Hot Dip Galvanizing by Perry Metal Protection

SPECIFYING HOT DIP GALVANIZING

It's simple to specify and more cost effective than alternative coating systems.

COMMERICAL | INDUSTRIAL | INFRASTRUCTURE | RESIDENTIAL

PERRY METAL PROTECTION

We've got you covered

COATING SELECTION PROCESS

When selecting a corrosion protection coating the overall environment at the location of the structure requires careful consideration. A structure situated in an aggressive environment will require a much higher standard of corrosion protection than one in a benign environment. The environment can affect both the steel and the coating system. Of prime importance is the effect the environment has on the corrosion of steel.

The following steps should be followed to select the most appropriate corrosion protection coating:

Specified Intended Life – Refer NZBC Clause B2 Durability

The NZ Building Code requires the detailing and specifying for durability of steel structures and members with a specified intended life of not less than 50 years for building structures. A shorter life to first maintenance may be selected in conjunction with a maintenance programme which together will meet the durability provisions of NZBC Clause B2. Where components of the structure are not accessible for maintenance after assembly the coating must achieve the specified intended life.

Determine the Atmospheric Corrosion Category – Refer NZS3404.1:2009 and NZS2312.2:2014

General atmospheric environments (macroclimate) are classified into six atmospheric corrosivity categories (C1 to C5 and CX) based on the corrosion rates of mild steel given in ISO 9223. In addition to climatic effects, the site specific environmental effects (microclimate) need to be considered. Factors requiring consideration include whether the steel surface is shaded, in a wet location, and whether the steel is in contact with timber or concrete. The most significant microclimate effect is if the steel surface is sheltered from rain washing but exposed to the windblown marine salts as this greatly influences the corrosion rate.

Determine the Life to First Maintenance – Refer NZS3404.1:2009 and NZS2312.2:2014

The life to first maintenance available options takes into account the asset owners expectations, and the general principles of design to avoid corrosion. The ease of maintenance of the coated article if the life to first maintenance of the coated article is less than the required durability also requires consideration.

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DESIGN AND DURABILITY OF HOT DIP GALVANIZING

Hot dip galvanizing has proven to be more serviceable and predictable than all other steel protective coatings in the New Zealand atmosphere. Its excellent performance is due to its inherent corrosion resistance, high tolerance to mechanical damage and inertness to the high UV levels prevailing over all of New Zealand.

Designers wishing to specify hot dip galvanizing (HDG) need only use two Standards; one covering the design and durability of HDG steel **AS/NZS 2312.2:2014**, and the other dealing with manufacturing process and tolerances **AS/NZS 4680:2006**.

A detailed section on the design of duplex coatings (paint over HDG) is included, with two performance options for durability (aesthetic and corrosion).

For engineers and fabricators the design details are extensive and pictorial advice on good design practice provides clear instruction. Appendices to the Standard also cover corrosion in different environments, including bimetallic corrosion and the interaction of HDG steel with soil, concrete, water, chemicals, and wood.

A single table is provided in AS/NZS 2312.2 for designers to compare the expected durability of different galvanized products, allowing for a faster product selection process. The durability of a HDG coating is calculated from the minimum average coating thickness in AS/NZS 4680, which also means non-standard HDG thicknesses can be easily assessed for estimated life to first maintenance.

Reference Standard	Article Thickness mm	Average Coating Thickness		Selected Corrosivity Category (ISO 9223) Calculated min.-max. life in years					
		g/m²	µm	C1	C2	C3	C4	C5	CX
HDG320	Less than 1.5	320	45	100+	64-100	21-64	11-21	5-11	2-5
HDG390	1.5 to 3.0	390	55	100+	78-100	26-78	13-26	6-13	2-6
HDG500	3.0 to 6.0	500	70	100+	100+	33-100	16-33	8-16	2-8
HDG600	Over 6.0	600	85	100+	100+	40-100	20-40	10-20	3-10
HDG900	Over 6.0+	900	125	100+	100+	60-100	30-60	15-30	5-15

The corrosion rate of a zinc coating is affected by the time for which it is exposed to wetness, air pollution and contamination of the surface. To a first approximation, the corrosion of all zinc surfaces is at the same rate in a particular environment. A brief description of macro environment corrosivity categories are detailed below.

Category C1 – Generally dry indoors and some alpine regions.

Category C2 - External environments in this category are mostly areas beyond at least 50 km from the sea.

Category C3 - This category mainly covers coastal areas with low salinity. Along ocean front areas with breaking surf and significant salt spray, it extends from about 1 km inland to between 10 to 50 km inland, depending on the strength of prevailing winds and topography. This category also includes urban and industrial areas with low pollution levels.

Category C4 - This category occurs mainly on the coast and can extends from about several hundred metres inland to about one kilometre inland. Industrial regions may also be in this category.

Category C5 - This category is common offshore and on the beachfront in regions of rough seas and surf beaches and can extend inland for several hundred metres. This category may also include aggressive industrial areas, where the environment may be acidic with a pH of less than 5.5.

Category CX - These regions are found at some surf beach shoreline regions with very high salt deposition and are also be found in severe acidic industrial environments.

MANUFACTURING PROCESSES AND TOLERANCES

AS/NZS 4680:2006 is the manufacturing standard for the hot dip galvanizing coatings on fabricated ferrous articles. The Standard includes requirements for coating mass and thickness, appearance, defect identification, and suitable repair methods.

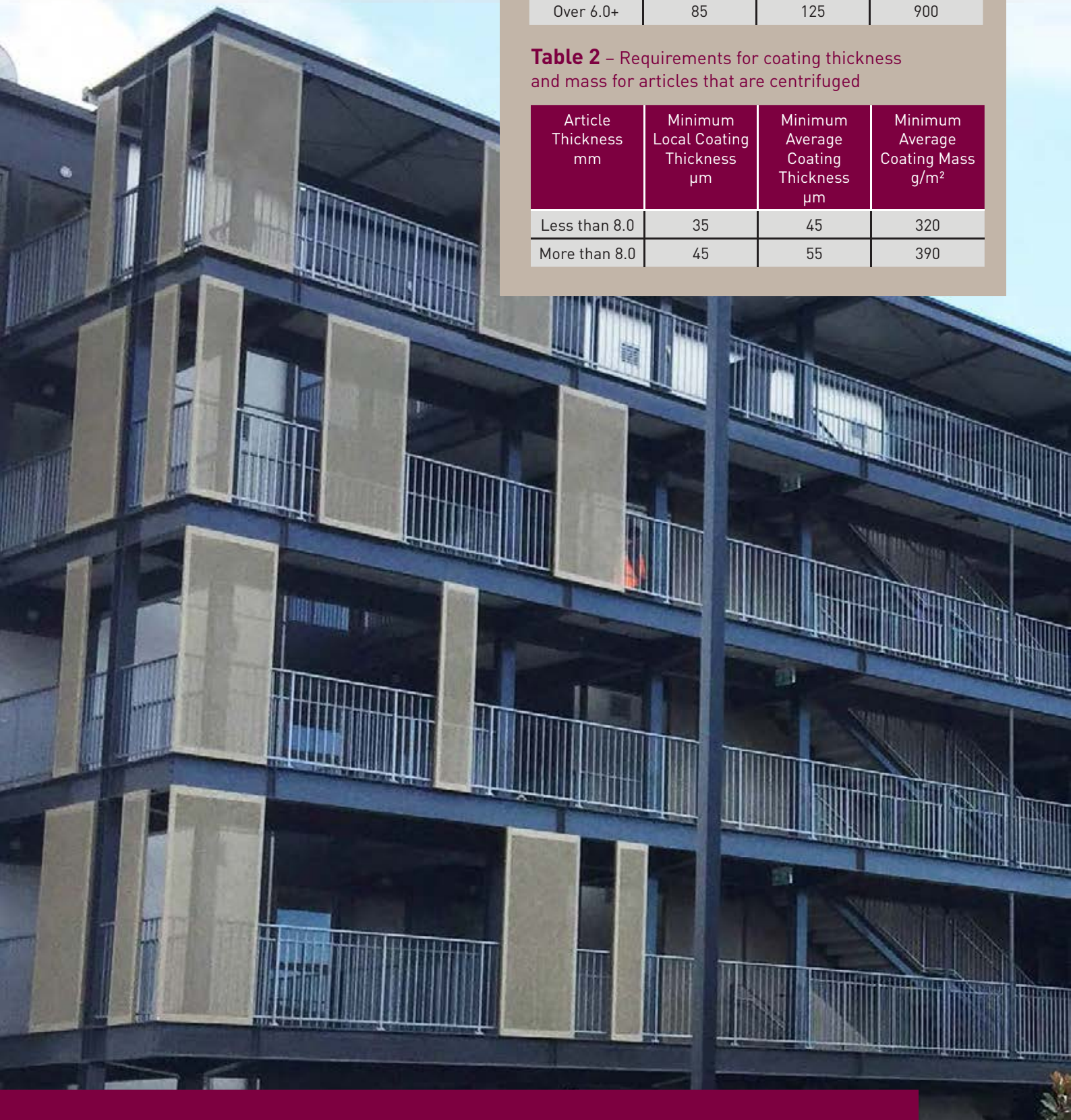
Table 1 and Table 2 of AS/NZS4680 state the requirements for coating thickness and mass, which are based on the steel article thickness.

Table 1 – Requirements for coating thickness and mass for articles that are not centrifuged

Article Thickness mm	Minimum Local Coating Thickness µm	Minimum Average Coating Thickness µm	Minimum Average Coating Mass g/m²
Less than 1.5	35	45	320
1.5 to 3.0	45	55	390
3.0 to 6.0	55	70	500
Over 6.0	70	85	600
Over 6.0+	85	125	900

Table 2 – Requirements for coating thickness and mass for articles that are centrifuged

Article Thickness mm	Minimum Local Coating Thickness µm	Minimum Average Coating Thickness µm	Minimum Average Coating Mass g/m²
Less than 8.0	35	45	320
More than 8.0	45	55	390



Freedom from defects

A galvanized coating should be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect that is detrimental to the stated end use of the coated article. The integrity of the coating can be determined by visual inspection and coating thickness measurements.
A galvanized coating should be sufficiently adherent to withstand normal handling during transport and installation.

Inspection

Inspecting galvanized steel is a simple process. Zinc will not adhere to or react with unclean steel; therefore, a visual inspection of the product provides a good assessment of the quality of the coating. The coating thickness is usually tested using a magnetic thickness gauge. The testing and sampling requirements are contained in the appropriate specification for the product (AS/NZS 4680 and AS 1214).

DUPLEX COATINGS

The AS/NZS2312.2:2014 Standard also includes a detailed section on the design of duplex coatings (paint over HDG), with two performance options for durability (aesthetic and corrosion).

A duplex system will increase the service life of the HDG article beyond that of the unpainted article. Further, the total life of a properly specified, applied and maintained duplex coating system is significantly greater than the sum of the lives of the HDG coating and the paint coating alone (by 1.5 – 2.3 times, depending on the environment).

AS/NZS 2312.2 includes seven decorative and industrial paint systems suitable for most corrosivity environments.

Painting for decorative, identifying colour or enhanced service life

Hot dip galvanized coatings are sometimes required to be painted for decorative reasons, to provide an identifying colour, or to enhance service life. In contrast with organic paints, which are degraded by solar radiation (UV), hot dip galvanized coatings are unaffected by sunlight, so over-painting is not usually required to extend service life in this circumstance.

The systems shown in the Standard, when applied and maintained correctly, will increase the service life of the hot dip galvanized article beyond that of the unpainted article.

Preparation for painting

When painting hot dip galvanized coatings, as when painting any other surface, the cleanliness and condition of the surface are of critical importance and a high proportion of paint failures on hot dip galvanized coatings can be attributed to inappropriate or inadequate surface preparation.

In preparing hot dip galvanized coatings for painting, the basic requirements are largely the same as for other surfaces. Namely, anything that prevents the paint wetting out or adhering to the surface needs to be removed. Therefore, oils, dirt, dust, salts, corrosion products and other friable material and soluble salts have to be removed prior to painting.

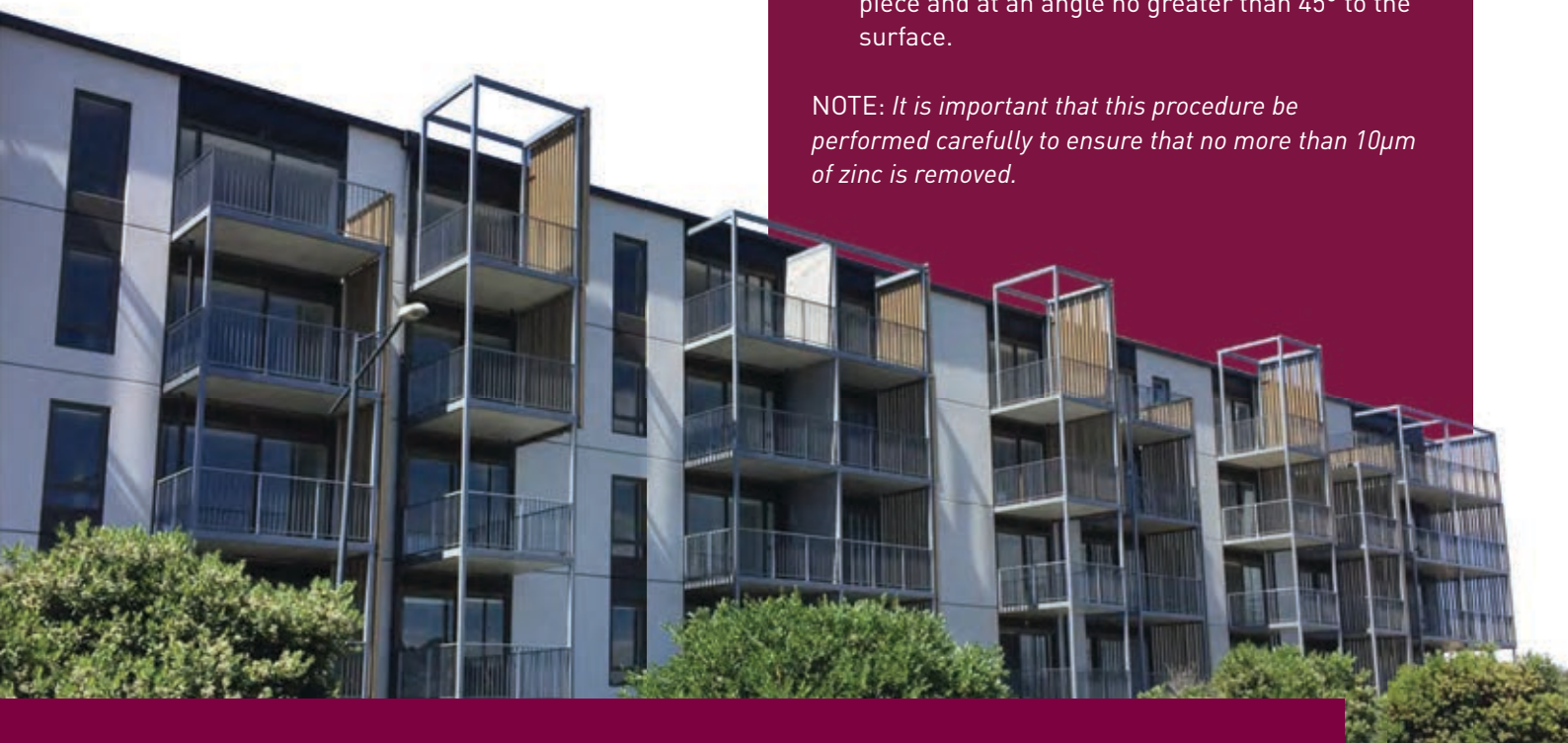
Abrasive sweep (brush) blast cleaning is a common method used for the preparation of a galvanized coating prior to the application of a paint coating. The purpose of this procedure is to remove the oxide film from the zinc surface. Paint coatings should be applied as soon as possible after galvanizing or abrasive blasting.

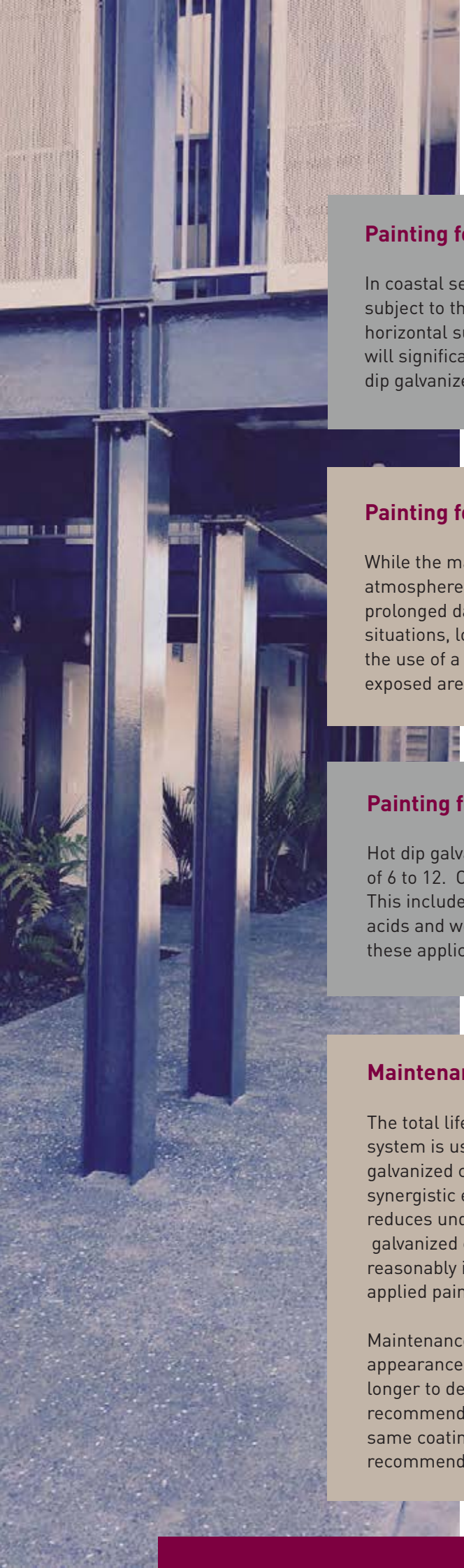
Procedure for sweep blast cleaning

The following procedure should be observed when sweep blast cleaning is carried out to ensure that a good surface is produced for painting, without severely damaging the existing galvanized coating:

1. Use fine non-metallic abrasives of a size which will pass through a test sieve of nominal aperture size 150 µm to 180 µm (e.g. ilmenite or garnet).
2. Use a venturi nozzle which has an orifice diameter of 10mm to 13mm.
3. Set the blast pressure at 275kPa maximum.
4. Keep the venturi nozzle at a distance of 350 mm to 400 mm from the surface of the work piece and at an angle no greater than 45° to the surface.

NOTE: *It is important that this procedure be performed carefully to ensure that no more than 10µm of zinc is removed.*





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Painting for unwashed surfaces

In coastal service and industrial atmospheres where the steel article is not subject to the cleansing influence of rain, such as on the underside of horizontal surfaces, the proper over-painting of hot dip galvanized coatings will significantly extend service life. In this case, the paint insulates the hot dip galvanized surface somewhat from the corrosive contaminants.

Painting for exposure to soil and/or prolonged dampness

While the majority of a hot dip galvanized structure might be exposed to the atmosphere, it may also be partially embedded in the soil or exposed to prolonged dampness, such as from the ponding of rainwater. In such situations, localized painting of the coating with a high build epoxy primer or the use of a tape or wrap may be needed to avoid premature corrosion in the exposed areas.

Painting for specific industrial chemical or solvent exposure

Hot dip galvanized coatings are recommended to be used within the pH range of 6 to 12. Outside this range, the service life is likely to be unacceptable. This includes exposure to strong acids and alkalis as well as salts of strong acids and weak bases and vice versa. Expert advice should always be sort for these applications.

Maintenance of duplex coatings

The total life of a properly specified, applied and maintained duplex coating system is usually significantly greater than the sum of the lives of the hot dip galvanized coating and protective organic coating alone. There is a synergistic effect, that is, the presence of the hot dip galvanized coating reduces under-rusting of the paint film; the paint preserves the hot dip galvanized coating from early corrosion. Where it is desired to retain a reasonably intact layer of paint as a basis for maintenance, the initially applied paint system should have extra thickness.

Maintenance usually takes place when the duplex coating loses its appearance or becomes degraded. Hot dip galvanized coatings usually take longer to degrade than paint. Hence, a hot dip galvanized coating may be recommended for 20 years or more up to first maintenance, whereas the same coating when covered by paint is, for reasons of appearance of the paint, recommended for only 10 years up to first maintenance.

TALKING TECHNICAL

Design, specification and inspection of galvanized products

To ensure consistently good galvanized steel products, it is essential that the basic requirements outlined in these guides are incorporated at the design and fabrication stages of production.

All design features should be discussed with a member of our advisory team.
Close liaison between the design engineer, materials engineer, specifier, fabricator and galvanizer will ensure the highest galvanizing standards.

Throughout New Zealand

Perry Metal Protection has four sites conveniently located throughout New Zealand.

All four plants have the capacity to galvanize a wide range of steel structures including mild and low alloy steels, and iron and steel castings.

We are the only galvanizer in New Zealand with the capacity to hot dip galvanize lengths up to 18m in length, giving you the flexibility to tackle any kind of job.

Why Perry Metal Protection

Perry Metal Protection is New Zealand's largest and only ISO 9001 accredited hot dip galvanizer.

Part of the highly successful family owned Perry Group, Perry Metal Protection has been in operation since 1974 and is a founding member of the Galvanizing Association of New Zealand.

We strive to deliver the highest quality galvanizing in a timely turnaround, at a competitive price.

CALL OUR TECHNICAL HELPLINE 0800 508 506

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ISO 9001 CERTIFIED GCS

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