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5.3 HAUPIRI STEAM SHOVEL

Figure 7. The Haupiri steam shovel, West Coast.
Photo: Jim Staton, Greymouth Area Office, DOC.

The Haupiri Steam Shovel is a current conservation project on the West Coast. Since the time of the photograph (Fig. 7), the surrounding vegetation has been removed and the steam shovel is now being treated each year with Ensis oil, which is a short-term preservative. This short-term measure will continue until funding for a longer term protective treatment is available.

5.4 BIG RIVER SAWMILL ROBEY ENGINE

Figure 8. The patent Robey fixed engine.

Even more of a challenge for preservation is the Robey semi-portable underslung sawmill engine (Fig. 8), which used to provide power for the Golden Lead Creek Sawmill. This sawmill produced timber for the nearby coalmines and the Big River Quartz Mine. The engine's remote location (c. 24 km south of Reefton near the end of the Big River Road) has preserved it from scrap metal merchants and souvenir hunters.

5.5 DENNISTON

Figure 9. Cable wheels, located near the top of the Denniston Incline, West Coast.

The photo shown in Fig. 9 was taken in 2002 near the top of the Denniston Incline, with the Tasman Sea in the background. One of the advantages of the West Coast climate is that items such as the cable wheels on display are regularly rain-washed. Because they are exposed and have few crevices and low mass, they also dry out rapidly when mounted clear of contact with soil or wet vegetation.

The advantages of having open structures that are regularly washed and do not pond or retain moisture are also demonstrated by the condition of the tower bases for the nearby coal bucket cableway system. The original lead-based alkyd system is still providing adequate protection to the steel.

5.6 COAL WAGONS

Figure 10. 'Q-wagons', Greymouth.

Figure 10 shows an example of 'Q wagons', which are now exhibits in a heritage park in Greymouth. They were lifted off the bogies when they reached the wharf and had a bottom outlet for emptying into the ship. Some of the original bituminous coating provides protection in places but, as can be seen, some of the thinner sheet material has already corroded away, as a result of contact with wet coal.

5.7 REEFTON VISITOR CENTRE

Figure 11. Restored winding engine, Reefton Visitor Centre, West Coast.

As an example of what can be done, Fig. 11 shows a restored winding engine, which is located in the Reefton Visitor Centre. It is now protected from the damp and salty West Coast environment (and damage by vandals) by a full enclosure and a simple protective coating system using alkyd paint.

5.8 URAPA FENCE, TARANAKI

Figure 12. Urapa fence, Te Rua O Te Huia Pa Reserve, Onaero, Taranaki.

Figure 12 shows a historic Maori grave site on the Te Rau O Te Huia Pa Reserve at Onaero, 30 km east of New Plymouth. The grave fence is said to be an early example of prefabricated wrought iron dating from the 1860s that may have originated in Australia. Most of the metalwork is still in reasonable condition, but there has been severe corrosion and loss of section at ground level where it is usually damp. It has been recommended that a concrete plinth be cast around the base to protect the remaining ironwork.

5.9 MAHINAPUA CREEK RAILWAY BRIDGE

Figure 13. 'Howe Truss' bridge, West Coast.

This 'Howe Truss' bridge (Fig. 13) is located 5 km south of Hokitika and just 250 m from the sea. It was built in 1905 with steel bottom chords and iron truss rods, and was refurbished by the Department of Conservation (DOC) in April 2000. The following system was used for restoration: all exposed metalwork was abrasive blast cleaned to a 'near-white' finish (Sa 2½), primed with 75 µm of an epoxy zinc-rich primer, and top coated with 200 µm of an epoxy-mastic. The work was carried out by Gray Bros Engineering of Greymouth under the supervision of Jim Staton (then at Hokitika Area Office, DOC), using paint material and inspection services supplied by International Protective Coatings.

5.10 DAVIDSON LOCOMOTIVE

Figure 14. The Davidson Locomotive before restoration.

Figure 15. The refurbished Davidson Locomotive. *Photo: Jim Staton, Greymouth Area Office, DOC.*

The Davidson Locomotive (Fig. 14) is thought to be the only surviving example of a locally built (i.e. at Hokitika) steam locomotive that was used on bush railways near Greymouth. Like the Mahinapua Creek bridge, this was also refurbished by Gray Bros Engineering in Greymouth under Jim Staton's supervision. After earlier attempts at painting with epoxy mastic (see Fig. 4), the locomotive was fully dismantled and new parts were fabricated where required. All of the metalwork was then abrasive blast cleaned, coated with 80 µm of zinc metal applied by arc spray, and finished with 120 µm of high-build epoxy (supplied by Altex Coatings). The end result is shown in Fig. 15.

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Appendix 1

PRODUCTS AND SERVICE PROVIDERS

The following is a list of coating manufacturers and distributors in New Zealand. It should be noted that this list is not exhaustive, but rather is intended as a good starting point for anyone wishing to restore or protect iron or steelwork. New Zealand manufacturers who are 'Recognised' by the Australian Paint Approvals Scheme (APAS) are denoted by an asterisk (*). Contact information is correct as at September 2007.

Akzo Nobel Coatings Ltd
Tel (09) 828 3009
Fax (09) 828 1129
Private Bag 19-995
Avondale, AUCKLAND
(Mfr. of 'International' coatings)

Altex Coatings Ltd*
Tel (07) 541 1221
Fax (07) 541 1310
PO Box 142, TAURANGA
(Mfr. of 'Devoe' coatings)

Ameron NZ Ltd
Tel (09) 573 2100
Fax (09) 573 0634
PO Box 22-122
Otahuhu, AUCKLAND

Fortec Paints Ltd
Tel (09) 444 7244
Fax (09) 444 3545
PO Box 100-208
NSMC, AUCKLAND
(Agents for 'Wasser' & 'Xymax')

Orica NZ Ltd*
Tel (04) 576 6400
Fax (04) 576 6425
PO Box 30-749, LOWER HUTT
(Mfr. of 'Dulux' & 'ICI' coatings)

Polymer Developments Group Ltd
Tel 0800 999 001
Fax (09) 274 1405
PO Box 58-256
Greenmount, AUCKLAND
(Mfr. of 'Carboline' coatings)

Resene Paints Ltd*
Tel (04) 577 0500
Fax (04) 577 0603
PO Box 38-242, WELLINGTON

Wattyl (NZ) Ltd
Tel (09) 828 4009
Fax (09) 820 3271
PO Box 1545, AUCKLAND
(Agent for 'Sigma' coatings)

Appendix 2

PROTECTIVE COATING SPECIFICATIONS

1. Clear coating system
2. Aluminium epoxy coating system
3. Moisture cure urethane system
4. Alkyd coating system
5. High performance coating system

SYSTEM 1 (CLEAR COATING)

1. Scope

This specifies a protective coating system to be used to preserve unpainted wrought iron or steel work outdoors that is exposed to contact by the public and/or animals, where a durable finish coat is required that does not significantly change the original rusted appearance of the item.

2. Materials

2.1 Sealer/primer

The primer shall be an approved low viscosity 100% volume solids epoxy in a clear colour.

Examples of this material are Altex 'Altra~Lock 577' and their low temperature/rapid cure version 'Altra~Lock 576', Ameron's 'Amerlock Sealer', Carboline's 'Rustbond Penetrating Sealer', and Resene's 'ArmourBond'.

2.2 Finish coat

The finish coat shall be an approved acrylic modified polyurethane or polysiloxane in a clear colour with a flat or low-gloss finish.

Examples of this material are Altex 'Devthane 379' + 'Flattening Agent', Ameron's 'PSX 700', Carboline's 'Carboline 133 HB', and Resene's 'Uracryl 404'.

3. Preparation

Where surfaces are covered with biogenic surface contamination such as algae, moss and lichens, pretreat with a 1.5% solution of benzylalkonium chloride biocide (e.g. 'Wet'n Forget', 'Clene Up', 'Ultramate', or 'Synthecol Quad LF') in water applied by brush or low-pressure garden spray and leave for at least 24 hours. Biocide to be applied when no rain is forecast for at least 24 hours. Note that this material is non-bleaching and biodegrades at below 20 ppm.

Carefully remove loosely adherent rust scale, flaking paint (if present), dirt and other surface deposits by hand tools such as chipping hammer, scrapers and wire brush. Following this, thoroughly scrub all surfaces with a nylon brush using water and a non-ionic detergent (Castrol 'Flexiclean' or equivalent), followed by a low-pressure fresh water rinse to remove any soluble non-visible contaminants from pits and crevices.

4. Application

Apply a single coat of the sealer/primer followed by two coats of the finish coat material (all from the same manufacturer wherever possible), allowing the recommended cure time between coats. Apply all coatings by brush to dry surfaces at above 10°C, working material into all crevices and any residual rust. Do not overbuild the primer and remove excess material, e.g. from ponding in pits.

Coatings are to be mixed and applied in accordance with the manufacturer's instructions. A copy of the product data sheet and material safety data sheet (MSDS) shall be available on site for all materials used including thinners. Follow the manufacturer's health and safety recommendations.

SYSTEM 2 (ALUMINIUM EPOXY COATING)

1. Scope

This specifies a protective coating system to be used to preserve wrought iron or steel work outdoors that is exposed to contact by the public and/or animals, where a metallic aluminium finish coat is required and preparation by abrasive blasting is not permitted or possible.

2. Materials

2.1 Epoxy mastic

The coating shall be an approved high-build, aluminium pigmented, surface-tolerant epoxy mastic that conforms to AS 3750.1. Examples of this material are Altex 'Bar Rust 236', Ameron's 'Amerlock 2, Carboline's 'Carbomastic 15' and Resene's 'Alumastic'.

3. Preparation

Where surfaces are covered with biogenic surface contamination such as algae, moss and lichens, pretreat with a 1.5% solution of benzylalkonium chloride biocide (e.g. 'Wet'n Forget', 'Clene Up', 'Ultramate', or 'Synthecol Quad LF') in water applied by brush or low-pressure garden spray and leave for at least 24 hours. Biocide to be applied when no rain is forecast for at least 24 hours. Note that this material is non-bleaching and biodegrades at below 20 ppm.

Remove loosely adherent rust scale, flaking paint (if present), dirt and other surface deposits by hand tools such as chipping hammer, scrapers and wire brush. Following this, thoroughly scrub all surfaces with a nylon brush using water and a non-ionic detergent (Castrol 'Flexiclean' or equivalent), followed by a low-pressure fresh water rinse to remove any soluble non-visible contaminants from pits and crevices.

4. Application

Apply at least two spray coats or three heavy brush coats of epoxy mastic, allowing the recommended cure time between coats. Apply all coatings to dry surfaces at above 10°C, working material into all crevices and any residual rust, and ensuring a good build is achieved on all edges.

Coatings are to be mixed and applied in accordance with the manufacturer's instructions. A copy of the product data sheet and material safety data sheet (MSDS) shall be available on site for all materials used including thinners. Follow the manufacturer's health and safety recommendations.

SYSTEM 3 (MCU COATING)

1. Scope

This specifies a protective coating system to be used to preserve wrought iron or steel work outdoors that is exposed to contact by the public and/or animals, where a durable finish coat is required that can be applied under cold and/or damp conditions. This system shall also be used to overcoat/encapsulate old systems where lead-based primers have been used.

2. Materials

2.1 Sealer/primer

The primer shall be an approved aromatic moisture cure urethane (MCU) sealer/primer complying with AS/NZS 3750.18.

Examples of this material are Carboline's 'E21 Primer', and Fortec's 'Wasser MC-Prepbond', and 'Xymax MonoLock'.

2.2 Intermediate/tie coat

This shall be an approved aromatic MCU tiecoat that is pigmented with micaceous iron oxide (MIO) suitable for overcoating aged alkyds.

Examples of this material are Fortec's 'Wasser MC-Miomastic' and 'Xymax Xyguard'.

2.3 Finish coat

This shall be an approved aliphatic MCU pigmented with MIO coloured light grey in a low gloss finish or, where a coloured finish is required, an approved acrylic-modified two-pack polyurethane (2PU).

Examples of the MCU material are Fortec's 'Wasser MC-Ferrox B' and Xymax 'Bridge Finish'. For examples of 2PU, refer to System1 (e.g. Resene's 'Uracryl' range).

2.4 Tar-based finish coat

Where a tar-based coating is required for steel work in contact with soil or water, or when previously coated with coal tar epoxy or a bituminous material (e.g. coal wagons), use a high-build MCU, preferably manufactured with a synthetic tar.

An examples of this material is Fortec's 'Wasser MC-Tar'. An alternative is Carboline's 'Polyline 1300' (note a 2 pack material which contains coal-tar also requires additional safety precautions during application).

Continued on next page

3. Preparation

Where surfaces are covered with biogenic surface contamination such as algae, moss and lichens, pretreat with a 1.5% solution of benzylalkonium chloride biocide (e.g. 'Wet'n Forget', 'Clene Up', 'Ultramate', or 'Synthecol Quad LF') in water applied by brush or low-pressure garden spray and leave for at least 24 hours. Biocide to be applied when no rain is forecast for at least 24 hours. Note that this material is non-bleaching and biodegrades at below 20 ppm.

Remove loosely adherent rust scale, flaking paint (if present), dirt and other surface deposits by hand tools such as chipping hammer, scrapers and wire brush. Following this, thoroughly scrub all surfaces with a nylon brush using water and a non-ionic detergent (Castrol 'Flexiclean' or equivalent), followed by a low-pressure fresh water rinse to remove any soluble non-visible contaminants from pits and crevices.

4. Application

Apply a single coat of the sealer/primer to areas of bare steel followed by a full coat of the intermediate/tiecoat, then apply a single finish coat in the required gloss level and colour allowing the recommended cure time between coats. When using the tar-based finish coat, apply two heavy coats directly over primed surfaces. Apply all coatings by brush and/or roller, working material into all crevices and any residual rust. Where a rapid cure is required, the primer and intermediate coat may have their cure accelerated, but this isocyanate-modified material shall not be applied to damp surfaces.

Coatings are to be mixed and applied in accordance with the manufacturer's instructions. A copy of the product data sheet and material safety data sheet (MSDS) shall be available on site for all materials used including thinners. Follow the manufacturer's health and safety recommendations.

SYSTEM 4 (ALKYD COATING)

1. Scope

This specifies a protective coating system to be used to preserve previously painted wrought iron or steel work outdoors, where a traditional finish coat is required using alkyd (i.e. thinned with turpentine) paint to preserve the original appearance of the item.

2. Materials

2.1 Penetrating liquid

The penetrating liquid shall be an approved low viscosity oil-based material with corrosion inhibiting pigmentation.

Examples of this material are Altex 'RIPO' and Wattyls 'Killrust Fishoilene'.

2.2 Metal primer

The primer shall be an approved zinc phosphate pigmented, high-build alkyd primer complying with AS 4089, Type 2.

Examples of this material are Altex 'High Build Rust Barrier', Wattyl's 'Killrust Metal Primer' and Resene's 'Rust-Arrest'.

2.3 Finish coat

The finish coat shall be an approved alkyd enamel in grey MIOX, red-oxide, or black colour.

Examples of this material are Altex 'Isotal Ferrox', Wattyl's 'Killrust Roof Paint' and Resene's 'Micabond' or 'Supergloss Enamel'.

3. Preparation

Where surfaces are covered with biogenic surface contamination such as algae, moss and lichens, pretreat with a 1.5% solution of benzylalkonium chloride biocide (e.g. 'Wet'n Forget', 'Clene Up', 'Ultramate', or 'Synthecol Quad LF') in water applied by brush or low-pressure garden spray and leave for at least 24 hours. Biocide to be applied when no rain is forecast for at least 24 hours. Note that this material is non-bleaching and biodegrades at below 20 ppm.

Carefully remove loosely adherent rust scale, flaking paint (if present), dirt and other surface deposits by hand tools such as chipping hammer, scrapers and wire brush. Collect any flakes of lead paint and remove from site for safe disposal, then thoroughly scrub all surfaces with a nylon brush using water and a non-ionic detergent (Castrol 'Flexiclean' or equivalent), followed by a low-pressure fresh water rinse to remove any soluble non-visible contaminants from pits and crevices.

4. Application

Apply a coat of penetrating liquid to all crevices, then two coats of the metal primer to all bare surfaces, followed by two full coats of the finish coat material, allowing the recommended dry time between coats. Apply all coatings by brush to dry surfaces at above 10°C, working material into all crevices and any residual rust. Remove excess penetrating material, e.g. from ponding in pits, by wiping with a clean rag before priming.

Coatings are to be mixed and applied in accordance with the manufacturer's instructions. A copy of the product data sheet and material safety data sheet (MSDS) shall be available on site for all materials used including thinners. Follow the manufacturer's health and safety recommendations.

SYSTEM 5 (HIGH PERFORMANCE COATING)

1. Scope

This specifies a protective coating system to be used to preserve wrought iron or steel work outdoors that is exposed to contact by the public and/or animals, where a very durable system and high gloss chemical-resistant finish coat is required. This system should only be used where abrasive blasting is possible.

2. Materials

2.1 Primer

The primer shall be an approved inorganic zinc silicate primer complying with AS/NZS 3750.15.

Examples of this material are Altex's 'Zinc Silicate 8641', Carboline's 'Carbozinc 11', and Resene's 'Zincilate 11'.

Alternatively, the steel surface may be primed with thermally applied zinc metal (99.9% purity).

2.2 Intermediate coat

This shall be an approved high-build epoxy coating complying with AS/NZS 3750.14.

Examples of this material are Altex's 'Bar-Rust 236, Carboline's '893 FD', and Resene's 'Armourcote 515'.

2.3 Finish coat

This shall be an approved high gloss aliphatic polyurethane complying with AS/NZS 3750.6.

Examples of this material are Altex's 'Devthane 379', Carboline's '134', and Resene's 'Imperite 413'.

3. Preparation

Remove any grease or oil by solvent cleaning or detergent washing, then remove rust and scale by abrasive blasting to AS 1627.4 to achieve a 'Commercial' or 'Sa 2' standard of cleanliness in accordance with ISO 8501-1. If dry blasting, follow with a low-pressure fresh water rinse to remove any soluble non-visible contaminants from pits and crevices, then re-abrasive blast to achieve a 'Near-white' or 'Sa 2½' standard of cleanliness in accordance with ISO 8501-1, and with a surface profile of between 50 and 75 µm. In coastal locations (to aid in removal of marine salts), leave overnight before reblasting.

4. Application

Apply a single coat of the zinc silicate primer to the prepared steel to achieve a minimum average dry film thickness (DFT) of 75 µm, followed by the high-build epoxy in one or more coats to give a total minimum DFT of 275 µm. (Alternatively, this can be achieved by arc spraying 200 µm of zinc metal and applying by spray a 75 µm seal coat of epoxy.) Apply a single finish coat in the required gloss level and colour of the polyurethane with a DFT of 75 µm, allowing the recommended cure time between coats.

Coatings are to be mixed and applied in accordance with the manufacturer's instructions. A copy of the product data sheet and material safety data sheet (MSDS) shall be available on site for all materials used including thinners. Follow the manufacturer's health and safety recommendations.

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