# Tech Note 11:
# Marine Spray Environments & Stainless Steel

**TN.11**

**Related Documents:**
- Tech Note TN.01 Chlorides, Chlorine & Stainless Steel

Stainless steel has a high resistance but as with all materials, is not resistant to everything and may be prone to pitting or damage from the interaction with *chlorides or chlorine* in certain conditions. These conditions are dependent on the grade of stainless, temperature, concentration and exposure.

Normally this is reviewed against internal exposure such as chemical additive ingredients, bore water or water sample test data results but in marine environments we consider the *external* exposure of the stainless material for shipping, wharf, jetty, offshore and other marine based applications.

Under jetty/wharf areas are a high risk area for 316 stainless steel, with the salts from the seawater damaging to the passive layer. Unprotected stainless is likely to experience a much-reduced lifespan compared to land based installation. For example, some projects allow for a 3- 5 year programme before repairs and/or replacement may be required.

**"Marine Grade" Stainless**
There is a perception that grade 316 stainless steel is, or referred to as, "marine grade" which in the assessment of exposure to seawater is somewhat misleading.

Example concentrations & comparative stainless resistance to Chlorides (Cl-):
- Potable Water: 250ppm max (Australian Drinking Water Guidelines 2011).
- Seawater: ~30,000ppm.
- 304 grade stainless steel at 20°C: Resistant up to 500ppm, pH neutral – PREN 24.
- 316 grade stainless steel at 20°C: Resistant up to 1,000ppm, pH neutral – PREN 35.
- Note with the increase of temperature, the resistance concentration reduces.

PREN (Pitting Resistance Equivalent Number) is a formula sometimes used as a simplified method to compare grades. Metals with a PREN above 32 are considered seawater (corrosion) resistant, but this depends on other conditions too. PREN = %Cr + 3.3 x (%Mo + 0.5%W) + 16 x %N.

**Design Considerations**
Specific consultant advice is recommended to assess the options for the design, including routing and risk reduction/elimination. One or more of the following can affect the performance and require review:
- Grade - Each grade of stainless has a different resistance, ie grade 316 stainless has a higher resistance to chlorides than grade 304 stainless.
- Exposure – Sea air, splash zone, immersion, rain protected.
- Access – Maintenance and inspection, safety equipment required.

Otherwise, it's a case of protecting the surface the best you can for longevity… options include:
- Electropolish – Reduce the surface roughness for the salts to reside in to extend the lifespan (by 1-2 years as an estimate).
- Paint – bitumen or otherwise suitable paint layer, ensuring all surfaces are suitably coated to protect the surface. May need priming first for some paint types.
- Wrap – Denso, overlap method to avoid gaps and moisture egress.
- Encase – Plastic casing, insulative fill to void.

**Ongoing Maintenance**
The resistance of grade 316 stainless is increased with simple regular maintenance when installed nearby to otherwise detrimental sea water and/or high chloride environments. Removing salt deposits from the stainless surface is the key objective with high pressure rinsing and physical cleaning methods.

Installation requires careful consideration to allow for regular inspection and maintenance access, with under wharf, splash zone and covered areas not recommended.

We suggest the following as a minimum requirement as part of a greater maintenance programme for the system installed:

- Regularly rinse the stainless with ambient potable water to wash away salt water residue and/or deposits, especially after storm events or periods of high temperatures.
- Heavy rainfall in tropical areas can be considered as 'rinsing' however, careful attention to be given to the under dripline of the pipework and concealed areas as these are often overlooked and likely location for surface contaminants to accumulate (ie salt residue).
- Yearly inspection to be completed, with areas displaying signs of surface deposits and/or tea staining to be cleaned and rinsed.

**Further Reading**
AusPress is a member of ASSDA and they're a great resource that we refer to often as the national body representing the stainless interests in Australia.
A starting article is "Misconception - 316 stainless steel is a marine grade and is suitable for seawater immersion" from https://www.assda.asn.au/blog/340-common-misconceptions-about-stainless-steel.

**Not sure?**
Please contact us before installation so we can offer advice and suitability.