Technical Update

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Corrosion Resistance of Pryda Products

1. General

The majority of Pryda products are manufactured using pre-galvanised steel. Some heavy gauge products which will be used outside are hot dip galvanised after manufacture eg Post Anchors. This type of corrosion protection has served the community well for many decades. However there are some environments which warrant an even higher degree of corrosion protection than provided by this galvanising, eg where there are high concentrations of air-borne sea salt, or an aggressive environment such as that produced by some swimming pools, and some heavy industrial plants.

There are two considerations to be taken into account when determining if corrosion resistance should be specified higher than that provided by galvanised steel. Is the product close to the coast? and Is it subject to wetting or condensation? If so, special consideration is required.

The first factor is the coastal / inland location, as areas close to the coast can be exposed to relatively high concentrations of airborne sea salt. If we are in a coastal region, then the location of the product within the building needs to be considered, as externally located product is more prone to corrosion than for products internally located.

2. Australian regulatory requirements

The Building Code of Australia 2011,(referred to as NCC 2011 as it is now part of the National Construction Code Series) provides special provisions for corrosion protection in Clause 3.3.3.2 (steel members built into masonry) and Clause 3.4.4.4 (steel members that are NOT built into masonry). The latter clause indicates that no protection is required if the steel member is located internally and in a permanently dry location (subject to no moisture).

However, in Part 3.4.2 of NCC 2011 covering light-gauge Steel Framing, the requirements are slightly different. A minimum coating class of Z275 or AZ150 is considered adequate protection against corrosion under the conditions detailed in clause 3.4.2.2. **However, this clause recommends "a higher level of corrosion protection" for frames that are within the building envelope but less than 300m from breaking surf.**

The Residential Timber-framed Construction Standard, AS1684-2010 series, specifies in Clause 1.15 that 'all metal used in structural timber connections shall be provided with corrosion protection appropriate for the particular conditions of use and where corrosion protection of steel is required it shall be in accordance with AS/NZS 4791, AS/NZS 4534, AS 1397 and AS1214'. It also states that:

- The level of corrosion protection shall take into considerations weather exposure, timber treatment, moisture and the presence of salt.
- The minimum corrosion protection that shall be applied to metal straps, framing anchors and similar structural connections shall be Z 275. Where other types of corrosion protection are provided, they shall satisfy the requirements of the relevant authority.

The NASH Standard –Residential and Low-rise Steel Framing:2005 has stopped short from being specific in their recommendations on the subject. Clause 1.3.3 (Note 2) says "In potential corrosive environments, advice should be obtained from the respective manufacturers on appropriate protective measures"

It is left to specifiers to determine what these conditions may be, so this Note is a guide to assist in this evaluation.

3. Special considerations

3.1 Corrosion Environment

Two general types of coastal environments, ocean coastal areas (or breaking surf) and sheltered bayside areas, should be considered when establishing corrosion environments. In addition **heavy industrial** areas may require specific considerations which are outside the scope of this technical note.

DISTANCE FROM COAST	CORROSION ENVIRONMENT FOR COASTAL AREAS (see note below)	
	OCEAN COAST (Subject to Breaking Surf)	**SHELTERED BAYSIDE** (Not subjected to Breaking Surf)
Up to 100m	SEVERE MARINE	SEVERE MARINE
100m to 1 km	SEVERE MARINE	MARINE
1 km to 10 km	MARINE	MODERATE
Greater than 10 km	MODERATE	MODERATE

Table 1 – Corrosion Environments

Note: The corrosion hazard area relative to the coast may vary depending on a number of factors like local climate, prevailing winds or the coastal topography. These areas should therefore be verified in each location from field observations and any existing corrosion studies. A useful map showing the effect of prevailing winds for local environments can be found on the internet at the Industrial Galvanisers website.

3.2 Locations

There are two general types of locations that need to be established when specifying corrosion protection for Pryda products:

LOCATION	GENERAL DESCRIPTION
INTERNAL	Areas **within building envelope** that are kept permanently dry. *Closed and non-ventilated roof spaces can be considered as an internal location*
EXTERNAL	Areas **outside the building envelope** that are exposed to repeated wetting. *'Sheltered' areas may be treated as an external location (see note below)*

Table 2 – Locations of Building Components

Note on 'Sheltered Areas':

The areas referred to as 'sheltered' are neither an internal nor an external location. Common examples of the sheltered areas are carports, open sub-floors with no perimeter walling, verandahs and roof overhangs with no ceiling lining etc. These areas have sometimes shown to sustain worse corrosion than bold exposures. Bold exposures are more rapidly dried because they are exposed to sunlight and washed by rain.

A prudent approach is to treat all of these areas as **external** situations, as they provide little protection against airborne salts, but it could be argued differently on a case-by-case basis. The cavity of an external masonry wall is to be regarded as an external location.

3.3 Corrosion protection selection

The level of corrosion resistance may now be selected for all locations, particularly external locations in the Severe Marine environments.

These recommendations are interpretations by Pryda Australia of the various codes and technical literature on the subject, based on available research and are subject to change in future technical updates.

Ultimately, it is the responsibility of the Building Designer or the relevant local authority to specify corrosion requirement for different locations within the building.

LOCATION	CORROSION PROTECTION REQUIREMENT FOR DIFFERENT ENVIRONMENT		
	SEVERE MARINE	MARINE	MODERATE
INTERNAL	Z275 or equivalent (1)	Z275 or equivalent	No Protection Required(4)
EXTERNAL (2)	Marine Grade 316 stainless steel or equivalent (2)	Marine Grade 316 stainless steel or equivalent (3)	Marine Grade 316 stainless steel or equivalent (3)

Notes:

1. Special Note on Roof Spaces in Severe Marine Environments: The roof space in Severe Marine environments require special consideration, as CSIRO investigations have shown that airborne sea salts can be deposited on steel surfaces in these circumstances. Even though there may be no wetting, some attack on simple steel coatings may still occur, but this is yet to be quantified. Therefore, until more knowledge is available, it is advisable to detail trusses in severe marine environments with oversized webs ensuring no part of the nailplate overhangs outside the joint.
   Furthermore, clause 3.4.2.2 of NCC 2011 (Vol 2) requires roof spaces within 300m from ocean coast (breaking surf) to have additional corrosion treatment on standard Z275 steel. See Note 3 for details on additional protection options.
2. Table 3.4.4.2 of NCC 2011 (Vol 2) provides alternative protective coatings for steelwork in severe marine applications.
3. For nailplates and brackets used in external locations in marine or moderate environment, the following may be used as an alternative to marine grade 316 stainless steel ;
   - Hot dip galvanizing not less than 300 gsm, but must comply with Tables 1 and 2 of AS/NZS 4680.
   - 100 micron thick epoxy powder coating or equivalent
   - 2 coats alkyd primer or alkyd gloss or equivalent to manufacturer's specifications.
4. Wall ties and other similar products that are **built into masonry walls** require a minimum Z600 even in a moderate environment. Refer NCC 2011 (Vol 2) Table 3.3.3.1 for further details.

3.4 Corrosion protection of Pryda products

Most Pryda products are manufactured using Z275 steel. However, there are a few products that have a corrosion protection other than Z275. They are Wall Tiles (Z600), Bottom Plate Anchors (Z450), Heavy Duty Truss Boots, Beam Hangers, Anti-Crush Plates, Post Anchors and other heavy gauge brackets (hot dip galvanized with min. 300 gsm per face).

There are also a limited range of products using Grade 316 stainless steel as discussed in clause 4.0

4. Stainless Steel

Some Pryda products are manufactured from stainless steel, i.e Multigrips, Strapbrace, Framing brackets, Nail-on plates, and a small range of Claw nailplates are available in the Pryda range. All of these products are manufactured using Grade 316L stainless steel, commonly known as Marine grade stainless steel.

Some FAQs on stainless steel and its use;

Q. Must I use stainless steel nails with stainless steel products?
A. There is no galvanic reaction between galvanised products and stainless steel products, so in that respect it is OK. But the corrosion resistance is mis-matched, so if you need a stainless steel product for corrosion resistance purposes, then you should use stainless steel nails as well.

Q. When should I supply Pryda products made from stainless steel?
A. When the use of stainless steel has been specified by the building designer, or when required as a "deemed to comply" by local authorities, or by government regulation.

5. Other Issues

5.1 Weather Exposure

If Pryda products are to be exposed to the weather, they should be either hot-dip galvanised after manufacture or coated with epoxy paint or some other suitable coating as described in Section 3.3 (Note 3).

Claw nailplates should not be used in this environment without additional considerations, as the nailplates may be partially ejected from the timber under the action of repeated swelling and contraction of the timber as it is subject to wetting and drying.

5.2 Timber Treatment

If the timber is treated with CCA, Pryda products may be used without additional protection as long as the timber stays dry in service. If the timber is exposed to the weather, the products must be fusion coated, or coated with epoxy paint, or made from stainless steel. This is because the zinc coating on the product will be attacked by the copper from the CCA treatment if the moisture content of the timber rises above 20% for a significant period of time.

ACQ treatment is also found to be more corrosive on fasteners and additional protection will be needed. Timbers treated with LOSP have no known reaction with galvanised steel.

Read Pryda Technical Update No. 31 on *The use of Nailplates in Treated Timbers (February 2012)* for further information on this subject.

5.3 Timber moisture content

If the timber is used in an internal environment and is initially unseasoned, but dries in service and remains dry, no further protection is required on the standard galvanised Pryda products. Otherwise, use the recommendations in section 5.1 (Weather Exposure).

5.4 Swimming Pools

The use of steel products within a swimming pool environment is a special case. To the best of our knowledge, the corrosive agents are chloramines which are formed by the combination of human sweat (urea) and chlorine. These are particularly aggressive to steel, and even Grade 316 stainless steel has been found to fail due to stress corrosion cracking in these environments.

Read Pryda Technical Update No. 23 on *Corrosion Resistance of Trusses over Enclosed Swimming Pools (March 2009)* for further details on how nailplates should be protected in this environment.

Pryda Australia | A Division of ITW Australia Pty Ltd
2 - 10 Nina Link, Dandenong South, Vic 3175
Offices in Melbourne, Sydney, Brisbane and Perth.
Representatives in all States.
Website: www.pryda.com.au
Email: pryda@pryda.com.au
Tel: (03) 9554 7001 Fax: (03) 9554 7000