CORROSION PROTECTION OF BUILDING SERVICES

INTRODUCTION

Corrosion is a common reason for mechanical services equipment and systems not reaching their intended service life (also known as economic life). Corrosion also increases maintenance costs and can negatively impact energy efficiency and plant performance. In extreme cases, corrosion can impact the effectiveness of life safety systems.

This TECHnote aims to provide specifiers with guidance in deciding the required protection to prevent excessive corrosion.

NATSPEC TECHnote NTN DES 010 provides guidance on the determination of corrosivity categories to AS 4312.

DETERMINING CORROSION PROTECTION

There are three basic steps for specifiers to determine the appropriate corrosion protection for an equipment item:

1. The required service life.
2. The sources of corrosion.
3. The required protection based on 2. to achieve the service life in 1.

AIRAH DA19 Table 2.1 provides typical values for the service life of equipment, some of which are:

Equipment	Years
Air conditioning unit - Split units (up to 10kW)	7-10
Air conditioning unit - Split package (10 kW-100kW)	10-15
Air handling unit - Proprietary line central station	20-25
Cooling towers	10-25
Ductwork and fittings	20-30
Refrigeration chillers - Screw/scroll	20-25

A further, possibly overriding, consideration is the consequences of failure due to corrosion which may outweigh this simple service life consideration. For example, motorised dampers required to operate in fire mode may require better corrosion protection than other dampers.

Other factors to consider are the intended life of the space the plant serves. For example, plant that serves a retail space with a 5 or 10 year lease may not warrant designing systems to last 25 years. A small split system serving such a retail space probably does not warrant additional coil corrosion protection. On the other hand, an air-cooled chiller providing chilled water to multiple retail tenancies probably warrants the relatively small cost of additional coil protection.

Source of corrosion

Mechanical plant is subject to several causes of corrosion including:

- **Corrosion in the environment outside the building** comes primarily from salt laden air but other sources such as nearby industrial plant can also contribute.
- **Internal sources of corrosion** include chlorine from swimming and hydrotherapy pools and fumes from some industrial processes.
- **Corrosion caused by plant operation** such as free moisture from dehumidification and galvanic corrosion due to electrical contact between dissimilar metals.

Sources of information on corrosive external environments

AS 4312

Exterior and interior atmospheric corrosivity categories to AS 4312 for the project are specified in *0171 General requirements*. The AS 4312 categories tend to be quite broad and aimed primarily at building elements such as structural steel and sheet metal roofing. As such they should be treated as only one factor to be considered in determining corrosion rates for building services.

Further, the concept of interior and exterior in AS 4312 can be misleading for building services. For example, an outside air duct located inside the building and carrying salt laden air is subject to the same salt burden as the outside of the building but without the benefit of being periodically washed by rain. As a

Related documents

- *AIRAH DA19 HVAC&R maintenance*
- *AS 4312 Atmospheric corrosivity zones in Australia*
- *NATSPEC TECHnote NTN DES 010 Atmospheric corrosivity categories*

The Corrosion Mapping System

This can be accessed by registering with Industrial Galvanizers at http://corrosion.ingal.com.au

result, despite being in the 'interior' of the building corrosion is likely to be higher than if it was on the 'exterior'.

The Corrosion Mapping System

The Corrosion Mapping System is a joint venture between Industrial Galvanizers and the CSIRO, provides corrosion data, based on CSIRO environmental modelling, for any location in Australia. It provides corrosion rates for steel, copper steel and zinc (galvanized) coatings based on geographic location and the element's location on the structure. It can be used to determine the predicted service life of galvanising in various situations for the site and may be used as a guide for corrosion of other metals.

Determining corrosion rates and risk

Factors to consider when determining the appropriate degree of corrosion protection include:

AS 4312 particularly Table 4.1 and Appendix A which can be used to determine corrosivity category. Table 2.1 relates corrosivity category to typical environments and corrosion rates of several metals. If the category for the situation is C5 or CX specifiers should seek, specialist advice on corrosion protection.

- Corrosion rates from Corrosion Mapping System.

The distance from breaking surf. See AS 4312 Table 4.1.
Distance from other salt water. See AS 4312 Table 4.1.
Height of the item above sea level. AS 4312 Table 4.1 suggests that if above 50 m, category C3 can be reduced to C2 in some cases.
Other macro and micro climatic conditions. See AS 4312 Section 2.

- Exposure to other corrosive environments such as industrial and laboratory fumes.
- The condition of similar plant and equipment on or near the site for which the age is known or can be estimated.
- General knowledge of corrosion rates for similar plant and materials in locations or conditions similar to the site.

NATSPEC worksections

NATSPEC worksections provide a range of options both in terms of default text and options for designers and specifiers to select based to achieve the most suitable protection for the equipment item, location in the building and external environment.

These decisions may be documented in the schedules or on the drawings. The following are of note:

- Worksections such as *0715 Chillers – combined, 0721 Packaged air conditioning* and *0733 Air coils* that include air cooled condenser coils contain clauses on additional coil corrosion protection that may be nominated by the specifier.
- *0753 Water treatment* deals with corrosion protection of piped systems including both chemical treatment and cathodic protection.
- Electrical worksections contain provision for specifying corrosion resistant materials in the schedules, e.g. *0941 Switchboards - proprietary.*
- Other worksections such as *0713 Cooling towers, 0741 Ductwork* and *1030 Combined wet fire suppression systems* contain a range of materials with different corrosion resistance that may be selected. For example, *0741 Ductwork* includes clauses for galvanized, aluminium, stainless steel, PVC-U and rigid pre-insulated ductwork. Once the duct material has been selected, the worksection provides defaults for associated components. For example, if Type 316 stainless steel duct is selected, dampers will be Type 316 stainless steel also.