SPECIFICATION FOR COATING STEELWORK ON HIGHWAY STRUCTURES

NZTA S9

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1. INTRODUCTION

1.1 General

This is a prescriptive specification for protective coating systems to be used on new structural steelwork for bridges and other highway structures. This specification is in three parts with this section 1. introduction and the following section 2. referenced standards applying across all three parts.

This specification covers the most commonly used industrial coatings systems, namely:

Part 1 – Specification for coating steelwork on highway structures with inorganic or organic coatings

Part 2 – Specification for galvanizing steelwork for highway structures

Part 3 – Specification for coating steelwork on highway structures with thermal metal spray

The specification also includes anti-graffiti (AG) systems that can be applied to these coating systems.

The expected minimum life to first major maintenance of a coating system provided under this specification is in accordance with the requirements of clause 4.3.6(a) of the *Bridge manual*(1), ie forty years for primary steelwork (eg bridge girders) and twenty-five years for more easily maintained secondary steelwork (eg bridge handrails). This maintenance is intended to refurbish the protective coating after loss of thickness and continuity due to exposure to the environment and so prevent loss of structural capacity due to corrosion.

Maintaining appearance of some decorative finishes that require earlier intervention will require specific approval for departure from the minimum maintenance intervals specified in the *Bridge manual*(1).

This standard specification should be read with the project specific specification and/or drawings that identify the system(s) to be applied, and that also specify any additional requirements such as minimum aesthetic performance. In the event of any conflict between clauses in this standard specification and a referenced standard, this specification shall take precedence.

1.2 Definitions

Terms used in this specification shall be as defined in AS/NZS 2310, AS/NZS 2312, AS/NZS 4680, AS/NZS 1214, NZS 3910, AS/NZS 5131 and additionally below:

- Waka Kotahi NZ Transport Agency: being the body having statutory powers to control the design and erection of a state highway structure.
- Principal: refer to NZS 3910
- Engineer: refer to NZS 3910
- Contractor: refer to NZS 3910
- Fabricator: the person or organization undertaking the fabrication of the complete works or components thereof. The Fabricator may subcontract components of the works to another fabricator and the Galvanizer is considered a subcontractor for the purpose of this specification.

2. REFERENCED STANDARDS

AS/NZS 1214	*Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)*
AS 1627	*Metal finishing – Preparation and pretreatment of surfaces* Part 1 Removal of oil, grease and related contamination
AS/NZS 2310	*Glossary of paint and painting terms*
AS/NZS 2312:2002	*Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings* (superseded)
AS/NZS 2312	*Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings* Part 1 Paint coatings (AS 2312.1) Part 2 Hot dip galvanizing
AS/NZS 2728	*Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements*
SNZ TS 3404	*Durability requirements for steel structures and components*
AS/NZS 3750	*Paints for steel structures* Part 9 Organic zinc-rich primer Part 15 Inorganic zinc silicate paint
AS 3894	*Site testing of protective coatings* Part 1 Non-conductive coatings - Continuity testing - High voltage ('brush') method Part 2 Non-conductive coatings - Continuity testing - Wet sponge method Part 3 Determination of dry film thickness Part 5 Determination of surface profile Part 6 Determination of residual contaminants Part 10 Inspection report – Daily surface and ambient conditions Part 12 Inspection report – Coating
NZS 3910	*Conditions of contract for building and civil engineering construction*
AS/NZS 4680	*Hot-dip galvanized (zinc) coatings on fabricated ferrous articles*
AS 4848.1	*Application specifications for coating systems. Single coat inorganic (ethyl) zinc silicate – Solvent-borne*
AS/NZS 5131	*Structural steelwork – Fabrication and erection*
AS/NZS ISO 9001	*Quality management systems – Requirements*
ASTM B201	*Standard practice for testing chromate coatings on zinc and cadmium surfaces*
ASTM D3359	*Standard test methods for rating adhesion by tape test*
ASTM D4285	*Standard test method for indicating oil or water in compressed air*
ASTM D4752	*Standard practice for measuring MEK resistance of ethyl silicate (inorganic) zinc-rich primers by solvent rub*
ISO 752	*Zinc ingots*
ISO 8501	*Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness* Part 1 Rust grades and preparation grades on uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8503	*Preparation of steel substrates before application of paints and related products – Surface roughness characteristics of blastcleaned steel substrates* Part 1 Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces

Part 1 – Specification for coating steelwork on highway structures with inorganic or organic coatings

3. INTRODUCTION

This is a prescriptive specification for shop application of protective coating systems to be used on new structural steelwork for bridges and other highway structures. It covers the most commonly used industrial paint systems, ie inorganic zinc silicate (such as IZS4); and organic systems, ie epoxy/polyurethane (such as PUR5), epoxy/polysiloxane (such as PSL2) and moisture cure urethane (such as MCU2). It also includes anti-graffiti (AG) systems that can be applied to these coating systems.

See also sections 1. and 2.

4. MANDATORY REQUIREMENTS

4.1 General

4.1.1 Labour and materials

The Contractor shall provide all labour, plant including scaffolding and containment (where required), paint, abrasive media, consumables including brushes, rollers, cleaners and thinners, required to prepare and coat surfaces in accordance with this specification.

The description and extent of items to be painted are fully detailed in the project drawings. Contractors are deemed to have familiarised themselves with the extent of the work prior to submitting their quotation.

4.1.2 Inspection equipment and personnel

The Contractor shall provide experienced supervisors including a coatings inspector and all equipment necessary to accurately measure wet and dry bulb temperatures and steel surface temperatures, wet and dry film thicknesses, coating adhesion and total soluble salts levels. The Contractor shall be responsible for the calibration and maintenance of all measuring and inspection equipment and that personnel are trained in their proper use.

The Contractor shall provide access and lighting (see 4.5.1) to allow inspection by the Engineer's representative and quality audits by an independent coatings inspector employed by the Principal or their agent. The independent coatings inspector will hold a Protective Coatings Inspector qualification available through the Certification Board for Inspection Personnel NZ (CBIP), or a Coating Inspector Program qualification from NACE International, minimum Level 2 (as outlined in section 9.2 of *Protective coatings for steel bridges guide*[2]).

4.1.3 Safety

The safety requirements for the preparation and application of a corrosion protection system on steelwork shall be in accordance with clauses 9.2.2 and 9.9.2 of AS/NZS 5131; and the Health and Safety at Work Act 2015 and regulations.

The manufacturer's technical and material safety data sheets for all materials including thinners and solvents shall be available for reviewed by the Engineer or their representative.

4.2 Requirements

4.2.1 Qualifications

As per clause 9.3.1 of AS/NZS 5131, coating applicators shall be experienced, competent workers, qualified and familiar with the materials and techniques specified. When required, the Contractor is to provide evidence of relevant qualifications on request.

4.2.2 Painting project commencement meeting

At least two weeks before work commences, a meeting shall be held between the Engineer's representative(s), coatings inspector, Contractor, coating manufacturer, and any subcontractors to clarify and agree the implementation of this specification, and the Contractor's proposed programme, methodology and inspection procedures.

The Contractor shall submit details of each of the proposed protective coating systems to the design engineer for review with the shop drawings, at least ten working days prior to the painting project commencement meeting.

The details outlined in clause 9.4 of AS 2312.1 must be included, including the following:

a. full details of the system, including preparation requirements, method of application, recoating intervals, and site touch-up and repair methods

b. full manufacturer's specifications of all proposed coatings

c. coating inspection and testing plan

d. a sample of the finish coat(s) for agreement, when this has been separately specified.

The design engineer's agreement to the Contractor's proposals listed above must be received prior to commencing any surface treatment.

4.3 Execution prior to application

All matters pertaining to the surface preparation of fabricated and welded steelwork prior to the application of corrosion protection system shall be undertaken in accordance with clause 9.8 of AS/NZS 5131, and the following.

4.3.1 Treatment grades

The treatment grades (clause 9.8.4 of AS/NZS 5131) shall be as follows, or as superseded by the construction drawings:

- for all painted primary steelwork, the treatment grade shall be to P3: very thorough treatment
- for all painted secondary steelwork, the treatment grade shall be to P2: thorough treatment
- remove heat affected zones formed by gas, laser or plasma cutting by grinding before abrasive blasting (clause 9.8.5 of AS/NZS 5131).

4.4 Application of coatings

All matters pertaining to the preparation and application of coatings shall be undertaken in accordance with the relevant details of clauses 9.4 and 9.9 of AS/NZS 5131, and the following additional specific requirements shall be applied.

4.4.1 Coating contractor's certification

Regarding the use of competent personnel (clause 9.9.1 of AS/NZS 5131), coating application on primary steelwork (eg bridge girders) shall only be undertaken by specialist industrial painting contractors whose QA system has current accreditation from the Painting Contractors Certification Program (PCCP) administered by CSIRO.

Note: A list of accredited contractors is available on the PCCP pages of the APAS website in Document PP-D016 PCCP accredited contractors[3].

4.4.2 Quality control

Quality control of the coating work shall comply with clause 9.9.4 of AS/NZS 5131.

During the course of the work, the Engineer's representative may take samples of paint from site for independent testing. If the results of the test show that the paint concerned does not comply with the relevant

specification, the Contractor (at their own expense) shall remove the non-complying paint and repaint the area with an approved paint in accordance with this specification.

The materials used shall be within their specified shelf life which may be extended if this has been certified by the manufacturer after testing. Any deteriorated or contaminated materials shall not be used. Materials shall be stored under conditions recommended by the manufacturer.

4.4.3 Stripe coating

Apply stripe coats to achieve additional thickness on, or sealing of, welds, outside corners, plate edges, crevices, holes, and other sharp discontinuities. Stripe coating is not required for the inside surface area of steel box girders.

Stripe coats may be applied before or after the full prime coat application and again before application of the final coat.

The prime coat material used for hand-striping shall be tinted to distinguish it from material used for full prime coat application. Striping shall extend a minimum of 25mm beyond the edge, weld, fastener, etc, and be worked into crevices.

4.5 Inspection

4.5.1 General

The Contractor shall provide to the satisfaction of the Engineer, an inspection and test plan (ITP). This plan will detail the procedures that will be undertaken by the Contractor in order to verify compliance with this specification. The plan shall nominate the coatings inspector and include; a copy of any qualifications, a list of inspection equipment to be used and their calibration details, and sample report forms.

Examples of ITPs for surface treatments and inorganic and organic coatings are given in Appendix B – Model inspection and testing plans.

The Contractor shall, at all times, allow the Engineer‘s representative access to the work in progress and shall provide every facility for inspection at all stages of the work. Lighting shall be provided to give a minimum of 500 lux illumination on surfaces being inspected. Any work rejected by the Engineer as not complying with this specification shall be made good at the Contractor's expense.

4.5.2 Quality assurance

Unless noted otherwise, the requirements for the surface preparation and application of corrosion protection coatings on all steelwork shall be in accordance with section 9 of AS/NZS 5131 for a coating quality level PC 2. Steelwork identified as architecturally exposed structural steelwork (AESS) shall comply with the requirements given in section 10 of AS/NZS 5131.

These include maintaining quality assurance programmes to AS/NZS ISO 9001 for specialist coatings, as necessary to assure that work is performed in accordance with this specification and the qualifying requirements of the contract documents.

The Contractor shall prepare a quality plan as set out in AS/NZS 5131 clause 4.5.2 and an inspection and test plan as set out in AS/NZS 5131 clause 13.8 for the inspection of surface treatment and clause 13.9 for the inspection of paint coatings.

4.5.3 Inspection before and during surface preparation and coating

The Contractor shall employ an experienced coatings inspector to monitor their own work and perform tests as are necessary to ensure that their materials, equipment and procedures comply with the specification. The Contractor’s coatings inspector shall hold a Protective Coatings Inspector qualification available through the Certification Board for Inspection Personnel (NZ), a Coating Inspector Program qualification from NACE International (minimum Level 1) or an equivalent qualification approved by the Principal.

The following measurements shall be taken by the Contractor immediately prior to, or during painting at least at four hourly intervals to ensure compliance with the appropriate specifications and shall be recorded with time of measurement on a daily inspection report (eg AS 3894.10 and AS 3894.12).

4.5.3.1 Ambient temperature

This shall be measured by the use of thermometers accurate to +0.5°C. Measurements shall be taken at a sheltered location adjacent to the area being painted.

4.5.3.2 Surface temperature

Measurement of the surface temperature of steelwork to be painted shall be made using a specially adapted thermometer accurate to +0.5°C.

4.5.3.3 Relative humidity

Relative humidity shall be measured by the use of a standard hygrometer accurate to +3%. Measurements shall be taken at a sheltered location adjacent to the area being painted.

4.5.4 Inspection of prepared surfaces

Where the quality of surface cleanliness is in question, reference shall be made to the relevant Society for Protective Coatings (SSPC) pictorial reference, eg SSPC-VIS 1[(4)]. The method for determining surface profile shall be AS 3894.5. Unless otherwise specified by the coating manufacturer, chloride contamination as determined by Bresle Patch method to AS 3894.6, shall be less than 30mg/m² for buried or immersed structures, and less than 50mg/m² for above ground steelwork.

After abrasive blasting surfaces shall be blown down or vacuumed (preferred) and upward facing surfaces shall be confirmed to be free of dust before coating or sealer application by tape testing to AS 3894.6 method C. A residual dust rating of 1 or less is required.

4.5.5 Inspection of coating

4.5.5.1 Inspection after priming

After priming, no further coats shall be applied without the approval of the Engineer's representative, who may require an independent inspection to be carried out prior to application of cover coats.

4.5.5.2 Thickness measurement

The method for determining dry film thickness shall be AS 3894.3. In multi-coat systems the average dry film thickness (DFT) of each coat shall be not less than 80% of the specified nominal DFT or be thicker than 120% of any specified maximum DFT. The average total DFT of the system shall be not less than 80% of the specified nominal total DFT or be thicker than 200% of the nominal total DFT.

4.5.5.3 Measurement of adhesion

Paint coatings when cured shall be firmly adherent to the substrate and to one another and, when required, this may be confirmed by testing as described below.

Satisfactory adhesion shall be determined by the 'X-cut tape test' using method A of ASTM D3359, where an average rating of 4A or better is obtained and no single result worse than 3A. Adhesive tape approved for this test is 3M No. 810 'Scotch Magic Tape' transparent pressure sensitive tape. Area of coatings that are rejected by the Engineer due to unsatisfactory adhesion shall be removed and the surface prepared and recoated.

4.5.5.4 Holiday testing

Continuity or "holiday" testing shall be carried out on all organic paint coatings (ie epoxy finish coats) to be buried or immersed, in accordance with AS 3894.1 or AS 3894.2. Testing shall be carried out at the voltages specified therein. Any defective areas shall be marked, and their location recorded for later repair.

4.5.5.5 Defects

Each coating and the completed coating system shall be substantially free from runs, sags, wrinkling, fat edges, entrained paint skin, dust or sand, irregular coated patches, dry spray, brush marks, blistering and pinholes, and shall be free from breaks in the coating.

Coatings that contain a significant number of these defects shall be removed and/or recoated.

4.6 Daily inspection report

The Contractor shall complete a daily inspection report of an approved format (eg AS 3894.10) detailing the type of surface preparation and environmental conditions for each work area. A report (eg AS 3894.12) shall also record the coating system description, coating thicknesses, mixing and application times, material batch numbers and quantities used. Copies shall be supplied to the Engineer at the end of each week.

4.7 Additional requirements

4.7.1 Faying and bearing surfaces

Follow any specific requirements for preparation of contact surfaces of high strength friction grip (HSFG) bolted joints, and bearing surfaces as noted on the project drawings and below. The stripe coating of bolt holes within a HSFG joint is not required. Unless otherwise specified by the designer, the coating thickness on faying and bearing surfaces shall be within (and shall not exceed) the range listed in the following table. After treatment and before application of the remaining system, mask over the faying and bearing surfaces to between 10-15mm from the joint edge.

System	TDFT (µm)
Inorganic	25 - 50 of inorganic zinc silicate
Organic	25 - 50 of friction rated epoxy zinc rich primer

4.7.2 Treatment of top flanges for composite action

Where shear studs are to be site welded to the top flange to provide composite action with cast in situ concrete bridge decking, a welding margin shall be masked off on the top flange before coating. Ensure that the top flange is completely coated for a minimum of 50mm from each edge and a nominal 150µm DFT epoxy barrier coat is applied for a minimum of 100mm either side of any deck construction joint.

When shear studs are welded offsite at the Fabricator's shop, 4.7.3 applies, except that the shear studs do not require the additional epoxy barrier coat.

4.7.3 Surfaces in contact with timber, concrete or cementitious mortar

Zinc silicate or zinc epoxy coated surfaces that are contact with timber, concrete or cementitious mortar that are exposed to the weather shall be precoated with a 150µm minimum DFT of a compatible epoxy barrier coat. Similarly, these zinc-based coating systems that are to be completely embedded in concrete shall receive an additional 350µm minimum DFT of compatible epoxy barrier coat to 100mm either side of the air/concrete interface prior to embedment. Barrier coating to be coloured light grey.

Similarly, organic coating systems described in section 6. shall be applied for a minimum distance of 100mm beyond the air/concrete interface prior to embedment.

4.8 Anti-graffiti treatment

4.8.1 General

All anti-graffiti (AG) coating materials shall be supplied by a manufacturer whose QA system shall be recognised by the Australian Paint Approval Scheme (APAS) and shall be applied as recommended in the manufacturer's current product data sheets. The requirements for the testing and supply of AG coatings are given in NZTA S10 *Specification for anti-graffiti coatings*[5].

The specified or agreed AG coating system shall be applied to areas shown on the drawings and, as a minimum, shall comply with the requirements given in clause 4.12.9 of the *Bridge manual*[1], ie:

- 1.2m from an accessible top edge
- 2.7m above adjacent ground or base level, and
- 1.5m horizontally from an accessible substructure element.

The edge of the AG system shall finish at a change in profile (eg web stiffener) where feasible, otherwise at a neat straight edge formed by masking.

In locations where, frequent removal of graffiti is anticipated, and/or when the finish coat colour is not a light colour, an additional clear coat of the same material (ie unpigmented) shall be applied to improve the durability of the AG system.

4.9 Repair of defects

4.9.1 General

Before application of any further coat of material, all damage to previous coats shall be repaired. Sagging, dimpling and curtaining not exceeding 5% of the total surface area coated shall not be considered as a defect requiring repair, where these are not visible to the public, and coating thickness above the sag remains more than the specified minimum.

4.9.2 Incorrect thickness

Areas with an inadequate coating thickness, shall be thoroughly cleaned and where necessary additional coats applied until the specified thickness for each layer or area is achieved. Refer to the coating specific repair methods given below. Where the specified maximum thickness has been exceeded on faying surfaces, the coating shall be removed and reapplied so that the DFT is within the specified thickness range.

4.9.3 Contaminated surfaces

Surfaces to be over coated that become contaminated shall be thoroughly cleaned in accordance with AS 1627.1 by washing with water to remove soluble contaminants (eg salt); solvent or detergent solution to remove organic material (eg oil or amine bloom); and after degreasing, hand sanding or lightly brush blasting if required by the coating manufacturer.

4.9.4 Damaged surfaces

After cleaning, the coating around the damaged area shall be hand sanded and feathered to ensure adhesion and continuity of the patch coating and then the full system shall be reinstated with each primer or build repair coat overlapping onto adjacent sound coating by between 25 and 50mm. The edge of the final coat of the patching system shall finish at a change in profile (eg web stiffener) where feasible, otherwise at a neat straight edge formed by masking.

5. INORGANIC ZINC SILICATE

5.1 Paint material

Where the coating system designated IZS4 in AS 2312.1 is specified, the surface shall be prepared and the coating applied in accordance with AS 4848.1. The paint shall be supplied by a coating manufacturer, whose QA systems shall have current certification by the APAS as complying with APAS Specification 2908 *Inorganic zinc silicate coating for the long term protection of steel*[6]; and/or a brand that complies with the requirements of AS/NZS 3750.15 type 4.

Coating brand and thinners shall be selected that will minimise overlapping edge effects on large surfaces.

Epoxy-modified zinc silicates shall not be used unless it is to be over-coated as part of a multi-coat system.

5.2 Curing

The appropriate curing and drying times recommended by the paint manufacturer shall be allowed to elapse before the application of additional coats or cover coats. For solvent-borne ethyl zinc silicate paints, a minimum resistance rating of 4 shall be achieved when testing in accordance with ASTM D4752, before application of subsequent organic coatings or anti-graffiti (AG) systems.

Note that water-borne alkali zinc silicates require low humidity, warm steel temperatures and very good ventilation to cure, so ethyl zinc silicate is the preferred option in most New Zealand locations.

5.3 Anti-graffiti treatment

The AG coating system for IZS4 shall include:

- an epoxy mist coat (not required if the IZS has been exposed to the weather and is more than one month old) using a thinned epoxy build coat as a sealer coat
- a surface tolerant epoxy-mastic build coat with a minimum average DFT of 150µm and a maximum average DFT of 300µm
- a satin or low gloss* re-coatable polyurethane or polysiloxane with a minimum average DFT of 50µm and a maximum average DFT of 125µm, unless a lower maximum is recommended by the manufacturer in their technical data sheet. Colour to be similar to the finish on adjacent IZS (light grey) coated surfaces unless otherwise specified.

The selected anti-graffiti top coat shall comply with the requirements of NZTA S10 *Specification for anti-graffiti coatings*[5].

Where the IZS has weathered and before application of the build coat, surfaces shall be pressure-washed at 5,000psi or lightly sanded to remove any loosely adherent material and surface oxidation, and then rinsed clean if exposed to wind borne contamination. Where IZS is freshly applied, first ensure it is fully cured before application of any AG overcoat.

5.4 Repair of defects

Under thickness of inorganic zinc silicate that is to be overcoated shall be repaired with the same brand of zinc silicate or where approved a zinc-rich epoxy. Approval may be given where aesthetics is not important and or the bridge is in a C2 or C3 environment, as defined in SNZ TS 3404. Areas of excessive thickness of inorganic zinc thickness that results in `mud cracking' to the substrate shall be totally removed by abrasive or bristle blasting and repaired as for under thickness.

* Where advised by the Engineer that a contrast in appearance is acceptable, a gloss finish shall be used to make removal of graffiti easier.

6. ORGANIC COATINGS

This section covers the requirements for the application of organic coating systems; for example with high-build epoxy as an intermediate coat and possibly also as a finish coat (eg EHB where in contact with concrete or cementitious mortar); urethane systems (such as MCU2 or PUR5); and epoxy with polysiloxane topcoats (such as PSL2), all as defined in AS 2312.1.

6.1 Paint material

All paints shall be supplied by the same coating manufacturer, whose QA systems shall have current certification by the Australian Paint Approval Scheme (APAS). The composition and performance of coating materials shall comply with the relevant product standard specified in the AS/NZS 3750 series.

6.2 Colour gloss and fade

Unless otherwise approved, gloss level of the finish should be low gloss as defined in AS/NZS 2310 (ie specular gloss reading of less than 20 gloss units at 60 degrees) to reduce the risk of reflected light interfering with driver vision. Finish coat resins shall be sufficiently UV resistant to comply with the change in gloss allowance given in table 2.4 of AS/NZS 2728.

Similarly, the pigmentation in coloured finish coats (eg red and blue) shall have low levels of titanium dioxide and be sufficiently UV resistant to comply with the maximum fade and colour shift (dE) allowance given in table 2.4 of AS/NZS 2728. Use of tinted basecoats shall not be permitted and colour pigmentation shall be added to the batch during its manufacture in the paint factory.

For each specified colour, the finish coat shall all be supplied from the same batch with sufficient additional quantity reserved to repair any defects or transport and erection damage.

6.3 Anti-graffiti Treatment

Polyurethane and polysiloxane have inherent anti-graffiti properties, and their selection shall comply with the requirements of NZTA S10 *Specification for anti-graffiti coatings*[(5)].

However, ensure that the selected gloss levels are suitable for the required aesthetics and level of service required.

Part 2 – Specification for galvanizing steelwork for highway structures

7. INTRODUCTION

This is a prescriptive specification for the hot dip galvanizing of structural steelwork for bridges and highway structures that have been fabricated to meet the requirements of AS/NZS 5131. It also covers the situation where the galvanized surface is top-coated to provide anti-graffiti protection or a decorative duplex topcoat where specified for architectural or safety purposes.

See also sections 1. and 2.

Note: This specification applies to after-fabrication hot dip galvanized coatings applied to general steel articles, structural steel sections, beams and columns, fabricated steel assemblies, castings, steel reinforcement and miscellaneous steel components (AS/NZS 4680) and threaded fasteners (AS/NZS 1214). It does not apply to the galvanized coating produced in continuous, semi-continuous or specialised plants on semi-finished products such as wire, tube or sheet and coil.

8. MANDATORY REQUIREMENTS

8.1 General

8.1.1 Scope of work

The description and extent of items to be galvanized are fully detailed in the project specification, schedules and project drawings. The Contractor and Galvanizer are deemed to have familiarised themselves with the extent of the work prior to submitting their quotation.

8.1.2 Inspection equipment and personnel

The Galvanizer shall provide experienced supervisors including an accredited galvanizing inspector and all equipment necessary to accurately measure the coating thickness and assess the appearance of the coating. The Galvanizer shall be responsible for the calibration and maintenance of all measuring and inspection equipment and that personnel are trained in their proper use.

The Galvanizer shall provide access to allow inspection by the Engineer's representative and quality audits by an independent coatings inspector employed by the Principal or their agent. The independent coatings inspector will hold a current CBIP or NACE CIP Level 2 Protective Coatings Inspector qualification (as outlined in 4.1.2) or, if the galvanizing is not painted, certification by ACA/GAA as a Hot Dip Galvanizing Inspector.

8.1.3 Safety

The safety requirements for the preparation for, and application of, a corrosion protection system on steelwork shall be included in a documented work method statement (WMS) in accordance with clause 9.2.2 of AS/NZS 5131; and the Health and Safety at Work Act 2015 and regulations.

The Galvanizer shall demonstrate previous experience with the galvanizing process and familiarity with the various regulations that apply. The manufacturer's material safety data sheets (SDS) for relevant materials used in the process including acids, thinners, coatings, and solvents shall be available for review by the Engineer's representative.

8.2 Requirements

8.2.1 Qualifications

Galvanizers shall be experienced and use competent workers who are qualified and familiar with the specified process. Evidence of relevant qualifications and/or experience shall be available for review by the Engineer's representative.

8.2.2 Galvanizing project commencement meeting

Before fabrication work commences a meeting shall be held between the Engineer or Engineer's representative, the principal Contractor's representative, the Galvanizer, galvanizing inspector, Fabricator, and any other relevant subcontractors to clarify and agree the implementation of this specification, and the Galvanizer's proposed programme, methodology and inspection procedures.

The requirements of AS/NZS 5131, AS/NZS 4680, and AS/NZS 1214 shall be confirmed prior to fabrication commencing:

AS/NZS 5131 clause 4.7: The Fabricator via the Contractor is to provide suitable traceability of the articles to be galvanized (eg laser marking, heat resisting tags, etc). Steel test certificates and product drawings stating the end use, including the location of any significant surfaces shall be provided to the Galvanizer for review.

Note: Reinforcing steel and bolts shall retain traceability of the batch, not individual pieces.

AS/NZS 5131 clause 9.2.3.2: The Engineer shall advise any special or supplementary requirement of the coating, eg for a special finish, painting, powder coating, or requirements for pre-treatment or post-treatment, including masking of surfaces prior to galvanizing or preparation of faying surfaces after galvanizing.

AS/NZS 5131 clause 9.3.3: Steels provided with temporary protective coatings (eg paints, lacquers, or oils) are to be assessed for suitability in the galvanizing process and a method and responsibility agreed for removing these coatings prior to galvanizing. Where items are proposed to be blasted by the Engineer to achieve a special coating thickness or to otherwise prepare the steel, these must be approved by the Galvanizer prior to blasting.

AS/NZS 5131 clause 9.6: Vent and drainage provisions shall be agreed for hollow sections and overlapping surfaces involving closed sections and continuous welds to the requirements of AS/NZS 2312.2 appendix A and GANZ *Design guide for hot dip galvanizing – best practice for venting and draining*[7] and these provisions shall be incorporated by the Fabricator into the articles to be hot dip galvanized based on the Galvanizer's advice. Hand flame cutting is not permitted in structural sections.

AS/NZS 5131 clause 9.8.5: Flame cut, laser cut, and plasma cut surfaces shall be ground off and the sharp edges associated with these surfaces shall be treated to the specified AS/NZS 5131 treatment grade. Internal faces for bolt holes, edges cut by saw, shear, or cropping, and venting and draining provisions are not required to be ground off or be rounded unless the section is to be subsequently duplex coated or there are otherwise sharp points.

AS/NZS 5131 clause 9.10: For galvanized articles that are to be subsequently duplex coated for aesthetics or anti-graffiti, the Fabricator shall prepare the surface of the fabricated steel before galvanizing to P2 (thorough treatment).

AS/NZS 5131 clause 9.10.4: Surfaces with weld porosity and spatter shall be rectified to a smooth finish. The use of anti-spatter sprays and compounds should be avoided on steelwork to be galvanized unless it can be established that such use does not interfere with coating adhesion.

AS/NZS 5131 clause 9.10.5: If required, a sample using material from the purchased steel shall be provided by the Engineer for galvanizing to assess conformance of the coating to this specification.

AS/NZS 5131 clause 10: Steelwork identified on the drawings as architecturally exposed structural steelwork (AESS) shall comply with these requirements.

Note: the specification of AESS categories may have significant cost implications.

AS/NZS 5131 clause 13.10: The inspection and testing plan for coating thickness and appearance shall be provided by the Galvanizer. Evidence of qualifications and/or experience of the inspection personnel shall be provided.

The Engineer's written agreement to the Galvanizer's proposals listed above must be received prior to commencing any galvanizing.

8.3 Application of the galvanized coatings

8.3.1 Surface preparation of articles to be hot dip galvanized

Articles shall be prepared and cleaned prior to galvanizing as per this specification, AS/NZS 4680 clause 6.1, AS/NZS 1214, and AS/NZS 5131 clause 9.10.2.

8.3.2 Bath composition

If requested, the Galvanizer shall provide zinc metal certificates showing the prime zinc used conforms to ISO 752 ZN-1, special high grade (SHG) zinc, or equivalent. Other elements are permitted to be added, so long as the zinc content of the bath is at least 98.0% (AS/NZS 4680, clause 6.2 and AS/NZS 1214 clause 4.2).

Where analysis of the zinc bath is required as part of this contract, it shall be carried out by an IANZ (International Accreditation New Zealand) registered laboratory. Samples from the bath shall be taken approximately in the pot centre line and from at least 50mm below the surface and the zinc content of the bath must be at least 98.0% (AS/NZS 4680 clause 6.2 and AS/NZS 1214 clause 4.2). The cost of this analysis shall be borne by the Galvanizer if the zinc content is less than 98.0%.

Where the galvanizing bath is measured to contain less than 98.0% by mass of zinc, the articles galvanized therein shall be rejected.

8.3.3 Galvanizing

The galvanized coating shall be formed to achieve the coating thickness and appearance requirements of this specification, AS/NZS 4680 and AS/NZS 1214.

8.3.4 Acceptance or rejection

Control samples shall conform to the requirements of AS/NZS 4680 and this specification. If the first control sample fails, a further two control samples shall be tested and if one of them fails the inspection lot shall be rejected.

Materials that have been rejected may be stripped and re-galvanized, and then resubmitted for test.

8.4 Inspection

8.4.1 General

The Galvanizer shall employ an experienced galvanizing inspector to monitor their own work and perform tests as are necessary to ensure that their materials, equipment, and procedures comply with the specification. The Galvanizer's inspector shall hold an ACA GAA HDG Inspector's Certificate or equivalent. In New Zealand a listing of accredited galvanizing inspectors can be obtained from the Galvanizing Association of New Zealand (GANZ) website[8].

The Galvanizer shall provide, to the satisfaction of the Engineer's representative, an inspection and test plan (ITP). This plan will detail the procedures that will be undertaken by the Galvanizer to verify compliance with this specification. The plan shall nominate the galvanizing inspector and include a copy of any qualifications, a list of inspection equipment to be used and their calibration details, and sample report forms.

An example of an ITP for hot dip galvanizing is given in Appendix B – Model inspection and testing plans.

The Galvanizer shall allow the Engineer access to the work in progress and shall provide every facility for inspection at all stages of the work. Any work not complying with this specification shall be made good at the Galvanizer's expense.

8.4.2 Quality assurance

The Galvanizer shall be a current member of GANZ and have a suitable quality management system as described in AS/NZS 5131 clause 4.5.1. An example of a suitable quality management system is set out in AS/NZS ISO 9001.

The Galvanizer shall prepare a quality plan as set out in AS/NZS 5131 clause 4.5.2 and an inspection and test plan as set out in AS/NZS 5131 clause 13.10 for the inspection of galvanized coatings.

8.4.3 Inspection of coating

8.4.3.1 General

A galvanized coating shall be assessed for appearance (including sharp points) and coating thickness. Adhesion tests are not normally required.

8.4.3.2 Appearance

When viewed from not less than 1 metre by normal or corrected vision, the coating shall be as smooth and evenly distributed as possible. The galvanized coating shall be free from sharp points, nodules, uncoated areas and defects or damage that will affect the stated use of the article. For some applications this could include runs, lumps, and zinc ash. Touch points from hanging wires, chains or jigs are unavoidable and these are acceptable when the underlying base steel is not exposed, and they are otherwise not sharp.

Note: The surface finish of batch hot dip galvanized coatings differs from that of continuously coated products, such as galvanized sheet, tube, and wire. Smoothness is a relative term and a definition relating to all surface conditions cannot be developed.

The coating may be renovated by the Galvanizer in defective or damaged areas when the sum total of the defects or damage does not exceed 0.5% of the total surface area or 250cm², whichever is the lesser. No individual damaged or uncoated area shall exceed 10cm². Uncoated areas greater than 10cm² which have been caused by design issues such as unavoidable air locks, product design, or blowouts from narrow overlapping surfaces are permitted to be renovated (see 8.5).

If the area requiring renovation is larger than described in this clause, the article must be re-galvanized.

The initial appearance shall not be a cause for rejection when the coating otherwise meets the requirements of this specification. The initial appearance of the galvanized coating can vary from shiny silver to partly or wholly grey due to material selection, design, and fabrication characteristics or essential galvanizing parameters. Stains resulting from acid salts weeping from overlapping surfaces before despatch cannot be avoided and shall not be a cause for rejection.

Note: Where initial appearance is a critical aspect of the specification, a reference sample should be prepared with the same steel selection, design and fabrication characteristics of the finished article(s).

8.4.3.3 Wet storage staining

Any wet storage staining which is formed at the Galvanizer's plant shall be removed prior to the hot dip galvanized articles leaving the plant. The underlying coating thickness after this removal treatment shall exceed the specified minimum average value for the relevant steel thickness.

Note: Wet storage staining often has little to no effect on the corrosion protection of the coating. However, if the source of the wet storage staining is not removed, the coating can be severely damaged. Transport and storage of newly galvanized steel is outside the requirements of this specification but is critical in ensuring the delivery of galvanized articles that meet this specification.

8.4.3.4 Thickness measurement

The coating thickness shall comply with the requirements of AS/NZS 4680, AS/NZS 1214 or the agreed alternative coating thickness as per this specification. The method for determining the coating thickness shall be one of the non-destructive methods shown in the Galvanizers Association of Australia (GAA) Advisory Note #37.3 *Acceptance inspection and sampling methods for demonstrating coating thickness compliance with AS/NZS 4680 and AS/NZS 1214*[9].

Note: GAA Advisory Note #37.3 outlines the steps required to check conformance with the coating thickness requirements of AS/NZS 4680 and AS/NZS 1214 as the standards do not provide explicit details of the steps required. Depending on the quantity of articles in an order lot, different sampling methods will be required. For example, statistical sampling of fastener assemblies to AS/NZS 1214 is likely to be required, while the inspection lot for articles galvanized to AS/NZS 4680 will usually involve a small number of identical items and a consequentially small sample size.

8.4.3.5 Measurement of adhesion

Measurement of adhesion of galvanized coatings is not usually required as a visual inspection will normally provide confidence of adherence of the coating. If there is any doubt, the test method outlined in AS/NZS 1214 annex E shall be used.

8.5 Renovation of defects, damage, and bare spots

8.5.1 General

The Engineer's representative should assess articles requiring renovation prior to the renovation being carried out. If this is not possible, the Galvanizer's inspector should take sample photos of the affected area before and after renovation and include these in the final inspection report.

If the galvanized coating is to be subsequently overcoated, the renovation of the coating shall only be permitted if the methods used are compatible with the duplex system. Use of zinc-alloy solder sticks to repair defects, damage and bare spots is not permitted. Use of lead plugs to close vent holes is not permitted.

8.5.2 Defects not exposing the steel substrate

When the coating is otherwise sound (eg when renovating touch marks, sharp points, runs, and nodules) the coating can be mechanically or hand-tool cleaned to smooth the surface. Touch up with compatible zinc rich paint to AS/NZS 3750.9 to restore the coating thickness to a minimum dry film thickness of 30µm more than the local coating thickness is acceptable. In some cases, touch-up will not be required such as when the coating thickness in the renovated area meets the local coating thickness requirements but may be applied for aesthetic reasons.

8.5.3 Defects exposing the steel substrate

For shop repair of exposed steel substrate, the Galvanizer shall repair the surface in accordance with clause 8.2 of AS/NZS 4680, except that zinc solder sticks shall not be used.

For site repair of damaged galvanizing, the Contractor shall repair the surface in accordance with clause 8.3 of AS/NZS 4680, and the following requirements.

The location of the uncoated or damaged area may affect the surface preparation equipment able to be used. Surface preparation shall be by solvent wiping to remove dust and contaminants, then abrasive or bristle blasting to NACE No. 2/SSPC-SP 10[10] or power-disk sanding to bright metal to SSPC-SP 11[11]. If the surface is inaccessible for power tool cleaning, then hand-tool cleaning to SSPC-SP 2[12] after power washing is permitted.

In C2 and C3 environments as defined in SNZ TS 3404, preparation by thorough power-wire brushing is acceptable; together with solvent wiping to remove dust and contaminants. Zinc-rich paint conforming to AS/NZS 3750.9 shall then be applied within four hours of surface preparation to a clean dry surface and in accordance with the manufacturer's recommendations. Paint shall be thoroughly mixed immediately prior to application.

Note: Solvent washing may require supplementary cleaning by alkaline and fresh water to fully remove some greases. See AS 1627.1 for more details. Care must be taken when power-wire brushing as this can lead to polishing of the surface, reducing the profile of the steel.

In C4 and C5 environments as defined in SNZ TS 3404, the protective coating shall be reinstated by the preferred application of inorganic zinc silicate paint in accordance AS/NZS 3750.15; or zinc-rich epoxy; or zinc

metal spray in accordance with NACE No. 12/AWS C2.23M/SSPC-CS 23.00[13] and NZTA S9 part 3; after preparation to SSPC-SP 10[10] or SP 11[11] with a target angular profile of 25-50 microns.

Note: Depending on the damage, it may be necessary for surrounding areas of intact coating to be dry abrasive brush-off blast cleaned in order to obtain a suitable surface profile for coating adhesion. Vacuum head blast equipment is recommended to avoid over blast damage to intact coating. Areas where abrasive brush blast methods cannot be used shall be either mechanically or hand abraded to de-gloss and impart a surface profile to the intact coating. Do not power wire brush. Feather any leading edges of the coating to ensure a smooth transition from the intact coating to the substrate.

For all situations, whether shop or site repaired, all exposed steel surfaces or damaged areas shall be coated to give a minimum dry film thickness of 30µm more than the average local coating thickness requirement for the steel thickness affected.

8.6 Treatment after galvanizing

8.6.1 Quenching and passivation

Unless otherwise agreed in this specification, the decision to quench, to exclude passivation from the quench, or to air cool, is based on best practice for the galvanized article and will be at the discretion of the Galvanizer. If the specification requires a test for passivation (eg as required for some duplex or powder coating specifications) the absence or presence of chromate passivation can be checked using the lead drop acetate test described in ASTM B201.

8.6.2 Faying and bearing surfaces

Unless otherwise specified faying surfaces shall be roughened by sweep blasting as specified in AS/NZS 4680 appendix I.

After treatment and before application any remaining system, mask over the faying and bearing surfaces to between 10-15mm from the joint edge.

Note: Where shear studs are to be welded to the top flange to provide composite action with cast in situ concrete bridge decking, a welding margin shall be masked off on the top flange with a heat resistant tape or suitable paint by the Fabricator before delivery to the Galvanizer. Ensure that the top flange is completely coated for a minimum of 50mm from each edge and a 150µm minimum DFT epoxy barrier coat is applied for a minimum of 100mm either side of any deck construction joint.

8.6.3 Surfaces in contact with timber, concrete or cementitious mortar

Galvanized surfaces that are in contact with timber, concrete or cementitious mortar that are exposed to the weather shall be precoated by the coating applicator with a 225µm minimum DFT of a compatible epoxy barrier coat (ie AS/NZS 2312.2 system 3I). Similarly, surfaces that are to be completely embedded in concrete shall receive an additional 350µm minimum DFT of compatible epoxy barrier coat (ie AS/NZS 2312.2 system 4I) to not less than 100mm either side of the air/concrete interface after galvanizing and prior to embedment. Barrier coating to be coloured light grey.

8.7 Anti-graffiti treatment

8.7.1 Painting galvanized steel

All matters pertaining to the application of paint coatings shall be undertaken in accordance with section 9.9 of AS/NZS 5131, and the following additional specific requirements shall be applied.

8.7.2 General

All anti-graffiti (AG) coating materials shall be supplied by a manufacturer whose QA system shall be recognised by the Australian Paint Approval Scheme (APAS) and shall be applied as recommended in the manufacturer's current product data sheets. The requirements for the testing and supply of AG coatings are given in NZTA S10 *Specification for anti-graffiti coatings*[5].

The specified or agreed AG coating system shall be applied to areas shown on the drawings and, as a minimum, shall comply with the requirements given in clause 4.12.9 of the *Bridge manual*[1]:

- 1.2 m from an accessible top edge
- 2.7 m above adjacent ground or base level, and
- 1.5 m horizontally from an accessible substructure element.

The edge of the AG system shall finish at a change in profile (eg web stiffener) where feasible, otherwise at a neat straight edge formed by masking.

In locations where, frequent removal of graffiti is anticipated, and/or when the finish coat colour is not a light colour, an additional clear coat of the same material (ie unpigmented) shall be applied to improve the durability of the AG system. However, ensure that the selected gloss levels are suitable for the required aesthetics and level of service required.

8.7.3 System and application

The AG coating system for hot dip galvanizing shall comply with table 7.1 of AS/NZS 2312.2 and provide the specified expected life to first maintenance for the macroenvironment. Colour to be similar to aged galvanizing* (light grey) unless otherwise specified.

The properties of the selected anti-graffiti topcoat shall comply with the requirements of NZTA S10 *Specification for anti-graffiti coatings*[5].

Immediately before application of the build coat, surfaces shall be lightly sanded to remove any loosely adherent material and surface oxidation, and then rinsed clean if surfaces have been exposed to wind borne contamination. For site application, degrease and thoroughly wash surfaces before sanding.

Inspection of AG coating application to comply with NZTA S9 part 1 requirements (see 0).

8.8 Duplex coating of galvanizing

8.8.1 Painting galvanized steel

All matters pertaining to the application of paint coatings shall be undertaken in accordance with section 9.9 of AS/NZS 5131, and the following additional specific requirements shall be applied.

8.8.2 General

Refer to separately specified requirements for duplex galvanizing (only where required for AG or otherwise approved by the Engineer), which shall be designated in accordance with AS/NZS 2312.2.

Preparation shall be by sweep blasting as described in AS/NZS 4680 appendix I and coating application shall be undertaken in accordance with 8.7.2 and AS/NZS 5131 clause 9.11.

Inspection of duplex coating application to comply with NZTA S9 part 1 requirements (see 4.5).

8.8.3 Paint material

Where the coating system designated 4D or 5D in AS/NZS 2312.2 is specified, it shall be applied in accordance with the relevant sections of AS/NZS 5131, eg sections 9.4 and 9.9.

All paints shall be supplied by the same coating manufacturer, whose QA systems shall have current certification by the Australian Paint Approval Scheme (APAS). The composition and performance of coating materials shall comply with the relevant product standard specified in the AS/NZS 3750 series.

* Where advised by the Engineer that a contrast in appearance is acceptable, a gloss finish shall be used to make removal of graffiti easier.

8.8.4 Colour gloss and fade.

Unless otherwise approved, gloss level of the finish should be low gloss as defined in AS/NZS 2310 (ie specular gloss reading of less than 20 gloss units at 60 degrees) to reduce the risk of reflected light interfering with driver vision. Finish coat resins shall be sufficiently UV resistant to comply with the change in gloss allowance given in table 2.4 of AS/NZS 2728.

Similarly, the pigmentation in coloured finish coats (eg red and blue) shall have low levels of titanium dioxide and be sufficiently UV resistant to comply with the maximum fade and colour shift (dE) allowance given in table 2.4 of AS/NZS 2728. Use of tinted basecoats is not permitted and colour pigmentation shall be added to the batch during its manufacture in the paint factory.

For each specified colour, the finish coat shall all be supplied from the same batch with sufficient additional quantity reserved to repair any defects or transport and erection damage.

8.9 Repair of defects in duplex or AG coating

8.9.1 General

Before application of any further coat of material, all damage to previous coats shall be repaired. Sagging, dimpling and curtaining not exceeding 5% of the total surface area coated shall not be considered as a defect requiring repair, where these are not visible to the public, and coating thickness above the sag remains more than the specified minimum.

8.9.2 Incorrect thickness

Areas with an inadequate coating thickness, shall be thoroughly cleaned and where necessary additional coats applied until the specified thickness for each layer or area is achieved. Refer to the coating specific repair methods given below. Where the specified maximum thickness has been exceeded on faying surfaces, the coating shall be removed and reapplied so that the DFT is within the specified thickness range.

8.9.3 Contaminated surfaces

Surfaces to be over coated that become contaminated shall be thoroughly cleaned in accordance with AS 1627.1 by washing with water to remove soluble contaminants (eg salt); solvent or detergent solution to remove organic material (eg oil or amine bloom); and after degreasing, hand sanding or lightly brush blasting if required by the coating manufacturer.

8.9.4 Damaged surfaces

After cleaning, the coating around the damaged area shall be feathered to ensure continuity of the patch coating and the full system reinstated.

Part 3 – Specification for coating steelwork on highway structures with thermal metal spray

9. INTRODUCTION

This is a prescriptive specification for shop application of a thermal metal spray (TMS) protective coating system to be used on new structural steelwork for bridges and other highway structures. It also includes an anti-graffiti (AG) system that can be applied to them.

This standard specification should be read with AS/NZS 5131 and the project specific specification that identifies which system (or systems) is to be applied, and that also specifies any additional requirements such as minimum aesthetic performance.

See also sections 1. and 2.

10. MANDATORY REQUIREMENTS

10.1 General

10.1.1 Labour and materials

The Contractor shall provide all labour, plant including scaffolding and containment (where required), paint, abrasive media, consumables including metal wire or powder, brushes, rollers, cleaners and thinners, required to prepare and coat surfaces in accordance with this specification.

The description and extent of items to be painted are fully detailed in the project drawings. Contractors are deemed to have familiarised themselves with the extent of the work prior to submitting their quotation.

10.1.2 Inspection equipment and personnel

The Contractor shall provide experienced supervisors including a coatings inspector and all equipment necessary to accurately measure wet and dry bulb temperatures and steel surface temperatures, wet and dry film thicknesses, coating adhesion and total soluble salts levels. The Contractor shall be responsible for the calibration and maintenance of all measuring and inspection equipment and that personnel are trained in their proper use.

The Contractor shall provide access and lighting (see 10.5.1) to allow inspection by the Engineer's representative and quality audits by an independent coatings inspector employed by the Principal or their agent. The independent coatings inspector will hold a Protective Coatings Inspector qualification available through the Certification Board for Inspection Personnel NZ (CBIP), or a Coating Inspector Program qualification from NACE International, minimum Level 2 (as outlined in section 9.2 of *Protective coatings for steel bridges guide*[2]).

10.1.3 Safety

The safety requirements for the preparation for, and application of, a corrosion protection system on steelwork shall be in accordance with clauses 9.2.2 and 9.9.2 of AS/NZS 5131 and the Health and Safety at Work Act 2015 and regulations.

The manufacturer's technical and material safety data sheets for all materials including thinners and solvents shall be available for review by the Engineer or his/her representative.

10.2 Requirements

10.2.1 Qualifications

As per clause 9.3.1 of AS/NZS 5131, coating applicators shall be experienced, competent workers, qualified and familiar with the materials and techniques specified. When required, the Contractor is to provide evidence of relevant qualifications on request.

10.2.2 Painting project commencement meeting

At least two weeks before work commences, a meeting shall be held between the Engineer's representative(s), coatings inspector, Contractor, coating manufacturer, and any subcontractors to clarify and agree the implementation of this specification, and the Contractor's proposed programme, methodology and inspection procedures.

The Contractor shall submit details of each of the proposed protective coating systems to the design engineer for review with the shop drawings, at least ten working days prior to the coating project commencement meeting.

The details outlined in clause 9.4 of AS 2312.1 must be included, including the following:

a. full details of the system, including preparation requirements, method of application, recoating intervals, storage, and site touch-up and repair methods

b. full manufacturer's specifications of all proposed coatings

c. details for and location of proposed storage of wire and hazardous material

d. coating inspection and testing plan

e. a sample of the finish coat(s) for agreement, when this has been separately specified.

The design engineer's agreement to the Contractor's proposals listed above must be received prior to commencing any surface treatment.

10.3 Execution prior to application

All matters pertaining to the surface preparation of fabricated and welded steelwork prior to the application of corrosion protection system shall be undertaken in accordance with clause 9.8 of AS/NZS 5131, and the following.

10.3.1 Treatment grades

The treatment grades (clause 9.8.4 of AS/NZS 5131) shall be as follows, or as superseded by the construction drawings:

- for all thermal sprayed steelwork, the treatment grade shall be to P3: very thorough treatment.
- remove heat affected zones formed by gas, laser or plasma cutting by grinding before abrasive blasting (clause 9.8.5 of AS/NZS 5131).

10.4 Application of coatings

All matters pertaining to the application of coatings shall be undertaken in accordance with section 9.9 of AS/NZS 5131, and the following additional specific requirements shall be applied.

10.4.1 Coating contractor's certification

Regarding the use of competent personnel (clause 9.9.1 of AS/NZS 5131), coating application on primary members (eg bridge girders) shall only be undertaken by specialist industrial coating contractors whose QA system has current accreditation from the Painting Contractors Certification Program (PCCP) administered by CSIRO.

Note: A list of accredited contractors is available on the PCCP pages of the APAS website in Document PP-D016 PCCP accredited contractors[(3)]*.*

10.4.2 Quality control

Quality control of the coating work shall comply with clause 9.9.4 of AS/NZS 5131.

During the course of the work, the Engineer's representative may take samples of metal spray wire or powder and sealer or duplex coating from site for independent testing. If the results of the test show that the material concerned does not comply with the relevant specification, the Contractor (at their own expense) shall remove

the non-complying material and recoat the area with an approved repair system in accordance with this specification.

The materials used shall be within their specified shelf life which may be extended if this has been certified by the manufacturer after testing. Any deteriorated or contaminated materials shall not be used. Materials shall be stored under conditions recommended by the manufacturer.

10.5 Inspection

10.5.1 General

The Contractor shall provide to the satisfaction of the Engineer, an inspection and test plan (ITP). This plan will detail the procedures that will be undertaken by the Contractor in order to verify compliance with this specification. The plan shall nominate the coatings inspector and include; a copy of any qualifications, a list of inspection equipment to be used and their calibration details, and sample report forms.

Examples of ITPs for surface treatments, thermal metal sprays and duplex coatings are given in Appendix B – Model inspection and testing plans.

The Contractor shall, at all times, allow the Engineer's representative access to the work in progress and shall provide every facility for inspection at all stages of the work. Lighting shall be provided to give a minimum of 500 lux illumination on surfaces being inspected. Any work rejected by the Engineer as not complying with this specification shall be made good at the Contractor's expense.

10.5.2 Quality assurance

Unless noted otherwise, the requirements for the surface preparation and application of corrosion protection coatings on all steelwork shall be in accordance with section 9 of AS/NZS 5131 for a coating quality level PC 2. Steelwork identified as architecturally exposed structural steelwork (AESS) shall comply with the requirements given in section 10 of AS/NZS 5131.

These include maintaining quality assurance programmes to AS/NZS ISO 9001 for specialist coatings, as necessary to assure that work is performed in accordance with this specification and the qualifying requirements of the contract documents.

The Contractor shall prepare a quality plan as set out in AS/NZS 5131 clause 4.5.2 and an inspection and test plan as set out in AS/NZS 5131 clause 13.8 for the inspection of surface treatment, and clause 13.9 for the inspection of coatings.

10.5.3 Inspection before and during surface preparation and coating

The Contractor shall employ an experienced coatings inspector to monitor their own work and perform tests as are necessary to ensure that their materials, equipment and procedures comply with the specification. The Contractor's coatings inspector shall hold a Protective Coatings Inspector qualification available through the Certification Board for Inspection Personnel (NZ), a Coating Inspector Program qualification from NACE International (minimum Level 1) or an equivalent qualification approved by the Principal.

The following measurements shall be taken by the Contractor immediately prior to, or during coating at least at four hourly intervals to ensure compliance with the appropriate specifications and shall be recorded with time of measurement on a daily inspection report (eg AS 3894.10 and AS 3894.12).

10.5.3.1 Ambient temperature

This shall be measured by the use of thermometers accurate to +0.5°C. Measurements shall be taken at a sheltered location adjacent to the area being painted.

10.5.3.2 Surface temperature

Measurement of the surface temperature of steelwork to be painted shall be made using a specially adapted thermometer accurate to +0.5°C.

10.5.3.3 Relative humidity

Relative humidity shall be measured by the use of a standard hygrometer accurate to +3%. Measurements shall be taken at a sheltered location adjacent to the area being painted.

10.5.4 Inspection of prepared surfaces

Where the quality of surface cleanliness is in question, reference shall be made to the relevant Society for Protective Coatings (SSPC) pictorial reference, eg SSPC-VIS 1[(4)]. The method for determining surface profile shall be AS 3894.5. Unless otherwise specified by the coating manufacturer, chloride contamination as determined by Bresle Patch method to AS 3894.6, shall be less than 30mg/m² for buried or immersed structures, and less than 50mg/m² for above ground steelwork.

After abrasive blasting, surfaces shall be blown down or vacuumed (preferred) and upward facing surfaces shall be confirmed to be free of dust before coating or sealer application by tape testing to AS 3894.6 method C. A residual dust rating of 1 or less is required.

10.5.5 Inspection of coating

10.5.5.1 Inspection after sealing

After sealing, no further coats shall be applied without the approval of the Engineer's representative, who may require an independent inspection to be carried out prior to application of cover coats.

Any wet storage staining or oxidation shall be removed prior to top coating. The underlying coating thickness after this removal treatment shall exceed the specified minimum thickness.

10.5.5.2 Thickness measurement

The method for determining dry film thickness shall be AS 3894.3. In multi-coat systems the average dry film thickness (DFT) of each coat shall be not less than 80% of the specified nominal DFT or be thicker than 120% of any specified maximum DFT. At any point the total DFT of the system shall be not less than 80% nor thicker than 200% of the nominal total DFT.

10.5.5.3 Measurement of adhesion

Coatings when cured shall be firmly adherent to the substrate and to one another and, when required, this may be confirmed by testing as described below.

Satisfactory adhesion shall be determined by the 'X-cut tape test' using method A of ASTM D3359, where an average rating of 4A or better is obtained and no single result worse than 3A. Adhesive tape approved for this test is 3M No. 810 'Scotch Magic Tape' transparent pressure sensitive tape. Area of coatings that are rejected by the Engineer due to unsatisfactory adhesion shall be removed and the surface prepared and recoated.

Adhesion of thermal metal spray shall comply with the requirements of their relevant standards. See also 11.5.2.

10.5.5.4 Holiday testing

Not required for thermal metal spray

10.5.5.5 Defects

Each coating and the completed coating system shall be substantially free from runs, sags, wrinkling, fat edges, entrained skin, dust or sand, irregular coated patches, dry spray, brush marks, blistering and pinholes, and shall be free from breaks in the coating.

Coatings that contain a significant number of these defects shall be repaired and/or recoated.

10.6 Daily inspection report

The Contractor shall complete a daily inspection report of an approved format (eg AS 3894.10) detailing the type of surface preparation and environmental conditions for each work area. A report (eg AS 3894.12) shall also record the coating system description, coating thicknesses, mixing and application times, material batch numbers and quantities used. Copies shall be supplied to the Engineer at the end of each week.

10.7 Additional requirements

10.7.1 Faying and bearing surfaces

Follow any specific requirements for preparation of contact surfaces of high strength friction grip (HSFG) bolted joints, and bearing surfaces as noted on the project drawings and below. The stripe coating of bolt holes within a HSFG joint is not required. Unless otherwise specified by the designer, the coating thickness on faying and bearing surfaces shall be within (and shall not exceed) the range listed in the following table. After treatment and before application of the remaining system, mask over the faying and bearing surfaces to between 10-15mm from the joint edge.

System	TDFT (µm)
TMS	50 – 75 and leave unsealed

10.7.2 Treatment of top flanges for composite action

Where shear studs are to be site welded to the top flange to provide composite action with cast in situ concrete bridge decking, a welding margin shall be masked off on the top flange before coating. Ensure that the top flange is completely coated for a minimum of 50mm from each edge and a nominal 150µm DFT epoxy barrier coat is applied for a minimum of 100mm either side of any deck construction joint.

When shear studs are welded offsite at the Fabricator's shop, 10.7.3 applies, except that the shear studs do not require the additional epoxy barrier coat.

10.7.3 Surfaces in contact with timber, concrete or cementitious mortar

Thermal metal spray surfaces that are in contact with timber, concrete or cementitious mortar that are exposed to the weather shall be precoated with a 150µm minimum DFT of a compatible epoxy barrier coat. Similarly, TMS coating systems that are to be completely embedded in concrete shall receive an additional 350µm minimum DFT of compatible epoxy barrier coat to 100mm either side of the air/concrete interface prior to embedment. Barrier coating to be coloured light grey.

10.8 Anti-graffiti treatment

10.8.1 General

All anti-graffiti (AG) coating materials shall be supplied by a manufacturer whose QA system shall be recognised by the Australian Paint Approval Scheme (APAS) and shall be applied as recommended in the manufacturer's current product data sheets. The requirements for the testing and supply of AG coatings are given in NZTA S10 *Specification for anti-graffiti coatings*[5].

The specified or agreed AG coating system shall be applied to areas shown on the drawings and, as a minimum, shall comply with the requirements given in clause 4.12.9 of the *Bridge manual*[1], ie:

- 1.2 m from an accessible top edge
- 2.7 m above adjacent ground or base level, and
- 1.5 m horizontally from an accessible substructure element.

The edge of the AG system shall finish at a change in profile (eg web stiffener) where feasible, otherwise at a neat straight edge formed by masking.

In locations where, frequent removal of graffiti is anticipated, and/or when the finish coat colour is not a light colour, an additional clear coat of the same material (ie unpigmented) shall be applied to improve the durability of the AG system.

10.9 Repair of defects

10.9.1 General

Before application of any further coat of material, all damage to previous coats shall be repaired. Sagging, dimpling and curtaining not exceeding 5% of the total surface area coated shall not be considered as a defect requiring repair, where these are not visible to the public, and coating thickness above the sag remains more than the specified minimum.

10.9.2 Incorrect thickness

Areas with an inadequate coating thickness, shall be thoroughly cleaned and where necessary additional coats applied until the specified thickness for each layer or area is achieved. Refer to the coating specific repair methods given below. Where the specified maximum thickness has been exceeded on faying surfaces, the coating shall be removed and reapplied so that the DFT is within the specified thickness range.

10.9.3 Contaminated surfaces

Surfaces to be over coated that become contaminated shall be thoroughly cleaned in accordance with AS 1627.1 by washing with water to remove soluble contaminants (eg salt); solvent or detergent solution to remove organic material (eg oil or amine bloom); and after degreasing, hand sanding or lightly brush blasting if required by the coating manufacturer.

10.9.4 Damaged surfaces

After cleaning, the coating around the damaged area shall be feathered to ensure continuity of the patch coating and the full system reinstated.

11. THERMAL METAL SPRAY

11.1 Specification

Where the specified coating system is designated TSZ150S, TSZ300S or TSA225S as defined in AS/NZS 2312:2002 clause 5.2, it shall be applied in accordance with NACE No. 12/AWS C2.23M/SSPC-CS 23.00[13] and the additional requirements listed in this specification.

In coastal areas designated as C4 or C5 according to SNZ TS 3404, 85/15 Zn/Al alloy or pure aluminium shall be used because of its superior performance to pure zinc in marine environments.

For steel piles immersed in sea or brackish water, only pure aluminium or AlMg5 shall be used and be sealed with an aluminium silicone and NOT be overcoated with epoxy. Where a ‘wear coat’ is required, such as on piles subject to abrasion, a duplex TSZ system should be used.

11.2 Additional requirements

Where an additional organic top coat system (ie duplex system) is required for anti-graffiti protection or otherwise approved by the Engineer for aesthetics, refer to 11.8. Note that in marine environments some duplex systems may have reduced durability. Also, where a duplex system is required for aesthetics, its time to first maintenance will be less than required for corrosion prevention.

11.3 Test panel

Prior to the commencement of work the Contractor shall supply for testing by the Engineer’s representative, a steel sample panel (minimum 250mm by 250mm) showing both the blasted surface profile and the metal spray (unsealed and sealed) proposed for the contract.

In addition, the Contractor shall supply copies of quality control documentation that shall include:

- manufacturer’s data sheets and material certificates for feedstock to be used

- equipment type and setup parameters
- brand of sealer to be used
- name of operator who prepared panel and is to be employed for the work.

After satisfactory testing of the sample panel, none of the above shall be changed without the consent of the Engineer who may require supply of a new test panel. The cost of preparing and testing any subsequent test panels shall be borne by the Contractor.

11.4 Abrasive blasting

Abrasive blasting shall be carried out in accordance with NACE No. 1/SSPC-SP 5[14] to achieve "white metal" finish where flame spray is used, and to a NACE No. 2/SSPC-SP 10[10] minimum finish where arc spray is used, both as illustrated in SSPC-VIS 1[4].

Compressed air for blast cleaning and metal spraying shall be free of oil or water as determined by ASTM D4285. Adequate separators, traps and filters shall be provided and effectively maintained for this purpose.

The surface shall be blasted in such a manner so as to provide an even sharp angular surface profile with an average peak to valley height of between 50 and 100 microns when measured in accordance with AS 3894.5. Attainment of this amplitude is also required on welds and heat-affected zones. When flame-spraying aluminium, a minimum profile of 75 microns is required.

11.5 Metal spraying

11.5.1 Application

The metal spray coating shall be of the specified metal or alloy and applied in a minimum of two passes to achieve a finished coating thickness and profile given elsewhere in the contract documents. Unless a non-slip finish is required, or otherwise specified or agreed, the maximum finish profile shall be 100 microns. However, where the metal spray is to be overcoated with a duplex system or an anti-graffiti coating, the maximum finish profile for zinc and its alloys shall be 50 microns, and 90 microns for aluminium metal spray. Alternatively, the finished profile shall not be rougher than “medium” when checked against a surface comparator complying with ISO 8503-1 for grit blasting.

The sprayed metal shall overlap on each pass of the gun. The two or more coats of this layer shall be sprayed alternately in both vertical and horizontal passes (where practicable) to ensure a uniform coverage. The first coat shall be applied as soon as practicable after blast cleaning and before any discolouration of the prepared surface occurs. This shall be within 4 hours*, and the total specified thickness applied within 8 hours after blast cleaning.

11.5.2 Quality control

Suitability of the surface preparation methodology, equipment set-up and operator competence, shall be demonstrated by the satisfactory completion of a coupon bend test, where a sprayed coupon 1.3 mm thick is bent through a 180 degree angle around a 13mm diameter mandrel as described in C6.1 of ANSI/AWS C2.18[15] or section 6.5 of NACE No. 12/AWS C2.23M/SSPC-CS 23.00[13]. This test shall be repeated whenever there is any change of operator, equipment setting, surface preparation methodology or abrasive media.

11.6 Seal coating of metal spray

For operating temperatures of up to 120°C and where a seal coat is specified, it shall be applied within 4 hours* of completion of metal spraying. Unless otherwise specified the seal coat shall consist of a low viscosity vinyl or if to be overcoated, a two-pack epoxy that has been recommended for this purpose by the

* Application intervals may be extended to 8 hours if inside a sheltered inland non-polluted environment where steel temperatures remain at least 3°C above dew point or reduced to 1 hour if in an exposed coastal environment – refer to project specification. Verify surface free of oxide, dust or salt contaminants before metal spraying or sealing by testing.

manufacturer. It shall be applied until both absorption by the surface is complete, and a uniform colour is achieved.

Where necessary, remove 'rogue peaks' by scraping or hand sanding to achieve specified finished profile range and remove dust from surfaces before applying a second seal coat or the intermediate coat of the duplex coating system.

11.7 Repair of defects

If a damaged or defective area is found during initial inspection, additional tests shall be performed to determine the extent of the thin or improperly adhering area. Defective areas shall be repaired by removing the damaged/defective coating, reblasting the surface and reapplication of the metal spray and sealer in accordance with this specification.

Where rejection of the coating has been due solely to insufficient thickness and found prior to application of the sealer coat, additional spraying of metal is allowed without reblasting if the substrate is kept completely dry, free of contamination or oxidation and recoated within the specified minimum 8-hour time period.

Areas of zinc metal spray less than 10mm wide damaged during transportation or erection may be site repaired by power tool cleaning to SSPC-SP 11[11] (eg by disc grinding or bristle blasting to bare metal) and applying epoxy zinc rich paint complying with AS/NZS 3750.9 to the same thickness as the adjacent sprayed metal. The areas of zinc rich paint shall then patch painted following the manufacturer's minimum overcoat time to match any adjacent sealer/ topcoat to the satisfaction of the Engineer's representative. Damaged zinc areas wider than 10mm, and any damage to sprayed aluminium shall be treated as a defect and repaired by reapplying metal spray as specified above.

The areas repaired or brought up to thickness shall be re-inspected in accordance with the original inspection procedure.

11.8 Anti-graffiti treatment

The AG coating system shall include:

- a low viscosity epoxy sealer (eg zinc phosphate epoxy primer thinned 30-40% with finely ground pigments or an unthinned 100% volume solids unpigmented two component low viscosity epoxy) applied to saturate into and fill the pores of the thermal metal spray before exposure to dewpoint conditions or contamination and preferably within 4 hours of application of thermal metal spray
- denib rogue peaks by scraping and then lightly sanding to reduce the surface profile to <100 microns, or when using the ISO 8503-1 grit surface comparator, medium or finer. Blow down before sealing and again after sanding and tape test to AS 3894.6 method C to ensure free of residual dust (rating 1 or less)
- application of a second sealer coat
- a high build epoxy intermediate coat with a nominal average DFT of 150µm
- a satin or low gloss* polyurethane or polysiloxane with a minimum average DFT of 50µm and a maximum DFT of 125µm in corners and on overlaps, unless a lower maximum is recommended by the manufacturer in their technical data sheet. Colour to be similar to the finish on adjacent sealed metal spray (light grey or silver aluminium) unless otherwise specified.

The selected anti-graffiti top coat shall comply with the requirements of NZTA S10 *Specification for anti-graffiti coatings*[5].

In locations where, frequent removal of graffiti is anticipated, and/or when the finish coat colour is not a light colour, an additional clear coat of the same material (ie unpigmented) within the same thickness ranges shall be applied to improve the durability of the AG system.

* Where advised by the Engineer that a contrast in appearance is acceptable, a gloss finish shall be used to make removal of graffiti easier, unless there is an issue with night-time reflectance dazzling drivers.

12. DUPLEX COATINGS

This section covers the requirements for the application of organic coatings onto TMS to form a duplex system; being high-build epoxy as an intermediate coat and possibly also as a finish coat (eg EHB where in contact with concrete or cementitious mortar), urethane system (such as a modified MCU2 or PUR5) or polysiloxane topcoat system (such as a modified PSL2) all as defined in AS 2312.1.

12.1 Paint material

All paints shall be supplied by the same coating manufacturer, whose QA systems shall have current certification by the Australian Paint Approval Scheme (APAS). The composition and performance of coating materials shall comply with the relevant product standard specified in the AS/NZS 3750 series.

The organic coatings shall be applied in accordance with the relevant details of clause 9.4 of AS/NZS 5131.

12.2 Colour gloss and fade

Unless otherwise approved, gloss level of the finish should be low gloss as defined in AS/NZS 2310 (ie specular gloss reading of less than 20 gloss units at 60 degrees) to reduce the risk of reflected light interfering with driver vision. Finish coat resins shall be sufficiently UV resistant to comply with the change in gloss allowance given in table 2.4 of AS/NZS 2728.

Similarly, the pigmentation in coloured finish coats (eg red and blue) shall have low levels of titanium dioxide and be sufficiently UV resistant to comply with the maximum fade and colour shift (dE) allowance given in table 2.4 of AS/NZS 2728. Use of tinted basecoats shall not be permitted and colour pigmentation shall be added to the batch during its manufacture in the paint factory.

For each specified colour, the finish coat shall all be supplied from the same batch with sufficient additional quantity reserved to repair any defects or transport and erection damage.

12.3 Anti-graffiti Treatment

Polyurethane and polysiloxane have inherent anti-graffiti properties, and their selection shall comply with the requirements of NZTA S10 *Specification for anti-graffiti coatings*[5].

However, ensure that the selected gloss levels are suitable for the required aesthetics and level of service required.

Appendices

APPENDIX A – REFERENCES

(1) NZ Transport Agency (2013) SP/M/022 *Bridge manual*. Wellington. (Incorporating amendment no. 3: 2018)

(2) NZ Transport Agency (2020) *Protective coatings for steel bridges: a guide for bridge and maintenance engineers*. Wellington.

(3) CSIRO Document PP D016 *PCCP accredited contractors*. Last accessed 22 October 2020. <http://www.apas.gov.au/pccp/pdfs/D016.pdf>.

(4) The Society for Protective Coatings (2002) SSPC-VIS 1 *Guide and reference photographs for steel surfaces prepared by dry abrasive blast cleaning*. Pittsburgh, PA, USA.

(5) NZ Transport Agency (2020) S10 *Specification for anti-graffiti coatings*. Wellington.

(6) CSIRO (2003) APAS Specification 2908 *Inorganic zinc silicate coating for the long term protection of steel*. Clayton, VIC, Australia.

(7) Galvanizing Association of New Zealand *Design guide for hot dip galvanizing – best practice for venting and draining.* Last accessed 9 September 2020. <https://www.galvanizing.org.nz/docs/Design_Guide_For_Hot_Dip_Galvanising-Best_Practice_for_Venting&Draining.pdf>

(8) Galvanizing Association of New Zealand *ACA accredited hot dip galvanizing inspectors - New Zealand*. Last accessed 22 October 2020. <https://www.galvanizing.org.nz/accredited-inspectors.php>

(9) Galvanizers Association of Australia (2017) *Acceptance inspection and sampling methods for demonstrating coating thickness compliance with AS/NZS 4680 and AS/NZS 1214*. GAA Advisory Note #37 issue 3, Melbourne, VIC, Australia.

(10) NACE International and The Society for Protective Coatings jointly (2006) NACE No. 2/SSPC-SP 10-2006-SG *Near-white metal blast cleaning*. Houston, TX, USA.

(11) The Society for Protective Coatings (2013) SSPC-SP 11 *Bare metal power tool cleaning*. Pittsburgh, PA, USA.

(12) The Society for Protective Coatings (2018) SSPC-SP 2 Hand *tool cleaning*. Pittsburgh, PA, USA.

(13) NACE International, American Welding Society and The Society for Protective Coatings jointly (2016) NACE No.12/AWS C2.23M/SSPC – CS 23.00 *Specification for the application of thermal spray coatings (metallizing) of aluminum, zinc, and their alloys and composites for the corrosion protection of steel.* (Under revision for adoption as a US National Standard.)

(14) NACE International and The Society for Protective Coatings jointly (2006) NACE No. 1/SSPC-SP 5 *White metal blast cleaning*. Houston, TX, USA.

(15) American National Standards Institute and American Welding Society jointly (1993) ANSI/AWS C2.18-93R *Guide for the protection of steel with thermal sprayed coatings of aluminium and zinc and their alloys and composites*.

APPENDIX B – MODEL INSPECTION AND TEST PLANS

Introduction

The following model inspection and test plans (ITPs) cover surface preparation for and the application of the following for structural steelwork:

- standard protective coating systems that are designated in AS 2312.1 as inorganic zinc silicate (such as IZS4); and organic systems, ie epoxy/polyurethane (such as PUR5), epoxy/polysiloxane (such as PSL2) and moisture cure urethane (such as MCU2)
- hot dip galvanizing
- standard protective coating systems that are designated in AS/NZS 2312:2002 as TSZ or TSA.

The NZ Transport Agency standard specifications (eg C26 and S9) require that the Contractor shall prepare a quality plan as set out in AS/NZS 5131 clause 4.5.2 and an inspection and test plan as set out in:

- AS/NZS 5131 clause 13.8 for the inspection of surface treatment
- AS/NZS 5131 clause 13.9 for the inspection of paint coatings
- AS/NZS 5131 clause 13.10 for the inspection of galvanized coatings.

Check list of specified requirements for the Engineer's representative

1. Is plant suitable?
   - for galvanizing, bath size(s) suitable for the articles to be galvanized
2. Check Contractor or Galvanizer supplied materials:
   - abrasive grading & cleanliness
   - zinc type (for galvanizing)
   - correct wire or powder alloy and in good condition (for thermal metal sprays)
   - coatings quantity, repair paints, storage, documents (eg SDS & PDS) and type (see later) compatible solvents and thinners
   - inspection equipment suitable and calibrated
   - lighting.
3. Sight evidence of applicator or Galvanizer competency.
4. Review of proposed coating system details and sample panel or of proposed reference galvanized sample, if required.
5. At project commencement meeting, review:
   - specification
   - programme
   - preparation & application methodology
   - ITP and hold points
   - test methods
   - transport and storage before erection (for galvanizing)
   - repair procedures
   - type, frequency and distribution of QC and audit reports.
6. Check on fabrication quality (AS/NZS 5131 clause 13.8) before delivery to coating contractor or Galvanizer

Add Note to all ITPs:

"In the event of any conflict between the relevant NZTA specification clause and a referenced standard (eg AS/NZS 5131 or AS/NZS 4680), the NZTA specification shall take precedence."

Model inspection test plan (ITP) – surface treatment
(for inorganic or organic coatings)

NZ Transport Agency model inspection test plan (ITP)	**Surface treatment**	Rev no.	
Project name:		Date:	
Contract ref:		ITP author:	
Work item:		No. of pages:	

No.	Activity	S9.1 ref cl.	AS/NZS 5131 ref cl.	Acceptance criteria	Inspection / audit by	Inspection type	Sign/date
1	Submit documents	4.2.2		AS 2312.1 Cl. 9.4	CS / ITPI		
2	Pre-job conference	4.2.2			CS / ITPI / DE		
3	Personnel competent	4.2.1 4.4.1 4.5.3	9.3.1	PCCP accreditation	DE	H	
4	Weld spatter, slag deposits and flux residue removed		9.3.2		CS	W	
5	Sharp edges rounded		9.8.4	Min. radius 2mm	CS	W	
6	Oil and grease removed by solvent cleaning		9.3.2	Water break test	CS	M	
7	Contaminants removed by power washing		9.3.2	<10µg/cm² to AS 3894.6	CS	M	
8	Masking where required			eg weld margins	CS / ITPI	W	
9	Abrasive blast cleaning to visual standard	4.3.1	9.4	ISO 8501-1 Sa 2½	CS / ITPI	H	
10	Surface profile within specified range		9.4.4	(40 to 75µm unless otherwise specified)	CS / ITPI	H	
11	Surface soluble salts below specified limit			5µg/cm² to AS 3894.6	CS / ITPI	H	
12	Abrasive media correct type, grade and cleanliness		9.4.1	Able to produce a sharp profile within specified range	CS	M	
13	Compressed air free of oil and water		9.4.2	Blotter test clean and dry	CS	M	
14	Adequate lighting	4.5.1		500 Lux minimum	CS	M	
15	Prewash black rust		9.4.3	Within the previous 48hrs in order to remove any salt contamination	CS	M	
16	Suitable weather	4.5.3	9.4.3	<85% relative humidity and surface temp >3°C above dew point	CS	M	
17	Dust removed	4.5.4	9.4.5	AS 3894.6 C Rating <2	CS	M	
18	Surface protected until primed		9.4.5		CS	M	
19	Complete report form	4.5.3		Record ambient conditions every 4 hrs using AS 3894.11	CS / ITPI	H	

Notes: H = hold point W = witness M = monitor regularly DE = design engineer
CS = coating supervisor ITPI = independent third-party inspector

Coating supervisor name:		*(in capital letters)*
Coatings supervisor's qualifications		*(eg NACE Certified Level 1 #123456)*

Model inspection test plan (ITP) – inorganic or organic coating application

NZ Transport Agency model inspection test plan (ITP)				**Coating application**		Rev no.	
	Project name:					Date:	
	Contract ref:					ITP author:	
	Work item:					No. of pages:	
No.	Activity	S9.1 ref cl.	AS/NZS 5131 ref cl.	Acceptance criteria	Inspection / audit by	Inspection type	Sign/date
1	Applicators competent	4.2.1 4.4.1 4.5.3	9.9.1	PCCP accredited	DE	H	
2	Coatings manufacture complies with standard and are the specified generic type	5.1 & 6.1	9.9.3	APAS accredited	DE or ITPI	W	
3	Coatings and thinners are all from same manufacturer and are compatible	6.1		As recommended on product data sheets (PDS)	DE or ITPI	W	
4	Coloured topcoats are from same batch and of correct colour and gloss and in sufficient quantity for project	6.2		Same batch numbers. Calculation of requirements including repair	CS / ITPI	W	
5	Coatings are correctly stored, within specified shelf life and containers are in good condition	4.4.2	9.9.4	As recommended on (PDS)	CS / ITPI	M	
6	Record coating data	4.6	9.9.5	AS 3894.12 & 14	CS / ITPI	M	
7	Masking of site welds and machined surfaces		9.9.9	As required on drawings	CS / ITPI	W	
8	Coating correctly mixed before application		9.9.6, 9.9.7 & 9.9.8	Correct ratios, induction time and within pot life	CS / ITPI	W	
9	Painting conditions and recoat times comply with data sheets and specification and are recorded	4.5.3	9.9.10	AS 3894.10	CS	M	
10	Stripe coat and prime over specified clean substrate		9.9.11	As specified and within 4 hours if outdoors	CS	M	
11	Masking of faying surfaces and bolted connections	4.7.1	9.9.9	As required on drawings	CS	M	
12	Inspection after priming	4.5.5.1	9.9.15 & 9.9.16	Continuous with correct DFT	CS / ITPI	H	
13	Application of coating to standard and specification	4.4	9.9.13 & 9.9.14	As specified or to PDS. If outdoors first check for contaminants and rewash if required	CS	M	
14	Check WFT and DFT and record for each coat	4.5.5.2	9.9.15	As specified or to PDS	CS	M	
15	Inspection equipment calibrated and used by competent personnel	4.5.3	9.9.15	Current calibration and certification	CS / ITPI	W	

No.	Activity	S9.1 ref cl.	AS/NZS 5131 ref cl.	Acceptance criteria	Inspection / audit by	Inspection type	Sign/date
16	Repair defects	4.5.5.5 & 5.4	9.12.1 & 9.12.2	As specified	CS	H	
17	Check cure before handling	5.2	9.9.17	As specified or to PDS	CS	M	
18	Protect coating during storage, handling transport and erection		9.9.19		CS	M	
19	Complete QC documentation	4.5.3	9.9.20	Report weekly or as specified	CS	H	
Notes: H = hold point W = witness M = monitor regularly DE = design engineer CS = coating supervisor ITPI = independent third-party inspector							
Coating supervisor name:					*(in capital letters)*		
Coatings supervisor's qualifications					*(eg NACE Certified Level 1 #123456)*		

Model inspection test plan (ITP) – hot dip galvanizing

NZ Transport Agency model inspection test plan (ITP)	**Hot dip galvanizing**	Rev no.	
Project name:		Date:	
Contract ref:		ITP author:	
Work item:		No. of pages:	

No.	Activity	S9.2 ref cl.	AS/NZS 5131 ref cl.	Acceptance criteria	Inspection / audit by	Inspection type	Sign/date
1	Check traceability & steel cert for suitability (mech & chem)	8.2.2	4.7 9.10.3	AS/NZS 2312.2 cl 9.1 AS/NZS 2312.2 cl 4	DE / G	W	
2	Check special / supplementary requirements	8.2.2	9.2.3.2 9.10 9.10.5	Specification	DE / G	W	
3	Check surface condition of steel suitable for galvanizing	8.2.2	9.3.3	AS/NZS 2312.2 cl 9.4 AS/NZS 4680 App C4	DE / G	W	
4	Check vent & drain holes size & location	8.2.2	9.6	AS/NZS 2312.2 App A GANZ venting guidelines	G	H	
5	Seal weld crevices	8.2.2	9.6	Crevices sealed	DE / G	M	
6	Check flame / plasma / laser cut faces ground & rounded	8.2.2	9.8.5	Case hardened material removed	DE / G	M	
7	Check welds cleaned & porosity to limits	8.2.2	9.10.4	All slag & spatter removed & porosity to limits	DE / G	M	
8	Check size matches bath	8.2.2	9.10.5	Double dipping allowed	DE / G	H	
9	Check zinc quality	8.3.2		AS/NZS 4680 cl 6.2 & supplier certification	G / ITPI	M	
10	Passivation	8.6.1		Specification	G / ITPI	M	
11	Sharp points removed	8.4.3.2		No handling hazards	G	M	
12	Defects assessed for size and fit for purpose	8.4.3.2	9.10.9	Size of bare spots and other damage acceptable or repaired	G / ITPI	H	
13	Repair defects	8.5	9.10.9	Coating reinstated	G / ITPI	H	
14	Check galvanizing thickness	8.4.3.4	13.10	AS/NZS 4680 cl 9.2 AS/NZS 1214 cl 8.3 GAA AN #37.3	G / ITPI	H	
15	Store correctly		9.10.10	As specified	G	M	
16	Complete inspection		13.10.1	As specified	G / ITPI	H	
17	Complete QC report		13.10.2	Report weekly	G / ITPI	W	

Notes: H = hold point W = witness M = monitor regularly DE = design engineer
G = Galvanizer ITPI = independent third-party inspector

Galvanizing supervisor name:		*(in capital letters)*
Galvanizing supervisor's qualifications		*(eg ACA/GAA HDGI cert #123)*

Note: In the event of any conflict between the relevant specification clause and a referenced standard (eg AS/NZS 5131 or AS/NZS 4680), the specification shall take precedence.

For duplex coating application, refer to the model ITP following.

Model inspection test plan (ITP) – surface treatment
(for thermal metal spray)

NZ Transport Agency model inspection test plan (ITP)	**Surface treatment**	Rev no.	
Project name:		Date:	
Contract ref:		ITP author:	
Work item:		No. of pages:	

No.	Activity	S9.3 ref cl.	AS/NZS 5131 ref cl.	Acceptance criteria	Inspection / audit by	Inspection type	Sign/date
1	Submit documents	10.2.2		AS 2312.1 Cl. 9.4	CS / ITPI		
2	Pre-job conference	10.2.2			CS / ITPI / DE		
3	Personnel competent	10.2.1 10.4.1 10.5.3	9.3.1	PCCP accreditation	DE	H	
4	Weld spatter, slag deposits and flux residue removed		9.3.2		CS	W	
5	Sharp edges rounded		9.8.4	Min. radius 2mm	CS	W	
6	Oil and grease removed by solvent cleaning		9.3.2	Water break test	CS	M	
7	Contaminants removed by power washing		9.3.2	<10µg/cm² to AS 3894.6	CS	M	
8	Masking where required			eg weld margins	CS / ITPI	W	
9	Abrasive blast cleaning to visual standard	10.3.1	9.4	ISO 8501-1 Sa 2½	CS / ITPI	H	
10	Surface profile within specified range		9.4.4	(40 to 75µm unless otherwise specified)	CS / ITPI	H	
11	Surface soluble salts below specified limit			5µg/cm² to AS 3894.6	CS / ITPI	H	
12	Abrasive media correct type, grade and cleanliness		9.4.1	Able to produce a sharp profile within specified range	CS	M	
13	Compressed air free of oil and water		9.4.2	Blotter test clean and dry	CS	M	
14	Adequate lighting	10.5.1		500 Lux minimum	CS	M	
15	Prewash black rust		9.4.3	Within the previous 48hrs in order to remove any salt contamination	CS	M	
16	Suitable weather	10.5.3	9.4.3	<85% relative humidity and surface temp >3°C above dew point	CS	M	
17	Dust removed	10.5.4	9.4.5	AS 3894.6 C Rating <2	CS	M	
18	Surface protected until primed		9.4.5		CS	M	
19	Complete report form	10.5.3		Record ambient conditions every 4 hrs using AS 3894.11	CS / ITPI	H	

Notes: H = hold point W = witness M = monitor regularly DE = design engineer
CS = coating supervisor ITPI = independent third-party inspector

Coating supervisor name:		*(in capital letters)*
Coatings supervisor's qualifications		*(eg NACE Certified Level 1 #123456)*

Model inspection test plan (ITP) – thermal metal spray

NZ Transport Agency model inspection test plan (ITP)	**Thermal metal spray**	Rev no.	
Project name:		Date:	
Contract ref:		ITP author:	
Work item:		No. of pages:	

No.	Activity	S9.3 ref cl.	NACE No. 12 ref cl.	Acceptance criteria	Inspection / audit by	Inspection type	Sign/date
1	Check edges rounded to >2mm	10.3.1	-		CS	W	
2	Check plasma cut edges ground		-	Case hardened material removed	CS	M	
3	Check metal alloy meets specification	11.1	4.0	Record batch number and retain sample of wire or powder	CS / ITPI	H	
4	Prepare test panel	11.3	7.1		CS	W	
5	Check set up and prep by bend test	11.5.2	A3		CS / ITPI	H	
6	Abrasive blasting	11.4	5	Angular profile to specification	CS	M	
7	Metal spraying	11.5.1	8.2		CS	M	
8	Check thickness		9.2	To specification and AS 3894.3	CS / ITPI	H	
9	Check finished profile	11.5.1	9.6	To specification	CS / ITPI	W	
10	Repair defects	11.7	8.4	To specification	CS	W	
11	Seal coating	11.6	10.2	Record type, batch no. time of application and environmental conditions	CS	M	

Notes: H = hold point W = witness M = monitor regularly DE = design engineer
CS = coating supervisor ITPI = independent third-party inspector

Coating supervisor name:		*(in capital letters)*
Coatings supervisor's qualifications		*(eg NACE Certified Level 1 #123456)*

Model inspection test plan (ITP) – duplex coating application

NZ Transport Agency model inspection test plan (ITP)				**Duplex coating application**			
					Rev no.		
Project name:					Date:		
Contract ref:					ITP author:		
Work item:					No. of pages:		
No.	Activity	S9.3 ref cl.	AS/NZS 5131 ref cl.	Acceptance criteria	Inspection / audit by	Inspection type	Sign/date
1	Applicators competent	10.2.1 10.4.1 10.5.3	9.9.1	PCCP accredited	DE	H	
2	Wire and coatings manufacture complies with standard and are the specified generic type	11.1 & 12.1	9.9.3	APAS accredited	DE or ITPI	W	
3	Coatings and thinners are all from same manufacturer and are compatible	12.1		As recommended on product data sheets (PDS)	DE or ITPI	W	
4	Coloured topcoats are from same batch and of correct colour and gloss and in sufficient quantity for project	12.2		Same batch numbers. Calculation of requirements including repair	CS / ITPI	W	
5	Wire and coatings are correctly stored, within specified shelf life and containers are in good condition	10.4.2	9.9.4	As recommended on (PDS)	CS / ITPI	M	
6	Record coating data	10.6	9.9.5	AS 3894.12 & 14	CS / ITPI	M	
7	Masking of site welds and machined surfaces		9.9.9	As required on drawings	CS / ITPI	W	
8	Coating correctly mixed before application		9.9.6, 9.9.7 & 9.9.8	Correct ratios, induction time and within pot life	CS / ITPI	W	
9	Painting conditions and recoat times comply with data sheets and specification and are recorded	10.5.3	9.9.10	AS 3894.10	CS	M	
10	Stripe coat and prime over specified clean substrate		9.9.11	As specified and within 4 hours if outdoors	CS	M	
11	Masking of faying surfaces and bolted connections	10.7.1	9.9.9	As required on drawings	CS	M	
12	Inspection after priming	10.5.5.1	9.9.15 & 9.9.16	Continuous with correct DFT	CS / ITPI	H	
13	Application of coating to standard and specification	10.4	9.9.13 & 9.9.14	As specified or to PDS. If outdoors first check for contaminants and rewash if required	CS	M	
14	Check WFT and DFT and record for each coat	10.5.5.2	9.9.15	As specified or to PDS	CS	M	

No.	Activity	S9.3 ref cl.	AS/NZS 5131 ref cl.	Acceptance criteria	Inspection / audit by	Inspection type	Sign/date
15	Inspection equipment calibrated and used by competent personnel	10.5.3	9.9.15	Current calibration and certification	CS / ITPI	W	
16	Repair defects	10.5.5.5	9.12.1 & 9.12.2	As specified	CS	H	
17	Check cure before handling		9.9.17	As specified or to PDS	CS	M	
18	Protect coating during storage, handling transport and erection		9.9.19		CS	M	
19	Complete QC documentation	10.5.3	9.9.20	Report weekly or as specified	CS	H	

Notes: H = hold point W = witness M = monitor regularly DE = design engineer
CS = coating supervisor ITPI = independent third-party inspector

Coating supervisor name:		*(in capital letters)*
Coatings supervisor's qualifications		*(eg NACE Certified Level 1 #123456)*