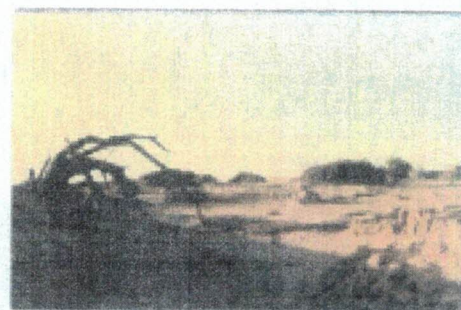


Pacific Testing Pty Ltd



REPORT 225/12

Evaluation of Roofing Gutter Spring Clips

Date 21st August 2012

PO Box 8 The Junction, NSW 2291 Ph/ Fax 02 4969 8808

ABN 93 118 284 094

robert@pacifictesting.com.au www.pacifictesting.com.au

Evaluation of Gutter Clips

EXECUTIVE SUMMARY

Australian Building and Plumbing Codes as well as Australian Standards specify materials for use as rainwater goods and accessories. Metallically coated sheet steel makes provisions for zinc coatings and aluminium/zinc alloy coatings but not for electroplated products. Electroplated spring clips fail to meet the minimum coating of Class AZ150 and therefore do not comply with the requirements of the Australian Codes and Standards for rainwater goods and are hence not fit for purpose.

1 PROJECT BRIEF

Pacific Testing has been asked to provide an independent assessment of electroplated spring clips that are used to install eaves gutters. In particular, whether electroplated spring clips meet the minimum coating of Class AZ150 requirements to comply with the relevant Australian Standards and Building Codes.

2 BACKGROUND

2.1 *Rainwater goods and accessories*

Rain water that falls onto the rooves of buildings is collected in eaves gutters and diverted to storm water or other collection systems. Previously brackets were nailed to the end of roof rafters to support the gutter itself. More recently, for aesthetic reasons, metal fascia boards are attached where the roof line meets the side of the building and the gutter is attached to the metal fascia.

Gutters are available in a number of shapes including half round, ogee, square and box gutters. In conjunction with gutters there is a large range of accessories to be used with the guttering including internal and external brackets, stop-ends, over-brackets and downpipe fittings. Another accessory used to attach the gutter to metal fascia is a spring clip. Figure 1 shows a section of eaves gutter attached to metal fascia by means of a spring clip. The gutter is attached to the fascia by the spring clip and the overstrap supports the front of the gutter. The bracket used to attach the fascia to the building is also shown on the right of the image.

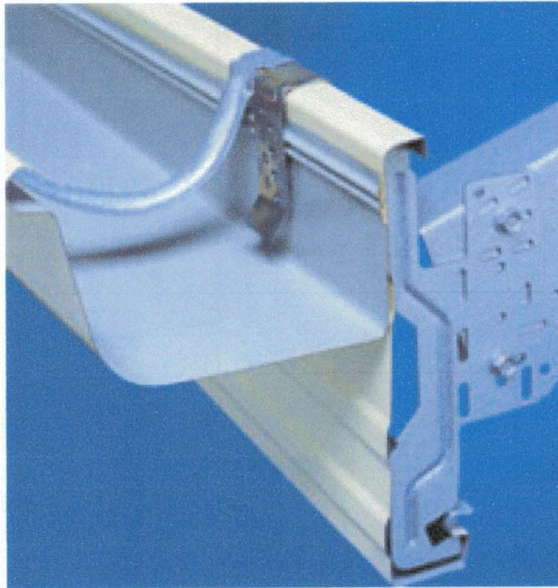


Figure 1: Image of rainwater gutter and spring clip and overstrap.

2.2 Materials and Coatings

By definition eaves gutters are an external fitting designed to handle rainwater. Many materials have been used for rainwater components in the past, Ancient Romans used lead, Chinese used terra-cotta and today, metallically coated steel is used extensively. In such an environment there is potential for corrosion of metals. To minimise corrosion, alternative materials have been employed such as copper, aluminium, stainless steel and plastics, however metallically coated steel remains economically the most popular selection.

The most common metallic coating is an aluminium-zinc alloy (55% aluminium, 43.5% zinc) one product is commercially known as Zinalume®. The other coating is almost pure zinc coating referred to as galvanising.

For aesthetic reasons and additional corrosion protection the metallically coated steel is often painted.

3 CODES AND STANDARDS

Section 3 of the report examines the coatings requirements to comply with the National Construction Code, the Plumbing code, AS/NZS 3500.3 Stormwater drainage and AS/NZS 2179.1 Specifications for rainwater goods, accessories and fasteners.

3.1 National Construction Code (NCC), the Building Code of Australia (BCA) and the Plumbing Code of Australia (PCA)

All buildings in Australia have to comply with the National Construction Code (NCC). The NCC comprises the Building Code of Australia (BCA), Volumes One and Two; and the Plumbing Code of Australia (PCA) as Volume Three.

The purpose of the BCA is to enable the achievement of nationally consistent, minimum necessary standards of relevant, health, safety (including structural safety and safety from fire), and amenity sustainability objectives efficiently.

In relation to stormwater drainage the Code calls up AS/NZS 3500.3 and AS/NZS 2179.1. These Standards covers materials, design, installation and testing of roof drainage systems, surface drainage systems and subsoil drainage systems to a point of connection.

The Building Code of Australia Part 3.5.2 Gutters and Downpipes states in section 3.5.2.2 Materials, that:

*“Gutters, downpipes and flashings **must-***

(a) Be manufactured in accordance with AS/NZS 2179.1 for metal”

Therefore to comply with the National Construction Code of Australia, all metal rainwater systems shall comply with AS/NZS 2179.1

3.2 AS/NZS 3500.3 Australian/New Zealand Standard™, Plumbing and drainage: Part 3: Stormwater drainage

The following sections are quoted from the Standard to highlight the requirements of aluminium-zinc alloy and zinc coatings to comply with AS/NZS 2179.1

AS/NZS 3500.3 Section 2 Materials and Products

“2.1 SCOPE OF SECTION

This Section specifies requirements for materials and products for use in a stormwater drainage system”.

“2.2 AUTHORIZATION

NOTE: In states and territories where stormwater installations are required to comply with the Plumbing Code of Australia, materials and products used in stormwater and drainage systems may require

authorization and shall be manufactured to the relevant Australian Standard (see PCA)."

"2.3 SELECTION AND USE

Materials and products used in stormwater drainage system shall be selected to ensure satisfactory service for the life of the installation."

"2.4 ROOF DRAINAGE SYSTEM

2.4.1 Roof drainage system components

Roof drainage system components made from aluminium alloys, aluminium/zinc alloy-coated steel, copper, copper alloys, zinc-coated steel, stainless steel and zinc shall comply with AS/NZS 2179.1"

"2.4.3 Accessories and fasteners

Accessories and fasteners manufactured from aluminium alloys, aluminium/zinc alloy-coated steel, copper, copper alloys, zinc-coated steel, stainless steel and zinc shall comply with AS/NZS 2179.1"

In addition to Section 2 of AS/NZS 3500.3 as quoted above, Section 4.16 (Support Systems) of the same standard also states that material used for support systems for eaves gutters, box gutters, vertical and graded downpipes

"(a) metals shall comply with AS/NZS 2179.1;"

3.3 AS/NZS 2179.1 Australian/New Zealand Standard Specifications for rainwater goods, accessories and fasteners

Part 1: Metal shape or sheet rainwater goods, and metal accessories and fasteners

"The objective of this Standard is to provide manufactures with requirements for metal shape or sheet rainwater goods and metal accessories and fasteners to determine fitness for purpose."

As noted above a selection of materials can be employed for rainwater goods and accessories including aluminium/zinc alloy-coated steel and zinc-coated steel. However, the vast majority of rainwater goods and accessories are manufactured from aluminium/zinc alloy coated steel and prepainted aluminium/zinc alloy coated steel.

Section 2 of AS/NZS 2179.1 sets out the requirements for materials used for rainwater good and accessories

Section 2.1 General, states *"Metal materials for use as rainwater goods, accessories and fasteners shall comply with the appropriate clauses of this Section and the minimum base metal thickness for rainwater goods and accessories shall comply with Section 3."*

Section 2.3 addresses the requirements for Aluminium/Zinc Alloy – Coated Steel components

“2.3 ALUMINIUM/ZINC ALLOY-COATED STEEL

2.3.1 General *Rainwater goods of aluminium / zinc alloy-coated steel may be plain or prepainted.*

2.3.2 Rainwater goods *Aluminium / zinc alloy-coated steel used for rainwater goods shall comply with AS 1397 with a minimum coating of Class AZ150. Prepainted materials shall comply with AS 2728.*

2.3.3 Accessories *Aluminium / zinc alloy-coated steel used for accessories shall comply with Clause 2.3.2.”*

The relevant sections of AS1397 are set out in Appendix A

Therefore to comply Rainwater goods made from Aluminium/zinc alloy-coated steel plain or prepainted are required to be used with accessories made from Aluminium/zinc alloy-coated steel.

Section 2.5 similarly addresses the requirements of zinc-coated rainwater gutters and accessories.

“2.5 ZINC-COATED STEEL

2.5.1 General *Rainwater goods of zinc-coated steel may be plain, prepainted or laminated organic-coated.*

2.5.2 Rainwater goods *Zinc-coated steel used for rainwater goods shall comply with materials specified in AS 1397 with a minimum coating of Class Z275. Prepainted and laminated organic-coated materials shall also comply with AS 2728.*

2.5.3 Accessories *Zinc-coated steel used for accessories shall comply with Clause 2.5.2.”*

The relevant sections of AS1397 are set out in Appendix A

Therefore to comply rainwater goods made from Zinc coated steel are required to be used with accessories made from Zinc coated steel.

NOTE- There is NO provision for electroplated products in this standard (AS/NZS 2179.1).

4 PREVIOUS TESTING

An extensive trial was undertaken by Pacific Testing Pty Ltd in 2007 whereby a selection of nine gutter clips was subjected to salt-spray exposure for 1000 hours. Some of the electro-plated clips showed red rust after as little as 120 hours and most had some degree of corrosion after 500 hours. At 1000 hours all but one of the clips had evidence of corrosion. All electroplated spring clips performed poorly in this evaluation as none of them matched the corrosion resistance the fascia and gutter.

5 CONCLUSIONS

Australian Building and Plumbing codes and adopted Standards AS/NZS 3500.3 and AS/NZS 2179.1 specify a selection of materials for the manufacture of rainwater goods and accessories.

Materials and products used in stormwater drainage system shall be selected to ensure satisfactory service for the life of the installation.

The Codes and Standards make no provisions electroplated rainwater goods or accessories. The current practice of manufacturing and using electroplated spring clips and other accessories that fail to meet the minimum coating of class AZ 150 or Z 275 does not comply with the appropriate Australian Codes and Standards and these products are therefore not fit for purpose.

Previous laboratory testing has shown that electroplated spring clips failed to perform when compared to those accessories that do conform with the pertinent Australian Codes and Standards



Robert Jeffrey

*BE (Chem), PhD, MIE (Aust)
Director,
Pacific Testing Pty Ltd*



Disclaimer

Every effort has been made to ensure that the information in this report is correct however, Pacific Testing accepts no responsibility for any loss, damage, cost or expense (whether direct or indirect) incurred by you as a consequence of acting or refraining from action as a result of material in this report.

APPENDIX A

AS 1397—2011 Australian Standard®: Continuous hot-dip metallic coated steel sheet and strip—Coatings of zinc and zinc alloyed with aluminium and magnesium

This Standard upgrades the requirements of AS 1397—2001 and introduces three new coating types: (a) Zinc and aluminium (Type ZA), (b) Zinc, aluminium and magnesium (Type ZM) and (c) Aluminium, zinc and magnesium (Type AM).

It retains the Type Z coatings for zinc coated sheet, and Type AZ for aluminium/zinc alloy coated strip.

Of relevance to accessories used in roofing industry are the grades Z and AZ which are defined in section 1.3.3 Coating Type.

“1.3.3.1 Zinc coating

A hot-dip coating of 99% zinc incorporating less than 1% of minor additions of control elements (Type Z) or a coating of zinc converted to a zinc/iron alloy (Type ZF).”

And

“1.3.3.4 Aluminium /zinc alloy coating

A hot-dip coating of 50% to 60% aluminium, 1% to 2% silicon, with the remainder zinc, and incorporating less than 1% of minor additions of control elements. (Type AZ).”

Table 3.1 specifies the minimum coating mass for Z275 as being 275 grams / meter ² (g/m²) for the total on both surfaces or 110 g/m² for a single spot on one side.

Likewise, Table 3.4 specifies the minimum coating mass for AZ150 as being 150 grams / metre ² (g/m²) for the total on both surfaces or 60 g/m² for a single spot on one side.

Table C2 specifies the minimum coating thickness for these two grades as 15 microns (µm) for zinc coated Z275 and 16 µm for Al/Zn coated AZ150 steels.

Author's CV

Dr Jeffrey is director and principal consultant for Pacific Testing Pty Ltd, a company that investigates corrosion issues. Additionally Robert is employed as a Research Scientist at the University of Newcastle where he has investigated atmospheric and marine corrosion for the past decade or so. He is an active member of Australian Standards Committee - M-014, *Corrosion of Metals*. He has been involved with the revision of AS/NZS 2728:2007 – Prepainted sheet metal, AS 4312-2008 – Atmospheric corrosivity zones in Australia and AS 2309-2008 - Durability of galvanized coatings – Atmospheric. Currently he is involved with the revision of AS 3566.2 – Self-drilling screws, Part 2 – corrosion resistance requirements.

Dr Jeffrey is an Honorary Life Member and past president of the Australasian Corrosion Association (ACA) and has been on the committee of the Newcastle ACA branch for over twenty years. He has authored or co-authored over 80 journal and conference papers related to corrosion of metals. Robert has twice been presented with the Marshal Fordham award for corrosion research.

He has had over 40 years' experience in heavy industry working as a metallurgist, non-destructive testing specialist, chemist, weld inspector, research and development engineer, inventor, forensic investigator and research scientist.