (see case study below)
- Prepainted galvanized steel roofing with galvanized steel gutters (see photo below)



- Water flowing from a glass roof on to galvanized steel roofing (see photo below)

- Water flowing from a terracotta roof into galvanized steel gutter (see photo below)

- Fibreglass skylights in conjunction with galvanized steel sheeting (see photo below)

BLUESCOPE STEEL RESEARCH LABORATORY STUDIES

BlueScope Steel Research, based at Port Kembla, NSW, investigated the relative performance of ZINCALUME® steel and zinc-coated steel under a variety of roof catchment conditions, including inert catchments. Distilled water containing 10mg of chloride (salt) per litre dripped continuously onto pairs of roof sections, each comprising different downstream materials.

The photographs presented in Tests 1-4 were taken after two years' testing and show that corrosion occurred on a zinc-coated sample below four different roofing material types, including a zinc-coated roof. However, there was negligible corrosion when water flowed from the same four roof types, including the zinc-coated roof, on to ZINCALUME® steel. The test on the ZINCALUME® steel sample was abandoned when no rusting was evident even after it had been exposed without failure for more than 17 times the period it took for rust to form on the zinc-coated sample.

Test 1: Aluminium to ZINCALUME® steel gutter (left); aluminium to zinc-coated (galvanised) gutter (right).

Test 2: COLORBOND® steel to ZINCALUME® steel gutter (left); COLORBOND® steel to zinc-coated steel gutter (right).

Test 3: ZINCALUME® steel to ZINCALUME® steel gutter (left); ZINCALUME® steel to zinc-coated steel gutter (right).

Test 4: Zinc-coated steel to ZINCALUME® steel gutter (left); Zinc-coated steel to zinc-coated steel gutter (right).

CORRECT SPECIFICATION PROVIDES THE ANSWER

The solution to the problem of inert catchment lies simply in understanding the mechanism of corrosion. Correct specification of catchment and subsequent materials will protect against surface breakdown.
For example, investigation carried out by BlueScope Steel Research has shown that ZINCALUME® steel and ZINCALUME® based COLORBOND® steel will resist corrosion when used as a gutter and downpipe product in combination with any traditional roofing material.

ZINCALUME® steel products will perform far better than zinc-coated material. BlueScope Steel recommends the use of COLORBOND® steel, ZINCALUME® steel, COLORBOND® Ultra steel or COLORBOND® Stainless steel in gutter and downpipe applications rather than galvanized steel.

A CASE STUDY

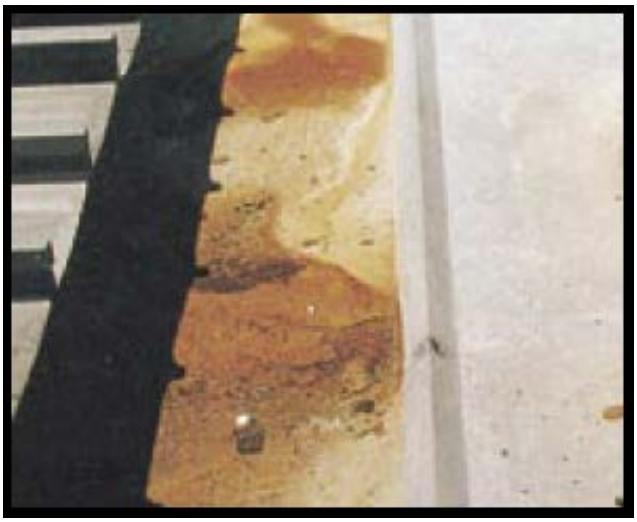
A large shopping complex installed zinc-coated box gutters in combination with roofing of both ZINCALUME® zinc/aluminium alloy-coated steel and COLORBOND® prepainted steel.

Early gutter failure occurred in all the box gutters and downpipes within 18 months because of the “inert catchment” phenomenon, caused by pure rainwater dripping or flowing into the gutters and sumps. Also noted were localised areas of severe corrosion, with complete loss of protective coating.

These areas were caused by ponding where water, such as run-off from the air conditioning plants, had been retained for long periods.

The specification of COLORBOND® steel, ZINCALUME® steel, COLORBOND® Ultra steel or COLORBOND® Stainless steel gutters and downpipes, installed to avoid ponding by allowing water to flow easily through and away, can prevent the type of corrosion observed in this case study.

Pictures: Severe corrosion caused by ponding and the use of zinc-coated gutters in combination with roofing of both ZINCALUME® zinc/aluminium alloy-coated steel and COLORBOND® prepainted steel



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