

		Corrosion	created	JL
			checked	JM
Tech. Bulletin	Rev. Nr. 2.1		valid from	24.08.2012

INTRODUCTION

The SunLock family of solar PV framing products is designed to have a service life of 25+ years, matching the lifetime of solar modules. This report describes some key points related to corrosion and why a 25+ year service life can be expected.

FUNDAMENTALS

SunLock rooftop components are fabricated from 6000 series aluminium and 304 stainless steel; while PoleLock and GroundLock frames also include galvanized or hot dip galvanized steel.

STANDARDS

AS/NZS 5033:2012 discusses corrosion in section 2.2.7, including the following statements:

“Module mounting frames...shall be made from corrosion resistant materials suitable for the lifetime and duty of the system...”

“If aluminium is installed in a marine or other highly corrosive environment, it shall be anodized to a thickness and specification suitable for the location and duty of the system.”

“Bolts and nuts should typically be stainless steel.”

“Care shall be taken to prevent electrochemical corrosion between dissimilar metals... Stand-off materials shall be used to reduce electrochemical corrosion between galvanically dissimilar metal surfaces...”

AS/NZS 2312:2002 provide definitions for the corrosivity classification of atmospheric environments, as summarised in the table below:

CATEGORY	ENVIRONMENT CORROSIVITY	CORROSION ENVIRONMENT CATEGORY DESCRIPTION
A	Very low	Environments in this category are found in internal building atmospheres and in semi-sheltered locations remote from marine and industrial influences such as alpine regions.
B	Low	Environments in this category can be found in dry rural areas and other areas free of pollution, typically in excess of 50km from the sea but can approach 1km from seas that are sheltered and quiet.
C	Medium	Environments in this category are mainly in coastal areas with low salinity which can be influenced by prevailing winds, topography, vegetation and wave action. Around sheltered seas it can extend from 50m to 1km inland but on rough shorelines it can extend from 1km from the shoreline to 10-50km inland.
D	High	Environments in this category are mainly coastal and on sheltered bays extend up to 50m from the shoreline and in areas with rough seas it extends from several hundred metres from the coast to about 1km inland. Industrial regions may also fall into this category and extend up to 1500m from the plant.
E-I	V High – Industrial	This category is also found in severe industrial areas where the environments are acidic (pH<5).
E-M	V High - Marine	Environments in this category are commonly offshore and along surf beaches and can extend several hundred metres inland.
F	Inland Tropical	Environments in this category are found above the Tropic of Capricorn, except where affected by salinity. The corrosivity is generally low (Category B) but can be damaging to organic coatings.

SUNLOCK RAILS, BRACKETS, CLAMPS AND BOLTS

SunLock is compliant with relevant standards as it is fabricated from 6000 series aluminium (predominantly 6106-T6) and stainless steel 304 fasteners.

COASTAL ENVIRONMENTS

The suitability of mill finish (i.e. non anodised) 6106-T6 aluminium SunLock components for use in coastal environments has been analysed by corrosion consultants CMET Pty Ltd. Their report concluded that SunLock has a 25+ year service life; excerpts from the report are shown below:

Aluminium Components

Based on the authors' direct experience in the aluminium industry and published data, the extruded 6106-T6 aluminium sections used in the photovoltaic panel frame and mounting brackets will provide a maintenance-free life of 25+ years in all environments.

In high corrosivity environments the aluminium components may experience some pitting corrosion but the rate of pitting will diminish rapidly with time with a minimal loss of section and no significant effect on the integrity of the structure. Improved resistance to pitting corrosion can be achieved by anodizing the aluminium but this tends to be inappropriate as unprotected cut edges are difficult to avoid.

Typical applications of unprotected aluminium in high corrosivity environments include aluminium boats (runabouts, yachts & catamarans) and coastal structures (ship-loaders & marinas)

Note: The use of the high strength 2xxx and 7xxx alloys is not recommended due to the inherent lower corrosion resistance which results from alloying with copper and zinc. These alloys require specific coating systems to achieve reliable performance in corrosive environments.

Aluminium Alloy System	Aluminium Alloy Type	ALUMINIUM ALLOY DURABILITY (years to first maintenance)						
		A Very Low	B Low	C Medium	D High	E-I V High (Ind)	E-M V High (Mar)	F Inland Trop
2xxx	Al-Cu							
3xxx	Al-Mn	25+	25+	25+	25+	25+	25+	25+
5xxx	Al-Mg	25+	25+	25+	25+	25+	25+	25+
6xxx	Al-Mg-Si	25+	25+	25+	25+	25+	25+	25+
7xxx	Al-Zn							

Furthermore, the www.permalite.com.au range of mill finish (non anodised) 6106-T6 aluminium roof cladding and structural framing products is a well-known industry standard solution for use in corrosive environments such as coastal regions, marinas and swimming pools.

ELECTROCHEMICAL CORROSION (DISSIMILAR METALS)

L-foot & roof cladding

SunLock L-feet are supplied with an EPDM washer (potable grade) which is installed between the L-foot and the roof cladding. This is primarily to mitigate water ingress around the roof screw, but also provides protection against electrochemical corrosion between the L-foot and the roof sheet. Even if the washer was not used, according to the BlueScope technical bulletin CTB-12 (Rev 3, November 2003) on dissimilar metals, aluminium accessories are compatible with all common roofing materials, including galvanized iron, Zinalume and Colorbond.

Cladding Material	Accessory/Fastener Material							
	Stainless Steel (300 Series)	Zinc-Coated Steel and Zinc	Zinc/aluminium coated steel	Aluminium	Copper & Brass	Lead	Monel	Carbon Black***
Zinc-coated steel & zinc	No	Yes	Yes*	Yes*	No	Yes**	No	No
Zinc/aluminium - coated steel	No	Yes*	Yes	Yes	No	No	No	No
COLORBOND®	No	Yes*	Yes	Yes	No	No	No	No
COLORBOND® METALLIC	No	Yes*	Yes	Yes	No	No	No	No
COLORBOND® ULTRA	No	Yes*	Yes	Yes	No	No	No	No
COLORBOND® STAINLESS	Yes	No	No	No	No	No	No	No

Key: * Inert catchment situation may apply. (See *Technical Bulletin TB15*)

Note: the “inert catchment” situation does not apply to the SunLock mounting brackets.

Aluminium & stainless fasteners

SunLock extruded aluminium rails, brackets and clamps are in direct contact with stainless steel machine screws, nuts and washers. CMET Pty Ltd 's report concluded that SunLock has a 25+ year service life; excerpts from the report are shown below:

Galvanic Connections

An important factor to consider in corrosive environments is the risk of galvanic corrosion caused by contact with more noble metals. Aluminium will corrode rapidly if in direct contact with copper or nickel but, although stainless steel is substantially more noble than aluminium, the rate of galvanic corrosion is retarded by the inherent passivity of both metals. Hence, it is not uncommon to find stainless steel connected directly to aluminium in a range of environments with minimal galvanic corrosion on the aluminium.

It is noted that stainless steel fasteners are used to fix aluminium fittings to vessels in marine environments with limited corrosion at the interface. However, as there a risk of salt deposition and concentration at the contact interfaces, some form of corrosion protection such as isolation is recommended to protect against galvanic corrosion.

What is the service life of assemblies fabricated from aluminium extruded sections bolted together with A2 stainless steel fasteners?

These sections will provide satisfactory performance over the 25 year design life in medium corrosivity environments but consideration should be given to protecting against galvanic corrosion in severe marine environments.

In severe marine environments the SunLock frame should be inspected as part of regular roof maintenance (e.g. every two years) and washed down with fresh water to minimize salt deposition in crevices and at contact interfaces.

FURTHER INFORMATION

For further information contact Apollo Energy on 1300 855 484 or sunlock@apolloenergy.com.au.